Stock Composition of Chinook Salmon caught in the Northern British Columbia Troll Fishery in 2006

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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 was used to address stock specific management in a mixed stock fishery. Chinook salmon stock compositions were estimated in-season for the 2006 NBC troll fishery and the fishery was managed in-season to catch targets 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 2006 NBC troll fisheries on all of the Chinook stock groups encountered.

INTRODUCTION

The commercial troll fishery is the largest fishery for Chinook salmon *(Oncorhynchus tshawytscha)* in Northern British Columbia (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 for the period 1999 to 2008 the NBC troll and Queen Charlotte Islands (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 NBC troll fishery makes up the north-western portion of Area F; Areas 1 to 5, 101 to 105, 130 and 142. Winther and Beacham (2006) provide a complete review of history of the NBC troll fishery. The size of the troll fleet in Area F was relatively stable from 2002 to 2005, varying between 146 and 168 licensed vessels. Prior to the 2006 season troll vessel operators were permitted to reselect fishing areas coast wide. Area F received an additional 80 vessels bringing the total number of licences in the area to 246. The influx of vessels was due to reduced fishing opportunities in southern areas and the introduction of individual transferable quotas (ITQ) in the NBC troll fishery for Chinook salmon.

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).

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. 2003b). For example, it is possible to discriminate among Chinook salmon populations from specific tributaries in the Fraser River drainage in southern British Columbia with a high degree of accuracy (Beacham et al. 2003a). 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 continued to apply the procedures developed by Winther and Beacham (2006) using microsatellite variation in Chinook salmon as a tool for management of stocks of conservation concern encountered by the 2006 troll fishery off the Queen Charlotte Islands. 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 age specific stock compositions for troll catch of Chinook salmon by time and area. We identify stock specific impacts for the fishery and attempt to generate information useful to structuring future fisheries.

METHODS

This study followed the sampling regimes and locations defined by Winther & Beacham (2006). Monthly samples were collected from the sites of La Perouse Reef in Area 101 and Buck Point in Area 2W (Figure 2). In addition samples were collected from the open fisheries to measure stock specific impacts.

CATCH DATA

Catch data were assembled from three sources; phone-in hails, fish slips and landing validations. These catch data were required as a condition of licence in the NBC troll fishery. Phone-in hails are required within 24 hours of landing or within 24 hours of the closure of the fishery and consist of a report of date fished, area fished, number of fish caught and retained by species and number of fish caught and released by species as well as other information. These reports are received and entered in the "Fishery Operations System" (FOS) by a service company contracted by the fishers. Fish slips are records of the fish landed by a vessel that include the weight and grade of fish landed. Landing validations are counts of Chinook salmon off-loaded by troll fishing vessels involved in the individual transferable quota (ITQ) fishery. Vessels that did not participate in the ITQ fishery were not required to validate their landings.

Fish slip data were queried from the Catch Statistics database by size, grade and gear type. Average weights were generated from fish slips matched with landing validations. These average weight data were used to generate piece estimates when there were insufficient data on pieces per delivery on the fish slips.

Daily catches reported in the FOS were summed and compared with landings reported on the fish slips and validated landings. Each record was reviewed and a decision was made on whether the validation, FOS or fish slip data best represented the catch. In this process the validation was used most often unless the comparison showed evidence of missing catch.

Since validation was not required for Chinook salmon caught in the derby fishery the audit process included only fish slip and FOS hail data. FOS records were used for the 6 vessels that participated in the traditional derby style fishery.

Catch and sample data are presented for October 1, 2005 to September 30, 2006 to parallel the year beginning and end dates used in presenting Chinook salmon data for the PST.

SAMPLE COLLECTION

Biological sampling

A common paper punch was used to collect tissue samples from the operculum of the Chinook salmon being sampled (Figure 3). One tissue sample was collected from each Chinook salmon. Tissues were preserved in a solution of 95% non-denatured ethanol. All tissue samples were kept in individual vials. 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.

Scale samples were collected on to scale books, five scales per fish, as described by MacLellan (1999).

Commercial fishery sampling

A program to sample commercial fishery landings was designed with the objective of collecting tissues from approximately 1% (~1500) of the Chinook salmon caught in the fishery. Samples were collected by a contractor involved in the existing MRP sampling program. The sampling procedure was to select vessel landings at random and sample less than 50 fish from

each delivery. Every 5th or 10th fish was sampled from the load depending on the size of the delivery. Individual Chinook salmon sampled from commercial fishery landings were sampled for nose-fork length, scales and tissue. (Sex could not be determined because fish landed by the commercial fishery were dressed.) These collections were matched to data on the area fished and date caught. A record identification number was included for fish sampled that had coded wire tags.

The collection targets were designed larger than the target for analysis because the sample collection was relatively cheap when compared to sample analysis. This protocol assured samples across all time and area strata and allowed for sub-sampling to best represent the commercial fishery landings.

Troll catches of Chinook salmon were sampled at sea on the opening day of the fishery, June 7. The sampling protocol was to collect a maximum of 25 tissue samples per vessel. No other biological data were collected from the fish sampled at sea.

Test fishery sampling

Test fishing vessels were solicited from Area F licensed troll fishing vessels. A lottery was used to select test fishing participants. Chinook caught in the test fishery were kept as payment by the test vessel operators. The use of fish funding was approved by the Area Harvest Committee (the body representing commercial troll fishers to Fisheries & Oceans Canada). Sampling sites and procedures were reviewed with the test fishing operators when they picked up their sampling equipment.

Test fishery samples were used to provide trends in stock composition for positioning the fishery temporally and spatially. The initial proposal was to collect 1200 Chinook salmon tissues from troll test fisheries near La Perouse Reef, south of Langara Island, and Buck Point, mid way down the west side of the Queen Charlotte Islands (Figure 2). Samples of 100 Chinook were collected monthly from April to September from each site. An additional pair of samples was collected beginning May 15 to provide additional stock information for a fishery opening proposed in June. The location of the northern sample in July was modified to test Chinook salmon from around Tartu Inlet, an intermediate location between the normal Buck Point site and the La Perouse Reef site. Fishery landings were sampled to make up the La Perouse Reef sample in July.

Each Chinook salmon encountered by a test fishing vessel was measured for nose-fork length and incised to determine sex. Scales and tissue were collected and date and location were recorded for each fish. Data were recorded on waterproof sampling sheets. Further sampling details are available in Winther & Beacham (2006).

Sample Size

Samples of the landed catch from the open fishery were used to determine the stock specific impacts. The sample design was approached from the perspective of a binomial problem where Chinook salmon were identified as either from WCVI or not. Available funds dictated the maximum extent of sample analyses. The catch ceiling of WCVI Chinook salmon was ~4% of the total catch (6433 WCVI / 153,200). If the actual catch approached the ceiling the level of precision afforded by the program would provide 95% confidence limits within ~30% of the estimated proportion of WCVI chinook. Smaller proportions would have respectively broader confidence limits and in-season data representing portions of the 1000 sample target would have respectively broader confidence limits as well.

SAMPLE ANALYSIS

Chinook salmon collections were compared against genetic baselines from 250 Chinook salmon populations from Southeast Alaska through Canada and the lower United States of America (Appendices 1 & 2). Samples were analyzed for 13 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. This program called "c-BAYES" is available upon request from the Fisheries & Oceans Canada, Molecular Genetics Laboratory at the Pacific Biological Station in Nanaimo. The model output presented includes the Bayesian probability estimates for the 5 most probable populations for each sample (J. R. Candy, Fisheries & Oceans Canada, pers. comm.).

RESULTS

STOCK COMPOSITION

Stock composition of the 2006 NBC troll catch is presented by stock group in Table 1. The 25 fish not assigned to the stock composition data represent catch that was not sampled in October of 2005. The most prevalent stock group in the NBC troll catch was South Thompson (SOTH), followed by North & Central Oregon and Upper Columbia Summer and Fall (Up Col-Su/F) stock groups.

2006 TROLL FISHING PLAN

The 2006 pre-season Aggregate Abundance Based Management (AABM) index was 1.53 with an associated allowable catch of 223,200 Chinook salmon for NBC Troll and QCI sport fisheries. The pre-season estimate of the sport catch was 70,000 fish leaving 153,200 fish as the pre-season troll allocation. The 2006 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 6344 fish.

A troll quota of 3000 Chinook salmon was assigned to the October to December, 2005 quarter and the remainder of the allocation was assigned to the summer fishery.

A demonstration fishery to examine the application of individual transferable quotas (ITQ) in the troll fishery first held in 2005 was continued in 2006. The in-season target for the traditional style or derby fishery was 3720 Chinook salmon and the target for the ITQ fishery was 148,800 Chinook salmon (620 per licence).

2006 TROLL CATCH

The NBC troll fishery landed 158,363 Chinook salmon in 2006. The QCI sport fishery caught 64,500 fish bringing the total 2006 AABM catch to 222,863 Chinook salmon. The NBC troll fishery was opened for Chinook salmon fishing from October 1, 2005 to December 31, 2005 and from June 7 to September 30, 2006. The total allowable catch for the winter fishery was 3000 Chinook salmon but only 1 vessel participated and only 25 Chinook salmon were caught. The summer fishery accounted for a total of 158,338 Chinook salmon, with 153,214 fish caught under the ITQ system and 3887 fish caught under the regular style or derby fishery. There were 159 licensed vessels that participated in the ITQ fishery and 6 vessels that participated in the derby fishery. The test fishery accounted for the remaining 1237 legal-sized Chinook salmon. Troll catch and effort by day are presented in Figure 4.

2006 SAMPLING & STOCK IDENTIFICATION

The NBC troll sampling protocol for 2006 included a test fishing program and a sampling program for landed catch.

The test fishing program was designed to collect 14 samples of 100 fish per sample over 7 time periods and 2 locations between April 1 and September 15, 2006. The test fishery began April 4 to sample 100 Chinook salmon from each of 2 sites: Area 101 between Langara and Frederick Island and Area 2/142 around Buck Point. Samples were collected near the beginning of each month with the exception of one additional pair of samples requested by managers to begin May 15. Complete samples were collected by the test fisheries in April, July and August. Test fisheries beginning May 1 and May 15 were completed for the Buck Point site but fell short by 7 and 3 fish respectively for the Area 1/101 sample. The June sample from Buck Point was complete but a vessel break-down left the Area 1/101 sample with only 77 Chinook salmon. Only 70 Chinook salmon were collected in the September sample in Area 2W/142 because blue sharks (*Prionace glauca*) had invaded the area. The September Area 1/101 test sample was abandoned. The damage inflicted by the sharks to the catch and the gear made it impossible to complete the samples. The total test catch was 1237 Chinook salmon and DNA analyses were completed for 1159 of the fish landed in test fisheries.

Catch was sampled from the ITQ demonstration fishery and the regular style fishery as the fish were landed. The objective was to collect tissue samples from 1% of the catch (~1500 Chinook salmon) and have the DNA analyses completed for approximately 0.65% of the catch (1000 Chinook salmon). Fishery sampling objectives were met with a total of 1750 Chinook salmon sampled from landings and 253 sampled at sea. Analyses were completed for 1118 of the tissues collected from fishery landings and 245 of the tissues collected at sea.

Only one test sample of 100 fish collected in August in Area 1/101 occurred in the same time and area as the open fishery. Consequently it was the only test sample that could represent any part of the commercial catch. Analyses were completed for 93 fish in this sample. It was flanked by open fishery samples with similar stock compositions (Table 2).

Stock compositions from legal-sized Chinook salmon sampled from the 2006 troll and test fisheries appear in Tables 2 and 3 for Areas 1/101 and 2W/142 respectively. Stock compositions in 2006 are applied to commercial troll and test catches in Tables 4 and 5. An inventory of samples collected appears in Appendix 3.

2006 MANAGEMENT ACTIONS

The catch ceiling for WCVI Chinook salmon was 6344 fish within the NBC troll total allowable catch (TAC) of 153,200 fish. The ceiling represented a maximum of 4.1% of the TAC. The trigger for opening the ITQ fishery was to open when the proportion of WCVI Chinook in the samples dropped below 6%. Similarly, samples above 6% WCVI would initiate a closure of the fishery.

The decision rules for the ITQ fishery were to open the fishery as early as May 15th if the WCVI component of the May 1st sample was less than 6%. Between May 15 and July 1 the ITQ fishery could open as soon as possible after samples indicated a WCVI component less than 6%. After July 1 the ITQ fishery would open regardless of the WCVI component in the samples and would close when the WCVI ceiling was met.

The decision rules for the derby fishery were to open as early as June 3 if the WCVI component of the May 15 sample was less than 6%. Alternatively the fishery could open as early as June 17th if the results from the samples collected June 1 indicated a WCVI component less than 6%. If all samples were above 6% WCVI the derby fishery would open July 1 regardless of the WCVI component in the samples and would close when the WCVI ceiling was met.

Table 6 presents the results of the sampling program relative to the management decisions made for the troll fishery. Test fishery samples remained above the trigger point until May 15th when an opportunity to fish was indicated by a sample that was 1.7% WCVI in Area 1/101. The Buck Point sample from May 17-18 was 20.7% WCVI so the fishery was opened north of Louis Point on June 7. Results from the test fishery samples collected in early June were delayed because the test vessel broke down. Consequently the analyses of the fishery samples collected on opening day arrived before the analyses of the test samples. The opening day sample collected below Frederick Island was 15.2% WCVI and the sample collected above Frederick Island was 4.2% WCVI. The test sample collected June 3 to 4 from Area 1/101 was 11.8% WCVI. Upon receipt of these data, June 16th, it appeared the derby fishery would exceed its allowance of WCVI Chinook salmon and the fishery was closed June 22. Managers kept the ITQ fishery open to wait for more fishery sample results because most of the fleet had left the area below Frederick Island because of poor fishing. On June 24 the results from the first fishery landings caught between June 7 and 19 indicated 2.5% WCVI. Managers re-opened the derby fishery June 29 and it remained open until the fishery met its target catch.

Most of the samples collected at the Buck Point site were above the 6% WCVI component necessary to open the fishery. The only Area 2W/142 samples below the trigger were collected at Tartu Inlet from July 1 to 3 and from Buck Point to Tian Head in September. Managers responded to the Tartu Inlet sample by extending the open area from Louis Point down to Hippa Island on July 20. No management action resulted from the September sample because fishing was very poor and the results were received just 10 days before the end of the season.

The majority of catch occurred in June and July when low proportions of WCVI Chinook salmon prevailed in Area 101. A fishery sample collected from Area 101 from fish caught between July 15th and 30th was 6.8% WCVI. Although this sample was above the management trigger and may have initiated a closure if analyzed immediately, the analysis of this sample occurred at the end of the year after the fishery was over.

The derby fishery opened from June 7 to 22 and from June 29 to July 4, 2006. The ITQ fishery was open from June 7 to September 30. The most important management decisions predicated by the DNA data were to keep the fisheries closed in the southern part of the region. The closure and subsequent re-opening of the derby fishery was based on the stock composition data available at the time. In hindsight we realized that the fishery could have remained open until the allowable catch was met.

