

Final Report DNA Stock Composition of the Chinook Salmon Catch in the April 2011 – March 2012 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 6,866 samples were collected from a total Area G troll catch of 107,601 Chinook, with a total of 2,913 samples analysed for stock composition. Included in the number of samples analysed are 282 and 266 sub-legal and legal Chinook samples, respectively. The project was completed on 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 fifth year of this study.

The program objectives were to:

- 1) Determine the stock composition of WCVI troll Chinook fisheries from April 2011 to March 2012 using DNA analysis techniques.
- 2) Determine stock composition of legal versus sub-legal Chinook from representative and comparative samples taken in September 2012.

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 2011, 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 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 2011 to March 2012 were sampled for DNA with the exception of small catches (<300 fish) in April (SWVI) and November through January, and March, that were not sampled (Table 1). A total of 6,866 DNA samples were collected from a total Area G troll catch of 107,601 Chinook from April 2011 to March 2012 (Table 1). An additional 276 sport DNA samples were obtained through the WCVI creel program to provide stock composition data for July and August. DNA samples were collected from 2.9% to 58.7% of the total Area G troll catch (average of 9%) 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 1% to 35% of the total catch (average of 4%) in each stratum (NWVI, SWVI) and month when sampling 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 6,866 DNA samples collected, 2,952 samples were analysed by the PBS molecular genetics lab at a cost of \$17 per fish. Of these 2,952 samples, we obtained data for 2,913 samples. 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. A total of 267 legal and 295 sub-legal samples were collected (Table 1). Of these, 266 legal and 282 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. There were a few minor issues with sample quality, but these were addressed with the contractor, and the lost samples did not prevent us from meeting the project objectives. During the 2010-11 project, there was an issue with the timeliness of sample delivery, as well as samples not being sent with data sheets. Both of these issues were addressed and were resolved for the 2011-2012 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 2011 to March 2012. 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
2011	April	Area G	SWVI	335	0	0	0.0%	0.0%
2011	April	Area G	NWVI	8,350	588	131	7.0%	1.6%
2011	May	Area G	SWVI	8,859	861	86	9.7%	1.0%
2011	May	Area G	NWVI	17,130	1,961	375	11.4%	2.2%
2011	June	Area G	SWVI	23,106	666	461	2.9%	2.0%
2011	June	Area G	NWVI	11,289	467	224	4.1%	2.0%
2011	July	Area G	SWVI	no fishery	0	0	0.0%	0.0%
2011	July	Area G	NWVI	15,620	524	310	3.4%	2.0%
2011	July	WCVI Sport	SWVI	13,939	84	84	0.6%	0.6%
2011	July	WCVI Sport	NWVI	5,917	47	45	0.8%	0.8%
2011	August	WCVI Sport	SWVI	20,820	81	80	0.4%	0.4%
2011	August	WCVI Sport	NWVI	10,598	64	64	0.6%	0.6%
2011	August	Area G Plug	SWVI	15,213	657	281	4.3%	1.8%
2011	August	Area G Plug	NWVI	6,070	404	119	6.7%	2.0%
2011	September	Area G	SWVI	no fishery	0	0	0.0%	0.0%
2011	September	Area G	NWVI	no fishery	0	0	0.0%	0.0%
2011	September	Area 123 Sublegal	SWVI	295	295	282	100.0%	95.6%
2011	September	Area 123 Legal	SWVI	267	267	266	100.0%	99.6%
2011	October	Area G	SWVI	no fishery	0	0	0.0%	0.0%
2011	October	Area G	NWVI	no fishery	0	0	0.0%	0.0%
2011	November	Area G	SWVI	4	0	0	0.0%	0.0%
2011	November	Area G	NWVI	53	0	0	0.0%	0.0%
2011	December	Area G	SWVI	93	0	0	0.0%	0.0%
2011	December	Area G	NWVI	95	0	0	0.0%	0.0%
2012	January	Area G	SWVI	45	0	0	0.0%	0.0%
2012	January	Area G	NWVI	84	0	0	0.0%	0.0%
2012	February	Area G	SWVI	242	0	0	0.0%	0.0%
2012	February	Area G	NWVI	300	176	105	58.7%	35.0%
2012	March	Area G	SWVI	23	0	0	0.0%	0.0%
2012	March	Area G	NWVI	128	0	0	0.0%	0.0%
Area G Catch				107,601	6,866	2,913	9%	4%
Sport Catch				51,274	276			
Total				158,875	7,142			

Financial Statement

The total overall allocated Southern Endowment Fund budget was \$83,738 (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.)	=	\$10,000	\$14,015
▪ Area G vessel costs (sublegal sampling)	=	\$7,500	\$5,850
▪ DNA sampling equipment	=	\$2,000	\$2,551
▪ travel expenses / shipping	=	\$2,100	\$0.00
▪ DNA lab analysis for 3000 samples, including labour and supplies (3000 samples x \$20/fish)	=	<u>\$51,000</u>	<u>\$50,184</u>
TOTAL PSC	=	\$72,600	\$72,600
<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	
TOTAL IN-KIND	=	\$11,138	
TOTAL ACTUAL COSTS	=	\$83,738	

