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Pacific Region

Proceedings of the Pacific regional peer review on the 2017 Fraser Sockeye Wild Salmon Policy integrated biological status re-assessment

June 6-7, 2017
Nanaimo, British Columbia

Chairperson: Jeffrey Lemieux
Editors: Bronwyn MacDonald and Jill Campbell

Fisheries and Oceans Canada
Science Branch
3190 Hammond Bay Road
Nanaimo, BC V9T 6N7

November 2021

Canada

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 on June 6-7, 2017 at the Pacific Biological Station in Nanaimo, B.C. The working paper outlining the integrated biological status re-assessment under the Wild Salmon Policy (WSP) for the 24 Fraser Sockeye conservation units (CU) was presented for peer review.

In-person and web-based participation included Fisheries and Oceans Canada Science, and Fisheries Management (FM) Sectors staff, and external representatives from First Nations, Fraser Panel technical Committee, academia and consultants.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report (SAR) providing advice to DFO Science regarding a re-assessment of Fraser Sockeye Conservation Unit (CU) status and a review and recommendation on re-assessment of status integration approaches going forward.

The Science Advisory Report and supporting Research Document will be made publicly available on the Canadian Science Advisory Secretariat website.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) meeting was held on June 6-7, 2017 at the Pacific Biological Station in Nanaimo to review the integrated biological status re-assessment under the Wild Salmon Policy (WSP) for the 24 Fraser Sockeye conservation units (CU).

The Terms of Reference (ToR) for the science review (Appendix A) were developed in response to a request for advice from DFO Science. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from First Nations, Fraser Panel Technical Committee, Fraser River Aboriginal Fisheries Secretariat, academia and consultants.

The following working paper (WP) was prepared and made available to meeting participants prior to the meeting (working paper abstract is provided in Appendix B):

> *Grant, S.C.H., Holt, C.A., Davis, B., Pestal, G. The 2017 Re-Assessment of the Integrated Biological Status Assessments for Fraser River Sockeye Salmon (Oncorhynchus nerka) Under the Wild Salmon Policy. CSAP Working Paper 2014SAL11*

The meeting Chair, Jeffrey Lemieux, welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair discussed the role of participants, the purpose of the various RPR publications (Science Advisory Report, Proceedings, and Research Document), and the definition and process around achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference, working papers, and agenda.

The Chair reviewed the Agenda (Appendix C) and the Terms of Reference for the meeting, highlighting the objectives and identifying the Rapporteur. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not consultation. The room was equipped with microphones to allow remote participation by web-based attendees, and in-person attendees were reminded to address comments and questions so they could be heard by those online.

Members were reminded that everyone at the meeting had equal standing as participants and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 31 people participated in the RPR (Appendix D). Bronwyn MacDonald was identified as the Rapporteur for the meeting.

Participants were informed that Al Cass and Karl English had been asked before the meeting to provide detailed written reviews for the working paper to assist everyone attending the peer-review meeting. Participants were provided with copies of the written reviews.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report (SAR) to DFO Fisheries Management to provide them with a re-assessment of Fraser Sockeye stock status and a review and recommendation on re-assessment of status integration approaches going forward. The Science Advisory Report and supporting Research Document will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

REVIEW

Working Paper: Grant, S.C.H., Holt, C.A., Davis, B., Pestal, G. The 2017 Re-Assessment of the Integrated Biological Status Assessments for Fraser River Sockeye Salmon (*Oncorhynchus nerka*) Under the Wild Salmon Policy. CSAP Working Paper 2014SAL11

