Genetic Analyses of samples collected in the Recreational Chinook Salmon Fisheries in Northern British Columbia 2015

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Winther, I. 2015. Genetic analyses of samples collected in the recreational Chinook salmon fisheries in northern British Columbia 2015. Unpublished report for the Pacific Salmon Commission Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund 2015. File # NF-2015-I-25: iv + 20 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 2015 NBC recreational fisheries in the waters of Chatham Sound and the waters around Langara Island and Graham Island. Stock compositions were applied to 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 2015. 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 2015 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 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 remain over 50,000 Chinook salmon annually.

Scale samples were collected from Chinook salmon caught in Areas 1, 3 and 4 in 2015. 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).

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 Nass and Skeena river systems are PSC escapement indicator stocks that drain into Chatham Sound.

Within the 25 fisheries currently defined in the Pacific Salmon Treaty (PST) Chinook model, recreational fisheries in northern British Columbia have been modeled as the North and Central BC (NCBC) Sport fishery which represents an aggregate of all Canadian sport fisheries north of Cape Caution. An issue known to the Chinook technical committee (CTC) is that the Chinook stocks from northern BC are over-represented in most of the modeled fisheries where they are encountered, but especially in the NCBC Sport fishery (Figure 2). Further, the current model fishery representing NCBC sport fisheries doesn't fit the AABM and ISBM area boundaries defined in 1999. The AABM model fishery for NBC includes NBC Troll fisheries in Areas 1 to 10 and QCI Sport fisheries in Areas 1 and 2. Sport fisheries in areas 3 through 10 are designated as ISBM fisheries. Proposed model improvements include separation of the AABM and ISBM components 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 NCBC Sport model fishery. The Haida Gwaii sport and the Chatham Sound sport fisheries are scheduled to be separated in future model improvements. Examination of actual stock mixes encountered by the fishery can guide 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 Kwinamass and Khutzeymateen River Chinook) and for accounting of Nisga'a

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 2015. 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. In Area 3 the months of July and August were pooled due to small sample size in August.

Two programs provided accounting of Chinook salmon caught in NBC recreational fisheries; lodge logbook programs and creel surveys. 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 2015 logbook program. 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 May to September. Creel survey crews from Prince Rupert sampled fishery landings from Chatham Sound, Areas 3 and 4. Individual Chinook salmon were sampled for nose-fork length, gender and scales. Gender could not be determined for fish that were landed after being dressed. Scale collections were matched to data on the area fished and date caught (Appendix 1).

A separate sample collected from Langara Island was a sample of large fish. All Chinook salmon over 40 pounds (18 kg) were sampled for size, gender and scales. This sample was kept separate from the random sample.

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 31,800 in 2015 and the Area 1 fishery was sampled at Langara Island. Samples were collected from 149 fish in June, and 155 fish in each month of July and August. Samples from the end of May included 30 fish and 34 fish were sampled from the beginning of September. The smaller sample sizes in May and September reflect catches from 6 and 7 days when the lodges began and concluded operations respectively. The scales samples from Langara Island represented 1.6% 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 a large proportion (23.3%) of the samples collected in May even though the sample size was small. The proportion of WCVI Chinook in the sample dropped to 15% in June. The highest proportion of WCVI fish was observed in August at 26.6% (Table 2). High proportions of fish from the Upper Columbia Summer / fall group persisted through the entire year.

Two stock groups dominated the samples of fish over 40 pounds sampled at Langara Island; the Skeena and Northern Mainland (NOMN) stock groups. Among the 32 fish over 40 pounds that were sampled, 31 of them (97%) came from the two major stock groups (Table 2). Fish from the Skeena stock group made up 25% of the sample and the NOMN stock group made up 72% of the sample. A single fish (3%) was from the Upper Pitt River in the Lower Fraser Spring stock group. When the specific stocks within the groups were examined we found that most of the fish over 40 pounds were from the Wannock River (20) in the NOMN stock group and from the Kitsumkalum River (8) in the Skeena stock group. The two remaining fish were from the Kateen River, a tributary of the Khutzeymateen River in the NOMN stock group. These large fish samples are dramatically different from the random samples where the Northern Mainland and Skeena stock groups contributed 8.5% and 3.5% to the catch respectively (Tables 1 and 2).

Chinook from the Skeena River stock group formed the largest component of the catch at 30.9% of the fish caught in Chatham Sound, Areas 3 and 4. Skeena Chinook formed the main component of the samples collected in Area 3 and 4 in all months except for Area 4 in August (Table 4). The second largest component in the Area 3 and 4 catch was from the South Thompson (SOTH) at 19.5%. Fish from the Skeena stock group made up most of the Area 3 (Table 5) and Area 4 catch (Table 6). Large contributions were also made by WCVI fish at 10.4% and Upper Columbia Summer / Fall fish at 9.8% (Table 7). The Nass River drains into Area 3 and has a large Chinook population but it made up only 6.8% and 1.1% of the Area 3 and Area 4 catches respectively. The total contribution to the Chatham Sound fishery was 500 Nass Chinook (Table 5, Table 6 and Table 7).

DISCUSSION

This report summarizes the results of genetic analyses of samples collected from 2015 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 2015 creel survey so the stock specific impacts presented remain preliminary. Size and age information were collected but have not been analyzed or presented.

