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Proceedings of the Pacific regional peer review on the Assessment of Southern British Columbia Chinook Salmon Conservation Units, Benchmarks and Status

February 4-6, 2014
Nanaimo, British Columbia

Chairperson: Bruce A. Patten
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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 discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Peer Review workshop conducted on February 4-6, 2014, at the Coast Bastion Hotel in Nanaimo, BC. The workshop involved the application of the status integration techniques developed for Fraser River Sockeye Salmon (Grant & Pestal 2013) to determine a Wild Salmon Policy (WSP) status for each of the 35 southern BC Chinook Salmon Conservation Units (CU). The workshop participants used the benchmarks and other information reviewed during two pre-COSEWIC Regional Peer Review meetings (March 6-8, 2013 and November 5-6, 2013).

Participants were invited based on their experience with different aspects of salmon assessment and included DFO staff from Science, Ecosystem Management and Fisheries Management sectors and external participants from First Nations organizations, the commercial and recreational fishing sectors, environmental non-governmental organizations, and academia. Participants were requested to join a pre-workshop online seminar in order to review the data summary layout and to provide feedback to organizers on the workshop format.

At the workshop, through a combination of small-group discussions and plenary debate, participants developed integrated status (which included one to two WSP status zones) for 15 out of the 35 southern BC Chinook CUs, status commentaries for each CU, and documented their decision process. Of the remaining CUs, 9 had insufficient information for status determination and 11 could not be assessed due to an unresolved issue regarding the method for incorporation of information from the enhanced fish contribution.

These Proceedings outline the structure of the workshop and summarize general discussions related to the process. These proceedings also include the results of breakout group evaluations, the final status table developed through plenary discussion and key recommendations for future work. A complete set of the materials presented at the workshop (e.g. status information by CU) and worked-up results from the workshop (e.g. consolidated status commentary for each CU) have been compiled and summarized in the Research Document associated with this workshop. Recommendations resulting from the meeting are documented in the Science Advisory Report resulting from the workshop.

Compte rendu de l’examen par les pairs de la région du Pacifique sur l’évaluation des unités de conservation, des points de référence et de l'état du saumon quinnat du sud de la Colombie-Britannique

SOMMAIRE

Le présent compte rendu résume les discussions et les conclusions clés de la réunion de consultation scientifique régionale de Pêches et Océans Canada (MPO) et du Secrétariat canadien de consultation scientifique qui s'est tenue du 4 au 6 février 2014 à l'hôtel Coast Bastion à Nanaimo, en Colombie-Britannique. L'atelier portait sur l'application des techniques d'intégration du statut élaborées pour le saumon rouge du fleuve Fraser (Grant et Pestal 2013) afin de déterminer, selon la Politique concernant le saumon sauvage (PSS), l'état de chacune des 35 unités de conservation (UC) du saumon quinnat du sud de la Colombie-Britannique. Les participants à l'atelier ont utilisé les points de référence et d'autres renseignements examinés lors de deux réunions régionales d'examen par les pairs, préalables à l'examen du COSEPAC (6-8 mars 2013 et 5-6 novembre 2013).

Ils avaient été invités en fonction de leur expérience touchant différents aspects de l'évaluation du saumon; parmi eux se trouvaient notamment des employés des Secteurs des sciences, de la gestion des écosystèmes et de la gestion des pêches du MPO ainsi que des collaborateurs externes provenant d'organisations des Premières Nations, d'organisations non gouvernementales de l'environnement, des secteurs des pêches commerciale et récréative, ainsi que du milieu universitaire. On avait demandé aux participants de prendre part à un webinaire préparatoire afin d'examiner le sommaire des données et de fournir des commentaires aux organisateurs au sujet de la formule de l'atelier.

Pendant l'atelier, au terme de discussions en petit groupe et de débats en plénière, les participants ont déterminé un état d'intégration (y compris une ou deux zones d'état selon la PSS) pour 15 des 35 UC de saumon quinnat du sud de la Colombie-Britannique. Ils ont également formulé des commentaires sur l'état de chaque UC et consigné par écrit leur processus décisionnel. En ce qui concerne les UC restantes, les renseignements n'étaient pas suffisants pour déterminer l'état de neuf d'entre elles et il n'a pas été possible d'évaluer les 11 dernières en raison d'un problème non résolu concernant la méthode d'intégration des données sur la contribution de la mise en valeur du poisson.

Ce compte rendu décrit la structure de l'atelier et résume les discussions générales pendant le processus. De plus, il contient les résultats des évaluations des groupes thématiques, le tableau final des états conçu pendant les discussions en plénière et les principales recommandations concernant les futurs travaux. Un ensemble complet des documents présentés lors de l'atelier (p. ex., les renseignements sur l'état pour chaque UC) et de ses résultats (p. ex., commentaires récapitulatifs sur l'état de chaque UC) a été compilé et résumé dans le document de recherche associé à cette réunion régionale d'examen par les pairs (Brown *et al.* 2014c). Les recommandations résultant de la réunion sont présentées dans l'avis scientifique créé au terme de l'atelier.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) workshop was held on February 4-6, 2014 at the Coast Bastion Hotel in Nanaimo to:

1. determine an integrated WSP status for each southern BC Chinook Salmon CU;
2. indicate the effect on the status assessments of including, or excluding, enhanced Chinook Salmon contributions;
3. provide advice on data and methods required for assessing the status of any CUs that are currently data deficient;
4. include information specific to each CU on fishing mortality, where possible;
5. provide advice on the appropriate frequency of status re-assessment, changes to monitoring variables that could invoke early re-assessment, and the appropriate timing for assessment relative to data availability; and
6. identify and recommend data management approaches required to support recommended changes to re-assessment of CUs.

The Terms of Reference (TOR) for the science review (Appendix A) were developed in response to a request for advice from DFO's Fisheries Management Branch (FM). Invitations for participation were sent to representatives with relevant expertise from First Nations, commercial and recreational fishing sectors, environmental non-governmental organizations and academia.

Prior to the workshop, participants were required to participate in one of four introductory seminars conducted via an online meeting. The main purpose of the seminar was to introduce participants to the standardized three- to four-page data summary format, called a "dashboard", which would be used extensively at the workshop. A separate dashboard was prepared for each CU, based on the benchmarks and other information reviewed during two pre-COSEWIC Regional Peer Review meetings, March 6-8, 2013[1] and November 5-6, 2013[2]. A secondary purpose for the seminars was to familiarize participants with the plans for the workshop activities and to provide an opportunity for their feedback on the plans. Several changes to the dashboard format and workshop plans were made based on the feedback received by the workshop organizers at the introductory seminars.

WORKSHOP SUMMARY

INTRODUCTIONS, LOGISTICS, AND BACKGROUND PRESENTATIONS

The meeting chairperson, Bruce Patten, welcomed participants and provided a general overview of the CSAS process, covering the role of participants, the purpose of the various

[1] Brown, G.S., Baillie, S.J., Thiess, M.E., Bailey, R.E., Candy, J.R., Parken, C.K., and Willis, D.M. 2014. Pre-COSEWIC Review of Southern British Columbia Chinook Salmon (*Oncorhynchus tshawytscha*) Conservation Units: Part I, Background. CSAS Working Paper 2012/P62. In revision.

[2] Brown, G.S., Baillie, S.J., Bailey, R.E., Candy, J.R., Holt, C.A, Parken, C.K., Pestal, G.P., Thiess, M.E., and Willis, D.M. 2014. Pre-COSEWIC Review of Southern British Columbia Chinook Salmon (*Oncorhynchus tshawytscha*) Conservation Units, Part II: Data, Analysis and Synthesis. CSAS Working Paper 2012/13 P23. In revision.

Regional Peer Review (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 to the goal of delivering scientifically defensible conclusions and advice.

The chairperson reviewed the TOR (Appendix A) and the Agenda (Appendix B) for the meeting, highlighting the objectives and outlining the reporting process. The chairperson then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation.

Participants were reminded that everyone at the meeting had equal standing and that they were expected to contribute actively. In total, 38 people participated in the RPR (Appendix C).

The workshop started with background presentations by Gayle Brown, Carrie Holt and Mary Thiess (DFO) covering the following topics:

- WSP metrics
- Data assembly and treatment work
- Brief summary of Independent Science Panel Report on southern BC Chinook
- Guidelines for integration of assessments
- Proposal for frequency of re-assessment

The presentations are included as Appendix D.

Following the presentations, participants asked questions of clarification.

WORKSHOP FORMAT

The workshop was conducted as a combination of small-group discussions and plenary debate:

- Participants were divided into six groups of six or seven individuals per group, chosen to provide a varied mix of views and expertise within each group.
- Thirty-five case studies were presented in seven sets over the first two days. Each case study represented a single CU. The identity of the CU represented by a case study was not revealed to the participants during the breakout sessions. Groups were given 15 minutes, 30 minutes, one hour or 1.5 hours, depending on the set size and complexity, to discuss each set in a breakout session. At the end of each breakout session, again in a full participant plenary session, groups compared results and discussed their reasoning for their final integrated statuses.
- All of the 35 CUs were evaluated by at least some of the groups, and each group evaluated a representative number of CU types (different metrics and statuses).
- Late on the second day, the CU identity of each case study was revealed to the participants. The third day of the workshop was a full day of plenary discussion to reconcile group integrated status results and to develop advice regarding the remaining workshop objectives that were not covered during the case study evaluations.

