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Proceedings of the Pacific regional advisory meeting on the Fraser Sockeye *(Oncorhynchus nerka)* Wild Salmon Policy Evaluation of Stock Status: State and Rate; Stock Status Nass River Sockeye Salmon; Stock Status Nass River Chum Salmon; Stock Status Skeena River Chum Salmon

November 15-18, 2010
Nanaimo, British Columbia

Chairperson: Michael Chamberlain
Editor: Marilyn Joyce

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Canada

Foreword

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

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Aussi disponible en français :

*MPO. 2023. Compte rendu de la réunion sur les avis scientifiques de la région du Pacifique de la Politique concernant le saumon sauvage – Évaluation de l'état des stocks de saumon rouge (*Oncorhynchus nerka*) du Fraser : état et taux; état des stocks de saumon rouge de la rivière Nass; état des stocks de saumon kéta de la rivière Nass; état des stocks de saumon kéta de la rivière Skeena; du 15 au 18 novembre 2010. Secr. can. des avis. sci. du MPO. Compte rendu 2023/007.*

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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 Advisory meeting of November 15 - 18, 2010 at the Pacific Biological Station in Nanaimo, B.C. Four working papers focusing on the status of Fraser River and Nass River Sockeye Salmon, and Skeena River and Nass River Chum Salmon were presented for peer review.

In-person and web-based participation included Fisheries and Oceans Canada (DFO) Science and Fisheries and Aquatic Management (FAM) Sectors staff and external participants from First Nations organizations, the commercial and recreational fishing sectors, environmental non-governmental organizations, and academia.

The conclusions and advice resulting from this review will be provided in the form of four Science Advisory Reports providing advice to Fisheries and Aquaculture Management to inform salmon fishery planning for the above-noted stocks.

The Science Advisory Reports and supporting Research Documents will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Advisory Process (RAP) meeting was held on November 15-18 at the Pacific Biological Station in Nanaimo to review four working papers focusing on the status of Fraser River and Nass River Sockeye Salmon, and Skeena River and Nass River Chum Salmon.

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

The following working papers (WP) were prepared and made available to meeting participants prior to the meeting (summaries provided in Appendix B):

S.C.H Grant, B.L. MacDonald, T.E. Cone, C.A. Holt, A. Cass, E.J. Porszt, J.M.B. Hume, and L.B. Pon. Fraser Sockeye *(Oncorhynchus nerka)* Wild Salmon Policy Evaluation of Stock Status: State and Rate. CSAP Working Paper 2010/P14.

D. Peacock, B. Spilsted, R.C. Bocking, and W. Duguid. Nass Chum *(Oncorhynchus keta)* Stock Status. CSAP Working Paper 2010/P58.

P.E.D. Hall, R.C. Bocking, J.M.B. Hume, D.T. Selbie, J.R. Candy, A.F. Alexande, and A.S. Gottesfeld. Status of Nass River Sockeye Salmon *(Oncorhynchus nerka)*. CSAP Working Paper 2010/P42.

D. Peacock and B. Spilsted. Skeena River Chum *(Oncorhynchus keta)* Stock Status. CSAP Working Paper 2010/P59.

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

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

Members were reminded that everyone at the meeting had equal standing as participants and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 69 people participated in the RAP (Appendix D).

Participants were informed that several reviewers had been asked before the meeting to provide detailed written reviews for the working papers to assist everyone attending the peer-review meeting. Participants were provided with copies of the written reviews.

The conclusions and advice resulting from this review will be provided in the form of Science Advisory Reports to Fisheries and Aquaculture management to inform salmon fishery planning

for the above-noted stocks. The Science Advisory Reports and supporting Research Documents will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

REVIEWS

WORKING PAPER: FRASER SOCKEYE *(ONCORHYNCHUS NERKA)* WILD SALMON POLICY EVALUATION OF STOCK STATUS: STATE AND RATE

CSAP RSIA: 2010/P14

Presentation: Sue Grant

Reviewer(s): Kim Hyatt, DFO

Michael Staley M.Sc. RPBio, I.A.S. International Analytic Science Ltd.

Randall M. Peterman, Simon Fraser University

Accepted with revisions

There were three formal reviews of the working paper; two by external researchers and one internal DFO research scientist. The review of the working paper was conducted in two parts. The first portion of the review on the 15th of November, focused on the conservation units (CU) and the data used within the analysis and the treatment of that data for inclusion or omission from the analysis. The second portion of the review was conducted on the 16th of November focused on the application of the *abundance* and *trends in abundance* metrics used by Holt et al. (2009) and Holt (2009) to derive the lower and upper benchmarks by CU. It was made clear that *distribution* and *fishing mortality* metrics were not covered within the document. Following the discussions around the implementation of the *abundance* and *trends in abundance* benchmarks, the review focused on the combination of metrics to determine a definitive stock status.

Discussions first focused on the current DFO Core Science Fraser Sockeye CU list and changes proposed by authors in their draft paper. Authors identified numerous discrepancies between the Core Science CU list and Fraser Stock Assessment's knowledge of the escapement time series and biology of Fraser Sockeye, which remained to be reconciled. A Stock Assessment Coordinating Committee (SACC) led process was recommended to integrate Area species knowledge with Core's CU methodology to develop a final CU list.

Next, treatment of data used for *abundance* and *trends in* abundance status evaluations was discussed. The authors provided clarity on which types of data were used and how missing values were in-filled to reduce gaps in the time series. They also discussed, when questioned, the process by which original data was audited and authenticated. Reviewers were complimentarily of the effort taken to 'clean-up' the data sets and the groups agreed on the justifications used for the exclusion of the spawning escapement data used within the analysis. Some additional appendices were recommended to document years, by site, that were gap filled and the methods used for each gap filled.

There was considerable discussion regarding where the revised, gap filled data sets should reside. The group recommended that the original NuSeds escapement data (not gap filled; data from escapement surveys only) should be retained, however, an additional column that contains gap filled data and sites used for status evaluations be included in the NuSeds escapement database. This would provide those without knowledge of Fraser Sockeye escapement data details and Fraser Sockeye biology to have access to a time series that is amenable to status

and other assessments that is currently not available in the NuSeds escapement database currently. Again the process to add to NuSEDs was recommended to be led by SACC and DFO Core Science.

