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## **Canadian Science Advisory Secretariat (CSAS)**

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#### **Pacific Region**

### **Proceedings of Pacific regional peer review of the Pre-COSEWIC assessment of Interior Fraser Coho Salmon**

**March 5, 2013  
Nanaimo, BC**

**Sean MacConnachie, Chairperson**

**Mary Thiess, Editor**

Fisheries and Oceans Canada  
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## **Foreword**

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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## **SUMMARY**

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meeting held on March 5, 2013 at the Pacific Biological Station in Nanaimo, B.C. A working paper providing an update and summary of DFO holdings of Interior Fraser coho salmon data relevant to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) criteria were presented for peer review.

Meeting participants were limited to in-person attendees only and included DFO Science and Fisheries and Aquatic Management staff and external participants from COSEWIC, the recreational fishing sector, and retired DFO researchers.

The results of this review will be provided in the form of a research document and proceedings which will be made publicly available on the [CSAS Science Advisory Schedule](#).

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## **Compte rendu de la réunion régionale d'examen par des pairs du Pacifique portant sur l'évaluation pré-COSEPAC du saumon coho du Fraser intérieur**

### **SOMMAIRE**

Le présent compte rendu résume l'essentiel des discussions et conclusions de la réunion régionale d'examen par des pairs de Pêches et Océans Canada (MPO) et du Secrétariat canadien de consultation scientifique (SCCS) qui a eu lieu le 5 mars 2013 à la station biologique du Pacifique de Nanaimo, en C.-B. Un document de travail dressant le portait complet des fonds de données du MPO sur le saumon coho du Fraser intérieur qui pourraient être utiles au Comité sur la situation des espèces en péril au Canada (COSEPAC) a été présenté aux fins d'examen par les pairs.

Au nombre des participants qui ont assisté à la réunion, qui n'était accessible qu'en personne, on compte des représentants de Gestion des pêches et de l'aquaculture (GPA) du MPO, du COSEPAC, du secteur de la pêche récréative ainsi que des chercheurs du MPO à la retraite.

Les résultats de cet examen prendront la forme d'un document de recherche et d'un compte rendu qui seront rendus publics sur le [Calendrier des avis scientifiques du SCCS](#).

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## INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) meeting was held on March 5, 2013 at the Pacific Biological Station in Nanaimo, BC to review updated information and analyses relevant to Interior Fraser coho salmon, in advance of a Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment (currently scheduled for autumn 2014).

The Terms of Reference (TOR) for the science review (Appendix C) were developed by DFO in accordance with established criteria set out by COSEWIC. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from DFO Science, Stock Assessment, Fisheries and Aquaculture Management and Ecosystem Management branches, COSEWIC, retired DFO researchers and the recreational fishing sector. In total, 19 people participated in the RPR (Appendix B).

The meeting Chair, Sean MacConnachie, welcomed participants, and initiated a round of introductions. The Chair then went over meeting logistics and reviewed the role of CSAS in the provision of peer-reviewed advice. The Chair stressed that this meeting is unique in that it is not intended to generate advice. It was also noted that management, economic and social decisions are not addressed through CSAS processes. The Chair discussed the role of participants, the purpose of the various regional peer review (RPR) publications that will result from this process (Research Document and Proceedings), and the definition and process around achieving consensus. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions. It was confirmed with participants that all had received copies of the Agenda, Terms of Reference, working paper and reviews. Mary Thiess was identified as the Rapporteur for the meeting. The Chair then reviewed the Agenda (Appendix A) and the Terms of Reference (Appendix C) for the meeting (noting that the Terms of Reference are a standard template provided by DFO). The Chair then reviewed the Species at Risk Act (SARA) process and how the pre-COSEWIC review fit into the overall objectives of SARA.

Clarification was sought on how the COSEWIC assessment stems from the pre-COSEWIC report. The Chair clarified that the pre-COSEWIC report is not meant to assess status or risk of extinction and highlighted that it is a DFO product, not a COSEWIC product. COSEWIC is free to use or not use any parts of the pre-COSEWIC report as they see fit when they conduct their assessment. The pre-COSEWIC report can also provide input to Wild Salmon Policy (WSP) status assessments.

Participants were informed that Mike Bradford and Tom G. Brown had been asked to provide detailed written reviews of the working paper to help guide discussions during the peer review meeting. Participants were provided with electronic copies of their written reviews in advance of the meeting.

The resulting Research Document and Proceedings will be made publicly available on the [CSAS Science Advisory Schedule](#).

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## REVIEW

Working Paper: Pre-COSEWIC Assessment of Interior Fraser coho salmon.  
Decker, S. and Irvine, J.R. CSAP Working Paper 2012/P22.  
Presenter: Scott Decker

## PRESENTATION OF WORKING PAPER

### *Background*

The presenter began by providing a review of previous assessments, management actions and designations of Interior Fraser coho (IFC) salmon. The first COSEWIC assessment was completed in 2002, resulting in an “endangered” designation. The Interior Fraser coho recovery team (IFCRT) was formed in 2003 and tasked with establishing a recovery plan. Between 2004 and 2006, IFC were proposed for SARA Schedule 1 listing, but cabinet rejected the listing based on socio-economic considerations.

### *Life History, Biology & Habitat*

Interior Fraser coho exhibit a dominant 3 year life history, with very few 4 year olds. They are also smaller and less fecund than other coho populations. IFC have specific habitat requirements (that are distinct from coastal populations). In particular, declining fall/winter hydrograph results in opportunistic selection of spawning sites, although spawning and juvenile rearing still takes place in specific habitats (groundwater fed and lake-headed streams). They also show little evidence of typical juvenile territorial behaviour and exhibit fairly large scale evidence of juvenile rearing in non-natal habitat.

### *Residence as defined by SARA*

IFC do have a residence, as defined by SARA. SARA guidelines recognize salmon spawning redds as residences because coho impart energy into a specific habitat location for a defined life history step (spawning).

### *Review of Designatable Units*

There is genetic evidence to support IFC as a designatable unit (DU) within the species: IFC have a unique Columbia River heritage and are an important component of the evolutionary legacy of the species. They are the most genetically distinct and least genetically diverse coho population examined to date (reproductively isolated by Fraser Canyon). Genetics show 1 metapopulation with five local populations identified to date (five conservation units in WSP terms). Eleven subpopulations have been identified by the IFCRT among the 5 local populations.

### *Data Sources, Methods & Results*

Aboriginal traditional knowledge (ATK) was not formally compiled and reviewed for this report on IFC. ATK has provided important guidance with respect to assessing distribution, and the development of past and present DFO and First Nations stock assessment programs.