The seven sets of case studies were:

- Set 1 – Wild CUs, trend metrics agree: this set included eight cases with only wild CUs (i.e., there was no Enhanced Unit associated with the CU) that showed similar results across the trend metrics.

- Set 2 – Wild CUs, trend metrics differed: this set included four cases that illustrated the diversity of scenarios (i.e. conflicting messages from different metrics, differences in data availability).
- Set 3 – Enhanced Units (EU), trend metrics agreed: this set included seven cases that generally resembled cases from Set 1, but the units had high levels of enhancement activity. Wild sites existed in the unit but none were represented by a data stream. It was suspected that proportions of hatchery-origin spawners were high in some wild systems.
- Set 4 - Enhanced Units, trend metrics differed: this set included four cases that generally resembled cases from Set 2, but the units had high levels of enhancement activity. Wild sites existed in the unit but none were represented by a data stream. It was suspected that proportions of hatchery-origin spawners were high in some wild systems.
- Set 5 - Wild CU & Total Unit, trend metrics agreed: this set included four cases where there was both a wild CU and a Total Unit to be assessed (Total Unit = CU + EU). These cases presented generally consistent patterns among the trend metrics within each unit.
- Set 6 - Wild CU & Total Unit, trend metrics differed: this set included three cases where there was both a wild CU and a Total Unit to be assessed (Total Unit = CU + EU). These cases also illustrated a diversity of scenarios (i.e. conflicting messages from different metrics, differences in data availability).
- Set 7 - Data deficient CUs, no data streams and no metric results: this set included five cases where no sites within the CU had data of sufficient quality or completeness to provide a data stream for calculation of metrics comparison against benchmarks.

As with the Fraser Sockeye workshop (Grant & Pestal 2013), case studies were conducted "blind", with generic labels rather than CU names. Several considerations shaped the decision to use blind case studies:

- to facilitate the development of a standardized WSP status integration approach;
- to focus discussion on the metrics presented in the dashboards, and how they can be combined into an overall status evaluation; and,
- to facilitate the discussion between experts with detailed local knowledge and those with broader salmonid and status evaluation experience.

BREAKOUT GROUP RESULTS

Following each breakout group session, participants were convened into a plenary discussion to present the factors each group considered in determining their CU status classifications. These presentations were then used to initiate group discussion on the rationale for status determinations and to develop consensus about a final CU status designation for each CU. Case study sets 3 and set 4 presented a substantial challenge for the participants. These sets represent units comprised of predominantly enhanced fish; consensus was not reached on how to derive a WSP status assessment for such units.

Different views were captured in several distinct ways:

- group results for each CU were documented separately; if differences within a group could not be resolved, the majority view was captured as a "provisional" group result;
- commentary that included the interpretation of data used to develop integrated statuses was recorded for each CU (Appendix C of the Research Document resulting from this workshop).

PLENARY RESULTS

Plenary CU and EU status classification are summarized in Table 1, Table 2, and Table 3. Information from these recordings, from group results and workshop notes were rolled together to provide a final integrated status and commentary for each CU presented in the Research Document resulting from this workshop.

Table 1. Summary of integrated status evaluations for southern BC Chinook Conservation Units; this table summarizes the consensus evaluations of participants on Day 3 of the CSAS workshop. Note that more detailed status commentaries were also developed for each CU (Appendix B of the Research Document resulting from this workshop).

Integrated status evaluation completed at workshop

Integrated Status	Case #	CU ID	CU Name	Area
RED	1	CK-10	Middle Fraser River_SP_1.3	Fraser
RED	4	CK-18	North Thompson_SP_1.3	Fraser
RED	6	CK-19	North Thompson_SU_1.3	Fraser
RED	11	CK-09	Middle Fraser River-Portage_FA_1.3	Fraser
RED	24	CK-17	Lower Thompson_SP_1.2	Fraser
RED	25	CK-31	West Vancouver Island-South_FA_0.x	WCVI
RED	26	CK-12	Upper Fraser River_SP_1.3	Fraser
RED	29	CK-29	East Vancouver Island-North_FA_0.x	Inner SC
RED	30	CK-32	West Vancouver Island-Nootka & Kyuquot_FA_0.x	WCVI
RED*	3	CK-16	South Thompson-Bessette Creek_SU_1.2	Fraser
RED*	5	CK-01	Okanagan_1.x	Columbia
RED / AMBER	27	CK-14	South Thompson_SU_1.3	Fraser
AMBER	12	CK-11	Middle Fraser River_SU_1.3	Fraser
GREEN(p)	9	CK-03	Lower Fraser River_FA_0.3	Fraser
GREEN	2	CK-13	South Thompson_SU_0.3	Fraser

Integrated status evaluation not possible based on information presented at workshop

Integrated Status	**Case #**	**CU ID**	**CU Name**	**Area**
DD	7	CK-82	Upper Adams River_SU_x.x	Fraser
DD	8	CK-06	Lower Fraser River_SU_1.3	Fraser
DD	10	CK-05	Lower Fraser River-Upper Pitt_SU_1.3	Fraser
DD	28	CK-28	Southern Mainland-Southern Fjords_FA_0.x	Inner SC
DD	31	CK-08	Middle Fraser-Fraser Canyon_SP_1.3	Fraser
DD	32	CK-20	Southern Mainland-Georgia Strait_FA_0.x	Inner SC
DD	33	CK-34	Homathko_SU_x.x	Inner SC
DD	34	CK-23	East Vancouver Island-Nanaimo_SP_1.x	Inner SC
DD	35	CK-35	Klinaklini_SU_1.3	Inner SC

"(p)" means provisional, and identifies cases where some participants held divergent views.
"*" means that CU definition should be reviewed.

Table 1 continued.

Integrated status evaluation not attempted at workshop due to unresolved methods

Integrated Status	Case #	CU ID	CU Name	Area
TBD**	13	CK-04	Lower Fraser River_SP_1.3	Fraser
TBD	14	CK-21	East Vancouver Island-Goldstream_FA_0.x	Inner SC
TBD	15	CK-33	West Vancouver Island-North_FA_0.x	WCVI
TBD	16	CK-22	East Vancouver Island-Cowichan & Koksilah_FA_0.x	Inner SC
TBD	17	CK-02	Boundary Bay_FA_0.3	Inner SC
TBD	18	CK-07	Maria Slough_SU_0.3	Fraser
TBD	19	CK-25	East Vancouver Island-Nanaimo & Chemainus_FA_0.x	Inner SC
TBD	20	CK-15	Shuswap River_SU_0.3	Fraser
TBD	21	CK-83	East Vancouver Island-Georgia Strait_SU_0.3	Inner SC
TBD	22	CK-27	East Vancouver Island-Qualicum & Puntledge_FA_0.x	Inner SC
TBD	23	CK-9008	Fraser-Harrison fall transplant_FA_0.3	Fraser

"**" means that CU status should be re-evaluated after review of enhancement level definition.

Table 2. Frequency table of integrated status evaluations for the 35 southern BC Chinook Conservation Units.

Status Zone	Count	Histogram
RED	11	
RED / AMBER	1	
AMBER	1	
GREEN	2	
DD	9	
TBD	11	
Total Evaluations	35	-

Table 3. Types of Data Deficient CUs of southern BC Chinook; this table outlines the reason for each DD designation. Note that more detailed status commentaries were also developed for each CU (Appendix C of the Research Document resulting from this workshop).

Type 1: Time series of good quality data available, but considered not representative or of unknown representativeness of whole CU.

CU ID	CU Name	Brief Comment
CK-05	Lower Fraser River-Upper Pitt_SU_1.3	Only 1 population, a small tributary, identified and surveyed (Blue River); likely others that have not yet been identified.
CK-06	Lower Fraser River_SU_1.3	Only 1 of at least 7 identified populations is surveyed, with only a short time series; likely others that have not yet been identified.

Table 3 continued.

Type 2: Good quality data available, but time series too short to make inferences about trends.

CU ID	CU Name	Brief Comment
CK-28	Southern Mainland-Southern Fjords_FA_0.x	Data quality issues need to be investigated.

Type 3: Data available, but none meet the quality criteria.

CU ID	CU Name	Brief Comment
CK-82	Upper Adams River_SU_x.x	Estimates based on redd counts, and are low quality though this is not accurately reflected in current NUSEDS Estimation Classification coding; corrections are needed
CK-08	Middle Fraser-Fraser Canyon_SP_1.3	Estimates derived from opportunistic observations during Sockeye Salmon surveys – considered incomplete at best

Type 4: Good quality data available, but none for sites classified as wild.

CU ID	CU Name	Brief Comment
CK-04	Lower Fraser River_SP_1.3	Enhancement stopped in 2002, should review classification. **Note that this CU is currently classified as TBD**, but may fall into this category once enhancement levels are reviewed.**

Type 5: No recent data.

