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Proceedings of the PSARC Salmon Subcommittee Meeting

Compte rendu de la réunion du sous-comité du CEESP sur le saumon

May 17-18, 2006
Pacific Biological Station
Nanaimo, BC

17-18 mai 2006
Station biologique du pacifique
Nanaimo, C.-B,

B. Riddell

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
SALMON SUBCOMMITTEE MEETING

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SUMMARY

S2006-01: Working paper on the status of lower Georgia Strait Chinook salmon (*Oncorhynchus tshawytscha*) stocks

D.A. Nagtegaal and K.L. Mathias

The Subcommittee acknowledged the significant effort undertaken to collate and describe the extensive information on the Cowichan fall Chinook population and the LGS stock group. However, the Subcommittee concluded that the working paper does not adequately address the stock status of the LGS Chinook stock and recommended deferring final consideration of this paper until the fall 2006. The Subcommittee recommends that revision of the paper specifically consider what other "wild" Chinook populations exist in the LGS stock group and whether Cowichan fall Chinook is an adequate indicator for this group. The development of a stock management model could aid managers in assessing alternative actions and risks but may not be developed and reviewed for the fall 2006. Some Subcommittee participants strongly recommended consideration of habitat concerns within the Cowichan River as potential factors in the production of Cowichan Chinook.

S2006-02: Status of Birkenhead River Chinook salmon (*Oncorhynchus tshawytscha*)

N.D. Schubert, J.R. Candy, R. Cook, J. Greenbank, D. Lofthouse, R. McNicol, C.K. Parken, D. Sneddon, J.A. Tadey, K. Wilson

The Subcommittee concluded that while the Birkenhead River Chinook population appears small though relatively stable, the low abundance and results of the genetic assessment are consistent with it being identified as a 'Population of Concern' (terminology analogous with COSEWIC). The Subcommittee recommended acceptance of the paper after some minor revisions or updates to some sections and additionally made the following specific recommendations concerning Birkenhead River Chinook:

1. Biological evidence is sufficiently compelling of the relative uniqueness of the Birkenhead River Chinook population that these and certain other lower Fraser River spring populations (e.g., Upper Pitt River) warrant consideration as a conservation unit under the Wild Salmon Policy.
2. The process currently underway to acquire aboriginal traditional knowledge from Lil'wat Nation elders should be expanded to include the In-SHUCK-ch Nation.
3. A response team should be formed to develop population and habitat assessment frameworks that are consistent with the information requirements for conservation units under the Wild Salmon Policy (WSP) and incorporates recommendations 1-5 of the Working Paper.

The large uncertainty in the terminal return data and the lack of a confidence measure around annual escapement estimates necessitates that caution be used in actions that could impact the abundance or productivity of Birkenhead River Chinook.

S2006-03: Assessment of Chinook salmon returns to the Fraser River Watershed using run reconstruction techniques, 1982-04
K.K. English, R.E. Bailey, and D. Robichaud

The paper was accepted as a description of an approach for run reconstruction of Fraser Chinook stocks, pending the authors addressing the data errors identified by the reviewers and Subcommittee; specifically the inconsistency in data presented in various tables of the paper for Fraser fall stocks. DFO staff will help address some of the data issues associated with missing catch information, stream arrival times and erroneous escapement and harvest information for Fraser late stocks. The authors were instructed to provide a list of recommendations, which would include further development of the model presented, including sensitivity analyses and incorporation of uncertainty in parameter estimates, as well as identifying a need for full model documentation. DFO should be the official custodian of this model, and the agency responsible for its further development.