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Escapement data available for IFC includes:

- North and South Thompson: 1975-2011
- Lower Thompson: 1984-2011
- Fraser Canyon and Upper/Middle Fraser River: 1998-2011

Since 1998 more surveys have been surveyed and more accurate estimates provided. The author reviewed the various escapement time series reconstruction methods that were used in prior assessments (COSEWIC 2002 and IFCRT 2006). In the current review, IFCRT estimates were used for the time period 1975-1997, infilling for missing years for 1998-2011 was based on observed ratios (similar to IFCRT 2006 methodology). Relatively little infilling was required. Infilled estimates accounted for 4% (on average) of total IFC escapement for 1998-2011.

Exploitation data analyzed includes pre-1998 mark-recapture data and post-1998 genetic stock identification and fishery encounter rate estimates scaled by historic coded wire tagged (CWT)-derived estimates. The CWT-derived estimates are fairly uncertain.

Smolt to adult survival estimates are represented by wild Strait of Georgia index populations. There are no consistent, reliable IFC-specific survival data. The author presented a figure showing the correlation between IFC exploitation rates and smolt-to-adult survival inferred from the wild Strait of Georgia coho time series. It shows smolt-to-adult survival dropping through the 1990s, then relatively stable at low levels since 2000 (with a temporary, small increase in 2001-2002). The exploitation time series shows a similar pattern, dropping to low level stability in 1998, which remained through 2011.

The author presented a figure illustrating the time series of total abundance, total escapement and total escapement including hatchery contributions (1975-2011). The time series shows a sharp decrease to low level stability in the mid-1990s.

#### *COSEWIC criteria for evaluating status*

The author reviewed the COSEWIC criteria for rate of decline (slope of regression of  $\ln(\text{esc})$ -year, over both the most recent 10 years and over the entire time series (based on results of Porszt et al. 2012); distribution (area of occupancy, extent of occurrence, number of locations and trends in each of these); absolute abundance (total escapement over the most recent 3-year generational mean)

The IFCRT's short-term recovery objective was to achieve 1,000 naturally spawning wild coho salmon (3-year geometric mean) in at least half of the subpopulations within each of the five local populations (i.e., within at least 7 subpopulations). This equates to total IFC escapements of 20,000-25,000 spawners annually. The intent of the IFCRT's objective was to ensure there are viable populations across the geographic range of the DU in order to protect the DU from regionally catastrophic events and to maintain genetic diversity in the long term. The author also discussed the possibility of using the IFCRT's short term objective as a benchmark in a WSP assessment.

#### *Rate of population change*

There was no trend in population change for the most recent 10 or 16 year periods, but an 80% decline when evaluated over the full time series (37 year period). Under the shorter time periods, COSEWIC listings would not be triggered (requires a 30% decline), but consideration over the full time series would trigger an endangered status assignment. The author also included a slide showing time trends in productivity (which is not explicitly considered by COSEWIC). Since the last assessment, productivity has

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been highly variable, and (in the absence of fishing) 4 out of the last 10 years have been at levels below replacement.

#### *Distribution*

Distribution of IFC is difficult to assess since not all drainages that likely contain coho are surveyed regularly and the time series is limited to 14 years (1998-2011). Extent of occurrence and area of occupancy were not quantified for IFC. As a proxy, the number of locations (streams) is commonly used to assess distribution status of Pacific salmon and is likely more useful as a metric for assessing IFC distribution. Coho were observed in an average of 68 streams across the DU during 1998-2011, and there was no time trend observed. The author also illustrated the proportion of streams surveyed with no coho observed decreased log-linearly as total estimated escapement fell below 30,000 spawners (The slide showed a modified version of the working paper Fig. 14.)

#### *Trend in distribution*

Percent stream occupancy declined as overall abundance declined from the 1980s through the 1990s. However, it is unclear whether current distribution is affected by the low abundance observed in the 1990s. Although not quantified, extent of occurrence and area of occupancy are expected to be large (coho were observed in greater than 50 locations every year from 1998-2011). There is also no strong evidence of extreme fluctuations or continuing decline in distribution.

#### *Absolute Abundance*

Recent escapement estimates exceed COSEWIC absolute abundance criteria, but it was noted that the criteria may not address concerns about individual populations within IFC. Total IFC escapement at levels greater than 20,000 spawners seems to translate into most subpopulations meeting the IFCRT short term recovery objective (based on 1975-2011 data). Total escapement (3-year running mean) was below the IFCRT's short term recovery objective 3 of the last 10 years and 7 of the last 20 years.

#### *Limiting Factors & Threats*

The author identified several threats to freshwater habitat: anthropogenic water use (valley-bottom areas converted to agriculture and residential use increasing to demand for surface and ground water), extent of human activity in watershed, and changes to the *Fisheries Act* that may affect habitat protection.

In estuarine and marine habitat areas, the author highlighted that coho are more reliant on nearshore marine habitat than other Pacific salmon. While understanding of seasonal use of estuaries and coastal marine habitat has improved in recent years, much remains unknown. Impacts to these habitats are difficult to quantify and represent a threat of unknown imminence and magnitude.

Climate Change was also identified as a threat since marine survival of salmon is correlated with climate-induced regime shifts and inter-annual variability in sea surface temperatures and ocean currents. Warmer water temperatures reduce usable habitat, carrying capacity and productivity in both freshwater and coastal marine environments. Human induced climate change is not reversible within a reasonable time frame.

Greatly reduced exploitation rates since 1998 have largely halted declines in abundance, despite continued low productivity. There is persistent pressure from various sectors to ease fisheries restrictions.

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The scale of coho hatchery production is modest and has declined in recent years. Hatchery origin fish contribute 7% to the total escapement for the most recent generation and an average of 13% across all years of enhancement (1986-2011). Large enhancement programs for coho and other species in other regions may pose a greater risk to IFC.

The author concluded with a brief summary of the data analyses and interpretations included in the working paper.

## QUESTIONS OF CLARIFICATION

(responses in *italics*)

A participant questioned the robustness of the scalers used to reconstruct the time series of escapement estimates, given that they were derived using a period of known low abundance. *The author clarified that this remains uncertain at this point. Additionally, he pointed out that infilling was only conducted for missing years in streams that otherwise had data and that the reconstructed time series was rigorously developed and has been used in a number of published CSAP reports.*

Clarification was sought on how to interpret the genetics dendrogram figure. *The author pointed out that the figure was intended to show the sharp separation between Lower Fraser and IFC populations.*

A participant questioned whether there had been any attempt to quantify the “fairly uncertain” exploitation estimates. *This issue was tabled for later discussion.*

A couple of COSEWIC-related clarifications were provided. *COSEWIC Criteria E would be used to capture the productivity time series information that does not fit into any of the previous COSEWIC criteria. COSEWIC has updated how it calculates the rate of population change. The method outlined here is the same method now used by COSEWIC.*

A participant commented that the 70% hatchery fish statistic is outdated. *The authors agreed to update with information from more recent Sweeting and Beamish work.*

## PRESENTATION OF WRITTEN REVIEWS

Reviewer comments have been grouped by general category from the working paper and may not reflect the order they were presented at the meeting or in their written version.