Total catch for 2006 was 158,338 Chinook salmon with 6,465 of WCVI origin. The catch of WCVI Chinook salmon was 102% of the pre-season target. The total catch of Chinook salmon was 103% of the pre-season target and 99.8% of the post season allowable catch (QCI sport catch was lower than expected). The estimated post-season exploitation rate on WCVI Chinook salmon was 2.9% and the estimated harvest rate on the return of WCVI Chinook salmon to Canada was 3.3%. Management targets and actual catches for 2006 are presented with pre-season forecasts and post-season estimates for WCVI and Robertson Creek Hatchery (RCH) Chinook salmon are presented in Appendix 6 and are compared to the results from 2002 to 2005.

GENERAL

The proportions of WCVI Chinook salmon in each sample are presented by date in Figure 5 and are compared to samples collected in previous years in Appendix 5 (Winther and Beacham 2006).

Chinook salmon age data are presented by stock region in Table 7. Size frequencies are presented by area in Figure 6 and compared to samples collected in previous years in Appendix 4 (Winther and Beacham 2006).

Stock proportions pooled by month and averaged across Areas 1/101 and 2W/142 are presented in Figure 7. Monthly stock proportions are separated by area in Figure 8 to reveal large differences between Area 1/101 and 2W/142 in the relative contributions by each stock group.

DISCUSSION

The troll fishery catch data represent the best estimate at the time of writing. Incidents that confounded analyses of catch were multiple fish slips generated for a single load, freezer vessels retaining catch over multiple deliveries, non-reporting of catch and deliberate misreporting of catch. The audit of catch initiated several investigations so final estimates aren't expected until later. Large scale changes to the catch are not expected.

Test fishery observations and anecdotal information from the sport fishery indicated changes in the distribution of Chinook salmon on the west side of QCI in 2006. In past years (2002 to 2005) it was common for test vessel operators to have more difficulty collecting the Buck Point sample than the La Perouse Reef sample. This situation was reversed in 2006 with some of the best fishing occurring off of Buck Point. The troll fleet was not permitted to fish on the abundance that appeared in Area 2W/142 in 2006 because of the relatively high components of WCVI Chinook salmon. Sport fisheries in Area 2W/142 reported their best catches ever while similar fisheries in Area 1/101 reported relatively modest catches.

Additional anecdotes from 2006 QCI fisheries were the differences in the distributions of other species. Herring *(Clupea harengus pallasi)* and Pacific sand lance *(Ammodytes hexapterus)* were reported to be less common around Langara Island than in previous years. The presence of dense schools of Pacific sardine *(Sardinops sagax)* around QCI was thought to affect Chinook salmon distribution. Incidences of blue sharks and Humboldt squid *(Dosidicus gigas)* were reported to be much higher off the west side of QCI in 2006. Humboldt squid were relatively unknown in the area prior to 2006.

Chinook salmon sizes measured in 2006 show some increase relative to those observed in 2005 yet remained smaller than sizes measured from 2002 to 2004 in Area 1/101 (Appendix 4). The size differential between years was less prevalent in the fish sampled from Area 2W/142. Winther and Beacham (2006) attributed the smaller size in 2005 due to relatively poor performance of most Chinook salmon cohorts that went to sea in 2001. Both 2000 brood ocean-type stocks and 1999 brood stream-type stocks appeared in much smaller proportions in the samples than cohorts from the previous brood.

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 off the beach has assisted in avoiding WCVI Chinook stocks (Winther and Beacham 2006). Appendices 7 and 8 provide comparisons of stock compositions observed in the sport and troll fisheries by area. The proportion of WCVI Chinook salmon was consistently higher in the sport fishery samples.

The majority of the 2006 troll fishery was conducted under an individual vessel quota of 620 Chinook salmon per vessel. Few management actions were required to meet the catch objectives set by the forecast of WCVI Chinook salmon. The post-season estimate of the return of WCVI Chinook salmon to Canada was within 2% of the pre-season forecast.

The relationship between the catch target for WCVI Chinook salmon and the management triggers set to control the fishery needs to be explored further. Currently the management trigger is set at approximately 150% of the target with the expectation that a portion of the fishery samples will be below target and if they don't the fishery will close before the PST

TAC is reached. These levels were set in consultation with industry, and perhaps that's the most effective method as industry provides input on the amount that they are willing to gamble in losing a portion of the TAC. The relationship between the trigger and the actual risk of foregone catch is unknown. The risk of exceeding the WCVI target given various triggers is unknown as are the relative risks to the biological success of WCVI Chinook salmon stock under current or past management regimes.

No management actions other than determining the fishery start time and fishery location have been invoked since the inception of the ITQ fishery. A full closure of the fishery has been unnecessary. However, more of the 2006 troll catch was carried later into the year than in any other year since the inception of the DNA program. The combination of Chinook salmon abundance and high proportions from WCVI makes troll fishery impacts on WCVI stocks most severe in August. To date the timing differential between WCVI Chinook salmon and abundant stocks in the Fraser River and Upper Columbia has provided opportunities to minimize impacts on WCVI stocks by fishing in June and July. Continued movement of the fishery into August during the rebuilding phase for WCVI stocks could jeopardize the ability of future fisheries to come under the ceiling. Since stock forecasts are unlikely to improve, management should explore "best practices" regarding fishery timing and location. These could be implemented in addition to the on/off triggers that are most subject to forecasting errors. (E.g. under similar stock abundances don't fish in August even if the samples are below the trigger because that seems to be the most detrimental period for WCVI stocks in NBC).

Most of the patterns in stock composition observed in 2006 are consistent with the data collected from 2002 to 2005 by Winther and Beacham (2006). Samples collected in Area 1/101 near Langara Island consisted of more stock groups than those collected further south at Buck Point or other locations in Area 2W/142. Northern stocks were not as prevalent down the west side of QCI reflecting the northern components of the mixture moving off to terminal areas as the season progressed. The greatest numbers of stocks were encountered in June and July. The proportion of samples made up by stocks from the United States was lowest in June and highest in April and September. The proportions of WCVI Chinook salmon observed in the samples were lowest in late June and early July (Figure 5).

We experienced considerable time lags between when fish were caught and when the results of the DNA analyses were available. Most of these delays were related to the remoteness of the fishing grounds and the logistics of getting samples collected and delivered to the lab. The collection of catch samples from vessel offloads typically took place almost week after the first fish were caught. Vessels often fished for the maximum time allowed by the buyers for deliveries of fresh fish (4 to 6 days) prior to landing. Test fishing or active sampling of the open fishery were alternatives to sampling vessel landings when stock composition data were required for active management of the fishery relative to trends in stock composition. However, direct sampling of catch was essential to measure the actual impacts of the fishery and sampling vessel landings was the cheapest method.

The combination of age and stock data revealed errors in the form of larger than normal stream type components identified for some stocks that were primarily ocean type, and the inverse, larger than normal ocean type contributions to primarily stream type stocks. The latter was more common (Table 7). Examples of these errors include the large proportion of ocean type fish identified for Skeena and Nass stock groups that are typically less than 3% ocean type. We attribute these errors to the difficulty in ageing the freshwater portion of the scales and to sampling errors in the collection procedures (where scales do not match the tissue collected). The actual cohorts for stocks with significant components of both stream and ocean types are suspect because of the difficulty interpreting freshwater age.

The proportion of any particular stock group of Chinook salmon in a sample was a function of the abundance of that stock group relative to other stocks present in the area sampled. We observed that relatively minor differences in timing and/or distribution could have significant effects on fishery impacts. In these experiments it was fortuitous that some of the more abundant stocks were present to dilute the WCVI Chinook salmon that the fishery was attempting to avoid and that the timing and distribution of the abundant stocks was different from the WCVI stock group. In particular, the abundant South Thompson (SOTH) stock group influenced stock compositions in 2006. The SOTH group experienced record escapements in 2006. Differences in timing and distribution between stock groups allowed the fishery to be positioned in time and space such the stocks of conservation concern were avoided and abundant stocks were harvested. In order to monopolize on these differences you must be able to identify them. Changes in abundance or distribution of either the stock of conservation concern or any of the major components encountered by the fishery would have significant consequences. The ability to have a successful fishery while avoiding a stock of conservation concern hinges on identifying such differences in timing or distribution.

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 2006 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 even random across the fishery, one could not define fishing periods or areas 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.

Management may be confounded by differences between fish within the same stock group. Currently the WCVI stock group is heavily enhanced with over 80% of the Chinook salmon from hatcheries. Enhanced stocks have shown a quicker recovery from recent low levels than wild stocks and management strategies for enhanced and wild components differ in areas where that option is available (e.g. terminal fisheries). For the NBC troll fishery, managers assume the wild and enhanced fish behave the same but management actions may not have the desired effect if the enhanced component has behavioral differences that influence their timing and distribution in the fishery. Finally, the biological effect of management actions in the troll fishery would be nil if the exploitation was simply transferred to another fishery.

The NBC Troll fishery essentially reached the allowable catch and the catch ceiling for WCVI Chinook salmon in 2006. The 158,363 Chinook salmon landed in the fishery represented approximately $9M gross revenue paid to the fishers.

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TABLES

Table 1. Chinook catch by stock group and area for 2006 NBC troll fisheries.

Abbreviations are described in Appendix 2. Standard deviations (STD) appear in brackets.

Stock Group	Area 1 catch	STD	Area 2W catch	STD	Total Catch	STD
Alaska	27	(57.6)	0	(0.4)	27	(57.6)
Alsek	25	(51.3)	1	(1.1)	26	(51.3)
Taku	135	(166.9)	3	(3.1)	138	(167.0)
Stikine	648	(376.9)	2	(2.5)	650	(376.9)
QCI	1,020	(388.1)	0	(0.2)	1,020	(388.1)
NASS	1,325	(466.4)	5	(2.5)	1,330	(466.4)
Skeena	4,539	(1034.5)	11	(4.2)	4,551	(1034.5)
NOMN	5,152	(946.6)	10	(3.8)	5,162	(946.6)
WCVI	6,393	(922.1)	72	(8.4)	6,465	(922.1)
ECVI	2,369	(668.3)	18	(5.0)	2,388	(668.3)
SOMN	115	(152.0)	1	(2.0)	117	(152.0)
UPFR	1,045	(418.1)	7	(2.9)	1,052	(418.1)
MUFR	3,532	(898.3)	10	(3.8)	3,541	(898.4)
NOTH	2,846	(736.8)	4	(2.5)	2,850	(736.8)
SOTH	62,707	(2294.9)	140	(11.1)	62,847	(2295.0)
LWTH	204	(147.2)	0	(0.5)	205	(147.2)
LWFR-Sp	365	(253.1)	1	(1.0)	366	(253.1)
LWFR-Su	133	(131.4)	0	(0.3)	133	(131.4)
LWFR-F	65	(120.4)	1	(1.5)	66	(120.4)
Puget Sound	923	(409.2)	3	(2.7)	927	(409.3)
Juan de Fuca	8	(31.0)	2	(2.2)	11	(31.0)
Coastal Wash	7,790	(1169.2)	49	(7.6)	7,839	(1169.2)
Up Col-Sp	103	(186.3)	0	(0.4)	103	(186.3)
Up Col-Su/F	22,637	(1736.6)	243	(14.5)	22,880	(1736.7)
Snake-Sp/Su	250	(275.4)	9	(4.3)	260	(275.4)
Snake-F	2,159	(943.9)	26	(8.5)	2,185	(943.9)
Mid Col-Sp	28	(62.6)	1	(0.9)	29	(62.6)
Up Willamette	3,685	(774.4)	16	(5.0)	3,701	(774.4)
Low Col	1,990	(617.3)	14	(4.9)	2,004	(617.4)
North & Central O	23,716	(1697.7)	109	(11.4)	23,825	(1697.7)
South Oregon coas	1,446	(549.3)	8	(4.5)	1,454	(549.3)
Klamath/Trinity	25	(51.8)	1	(1.0)	25	(51.8)
Cent Val-Sp	29	(61.3)	0	(0.4)	29	(61.3)
Cent Val-F	130	(143.1)	0	(0.7)	131	(143.1)

The catch assigned to stock groups represents 158,338 of the total 158,363 Chinook salmon caught from October 1, 2005 to September 30, 2006. 25 Chinook salmon caught in October 2005 were not sampled.

Table 2. Chinook stock composition as observed in samples of 2006 troll catches from Area 1/101.

Composition presented as % of the sample N. Abbreviations are described in Appendix 2. Standard deviations appear in brackets.

