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Proceedings of the Pacific regional peer review on Pre-COSEWIC Assessment of Southern British Columbia Chinook Salmon – Part II

November 5-7, 2013
Nanaimo, BC

Chairperson: Sean MacConnachie
Editor: Erin Porszt

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Foreword

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

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SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meeting held November 5-6, 2013 at the Pacific Biological Station in Nanaimo, B.C. As the primary agency responsible for holding data and information on aquatic species, DFO's standard practice is to make its data holdings available to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) so that they may conduct assessments to determine if the species is at risk of extinction as defined by the Species at Risk Act (SARA). As such, a working paper focusing on a pre-COSEWIC review of data relevant to the assessment of status for populations of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) was presented for peer review. This process is subsequent to an initial review conducted in March 2013, and focuses primarily on the suitability of relevant spawner abundance data and its treatment and the analyses and results derived from this data.

In-person and web-based participants included DFO Science, Ecosystem Management and Fisheries Management staff from regional and national offices, as well as staff from the Province of BC, members of the southern BC Chinook Technical Working Group and external participants from First Nations, the commercial and recreational fishing industries, and environmental non-governmental organizations.

The conclusions and advice resulting from this review will be incorporated into the Research Document, which will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

Compte rendu de l'examen par les pairs de la région du Pacifique sur l'évaluation pré-COSEPAC du saumon quinnat du sud de la Colombie-Britannique - Partie II

SOMMAIRE

Le présent compte rendu résume les discussions et les conclusions clés de la réunion d'examen régional par des pairs de Pêches et Océans Canada (MPO) et du Secrétariat canadien de consultation scientifique (SCCS) qui s'est tenue les 5 et 6 novembre 2013 à la Station biologique du Pacifique à Nanaimo, en Colombie-Britannique. À titre de principal organisme responsable de la tenue de données et de renseignements sur les espèces aquatiques, Pêches et Océans Canada a pour pratique de mettre ses fonds de données à la disposition du Comité sur la situation des espèces en péril au Canada (COSEPAC) de sorte que celui-ci puisse mener des évaluations et déterminer si une espèce est menacée d'extinction d'après la définition de la *Loi sur les espèces en péril* (LEP). Un document de travail portant sur un examen pré-COSEPAC des données utiles à l'évaluation de l'état des populations de saumon quinnat (*Oncorhynchus tshawytscha*) du sud de la Colombie-Britannique a été présenté aux fins d'examen par les pairs. Ce processus fait suite à un examen initial mené en mars 2013 et vise la qualité et le traitement des données pertinentes sur l'abondance de reproducteurs de même que les analyses et les résultats découlant de ces données.

Au nombre des participants qui ont assisté à la réunion en personne ou par conférence Web, il y avait des employés des bureaux régionaux et nationaux du Secteur des sciences, de la Gestion des écosystèmes et de la Gestion des pêches du MPO, des employés de la Province de la Colombie-Britannique, des membres du groupe de travail technique sur le saumon quinnat du sud de la Colombie-Britannique ainsi que des participants externes de Premières Nations, des industries de la pêche commerciale et récréative et d'organisations non gouvernementales de l'environnement.

Les conclusions et avis découlant de cet examen seront intégrés au document de recherche qui sera rendu public sur le site Web du Secrétariat canadien de consultation scientifique (SCCS).

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INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) meeting was held on November 5-6, 2013 at the Pacific Biological Station in Nanaimo, BC to review the draft Part II Pre-COSEWIC Assessment for southern BC Chinook Salmon, which will include: the time series of mature spawner abundance data for each of the proposed designatable units (DUs), a description of the methods used to determine annual mature spawner abundance and data treatments, contextual information to aid the assessment of data uncertainty, and the results of the application of the COSEWIC quantitative criteria.

This RPR meeting was a follow-up to the RPR process held in March 2013, where it was determined that the draft document submitted for review at that time did not sufficiently address all of the required criteria outlined in the standard terms of reference for a pre-COSEWIC assessment. The sections that did meet COSEWIC criteria have been compiled into a CSAS Research Document, "Part I" Pre-COSEWIC Assessment (Brown et al. in prep.). The Part I document focuses primarily on describing the life history characteristics of Chinook salmon occurring in southern BC, the basis for using Conservation Units (CUs) as DUs, an evaluation of whether Chinook salmon meet the residence criteria in Canada as defined by the Species at Risk Act (SARA) and a review of information concerning threats to this species. A second "Part II" Pre-COSEWIC Assessment has been prepared to address the remaining elements from the pre-COSEWIC Terms of Reference.

The meeting Chair, Sean MacConnachie, welcomed participants, and initiated a round of introductions. 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. In total, 39 people participated in the RPR (Appendix D).

The Chair then went over meeting logistics and reviewed the role of CSAS in the provision of peer-reviewed advice. The Chair discussed the ground rules for the meeting, the role of participants, the purpose of the various RPR publications that will result from this process (a Research Document and Proceedings), and the definition and process around achieving consensus. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions. Erin Porszt was identified as the Rapporteur for the meeting. The Chair then reviewed the Agenda (Appendix C), noting that it had been changed from what was sent out prior to the meeting. The chair stated that equally plausible outcomes will be noted in the proceedings.

The Chair reviewed the Terms of Reference (TOR) (Appendix A) for the meeting, outlining the standard objective of a pre-COSEWIC review by DFO, and the specific objectives of the meeting. The Chair stressed that this meeting is not intended to generate advice, and emphasized that we are not assessing status of CUs but only reviewing the data and methods used to compile the data. The remaining deficiencies from the previous pre-COSEWIC assessment in March 2013 were outlined by the Chair (i.e., methods to infill data and describe threats to abundance and habitat). The Chair noted that the data needs to be in the right format for a COSEWIC assessment as well as a Wild Salmon Policy (WSP) status assessment that will occur in February 2014. The chair also described the SARA process, emphasizing that once a species is assessed at risk it will be re-assessed at least every 10 years until it is no longer at risk.

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

Pre-COSEWIC review of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) conservation units, Part II: Data, analysis and synthesis by G.S. Brown, S.J. Baillie, R.E. Bailey, J.R. Candy, C.A. Holt, C.K. Parken, G.P. Pestal, M.E. Thiess and D.M. Willis. (CSAP WP2013/14-P73)

It was confirmed with participants that all had received copies of the Terms of Reference and working paper.

Participants were informed that Sue Grant and David O'Brien had been asked before the meeting to provide detailed written reviews of the working paper to assist everyone attending the peer-review meeting. Participants were also provided with copies of the written reviews (Appendix B).

The conclusions and advice resulting from this review will be incorporated into the Research Document, which will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

UPDATE REPORT FROM COSEWIC

As part of the introductory remarks for the meeting, Alan Sinclair, co-chair of COSEWIC's Marine Fishes Species Specialist Subcommittee (MFSSC), provided a brief update on recent COSEWIC decisions that could impact the status assessment of southern BC Chinook. The committee met in August 2013 to review the proposed management unit for their assessment (called DUs under COSEWIC). The general approach developed by Holtby and Ciruna to develop conservation units (CUs) was accepted unanimously by COSEWIC, and they will move forward with this approach with a few minor modifications proposed to meet COSEWIC criteria (i.e., combining of CUs to create a DU). This exception occurs in three areas: South Thompson ocean summer (three CUs combined into one DU), South Thompson stream summer (two CUs combined into one DU), and Eastern Vancouver ocean fall spawners (four CUs combined into one DU). In these exceptional cases, current evidence to justify keeping the CUs as separate DUs was not sufficient.

The way that CUs will be rolled up into DUs will depend on the data provided. If trend data for CUs is put forward in numbers of spawners they will just be added up across CUs, however, if CPUE or other data is provided, then COSEWIC may develop a different approach.

John Candy provided clarification that the genetic data at the CU level is very compelling and shows that CUs are very diverse genetically, with the dendogram showing genetic groupings at the JAZ level. Al Sinclair is confident that the bigger table at COSEWIC will approve the proposed process.

Al Sinclair clarified COSEWIC's next steps. COSEWIC is prioritizing DUs where assessment is needed and focusing on ones at risk. First the DU definition needs to be accepted, then they can move onto other salmonid species, and see which DUs will be prioritized within each species. For southern BC (SBC) Chinook, 25 plus DUs will each undergo a separate assessment, and within one report each DU will have a section with its assessment of status.

PRESENTATION OF THE WORKING PAPER

Gayle Brown, Carrie Holt, Gottfried Pestal and Mary Thiess presented an overview of the working paper, with special emphasis placed on outlining key decisions made regarding data sources and treatment methods applied to the data.

A question was posed asking whether the downward trend in abundance is exaggerated when there is less survey effort at low abundances. The authors responded that this is captured by

data quality information provided in the paper (i.e., more uncertainty in years with less survey effort). The Chair reiterated that all changes made were based on advice from the RPR and the workshop in May 2013.

Clarification was provided on what defines an aggregate site. It is either a double count (another site includes the information already), or the count entered in nuSEDS is already an aggregate of counts from several sites. Clarification was provided on the term census site, which is a location that has been assigned a name where people have counted spawning fish.

