

Final Report of DNA Determination of Stock Composition for Catch and Release Chinook

SP10- A008

Background

The DNA will provide information to supplement and contrast with CWT data regarding stock group specific impacts of the WCVI troll fishery. This is important in the current WCVI troll fishery because it operates during parts of the year where little CWT data exists. In addition, the low sample rate associated with the regular mark recovery program (MRP) for CWT may not have the capability to identify impacts in new fisheries, especially on the monthly time scale required. Consequently, DNA is used to supplement the CWT information to provide the best available estimate of impact on stocks.

The available DNA information suggests a non random distribution of chinook in the ocean. Stocks have different behaviours (e.g. WCVI chinook are near shore oriented), likely rear in schools of similar stock origin, and likely have different migration pathways. This patchy distribution of chinook is likely represented in the distribution of chinook catch.

Due to logistic considerations the chinook troll fisheries have been sampled using the boat as the basic unit. Consider this to be “clustered” random sampling. If the catch is also patchy then the current method of expanding CWT to the entire fishery may be inappropriate and result in considerable imprecision in the stock composition.

Statistical uncertainties in the current CWT sampling program, and the subsequent analyses using CWT, will be explored in 1-2 discrete fisheries. In these 1-2 fisheries the sample rates will be increased from 20% to 80+% for CWT, and from 100 DNA samples per opening to 1000+ DNA samples per opening to evaluate the effects of patchy fish distribution, clustered sampling rather than simple random sampling, and stratification by area and gear. This will provide insight into both accuracy and precision of CWT and DNA information.

Project Objectives

In summary the program objectives were to:

Provide stock composition of catch of 2004 WCVI troll fisheries, using DNA stock identification techniques. Evaluation and comparison of CWT and DNA stock composition estimates in relation to the sampling techniques. Provide the above information to the CWT workshop in 2004.

Project Description / Deliverables

CWT sampling is an ongoing operational requirement and is therefore well understood. Increased sampling in 1-2 openings will be accomplished through fishery management (limit opening to 3 days) and through increased sampling effort. In May 2004 high intensity CWT and DNA sampling was conducted to allow calibration of results in other months, and evaluation of precision and accuracy of results. DNA sampling can be accomplished through simple random sampling of every 5th fish. Pre-assessment of the sampling requirements suggests this project has a high probability of success. Sampling and analytical standards are in place for regular sampling periods (e.g. random sample of 100-200 fish for DNA and genetic analysis techniques).

Intensive sampling periods will be used to evaluate current standards for sampling (current clustered random sample vs. simple random sample).

- Each fishery opening (stratum is generally month and SWTR or NWTR catch region) will be sampled, using clustered random sampling, to obtain 100 DNA samples per stratum. These samples will be collected using existing MRP, fishery observer programs, or fishermen programs.
- Samples will be collected with scales to determine age.

- Samples will be analysed by the genetics lab at PBS for allocation to stock group.
- Results will be applied to catch estimates to determine impact by stock group. This will be done for each month/region stratum.

- For 1-2 openings on the WCVI, a very large fraction of the boats (>70%) will be intensively sampled for CWT. All fish off of a boat will be sampled. Incidence of CWT will be determined using electronic tube detectors. An independent sample of DNA and additional biological data will be taken by sampling every 5th fish prior to electronic detection for CWT. Each opening will be short enough to approximate an “instantaneous” sample with no emigration or immigration of stocks. One opening in May 2004 and another later in the year will be sampled.
- A database of each fish will be developed to evaluate alternative sampling protocols, including clustered random sampling and simple random sampling. The precision of CWT estimates of hatchery contribution will be assessed from these data.
- DNA quality control has also been determined through analysis of known origin samples, including CWT and spawner samples.
- Sampling will be coordinated and monitored by DFO biologists.
- Bootstrapping sample data will be done to evaluate outcomes of alternative sampling regimes. A MS Access database will be developed to hold the data.

Benefits

This project relates to the harvest rate indices prescribed in the PST for chinook salmon in the WCVI 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 process 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. The main audience is the technical staff associated with salmon management and assessment. The initial results could be provided for the June 14 CWT workshop:

1. Identification of impacts of chinook caught in the WCVI troll fishery during periods with little information.
2. Insight into the spatial and temporal distribution of various chinook stock groups. Using DNA data we can learn more about how to shape fisheries to avoid stocks of concern.
3. Evaluation of the utility of CWT data under current sampling program. CWT is the basis for current assessment and conservation programs. There is potential for improvement in the utility of CWT through improved sampling regimes.

Budget

The total overall allocated Pacific Endowment fund budget was \$151,000 (Canadian funds). The DFO in kind contribution was estimated at \$49,000.

