

**PACIFIC SALMON COMMISSION**  
**CHUM TECHNICAL COMMITTEE REPORT**  
**REPORT TCCHUM (92)-3**

**UPDATE OF RESEARCH NEEDS**  
**FOR SOUTHERN BRITISH COLUMBIA**  
**AND WASHINGTON CHUM SALMON**

A REPORT  
TO THE STANDING COMMITTEE ON RESEARCH AND STATISTICS  
FROM THE CHUM TECHNICAL COMMITTEE

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# UPDATE OF RESEARCH NEEDS FOR SOUTHERN BRITISH COLUMBIA AND WASHINGTON CHUM SALMON

## I. INTRODUCTION

This report is an update of a Chum Technical Committee (CTC) report prepared in February of 1987 (TCChum (87)-3), identifying research required to comply with the provisions of Annex IV, chapter 6 (Chum Chapter) of the Pacific Salmon Treaty (PST). The CTC is required by the PST to provide the Pacific Salmon Commission (PSC) with a variety of technical information concerning Southern B.C. and Washington chum salmon, as well as an assessment of the adequacy of this information and an identification of future research needs.

Specifically, the chum salmon annex of the PST directs the CTC to 1) identify and review the status of stocks of primary concern; 2) present the most current information on the harvest rates and patterns on these stocks, and develop a joint data base for assessment; 3) collate available information on the productivity of chum stocks to identify escapements which produce maximum sustainable harvests and allowable harvest rates; 4) present historical catch data, associated fishing regimes, and information on stock composition in fisheries harvesting those stocks; 5) devise analytical methods for the development of alternative regulatory and production strategies; 6) identify information and research needs, to include future monitoring programs for stock assessment; and, 7) for each season, make stock and fishery assessments and evaluate the effectiveness of management. Research needs identified in this report are designed to address these standing assignments.

In addition to these standing assignments, the Research and Statistics Committee of the PSC has recently requested (November 13, 1991) that each technical committee provide a report on research needs and priorities relative to their respective areas of responsibility, which will be used in developing the overall research priorities of the PSC.

As in the 1987 report, special emphasis has been placed on stock composition research, which continues to be a high priority of

the PSC. Considerable work has been completed by the Chum Committee and various agency researchers in the U.S. and Canada on methods of estimating stock composition for chum salmon. Brief highlights of progress on some of these tasks, since the last report on research needs, are provided in this report under each topic. For detailed information on committee activities related to estimating chum stock composition, please refer to the following PSC reports: TCCHUM (87)-2; TCCHUM (88)-2; TCCHUM (89)-1; TCCHUM (92)-2 (in preparation). General information on chum research activities of the two countries prior to 1987 is highlighted in TCCHUM (87)-3.

## II. CURRENT RESEARCH NEEDS

The following are the research needs identified by the CTC to address its current assignments and the anticipated immediate needs of the PSC. They are not presented in any order of priority.

### **A. STOCK COMPOSITION ESTIMATION**

An immediate research need for southern chum salmon is to complete the November 1986 assignment from the PSC to develop interception estimates. That assignment was to; 1) Attempt to develop agreed-upon criteria and methods for the application of currently available genetic stock identification (GSI) data to catch data; 2) Evaluate and develop recommendations for standardization of GSI sampling, processing, and analysis methods; and 3) Apply the above methodology to catch data for the fisheries for which adequate GSI data are available. This task is also addressed in the Chum Chapter, which directs the CTC to develop estimates of catch composition in fisheries covered by the chapter.

Considerable progress has been made on these assignments over the past three years, and agreed upon preliminary interception estimates have been provided to the Joint Interception Committee (JIC) for inclusion in their reports (JIC (89)-1; JIC (91)-1). However, several tasks still remain to be completed before these estimates of interceptions can be considered final. These are:

1. Develop methods for correcting bias in GSI estimates. Considerable work has been undertaken by the CTC to address concerns with GSI methods and analysis. There has been an evaluation of sampling design and a number of improvements

have been made. This includes increased sample sizes in some fisheries; an expansion of the baseline to include additional stocks potentially contributing to mixed stock fisheries; the identification of additional variable loci; the standardization of analytical methods; and an examination of bias and precision of the GSI derived estimates of contribution.