There were discussions and questions regarding uncertainties within the spawner abundance data (in the annual abundance estimates) and how methods to estimate abundance may have changed over time within CUs. Specifically, that the authors assign the Fraser Sockeye CUs a categorical status as to the confidence that one should have in current abundance estimates for spawners. It was thought that this may be relevant when a CU is right on the edge of being classified as red or yellow and that the additional consideration of uncertainty in spawner abundance may tip the rating to one side or the other.

Clarity was sought and provided regarding the switching between the use of effective female spawner (EFS) and effective total spawner (ETS) for the *trends in abundance* and *abundance* metrics.

The discussion then moved on to discuss the priors presented for rearing carrying capacity and the use of rearing lake capacity data. The analysis used independent measures of rearing capacity based on J. Hume's (CDFO) data. It was suggested that the authors provide some clarity in the methodologies as to exactly which data was used and how it was applied. It was also suggested that the other end of recruitment relationship is explored (possibility of positive change in productivity at low abundance, enrichment from carcasses). Conservation arguments suggest that we should look for MDM affects as model structures are optimistic with what goes on at lower stock size as doing so may push the lower benchmarks upward. It was concluded that the spawning habitat capacity be eliminated from the assessments given this data was not peer-reviewed and methods are unknown, where used, and only lake rearing capacity (J. Hume and L. Pon's updated research) be used when available and appropriate for a CU.

The authors were then asked to clarify the decision not to provide benchmarks based on a *distribution* or *fishing mortality* metrics. The author's explained that generally, the data doesn't provide flexibility to assess *distribution* stock status. *Distribution* is a complex indicator to assess and data are generally not available for these assessments. Specifically, *distribution* sampling design must be consistent over space and time, yet historically and current enumeration programs have not been specifically designed to monitor changes in distribution over time. The authors recommend that *distribution* could be coupled with habitat status indicators (which are to be developed) potentially in the future, as study designs are modified to assess distributional changes. The group agreed as it was noted only five CUs in the Fraser have enough data of which probably three of these are consistently sampled over time. Only Shuswap showed a significant loss of diversity over time and the reason for this was not pursued. Trying to determine why some populations dropped out (or appeared to) is too much to ask the authors to address. Without a spatially random sampling design it is impossible to address as on larger systems, people go to where they see fish (core areas), and do no sample randomly so as to miss variability in abundance.

A *fishing mortality* (FM) indicator was not included because the authors concluded that it was not an intrinsic property of a CU; f*ishing mortality* is an external threat to the CU. In Holt et al. (2009), *fishing mortality* indicators are generally used when stock recruit time series is not available. Also, on-going work with determining appropriate upper and lower benchmarks associated with fishing mortality indictor has not been concluded.

Technical debates revolved around the appropriateness of different stock recruitment (SR) model forms and the underlying assumptions and strengths and weakness of each of the individual SR models. The main issue which arose during this debate was the issue of cycle-line dominance in some CUs and which model was most appropriate to deal with those dynamics

(Ricker or Larkin model forms). The selection of the appropriate model would effect the designation of the abundance benchmark with some models producing substantially lower abundance benchmarks. It was concluded that the group could not come to consensus around which model to choose based solely on statistical grounds as both are statistically 'correct'. Debate then refocused on the criteria for defining a lower benchmark in the Wild Salmon Policy (WSP), mainly around the provision to provide an adequate buffer between the benchmark and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listing criteria. It was speculated that some forms of the Larkin model while statistically and biologically appropriate, may violate the 'adequate buffer' criteria of the benchmark.

The group was reminded that the metric not model is key in setting the lower benchmark and that '*Sgen*.' was the metric that provided a substantial buffer to avoid COSEWIC listing (see Holt et. al. 2009). It was cautioned that the issue with the benchmark even at *Sgen* for some CUs the actual abundance would still be listed or flagged by COSEWIC and that some CUs just by their nature will always be at risk.

Considerable discussion was then spent on the role of varying and declining stock productivity and how or if it would be incorporated into the benchmarks. The authors paper addressed time varying productivity in Ricker models in their draft paper and generally benchmarks were higher (more biologically conservative) for models that assumed time varying productivity. It was recommended that time varying productivity be similarly considered for the Larkin models and including a smoothed-Ricker model (as recommended by Carl Walters), in addition to the ones the authors already included, to incorporate time varying productivity in benchmark estimates.

There was also considerable discussion on the use of geometric versus arithmetic means that produce very different statuses for highly cyclic stocks. Given there was no scientific consensus at the end of the meeting, it was recommended that the authors continue to present status separately for the two methods of estimating the average abundance in recent years.

Finally, the group raised the issue how a single CU can be represented by multiple statuses (Red, Amber and Green) across benchmarks and metrics. There was no scientific consensus regarding whether or not divergent statuses across benchmarks and metrics for an individual CU had to be merged into a final single status for each CU during this meeting. There were arguments for both sides of the debate regarding whether to merge or not merge. The meeting concluded that the decision to merge or not merge statuses (not specifically a requirement of WSP) across benchmarks and metrics will require further discussion in the future, and will be part of subsequent processes.

POST MEETING ADDENDUM: The original (CSAS November 15/16 version) and current (August 19) draft of this working paper presents uncertainty in *abundance* metric benchmarks and status across the range of *abundance* benchmarks and *abundance* and *trends in abundance* metrics considered. To better reflect the content of this paper, the title of the working paper has changed: Evaluation of Uncertainty in Fraser Sockeye (*Oncorhynchus nerka*) Wild Salmon Policy Status using Abundance and Trends in Abundance Metrics.

WORKING PAPER: STATUS OF NASS RIVER SOCKEYE SALMON *(ONCORHYNCHUS NERKA)*

CSAP RSIA:	2010/P42
Presentation:	Peter Hall
Reviewer(s):	Gottfried Pestal, SOLV Consulting Ltd.
	Robert Bison, Fish and Wildlife, Province of B.C.

