# SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON SALMON METHODOLOGY REVIEW

The Scientific and Statistical Committee (SSC) Salmon Subcommittee and the Salmon Technical Team (STT) met at the Sheraton Portland Airport on October 24-25, 2007, to review four salmon methodology issues:

- Revisions to Council Operating Procedure 15.
- Genetic Stock Identification Study Proposal and EFP.
- Coho Fishery Regulation Assessment Model (FRAM) Base Period Revisions.
- Review of recovery exploitation rate for Lower Columbia River natural tules.
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The Model Evaluation Workgroup (MEW) was also present. Comments on these four items follow.

## Council Operating Procedure (COP) 15

The SSC reviewed proposed changes to the Salmon Estimation Methodology Updates and Review COP (COP 15) presented by Mr. Chuck Tracy. The changes were suggested primarily in order to:

1. Acknowledge the role of MEW.
2. Define what, in general, merits SSC review.
3. Make it clear that data modifications (including changes in the range of data to which an accepted methodology is applied) do not generally require SSC review. This includes such changes that occur subsequent to adoption of the final methodology review in November and prior to preseason forecast calculations early in the following year.

The SSC approves of the proposed changes and makes the following suggestions for clarification purposes:

1. In the second proposed new sentence below “Objectives and Duties”, add the word “could” before “merit a full review…”
2. In the second paragraph below “Objectives and Duties”, replace “selected” with “ready”.
3. Towards the end of the third paragraph below “Objectives and Duties”, replace “three weeks” with “two weeks”.

## Genetic Stock Identification Study Proposal and EFP

Dr. Peter Lawson presented a project proposal for “Strategies to Minimize Catch of Klamath River Chinook Salmon in West Coast Mixed Salmon Fisheries”. The goals of this project are to use genetic stock identification methods to determine the distribution of Klamath River and other PFMC-managed Chinook stocks in areas off the northern California and Oregon Coasts. The goals and objectives of the project are well defined and, if achieved, will provide information that will be valuable to fishery managers.

The proposed project would be similar to the Collaborative Research on Ocean Salmon (CROOS) Project conducted primarily in the waters off of central Oregon during 2006. Sampling methodologies and protocols developed by the CROOS project would be used in the proposed project which would extend sampling into the waters off of southern Oregon and northern California. The sample design, data collection methods, and proposed methods of analysis will meet project goals and objectives. The sampling design defines 144 weekly time/area strata for sampling. In recent years, a large number of the proposed strata have been closed to commercial fishing (51 in 2007). Therefore, an experimental fishing permit will be needed in order for samples to be collected from those areas which may be closed in 2008. If the project cannot collect samples from closed areas in 2008, the project goals and objectives will be compromised as the distribution and stock composition of fish in closed time/area strata will remain unknown. Therefore, the Scientific and Statistical Committee (SSC) supports the EFP application.

Sample size objectives of 240 fish per time/area strata are proposed. The analyses presented support these sample size goals. However, these analyses were based on the assumption of a random distribution of fish from a stock within a sampled time/area stratum. The SSC suggests that an analysis of the CROOS data be conducted to examine the assumption of a random distribution of fish from a stock or whether there is "clustering" of fish from a stock. If it appears clustering (due to schooling behavior) exists, the possible effect of this on the sample size objectives should be evaluated and appropriate sample allocation should be addressed. Additional details will need to be provided on the spatial distribution of sampling effort in closed areas under Plan A (such as transects versus random locations). Similar information should be provided with regard to Plan B (no EFP).

Finally, the stock impact analysis for the project (number of fishery-induced mortalities due to fishing in closed areas) is based on a maximum sample size of 12,240 fish (240 samples collected from each of 51 closed time/areas). However, sampling efforts in closed areas may continue after the sample size goal is obtained in order to distribute samples across the entire weekly time period, if possible. The SSC recommends that an additional impact analysis be conducted that accounts for the possibility of sampling more than 240 fish per time/area strata.

## Coho FRAM Base Period Revisions

Mr. Jim Packer reviewed the status of base period updates to the coho FRAM. Over the past several months he has held a series of regional meetings from Canada to the Oregon Coast to explain recent developments in the model and to solicit suggestions and updates to the base period input data. As a result, there is an increased familiarity with the model, an increased acceptance of the model, and a substantially improved and updated input data set.

A considerable effort has gone into conducting new cohort analyses for the years from 1992 to 1997 with the intention of updating the FRAM base period. Except for 1992, fishing has been restricted in these years to the point that it is difficult to incorporate them into the base period. As a result, Mr. Packer recommended a new base period that included the updated data set and added only the year 1992 to the current 1986-1991 base period. Data from the Upper Fraser River in 1986 would be omitted because of poor data quality and anomalous estimates for the

Thompson River stock in that year. An alternative is to use the current 1986-1991 base period years (without Upper Fraser 1986) but with updated data.

The SSC agrees that, because of the regional meeting process that was used, the updated data set should constitute an improvement over the earlier version and should be used for modeling. We had no objective way to evaluate the addition of the 1992 year to the base period. However, based on Mr. Packer's information that 1992 was similar in data scope and quality to the earlier years it seems that the addition of a seventh year would likely lead to a more robust base period.

