

# **Final Report DNA Stock Composition of the Chinook Salmon Catch in the April 2014 – March 2015 WCVI Troll Fishery**

## **ABSTRACT**

In response to weak stock management the timing of the West Coast Vancouver Island (WCVI) troll fishery has moved away from the predominantly late spring to summer time period to be more evenly distributed throughout the year. However, international management of the WCVI troll fishery uses coded-wire tag (CWT) recoveries from the 1979-1982 base period to estimate current fishery impacts. In order to more accurately characterize the stock composition of the WCVI troll Chinook fishery catch throughout the year, genetic (DNA) samples were collected from a target of 4% of the total catch. Samples from a target of 2% of the total catch were analysed using the Genetic Analysis of Pacific Salmon (GAPS) baseline. The primary project objectives were met: a total of 4,552 samples were collected from a total Area G troll catch of 107,125 Chinook (4.2% sample rate), with a total of 2,255 samples analysed for stock composition (2.2% analysis rate). DNA samples were also obtained from and analysed for T'aaq-wiihak (481 samples) and WCVI sport (733 samples) fisheries. The secondary project objective of collecting and analysing samples to compare the stock compositions of sub-legal and legal sized Chinook was not conducted. The project was completed within the allocated budget.

## **INTRODUCTION**

DNA can provide information on stock group specific impacts of the West Coast Vancouver Island (WCVI) troll fishery. This is important for managing the WCVI troll fishery since limited coded-wire tag (CWT) information exists for non-summer portions of the year. In response to domestic conservation requirements in recent years, the timing of the WCVI troll fishery has shifted slightly compared to the Pacific Salmon Commission (PSC) Chinook model base period (1979-82). During the base period, fishery impacts occurred mainly from March to October, whereas recently, fishery impacts have shifted away from summer months to avoid weak stocks, and expanded further into the winter months. Additionally, catches are currently considerably lower than they were during the base period. Consequently, the current impacts of the WCVI troll fishery as determined by the PSC Chinook model (using CWT data from the base period) may not be comparable. In addition, the relatively low numbers of CWT recovered by the Mark Recovery Program (MRP) from the lower catch levels may not be sufficient to accurately identify fishery impacts from the smaller catches characteristic of winter fishery openings, especially on the monthly time scale required. The use of DNA methods provides an independent means of evaluating the impact of this fishery on chinook stocks, and is used to supplement CWT information to provide the best available estimate of impact on stocks. In addition, WCVI troll fishery planning for Chinook requires that management objectives for weak stocks are met using limited CWT and

DNA information. This project provides improved information for evaluating current impacts and avoiding future impacts on weak stocks, thereby achieving conservation objectives of the Pacific Salmon Treaty (PST) while minimizing economic disruption associated with elimination of fisheries. This report summarizes the ninth year of this study.

Objective 1 of the program was to (a) directly collect genetic samples from the WCVI troll (Area G) fishery from April 2014 to March 2015, (b) obtain genetic samples collected from T'aaq-wiihak and WCVI troll fisheries, (c) and determine the Chinook stock composition of all AABM Chinook fisheries (Area G troll, T'aaq-wiihak, and WCVI sport) using DNA analysis techniques.

Objective 2 of the program was to continue the collection of DNA samples from sub-legal chinook releases to validate the assumption that adult chinook stock composition represents the distribution and composition of sub-legal chinook.

## METHODS

### **Fishery Sampling**

The Area G troll fishery catch is sampled through the MRP. The goal of the MRP is to sample 20% of the total Area G troll catch to detect and recover CWTs according to a stratified random design (strata=Pacific Fishery Management Area (PFMA) and statistical week). The MRP contractor was tasked with randomly sub-sampling their 20% MRP sample for DNA, with a minimum objective of 4% of the catch. The DNA sampling protocol is outlined in Appendix II.