Neil Schubert, DFO

Accepted with revisions

There were three formal reviews of the Nass River Sockeye Salmon status paper presented during the RAP, each of which formed the basis discussions within the review group; one from an internal DFO scientist and two from external biologists. Each of the three reviews commented on different aspects of the paper and provided to be useful to guide the group discussions, some of which was focused on larger regional issues outside the scope of the presented paper.

Generally the group and the reviews were complementary on the paper and the information collated within it; however there were concerns regarding the format of the paper, specifically its lack of tie-in to the current Wild Salmon Policy (WSP) definitions and methodologies. Recommendations were made by the reviewers and the group as a whole to restructure the document to lay out clearly the Conservation Units being addressed, the data associated with each of them and the proposed benchmarks to meet Wild Salmon Policy objectives. There were also suggestions to expand the sections regarding 'threats' to the CUs as well as a summary of the exploitation rates (ER) on Sockeye originating from the CUs.

The discussion around the format of the paper covered the broader issue of what the salmon sub-committee should be presented when reviewing stock status papers in the future (what data should be presented versus referenced in supporting documents). The discussion was relevant to the process as it was agreed that most of the salmon WSP CUs will be similar to those within the Nass watershed, where assumptions regarding status and state are inferred or based on sparse datasets of varying quality. There was also discussion around how the sub-committee should deal with recommendations to do with increasing or decreasing the number of Conservation Units within the Region. There was recognition that with WSP related stock status and benchmark analysis that there may be justification to eliminate or add CUs. The sub-committee agreed that any recommended changes to the CU list should be dealt with through a separate Science work group.

The authors agreed that the document should be restructured and that they purposely did not include benchmarks for the Nass CUs, but simply presented the data at hand for each CU. There was specific intent to show that some CUs within the Nass Watershed were in the 'red' status presently and did not need a full assessment to determine that. The sub-committee agreed that the data supported the assertion that the Fred-Wright CU was likely at risk.

One of the reviewers raised caution that indeed there may be biases in the Meziadin escapement estimates (low) and that many of the other CUs in the Nass may have a 'less green' status and that the non-Meziadin CUs may be well below a green status. There was also a suggestion that in the data-limited situations like those with Nass Sockeye CUs the use of a fishing rate benchmarks should not be excluded.

Following discussions centered on the structure of the paper, the sub-committee moved the discussion towards the potential use of the non- stock recruit model based 'synoptic survey' analysis currently being developed within DFO to aid in determining CU status for the Nass Sockeye CUs. Indications from the synoptic overview state that the Gingit and Meziadin status may be stable and not at risk and the Fred-Wright status is declining at a high rate and has a low abundance. The sub-committee then discussed how to incorporate those findings into the report presented for review and whether or not it would require a new report and an additional review process. There was agreement that this may be an unneeded delay as the status of the stocks was evident from the information at hand. It was suggested that the incorporation of the synoptic assessment methods and results for the Nass CUs be incorporated as a revision to the

document, and that the approved benchmark WSP methodologies (Holt et. al 2009) be applied to the Meziadin CU. A discussion around whether or not the Meziadin consisted of one or two CUs (based on run timing) was deferred until such a point as more information was collected.

It was also suggested that with these revisions, the working paper be re-titled a, “Preliminary status of Nass River Sockeye Salmon” and that the revised document will be circulated to the committee to decide if it can be signed off or that the changes requested are such that the document requires a full review.

WORKING PAPER: NASS CHUM *(ONCORHYNCHUS KETA)* STOCK STATUS

CSAP RSIA: 2010/P58

Presentation: D. Peacock

Reviewer(s): Pieter Van Will, DFO

Accepted with revisions

The objective of this paper was to determine the status of Chum stocks in Statistical Area 3, referred to as Nass River Chum Salmon. It was felt that the authors had taken an important step in the WSP direction in dealing with the stock status question for an area/species with extremely poor escapement and harvest data. The RAP agreed that it was likely that the majority of CUs in the Pacific region would be data deficient as such it was hoped that the utility of this work will set a foundation that can be used for other similar data starved situations within the Pacific Region.

The main criticism of the paper was related to the slightly disjointed layout and text. It was suggested that the authors reformat and address some of the shortcomings within the text.

Overall it was agreed that the paper pulled together all of the escapement data for the various Chum Salmon systems within Area 3 and attempted to combine and aggregate data by CU and larger units in an attempt to assess whether there is any directional trend in the status of these populations. The use of the *Pavg* technique to scale the available escapement data was deemed appropriate and allows for some approximation of trend within the CUs.

It was agreed that while the scaling technique was appropriate most of the time-series is extremely fragmented to almost non existent (i.e. the Lower Nass CU) and provides no indication of trend for any of the CUs or aggregation of CUs identified in this paper. There was agreement that while the data was limited, there is evidence of extremely low returns for the few monitored systems in recent years coupled with little improvement based on an indication of reduced harvest. While there was agreement that the authors suggestion that the Chum abundance in this area is strongly affected by reduced marine survival conditions there was concern that the uncertainties in the application of exploitation rates to reconstruct the stocks may not be suitable (i.e. use of Nass River Sockeye exploitation rates as proxies for Chum) and as such fisheries effects could not be discounted.

It was suggested that the authors may benefit from exploring a meta-analysis of sustainable exploitation rates from other Chum stocks may allow for advice on acceptable ERs. This is of importance given that current management escapement targets are not biologically based.

The limited and fragmented nature of the data available for Nass River Chum resulted in the authors to provide a concrete status of the Chum Salmon in the area. As with the Nass River Sockeye working paper the RAP suggested that the non- stock recruit model based ‘synoptic survey’ analysis be applied to the Nass Chum conservation units to aid in the status designation. Indications from the synoptic overview provided at the meeting suggest that there

is evidence that the Portland Canal – Observatory Inlet Chum CUs is a conservation concern, the Portland Inlet Chum conservation unit is also a conservation concern and that the Lower Nass Chum conservation unit is data deficient so that its status cannot be judged.