SOMMAIRE

S2006-01 : Document de travail sur l'état des stocks de saumon quinnat (*Oncorhynchus tshawytscha*) de la partie inférieure du détroit de Georgia
D.A. Nagtegaal et K.L. Mathias

Le sous-comité reconnaît l'ampleur des efforts entrepris pour recueillir et catégoriser l'information détaillée sur la population de quinnat d'automne de la Cowichan et le groupe de stocks de la partie inférieure du détroit de Georgia. Cependant, le sous-comité conclut que le document de travail ne décrit pas suffisamment l'état des stocks de la partie inférieure du détroit de Georgia et recommande de reporter l'étude finale du document à l'automne 2006. Il recommande une révision du document principalement axée sur la définition des autres populations « sauvages » de quinnats au sein du groupe de stocks de la partie inférieure du détroit de Georgia et sur la pertinence du quinnat d'automne de la Cowichan comme indicateur de ce groupe. L'établissement d'un modèle de gestion du stock pourrait aider les gestionnaires à évaluer les autres mesures possibles et les risques, mais il ne pourrait peut-être pas être élaboré et examiné d'ici l'automne 2006. Certains membres du sous-comité recommandent fortement que l'on se penche sur les préoccupations relatives à l'habitat dans la rivière Cowichan, comme facteurs ayant une incidence possible sur la production de quinnats dans la Cowichan.

S2006-02 : État du saumon quinnat (*Oncorhynchus tshawytscha*) de la rivière Birkenhead
N.D. Schubert, J.R. Candy, R. Cook, J. Greenbank, D. Lofthouse, R. McNicol, C.K. Parken, D. Sneddon, J.A. Tadey, K. Wilson

Le sous-comité conclut que, même si la population de saumons quinnats de la rivière Birkenhead semble limitée quoique relativement stable, la faible abondance et les résultats de l'évaluation génétique confirment sa désignation de « population préoccupante » (terminologie analogue à celle du COSEPAC). Le sous-comité recommande l'acceptation du document après quelques révisions ou mises à jour mineures de certaines sections et, en outre, fait les recommandations particulières suivantes au sujet du quinnat de la Birkenhead :

4. L'information biologique à propos du caractère relativement unique de la population de quinnats de la Birkenhead est suffisamment convaincante pour que, comme d'autres populations de printemps du bas-Fraser (p. ex. partie supérieure de la rivière Pitt), elle soit considérée comme une unité de conservation conformément à la Politique pour la conservation du saumon sauvage.
5. Le processus en cours pour l'acquisition de connaissances traditionnelles autochtones auprès des anciens de la Première nation Lil'wat devrait être élargi de manière à inclure la nation In-SHUCK-ch.
6. Une équipe d'intervention devrait être formée afin d'établir des cadres d'évaluation des populations et de l'habitat conformes aux besoins d'information pour les unités de conservation définies selon la Politique pour le saumon sauvage et d'intégrer les recommandations 1-5 du document de travail.

La grande incertitude concernant les données sur la remonte terminale et l'absence de mesure de confiance quant aux estimations annuelles de l'échappée exige que l'on fasse preuve de prudence au moment de prendre des mesures susceptibles d'avoir des répercussions sur l'abondance ou la productivité du quinnat de la rivière Birkenhead.

S2006-03 : Évaluation des retours de saumon quinnat dans le bassin du Fraser à l'aide de techniques de reconstitution des remontes, 1982-2004
K.K. English, R.E. Bailey et D. Robichaud

Le document est accepté comme description d'une démarche de reconstitution de la remonte des stocks de quinnat du Fraser, moyennant la correction par les auteurs des erreurs dans les données, notées par les examinateurs et le sous-comité, notamment l'incohérence des données présentées dans les divers tableaux du document sur les stocks d'automne du Fraser. Le personnel du MPO aidera à corriger certains des problèmes liés à des données manquantes sur les prises, sur le moment de l'arrivée dans le cours d'eau et à l'information erronée sur l'échappée et la pêche pour les stocks d'arrivée tardive dans le fleuve. Les auteurs ont reçu pour

instructions de fournir une liste de recommandations, notamment sur le perfectionnement du modèle présenté, incluant les analyses de sensibilité et l'intégration d'incertitude dans l'estimation des paramètres, ainsi que sur la détermination des besoins de documentation pour le modèle complet. Le MPO devrait être le gardien officiel de ce modèle et l'organisme responsable de son perfectionnement.