There were no management constraints on recreational fisheries for Chinook in the North Coast in 2015. Fisheries in Areas 1 through 10 operated under the maximum daily bag, possession and annual limits offered under the current allocation policy: Sport fishing for Chinook salmon was open with a daily limit of two per day, a possession limit of four, and an annual limit of 30 Chinook salmon. A minimum size limit of 45 cm was in effect and barbless hooks were mandatory. An estimated 52,200 chinook were caught in the Haida Gwaii sport fishery and 12,756 were caught in Chatham Sound.

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 I've applied the stock compositions 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 have been undertaken by commercial fisheries. 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 but it was within 1,500 fish in 2015 (preliminary catch estimate of 158,903 out of a total allowable catch of 160,400).

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).

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 2015 data for Area 1 recreational fisheries. 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 2015 Area 1 Recreational fishery. Standard deviations (STD) appear in brackets. N = 523.

Code	Region	Proportion	STD	Catch	STD
1	Upper Fraser (UPFR)	0.3	(0.3)	105	(85)
2	Middle-Upper Fraser (MUFR)	0.1	(0.2)	36	(56)
3	Lower Fraser Fall (LWFR-F)	0.0	(0.0)	1	(15)
4	North Thompson (NOTH)	0.0	(0.1)	0	(20)
5	South Thompson (SOTH)	8.7	(1.3)	2,782	(411)
6	Lower Thompson (LWTH)	0.0	(0.1)	3	(27)
7	East Coast Vancouver Island (ECVI)	1.5	(0.6)	485	(189)
8	West Coast Vancouver Island (WCVI)	20.5	(1.8)	6,505	(570)
9	Southern BC Mainland (SOMN)	0.6	(0.4)	183	(125)
10	Northern BC Mainland (NOMN)	8.5	(1.3)	2,701	(424)
11	Nass	0.6	(0.4)	186	(120)
12	Lower Fraser Spring (LWFR-Sp)	0.2	(0.3)	75	(80)
13	Lower Fraser Summer (LWFR-Su)	0.0	(0.0)	0	(12)
14	Haida Gwaii (QCI)	0.6	(0.4)	203	(118)
15	Alaska	0.0	(0.1)	2	(25)
17	Taku	0.1	(0.2)	25	(64)
18	Stikine	0.2	(0.3)	56	(96)
19-23	Skeena	3.5	(1.0)	1,105	(328)
24	Alsek	0.0	(0.1)	0	(16)
50	Puget Sound	0.5	(0.3)	146	(103)
51	Juan de Fuca	0.2	(0.2)	68	(68)
52	Coastal Washington	12.0	(1.6)	3,815	(502)
53	Lower Columbia	0.5	(0.3)	152	(105)
54	Upper Columbia Spring	0.0	(0.1)	0	(16)
55	Upper Columbia Summer/Fall	34.3	(2.3)	10,898	(722)
56	Snake Spring/Summer	0.0	(0.1)	2	(35)
57	Snake Fall	2.3	(1.0)	721	(319)
58	North & Central Oregon	3.7	(1.0)	1,166	(310)
59	South Oregon Coastal	0.4	(0.3)	114	(102)
61	Klamath/Trinity	0.0	(0.1)	1	(16)
62	Middle Columbia Spring	0.0	(0.1)	7	(32)
63	Upper Willamette	0.7	(0.4)	224	(119)
64	Central Valley Fall	0.1	(0.2)	29	(56)
65	Central Valley Spring	0.0	(0.0)	0	(13)
66	Coastal California	0.0	(0.0)	0	(5)
	TOTAL	100.0		31,800	(85)

Table 2. Chinook stock proportions observed in monthly samples from 2015 Area 1 Recreational catches.

