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**Proceedings of the PSARC Salmon
Subcommittee Meeting,
March 3, 2005**

**Compte rendu de la réunion du
sous-comité du saumon du
CEESP; 3 mars 2005**

**March 3, 2005
Nanaimo, B.C.**

**Greg Thomas
PSARC Chair**

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, B.C. V9T 6N7

June 2005

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**PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
SALMON SUBCOMMITTEE MEETING**

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SUMMARY

Scientific advice for input to the Allowable Harm Assessment for Interior Fraser Coho Salmon.

- The Subcommittee concluded that the data and methods used in the analysis were not described in sufficient detail to properly evaluate the conclusions.
- The Subcommittee concluded that the Working Paper could not be accepted without major revisions as follows:
 - Include a table of the data and commentary on their sources;
 - Sample the like-last-year (LLY) forecast of the coho marine survival probability distribution to simulate interior Fraser coho (IFC) marine survival in both short (2-year) and long-term (3-generation) projections of spawning escapements;
 - Include an auto-regressive component in the simulated long-term projections. The data series of marine survival estimates are highly autocorrelated;
 - Terminate any simulated projection if the spawning escapement fell below the biologically-based limit reference point, and;
 - Calculate the probability of recovery (population growth) as the proportion of the trials at the end of each simulated scenario that exceeded the initial 2002-2004 geometric mean escapement.

Forecast return for Barkley Sound sockeye salmon to Great Central and Sproat Lakes in 2005.

The paper provided forecast returns for Great Central Lake and Sproat Lake sockeye in 2005 from three previously approved methods and a new method, the Coho Leading Indicator (CLI). The Subcommittee approved the CLI approach noting that a retrospective analysis indicated this method provided the most reliable abundance estimate of the methods examined. A further biologically based forecast was reviewed for information only. The Subcommittee noted that sockeye abundance forecast is lower for 2005 compared to 2004, based on the forecasts of all 4 methods. The 50% probability forecasts range from 345,000 to 645,000 sockeye.

SOMMAIRE

Avis scientifiques pour l'évaluation des dommages admissibles au saumon coho du Fraser intérieur

- Le sous-comité conclue que les données et les méthodes utilisées dans l'analyse n'ont pas été décrites de façon suffisamment détaillée pour bien évaluer les conclusions.
- Le sous-comité conclue que le document de travail ne peut pas être accepté à moins que les révisions majeures suivantes soient apportées :
 - Inclure un tableau des données et des commentaires sur leurs sources.
 - Échantillonner la prévision LLY (« like-last-year ») de la distribution de probabilité de la survie en mer pour simuler la survie en mer du saumon coho du Fraser intérieur dans des projections à court (deux ans) et à long (trois générations) termes de l'échappée.
 - Inclure une composante autorégressive dans les projections simulées à long terme. Les séries chronologiques des estimations de la survie en mer présentent une forte autocorrélation.
 - Mettre fin à toute projection simulée si l'échappée est inférieure au point de référence limite biologique.
 - Calculer la probabilité de rétablissement (accroissement de la population) comme la proportion des essais qui, à la fin de chaque scénario simulé, donnent une échappée supérieure à la moyenne géométrique initiale de l'échappée de 2002 à 2004.

Prévision des remontes du saumon rouge de la baie Barkley aux lacs Great Central et Sproat en 2005

Le document présente les prévisions de remonte du saumon rouge aux lacs Great Central et Sproat en 2005 selon trois méthodes approuvées antérieurement et une nouvelle méthode désignée « Coho Leading Indicator » (CLI). Le sous-comité approuve la méthode CLI en faisant remarquer qu'une analyse rétrospective indique que, parmi les méthodes examinées, la méthode CLI donne l'estimation de l'abondance la plus fiable. Une autre prévision biologique a été examinée à titre indicatif seulement. Le sous-comité relève que, selon les prévisions faites par les quatre méthodes, l'abondance prévue du saumon rouge est plus basse en 2005 qu'en 2004. Les prévisions à 50 % de probabilité varient de 345 000 à 645 000 saumons rouges.

