

**Genetic Analyses of samples collected in the  
Recreational Chinook Salmon Fisheries in  
Northern British Columbia 2018**

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**ABSTRACT**

Winther, I. 2018. Genetic analyses of samples collected in the recreational Chinook salmon fisheries in northern British Columbia 2018. Unpublished report for the Pacific Salmon Commission Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund 2018. File # NF-2018-VHP-8: iv + 17 p.

The stock compositions of Chinook salmon (*Oncorhynchus tshawytscha*) caught in recreational fisheries in Northern British Columbia (NBC) were examined using genetic analyses of scale samples from fish caught near Langara Island and in Chatham Sound. Microsatellite DNA based stock identification techniques have been used to address stock specific management in mixed stock fisheries in NBC since 2002. Chinook salmon stock compositions were estimated for the 2018 NBC recreational fisheries in the waters around Langara Island and Graham Island, Area 1, and in the waters of Chatham Sound, Areas 3 and 4. Stock compositions were applied to preliminary estimates of catch to provide region specific estimates of the impact of the fisheries on the Chinook stock groups encountered.

## INTRODUCTION

Chinook salmon (*Oncorhynchus tshawytscha*) stock compositions were estimated for Northern British Columbia (NBC) recreational fisheries from 2018. Funding for the genetic analyses was provided by the Pacific Salmon Commission's (PSC) Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund (Northern Fund). The results are part of a continuing project to examine the genetics of Chinook salmon caught in mixed stock fisheries in NBC. This document fulfills the reporting requirements for the 2018 Northern Fund project but is not an exhaustive presentation of the data available. Costs to the Northern Fund consisted of the genetic analyses alone as sampling costs and other components of the project were funded by Fisheries & Oceans Canada and through volunteer efforts by sport fishing lodges.

Sport fisheries in Haida Gwaii or Pacific Fishery Management Areas 1 & 101, 2W & 142, 2E & 102 (Figure 1) are part of the PSC *Aggregate Abundance Based Management Regime* (AABM). Sport Fisheries in Chatham Sound or Areas 3 and 4 are part of the PSC *Individual Stock Based Management Regime* (ISBM). Areas 3 and 4 roughly represent the terminal areas of the Nass and Skeena Rivers respectively. The Skeena river system is a PSC escapement indicator stock that drains into Chatham Sound. The Kitsumkalum River is a PSC exploitation rate indicator stock with a single Chinook salmon conservation unit that forms part of the Skeena River aggregate.

Sport fisheries in Canada receive priority access to Chinook salmon over commercial fisheries. Two of the largest sport fisheries in NBC occur in Haida Gwaii and Chatham Sound. NBC Sport fisheries experienced significant growth until 2005 when they reached a maximum catch of 82,000 Chinook. Since then catches have moderated but have remained over 40,000 Chinook salmon annually. An estimated 36,700 chinook were caught in the Area 1 and 2 sport fishery and 5,821 were caught in Chatham Sound in 2018.

Chinook salmon fisheries in Areas 1 to 6 were subject to management measures in 2018 aimed at reducing the overall exploitation rate on Chinook salmon returning to the north coast by 25 to 35 percent. Commercial troll fisheries were reduced and retention of Chinook salmon was eliminated in commercial net fisheries in Areas 1 to 6. Freshwater sport fisheries were closed (no fishing) for much of the season and were Chinook non-retention for the rest of the year. A number of time and area restrictions were implemented in marine sport fisheries including bag limit reductions and Chinook non-retention measures directed at passing north coast stocks.

Scale samples were collected from Chinook salmon caught in Areas 1, 3 and 4 in 2018. Scales provide an opportunity to extract DNA for genetic analyses to identify stock specific impacts. Scales have been used successfully for genetic analyses of Chinook salmon caught in sport fisheries in previous studies (Winther, I. 2008. Northern Fund file # NF-2007-I-3).

Recreational fisheries in northern British Columbia have been modeled in the Pacific Salmon Treaty (PST) Chinook model. Recent improvements included separation of the AABM and ISBM components of NBC recreational fisheries and correcting the over-representation of NCBC stocks in the model fisheries. The genetic samples proposed for analyses in this project represent the two largest components of the NBC Sport fishery. Examination of actual stock mixes encountered by the fishery have guided model improvements to better represent contributions to modeled fisheries.

Genetic data have been used to estimate fishery impacts on Chinook stocks and used to manage fisheries to avoid stocks of concern (Winther and Beacham 2006, 2009). Stock definition is essential to assessing fishery impacts. Genetic data are useful for the assignment of Chinook mortalities for the purposes of specific stock management (e.g. WCVI Chinook or local

concerns for NBC Chinook) and for accounting of domestic Treaty entitlements. Genetic data supplement cwt data to estimate fishery impacts on stocks of concern. The project reports stock specific data for Chinook catches in NBC sport fisheries and general stock composition data for weak stock considerations and support of treaty accounting.

The sport fisheries in Haida Gwaii and Chatham Sound are mixed stock fisheries and migrating stocks of Chinook salmon originating from Alaska to California are encountered. Stock identification is essential to the objective of defining fishery impacts and productivity estimates. Understanding stock compositions in fisheries has broad benefits to understanding the status of Chinook salmon.

The primary objective of this study was to estimate stock components within NBC recreational fisheries in Areas 1, 3 and 4 in 2018. Stock identification is a key component in the management of mixed stock salmon fisheries. The application of DNA-level markers for stock identification, particularly microsatellites, has provided much greater resolution among Chinook salmon populations than was possible with previous genetic markers (Beacham et al. 1996; Banks et al. 2000; Beacham et al. 2003). If the baseline used to estimate stock composition is adequate, microsatellites can be applied successfully on a local basis to provide information on stock composition even when there is a complex mixture of populations in the catch (Beacham et al. 2006). We used microsatellite variation in Chinook salmon to examine the stock compositions of NBC recreational fisheries.

## METHODS

Stock specific catch estimates were generated from genetic samples and catch data. Area specific genetic samples were grouped monthly and weighted to the catch for the month and area sampled. Samples from Area 3 and Area 4 were pooled due to small sample sizes.

Three programs provided accounting of Chinook salmon caught in NBC recreational fisheries; lodge logbook programs, creel surveys and internet-based surveys (iREC). Lodge dock tallies or logbooks are essentially a census of the Chinook salmon caught at the lodge. All of the lodges in Areas 1 and Area 3 participated in the 2018 logbook program. There are no lodges in Area 4. Catches in Areas 1 through 3 were estimated using a combination of catch data from logbooks and creel surveys. Catches in Area 4 were estimated from creel surveys alone. Creel survey data are preliminary.

Scale samples provided the source of genetic material from each fish. Lodge samples collected from Area 1 consisted of a random sample of scales from 5 fish per day through the entire season from 22 May to 11 September. Individual Chinook salmon were sampled for nose-fork length, gender and scales. The random sample consisted of scales collected from 563 Chinook salmon. Scale collections were matched to data on the location fished and date caught (Appendix 1).

Creel survey crews from Prince Rupert sampled fishery landings from Chatham Sound, Areas 3 and 4. Scales were collected from a total of 226 Chinook salmon and genetic results were produced for 215 of them. Only 10 Chinook salmon were sampled from Area 3 in each of the months of June and July and only 21 were sampled in August so samples from Area 3 and Area 4 were pooled together. Gender could not be determined for most of the fish that were landed because they had been eviscerated. The small sample sizes preclude meaningful estimates for most stock components so are applied to catch and presented here only for comparison.

Scale samples were collected onto scale books, five scales per fish, as described by MacLellan (1999). Data on the geographic location, date, and sampler accompanied each sample.

Samples were forwarded to the Fisheries & Oceans Canada, Molecular Genetics Laboratory at the Pacific Biological Station in Nanaimo.

Chinook salmon collections were compared against genetic baselines from 296 Chinook salmon populations from Southeast Alaska through Canada and the lower United States of America (Appendix 2). Samples were analyzed for 15 microsatellite loci using methods of DNA extraction, PCR reaction, electrophoresis, and allele scoring described by Candy et al. (2002) and Beacham et al. (2006).

The Molecular Genetics Laboratory provided the sample analysis. A new version of the computer program as outlined by Pella and Masuda (2001) was developed and used for the analyses presented here. The program CBAYES (Neaves et al 2005) can be downloaded from the Molecular Genetics Laboratory website (Fisheries & Oceans Canada, Molecular Genetics Laboratory, Pacific Biological Station, Nanaimo). The model output presented includes the Bayesian probability estimates for the 5 most probable populations for each sample.

## RESULTS

Recreational catches of Chinook salmon from Area 1 were estimated at 19,250 in 2018 and the Area 1 fishery was sampled at Langara Island. The total AABM fishery catch was estimated at 36,700 Chinook salmon. Samples were collected from 150 fish in June, and 155 fish in each month of July and August. Samples from the end of May included 50 fish and 53 fish were sampled from the beginning of September. The smaller sample sizes in May and September reflect catches from 10 and 11 days respectively when the lodges began and concluded operations. The scales samples from Langara Island represented 2.9% of the annual catch in Area 1 (Table 1, Table 2 and Table 3).