Area 1/101	2006		2006		2006		2006		2006		2006		2006		2006		2006		2006		2006	
Date	Apr 4-6		May 11-14		May 15		Jun 3-4		Jun 7		Jun 7		Jun 7-19		Jun 16-26		Jun 17-26		Jun 27-Jul 1	
Fishery	Test		Test		Test		Test		Troll		Troll		Troll		Troll		Troll		Troll	
N	84		92		94		76		143		102		183		92		98		87	
UPFR	0.1	(0.3)	0.1	(0.3)	1.1	(1.4)	1.5	(1.8)	3.6	(1.7)	2.9	(1.7)	1.7	(1.4)	0.2	(0.5)	2.6	(1.8)	0.1	(0.3)
MUFR	0.1	(0.3)	3.0	(2.1)	3.2	(2.3)	6.1	(3.2)	0.5	(1.1)	0.2	(0.7)	4.5	(2.1)	2.7	(2.5)	3.2	(2.3)	0.2	(0.5)
LWFR-F	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	1.3	(1.4)	0.1	(0.3)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)
NOTH	1.3	(1.2)	0.1	(0.4)	2.5	(2.1)	0.1	(0.3)	2.5	(1.7)	0.0	(0.2)	0.5	(0.7)	0.0	(0.2)	2.1	(1.8)	4.0	(2.2)
SOTH	11.9	(3.7)	32.6	(5.0)	31.4	(4.9)	33.4	(5.5)	46.2	(4.2)	16.3	(3.6)	33.1	(3.6)	47.1	(5.4)	57.7	(5.3)	49.5	(5.5)
LWTH	0.0	(0.2)	0.8	(1.1)	0.1	(0.3)	0.0	(0.2)	0.0	(0.1)	1.0	(1.0)	0.7	(0.7)	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)
ECVI	2.8	(1.9)	1.6	(1.4)	0.3	(0.7)	0.9	(1.2)	0.9	(0.8)	4.7	(2.2)	0.6	(0.6)	1.8	(1.5)	2.8	(2.1)	1.6	(1.5)
WCVI	8.8	(3.4)	8.5	(3.0)	1.7	(1.6)	11.8	(3.7)	4.2	(1.7)	15.2	(3.6)	2.5	(1.2)	5.5	(2.4)	3.2	(1.9)	0.1	(0.4)
SOMN	0.0	(0.2)	0.0	(0.2)	0.1	(0.5)	0.1	(0.4)	0.0	(0.1)	0.1	(0.4)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.3	(0.8)
NOMN	9.2	(3.5)	2.6	(2.2)	0.2	(0.6)	1.8	(1.7)	5.4	(2.2)	1.8	(1.5)	5.3	(1.9)	10.1	(3.3)	4.6	(2.5)	0.1	(0.4)
NASS	0.1	(0.3)	2.0	(1.9)	1.6	(1.4)	2.0	(2.4)	4.2	(1.9)	0.9	(1.1)	1.0	(0.9)	0.1	(0.5)	0.1	(0.5)	4.6	(2.4)
LWFR-Sp	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.2	(0.4)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)
LWFR-Su	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	0.0	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
QCI	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	1.1	(1.1)	0.0	(0.1)	0.0	(0.1)
Alaska	0.0	(0.1)	0.0	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)
Taku	0.1	(0.3)	0.2	(0.7)	2.0	(1.9)	0.3	(1.0)	0.1	(0.5)	0.1	(0.3)	0.1	(0.3)	0.0	(0.2)	0.2	(0.6)	0.0	(0.2)
Stikine	0.1	(0.4)	0.1	(0.4)	1.0	(2.0)	0.1	(0.6)	0.1	(0.4)	2.5	(2.0)	0.0	(0.2)	0.1	(0.3)	0.8	(1.5)	0.0	(0.2)
Skeena	7.3	(5.3)	6.8	(4.3)	4.0	(3.7)	12.5	(4.5)	7.7	(4.6)	1.1	(1.5)	8.1	(2.4)	6.1	(4.9)	1.8	(1.9)	3.3	(2.4)
Alsek	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Puget Sound	0.4	(1.3)	0.5	(1.0)	0.1	(0.3)	0.1	(0.3)	1.3	(1.0)	2.7	(1.8)	0.6	(0.6)	0.0	(0.2)	1.0	(1.3)	0.9	(1.2)
Juan de Fuca	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Coastal Wash	3.0	(2.4)	5.7	(3.1)	3.7	(2.2)	0.6	(1.3)	0.2	(0.5)	3.3	(2.7)	1.4	(1.0)	0.0	(0.2)	7.0	(2.9)	0.3	(0.9)
Low Col	0.0	(0.1)	3.9	(2.4)	0.0	(0.1)	0.2	(0.7)	0.0	(0.1)	2.2	(1.8)	0.4	(0.9)	0.0	(0.1)	0.0	(0.2)	0.0	(0.3)
Up Col-Sp	0.1	(0.4)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)
Up Col-Su/F	27.1	(6.8)	11.6	(3.5)	16.6	(3.9)	14.6	(4.2)	12.3	(2.8)	22.2	(4.2)	21.7	(3.2)	8.1	(3.3)	6.8	(2.9)	6.9	(2.9)
Snake-Sp/Su	0.3	(1.2)	0.1	(0.3)	0.1	(0.4)	0.1	(0.5)	0.1	(0.2)	0.1	(0.3)	0.0	(0.2)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)
Snake-F	5.0	(5.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	1.7	(1.3)	0.0	(0.1)	0.0	(0.1)	4.3	(2.8)	0.0	(0.1)	0.0	(0.1)
North & Central O	15.3	(4.7)	17.5	(4.1)	28.8	(4.7)	10.7	(3.9)	6.8	(2.1)	21.5	(4.6)	11.2	(2.8)	11.1	(3.3)	5.7	(2.9)	20.5	(4.4)
South Oregon coas	0.1	(0.6)	0.0	(0.2)	0.0	(0.1)	0.2	(0.8)	0.1	(0.4)	0.1	(0.4)	3.4	(1.8)	0.0	(0.2)	0.1	(0.5)	0.1	(0.4)
Klamath/Trinity	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
Mid Col-Sp	1.0	(1.6)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Up Willamette	5.6	(2.6)	1.1	(1.2)	1.1	(1.1)	1.4	(1.4)	1.8	(1.2)	1.0	(1.8)	2.6	(1.3)	1.2	(1.2)	0.0	(0.1)	6.9	(3.1)
Cent Val-F	0.2	(0.6)	0.8	(1.1)	0.1	(0.3)	0.1	(0.3)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.1	(0.2)	0.0	(0.2)	0.1	(0.2)
Cent Val-Sp	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)

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Table 2 continued.

Area 1/101	2006		2006		2006		2006		2006		2006		2006		2006	
Date	Jul 1-9		Jul 6-20		Jul 14-30		Jul15-30		Aug 1-2		Aug 2-13		Aug 16-Sep 1		Aug 31-Sep 22	
Fishery	Troll		Troll		Troll		Troll		Test		Troll		Troll		Troll	
N	96		94		93		95		93		94		98		88	
UPFR	0.1	(0.4)	0.3	(0.7)	0.1	(0.3)	0.1	(0.4)	0.2	(0.5)	0.1	(0.4)	0.1	(0.2)	0.1	(0.3)
MUFR	4.8	(2.5)	3.1	(2.1)	0.1	(0.4)	0.6	(1.0)	4.9	(3.3)	0.1	(0.4)	0.1	(0.3)	0.1	(0.3)
LWFR-F	0.1	(0.4)	0.0	(0.2)	0.0	(0.2)	0.1	(0.3)	0.0	(0.2)	0.0	(0.2)	0.1	(0.5)	0.0	(0.1)
NOTH	3.2	(2.2)	2.8	(1.9)	3.5	(2.3)	4.2	(2.3)	0.1	(0.3)	0.3	(0.8)	0.0	(0.2)	0.0	(0.2)
SOTH	49.6	(5.4)	39.9	(5.3)	39.2	(5.3)	34.4	(5.0)	34.9	(5.5)	42.9	(5.4)	11.8	(3.3)	8.2	(3.1)
LWTH	0.0	(0.2)	0.0	(0.2)	0.1	(0.2)	0.0	(0.2)	0.1	(0.3)	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)
ECVI	0.7	(1.3)	1.6	(1.5)	5.2	(2.5)	0.1	(0.3)	0.2	(0.5)	1.8	(1.6)	0.1	(0.3)	0.1	(0.3)
WCVI	2.8	(1.8)	1.3	(1.2)	5.3	(2.5)	6.8	(2.6)	5.8	(2.6)	3.3	(2.2)	6.1	(2.4)	4.5	(2.3)
SOMN	0.1	(0.3)	0.0	(0.2)	0.1	(0.2)	0.0	(0.2)	0.1	(0.4)	0.1	(0.5)	0.1	(0.3)	0.0	(0.2)
NOMN	4.8	(2.4)	5.2	(2.7)	1.4	(1.7)	0.5	(1.0)	0.1	(0.4)	0.1	(0.4)	0.1	(0.4)	0.1	(0.4)
NASS	0.2	(0.7)	0.1	(0.4)	2.0	(1.8)	0.6	(1.2)	0.1	(0.2)	0.1	(0.7)	0.1	(0.2)	0.1	(0.3)
LWFR-Sp	0.9	(1.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	1.1	(1.0)	0.0	(0.1)	0.0	(0.1)
LWFR-Su	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	1.0	(1.0)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
QCI	1.0	(1.0)	0.0	(0.1)	1.1	(1.1)	3.2	(1.8)	0.0	(0.1)	0.0	(0.1)	1.0	(1.0)	0.0	(0.0)
Alaska	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Taku	0.0	(0.2)	0.6	(1.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
Stikine	0.1	(0.3)	0.9	(1.4)	0.5	(1.1)	0.1	(0.5)	0.0	(0.2)	2.1	(1.6)	0.0	(0.2)	0.0	(0.2)
Skeena	0.7	(1.4)	6.4	(3.8)	1.7	(2.1)	2.1	(2.2)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)
Alsek	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Puget Sound	1.1	(1.1)	0.5	(1.1)	0.1	(0.5)	0.1	(0.4)	1.4	(1.6)	0.1	(0.5)	0.0	(0.2)	0.0	(0.2)
Juan de Fuca	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)	0.0	(0.1)	0.0	(0.1)	0.0	(0.0)
Coastal Wash	5.1	(2.9)	0.2	(0.7)	3.9	(2.2)	10.4	(4.2)	9.7	(3.8)	0.6	(1.3)	20.3	(4.7)	5.4	(2.8)
Low Col	1.3	(1.7)	0.0	(0.2)	4.9	(2.4)	0.2	(0.7)	0.1	(0.5)	4.7	(2.4)	2.8	(2.0)	0.0	(0.3)
Up Col-Sp	0.4	(0.9)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Up Col-Su/F	6.2	(3.5)	12.6	(3.6)	12.6	(4.1)	13.4	(4.0)	27.7	(5.0)	21.5	(5.2)	27.9	(5.0)	15.4	(4.1)
Snake-Sp/Su	0.5	(1.2)	0.1	(0.5)	0.1	(0.3)	0.3	(0.7)	0.2	(0.6)	0.1	(0.2)	0.2	(0.7)	0.1	(0.3)
Snake-F	1.2	(2.6)	0.1	(0.6)	2.9	(3.1)	3.1	(2.6)	0.2	(1.2)	2.7	(2.9)	0.4	(1.4)	0.0	(0.2)
North & Central O	12.5	(3.7)	23.0	(4.5)	13.0	(3.8)	14.4	(4.2)	10.4	(3.8)	8.6	(3.4)	26.9	(5.3)	65.2	(5.4)
South Oregon coas	0.1	(0.3)	0.0	(0.2)	0.1	(0.3)	0.2	(0.7)	3.3	(2.4)	2.4	(2.4)	1.4	(1.8)	0.1	(0.4)
Klamath/Trinity	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
Mid Col-Sp	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Up Willamette	2.4	(1.7)	1.1	(1.3)	1.6	(1.8)	3.8	(2.2)	0.3	(0.9)	7.1	(2.9)	0.0	(0.1)	0.0	(0.1)
Cent Val-F	0.1	(0.2)	0.0	(0.2)	0.4	(0.8)	0.1	(0.2)	0.1	(0.2)	0.1	(0.2)	0.1	(0.2)	0.1	(0.4)
Cent Val-Sp	0.0	(0.1)	0.0	(0.2)	0.0	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)

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Table 3. Chinook stock composition as observed in samples of 2006 troll catches from Area 2W/142.

Composition presented as % of the sample N. Abbreviations are described in Appendix 2. Standard deviations appear in brackets.

Area 1/101	2006		2006		2006		2006		2006		2006		2006		2006		2006	
Date	Apr 7		May 5-11		May 17-18		Jun 1-2		Jun 3		Jul 1-3		Jul 5-7		Aug 3-4		Sep 1-10	
Fishery	Test		Test		Test		Test		Test		Test		Test		Test		Test	
N	96		96		95		79		20		96		85		85		68	
UPFR	1.2	(1.1)	0.1	(0.4)	1.4	(1.3)	3.1	(2.3)	2.4	(4.0)	1.1	(1.1)	0.1	(0.4)	0.1	(0.4)	0.1	(0.4)
MUFR	0.1	(0.4)	0.2	(0.5)	0.2	(0.6)	0.6	(1.3)	4.2	(6.1)	0.1	(0.4)	2.8	(1.9)	4.9	(2.6)	0.2	(0.5)
LWFR-F	0.1	(0.6)	0.2	(0.6)	0.0	(0.1)	0.4	(1.0)	0.8	(2.5)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.3	(1.0)
NOTH	0.0	(0.2)	0.0	(0.2)	0.6	(1.0)	0.1	(0.4)	0.2	(0.9)	0.0	(0.2)	3.1	(2.2)	0.2	(0.6)	0.0	(0.2)
SOTH	4.7	(2.2)	23.9	(4.4)	8.1	(3.0)	17.9	(4.5)	15.9	(8.0)	12.6	(3.5)	40.9	(5.7)	27.6	(5.1)	7.2	(3.2)
LWTH	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)	0.1	(0.8)	0.0	(0.2)	0.0	(0.2)	0.0	(0.2)	0.1	(0.2)
ECVI	1.2	(1.3)	0.1	(0.5)	7.3	(2.8)	5.2	(2.5)	0.7	(2.2)	1.7	(2.3)	3.6	(2.3)	0.1	(0.3)	0.2	(0.6)
WCVI	9.6	(3.0)	7.0	(2.6)	20.7	(4.3)	10.1	(3.4)	19.3	(8.5)	3.6	(2.0)	7.4	(2.9)	8.0	(3.1)	5.9	(2.9)
SOMN	0.0	(0.2)	0.1	(0.4)	0.1	(0.2)	0.0	(0.2)	0.1	(0.8)	0.8	(1.7)	0.3	(0.8)	0.1	(0.3)	0.0	(0.2)
NOMN	3.4	(2.1)	5.3	(2.7)	0.7	(1.1)	0.2	(0.7)	0.4	(1.4)	0.1	(0.4)	0.1	(0.5)	0.2	(0.5)	0.1	(0.4)
NASS	0.1	(0.3)	0.1	(0.3)	2.5	(1.9)	0.1	(0.3)	9.5	(6.2)	0.1	(0.5)	0.1	(0.3)	0.1	(0.4)	0.1	(0.3)
LWFR-Sp	0.0	(0.1)	0.0	(0.1)	0.7	(1.0)	0.0	(0.1)	0.1	(0.5)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)	0.0	(0.3)
LWFR-Su	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)
QCI	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)
Alaska	0.0	(0.2)	0.0	(0.1)	0.0	(0.2)	0.0	(0.1)	0.1	(0.6)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
Taku	0.1	(0.4)	0.1	(0.5)	0.1	(0.6)	0.9	(1.9)	0.1	(0.9)	0.0	(0.2)	2.1	(2.5)	0.0	(0.2)	0.4	(1.0)
Stikine	0.2	(0.6)	0.1	(0.3)	0.1	(0.5)	0.1	(0.8)	0.1	(0.7)	0.0	(0.2)	1.7	(2.2)	0.1	(0.3)	0.1	(0.3)
Skeena	0.4	(0.8)	6.6	(3.4)	0.3	(0.9)	3.7	(3.3)	0.3	(1.2)	0.2	(0.6)	0.7	(1.4)	0.1	(0.3)	0.2	(0.5)
Alsek	0.0	(0.1)	0.0	(0.1)	0.4	(1.0)	0.0	(0.1)	0.1	(0.4)	0.0	(0.1)	0.1	(0.3)	0.0	(0.1)	0.0	(0.2)
Puget Sound	0.1	(0.3)	0.1	(0.4)	0.6	(1.1)	1.9	(2.5)	3.1	(5.1)	0.1	(0.4)	0.3	(0.9)	0.1	(0.2)	0.1	(0.4)
Juan de Fuca	0.0	(0.1)	1.0	(1.6)	0.0	(0.1)	0.8	(1.6)	0.0	(0.2)	0.0	(0.1)	0.5	(0.9)	0.0	(0.1)	0.0	(0.1)
Coastal Wash	4.2	(2.2)	3.1	(1.9)	2.9	(2.1)	0.6	(1.2)	0.1	(1.0)	0.1	(0.3)	1.1	(2.1)	13.8	(4.2)	33.0	(6.6)
Low Col	0.0	(0.2)	0.0	(0.2)	0.0	(0.1)	6.7	(3.2)	7.7	(6.2)	2.6	(2.9)	0.6	(1.6)	3.6	(2.3)	0.0	(0.4)
Up Col-Sp	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.1	(0.7)	0.0	(0.1)	0.0	(0.2)	0.0	(0.2)	0.0	(0.1)
Up Col-Su/F	57.6	(6.5)	40.9	(5.0)	41.3	(5.7)	34.6	(5.4)	24.5	(9.3)	38.0	(5.9)	10.0	(4.4)	18.3	(5.3)	6.0	(4.0)
Snake-Sp/Su	1.0	(2.1)	0.3	(0.7)	0.2	(0.7)	0.1	(0.3)	0.2	(1.1)	0.1	(0.4)	7.3	(3.4)	0.3	(1.0)	0.1	(0.3)
Snake-F	1.8	(3.9)	0.0	(0.1)	1.5	(2.9)	0.1	(0.6)	0.1	(1.0)	13.8	(4.5)	2.1	(3.3)	6.0	(3.7)	1.0	(2.0)
North & Central O	8.3	(3.1)	8.8	(3.0)	8.6	(3.4)	11.4	(4.1)	2.7	(4.4)	16.3	(5.5)	14.0	(4.1)	13.9	(4.2)	41.4	(6.8)
South Oregon coas	0.0	(0.2)	0.0	(0.2)	0.6	(1.5)	0.5	(1.3)	4.3	(4.9)	3.8	(3.4)	0.0	(0.1)	0.0	(0.2)	3.3	(3.0)
Klamath/Trinity	0.0	(0.1)	0.5	(0.9)	0.0	(0.1)	0.1	(0.3)	0.1	(0.5)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.2)
Mid Col-Sp	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	2.1	(3.9)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.3)
Up Willamette	5.8	(2.8)	1.2	(1.2)	0.9	(1.3)	0.4	(1.4)	0.1	(0.6)	4.5	(2.5)	0.8	(1.5)	2.4	(2.1)	0.1	(0.5)
Cent Val-F	0.0	(0.2)	0.1	(0.3)	0.1	(0.2)	0.1	(0.3)	0.3	(1.2)	0.1	(0.2)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)
Cent Val-Sp	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)	0.1	(0.6)	0.0	(0.2)	0.0	(0.1)	0.0	(0.1)	0.0	(0.1)