Mike Bradford

*Overview*

The full review is provided in Appendix D. The reviewer commended the authors for an excellent report and noted that it goes beyond the requirements of a pre-COSEWIC report. He also commented on how easy it can be to muddle WSP and COSEWIC requirements.

In terms of the overall focus of the paper, the reviewer suggested more emphasis on specifying what has changed since the last update, particularly with respect to habitat threats and changes to those threats.

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### *Conservation Unit vs. Designatable Unit*

The reviewer also pointed out some confusion between conservation units (CUs) and designatable units (DUs). Recent sockeye work focused on presenting results at the CU level. The original coho assessment was completed prior to the implementation of CUs, so was focused at a DU level. In the interim, five IFC CUs have been defined. In order to be consistent with current work, the results presented in this paper should be provided at the CU level. There is no requirement to stick with the population structure identified in the first two assessments. COSEWIC's definition identifies isolation and adaptive significance as criteria and CUs fit that definition. Participants recommended using Holtby and Ciruna (2007) as the starting point, and also ensuring consistent use of current WSP terminology: conservation units, populations and demes. It was suggested that the authors could include a table of equivalencies between original terms and current ones, to foster consistent use of terminology.

### *Distribution metrics*

Regarding the COSEWIC distribution metrics, someone will need to calculate extent of occupancy (EO) and area of occupancy (AO) at some point. The data exists to calculate EO, since you just need at least 3 UTM coordinates for spawning sites. Some difficulty will exist for single spawning site CUs. Existing software can do the calculations (M. Bradford can provide). COSEWIC only needs the coordinates and then has the capacity to make their own calculations, but it is a question of workload. EO is easier to calculate than AO, and should be completed for this paper, if time permits. There was discussion around whether stream lengths could be translated into AO, and how accessible habitat was differentiated from observed spawning habitat. It was specified that AO must look at the life stage of the animal when it is most constrained (so in the case of coho, AO should be limited to areas where spawning is observed). A watershed approach doesn't address the question sufficiently.

The review recommended that the authors sharpen their discussion on location. The reviewer pointed out that the definition of location used by COSEWIC involves a link to an identified threat (instead of considering streams in and of themselves as locations). This led to some discussion on how threats should be defined, and how to resolve the scale at which they operate (number of locations within a CU will vary depending on the scale of the threat being considered). The authors asserted they would like to retain the use of "stream" terminology, but will remove inappropriate references to location.

### *Population trend calculations*

The reviewer provided a technical comment relating to the use of statistics in the working paper. Complete censuses do not require statistics (the authors could provide confidence intervals around the slopes presented rather than p-values of statistical difference from zero).

There was some discussion around the calculations of rate of population change that were presented. Some participants thought that total escapement was the best estimate of the number of maturing individuals; while others felt total abundance should be reported. The final consensus was that both should be reported with explicit definition of each quantity and what it (does and does not) represent. It was felt the end result would not change as a result of this. It was pointed out that a ten-year period requires 11 data points. Participants felt it was important to clearly differentiate between a fisheries perspective and a SARA perspective with respect to this discussion.

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There was some discussion around whether the IFCRT objective was actually relevant to COSEWIC objectives. Depending on the approach taken by COSEWIC, it may or may not be. The author clarified that they will remove any suggestion of status rating from the working paper.

### *Threats*

The reviewer encourages the authors to address the fitness consequences of wild/hatchery interactions more fully. Participants questioned whether there was consensus in the scientific community about these potential impacts. A growing body of evidence exists, suggesting there is a 20% suppression of wild fitness per generation in the presence of enhancement, along with empirical evidence as well. The reviewer suggested that the authors simply identify this as a potential risk and provide relevant references.

Participants pointed out that the *Fisheries Act* is not a threat unto itself. The implementation of it might be, but in the absence of specific policy, no threat exists. Participants suggested that this reference be removed from the paper (though the author clarified that it was only in the presentation and not included in the working paper to begin with).

Tom G. Brown

### *Overview*

The full review is provided in Appendix D. The reviewer felt the working paper was well written, and that all the necessary basics were included. The reviewer did feel that the paper should provide more context in the introduction as to why it was being written and what it was intending to convey, particularly highlighting what was being provided as new information since the last report. It was also felt that the authors should stress the reasons or motivations for the original assessments as additional context for this update.

The reviewer provided additional background information about the original IFC assessment. The rationale for not listing IFC during the original process was not just socio-economic. DFO felt they could manage the stock on their own under the Fisheries Act. Now, based on the recent killer whale ruling and changes to the *Fisheries Act*, this ability may have changed.

The authors refer to “earlier periods”, “later periods” and “recent periods”. They need to define what years are included in each and ensure the terms are used consistently throughout the report.

### *Threats*

The reviewer noted that alien invasive species should be discussed as an additional threat, as well as possibly marine mammal predation (e.g., seals). There was further discussion on the use of location as per the first reviewer’s comments. The COSEWIC definition of location is threat-based, not spatially oriented so the number of locations will change depending on the nature of the threat (e.g., rail car derailment versus yellow perch invasion, and within the yellow perch invasion, whether it is a point source introduction or through natural range expansion.) There was discussion around the fact that COSEWIC also identifies threats based on their impact over a short period of time and invasive species may not operate on this time scale. Most threats are speculative and the COSEWIC criteria species the need to provide data in order to assign risk to a given threat. If there is existing knowledge surrounding a threat, it should be referenced

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in the report. The report should also capture the extent of impact of the threat if it was realized. Reference de Mestral Bezanson et al. (2012) for definition and interpretation of “location”.

#### *Habitat*

IFC have 3 habitats: spawning, summer and winter. The reviewer suggested that the authors should provide additional text around how coho use lakes (e.g., use confined to backwaters), and felt this aspect had been ignored in the working paper. Some numbers of IFC (an unknown proportion) overwinter in the Fraser Valley (a.k.a. Lower Fraser River) instead of remaining in their natal stream. This is a key variation in life strategy which is not accounted for through the mark-recapture program. It should be addressed in the paper as it is a factor that will likely need to be considered when developing recovery documents.

#### *Threats to Habitat*

The reviewer noted that the loss of coho habitat in the Fraser Valley is considerable and irreversible and that it simply will not be possible to return to historic levels of coho escapement due to extensive habitat loss. The authors should capture this in their report.

#### *Sources of data*

The reviewer questioned whether it is possible to get a good aerial count of spawning coho. He suggested it is relatively impossible given coho behaviour (i.e., hiding) and suggested that perhaps it would be more feasible to assess juveniles (due to their more aggressive behaviour). The author countered that aerial adult enumeration is possible in particular locations (e.g., areas of the river where there is no riparian cover, suitable water clarity, etc.).

The reviewer raised the question about what qualifies as “straying” in terms of genetic flow and noted there is both spatial and temporal view of genetic mixing that should be addressed in the paper. The level of genetic exchange at 20,000 to 25,000 total spawners (i.e., when the IFCRT short term recovery objective is realized is not a temporal or spatial bottleneck.

