

**Final Report  
DNA Stock Composition  
of the Chinook Salmon Catch in the  
April 2010 – March 2011 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. In addition, samples to compare the stock compositions of sub-legal and legal sized Chinook were collected and analysed. The project objectives were met: a total of 6,300 samples were collected from a total catch of 82,287 Chinook, with a total of 2,889 samples analysed for stock composition. Included in the number of samples analysed are 158 and 282 sub-legal and legal Chinook samples, respectively. The project was completed \$16,162 under budget, partly due to a substantial reduction in sample processing costs.

**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 fifth year of this study.

The program objectives were to:

- 1) Determine the stock composition of WCVI troll Chinook fisheries from April 2010 to March 2011 using DNA analysis techniques.
- 2) Determine stock composition of legal versus sub-legal Chinook from representative and comparative samples taken in September 2010.

## 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 seven time periods were 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, September 2009, and September 2010. 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. In 2009, (September 10-14), 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. In 2010 (September 5-8), an Area G troller was again contracted to collect 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 handheld 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

The project objectives were met as described below:

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

All Area G troll fisheries from April 2010 to March 2011 were sampled for DNA with the exception of two small catches that were not sampled (Table 1). A total of 6,300 DNA samples were collected from a total catch of 82,287 Chinook from April 2010 to March 2011 (Table 1). DNA samples were collected from 1% to 17% of the total catch (average of 9%) in each stratum (NWVI, SWVI) and month when fishery openings occurred.

Of samples collected, the goal was to analyse samples from approximately 2% of the total 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 23% of the total catch (average of 6%) in each stratum (NWVI, SWVI) and month when fishery openings occurred. 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 6,300 DNA samples collected, 2,889 samples were analysed by the PBS molecular genetics lab at a cost of \$17 per fish. Stock composition results by month and catch region are found in Appendix III.

At the time of report submission (June 21, 2011), the stock composition data from the July and August 2010 sport fishery samples were not available. It is anticipated they will be available by July 1, 2011 at which time, an updated electronic and hard copy report will be forwarded. The sport fishery samples were overlooked by PBS Genetics Lab staff as not being related to the WCVI troll fishery samples, and of lower priority for processing.

### **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. A total of 282 legal and 158 sub-legal samples were collected (Table 1). Of these, 160 legal and 153 sub-legal samples were analysed. Stock composition results from sub-legal and legal Chinook are presented in Appendix IV.

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

Both aspects of the project (full fleet sampling and legal/sub-legal sampling) were conducted according to schedule and without major issues. The samples were collected using the outlined methods, were generally representative of the fishery catch by time and area, and were of good quality. However there was an issue with the timeliness of sample delivery, as well as samples not being sent with data sheets. This made it

difficult to deliver samples to the lab throughout the year as planned. Instead most samples were taken to the lab in one large delivery during late fall. The issue of missing data sheets was resolved with the contractor via email. Both of these issues have been addressed for the 2011-2011 project through the use of a required data sheet and specific delivery schedule provided to the contractor.

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 2010 to March 2011. 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
2010	April	Area G	SWVI	506	not sampled	not sampled	0	0%
2010	April	Area G	NWVI	8,047	240	238	3%	3%
2010	May	Area G	SWVI	14,481	1,343	400	9%	3%
2010	May	Area G	NWVI	16,815	2,054	400	12%	2%
2010	June	Area G	SWVI	18,725	354	353	2%	2%
2010	June	Area G	NWVI	4,927	384	199	8%	4%
2010	July	Area G	SWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	July	Area G	NWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	July	WCVI Sport	SWVI	n/a	49	49	n/a	n/a
2010	July	WCVI Sport	NWVI	n/a	69	69	n/a	n/a
2010	August	WCVI Sport	SWVI	n/a	72	72	n/a	n/a
2010	August	WCVI Sport	NWVI	n/a	20	0 (low sample size)	n/a	n/a
2010	August	Area G Plug	SWVI	9,068	231	160	3%	2%
2010	August	Area G Plug	NWVI	2,574	436	199	17%	8%
2010	September	Area G	SWVI	1,688	219	96	13%	6%
2010	September	Area G	NWVI	2,292	138	95	6%	4%
2010	September	Area 123 Sublegal	SWVI	158	158	153	100%	97%
2010	September	Area123 Legal	SWVI	282	282	160	100%	57%
2010	October	Area G	SWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	October	Area G	NWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	November	Area G	SWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	November	Area G	NWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	December	Area G	SWVI	no fishery	no fishery	no fishery	n/a	n/a
2010	December	Area G	NWVI	no fishery	no fishery	no fishery	n/a	n/a
2011	January	Area G	SWVI	no fishery	no fishery	no fishery	n/a	n/a
2011	January	Area G	NWVI	no fishery	no fishery	no fishery	n/a	n/a
2011	February	Area G	SWVI	447	48	0 (low sample size)	11%	n/a
2011	February	Area G	NWVI	1,402	16	0 (low sample size)	1%	n/a
2011	March	Area G	SWVI	79	not sampled	not sampled	n/a	n/a
2011	March	Area G	NWVI	796	187	184	23%	23%
				<b>82,287</b>	<b>6,300</b>	<b>2,889</b>	<b>9%</b>	<b>6%</b>

