Genetic Stock Identification of Chinook Salmon caught in Northern British Columbia Troll Fisheries 2015

Ivan Winther

Fisheries & Oceans Canada
Science Branch, Pacific Region
417-2nd Avenue West
Prince Rupert, British Columbia
V8J-1G8

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Fisheries & Oceans Canada has managed the Northern British Columbia (NBC) troll fishery since 1995 to reduce impacts on Chinook salmon (*Oncorhynchus tshawytscha*) stocks from the West Coast of Vancouver Island (WCVI). Microsatellite DNA based stock identification techniques have been used to address stock specific management in this mixed stock fishery since 2002. Chinook salmon stock compositions were estimated for the 2015 NBC troll fishery and the fishery was managed in-season to a harvest rate target for WCVI Chinook salmon. The application of stock specific management allowed the internationally negotiated catch allocation to be reached while reducing the exploitation of WCVI Chinook. Stock compositions were applied to catch to provide region specific estimates of the impact of the 2015 NBC troll fisheries on all of the Chinook stock groups encountered.

INTRODUCTION

Funding for this project was provided by the Pacific Salmon Commission's Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund (Northern Fund) to estimate Chinook salmon (*Oncorhynchus tshawytscha*) stock compositions in Northern British Columbia (NBC) troll fisheries in 2015. This report presents estimates of the Chinook salmon stock identification based on genetic analyses of samples collected from the fishery. The results are part of a continuing project to examine the genetics of Chinook salmon caught in NBC Troll fisheries. This document fulfills the reporting requirements for the 2015 Northern Fund project. Costs to the Northern Fund consisted of the genetic analyses and a portion of the sampling costs. Other components of the project were funded by Fisheries & Oceans Canada in existing programs.

The primary objective of this study was to estimate stock specific catches by the NBC Troll fishery in 2015. The commercial troll fishery is the largest fishery for Chinook salmon in NBC and is one of two fisheries defined within the Aggregate Abundance Based Management (AABM) regime implemented by the Pacific Salmon Treaty (PST)(2000) for the North Coast. Under the revised international agreement the NBC troll and Haida Gwaii (QCI) sport fisheries are managed in aggregate within the same regime. Current domestic allocation policies within Canada require the NBC troll fishery to be influenced first by any management actions required to protect weak stocks (Winther and Beacham 2006).

The North Coast troll fishery has been defined as Area F consisting of Pacific Fishery Management Areas 1 to 10, 101 to 110, and 130 and 142 (Figure 1.). The AABM portion of the NBC troll fishery makes up the north-western portion of Area F; Areas 1 to 5, 101 to 105, 130 and 142. Historically the size of the troll fleet in Area F was relatively stable from 2002 to 2005, varying between 146 and 168 licensed vessels. Through a series of area selection processes the Area F fleet increased to 284 licensed vessels from 2008 to 2010 and then declined to 238 in 2015. The change in fleet size was initially due to reduced fishing opportunities in southern areas and the introduction of individual transferable quotas (ITQ) in the NBC troll fishery for Chinook salmon in 2005. The number of vessels fishing is considerably less than the licenses available in Area F, for example 137 vessels fished in 2015.

The application of DNA-level markers for stock identification in the NBC troll fishery has continued since 2002. After moderate success in the initial year the experiments essentially met their objective of allowing the Chinook salmon quota negotiated under the PST agreement to be harvested while continuing to reduce impacts on stocks of conservation concern from the West Coast of Vancouver Island (WCVI) (Winther and Beacham 2006 & 2009). Subsequent fisheries were less successful averaging only 72% of the pre-fishery allowance to the troll fishery. These lower catches were the result of forecasting errors and policy changes. A series of under forecasts of WCVI Chinook lead to early closures of the NBC Troll fishery after 2006. The movement of troll licenses to the Pacific Integrated Commercial Fisheries Initiative (PICFI), the Allocation Transfer Program (ATP) and other processes essentially removed licenses from fishing in Area F while leaving their allocation within the ITQ. Consequently a portion of the quota was not available to be fished and Area F could not reach the allowable catch determined under the Treaty.

The 2015 pre-season Aggregate Abundance Based Management (AABM) index was 1.23 with an associated allowable catch of 160,400 Chinook salmon for NBC Troll and QCI sport fisheries. The pre-season estimate of the sport catch was 43,000 fish leaving 117,400 fish as the pre-season troll allocation. The 2015 in-season target for the NBC troll fishery was a maximum

harvest rate of 3.2% on Chinook salmon of WCVI origin returning to Canadian waters. This target was estimated at 4,100 fish (Dobson, 2015).

A demonstration fishery to examine the application of individual transferable quotas (ITQ) in the troll fishery was first held in 2005 and was continued in 2015. The pre-season troll allocation was divided among 238 licenses for an individual quota of 493 Chinook salmon per licence.

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 as a tool for management of stocks of conservation concern encountered by the NBC troll fishery. Our challenge was to provide advice to managers that would allow the Northern British Columbia (Area F) troll fishery to maximize catch of Chinook salmon while minimizing the exploitation of WCVI Chinook salmon. The biological sampling objectives were to generate stock compositions for the troll catch of Chinook salmon in NBC.

METHODS

Stock specific catch estimates were generated from genetic samples and catch data. Genetic samples were grouped temporally and weighted the catch for the periods sampled. In cases where the temporal strata for samples overlapped, the daily catch during the overlapping days were weighted to each sample based on the relative number of fish in each sample.