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Table 4. Chinook catch applied to stock compositions observed in samples of 2006 troll catches from Area 1/101. Abbreviations are described in Appendix 2. Standard deviations appear in brackets.

Area 1/101	2006		2006		2006		2006		2006		2006		2006		2006		2006		2006	
Date	Apr 4-6		May 11-14		May 15		Jun 3-4		Jun 7		Jun 7		Jun 7-19		Jun 16-26		Jun 17-26		Jun 27-Jul 1	
Fishery	Test		Test		Test		Test		Troll		Troll		Troll		Troll		Troll		Troll	
Catch	100		93		97		77		3,365		2,400		17,255		16,005		15,633		11,481	
N	84		92		94		76		143		102		183		92		98		87	
UPFR	0	(0)	0	(0)	1	(1)	1	(1)	120	(58)	69	(40)	288	(246)	25	(82)	405	(285)	12	(38)
MUFR	0	(0)	3	(2)	3	(2)	5	(2)	18	(36)	6	(16)	784	(367)	435	(404)	500	(353)	18	(62)
LWFR-F	0	(0)	0	(0)	0	(0)	1	(1)	3	(12)	1	(4)	2	(9)	4	(29)	3	(21)	2	(14)
NOTH	1	(1)	0	(0)	2	(2)	0	(0)	86	(57)	1	(5)	93	(120)	7	(35)	325	(289)	455	(253)
SOTH	12	(4)	30	(5)	30	(5)	26	(4)	1553	(142)	391	(87)	5714	(613)	7539	(863)	9025	(825)	5682	(632)
LWTH	0	(0)	1	(1)	0	(0)	0	(0)	1	(4)	23	(23)	120	(118)	6	(27)	7	(31)	5	(26)
ECVI	3	(2)	1	(1)	0	(1)	1	(1)	29	(28)	113	(54)	109	(107)	281	(247)	440	(321)	185	(176)
WCVI	9	(3)	8	(3)	2	(2)	9	(3)	142	(57)	365	(86)	424	(204)	887	(383)	493	(294)	13	(40)
SOMN	0	(0)	0	(0)	0	(1)	0	(0)	1	(4)	2	(9)	5	(25)	7	(35)	5	(24)	37	(92)
NOMN	9	(4)	2	(2)	0	(1)	1	(1)	182	(73)	42	(37)	914	(328)	1622	(535)	717	(386)	15	(49)
NASS	0	(0)	2	(2)	2	(1)	2	(2)	140	(64)	22	(27)	166	(161)	21	(80)	19	(73)	530	(270)
LWFR-Sp	0	(0)	0	(0)	0	(0)	0	(0)	0	(3)	0	(3)	35	(76)	3	(22)	4	(28)	2	(19)
LWFR-Su	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)	0	(1)	1	(6)	1	(15)	1	(8)	1	(13)
QCI	0	(0)	0	(0)	0	(0)	0	(0)	0	(2)	0	(1)	1	(5)	170	(171)	1	(13)	1	(8)
Alaska	0	(0)	0	(0)	0	(0)	0	(0)	2	(10)	0	(2)	2	(15)	4	(27)	3	(20)	2	(16)
Taku	0	(0)	0	(1)	2	(2)	0	(1)	5	(18)	2	(8)	13	(50)	5	(28)	26	(96)	3	(18)
Stikine	0	(0)	0	(0)	1	(2)	0	(0)	2	(12)	61	(49)	8	(37)	9	(44)	118	(228)	5	(26)
Skeena	7	(5)	6	(4)	4	(4)	10	(3)	261	(155)	26	(36)	1405	(423)	975	(781)	279	(300)	381	(278)
Alsek	0	(0)	0	(0)	0	(0)	0	(0)	1	(5)	0	(3)	4	(22)	2	(14)	2	(14)	2	(14)
Puget Sound	0	(1)	0	(1)	0	(0)	0	(0)	44	(33)	64	(43)	106	(106)	7	(33)	155	(209)	102	(138)
Juan de Fuca	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)	0	(1)	1	(6)	1	(8)	1	(7)	1	(6)
Coastal Wash	3	(2)	5	(3)	4	(2)	0	(1)	8	(18)	80	(65)	243	(178)	4	(26)	1096	(448)	38	(101)
Low Col	0	(0)	4	(2)	0	(0)	0	(1)	0	(3)	53	(43)	75	(158)	2	(14)	4	(31)	5	(36)
Up Col-Sp	0	(0)	0	(0)	0	(0)	0	(0)	1	(3)	1	(4)	2	(13)	4	(25)	3	(19)	3	(17)
Up Col-Su/F	27	(7)	11	(3)	16	(4)	11	(3)	414	(94)	532	(101)	3749	(546)	1292	(530)	1055	(447)	796	(329)
Snake-Sp/Su	0	(1)	0	(0)	0	(0)	0	(0)	2	(7)	2	(6)	8	(26)	11	(40)	12	(44)	8	(29)
Snake-F	5	(5)	0	(0)	0	(0)	0	(0)	56	(43)	0	(2)	1	(9)	689	(442)	1	(19)	1	(7)
North & Central O	15	(5)	16	(4)	28	(5)	8	(3)	230	(72)	517	(111)	1939	(475)	1783	(536)	894	(450)	2355	(508)
South Oregon coas	0	(1)	0	(0)	0	(0)	0	(1)	3	(14)	2	(9)	591	(311)	6	(35)	21	(79)	11	(51)
Klamath/Trinity	0	(0)	0	(0)	0	(0)	0	(0)	0	(3)	0	(2)	2	(13)	2	(17)	2	(18)	2	(19)
Mid Col-Sp	1	(2)	0	(0)	0	(0)	0	(0)	0	(3)	0	(2)	2	(11)	3	(22)	2	(16)	2	(14)
Up Willamette	6	(3)	1	(1)	1	(1)	1	(1)	60	(41)	23	(42)	441	(218)	186	(188)	3	(21)	796	(350)
Cent Val-F	0	(1)	1	(1)	0	(0)	0	(0)	1	(5)	1	(5)	6	(21)	9	(35)	7	(29)	6	(25)
Cent Val-Sp	0	(0)	0	(0)	0	(0)	0	(0)	0	(2)	0	(2)	2	(12)	2	(15)	2	(18)	2	(14)

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Table 4 continued.

Area 1/101	2006		2006		2006		2006		2006		2006		2006		2006	
Date	Jul 1-9		Jul 6-20		Jul 14-30		Jul15-30		Aug 1-2		Aug 2-13		Aug 16-Sep 1		Aug 31-Sep 22	
Fishery	Troll		Troll		Troll		Troll		Troll & Test		Troll		Troll		Troll	
Catch	19,287		8,424		13,022		12,349		9,381		12,702		11,288		4,610	
N	96		94		93		95		93		94		98		88	
UPFR	28	(85)	24	(58)	12	(38)	16	(48)	15	(46)	15	(46)	9	(27)	5	(15)
MUFR	916	(479)	264	(177)	17	(52)	70	(123)	460	(311)	18	(54)	10	(30)	5	(16)
LWFR-F	13	(72)	2	(15)	4	(30)	8	(42)	3	(20)	3	(25)	16	(60)	1	(6)
NOTH	613	(417)	235	(163)	457	(293)	524	(282)	6	(28)	33	(96)	4	(21)	2	(11)
SOTH	9563	(1043)	3357	(451)	5100	(688)	4249	(619)	3274	(516)	5449	(685)	1336	(369)	377	(142)
LWTH	8	(33)	3	(15)	7	(30)	6	(29)	6	(27)	5	(24)	4	(18)	2	(7)
ECVI	131	(259)	134	(127)	673	(328)	11	(41)	16	(50)	226	(200)	11	(36)	4	(14)
WCVI	546	(347)	108	(104)	696	(319)	837	(322)	542	(248)	415	(284)	689	(271)	208	(104)
SOMN	11	(54)	3	(13)	7	(31)	5	(24)	7	(36)	15	(70)	8	(34)	2	(10)
NOMN	917	(470)	440	(225)	183	(221)	57	(129)	14	(42)	14	(46)	15	(48)	7	(20)
NASS	45	(135)	9	(36)	261	(230)	76	(147)	5	(21)	18	(84)	6	(23)	3	(12)
LWFR-Sp	175	(194)	1	(10)	2	(17)	2	(15)	2	(15)	134	(133)	2	(16)	1	(4)
LWFR-Su	1	(11)	0	(6)	1	(8)	126	(128)	0	(5)	1	(8)	1	(6)	0	(2)
QCI	195	(195)	0	(4)	146	(147)	389	(219)	0	(5)	1	(12)	115	(115)	0	(2)
Alaska	3	(21)	1	(10)	2	(20)	2	(12)	1	(9)	2	(14)	2	(16)	1	(4)
Taku	8	(43)	53	(104)	3	(18)	5	(26)	3	(17)	3	(18)	3	(15)	1	(8)
Stikine	15	(65)	72	(119)	63	(146)	14	(60)	3	(16)	272	(198)	4	(20)	2	(7)
Skeena	139	(264)	535	(318)	225	(268)	255	(267)	7	(24)	11	(35)	9	(32)	4	(12)
Alsek	3	(25)	1	(9)	2	(14)	2	(13)	1	(10)	2	(17)	1	(8)	1	(4)
Puget Sound	217	(220)	38	(96)	17	(61)	14	(53)	133	(146)	16	(59)	5	(21)	2	(8)
Juan de Fuca	1	(11)	0	(5)	1	(13)	2	(18)	0	(4)	1	(8)	1	(8)	0	(2)
Coastal Wash	979	(557)	14	(62)	505	(283)	1287	(515)	914	(359)	70	(170)	2289	(535)	250	(127)
Low Col	254	(324)	3	(21)	636	(311)	29	(89)	10	(45)	597	(301)	316	(222)	2	(12)
Up Col-Sp	74	(178)	2	(12)	3	(17)	3	(18)	2	(13)	3	(17)	2	(14)	1	(6)
Up Col-Su/F	1188	(681)	1060	(303)	1641	(531)	1658	(499)	2599	(468)	2730	(666)	3149	(569)	711	(190)
Snake-Sp/Su	105	(226)	9	(40)	10	(39)	33	(82)	15	(54)	8	(30)	23	(76)	4	(13)
Snake-F	226	(505)	12	(49)	377	(400)	387	(319)	21	(109)	339	(371)	43	(155)	2	(11)
North & Central O	2416	(704)	1938	(378)	1687	(496)	1780	(514)	972	(359)	1093	(438)	3038	(600)	3005	(248)
South Oregon coas	12	(64)	3	(15)	9	(44)	20	(82)	305	(225)	299	(300)	161	(202)	4	(19)
Klamath/Trinity	3	(21)	1	(10)	2	(13)	2	(17)	2	(15)	2	(12)	1	(8)	1	(7)
Mid Col-Sp	5	(38)	1	(11)	2	(16)	2	(12)	2	(21)	2	(14)	2	(14)	1	(4)
Up Willamette	463	(319)	92	(113)	211	(236)	471	(268)	31	(87)	897	(374)	2	(12)	1	(5)
Cent Val-F	10	(44)	4	(17)	54	(110)	6	(26)	5	(22)	7	(29)	7	(26)	5	(19)
Cent Val-Sp	3	(20)	2	(17)	5	(35)	2	(16)	2	(11)	2	(17)	2	(18)	1	(4)

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Table 5. Chinook catch applied to stock compositions observed in samples of 2005 troll catches from Area 2W/142.

Abbreviations are described in Appendix 2. Standard deviations appear in brackets.