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

	Year	2015		2015		2015		2015		2015		2015	
	Month	May		June		July		August		September		May-Sep	
	Sample type	Random		Random		Random		Random		Random		Large fish	
	N	30		149		155		155		34		32	
Code	Region	%	STD	%	STD	%	STD	%	STD	%	STD	%	STD
1	Upper Fraser (UPFR)	0.0	(0.8)	1.3	(1.0)	0.0	(0.2)	0.0	(0.2)	0.0	(0.9)	0.0	(0.7)
2	Middle-Upper Fraser (MUFR)	3.4	(3.5)	0.1	(0.4)	0.0	(0.3)	0.0	(0.2)	0.4	(1.4)	0.0	(0.7)
3	Lower Fraser Fall (LWFR-F)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.1	(0.5)	0.0	(0.8)
4	North Thompson (NOTH)	0.0	(0.5)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.4)	0.0	(0.5)
5	South Thompson (SOTH)	13.9	(6.0)	11.4	(2.6)	8.2	(2.3)	7.4	(2.2)	6.0	(4.2)	0.0	(0.6)
6	Lower Thompson (LWTH)	0.0	(0.4)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.2	(1.2)	0.0	(0.4)
7	East Coast Vancouver Island (ECVI)	0.0	(0.8)	1.2	(1.0)	2.3	(1.3)	1.4	(1.0)	0.0	(0.6)	0.0	(0.7)
8	West Coast Vancouver Island (WCVI)	23.3	(7.7)	14.9	(2.9)	18.3	(3.1)	26.6	(3.5)	20.1	(6.5)	0.0	(0.7)
9	Southern BC Mainland (SOMN)	0.0	(0.8)	0.0	(0.3)	1.7	(1.1)	0.0	(0.2)	0.1	(1.0)	0.0	(0.4)
10	Northern BC Mainland (NOMN)	3.6	(3.5)	11.1	(2.9)	7.9	(2.4)	8.6	(2.3)	0.0	(0.7)	71.8	(8.1)
11	Nass	3.6	(4.3)	1.8	(1.3)	0.2	(0.5)	0.0	(0.1)	0.0	(0.5)	0.0	(0.7)
12	Lower Fraser Spring (LWFR-Sp)	0.0	(0.5)	0.0	(0.1)	0.0	(0.2)	0.7	(0.7)	0.0	(0.5)	3.1	(2.9)
13	Lower Fraser Summer (LWFR-Su)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)
14	Haida Gwaii (QCI)	0.0	(0.2)	0.0	(0.0)	1.9	(1.1)	0.0	(0.0)	0.0	(0.1)	0.0	(0.3)
15	Alaska	0.0	(0.5)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.4)	0.0	(0.3)
17	Taku	1.1	(2.8)	0.1	(0.6)	0.1	(0.4)	0.0	(0.1)	0.0	(0.4)	0.0	(0.6)
18	Stikine	0.4	(1.5)	0.2	(0.5)	0.4	(0.8)	0.0	(0.2)	0.0	(0.5)	0.0	(0.5)
19-23	Skeena	10.2	(6.1)	3.6	(2.1)	7.2	(2.6)	0.0	(0.2)	0.0	(1.1)	24.9	(7.7)
24	Alsek	0.0	(0.4)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.4)	0.0	(0.5)
50	Puget Sound	0.0	(0.7)	0.0	(0.2)	1.4	(1.0)	0.0	(0.2)	0.1	(0.8)	0.0	(0.6)
51	Juan de Fuca	0.0	(0.3)	0.0	(0.0)	0.6	(0.6)	0.0	(0.0)	0.0	(0.2)	0.0	(0.3)
52	Coastal Washington	6.9	(4.4)	11.5	(2.7)	11.8	(2.8)	11.6	(2.9)	20.0	(7.3)	0.0	(0.3)
53	Lower Columbia	0.0	(0.3)	1.6	(1.1)	0.0	(0.1)	0.1	(0.3)	0.7	(2.3)	0.0	(0.2)
54	Upper Columbia Spring	0.0	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.4)	0.0	(0.2)
55	Upper Columbia Summer/Fall	30.0	(8.1)	32.6	(4.2)	28.7	(4.2)	41.0	(4.0)	34.0	(8.3)	0.0	(0.3)
56	Snake Spring/Summer	0.0	(0.8)	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)	0.0	(0.7)	0.1	(1.0)
57	Snake Fall	0.0	(0.4)	3.2	(2.2)	4.3	(2.5)	0.0	(0.3)	0.0	(0.2)	0.0	(0.1)
58	North & Central Oregon	0.0	(0.6)	2.1	(1.3)	4.8	(1.9)	1.9	(1.7)	17.8	(6.7)	0.0	(0.4)
59	South Oregon Coastal	0.0	(0.6)	0.5	(0.7)	0.1	(0.4)	0.5	(0.7)	0.0	(0.5)	0.0	(0.4)
61	Klamath/Trinity	0.0	(0.5)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
62	Middle Columbia Spring	0.0	(0.4)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.1	(0.5)	0.0	(0.5)
63	Upper Willamette	3.3	(3.2)	2.4	(1.4)	0.0	(0.1)	0.1	(0.3)	0.0	(0.4)	0.0	(0.2)
64	Central Valley Fall	0.0	(0.7)	0.3	(0.6)	0.0	(0.2)	0.0	(0.1)	0.2	(1.3)	0.0	(0.5)
65	Central Valley Spring	0.0	(0.4)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.3)
66	Coastal California	0.0	(0.4)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.4)

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Table 3. Chinook catch composition from 2015 Area 1 Recreational fisheries by month.