The RAP made comments regarding the recommendations put forward by the authors in the working paper. The following points were highlighted for support:

- that a monitoring program assess the status of Area 3 Chum be initiated. This program may include the use the Nisga'a fish wheels.
- the proposal to explore the feasibility of a basin wide estimation assessment as well as the north coast Chum DNA stock identification initiatives
- The RAP also recommend that the authors provide an overview of potential habitat threats to Area 3 Chum and if possible suggest directed habitat studies which would aid in the evaluation of status.

WORKING PAPER: SKEENA RIVER CHUM *(ONCORHYNCHUS KETA)* STOCK STATUS

CSAP RSIA: 2010/P59

Presentation: D. Peacock

Reviewer(s): Robert Bocking, LGL Limited

Blair Holtby, DFO

Accepted with revisions

The objective of this research document was to determine the status of the Chum stocks in DFO statistical Area 4 (Skeena River CUs). There had never been a stock assessment review of the Area 4 Chum and the report was intended to review historic escapement patterns (aggregate and by CU), and aggregate exploitation rate reconstructions. Area 4 Chum are identified as a conservation concern in the DFO Outlook and chum recovery planning is a central focus of the MSC report as well as the IFMP. Area 4 net fisheries have been non-retention for Chum in recent years.

As with the Nass Chum stock status paper, reviewers found that the paper could benefit from a reorganization of the layout and some changes to the text. It was appreciated that historical escapement data was brought into the time series and it was suggested that those data be uploaded to the Regional NuSEDS database and that the location of the grey literature from which it originated be made available.

Within the document reviewers found that the authors made some assumptions regarding the use of Tyee test fishery capture efficiencies, the catch composition of terminal fisheries in Area 4 are all Skeena River Chum and that the use of Sockeye harvest rates are a suitable surrogate for Chum harvest rates in Canada and Alaska. The reviewer or the RAP could not dispute the validity of the three assumptions however it was suggested that more discussion was warranted.

Reviewers also pointed out that when the overall 60-year patterns of abundance are considered for Skeena Chum (both by indices of abundance or the Tyee test fishery index), Skeena Chum appear to wax and wane with some consistency. Area 4 Chum appear to have entered a period of low abundance as they have at least once in the past (mid-60's to perhaps early 80's). At least the two Skeena River CUs don't appear to be at risk and characterizing their current abundance as severely depressed is, perhaps, an overstatement. It was recommended that the

authors explore this cyclical pattern for correlation with other cyclical process which may effect salmon productivity.

The RAP also discussed the use of Tyee test fishery catch as a potential indices of escapement of Chum to the lower and middle Skeena CUs. A recommendation was made for the authors to explore this relationship to determine if the test fishery would be an informative proxy for escapements into the two CUs.

The limited and fragmented nature of the data available for Nass River Chum resulted in the authors to provide a concrete status of the Chum Salmon in the area. It was agreed that the data presented are suitable to do a limited assessment of status however the analysis did not include an evaluation of CU benchmarks and, therefore, stock status classification against Wild Salmon Policy benchmarks could not be done. As with the Nass River Sockeye and Chum working papers the RAP suggested that the non- stock recruit model based ‘synoptic survey’ analysis be applied to the Nass Chum conservation units to aid in the status designation. A preliminary exploration of the ‘synoptic’ analysis given during the RAP indicated that the Lower Skeena CU would be classified “At Risk”, the Middle Skeena CU maybe at risk, and the Skeena Estuary would be considered data deficient, so that status cannot be determined.

REFERENCES CITED

Bocking, R.C., Link, M.R., Baxter, B., Nass, B. and Jantz, L. 2002. Meziadin Lake biological escapement goal and considerations for increasing yield of Sockeye salmon (*Oncorhynchus nerka*). Can. Sci. Advis. Sec. Res. Doc 2002/124. 55 p.

Bocking, R.C. and Gaboury, M.N. 2003. Feasibility of reintroducing Sockeye and other species of Pacific salmon in the Coquitlam Reservoir BC. Prepared for the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program. BCRP Report 04.Co.03. LGL Limited. 105 p.

Carr-Harris, C. 2010. 2009 Skeena and Nass Sockeye Lakes Hydroacoustic Surveys. Skeena Fisheries Commission, Hazelton BC.

Cox-Rogers, S. 1994. Description of a daily simulation model for the Area 4 commercial salmon fishery. Can. Man. Rep. Fish. Aquat. Sci. 2256. 46p.

Cox-Rogers, S., Hume, J.M.B., Shortreed, K.S., and Spilsted, B. 2010. A risk assessment model for Skeena River Sockeye Salmon. Can. Manuscr. Rep. Fish. Aquat. Sci. 2920: viii + 60 p.

DFO. 2005. Canada's Policy for Conservation of Wild Pacific Salmon.

English, K.K., A. Blakley, T. Mochizuki and Robichaud, D. 2009. Coast-wide review of BC salmon indicator streams and estimating escapement, catch and run size for each salmon conservation unit. Draft report prepared for Fisheries and Oceans Canada and Ecotrust, Nanaimo, BC. 78 p.

Gottesfeld, A.S. 2003. Oweegee watershed Coho assessment study. Final Report to Fisheries Renewal B.C. File No. S-037-Y02-08. Skiikm Lax Ha Habitat Restoration and Stewardship Society. 27 p.

Grant, S.C.H., MacDonald, B.L., Cone, T.E., Holt, C.A., Cass, A., Porszt, E.J., Hume, J.M.B., Pon, L.B. 2011. Evaluation of Uncertainty in Fraser Sockeye (*Oncorhynchus nerka*) Wild Salmon Policy Status using Abundance and Trends in Abundance Metrics. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/087. viii + 183 p.

Henderson, M.A., Cass, A., Wood, C.C., Rutherford, D., Diewert, R. and Jantz, L. 1991. Assessment of the status of Nass River Sockeye salmon (*Oncorhynchus nerka*). Pacific Stock Assessment Review Committee, Department of Fisheries and Oceans, Nanaimo, BC. PSARC Working Paper S91-11. 36 p.

Hill, B., Gilchrist, A. and Grieve, G. 1997. Reconnaissance Inventory of Kwinageese Lake. Prepared for the Ministry of Environment, Lands and Parks, Fisheries Branch, Skeena Region, Smithers, BC.