Area 2W/142	2005		2005		2005		2005		2005		2005		2005		2005		2005	
Date	Mar 5-24		May 5-6		May 16-17		June 2-3		July 1-2		July 15-17		Aug 1-2		Aug 15		Sep 1-10	
Fishery	Troll		Test		Test		Test		Test		Test		Test		Test		Test & Troll	
Catch	3,173		100		100		100		100		100		100		100		689	
N	91		96		96		96		95		96		95		96		75	
UPFR	0	(10)	4	(2)	0	(1)	0	(0)	2	(2)	0	(0)	0	(1)	0	(0)	0	(3)
MUFR	0	(17)	0	(1)	1	(2)	0	(1)	0	(1)	4	(2)	0	(1)	2	(2)	0	(3)
LWFR-F	0	(5)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)
NOTH	0	(6)	3	(2)	0	(0)	0	(0)	1	(1)	10	(3)	0	(0)	0	(0)	0	(2)
SOTH	10	(46)	10	(3)	12	(3)	24	(4)	22	(4)	23	(4)	16	(4)	13	(4)	7	(10)
LWTH	0	(7)	0	(0)	0	(0)	0	(0)	0	(0)	1	(1)	0	(0)	0	(0)	0	(2)
ECVI	310	(101)	0	(0)	3	(2)	7	(3)	3	(2)	1	(2)	1	(1)	1	(1)	0	(6)
WCVI	1189	(165)	3	(2)	9	(3)	9	(3)	10	(3)	5	(2)	12	(3)	15	(4)	0	(3)
SOMN	0	(12)	0	(0)	0	(0)	0	(1)	0	(1)	0	(0)	0	(0)	0	(0)	0	(2)
NOMN	62	(64)	9	(3)	2	(2)	4	(2)	4	(2)	3	(2)	0	(0)	0	(0)	0	(2)
NASS	0	(8)	0	(1)	3	(2)	0	(0)	0	(1)	1	(1)	0	(0)	0	(0)	0	(2)
LWFR-Sp	0	(4)	0	(0)	0	(0)	2	(1)	1	(1)	0	(0)	0	(0)	0	(0)	0	(1)
QCI	0	(2)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Alaska	0	(3)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)
Taku	0	(3)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Stikine	73	(79)	10	(4)	0	(1)	0	(1)	0	(2)	0	(0)	0	(0)	0	(0)	0	(2)
Skeena	0	(50)	15	(4)	6	(3)	0	(1)	0	(1)	0	(1)	0	(1)	0	(0)	0	(3)
Alsek	0	(4)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)
Puget Sound	0	(54)	0	(0)	0	(0)	0	(0)	0	(1)	4	(2)	0	(0)	1	(2)	0	(2)
Juan de Fuca	0	(2)	0	(0)	0	(0)	0	(0)	1	(1)	1	(2)	0	(0)	0	(0)	0	(0)
Coastal Wash	73	(64)	4	(2)	4	(2)	1	(2)	9	(3)	4	(3)	10	(4)	4	(3)	267	(43)
Low Col	195	(85)	0	(1)	7	(3)	1	(2)	1	(1)	0	(0)	1	(2)	6	(3)	0	(2)
Up Col-Sp	0	(4)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)
Up Col-Su/F	1261	(168)	23	(4)	22	(5)	39	(5)	24	(5)	21	(4)	32	(6)	32	(5)	67	(24)
Snake-Sp/Su	0	(8)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)	0	(0)	0	(2)
Snake-F	0	(12)	0	(1)	8	(3)	0	(1)	2	(3)	0	(1)	6	(3)	11	(4)	0	(1)
Oregon coastal	0	(30)	14	(4)	22	(4)	11	(3)	21	(4)	22	(4)	23	(5)	15	(4)	348	(43)
S.Or./Cal coast	0	(3)	0	(0)	0	(0)	0	(0)	1	(1)	0	(0)	0	(0)	0	(0)	0	(1)
Up Klam/Trinity	0	(3)	0	(0)	0	(0)	0	(0)	0	(1)	0	(0)	0	(0)	0	(0)	0	(1)
Mid Col-Sp	0	(4)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)	0	(0)	0	(1)
Up Willamette	0	(12)	4	(2)	0	(0)	1	(1)	0	(0)	0	(0)	0	(0)	0	(0)	0	(1)
Cent Val-F	0	(16)	0	(1)	0	(1)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(3)
Cent Val-Sp	0	(4)	0	(0)	0	(1)	0	(0)	0	(1)	0	(0)	0	(0)	0	(0)	0	(1)

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Table 6. Decision table describing the data delivered from the troll sampling program and how the test results contributed to the management of the troll fishery.

Area	Sample site description	Fishery	Dates fish were caught	Analysis Received	WCVI %	Comment	Result
101	LaPerouse Reef	Test	Apr 4-6	21-Apr	8.8		remain closed
2W/142	Buck Pt	Test	Apr 7	21-Apr	9.6		remain closed
2W/142	Buck Pt	Test	May 5-11	20-May	7.0		remain closed
Area101	LaPerouse Reef	Test	May 11-14	20-May	8.5		remain closed
Area101	LaPerouse Reef	Test	May 15	28-May	1.7		Open ITQ & derby fisheries June 7 N. of Louis Pt.
2W/142	Buck Pt	Test	May 17-18	28-May	20.7		Keep remainder of Area 2W/142 closed.
2W/142	Buck Pt	Test	Jun 1-2	16-Jun	10.1		Keep remainder of Area 2W/142 closed.
2W/142	Tartu Inlet	Test	Jun 3	16-Jun	19.3	small sample size (N=20)	
101	LaPerouse Reef	Test	Jun 3-4	16-Jun	11.8	Test boat broken down June 4	Close derby fishery June 22.
101	LaPerouse Reet	Troll	Jun 7	15-Jun	4.2	North of Frederick I.	Keep ITQ open until more fishery samples arrive.
101	Tian Head	Troll	Jun 7	15-Jun	15.2	South of Frederick I.	Close derby fishery June 22.
1/101		Troll	Jun 7-19	24-Jun	2.5	double sample (N=200)	Re-open derby fishery June 29. Keep ITQ fishery open.
101		Troll	Jun 14-24			not submitted for analysis	
101	West of Langara	Troll	Jun 16-26	1-Jul	5.5		remain open
1/101	East of Langara	Troll	Jun 17-26	1-Jul	3.2		remain open
1/101		Troll	Jun 21 - Jul 3			not submitted for analysis	
101		Troll	Jun 27-Jul 1	18-Jul	0.1		remain open
2W/142	Tartu Inlet	Test	July1-3	18-Jul	3.6		Extend opening south to Hippa I.
1/101	Dixon & West Langara	Troll	Jul 1-9	18-Jul	2.8		remain open
2W/142	Buck Point	Test	Jul 5-7	18-Jul	7.4		Retain closure of southern areas.
1/101		Troll	Jul 2-14			not submitted for analysis	
1/101		Troll	Jul 6-20	30-Jul	1.3		remain open
1/101		Troll	Jul 14-30	18-Aug	5.3		remain open
1/101		Troll	Jul 15-30	24-Oct	6.8		This sample was above the trigger but was not submitted for analysis until after the fishery was closed.
mixed		Troll	Jul 26 - Aug 5			not submitted for analysis	
101	Langara to Tian	Test	Aug 1-2	18-Aug	5.8		remain open
2W/142	Buck Pt	Test	Aug 3-4	18-Aug	8.0		Retain closure of southern areas.
1/101		Troll	Aug 2-13	20-Aug	3.3		remain open
mixed		Troll	Jul 28 - Aug 14			not submitted for analysis	
101		Troll	Aug 16-Sep 1	20-Sep	6.1		Above trigger but fishery closing Sep 30
1/101		Troll	Aug 12 - Sep 4			not submitted for analysis	
2W/142	Buck Pt. to Tian	Test	Sep 1-10	20-Sep	5.9		This sample was below the trigger but the area was not opened because of poor fishing and the late date.

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Table 7. Chinook salmon age data by stock region for NBC Troll fishery samples.

Gilbert – Rich age designation system A_b where A = the age of the fish in years starting from the egg stage and b = the number of winters in fresh water starting from the egg stage. M = marine age only for those cases where the freshwater age could not be interpreted.

Stock Region	3_1	4_1	4_2	5_1	5_2	6_1	6_2	6_3	7_1	7_2	2M	3M	4M	5M	6M	Total aged
Taku		1		2	1							1				5
Stikine		1		2							1	1				5
QCI	4	1	1													6
NASS	2	3	2	1	4		2				1	1				16
Skeena		17	8	7	9		8			2	2	7	7			67
NOMN	3	18	2	13	7		1				2	9	2			57
WCVI	24	64		33		1					1	9	2			134
ECVI	11	12	1	7								4		1		36
UPFR		4	2		3						1	2				12
MUFR	1	8	7	3	18						4	5	1			47
NOTH	1	7	1	1	12	1					1	2				26
SOTH	15	413	7	135	5	3	3				4	54	22	2		663
LWTH													2			2
LWFR-Sp			1		2											3
LWFR-Su		1														1
LWFR-F												1				1
Puget Sound		4		3												7
Juan de Fuca		2											1			3
Coastal Wash	1	41	1	46	1	6					2	4	6	2	1	111
Up Col-Sp			1													1
Up Col-Su/F	17	158	6	205	6	14	12			2	8	13	24	4		469
Snake-Sp/Su		2		2									2			6
Snake-F	3	6		15	2						3		1			30
Mid Col-Sp		1				1										2
Up Willamette	4	14	3	11	4	1		1			1	6	4			49
Low Col	5	13		6		1	3					1	2	1		32
North & Central O	9	111	2	134	7	26	9		1	1	5	20	39	7		371
South Oregon coas	2	8	1	5		1				1						18

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FIGURES

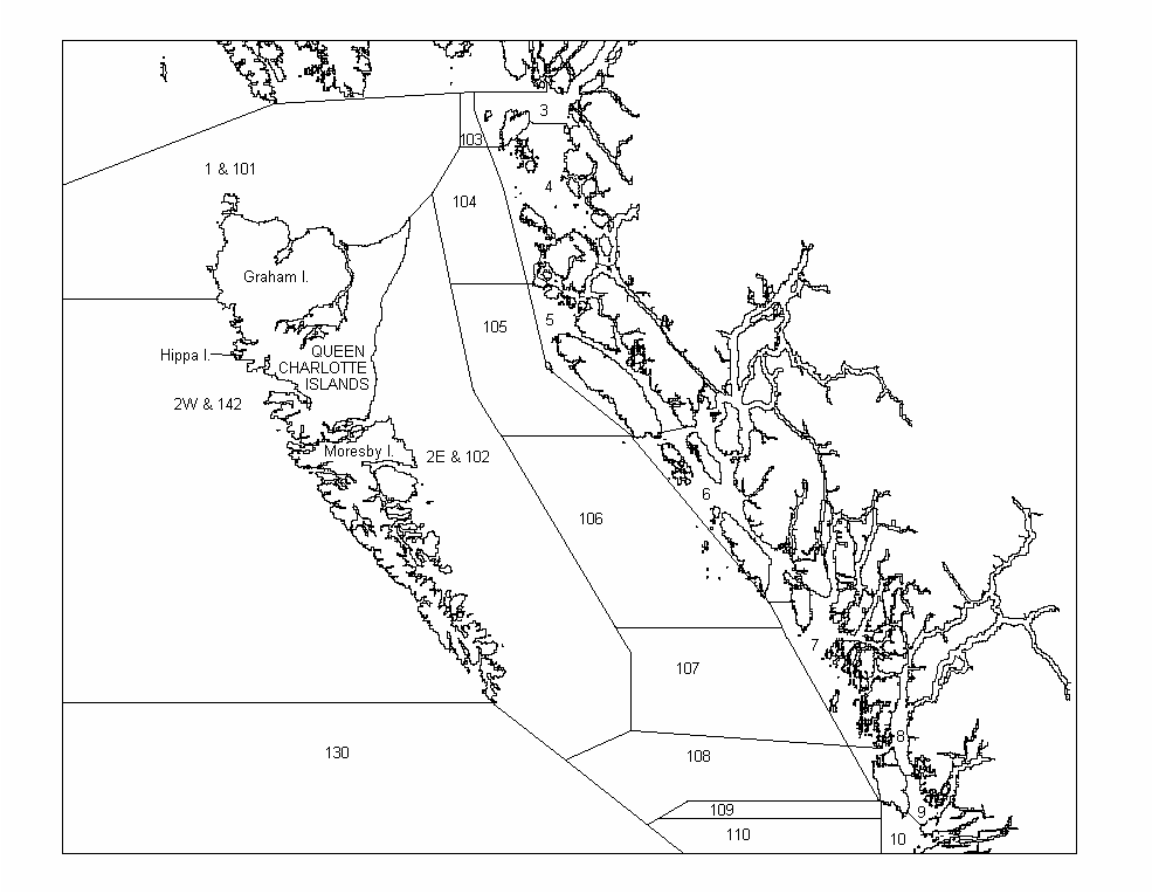


Figure 1. The North Coast of British Columbia showing Pacific Fishery Management Areas 1 to 10, 101 to 110, 130 and 142.

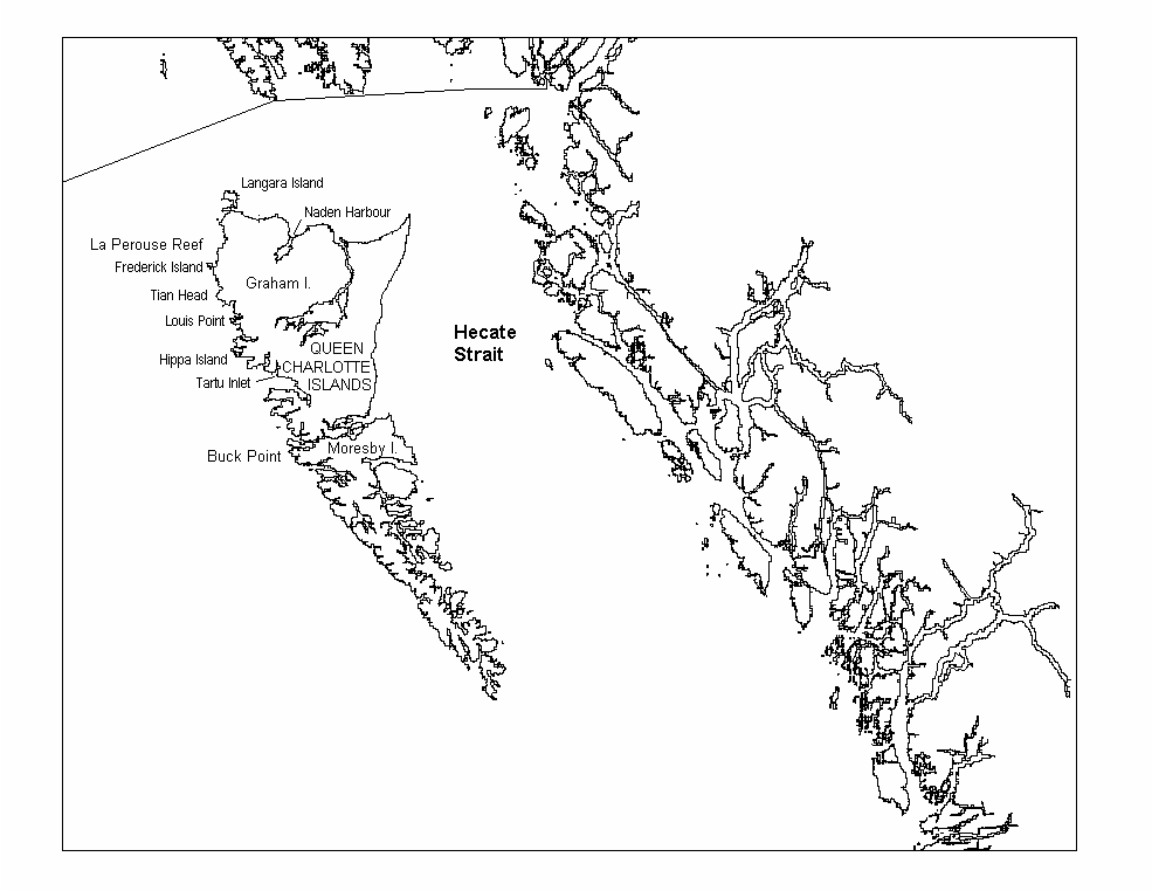


Figure 2. 2006 Troll test fishery sample sites and locations relevant to the open fishery.