Concerns for WCVI Chinook salmon have been the major driver for the management of NBC fisheries so the pattern of abundance is of particular interest. WCVI Chinook made up the largest component (31%) of the Area 1 samples. The proportion of WCVI Chinook in the samples was 36% in May, 19% in June, 27% in July and 40.5% in August and 21.2% at the beginning of September (Table 2).

Chinook from the WCVI stock group also formed the largest component of the catch at 22.2% of the fish caught in Chatham Sound. Skeena Chinook formed 12.4% of the samples collected in Area 3 and 4 (Table 4). Large contributions were also made by Puget Sound at 13.9%, Northern Mainland (NOMN) at 10.7% and South Thompson (SOTH) at 10% (Table 5). The Nass River drains into Area 3 and has a large Chinook population but it made up only 3.4% of the Area 3 and 4 catches. The preliminary estimates of the contributions to the Chatham Sound fishery were 1,290 WCVI, 198 Nass and 721 Skeena Chinook salmon (Table 5). Estimates are presented for comparison purposes only recognizing the small sample sizes from Chatham Sound.

## DISCUSSION

This report summarizes the results of genetic analyses of samples collected from 2018 recreational Chinook salmon fisheries in NBC to meet the reporting requirements for the PSC Northern Fund project. As a basic presentation of the findings it reports the stock components determined from the genetic analyses of scale samples and applies them to preliminary catch estimates. A number of items precluded a final report at the time of writing. Catch estimates from Areas 3 and 4 have not been finalized from the 2018 creel survey so the stock specific impacts presented remain preliminary. Further, sample sizes from Chatham Sound represent

about half of the sampling objective (>400 fish) so expansions remain suspect. Size and age information were collected but have not been analyzed or presented.

There were significant management constraints on recreational fisheries for Chinook in the North Coast in 2018. Fisheries in Areas 1 through 10 typically operate under the maximum daily bag, possession and annual limits offered under the current allocation policy: Normally sport fishing for Chinook salmon is open with a daily limit of two per day, a possession limit of four, and an annual limit of 30 Chinook salmon. In Areas 1 and 2 Chinook bag limits were reduced to 1 fish per day with a possession limit of 2 fish from June 1 to July 10. In Areas 3 to 5 similar bag limit reductions occurred from June 1 to 15 and from July 10 to 31. Chinook were not permitted to be retained in the Area 3 to 5 sport fishery from June 16 to July 9. A minimum size limit of 45 cm was in effect and barbless hooks were mandatory as usual. An estimated 36,700 chinook were caught in the Area 1 and 2 sport fishery and 5,821 were caught in Chatham Sound (estimates preliminary).

The stock proportions observed in the samples from Langara Island were applied to the catch estimates for Area 1 (PFMA's 1 and 101). The samples were collected from a single location on Langara Island and although the lodge fleet commonly ranges east and southwest through much of PFMA's 1 and 101 the samples are not a random selection of Chinook catch across all areas. Langara and Graham Islands represent obstacles to fish passage that the north to south Chinook salmon migration flows around. The continuous sample of fish as they move around the islands probably represents the broader spatial area, especially when considered for longer periods like a month. Further, the application of the samples to catch data assists in understanding relative contributions to the fishery. For this reason the stock compositions have been applied to the total monthly catch from Area 1. In addition, most of the Area 1 catch comes from lodges on or near Langara Island.

Recreational fisheries have priority access to Chinook salmon in British Columbia so management actions for weak stocks are usually undertaken by commercial fisheries alone. The shares within the AABM allowable catch are determined pre-season by forecasting the recreational catch and providing the remainder to the commercial troll fishery. Reaching the AABM catch is attempted by the commercial fishery once domestic management constraints have been met. Typically the AABM allowable catch for NBC is not attained (the preliminary 2018 AABM catch estimate was 106,976 out of a total allowable catch of 131,300).

In 2018 commercial troll fisheries in NBC were delayed until July 10 to reduce or eliminate impacts on northern Chinook salmon stocks. Summer troll fisheries have been excluded from areas around Langara Island and the north end of Graham Island since 1997 to avoid conflicts with the sport fishery. The ribbon boundary that keeps the troll fishery away from the shore has assisted in the objective of avoiding WCVI Chinook stocks since those fish tend to migrate closer to the shore (Winther and Beacham, 2006 & 2009). Further, an effort / harvest rate approach was used to reduce troll fishery impacts on WCVI Chinook salmon.

Commercial net fisheries for Chinook salmon were eliminated in 2018 and Chinook salmon retention was not permitted in net fisheries directed on other species.

The combination of Chinook salmon abundance and high proportions of WCVI fish made troll and recreational fishery impacts on WCVI stocks most significant in August (Winther and Beacham, 2006 & 2009). That pattern was also expressed in the 2018 data for Area 1 recreational fisheries. Although the WCVI component was high in May the low catch during that month make the impacts low. The timing differential between WCVI Chinook salmon and abundant stocks in the Fraser and Columbia Rivers provided opportunities to minimize impacts on WCVI stocks by having commercial troll fisheries in June and July.

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## TABLES

Table 1. Chinook salmon catch by stock group for the 2018 Area 1 Recreational fishery.

Standard deviations (STD) appear in brackets. N = 557.

| Code  | Region                             | Proportion | STD    | Catch  | STD   |
|-------|------------------------------------|------------|--------|--------|-------|
| 1     | Upper Fraser (UPFR)                | 0.3%       | (0.2%) | 49     | (39)  |
| 2     | Middle-Upper Fraser (MUFR)         | 0.2%       | (0.3%) | 42     | (56)  |
| 3     | Lower Fraser Fall (LWFR-F)         | 0.6%       | (0.4%) | 117    | (83)  |
| 4     | North Thompson (NOTH)              | 0.4%       | (0.3%) | 84     | (62)  |
| 5     | South Thompson (SOTH)              | 15.5%      | (1.7%) | 2,982  | (320) |
| 6     | Lower Thompson (LWTH)              | 0.0%       | (0.1%) | 0      | (13)  |
| 7     | East Coast Vancouver Island (ECVI) | 2.8%       | (0.8%) | 545    | (158) |
| 8     | West Coast Vancouver Island (WCVI) | 31.2%      | (2.2%) | 6,005  | (421) |
| 9     | Southern BC Mainland (SOMN)        | 1.8%       | (0.6%) | 354    | (123) |
| 10    | Northern BC Mainland (NOMN)        | 4.0%       | (0.8%) | 777    | (159) |
| 11    | Nass                               | 0.1%       | (0.1%) | 13     | (24)  |
| 12    | Lower Fraser Spring (LWFR-Sp)      | 0.2%       | (0.2%) | 42     | (44)  |
| 13    | Lower Fraser Summer (LWFR-Su)      | 0.0%       | (0.0%) | 0      | (4)   |
| 14    | Haida Gwaii (QCI)                  | 1.0%       | (0.4%) | 187    | (86)  |
| 15    | Alaska                             | 0.0%       | (0.1%) | 5      | (14)  |
| 17    | Taku                               | 0.1%       | (0.2%) | 10     | (29)  |
| 18    | Stikine                            | 0.6%       | (0.4%) | 106    | (80)  |
| 19-23 | Skeena                             | 3.1%       | (1.1%) | 605    | (204) |
| 24    | Alsek                              | 0.0%       | (0.1%) | 1      | (12)  |
| 50    | Puget Sound                        | 0.6%       | (0.3%) | 117    | (57)  |
| 51    | Juan de Fuca                       | 0.4%       | (0.2%) | 73     | (42)  |
| 52    | Coastal Washington                 | 10.5%      | (1.5%) | 2,019  | (294) |
| 53    | Lower Columbia                     | 1.6%       | (0.6%) | 313    | (122) |
| 54    | Upper Columbia Spring              | 0.0%       | (0.0%) | 0      | (8)   |
| 55    | Upper Columbia Summer/Fall         | 13.3%      | (1.8%) | 2,562  | (340) |
| 56    | Snake Spring/Summer                | 0.1%       | (0.2%) | 14     | (42)  |
| 57    | Snake Fall                         | 3.0%       | (1.2%) | 573    | (224) |
| 58    | North & Central Oregon             | 5.9%       | (1.3%) | 1,142  | (243) |
| 59    | South Oregon Coastal               | 1.5%       | (0.6%) | 284    | (111) |
| 61    | Klamath/Trinity                    | 0.0%       | (0.1%) | 0      | (10)  |
| 62    | Middle Columbia Spring             | 0.0%       | (0.1%) | 6      | (21)  |
| 63    | Upper Willamette                   | 1.2%       | (0.4%) | 222    | (80)  |
| 64    | Central Valley Fall                | 0.0%       | (0.1%) | 0      | (14)  |
| 65    | Central Valley Spring              | 0.0%       | (0.0%) | 0      | (7)   |
| 66    | Coastal California                 | 0.0%       | (0.0%) | 0      | (5)   |
|       | TOTAL                              | 100.0      |        | 19,250 |       |

Table 2. Chinook stock proportions observed in monthly samples from 2018 Area 1 Recreational catches.