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

	Year	2015		2015		2015		2015		2015	
	Date	May		June		July		August		September	
	Catch (preliminary)	500		8,200		10,500		11,000		1,600	
	Sample size (N)	30		149		155		155		34	
Code	Region	Catch	STD	Catch	STD	Catch	STD	Catch	STD	Catch	STD
1	Upper Fraser (UPFR)	0	(4)	105	(79)	0	(18)	0	(21)	0	(15)
2	Middle-Upper Fraser (MUFR)	17	(17)	7	(33)	4	(28)	1	(20)	7	(23)
3	Lower Fraser Fall (LWFR-F)	0	(1)	0	(5)	0	(7)	0	(9)	1	(9)
4	North Thompson (NOTH)	0	(2)	0	(12)	0	(9)	0	(11)	0	(6)
5	South Thompson (SOTH)	70	(30)	937	(217)	859	(240)	819	(242)	97	(67)
6	Lower Thompson (LWTH)	0	(2)	0	(11)	0	(12)	0	(10)	3	(19)
7	East Coast Vancouver Island (ECVI)	0	(4)	95	(79)	241	(134)	149	(107)	0	(9)
8	West Coast Vancouver Island (WCVI)	117	(38)	1,222	(240)	1,922	(324)	2,924	(388)	321	(104)
9	Southern BC Mainland (SOMN)	0	(4)	4	(27)	175	(119)	2	(24)	2	(15)
10	Northern BC Mainland (NOMN)	18	(17)	914	(234)	827	(249)	942	(250)	1	(12)
11	Nass	18	(22)	151	(107)	16	(48)	0	(13)	0	(9)
12	Lower Fraser Spring (LWFR-Sp)	0	(3)	0	(8)	2	(18)	74	(77)	0	(8)
13	Lower Fraser Summer (LWFR-Su)	0	(1)	0	(4)	0	(7)	0	(8)	0	(3)
14	Haida Gwaii (QCI)	0	(1)	0	(3)	203	(118)	0	(3)	0	(2)
15	Alaska	0	(2)	2	(18)	0	(11)	0	(13)	0	(6)
17	Taku	6	(14)	12	(45)	8	(40)	0	(13)	0	(6)
18	Stikine	2	(8)	13	(44)	39	(82)	3	(20)	0	(8)
19-23	Skeena	51	(31)	293	(175)	759	(274)	1	(22)	0	(17)
24	Alsek	0	(2)	0	(8)	0	(9)	0	(8)	0	(6)
50	Puget Sound	0	(3)	1	(12)	143	(100)	1	(19)	2	(12)
51	Juan de Fuca	0	(2)	0	(4)	68	(68)	0	(4)	0	(3)
52	Coastal Washington	35	(22)	942	(222)	1,238	(293)	1,279	(321)	321	(117)
53	Lower Columbia	0	(2)	135	(93)	0	(6)	6	(31)	12	(38)
54	Upper Columbia Spring	0	(1)	0	(7)	0	(9)	0	(9)	0	(7)
55	Upper Columbia Summer/Fall	150	(41)	2,672	(348)	3,018	(437)	4,514	(435)	544	(133)
56	Snake Spring/Summer	0	(4)	1	(17)	1	(20)	1	(20)	0	(11)
57	Snake Fall	0	(2)	261	(181)	457	(261)	3	(28)	0	(4)
58	North & Central Oregon	0	(3)	171	(108)	504	(200)	206	(182)	285	(108)
59	South Oregon Coastal	0	(3)	40	(56)	15	(45)	59	(72)	0	(8)
61	Klamath/Trinity	0	(2)	0	(6)	0	(7)	1	(13)	0	(2)
62	Middle Columbia Spring	0	(2)	0	(9)	0	(10)	5	(28)	1	(7)
63	Upper Willamette	17	(16)	199	(111)	0	(5)	9	(37)	0	(6)
64	Central Valley Fall	0	(3)	24	(45)	1	(20)	0	(16)	3	(21)
65	Central Valley Spring	0	(2)	0	(6)	0	(5)	0	(9)	0	(4)
66	Coastal California	0	(2)	0	(2)	0	(2)	0	(3)	0	(2)

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Table 4. Chinook stock proportions observed in monthly samples from 2015 Areas 3 and 4 Recreational fishery catches. Composition presented as % of the sample N. Standard deviations appear in brackets.

	Year	2015		2015		2015		2015		2015		2015	
	Area	3		3		3		4		4		4	
	Month	June		July		August		June		July		August	
	N	71		36		12		353		211		58	
Code	Region	%	STD	%	STD	%	STD	%	STD	%	STD	%	STD
1	Upper Fraser (UPFR)	0.0	(0.3)	0.0	(0.7)	0.0	(1.8)	0.3	(0.3)	0.3	(0.4)	0.0	(0.4)
2	Middle-Upper Fraser (MUFR)	0.0	(0.4)	0.0	(0.8)	0.0	(1.8)	0.0	(0.1)	0.4	(0.6)	0.2	(0.8)
3	Lower Fraser Fall (LWFR-F)	0.0	(0.2)	0.3	(1.2)	0.0	(1.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.3)
4	North Thompson (NOTH)	0.0	(0.2)	0.0	(0.5)	0.0	(0.7)	0.0	(0.1)	0.0	(0.2)	0.0	(0.3)
5	South Thompson (SOTH)	14.6	(4.2)	31.3	(7.9)	0.0	(1.4)	16.7	(2.0)	23.6	(2.9)	28.9	(6.0)
6	Lower Thompson (LWTH)	0.0	(0.2)	0.0	(0.5)	0.0	(1.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.4)
7	East Coast Vancouver Island (ECVI)	4.3	(2.4)	0.2	(1.1)	41.7	(13.0)	6.2	(1.4)	2.4	(1.2)	5.2	(2.9)
8	West Coast Vancouver Island (WCVI)	5.0	(2.7)	5.6	(3.8)	8.3	(7.4)	14.7	(1.9)	13.6	(2.4)	22.3	(5.4)
9	Southern BC Mainland (SOMN)	1.5	(1.4)	0.4	(1.4)	0.0	(1.6)	1.3	(0.6)	0.1	(0.4)	3.9	(3.5)
10	Northern BC Mainland (NOMN)	8.3	(3.7)	5.1	(5.3)	0.0	(1.6)	12.3	(2.0)	3.8	(1.5)	5.5	(3.6)
11	Nass	10.9	(5.3)	0.7	(1.9)	0.0	(1.4)	1.5	(1.0)	1.0	(0.9)	0.0	(0.4)
12	Lower Fraser Spring (LWFR-Sp)	0.0	(0.1)	0.0	(0.4)	0.0	(1.1)	0.0	(0.0)	0.0	(0.1)	0.0	(0.3)
13	Lower Fraser Summer (LWFR-Su)	1.4	(1.3)	0.0	(0.2)	0.0	(0.8)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)
14	Haida Gwaii (QCI)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)
15	Alaska	0.0	(0.2)	0.0	(0.3)	0.0	(0.9)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)
17	Taku	0.0	(0.4)	0.4	(1.7)	0.0	(1.5)	0.1	(0.3)	0.0	(0.2)	0.1	(0.6)
18	Stikine	0.2	(1.0)	0.6	(2.3)	0.0	(0.9)	0.5	(0.8)	0.2	(0.5)	0.0	(0.4)
19-23	Skeena	36.9	(12.2)	42.1	(14.9)	50.0	(16.7)	24.5	(4.7)	26.2	(4.2)	3.3	(3.4)
24	Alsek	0.0	(0.2)	0.0	(0.5)	0.0	(1.2)	0.0	(0.0)	0.0	(0.1)	0.0	(0.2)
50	Puget Sound	6.2	(3.1)	1.1	(3.0)	0.0	(1.1)	4.3	(1.2)	5.2	(2.0)	3.6	(3.1)
51	Juan de Fuca	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.0)	0.0	(0.0)	1.8	(1.7)
52	Coastal Washington	0.0	(0.2)	0.2	(1.1)	0.0	(1.2)	1.5	(0.7)	2.7	(1.2)	1.4	(2.0)
53	Lower Columbia	1.2	(1.9)	0.0	(0.2)	0.0	(0.5)	2.2	(0.8)	0.2	(0.4)	2.0	(1.9)
54	Upper Columbia Spring	0.0	(0.1)	0.0	(0.3)	0.0	(0.7)	0.0	(0.0)	0.0	(0.1)	0.0	(0.2)
55	Upper Columbia Summer/Fall	4.8	(3.6)	0.7	(2.5)	0.0	(1.4)	13.3	(1.9)	19.2	(3.0)	20.9	(5.4)
56	Snake Spring/Summer	0.0	(0.3)	0.0	(0.7)	0.0	(1.6)	0.0	(0.1)	0.0	(0.2)	0.0	(0.4)
57	Snake Fall	2.2	(2.7)	10.0	(5.8)	0.0	(0.1)	0.1	(0.5)	0.4	(1.0)	0.0	(0.4)
58	North & Central Oregon	0.0	(0.2)	0.1	(0.9)	0.0	(1.1)	0.1	(0.3)	0.7	(0.6)	0.5	(1.2)
59	South Oregon Coastal	0.1	(0.6)	0.0	(0.5)	0.0	(1.0)	0.0	(0.1)	0.0	(0.2)	0.3	(1.1)
61	Klamath/Trinity	0.0	(0.1)	0.0	(0.2)	0.0	(1.1)	0.4	(0.4)	0.0	(0.1)	0.0	(0.2)
62	Middle Columbia Spring	1.1	(1.6)	0.8	(2.0)	0.0	(0.9)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)
63	Upper Willamette	1.3	(1.5)	0.0	(0.5)	0.0	(0.6)	0.0	(0.1)	0.0	(0.1)	0.1	(0.6)
64	Central Valley Fall	0.0	(0.4)	0.1	(0.9)	0.0	(1.6)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)
65	Central Valley Spring	0.0	(0.1)	0.0	(0.5)	0.0	(1.2)	0.0	(0.0)	0.0	(0.1)	0.0	(0.2)
66	Coastal California	0.0	(0.1)	0.0	(0.3)	0.0	(0.7)	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)