Two programs provided catch accounting of Chinook salmon from the NBC Troll fishery; daily catch records (hails) and landing validation. Vessel operators must provide a record of their daily catch either electronically or by phone to the Fisheries Operating System as a condition of licence. Electronic or phone-in records were required within 24 hours of landing or within 24 hours of the closure of the fishery and consisted of date fished, area fished, number of fish caught and retained by species and number of fish caught and released by species. In addition, all vessel landings of Chinook salmon must be counted and reported (validated) by the third party contractor. The combination of daily records reported by the fishers and validation by the third party provide records that are essentially a census of the Chinook salmon catch. Catch records were treated as a census without variance.

The sample design was approached from the perspective of a binomial problem where Chinook salmon were identified as either from WCVI or not. The catch ceiling of WCVI Chinook salmon was ~3.5% of the total allowable catch of 117,400. The forecast of the WCVI Chinook salmon return to Canada was 128,650 (Dobson, 2015). If the actual catch approached the ceiling of 117,400 then the level of precision afforded by ~2,600 samples would provide 95% confidence limits plus or minus ~25% of the estimated proportion of WCVI Chinook. Smaller proportions would have respectively broader confidence limits and smaller sample sizes would have respectively broader confidence limits as well.

The program to sample commercial fishery landings was designed with the objective of collecting tissues from approximately 1.6% (~3000) of the Chinook salmon caught in the fishery. Samples were collected by a contractor involved in the existing MRP sampling program. The collection target (3,000) was designed larger than the target for analysis (2,600) because sample

collection was relatively cheap when compared with genetic analyses. The extra samples also allowed for sub-sampling such that the samples submitted for analyses would best represent the commercial fishery landings across the time and area strata in the fishery. Ultimately 2,250 fish were sampled, 1,991 fish were submitted for analyses and results were received from 1,897 samples.

The NBC Troll fishery was sampled by a third party contractor. The contract description included random selection of troll vessel landings with stratified sampling of fish within the selected landing. The sampling procedure was to select vessel landings at random and sample less than 50 fish from each delivery. Every 5^{th} or 10^{th} fish was sampled from the load depending on the size of the delivery to spread the samples through the load and to reduce autocorrelation. Individual Chinook salmon sampled from commercial fishery landings were sampled for nose-fork length and scales. Fish landed by the commercial fishery were dressed so gender could not be determined. These collections were matched to data on the area fished and date caught. An identification number was included for fish sampled that had coded wire tags (Appendix 1).

Scale samples were collected on to 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

The NBC troll fishery landed 106,703 Chinook salmon in 2015. Chinook salmon fishing was permitted from June 18 to July 31 and from August 25 to September 30. Chinook salmon catches included 104,020 fish in the June and July fishery and 2,683 fish in the August and September fishery. Daily catch was highest on opening day, June 21, when 103 active vessels caught 13,525 Chinook salmon. Catches remained above 10,000 fish per day for the first 5 days of the fishery and only declined with reduced effort (Figure 2.).

Genetic samples were collected from 114 of the 289 vessel landings that unloaded Chinook salmon from the 2015 Troll fishery. The collection was sub-sampled and 1,991 fish samples from 101 vessel landings were submitted for analyses. The samples were submitted and reported in 6 groups. The first 5 groups were from the June to August fishery and represented catches from periods ranging from 6 to 18 days. Since fishing was continuous from June 18 to July 30, the groups of samples overlapped for periods up to 6 days. The samples from the September fishery were submitted as a single group. In September catch declined through the month and there were 9 days near the end of the month without any Chinook salmon catches.

The most prevalent stock group in the NBC troll catch was the Upper Columbia Summer/Fall stock group making up 41.8% of the catch or 44,631 fish. Other significant components were South Thompson (SOTH), Coastal Washington and North & Central Oregon

stock groups (Table 1). This pattern persisted through the samples collected from the June to August fishery but changed in September as the SOTH fish declined significantly and the Oregon component increased(Table 2.). Chinook salmon from WCVI were most prevalent in the August 25 to September 5 samples at 2.9%. They were least prevalent in the July 10th to 19th sample making up only a trace amount of the sample. A total of 1,129 fish from WCVI were estimated to be caught by the fishery.

DISCUSSION

The NBC troll fishery landed 106,703 Chinook salmon in 2015. While there were potentially 117,400 fish available to the troll fishery (160,400 total AABM allowable catch less 43,000 QCI sport catch), catches were limited by the ITQ program. The quota associated with 20 licenses held by PICFI and ATP programs was not fished (~10,000 Chinook). The fishery was managed for concerns for WCVI Chinook salmon but the only management action in this regard was to close the fishery from August 1 to 24.

Catch per unit effort (CPUE) is difficult to interpret for the Chinook troll fishery because of the influence of ITQ's on fishing behavior. CPUE's in the first week of the 2015 fishery were among the highest observed since 2002. CPUE on opening day, June 18, was 131 Chinook salmon per boat day. CPUE dropped to 93 on the second day but then increased steadily to 126 fish per boat day by the end of the week. Subsequently catch and CPUE declined but this was largely due to vessels completing their quota and/or delivering their catch. Effort increased after July 10 associated with the opening of the Coho fishery. A number of vessels saved portions of their Chinook ITQ until after July 10 to be able to retain Chinook and Coho at the same time.

