

**Final Report  
DNA Stock Composition  
of the Chinook Salmon Catch in the  
April 2013 – March 2014 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 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 objective was met: a total of 5,393 samples were collected from a total Area G (including T'aaq-wiihak) troll catch of 36,320 Chinook, with a total of 2,404 samples analysed for stock composition. 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 eighth year of this study.

The program objectives were to:

- 1) Determine the stock composition of WCVI troll Chinook fisheries from April 2013 to March 2014 using DNA analysis techniques.
- 2) Determine stock composition of legal versus sub-legal Chinook from representative and comparative samples taken in September 2013.

## METHODS

### **Fishery Sampling**

#### *Legal Chinook from Full Fleet fisheries*

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.

#### *Legal versus Sub-legal Chinook*

DNA samples from a total of eight time periods have been taken to compare the stock composition of sub-legal sized with legal sized Chinook. These include May/June 1998 and 2002, May, June and September 2008-2011. May/June 1998 and 2002 samples were taken from archived scale samples. In 2008, sublegal Chinook samples were collected by a small number of volunteer trollers. These samples were contrasted against legal Chinook DNA samples collected through the dockside MRP. From 2009 to 2012, an Area G troller was contracted to collect both legal and sublegal Chinook DNA samples from Area 123, troll zones 8, 10, 13, 16, and 15A. All Chinook caught were sampled for DNA by taking a tissue plug with a hand held hole punch from the tail fin. All Chinook caught were released.

### **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.

### **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 2013 to March 2014 were sampled for DNA with the exception of small catches (<200 fish) from November to December 2013 (Table 1). A total of 5,393 DNA samples were collected from a total Area G troll (including the T'aaq-wiihak fishery, operating in the same time-areas as the Area G fishery) catch of 36,320 Chinook from April 2013 to March 2014 (Table 1). An additional 311 sport DNA samples were obtained through the WCVI creel program to provide stock composition data for July and August. DNA samples were collected from 8% to 88% of the total Area G troll catch (average of 30%) in each stratum (NWVI, SWVI) and month when sampling occurred.

Of samples collected, the goal was to analyse samples from approximately 2% of the total Area G troll catch in each catch region and month (or a minimum of 100 plugs), totalling a projected 3,000 samples for the project duration. DNA samples were analysed from 2% to 88% of the total catch (average of 23%) in each stratum (NWVI, SWVI) and month when samples were analysed. Samples were selected to be representative of the catch in each PFMA and then rolled up to the catch region (NWVI, SWVI) level. Of the 5,704 (including sport) DNA samples collected, 2,404 samples were analysed by the PBS molecular genetics lab. Of these 2,404 samples, we obtained (or expect to obtain, in the case of samples currently being analysed) data for 1,612 samples. The difference is largely due to a sample contamination issue (discussed below). Stock composition results by month and catch region are found in Appendix III.

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

The sampling goal was to collect approximately 200 legal and 200 sub-legal samples. This study was not conducted due to the troller, who had previously conducted the work, being unavailable at short notice. There was insufficient time to start the process to hire another troller.

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

Most aspects of the project (Objective 1) met quality standards. Generally, samples were collected according to the protocol, and were representative of the fishery catch by time and area. The exception was the quality of samples collected by one sampler in April (SWVI and NWVI), May (NWVI only) and September (NWVI only). Samples associated with this sampler were preserved in a non-ethanol solution which resulted in the complete failure of DNA amplification during processing. As a result, 792 samples were unusable. This issue was dealt with by: 1) removing the sampler from the project operations (the sampler is no longer employed by the contractor), and 2) switching from DNA collection in bulk vials (ethanol preservative) to Whatman Sheets (no preservative used). There were no other issues with sample quality. Samples and data sheets were delivered on schedule. Objective 2 of the project was not conducted.