DNA sampling costs were higher than proposed due to higher travel and staffing costs. Area G vessel costs for sub-legal Chinook sampling were slightly lower than anticipated as catch rates were good enabling the sampling goal to be achieved in fewer days. The DNA sampling material cost was close to anticipated. Travel and shipping costs were lower than proposed since shipping was not required, and travel was conducted in conjunction with another project. Samples were usually dropped off at a DFO office by JOT staff. The DNA lab analysis cost was as anticipated. 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 2011 to March 2012)

Appendix III. Regional DNA results from the sampling of the 2011/12 West Coast Vancouver Island Chinook troll fisheries (combined from files:
WCTR_CN_2011DNAdata_SEF.xls,
WCTR_CN_2012DNAdata_SEF.xls)

Appendix IV. Regional DNA results from sublegal and legal Chinook sample comparisons (WCTR_CN_2011DNAdata_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 2011-12 WCTR Chinook DNA Cover Letter.doc
2. SEF 2011-12 WCTR Chinook DNA Final Report.doc
3. WCTR_CN_2011DNAdata_SEF.xls
4. WCTR_CN_2012DNAdata_SEF.xls
5. detailed expenditures Fiscal 2011-2012.pdf
6. Final Budget - DNA Based Chinook Stock Composition 2011-2012 - June 2012.xls

APPENDIX I

Financial Statement of Expenditures

(Detailed Transactions were provided by Financial Officer)

See electronic files:
detailed expenditures Fiscal 2011-2012.pdf

Project Budget Form

Name of Project: Collection of DNA Based Stock Composition Data from the WCVI Chinook Troll Fishery

ELIGIBLE COSTS	TOTAL PROJECT BUDGET	OTHER FUNDING	PSC S. FUND GRANT AMOUNT	ACTUAL PSC GRANT FUNDS SPENT
-----------------------	-------------------------------------	--------------------------	---	---

**Labour
Wages & Salaries**

Position	# of crew	# of work days	hrs per day	rate per hour	Total (PSC + In-kind + cash)	In-Kind & Cash	PSC Amount	Total Against PSC Amount
Project consultation	1	5	7.5	45	1,688	1,688		
Project management / coordination	1	30	7.5	42	9,450	9,450		
DNA lab salaries (3500 samples)	6	37	7.5	31	51,000		51,000	50,184
Person Days (# of crew x work days)					sub total	11,138	51,000	50,184
					62,138			

Subcontractors & Consultants	# of crew	# of work days	hrs per day	rate per hour	Total	In-Kind & Cash	PSC Amount	Total Against PSC Amount
DNA sampling (Contractor)					10,000		10,000	14,015
Area G vessel costs - sublegal sampling (\$1500/day)					7,500		7,500	5,850
Insurance if applicable		rate	0%		sub total		17,500	19,865
					17,500			

Volunteer Labour	# of crew	# of work days	hrs per day	rate per hour	Total	In-Kind & Cash	PSC Amount	Total Against PSC Amount
Skilled								
Un-skilled								
Insurance if applicable		rate	0%		sub total			
					sub total			

Total Labour Costs	79,638	68,500	70,049
---------------------------	---------------	---------------	---------------

Site / Project Costs	Provide details in the space below (use an additional page if needed)	Total	In-Kind & Cash	PSC Amount	Total Against PSC Amount
Travel (do not include to & from work)	mileage, travel expense	1,800		1,800	-
Small Tools & Equipment	vials, chemicals, data sheets, scale books	2,000		2,000	2,551
Site Supplies & Materials					
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenance					
Permits					
Technical Monitoring					
Other site costs	sample shipping	300		300	-
Total Site / Project Costs		4,100		4,100	2,551

Project Total Costs	83,738	-	72,600	72,600
----------------------------	---------------	----------	---------------	---------------

APPENDIX II

WCVI Chinook Troll DNA Sampling Protocol
(April 2011 to March 2012)

WCVI Troll Chinook DNA Sampling Protocol For Dockside MRP Sampling from April 2011 to March 2012

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, 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.

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

Sampling Month	Sample and Data Delivery Deadline
April	15-May-2011
May	15-June-2011
June	15-July-2011
July	15-August-2011
August	15-Sep-2011
September	15-Oct-2011
October	15-Nov-2011
November	15-Dec-2011
December	15-Jan-2012
January	15-Feb-2012
February	15-Mar-2012
March	15-April-2012

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
2011/12 West Coast Vancouver Island
Chinook troll fisheries

See electronic files:
WCTR_CN_2011DNAdata_SEF.xls
WCTR_CN_2012DNAdata_SEF.xls

APPENDIX IV

Regional DNA results from sublegal and legal Chinook samples collected during a September 2011 assessment fishery from PFMA 123, West Coast Vancouver Island

See electronic file:
WCTR_CN_2011DNAdata_SEF.xls