Recreational fisheries have priority access to Chinook salmon so the shares within the AABM allowable catch are determined pre-season by forecasting the recreational catch. The forecast for the AABM recreational catch of 43,000 probably underestimated the amount of fish caught. Final sport catch estimates were not available at the time of writing. The recreational catch is expected to bring the total AABM catch near the 160,400 pre-season allowable catch.

The primary management target for the NBC Troll fishery is to have an exploitation rate (ER) of less than 3.2% on WCVI Chinook salmon. Since Alaskan harvests are unknown in-season this ER is approximated by a harvest rate of 3.2% on the return of WCVI Chinook salmon to Canadian waters. Given a pre-season forecast for WCVI Chinook salmon return to Canada of 128,650 fish (Dobson, 2015) the 3.2% harvest rate was forecast as 4,100 fish. The estimate of WCVI Chinook salmon caught by the troll fishery using genetic samples was 1,129 fish. The catches were well below the forecast 3.2% harvest rate estimate but the actual harvest rate on WCVI Chinook will not be known until the post-season fishery and escapement data have been analyzed.

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 makes troll fishery impacts on WCVI stocks most severe in August (Winther and Beacham, 2006 & 2009). The second portion of the 2015 troll fishery was opened August 25, earlier than normal since there was very little Chinook quota remaining and few vessels to catch the fish. A sample collected from catches between August 25 and September 5 also had the highest component of WCVI Chinook salmon of the season at 2.9% (Table 2.). The majority of the fish caught in the

second opening were caught during the beginning of the opening. Catches during the first 11 days of the fishery accounted for 2,384 of the 2,683 fish caught over the entire August 25 to September 30 fishery.

The timing differential between WCVI Chinook salmon and abundant stocks in the Fraser River and Upper Columbia provided opportunities to minimize impacts on WCVI stocks by fishing in June and July. The increase in Columbia Summer/Fall stocks doesn't appear to have changed these conditions of higher WCVI proportions in August. The sample collected from catches in late August to early September had the highest amount of WCVI Chinook in the stock mixtures (2.9%). Typically samples later in September have few fish from WCVI but the fishing opportunities in September are hampered by bad weather and the decline of Chinook abundance through the month.

Differences in timing and distribution between stock groups have allowed the fishery to be positioned such the stocks of conservation concern were avoided and more abundant stocks were harvested. Changes in abundance or distribution of either the stock of conservation concern or any of the major components encountered by the fishery could have significant consequences. The ability to have a successful mixed stock fishery while avoiding a stock of conservation concern hinges on identifying such differences.

The application of DNA level markers for stock identification to the management of a particular stock within a mixed stock fishery depends heavily on the ability to identify the stock and detect it with a reasonable level of precision. The management targets and proportions of WCVI Chinook salmon experienced in 2014 and 2015 are near the edge of the effective range of the technique given the sample sizes that the program could afford (i.e. proportions near 5%). In addition, the relative proportions of component stocks present in the fishery must show some variability across time or space. If the proportion of a stock of conservation concern was static or random across the fishery, fishing periods or areas could not be defined that were any better for avoiding the stock. This could happen if the stock of conservation concern had the same or similar timing and distribution as abundant stocks within the fishery.

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TABLES

Table 1. Chinook salmon catch by stock group for 2015 NBC troll fisheries.
Standard deviations (STD) appear in brackets.

Code	Region	Proportion (%)	STD (%)	Catch	STD
1	Upper Fraser (UPFR)	0.2	(0.2)	232	(174)
2	Middle-Upper Fraser (MUFR)	0.8	(0.3)	871	(328)
3	Lower Fraser Fall (LWFR-F)	0.1	(0.1)	156	(142)
4	North Thompson (NOTH)	0.7	(0.3)	797	(287)
5	South Thompson (SOTH)	19.5	(1.0)	20,805	(1109)
6	Lower Thompson (LWTH)	0.3	(0.2)	321	(174)
7	East Coast Vancouver Island (ECVI)	0.5	(0.3)	496	(285)
8	West Coast Vancouver Island (WCVI)	1.1	(0.3)	1,129	(301)
9	Southern BC Mainland (SOMN)	0.1	(0.2)	81	(175)
10	Northern BC Mainland (NOMN)	1.2	(0.3)	1,285	(342)
11	Nass	0.4	(0.2)	424	(218)
12	Lower Fraser Spring (LWFR-Sp)	0.0	(0.0)	17	(42)
13	Lower Fraser Summer (LWFR-Su)	0.2	(0.1)	212	(152)
14	Haida Gwaii (QCI)	0.1	(0.1)	108	(91)
15	Alaska	0.0	(0.0)	2	(29)
17	Taku	0.0	(0.1)	19	(66)
18	Stikine	0.1	(0.1)	79	(112)
19-23	Skeena	1.9	(0.6)	2,035	(687)
24	Alsek	0.0	(0.0)	1	(25)
50	Puget Sound	0.5	(0.2)	506	(230)
51	Juan de Fuca	0.0	(0.0)	44	(45)
52	Coastal Washington	11.2	(1.0)	11,963	(1090)
53	Lower Columbia	2.9	(0.5)	3,116	(558)
54	Upper Columbia Spring	0.0	(0.0)	8	(27)
55	Upper Columbia Summer/Fall	41.8	(1.4)	44,632	(1459)
56	Snake Spring/Summer	0.1	(0.2)	73	(204)
57	Snake Fall	0.8	(0.6)	808	(594)
58	North & Central Oregon	12.1	(1.1)	12,938	(1163)
59	South Oregon Coastal	2.2	(0.6)	2,330	(589)
61	Klamath/Trinity	0.0	(0.0)	15	(38)
62	Middle Columbia Spring	0.0	(0.1)	22	(62)
63	Upper Willamette	1.1	(0.3)	1,134	(370)
64	Central Valley Fall	0.0	(0.1)	39	(83)
65	Central Valley Spring	0.0	(0.0)	7	(35)
66	Coastal California	0.0	(0.0)	0	(10)
	TOTAL	100%		106,703	

Table 2. Chinook stock proportions observed in samples from 2015 NBC Troll catches.