However, questions still exist as to the acceptable levels of accuracy and precision required of GSI based stock composition estimates. Based on fishery simulations, the CTC has concluded that the level of statistical bias present in stock composition estimates for some fisheries is unacceptably high.

*The CTC recommends that methods be developed for correction of bias associated with GSI estimates of stock composition, particularly for stock groupings that contribute less than 20% to the fishery.*

2. Work with the various agencies to develop periodic testing of laboratory variability using replicate samples.

Concern has been raised over the comparability of results from different laboratories due to different laboratory procedures and/or scoring of protein electrophoretic gels. A number of replicate chum samples were analyzed at two different laboratories (one in the U.S. and one in Canada) and the results indicated there were relatively minor discrepancies between the laboratories when scoring 7 loci. However, similar work by the PSC staff with pink salmon, comparing the results from three separate laboratories, indicated that significant discrepancies can occur. The coastwide GSI Consortium is in the process of developing recommendations for regular analysis of replicates between GSI labs.

*The CTC supports and recommends this effort to assess laboratory variability.*

3. Develop agreed upon methods for the application of stock composition estimates to catch, and agreed upon future sampling requirements and design.

Differing methods for the application of GSI results to catch data to derive interception estimates have been proposed for the various fisheries dependent on management needs and other factors. The CTC has identified alternative approaches for the application of GSI information, but additional analysis is required to determine the appropriate method for each fishery. The methods of application are

often constrained by the original sampling design.

*The CTC recommends an evaluation of management needs and an analysis of intra- and interannual variation in stock contributions, for each fishery, to allow the CTC to assess different application methods and to define appropriate modifications to sampling designs.*

4. Annually develop agreed upon estimates of harvest, stock compositions and interceptions.

Various assignments to the CTC from the PSC, as well as the CTC's terms of reference from the Chum Chapter, require annual assessments of harvest, stock composition and interceptions. Estimates of interceptions have been jointly agreed upon for use by the JIC using GSI information collected in most major commercial fisheries in Southern B.C. and Washington. However, these estimates are qualified by the need to further assess methods for application of GSI results and for bias correction, as noted in 2 and 3 above.

GSI samples have been collected for a number of years from Canadian commercial fisheries in the Johnstone Strait, Georgia Strait and Nitinat areas, and from U.S. commercial fisheries in the Strait of Juan de Fuca, the San Juan Islands and Point Roberts areas. Test fisheries have also been employed in many of these areas to collect GSI samples to help further define patterns of migration and expected interception levels. Annual updates in interception estimates are expected to continue to be required by the PSC.

*The CTC recommends that, at a minimum, the above mentioned commercial fisheries continue to be sampled to accomplish its task of providing annual interception estimates.*

**B. ANALYTICAL METHODS**

1. Develop analytical tools to allow the rapid analysis of various enhancement and fishery options to meet defined goals and objectives of the parties ( The CTC will develop and evaluate management and enhancement alternatives as directed by the PSC).

The PSC has recently placed a high priority on the development of fishery goals and objectives by the two nations, and formed a special work group to develop them (Joint Objectives and Goals Committee - JOGC). It is anticipated that meeting these defined goals and objectives will require the examination of various enhancement and

fishery management options. The Chum Technical Committee does not currently have joint evaluation methods to assess the implications of enhancement and management options on harvest levels and interceptions between the two countries. The stock composition information now available from the major southern B.C. and Washington chum fisheries provides the basic data necessary to develop these analytical tools, and this is the next logical step in the CTC's work. The CTC's terms of reference (Annex IV, chapter 6, paragraph 1(e)) address this task, however it is a time consuming effort.

*The CTC recommends that, if the PSC requires this type of analysis in the near future, it must become the next highest priority for the Committee after assessment of GSI methods.*

2. Develop a joint data base for the exchange and analysis of fishery information.

The development of joint analytical tools by the U.S. and Canada is dependent on the ready availability of acceptable and agreed upon data sets. The ability of the CTC to meet its present obligations, as well as future assignments, will be greatly enhanced by this activity.

*The Technical Committee on Data Sharing is currently undertaking this task and the CTC strongly encourages its completion.*

### III. LONG TERM RESEARCH NEEDS

The following is a summary of the Committee's long-term research recommendations. These recommendations are designed to continue addressing the CTC's priority assignments listed above, while incorporating emerging technologies, and to begin addressing all other Chum Chapter assignments.