CU ID	CU Name	Brief Comment
CK-20	Southern Mainland-Georgia Strait_FA_0.x	Data quality issues need to be investigated. Limited number of low quality estimates for wild sites. 1 enhanced site with long continuous time series indicates modest numbers (>10,000).
CK-23	East Vancouver Island-Nanaimo_SP_1.x	Flagged for investigation whether this CU still exists. Some low quality estimates but only1 high quality. Numbers are low.
CK-34	Homathko_SU_x.x	Visual surveys not feasible on this large and turbid river.
CK-35	Klinaklini_SU_1.3	Past fishwheel surveys showed large number of Chinook (7,000 to18,000), but no data from recent years and not part of regular survey program.

Day 3 began with a discussion of the enhanced contribution issue. A method to consider enhanced contribution by redefining the wild site versus enhanced site classification was proposed by the workshop organizers. However, there was consensus that a review of the proposed method was not within the scope of the workshop as defined by the TOR and that this review should be the subject of a future RPR process.

RECOMMENDATIONS AND ADVICE

In addition to the workshop objectives relating to status determinations, participants were asked to develop advice regarding the following objectives:

- data and methods required for assessing the status of any CUs that are currently data deficient;

- appropriate frequency of status re-assessment, changes to monitoring variables that could invoke early re-assessment, and the appropriate timing for assessment relative to data availability; and
- identify and recommend data management approaches required to support future re-assessment of CUs.

Participants concluded that the classification of data deficient CUs could be improved by further categorization into one of several categories of data deficiency, for example:

- no spawner data (but may have data relating to another life history stage);
- no data at all;
- no data of sufficient quality; and
- some data of sufficient quality, but not enough to judge trends.

The proposal for re-assessment frequency that was presented on Day 1 by Carrie Holt was generally endorsed by the participants. A detailed re-assessment could be focused on one or a few CUs rather than all 35 CUs in order to be a less onerous process than a multi-day workshop. The re-assessments would be more efficient if the data treatments that had to be handled manually for the present workshop could be incorporated into more automated treatments in the regional Salmon Escapement Data System (nuSEDS).

ACKNOWLEDGEMENTS

The chairperson would like to recognize the contributions of the workshop organizing team, consisting of Gayle Brown, Carrie Holt, Gottfried Pestal and Mary Thiess. These four individuals spent countless hours working out the details of the workshop, including the preparation and multiple reviews of the large volume of presentation material.

The chairperson would also like to highlight the contributions by Sue Grant. She generously contributed advice and documentation based on her Fraser Sockeye WSP Assessment workshop experience. Without her assistance (during a very busy time in her work schedule) this workshop would not have achieved the level of success that it did.

The workshop involved extensive plenary discussion. The chairperson would like to thank Nicole Trouton, Kristin Singer, and Cheryl Lynch who acted as the rapporteurs to capture the discussions.

The chairperson would like to thank Lesley MacDougall, Rob Kronlund and Marilyn Hargreaves from the Centre for Science Advice, Pacific for their support in the organization and delivery of the workshop.

Last but not least the chairperson would to thank all of the workshop participants. The days were long and the discussions were often challenging. However, all remained committed and professional during the course of the workshop. Ultimately, the success of the process is the result of their dedication.

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APPENDIX A: TERMS OF REFERENCE

Assessment of Southern British Columbia Chinook Salmon Conservation Units, Benchmarks and Status

Regional Peer Review Meeting - Pacific Region

February 4-6, 2014
Nanaimo, British Columbia

Chairperson: Bruce Patten

Context

Populations of southern British Columbia (BC) Chinook Salmon (*Oncorhynchus tshawytscha*), defined as those entering the ocean south of Cape Caution, have experienced repeated years of low returns and there is a high degree of uncertainty about their longer term abundance and productivity. DFO is currently undertaking a number of initiatives in order to assess the current status of these stocks and to guide the implementation of appropriate actions for their conservation. These actions are within the context of both the Wild Salmon Policy (WSP) and in light of a pending Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment of status.

As part of implementing Strategy 1 of the WSP, Canada is required to assess the biological status of WSP Conservation Units (CUs) for Pacific salmon. To meet this requirement for southern British Columbia Chinook Salmon, this Canadian Science Advisory Secretariat (CSAS) workshop will apply the status integration techniques developed for Fraser River Sockeye Salmon (Grant & Pestal 2013) to determine a WSP status for each of the 35 southern BC Chinook Salmon CUs. This process will use the benchmarks and other information reviewed during two pre-COSEWIC Regional Peer Review meetings (March 6-8, 2013 and November 5-6, 2013).

Objectives

The objectives of this workshop are to:

1. Determine an integrated WSP status for each southern BC Chinook Salmon CU;
2. Indicate the effect on the status assessments of including, or excluding, enhanced Chinook Salmon contributions;
3. Provide advice on data and methods required for assessing the status of any CUs that are currently data deficient;
4. Include information specific to each CU on fishing mortality, where possible;
5. Provide advice on the appropriate frequency of status re-assessment, changes to monitoring variables that could invoke early re-assessment, and the appropriate timing for assessment relative to data availability; and
6. Identify and recommend data management approaches required to support recommended changes to re-assessment of CUs.

The workshop will deal exclusively with assessments of biological status under WSP Strategy 1, and will be based on CSAS-accepted metrics and benchmarks. An integrated WSP status will be determined for each of the 35 CUs by breakout groups, each assigned CUs defined by one or more features or issues (e.g., low data quality, short time series or the presence of an enhanced component within a CU). Each group will report how they arrived at a status assessment for their CUs. The final integrated status will be assigned in a plenary session and

CU-specific characteristics of data or metrics used by participants in their decision making will be captured for inclusion in a research document to be prepared following the workshop.

Questions for participants to consider in support of achieving the objectives include:

1. How should status assessments be combined across different metrics?
2. How should uncertainty in benchmarks be considered?
3. How should data quality be considered in the status evaluation?
4. How should additional information be considered in status integration?

Participants will be invited to respond to these four questions through small group or individual interviews prior to the workshop. During the interviews, participants will be introduced to the information to be used in the integrated status review process.

Expected Publications

- Science Advisory Report
- Proceedings Document
- Research Document

Participation

- DFO (Science Branch, Fisheries Management Branch)
- Province of British Columbia
- Southern BC Chinook Technical Working Group
- Commercial and recreational fishing interests
- First Nations
- Non-government organizations
- Academia

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APPENDIX B: AGENDA

Regional Workshop
Centre for Science Advice Pacific
Southern BC Chinook WSP Status Assessment

February 4-6, 2014
Coast Bastion Hotel, Nanaimo, British Columbia

Chairperson: Bruce Patten

Tuesday, February 4, 2014, 9:00 to 5:00

Time	Subject	Presenter
9:00	Introductions • Review Agenda & Housekeeping • CSAS Overview and Procedures • Review Terms of Reference	Bruce Patten
9:30	Background Presentations • WSP metrics • Data assembly and treatment work • Brief summary of Independent Science Panel Report on SBC Chinook • Guidelines for integration of assessments • Proposal for frequency of re-assessment • Questions for clarification	Gayle Brown Carrie Holt Mary Thiess
10:30	Break	
10:45	Guide to CU Dashboards	Gottfried Pestal
11:00	Breakout Groups to Work on CU Set #1 (Wild Only – Trends Agree)	Participants
12:00	Lunch	
1:00	Plenary Session to Discuss CU Set #1	Bruce Patten
1:30	Breakout Groups to Work on CU Set #2 (Wild Only – Trends Differ)	Participants
2:30	Break	
2:45	Plenary Session to Discuss CU Set #2	Bruce Patten
3:15	Breakout Groups to Work on EU Set #3 (Enhanced Only - Trends Agree)	Participants
4:15	Plenary Session to Discuss EU Set #3	Bruce Patten
4:45	Plan for Day 2	Bruce Patten
5:00	Adjourn	

Wednesday, February 5, 2014, 8:00 to 5:00

Time	Subject	Presenter
8:00	Welcome & Introductions	Bruce Patten
8:10	Recap of Day 1 and Outcomes So Far	Gottfried Pestal
8:30	Breakout Groups to Work on EU Set #4 (Enhanced Only – Trends Differ)	Participants
9:00	Plenary Session to Discuss EU Set #4	Bruce Patten
9:15	Breakout Groups to Work on CU/TU Set #5 (Wild & Enhanced – Trends Agree) includes coffee break	Participants
10:45	Plenary Session to Discuss CU Set #5	Bruce Patten
11:30	Breakout Groups to Start Work on CU/TU Set #6 (Wild & Enhanced – Trends Differ)	Participants
12:30	Lunch	
1:30	Plenary Session to Discuss CU Set #6	Bruce Patten
2:15	Breakout Groups to Work on CU Set #7 (Data Deficient)	Participants
2:30	Plenary Session to Discuss CU Set #7	Bruce Patten
2:45	Reveal CU Names	
3:00	Break	
3:30	Review Blind Assessment Results and Classify for Further Discussion	Bruce Patten
5:00	Adjourn	