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

	Year	2015		2015		2015		2015		2015		2015	
	Date	June 18-23		June 24-July 1		June 26-July 13		July 10-19		July 16-31		Aug 25 - Sep 5	
	Catch	64,840		17,228		10,519		6,494		4,939		2,683	
Code	N	781		402		189		185		199		141	
		%	STD	%	STD	%	STD	%	STD	%	STD	%	STD
1	Upper Fraser (UPFR)	0.3	(0.3)	0.0	(0.1)	0.1	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
2	Middle-Upper Fraser (MUFR)	1.1	(0.5)	0.2	(0.4)	0.6	(0.8)	0.3	(0.7)	0.3	(0.5)	0.0	(0.2)
3	Lower Fraser Fall (LWFR-F)	0.2	(0.2)	0.1	(0.3)	0.0	(0.1)	0.0	(0.1)	0.6	(0.6)	0.0	(0.1)
4	North Thompson (NOTH)	1.1	(0.4)	0.1	(0.2)	0.0	(0.1)	0.3	(0.7)	0.7	(0.8)	0.0	(0.1)
5	South Thompson (SOTH)	20.8	(1.5)	20.8	(2.1)	17.6	(2.9)	14.6	(2.7)	18.5	(2.9)	1.5	(1.1)
6	Lower Thompson (LWTH)	0.5	(0.3)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
7	East Coast Vancouver Island (ECVI)	0.6	(0.4)	0.0	(0.1)	0.0	(0.1)	1.0	(1.0)	1.0	(0.8)	0.0	(0.1)
8	West Coast Vancouver Island (WCVI)	1.5	(0.4)	0.2	(0.3)	0.5	(0.5)	0.0	(0.2)	0.3	(0.5)	2.9	(1.4)
9	Southern BC Mainland (SOMN)	0.1	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
10	Northern BC Mainland (NOMN)	0.9	(0.4)	2.8	(0.9)	0.8	(0.7)	1.2	(1.2)	0.8	(0.7)	0.0	(0.2)
11	Nass	0.4	(0.3)	0.2	(0.3)	0.0	(0.2)	1.6	(0.9)	0.0	(0.1)	0.0	(0.1)
12	Lower Fraser Spring (LWFR-Sp)	0.0	(0.0)	0.1	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
13	Lower Fraser Summer (LWFR-Su)	0.3	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.1	(0.3)	0.0	(0.1)
14	Haida Gwaii (QCI)	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.5	(0.5)	0.0	(0.0)
15	Alaska	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
17	Taku	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.2)	0.0	(0.1)
18	Stikine	0.0	(0.1)	0.1	(0.2)	0.0	(0.3)	0.3	(0.7)	0.4	(0.7)	0.0	(0.1)
19-23	Skeena	2.2	(1.0)	1.0	(0.9)	2.9	(1.8)	1.8	(1.5)	0.4	(0.6)	0.7	(0.8)
24	Alsek	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
50	Puget Sound	0.3	(0.3)	1.4	(0.7)	0.0	(0.1)	1.0	(1.0)	0.0	(0.1)	0.0	(0.2)
51	Juan de Fuca	0.0	(0.0)	0.3	(0.3)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
52	Coastal Washington	9.3	(1.5)	13.0	(1.8)	11.9	(2.5)	14.9	(2.9)	18.6	(3.2)	19.8	(4.3)
53	Lower Columbia	3.2	(0.8)	2.7	(0.9)	3.5	(1.4)	2.7	(1.3)	0.1	(0.4)	2.1	(1.4)
54	Upper Columbia Spring	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.2	(0.4)	0.0	(0.1)
55	Upper Columbia Summer/Fall	40.4	(2.0)	40.1	(2.7)	47.1	(4.0)	48.3	(4.0)	47.8	(3.8)	40.4	(4.6)
56	Snake Spring/Summer	0.1	(0.3)	0.0	(0.1)	0.0	(0.3)	0.1	(0.4)	0.0	(0.1)	0.0	(0.2)
57	Snake Fall	0.7	(0.8)	1.4	(1.2)	0.6	(1.1)	0.5	(1.3)	0.3	(1.0)	0.9	(1.8)
58	North & Central Oregon	12.6	(1.6)	12.0	(1.8)	11.4	(2.6)	9.0	(2.4)	8.4	(2.4)	18.8	(4.4)
59	South Oregon Coastal	1.7	(0.8)	2.8	(1.1)	2.5	(2.0)	1.7	(1.7)	0.8	(0.8)	12.5	(3.4)
61	Klamath/Trinity	0.0	(0.0)	0.1	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	0.0	(0.1)
62	Middle Columbia Spring	0.0	(0.1)	0.0	(0.0)	0.0	(0.1)	0.1	(0.3)	0.0	(0.1)	0.0	(0.1)
63	Upper Willamette	1.5	(0.5)	0.7	(0.6)	0.0	(0.2)	0.4	(0.9)	0.0	(0.1)	0.4	(0.7)
64	Central Valley Fall	0.0	(0.1)	0.0	(0.1)	0.2	(0.6)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
65	Central Valley Spring	0.0	(0.0)	0.0	(0.0)	0.1	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
66	Coastal California	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)

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Table 3. Chinook catch composition from 2015 NBC troll fisheries by sample group.