The T'aaq-wiihak troll fishery is biologically sampled dockside by the same Certified Service Provider, and according to the same protocols, as the Area G troll fishery.

The WCVI sport fishery Chinook catch is randomly biologically sampled by the WCVI Creel Program.

### **DNA Analysis**

Samples were analysed with the GAPS (Genetic Analysis of Pacific Salmon; version 2.1, plus additional DFO populations submitted but not included in a new GAPS release) baseline which is based on thirteen microsatellite loci surveyed in approximately 25,000 chinook from 181 populations ranging from Russia and Alaska to California.

The target sample size for DNA analysis was 2% of the catch by time-area strata. Samples were selected to be representative of the catch in each PFMA and then rolled up to the catch region (NWVI, SWVI) level.

### **Monitoring and Quality Assurance/Quality Control**

Sample collection was monitored on a monthly basis. Samples were inventoried and labelled upon receipt, and the vial data corroborated with the data sheets provided. Sampling rates by PFMA were evaluated after each fishery period, and if needed, feedback was provided to the contractor.

## RESULTS AND DISCUSSION

Achievement of the project objectives is described below:

### **Objective 1: Stock Composition Estimates of the WCVI Chinook Troll Fishery Catch**

All Area G troll fisheries from April 2014 to March 2015 were sampled for DNA with the exception of small catches (<200 fish) from November 2014 to February 2015 (Table 1). A total of 4,552 samples were collected from a total Area G troll catch of 107,125 Chinook (average sample rate of 4.2%) from April 2013 to March 2014 (Table 1).

A total of 2,160 and 1,162 DNA samples were obtained from the T'aaq-wiihak and sport fisheries, respectively. Of these, 481 and 733 samples were analysed by the PBS molecular genetics lab (Table 1).

For all three fisheries (Area G troll, T'aaq-wiihak troll, and WCVI sport), the objective was to analyse samples from approximately 2% of the catch (or a minimum of 100 plugs) in each time-area when fisheries occurred, was met (Table 1). Samples were selected to be representative of the catch in each PFMA and then rolled up to the catch region (NWVI, SWVI) level. Stock composition results by month and catch region are found in Appendix III.

### **Objective 2: Stock Composition Estimates of Legal versus Sub-legal Chinook**

We proposed to continue the collection of DNA samples from sub-legal chinook releases to validate the assumption that adult chinook stock composition represents the distribution and composition of sub-legal chinook. However, we discontinued the collection of DNA samples from sub-legal chinook releases as the Chinook Technical Committee has advised that sufficient data have been collected to validate the assumption that adult chinook stock composition represents the distribution and composition of sub-legal chinook. The portion of the budget allocated to this work (\$5,000) was re-allocated to DNA analyses.

### **Monitoring and Quality Assurance/Quality Control**

Generally, the project met quality standards. Samples were collected according to the protocol, and were representative of the fishery catch by time and area. One exception was the quality of samples collected in August and September for Area G troll: the samples were accidentally frozen at the back of a storage fridge, making a significant portion of the DNA sample unsuitable for DNA analysis. This issue was reported to the Project Manager by the Genetics Lab, and follow up with the contracted samplers resulted in a change in protocol to prevent future occurrences.

Table 1. Chinook catch, number of DNA samples collected and analysed, and percent of catch sampled and analysed, by fishery, month and catch region stratum (SWVI, NWVI), April 2014 to March 2015. Note: NWVI = Northwest Vancouver Island; SWVI = Southwest Vancouver Island.

