Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2022/032

Pacific Region

Proceedings of the Pacific regional peer review on a Recovery Potential Assessment – Southern British Columbia Chinook Salmon – Four Designatable Units

February 22-24, 2022
Virtual Meeting

Chairperson: Ben Davis
Editor: Jill Campbell

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

August 2022

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.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280
ISBN 978-0-660-44554-0 Cat. No. Fs70-4/2022-032E-PDF

Correct citation for this publication:

DFO. 2022. Proceedings of the Pacific regional peer review on a Recovery Potential Assessment – Southern British Columbia Chinook Salmon – Four Designatable Units; February 22-24, 2022. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2022/032.

Aussi disponible en français :

MPO. 2022. Compte rendu de l'examen par les pairs de la région du Pacifique sur l'évaluation du potentiel de rétablissement : saumon chinook du sud de la Colombie-Britannique – quatre unités désignables; du 22 au 24 février 2022. Secr. can. des avis. sci. du MPO. Compte rendu 2022/032.

TABLE OF CONTENTS

SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meeting on February 22-24, 2022. Due to the COVID-19 pandemic, in-person gatherings have been restricted and a virtual format for this meeting was adopted, via the online meeting platform Zoom. The working paper presented for peer review was a Recovery Potential Assessment (RPA) for four populations of Chinook Salmon (Designatable Unit (DU) 1 Boundary Bay Ocean Fall, DU 6 Lower Fraser Ocean Summer, DU 13 South Thompson Stream Summer, DU 15 Lower Thompson Stream Spring) based upon the national RPA Guidance. Meeting participants agreed the working paper satisfied all Terms of Reference objectives. The working paper was accepted with minor revisions.

Participation included Fisheries and Oceans Canada (DFO) Science, Species at Risk Program, Salmon Enhancement Program, Fish and Fish Habitat Protection Program, and Fisheries and Resource Management staff, and external participants from First Nations, 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 a Science Advisory Report (SAR) providing advice to decision makers in DFO's Ecosystem Management Branch, Species at Risk Program, and Committed on the Status of Endangered Wildlife in Canada (COSEWIC) to inform *Species at Risk Act* (SARA) recovery planning.

The Science Advisory Report, Proceedings and supporting Research Document 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 Peer Review (RPR) was held on February 22-24, 2022, via the online meeting platform Zoom to review the working paper on the Recovery Potential Assessment (RPA) for four populations of Chinook Salmon (Designatable Units (DU) 1 Boundary Bay Ocean Fall, DU 6 Lower Fraser Ocean Summer, DU 13 South Thompson Stream Summer, DU 15 Lower Thompson Stream Spring) based upon the national RPA Guidance.

The Terms of Reference (TOR, Appendix A) for the science review were developed in response to a request for advice from the Species at Risk Program. Invitations to the science review and conditions for participation were sent to DFO Science, Species at Risk Program, Salmon Enhancement Program, Fish and Fish Habitat Protection Program, and Fisheries Management staff, and external participants from First Nations, Province of British Columbia (BC), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), National Oceanic and Atmospheric Administration, the commercial and recreational fishing sectors, environmental non-governmental organizations, and academia.

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

> Recovery Potential Assessment for Southern British Columbian Chinook Populations, Fraser and Southern Mainland Chinook Designatable Units (1, 6, 13 and 15) by Kaitlyn Dionne, Théa Rachinski, Chuck Parken, Lauren Weir, Daniel Doutaz, Lynda Ritchie, Richard Bailey, Brittany Jenewein, Kristi Miller-Saunders, Marc Labelle, Murray Manson, Paul Welch, Nicole Trouton, Michelle Walsh, Paul Mozin. CSAS Working Paper [2020SAR02]

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

The Chair reviewed the Agenda (Appendix C) and the Terms of Reference for the meeting, highlighting the objectives and identifying Jill Campbell as the Rapporteur for the meeting. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation. 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, 37 people participated in the RPR (Appendix D).

Participants were informed that Laura Tessier (DFO Science) and Dave Scott (University of British Columbia) had been asked before the meeting to provide detailed written reviews for the working paper to facilitate the peer-review process.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report (SAR) to decision makers in DFO's Ecosystem Management Branch, Species at Risk Program, and COSEWIC to inform *Species at Risk Act* (SARA) recovery planning. The Science Advisory Report, Proceedings and supporting Research Document will be made publicly available on the Canadian Science Advisory Secretariat website.

GENERAL DISCUSSION

This Proceedings document summarizes the discussions that took place by RPA Element, with points of clarification presented by the authors in their presentations and questions and comments raised by the reviewers and participants captured under each Element heading. Not all elements generated discussion. One of the reviewers, Laura Tessier, was unable to attend the meeting, so her comments were presented to the group by the Chair. The other reviewer, Dave Scott, provided his comments as part of the group discussion for each Element.

WORKING PAPER INTRODUCTION

A participant indicated that Table 1, which shows reasoning behind the designated COSEWIC status was not verbatim from the COSEWIC documentation on these DUs. The authors will ensure the text in the Research Document matches the wording provided by COSEWIC.

There was further discussion on why 'low marine survival' was not included by COSEWIC as a reasoning for all four of the DU status. Some participants indicated that perhaps there was not enough data to support that claim for each DU. As well, participants were unsure what 'low' referred to. Another participant indicated that not all stocks appear to be doing poorly in the marine environment. The authors will provide some clarification on the COSEWIC reasoning and can provide references to research on Chinook marine survival.