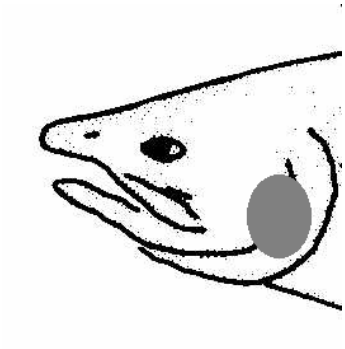


Figure 3. Tissue samples were punched from the opercula of Chinook salmon in the location indicated by the shaded area on the diagram.

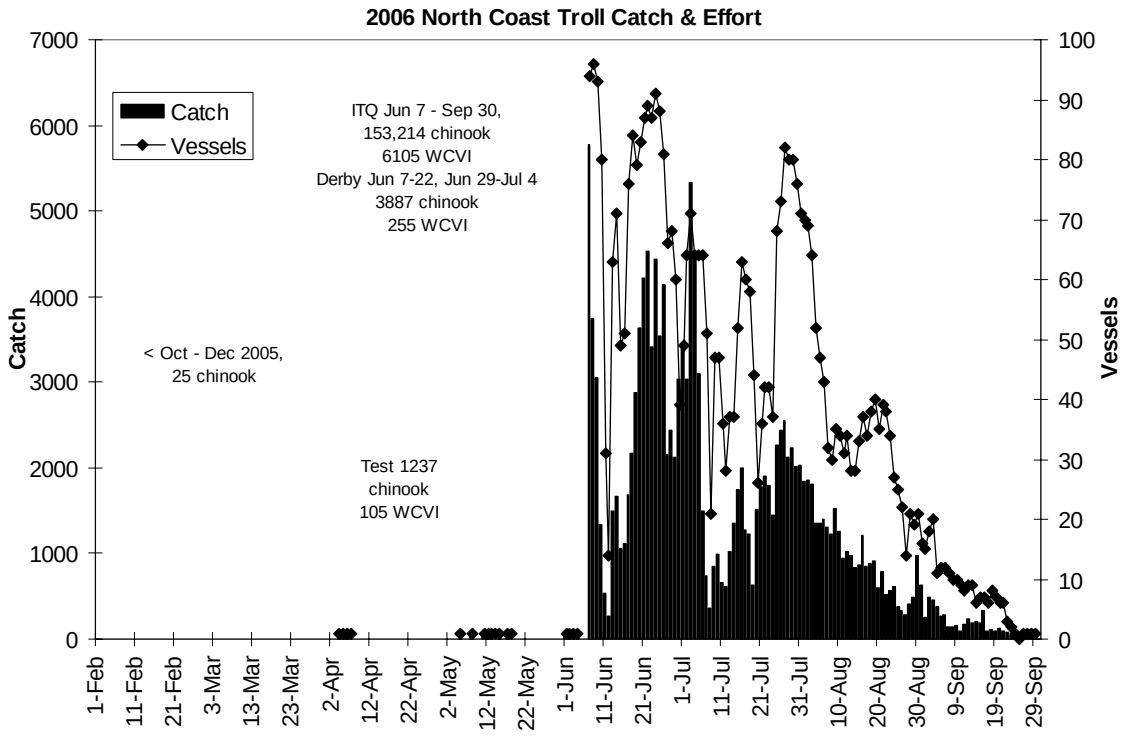


Figure 4. 2006 Chinook daily catch and effort in the NBC Troll fishery.

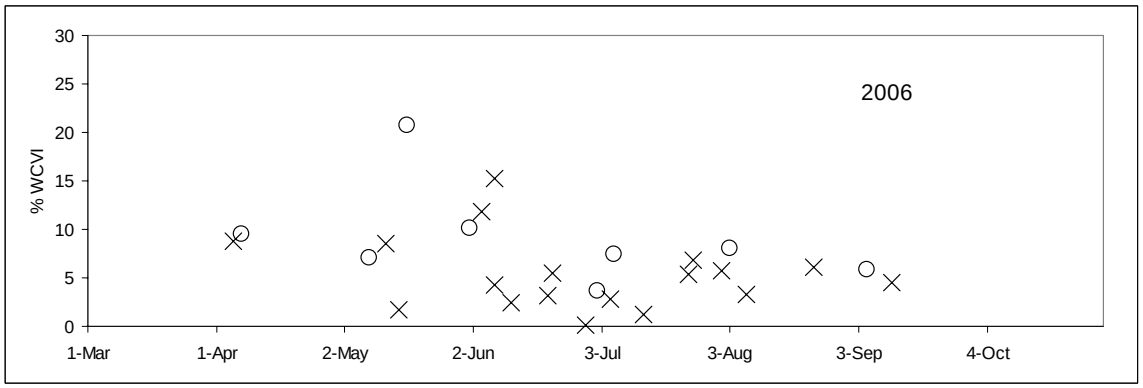


Figure 5. Proportion of WCVI Chinook salmon observed in NBC troll fishery and test samples plotted against date sampled.

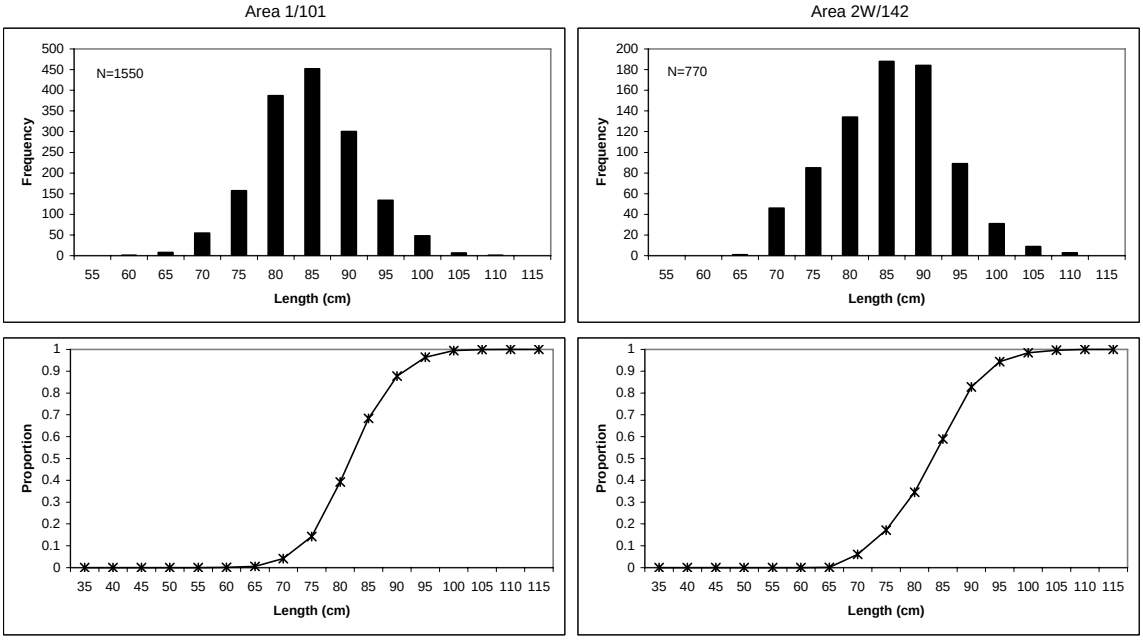


Figure 6. Chinook salmon length frequencies from fish sampled in 2006 and cumulative proportions of total length sampled.

The division between bins labeled 65 and 70 cm corresponds with the 67 cm size limit. Length frequencies are compared to samples collected from 2002 to 2005 in Appendix 4.

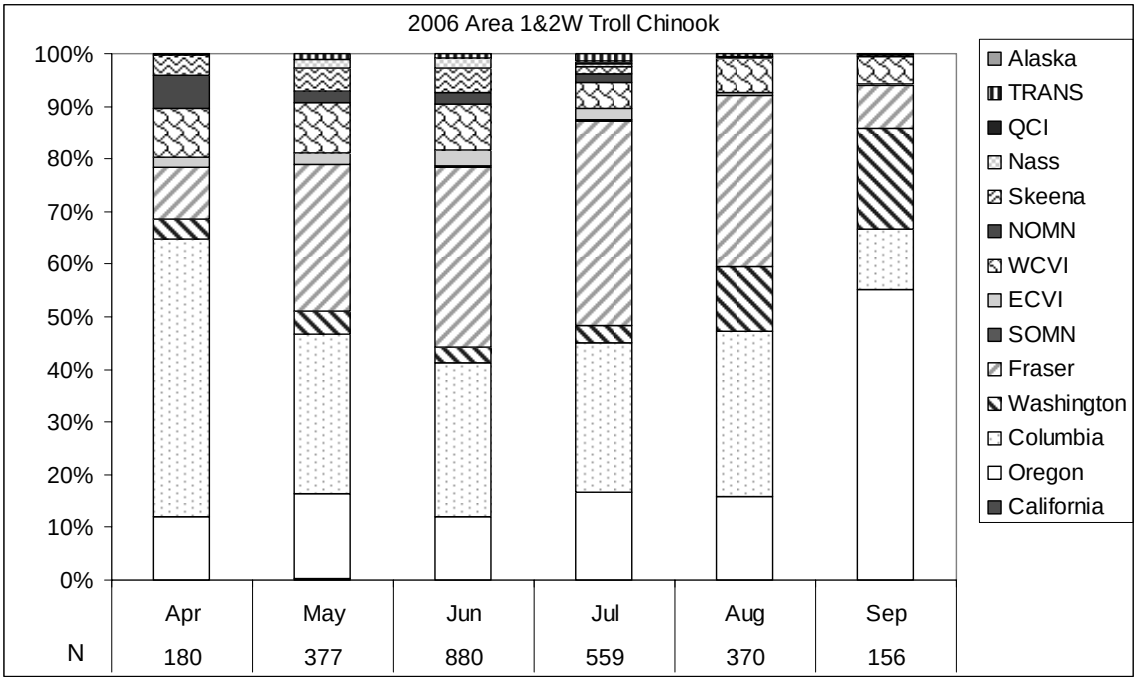


Figure 7. Monthly proportions of major stock groups from troll samples collected on the West Coast of QCI in 2006. Samples from Areas 1/101 & 2W/142 are pooled.

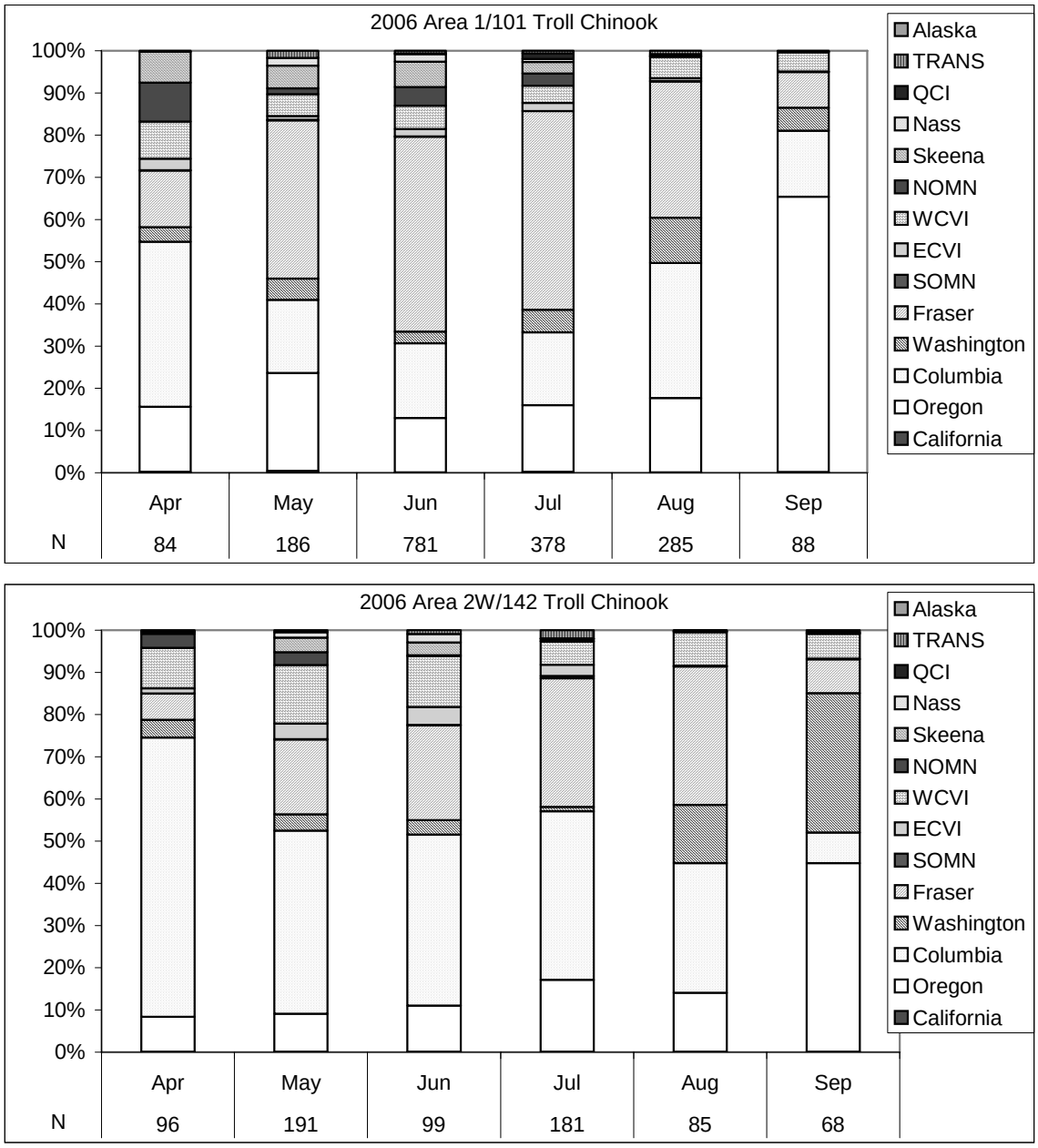


Figure 8. Monthly proportions of major stock groups from troll samples collected on the West Coast of QCI in 2006. Samples from Areas 1/101 & 2W/142 are presented as separate graphs.

APPENDICES

Appendix 1. Baseline samples used in the mixture analyses.