The authors did not look at whether mean generation times are consistent when using coded wire tag (CWT) data, or other available data (e.g. otoliths) because of time constraints. An example was brought up where Quinsam/Campbell River fish aged by otoliths in Campbell are much older than those aged when they returned to Quinsam hatchery. The authors responded that there will be error when deriving age from different means and this error needs to be assessed but that they did not undertake it in this procedure. The authors reiterated that generation time was based on CWT (i.e., enhanced) fish and that they realize enhancement have may have affected mean generation time so it should be considered a minimum age especially when applied to wild stocks. The authors chose to average generation time across the entire time series of broods. In some indicators, there is a definite trend in generation time over time but other showed no trend (even when enhanced).

However, another confounding factor is if fisheries have been selective over time and we cannot correct for that long term cumulative effect. The authors pointed out that there does not appear to be a geographic trend in mean generation time.

The trends in abundance metrics and benchmarks were described. There is a typographical error in the text that will be revised to reflect the correct metric definition and benchmarks. The authors intend to revise the document to not use infilling for trend analysis for cases where the time series average infilling method was previously used. This will be a small revision because it is only used in a few cases. The authors did not smooth time series with generational averages because of the high proportion of missing years.

The distribution metrics show the concentration of spawners among sites and temporal trends among sites. Clarification was provided on the extent of occurrence and occupancy criteria used by COSEWIC. The authors did not do the calculations but provided the data to COSEWIC (in Part I document) for these criteria. The authors emphasized that no individual metric will provide CU status and that expert opinion is needed to incorporate information from all metrics. The dashboards also show productivity which helps to interpret metrics and to see if there are changes in regimes.

In conclusion, the results obtained are consistent regardless of the major data treatment approach used (e.g., infilling, start year, etc.), and the majority of CUs show declines during the past three generations. For most CUs with both wild and enhanced escapement time series, trend direction is same (mostly downward). Aggregating data of varying quality is a feature of multi-site CUs and the authors tried to provide standardized procedures across all of the time series of data to try to have a standardized set of data across CUs. The authors reiterated that this process is meant to review the data, not to assess status. Status assessment is to be covered at a future meeting in February 2014.

WRITTEN REVIEWS

SUE GRANT

The reviewer provided commendation on the amount of work done by authors and outlined some general revisions:

- Improve logical flow and clarity of document
    - Frame assumptions
    - Outline with bullets what you are addressing in paper
    - Provide a glossary of terms and use them consistently, including examples such as high quality/ sufficient quality/reasonable effort
    - Flow diagram or ordered bullets with processing steps
    - Criteria used for infilling in ordered list or table
- Remove value-laden terms

Under each CU descriptor authors should describe the risks in interpretation when assessing this CU (e.g., what are risks that escapement estimation methods are not standardized across time series because they shifted from mark-recapture to Area Under the Curve (AUC)).

There was discussion around the fact that CU names have inconsistent structure. The text could clarify that CU names could possibly be standardized in the future, however past attempts to do so have been rejected.

The definition of a persistent site was pointed out as needing clarification, and there was confusion as to whether it consisted of only high-quality non-zero observations. Authors pointed out that zeroes in nuSEDS are problematic because they have been used inconsistently over time. They are not confident that zeroes in nuSEDS are true zeroes and they clarified that they retained the high quality zeroes from nuSEDS but low quality zeroes were counted as none observed. This will be clarified in the text. A contradiction was pointed out where the authors maintained low quality data they thought was reasonable even though that contradicts persistent definition. The authors responded that this was only for one CU.

The dashboards show data pre-1995; the authors should clarify in text that some data prior to 1995 may be useful, however this was not within the scope of the paper. In the paper they only used data pre-95 if it came from a high quality source. For cases where nuSEDS data was cross-checked with other sources the text needs to clarify whether expert opinion helped decide which one to use (or other means).

Sensitivity analysis

In the results and discussion section provide less emphasis on trend metrics and instead provide details of the sensitivity analysis presented at the meeting, and provide more emphasis on the concluding observation section (with key information on risks to the status assessment classifications based on methods used).

Further analyses are suggested to look at a range of possible methods to infill (rather than only infilled versus non-infilled). The authors second criteria for infilling, where data is not infilled if the gap is greater than the average age of fish, could affect the sensitivity of results, therefore different lengths of gaps that can be filled should be included in the sensitivity analysis.

Infilling

Stanza infilling method is not appropriate in most cases, but the authors clarified that it is only used in one case so this should be emphasized in the paper. Authors stated that they will make a revision to remove infilling for cases where they have no data in any given year, or for single site CUs, but will keep infilling for cases where they have multiple sites within a CU. The reviewer pointed out that Fraser sockeye did infill on single sites so this shows an evolution in thinking.

For the case where two sites were negatively correlated but infilling was still used the paper indicated the negative correlation could be due to observation error. This requires clarification.

Enhancement

There was discussion on the importance of stating the magnitude of enhancement, not just the number of years where it occurs. The authors responded that there are endless ways to describe the level of enhancement, including considerations of what type of rearing strategy was used because different strategies will have varying survival rates. Enhanced contribution was deemed more appropriate than the number of releases in a given year because enhanced contribution depends on the scale of wild production as well as rearing strategy, etc.

There was discussion on the risk of the enhancement category breakpoints. The authors responded that they ended up collapsing 'moderate' and 'high' enhancement into one enhancement category which reduces the number of breakpoints. This leaves only one relevant breakpoint between low and moderate. If enhanced contribution from CWTs is less than the given level (25%) then it is deemed a low level of enhancement, and if that data was unavailable the breakpoint between low and moderate was based on whether enhancement had occurred in period prior to 2000. Authors acknowledge that it is a tough category; however most cases were classified as unknown or as high levels of enhancement and were thus not affected by this breakpoint.

To avoid inconsistencies, it should be clarified in the text how strays were handled (i.e., clarify strays, transplants, etc.).

Metrics and benchmarks

This section requires some clarification and consistency with language and definitions in order to be consistent with the WSP literature. Specifically, the authors were recommended to clarify whether they applied metrics and benchmarks at the CU level but only presented results for wild sites/ CUs. Further they were asked to clarify that trends in abundance is the metric that will be applied most commonly to time series and that further analysis is ongoing to determine how other metrics can be applied to other time series. The authors may not need a description of S_{gen} and S_{msy} if they were not able to apply these benchmarks to any time series. The method used in the appendices should be moved from discussion section to the method section.

DAVID O'BRIEN

The reviewer concurred with the previous review and also praised the authors for the amount of work done, and especially appreciated the sensitivity analysis described at the meeting.

He suggested that because there was an evolution of methods over this entire process, that the description of some earlier process steps could be eliminated (e.g., merging of moderate and high enhancement activity into one enhancement category). The methods from the English et al. (2006) paper should be briefly described instead of only cited.

The reviewer expressed concern of averaging classification of data quality within a CU, because quality criteria are subjective and by applying an average valuable information is left out. The authors responded that this average value was only used as snapshot of data quality (annual values are in the dashboard), and that it was not actually used to analyze data.

It was pointed out that wild fish are of critical importance and there is an explicit definition of wild fish in the WSP but we can never meet definition of wild fish set out, so should we just replace the language in the WSP to be unknown and low level of enhancement instead of wild?

There was discussion concerning the potential implications variable production regimes may have on interpretations of habitat based models, because they are based on stock-recruit models and habitat features. We won't know for a while if productivity patterns of the past represent what's going on now.

Southern BC Chinook are a managed population and we are not clear how that will impact COSEWIC assessment, but the Chair pointed out that this is beyond the scope of this process, however, it was recommended that the authors make a comment on this and refer back to part I to link to the fishery impact threats described there. Also, it was suggested that the authors provide more information about management regimes and how they could/would impact interpretation of the data, but the authors responded that this fits better in section I which included impacts of fisheries.

GENERAL DISCUSSION

The Chair thanked the reviewers and reiterated the main points of their reviews, which were to clarify terms and description of terms, provide visual aids/figures, expand the sensitivity analysis, and provide criteria in tabular content to facilitate clarity.

DATA

This document was deemed another version of the synoptic survey where large amounts of data are provided along with a snapshot of current levels. This is the first cut and is not intended to go into all the nuances an analyst needs to assess status of specific CUs.

There was discussion of the management framework that was developed in the 1980s as part of Pacific Salmon Treaty (PST) negotiations, and it was suggested that a general description of the management framework be provided. The authors responded that this description could be added to the Part I document and the linkages between Parts I and II could be strengthened.

Discussion occurred on the use of post-1995 data only. At the previous RPR for this initiative, it was agreed that there are issues with the pre-1995 data so the document will mention that this data exists but it is not being used. The authors pointed out that data presented in this document is published in annual reports and they do not want to give the impression that data is deficient, so they will clarify that the data presented is the same data that goes into annual reports elsewhere, and this document actually provides more information than is used by the Pacific Salmon Commission Chinook Technical Committee (CTC). The group reached consensus that the working paper has provided enough information in the appendices for COSEWIC to do an assessment. There are no confidence intervals on numbers but COSEWIC is not sure how they would use confidence intervals anyway.

INFILLING

In the document reviewed in March 2013 RPR, there was no infilling of data so this is one of the major revisions included Part 2. The only reason why the authors infilled using an average

approach for single site CUs was because they would only be able to calculate metrics for complete time series. However, they will change restrictions so they will now be able calculate metrics on incomplete time series, so the average of high quality escapement estimates infilling method will be gone.