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 2013 to March 2014. 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
2013	April	Area G/T'aaq-wiihak	SWVI	168	20	0	11.9%	n/a
2013	April	Area G/T'aaq-wiihak	NWVI	1,145	124	124	10.8%	10.8%
2013	May	Area G/T'aaq-wiihak	SWVI	23,631	1,838	473	7.8%	2.0%
2013	May	Area G/T'aaq-wiihak	NWVI	3,895	1,961	200	50.3%	5.1%
2013	June	Area G/T'aaq-wiihak	SWVI	750	147	147	19.6%	19.6%
2013	June	Area G/T'aaq-wiihak	NWVI	12	6	0	50.0%	n/a
2013	July	Area G	SWVI	no fishery	n/a	n/a	n/a	n/a
2013	July	Area G	NWVI	no fishery	n/a	n/a	n/a	n/a
2013	July	WCVI Sport	SWVI	AABM	96	96	currently being analysed	
2013	July	WCVI Sport	NWVI	AABM	98	98	currently being analysed	
2013	August	WCVI Sport	SWVI	AABM	62	62	currently being analysed	
2013	August	WCVI Sport	NWVI	AABM	55	55	currently being analysed	
2013	September	Area G	SWVI	0	0	0	n/a	n/a
2013	September	Area G	NWVI	2,531	356	356	14.1%	14.1%
2013	September	Area 123 Sublegal	SWVI	study not conducted				
2013	September	Area123 Legal	SWVI	study not conducted				
2013	October	Area G	SWVI	2,358	240	92	10.2%	3.9%
2013	October	Area G	NWVI	0	0	0	n/a	n/a
2013	November	Area G	SWVI	28	0	0	n/a	n/a
2013	November	Area G	NWVI	0	0	0	n/a	n/a
2013	December	Area G	SWVI	25	0	0	n/a	n/a
2013	December	Area G	NWVI	0	0	0	n/a	n/a
2014	January	Area G	SWVI	49	0	0	n/a	n/a
2014	January	Area G	NWVI	0	0	0	n/a	n/a
2014	February	Area G	SWVI	159	0	0	n/a	n/a
2014	February	Area G	NWVI	147	0	0	n/a	n/a
2014	March	Area G	SWVI	305	270	270	88.5%	88.5%
2014	March	Area G	NWVI	1,117	431	431	38.6%	38.6%
<b>Area G Totals</b>					<b>5,393</b>	<b>2,404</b>	<b>30%</b>	<b>23%</b>
<b>Sport Totals</b>					<b>311</b>			
<b>Total</b>					<b>5,704</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 (J.O. Thomas and Associates Ltd.)	=	\$17,000	\$10,242
▪ Area G vessel costs (sublegal sampling)	=	\$5,000	\$0.00
▪ DNA sampling equipment	=	\$700	\$0.00
▪ travel expenses / shipping	=	\$1,300	\$0.00
▪ DNA lab analysis for 3000 samples, including labour and supplies (3000 samples x \$20/fish)	=	<u>\$51,000</u>	<u>\$43,500</u>
<b>TOTAL PSC</b>	<b>=</b>	<b>\$75,000</b>	<b>\$53,742</b>
<u>DFO – In Kind</u>			
▪ Project consultation (1 staff @5 days @7.5 hr/day @\$50/hr)	=	\$1,875	
▪ Project management (1 staff @30 days @7.5 hr/day @\$42/hr)	=	\$9,450	
▪ Administrative Coordinator (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>\$66,012</b>	

The proposed project cost to the PSC was \$75,000. The actual funds used were \$53,742, largely due to the lower than anticipated Area G fishery catches, resulting in lower field sampling and laboratory analysis costs. In March 2014 (DFO Fiscal Year end), a total of \$13,758.30 unused funds were returned to the PSC. In addition, this year 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 eight 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 2013 to March 2014)

Appendix III. Regional DNA results from the sampling of the 2013/14 West Coast Vancouver Island Chinook troll fisheries (From file: WCTR\_CN\_2013\_2014\_DNAdata\_SEF.xls)

### **Data**

DNA results are provided in hardcopy (regional data spreadsheets only) as well as on the accompanying CD.

### **Electronic Files Provided**

1. SEF 2013-14 WCTR Chinook DNA Cover Letter.doc
2. SEF 2013-14 WCTR Chinook DNA Final Report.doc
3. WCTR\_CN\_2013\_2014\_DNAdata\_SEF.xls
4. detailed expenditures Fiscal 2013-2014.pdf
5. Final Budget - DNA Based Chinook Stock Composition 2013-2014\_July2014.xls

## APPENDIX I

### Financial Statement of Expenditures

(Detailed Transactions were provided by Financial Officer)

See electronic files:  
detailed expenditures Fiscal 2013-2014.pdf



## APPENDIX II

WCVI Chinook Troll DNA Sampling Protocol  
(April 2013 to March 2014)

## **WCVI Troll Chinook DNA Sampling Protocol For Dockside MRP Sampling from April 2013 to March 2014**

### **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-2013
May	15-June-2013
June	15-July-2013
July	15-August-2013
August	15-Sep-2013
September	15-Oct-2013
October	15-Nov-2013
November	15-Dec-2013
December	15-Jan-2014
January	15-Feb-2014
February	15-Mar-2014
March	15-April-2014

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  
2013/14 West Coast Vancouver Island  
Chinook troll fisheries

See electronic file:  
WCTR\_CN\_2013\_2014\_DNAdata\_SEF.xls