#	Region	Population	N	#	Region	Population	N
1	UPFR	Bowron__	176	6	LWTH	Spius___	136
1	UPFR	Dome____	385	6	LWTH	U._Coldwat_SP	141
1	UPFR	Fontoniko	63	6	LWTH	U._Spius_SP	128
1	UPFR	Goat____	77	7	ECVI	Big_Qualicum	374
1	UPFR	Holmes___	216	7	ECVI	BigQul@Lang	293
1	UPFR	Horsey___	41	7	ECVI	Chemainus	261
1	UPFR	Indianpoint	47	7	ECVI	Cowichan	684
1	UPFR	James	57	7	ECVI	L._Qualicum	209
1	UPFR	Kenneth_Cr	78	7	ECVI	Nanaimo_F	546
1	UPFR	McGregor	126	7	ECVI	Nanaimo_SP	99
1	UPFR	Morkill_River	208	7	ECVI	Nanaimo_SU	281
1	UPFR	R_Chehalis	127	7	ECVI	NanaimoUpper	118
1	UPFR	R_Chilliwack	163	7	ECVI	Nimpkish	57
1	UPFR	Salmon@PG	263	7	ECVI	Puntled_SU	1326
1	UPFR	Slim_____	204	7	ECVI	Puntledge_F	716
1	UPFR	Swift____	411	7	ECVI	Quatse___	38
1	UPFR	Tete_Jaune	488	7	ECVI	Quinsam_	457
1	UPFR	Torpy_River	170	7	ECVI	Woss_Lake	31
1	UPFR	Walker__	42	8	WCVI	Burman__	273
1	UPFR	Willow___	85	8	WCVI	Colonial_Cay	58
2	MUFR	Baezaeko	82	8	WCVI	Conuma__	456
2	MUFR	Bridge__	425	8	WCVI	Gold_R	93
2	MUFR	Chilako_	45	8	WCVI	Kennedy_	239
2	MUFR	Chilcotin_mix	47	8	WCVI	Marble@NVI	507
2	MUFR	Chilko__	270	8	WCVI	Nahmint__	412
2	MUFR	Cottonwood	53	8	WCVI	Nitinat_	346
2	MUFR	Elkin____	235	8	WCVI	Rob@Gold	224
2	MUFR	Endako__	87	8	WCVI	Rob@Muchalat_	33
2	MUFR	Horsefly	58	8	WCVI	Robertson	386
2	MUFR	L._Cariboo	33	8	WCVI	San_Juan	196
2	MUFR	L._Chilcoti	232	8	WCVI	Sarita__	415
2	MUFR	Nazko	193	8	WCVI	Sooke	58
2	MUFR	Nechako_	577	8	WCVI	Stamp___	303
2	MUFR	Portage_	201	8	WCVI	Tahsis	310
2	MUFR	Quesnel_	565	8	WCVI	Thornton_	518
2	MUFR	Stuart__	555	8	WCVI	Tlupana	66
2	MUFR	Taseko__	200	8	WCVI	Toquart_River	87
2	MUFR	U._Cariboo	171	8	WCVI	Tranquil	342
2	MUFR	U._Chilcotin	277	8	WCVI	Zeballos_	34
2	MUFR	Westroad	39	9	SOMN	Bute____	72
3	LWFR-F	Chilliwac@Stav	375	9	SOMN	Capilano	126
3	LWFR-F	Harrison	603	9	SOMN	Devereux	329
3	LWFR-F	W_Chilliwack	481	9	SOMN	Homathko	52
4	NOTH	Barriere	55	9	SOMN	Klinaklini	448
4	NOTH	Blue_River	51	9	SOMN	Porteau_Cove	357
4	NOTH	Clearwater	262	9	SOMN	Squamish	157
4	NOTH	Finn____	171	10	NOMN	Ashlulm__	64
4	NOTH	Lemieux_Creek	98	10	NOMN	Atnarko_	275
4	NOTH	N._Thom@Main	115	10	NOMN	Chuckwalla	279
4	NOTH	Raft____	248	10	NOMN	Dean_River	66
5	SOTH	Bessette	59	10	NOMN	Docee__	107
5	SOTH	Duteau_Cr	46	10	NOMN	Hirsch__	474
5	SOTH	Eagle___	42	10	NOMN	Kateen	134
5	SOTH	L._Adams_	208	10	NOMN	Kilbella	161
5	SOTH	L._Shuswap	356	10	NOMN	Kildala_	441
5	SOTH	L._Thompson	173	10	NOMN	Kitimat_	482
5	SOTH	L_Shus@U_Adams	45	10	NOMN	Kitlope	201
5	SOTH	Little__	158	10	NOMN	Kwinamass	362
5	SOTH	M._Shuswap	376	10	NOMN	Neechanze	57
5	SOTH	Salmon@SA	214	10	NOMN	Nusatsum	43
5	SOTH	South_Thom	267	10	NOMN	Saloompt	96
6	LWTH	Bonaparte	308	10	NOMN	Takia_River	31
6	LWTH	Coldwater	279	10	NOMN	U._Atnarko	155
6	LWTH	Deadman__	299	10	NOMN	U._Dean	82
6	LWTH	Louis___	577	10	NOMN	Wannock_	510
6	LWTH	Nicola__	468	11	NASS	Cranberry	164

#	Region	Population	N
11	NASS	Damdochax	257
11	NASS	Ishkheenickh	88
11	NASS	Kincolith	287
11	NASS	Kwinageese	299
11	NASS	Meziadin	195
11	NASS	Owegee__	220
11	NASS	Seaskinnish	99
11	NASS	Snowbank_	54
11	NASS	Tseax___	180
12	LWFR-Sp	Big_Silver	115
12	LWFR-Sp	Birkenhead	267
12	LWFR-Sp	Upper_Pitt	103
13	LWFR-Su	Maria_Slough	302
14	QCI	Yakoun__	201
15	Alaska	Chickamin	116
15	Alaska	King_Salmon	57
15	Alaska	Unuk____	193
17	Taku	Dudidontu_R	103
17	Taku	Little_Tatsam.	204
17	Taku	Nahlin__	116
17	Taku	Nakina	197
18	Stikine	Andrew_Creek	144
18	Stikine	Christina	216
18	Stikine	Craig_River	113
18	Stikine	Little_Tahltan	615
18	Stikine	Shakes_Creek	170
18	Stikine	Verrett	467
19	Skeena Upper	Bear____	177
19	Skeena Upper	Slamgeesh	34
19	Skeena Upper	Sustut__	425
20	Skeena Babine	Babine__	266
21	Skeena Bulkley	Bulkley	585
21	Skeena Bulkley	Morice__	228
22	Skeena Mid	Kispiox_	167
22	Skeena Mid	Kitwanga	288
22	Skeena Mid	Sweetin_River	44
23	Skeena Lower	Cedar___	116
23	Skeena Lower	Ecstall_	293
23	Skeena Lower	Gitnadoix	42
23	Skeena Lower	L._Kalum	457
23	Skeena Lower	L._Kalum@AC	190
24	Alsek	Blanchard	376
24	Alsek	Klukshu_	432
24	Alsek	Takhanne	187
50	Puget Sound	Green@Kendal_F	50
50	Puget Sound	Green_F@Soos	100
50	Puget Sound	LittleCampbell	89
50	Puget Sound	Nooksack_SP@Ke	100
50	Puget Sound	Serpentine	46
50	Puget Sound	Skagit_Su	282
50	Puget Sound	Skykomish_Su	75
50	Puget Sound	StillaguamishS	87
50	Puget Sound	White_F_	100
51	Juan de Fuca	Elwha_F_	99
52	Coastal Wash	Hoh_River_SP_S	59
52	Coastal Wash	Queets__	57
52	Coastal Wash	Quinault_F	64
52	Coastal Wash	Solduc_F	98
53	Low Col	Abernathy_F	100
53	Low Col	Coweeman_	77
54	Up Col-Sp	Chewuch_SP	100
54	Up Col-Sp	Chiwawa_SP	100
54	Up Col-Sp	Entiat_Sp	64
54	Up Col-Sp	Twisp_SP	100
55	Up Col-Su/F	Deschutes-F	100
55	Up Col-Su/F	Hanford_Reach	98
55	Up Col-Su/F	Okanagan_R	43
55	Up Col-Su/F	Silmilkameen_S	195
55	Up Col-Su/F	Wenatchee_Su	100
56	Snake-Sp/Su	Frenchman-SP	61
56	Snake-Sp/Su	Imnaha__	99
56	Snake-Sp/Su	Marsh_Creek	219
56	Snake-Sp/Su	McCall_Hat	41
56	Snake-Sp/Su	McCall_River	32
56	Snake-Sp/Su	Rapid_Sp	80
56	Snake-Sp/Su	Salmon_E.Fork	53
56	Snake-Sp/Su	Snake_S	62
56	Snake-Sp/Su	Tucannon_SP	100
56	Snake-Sp/Su	Up_Salmon-SP	165
56	Snake-Sp/Su	Upper_Valley	77
56	Snake-Sp/Su	Valley_Creek	43
56	Snake-Sp/Su	Wenaha__	43
57	Snake-F	Lyon's_Ferry_F	112
58	North & Central O	Elk_River	68
58	North & Central O	Euchre_Creek	57
58	North & Central O	Nehalem__	53
58	North & Central O	Siuslaw__	37
58	North & Central O	Trask_hat_F	98
58	North & Central O	Trask_hat_SP	48
58	North & Central O	Umpqua_Smith	93
59	South Oregon coas	Cole_River	49
59	South Oregon coas	Hunter_Creek	96
59	South Oregon coas	Lobster_Creek	49
59	South Oregon coas	Pistol_River	94
59	South Oregon coas	Winchuk__	80
61	Klamath/Trinity	Blue_Creek	94
61	Klamath/Trinity	Trinity_F	100
61	Klamath/Trinity	Trinity_SP	100
62	Mid Col-Sp	John_Day_main	36
62	Mid Col-Sp	John_Day_mid	40
62	Mid Col-Sp	John_Day_north	40
63	Up Willamette	Clackamas_No	79
63	Up Willamette	North_Santiam	97
63	Up Willamette	Sandy___	89
64	Cent Val-F	American_River	69
64	Cent Val-F	Battle_Creek	40
64	Cent Val-F	Butte_F	49
64	Cent Val-F	Feather_F	128
64	Cent Val-F	Merced__	200
64	Cent Val-F	Mokelumne	94
64	Cent Val-F	Sacr_F___	136
64	Cent Val-F	Sacr_LF__	96
64	Cent Val-F	Toulumne__	34
64	Cent Val-F	Yuba____	50
65	Cent Val-Sp	Butte_Sp	43
65	Cent Val-Sp	Feather_Sp	82
65	Cent Val-Sp	Yuba_Sp__	32

Appendix 2. Abbreviations used to describe regions.

#	Abbreviation	Region
1	UPFR	Upper Fraser River
2	MUFR	Middle Fraser River
3	LWFR-F	Lower Fraser River Fall
4	NOTH	North Thompson River
5	SOTH	South Thompson River
6	LWTH	Lower Thompson River
7	ECVI	East Coast of Vancouver Island
8	WCVI	West Coast of Vancouver Island
9	SOMN	Southern Mainland BC
10	NOMN	Northern Mainland BC
11	NASS	Nass River
12	LWFR-Sp	Lower Fraser River Spring
13	LWFR-Su	Lower Fraser River Summer
14	QCI	Yakoun River
15	Alaska	Alaska
17	Taku	Taku River
18	Stikine	Stikine River
19	Skeena Upper	Skeena Upper
20	Skeena Babine	Skeena Babine
21	Skeena Bulkley	Skeena Bulkley
22	Skeena Mid	Skeena Mid
23	Skeena Lower	Skeena Lower
24	Alsek	Alsek
50	Puget Sound	Puget Sound
51	Juan de Fuca	Juan de Fuca Strait
52	Coastal Wash	Coastal Washington
53	Low Col	Lower Columbia
54	Up Col-Sp	Upper Columbia spring timed
55	Up Col-Su/F	Upper Columbia summer & fall timed
56	Snake-Sp/Su	Snake River spring & summer timed
57	Snake-F	Snake River fall timed
58	North & Central O	North and Central Oregon
59	S.Oregon coas	Southern Oregon Coastal
61	Klamath/Trinity	Klamath & Trinity Rivers
62	Mid Col-Sp	Middle Columbia Spring timed
63	Up Willamette	Upper Willamette
64	Cent Val-F	Central Valley fall timed
65	Cent Val-Sp	Central Valley spring timed
1-6, 12 & 13	Fraser	Fraser River and tributaries
19-23	Skeena	Skeena River and tributaries
17, 18 & 24	TRANS	Transboundary Rivers originating in Canada flowing through Southeast Alaska
53-57, 61-63	Columbia	Columbia River and tributaries
58 & 59	Oregon	Oregon coastal
61, 64 & 65	California	California
50-52	Washington	Washington

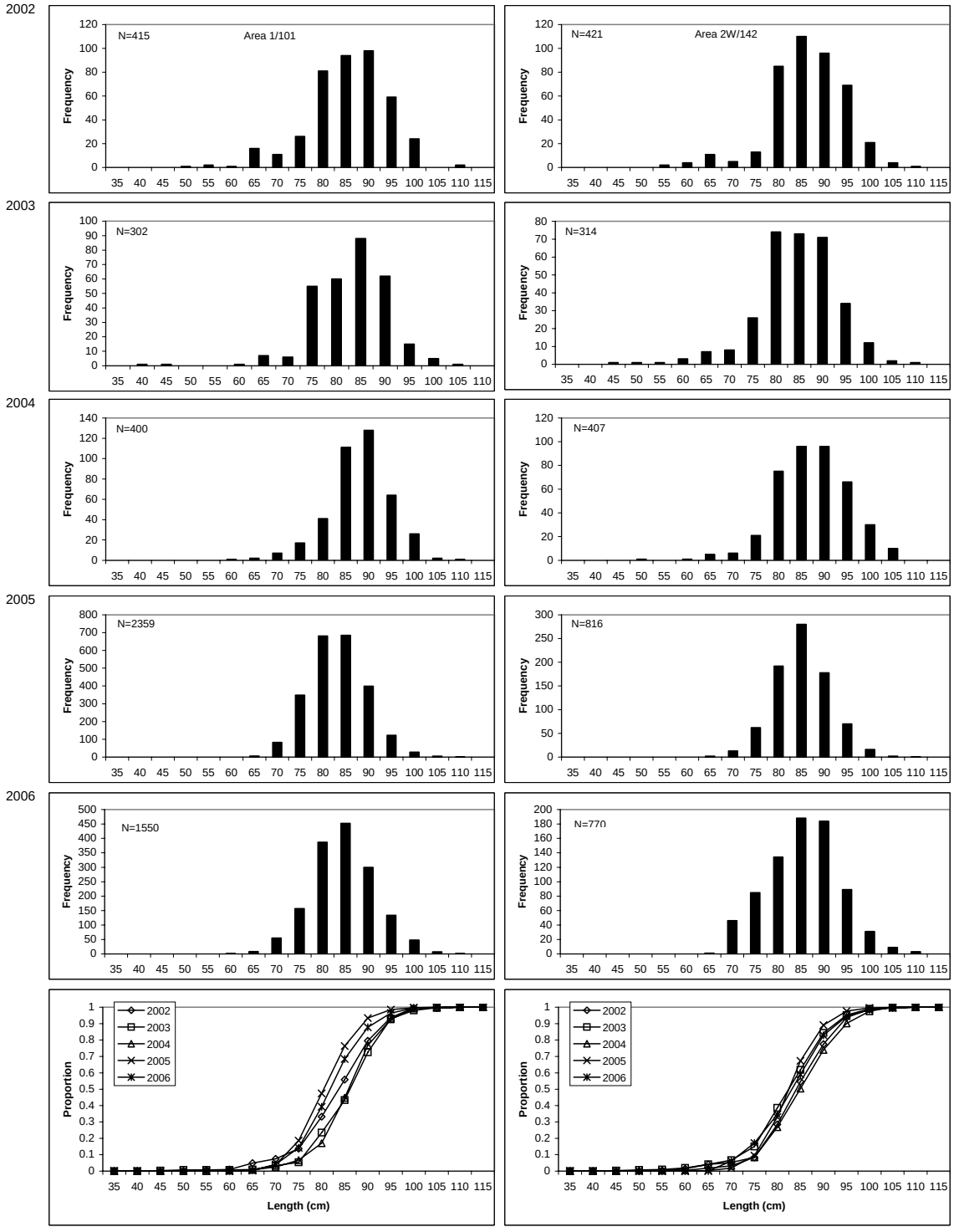
Appendix 3. Inventory of samples collected from the 2006 NBC Troll Fishery.