Rappoteur: Bronwyn MacDonald

Presenters: Sue Grant and Carrie Holt

GENERAL DISCUSSION

COMMENTS FROM REVIEWERS

- A reviewer wanted to know if the authors have any recommendations to managers when defining benchmarks, such as what value would you use to define when an Excess Salmon to Spawning Requirement fishery can occur or how the upper benchmarks (BMs) can be used by managers and at what probability level. The authors indicated that this paper focuses on biological benchmarks to estimate status; Holt & Irvine (2013) discusses differences between biological benchmarks and reference points. As well the ToR does not cover reference points as per this question, therefore, this was not addressed in this meeting.
- A reviewer commented on S_{max} figures and the use of S_{max}. The authors indicated they will include some tables in the report to show the photosynthetic rate values that were included and also indicate the years of those data points so one can see if there are patterns in the photosynthetic rate data. They will also indicate that there were individual years.
- A reviewer requested clarification on Effective Total Spawners (ETS) vs Effective Female Spawners (EFS). The authors responded by saying short- and long-term trends use EFS because they consider the sex ratio and the success of spawners. As a result, EFS is the most conservative measure of the trends in abundance and this is the gold standard in spawning escapement data. Future work could compare EFS to total spawner trend results in a sensitivity analysis, since most other non-Fraser Sockeye CUs will not have EFS data; it is useful to see how much of this information changes the trend information. However, these analyses are not required for the current assessment.
- A reviewer inquired about the CUs without sufficient stock-recruitment data and no estimated benchmarks whether the S_{max} BM that was used for Chilliwack could be used for other stocks, or whether the percentile BMs could be used to estimate benchmarks for every single CU. The response was that of CUs without stock-recruit (SR) data, only Chilliwack had S_{max} data, so only this CU could these BMs be estimated. For other CUs there are long-term trend metrics used and they are largely identical to the percentile metric and, therefore, including percentile metrics would be redundant. Also, these percentile metrics have not been formally reviewed yet for inclusion. The CUs that do not have the relative abundance metrics already have this data used as a BM via the long-term metric, but it has not been explicitly shown in the document. The authors indicated that they could include the definition of all of the benchmarks as per the slide in the presentation, but they do not think it will benefit the status process. The authors also added that they could add in a table the calculated actual numbers for each CU i.e. 50% and 75% of the CU long-term average, so that the reader can see these actual values. However, this is not meant for fisheries management purposes, but rather for status evaluation only.

- A reviewer asked if there could be categorization of the CU groups for status evaluation. The authors responded by saying this was an art not a science but does need to be better explained re: how we grouped CUs for the nine individuals who assessed status.
- A reviewer commented on Appendix 8 and the Larkin model BMs. The authors explained that the grey lines are for each year and that for the Shuswap Late CU, the Larkin lines are shifted between cycle lines. All of the data are used to estimate the parameters, but the specific lagged spawner abundances are used to plot the individual curves. Each line is a different *α'* because even though the parameters are not changing, the lagged spawner abundances are different for each year and these affect alpha prime *α'.*
- A reviewer wanted the authors to show the distribution of the lines so the reader could identify the central tendency, instead of plotting the individual lines. In the off-cycle years those benchmarks get pulled up from what they would be in the Ricker model. The authors responded by saying when the abundance is really low the S_{gen} tends to go up as a precautionary measure. The reviewer wanted this flagged - if the Larkin model is being very responsive you might have larger spread. The tendency will be that even in off cycle years the BMs will be pulled up higher than the escapement records, so people do not take these numbers away as the true realistic BMs for the populations.
- A reviewer requested some of the plots in Appendix 12 not be on the log-scale. The authors stated that the cycle line patterns were plotted on the different scales per plot so people could identify the cycle specific patterns - the log scale estimates the short-term trend and helps to see what that trend metric is picking up since the purpose of this appendix is to illustrate the trends in the cycles. The reviewer suggested a linear axis would make it more clear what the actual changes are.

TOR OBJECTIVE #1: APPLICABILITY OF THE LARKIN MODEL

- The mechanism behind delayed density dependence is not fully understood, and if it does not exist, there is an issue between fitting the Larkin model (a time-series model) and calculating biological benchmarks from that model (which assumes biological rationale). While this is noted in the paper, clarity surrounding this should be noted in the SAR. As well further research into in-lake mechanisms of cyclical CUs and density dependence versus delayed density dependence should be conducted.
- The formulation of the Larkin model is not necessarily applicable to management objectives. Therefore, the wording around the word “applicability” should be in relation to the WSP BMs and not the Fraser River Sockeye Spawning Initiative (FRSSI).
- A participant notes that there are many unanswered questions regarding cyclicity when it comes to managing fisheries and using the Larkin model to address cyclicity applies only to this process. As well, they indicated that the fishery management response to cycles may contribute to the stochasticity observed. Whether cyclic CUs are driven by biological or stochastic processes is not fully understood and requires further research since this would influence model choice for relative abundance metrics.