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Table 5. Chinook catch composition from 2015 Area 3 Recreational fisheries by month.

July and August samples from Area 3 were pooled because of small sample sizes.
Catch composition presented in numbers of fish. Standard deviations appear in brackets. Catch estimates are preliminary.

	Year	2015		2015		2015 Total		2015 Total	
	Area	3		3		3		3	
	Date	June		July & August		June-August		June-August	
	Catch	3,807		2,528		6,335		%	
	N	71		48		119		119	
Code	Region	Catch	STD	Catch	STD	Catch	STD	%	STD
1	Upper Fraser (UPFR)	0	(13)	0	(17)	0	(22)	0.0	(0.3)
2	Middle-Upper Fraser (MUFR)	0	(14)	1	(19)	1	(24)	0.0	(0.4)
3	Lower Fraser Fall (LWFR-F)	0	(6)	5	(24)	5	(25)	0.1	(0.4)
4	North Thompson (NOTH)	0	(7)	0	(10)	0	(12)	0.0	(0.2)
5	South Thompson (SOTH)	555	(159)	594	(150)	1,149	(219)	18.1	(3.5)
6	Lower Thompson (LWTH)	0	(9)	0	(12)	0	(15)	0.0	(0.2)
7	East Coast Vancouver Island (ECVI)	165	(91)	266	(85)	431	(125)	6.8	(2.0)
8	West Coast Vancouver Island (WCVI)	190	(104)	159	(85)	349	(134)	5.5	(2.1)
9	Southern BC Mainland (SOMN)	56	(54)	8	(29)	63	(61)	1.0	(1.0)
10	Northern BC Mainland (NOMN)	316	(141)	97	(100)	413	(173)	6.5	(2.7)
11	Nass	415	(203)	13	(38)	428	(206)	6.8	(3.3)
12	Lower Fraser Spring (LWFR-Sp)	0	(6)	0	(10)	0	(11)	0.0	(0.2)
13	Lower Fraser Summer (LWFR-Su)	54	(50)	0	(7)	54	(50)	0.8	(0.8)
14	Haida Gwaii (QCI)	0	(3)	0	(2)	0	(4)	0.0	(0.1)
15	Alaska	0	(9)	0	(9)	0	(12)	0.0	(0.2)
17	Taku	1	(15)	8	(33)	10	(36)	0.2	(0.6)
18	Stikine	7	(39)	12	(43)	20	(58)	0.3	(0.9)
19-23	Skeena	1,407	(466)	1,115	(301)	2,521	(555)	39.8	(8.8)
24	Alsek	0	(7)	0	(13)	0	(14)	0.0	(0.2)
50	Puget Sound	234	(116)	21	(57)	255	(130)	4.0	(2.0)
51	Juan de Fuca	0	(2)	0	(3)	0	(4)	0.0	(0.1)
52	Coastal Washington	0	(8)	4	(22)	4	(23)	0.1	(0.4)
53	Lower Columbia	44	(72)	0	(6)	44	(72)	0.7	(1.1)
54	Upper Columbia Spring	0	(6)	0	(7)	0	(9)	0.0	(0.1)
55	Upper Columbia Summer/Fall	184	(136)	13	(47)	196	(144)	3.1	(2.3)
56	Snake Spring/Summer	0	(11)	0	(17)	1	(20)	0.0	(0.3)
57	Snake Fall	83	(103)	190	(110)	273	(150)	4.3	(2.4)
58	North & Central Oregon	0	(9)	2	(18)	2	(20)	0.0	(0.3)
59	South Oregon Coastal	3	(21)	0	(11)	4	(24)	0.1	(0.4)
61	Klamath/Trinity	0	(5)	0	(8)	0	(9)	0.0	(0.1)
62	Middle Columbia Spring	43	(60)	15	(38)	58	(71)	0.9	(1.1)
63	Upper Willamette	50	(55)	1	(11)	51	(56)	0.8	(0.9)
64	Central Valley Fall	1	(15)	2	(19)	4	(24)	0.1	(0.4)
65	Central Valley Spring	0	(5)	1	(11)	1	(12)	0.0	(0.2)
66	Coastal California	0	(3)	0	(7)	0	(8)	0.0	(0.1)