Estimated costs and In-kind contribution are shown below:

Costs

Direct

▪ fishery samplers – 10 @ \$900/sampler	=	\$9,000
▪ statistical & reporting support	=	\$6,000
▪ DNA analysis	=	\$117,000
▪ scale lab	=	\$1,500

▪ head lab	=	\$7,500
▪ travel	=	\$4,000
▪ sample supplies	=	\$1,500
▪ vehicle leases	=	\$3,000
▪ rain gear, safety kits	=	\$1,000
▪ technical monitoring	=	<u>\$500</u>
▪ total	=	\$151,000

DFO – in kind

▪ project management/coordination BI-2 @248/day=		\$1,000
▪ MRP sampling program GL-ELE @121/day =		\$39,000
▪ Report writing BI-3 @266/day	=	\$3,000
▪ Database & analytical support EG-4 @187.5/day=		\$6,000
▪ total	=	\$49,000

Total costs = \$200,000

The table of actual expenditures is detailed below:

2004-05 SOUTH COAST BUDGET LEDGER			\$ 151,228.64
Date	Supplier	Item	Cost
01-Apr-05	DNA Stock Comp. of Catch & Release Chinook	* Project Title	
06-May-04	Travel - Brenda Wright	MRP Sampling - Vancouver	\$ 384.82
07-May-04	Travel - Ted Carter	MRP Sampling - Ucluelet	\$ 312.64
03-May-04	Travel - Dawn Lewis	MRP Sampling - Ucluelet	\$ 296.27
06-May-04	Travel - James Patterson	MRP Sampling	\$ 466.46
06-May-04	Budget Rent A Car	Van rental for MRP Sampling in Vancouver	\$ 607.69
11-May-04	Iris Lodge	Provide lodging for two MRP samplers in Zeballos	\$ 433.46
02-May-04	The 500 Staff Services	MRP Sampling-008	\$ 1,249.50
05-Apr-04	Travel - Rob Houtman	MRP Sampling - Ucluelet	\$ 230.10
28-May-04	Travel - Shawn Stenhouse	MRP Sampling - Ucluelet	\$ 152.08
30-Jun-04	LGL Limited	Numerical Methods for Determining Uncert.	\$ 728.95
10-Jun-04	J.O. Thomas & Associates Ltd.	Commercial Catch Sampling	\$ 697.19
30-Jun-04	LGL Limited	Numerical Methods for Determining Uncert.	\$ 877.32
14-Jun-04	LGL Limited	MRP Statistical Analysis - Historical CWT Data	\$ 4,625.06
30-Jun-04	LGL Limited	Numerical Methods for Determining Uncert.	\$ 8,243.99
12-Aug-04	LGL Limited	Numerical Methods for Determining Uncert.	\$ 1,256.01
07-Sep-04	Ono Trading Co. of Canada	Sampling Gear - Boots & Rain Gear	\$ 94.00
14-Sep-04	MAR - Regular Pay - CFT	JV to DNA Lab	\$ 2,688.94
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 2,469.54
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 18,832.38
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 27,500.00
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 1,400.00
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 4,098.37
14-Sep-04	MAR - SPA - Miscellaneous Accounts - Debit	JV to DNA Lab	\$ 24,364.73
23-Sep-04	LGL Limited	MRP Statistical Analysis - Historical CWT Data	\$ 1,118.93
06-Oct-04	Travel - Sue Di Novo	MRP Sampling	\$ 300.00
06-Oct-04	Seacology	MRP - CWT Recovery	\$ 3,700.21
10-Feb-05	LGL Limited	Relationship between CWT	\$ 15,000.00
01-Feb-05	DNA	JV to DNA Lab	\$ 10,000.00
01-Feb-05	DNA	JV to DNA Lab	\$ 10,000.00
12-Apr-05	Dr Marc Labelle	coded wire tag evaluation	\$ 9,100.00

Project Schedule

The schedule of tasks centres on several areas. Data collection is required to occur when and where commercial troll fisheries are harvesting chinook. Often times the sampling occurs in remote locations, and heavily focused in a particular season (spring and fall). Thus both DNA and CWT recoveries are collected at the same time. Processing of both types of samples requires an annual turn around time, and in some instances a shorter time period (weeks) maybe required for in-season management fishery adjustments. Presentation of sample processing and data analysis results have specific deadlines (i.e. February 2005). The final PSC report was delayed by one month in order to provide additional report time.

Monitoring and Evaluation

The project was monitored by Fisheries and Oceans Departmental staff, who are experienced in a variety of sampling techniques. The project was done in conjunction with other Departmental programs, to insure quality, and to streamline respective projects. DNA lab processing and analyses are done by the Pacific Biological Station, and CWT decoding occurs utilizing a long standing contractor.