INTRODUCTION

The PSARC Salmon Subcommittee met May 17-18, 2006 at the Pacific Biological Station in Nanaimo, British Columbia. External participants from industry, academia, First Nations and conservation groups attended the meeting. The Subcommittee Chair, B. Riddell opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed three Working Papers which are summarized in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3

DETAILED COMMENTS FROM THE REVIEW

S2006-01: Working paper on the status of Lower Georgia Strait Chinook salmon (*Oncohynchus tshawytscha*) stocks

D.A. Nagtegaal, and K.L. Mathias

'Defer further review and recommendations until fall 2006 pending revisions'

Subcommittee Discussion

Two reviews provided extensive written comments on the Working Paper and both reviewers were present at the meeting. Reviewers and participants requested clarification of the Chinook populations included in the "Lower Strait of Georgia" (LGS stock group) and why certain data was included or not. For example, the primary data presented was based on returns and coded-wire tag data from the Cowichan River fall Chinook populations but several other streams and hatchery populations were noted in the appendices and discussions in the paper. What other populations should be included in an assessment of the LGS stock group, and why were data presented for Nanaimo, Big Qualicum, and Puntledge Chinook not considered in the assessment? The spawning escapements to other fall Chinook populations in the LGS group should be included in revisions to the paper. Several examples of clarifications requested (related to how analyses were conducted and the basis for some conclusions) were presented.

i) How are First Nations catches in terminal areas included in coded-wire tag data used in exploitation rate analyses?
ii) Clarify the analysis and data supporting Figure 2 (page 10) in the section "Resident Stock Movement".
iii) Re-consideration of the analysis supporting Table 2 (pages 19-20) concerning recreational fishery impacts in 2005 relative to previous years. A number of other factors could be confounded with the results presented and should be assessed (written suggestions provided by both reviews).

iv) What is the basis of calculations on page 25 that concluded “In 2005, the WCVI troll fishery harvested 23% of the total Cowichan terminal run of 9300 Chinook … “?

v) Review of the data legends and captions for several charts and tables provided in the text.

Reviewers and the participants noted that clear statements on the status of the stock group were not included in the working paper. One reviewer particularly stated that “it is troubling that the escapement of the Cowichan stock has been declining steadily since the mid-1990s, concurrent with increasing exploitation rates (ER) and fishing related mortality (FRM) in figures 13 and 16. There has also been an apparent increase in FSC (food, social, and ceremonial) harvest, which I don’t think is captured in the ER or FRM plots. Clearly, under present environmental conditions, Cowichan fall Chinook cannot sustain exploitation rates as high as they have recently experienced.” The other review provided suggestions how to summarize the current status for Cowichan fall Chinook including the exploitation rate trend, present spawning levels relative to the escapement goal, and the present level of enhancement. Both reviewers felt that recommendations presented in the working paper were supported by the papers content.

Meeting participants provided numerous suggestions for clarifications of the text, requests for additional information on the other Chinook populations in the LGS group and temporal and spatial distribution of coded-wire tag recoveries for more in-depth review, and consideration of habitat actions in the recommendations. The latter was discussed in the working paper but not addressed in the recommendations. Specific comments from the Subcommittee will be provided in writing to the authors.

Subcommittee Conclusions

The Subcommittee acknowledged the significant effort undertaken to collate and describe the extensive information on the Cowichan fall Chinook population and the LGS stock group. However, the Subcommittee concluded that the working paper does not adequately address the stock status of the LGS Chinook stock, and recommended deferring final consideration of this paper until the fall 2006. Core assessment staff should provide more support to the coded-wire tag analyses, the inclusion of other fall Chinook populations in this assessment of LGS Chinook, and status assessment. The paper needs to:

a) clarify why the analytical focus of this paper is on Cowichan fall Chinook but the LGS group incorporates other populations noted in Appendix 8,

b) describe the spatial units within the LGS group to be assessed under the Wild Salmon Policy, and

c) recommend benchmarks for status assessment of these units.