Year	Month	Area	N	Format	GSI	Catch applied to DNA	Catch without samples	Catch for Time/Area	Comment
2005	Oct	1/101					25	25	no sample
2006	Apr	101	100	Test	84	100		100	
2006	Apr	2W	100	Test	96	100		100	
2006	May	101	93	Test	92	93		93	
2006	May	101	97	Test	94	97		97	
2006	May	2W	100	Test	96	100		100	
2006	May	2W	100	Test	95	100		100	
2006	Jun	101	77	Test	76	77		77	
2006	Jun	101	151	Opening	143	3365		3365	
2006	Jun	101	102	Opening	102	2400		2400	
2006	Jun	1/101	200	Troll	183	17255		17255	
2006	Jun	101	100	Troll	92	16005		16005	
2006	Jun	101	100	Troll	98	15633		15633	
2006	Jun	101	100	Troll	87	11481		11481	
2006	Jun	2W	80	Test	79	80		80	
2006	Jun	2W	20	Test	20	20		20	
2006	Jun	101	100	Troll					not submitted
2006	Jun-Jul	1/101	100	Troll					not submitted
2006	Jul	1/101	100	Troll	96	19287		19287	
2006	Jul	1/101	100	Troll	94	8424		8424	
2006	Jul	1/101	100	Troll	93	13022		13022	
2006	Jul	101+142	100	Troll	95	12349		12349	
2006	Jul	2W	100	Test	96	100		100	
2006	Jul	2W	100	Test	85	100		100	
2006	Jul	1/101	100	Troll					not submitted
2006	Jul-Aug	1/101/142	100	Troll					not submitted
2006	Jul-Aug	1/101/142	100	Troll					not submitted
2006	Aug	101	100	Test	93	9381		9381	
2006	Aug	1/101	100	Troll	94	12702		12702	
2006	Aug	101	100	Troll	98	11288		11288	
2006	Aug	2W	100	Test	85	100		100	
2006	Aug-Sep	1/101	50	Troll					not submitted
2006	Sep	101/142	100	Troll	88	4610		4610	
2006	Sep	2W	70	Test	68	70		70	

N = number of samples collected
GSI = analysis completed for this number of samples.
Test = Samples collected at sea by test fishing vessels in individual vials with associated biological data.
Troll = Samples collected from NBC troll fishery landings in individual vials with associated biological data. Maximum 50 fish per vessel. Samples were collected from every 5^{th} or 10^{th} fish depending on load size.
Opening = Samples collected on the opening day of the fishery, June 7. Tissue samples only.
Further sampling details are provided in the text.

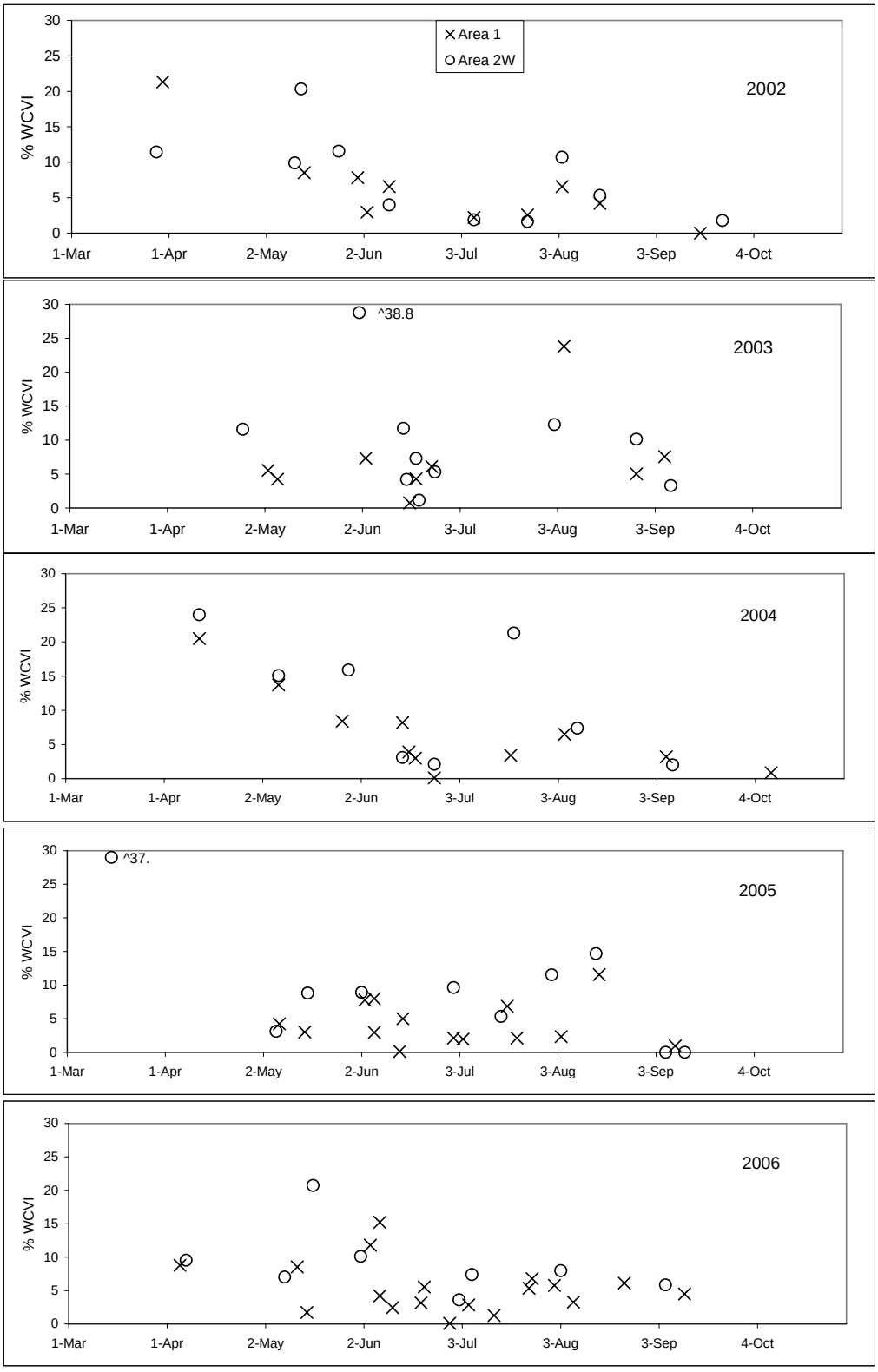
Appendix 4. Comparison of length frequencies from NBC Troll caught Chinook salmon sampled from 2002 to 2006.

Bottom graphs are cumulative proportions of total length sampled.



2002 to 2005 data from Winther and Beacham (2006).

Appendix 5. Comparison of %WCVI component from Chinook salmon samples collected from 2002 to 2006



2002 to 2005 data from Winther and Beacham (2006).

Appendix 6. Management targets and actual catches for NBC troll fisheries from 2002 to 2006.

Year	AABM Preseason Ceiling	Total AABM Catch	QCI Sport Catch	Pre-season NBC Troll allocation	Post-season NBC Troll allowable catch	Actual NBC Troll Catch
2002	192,700	150,617	47,100	162,000	145,600	103,517
2003	197,067	191,657	54,300	152,000*	142,767	137,357
2004	243,640	241,508	74,000	183,640	169,640	167,508
2005	246,600	243,606	68,800	170,000	177,800	174,806
2006	223,200	222,838	64,500	153,200	158,700	158,363

* Revised in-season to 142,000

Year	Pre-season Troll target of WCVI Chinook (pieces)	Actual Troll catch of WCVI Chinook (pieces)	Pre-season Troll HR Target on WCVI Returns to Canada	Estimated Post-Season Troll HR on WCVI Return to Canada	Pre-season Target NBC Troll ER on WCVI	Estimated Post-season NBC Troll ER on WCVI Chinook
2002	3,052	6,811	1.6%	3.6%	1.5%	3.3%
2003	6,811	7,637	!	3.2%	!	2.7%
2004	7,800	10,065	3.6%	3.4%	3.3%	2.9%
2005	11,600	8,125	3.6%	4.1%	3.3%	3.5%
2006	6,344	6,465	3.2%	3.3%*	3.2%	2.9%

* preliminary 12 January 2007

Year	RCH Chinook returns to Canada		RCH Chinook catch in Alaskan fisheries[1]	Total WCVI Chinook returns to Canada		Proportion of RCH in WCVI Chinook returns	
	Pre-season forecast	Post-season estimate		Pre-season forecast	Post-season estimate	Pre-season forecast	Post-season estimate
2002	80,300	92,237	9,179	170,900	190,967	47%	48%
2003	86,600	103,184	16,054	180,400	241,084	48%	43%
2004	96,437	153,688	34,416	211,700	279,433	45.6%	55%
2005	189,400	114,910	21,007	313,600	198,121	60.4%	58%
2006	115,000	132,162*	16,267	198,275	198,034*	58%	67%*

* preliminary 12 January 2007

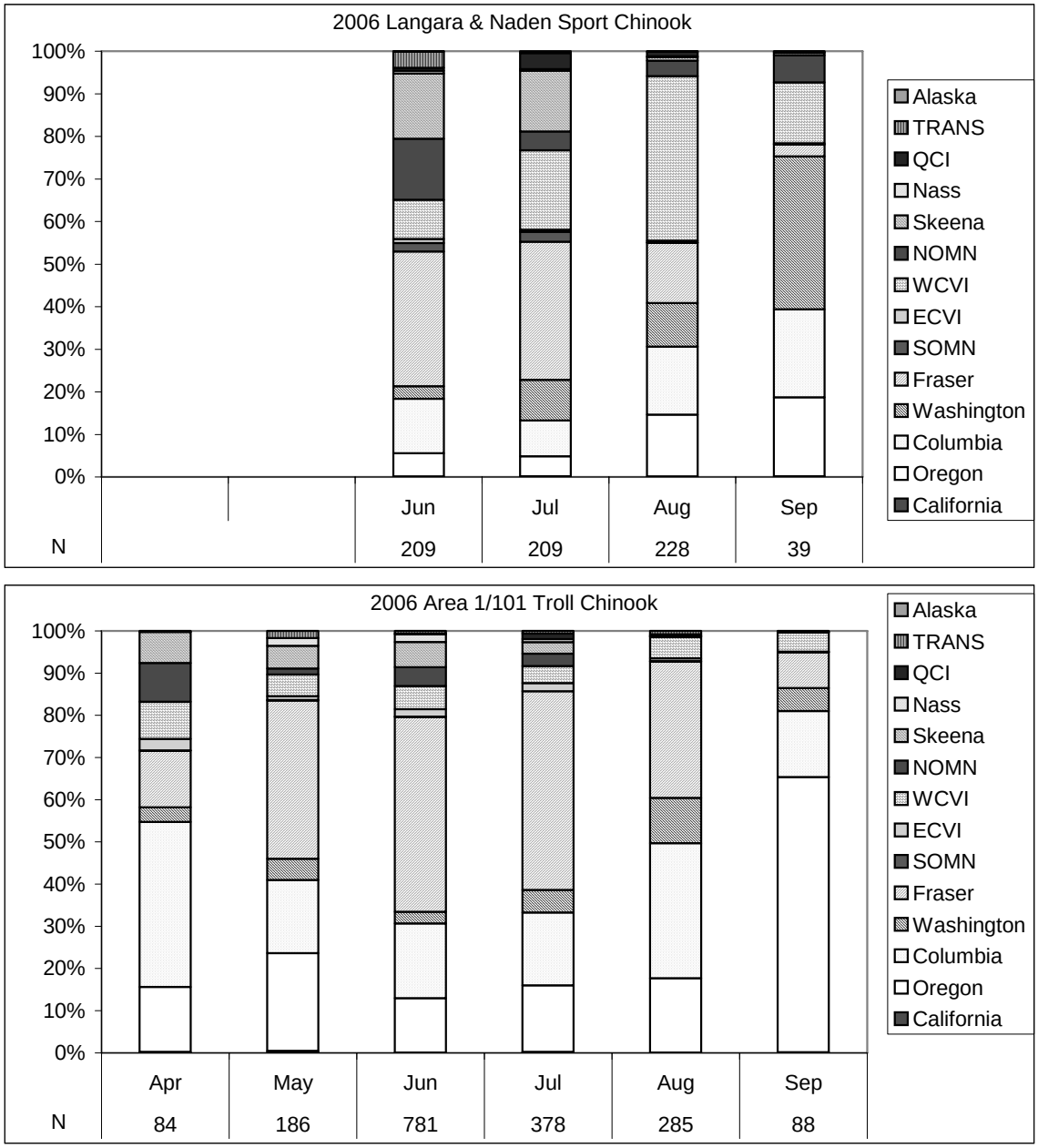
Returns to Canada = catch in Canadian fisheries + Escapement
HR = Harvest Rate
ER = Exploitation Rate approximated by NBC Troll Catch / (Total Catch in all fisheries + Escapement) assuming all catch is of fish returning the same year caught.

! Pre-season ER and HR targets were not developed in 2003 because the forecast was not available at the time the target was set. The 2003 target was the equivalent number of chinook caught in 2002 which was expected to provide slightly lower ER and HR targets than realized by the 2002 catch.

[1] from CWT's (State of Alaska, Department of Fish and Game. Mark, Tag and Age Laboratory. PO Box 115526, Juneau, AK 99811-5526. http://tagotoweb.adfg.state.ak.us). Total hatchery contribution to Alaskan fisheries in 2006 was 25,583.

2002 forecast data from Riddel et. al. (2002). RCH and WCVI return data and forecasts for 2003 to 2006 from A. Tompkins, W. Luedke, D. Dobson, D. Lewis, Fisheries & Oceans Canada, 3190 Hammond Bay Road, Nanaimo, B.C. V9T-6N7 unpublished data.

Appendix 7. Monthly proportions of major stock groups from troll samples compared with sport samples collected from Area 1/101 in 2006.



Appendix 8. Monthly proportions of major stock groups from troll samples compared with sport samples collected from Area 2W/142 in 2006.