| Sampling Year          | Sampling Month | Fishery Sampled | Sampling Strata | Chinook Catch     | Number of DNA Plugs Collected | Actual # Plugs Analysed | Percent of Catch Sampled | Percent of Catch Analysed |
|------------------------|----------------|-----------------|-----------------|-------------------|-------------------------------|-------------------------|--------------------------|---------------------------|
| 2014                   | April          | Area G          | SWVI            | 104               | 0                             | 0                       | 0%                       | 0%                        |
| 2014                   | April          | Area G          | NWVI            | 17,810            | 738                           | 441                     | 4%                       | 2%                        |
| 2014                   | May            | Area G          | SWVI            | 3,091             | 479                           | 99                      | 15%                      | 3%                        |
| 2014                   | May            | Area G          | NWVI            | 32,676            | 1,057                         | 643                     | 3%                       | 2%                        |
| 2014                   | May            | T'aaq-wiihak    | SWVI            | 1,000             | 322                           | 90                      | 32%                      | 9%                        |
| 2014                   | May            | T'aaq-wiihak    | NWVI            | 280               | 104                           | 0                       | 37%                      | 0%                        |
| 2014                   | June           | T'aaq-wiihak    | SWVI            | 1,181             | 444                           | 99                      | 38%                      | 8%                        |
| 2014                   | June           | T'aaq-wiihak    | NWVI            | 2,519             | 281                           | 100                     | 11%                      | 4%                        |
| 2014                   | June           | WCVI Sport      | Area 121        | 1,528             | 41                            | 41                      | 3%                       | 3%                        |
| 2014                   | June           | WCVI Sport      | SWVI            | 4,892             | 82                            | 87                      | 2%                       | 2%                        |
| 2014                   | June           | WCVI Sport      | NWVI            | 175               | 53                            | 18                      | 30%                      | 10%                       |
| 2014                   | July           | Area G          | SWVI            | no fishery        |                               |                         |                          |                           |
| 2014                   | July           | Area G          | NWVI            | 26,494            | 767                           | 528                     | 3%                       | 2%                        |
| 2014                   | July           | T'aaq-wiihak    | SWVI            | 1,860             | 598                           | 95                      | 32%                      | 5%                        |
| 2014                   | July           | T'aaq-wiihak    | NWVI            | 8,294             | 405                           | 97                      | 5%                       | 1%                        |
| 2013                   | July           | WCVI Sport      | Area 121        | 5,220             | 62                            | 62                      | 1%                       | 1%                        |
| 2014                   | July           | WCVI Sport      | SWVI            | 8,670             | 113                           | 110                     | 1%                       | 1%                        |
| 2014                   | July           | WCVI Sport      | NWVI            | 6,772             | 229                           | 128                     | 3%                       | 2%                        |
| 2014                   | August         | Area G          | SWVI            | 631               | 0                             | 0                       | 0%                       | 0%                        |
| 2014                   | August         | Area G          | NWVI            | 9,371             | 330                           | 135                     | 4%                       | 1%                        |
| 2014                   | August         | WCVI Sport      | Area 121        | 2,849             | 44                            | 44                      | 2%                       | 2%                        |
| 2014                   | August         | WCVI Sport      | SWVI            | 6,228             | 230                           | 117                     | 4%                       | 2%                        |
| 2014                   | August         | WCVI Sport      | NWVI            | 6,649             | 308                           | 126                     | 5%                       | 2%                        |
| 2014                   | September      | Area G          | SWVI            | 12,276            | 596                           | 76                      | 5%                       | 1%                        |
| 2014                   | September      | Area G          | NWVI            | 2,875             | 253                           | 22                      | 9%                       | 1%                        |
| 2014                   | September      | T'aaq-wiihak    | SWVI            | 224               | 6                             | 0                       | 3%                       | 0%                        |
| 2014                   | September      | T'aaq-wiihak    | SWVI            | no catch reported |                               |                         |                          |                           |
| 2014                   | October        | Area G          | SWVI            | 213               | 10                            | 0                       | 5%                       | 0%                        |
| 2014                   | October        | Area G          | NWVI            | 0                 | 0                             | 0                       |                          |                           |
| 2014                   | October        | T'aaq-wiihak    | SWVI            | 50                | 0                             | 0                       | 0%                       | 0%                        |
| 2014                   | October        | T'aaq-wiihak    | SWVI            | 0                 | 0                             | 0                       |                          |                           |
| 2014                   | November       | Area G          | SWVI            | 32                | 0                             | 0                       | 0%                       | 0%                        |
| 2014                   | November       | Area G          | NWVI            | 24                | 0                             | 0                       | 0%                       | 0%                        |
| 2014                   | December       | Area G          | SWVI            | 0                 | 0                             | 0                       |                          |                           |
| 2014                   | December       | Area G          | NWVI            | 0                 | 0                             | 0                       |                          |                           |
| 2015                   | January        | Area G          | SWVI            | 119               | 0                             | 0                       | 0%                       | 0%                        |
| 2015                   | January        | Area G          | NWVI            | 67                | 0                             | 0                       | 0%                       | 0%                        |
| 2015                   | February       | Area G          | SWVI            | 542               | 0                             | 0                       | 0%                       | 0%                        |
| 2015                   | February       | Area G          | NWVI            | 69                | 0                             | 0                       | 0%                       | 0%                        |
| 2015                   | March          | Area G          | SWVI            | 305               | 109                           | 106                     | 36%                      | 35%                       |
| 2015                   | March          | Area G          | NWVI            | 426               | 213                           | 205                     | 50%                      | 48%                       |
| <b>Area G Total</b>    |                |                 |                 | <b>107,125</b>    | <b>4,552</b>                  | <b>2,255</b>            | <b>4%</b>                | <b>2%</b>                 |
| <b>T'aaq Total</b>     |                |                 |                 | <b>15,408</b>     | <b>2,160</b>                  | <b>481</b>              | <b>14%</b>               | <b>3%</b>                 |
| <b>Sport Totals</b>    |                |                 |                 | <b>42,984</b>     | <b>1,162</b>                  | <b>733</b>              | <b>3%</b>                | <b>2%</b>                 |
| <b>Grand Total/Avg</b> |                |                 |                 | <b>165,517</b>    | <b>7,874</b>                  | <b>3,469</b>            | <b>7%</b>                | <b>2%</b>                 |