It was asked whether the infilling methods used here were different than Blair Holtby's work on infilling (i.e. in the Holtby synoptic survey) or in Carrie Holt's workshop. The authors responded that Holtby found that results were robust across infilling methods (and he also used the English et al. (2006) method). The authors pointed out that their infilling methods have been approved before and since they have not been changed in this application, they should be approved here.

ENHANCEMENT DATA

The difference between COSEWIC and DFO's definition of enhanced fish and our inability to identify those fish as they are defined under each policy was discussed.

It was questioned whether we can use enhancement as a recovery tool when we cannot distinguish enhanced fish. In order to operationalize something that recognizes the spirit of the WSP, the authors made available the magnitude of enhancement for each CU (Appendices C and D in the working paper).

The difficulty of quantifying the magnitude of enhancement was discussed, and the authors noted that this difficulty is why they described populations as either enhanced or not enhanced and for how many years. There may be other cases with additional information, and it would require people with local expertise to verify enhancement numbers.

The enhancement categories were discussed and the enhanced/not enhanced categorization was approved by the group. It was deemed sufficient to classify a population as not enhanced when it has not been enhanced in the last three generations (even if there was prior enhancement). The text in the document should be simplified to reflect these categorizations (i.e., just enhanced or not enhanced instead of four categories).

The case where fish are transplanted and then enhancement ceased and fish still return was discussed. Fraser Sockeye had a similar situation where a CU was extirpated and then enhanced and came back through transplantation. In this case it was called it a new CU. Perhaps a similar approach could be taken for these situations.

METRICS, BENCHMARKS AND STATUS

There was discussion on the change of upper benchmark to 85% of S_{msy} from 80% S_{msy} in Holt et al. (2009) in order to comply with PST requirements. This is a moot point in this case because no CUs fell within the 80-85% range where the change of benchmark would have changed their status. It only needs to be decided if this same approach is applied for future Chinook work in other areas. A reference should be provided for the choice of benchmark.

The reliability of the CU spawning lengths in Table 13 was discussed. This is the best available data we have right now, although its accuracy is unconfirmed, it needs to be included to meet our obligations to COSEWIC for assessment against Criterion B. The numbers shown in Table 13 are low relative to COSEWIC's benchmark. The authors will accept feedback from those with expertise.

There was discussion on the use of all spawners versus only wild spawners for the distributional metrics in the dashboard. Currently, they are based on all spawners (not just wild). The group thought it would be useful to show the distribution metrics for both wild and all spawners.

Perhaps this could be through the insertion of wild only bars on the existing plots in the dashboard.

COHORT ANALYSIS

The cohort analysis was discussed. Full exploitation rates are available for 11 stocks with CWT and spawner data available and this is used to extrapolate exploitation rates for other stocks. We cannot assume that exploitation rates can be extrapolated in the same way as age composition. There is an assumption that survival rates are fixed in the cohort analysis, and this allows maturation rates to vary. However, there may be large scale mortality after fishery and before spawning which is not captured. This should be discussed in the paper as well as how survival rates may change over time.

OVERVIEW OF GENETICS

John Candy provided a review of CU structure in the region and how they group in terms of larger regional structure. He showed a table of CU numbers and their corresponding regional genetic groups (GSI). On the dendogram, horizontal distance is the distance between populations and populations are actually sample sites (126 sample sites in whole region). Dendogram trees are not directed and they independently group sites based on genetic data. Dendograms show different colonization histories and the relationship between populations within CUs as well as among CUs.

He showed slides that expanded the dendogram for each GSI group. The upper Fraser/mid Fraser group showed a continuum geographically from the mid to upper Fraser, and had few exceptions in terms of individual populations. One exception is the Horsefly is in upper Fraser group on dendogram but located mid-Fraser geographically.

Maria Slough is a south Thompson-like population even though it is in the lower Fraser geographically. Quinsam/Campbell is part of northern ECVI GSI group (as we would expect). Nanaimo summer timing sites are grouped closely, as are the Nanaimo fall timing sites. The DU in this area would be everything down from the falls on ECVI (CUs 21, 22, 25, and 27) and John showed how they grouped on the dendogram. Cowichan Chinook (CK-22) was transplanted to the Cheakamus (CK-20) so CK-20 still shows up in the ECVI group. Capilano is a transplant from a few locations (various CUs).

CK-28 and CK-29 are north of Discovery pass and are not on the dendogram. CK-28 is mostly on its own but groups up loosely with ECVI. It was highlighted as one needing more samples in order to get more stock structure delineation.

John showed a slide with a consensus tree. The consensus tree takes a sample of 15 markers, bootstraps, and creates variation in the estimate of genetic distance. Then the distance is calculated and a tree is built, and this is repeated 1000 times to build a consensus. Each node is how many times the tree is recreated out of the 1000 possible trees, which provides confidence in the tree structure. The consensus tree shows how fixed the dendogram is and what parts are more variable. On the consensus tree, further out to the right is less certain and further to the left indicates more confidence in the nodes. There is confidence in the structure of the dendogram because it matches well to the consensus tree.

There was discussion on whether we need to rethink our management units because they are not exactly matching up to GSI groups.

There was discussion on the many different views of genetic structure. Microsatellites used here provide a definitive view of the genetics of the populations based on current gene flow, and within geographic regions it is clear there is a lot of recent gene flow. However, microsatellites

do not pick up phenotypic similarities seen in other populations not shown with GSI, which may indicate more distant gene flow in the past. Mitochondrial gives maternal lineage.

COSEWIC provided clarification that their DUs are based on the whole Holtby and Ciruna (2007) package (genetics and other relevant factors). In cases where they have combined CUs into one DU it was because the CUs have the same life histories.

SYNOPSIS OF CU OVERVIEW SHEETS

Mary Thiess provided a synopsis of the CU overview sheets in Appendix D, which provide contextual information for each CU on a CU-by-CU basis. The first table outlines basic characteristics of each CU, and the CU spawning length reported here is from the Porter et al. 2013 report, which the authors acknowledge has issues. This report was commissioned by DFO and was considered suitable by DFO (although the numbers are proximate) so the values are included in this paper, however, ongoing work by DFO or others is needed to refine the estimates. Stream lengths will be used by COSEWIC for multiple criteria (i.e., area of occupancy and fragmentation), so they are concerned that these estimates may not be accurate.

The next section is escapement at census site level (CU-level escapement is in Appendix B), and the table above the time series shows the data quality of escapement estimates. The following two sections are the enhancement profile, which is mainly filled out by SEP staff, and the exploitation section, which is particularly relevant for CWT indicator stocks.

The following section is the habitat report card which generated a lot of discussion. The report card has a list of potential threats and a proxy measure of that threat was taken for each CU, and then all of the CUs were ranked based on that measure. The score is the relative score of that CU for that threat compared to all the other CUs. The highest 1/3 of CUs are red, and the lowest 1/3 are green. There was concern amongst the group that these reported threat levels can be misleading because they are only relative to other CUs, and although CUs may rank in the lowest 1/3 for a given threat compared to other CUs, it could still be a major threat for that CU.

The authors responded that the specific threats table should address this concern by pointing out the specific threats for each CU that were gathered from experts at the workshop. The authors also need to describe the process used at the workshop to gather information on specific threats for each CU. These are not CSAS approved threats but are instead expert opinion gathered through an ad hoc brainstorm session at a workshop. The process to gather the expert opinion on threats should be well-documented in the text as well as the limitations of the information. References for grey literature (e.g., Porter et al. 2013 report) should be checked and made more readily available to the group.

There was concern that because the information from the habitat report card comes from a report that has not been approved by CSAS, its publication in this document could be a de facto endorsement of non-approved data. The authors responded that this information is available and so it should be included, as long as it is cited. COSEWIC will also identify specific threats to DUs and use this information in their assessment, and this information is especially important to recovery planning. The IUCN deals with 3 things for each threat: how much population is affected by threat, what would impact of threat be (impact rating), and how frequently does threat occur.

The group agreed that the habitat report card is still useful and approved its inclusion in paper. The suggested revisions to the habitat report card are to remove colours, provide a better descriptor of the calculation (as opposed to only a reference) along with a disclaimer, change

title to the ranked habitat pressure indicator, and to remove statements at bottom of plot that refer to 'risks'. The authors should also seek direction from CSAS on how to cite grey literature or make it better available.

OVERVIEW OF DASHBOARDS

Gottfried Pestal provided an overview of the dashboards in Appendix E. The time range plotted is always the same but the y axis (spawner abundance) changes depending on the CU, and is thus not comparable across CUs. Spawner abundance is not log transformed on the plot on page 1 but page 3 has the log transformed time series. It was suggested that the running average be plotted versus mid-year of running average, but the authors responded that to calculate current year value for metrics it is important to have current year and all years prior (as opposed to mid-point).

The plot currently titled "% Wild Spn in All Sites" should be changed to "% spawners from wild sites" to better represent what is plotted. The table titled "Spn Range by Year" should include COSEWIC C and D criterion values (e.g., 2500).