Holt, C. A. 2009. Evaluation of Benchmarks for Conservation Units in Canada's Wild Salmon Policy: Technical Documentation. Can. Sci. Advis. Sec. Res. Doc. 2009/059. x + 50 p.

Holt, C. A., 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.

Holt, C.A. and Bradford, M.J. 2011. Evaluating Benchmarks of Population Status for Pacific Salmon. N. Am. J. Fish. Manage. 31:2, 363-378.

Holtby, B. and Ciruna, K. 2007. Conservation Units for Pacific Salmon under the Wild Salmon Policy. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/070. viii + 350 p.

International Union for Conservation of Nature (IUCN). 2001. IUCN Red List categories and criteria, version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. ii + 30 p.

Johannes, M.R.S., Hyatt, D.P. and McCreight, D.K. 1994. DFO-Nisga'a Interim Measures Program status report on assessment of Sockeye salmon smolts from the Nass River system. Report to file SRe: 19-94. Recruitment Assessment Section, Pacific Biological Station, Nanaimo, BC.

Rutherford, D.T., Wood, C.C., Jantz, A.L. and Southgate, D.R. 1994. Biological characteristics of Nass River Sockeye Salmon (*Oncorhynchus nerka*) and their utility for stock composition analysis of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. 1988: vii + 65 p.

Tchaplinski, P.J. and Hyatt, K.D. 1991. A comparison of population assessment methods employed to estimate the abundance of Sockeye salmon (*Oncorhynchus nerka*) returning to Henderson Lake, Vancouver Island during 1989. Canadian Technical Report of Fisheries and Aquatic Science: 1798. 101 p.

APPENDIX A: TERMS OF REFERENCE

FRASER SOCKEYE (*ONCORHYNCHUS NERKA*) WILD SALMON POLICY EVALUATION OF STOCK STATUS: STATE AND RATE; STOCK STATUS NASS RIVER SOCKEYE SALMON; STOCK STATUS NASS RIVER CHUM SALMON; STOCK STATUS SKEENA RIVER CHUM SALMON

Pacific Regional Advisory Process

November 15 - 18, 2010
Nanaimo, British Columbia

Chairperson: Michael Chamberlain

Context

This Regional Advisory Meeting (RAP) will review four scientific working papers on Fraser Sockeye (36 CUs), Nass River Chum, Skeena River Chum and Nass River Sockeye.

The Fraser River Sockeye Salmon working paper uses the existing Wild Salmon Policy (WSP) toolkit presented in Holt et al. (2009) to evaluate stock status for various Pacific Salmon Conservation Units (CUs). The working paper provides both a general background on Fraser Sockeye life-history, population trends and threats and a specific background on the history and data quality and quantity for each of the 36 CUs. This paper addresses required 'Action Steps' in the Department of Fisheries and Oceans (DFOs) WSP Strategy 1 (Standardized Monitoring of Wild Salmon Status). It specifically provides advice on the Fraser Sockeye Conservation Units (CUs) and data use, the benchmarks for *abundance* and *trends in abundance* metrics, and the stock status for each of the metrics used for the 26 assessable CUs. *Abundance* benchmarks estimated using different model forms that describe the stock-recruitment relationship (Ricker, Kalman Filtered Ricker model, Larkin model) will also be compared.

Fraser Sockeye have been identified as one of the priorities for WSP CU benchmark development by the WSP Strategy 1 Steering Committee. Further, formal WSP stock status evaluations are conditions of certification for the Marine Stewardship Council (MSC).

The objectives of the three North Coast reviews are to describe the current status of Chum Salmon in the Nass and Skeena Rivers and Sockeye Salmon in the Nass River. The working papers represent the first formal review of status for Chum Salmon in the Nass and Skeena Rivers and the first description of status for non-Meziadan origin Sockeye stocks within the Nass River Watershed. Information and advice presented in these documents and through the RAP proceedings will be used for the development of the 2010 Integrated Fisheries Management Plan (IFMP) and the Nisga'a fishing plan (Nass River stocks), and will contribute to the annual reporting requirements of the Marine Stewardship Certification (MSC) process. The following provides a general overview of the four working papers to be reviewed.

Fraser Sockeye (*Oncorhynchus nerka*) Wild Salmon Policy Evaluation of Stock Status: State and Rate

- The current paper updates WSP Strategy 1, Action Step 1.1 (the identification of Conservation Units (CUs)) and Action Step 1.2 (identification of benchmarks) and Action Step 1.3 (CU status assessment) for Fraser River Sockeye Salmon (*Oncorhynchus nerka*) CUs.

- For each *trends in abundance* and *abundance* metric, the current state of each to the 26 assessable Fraser Sockeye CUs is compared to the associated benchmark and status was assigned.
- *Abundance* benchmarks estimated using different model forms (Ricker, Kalman Filtered Ricker model, Larkin model) that describe the stock-recruitment relationship will also be compared.

Stock Status Nass River Sockeye Salmon

- The objective of this working paper is to determine the status of the individual Sockeye stocks in the Nass watershed.
- The paper represents the first formal stock assessment review of the Nass Sockeye other than Meziadin origin sockeye.
- The report will include a review of historic escapement patterns (from adult and juvenile surveys - aggregate and stock (CU) specific), aggregate exploitation rate reconstructions, review of data on stock specific run timing, a review of lake capacity studies, and a summary discussion of the status of each Sockeye stock.

Stock Status Nass River Chum Salmon

- The objective of this working paper is to determine the status of Chum stocks in DFO statistical Area 3.
- There has never been a stock assessment review of Area 3 Chum and the report will review historic escapement patterns (aggregate and by CU), and aggregate exploitation rate reconstructions.
- The document will also provide a summary discussion of the status of the aggregate and each CU.
- Area 3 Chum are identified as a conservation concern in the DFO Outlook, and chum recovery planning is a central focus of the MSC report and the IFMP.
- The status of Chum stocks has been identified by the Nisga'a as a concern.