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Table 6. Chinook catch composition from 2015 Area 4 Recreational fisheries by month.

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

	Year	2015		2015		2015		2015 Total		2015 Total	
	Area	4		4		4		4		4	
	Date	June		July		August		June-August		June-August	
	Catch	3,264		2,284		874		6,421		%	
	N	353		211		58		622		622	
Code	Region	Catch	STD	Catch	STD	Catch	STD	Catch	STD	%	STD
1	Upper Fraser (UPFR)	10	(10)	6	(10)	0	(4)	15	(15)	0.2	(0.2)
2	Middle-Upper Fraser (MUFR)	1	(4)	8	(14)	1	(7)	10	(16)	0.2	(0.3)
3	Lower Fraser Fall (LWFR-F)	0	(1)	0	(2)	0	(3)	0	(4)	0.0	(0.1)
4	North Thompson (NOTH)	0	(2)	0	(4)	0	(3)	1	(5)	0.0	(0.1)
5	South Thompson (SOTH)	544	(65)	538	(67)	252	(52)	1,334	(107)	20.8	(1.7)
6	Lower Thompson (LWTH)	0	(2)	0	(2)	0	(3)	0	(4)	0.0	(0.1)
7	East Coast Vancouver Island (ECVI)	203	(45)	54	(27)	45	(26)	302	(59)	4.7	(0.9)
8	West Coast Vancouver Island (WCVI)	479	(61)	310	(55)	195	(47)	984	(95)	15.3	(1.5)
9	Southern BC Mainland (SOMN)	42	(21)	3	(9)	34	(31)	79	(38)	1.2	(0.6)
10	Northern BC Mainland (NOMN)	401	(64)	88	(34)	48	(31)	537	(80)	8.4	(1.2)
11	Nass	49	(31)	23	(20)	0	(4)	72	(37)	1.1	(0.6)
12	Lower Fraser Spring (LWFR-Sp)	0	(1)	0	(2)	0	(2)	0	(3)	0.0	(0.0)
13	Lower Fraser Summer (LWFR-Su)	0	(1)	0	(2)	0	(1)	0	(2)	0.0	(0.0)
14	Haida Gwaii (QCI)	0	(1)	0	(1)	0	(1)	0	(1)	0.0	(0.0)
15	Alaska	0	(2)	0	(2)	0	(3)	0	(4)	0.0	(0.1)
17	Taku	2	(8)	0	(4)	1	(5)	3	(10)	0.1	(0.2)
18	Stikine	15	(27)	4	(10)	0	(4)	19	(29)	0.3	(0.5)
19-23	Skeena	798	(155)	599	(96)	29	(30)	1,426	(184)	22.2	(2.9)
24	Alsek	0	(1)	0	(2)	0	(2)	0	(3)	0.0	(0.0)
50	Puget Sound	140	(40)	118	(45)	31	(27)	290	(66)	4.5	(1.0)
51	Juan de Fuca	0	(1)	0	(1)	16	(15)	16	(15)	0.2	(0.2)
52	Coastal Washington	50	(23)	62	(27)	12	(17)	124	(39)	1.9	(0.6)
53	Lower Columbia	72	(27)	4	(9)	17	(16)	94	(33)	1.5	(0.5)
54	Upper Columbia Spring	0	(1)	0	(1)	0	(2)	0	(3)	0.0	(0.0)
55	Upper Columbia Summer/Fall	434	(63)	439	(68)	183	(47)	1,056	(104)	16.5	(1.6)
56	Snake Spring/Summer	0	(4)	0	(4)	0	(4)	1	(7)	0.0	(0.1)
57	Snake Fall	3	(16)	9	(24)	0	(3)	13	(28)	0.2	(0.4)
58	North & Central Oregon	5	(11)	16	(15)	5	(11)	25	(21)	0.4	(0.3)
59	South Oregon Coastal	1	(4)	1	(5)	2	(9)	4	(11)	0.1	(0.2)
61	Klamath/Trinity	14	(13)	0	(1)	0	(2)	14	(14)	0.2	(0.2)
62	Middle Columbia Spring	0	(2)	0	(2)	0	(2)	0	(4)	0.0	(0.1)
63	Upper Willamette	0	(2)	0	(2)	1	(6)	1	(6)	0.0	(0.1)
64	Central Valley Fall	0	(2)	0	(3)	0	(3)	0	(4)	0.0	(0.1)
65	Central Valley Spring	0	(1)	0	(2)	0	(1)	0	(2)	0.0	(0.0)
66	Coastal California	0	(1)	0	(1)	0	(1)	0	(1)	0.0	(0.0)