The dashboards show a finer scale of survey quality than in text where moderate and high were grouped together. The distribution of spawners among sites plots include pre-1995 data, so it needs to be highlighted in paper and in dashboard description that most of these data would have unknown quality. It should also be explicitly flagged on the plot through a breakpoint where data quality assurance has changed (breakpoint will be vertical line and then use same colours from time series plots in distribution plots for the years post-95 to highlight that they are the same data). Discussion took place on how these plots can be deceptive because enhanced and wild sites are both included. A figure should be added to the dashboard that looks at the distribution of spawners across wild sites only. The plots really only show if a CU is becoming more concentrated because distribution may vary among sites but the proportion may not change (i.e., different site is one with most spawners), and they are also aggregated across a decade. These plots may also be confounded by survey effort (i.e., more surveys of small streams in the 1980s than in recent years).

Appendix B provides data of sufficient quality to be included in COSEWIC assessment procedures and it does not include data available that is not of a suitable quality. In Table B6 decimal points are an indicator of infilling. Carrie Holt will eliminate infilling in single site CUs for trend analysis. Table B6 should be revised so that each CU has a mean estimate class (EC) across sites per year to inform quality on an annual basis. This would add one column per CU and some CUs may have two new columns (one for each enhancement categorization).

There was discussion on the usefulness of the 'Spn Range by Year' table in the dashboard because it is not absolute numbers due to missed sites and/or data quality. This is an issue because the thresholds in the table are built for absolute abundance and the estimates presented may be relative abundance. Different methods of expanding these estimates to absolute numbers were discussed. In order to add clarity to these tables the group decided there should be additional comments in the dashboard to specify that the estimates are relative as opposed to absolute abundance, and the title of the CU on dashboard could flag that CU as having either relative or absolute abundance.

COSEWIC expressed concern that most CUs have relative as opposed to absolute abundance estimates. There are 13 CUs where all sites have been sampled but even those CUs may still have relative abundance estimates depending on data quality and mean estimation classification. It is difficult to compare abundance across CUs because the characteristics resulting in a relative as opposed to absolute abundance estimate are specific to each CU (e.g., data quality or what proportion of tributary systems is surveyed). The salmon literature indicates

that fewer surveys most likely results in biased low abundance estimates, therefore many of our CUs with relative abundance estimates are most likely biased low. It was discussed that following this assumption, CUs can still be flagged as a concern if the relative abundance falls well below a threshold, or be classified as not of immediate concern if the relative abundance is above the threshold. Classification in those cases where the relative abundance is close to the threshold may be difficult to determine based on data quality. Many of the CUs have data suitable for trend analysis.

The group discussed means to try and reduce the likelihood of misinterpretation of abundance estimates. The authors clarified that it is difficult to provide the number of possible sites that have been surveyed because it is difficult to distinguish between spawning sites and counting sites. It was decided that the Appendix B tables should indicate whether the estimates are relative or absolute abundance estimates, and COSEWIC said that this additional information is crucial to their assessment. Even if confidence intervals were provided on the abundance estimates COSEWIC would not know how to use this additional information.

There was discussion around the difficulties that can arise if COSEWIC does not have sufficient information for its assessment (i.e., species can be listed as special concern due to insufficient information). COSEWIC clarified their assessment procedure. They will use the information DFO provides to assess status for every DU and the report will be passed out for comment and three separate reviews. They are not only assessing DUs of concern. Therefore, it is important that this group agrees that information provided in paper II is the best available information.

CSAS PROCESS AND PRODUCTS

There was a discussion of the CSAS review process for this paper, which began over six months ago with the first regional peer review process. The Part I document is not yet complete because this is a fluid process. The Chair asked the group whether they wanted to review Part I again, but the group agreed that this was not necessary because the Part II document seems to have addressed all the issues that caused the original document to be rejected. The original reviewers from the March 2013 process can review Part I to make sure that everything was addressed prior to publication. The Part II document will be used by COSEWIC for their assessment of status will influence the WSP process that will be held in February 2014, and be applied to other future work such as strategic planning.

The workshop held in May 2013 consisted of expert, non-DFO scientists trying to synthesize factors affecting trends in southern BC Chinook, and it was not a comprehensive assessment and there is not necessarily full agreement from DFO scientists. There is a document from this workshop which the authors have referenced in the specific threats section.

The Chair summarized the products that will result from this CSAS review process. There will be two separate papers (Parts I and II) with their associated appendices.

Paper I will provide a review of life history characteristics, issues of residence, and threats to habitat and CU designation. Paper II will provide data and information needed for assessment with COSEWIC criteria (declining total population, small distribution and decline or fluctuation, small total population size and decline). Gayle Brown captured in a table the relevance of data for each of COSEWIC's criteria.

CONCLUSIONS

CU-BY-CU REVIEW

For all CUs, the authors will:

- include both accessible and spawning length from the ESSA report;
- in Appendix D, highlight persistent systems so they are easy to pick out;
- change habitat report card figure to remove colours and change caption.

Table 1: Summary of discussion points and revisions required for a list of CUs reviewed by the group

CU	Revisions to paper	Additional comments/discussion
CK-01: CK_Okanagan	Clarify that although there is no directed enhancement from any hatchery in Canada, these are probably stray fish from an American hatchery (however do get some recruitment). Provide more info for this CU description (i.e., spawning above the dam and in other tributaries—Elinor from Okanagan will work with Gayle)	Threats for this CU outlined in COSEWIC and SARA documents referenced. CU spawning length in Table 13 is deemed fairly accurate.
CK-02: CK_Boundary Bay	Add commentary that some component of escapement may be missed below the fence. Revise to not infill any data because it is a single site. Georgia Basin CUs: specific threats table will be redone due to an import error (applies to CUs 2 and 20-27)	No wild sites in this CU but there are wild fish. Suitable for trends analysis, but not absolute abundance metric because missing some component of escapement (i.e., 2/3 sites not surveyed and may be fish below the counting fence). Spawning length in Table 13 is the current best estimate.
CK-03: Lower Fraser River-fall timing (white)	Reconcile start year issue (1984 or 1985), and be consistent throughout document and appendices (Appendix D tables and commentary for this CU) 1985 is the first high quality estimate in nuSEDs, however nuSEDS may need to be revised because Richard Bailey says 1984 is first year of mark-recapture (and thus high quality estimates).	Good example of the effect of data quality filters because there are many past years with low abundances excluded from analysis. Also shows how variable slope estimates have been over the years. CU spawning length in Table 13 is accurate.
CK-9000: CK_Hatchery Exclusion-Lower Fraser	-	Under WSP process, this CU would not be assessed. COSEWIC would not assess either because if the hatchery was turned off, the

CU	Revisions to paper	Additional comments/discussion
River		population would disappear.
CK-04: CK_Lower Fraser River-spring timing	Provide additional commentary on the fish counts in Alouette and Stave rivers, which are transplants from Harrison and Chilliwack because dams on Alouette and Stave led to extirpation.	Five census sites and only one site met the appropriate criteria to be included in analysis. Likely fish in other sites, but do not have means to survey there. Minimum estimate, not suitable for absolute abundance metric. Trend analysis is suitable, because escapement from the one site is probably a large component of total escapement to the CU.
CK-05: Lower Fraser River-Upper Pitt	Insert a disclaimer around fact that data is only one site of a larger CU, and it is unknown whether this site is representative of the CU. In nuSEDs should be entered as only Blue Creek, as opposed to Upper Pitt aggregate.	One census site for a multi-branching system, therefore not really true abundance of whole system. Recorded in nuSEDs as Pitt River Upper (however know from other sources that it is Blue Creek), which is a larger issue in terms of nuSEDs data entry/management. Data only a reliable estimate of Blue Creek abundance, not Upper Pitt aggregate abundance. Discussion on the issue of cases where only one site is surveyed for a CU with numerous possible sites, and whether the site can be considered representative of the CU. The site may have been selected for convenience as opposed to its representativeness (as in this case). Even in cases where the site is selected because it is assumed to be a good indicator of the CU, the reliability of this indicator is still unknown. Not sure if fish would use other sites in different flow or abundance scenarios. Argument is then that if a system is not an indicator of a CU why do we invest money in counting there (is a reliable estimate of a given site but not entire CU). Not a reasonable indicator of absolute abundance; not suitable for COSEWIC criterion A. Not suitable for trend analysis (we

CU	Revisions to paper	Additional comments/discussion
		don't know if fish consistently using one site at same rate).
CK-06: CK_Lower Fraser River-summer timing	-	Same situation as above CU (CK-05), where one small river is counted in a bigger river system. There are probably a lot more fish in the CU than the Big Silver number indicates but we cannot see in the water to count them (due to water clarity issues). Not convinced that trend in Big Silver is indicative of trend in CU. Not suitable for absolute abundance or trend metrics. Spawning length in Table 13 is best estimate for CU.
CK-07: CK_Maria Slough	2004 infilled value will be removed because it is a single site	Was highly enhanced, but still has natural production. Enhancement stopped 6 or 7 years ago, so all natural returns as of last year. Exploitation data is not available, because although CWTs were applied, we are missing escapement data. Habitat in this CU was rebuilt. Spawning length in Table 13 is accurate. CU is suitable for trend and absolute abundance metrics.
CK-08: CK_Fraser Canyon-Nahatlatch	Check data report for CU spawning length.	CU is data deficient. Spawning length in Table 13 seems unreasonable.
CK-21: CK_East Vancouver Island-Goldstream	-	Genetics information is unknown. Considered absolute abundance (although highly enhanced).
CK-20: CK_South Coast-Georgia Strait	-	Data deficient. All available information is presented, but there is no dashboard because there is no escapement data.
CK-22: CK_East Vancouver Island-	Insert a footnote indicating that spawning length is suspected to be low estimate. In additional commentary section,	Spawning length of 6km seems low (perhaps just length of upper river and not upper tributaries). Accessible habitat is 766km from ESSA report.