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

	Year	2015		2015		2015		2015		2015		2015	
	Date	June 18-23		June 24-July 1		June 26-July 13		July 10-19		July 16-31		Aug 25 - Sep 5	
	Catch	64,840		17,228		10,519		6,494		4,939		2,683	
Code	N	781		402		189		185		199		141	
		Catch	STD	Catch	STD	Catch	STD	Catch	STD	Catch	STD	Catch	STD
1	Upper Fraser (UPFR)	215	(168)	7	(25)	10	(36)	0	(9)	0	(7)	0	(4)
2	Middle-Upper Fraser (MUFR)	735	(308)	41	(64)	61	(79)	21	(42)	13	(25)	0	(5)
3	Lower Fraser Fall (LWFR-F)	107	(130)	21	(47)	0	(7)	0	(6)	28	(28)	0	(3)
4	North Thompson (NOTH)	727	(280)	10	(29)	1	(14)	22	(43)	36	(37)	0	(3)
5	South Thompson (SOTH)	13475	(975)	3578	(364)	1849	(308)	948	(175)	916	(142)	40	(28)
6	Lower Thompson (LWTH)	321	(174)	0	(8)	0	(9)	0	(5)	0	(4)	0	(3)
7	East Coast Vancouver Island (ECVI)	376	(273)	3	(21)	0	(12)	66	(67)	52	(38)	0	(4)
8	West Coast Vancouver Island (WCVI)	941	(288)	37	(45)	57	(57)	1	(11)	15	(26)	78	(38)
9	Southern BC Mainland (SOMN)	77	(174)	3	(18)	0	(11)	0	(7)	0	(6)	0	(6)
10	Northern BC Mainland (NOMN)	604	(281)	479	(158)	85	(78)	77	(76)	39	(35)	0	(5)
11	Nass	280	(202)	36	(49)	1	(16)	107	(62)	0	(6)	0	(4)
12	Lower Fraser Spring (LWFR-Sp)	0	(19)	17	(36)	0	(8)	0	(5)	0	(5)	0	(3)
13	Lower Fraser Summer (LWFR-Su)	205	(151)	1	(9)	1	(13)	0	(4)	5	(15)	0	(2)
14	Haida Gwaii (QCI)	83	(87)	0	(3)	0	(4)	0	(1)	25	(24)	0	(1)
15	Alaska	1	(24)	1	(12)	0	(9)	0	(5)	1	(6)	0	(3)
17	Taku	12	(59)	1	(15)	1	(13)	3	(17)	1	(10)	0	(3)
18	Stikine	24	(84)	11	(36)	4	(28)	20	(49)	20	(34)	0	(3)
19-23	Skeena	1398	(635)	179	(152)	303	(187)	114	(98)	21	(31)	19	(22)
24	Alsek	0	(21)	0	(8)	0	(8)	0	(5)	0	(3)	0	(3)
50	Puget Sound	203	(185)	239	(119)	2	(16)	63	(64)	0	(6)	0	(4)
51	Juan de Fuca	0	(8)	44	(44)	0	(2)	0	(2)	0	(2)	0	(1)
52	Coastal Washington	6057	(971)	2235	(318)	1256	(264)	966	(190)	919	(159)	530	(116)
53	Lower Columbia	2053	(504)	457	(160)	365	(152)	177	(85)	6	(18)	57	(37)
54	Upper Columbia Spring	0	(18)	0	(5)	0	(7)	0	(4)	8	(18)	0	(2)
55	Upper Columbia Summer/Fall	26193	(1275)	6902	(461)	4953	(416)	3140	(260)	2363	(190)	1081	(123)
56	Snake Spring/Summer	62	(199)	0	(12)	4	(28)	7	(29)	0	(6)	0	(4)
57	Snake Fall	441	(534)	233	(205)	62	(120)	34	(83)	15	(47)	23	(49)
58	North & Central Oregon	8161	(1060)	2069	(316)	1201	(275)	584	(159)	417	(120)	505	(117)
59	South Oregon Coastal	1102	(497)	479	(182)	264	(212)	111	(110)	38	(41)	335	(91)
61	Klamath/Trinity	0	(15)	14	(34)	0	(7)	0	(4)	0	(2)	0	(2)
62	Middle Columbia Spring	15	(55)	1	(8)	0	(11)	6	(22)	0	(6)	0	(2)
63	Upper Willamette	962	(352)	129	(95)	4	(22)	27	(56)	1	(7)	11	(18)
64	Central Valley Fall	10	(51)	3	(17)	26	(62)	0	(8)	0	(5)	0	(4)
65	Central Valley Spring	0	(14)	0	(6)	7	(31)	0	(5)	0	(3)	0	(2)
66	Coastal California	0	(9)	0	(3)	0	(3)	0	(2)	0	(2)	0	(1)