DETAILED COMMENTS FROM THE REVIEW

S2005-01: Scientific Advice for Input to the Allowable Harm Assessment of Interior Fraser Coho

M. Folkes, B. Ionson **major revisions required**

Subcommittee Discussion

Both reviewers were critical of the Working Paper citing deficiencies in the documentation of the data and general confusion over treatment of the data. The Subcommittee agreed that the data used in the analysis was not adequately described and requested that the authors provide more detailed documentation of the data in revisions of the Working Paper. The revision needs to include a table of all the pertinent data used in the analysis. The Subcommittee further noted that poor documentation of salmon assessment data is a generic data management issue that needs to be resolved.

One reviewer identified a clerical error in the stock-recruitment data used in the Working Paper to estimate the stock-recruitment parameters. In the reviewer's opinion, this brought into question the general quality of analysis in the Working Paper. The senior author addressed some of the reviewers' concerns regarding treatment of the data during the presentation at the meeting.

There was considerable discussion about how the marine survival indices used in the simulated projections were sampled. The Subcommittee agreed that the distribution of recent low marine survival indices should be used in both the short (2-year) and long-term (3-generation) projections of harvest impacts on survival and recovery probabilities. The Subcommittee concluded that a reasonable representation of the recent marine survival trends is the probability distribution of the IFC like-last-year marine survival forecast. Longer-term projects should consider an auto-regressive term in the simulated projection of escapement to account for the high autocorrelation in the marine survival series.

The Subcommittee discussed implications of comparing the projected generational mean escapement: 1) to the benchmark limit reference point (i.e. 20,000 spawners) used to assess survival, and 2) to the most recent observed mean as a measure of recovery. There was concern that the mean escapement metric does not permit an evaluation of the loss of a brood line within a generation. The Subcommittee noted that the mean escapement was computed using the geometric mean and therefore is more conservative compared to the arithmetic mean.

Subcommittee Conclusions

The Subcommittee concluded that the data and methods used in the analysis were not explained in sufficient detail to properly evaluate the conclusions.

The Subcommittee concluded that the Working Paper could not be accepted without major revisions as follows:

- 1) include a table of the data and commentary on their sources;
- 2) sample the like-last-year (LLY) forecast of the coho marine survival probability distribution to simulate interior Fraser coho (IFC) marine survival in both short (2-year) and long-term (3-generation) projections of spawning escapements;
- 3) include an auto-regressive component in the simulated long-term projections. The data series of marine survival estimates are highly autocorrelated ($\rho=0.7$);
- 4) terminate any simulated projection if the spawning escapement fell below the biologically-based limit reference point, and;
- 5) calculate the probability of recovery (population growth) as the proportion of the trials at the end of each simulated scenario that exceeded the initial 2002-2004 geometric mean escapement.

Subcommittee Recommendations

The Subcommittee recommended that revisions to the Working Paper be circulated to all participants that attended the March 3 meeting to determine if the revised Working Paper meets the conditions of the Subcommittee.

The Subcommittee recommended that the revised Working Paper be reviewed at a subsequent PSARC meeting to evaluate the revisions and to formulate Subcommittee advice.

S2005-02: Forecast return for Barkley Sound sockeye salmon to Great Central and Sproat Lakes in 2005

D. Dobson, R. Tanasichuk, K. Hyatt **accepted with minor revisions**

Subcommittee Discussion

The Working Paper provides forecasted returns of sockeye salmon in 2005 to Great Central and Sproat lakes in Barkley Sound, based on three methods already reviewed by PSARC and two new methods. Of the two new methods, the Coho Leading Indicator (CLI) method has been presented in past PSARC forecasts as additional information, but was presented in the present Working Paper as an alternative forecasting method. It is based on the relationship between the abundance of coho in the Somass system, which return as three-year-olds, and returns of four- and five-year-old sockeye from the same smolt ocean-entry-year. The Mean-Absolute-Percent-Error (MAPE) performance criteria for the CLI forecast return versus actual return over the 18 years examined in a retrospective analysis was 34% compared to the next lowest MAPE of 40% for the Survival Stanza Method, (SStM).