The latter two requirements would begin implementation of the Wild Salmon Policy in the assessment of this important group of Chinook populations. Advice from fishery

managers participating in the meeting noted that final consideration of this review could be deferred until this fall but emphasized the need for completion in the fall.

Subcommittee Recommendations

The Subcommittee recommends that revision of the paper specifically consider what other "wild" Chinook populations exist in the LGS stock group and whether Cowichan fall Chinook is an adequate indicator for this group. Within the Cowichan River, the revision should more fully assess the relative survival of hatchery and naturally-produced juveniles and if current information support density-dependent limits to production in freshwater and/or marine environments. Recommendations for management actions, depending on the final assessment results, should consider alternative sets of actions considered over all aspects of the assessment (hatchery production, habitat issues, fishery actions, and information needs). The development of a stock management model (a recommendation of the working paper) could aid managers in assessing alternative actions and risks but may not be developed and reviewed for the fall 2006. Some sub-committee participants strongly recommended consideration of habitat concerns within the Cowichan River as potential factors in the production of Cowichan Chinook and attention to this is recommended.

S2006-02: Status of Birkenhead River Chinook salmon (*Oncorhynchus tshawytscha*)

N.D. Schubert, J.R. Candy, R. Cook, J. Greenbank, D. Lofthouse, R. McNicol, C.K. Parken, D. Sneddon, J.A. Tadey, K. Wilson

'Accept the paper with minor revision'

Subcommittee Discussion

Two reviewers, both present at the meeting, provided detailed and comprehensive reviews of the document. One of the reviewers focused attention on the poor quality of the First Nations harvest data and the spawning escapement data and the need to improve the quality of these data. This reviewer agreed with the author's caveats to the assumptions they made in constructing a time series of spawner escapement and terminal fishery estimates, and noted that the uncertainty in the data required the use of the precautionary principle in planning of fisheries that could impact Birkenhead River chinook. The other reviewer focused attention on inferences that could be drawn concerning productivity of the Birkenhead River Chinook through reconstruction of brood returns from the annual terminal harvest and escapement data. The reviewer performed a stock-recruit analysis and concluded that, for the years of data available for the analysis, the population was likely below its productive capacity. This reviewer noted that the population had remained stable during a period when marine fishery impacts had declined, and recommended that the author's present hypotheses to explain this observation and to structure future work. Both reviewers highlighted the large uncertainty in the terminal harvest and escapement

data and the difficulty this created for the assessment of the status of the population; both recommended improved assessments. Both also commended the authors for their extensive efforts to assemble and organize all available information on Birkenhead River Chinook.

Several areas emerged as key focal points for the Subcommittee discussion. These were:

1. Little is known about juvenile rearing habitats and the factors that limit the population's freshwater productivity.
2. The current assessments of terminal (mainly First Nations) harvest and spawning escapement estimates are inadequate to allow a scientifically defensible characterization of population status; improvements are required.
3. The available escapement data, while of uncertain accuracy and precision, show a population that is stable but at an abundance that may threaten its future viability.
4. Tagging results and genetic assessments indicate that the population is genetically isolated and has attributes that made it distinctive. It represents a relatively unique and significant component of the genetic diversity of chinook in the Fraser River and BC.
5. The genetic assessment also indicated relatively low within-population allelic diversity and heterozygosity which raised concerns about the longer term viability of the population and its ability to adapt to changing environmental conditions.

Subcommittee Conclusions

The Subcommittee concluded that while the Birkenhead River Chinook population appears small though relatively stable, the low abundance and results of the genetic assessment are consistent with it being identified as a 'Population of Concern' (terminology analogous with COSEWIC).