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Table 7. Chinook salmon catch by stock group for the 2015 Recreational fishery in Areas 3 and 4.

Standard deviations (STD) appear in brackets. Catch estimates are preliminary.

	Year	2015	2015	2015	2015
	Areas	3 & 4	3 & 4	3 & 4	3 & 4
	Date	Jun-Aug	Jun-Aug	Jun-Aug	Jun-Aug
	Sample N or Catch	N=1,482		12,756	
Code	Region	%	STD	Catch	STD
1	Upper Fraser (UPFR)	0.1	(0.2)	16	(26)
2	Middle-Upper Fraser (MUFR)	0.1	(0.2)	11	(29)
3	Lower Fraser Fall (LWFR-F)	0.0	(0.2)	6	(25)
4	North Thompson (NOTH)	0.0	(0.1)	1	(13)
5	South Thompson (SOTH)	19.5	(1.9)	2,483	(243)
6	Lower Thompson (LWTH)	0.0	(0.1)	0	(16)
7	East Coast Vancouver Island (ECVI)	5.7	(1.1)	733	(138)
8	West Coast Vancouver Island (WCVI)	10.4	(1.3)	1,333	(165)
9	Southern BC Mainland (SOMN)	1.1	(0.6)	142	(72)
10	Northern BC Mainland (NOMN)	7.4	(1.5)	950	(190)
11	Nass	3.9	(1.6)	500	(210)
12	Lower Fraser Spring (LWFR-Sp)	0.0	(0.1)	0	(12)
13	Lower Fraser Summer (LWFR-Su)	0.4	(0.4)	54	(50)
14	Haida Gwaii (QCI)	0.0	(0.0)	0	(4)
15	Alaska	0.0	(0.1)	1	(13)
17	Taku	0.1	(0.3)	13	(38)
18	Stikine	0.3	(0.5)	38	(65)
19-23	Skeena	30.9	(4.6)	3,947	(584)
24	Alsek	0.0	(0.1)	0	(15)
50	Puget Sound	4.3	(1.1)	545	(145)
51	Juan de Fuca	0.1	(0.1)	16	(15)
52	Coastal Washington	1.0	(0.4)	128	(46)
53	Lower Columbia	1.1	(0.6)	138	(79)
54	Upper Columbia Spring	0.0	(0.1)	0	(10)
55	Upper Columbia Summer/Fall	9.8	(1.4)	1,253	(178)
56	Snake Spring/Summer	0.0	(0.2)	1	(21)
57	Snake Fall	2.2	(1.2)	285	(153)
58	North & Central Oregon	0.2	(0.2)	27	(29)
59	South Oregon Coastal	0.1	(0.2)	7	(26)
61	Klamath/Trinity	0.1	(0.1)	14	(17)
62	Middle Columbia Spring	0.5	(0.6)	58	(71)
63	Upper Willamette	0.4	(0.4)	52	(57)
64	Central Valley Fall	0.0	(0.2)	4	(25)
65	Central Valley Spring	0.0	(0.1)	1	(13)
66	Coastal California	0.0	(0.1)	0	(8)
	TOTAL	100%		12,756	