#### **A. STOCK IDENTIFICATION**

1. Evaluate technical improvements in protein electrophoresis.

Research into the discovery and evaluation of new polymorphic loci may lead to increased discrimination among stocks or stock groups of chum salmon. Statistical procedures should be explored to streamline and/or increase the accuracy of stock estimates (e.g. procedures that

evaluate and determine the minimum number of loci required for a specific fishery application, and procedures that determine and adjust for bias in composition estimates).

*The CTC recommends that efforts to identify means of improving the currently utilized protein electrophoretic methods continue.*

2. Assess temporal variability of allele frequencies in the GSI baseline.

It is assumed that allele frequency characteristics of the stocks in the GSI baseline are stable through time. However, genetic changes can occur in stocks naturally and/or through man's manipulation (intentionally or non-intentionally).

*The CTC recommends routine checks of the baseline by resampling to assess this assumption and to adjust the baseline, if necessary.*

3. Examine other stock composition techniques.

Other stock identification techniques, including adult or juvenile tagging and morphometric/scale pattern analyses, should be evaluated as alternatives to protein electrophoresis and for special applications on a less comprehensive basis. Current research in molecular biology of vertebrates indicates that new genetic markers may soon be available that can be applied to salmon GSI. Although this research is at an incipient stage, these new DNA-type markers hold the promise of greatly increasing the discrimination among stocks or stock groups. Because any tissue (e.g. fin tissue) can in theory be used for DNA laboratory procedures, these markers also have the potential advantage of being non-invasive and non-lethal.

*The CTC recommends the examination of stock identification techniques other than protein electrophoresis.*

**B. PRODUCTIVITY/STOCK ASSESSMENT**

1. Continue efforts to improve spawning escapement estimates and to define optimum escapement goals.

Annual assessment of spawning escapements and the determination of maximum sustained harvest (MSH) or optimum harvest (OH) escapement levels by the parties are critical to the assessment of management approaches and rebuilding strategies by the CTC.

*The CTC recommends the parties continue their efforts to improve these estimates.*

2. Improve methods for preseason and inseason estimation of run strength.

Accurate estimates of stock abundance developed by the parties are critical to the implementation of specific management strategies, meeting the allocations prescribed in the annex, and in achieving the desired level of spawning escapement.

*The CTC recommends the parties continue efforts to improve methods for estimating run strength.*

**C. MANAGEMENT STRATEGIES**

1. Develop alternative management strategies to specifically address the goals and objectives of the PSC.

The PSC has formed the JOGC to begin looking at alternative management strategies and enhancement efforts that would prove beneficial to meeting the long range goals of both countries. The CTC is assigned this responsibility in the Chum Chapter, and anticipates specific requests from the PSC for management alternatives as the JOGC process proceeds.

*If this continues to be a priority of the PSC, the CTC recommends its future work efforts focus on developing alternative management strategies as well as tools for the evaluation of those strategies.*

### LITERATURE CITED

- Chum Technical Committee. 1987. Working Paper on Genetic Stock Identification Methods for Southern Chum Stocks. Pacific Salmon Commission. Report TCCHUM (87)-2.
- Chum Technical Committee. 1987. Research Needs on Southern British Columbia and Washington State Chum. Pacific Salmon Commission. Report TCCHUM (87)-3.
- Chum Technical Committee, 1988. Progress Report on Genetic Stock Identification of Chum Salmon in Southern British Columbia and Washington. Pacific Salmon Commission. Report TCCHUM (88)-2.
- Chum Technical Committee. 1989. 1989 Progress Report on Genetic Stock Identification of Chum Salmon in Southern British Columbia and Washington. Pacific Salmon Commission. Report TCCHUM (89)-1.
- Chum Technical Committee (GSI Subcommittee Report). 1992. Accuracy and Precision of Genetic Stock Identification for Estimating the Stock Composition of Mixed-Stock Chum Salmon Fisheries in Northern Puget Sound and Southern Georgia Strait. Pacific Salmon Commission. Report TCCHUM (92)-2.
- Joint Interceptions Committee, 1989. Report on Progress in Resolving Differences in the Parties' Estimates of Salmon Interceptions. Pacific Salmon Commission. Report JIC (89)-1.
- Joint Interceptions Committee. 1991. Second Report on the Parties Estimates of Salmon Interceptions. Pacific Salmon Commission. Report JIC (91)-1.