Subcommittee Recommendations

The Subcommittee recommended acceptance of the paper after some minor revisions or updates to some sections and additionally made the following specific recommendations concerning Birkenhead River Chinook:

7. Biological evidence is sufficiently compelling of the relative uniqueness of the Birkenhead River Chinook population that these and certain other lower Fraser River spring populations (e.g., Upper Pitt River) warrant consideration as a conservation unit under the Wild Salmon Policy.
8. The process currently underway to acquire aboriginal traditional knowledge from Lil'wat Nation elders should be expanded to include the In-SHUCK-ch Nation.

9. A response team should be formed to develop population and habitat assessment frameworks that are consistent with the information requirements for conservation units under the Wild Salmon Policy (WSP) and incorporates recommendations 1-5 of the Working Paper.
10. The large uncertainty in the terminal return data and the lack of a confidence measure around annual escapement estimates necessitates that caution be used in actions that could impact the abundance or productivity of Birkenhead River Chinook.

S2006-03: Assessment of Chinook salmon returns to the Fraser River Watershed using run reconstruction techniques, 1982-04

K.K. English, R.E. Bailey, D. Robichaud

'Accept the paper with minor revision'

Subcommittee Discussion

Two reviews provided written comments on the working paper, with one review in particular providing explicit, detailed comments. Both reviewers were present at the meeting. Both reviewers had similar comments on this paper. No Request for Working Paper (RFWP) was provided, and the intended use of the run reconstruction data was not clearly conveyed. Both reviewers felt that the description of the model used for the run reconstruction was sketchy. They felt that even though a paper describing this approach in more detail had been cited, the algorithms used should be explicitly stated in this paper. Other common comments were as follows:

1) No attempts were made to incorporate uncertainty in parameter estimates into the model. As escapement formed the bulk of terminal returns, one reviewer pointed out that it would be particularly important to build in uncertainty into these estimates, and that variance estimates would be available for some individual stocks to allow this (e.g. where mark-recapture estimates were made). Other sources of uncertainty would include variation in residency time through fisheries, and river arrival times.
2) Missing escapement data for individual stocks were estimated using specified algorithms. However, no similar attempt was made to estimate catch in fisheries and years where fisheries were known to have occurred. The reviewers were also unsure what a blank catch cell meant versus one containing a zero value.
3) No sensitivity analyses were conducted to evaluate the effect of variation in estimates of catch, escapement, run-timing or fishery residency times.
4) Both reviewers noted that while the reconstructed data could have been used for trend analysis, no such analysis was attempted.
5) No conclusions or recommendations were provided in this paper.

Other noteworthy individual review comments were as follows:

1) No information was provided on model validation. The reviewer pointed out that there are several other run-reconstruction models available that might be applicable to these data, yet no evaluation of these other approaches relative to the one used in this paper is provided (model evaluation).
2) There appears to be some spreadsheet errors in the data presented for the lower Fraser fall stocks.
3) No attempt was made to assess the validity of the data generated by the model (model validation). However, when the reviewer compared reconstructed run sizes and harvest rates generated for the lower Fraser fall stock group to those generated annually by DFO from directly estimated data (considered accurate), harvest rates tended to be underestimated by as much as 95%, while run sizes could differ by as much as 220%.
4) The authors assumed that catchability was the same for each stock. The reviewer noted that because size at return will vary among stocks, that catchability may also be stock specific, depending on the gear used in a fishery. This could lead to errors in estimates of catch by stock and fishery.
5) One reviewer felt that incidental mortality should be taken into account when reconstructing run size. Sources of such mortality would include release mortality in CNR sport fisheries, seal predation and net drop-off, and in some fisheries, could be considerable.
6) Clarification was needed where the authors referred to 'total return to Canada'; adjustments would have to be made for stocks harvested prior to leaving Canadian waters as well as those which stocks largely do not leave Canadian waters before returning to spawn.