Stock Status Skeena River Chum Salmon

- The objective of this working paper is to determine the status of the Chum stocks in DFO statistical Area 4.
- There has never been a stock assessment review of Area 4 Chum and the report will review historic escapement patterns (aggregate and by CU), and aggregate exploitation rate reconstructions.
- The working paper will also provide a summary discussion of the status of the aggregate and each CU.
- Area 4 Chum are identified as a conservation concern in the DFO Outlook and Chum recovery planning is a central focus of the MSC report and the IFMP.
- Area 4 net fisheries have been non-retention for Chum in recent years.

Objectives

The objectives for the review of each working paper are to:

- Evaluate each paper to determine the appropriateness of the data and the methods used within the analysis;
- Identify and evaluate the sources of uncertainty and the assumptions used in analysis;
- Evaluate the conclusions and recommendations respecting proposed stock status and benchmarks (Fraser River Sockeye) along with any other conclusions and recommendations in each paper; and,
- Provide a synthesis of the working papers, conclusions and advice.

Expected Publications

- CSAS Science Advisory Reports (4)
- CSAS Proceedings
- CSAS Research Documents (based on Working Papers) (1-4)

Participation

- DFO Science Branch
- DFO Fisheries and Aquatic Management Branch
- Non-Government Organizations
- First Nations Organizations
- Commercial and Recreational Fishing Interests

APPENDIX B: WORKING PAPER SUMMARIES

FRASER SOCKEYE *(ONCORHYNCHUS NERKA)* WILD SALMON POLICY EVALUATION OF STOCK STATUS: STATE AND RATE

The Department of Fisheries and Oceans (DFO) Wild Salmon Policy (WSP) goal is "to restore and maintain healthy salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity" (DFO 2005). In order to achieve this goal, the WSP outlines a number of strategies, including '*Strategy 1: standardized monitoring of wild salmon statuses*, which is the subject of this paper. In the current paper, Fraser Sockeye (*Oncorhynchus nerka*) conservation units (CUs) from 'WSP *Action Step 1.1: the identification of conservation units'* are used to update '*Action Step 1.2: the development of criteria to assess CUs and identify benchmarks to represent biological statuses*, and to address '*Action Step 1.3: CU status assessment'*, for the 22 current and two *de novo* CUs. Using a previously developed toolkit for CU status assessment (Holt et al. 2009; Holt 2009), *abundance* benchmarks were estimated for each CU with stock-recruitment data (each CU has unique benchmarks), and *trends in abundance* upper and lower benchmarks (identical benchmarks for all CUs) were modified for Fraser Sockeye. These benchmarks were used to delineate the three WSP biological status zones (Red, Amber, and Green). *Abundance* benchmarks were estimated across a range of stock-recruitment models, including the standard Ricker model that assumes constant productivity and other Ricker model forms that assume time varying productivity. Given most Fraser Sockeye CUs have exhibited systematic declines in productivity over recent decades (Grant et al. 2011), consideration of time varying productivity in the estimation of *abundance* benchmarks was important since extirpation risk can increase when a CUs productivity is linearly decreasing or low (Holt 2009; Holt and Bradford 2011). *Abundance* benchmarks were also estimated across a range of probability levels to reflect uncertainty in the estimation process. Estimates of a CUs spawner abundances at maximum juvenile production (S_{max}) were also updated and used as carrying capacity priors in Ricker models, where available and appropriate. In the evaluation of status using the *abundance* metric, both geometric and arithmetic means of recent CU abundance were compared against benchmarks. Since multiple metrics (one *abundance* and three *trends in abundance* metrics, depending on the CU*)* and uncertainty in *abundance* benchmarks are presented in the current paper, statuses for a CU can comprise all three WSP status zones. Further work to aggregate statuses across these metrics and benchmarks into a final single status for each CU is required. This current paper will be foundational to future status aggregation processes and publications.

STATUS OF NASS RIVER SOCKEYE SALMON *(ONCORHYNCHUS NERKA)*

The objective of this working paper is to assess stock status of each Sockeye conservation unit (CU) in the Nass watershed. Henderson et al. (1991) were the last to formally assess Nass Sockeye stock status. Bocking et al. (2002) evaluated the stock status of only the Meziadin Lake CU in 2002. Recent stock assessment and science research results including limnology surveys, fall fry surveys, weir programs, run reconstructions and genetic analyses were presented at a Nass workshop attended by DFO and First Nations biologists and representatives on May 31st and June 1st. We present the results from the Nass workshop in this paper and any additional data as it has come available. A Nass stock status report was identified at the workshop as a first step in addressing stock status concerns for non-Meziadin Sockeye, particularly the Fred Wright Lake CU.

Bowser Lake Conservation Unit

Historically, the Bowser Lake CU has been considered the second largest Sockeye CU in the Nass watershed. Escapements were estimated for the Bowser Lake CU from 1964 to 1999 by

scale pattern analysis when they were abandoned due to cost, contradictory results from DNA analysis, and improvements in estimating the non-Meziadin aggregate escapement by fishwheel tagging. There are two more recent sources of data for assessing Bowser Lake stock status: a fry population estimate in 2009 and genetic stock compositions from the fishwheels. Despite the concerns with these sources described in the working paper, both indicate escapements to Bowser Lake much smaller than the historic average based primarily on scale pattern analysis (26,255). An *O nerka* fry population estimate (that likely includes Kokanee) of 133,000 suggests a spawner escapement of 300 to 3,000 if we assume approximately 500 to 50 fall fry per spawner. Bowser proportions from the fishwheel DNA samples ranged from 1.5% to 3.9% which would suggest escapements of 4,000 to 7,000. Because we don't have estimates based on scale pattern analysis for the same years, it is unknown how these estimates would compare and therefore it is impossible to determine if there is a trend in escapements.

Fred Wright Lake Conservation Unit

Sockeye escapements to the Fred Wright Lake CU have declined precipitously in the last two years. Over the last 15 years (approximately 3 generations) Sockeye escapements have declined by 96%. This decline rate would result in a classification of "Critically Endangered" (CR A2b) by the International Union for Conservation of Nature (IUCN 2001). The *O. nerka* fry population estimate from 2009 (280,866) suggests escapement in 2008 may also have been low.