Composition presented as % of the sample N. Standard deviations appear in brackets.

|       | Year                               | 2018   |       | 2018   |       | 2018   |       | 2018   |       | 2018      |       |
|-------|------------------------------------|--------|-------|--------|-------|--------|-------|--------|-------|-----------|-------|
|       | Month                              | May    |       | June   |       | July   |       | August |       | September |       |
|       | Sample type                        | Random |       | Random |       | Random |       | Random |       | Random    |       |
|       | N                                  | 50     |       | 148    |       | 155    |       | 155    |       | 49        |       |
| Code  | Region                             | %      | STD   | %      | STD   | %      | STD   | %      | STD   | %         | STD   |
| 1     | Upper Fraser (UPFR)                | 0.0    | (0.6) | 1.4    | (1.0) | 0.0    | (0.2) | 0.0    | (0.2) | 0.0       | (0.6) |
| 2     | Middle-Upper Fraser (MUFR)         | 0.0    | (0.6) | 0.0    | (0.2) | 0.6    | (0.8) | 0.0    | (0.2) | 0.0       | (0.6) |
| 3     | Lower Fraser Fall (LWFR-F)         | 0.0    | (0.3) | 0.0    | (0.1) | 0.0    | (0.1) | 1.4    | (1.0) | 0.0       | (0.2) |
| 4     | North Thompson (NOTH)              | 0.0    | (0.3) | 0.0    | (0.1) | 1.3    | (0.9) | 0.0    | (0.1) | 0.0       | (0.2) |
| 5     | South Thompson (SOTH)              | 11.4   | (4.4) | 22.9   | (3.5) | 18.7   | (3.1) | 10.8   | (2.5) | 0.0       | (0.5) |
| 6     | Lower Thompson (LWTH)              | 0.0    | (0.2) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0       | (0.2) |
| 7     | East Coast Vancouver Island (ECVI) | 0.0    | (0.4) | 2.8    | (1.4) | 2.5    | (1.3) | 3.4    | (1.5) | 0.0       | (0.3) |
| 8     | West Coast Vancouver Island (WCVI) | 36.0   | (6.8) | 19.0   | (3.3) | 26.7   | (3.5) | 40.5   | (4.0) | 21.2      | (5.7) |
| 9     | Southern BC Mainland (SOMN)        | 0.0    | (0.4) | 4.1    | (1.6) | 2.7    | (1.4) | 0.3    | (0.7) | 0.0       | (0.5) |
| 10    | Northern BC Mainland (NOMN)        | 11.6   | (4.5) | 12.3   | (2.8) | 3.8    | (1.7) | 0.7    | (0.7) | 0.0       | (0.5) |
| 11    | Nass                               | 4.0    | (2.8) | 0.0    | (0.2) | 0.0    | (0.3) | 0.0    | (0.1) | 0.0       | (0.5) |
| 12    | Lower Fraser Spring (LWFR-Sp)      | 0.0    | (0.3) | 0.0    | (0.1) | 0.6    | (0.6) | 0.0    | (0.1) | 0.0       | (0.2) |
| 13    | Lower Fraser Summer (LWFR-Su)      | 0.0    | (0.1) | 0.0    | (0.0) | 0.0    | (0.0) | 0.0    | (0.0) | 0.0       | (0.1) |
| 14    | Haida Gwaii (QCI)                  | 0.0    | (0.1) | 1.4    | (0.9) | 1.3    | (0.9) | 0.7    | (0.6) | 0.0       | (0.2) |
| 15    | Alaska                             | 0.0    | (0.4) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 1.0       | (1.8) |
| 17    | Taku                               | 0.0    | (0.4) | 0.0    | (0.3) | 0.1    | (0.3) | 0.0    | (0.2) | 0.9       | (1.5) |
| 18    | Stikine                            | 0.2    | (1.0) | 2.4    | (1.6) | 0.0    | (0.1) | 0.2    | (0.7) | 0.3       | (1.1) |
| 19-23 | Skeena                             | 3.3    | (3.8) | 4.8    | (2.5) | 5.0    | (2.3) | 1.1    | (1.3) | 0.1       | (0.7) |
| 24    | Alsek                              | 0.0    | (0.3) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 0.1       | (0.6) |
| 50    | Puget Sound                        | 0.0    | (0.4) | 3.2    | (1.5) | 0.0    | (0.2) | 0.0    | (0.2) | 0.0       | (0.3) |
| 51    | Juan de Fuca                       | 0.0    | (0.1) | 2.0    | (1.1) | 0.0    | (0.0) | 0.0    | (0.0) | 0.1       | (0.5) |
| 52    | Coastal Washington                 | 1.2    | (1.9) | 9.3    | (2.7) | 6.7    | (2.0) | 13.0   | (2.9) | 32.0      | (7.6) |
| 53    | Lower Columbia                     | 0.2    | (0.7) | 0.5    | (0.8) | 3.9    | (1.6) | 0.4    | (0.7) | 0.7       | (1.9) |
| 54    | Upper Columbia Spring              | 0.0    | (0.2) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0       | (0.2) |
| 55    | Upper Columbia Summer/Fall         | 17.7   | (5.3) | 7.7    | (2.3) | 17.6   | (3.2) | 12.0   | (3.0) | 17.8      | (6.1) |
| 56    | Snake Spring/Summer                | 0.0    | (0.4) | 0.0    | (0.2) | 0.0    | (0.1) | 0.2    | (0.5) | 0.0       | (0.4) |
| 57    | Snake Fall                         | 0.1    | (0.5) | 0.0    | (0.1) | 0.4    | (1.1) | 6.5    | (2.5) | 1.4       | (2.6) |
| 58    | North & Central Oregon             | 4.2    | (3.2) | 2.0    | (1.5) | 3.8    | (1.8) | 8.8    | (2.4) | 15.2      | (5.9) |
| 59    | South Oregon Coastal               | 4.2    | (2.7) | 0.0    | (0.2) | 3.5    | (1.6) | 0.0    | (0.3) | 7.9       | (4.0) |
| 61    | Klamath/Trinity                    | 0.0    | (0.2) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0       | (0.2) |
| 62    | Middle Columbia Spring             | 0.0    | (0.3) | 0.1    | (0.4) | 0.0    | (0.1) | 0.0    | (0.2) | 0.0       | (0.3) |
| 63    | Upper Willamette                   | 6.0    | (3.2) | 4.1    | (1.6) | 0.8    | (0.8) | 0.0    | (0.1) | 1.4       | (2.1) |
| 64    | Central Valley Fall                | 0.0    | (0.3) | 0.0    | (0.1) | 0.0    | (0.2) | 0.0    | (0.1) | 0.0       | (0.3) |
| 65    | Central Valley Spring              | 0.0    | (0.2) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0    | (0.1) | 0.0       | (0.1) |
| 66    | Coastal California                 | 0.0    | (0.1) | 0.0    | (0.0) | 0.0    | (0.0) | 0.0    | (0.0) | 0.0       | (0.1) |

Table 3. Chinook catch composition from 2018 Area 1 Recreational fisheries by month.

Catch composition presented in numbers of fish. Standard deviations appear in brackets.