Thursday, February 6, 2014, 8:00 to 4:00

Time	Subject	Presenter
8:00	Welcome & Introductions	Bruce Patten
8:10	Recap of Day 2 and Outcomes So Far	Gottfried Pestal
8:30	Review Non-contentious CUs and Assign Status Category	Carrie Holt
9:30	Discuss Contentious CUs and Incorporate Qualitative Information	Gayle Brown
10:00	Break	
10:30	Discuss Contentious CUs and Incorporate Qualitative Information (cont'd)	Gayle Brown
12:00	Lunch	

Time	Subject	Presenter
1:00	Discuss Contentious CUs and Assign Status Category	Gayle Brown
2:00	Break	
2:30	Develop Advice Regarding Remaining Objectives • data and methods required for assessing the status of any CUs that are currently data deficient; • appropriate frequency of status re-assessment, changes to monitoring variables that could invoke early re-assessment, and the appropriate timing for assessment relative to data availability; and • identify and recommend data management approaches required to support recommended changes to re-assessment of CUs	Gayle Brown
3:30	Communications, Publications and Parking Lot Items	Bruce Patten
3:50	Next Steps	Bruce Patten
4:00	Adjourn	

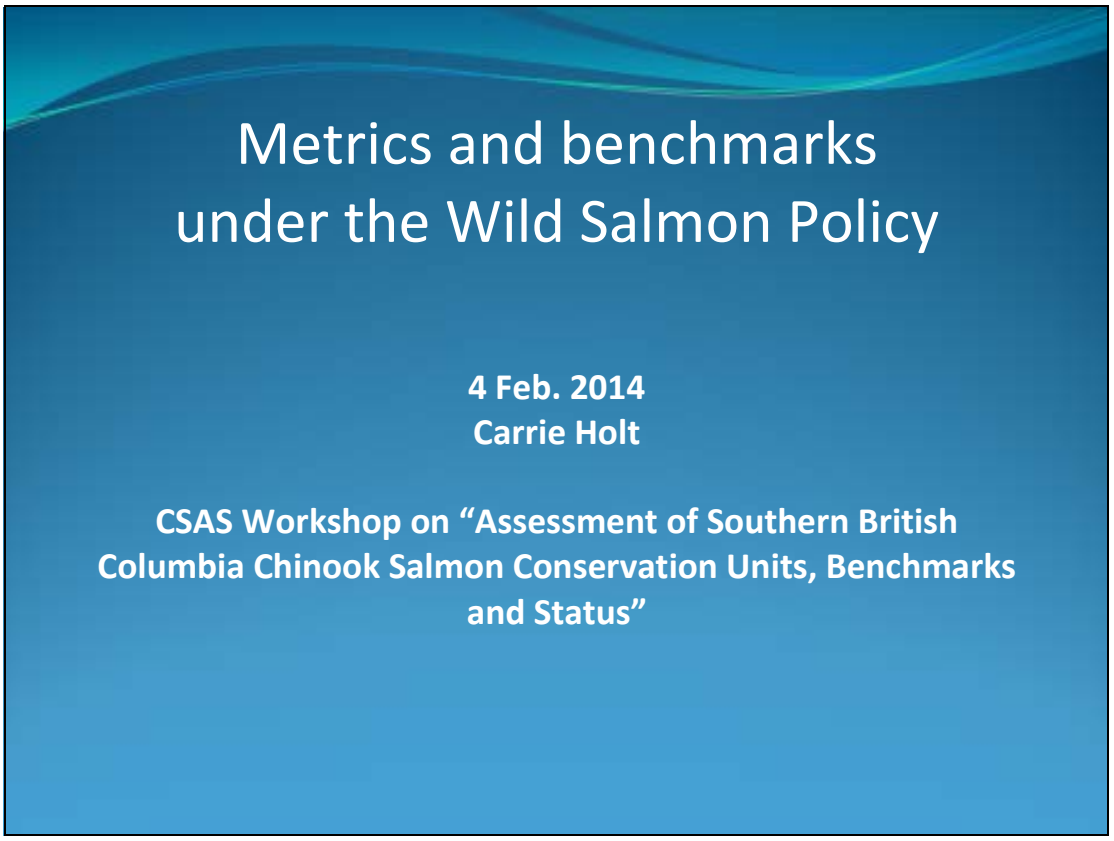
APPENDIX C: PARTICIPANTS AT WEBINARS AND WORKSHOP

Table C1. List of participants and their attendance at the pre-workshop webinars and the workshop.

Name	Affiliation Type	Webinar				Workshop Day		
		1	2	3	4	1	2	3
Bailey, Richard	DFO	no	no	yes	no	yes	yes	yes
Baillie, Steve	DFO	no	yes	no	no	yes	yes	yes
Candy, John	DFO	yes	no	no	no	yes	yes	yes
Grant, Sue	DFO	no	yes	no	no	yes	yes	yes
Hargreaves, Marilyn	DFO	no	no	no	no	yes	no	yes
Kadowaki, Ron	DFO	no	no	no	no	yes	yes	yes
Lewis, Dawn	DFO	yes	no	no	no	yes	yes	yes
Lynch, Cheryl	DFO	yes	no	no	no	yes	yes	yes
MacDougall, Lesley	DFO	no	yes	no	no	yes	yes	yes
Maxwell, Marla	DFO	no	yes	no	no	yes	yes	yes
O'Brien, Dave	DFO	yes	no	no	no	yes	yes	yes
Parken, Chuck	DFO	yes	no	no	no	yes	yes	yes
Saunders, Mark	DFO	no	yes	no	no	yes	yes	yes
Sawada, Joel	DFO	no	no	no	yes	yes	yes	no
Singer, Kristin	DFO	no	no	yes	no	yes	yes	yes
Tompkins, Arlene	DFO	yes	no	no	no	yes	yes	yes
Trouton, Nicole	DFO	no	no	yes	no	yes	yes	yes
Vélez-Espino, Antonio	DFO	yes	no	no	no	yes	yes	yes
Whitehouse, Timber	DFO	no	no	no	no	yes	yes	yes
Whithler, Ruth	DFO	no	yes	no	no	yes	yes	yes
Willis, Dave	DFO	no	yes	no	no	yes	yes	yes
Ayers, Cheri	External	yes	no	no	no	yes	yes	yes
Campbell, Kelsey	External	yes	no	no	no	yes	yes	yes
Crawley, Sabrina	External	no	no	no	no	yes	yes	no
Gale, Rupert	External	no	yes	no	no	yes	yes	yes
MacDuffee, Misty	External	no	no	no	yes	yes	yes	yes
Ormond, Chad	External	no	no	yes	no	yes	yes	yes
Peterman, Randall	External	no	yes	no	no	yes	yes	yes
Riddell, Brian	External	no	no	no	no	yes	yes	no
Rosenberger, Andy	External	no	yes	no	no	yes	yes	yes
Sakich, Peter	External	yes	no	no	no	yes	yes	yes
Staley, Mike	External	yes	no	no	no	yes	yes	yes
Walsh, Michelle	External	no	yes	no	no	yes	yes	yes
Brown, Gayle	Organizing Team	yes	no	yes	no	yes	yes	yes
Holt, Carrie	Organizing Team	yes	yes	no	no	yes	yes	yes
Patten, Bruce	Organizing Team	yes	yes	yes	yes	yes	yes	yes
Pestal, Gottfried	Organizing Team	yes	yes	yes	yes	yes	yes	yes
Thiess, Mary	Organizing Team	yes	yes	yes	yes	yes	yes	yes
	Count of Participants	16	15	8	5	38	37	35

APPENDIX D: BACKGROUND PRESENTATIONS

WSP METRICS AND GUIDELINES FOR STATUS INTEGRATION – CARRIE HOLT



Workshop using Biological Benchmarks

Biological Benchmark

- a biological benchmark against which the biological attributes (e.g. abundance or trends in abundance) of a CU can be measured in order to determine its status;
- describes zones of biological status; **not** prescriptive for management actions;
- biological considerations only

Wild Salmon Policy Strategy 4: Future (Not at this Workshop)

Management Reference Point (e.g. limit and target reference points)

- describe harvest rules (e.g., thresholds in abundances which trigger management actions);
- link directly to management actions;
- in addition to biological factors (strategy 1), also includes the consideration of habitat (strategy 2) and socio-economic factors.