Microsatellite DNA analysis of the fishwheel samples suggests 7,500 Sockeye escaped through the fishwheels in 2009 compared with 107 counted through the video weir. Standard deviations are large (111%) for the genetic estimate of escapement past the fishwheels and consequently the difference is not statistically significant. A similar stock composition however, was also found in the genetic analysis of the Area 3 Canadian marine gillnet and seine fishery in 2009 (n = 1,540).

The discrepancy between the genetic results and the video weir can be explained by several hypotheses. The genetic escapement estimate could be biased too high if there is a Nass Sockeye population that is not included in the baseline that is getting incorrectly allocated to the Fred Wright Lake CU. Migration through the weir outside of the period of operation or leakage undetected through the weir is a possibility but stream inspections in 2009 and 2010 did not find any more Sockeye than was indicated by the weir counts. In-river mortality upstream of the Gitwinksihlkw fishwheels could also be indicated by the genetic results. Chinook escapements to the Kwinageese River also showed a decline in 2010 but not in 2009 and not to a historic low like the Sockeye escapement.

The 2009 *O. nerka* fall fry biomass estimate from 2009 suggests that only 18% of lake rearing capacity was utilized as estimated by the Photosynthetic Rate (PR) model. Escapements in the past two years have been at 0.2% and 0.5% of the PR modelled S_{MAX}. It is unknown, however, if lake rearing habitat or spawning habitat is the ultimate factor limiting capacity for the Fred Wright Lake conservation unit.

Kwinageese Lake Conservation Unit

It is clear that *O. nerka* rear in Kwinageese Lake however it is not clear what proportion are Sockeye versus Kokanee. There is strong evidence for Kokanee presence in the lake as mature *O. nerka* have been caught under 30 cm fork length (Hill et al. 1997). Beaver dams between the main spawning location in the upper Kwinageese River and the lake make it unlikely that fry migrate upstream to access the lake after hatching. The strongest evidence for Sockeye rearing in Kwinageese Lake is the smolt catches from the upper Kwinageese River in 1992 and 1993 (Johannes et al. 1994) although the parents of these smolts could have theoretically been

Kokanee (Bocking and Gaboury 2003). Further research is required to determine if Kwinageese Lake is or was a Sockeye CU.

Damdochax Lake Conservation Unit

The LOWESS smooth trend line for the Damdochax Lake CU shows a general decline over the escapement time series. However, over the last 15 years (approximately 3 generations) Sockeye escapements to the Damdochax Lake CU have remained flat. The methodology for estimating escapements has remained relatively constant over the time series although visual stream inspections are known to typically underestimate the true escapement (e.g. Tschaplinski and Hyatt 1991). Recent surveys of fall fry biomass (Carr-Harris 2010) compared against the PR modeled R_{MAX} show that 14% to 48% of Damdochax Lake's rearing capacity was being used and 7.6% to 31% of Wiminasik Lake's rearing capacity was being used. The average escapement from 2005 to 2009 (1,598) is 26% of the PR modeled S_{MAX}. It is unknown, however, if lake rearing habitat or spawning habitat is the ultimate factor limiting capacity for the Damdochax Lake CU.

Oweegee Lake Conservation Unit

Very little is known about the Oweegee Lake CU. It is not known if Oweegee Lake is used for rearing or if the Sockeye spawners in the Oweegee Creek watershed are instead part of the Upper Nass river-type CU. The largest estimated escapement for the Oweegee Lake CU was 250 in 1973. The most recent escapement survey in 2001 observed a peak count of 16 Sockeye (Gottesfeld 2003).

Upper Nass River River-Type Conservation Unit

The Upper Nass River river-type CU includes the Brown Bear Creek, Cranberry River and Tchitin River survey units. Brown Bear Creek is the only survey unit with recent escapement estimates that show a small number of spawners (average of 400 from 2004-2009) fluctuating at about the same abundance levels as observed in the late 1970's and early 1980's (average of 185 from 1978 to 1985). Microsatellite DNA analysis of the fishwheel samples suggest a much larger escapement to Brown Bear Creek. These escapement estimate results may be true for the CU if other river-type Sockeye from the CU are numerous and are more closely genetically related to Brown Bear Creek Sockeye than any other Sockeye in the Nass watershed. The numerous unmonitored and glacially turbid streams in the geographic region of the conservation unit make this hypothesis plausible. The fact that the Brown Bear Creek baseline sample is most closely related to the most abundant stock in the adjacent watershed makes straying hypotheses equally plausible. The question of the true origin of the Sockeye identified with the Brown Bear Creek genetic baseline from the fishwheels samples needs to be resolved before the genetic results from the fishwheels can be used to assess stock status for the Upper Nass River CU.

Lower Nass – Portland River-Type Conservation Unit

The Lower Nass - Portland river-type CU includes the Gingit Creek, Gitzyon Creek, Tseax River, Seaskinnish Creek, Zolzap Creek, Ishkeenichkh River and Khutzeymateen River survey units. The Khutzeymateen River is not included in this report because it is outside of the Nass watershed; however there have only been two Sockeye escapement estimates to the Khutzeymateen River in 1986 and 1987 (10 and 3 respectively). The presence of Sockeye spawners in the Khutzeymateen River was recorded in 8 of the past 10 years.

It has been well established that Gingit Creek Sockeye have the earliest timing of any Nass Sockeye stock (e.g. Rutherford et al. 1994) and our genetic analysis of the fishwheels samples also confirms this. Because of this timing difference, the Nass Sockeye aggregate exploitation

rates calculated using run reconstruction techniques may not be indicative of the exploitation rates experienced by Gingit Creek Sockeye. It is unknown if any of the other survey units included in the Lower Nass – Portland conservation unit have the same early timing. Brown Bear Creek was the only other river-type genetic baseline used for the timing analysis and they appeared to be much later.

Gingit Creek appears to have the largest abundance of any spawning site in the Lower Nass – Portland CU. Recent escapements show an increasing trend from the lows observed in the early 1990s. Average escapements since 2001 (3,226) have returned to the long-term average of 3,000.