FIGURES

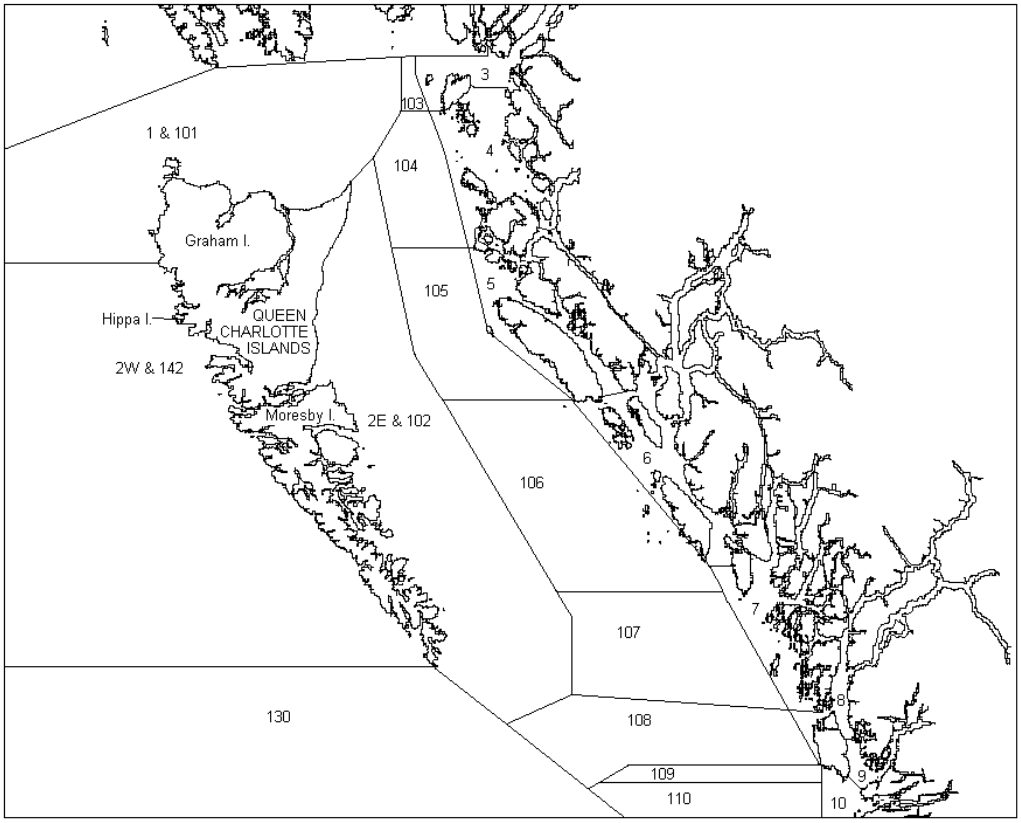
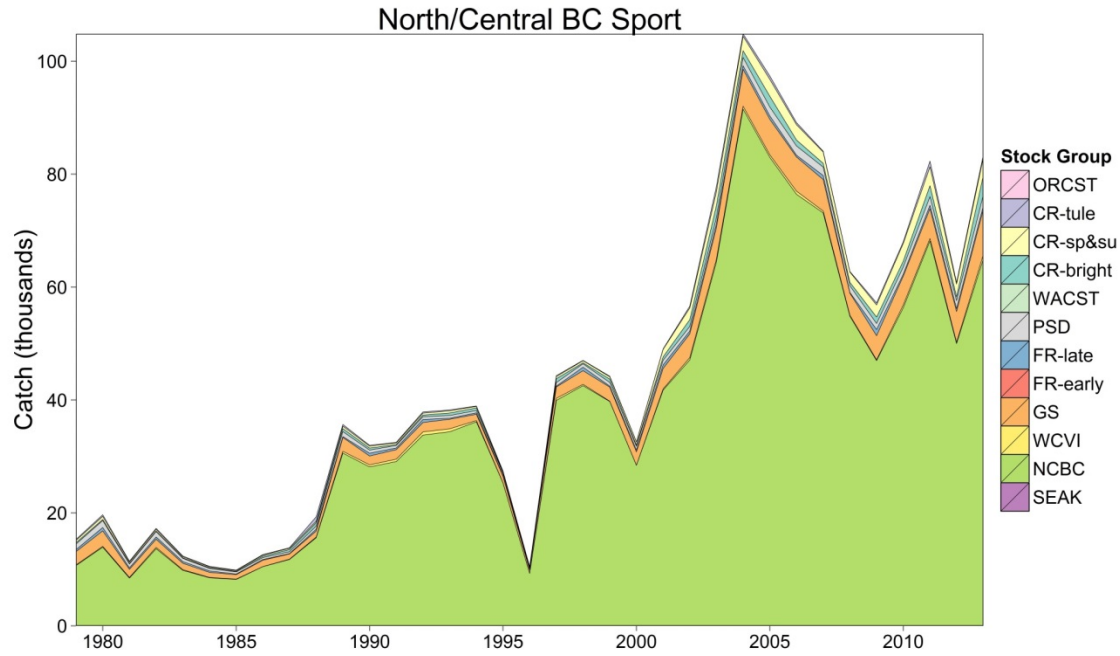


Figure 1. The North Coast of British Columbia showing Pacific Fishery Management Areas 1 to 10, 101 to 110, 130 and 142.



Appendix E19 Chinook Model estimates of landed catch stock composition for North/Central BC Sport 1979-2013

(Pacific Salmon Commission Joint Chinook Technical Committee Report, 2014)

Figure 2. Chinook model-generated stock composition of actual landed catch for the North / Central BC Sport model fishery, 1979-2013.

APPENDICES

Appendix 1. Scale sampling instructions for Chinook salmon caught in the 2015 Northern British Columbia, Area 1 Recreational fishery.

2015 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:

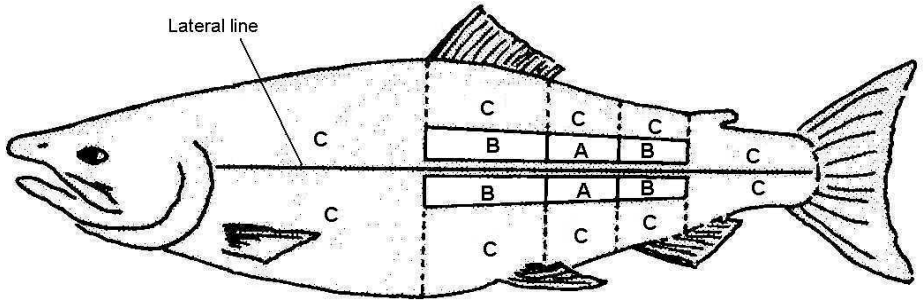
- 75 scale books have been provided. Each book holds 50 scales for 10 fish sampled at 5 scales per fish.
- Please collect samples from 5 Chinook salmon per day. You can modify this procedure so long as you set up a program in advance and stick to it.
- On days where you can't sample 5 fish, simply collect 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 2nd 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:

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

#	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