|       | Year                               | 2018  |      | 2018  |       | 2018  |       | 2018   |       | 2018      |      |
|-------|------------------------------------|-------|------|-------|-------|-------|-------|--------|-------|-----------|------|
|       | Date                               | May   |      | June  |       | July  |       | August |       | September |      |
|       | Area 1 Catch                       | 250   |      | 3,600 |       | 6,600 |       | 8,300  |       | 500       |      |
|       | Sample size (N)                    | 50    |      | 148   |       | 155   |       | 155    |       | 49        |      |
| Code  | Region                             | Catch | STD  | Catch | STD   | Catch | STD   | Catch  | STD   | Catch     | STD  |
| 1     | Upper Fraser (UPFR)                | 0     | (2)  | 49    | (35)  | 0     | (11)  | 0      | (14)  | 0         | (3)  |
| 2     | Middle-Upper Fraser (MUFR)         | 0     | (1)  | 0     | (7)   | 41    | (52)  | 1      | (18)  | 0         | (3)  |
| 3     | Lower Fraser Fall (LWFR-F)         | 0     | (1)  | 0     | (2)   | 0     | (5)   | 117    | (82)  | 0         | (1)  |
| 4     | North Thompson (NOTH)              | 0     | (1)  | 0     | (4)   | 84    | (61)  | 0      | (11)  | 0         | (1)  |
| 5     | South Thompson (SOTH)              | 28    | (11) | 824   | (126) | 1237  | (206) | 892    | (210) | 0         | (2)  |
| 6     | Lower Thompson (LWTH)              | 0     | (1)  | 0     | (4)   | 0     | (7)   | 0      | (10)  | 0         | (1)  |
| 7     | East Coast Vancouver Island (ECVI) | 0     | (1)  | 101   | (51)  | 163   | (84)  | 280    | (124) | 0         | (2)  |
| 8     | West Coast Vancouver Island (WCVI) | 90    | (17) | 685   | (117) | 1764  | (229) | 3360   | (332) | 106       | (29) |
| 9     | Southern BC Mainland (SOMN)        | 0     | (1)  | 148   | (59)  | 178   | (93)  | 28     | (57)  | 0         | (3)  |
| 10    | Northern BC Mainland (NOMN)        | 29    | (11) | 444   | (100) | 248   | (109) | 56     | (58)  | 0         | (3)  |
| 11    | Nass                               | 10    | (7)  | 0     | (6)   | 3     | (18)  | 0      | (12)  | 0         | (2)  |
| 12    | Lower Fraser Spring (LWFR-Sp)      | 0     | (1)  | 0     | (3)   | 42    | (42)  | 0      | (11)  | 0         | (1)  |
| 13    | Lower Fraser Summer (LWFR-Su)      | 0     | (0)  | 0     | (1)   | 0     | (2)   | 0      | (3)   | 0         | (0)  |
| 14    | Haida Gwaii (QCI)                  | 0     | (0)  | 49    | (34)  | 83    | (58)  | 55     | (53)  | 0         | (1)  |
| 15    | Alaska                             | 0     | (1)  | 0     | (4)   | 0     | (5)   | 0      | (9)   | 5         | (9)  |
| 17    | Taku                               | 0     | (1)  | 2     | (10)  | 3     | (21)  | 0      | (15)  | 5         | (8)  |
| 18    | Stikine                            | 0     | (3)  | 85    | (57)  | 1     | (9)   | 18     | (55)  | 2         | (6)  |
| 19-23 | Skeena                             | 8     | (10) | 172   | (90)  | 330   | (151) | 94     | (104) | 0         | (4)  |
| 24    | Alsek                              | 0     | (1)  | 0     | (3)   | 0     | (6)   | 0      | (9)   | 1         | (3)  |
| 50    | Puget Sound                        | 0     | (1)  | 116   | (54)  | 0     | (10)  | 1      | (14)  | 0         | (1)  |
| 51    | Juan de Fuca                       | 0     | (0)  | 72    | (41)  | 0     | (3)   | 0      | (2)   | 0         | (3)  |
| 52    | Coastal Washington                 | 3     | (5)  | 336   | (96)  | 443   | (135) | 1077   | (239) | 160       | (38) |
| 53    | Lower Columbia                     | 0     | (2)  | 17    | (31)  | 258   | (104) | 34     | (55)  | 4         | (9)  |
| 54    | Upper Columbia Spring              | 0     | (0)  | 0     | (3)   | 0     | (5)   | 0      | (6)   | 0         | (1)  |
| 55    | Upper Columbia Summer/Fall         | 44    | (13) | 276   | (82)  | 1159  | (209) | 994    | (253) | 89        | (30) |
| 56    | Snake Spring/Summer                | 0     | (1)  | 0     | (6)   | 0     | (9)   | 14     | (40)  | 0         | (2)  |
| 57    | Snake Fall                         | 0     | (1)  | 0     | (4)   | 30    | (75)  | 536    | (211) | 7         | (13) |
| 58    | North & Central Oregon             | 11    | (8)  | 71    | (54)  | 251   | (119) | 733    | (203) | 76        | (29) |
| 59    | South Oregon Coastal               | 11    | (7)  | 2     | (9)   | 230   | (106) | 3      | (23)  | 39        | (20) |
| 61    | Klamath/Trinity                    | 0     | (0)  | 0     | (4)   | 0     | (4)   | 0      | (8)   | 0         | (1)  |
| 62    | Middle Columbia Spring             | 0     | (1)  | 5     | (15)  | 0     | (7)   | 1      | (14)  | 0         | (1)  |
| 63    | Upper Willamette                   | 15    | (8)  | 147   | (59)  | 53    | (51)  | 1      | (10)  | 7         | (11) |
| 64    | Central Valley Fall                | 0     | (1)  | 0     | (4)   | 0     | (10)  | 0      | (9)   | 0         | (1)  |
| 65    | Central Valley Spring              | 0     | (0)  | 0     | (2)   | 0     | (4)   | 0      | (6)   | 0         | (1)  |
| 66    | Coastal California                 | 0     | (0)  | 0     | (1)   | 0     | (3)   | 0      | (3)   | 0         | (0)  |

Table 4. Chinook stock proportions observed in monthly samples from 2018 Areas 3 and 4 Recreational fishery catches. Composition presented as % of the sample N. Standard deviations appear in brackets.

|       | Year                               | 2018  |       | 2018  |       | 2018   |       | 2018 Total  |        |
|-------|------------------------------------|-------|-------|-------|-------|--------|-------|-------------|--------|
|       | Area                               | 3 & 4 |       | 3 & 4 |       | 3 & 4  |       | 3 & 4       |        |
|       | Date                               | June  |       | July  |       | August |       | June-August |        |
|       | N                                  | 79    |       | 105   |       | 31     |       | 215         |        |
| Code  | Region                             | %     | STD   | %     | STD   | %      | STD   | %           | STD    |
| 1     | Upper Fraser (UPFR)                | 0.0   | (0.3) | 0.0   | (0.2) | 0.2    | (1.6) | 0.1%        | (0.5%) |
| 2     | Middle-Upper Fraser (MUFR)         | 0.0   | (0.3) | 0.0   | (0.3) | 0.0    | (0.7) | 0.0%        | (0.3%) |
| 3     | Lower Fraser Fall (LWFR-F)         | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.6) | 0.0%        | (0.2%) |
| 4     | North Thompson (NOTH)              | 0.0   | (0.2) | 0.0   | (0.1) | 0.0    | (0.5) | 0.0%        | (0.2%) |
| 5     | South Thompson (SOTH)              | 5.1   | (2.4) | 13.8  | (3.4) | 6.6    | (4.4) | 10.0%       | (2.2%) |
| 6     | Lower Thompson (LWTH)              | 0.0   | (0.2) | 0.0   | (0.2) | 0.0    | (0.4) | 0.0%        | (0.1%) |
| 7     | East Coast Vancouver Island (ECVI) | 10.2  | (3.6) | 9.8   | (3.0) | 10.2   | (5.5) | 10.0%       | (2.3%) |
| 8     | West Coast Vancouver Island (WCVI) | 25.3  | (4.8) | 23.9  | (4.1) | 16.3   | (6.5) | 22.2%       | (3.0%) |
| 9     | Southern BC Mainland (SOMN)        | 8.5   | (3.4) | 1.3   | (1.4) | 0.1    | (1.0) | 2.6%        | (1.1%) |
| 10    | Northern BC Mainland (NOMN)        | 10.4  | (3.6) | 9.9   | (3.1) | 12.4   | (6.3) | 10.7%       | (2.4%) |
| 11    | Nass                               | 8.7   | (3.7) | 0.0   | (0.2) | 5.5    | (4.3) | 3.4%        | (1.4%) |
| 12    | Lower Fraser Spring (LWFR-Sp)      | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.3) | 0.0%        | (0.1%) |
| 13    | Lower Fraser Summer (LWFR-Su)      | 0.0   | (0.1) | 1.0   | (0.9) | 0.0    | (0.1) | 0.5%        | (0.5%) |
| 14    | Haida Gwaii (QCI)                  | 0.0   | (0.1) | 0.0   | (0.0) | 0.0    | (0.1) | 0.0%        | (0.0%) |
| 15    | Alaska                             | 0.0   | (0.2) | 0.0   | (0.1) | 0.0    | (0.4) | 0.0%        | (0.1%) |
| 17    | Taku                               | 0.1   | (0.4) | 0.0   | (0.2) | 0.0    | (0.4) | 0.0%        | (0.2%) |
| 18    | Stikine                            | 0.2   | (0.9) | 0.0   | (0.2) | 0.0    | (0.5) | 0.0%        | (0.3%) |
| 19-23 | Skeena                             | 17.3  | (5.8) | 14.1  | (4.1) | 5.2    | (4.4) | 12.4%       | (2.7%) |
| 24    | Alsek                              | 0.0   | (0.2) | 0.0   | (0.2) | 0.0    | (0.2) | 0.0%        | (0.1%) |
| 50    | Puget Sound                        | 6.0   | (2.8) | 12.5  | (3.5) | 23.1   | (7.7) | 13.9%       | (2.8%) |
| 51    | Juan de Fuca                       | 2.5   | (1.9) | 1.3   | (1.2) | 0.0    | (0.1) | 1.2%        | (0.7%) |
| 52    | Coastal Washington                 | 1.3   | (1.3) | 0.0   | (0.2) | 0.0    | (0.5) | 0.3%        | (0.3%) |
| 53    | Lower Columbia                     | 1.3   | (1.2) | 1.0   | (1.0) | 0.0    | (0.4) | 0.8%        | (0.6%) |
| 54    | Upper Columbia Spring              | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.3) | 0.0%        | (0.1%) |
| 55    | Upper Columbia Summer/Fall         | 3.1   | (2.0) | 10.7  | (3.3) | 9.5    | (7.5) | 8.7%        | (2.7%) |
| 56    | Snake Spring/Summer                | 0.0   | (0.2) | 0.0   | (0.3) | 0.0    | (0.6) | 0.0%        | (0.2%) |
| 57    | Snake Fall                         | 0.0   | (0.1) | 0.5   | (1.4) | 7.5    | (7.5) | 2.3%        | (2.2%) |
| 58    | North & Central Oregon             | 0.0   | (0.3) | 0.0   | (0.1) | 3.3    | (3.1) | 0.9%        | (0.9%) |
| 59    | South Oregon Coastal               | 0.0   | (0.2) | 0.0   | (0.1) | 0.0    | (0.8) | 0.0%        | (0.2%) |
| 61    | Klamath/Trinity                    | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.4) | 0.0%        | (0.1%) |
| 62    | Middle Columbia Spring             | 0.0   | (0.2) | 0.0   | (0.3) | 0.1    | (1.0) | 0.1%        | (0.3%) |
| 63    | Upper Willamette                   | 0.0   | (0.2) | 0.1   | (0.4) | 0.0    | (0.3) | 0.0%        | (0.2%) |
| 64    | Central Valley Fall                | 0.0   | (0.3) | 0.1   | (0.4) | 0.0    | (0.5) | 0.0%        | (0.3%) |
| 65    | Central Valley Spring              | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.3) | 0.0%        | (0.1%) |
| 66    | Coastal California                 | 0.0   | (0.1) | 0.0   | (0.1) | 0.0    | (0.2) | 0.0%        | (0.1%) |