When discussing “fisheries”, the reviewer suggested the authors should indicate which fisheries are included in that discussion. CSAP representatives noted that the last full CSAP review of IFC data was done in 2004, then updated through Science Advisory Reports (SARs) in 2005, 2006, 2008, 2009, and 2012. The authors should check these reports and incorporate published data from them with references (or else document why they were not used). The SARs discuss sources of uncertainty which should also be included in this pre-COSEWIC report.

#### *Method*

The method to calculate rate of decline, (i.e., first year – last year) is not used anymore. The reviewer suggested that the authors should just present the updated approach (i.e., the regression of  $\log_e(\text{esc})$  versus year instead). The reviewer also recommended that all results should be stated (not just the number that decreased, etc.). The reviewer would like the authors to specify the differences between 0 escapements, “none observed” and “not inspected”.

The reviewer questioned whether the change in annual exploitation rates from 7% to 13% in recent years is significant and wondered about the reason for the increase. The reviewer also noted that the data source for the reported exploitation rates was not listed

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in the caption for Table 2 and it also does not appear to be data from the source specified in the text. Earlier years used coded-wire tags, then a short period of DNA information used, then the PSC coho technical committee FRAM was used (which may or may not be what's reported). The authors need to check these values and make sure changes in time series are noted and referenced. Note that DFO uses 2 exploitation rate models: one for marine fisheries and one for the Fraser River. The PSC has its own model as well. Each one has its own benefits and disadvantages. The authors need to identify their data sources as well as the uncertainty associated with that source. If the PSC Coho technical committee has updated its methods, the revised methods have not gone through CSAP review yet. It is also important to note that there is additional uncertainty in all of these models that cannot be quantified.

#### *Suggested Updates to Tables & Figures*

- Exploitation rates listed in Table 2 (last column) include a high degree of uncertainty. The authors should consider providing a measure of the degree of uncertainty.
- Table 3: Change to "Estimated rate of change" rather than "Decline", otherwise it is difficult to interpret positive and negative values (i.e., otherwise negative values indicate increase?)
- The authors should check for an updated genetics dendrogram (likely new data/information since 2001).
- Figure 11. The reviewer questioned what this means for the future of this document? Suggests excluding any references to metrics, benchmarks, and assessment of status.
- Figure 15. Can variability in productivity estimates be displayed in this figure? It may be useful for interpretation of changes in productivity.

## **GENERAL DISCUSSION**

The Chair opened the floor for general discussion and suggested that the group review each item of the terms of reference in relation to the working papers. He also re-iterated that this species was designated at risk previously time but ultimately was not listed under SARA.

### **1. Life History Characteristics**

Specific elements include: growth, mortality, recruitment, fecundity and generation time. There was discussion about how representative brood stock are of general populations with respect to growth, size, etc. It was determined that this information should be reported to the greatest extent possible. There was also discussion about the inclusion of jacks. The consensus was that they should be included with additional clarification in the text about the specific treatment of jacks in the data (relative contributions, etc.)

### **2. Review of Designatable Units**

There was general consensus that the report needed to standardize its terminology (population, subpopulation, census site, CU, DU) with WSP terms.

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3. Residence as defined by SARA

The report should specify that a salmon redd is a residence (with reference to the de Mestral Bezanson sockeye paper).

4. COSEWIC Criteria

A. Distribution: Area of Occupancy (AO)/Extent of Occurrence (EO)

The group discussed if data exists that could be used to calculate extent of occurrence (by drawing polygons around UTM coordinates of spawning sites). Accessible/useable stream lengths were reported in 2002. The group discussed if that can be used to measure of Area of Occupancy or if it should focus more specifically on spawning area.

To calculate EO, polygons can be drawn around all spawning known spawning sites (de Mestral Bezanson et al 2012) used this approach for sockeye because it was the most constrained area in the sockeye life history), but this does not provide a trend over time. For coho, it might be more relevant to use summer or winter habitat (i.e., where coho are most constrained). The key question is, does the data exist? If “yes”, then EO should be calculated, and the data should be made available to COSEWIC.

It was noted that data quality varies by life stage, but this should be an achievable exercise on the adult spawner distribution. It was also noted that the critical threshold is 20,000 km<sup>2</sup>, so the authors should not spend too much time on CUs where EO will greatly exceed this value. The authors do need to describe what data is available and the uncertainties associated with it.

Conversely, to calculate the COSEWIC definition of AO, analysts must overlay a 2km grid and calculate squares that contain the geo-referenced points. It was proposed that the grid could be overlayed on an estimate of usable stream lengths instead. This was determined to be not particularly informative. The authors noted that full systems are not assessed, so calculations would lead to underestimation of AO. It was determined that there is insufficient data to calculate AO at this time. (Authors should ensure this is clarified in the report.)

It was questioned how often change in AO or EO is a key factor in COSEWIC assessments. The response was that AO/EO are used with some regularity, but often only in cases where abundance data are missing (so less likely to play an important role in this case).

There was concern about the figure expressing the proportion of streams with zero escapements. Based on the assessment methods used, escapement estimates reported as zeros are likely not true zeros. It was recommended that the authors ensure text clarifies that true zeros are difficult to establish. Change y-axis label to “Number of streams with no spawners observed/detected”

Even though the quality of data improved substantially since 1998, it still varies considerably among CUs through to the present time. The authors were cautioned to be very specific about identifying uncertainties, limitations, and variation among CUs. Observer efficiency is a key uncertainty.

There was additional discussion about the data contained in Table 2. The authors should include more description in the text sections on how data from Table 2 were treated. Exploitation rate methods and references need to be added, including more clarity on sources of data and variation among sources over time. Sources of

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uncertainty in exploitation rates that have been identified in previous CSAP documents should be included in the text. The authors should log transform the data then calculate 3 year running averages, with references to Grant et al. (2011) and Holt et al. (2009). They could also calculate Bayesian regressions on transformed data. If authors decide to proceed with Bayesian analysis, participants with previous experience (i.e., Sue Grant) would be called on to review the analysis and results to ensure the method has been applied appropriately. COSEWIC would need to obtain relevant data, and methods in order to replicate results.

The very small escapement value in Fraser Canyon CU in 2006 was noted. The authors should add a footnote to identify this and explain reasons why it is so much smaller than all other available years for this CU.

#### 5. Abundance/Trends in Abundance

Any comments or statements about assessments of status will be removed from the revised report (assessing status is beyond the scope of this report). For example, parts of the Distribution section and figure 12 will need to be removed. The authors were cautioned not to use the terms “benchmark” or “reference point” except in the strict WSP context (which is also beyond the scope of this document). The terms could be clearly defined and discussed generally, but not in a specific assessment framework. IFCRT terminology used “critical level” and “short term recovery objective”, which may be acceptable. It was recommended that figure 12 be excluded. This report should still incorporate the work of the IFCRT and reference the terms used by the IFCRT, but with updates and links to current WSP terminology.