Data Uncertainty

- Errors in the variables problem should be highlighted as something to examine.
- There are issues with estimating recruitment in cyclic CUs small off-cycle years and escapement

- The details of stock peculiarities should be investigated, i.e. Shuswap age structure on cycles
- Additional potential biases on the data during certain periods

TOR OBJECTIVE #2 - DATA SUMMARIES

Use and Presentation of Spawner-Based Benchmarks

- A reviewer noted that the authors had not gone into the details of the data. For example, Taseko in the past would have been called Data Deficient and the reviewer can only assume that those involved have been rigorous in collecting the necessary data. The authors responded by saying that most of the detail on the data processing was presented in the 2011 paper (Grant and Pestal 2012) and this process has not been changed, only updated with 5 years of data. Taseko is a CU with lake spawners, enumeration is done visually of carcasses on the lake and is an index of abundance only. This CU is consistently assessed through time, but it is biased low. There was one year (2016) where a sonar method was used, and that can be used going forward as an estimate of absolute abundance. This sonar method indicated that the visual methods were biased low, but it was less than an order of magnitude (i.e. the bias was moderate).
- BMs derived from the data should all be included in the data summaries so readers may see the numbers and evaluate. Perhaps refer to BMs as interim BMs so people know that they are not permanent but are continually changing as data is updated.
- A reviewer wanted to see the long-term trend metric calculations added into the data summaries, but the authors declined because they were not used in the process, and these are not applicable to fisheries management.
- A reviewer suggested a single table of the calculated percentiles of the spawning abundances be added to show the actual numbers we are working with as this could be informative for management. An author suggested that they can add this table but not call it "benchmarks" and instead refer to the "estimated percentiles" of the spawning abundances. However, another author mentioned that perhaps it has been misleading as we tend to emphasize the abundance-based BM, when this metric is not the be all end all since we have additional data for this process. A third author said the advice being delivered to management is in the form of the data summaries and the integrated statuses. The TOR does not include having benchmarks for abundance metrics for use in fisheries management. If the intention of the benchmarks table is for use for fisheries management this could be misleading since there are a lot of caveats with these benchmarks - eg. high exploitation rates in the early time-series create bias. This is not the intention of this table as the table is for description. It was decided that a table with the percentiles of the spawning abundances be added with a caption referring to the text where the benchmarks are described.

Data and Model Bias

- A participant wanted to know more about the frequency of auditing the data and drilling into the stock recruit methodology. An author indicated they did look into the effect of informative and uninformative priors this year (for the Ricker model) but they did not get into the diagnostics of the Ricker, error in the catch and escapement time-series, and potential effects on BMs in terms of bias from the error in the variables/time-series bias issues. The participant indicated that some auditing should be done at some point, but not with every

assessment. Not auditing can result in positive or negative biases in the parameter estimates which can lead to over/underestimates of S_{msy}. It was indicated that metadata from the programs exists on the types of errors we can expect, and we can use this to get estimates of any bias. An author indicated that this concern is broader than just Fraser Sockeye and is common amongst systems where stock recruit data are used. Some issues are specific to Fraser Sockeye due to cyclicity but a lot of these are generic and a more generic evaluation of BMs would be useful. Ricker BMs were evaluated to some extent in previous work but could use Fraser Sockeye as an example to parameterize a simulation model that could be used to estimate these biases. As well, the time-series bias is important to all of our stock recruit analyses.

- The author also suggested that the uncertainties are assessed as a separate Science-led CSAS process. A participant suggested a re-assessment of the methodology in general be added as a part of the WSP process so that assessments look into these types of bias or take them into account. This was added as a recommendation in the research document.

General Comments

- Some of the 2012 and 2013 data points have not gone through the run size adjustments process. While this may not result in large changes, it should be noted.
- A participant recommended that the average R/ETS plots should be added into the data summaries for future status evaluations.
- A participant asked for information on the data quality of the recruitment data, similar to that of the spawner data. An author indicated that the data quality metric for the escapement data is very general and may be different for off-cycle years (eg: Shuswap-L).

TOR OBJECTIVE #3 - INTEGRATES STATUSES

- A participant suggested the status narratives be standardized so it is easier to pick out the differences between CUs, CU statuses, and BMs. An author will look over the research document to organize and standardize. The authors have also put together a table for the SAR that will collapse the narratives.