The SSC had difficulty evaluating the new data set or proposed base periods because we have no objective measure of stock distributions or model performance for comparison. Now that there are five additional years of reconstructed fisheries that may not be used in the base period fisheries could be simulated using different base periods to reproduce 1993-1997 fisheries. Output could then be compared with the reconstructed fisheries and escapements to see how well they match. This would help resolve three important questions: (1) how well does a base period that uses years of coast-wide fishing and average exploitation rates represent catch patterns in years with restricted fishing or differing ocean conditions, (2) how sensitive is the model to the selection of base period, and (3) does the addition of 1992 to the base period improve the simulation of current fisheries? A set of metrics needs to be developed to facilitate this comparison among model runs.

In the future the SSC recommends that the MEW use the new cohort reconstruction tools to focus on post-season analysis. We now have a tool that could be used for estimating total abundance of coho salmon. This could lead to an agreed-to coast-wide coho data set for preseason forecasting in terms of the FRAM base period and for postseason evaluation of exploitation rates and escapements. It would also be useful to have the MEW use the current tools to analyze the 1979-1985 catch years. In addition to providing more data for potential base years this would fulfill the original intent of the MEW to have more people trained in the use and development of FRAM base period data.

<u>Review of recovery exploitation rate for Lower Columbia River natural tules</u>

Due to an apparent oversight, the document describing this analysis was not provided to the SSC or the Council prior to the November meeting. While the SSC salmon subcommittee (SSCSS) was able to conduct a review at the October Salmon Methodology Review Meeting, and the SSC recognizes their expertise, the SSC as a whole was not able to provide a complete review of this topic at this meeting and would be interested in revisiting this topic in March, 2008.

Dr. Michael Ford (NWFSC, Conservation Biology Division) gave a presentation on analyses to support a review of an Endangered Species Act jeopardy consultation on fisheries impacting Lower Columbia River (LCR) tule (early fall run) Chinook salmon. The work, conducted by a joint NMFS/WDFW working group, provides a comprehensive review of the data available to assess the status of the LCR tule populations and presents two analyses useful for evaluating rebuilding exploitation rates (RERs). There is an apparent lack of data on tule Chinook populations for the Oregon side of the Lower Columbia River. Beginning in 2007, harvest actions on these stocks are evaluated on the basis of a RER limit of 42% based on results from the analysis of three natural-origin tule populations. This was a reduction from the 49% limit that was used during the previous five years based on an analysis of the Coweeman River population. Estimates for the Coweeman River population indicate that recent brood-years have experienced adult equivalent exploitation rates in excess of both the 42% and 49% exploitation rate limits.

The working group developed two possible approaches for evaluating run status, one based on a viability curve analysis and the other based on rebuilding exploitation rates (RER). A viability curve shows how extinction risk varies with population abundance and productivity. Curves were presented for three harvest rates (0, 25%, 50%). Probability contours for estimates of current population abundance and productivity are superimposed on the viability curves to evaluate the current status of the population relative to extinction risk at three harvest levels. The RER approach uses a stochastic Viability-Risk Assessment Procedure (VRAP) to project population abundance into the future based on current productivity and capacity conditions. For their analyses the working group applied both approaches to the same fundamental run reconstruction data to develop relationships between recruitment and parental spawning stock for the three LCR tule populations with the best available data sets (Coweeman, Grays, and Lewis). The working group considered the data available from the other LCR tule populations to be too poor or too tainted by hatchery strays to use in the analyses. Plots of the curves fitted to the recruits versus spawner data for the three populations indicated that the data are extremely noisy and not well characterized by any of the spawner-recruit curves considered by the working group.

The results from both methods of analysis are sensitive to model parameters used to assess stock status when projecting a population’s abundances into the future (e.g., the quasi-extinction threshold [QET] for the viability curve analysis and the lower and upper escapement thresholds [LET and UET] for the VRAP analysis). The choice of these values embodies the level of risk inherent in the chosen RER and, therefore, is partly (but not wholly) a policy decision

The SSCSS is concerned by the very poor quality of the data underlying the working group's analyses. The analyses are complicated and it is unclear how measurement errors propagate through the calculations and influence the results. The SSCSS suggests that the working group conduct an evaluation of the two methods using simulated data with known levels of measurement error, including a perfect data set with no measurement error. Comparing the results from such an evaluation would provide a basis for selecting between the viability curve approach versus the RER approach. Analyses with simulated data could also measure the relative sensitivity of the two approaches to different forms of measurement error, the choice of values for assessing a population’s projected future abundance (QET, etc.), and indicate possible sources of bias.

For the viability analyses, the probability distributions for the population’s current status were generated using random time-series with 20% uniform error, which has a coefficient of variation of 11%. This seems a low level of uncertainty. The SSCSS suggests using normally distributed random errors with coefficients of variation of at least 20%.

Both methods are based on the assumption that the most important factors governing viability of these populations are the recently realized stock-recruit relationships rather than changes in ocean or freshwater environmental conditions or in hatchery supplementation practices. The data supporting this assumption are weak, so the degree of confidence that can be placed in either of these methods is low. The SSCSS recommends that sensitivity analyses to these other relevant factors should be conducted.

The SSCSS concurs with the working group's suggestion of exploring other analytical techniques. A mixed-model approach that simultaneously analyses data from multiple populations might provide better parameter estimates and allow for use of data from more of the populations.

PFMC
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