It was recommended that all measures of abundance be converted to log space in order to be consistent with similar (sockeye) work. Furthermore, figures 3, 4 and 5 should also be converted to log space. There was some debate over the need to display all abundance time series in log space, though there was no question it is appropriate for analysis.

The report also references Porszt et al.’s work but has misinterpreted their conclusions. Their work showed a range of trends in abundance metrics, from short term trends to long term trends. Performance differences observed among the metrics were a continuum of results, no one metric could be interpreted as strictly “better” than the others. Correct report to reference Porszt et al.’s work accurately.

#### 6. Habitat and Threats to Habitat

Although the report provides some qualitative assessment of threat risks, it should try to quantify threats in relation to some measure of abundance. That being said, a formal risk assessment framework is not within the scope of this paper. For example, are there ways in which coho are more susceptible to climate change than other species? This should be documented (with supporting data if possible). How will various threats affect coho uniquely? Due to their complex life history, coho will be susceptible to impacts at all life history stages in different ways. The authors should consider the impact of one-time events as well as longer term changes. It is important to note that coho buffer themselves by doing everything, everywhere.

In the section that details freshwater habitat threats, the authors need to be more specific why it has been identified as “low to high severity”. The text should clarify that some areas of the watershed are pristine, while others are not. Need to be as

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specific as possible. Simplify by making a simple statement, and provide as many key literature references as possible.

## 7. Threats & Limiting Factors

The authors identified five or six categories of threat. Meeting participants noted additional categories of threat that could be added: disease, marine mammal predation, competition, alien invasive species (reference Mathias Herborg's work). The authors will need to include data sources and/or references for each additional category, and also address whether anything has changed substantially since last assessment.

Meeting participants noted that additional data may be available in FISS and the authors should include references to these reports. This section was written at the DU level, but should include CU-specific information if it exists. Examples given include: a rockslide in the Nahatlatch drainage that created a barrier (unknown year); the possibility of twinned oil pipelines bisecting some CUs; and a possible increase in Mountain Pine Beetle impacts in some CUs, such as additional forest cutting.

Impact of hatcheries: Salmon Enhancement Program (SEP) production is half now what it was 10 years ago (in the Strait of Georgia). There is more of a risk-based approach used now. The authors should consider providing summaries of percent enhanced contributions by year.

Harvest section: This section notably strayed into management recommendations. The authors should remove the bracketed info. The report should indicate that there is an upcoming assessment of mark selective fisheries later in 2013.

## 8. Other/Anything Else:

It was noted that the ATK section does not fully address the work that has taken place in this regard. The ATK section should recognize how ATK/LEK has shaped the current assessment framework over time. This (generally anecdotal) information is not easily referenced, but should be acknowledged as it has been influential over time.

The report documents that one third to one half of the IFC population overwinters in the Fraser Valley. The actual figure is that of the fish assess in the Fraser Valley, one third of them were from IFR. This phenomenon could be similar to non-natal rearing fish from Thompson River. It is a life history variant that provides an unknown contribution to productivity.

The authors were cautioned in their use of "regime shifts" and "climate change". These are loaded terms.

## CONCLUSIONS

The peer review participants agreed that the working paper should be accepted with minor revisions as noted in the proceedings and summarized under Recommendations.

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## RECOMMENDATIONS

The following list provides a summary of the key revisions recommended throughout the course of the review.

- Provide all results at the CU level rather than the DU level.
- Table 2 is of primary concern to COSEWIC, so must ensure that the data contained in it are verified and referenced.
- Check source of exploitation rate data (reference in Table caption) and include additional text around uncertainties associated with data source.
- A CSAP report exists for IFC data from 2004, as well as SARs from 2005, 2006, 2008, 2009, and 2012. The authors should check these reports and incorporate published data from them with references (or else document why they were not used).
- The SARs also discuss sources of uncertainty which should be summarized in this report.
- The very small escapement value in Fraser Canyon CU in 2006 was noted. The authors should add a footnote to identify this and explain reasons why it is so much smaller than all other available years for this CU.
- Exploitation rates listed in Table 2 (last column) include a high degree of uncertainty. The authors should consider providing a measure of the degree of uncertainty.
- Table 3: Change to “Estimated rate of change” rather than “Decline”, otherwise it is difficult to interpret positive and negative values (i.e., otherwise negative values indicate increase?)
- The authors should check for an updated genetics dendrogram (likely new data/information since 2001).
- Figure 11. The reviewer questioned what this means for the future of this document? Suggests excluding any references to metrics, benchmarks, and assessment of status.
- Figure 14. Change y-axis label to “No. of streams with no spawners observed/detected”.
- Figure 15. Can variability in productivity estimates be displayed in this figure? It may be useful for interpretation of changes in productivity.
- A small editorial committee including Sue Grant (trends in abundance), Cheryl Lynch (enhancement) and the reviewers should review the sections of the revised document relevant to their expertise prior to submission.
- Abundance/Trends in Abundance: Correct report to reference Porszt et al.’s work accurately regarding short term versus long term trend metrics.

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## ACKNOWLEDGEMENTS

The chair of the meeting would like to thank the authors for their hard work, the reviewers for their constructive comments, and the participants for their active engagement in the review process. Thank you to the CSAS office for help in coordinating the meeting. Finally heartfelt thanks to Mary Thiess for excellent rapporteuring.

## REFERENCES

- de Mestral Bezanson, L., Bradford, M.J., Casley, S., Benner, K., Pankratz, T., Porter, M. 2012. Evaluation of Fraser River Sockeye salmon (*Oncorhynchus nerka*) spawning distribution following COSEWIC and IUCN Redlist guidelines. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/064. v + 103 p
- Grant, S.C.H., MacDonald, B.L., Cone, T.E., Holt, C.A., Cass, A., Porszt, E.J., Hume, J.M.B., Pon, L.B. 2011. Evaluation of Uncertainty in Fraser Sockeye (*Oncorhynchus nerka*) Wild Salmon Policy Status using Abundance and Trends in Abundance Metrics. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/087. viii + 183 p.
- Holt, C., Cass, A., Holtby, B., and Riddell, B. 2009. Indicators of status and benchmarks for conservation units in Canada's Wild Salmon Policy. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/058. viii + 74 p.
- Holtby, L.B. and Ciruna, K.A. 2007. Conservation units for Pacific salmon under the wild salmon policy. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/070.