## Financial Statement

The total overall allocated Southern Endowment Fund budget was \$82,000 (Canadian funds). The DFO in-kind contribution was estimated at \$11,138. 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.)	=	\$9,000	\$10,744
▪ Area G vessel costs (sublegal sampling)	=	\$9,000	\$5,625
▪ DNA sampling equipment	=	\$2,000	\$144.78
▪ travel expenses / shipping	=	\$2,000	\$210.95
▪ DNA lab analysis for 3000 samples, including labour and supplies (3000 samples x \$20/fish)	=	<u>\$60,000</u>	<u>\$49,113</u>
<b>TOTAL PSC</b>	<b>=</b>	<b>\$82,000</b>	<b>\$65,837.73</b>
<u>DFO – In Kind</u>			
▪ Project consultation, (1 staff @5 days @7.5 hr/day @\$45/hr)	=	\$1,688	
▪ Project management (1 staff @30 days @7.5 hr/day @\$42/hr)	=	\$9,450	
<b>TOTAL IN-KIND</b>	<b>=</b>	<b>\$11,138</b>	
<b>TOTAL ACTUAL COSTS</b>	<b>=</b>	<b>\$76,975.73</b>	

DNA sampling costs were similar to those proposed. Area G vessel costs for sub-legal Chinook sampling were lower than anticipated as catch rates were good enabling the sampling goal to be achieved in fewer days. The DNA sampling material cost was lower than anticipated based on previous years due to the incorporation of the material costs into the DNA analysis cost per fish. Travel and shipping costs were lower than proposed since a buffer was planned for in the event of unanticipated travel and/or shipping. Samples were usually dropped off at a DFO office by JOT staff. The DNA lab analysis cost was lower than that proposed since n=111 fewer than planned samples were analysed (due to fisheries not occurring in certain months) and due to the lab analysis cost per fish dropping from \$20 to \$17 just prior to the project start date (a savings of \$8,667). In-kind costs were as anticipated. As the total PSC cost was \$65,837.73, the 10% holdback amount of \$8,200 will not be required, and a total of \$7,962 in unused funds will be returned to the Pacific Salmon Commission.

## **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 2010 to March 2011)

Appendix III. Regional DNA results from the sampling of the 2010/11 West Coast Vancouver Island Chinook troll fisheries (combined from files:  
WCTR\_CN\_2010DNAdata\_SEF.xls,  
WCTR\_CN\_2011DNAdata\_SEF.xls)

Appendix IV. Regional DNA results from sublegal and legal Chinook sample comparisons (WCTR\_CN\_2010DNAdata\_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 2010-11 WCTR Chinook DNA Cover Letter.doc
2. SEF 2010-11 WCTR Chinook DNA Final Report.doc
3. WCTR\_CN\_2010DNAdata\_SEF.xls (sport data not included – to be forwarded by July 1, 2011)
4. WCTR\_CN\_2011DNAdata\_SEF.xls
5. detailed expenditures Fiscal 2010-2011.pdf
6. detailed expenditures Fiscal 2011-2012.pdf
7. Final Budget - DNA Based Chinook Stock Composition 2010-2011 - June 2011.xls

## APPENDIX I

### Financial Statement of Expenditures

(Detailed Transactions were provided by Financial Officer)

See electronic files:

detailed expenditures Fiscal 2010-2011.pdf

detailed expenditures Fiscal 2011-2012.pdf



## APPENDIX II

WCVI Chinook Troll DNA Sampling Protocol  
(April 2010 to March 2011)

## **WCVI Troll Chinook DNA Sampling Protocol For Dockside MRP Sampling from April 2010 to March 2011**

### **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. 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, labeled (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-2010
May	15-June-2010
June	15-July-2010
July	No fishery
August	15-Sep-2010
September	15-Oct-2010
October	15-Nov-2010
November	15-Dec-2010
December	15-Jan-2011
January	15-Feb-2011
February	15-Mar-2011
March	15-April-2011

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  
2010/11 West Coast Vancouver Island  
Chinook troll fisheries

See electronic files:  
WCTR\_CN\_2010DNAdata\_SEF.xls  
(sport data not included – to be forwarded by July 1, 2011), and  
WCTR\_CN\_2011DNAdata\_SEF.xls

## APPENDIX IV

Regional DNA results from sublegal and legal Chinook samples collected during a September 2010 assessment fishery from PFMA 123, West Coast Vancouver Island

See electronic file:  
WCTR\_CN\_2010DNAdata\_SEF.xls