Table 5. Chinook catch composition from 2018 Area 3 and 4 Recreational fisheries by month.

Catch composition presented in numbers of fish for comparison only due to small sample sizes. Standard deviations appear in brackets. Catch estimates are preliminary.

|       | Year                               | 2018  |      | 2018  |       | 2018   |       | 2018 Total  |       |
|-------|------------------------------------|-------|------|-------|-------|--------|-------|-------------|-------|
|       | Area                               | 3 & 4 |      | 3 & 4 |       | 3 & 4  |       | 3 & 4       |       |
|       | Date                               | June  |      | July  |       | August |       | June-August |       |
|       | Catch                              | 1,273 |      | 2,964 |       | 1,584  |       | 5,821       |       |
|       | N                                  | 79    |      | 105   |       | 31     |       | 215         |       |
| Code  | Region                             | Catch | STD  | Catch | STD   | Catch  | STD   | Catch       | STD   |
| 1     | Upper Fraser (UPFR)                | 0     | (4)  | 0     | (6)   | 4      | (25)  | 4           | (26)  |
| 2     | Middle-Upper Fraser (MUFR)         | 0     | (4)  | 0     | (9)   | 0      | (12)  | 0           | (15)  |
| 3     | Lower Fraser Fall (LWFR-F)         | 0     | (1)  | 0     | (3)   | 0      | (9)   | 0           | (10)  |
| 4     | North Thompson (NOTH)              | 0     | (3)  | 0     | (4)   | 0      | (8)   | 0           | (10)  |
| 5     | South Thompson (SOTH)              | 65    | (31) | 410   | (102) | 104    | (69)  | 580         | (127) |
| 6     | Lower Thompson (LWTH)              | 0     | (3)  | 0     | (4)   | 0      | (7)   | 0           | (8)   |
| 7     | East Coast Vancouver Island (ECVI) | 130   | (46) | 290   | (88)  | 161    | (88)  | 581         | (132) |
| 8     | West Coast Vancouver Island (WCVI) | 322   | (61) | 709   | (123) | 258    | (104) | 1290        | (172) |
| 9     | Southern BC Mainland (SOMN)        | 108   | (43) | 39    | (42)  | 1      | (15)  | 149         | (62)  |
| 10    | Northern BC Mainland (NOMN)        | 133   | (45) | 292   | (91)  | 196    | (100) | 621         | (142) |
| 11    | Nass                               | 111   | (47) | 0     | (7)   | 87     | (69)  | 198         | (84)  |
| 12    | Lower Fraser Spring (LWFR-Sp)      | 0     | (2)  | 0     | (4)   | 0      | (5)   | 0           | (7)   |
| 13    | Lower Fraser Summer (LWFR-Su)      | 0     | (1)  | 28    | (27)  | 0      | (2)   | 28          | (27)  |
| 14    | Haida Gwaii (QCI)                  | 0     | (1)  | 0     | (1)   | 0      | (2)   | 0           | (3)   |
| 15    | Alaska                             | 0     | (2)  | 0     | (3)   | 0      | (6)   | 0           | (7)   |
| 17    | Taku                               | 1     | (6)  | 0     | (5)   | 0      | (7)   | 1           | (10)  |
| 18    | Stikine                            | 2     | (11) | 0     | (7)   | 0      | (7)   | 3           | (15)  |
| 19-23 | Skeena                             | 221   | (73) | 419   | (120) | 82     | (70)  | 721         | (157) |
| 24    | Alsek                              | 0     | (2)  | 0     | (5)   | 0      | (4)   | 0           | (7)   |
| 50    | Puget Sound                        | 76    | (36) | 370   | (104) | 366    | (122) | 812         | (164) |
| 51    | Juan de Fuca                       | 32    | (24) | 37    | (34)  | 0      | (1)   | 70          | (42)  |
| 52    | Coastal Washington                 | 16    | (16) | 0     | (5)   | 0      | (8)   | 17          | (19)  |
| 53    | Lower Columbia                     | 16    | (16) | 30    | (30)  | 0      | (6)   | 46          | (35)  |
| 54    | Upper Columbia Spring              | 0     | (2)  | 0     | (4)   | 0      | (4)   | 0           | (6)   |
| 55    | Upper Columbia Summer/Fall         | 39    | (25) | 317   | (98)  | 151    | (118) | 507         | (156) |
| 56    | Snake Spring/Summer                | 0     | (3)  | 0     | (8)   | 0      | (9)   | 0           | (12)  |
| 57    | Snake Fall                         | 0     | (1)  | 16    | (42)  | 119    | (119) | 135         | (127) |
| 58    | North & Central Oregon             | 0     | (3)  | 0     | (4)   | 52     | (49)  | 53          | (50)  |
| 59    | South Oregon Coastal               | 0     | (2)  | 0     | (4)   | 0      | (12)  | 0           | (13)  |
| 61    | Klamath/Trinity                    | 0     | (1)  | 0     | (3)   | 0      | (7)   | 0           | (8)   |
| 62    | Middle Columbia Spring             | 0     | (2)  | 1     | (9)   | 2      | (16)  | 3           | (19)  |
| 63    | Upper Willamette                   | 0     | (2)  | 2     | (12)  | 0      | (5)   | 2           | (13)  |
| 64    | Central Valley Fall                | 0     | (4)  | 2     | (12)  | 0      | (8)   | 3           | (15)  |
| 65    | Central Valley Spring              | 0     | (1)  | 0     | (3)   | 0      | (5)   | 0           | (6)   |
| 66    | Coastal California                 | 0     | (1)  | 0     | (2)   | 0      | (3)   | 0           | (3)   |