CU	Revisions to paper	Additional comments/discussion
Cowichan & Koksilah	provide references for extra info/reports (e.g., limiting factors, habitat status). Describe some work that was done to rebuild the stock over the last 3 generations, including sport area closures (put under exploitation section).	COSEWIC states they want estimate of spawning habitat (not just accessible habitat). Concern surrounding the application of these unapproved spawning length values to the WSP benchmark process once this paper is approved, however so far no WSP benchmarks incorporate spawning length values. Discussion surrounding the genetics relating to CU designation (i.e., genetics don't show this as a distinct population but rather as embedded within fall runs of Strait of Georgia on the dendogram). Authors responded that the basis for CU designation came from Holtby and Ciruna, which used genetics and marine distribution. Confident in use for trends and absolute abundance metrics.
CK-31: CK_Southwest Vancouver Island	Revise spawning length to 28 km (revised spawning length from workshop in May). P-U means persistent and unknown enhancement (aka wild). Make this terminology clear throughout text. **Figure 59**: Should not go down to 0% for Nitinat. For the Sarita site, should be more than one year, therefore need to find spawner abundance data to go with CWT data. (Dave Willis will look into these issues). Include in additional commentary that hatchery fish are separated from other fish by large chunks of land, therefore the wild stocks are isolated (e.g., Clayoquot) and we have separate indicators in these wild areas. Uchuck Creek listed as extirpated but may not be. Needs clarification. Thermal marks information could go into additional commentary section (i.e., hatchery populations are thermally marked and there will be a report coming out next year). In specific threats table, returning adults section, the following sentence	Discussion surrounding the spawning length reported (23km), which seemed low, especially considering the number of census sites. However, some sites do not have large spawning areas (e.g., Stamp may have only 2km spawning area, with 4623km of accessible habitat). Perhaps spawning length in ESSA report was based on where majority of spawning occurred instead of an estimate of all spawning areas. Regardless of how spawning length was measured it is unlikely we will reach the 250km threshold from COSEWIC. It would be useful to have the amount of habitat surveyed, but this information is difficult to come across. Not in nuSEDS but maybe in the SILs. Lots of census sites are not used because enhanced. Three persistent wild sites (Megin, Moyeha and Bedwell) can be used for trends. Bedwell is 100% marked for enhancement.

CU	Revisions to paper	Additional comments/discussion
	requires clarification: "Data gap with stocks outside of Stamp/Somass".	Consider data as relative abundance estimates, which are suitable for trend analysis. There was discussion on whether populations in heavily enhanced zones of the WCVI would go to zero if we stop putting hatchery fish in these rivers. Populations would not go to zero. These rivers have spawning capacity which is estimated using Chuck Parken's habitat-based model. Natural production would be expected. However, the abundance would be much smaller. For a system such as the Stamp River, the Parken model suggests about 4000 Chinook might occur naturally. With hatchery enhancement, the returns have been more than an order of magnitude larger. Natural production may be important in the overall abundance of Chinook in the CU and especially in some geographic areas such as Clayoquot Sound in the SWVI Chinook CU.
CK-32: CK_Nootka & Kyuquot	Inconsistencies between data deficient and extirpated for Narrowgut. Remove any reference to extirpated for Narrowgut in enhancement profile. Figure 63 caption needs revising. *Enhanced contribution to total adult escapement for CK-32* should be *enhanced contribution to Conuma River* (not CU). Look for other cases of this. Canton Creek is more like a tributary of Conuma (should not use).	

RECOMMENDATIONS

The authors will try to apply the suggestions for the specific CUs reviewed today to other CUs, and will incorporate a new table that will list whether the data for each CU is suitable for assessment by each COSEWIC criterion. The Chair reiterated that we need to give COSEWIC the best information possible because their assessment will come back to us to review and comment on. The Chair asked the group whether we wanted a few people to do one final review to make sure nuances are incorporated, but it was decided that the additional review was not necessary. The Chair thanked the authors, reviewers, and the group as a whole. The paper was accepted with revisions.

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English, K.K., Peacock, D. and Spilsted, B. 2006. North and central coast core stock assessment program for salmon. Prepared by LGL Limited for the Pacific Salmon Foundation and Fisheries and Oceans Canada. 78 pp.

Holt, C., Cass, A., Holtby, B., and Riddell, B. 2009. Indicators of status and benchmarks for conservation units in Canada's Wild Salmon Policy. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/058. viii + 74 p. (Accessed September 9, 2015)

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Porter, M., Casley, S., Pickard, D., Nelitz, M. and Ochoski, N. 2013. Southern Chinook Conservation Units: Habitat Indicators Report Cards. Report prepared by ESSA Technologies Ltd. for Fisheries and Oceans Canada.

APPENDIX A: TERMS OF REFERENCE

Pre-COSEWIC Assessment of Southern British Columbia Chinook Salmon – Part II

Regional Peer Review - Pacific Region

November 5-7, 2013
Nanaimo, BC

Chairperson: Sean MacConnachie

Context

Vancouver Island, Sunshine Coast, and Fraser River Chinook salmon (*Oncorhynchus tshawytscha*) are currently being assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken. The standard objective of a pre-COSEWIC review by DFO is to:

1. Provide information on life history characteristics
2. Identify and provide rationale for Designatable Units (DUs),
3. Review the COSEWIC quantitative criteria (COSEWIC 2010)
4. Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat
5. Describe, to the extent possible, whether the species has a residence as defined by SARA
6. Identify and describe threats (other than those related to habitat),
7. Provide other information particular to the species that may be relevant to assessing status, and
8. Assemble and provide the best available abundance and other data for use by COSEWIC.

In March 2013, a pre-COSEWIC assessment reviewed through a Canadian Science Advisory Secretariat (CSAS) Regional Peer Review (RPR) process. It was determined that the draft document submitted for review did not sufficiently address all of the required criteria outlined in the standard terms of reference for a pre-COSEWIC assessment. The sections that did meet COSEWIC criteria have been compiled into a CSAS Research Document, ”Part I” Pre-COSEWIC Assessment (Brown et al. in prep.). The Part I document focuses primarily on describing the life history characteristics of Chinook salmon occurring in southern British Columbia, the basis for DUs, an evaluation of whether Chinook salmon meet the residence criteria in Canada as defined by SARA and reviews information concerning threats to this species. A second “Part II” Pre-COSEWIC Assessment has been prepared to address the remaining deficiencies.

The objective of this Canadian Science Advisory Secretariat (CSAS) Regional Peer Review is to review the draft Part II Pre-COSEWIC Assessment for Southern BC Chinook Salmon, which will include: the time series of abundance data for each of the proposed DUs of the mature spawners, a description of the methods used to determine annual mature spawner abundance and data treatments, contextual information which aid the assessment of data uncertainty, and provide the results of the application of the COSEWIC quantitative criteria.

This assessment is also intended to support future work respecting the implementation of the DFO Wild Salmon Policy (WSP); therefore, utilizing previously reviewed and accepted methodologies (Holt et al. 2009; Parken et al. 2006), quantified values of WSP metrics used for status assessment will also be reviewed. A determination of WSP status will not be considered.

Results of this Regional Peer Review (RPR) will be made available to COSEWIC, the author(s) of the species status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee and is intended to inform a subsequent WSP status assessment scheduled for February 2014.

Objectives

The objective of this RPR is to review available DFO information relevant to the COSEWIC criterion to assess a species risk of becoming extirpated, endangered or threatened for Chinook salmon occurring in southern British Columbia that were not previously accepted.

Specific objectives include:

1. Provide data tables of the time series of annual spawner abundance data.
2. Describe the methods used to obtain the time series of annual spawner abundance data, including data selecting criteria and data treatments (i.e. procedures applied to in-fill missing data).
3. Provide, by system and summarized by Wild Salmon Policy Conservation Unit, trends in abundance (over as long a period as possible and in particular for the past three generations) and additional data and analysis relevant to the determination of WSP status.
4. Identify threats to abundance and habitat.

Expected Publications

- CSAS Research Document
- CSAS Proceedings

Participation

- DFO Sectors (Science, Oceans, Habitat and Species at Risk)
- Aboriginal Communities
- Province of British Columbia
- Academia
- Industry
- Non-government Organizations
- Other Stakeholders
- COSEWIC status report author
- Members of COSEWIC (Co-Chairs and/or SSC experts)

Sources of Information

COSEWIC. 2010.COSEWIC's Assessment Process and Criteria.

Holt, C., Cass, A., Holtby, B., and Riddell, B. 2009. Indicators of status and benchmarks for conservation units in Canada's Wild Salmon Policy. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/058. viii + 74 p.

Parken, C. K., R. E. McNicol, and J. R. Irvine. 2006. Habitat-based methods to estimate escapement goals for data limited Chinook salmon stocks in British Columbia, 2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/083. vii + 67 p.