## Financial Statement

The total overall allocated Southern Endowment Fund budget was \$87,270 (Canadian funds). The DFO in-kind contribution was estimated at \$12,270. Below is a summary of the proposed and actual costs, with a detailed Financial Statement of Expenditures (verified by our financial officer) given in Appendix I.

Proposed and actual direct costs and DFO in-kind contributions are as follows:

| <u>Direct</u>   |          | <u>Proposed</u> | <u>Actual</u>   |
|---|----------|-----------------|-----------------|
| ▪ DNA sampling<br>(J.O. Thomas and Associates Ltd.)   | =        | \$17,000        | \$15,479        |
| ▪ Area G vessel costs (sublegal sampling)   | =        | \$5,000         | \$0             |
| ▪ DNA sampling equipment  | =        | \$700           | \$0             |
| ▪ travel expenses / shipping  | =        | \$1,300         | \$0             |
| ▪ DNA lab analysis for 3000 samples,<br>including labour and supplies<br>(3000 samples x \$20/fish) | =        | <u>\$51,000</u> | <u>\$52,021</u> |
| <b>TOTAL PSC</b>  | <b>=</b> | <b>\$75,000</b> | <b>\$67,500</b> |
| <br>  |          |                 |                 |
| <u>DFO – In Kind</u>  |          |                 |                 |
| ▪ Project consultation<br>(1 staff @5 days @7.5 hr/day @\$50/hr)                                    | =        | \$1,875         |                 |
| ▪ Project management<br>(1 staff @30 days @7.5 hr/day @\$42/hr)                                     | =        | \$9,450         |                 |
| ▪ Administrative Coordinator<br>(1 staff @3 days @7.5 hr/day @\$42/hr)                              | =        | \$945           |                 |
| <b>TOTAL IN-KIND</b>  | <b>=</b> | <b>\$12,270</b> |                 |
| <b>TOTAL ACTUAL COSTS</b>   | <b>=</b> | <b>\$79,770</b> |                 |

The proposed project cost to the PSC was \$75,000. The actual funds used were \$67,500, largely due to the lower than anticipated Area G fishery catches, and the suspension of the sub-legal Chinook sampling. This resulted in lower field sampling and laboratory analysis costs. As a result, we will not require the \$7,500 hold back amount.