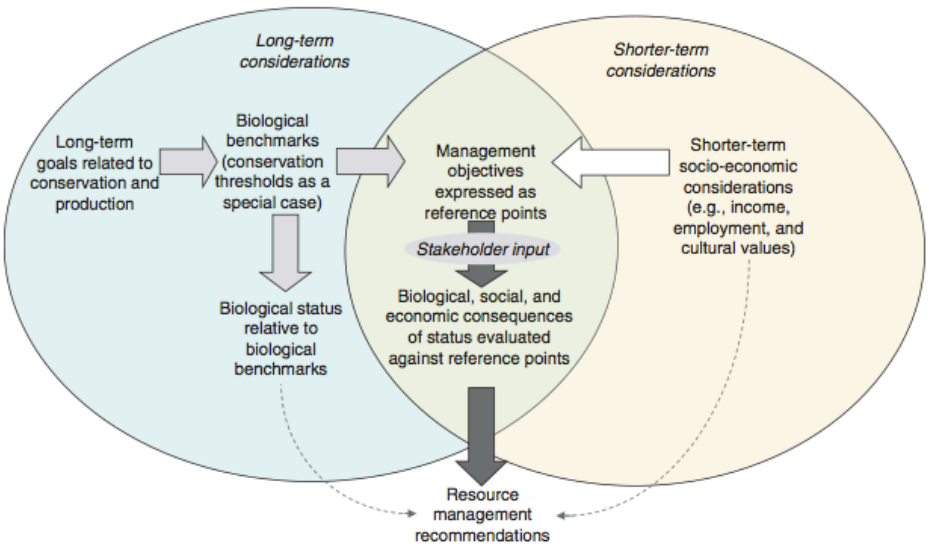
(Adapted from Grant and Cass, Nov. 2011)

Distinguishing benchmarks of biological status from management reference points: A case study on Pacific salmon in Canada

THEMATIC SECTION
Politics, Science and Policy of Reference Points for Resource Management

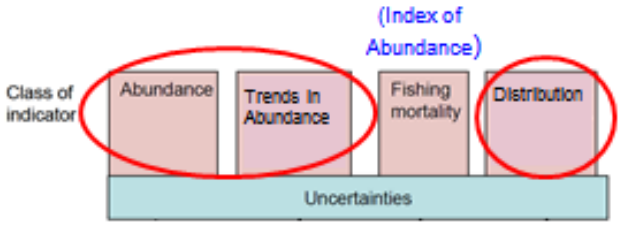
CARRIE A. HOLT* AND JAMES R. IRVINE

Fisheries and Oceans Canada, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, British Columbia V9T 6N7. Canada



Metrics

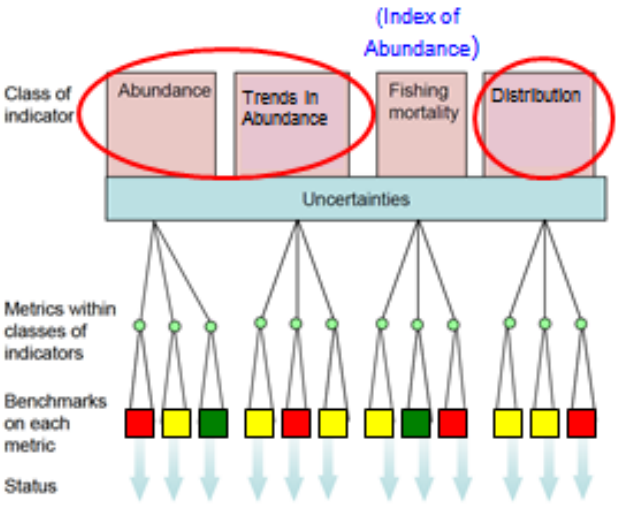
Goal of Strategy 1 of the WSP is to assess biological status of CUs



(Holt et al. 2009).

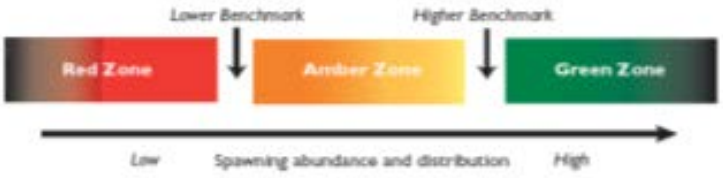
Metrics and benchmarks

Goal of Strategy 1 of the WSP is to assess biological status of CUs



(Holt et al. 2009).

Benchmarks



"lower benchmark…will be established at a level of abundance high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC"

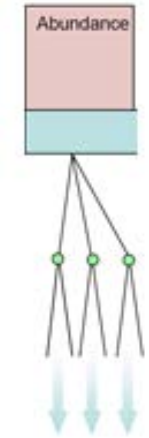
"**While a CU in the Amber zone should be at a low risk of loss,** there will be a degree of lost production. Still this situation may result when CUs share risk factors with other more productive units."

"…identif[ies] whether harvests are greater than the level expected to provide on an average annual basis, the maximum annual catch for a CU, given existing environmental conditions…**there would not be a high probability of losing the CU"**

(Adapted from Grant and Cass, Nov 2011)

	Assessment Actions (WSP p19, 26, 32)	Management Action (WSP p17)	Management Drivers (WSP p17-18)
Red	"…a detailed analytical assessment will normally be triggered to examine impacts on the CU of fishing, habitat degradation, and other human factors, and evaluate restoration potential.""…"detailed stock assessments…will identify the reasons for the change in status." "CUs in the Red zone…will be identified as management priorities…the protection and restoration of these CUs will be primary drivers for harvest, habitat and enhancement planning."	"The presence of a CU in the Red zone will initiate immediate consideration of ways to protect the fish, increase their abundance and reduce the potential risk of loss."	'Biological considerations will be the primary drivers for the management of CUs with Red status"
Amber	"…a detailed analytical assessment may be required to input to Strategies 2 & 3.."	"…implies caution in the management of the CU"	"Decisions about the conservation of CUs in the Amber zone will involve broader considerations of biological, social and economic issues…involves a comparison of the benefits from restoring production versus the costs arising from limitations imposed on the use of other CUs to achieve that restoration."
Green	"…a detailed analytical assessment of its biological status will not usually be needed."	(see drivers)	"Social and economic considerations will tend to be the primary drivers for the management of CUs in the Green zone, though ecosystem or other non-consumptive use values could also be considered"

(Adapted from Grant and Cass, Nov. 2011)



Abundance Metrics:

Relative-abundance: last generation geometric average

Lower benchmark: S_{gen}, spawner abundances that will recover to S_{MSY} within one generation under equilibrium conditions

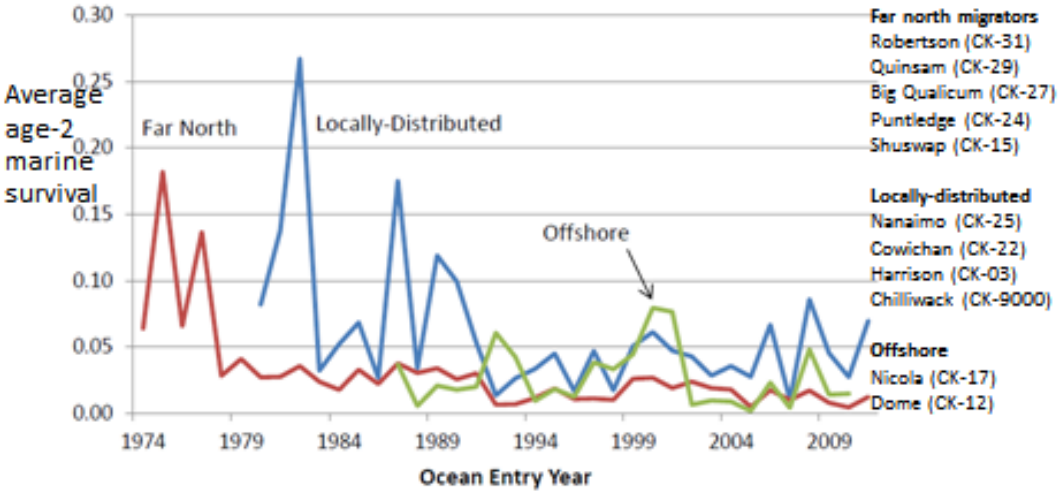
Upper benchmark: 85% S_{MSY}, deviation from recommended 80%S_{MSY}, but was chosen to be consistent with bilateral PST obligations

(1) Accessible watershed area model (Parken et al. 2006) provided estimates of S_{MSY} and spawner abundances at replacement (S_{REP}).
(2) From model outputs, we inferred parameters for stock-recruitment relationship (productivity parameter, Ricker *a*; capacity parameter, Ricker *b*).
(3) Estimated lower and upper benchmarks from Ricker parameters (as in Holt et al. 2009).