Small Abundance CUs

- A participant wanted CUs with small abundances or habitats to have a specific categorization or label so the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) does not recommend action when there is little that can be done to improve their status. An author indicated that CUs such as this have been at low abundances for a long time and appear stable, however wording could be added to the narrative to indicate this: "consistently low abundance constrained by habitat" and “unlikely to increase to larger abundances”. Indicating this on a map is less certain as they do not know the extirpation risk of these CUs. Another author indicated that these CUs should also be flagged that they should be watched rather than pushed aside as being stable.

Advice to Management

- There was concern from some participants about how to highlight the statuses of the CUs and provide this advice to management. It was suggested that CUs of note or CUs that change in status are flagged to fisheries management. It was suggested that a table be added to the research document indicating how the CU statuses have changed from 2012 to

2017, also with a brief narrative about the mechanism behind the change. This table could be sorted by magnitude of change, run timing, or watershed.

- It was noted that there was no rigorous assessment of the mechanisms of change, and that this should be more clear in the research document. However, where information was known it was added to the narratives. While this information is useful for investigating the drivers of change, this is not in the TOR for this research document.

TOR OBJECTIVE #4 - RECOMMENDATIONS FOR FUTURE STATUS RE-INTEGRATION PROCESSES

- A participant expressed concern that certain people or voices are not being included in the integration process (industry representatives, NGOs). An author indicated participants were identified from the invites to the last process and input from key participants and they think key people were included in the distribution. Another participant indicated that the line between science and policy is being blurred. They said this paper provides methods as well as statuses and we are getting hung up on the statuses. What we want is the best status based on the best science, so if a streamlined process with nine people is the best way to get that then broadening it out to a less technical audience is the subsequent step. An author indicated that in the future perhaps this will go through a science response once methods are approved and with that sort of process is it possible to have a broader audience. It was noted that CSAS is developing a list of people with species-specific specialties. A participant wanted text added into the research document and the SAR indicating the integration process should be as inclusive as possible to maintain scientific rigour. Another participant suggested that the expert-reviewed status be submitted to a broader group to provide comments which could be incorporated by re-convening the group. This could avoid including people with the same background and training and allow for other types of information, specifically Traditional Ecological Knowledge, to be included. It was noted that people with certain skills be targeted for input (ie those that can expand on the knowledge of the data) to avoid it being pushed into the management realm. The representative from CSAS suggested this be a CSAS response and indicated that a process involving multiple reviews that contribute to the formation of the draft might work. Another participant indicated that having different people review the statuses and the process to incorporate multiple viewpoints, information, and clarification. An author indicated that having people who understand the process and have this as part of their workplan will ensure these evaluations can be done on a four-year cycle. There was discussion about having a larger workshop every five years which could incorporate a wider audience. It was discussed that how this process is constructed is a national issue and should not be decided on a case-by-case basis and is beyond the capacity of this group at this time. It was concluded that using the “group of nine” approach with more broad inclusion for the integrations, then fanning those out to a wider audience with their comments and assessments for the “group of nine” to consider and determine, is what should be included in the narratives. It was recommended that a re-assessment of the CU statuses should be done every 5 years (ie every generation) or if any major changes are observed.

TOR OBJECTIVE #5 - UNCERTAINTIES AND KNOWLEDGE GAPS

- Data modeling and uncertainties as discussed under TOR Objective #1.
- Larkin model evaluation given uncertainties specific to data for Fraser Sockeye as discussed under TOR Objective #2.

- Sensitivity analysis of the short-term trends relative to uncertain data points as discussed under TOR Objective #2.
- Create a list of CUs that are more uncertain than others and what measures may be taken to make them less uncertain as discussed under TOR Objective #2.

GENERAL COMMENTS

- There was concern that the 8 extirpated CUs were not discussed in the paper. The authors indicated they only addressed the current and new CUs where there was data to produce statuses. The extirpated CUs are listed in the CU list table in the research document and SAR. Additional information on how extirpation is defined and applied in the 2011 publication (Grant and Pestal 2012).
- A participant indicated that the models do not consider marine survival, only freshwater productivity and that text about this stochastic uncertainty due to ocean productivity should be included in the SAR. Another participant indicated that more text be added to the research document indicating that these models only capture average marine conditions. The authors indicated marine productivity was included in the 2011 document in the Kalman models, but the time-varying component created challenges and these models are no longer used. The authors will make it more explicit that marine productivity is included in the productivity indices. As well, it is a stochastic mechanism that is driving cycles, then the Larkin model may not be appropriate. A participant indicated that the Larkin model is clearly superior for the cyclic stock, but does not capture all of the dynamics. What has been measured in terms of productivity includes both marine and freshwater and if there are any trends in the lakes, the indices of lake productivity will be informative, but this is harder to do in the ocean. Also, one of the causes for the next re-assessment may be triggered by another change in productivity.