Funds to sample sub-legal Chinook were unused since the sampling was not conducted. Funds for sampling equipment and travel were unused since the sub-legal Chinook sampling was not conducted. Shipping costs were unused as samples were dropped off at a DFO office by JOT staff. The DNA lab analysis cost was lower than anticipated since Area G monthly catches were lower, resulting in ten time-areas that were not sampled due to low/no catch. In-kind costs were as anticipated.

## **Project Benefits**

This project relates to the harvest rate indices prescribed in the PST for Chinook salmon in the WCVI Aggregate Abundance Based Management (AABM) fishery. These are management goals based on base period fishing patterns. Regional planning processes use CWT information related to base period fishing patterns as the basis for planning. In the non-summer fishing period there are few CWT data and so planning processes are compromised. The effect of changes in fishing patterns from the base period and impact on harvest rate indices is an issue. DNA information from the fisheries will improve the knowledge base more quickly than using CWT only. Increased conservation and improved fisheries management will provide potential for increased returns of stocks of concern. Increased returns will provide more rapid rebuilding. DNA information will also provide insight into the spatial and temporal distribution of various chinook stock groups, allowing fisheries to be better shaped to avoid stocks of concern.

This project will benefit the chinook stocks, the fishery managers, the fishermen, and the local WCVI communities. Chinook stocks will benefit from increased conservation and more rapid rebuilding of weaker stocks. Fishery managers will benefit through improved fisheries management information, including the ability to avoid weaker stocks. Fishers will benefit from greater fishing opportunities made possible through avoidance of weaker stocks. Rebuilding of weaker stocks may increase TAC in future years. Local WCVI communities will benefit from greater fishing activity in their areas, improving their economic outlook.

## APPENDICES

Appendix I. Financial Statement of Expenditures

Appendix II. WCVI Chinook Troll DNA Sampling Protocol (April 2014 to March 2015)

Appendix III. Regional DNA results from the sampling of the 2014/15 West Coast Vancouver Island Chinook troll fisheries (From file: WCTR\_CN\_2014\_2015\_DNAdata\_SEF.xls)

## Data

DNA results are provided in hardcopy (regional data spreadsheets only) as well as attached to an email sent August 18, 2015.

## Electronic Files Provided

1. SEF 2014-15 WCTR Chinook DNA Cover Letter.doc
2. SEF 2014-15 WCTR Chinook DNA Final Report.doc
3. WCTR\_CN\_2014-2015\_DNAdata\_SEF.xls
4. detailed expenditures Fiscal 2014-2015.pdf
5. Final Budget - DNA Based Chinook Stock Composition 2014-2015\_August 2015.xls

## APPENDIX I

### Financial Statement of Expenditures

(Detailed Transactions were provided by Financial Officer)

See electronic files:  
detailed expenditures Fiscal 2014-2015.pdf

(project # 57369 on p.2)



## APPENDIX II

WCVI Chinook Troll DNA Sampling Protocol  
(April 2014 to March 2015)

## **WCVI Troll Chinook DNA Sampling Protocol For Dockside MRP Sampling from April 2014 to March 2015**

### **Objective:**

- To collect a sample of chinook DNA from each WCVI troll catch region that is representative of catch in that catch region (NWVI is 25/125-27/127, SWVI is 21/121-24/124)
- The temporal stratum is a month (samples should represent the catch over the whole length of a fishery opening within a month).
- Sample Size: objective is 4% of the catch by month and catch region (the larger the catch, the greater the number of samples). A minimum of 200 plugs should be collected for each catch region (NWVI and SWVI) barring very small catches. The exception is April through June when a minimum of 500 plugs should be collected when possible. If any questions or concerns arise regarding any aspect of sampling, please contact **Karin Mathias, (250) 756-7290 or (250) 714-4304**.