FIGURES

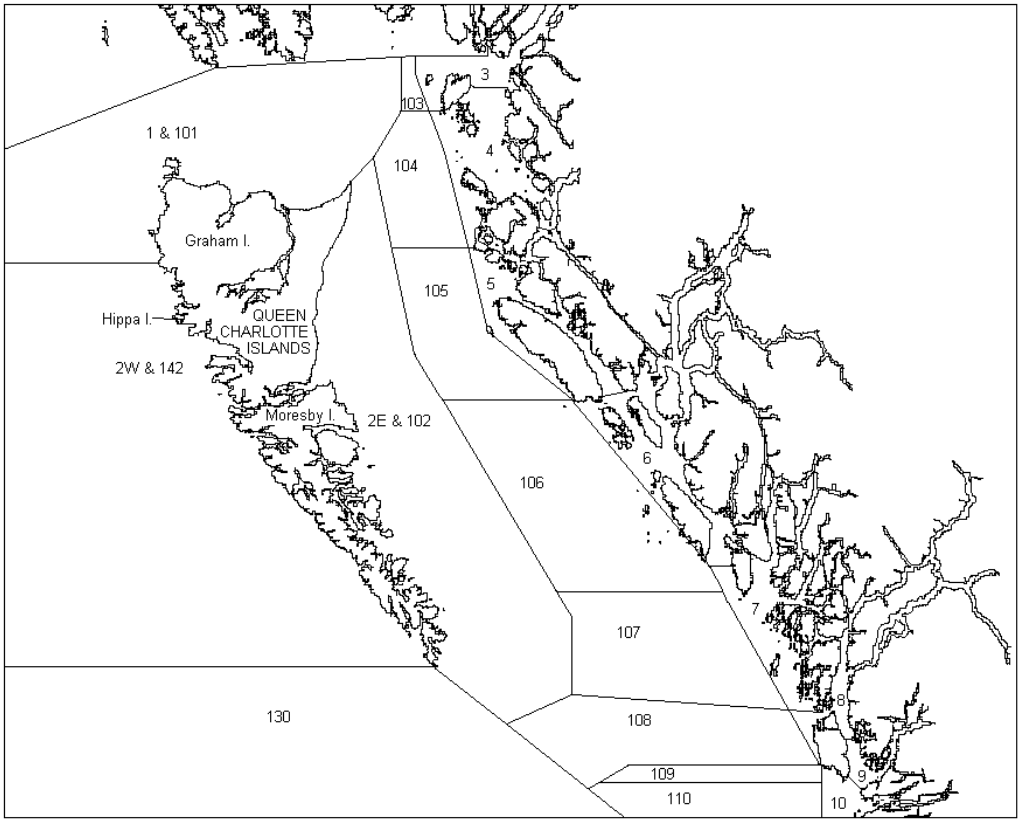


Figure 1. The North Coast of British Columbia showing Pacific Fishery Management Areas 1 to 10, 101 to 110, 130 and 142.

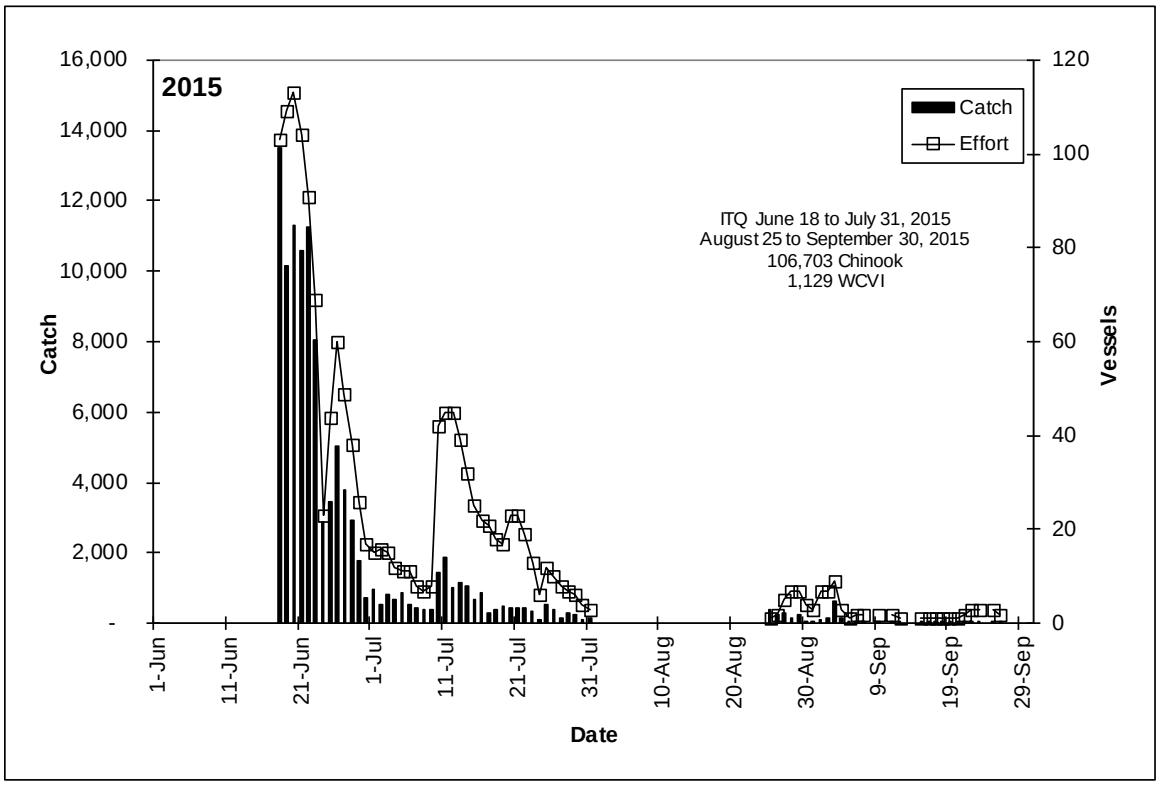


Figure 2. Chinook salmon daily catch and effort in the 2015 NBC Troll fishery.