APPENDIX B: REVIEWS OF THE WORKING PAPER

REVIEWER: SUE GRANT, DFO

Fisheries and Oceans Canada

Canadian Science Advisory Secretariat (CSAS)

Regional Peer Review Process - Pacific

November 4, 2013

TOR objectives:

1. Provide data tables of the time series of annual spawner abundance data.
2. Describe the methods used to obtain the time series of annual spawner abundance data, including data selecting criteria and data treatments (i.e. procedures applied to in-fill missing data).
3. Provide, by system and summarized by Wild Salmon Policy Conservation Unit, trends in abundance (over as long a period as possible and in particular for the past three generations) and additional data and analysis relevant to the determination of WSP status.
4. Identify threats to abundance and habitat.

Review Overview

Overall, this report represents a considerable amount of effort in the processing of Southern British Columbia Chinook escapement data. In addition, survival and exploitation data were also compiled for the current report. Data processing is the single largest step in status evaluations and the authors should be commended for the amount of effort, collaboration, and thought that went this work. This report represents the first group of CUs to consider the influence of enhancement on escapement data sets required for status evaluations, and as such, the authors developed and applied consistent approaches to classify data based on the level of enhancement. This reports presents escapement data in the Appendices (A&B) that summarize data quality and quantity for each CU, and present the final escapement data set recommended for trends in abundance metrics (Appendix B1). This compilation is helpful to assist analysts working on subsequent WSP or COSEWIC status evaluations to understand what analyses are possible and the limitations on status inferences based on the data. There was also a lot of background on the enhancement that has occurred or currently occurs in each CU based on Appendix C to also assist with the requirements of WSP and COSEWIC status evaluations to exclude respectively enhanced, or manipulated fish. Appendix D also provided a helpful summary of each CUs escapement and threats using a standardized approach to facilitate comparisons between CUs.

My major critique of this paper is in regards to the methods and results/discussion section of the paper. Strengthening of the report's text for consistency in the use of terms, logical flow of methodological steps, and justification for certain choices in data selection and treatment is recommended. I have provided the authors with many comments within their pdf document and have also provided some specifics below for discussions within the CSAS review. Linked to my comments on the methods section, the results/discussion section (which also contained some methods) did not provide the reader with key information on risks to the status assessment classifications based on methods used (such as different gap filling approaches effect on detecting trends in abundance). The two paragraph 'concluding observations' section at the

end of the report section is a useful start, but I would think the results/discussion section should be flipped around to focus and expand on this final section, with smaller sections on trends (trends being the third objective in the TOR). Actual analyses to evaluate assumptions and effects of different data treatments on status evaluations is likely not within the scope of this paper, however, given the authors expertise on the data, listing assumptions and methods applied to the data that should be considered as risks to status evaluations could be extremely helpful. Finally, the authors mention abundance and distribution metrics in the methods, but do not discuss in the results/discussion and in the body of the text there is no link to the appendix of threats and explanation that this is covered in more detail in Part 1 (if that is correct?).

Is The Purpose Of The Working Paper Clearly Stated?

The paper clearly articulates the first two objectives, and in part, the third objective early in the introduction (see TOR objectives 1 & 2 above). However, it is not clear in the introduction that other data besides escapement data are being presented in the current paper (as in 'additional data…relevant to the determination of WSP status') or that 'threats in abundance and habitat' were addressed. Perhaps some bullets from (1) to (5) should be listed at the end of the introduction to clearly articulate objectives covered in this paper related to the TOR. Included in this list, it would be helpful for the authors to include what additional data specifically (ER, productivity/survival, etc.) they are including to support objective 3 of the TOR. Finally, there is no threats section as per the TOR in this report, however, I no longer can recollect if this was going to be part of Part I and if so the authors should have been clear in the text where details on threats is presented. There is an appendix D that is referenced as a habitat report card, but is not referenced as part of a threat evaluation. Separately, I think since this report is titled Part II, they need to clearly articulate what Part I is comprised of, and timeline for publication (where Part I is located as referenced on page 2).

Broader Comments

Conservation Units

- Since it forms the foundation of the report, I recommend the presentation of the major naming conventions for Southern BC CN; although details are presented in a separate report, a high level overview would be helpful in the current paper (i.e. why a CU is named based on its River or broader spatial aggregate plus age or timing or nothing; explain discrepancies between CUs in regards to what is included in a CN CU name); a single map in the report would also be helpful to visualize where in BC the CUs occur (including broader aggregates you refer to such as Fraser versus non-Fraser CUs); again in reference to Part 1's focus on linkages of CUs to COSEWIC DUs, need to remind readers what Part 1 is and where to find it (provide a reference);

Escapement Data

- It was a challenge to understand your quality classification schemes for escapement data. You mention you used NuSeds categories (you need to reference your table 5 here for clarity) to provide 'an estimate of **survey quality'** and you specifically call this '**reasonable effort'** (p6)**;** later on under data methods section, you write that 'each contributing time series had to be **complete** and of **sufficient quality**' and that a **series of criteria were established** to determine if a census site would contribute to subsequent analysis for each CU. At this stage I get a bit lost. You don't provide a '**series of criteria'** or define '**sufficient quality'**, unless this is the same as what you defined as '**reasonable effort**' on pg6.
- You define '**persisten**t' sites as 'those having 10 or more **high quality**, **non-zero** observation during the period 1995 to 2012'

- First, and most importantly, is this the 'series of criteria' you were referring to for selecting census sites; although as written it does not seem to represent a 'series';
- If your definition of persistence is your selection criteria, zeros should be important in status evaluations so not clear why you would exclude them; could they also not represent shifts in distribution between sites? Are you trying to distinguish between Extinct versus Persistence? Timing of extirpation would be of interest to analysts.
- I'm not sure how you define '**high quality sites'** (i.e. are they the same as 'reasonable effort' and 'sufficient quality' sites or I could guess that they are NuSed's categories 1 & 2?). **There are many different terms used here and the gap filling section that are not defined or used consistently, so I'm not sure what exactly you are using and also what series of criteria you used for data selection as you defined.**
- At the start of your Census site categorization section you state that '**each contributing time series had to be complete and of sufficient data quality**', yet your definition of '**persistence**' for site selection includes sites with 10 or more high quality, non-zero observations (which represents 50% of data from 1995 to 2012); further, you later define '**persistence**' as sites that include 8 or 9 observations if they can be gap filled; it seems inconsistent to define persistence in the opening sentence and then change the definition later in the paragraph; in Grant et al (2011) we defined number of sites required for inclusion as >70% and if that criteria were met, we would then gap fill for the gaps >70% of sites;

- I'm not clear on how if pre-1995 data were generated from Fisheries Officer's observations (pg 5) presumably not using scientifically derived methods that include peak live cumulative dead or AUCs, and in addition, pre-1995 data were not verified by authors with BC16's (described on pg8), how data pre-1995 could be used in data sets since they would fall below NuSeds category 4, and yet they do exist in the final time series presented?
- (pg8): you mention that you cross-checked NuSEDS escapement data with EPAD, CTC files and BC16s; how would you justify changing NuSeds (i.e. were there broad criteria, such as when EPAD data versus CTC data would be considered superior); on pg5 you indicate that BC16s were used pre-1995 by C&P to record escapement data, and then on pg8 you write that no verification occurred on data pre-1995, so unclear then why you would cross-check data with BC16s as you indicated on pg8.

Infilling:

- for single sites with gaps, you infilled with a time series average broken into two periods (pre-1995 and post-1995); you mention the purpose of gap filling over what you call 'stanzas' to account for changes over time windows and global averages would reduce detection of these changes; in a draft data processing report, Holt recommended using time series averages in cases where escapement data were not autocorrelated, and in cases where data were autocorrelated (which I assume your data would be?), Holt recommends using averages between the gap year's two adjacent cycle years (i.e. if generation length is four years and a gap occurred in 1999, then the average escapement in 1995 and 2003 would be used); what is your justification for departing from recommended (and also previously applied in Grant et al. 2011) approaches (I assume it was due to data limitations but you should include if this is the case);
- If you used a pre-1995 period to gap fill, based on different start dates of different time series, could this not result in different filled values depending on where the period starts,

which could bias time series pre-1995; what was the maximum number of gaps (i.e. what percentage of the total observations could be missing) in the early time series for gap filling, since you have no criteria for that, only that post-1995 you had to have greater than 44% of the years in this period assessed;

- on pg9 you indicate that "the stanza approach to high quality average infilling was used to ensure comparability with multi-site CUs which were infilled for 1995-2012); why did you not infill for pre-1995 for multi-site CUs, or did you???
- For the two CUs that had sites that were negatively correlated you indicated that this could be due to observation error, therefore, I'm not sure what gap filling approach you used for these two since the last sentence is not clear to me; I would assume the stanza method given correlations may not reflect true covariation between sites;
- what criteria did you use to determine whether or not a gap filled value was 'realistic'; not sure why you would retain low quality estimates in the time series in cases where filled gap values were not realistic, since it would violate your CU quality criteria (although not completely sure what these criteria are, but if they are NuSEDS classifications 1&2 then it would)?