The Subcommittee noted that this run reconstruction approach had previously been used for Fraser Chinook stocks in 1994. However, this paper included fall stocks, which the previous run reconstruction did not. In addition, DNA stock composition data, not available for the previous model run, were used extensively for run timing estimation in this model run. The Subcommittee also noted that the RFWP for this paper was generated after the completion of the analysis.

Subcommittee Conclusions

There was considerable discussion around the purpose of this paper. The lead author maintained that the intent of this paper was as a source data document for First Nations (FN) Treaty negotiation purposes, and that documenting all sources of harvest for stocks subject to such negotiations was important for FN 'buy-in'. How these data are used will likely depend on the particular FN: those residing near the river mouth will be more concerned about ocean harvest of Fraser CN stocks, while those living further upstream will be more concerned about impacts of in-river fisheries downstream of their location. There was some question of whether the model presented should be expected to include the effects of uncertainty in parameter estimates, and include sensitivity analyses, or rather be considered one step in an iterative process of developing a robust run reconstruction model. The Subcommittee concluded that the latter was more appropriate, and that apart from

addressing questions raised concerning missing data, and possibly incorrect data, no further development work was required on the model presented at this time.

Subcommittee Recommendations

The Subcommittee made the following recommendations:

1) The paper should be accepted as a description of an approach for run reconstruction of Fraser Chinook stocks, pending the authors addressing the data errors identified by the reviewers and Subcommittee; specifically the inconsistency in data presented in various tables of the paper for Fraser fall stocks.
2) DFO staff will help address some of the data issues associated with missing catch information, stream arrival times and erroneous escapement and harvest information for Fraser late stocks.
3) The authors are instructed to provide a list of recommendations, which would include further development of the model presented, including sensitivity analyses and incorporation of uncertainty in parameter estimates, as well as identifying a need for full model documentation.
4) It is recommended that DFO be the official custodian of this model, and the agency responsible for its further development.

Additional Subcommittee Discussion

During review of these three working papers the Subcommittee identified three topics for Regional consideration:

1) Development of a stock assessment template consistent with information requirements under the Wild Salmon Policy and that provide the content necessary to provide advice on conservation units of concern to Regional managers.
2) Development of a Regional process for acquiring Aboriginal Traditional Knowledge (ATK) that would aid assessment of conservation units. At present, the acquisition of ATK may occur during the development of a specific assessment task (or for a COSEWIC review). While the potential value of ATK is frequently noted there is no proactive process to acquire this information.
3) Preparation of a working paper on the potential methods useful in determining benchmarks for Pacific salmon under the WSP. The information available for assessment of conservation units will be highly variable and the Subcommittee suggests that such technical advice could greatly assist the Subcommittee's review of future assessments.

APPENDIX 1: Working Paper Summaries

S2006-01:Working paper on the status of Lower Georgia Strait Chinook salmon (Oncorhynschus tshawytscha) stocks

D.A. Nagtegaal and K.L. Mathias

This paper provides an updated overview of the status of Lower Georgia Strait (LGS) fall Chinook stocks for which conservation concerns are most critical. Information presented includes a review of the fisheries, management and stock assessment frameworks, and a detailed stock status summary with an examination of trends in fishery exploitation, escapement, and enhancement data. Factors influencing stock status are explored including both freshwater and marine effects. Cowichan and Nanaimo River fall Chinook stocks are used to indicate trends in LGS natural fall Chinook stocks, and Big Qualicum (fall stock) and Puntledge (summer stock) River Chinook are used to indicate trends in LGS hatchery Chinook stocks.

As LGS Chinook are predominantly resident within Georgia Strait, they are both highly vulnerable and important to local fisheries. Throughout the early to mid 1970's, sport and commercial catch of Georgia Strait Chinook salmon steadily increased until late in the decade when total catch started to decline sharply. This decline has continued over the last 25 years despite a six-fold increase in the number of juvenile hatchery Chinook released into Georgia Strait. Over the same period, Georgia Strait Chinook also experienced an abrupt drop in marine survival which may be attributed to a decline in the carrying capacity of Georgia Strait for Chinook salmon (Beamish ***et al.*** 1995).