REFERENCES CITED

Grant, S.C.H., and Pestal, G. 2012. Integrated biological status assessments under the Wild Salmon Policy using standardized metrics and expert judgement: Fraser River Sockeye Salmon (Oncorhynchus nerka) case studies. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/106. v + 132.

Holt, C.A., Irvine, J.R. 2013. Distinguishing benchmarks of biological status from management reference points: A case study on Pacific salmon in Canada. Env Cons. 40(4): 345-355.

APPENDIX A: TERMS OF REFERENCE

The 2017 Fraser Sockeye Wild Salmon Policy Integrated Biological Status Re-Assessment

Regional Peer Review Process – Pacific Region

June 6-7, 2017

Nanaimo, British Columbia

Chairperson: Jeffrey Lemieux

Context

The previous Wild Salmon Policy assessment for Fraser River Sockeye was conducted in 2011, and included data up to 2010 escapements (Grant et al. 2011; Grant & Pestal 2012). In the previous assessment, Fraser Sockeye productivity (recruits-per-spawner) experienced declines in the most recent decades. In the last five years, however, productivity has improved for many Fraser Sockeye Conservation Units (CUs) and additional data up to 2015 is now available. Additionally, the previous assessment did not provide abundance benchmarks for cyclic CUs due to analytical challenges associated with the model in use at the time. The five cyclic CU's where new Larkin-based abundance benchmarks applied included the following: Takla-Trembleur-Early Stuart, Shuswap-ES, Takla-Trembleur-Stuart-S, Quesnel-S, Shuswap Complex-L.

Due to the time that has transpired since the previous assessment, the potential productivity changes for some of the Fraser River Sockeye CUs, updated data available, and a revised method by which to assess cyclic CUs, a re-assessment of Fraser River Sockeye CUs is required. The re-assessment is needed to provide updated data - up to the 2015 escapements (for both trends and abundance metrics) and 2011 brood year (for stock recruitment models) for CUs where these data are available, and to provide abundance benchmarks for the five cyclic CUs that were evaluated without abundance benchmarks in the previous assessment. DFO Science has requested that Science Branch provide a re-assessment of Fraser Sockeye stock status and a review and recommendation on re-assessment of status integration approaches going forward.

Standardized data summaries will be updated for each CU as presented in the previous assessment (Appendix 1: Grant & Pestal 2012). New benchmarks will be provided for the five cyclic CUs with stock-recruitment data based on the delayed-density dependence between cycle lines. The information from the updated data summaries will be used to develop integrated statuses for the 24 Fraser Sockeye CUs. Lessons learned from the previous Fraser Sockeye integration process, and the subsequent Southern British Columbia Chinook and Interior Fraser Coho integration processes, will be used to develop this current re-assessment of status integration. The first status assessments for a species group will be more comprehensive, and used as a framework for subsequent more streamlined re-assessments.

The assessment, and advice arising from this Canadian Science Advisory Secretariat (CSAS) Regional Peer Review (RPR), will be used to provide a framework for subsequent re-assessments across species groups. The Fraser Sockeye CU integrated status results will inform fisheries management, habitat, and hatchery enhancement work as they feed into the WSP integrated planning process.

Objectives

The following working paper will be reviewed and provide the basis for discussion and advice on the specific objectives outlined below.

Grant, S.C.H., Holt, C.A., Davis, B., Pestal, G. The 2016 Re-Assessment of the Integrated Biological Status Assessments for Fraser River Sockeye Salmon (*Oncorhynchus nerka*) Under the Wild Salmon Policy. CSAP Working Paper2014SAL11.