Appendices

- Appendix I. Description of sampling and steps outlining some analysis to estimate DNA/CWT combined stock composition.
- Appendix II. Power point presentation to Pacific Salmon Commission in Portland, Oregon, February 2005, Title "WCVI Troll 2003 - 2004 Summary". Electronic file name is "WCVI Troll 2003 - 2004 Summary.ppt"
- Appendix III. Report on Comparison of Chinook stock contribution estimates to BC troll catches based on DNA and CST data, using alternative catch sampling procedures. Prepared by Marc Labelle, LGL Limited for Department of Fisheries and Oceans.- Jan 2005. Electronic File name is "Chinook Comparison CWT DNA LGL.doc
- Appendix IV. Report on Evaluation of errors associated with recoveries of coded wire tags In the northern troll fisheries. Prepared by Marc Labelle, L4 Biotech for Department of Fisheries and Oceans. - May 2005.

Data

DNA and MRP results (raw data spreadsheet) and accompanying analyses is provided on an accompanying CD.

Electronic Files Provided

Cover Letter SP10-A008.doc
SP10 (A-008) DNA Chinook Final Rpt.doc
SP10 DNA Final Budget.xls
WCVI Troll 2003 - 2004 Summary.ppt
Chinook CWT DNA Comparison LGL1.doc
Chinook CWT DNA Comparison NCTR.doc
Cwt dna comparison PST.xls

Appendix I. Description of sampling and steps outlining some analysis to estimate DNA/CWT combined stock composition.

DNA/CWT Combined Stock Composition Methodology

- CWTs were collected from MRP sample (~20% of total catch)
- CWT data entered into MRP database
- Used query in “query summary” worksheet (dna_cwt-comparison.xls) to extract all data from Oct 2003 to Sep 2004.
- Tagcodes from DIT groups (nonAFC CWT’s) were removed from query output so that Expanded AFC (total # AFC / AFC CWT) values could be calculated (otherwise a DIV/0 error would result since no AFC CWT chinook were released in DIT groups).
- Pivot tables (“pivot – no DITs” worksheet) and lookup tables were used to create monthly summaries of:
 - Observed CWT (# CWT in the MRP sample)
 - Estimated CWT (# CWT in the total catch)
 - Expanded CWT (# CWT in the hatchery population)
 - Expanded AFC (# AFC chinook in the total catch)

The summaries are by month (worksheets Oct03 to Sep04) and MRP production area (NWVI and SWVI have been combined for now).

- For each month, Expanded AFC catch was summed and used to calculate % stock composition ($\frac{\# \text{ExpAFC chinook in each prod. area}}{\sum \text{ExpAFC catch}}$) which represents the stock composition as determined solely by CWTs.
- DNA samples were collected from the nonAFC portion of the MRP sample (those chinook without an AFC and/or a CWT. From that sample, a sub-sample of usually $n=100$ was analysed in the DNA lab at PBS for stock composition by month, area (NWVI and SWVI), and DNA Regions.
- DNA Region and MRP Production Areas had to be merged so they represented the same stocks.
- Total catch of nonAFC chinook was calculated by subtraction:
(Total Catch – \sum AFC chinook + Total DITs).
- For each production area, DNA derived percent stock composition was multiplied by the Total catch of nonAFC chinook to calculate numbers of nonAFC chinook.
- Numbers of AFC and nonAFC chinook were summed by production area, and divided by the Total Catch to calculate percent stock composition (not including DITs).
- For each month, percent DITs were calculated ($\frac{\# \text{DITs}}{\text{Total Catch}}$) and appended to the stock composition. In the future, DITs will be re-assigned to their stock production areas.

Appendix II. Power point presentation to Pacific Salmon Commission in Portland, Oregon, February 2005, Title “WCVI Troll 2003 - 2004 Summary”.

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Appendix III. Report on Comparison of Chinook stock contribution estimates to BC troll catches based on DNA and CST data, using alternative catch sampling procedures. Prepared by Marc Labelle, LGL Limited for Department of Fisheries and Oceans. - Jan 2005

First page only below:

Comparison of Chinook stock contribution estimates to BC troll catches based on DNA and CWT data, using alternative catch sampling procedures

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January 2005

Appendix IV Report on Evaluation of errors associated with recoveries of coded wire tags in the northern troll fisheries. Prepared by Marc Labelle, L4 Biotech for Department of Fisheries and Oceans. - May 2005

First page only below:

**Evaluation of errors associated with recoveries of coded wire tags
In the northern troll fisheries**

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May 2005