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## APPENDIX A: AGENDA

### Regional Advisory Process

Centre for Science Advice Pacific

## AGENDA

### Pre-COSEWIC Assessment for Interior Fraser Coho

March 5, 2013

PBS Seminar Room, Taylor Building Rooms 227A&B

Pacific Biological Station, 3190 Hammond Bay Rd., Nanaimo

Chairperson: Sean MacConnachie

Decker, S, and Irvine, J. 2013. Pre-COSEWIC Assessment of Interior Fraser Coho salmon. CSAP Working Paper 2013/PXX

<b>Time</b>	<b>Topic</b>	<b>Presenter</b>
9:00	Introductions	Sean MacConnachie
	Review Agenda & Housekeeping	Sean MacConnachie
	CSAS Overview & Procedures	Sean MacConnachie
	Review of Terms of Reference as pertains to research document	Sean MacConnachie & RAP Participants
9:30	Presentation of Working Paper	Authors
<b>10:30</b>	<b>Break</b>	
10:50	Questions of Clarification	RAP Participants
11:00	Presentation of Reviews & Authors' Responses	Reviewers & Author(s)
<b>12:00</b>	<b>Lunch Break</b>	
1:00	Discussion and Building Agreement on Conclusions, Recommendations, Advice and Future Work	RAP Participants
<b>4:00</b>	<b>Adjournment</b>	

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## APPENDIX B: ATTENDEES

Centre for Science Advice Pacific

Regional Advisory Process Participation Plan

Meeting Title: **Pre-COSEWIC Interior Fraser Coho**

Last Name	First Name	Affiliation	Attend Mar. 4
Bradford	Mike	Science SAFE	Y
Brown	Tom G	Science SAFE	Y
Decker	Scott	SA Fraser-BCI	Y
Druce	Courtney	SARA -RHQ	Y
Grant	Sue	SA Fraser-BCI	Y
Hargreaves	Marilyn	Science CSAP	Y
Irvine	James	Science SAFE	Y
Lynch	Cheryl	Science	Y
MacConnachie	Sean	Science MEAD	Y
Patten	Bruce	Science SAFE SA	Y
Saunders	Mark	Science SAFE	Y
Sawada	Joel	Science SAFE SA	Y
Thiess	Mary	Science SAFE	Y
Tompkins	Arlene	Science SAFE SA	Y
Whitehouse	Timber	SA Fraser-BCI	Y

External			
Aikenhead	Scott		Y
Blackborn	David		Y
Gale	Rupert	Sports Fish Advisory Board	Y
Simpson	Kent		Y
Sinclair	Alan	COSEWIC species sub-group co-chair	Y

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## APPENDIX C: TERMS OF REFERENCE

### Pre-COSEWIC Assessment For Interior Fraser Coho Salmon

Regional Peer Review – Pacific Region

March 5, 2013

Nanaimo, BC

Chairperson: S. MacConnachie

#### Context

The implementation of the federal *Species at Risk Act* (SARA), proclaimed in June 2003, begins with an assessment of a species' risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC is a non-government scientific advisory body that has been established under Section 14(1) of SARA to perform species assessments, which provide the scientific foundation for listing species under SARA. Therefore, an assessment initiates the regulatory process whereby the competent Minister must decide whether to accept COSEWIC's assessment and add a species to Schedule 1 of SARA, which would result in legal protection for the species under the Act. If the species is already on Schedule 1 of SARA, the Minister may decide to keep the species on the list, reclassify it as per the COSEWIC assessment, or to remove it from the list (Section 27 of SARA).

Interior Fraser Coho is currently being assessed by COSEWIC. Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species and some freshwater species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken.

Pre-COSEWIC reviews normally try to provide information for the categories: 1) Life history characteristics; 2) Review of designatable units; 3) Review the COSEWIC criteria (COSEWIC, 2010); 4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat; 5) Describe, to the extent possible, whether the species has a residence as defined by SARA, 6) Threats; and, 7) Other.

Results of this Regional Advisory Process (RAP) will be made available to COSEWIC, the author(s) of the species status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee.

#### Objectives

The overall objective is to review available DFO information relevant to the COSEWIC criterion to assess a species risk of becoming extirpated, endangered or threatened.

One working paper will be developed to address the following specific items:

##### 1) Life history characteristics

- Growth parameters: age and/or length at maturity, maximum age and/or length
- Total and natural mortality rates and recruitment rates (if data are available)
- Fecundity
- Generation time
- Early life history patterns
- Specialised niche or habitat requirements

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## 2) Review of designatable units

Available information on population differentiation, which could support a COSEWIC decision of which populations below the species' level would be suitable for assessment and designation, will be reviewed. Information on morphology, meristics, genetics and distribution will be considered and discussed.

See COSEWIC 2008 "Guidelines for recognizing Designatable Units below the Species Level" at: [http://www.cosewic.gc.ca/eng/sct0/assessment\\_process\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm)

**Review the COSEWIC criteria** for the species in Canada as a whole, and for each designatable units identified (if any) at:  
[http://www.cosewic.gc.ca/eng/sct0/assessment\\_process\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm)

## 3) COSEWIC Criterion – Declining Total Population

- a. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations (taken as mean age of parents). Additionally, present data on a scale appropriate to the data to clarify the rate of decline.
- b. Identify threats to abundance— where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity.
- c. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and the likely time scales for reversibility.

**COSEWIC Criterion – Small Distribution and Decline or Fluctuation:** for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

- a. Summarise the current extent of occurrence (in km<sup>2</sup>) in Canadian waters
- b. Summarise the current area of occupancy (in km<sup>2</sup>) in Canadian waters
- c. Summarise changes in extent of occurrence and area of occupancy over as long a time as possible, and in particular, over the past three generations.
- d. Summarise any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.
- e. Summarise the proportion of the population that resides in Canadian waters, migration patterns (if any), and known breeding areas.

**COSEWIC Criterion – Small Total Population Size and Decline and Very Small and Restricted:** for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

- a. Tabulate the best scientific estimates of the number of mature individuals;
- b. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.

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Summarise the options for combining indicators to provide an assessment of status, and the caveats and uncertainties associated with each option.

For transboundary stocks, summarise the status of the population(s) outside of Canadian waters. State whether rescue from outside populations is likely.

#### **4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat**

Habitat is defined as “in respect of aquatic species, spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced”.

The phrasing of the following guidelines would be adapted to each specific species and some could be dropped on a case-by-case basis if considered *biologically* irrelevant. However, these questions should be posed even in cases when relatively little information is expected to be available, to ensure that every effort is made to consolidate whatever knowledge and information does exist on an aquatic species’ habitat requirements, and made available to COSEWIC.