The specific objectives of this review are to:

1. Provide advice on the applicability of the Larkin model methodology for determining benchmarks used for cyclic CUs (Takla-Trembleur-EStu, Shuswap-ES, Takla-Trembleur-Stuart-S, Quesnel-S, Shuswap Complex-L).
2. Present updated data summaries for the 24 Fraser Sockeye CU's, including escapement data up to 2015 and stock-recruitment data up to the 2011 brood year (for CU's with recruitment data). This includes the inclusion of Larkin benchmarks for each cycle of the five cyclic CUs.
3. Review the presented integrated statuses for the 24 Fraser Sockeye CUs and the associated narratives (descriptions of the information used to assess status) that result from the status integration process, and provide advice regarding their applicability.
4. Provide recommendations for future status re-integration processes across all species.
5. Identify uncertainties and knowledge gaps.

Note: The initial synthesis of information to propose re-assessment statuses will be conducted with a subgroup of subject matter experts. Assessments will be conducted separately by individuals, and then integrated together using similar plenary processes of past assessments in half day meeting prior to the CSAS Regional Peer Review. The pre-vetted re-assessment statuses will subsequently be included in the working paper and subject to broader peer review at the Regional Peer Review meeting. The working paper will capture the areas of common and differing expert judgement across participants through narratives.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- DFO Science, Fisheries Management, Salmon Enhancement Program
- First Nations
- External Reviewers
- Commercial and recreational fishing industry
- Academia

References

Grant, S.C.H., and Pestal, G. 2012. Integrated biological status assessments under the Wild Salmon Policy using standardized metrics and expert judgement: Fraser River Sockeye Salmon (*Oncorhynchus nerka*) case studies. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/106. v + 132 pp.

Grant, S.C.H., MacDonald, B.L., Cone, T.E., Holt, C.A., Cass, A., Porszt, E.J., Hume, J.M.B., and 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.

APPENDIX B: WORKING PAPER ABSTRACT

The first integrated biological status re-assessment under the Wild Salmon Policy (WSP) was completed for 24 Fraser Sockeye Conservation Units (CUs) in 2017. The first status assessment was conducted in 2012 (Grant et al. 2011; Grant & Pestal 2012), and this current status re-assessment adds five years of escapement data from 2011 to 2015 and recruitment data from the 2006 to 2010 brood years.

This re-assessment identified the following integrated statuses for Fraser Sockeye CUs:

- 7 Red
- 2 Red/Amber
- 5 Amber
- 6 Amber/Green
- 3 Green
- 1 data deficient

Eleven out of 24 CUs had the same status in the 2012 and 2017 assessments: five CUs remained in the Red status zone: Bowron-ES, Cultus-L, Takla-Trembleur-EStu, Taseko-ES, and Widgeon-(River-Type); two CUs each remained in the Red/Amber status zone: Quesnel-S & Takla-Trembleur-Stuart-S, the Amber status zone: North Barriere-ES and Kamloops-ES; and the Green status zone: Chilko-S/Chilko-ES aggregate and Harrison (River-Type).

Thirteen out of 24 CUs had different statuses between the 2012 and 2017 assessments. This demonstrates the need for re-assessments at least every five years. The status for six CUs declined to Red: Harrison (U/S)-L and Seton-L; or Amber: Shuswap-ES and Lillooet-Harrison-L; or Amber/Green: Harrison (D/S)-L and Shuswap-L. The status for seven CUs improved to Amber: Nahatlach-ES; Amber/Green: Nadina-Francois-ES, Chilliwack-ES, Francois-Fraser-S, and Anderson-Seton-ES; and Green: Pitt-ES. These differences emphasize that without regular re-assessments recovery actions cannot be appropriately prioritized.

In addition to providing status designations, narratives on the factors that contributed to these statuses are provided for each CU. The combination of CU statuses, data summaries, and narratives, are recommended as inputs into the WSP's Strategy 4 on Integrated Planning. As a package, this information can guide recovery actions among the Red to Amber CUs, and also guide management actions (fisheries, salmonid enhancement, and habitat) that affect all CUs.

This status re-assessment process demonstrated that re-assessments can be conducted on a smaller scale (<9 individuals in a 1 day plenary session) than first-time WSP status assessments (~30 individuals over a 3 day plenary session in the case of Fraser Sockeye).

Similar to past status assessments, the current assessment also concludes that no single algorithm for status integration can be developed, since CUs with the same status, will not always have the same factors that drive their status designations. Instead, expert-judgement applied consistently to assess WSP status is recommended.