Currently there are serious conservation concerns for LGS stocks. With present marine survival rates estimated to be very poor (averaging 0.5% for 2000-2001 broods), and recent high fishery exploitation rates (averaging 74% over the last two (2000 and 2001) broodyears), present population sizes are not sustainable.

Recommendations made include: 1) reduce fishery exploitation rates on Cowichan Chinook, 2) maintain and improve the Cowichan fall Chinook stock assessment program, 3) improve monitoring of the recreational and First Nations fisheries, and 4) develop a LGS Chinook harvest management model.

S2006-02: Status or Birkenhead River Chinook salmon (*Oncorhynchus tshawytscha*)

N.D. Schubert, J.R. Candy, R. Cook, J. Greenbank, D. Lofthouse, R. McNicol, C.K. Parken, D. Sneddon, J.A. Tadey, K. Wilson

Birkenhead River Chinook (*Oncorhynchus tshawytscha*) is a Fraser spring run population that spawns in a tributary of the Harrison-Lillooet River system in southwestern BC. It is a genetically isolated population that possesses local adaptations (***e.g.,*** far north marine distribution and very early spawner migration) that are an important component of the evolutionary legacy of the species.

Population status is assessed by evaluating spawner abundance and trends relative to potential benchmarks, fishery harvest and potential limiting factors and threats. This required the reconstruction of escapement and terminal fishery catch estimates based on a reevaluation of historic data and the inclusion of recent data. The spawner population has been trendless over a thirty year period when both enhancement was attempted and conservation actions were applied to the fisheries. The spawner population averaged 480, with an effective population size of about 300; both are below literature estimates for viable, genetically isolated populations. Potential benchmarks are discussed, with the lowest ($\hat{S}_{msy}$ = 1,700) over triple current abundances, suggesting that considerable population growth is required.

Small populations are especially vulnerable to threats such as those posed by fishery exploitation, climate change and habitat alteration. The Birkenhead has been harvested at about 50%, with three fisheries predominant: Alaska troll and the First Nations fisheries in the lower Fraser and Lillooet System. The impacts of climate change are already apparent in freshwater and are expected to increase in future decades, while the threat from habitat alteration, geomorphic processes and rapid human population growth remain significant. A comprehensive recovery plan is required.

S2006-03: Assessment of Chinook salmon returns to the Fraser River Watershed using run reconstruction techniques, 1982-04
K.K. English, R. Bailey, D. Robichaud

The Fraser River watershed is the largest Canadian producer of Chinook salmon. In 2005, technical advisors to several Fraser River First Nations recommended that a run reconstruction analyses similar to that conducted in 1994 be conducted to provide estimates of the total return of Chinook to the Fraser River that could be used to define abundance based Treaty allocations. This document provides a description of data and model parameters used to reconstruct 1982-2004 Chinook salmon returns to the Fraser River. The fundamental building blocks for our run reconstruction analysis are DFO estimates for in-river harvests, tributary specific escapement numbers and timing, and upstream migration rates. Annual escapement estimates are derived from a combination of visual survey, mark-recapture studies and counting fences. Annual escapement summaries for each timing-age aggregate show increasing trend for most aggregates and the substantial difference in the abundance of fall Chinook relative to other aggregates. The only aggregate that has not shown a substantial increase in escapement since the late 1980's is the Spring 5.2 aggregate. On average, 38,700 Chinook are harvested in annual fisheries within the Fraser watershed. Catch estimates by aggregate indicate that harvest of spring and summer timing groups increased substantially since 1999. The largest annual harvest occurred in 2004 when over 63,000 chinook were harvested in river fisheries. The average total return of Chinook salmon to the Fraser River was 305,563 over the period from 1982-2004. The average contribution of timing-age aggregates were: 6% Spring 4.2, 16% Spring 5.2, 13% Summer 5.2, 16% Summer 4.1 and 50% Fall. The