* For 2 CUs where recruitment time-series was available, abundance benchmarks were derived directly from spawner-recruit relationship

8

Models rely on historical data, but productivity has changed

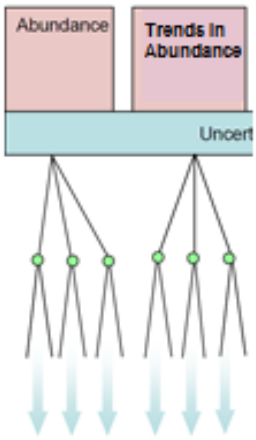


(Independent Science Panel Review Southern BC Chinook, May 2013, p.81)

9

Benchmarks on abundances adjusted to account for reductions in productivity

- Independent Science Panel Review (May 2013) of Southern BC Chinook suggested revising fisheries reference points to account for the ~ 50% reduction in productivity observed across numerous populations
- In consultation with regional experts, the same adjustment (0.5 x Ricker *a*) has been implemented in derivation of abundance-based benchmarks (resulting in higher benchmark values, i.e., more precautionary)



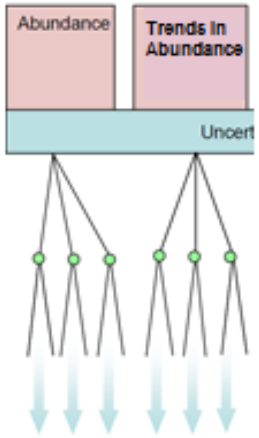
Trends in Abundance Metrics

Short-Term trends in abundance: last 3 generation trend

Short-Term trends in abundance probability last 3 gen. trend is greater than 25% decline

Extent of change in abundance: ratio of last generation to long-term geometric average

11



Trends in Abundance Metrics

Short-Term trends in abundance: last 3 generation trend

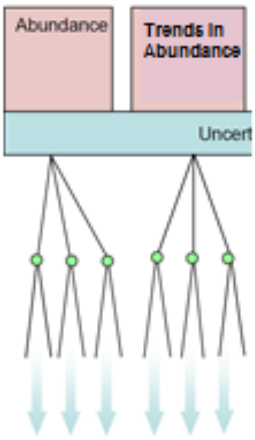
Short-Term trends in abundance probability last 3 gen. trend is greater than 25% decline

Extent of change in abundance: ratio of last generation to long-term geometric average

Lower benchmark: 25% decline over longer of 3 generations or 10 years

Upper benchmark: 15% decline over longer of 3 generations or 10 years

12



Trends in Abundance Metrics

Short-Term trends in abundance: last 3 generation trend

Short-Term trends in abundance probability last 3 gen. trend is greater than 25% decline

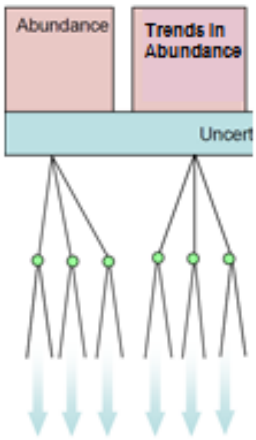
Extent of change in abundance: ratio of last generation to long-term geometric average

Lower benchmark: 40% probability that the decline over 3gen (or 10 years) is greater than 25% (i.e., is more extreme than lower benchmarks on short-term trends)

Upper benchmark: 20% probability that the decline over 3gen (or 10 years) is greater than 25% (i.e., is more extreme than lower benchmarks on short-term trends)

Benchmarks derived from Grant and Pestal (2012)

13



Trends in Abundance Metrics

Short-Term trends in abundance: last 3 generation trend

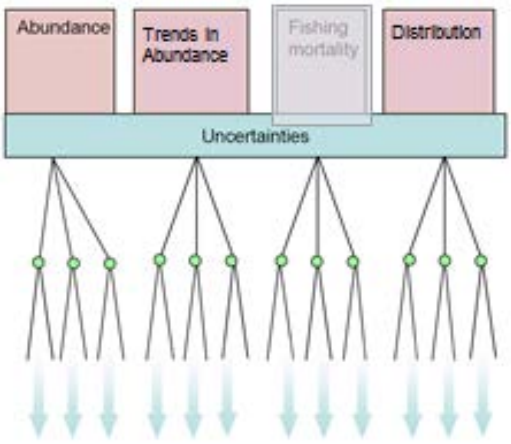
Short-Term trends in abundance probability last 3 gen. trend is greater than 25% decline

Extent of change in abundance: ratio of last generation to long-term geometric average

Lower benchmark: 0.5

Upper benchmark: 0.75

as in Grant et al. (2011) and Grant and Pestal (2012)



Distribution Metrics

Concentration of spawners among sites (stacked bar plots per decade)

Distribution of temporal trends among sites (whisker plots)

Distribution of sites among abundance classes (table)

Uncertainties

- Uncertainties in estimates of abundance benchmarks: quantified on dashboard with confidence intervals
- Uncertainties in status relative to short-term trend metrics: quantified with probability of declines
- Uncertainties due to data quality/quantity: displayed graphically on dashboard
- Uncertainties due to data representativeness: included on dashboards with comparison of # sites included in analyses and total # of sites reported in NuSEDS

Precautionary Approach

"being cautious when scientific information is uncertain, unreliable or inadequate and not using the absence of adequate scientific information as a reason to postpone or fail to take action to avoid serious harm to the resource"

"scientific uncertainty about stock status and/or stock trajectory must be explicitly considered when establishing decision rules and management actions. Where due to uncertainty, two or more status/trajectory combinations could be considered on the basis of the scientific advice, provided management actions from the more precautionary [status] should be followed."

DFO 2009. A Fishery Decision-Making Framework Incorporating the Precautionary Approach.

Workshop goal

Integrate status across multiple metrics and benchmarks

Proposal for frequency of re-assessment

(To be re-visited on Day 3 of Workshop)

- Staff to reassess individual metrics annually
- Meeting required only if results indicate a change in individual metric status that could change the overall status for the CU, as identified in the CU narratives.
- In these cases, a smaller/shorter meeting would be convened to address the affected CUs only (e.g., through a CSAS Science Special Response review, or possibly through SAC).
- A full reassessment of all CUs every 4 years
- Reassessment meetings could be shorter/smaller than the current workshop

Guidelines for status integration

Recommendations from Grant and Pestal (2012) on Fraser River sockeye salmon

"Based on the in-depth discussions at the workshop and the case-by-case nuances in metrics used and associated commentaries on the underlying data, it is not likely that a single prescriptive algorithm for status integration under the WSP can be developed"

- In general, metric on abundance weighted over short and long-term trend metrics*
- Interpretation of trend metrics depended on productivity, abundances (including relative to the COSEWIC criterion on very small abundances), and fishing mortality

* Likely not applicable to SBC chinook

Guidelines for status integration

Recommendations from Grant and Pestal (2012) on Fraser River sockeye salmon

- In particular, participants felt trends were not reflective of intrinsic biological status because of influence of fishing mortality, so interpreted in light of productivity trends
- Also, retrospective analysis of status used to weight metrics

Guidelines for status integration

Recommendations from Brunet (2012)

Combining multiple Indicators to determine conservation status based on expert preferences (MRM thesis, SFU)

- Quantitative stated-preference methods to elicit expert opinion on integration of multiple metrics for WSP

Conclusions:

- Metric on abundance weighted over other metrics*
- Productivity influenced status
- Interactions between metrics were important
  - E.g., effect of green status on long-term trends was dampened when harvest rates were high (but only when productivity was low)
- Data quality had little impact on overall status

* Likely not applicable to SBC chinook

Guidelines for status integration

See poster for proposed guidelines for current assessment based on previous recommendations and webinar discussions

Appendix slides

Example benchmark calculation: CK 13

Accessible watershed-area model output:

S_{MSY}= 104263

S_{REP}=270229

(1) $log_e(\alpha) = \dfrac{0.5 - \dfrac{S_{REP}}{S_{MSY}}}{0.07}$

(2) $\beta = \dfrac{log_e(\alpha)}{S_{REP}}$

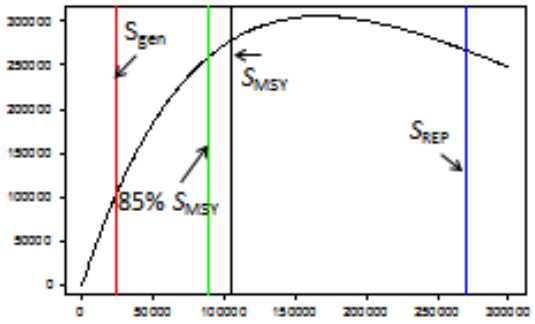
α = 4.97, β = 5.98e-06,

$1/\beta = S_{MAX}$= 167219

Ricker equation:

$$R = \alpha S e^{-\beta \cdot S + \omega}, \omega \sim (N, \sigma_\omega^2),$$

Derived Ricker model



Lower benchmark: S_{gen}=24183

Upper benchmark: 85% S_{MSY}= 88624

(Equations from p.23, & Holt et al. 2009)

Example benchmark calculation: CK 16 (highly productive CU)

Accessible watershed-area model output:

S_{MSY}= 1003

S_{REP}=2624

(1) $log_e(\alpha) = \frac{0.5 - \frac{S_{REP}}{S_{MSY}}}{0.07}$

(2) $\beta = \frac{log_e(\alpha)}{S_{REP}}$

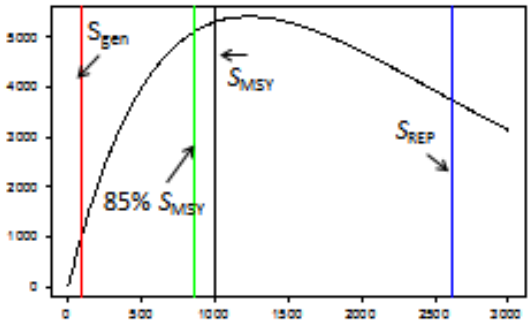
$\alpha = 11.9$, $\beta = 0.00064$,

$1/\beta = S_{MAX}$= 1560

Ricker equation:

$$R = \alpha S e^{-\beta \cdot S + \omega}, \omega \sim (N, \sigma_\omega^2),$$

Derived Ricker model



Lower benchmark: S_{gen}=91

Upper benchmark: 85% S_{MSY}= 853

(Equations from p.23, & Holt et al. 2009)