APPENDICES

Appendix 1. Contract Statement of work for scale sampling of Chinook Salmon from the 2015 Northern British Columbia Troll fishery.

PERIOD OF AMENDMENT: June 15 to September 30, 2015.
The contractor agrees to collect scale samples from Chinook salmon caught in the Northern British Columbia Troll fishery in conjunction with sampling for coded wire tags (cwt's) as described in this amendment to the Statement of Work.

1. SCOPE

Genetic stock identification of Chinook salmon caught in the Northern British Columbia (NBC) troll fishery is used to establish the origin of fish encountered. The data generated by the program contribute to Canada's domestic management of the fishery. The information has also been used in support of Pacific Salmon Treaty (PST) negotiations. Genetic material and age information are available from scale samples.

The objectives for the genetic program are to provide estimates of the stock composition of Chinook caught in the NBC Troll fishery. These data are essential to the management of the fishery. The management objectives for the NBC Troll fishery are to catch as many of the Chinook salmon allowed within the PST allocation while remaining below a harvest rate of 3.2% of the WCVI Chinook return to Canadian waters. The preliminary estimate of the Chinook available to the NBC Troll fishery is 117,400 fish.

The NBC Troll Fishery is scheduled to open on or after June 15, 2015. The fishery may close near the end of July and reopen in September if the total allowable catch and the WCVI harvest rate objective have not been reached. The dates may change and the fishery will close once either of the targets has been met. A proposed licence condition will require all vessels to land their catch within 5 days of a closure.

The coordinator for the NBC Troll Chinook genetics program is Ivan Winther. Sample collection for the NBC Troll genetic program has been conducted by J.O. Thomas & Associates for Fisheries & Oceans Canada since 2002. Fisheries & Oceans Canada is proposing the following amendment to the Mark Recovery Program contract to include genetic sampling of the NBC Troll fishery.

2. SAMPLE COLLECTION

The NBC Troll genetic sampling objectives are to collect scales and length data from a representative sample of the Chinook salmon catch and supply the samples with the associated capture information to Fisheries & Oceans Canada. Complete documentation will accompany the samples. Fisheries & Oceans Canada will supply the scale books and the sampling forms.

The collection of tissue samples preserved in ethanol has been discontinued as the preferred method for samples of genetic material. Genetic material is available from the scales however it is subject to cross contamination from contact with other fish. In the revised scale sampling procedure the preferred location on each fish sampled will be wiped with a clean paper towel to avoid problems associated with cross contamination.

The sampling objective will be to collect a representative sample of 3000 Chinook salmon from the proposed catch of 117,400. This strategy is intensive in an attempt to measure the relatively small component of WCVI Chinook anticipated in the fishery. A random / stratified approach is used to ensure a representative sample. Vessels are selected at random and every 5^{th} fish or every 10^{th} fish offloaded is sampled to reduce autocorrelation. Fewer than 50 fish are

sampled from each vessel landing. Vessel operators are interviewed to determine areas of catch and number of Chinook being delivered. Samples of fresh landings are preferred as they provide the opportunity to sample for size, age and genetic information (as provided by length measurements and scales). The scale samples and data are matched with coded wire tag recoveries when cwt's are encountered. Samples from fish frozen at sea are a second choice as they can only consist of genetic information available from tissue samples. Samples from frozen fish consist of batch collections of tissues preserved in ethanol and supplied with the capture information. Scales and length information are not available from frozen fish.

The contractor shall:

- Communicate with the coordinator or designate on appropriate sample times, locations and sample amounts. Sampling rate will be dictated by the rate of the fishery. It will be essential to sample heavily from the first landings of Chinook salmon and again once the fishery closes. The coordinator may be contacted by email at Ivan.Winther@dfo-mpo.gc.ca or by telephone at 250-627-3459.
- Examine scale books and written materials provided by the coordinator to ensure they have all necessary data sheets to successfully collect and report the samples. Report deficiencies to the coordinator verbally or by email.
- Collect scale samples from up to 3000 Chinook salmon following the instructions in section 3.
- Collect batched samples of tissue into ethanol from frozen landings if requested.
- Discuss modifications to procedures with the coordinator and incorporate modifications if necessary. If additional contract costs will be incurred, discuss modifications to procedures and cost estimate with Scientific Authority.
- Return all of the unused scale books and forms to the coordinator at the end of the season.

3. SAMPLE INSTRUCTIONS

2015 North Coast Chinook Troll Commercial Fishery Samples

Samples of chinook tissue and scales will be collected from the Commercial Troll Fishery on the Queen Charlotte Islands. The sampling target is to collect 3000 scale samples from the Area F troll fishery in 2015.