The Subcommittee discussed the biological basis for this new method, but overall the Subcommittee and reviewers were in agreement that it is a useful forecasting method. The Salinity Survival Method (SSM) has performed poorly in recent years (MAPE = 107%) due to recent salinity observations that are outside the range of the historic salinities used to develop the regression relationship. The last method, the Salmonid Enhancement Biostandard Method (SEPB) uses a fixed smolt-to-adult survival rate of 4.5% and can be expected to be a good predictor only in years of average survival (MAPE = 58%).

The second new method, the Biologically Based Forecast, which is based on euphausiid abundance in the smolt ocean-entry-year, was presented in the Working Paper as additional information only. The forecast derived from this method is not presented as a viable alternative due to the shortness of the data series. One reviewer requested that in the future the retrospective performance analysis should be assessed in the same way that the other four forecasting methodologies were assessed. The Subcommittee and reviewers agreed that this method will need more years of data before it can be considered as a forecasting tool.

All forecast methods presented in the Working Paper predict lower abundance in 2005 as compared to 2004. There will be an effect from the poor 2000 brood escapement on the 5-year-old return. Fry abundance in Sproat and Great Central lakes for the 2003 smolt entry year was estimated at below average and the forecast parameters suggest that the marine survival rate for these smolts deteriorated to below average compared to the past several years. The 50% probability estimates provided by the four abundance forecasting methods range from 345,000 to 645,000 sockeye.

One reviewer commented on the lack of a forecast for the Henderson Lake stock, which is mentioned as part of the aggregate stock. The authors responded that there is no reliable method for separating Henderson from the other two stocks in the catch and present escapement estimation methodology has changed from that of the past, so results cannot be compared. Precision in the catch estimates would be low because Henderson comprises a maximum of about 10% of the Barkley Sound aggregate. This information should be included in revisions to the Working Paper. There were also inconsistencies in the smolt data presented in Table 11 versus Tables 18-23 in the Working Paper. For Great Central Lake, age 1 smolt output only was used for analysis of 1999-2003 data while age 1 and age 2 smolt output was used in earlier years.

Both reviewers questioned the use of the average of the four methods for the pre-season forecast given the variation in estimates of uncertainty among the methods. One suggested that a Bayesian model be developed that would produce a posterior distribution of the forecasted abundance, incorporating a smolt-based method (SSM, SStM or SEPB) as the prior information and the biologically-based method (CLI) as the likelihood function. The Subcommittee agreed that alternative methods, including Bayesian methods, for combining forecasts should be explored in the future. The forecast is used for pre-season planning only and test fishery analysis of abundance is used to refine harvest rates in-season. A Bayesian model could be useful in a year when the four methods produce widely disparate forecasts. The authors agreed to include more information on the weighted-average method and to include a retrospective analysis of the method in the revisions.

Subcommittee Conclusions

1. The Subcommittee accepted the Working Paper with revisions, noting that three of the forecast methodologies were previously reviewed and accepted.
2. The Subcommittee approved the new Coho Leading Indicator method. It outperformed the other 3 methods in the retrospective analysis.
3. The Subcommittee noted that sockeye abundance forecast is lower for 2005 compared to 2004, based on the forecasts of all 4 methods. The 50% probability forecasts range from 345,000 to 645,000 sockeye.

Subcommittee Recommendations

1. The Subcommittee recommended the acceptance of the forecasts, including that for the new Coho Leading Indicator method.
2. The Subcommittee recommended that future forecasts include a Bayesian model to produce a posterior distribution of abundance for the smolt-based (SSM, SStM, SEPB) and biologically-based (CLI) methods.

3. The Subcommittee recommended further work on the Biologically Based method, (euphausiid abundance) which shows some promise, but has few years of data at present.

APPENDIX 1: Working Paper Summaries

S2005-01: Scientific Advice for Input to the Allowable Harm Assessment of Interior Fraser Coho

M. Folkes, B. Ionson

In 2002 COSEWIC designated Interior Fraser River coho (IFC) as “endangered”. IFC could become legally listed in 2005 under the Species At Risk Act (SARA). This Working Paper was in response to a request to assess the potential for incidental harm permitting. Questions addressed in the Working Paper were: 1) What is the present/recent species trajectory? 2) What is the present/recent species status? 3) What is the expected order of magnitude/target for recovery? 4) What is the general time frame for recovery to the target? And 5) What is the maximum human-induced mortality which the species can sustain and not jeopardize survival or recovery of the species?