Enhancement Data:

- I find the enhancement section methods a bit challenging to follow again due to inconsistencies in the use of terms and organization:
- first, you use the word '**system**' a lot throughout your enhancement section and I'm not clear on what a **system** is, does it mean census site, or CU, or some broader aggregate?; you provide a 5 step approach for dealing with enhancement to include developing escapement data for enhanced sites (#3) and 'apply metrics and benchmarks to the data available for group but base status assessment conclusions on wild site only'; when you apply metrics and benchmarks do you mean assess status for individual metrics for each enhanced and wild '**sites',** although not sure why if you are 'integrating' status (I assume that is what you mean) for 'wild sites' only?; also when you summarize your approach after #5, you indicate that these steps 'include **separating and aggregating** entire **systems** based on enhancement ranking', I am again not sure what a system is, and what you mean by aggregating, since all your steps (1-5) seem to be about separating wild from enhanced sites?
    - (p16-17): I assume your enhancement categorization scheme applies to census sites, but you don't make this clear and should reference this in step 1 of 'the approach';
    - you mention that the enhancement classification 'scheme uses all release, brood take and enhanced contribution data regardless of whether the origin of release is from outside the local **system**; I am not clear how close in proximity to the CUs system this enhancement had to occur in order for a CU to be classified as having enhancement occurring;
    - you mention the number of years of enhancement used to distinguish between moderate (<=4 years in 12) to high enhancement (>4 years in 12 for example), but what about the magnitude that occurred within these years, although not sure classification from moderate to high is important for WSP or COSEWIC assessments if they are to be excluded in any case;
    - you write your 'classification scheme was conservative, in that it does not consider strays', and yet you mention in a previous paragraph on this page that 'the scheme

uses all release, brood take and enhanced contribution data regardless of whether origin of release is from outside the local system' and doesn't this mean strays?

- o you indicate that sites with no evidence of enhancement are categories as having 'unknown level' rather than designated as 'wild' and yet your classification scheme on the previous page does have a 'wild' category that contradicts this and you write that you do use all four categories in this paper, so assume 'wild' is one of them?? your table has different categories for Wild (Unknown vs low) and a 'high-cross' category that you don't mention in your text;

- did you include or exclude brood stock removals in escapement estimates; they represent 'escapement', however, they do not contribute to the IUCN's defn of 'mature individuals'; just want to be clear on how broodstock was treated.

Metrics and benchmarks

- It would be helpful to perhaps provide the diagram in Holt et al. 2009 (Figure 4) that explains the how class of indicators, metrics, and benchmarks fit together. The piece you jump to is metrics and this is not distinguished from class of indicators in your background section.
- Holt et al. (2009) recommended using Bayesian approaches, is this not possible with the CN CUs and perhaps need an rationale for not using recommended approach.
- 'Probability of decline' metric wasn't clear to me as described; the metric Holt et al. (2009) recommend (applied in Grant et al. (2011)) is defined as "the probability that the last three generation slope is below the lower benchmark of 25%" and in our paper we considered this metric an exploration of uncertainty in the last three generation change metric, and that it was not independent but complementary to this metric; the way you describe this metric is not clear, I assume you are estimating the same thing, described in quotes above, but if that is the case your benchmarks do not make sense (LB of 50% and UB of 75%)?
- Distribution metrics (p23) hard to understand as described (one example includes, 'The distribution of spawner across sites within a CU and temporal trends in that distribution are presented using stacked bar plots of abundances by site for each decade'); perhaps a figure to reference as a start would be helpful; these however, are not mentioned in results, so wonder if methods are required? You don't mention Extent of Occurrence or Area of Occupancy metrics used by COSEWIC?

Generation Time

- how do you select CUs with CWT data to calculate generation time to represent CUs without CWT data?

Survival Rate

- you call survival rate smolt-to-age-2, however, it might be more appropriate to call this smolt-to-age 2_1 (or 3_1) and to use more formal aging convention to make it clear what you are referring to (as per your text description);

Results and Discussion

- again I would flip around the results/discussion section and focus on what you started in the 'escapement' and 'concluding observations' section, followed by more concise trend information; in the discussion section, there was a section on methods that should be moved out of the discussion and described Appendix B (most of the second paragraph);

in Appendix B it might be useful (just a thought?) for each final data set to have a column beside highlighting the data quality as per the preceding figures' legend (plus one of four NuSEDs categories indicated) so it is easier to know exactly what each data point represents when used;

- To be clear in the very first sentence of the discussion I would highlight first the 20 wild sites available for WSP and COSEWIC assessments, and then provide some details on these (referenced in Appendix B). As the purpose of this report is to provide data for COSEWIC and WSP status assessment, the key is how many CUs can be assessed based on you NuSEDs criteria, definition of 'persistence' and 'wild';
- An important highlight you mention (although somewhat buried amongst methods in the discussion) is that 19 out of the 20 'wild' sites are not recommended for abundance metrics, but rather trends in abundance only and this is an important conclusion of your work; a reminder that you specifically mean short term trends (is that correct, you don't feel long-term metrics can be used for SBC CN?);
- You provide methods for abundance metrics (which you indicate in results/discussion could be conducted for one CU) and distribution metrics, but do not provide any results/discussion on these.
- **Some questions I would have on risks to status evaluations (these I'm pulling together quickly so a bit random, but is more for brainstorming purposes):**

    1. If gaps of up to one generation occurred in the last three generations (and could include 56% of the observations in the 1995-2012 period) what risk would this have on last three generation trend metric; basically does this occur or are all last three generation trends for the 20 'wild' CUs complete (no gaps)? (sure the reader can check but would be helpful to have a punchline, as in don't worry about it, or for some CUs worry about it); does this size of gaps you permit in your definition of 'persistence' introduce risk to accurately assessing status for the recent trend metrics?
    2. for single sites with gaps, you infilled with a time series average broken into two periods (pre-1995 and post-1995); you mention the purpose of gap filling over what you call 'stanzas' to account for changes over time windows and global averages would reduce detection of these changes; in a draft data processing report, Holt recommended using time series averages in cases where escapement data were not autocorrelated, and in cases where data were autocorrelated (which I assume your data would be?), Holt recommends using averages between the gap year's two adjacent cycle years (i.e. if generation length is four years and a gap occurred in 1999, then the average escapement in 1995 and 2003 would be used); what is your justification for departing from recommended (and also previously applied in Grant et al. 2011) approaches (I assume it was due to data limitations but you should include if this is the case); what are the risk to trend status evaluations given your approach?
    3. In addition, since you mention that escapement estimates were not standardized across different survey methods, in the discussion section some evaluation even qualitatively on what the influence/risk on status assessments this might have (where did methods change and particular concern if methods changed between NuSeds classifications 1 to 4);
    4. your statement that "it must be assumed that the annual escapement estimate provide a consistent and reliable index of abundance although there is little possibility of confirming this for most CUs", this is a risk to escapement estimates;

5. (pg8) records were verified post-1995 only; it would be interesting to note how many discrepancies there were between paper records, EPAD and CTC files and the data;
6. only 2 time series have survival data how do these relate to other CUs
7. I'm not clear on how if pre-1995 data were generated from Fisheries Officer's observations (pg 5) presumably not using scientifically derived methods that include peak live cumulative dead or AUCs, and in addition, pre-1995 data were not verified by authors with BC16's (described on pg8), how data pre-1995 could be used in data sets since they would fall below NuSeds category 4, and yet they do exist in the final time series presented?
8. Pre-1995 data conducted by Fisheries Officers I would assume is all low quality data based on your description and yet looking at Appendix A this is not always the case; in cases where there is poorer quality data earlier in the time series emphasis that long-term trend metrics could be problematic;

Some editorial comments (more in pdf files)

- Appendix A, page A4 'visual summary of data availability and quality by CU' requires figure caption here to describe the data presented here and how the high versus low quality estimates map on to NuSEDS escapement estimation classifications 1 to 4 to map onto previous table; I assume these figure are all sites, not just sites in 1-4 categories as per the previous table so need to make that clear in figure caption; also recommend flipping the figures so they can be viewed easily on a computer; census site names were blurry on my computer and not easy to see; you include a vertical line for the start of the time series, would also be helpful to have a vertical line for the three generation metric's start of the time series; an asterisk next to the sites recommended for trend analysis would also be helpful for linkages to previous appendices
- Appendix C, in contrast, has a huge section on methodology and descriptions, which make it hard to use this table quickly; some of the methods should be transferred to text and then the table referred to in the text, with captions for headers.

REVIEWER: DAVID O'BRIEN, SOUTH COAST STOCK ASSESSMENT

Pre-COSEWIC review of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) conservation units, Part II: Data, analysis and synthesis

CSAP Working Paper 2012/13 – P23

Resubmission: 6-8 November 2013

This paper represents a substantial rewrite of a paper first presented for CSAP review in March 2013. Significant changes and improvements have been incorporated based on the comments of the previous reviewers and the discussion during that meeting. It is clear the paper is now more focused on the specific terms of reference relative to providing a clear dataset with transparent methods for COSEWIC review. As noted by previous reviewers, the magnitude of the task to assemble this information from such a diverse range of sources is clearly significant. I commend the authors on their work!

I was instructed to focus my review on the main body of the document and the specific analyses and data treatments used to prepare the data for COSEWIC review. I essentially stuck to these instructions although I did scan the two files associated with the appendices for the report and identified some minor issues.