## FIGURES

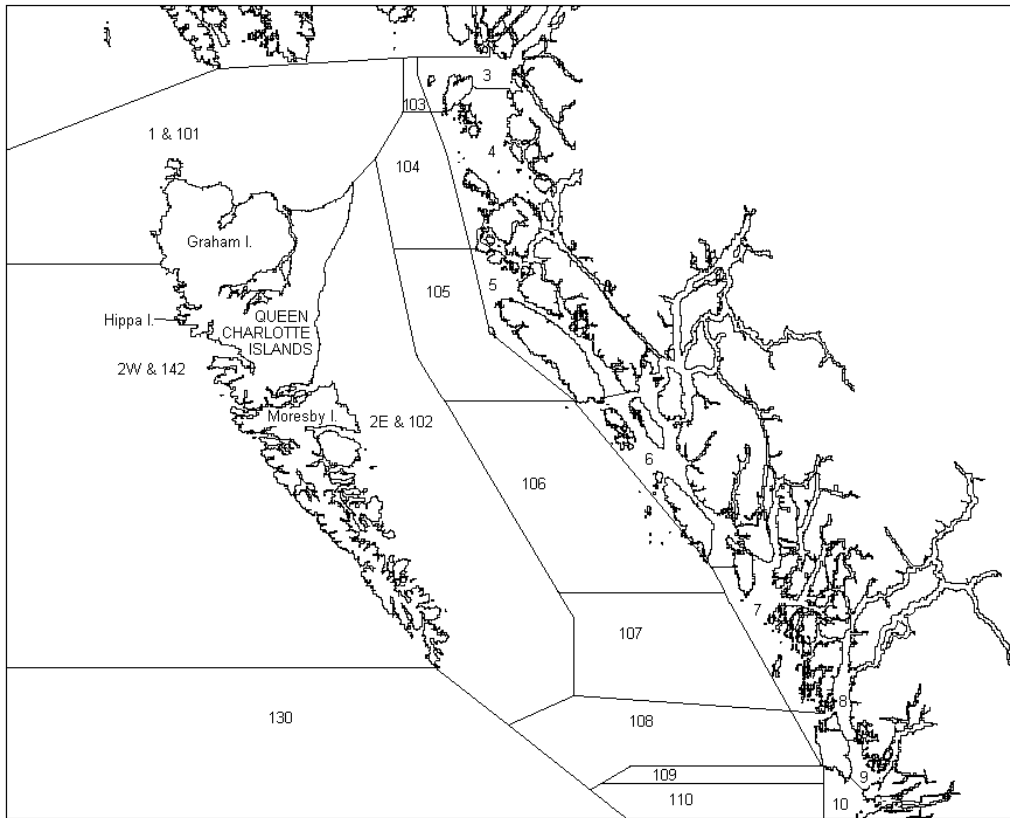


Figure 1. The North Coast of British Columbia showing Pacific Fishery Management Areas 1 to 10, 101 to 110, 130 and 142.

## APPENDICES

Appendix 1. Scale sampling instructions for Chinook salmon caught in the 2018 Northern British Columbia, Area 1 Recreational fishery.

### 2018 FISHING LODGE CHINOOK SAMPLE INSTRUCTIONS

The sample data will consist of date, length and sex information matched to scales. Scales will be collected onto scale books and the age information and DNA will be extracted from the scales. Please sample 5 Chinook salmon each day that the lodge operates according to the following protocol:

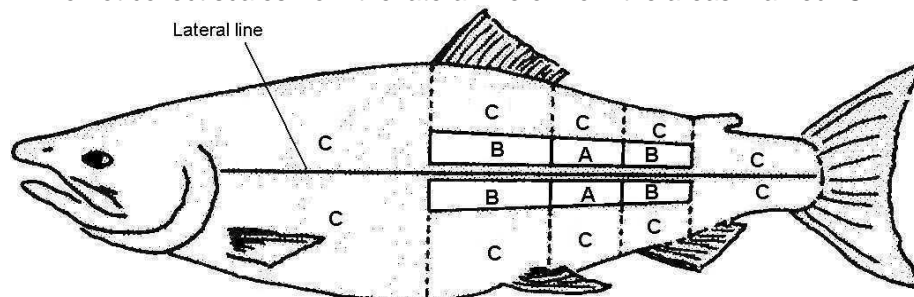
- 75 scale books have been provided. Each book holds 50 scales for 10 fish sampled at 5 scales per fish.
- Please collect samples from 5 Chinook salmon per day. You can modify this procedure so long as you set up a program in advance and stick to it.
- On days where you can't sample 5 fish, simply collect those samples from the catch on the following day.
- It's important that you collect a random sample and not select fish. You might sample the first 5 fish that arrive at the dock each day (or use some other way to ensure that you randomize the sample).
- Collect 5 scales from each fish as noted below.
- The scale books are individually numbered and the number must be entered on the data sheet.
- Note the date sampled on the back of this sheet. Use dittos or arrows for fish sampled on the same day.
- Record the length to the nearest cm and determine the sex for each fish sampled.

If you have a special fish that you want sampled, like a huge Chinook or a derby winner, collect the scale sample as above in a separate scale book and put a note at the bottom of the sample sheet describing why it's special. Other valuable data would be the date, length, sex and whether the chinook had an adipose fin clip or not. In the past you have collected samples from all the fish over 40 pounds. Thanks. It would be great if you could continue to collect this fascinating sample. If you have any questions feel free to call or email.

Please return all data and samples to: Ivan Winther, Fisheries & Oceans Canada  
417 West 2<sup>nd</sup> Avenue  
Prince Rupert, B.C. V8J-1G8  
(250) 627-3459 Ivan.Winther@dfo-mpo.gc.ca

### SCALE SAMPLES:

- Record the scale book number on the data sheet.
- Collect 5 scales from the chinook salmon as follows:
- Scale samples must come from preferred locations on the fish as indicated by an "A" in the diagram below.
- Avoid collecting scales near scars, wounds or net marks. To avoid scars you may have to collect scales from the locations marked "B" in the diagram below.
- Do not collect scales from the lateral line or from the areas marked "C".



- Using forceps, remove a scale from the preferred location.



- Check the scale to ensure the rings extend all the way to the center of the scale. If not, discard the scale and select another. Regenerated scales have a clear spot in the center of the scale that is missing the rings necessary to determine the age of the fish.
- Wipe off the scale and add it to the scale book on the appropriate numbered square.
- Do not turn the scale over. The scale should be mounted in the book with the same side up as it was on the fish.
- Select 5 scales from the fish, 3 from one side and 2 from the other.
- The 5 scales are applied to the numbered squares in the book from top to bottom starting at the column with numbers 1, 11, 21, 31 & 41. Scales from the second fish are applied to squares 2, 12, 22, 32 & 42. etc.
- THE SCALES in the SCALE BOOKS MUST MATCH THE NUMBERS ON THE DATA SHEETS.
- Keep the scale books dry.
- Once the book is full, fill out the information on the back of the page bearing the scales. Let the books dry out completely then store in a dry location.

Sport Chinook Salmon scale samples

**Scale Book # \_\_\_\_\_**

| DATE | Length (cm) | SEX (M / F) | SCALE #  |
|------|-------------|-------------|----------|
|      |             | M / F       | 1 to 41  |
|      |             | M / F       | 2 to 42  |
|      |             | M / F       | 3 to 43  |
|      |             | M / F       | 4 to 44  |
|      |             | M / F       | 5 to 45  |
|      |             | M / F       | 6 to 46  |
|      |             | M / F       | 7 to 47  |
|      |             | M / F       | 8 to 48  |
|      |             | M / F       | 9 to 49  |
|      |             | M / F       | 10 to 50 |

**Scale Book # \_\_\_\_\_**

| DATE | Length (cm) | SEX (M / F) | SCALE #  |
|------|-------------|-------------|----------|
|      |             | M / F       | 1 to 41  |
|      |             | M / F       | 2 to 42  |
|      |             | M / F       | 3 to 43  |
|      |             | M / F       | 4 to 44  |
|      |             | M / F       | 5 to 45  |
|      |             | M / F       | 6 to 46  |
|      |             | M / F       | 7 to 47  |
|      |             | M / F       | 8 to 48  |
|      |             | M / F       | 9 to 49  |
|      |             | M / F       | 10 to 50 |

**Scale Book # \_\_\_\_\_**

|  |  |       |          |
|--|--|-------|----------|
|  |  | M / F | 1 to 41  |
|  |  | M / F | 2 to 42  |
|  |  | M / F | 3 to 43  |
|  |  | M / F | 4 to 44  |
|  |  | M / F | 5 to 45  |
|  |  | M / F | 6 to 46  |
|  |  | M / F | 7 to 47  |
|  |  | M / F | 8 to 48  |
|  |  | M / F | 9 to 49  |
|  |  | M / F | 10 to 50 |

Notes:

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## Appendix 2. Baseline samples used in the mixture analyses.