Recent revisions of the historical escapement time series suggests that the rates of decline (estimated by two methods), while still within the COSEWIC criteria for listing, are not as severe as was presented in the COSEWIC status report (COSEWIC, 2002). An immediate recovery goal for the Designated Unit (DU) has been defined (three year geometric mean $\geq 20,000$ wild spawners) by the Interior Fraser Coho Recovery Team. The three year running geometric mean escapement (2001-2003: 34,000 spawners & 2002-2004: $\sim 31,000$ spawners) for the DU is above the 20,000 objective. Harvest impacts on escapement are assessed at both recent and long term levels of marine survival and a full range of mortality rates. Probability of jeopardizing survival and recovery of the species are included. Potential sources of harm to the DU are discussed and their impact is quantified.

S2005-02: Forecast return for Barkley Sound sockeye salmon to Great Central and Sproat Lakes in 2005

D. Dobson, R. Tanasichuk, K. Hyatt

This paper provides a forecast of sockeye returns for 2005 to Great Central and Sproat Lakes. It also reviews the returns of these stocks in 2004 plus updates the historic catch and escapement time series from previous reports. The forecast returns for 2005 are based on previously established methods as well as a newly presented forecast method dependent on observations of adult coho marine survival rate in proceeding return years. Also, the potential of using observations of euphausiid abundance as an indicator of ocean productivity and correlate of early marine survival rate for juvenile sockeye is examined. Forecast returns for 2005 are below average and also below levels observed in 2004, due to the continuing effect of the poor 2000 brood escapement and the indication that marine conditions were less favourable during the 2003 smolt migration year. The suggested forecast is 495,000 adults to both systems with a range between 345,000 and 645,000

APPENDIX 2: PSARC Salmon Subcommittee Meeting Agenda, March 3, 2005

**PSARC Salmon Subcommittee Agenda
March 3, 2005
9:00-4:00
Seminar Room, PBS, Nanaimo**

March 3:

9:00-12:00	Review of working paper, <i>Allowable Harm Assessment of Interior Fraser Coho</i> Authors: M. Folkes, B. Ionsen
12:00-1:00	Lunch
1:00-4:00	Review of Working Paper, <i>Forecast return of Barkley Sound Sockeye in 2005</i> Authors: D. Dobson, R. Tanasichuk, K. Hyatt

APPENDIX 3: List of Attendees and Reviewers

Subcommittee Chair: Greg Thomas
 PSARC Chair: Al Cass

NAME	
EXTERNAL PARTICIPANTS	
Argue, Sandy	BC Ministry of Agriculture, Food and Fisheries
Blackbourn, David	Consultant
Galesloot, Mike	Shuswap Nation Fisheries Commission
Gottesfeld, Allen	Skeena Fisheries Committee
Holtby, Blair	Pacific Fisheries Resource Conservation Council
Lane, Jim	Nuu Chah Nulth Tribal Council
Webb, Lloyd	Fishing Vessel Owners Association
Wilson, Ken	Fraser River Aboriginal Fishery Society
DFO MEMBERS	
Baillie, Steve	
Bradford, Mike	
Cass, Al (PSARC Chair)	
Chamberlain, Mike	
Cook, Roberta	
Dobson, Diana	
Eros, Carole	
Grout, Jeff	
Hargreaves, Brent	
Hyatt, Kim	
Ionson, Bert	
McNicol, Rick	
Meerberg, Dave	
Parken, Chuck	
Perry, Ted	
Sawada, Joel	
Shaw, Bill	
Simpson, Kent	
Thomas, Greg (Chair)	
Tompkins, Arlene	
West, Kim	
Yockey, Cindy	

Reviewers for the PSARC papers presented at this meeting are listed below, in alphabetical order. Their assistance is invaluable in making the PSARC process work.

Dobson, Diana	Fisheries and Oceans Canada
Folkes, Michael	Fisheries and Oceans Canada
Grout, Jeff	Fisheries and Oceans Canada
Tompkins, Arlene	Fisheries and Oceans Canada