Most of my comments are embedded in the electronic version of the main document. Please let me know if you have any questions when you are able to review them. I provide a high level summary of my comments here.

Overall, I found that the document was a difficult read. The difficulty arose primarily from mixing methods, results and discussion information throughout. In addition, because similar data sources were applied to multiple analyses and separately identified in the "data sources" section, portions of the document felt unnecessarily repetitive. With minor reorganization the document would be easier to navigate – please see the electronic version for specific suggestions.

The document contains two key data review and treatment steps:

1. Escapement data review and infilling
2. Enhancement level categorisation,

as well as two of classes of analysis:

1. WSP Benchmark calculations & trend analysis
2. CWT-based estimates of generation time, survival and exploitation rate.

I have separated my key comments to these four 'components' of the paper as well as the appendices.

Escapement data

- The specific categories (P, AGG, DD, EX) and their associated criteria applied to the census site data should be described fully in the text. I wasn't aware of the four categories until I saw them used in the results table.
- It was unclear from the text how the escapement categories would be applied to CU timeseries.
- The use of the English et al infilling procedure seems appropriate for infilling missing data for multi-census site CU's. Given the importance of this method in subsequent analyses, I think a brief review of the specifics of the method is warranted in the text. Note that the specific reference to the English et al 2006 document is missing from the references section.
- I don't think the simple average approach for infilling of single-census site CU's makes sense. There are certainly nearby CU's/ census sites or perhaps specific appropriate census sites that are correlated with these. You were able to define appropriate CWT indicators for all CU's; is it possible to utilise these to provide more reasonable infilling in these cases?
- I think that the presentation of only the average NUSEDS "data quality" categorization (average of the 1-4 estimate classification; any classed as quality 5 or 6 omitted) for CU's leaves out detail required by COSEWIC. Although I'm aware of concern about the consistency of application of these classifications in SENS, I think that the specific annual classification values should be provided for all timeseries. I noticed that in one case estimates of lower quality than generally used (5 or 6) were used when infilling procedures resulted in escapement values that were "suspicious". Perhaps these low quality estimates, if they exist, should always be provided as well as the infilled data to allow COSEWIC to assess the sensitivity of their results to the inclusion of infilled data vs low quality escapement estimates.

- Correlations were provided to evaluate the "appropriateness" of the infilling method. Was there any thought of re-evaluating the method when correlations were poor within specific CU's?

Enhancement level

- The text clearly describes four categories of enhancement level. It's only when you see the results table that you realise there are actually five categories! Add a description of the *High-Cross* category to the text.
- There are five categories, but then data limitations require that these categories be combined to only two for analysis. Likely it would be easier to simply stick with two categories throughout.
- Despite the categorisation of enhancement level described, we lack the assessment information to live up to the stated objective of the WSP with respect to assessing only wild Chinook. It seems likely that we will never have the resources to collect the data required to do this. Is it time to re-evaluate just what we are trying to do here?
- The text specifically, and rightly, defines no category as "wild" – the best that can be achieved is "unknown"; however, the result tables then revert to discussing how some categories represent wild fish… consistency is required.
- Many key results are relegated to footnotes in results tables; cleaning up the organization of methods-results-discussion would perhaps give a home to these key results in the text (this really applies to all sections).

WSP trend analysis

- The linear regression analysis proceeds on the infilled data. Are the results sensitive to the infill procedure?
- Does the Bayesian analysis really add to the inferences from the decline rate?
- The presentation of escapement plots in this section highlight the key issue of restricting the COSEWIC review to the last three generations. In most cases the last three generations reflect a sustained period of relatively low escapement and – given that exploitation rates are generally lower during this period – productivity. Could the potential implications of this on status assessment be more explicitly described for the COSEWIC reviewers?

CWT-based analyses

- Labelle 2013 is cited for updated analysis of CU-22, however, the citation is missing from the references section.
- There is a very high level of detail provided regarding the cohort analysis relative to others in the document. This analysis is perhaps less important to this paper than the infilling procedure and is better described elsewhere – perhaps downplay the detail here (provide citations only)?
- Survival and exploitation rate plot are very useful.

Appendices

- I'm not sure of the value of the plots in Appendix A (visual summary plots – although they are visually exciting); I think including the SEN estimate quality (1-6) associated with the

actual escapement data would be more valuable for future analysis – I'm sure all of these data will be passed to the COSEWIC reviewer.

- In Appendix D there are some strange entries in the "specific threats" sections for some Strait of Georgia CU's I'm familiar with. Seemingly unfinished threat summaries (posed as questions – "how much effort to fill a stomach?") are associated with the wrong threat category. Additional review is required.

I hope that some of these comments will be helpful in revising the document prior to publication. Thank you for the opportunity to review the document, and good luck with completion!

APPENDIX C: AGENDA

Regional Peer Review Meeting (RPR)

Proceedings of the Pacific regional peer review on Pre-COSEWIC assessment of southern British Columbia Chinook salmon conservation units, Part II:

November 5-7, 2013

Pacific Biological Station
Nanaimo, BC

Chairperson: Sean MacConnachie

Day 1 - Tuesday November 5, 2013

Time	Subject	Presenter
0900	Welcome & introductions	Sean MacConnachie
0910	Review agenda & housekeeping	Sean MacConnachie
0920	CSAS overview & meeting procedures	Sean MacConnachie
0930	Review terms of reference	Sean MacConnachie
0945	Presentation of Working Paper by Author(s)	Authors
1045	**Break**	
1100	Presentation continued	Authors
1140	Discussion	All Participants
1220	**Lunch Break**	
1330	Discussion continued	All Participants
1445	**Break**	
1500	Discussion	All Participants
1630	***Adjournment***	

Day 2 - Wednesday November 6, 2013

Time	Subject	Presenter
0900	Introductions & Housekeeping	Sean MacConnachie
0915	Review Day 1 & Confirm Agenda for the day	Sean MacConnachie
0930	Science Advisory Report *(draft will be circulated)* Develop Consensus on: • Key findings • Key conclusions and recommendations • Uncertainties • Ecosystem Considerations • Advice for Management • Recommendations for future work • Other	All Participants
1030	***Break***	
1050	Science Advisory Report	All Participants
1205	***Lunch Break***	
1305	Science Advisory Report	All Participants
1530	Wrap-up, next steps, other business	Sean MacConnachie
1600	***Adjournment***	

APPENDIX D: PARTICIPANTS

Last Name	First Name	Affiliation
DFO		
Bailey	Richard	SA Fraser-BCI
Baillie	Steve	SA South Coast
Brown	Gayle	Science SAFE SA
Brown	Tom G	Science SAFE
Candy	John	Science SAFE
Fraser	Kathy	Science SAGE
Grant	Sue	SA Fraser-BCI
Holt	Carrie	Science SAFE
Houtman	Rob	Science SAFE
Jantz	Lester	SA Fraser-BCI
Kronlund	Rob	CSAP
Leslie	Karen	SARA -RHQ
Lewis	Dawn	Science SAFE SA
Luedke	Wilf	SA South Coast
MacConnachie	Sean	Science MEAD
MacDougall	Lesley	CSAP
MacIsaac	Erland	Science SAFE
O'Brien	David	SA South Coast
Parken	Chuck	Science SAFE SA
Patten	Bruce	Science SAFE SA
Porszt	Erin	SA South Coast
Sawada	Joel	Science SAFE SA
Thiess	Mary	Science SAFE
Tompkins	Arlene	Science SAFE SA
Whitehouse	Timber	SA Fraser-BCI
Willis	Dave	Enhancement Assessment
Withler	Ruth	Science SAFE
EXTERNAL		
Ayers	Cheri	Cowichan Tribes
Beach	Katie	IMAWG
Blackbourn	Dave	Retired DFO
Bocking	Bob	LGL-Maa-nulth FN representative
Doire	Janvier	Skeena Fisheries
Gale	Rupert	Sports Fish Advisory Board
MacDufee	Misty	Raincoast
McGrath	Elinor	First Nations/Snc Chinook TWG
Pestal	Gottfried	Contractor
Rosenberger	Andy	Raincoast
Sinclair	Alan	COSEWIC species sub-group co-chair
Walsh	Michelle	Shuswap First Nation

APPENDIX E: WORKING PAPER ABSTRACT

The 35 Conservation Units of southern BC Chinook salmon will undergo status assessment by COSEWIC and DFO in 2014. Both processes require time series of spawner escapement data for application of quantitative metrics and benchmarks for the assessments. There are significant challenges to assembling the escapement data for the CUs and a variety of issues to address. These include issues related to data quality and quantity; much of the data is of lower quality, quality varies within and among census sites in CUs and sometimes, especially prior to 1995 in the NUSEDS, DFO's primary repository for escapement data, data quality is mostly unknown. There may be substantial gaps in data for individual census sites due to lack of enumeration programs in some years or incomplete data entry. In addition, other issues such as a long history of enhancement activities at many sites are problematic given that DFO's Wild Salmon Policy considers that wild fish only should comprise CUs and be considered in status assessments. In this report we document the methods we used to assemble and prepare time series of escapement data, separated into time series for census sites in CUs categorized as either wild or enhanced. Data and supplementary information for each CU to support the status assessment process are provided in appendix tables. We also provide a preliminary summary of trend and other metrics that are consistent with a previous status assessment process for the Fraser River sockeye CUs.