- The sampling protocol is to collect scale samples with associated length measurements and capture data. The samples will be collected according to a stratified random procedure. Data from Chinook with cwt's encountered during the will be matched to the scale sample data.
- The initial opening is scheduled after June 15, 2015 in areas north and west of the Graham Island. The fishery may close at the end of July or when the allowable catch has been reached (as measured by the component of West Coast Vancouver Island Chinook caught or the total allowable catch of 117,400).
- Samples will be collected in lots of 100 fish from 2 or more vessels. Sample 50 or less Chinook from each vessel landing.
- Once a random vessel is selected to be sampled the scales and data are collected in a stratified procedure where every 5^{th} or 10^{th} Chinook from the load is sampled depending on the total number of fish delivered.
- The selection of Chinook for scale sampling shall be independent of whether a cwt is detected (either by an adipose fin clip or a detector). A unique MRP identification number (the head label number) shall be recorded for the scale samples of Chinook with a cwt.
- Scale collections will be 5 per fish onto standard 5-down format scale books. **Please check for REGENERATE SCALES.**

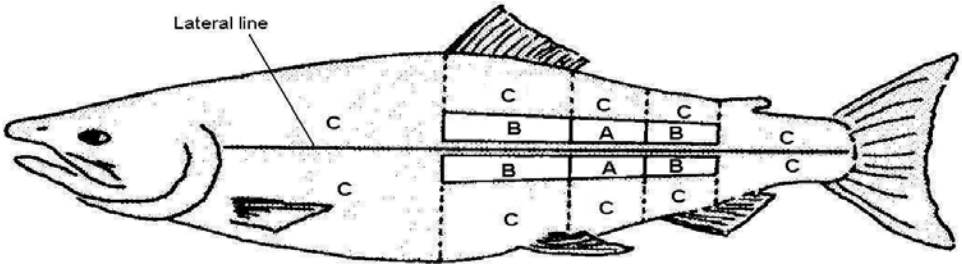
- Ship the scale books and completed sample forms to Prince Rupert within 2 days of sampling.

COLLECT SCALES AND CAPTURE DATA FROM EACH FISH ACCORDING TO THE FOLLOWING PROTOCOL:

- Use pencil.
- Record the scale book number at the top of every column of 10 fish.
- Record the vessel, date and area fished (you can use dittos or arrows for fish sampled from the same vessel on the same day).
- Sample each fish in sequence according to the numbers on the scale books.
- WIPE THE SLIME FROM THE PREFERRED SCALE LOCATION ON EACH FISH WITH A CLEAN SHEET OF PAPER TOWEL.
- Collect 5 scales from each fish as noted on the back of this sheet.
- Ensure the numbers on the data sheets match the numbers on the scale books.
- **The completed data sheets must accompany the samples to Prince Rupert.**

SCALE SAMPLES:

- Record the scale book number on the data sheet. Each book will contain scales from 10 fish.
- 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".



- WIPE THE SLIME FROM THE PREFERRED LOCATION WITH A CLEAN SHEET OF PAPER TOWEL.
- Using forceps collect 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 which 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; leave the scale with the same side up as it is on the fish.
- Select a second scale and add it to the adjacent square bearing the same number.
- Keep the scale books dry.
- Once the book is full, fill out the information on the back of the page bearing the scales.
- THE SCALES MUST MATCH THE NUMBERS ON THE DATA SHEETS.

Return all data, samples and equipment 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

4. SAMPLE FORM

4.1 The following is an example of the sample form to be completed and provided with the scale collections.

NC CHINOOK TROLL FISHERY 2015 JOT Commercial fishery sample **USE PENCIL**

Sampler: _____ **Location:** _____

Chinook Scales 1-50 on this side **Date Sampled** _____

Scale Book # _____ SCALE BOOK CONTINUED FROM BELOW at 25

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
1	1 to 41					
2	2 to 42					
3	3 to 43					
4	4 to 44					
5	5 to 45					
6	6 to 46					
7	7 to 47					
8	8 to 48					
9	9 to 49					
10	10 to 50					

Scale Book # _____

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
11	1 to 41					
12	2 to 42					
13	3 to 43					
14	4 to 44					
15	5 to 45					
16	6 to 46					
17	7 to 47					
18	8 to 48					
19	9 to 49					
20	10 to 50					

Scale Book # _____

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
21	1 to 41					
22	2 to 42					
23	3 to 43					
24	4 to 44					
25	5 to 45					

scale book continued above at 26

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
26	6 to 46					
27	7 to 47					
28	8 to 48					
29	9 to 49					
30	10 to 50					

Scale Book # _____

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
31	1 to 41					
32	2 to 42					
33	3 to 43					
34	4 to 44					
35	5 to 45					
36	6 to 46					
37	7 to 47					
38	8 to 48					
39	9 to 49					
40	10 to 50					

Scale Book # _____

	SCALE #	Vessel	Date Caught	Area Fished	Length (cm)	CWT head #
41	1 to 41					
42	2 to 42					
43	3 to 43					
44	4 to 44					
45	5 to 45					
46	6 to 46					
47	7 to 47					
48	8 to 48					
49	9 to 49					
50	10 to 50					

Appendix 2. Baseline samples used in the mixture analyses.

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

#	Region	Population	N
10	NOMN	Kwinamass	362
10	NOMN	LowAtnarko	50
10	NOMN	Marble@CC	41
10	NOMN	Neechanze	57
10	NOMN	Nusatsum	103
10	NOMN	Saloompt	138
10	NOMN	Takia	63
10	NOMN	U_Atnarko	200
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

#	Region	Population	N
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
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