The current process also had recommendations for particular metrics applied. The three generation-trend metric, relied upon by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the International Union for Conservation of Nature (IUCN) for their status evaluations, was considered less applicable to Pacific Salmon in WSP integrated status processes. New relative-abundance benchmarks, derived from the Larkin model, were included in the status assessment process for cyclic Fraser Sockeye CUs. The six cyclic CUs include Shuswap-ES, Shuswap-L, Takla-Trembleur-Early Stuart, Takla-Trembleur-Stuart-S, and

Quesnel, and Chilliwack-ES. When applied in this expert-driven context, Larkin-model benchmarks are recommended for future status assessment processes for cyclic CUs.

APPENDIX C: AGENDA

Canadian Science Advisory Secretariat

Centre for Science Advice Pacific

Regional Peer Review Meeting (RPR)

The 2017 Fraser Sockeye Wild Salmon Policy Integrated Biological Status Re-Assessment

June 6-7, 2017
Nanaimo, BC

Chair: Jeffrey Lemieux

DAY 1 - Tuesday, June 6, 2017

Time	Subject	Presenter
0900	Review Agenda & Housekeeping CSAS Overview and Procedures. Introductions	J. Lemieux (Chair)
0915	Review Terms of Reference	J. Lemieux (Chair)
0930	Presentation of Working Paper	C. Holt and S. Grant
1045	***Break***	
1100	Overview Written Reviews	K. English and A. Cass
12:00	***Lunch Break***	
1300	Identification of Key Issues for Group Discussion	Group
1330	Discussion & Resolution of Technical Issues	RPR Participants
1445	***Break***	
1500	Discussion & Resolution of Results & Conclusions	RPR Participants
1600	Develop Consensus on Paper Acceptability & Agreed-upon Revisions	RPR Participants
1630	Table draft SAR	
1700	Adjourn for the Day	

Day 2 - Wednesday, June 7, 2017

Time	Subject	Presenter
0900	Introductions Review Agenda & Housekeeping Review Status of Day 1	J. Lemieux (Chair)
0915	*(As Necessary)* Carry forward outstanding issues from Day 1	RPR Participants
0930	*Science Advisory Report (SAR)* Develop consensus on the following for inclusion: • Sources of Uncertainty • Results & Conclusions • Additional advice to Management (as warranted)	RPR Participants
1030	***Break***	
1050	*Science Advisory Report (SAR)* • Continued	RPR Participants
1130	Next Steps – Chair to review • SAR review/approval by participants and timelines • Research Document & Proceedings timelines • Other follow-up or commitments (*as necessary)*	J. Lemieux (Chair)
1145	Other Business arising from the review	Chair & Participants
1200	***Adjourn meeting***	

APPENDIX D: PARTICIPANT LIST

Last Name	First Name	Affiliation
Beach	Katie	DFO Science
Benner	Keri	DFO Science
Blackbourn	David	DFO (retired)
Bradford	Mike	DFO Science
Cass	Alan	DFO (retired)
Christensen	Lisa	DFO Centre for Science Advice Pacific
Cone	Tracy	DFO Science
Cox-Rogers	Steven	DFO Science
Davis	Brooke	DFO Science
English	Karl	LGL Limited
Godbout	Lyse	DFO Science
Grant	Sue	DFO Science
Hawkshaw	Mike	DFO Science
Hertz	Eric	Simon Fraser University
Holt	Carrie	DFO Science
Huang	Ann-Marie	DFO Science
Jantz	Lester	DFO Fisheries Management
Laliberte	Bernette	Cowichan Tribes
Lemieux	Jeffrey	DFO Science
Litz	Marisa	Fraser River Technical Committee
MacDonald	Bronwyn	DFO Science
MacDougall	Lesley	DFO Centre for Science Advice Pacific
Mundy	Peggy	Fraser River Technical Committee
Neill	Aidan	Fraser River Aboriginal Fisheries Secretariat
Nicklin	Pete	Fraser River Aboriginal Fisheries Secretariat
Ormond	Chad	Q'ul-lhanumutsun
Pestal	Gottfried	Solv Consulting
Porszt	Erin	DFO Science
Staley	Mike	Fraser River Aboriginal Fisheries Secretariat
Walsh	Michelle	Secwepemc Fisheries Commission
Whitehouse	Timber	DFO Science