- a. Describe the functional properties that a species’ aquatic habitat must have to allow successful completion of all life history stages.  
In the best cases, the functional properties will include both features of the habitat occupied by the species and the mechanisms by which those habitat features play a role in the survivorship or fecundity of the species. However, in many cases the functional properties cannot be described beyond reporting patterns of distribution observed (or expected) in data sources, and general types of habitat feature known to be present in the area(s) of occurrence and suspected to have functional properties. Information will rarely be equally available for all life history stages of an aquatic species, and even distributional information may be missing for some stages. Science advice needs to be carefully worded in this regard to clearly communicate uncertainties and knowledge gaps.
- b. Provide information on the spatial extent of the areas that are likely to have functional properties. Where geo-referenced data on habitat features are readily available, these data could be used to map and roughly quantify the locations and extent of the species’ habitat. Generally however, it should be sufficient to provide narrative information on what is known of the extent of occurrence of the types of habitats identified. Many information sources, including Aboriginal Traditional Knowledge (ATK) and experiential knowledge, may contribute to these efforts.
- c. Identify the activities most likely to threaten the functional properties, and provide information on the extent and consequences of those activities.  
COSEWIC’s operational guidelines require consideration of both the imminence of each identified threat, and the strength of evidence that the threat actually does cause harm to the species or its habitat. The information and advice from the Pre-COSEWIC review should provide whatever information is available on both of those points. In addition, the information and advice should include at least a narrative discussion of the magnitude of impact caused by each identified threat when it does occur.
- d. Recommend research or analysis activities that are necessary. Usually the work on the other Guidelines will identify many knowledge gaps. Recommendations made and enacted at this stage in the overall process could result in much more information being available should a Recovery Potential Assessment be required for the species.

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## **5) Describe to the extent possible whether the species has a residence as defined by SARA**

SARAs. 2(1) defines Residence as “a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating.”

## **6) Threats**

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur. Guidance is provided in: Environment Canada, 2007. Draft Guidelines on Identifying and Mitigating Threats to Species at Risk. *Species at Risk Act* Implementation Guidance.

List and describe threats to the species considering:

- Threats need to pose serious or irreversible damage to the species. It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
- Naturally limiting factors, such as aging, disease and/or predation that limit the distribution and/or abundance of a species are not normally considered threats unless they are altered by human activity or may pose a threat to a critically small or isolated population.
- Distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains), which are caused by general activities.
- The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation.

## **7) Other**

Finally, as time allows, review status and trends in other indicators that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWIC Status Reports.

## **Expected Publications**

- Proceedings
- Research Document

## **Participation**

Participation is expected from:

- DFO Sectors (Science, Oceans, Habitat and Species at Risk)
- Aboriginal Communities
- Province of British Columbia
- Academia

- 
- Industry
  - Non-government Organizations
  - Other Stakeholders
  - COSEWIC status report author
  - Members of COSEWIC (Co-Chairs and/or SSC experts)

## **References**

COSEWIC. 2010. COSEWIC's Assessment Process and Criteria.  
[http://www.cosewic.gc.ca/eng/sct0/assessment\\_process\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm)

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## APPENDIX D: WRITTEN REVIEWS

### REVIEW 1: MIKE BRADFORD

**Reviewer comments on Decker and Irvine, Pre-COSEWIC assessment of Interior Fraser Coho salmon.**

**Mike Bradford**  
**Feb 28 2013**

This is an excellent document. It is generally well written, and provides a valuable update on the status of IF coho. It is encouraging that the analysis, metrics and benchmarks established in the late 1990s and early 2000s appear to be robust and remain useful.

It is unclear what level of resolution COSEWIC may choose for its assessment. DFO has suggested that WSP CUs are useful analog for DUs and our advice on Fraser Sockeye was provided at the CU level. The IUCN sockeye review was conducted at a level similar to WSP CUs. Decker and Irvine note that the WSP CUs for IF Coho are very close to the “populations” identified by the recovery team. In the paper some information is provided at the CU level, while other is at the DU level.

In my opinion the most useful approach, to the extent possible, is to conduct the analysis and tabularize the results at the CU (population) level (consistent with a WSP assessment), along with a DU roll-up. I suggest heeding the requirements of the quantitative assessment criteria and match, to the extent possible, the available information to what is required to fill in the COSEWIC assessment table (for each CU). This will minimize possible misinterpretation of the data if an outside contractor ends up conducting these analyses themselves.

#### **Specific comments:**

Line 565: Residence. There is specific guidance on the definition of residence in DFO (2010) and the authors should consult that document. Specifically it notes that Redds can be identified as residences, but it is less clear that general rearing habitat would qualify (in either freshwater or marine environments).

Line 905 trends: Can these be conducted for the 5 CUs?

Line 906: Trends—I don’t think that hypothesis tests and P-values are useful for the trend analysis—these are not random samples drawn from a larger population that we are attempting to make inferences about. Confidence intervals for the slope could be a reasonable approximation of the uncertainty surrounding the trend estimate (in lieu of other analysis frameworks).

Line 933. I am not sure that this document should perform the COSEWIC assessments as there are many factors that go into the analysis, including the spatial scale of assessment. For example, there is reference to COSEWIC criteria being applied to individual demes (lines 943+) which is clearly not the practise of COSEWIC (to assess subpopulations individually).

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Line 1003: How comfortable are we in assuming that coho were under high rates of exploitation in the “early 1900s” given the nature of the commercial fishery at that time? Certainly was true later in the 1900s.

Line 1022: Overfishing is an ambiguous term—prefer: fishing at a rate that prevented replacement or something more elegant.

Line 1055: You may wish to refer to Bradford and Wood (2004) for a more detailed description of the recovery goals.

Line 1134: Populations in the Amber zone can also sustain fisheries, but not at optimal (for that population) levels.

Line 1171: Perhaps more appropriate to suggest that the genetic diversity may be at increased risk. Its difficult to be certain about genetic effects.

Line 1236: This section falls short of the requirements of COSEWIC needs for distributional data. The EO should be calculated for each CU and the total aggregate. The AO calculation methods have been well specified by COSEWIC but considerable effort identifying spawning locations will be needed to develop estimates. The number of “locations” is less difficult to estimate and should be tabulated. See de Mestral Bezanson et al. 2012 for criteria used to define location for Fraser sockeye.

Line 1257. EO and AO calculations are required by COSEWIC – only for salmon populations under review will this work be done, to suggest it was not done for the majority of populations is irrelevant, the majority are not being assessed by COSEWIC.

Line 1320. This work is interesting but COSEWIC has specific requirements for their tables—the number of locations, and trends in locations is needed. I suggest developing defensible definition for location, and providing counts of locations for each CU by decade or similar time interval so the assessor can detect trends.

Line 1342: Is this assessment of a “greater diversity of habitats” or a greater number of habitats? (see also 1579). COSEWIC is interested in a trend in the number of locations as it related to the spreading of risk—it seems that the data suggest that has abundance has fallen from the 1980s to present the number of locations has as well. Perhaps not critically but it seems the trend exists.

Line 1396: I am not 100% sure, but I think there’s been enough sampling in the Fraser Estuary in the 1970s and 1980s to make some statements about the passage of coho smolts.

Line 1397. The cited paper says little specifically about survival through the estuary. Sample sizes are very small, and the recent work on Chilko sockeye (Hinch et al) suggest that there is a large initial mortality soon after release of acoustically tagged smolts that may be a handling issue. Chilko smolt survival through the Fraser mainstem and estuary was very high. The coho study was unable to separate the initial mortality from the later, downriver mortality. Certainly there is potential for sub-lethal stress from the various sources of pollution etc. in the lower river, but I don’t think anyone can relate this to survival. The other issue is whether these things have become noticeably worse in the period of rapid decline.