| # | Region | Population     | N   | #  | Region | Population      | N    |
|---|--------|----------------|-----|----|--------|-----------------|------|
| 1 | UPFR   | Bowron         | 250 | 6  | LWTH   | U_Coldwat_SP    | 221  |
| 1 | UPFR   | Dome           | 382 | 6  | LWTH   | U_Spius_SP      | 175  |
| 1 | UPFR   | Fontoniko      | 63  | 7  | ECVI   | Big_Qualicum    | 365  |
| 1 | UPFR   | Goat           | 76  | 7  | ECVI   | Chemainus       | 261  |
| 1 | UPFR   | Holliday_Cr    | 29  | 7  | ECVI   | Cowichan        | 680  |
| 1 | UPFR   | Holmes         | 219 | 7  | ECVI   | L_Qualicum      | 305  |
| 1 | UPFR   | Horsey         | 47  | 7  | ECVI   | Nanaimo_F       | 523  |
| 1 | UPFR   | Indianpoint    | 47  | 7  | ECVI   | Nanaimo_SP      | 95   |
| 1 | UPFR   | James          | 58  | 7  | ECVI   | Nanaimo_SU      | 459  |
| 1 | UPFR   | Kenneth_Cr     | 98  | 7  | ECVI   | NanaimoSu_BackX | 135  |
| 1 | UPFR   | McGregor       | 125 | 7  | ECVI   | Nimpkish        | 316  |
| 1 | UPFR   | Morkill        | 208 | 7  | ECVI   | Puntledge_BackX | 1025 |
| 1 | UPFR   | Nevin_Cr       | 50  | 7  | ECVI   | Puntledge_F     | 652  |
| 1 | UPFR   | Ptarmigan      | 32  | 7  | ECVI   | Puntledge_Su    | 1120 |
| 1 | UPFR   | Salmon@PG      | 263 | 7  | ECVI   | Quatse          | 30   |
| 1 | UPFR   | Slim_C         | 240 | 7  | ECVI   | Quinsam         | 503  |
| 1 | UPFR   | Swift          | 448 | 7  | ECVI   | Woss_Lake       | 31   |
| 1 | UPFR   | Tete_Jaune     | 475 | 8  | WCVI   | Burman          | 315  |
| 1 | UPFR   | Torpy          | 174 | 8  | WCVI   | Colonial_Cay    | 58   |
| 1 | UPFR   | Walker         | 45  | 8  | WCVI   | Conuma          | 455  |
| 1 | UPFR   | Willow_R       | 117 | 8  | WCVI   | Gold_R          | 227  |
| 2 | MUFR   | Baezaeko       | 82  | 8  | WCVI   | Kaouk_R         | 196  |
| 2 | MUFR   | Baker_Cr       | 31  | 8  | WCVI   | Kennedy         | 383  |
| 2 | MUFR   | Bridge         | 424 | 8  | WCVI   | Marble@NVI      | 512  |
| 2 | MUFR   | Chilako        | 45  | 8  | WCVI   | Megin_R         | 90   |
| 2 | MUFR   | Chilko         | 425 | 8  | WCVI   | Moyeha_R        | 57   |
| 2 | MUFR   | Cottonwood     | 176 | 8  | WCVI   | Nahmint         | 411  |
| 2 | MUFR   | Elkin_R        | 248 | 8  | WCVI   | Nitinat         | 346  |
| 2 | MUFR   | Endako         | 207 | 8  | WCVI   | Robertson       | 388  |
| 2 | MUFR   | Horsefly       | 80  | 8  | WCVI   | San_Juan        | 202  |
| 2 | MUFR   | Kuzkwa_Cr      | 93  | 8  | WCVI   | Sarita          | 429  |
| 2 | MUFR   | L_Cariboo      | 104 | 8  | WCVI   | Sooke           | 58   |
| 2 | MUFR   | L_Chilcoti     | 236 | 8  | WCVI   | Stamp           | 299  |
| 2 | MUFR   | Nazko          | 194 | 8  | WCVI   | Tahsis          | 355  |
| 2 | MUFR   | Nechako        | 562 | 8  | WCVI   | Thornton        | 522  |
| 2 | MUFR   | Portage_C      | 286 | 8  | WCVI   | Tlupana         | 66   |
| 2 | MUFR   | Quesnel        | 562 | 8  | WCVI   | Toquart         | 87   |
| 2 | MUFR   | Stuart         | 545 | 8  | WCVI   | Tranquil        | 395  |
| 2 | MUFR   | Taseko         | 205 | 8  | WCVI   | Zeballos        | 199  |
| 2 | MUFR   | U_Cariboo      | 171 | 9  | SOMN   | Bute            | 66   |
| 2 | MUFR   | U_Chilcotin    | 276 | 9  | SOMN   | Capilano        | 126  |
| 2 | MUFR   | Westroad       | 104 | 9  | SOMN   | Cheakamus       | 50   |
| 3 | LWFR-F | Chilliwac@Stav | 381 | 9  | SOMN   | Cheakamus_F     | 114  |
| 3 | LWFR-F | Chilliwack_F   | 696 | 9  | SOMN   | Cheakamus_Su    | 40   |
| 3 | LWFR-F | Harrison       | 686 | 9  | SOMN   | Devereux        | 325  |
| 4 | NOTH   | Barriere       | 55  | 9  | SOMN   | Homathko        | 51   |
| 4 | NOTH   | Blue           | 84  | 9  | SOMN   | Klinaklini      | 472  |
| 4 | NOTH   | Clearwater     | 281 | 9  | SOMN   | Mamquam         | 35   |
| 4 | NOTH   | Finn           | 211 | 9  | SOMN   | Phillips        | 641  |
| 4 | NOTH   | Lemieux_Cr     | 153 | 9  | SOMN   | Squamish_R      | 161  |
| 4 | NOTH   | N_Thom@Main    | 116 | 10 | NOMN   | Ashlulm         | 66   |
| 4 | NOTH   | Raft_R         | 457 | 10 | NOMN   | Atnarko         | 275  |
| 5 | SOTH   | Bessette       | 164 | 10 | NOMN   | Chuckwalla      | 315  |
| 5 | SOTH   | Duteau_Cr      | 73  | 10 | NOMN   | Dean            | 219  |
| 5 | SOTH   | Eagle_R        | 331 | 10 | NOMN   | Dean@Main       | 25   |
| 5 | SOTH   | L_Adams        | 340 | 10 | NOMN   | Docee           | 126  |
| 5 | SOTH   | L_Shus@U_Adams | 46  | 10 | NOMN   | Hirsch          | 474  |
| 5 | SOTH   | L_Shuswap      | 389 | 10 | NOMN   | Kateen          | 244  |
| 5 | SOTH   | L_Thompson     | 229 | 10 | NOMN   | Kilbella        | 196  |
| 5 | SOTH   | Little_R       | 254 | 10 | NOMN   | Kildala         | 441  |
| 5 | SOTH   | M_Shuswap      | 375 | 10 | NOMN   | Kitimat         | 483  |
| 5 | SOTH   | Salmon@SA      | 215 | 10 | NOMN   | Kitlope         | 201  |
| 5 | SOTH   | Seymour@Thomp  | 44  | 10 | NOMN   | Kwinamass       | 362  |
| 5 | SOTH   | South_Thom     | 266 | 10 | NOMN   | LowAtnarko      | 50   |
| 6 | LWTH   | Bonaparte      | 344 | 10 | NOMN   | Marble@CC       | 41   |
| 6 | LWTH   | Coldwater      | 274 | 10 | NOMN   | Neechanze       | 57   |
| 6 | LWTH   | Deadman        | 492 | 10 | NOMN   | Nusatsum        | 103  |
| 6 | LWTH   | Louis          | 618 | 10 | NOMN   | Saloompt        | 138  |
| 6 | LWTH   | Nicola         | 433 | 10 | NOMN   | Takia           | 63   |
| 6 | LWTH   | Spius          | 137 | 10 | NOMN   | U_Atnarko       | 200  |