### **DNA Sampling Approach:**

- No more than 50 samples are to be put into each vial. Over packing vials has resulted in the loss of some samples. (Need 2/3 ethanol to 1/3 samples.) If it is necessary to temporarily store more than 50 in one vial, at the earliest opportunity the samples should be split into separate, labelled (1 of 2 and 2 of 2) vials.
- Samples and inventory/data sheets are to be submitted monthly.
- The approximate number of DNA samples to be collected from each offload is summarized in Table 1 below.
- DNA sample collection should be spread out over the length of the month as much as possible (although collect more plugs than needed at the start of the fishery opening in case of unforeseen closures and difficulties sampling small catches).
- DNA sample collection should be taken from single vessel samples (unmixed samples) and single (unmixed) areas as priorities wherever possible. Sample the entire catch from a vessel (or vessels if the catch was graded and combined over PFMA).
- DNA sample collection should be taken from as many vessels as possible.
- Whether fish are graded or ungraded, the sample should be taken so as to be random and representative of the catch, regardless of mark.
- DNA samples should be kept separate by mark (1 bulk vial for each of adipose-on fish and adipose-off fish). Collect samples from the tail fin rather than operculum. This is due to high rates of delamination of operculum punches in some samples, resulting in duplication of sample analysis.
- Where fish caught on more than one vessel have been mixed as a result of grading (i.e. 2 boats' fish in 1 tote), these fish can be sampled as long as the boats have fished in the same catch region (NWVI or SWVI) and the areas fished are known.

**Table 1.** DNA sampling requirements for different chinook catch levels in the WCVI troll fishery.

| <b>Number of Offloaded Chinook</b> | <b>DNA Sample To be Taken From:</b> |
|------------------------------------|-------------------------------------|
| <35                                | Every fish                          |
| 36-75                              | Every 2 <sup>nd</sup> fish          |
| 76-125                             | Every 3 <sup>rd</sup> fish          |
| 126-750                            | Every 5 <sup>th</sup> fish          |
| 751 or greater                     | Every 10 <sup>th</sup> fish         |

**Data Recording Requirements on each vial and on Sample Collection Inventory datasheet:**

- Sampling Date and Location
- Sampler Name
- Vessel Name (s)
- PFMA Fished
- Mark Type (adipose-on, adipose-off)
- DNA Vial #
- # plugs in each vial

**Table 2.** Sample and Data Delivery Schedule

| <b>Sampling Month</b> | <b>Sample and Data Delivery Deadline</b> |
|-----------------------|--|
| April                 | 15-May-2014                              |
| May                   | 15-June-2014                             |
| June                  | 15-July-2014                             |
| July                  | 15-August-2014                           |
| August                | 15-Sep-2014                              |
| September             | 15-Oct-2014                              |
| October               | 15-Nov-2014                              |
| November              | 15-Dec-2014                              |
| December              | 15-Jan-2015                              |
| January               | 15-Feb-2015                              |
| February              | 15-Mar-2015                              |
| March                 | 15-April-2015                            |

Return all samples and data to: Karin Mathias  
 Fisheries & Oceans Canada  
 3225 Stephenson Point Road  
 Nanaimo, B.C. V9T 1K3  
 (250) 756-7290 (office) or (250) 714-4304 (cell)  
 Karin.Mathias@dfo-mpo.gc.ca

## APPENDIX III

Regional DNA results from the sampling of the  
2014/15 West Coast Vancouver Island  
Chinook troll fisheries

See electronic file:  
WCTR\_CN\_2014\_2015\_DNAdata\_SEF.xls