Line 1527. Probably should be re written: The Federal *Fisheries Act*, and in particular the Fisheries Protection Provisions have the goal of maintaining the productivity of salmon populations and their habitats. (the 1986 policy will be replaced shortly). The *Act* is not “DFO’s”

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Cited references.

Bradford, M.J. and C.C. Wood. A review of the biological principles and methods involved in setting minimum population sizes and recovery objectives for the September 2004 drafts on the Cultus and Sakinaw Lake sockeye salmon and Interior Fraser coho salmon recovery plans. CSAS Res Doc. 2004/128.

DFO. 2010. Guidelines for terms and concepts used in the species at risk program. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/065.

**REVIEW 2: TOM G. BROWN**

Centre for Science Advice Pacific  
Regional Advisory Process

March, 2013

Written Review

Date: Feb26/13

Reviewer: Tom G. Brown DFO – Conservation Group

Working Paper: Pre-COSEWIC Assessment of Interior Fraser Coho Salmon by Decker and Irvine Feb/13

1. What is a pre-COSEWIC? – for Interior Coho – most important: first outline why it was assessed (endangered), second what new information, reports, and data points are now available since last time assessment. Reason for paper was never clearly given. Thank you for removing your opinion of what the assessment should be from the abstract of an earlier draft. But still feel that you are making an argument for a given assessment throughout, not sure if this should be done in a pre-COSEWIC.
2. Rational for not listing; not simply socio-economic cost. DFO indicated it could manage and recover just as well as through legal protection; main tool to be used was the Fisheries Act. This concept has changed during the last 5 years. DFO can't simply say that the species is protected under the Fisheries Act (Killer Whale ruling) and habitat provisions under the Fisheries Act have changed and now provide little to no habitat protection
3. In my view the Number 2 threat (after fishing) is invasive species, since the alteration of the fishing threat, may be the most relevant threat and lots of info has come out in the last 10 years for B.C (i.e. yellow perch in the Shuswap, bass in the Beaver Creek-Quesnel River, all kinds in the Lower Fraser). No indication of this threat in paper.
4. Reason for assessment as endangered is not clearly outlined in background. Lines 253-258. In Rationale section (page 3) In the Get rid of or move all most all of the prehistory stuff (i.e. ice age stuff, genetic uniqueness, national significance, population structure etc are not a basis for assessment) Give exact criteria from the COSEWIC guidelines, and then indicate where the COSEWIC assessment fell last time.
5. Line 468 – Not sure if a pre-COSEWIC should make recommendations concerning DU's but this sentence is important in regards to genetic fragmentation.

- 
6. How many locations exist for interior coho? I don't think it changes much and it is ok to talk about populations and sub-populations but COSEWIC might want to know how many locations (For the most part, I think this would be individual streams, however). Line 1266+ not true – locations are not a metric of distribution but are an indication of threat. You must have 6 or more locations to prevent extinction from a threat. Don't confuse locations with sites (line 1278)
  7. Line 817+ where are the smolt counts for smolt-adult survival made, from hatcheries, in the interior, prior to passage down the Fraser? Are the interior coho that rear in the Fraser River floodplain counted? Are these items different than measuring exploitation rates of hatchery reared fish CWT-ed released in spring? Thus, you have two different life strategies of wild coho and are measuring only one with CWT hatchery fish. Again-- Line 1525 – how can you measure smolt-adult survival using only 1 of 2 life strategies?
  8. Line 527 – Coho use of lake littoral zones – its more restrictive than that – are not found on exposed beaches but use backwaters and alcoves along lake edges as lake levels rise, tend to occur near natal streams, are strongly nocturnal as fry and juveniles.
  9. Comment -- Implications of Sumas Lake drainage for interior coho trying to rear in the lower Fraser floodplain. Since 1930's may have lost the habitat capacity to ever rebuilt interior coho to historic levels. Lines 534+. Fortunately escapement counts don't start until 1975. I think I need a better reference than data on file -- line 539.
  10. Nice definition of ATK – but what ATK info have you got? Are there native coho fisheries in the interior?
  11. Line 635 – Can you get an aerial count of spawning coho?
  12. What is the area of occupancy? I think you sneak this in Line 1086 but not sure? What is the Area of Occupancy for the interior Coho – Lines 1236+ I have always felt that this is not relevant for all except the most restricted species? However you are making the claim that it is greater than 20,000 so what is it; I would like some kind of wild number.
  13. Good outline of rates of decline (74% since 1975) (5 generations 40%) (3 generations 6-20% decline) (COSEWIC 3 generations is 42% increase) Why the two extremes?
  14. Line 943+ if 9 of 26 streams examined individually had a decline of >30%, than 17 streams did not. So what did the 17 do stable/increase? This is why COSEWIC looks at the total DU. This is an issue if there is little fish movement (fragmentation).
  15. Not sure how to interpret lines 1021-1029. I think this means that 1/3 brood years has a decline but 2/3 have an increase or stable? Are you implying that the conservation measures have not worked?
  16. Line 1059+ you indicated earlier that there was a degree of genetic flow between populations. Thus a benchmark of 1000/subpopulation, is it based on no flow or does it consider a degree of genetic flow. I am not sure of what geographic range has to do with it and does it consider gene flow between brood lines? Does it consider flow from jacks and mini-jacks? I have sent you a couple of papers that might help or not.

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17. Line 1079 where does 7000 spawners come from?
  18. Line 1178 – Coho exist in the Arctic (rare so doesn't really count).
  19. Comment - Coho habitat 3 distinct freshwater types (spawning, summer rearing and winter rearing) all are very different. Most important winter habitat may be in the lower Fraser, not sure if this is in abundance anymore?
  20. Care in interpretation (especially for coho and older records). Lines 1274+ Difference between none-observed and zero. How many sites were considered none-observed vs. we didn't look. Using only surveyed streams sure helps.
  21. I assume that harvest includes by-catch? Lines 1451. Has the in-river bar fishery ended? Is there a native fishery.
  22. Comment -- Have you considered that an increase in seals may have had an impact?
  23. Lines 1527 – changes to Fisheries Act and all the habitats people have been removed. May be significant changes to provincial water act in the future; currently does little to protect fish.
  24. Line 1550 + what is recent (give the period). What's earlier period? Line 1552 recent generation?
  25. Summary has to include --- What is new since the last COSEWIC report.
  26. I have a problem with a population of 23,000 spawners with both temporal and spatial exchange being insufficient to conserve genetic diversity.
  27. Table 2. Why has the exploitation rate changed from aprox 7.0% for 1999-2003 to aprox 13% 2009-2011?
  28. Table 3. Not wrong -- but a little confusing when a negative change is an increase. Maybe table should be estimated rates of changes in abundance.
  29. Figure 2 Might be a new genetic chart since 2001.
  30. Figure 11. Not sure what this does for a COSEWIC assessment might be nice to consider during recovery planning.