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APPENDIX

CU	Indicator Stock	Mean 1995-2008 brood exploit. Rate	Assumed Ricker 'a'	E_{MSY}	Adjusted Ricker 'a'	Adjusted E_{MSY}
FAR NORTH MIGRANTS						
SWVI	Robertson	**0.578***	2.03	0.73	1.015	**0.44**
NEVI	Quinsam	0.405	2.03	0.73	1.015	0.44
Qual-Punt Falls	Big Qualicum	0.415	2.03	0.73	1.015	0.44
Mid ECVI Summer	Puntledge	0.302	2.03	0.73	1.015	0.44
Shuswap Summer 0.3	Lower Shuswap	**0.486**	2.07	0.74	1.035	**0.44**
Thompson Summer 0.3	Lower Shuswap	**0.486**	1.59	0.62	0.80	**0.35**
LOCALLY-DISTRIBUTED						
Nanaimo-Chemainus	Nanaimo	**0.507**	2.34	0.79	1.17	**0.49**
Cowichan	Cowichan	**0.644**	1.87	0.69	0.99	**0.43**
Lower Fraser Fall	Harrison (Chehalis)	0.355	1.67	0.64	1.34	0.54
Lower Fraser Fall	Chilliwack	0.301	1.67	0.64	1.34	0.54
OFFSHORE						
Lower Thompson Spring (1.2)	Nicola	0.238	1.51	0.60	0.75	0.34
Upper Fraser Spring	Dome	**0.698**	1.65	0.63	0.82	**0.36**

*The total exploitation rate for the Robertson Creek stock is probably unusually high due to the intensive terminal fisheries targeting these hatchery-origin fish.

Far north migrators
Robertson (CK-31)
Quinsam (CK-29)
Big Qualicum (CK-27)
Puntledge (CK-24)
Shuswap (CK-15)

Locally-distributed
Nanaimo (CK-25)
Cowichan (CK-22)
Harrison (CK-03)
Chilliwack (CK-9000)

Offshore
Nicola (CK-17)
Dome (CK-12)

(Independent Science Panel Review Southern BC Chinook, May 2013, p.82)

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Integrated status: next steps

- Inform long-term strategic planning for FAM, SEP, habitat management
- Components of WSP assessments have been used in annual harvest planning (e.g., FRSSI process)
- Development of linkages between WSP biological assessment and management response is on-going (not the focus of this workshop)

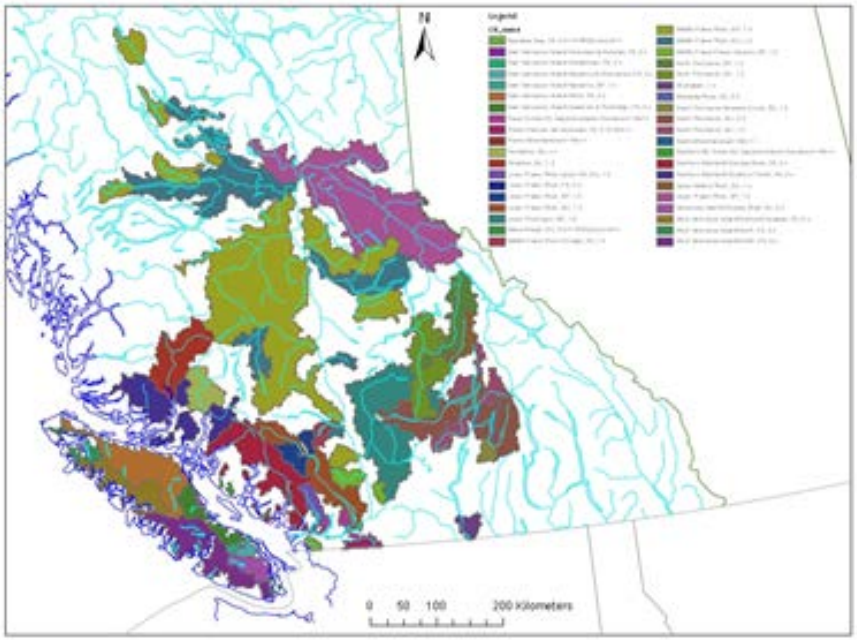
DATA ASSEMBLY AND TREATMENT WORK – MARY THIESS

Escapement Data: Quality, Treatments & Issues

February 4, 2014
Mary Thiess

CSAS Workshop
"Assessment of Southern British Columbia Chinook Salmon Conservation Units and Status"

Southern British Columbia Chinook Conservation Units



Reviewed February 2013 (DFO 2013)

Conservation Unit Summary

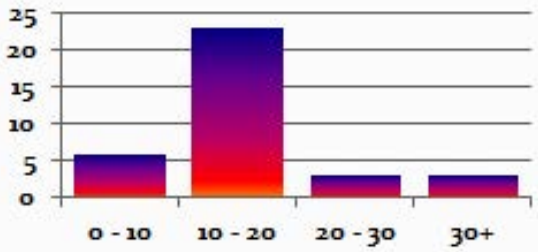
Geographical Grouping	No. CUs	Adult Run Timing			Juvenile Type	
		Spring	Summer	Fall	Ocean	Stream
Inside Fraser	19	6	10	3	6	13
Outside Fraser	16	1	4	11	13	3
Total	35	7	14	14	19	16

Escapement data

- Available time series were filtered by:
  - Estimate Classification (Type 1 – Type 4 only)
  - Only "Persistent" or "Extirpated" sites contributed data to analysis (based operational definitions)
  - A Start Year was implemented to focus analysis on most consistent data (unique to each CU)

Time Series Length

Number of years of data – Start Year to 2012



- Longest – 38 years (CK-04)
- Shortest – 8 years (CK-06)

Escapement data

Infilling was used to make multi-site CUs consistent across years:

- Single-site CUs were not infilled
- Multi-site CUs with missing or low quality years of data (no more than 1 complete generation) were infilled using the English et al. method (2007)

Escapement Data Summary

- **114/262** "P" or "EX" sites passed data quality and completeness criteria [**148** data deficient sites]
- "P" sites distributed among **30/35** CUs [**5** CUs are DD]
  - **15** CUs are single-site
    - **8** were single-site to start with, **7** were multi-site CUs but only have 1 time series after data treatments were applied
  - **15 CUs are multi-site**
    - **1** has more than 20 sites, **2** have between 10-19 sites, **12** have 2-9 sites (most are 2-4 sites)

Escapement data: Bottom Line

- The best available data has been compiled and reviewed.
- The data available for analysis from "Start Year" to 2012 is consistent across years within each CU.
- The question remains… how representative of the CU is each escapement time series?

  ➔ Expert opinion will have to be the judge of this

Representativeness

1. Even with a data quality filter, there is still a range of average data quality among CUs & EUs .
2. Extent of coverage provided by available data varies among CUs & EUs. There has been no expansion factors or adjustments made to data streams that represent only partial coverage .
3. Length of available data is shorter than three generations for some CUs/EUs, but metrics have been applied anyway.
4. Data streams contain gaps in the annual estimates in a few cases where infilling could not be carried out .

Site Categorization

- Based on quantity and quality of available escapement estimates, 1995-2012 (or "Start Year" for single-site CUs only).
- **Persistent**: at least 10 high quality observations, or 8-9 high quality observations which can be supplemented with infilling to give at least 10 observations, 1995-2012
- **Data deficient**: 7 or fewer high quality observations, or 8-9 high quality observations which cannot be supplemented with infilling (no more than 1 complete generation missing)
- **Aggregated, Extirpated, Deleted**

Escapement Data - Enhancement

- Enhancement of Chinook in southern BC started at least in the '60s, probably earlier to:
  - Increase fish in fisheries
  - Conserve/rebuild stocks of concern
  - Provide information for management
  - Meet Pacific Salmon Treaty obligations
    - CWT Exploitation Rate Indicator Stock program (11 southern BC CUs have indicators)
- Out of **35** CUs, only **6** with no evidence of enhancement

Wild Salmon Policy & Wild Salmon

- **Wild salmon** → those that "have spent their entire life cycle in the wild and originate from parents that were also produced by natural spawning and continuously lived in the wild." (p.2, Wild Salmon Policy 2005)
- **Enhanced salmon** → those "that originate directly from hatcheries and managed spawning channels."
- Definition "safeguards against potential adverse effects resulting from artificial culture"
- Independent Advisory Panel concluded that adverse enhancement effects likely minimal in the Fraser watershed but highly likely in other SBC regions (2013)

Status Assessment under the WSP

- "WSP conservation units (CUs) developed for Pacific salmon in BC are defined as being based on "wild" fish and status assessment of CUs is also to be based on wild fish."

> Abundance and productivity of hatchery fish not regulated by natural rearing and spawning habitat; protected from natural mortality

- "The status of CUs will be monitored, assessed against selected benchmarks, and reported publicly."