| #  | Region         | Population     | N   | #  | Region                 | Population     | N   |
|----|----------------|----------------|-----|----|------------------------|----------------|-----|
| 10 | NOMN           | U_Dean         | 203 | 23 | Skeena Lower           | Kitsumkalum_R  | 810 |
| 10 | NOMN           | Wannock_R      | 506 | 23 | Skeena Lower           | Thomas_Cr      | 117 |
| 11 | NASS           | Cranberry      | 175 | 23 | Skeena Lower           | Zymogotitz_R   | 120 |
| 11 | NASS           | Damdochax      | 273 | 24 | Alsek                  | Blanchard      | 381 |
| 11 | NASS           | Ishkheenickh   | 199 | 24 | Alsek                  | Goat_Cr        | 134 |
| 11 | NASS           | Kincolith      | 286 | 24 | Alsek                  | Klukshu        | 433 |
| 11 | NASS           | Kiteen         | 59  | 24 | Alsek                  | Kudwat_Cr      | 70  |
| 11 | NASS           | Kwinageese     | 266 | 24 | Alsek                  | Takhanne       | 218 |
| 11 | NASS           | Meziadin       | 194 | 24 | Alsek                  | Tatshenshi     | 24  |
| 11 | NASS           | Owegee         | 235 | 50 | Puget Sound            | Green@Kendal_F | 50  |
| 11 | NASS           | Seaskinnish    | 99  | 50 | Puget Sound            | Green_F@Soos   | 100 |
| 11 | NASS           | Snowbank       | 51  | 50 | Puget Sound            | Nooksack_SP@Ke | 200 |
| 11 | NASS           | Teigen         | 30  | 50 | Puget Sound            | Serpentine     | 46  |
| 11 | NASS           | Tseax          | 244 | 50 | Puget Sound            | Skagit_Su      | 310 |
| 12 | LWFR-Sp        | Big_Silver     | 210 | 50 | Puget Sound            | Skykomish_Su   | 114 |
| 12 | LWFR-Sp        | Birkenhead     | 347 | 50 | Puget Sound            | Snohomish_R    | 306 |
| 12 | LWFR-Sp        | BlueCr_UpPitt  | 50  | 50 | Puget Sound            | Soos_Cr_H      | 183 |
| 12 | LWFR-Sp        | Sloquet_Cr     | 35  | 50 | Puget Sound            | StillaguamishS | 87  |
| 12 | LWFR-Sp        | Upper_Pitt     | 235 | 50 | Puget Sound            | White_F        | 252 |
| 13 | LWFR-Su        | Maria_Slough   | 366 | 51 | Juan de Fuca           | Elwha_F        | 99  |
| 13 | LWFR-Su        | Nahatlatch_R   | 26  | 52 | Coastal Wash           | Hoh_River_SP_S | 59  |
| 14 | QCI            | Yakoun         | 211 | 52 | Coastal Wash           | Queets         | 138 |
| 15 | Alaska         | Big_Boulder_C  | 144 | 52 | Coastal Wash           | Quinault_F     | 100 |
| 15 | Alaska         | Chickamin      | 259 | 52 | Coastal Wash           | Solduc_F       | 98  |
| 15 | Alaska         | King_Salmon    | 266 | 52 | Coastal Wash           | Willapa_Cr     | 261 |
| 15 | Alaska         | Situk          | 132 | 53 | Low Col                | Abernathy_F    | 100 |
| 15 | Alaska         | Tahini         | 142 | 53 | Low Col                | Coweeman       | 195 |
| 15 | Alaska         | Unuk           | 336 | 53 | Low Col                | Cowlitz_H_Sp   | 138 |
| 17 | Taku           | Dudidontu      | 352 | 54 | Up Col-Sp              | Chewuch_SP     | 100 |
| 17 | Taku           | Hackett_r      | 233 | 54 | Up Col-Sp              | Chiwawa_SP     | 100 |
| 17 | Taku           | Kowatua        | 379 | 54 | Up Col-Sp              | Entiat_SP      | 142 |
| 17 | Taku           | Little_Tatsam  | 698 | 54 | Up Col-Sp              | Twisp_SP       | 227 |
| 17 | Taku           | Nahlin         | 303 | 55 | Up Col-Su/F            | Deschutes-F    | 230 |
| 17 | Taku           | Nakina         | 480 | 55 | Up Col-Su/F            | Hanford_Reach  | 617 |
| 17 | Taku           | Tatsamenie     | 38  | 55 | Up Col-Su/F            | Okanagan       | 132 |
| 17 | Taku           | Tseta          | 327 | 55 | Up Col-Su/F            | Osoyoos_Resid  | 35  |
| 17 | Taku           | Yeth_Cr        | 53  | 55 | Up Col-Su/F            | Silmilkameen_S | 370 |
| 18 | Stikine        | Andrew_Cr      | 144 | 55 | Up Col-Su/F            | Wenatchee_Su   | 235 |
| 18 | Stikine        | Christina      | 240 | 56 | Snake-Sp/Su            | Frenchman-SP   | 61  |
| 18 | Stikine        | Craig          | 114 | 56 | Snake-Sp/Su            | Imnaha         | 239 |
| 18 | Stikine        | Johnny_Tashoot | 99  | 56 | Snake-Sp/Su            | Johnson_Cr     | 240 |
| 18 | Stikine        | Little_Tahltan | 745 | 56 | Snake-Sp/Su            | Marsh_Cr       | 220 |
| 18 | Stikine        | Shakes_Cr      | 225 | 56 | Snake-Sp/Su            | McCall         | 32  |
| 18 | Stikine        | Tahltan_R      | 212 | 56 | Snake-Sp/Su            | McCall_Hat     | 41  |
| 18 | Stikine        | Verrett        | 854 | 56 | Snake-Sp/Su            | Minam_Cr       | 144 |
| 19 | Skeena Upper   | Bear           | 270 | 56 | Snake-Sp/Su            | Rapid_Sp       | 363 |
| 19 | Skeena Upper   | Kluatantan     | 38  | 56 | Snake-Sp/Su            | Salmon_E_Fork  | 53  |
| 19 | Skeena Upper   | Kluayaz_Cr     | 165 | 56 | Snake-Sp/Su            | Secech         | 277 |
| 19 | Skeena Upper   | Kuldo_C        | 171 | 56 | Snake-Sp/Su            | Snake_S        | 36  |
| 19 | Skeena Upper   | Otsi_Cr        | 276 | 56 | Snake-Sp/Su            | Tucannon_SP    | 274 |
| 19 | Skeena Upper   | Sicintine_R    | 319 | 56 | Snake-Sp/Su            | Up_Salmon-SP   | 165 |
| 19 | Skeena Upper   | Slamgeesh      | 129 | 56 | Snake-Sp/Su            | Upper_Valley   | 77  |
| 19 | Skeena Upper   | Squingula_R    | 271 | 56 | Snake-Sp/Su            | Valley_Cr      | 43  |
| 19 | Skeena Upper   | Sustut         | 509 | 56 | Snake-Sp/Su            | Wenaha         | 89  |
| 20 | Skeena Babine  | Babine         | 198 | 57 | Snake-F                | Lyon's_Ferry_F | 370 |
| 21 | Skeena Bulkley | Bulkley_Early  | 567 | 58 | North & Central Oregon | Cle_Elm_Hatch  | 95  |
| 21 | Skeena Bulkley | Morice_R       | 243 |    |                        |                |     |
| 21 | Skeena Bulkley | Suskwa         | 111 | 58 | North & Central Oregon | Elk            | 206 |
| 22 | Skeena Mid     | Kispiox        | 197 |    |                        |                |     |
| 22 | Skeena Mid     | Kitseguecla_R  | 260 | 58 | North & Central Oregon | Euchre_Cr      | 57  |
| 22 | Skeena Mid     | Kitwanga       | 284 |    |                        |                |     |
| 22 | Skeena Mid     | Nangeese_R     | 32  | 58 | North & Central Oregon | Nehalem        | 327 |
| 22 | Skeena Mid     | Shegunia_R     | 132 |    |                        |                |     |
| 22 | Skeena Mid     | Sweetin        | 245 |    |                        |                |     |
| 23 | Skeena Lower   | Cedar_Early    | 116 | 58 | North & Central Oregon | Siuslaw        | 258 |
| 23 | Skeena Lower   | Ecstall        | 367 |    |                        |                |     |
| 23 | Skeena Lower   | Exchamsiks     | 116 | 58 | North & Central Oregon | Trask_hat_F    | 236 |
| 23 | Skeena Lower   | Extstew_R      | 140 |    |                        |                |     |
| 23 | Skeena Lower   | Fiddler_Cr     | 113 | 58 | North & Central Oregon | Trask_hat_SP   | 48  |
| 23 | Skeena Lower   | Gitnadoix      | 245 |    |                        |                |     |
| 23 | Skeena Lower   | Kasiks_R       | 63  | 58 | North & Central Oregon | Umpqua_Smith   | 229 |
| 23 | Skeena Lower   | Khyex_R        | 37  |    |                        |                |     |

| #  | Region               | Population    | N   |
|----|----------------------|---------------|-----|
| 59 | South Oregon coastal | Cole          | 188 |
| 59 | South Oregon coastal | Hunter_Cr     | 96  |
| 59 | South Oregon coastal | Lobster_Cr    | 49  |
| 59 | South Oregon coastal | Nestucca_F    | 153 |
| 59 | South Oregon coastal | Pistol        | 98  |
| 59 | South Oregon coastal | Umpqua_Sp     | 136 |
| 59 | South Oregon coastal | Winchuk       | 80  |
| 61 | Klamath/Trinity      | Blue_Cr       | 94  |
| 61 | Klamath/Trinity      | Salmon_Cal    | 28  |
| 61 | Klamath/Trinity      | Trinity_F     | 244 |
| 61 | Klamath/Trinity      | Trinity_SP    | 100 |
| 62 | Mid Col-Sp           | Granite       | 93  |
| 62 | Mid Col-Sp           | John_Day_main | 228 |
| 62 | Mid Col-Sp           | John_Day_Mid  | 40  |
| 62 | Mid Col-Sp           | John_Day_N    | 40  |
| 62 | Mid Col-Sp           | Naches_Sp     | 109 |
| 62 | Mid Col-Sp           | Spring_Cr_H   | 137 |
| 63 | Up Willamette        | Clackamas_N   | 79  |
| 63 | Up Willamette        | North_Santiam | 236 |
| 63 | Up Willamette        | Sandy         | 208 |
| 64 | Cent Val-F           | American      | 69  |
| 64 | Cent Val-F           | Battle_Cr     | 183 |
| 64 | Cent Val-F           | Butte_F       | 49  |
| 64 | Cent Val-F           | Feather_F     | 272 |
| 64 | Cent Val-F           | Merced        | 200 |
| 64 | Cent Val-F           | Mokelumne     | 95  |
| 64 | Cent Val-F           | Sacr_F        | 129 |
| 64 | Cent Val-F           | Sacr_LF       | 211 |
| 64 | Cent Val-F           | Stanislaus    | 101 |
| 64 | Cent Val-F           | Toulumne      | 34  |
| 64 | Cent Val-F           | Yuba          | 50  |
| 65 | Cent Val-Sp          | Butte_Sp      | 186 |
| 65 | Cent Val-Sp          | Feather_Sp    | 226 |
| 65 | Cent Val-Sp          | Yuba_Sp       | 32  |
| 66 | Coastal California   | Eel_F         | 279 |