NASS CHUM *(ONCORHYNCHUS KETA)* STOCK STATUS

This paper provides a preliminary assessment of Area 3-Nass Chum Salmon (*Oncorhynchus keta*) stock status and is intended to be an intermediate step to feed into the DFO salmon stock status research project headed by Blair Holtby. Building on the initial CU specific reconstruction method documented in English et al. (2009), Dr. Holtby has developed a generic approach to escapement reconstruction and uses estimated harvest rate histories and age structure to estimate annual catch, escapement and brood year production estimates and explore the utility of a range of determinants of stock status.

This review of the Area 3-Nass chum escapement history and abundance trends includes records dating back to 1934. The escapement history is reviewed for each of the three Nass Chum conservation units (CUs) defined by Holtby and Ciruna (2007). Also presented are escapement and run reconstruction results (including harvest rate estimates) for the period 1982 to 2008 for Chum stocks within the Nass Area as defined in the Nisga'a Final Agreement (Nass Joint Technical Committee analyses). The Nass Area includes all of the Lower Nass and Portland Canal/Observatory Inlet chum conservation units and a portion of the Portland Inlet Chum conservation unit. Overall trends in escapement, historical harvest impacts, indications of ocean survival patterns and existing management escapement targets are evaluated to provide a preliminary understanding of stock status for Chum Salmon.

SKEENA RIVER CHUM *(ONCORHYNCHUS KETA)* STOCK STATUS

This working paper presents new stock assessment information on Skeena Chum Salmon (*Oncorhynchus keta*) spawning escapement for the period 1934 to 1950, and provides a new application of the Skeena model (Cox-Rogers 1994 and Cox-Rogers et al. 2010) to estimate historical annual Skeena Chum Salmon Canadian commercial harvest rates. The paper also introduces separate assessments by the three Skeena Chum conservation units (CUs) based on the CU delineations of Holtby and Ciruna (2007). Trends in abundance and historical harvest impacts are evaluated to provide a report on stock status.

This paper demonstrates that in contrast to Fraser Sockeye for example, the Skeena Chum CUs are in the shallow end of the stock assessment data pool. There is very limited quantitative data to assess stock status. This presents a different set of challenges to define benchmarks, reference points and establish stock status. The results from this paper are also intended to provide technical contributions for two ongoing research projects that include assessments for Skeena Chum. Updated data will be available for the ongoing DFO research to evaluate the utility of a suite of potential indicators of stock status (headed by Blair Holtby). The data will also be used to inform the Skeena Watershed Initiative – Pacific Salmon Foundation research to develop benchmarks for Skeena salmon. Under the technical chair of Brian Riddell, Josh Korman will be working with technical representatives from the Skeena Watershed and other

technical experts as required. This group will also work in concert with the regional DFO benchmark working group.

APPENDIX C: AGENDA

DAY 1 - MONDAY, NOVEMBER 15, 2010 (ALL TIMES BELOW IN PACIFIC STANDARD TIME)

Time	Subject
1030	Introductions and Procedures
1100	Review: ***Fraser Sockeye Stock Status Research Document*** • Presentation
1200	***Lunch Break***
1300	• Points of Clarification
1330	• Review: Conservation Units, Data Treatment, Abundance Trends (tentative)
1630	***Adjourn for the Day***

DAY 2 - TUESDAY, NOVEMBER 16, 2010

Time	Subject
0900	Introductions and Procedures
0930	Review: ***Fraser Sockeye Stock Status Research Document*** cont. • Presentation
0945	• Review: Abundance, and Combining Metrics
1200	***Lunch Break***
1300	• Discussion and formation of advice, and recommendations
1630	***Adjourn for the Day***

DAY 3 - WEDNESDAY, NOVEMBER 17, 2010

Time	Subject
0900	Introductions and Procedures
0930	Review: ***Status of Nass River Sockeye Salmon (*****Oncorhynchus nerka*****)*** • Presentation
1000	• Review

Time	Subject
1030	***Break***
1045	• Review
1130	• Advice and Recommendations
1200	***Lunch Break***
1300	Review: ***Nass River Chum (*Oncorhynchus keta*) Stock Status*** • Presentation
1330	• Review
1430	***Break***
1445	• Review
160	• Advice and Recommendations
1200	***Adjourn for the Day***

DAY 4 - THURSDAY, NOVEMBER 18, 2010

Time	Subject
0900	Introductions and Procedures
0930	Review: ***Skeena River chum (*Oncorhynchus keta*) Stock Status*** • Presentation
1000	• Review
1030	***Break***
1045	• Review
1130	• Advice and Recommendations
1200	***Lunch Break***
1300	Advice and SAR's North Coast papers (tentative)
1630	***Adjourn for the Day***

APPENDIX D: PARTICIPANTS

Last Name	First Name	Affiliation
DFO		
Bailey	Richard	Stock Assessment - BC Interior
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Willis	Dave	Stock Assessment Fraser - BC Interior
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Argue	Sandy	Province of British Columbia
Ashton	Chris	Area B Harvest Committee
Atkinson	Mary-Sue	Pacific Fisheries Resource Conservation Council
Bison	Robert	Province of British Columbia
Blackbourn	Dave	DFO Scientist Emeritus
Bocking	Bob	LGL Limited (Nisga'a)
Brunet	Elysia	Simon Fraser University (SFU)
Cleveland	Mark	Gitanyow Fisheries Authority
English	Karl	LGL Limited
Fugere	Charles	Cohen Commission of Inquiry
Gottesfeld	Allen	Skeena Fisheries Commission
Harling	Wayne	Pacific Salmon Commission
Hill	Aaron	Watershed Watch
Knox	Greg	SkeenaWild Conservation Trust
Korman	Josh	Pacific Salmon Foundation
Kristiansen	Gerry	Sport Fishing Advisory Board
Levy	David	Cohen Commission of Inquiry
Michielsens	Catherine	Pacific Salmon Commission
Moray	Clea	Pacific Salmon Foundation
Nyce	Harry	Nisga'a First Nation
Pestal	Gottfried	Contractor
Peterman	Randall	Simon Fraser University (SFU)
Staley	Mike	BC Aboriginal Fisheries Commission
Tsurumi	Maia	Cohen Commission of Inquiry
Walters	Carl	University of British Columbia (UBC)
Wieckowski	Katherine	ESSA Technologies
Wilson	Ken	Marine Conservation Caucus