Categorization of Enhancement

- Only some 1st generation enhanced BC Chinook are marked, internally or externally
- No way to ID most 1st generation hatchery fish & no way to ID 2nd generation hatchery fish in escapements
- Practical approach is to categorize sites, not fish, based on records of enhancement activity available in SEPs EPADS database

Categorization of Enhancement

- **For the 12 period (3 gen) from 2000-2011:**
- >25% mean hatchery-origin contribution or >25% of years with enhancement = HIGH, otherwise MODERATE
- Any evidence of enhancement before 2000 rated as LOW, otherwise UNKNOWN
- No evidence doesn't = no enhancement (historical records incomplete) thus UNKNOWN rating
- Other sources of information (thermal otolith marks, DNA, etc.) not incorporated yet
- Sites with substantial releases from other CUs excluded

Summary of Enhancement Categorization

	Unknown	Low	Moderate	High
Total Sites	235	31	17	48
% "P"	23.0%	71.0%	41.2%	64.6%

Escapement Data – CU summary

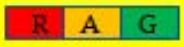
- **12** CUs → data for wild sites only – assess WSP status
- **9** CUs → no data for wild sites but data for enhanced sites – assess status of EU
- **2** CUs → data for enhanced sites only – assess status of EU
- **7** CUs → data for both wild & enh sites – assess WSP status of CU and status of TU
- **5** CUs (1 with an EU) → no data for either wild or enh sites – any recommendations for these?

Status Assessments of CUs

CUs with Wild Sites

↓

Assess WSP status



TUs with Wild & Enhanced Sites

↓

Assess status to inform management plans, inform assessment of CUs with no data?

WSP Status Outcomes vs Annual Preseason Outlook - DRAFT

- Types of data -> various, rigorously reviewed with approved 'treatments vs recent escapements primarily
- Status of data – finalized vs preliminary
- Time frame covered by data – all available vs previous or recent few years
- "Status" assessment process – integration of multiple metrics by experts vs ??
- Management plans – longer term baseline vs upcoming year

APPENDIX E: HANDOUT WITH GUIDELINES FOR INTEGRATION

Preliminary Guidelines for Integration of WSP Metrics

Note: This is the version distributed at the workshop. An updated version incorporating workshop discussions is included in Brown et al. (2014c).

1. **Note whether the escapement time series is an absolute abundance or a relative index.**

   When the abundance time series represents a relative index, the WSP metric on absolute abundances should be interpreted very cautiously because a relative abundance estimate most likely *under-estimates* absolute abundance. Therefore, a red zone status for a relative abundance index may not be reliable. On the other hand, a green zone status for a relative abundance index is quite likely representative of a green zone status for absolute abundance.

2. **Escapement data availability for the most recent period is consistent over time within a CU.**

   The number of sites included in the most recent time period contains data of sufficiently high quality (as determined in the November 2013 pre-COSEWIC CSAS review), and uses the same number of sites for each year within a CU. Differences in abundances cannot be attributed to changes in the numbers of sites sampled within this time period.

3. **Escapement data quality for the most recent period is variable among sites and between years within a CU.**

   Data quality varies by year (predominately between moderate and high quality) within the most recent period as shown in the dashboard (middle row, middle panel, page 1), and may influence the level of confidence in an assessment.

4. **Data representativeness is variable between CUs.**

   Data representativeness can be assessed by comparing the number of sites used for analyses versus the total number of sites in the CU (as found in the NUSEDS database). Refer to bottom row, first panel, page 1 of the dashboard for this information. When the number of sites used for analysis is much less than the total number of sites in the CU, confidence in assessments may be reduced (depending on the relative contributions expected from the missing sites). Both data quality and data quantity will impact the degree of certainty in the assessment of status. DFO's Decision-Making Framework Incorporating the Precautionary Approach suggests that when there is uncertainty in assessed status, management actions from more precautionary assessments should be followed.

5. **Where available, marine survival rate time series may provide context for interpreting trends in abundance.**

   Marine survival represents an intrinsic biological characteristic and may help interpret temporal trends in abundances. For example, declines in abundances that are associated with declining marine survival rates may be of greater concern than reductions in abundances associated with constant or increasing survival.

6. **Where available, exploitation rate time series may provide context for interpreting trends in abundance.**

   As in the assessment of Fraser River sockeye salmon, fishing mortality has not been included as a WSP metric in this assessment because it does not reflect an intrinsic property of the biological population. However, time series of exploitation rates may help interpret temporal trends in abundances. For example, declines in abundances that are associated with stable or reduced exploitation rates may be of greater concern than reductions in abundances associated with managed increases in exploitation.

7. **Habitat-based abundance benchmarks are more relevant for wild CUs than Total Units that include enhancement.**

   Benchmarks on abundances are derived from freshwater capacity estimates, and are more relevant for wild CUs than for total units that include enhancement. Abundances of enhanced populations are less limited by freshwater capacity.

8. **Metric results that are highly variable over time within a CU should be given less weight than more consistent ones.**

   Metrics with results that vary widely over the course of retrospective analyses (shown in line plots on page 2 of the dashboard) may have less weight in the overall integration of status than those that show a consistent pattern in one zone, or persistent trend from one zone to another over time.

9. **"Wild" actually means "low" plus "unknown" enhancement.**

   In some cases, sites with "unknown" enhancement are suspected to contain enhanced Chinook, but no data is presently available to confirm or disprove this.

Additional Guidelines for Integration of WSP Metrics
(Identified during the workshop)

10.	
11.	
12.	
13.	
14.	
15.	

APPENDIX F: REFERENCE POSTERS ON DISPLAY DURING THE WORKSHOP

Workshop Objectives

1. Determine integrated WSP status for each southern BC Chinook salmon Conservation Unit;
2. Indicate the effect of including and excluding enhanced chinook salmon contributions on the status assessments;
3. Provide advice on data and methods required for assessing the status of any Conservation Units that are currently data deficient;
4. Include Conservation Unit-specific information on fishing mortality in the information provided for status assessment, where possible;
5. Provide advice on the appropriate frequency of status re-assessment, changes in monitoring variables that could invoke early re-assessment, and appropriate timing for assessment relative to data availability;
6. Identify and recommend data management approaches required to support recommended changes to re-assessment of CUs.

WSP Strategy 1: Standardized Monitoring of Wild Salmon Status

Action Step 1.1

"Identify CUs"
(Holtby & Ciruna 2007; DFO 2013)

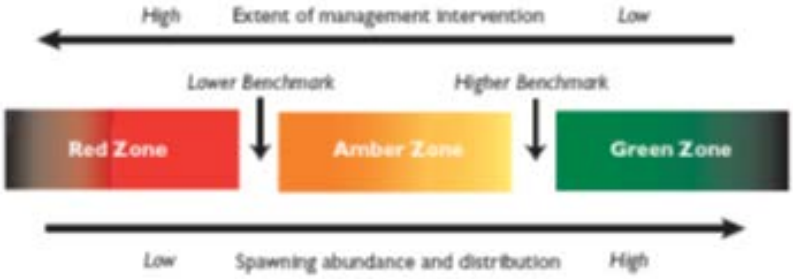
Action Step 1.2

"Develop criteria to assess CUs and identify benchmarks to represent biological status"
(Holt et al. 2009; Holt 2009; Holt & Bradford 2011; Grant et al. 2011; Grant & Pestal 2012)

Action Step 1.3 ← **Focus of this workshop**

"Monitor and **assess status of CUs**"
(Purpose of February 4-6 Workshop using results from Grant et al. 2011 and Grant & Pestal 2012)

"[Biological] Benchmarks identify when the biological production status has changed significantly"

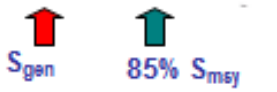


"lower benchmark…will be established at a level of abundance high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC"

"**While a CU in the Amber zone should be at a low risk of loss,** there will be a degree of lost production. Still this situation may result when CUs share risk factors with other more productive units."

"…identif[ies] whether harvests are greater than the level expected to provide on an average annual basis, the maximum annual catch for a CU, given existing environmental conditions**…there would not be a high probability of losing the CU"**

(Adapted from Grant and Cass, Nov. 2011)

METRICS	BENCHMARKS
Abundance vs. WSP BM (estimated using S-R analysis or habitat-based method)	S_{gen}: recovery to S_{msy} in one generation under equilibrium conditions  S_{gen} 85% S_{msy}
Short-term Trend (% change over 3 generations)	 25% decline (slope in log space: -0.028) 15% decline (slope in log space: -0.018)
Extent of Decline (ratio of recent generation average vs. full time series average)	 ratio of 0.5 (50%) ratio of 0.75 (75%)

Biological Benchmarks vs. Management Reference Point

Biological Benchmark (used in Workshop)

- a biological benchmark against which the biological attributes (e.g., abundance or trends in abundance) of a CU can be measured in order to determine its status;
- describes zones of biological status; **not** prescriptive for management actions;
- biological considerations only

Management Reference Point (e.g. limit and target reference points) (NOT PART OF WORKSHOP BUT FOR FUTURE PROCESSES)

- describe harvest rules (e.g., thresholds in abundances which trigger management actions);
- link directly to management actions;
- in addition to biological factors (strategy 1), also includes the consideration of habitat (strategy 2) and socio-economic factors.