trends in total return are very similar to those observed in the escapement data. The similarity between escapement and total returns for fall stocks is not surprising given that harvest rates are typically less than 5% for this run timing group. Fishery restrictions in the mid 1980's resulted in large reductions in harvest rates for the spring and summer timing groups. Since 1988, in-river harvest rates for summer runs have varied between 10% and 30% while the Spring 4.2 stocks tend to have the highest harvest rates (28-42%). Estimates for total mortality in Canadian marine fisheries were used to convert the river entry abundances into estimates of the Total Return to Canada for each timing-age aggregate.

APPENDIX 2: PSARC Salmon Subcommittee Meeting Agenda, May 17-18, 2006

PSARC Salmon Subcommittee Agenda
May 17-18, 2006
Seminar Room, Pacific Biological Station
Nanaimo BC

Wednesday, May 17

9:00	Introductions and Overview of the agenda
9:30	Review of Working Paper – *Lower Strait of Georgia Chinook*
11:00	Formulation of Subcommittee conclusions and recommendations
12:00	Lunch
1:00	Review of Working Paper – Status of *Birkenhead River Chinook Salmon*
3:00	Formulation of Subcommittee conclusions and recommendations
4:00	Adjournment

Thursday, May 18

9:30	Review of Working Paper – *Reconstruction of Fraser River Chinook Returns*
11:00	Formulation of subcommittee conclusions and recommendations
12:00	Adjournment

APPENDIX 3: List of Attendees and Reviewers

Subcommittee Chair: Brian Riddell
PSARC Chair: Al Cass

NAME	
EXTERNAL PARTICIPANTS	
Alexandersdottir, Mariana	Northwest Fisheries Commission
Argue, Sandy	BC Ministry of Food and Fisheries
Blackbourn, Dave	Consultant
Dan, Vanessa J.	Lil'wat Nation
English, Karl	LGL
Ernie, Jim	Lil'wat Nation
Greenbank, Jeff	
Harling, Wayne	Sport Fishing Advisory Board
Joseph-Bruce, Maxine	Lil'wat Nation
Kope, Robert	NOAA
Kristianson, Gerry	Sport Fishing Advisory Board
La Boucan, Guuduniia	Cowichan Tribes
LeBlond, Paul	PFRCC
Lee, Montgomery	
Rickard, Paul	Sport Fishing Advisory Board
Ryan, Teresa	
Sands, Norma-Jean	NOAA
Scarfo, Kathy	Area G, West Coast Troll Assoc.
Wells, Fred	Lil'wat Nation
Willett, Jim	
DFO MEMBERS	
Bailey, Richard	
Baillie, Steve	
Brown, Gayle	
Candy, John	
Carter, Ted	
Cass. Al (PSARC Chair)	
Chamberlain, Mike	
Cook, Roberta	
Curry, Gordon	
Hargreaves, Brent	
Hein, Kris	
Holtby, Blair	
Hop Wo, Leroy	
Ionson, Bert	
Irvine, Jim	
Kearey, Lee	
Kelly, Gerry	
Mathias, Karin	
McNicol, Rick	
Parken, Chuck	
Riddell, Brian (Subcommittee Chair)	
Samaha, Cindy	
Sawada, Joel	

NAME	
Schubert, Neil	
Shaw, Bill	
Singer, Kristin	
Sneddon, Debra	
Spencer, Kent	
Sullivan, Melanie	
Sweeting, Ruston	
Tadey, Joe	
Thomas, Greg	
Tompkins, Arlene	
Wood, Chris	

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.

Alexandersdottir, Mariana	Northwest Indian Fisheries Commission
Bailey, Richard	Fisheries and Oceans Canada
Kope, Richard	NOAA
Parken, Chuck	Fisheries and Oceans Canada
Sands, Norma-Jean	NOAA
Tompkins, Arlene	Fisheries and Oceans Canada