Similarly, there was discussion on why by-catch is only referenced as a reasoning for the COSEWIC status for DU1. An author indicated that this stock tends to reside in the Salish Sea, West Coast of Vancouver Island, and coastal Washington which increases its vulnerability to bycatch, particularly from groundfish trawls.

ELEMENT 1: SUMMARY OF CHINOOK SALMON BIOLOGY

A number of participants had additional background information on these DUs, including hatchery information, observations of marked fish both spatially and temporally, and information on recreational fishing effort. One participant indicated that in DU1 as far back as the late 1970s Green River and Dakota Creek hatchery fish (located in Washington state) were present in DU1 rivers. A participant noted that in recent years fishing along the DU1 rivers has been greatly restricted due to the presence of a golf course, farmers field, and a First Nation reserve. As well, no creel surveys in DU1 exist, despite Chinook, Coho, and Chum retention being permitted. In DU6, once Maria Slough had a consistent return of Chinook Salmon greater than 500 spawners, as a result of a combined application of habitat restoration and fish culture enhancement, then various transplants from Maria Slough were introduced into nearby Fraser River sloughs (Hope Slough and Wahleach slough) in an attempt to create viable satellite populations to improve the resiliency of DU 6 to habitat changes within its existing very restricted habitats within Maria Slough. No transfers of eggs or fry from other Chinook populations were ever released into the Maria Slough itself. The authors welcomed this information and will work with those participants to include this and other available background information.

A participant had concerns on how DU1 and DU6 were classified by COSEWIC. DU1 has evidence of being genetically related to hatchery fish in Washington as far back as 1978, likely due to straying. As well, populations on the Serpentine and Nicomekl Rivers were established from out of DU transplants. The participant questioned why Serpentine and Nicomekl Rivers were included in this DU and also questioned the viability of this DU without future enhancement. An author indicated that wild Chinook were present in the Little Campbell River prior to the start of the hatchery program and out of DU transplants. For DU6 the participant wondered why nearby Hope and Wahleach Sloughs, nearby side channels, and the entire Fraser River gravel reach were not included in this DU. They noted that these other sloughs

have not been surveyed however there are known spawning populations there. If these additional areas were included in this DU, it might have a better chance of survival. A participant from COSEWIC indicated that this information will be valuable for future COSEWIC DU assessments.

ELEMENT 2: EVALUATION OF RECENT CHINOOK SALMON ABUNDANCE TRAJECTORY, DISTRIBUTION, AND NUMBER OF POPULATIONS

Several participants asked the authors to provide clarity on if the abundance trends included hatchery fish or not, particularly in reference to Table 8 and Figure 3. The authors will change the 'Hatchery, Wild, or Both' column to indicate 'Both' for this DU.

A participant asked Figure 3 to be altered so the y-axis includes 0. The authors agreed to alter this figure.

A participant asked for clarity on Figure 8 (DU15) where no marked releases were reported for 2019. The authors indicated there were marked releases, but that these data had not been reported to the database prior to the working paper being released. The authors will provide clarification on this point or include the data if they are available.

A participant requested additional information be provided on proportionate natural influence (PNI) metrics for these DUs. The authors indicated that there are many gaps in the PNI data and that marking and sampling has not occurred for many enhanced populations which means there will be a great deal of uncertainty surrounding any reported PNI metrics. The authors will provide the PNI data that are available and will discuss the caveats and uncertainties around these metrics.

A reviewer indicated that there is a lack of clarity around the abundance trends and the level of risk these populations face, particularly for DUs 1 and 6, given the amount of enhancement. The authors will provide clarity around the utility of the data to accurately depict the risk to wild stocks. As well, more context will be provided in the paper to address the mismatch between what the text in the paper says versus what the abundance trends indicate.

The authors will clarify in the Research Document that DU1 was assessed by COSEWIC as Threatened based on abundances below 1000 spawners, rather than based on abundance trends.

ELEMENT 3: RECENT LIFE HISTORY PARAMETERS

A participant indicated that they have recently provided the authors with more information on how pathogens and parasites impact migrating Chinook. The authors will include this information in the Research Document (Bass et al., 2017).

A participant noted an error in Table 13, where the survival rates for the Shuswap and Sammish River indicator stocks were reported as proportions instead of percentages. The authors will adjust this table.

Elements 4-7 were presented but the information did not generate questions or comments.

ELEMENT 8: THREATS TO SURVIVAL AND RECOVERY

Residential and Commercial Development

Commercial and Industrial Areas

A reviewer and participant indicated that in DU1 there is a proposed industrial area that will bridge the Little Campbell River, potentially impacting the movement of Fall Chinook. This work has not yet been approved but appears likely to go ahead. The reviewer suggested this industrial development be monitored closely to determine if the threat ranking should be increased in the future.

A participant thought that the footprint for the proposed Roberts Bank Port Expansion would represent a larger threat to DU6 as it would increase the migration barrier further out into the Strait of Georgia. The authors indicated that this threat was mainly assessed in the context of freshwater and estuarine habitat usage. The participant wondered if the group thought this project would represent a higher risk ranking. Other participants indicated that this project has not yet been approved and that the current Low risk ranking encompasses a 1-10% change in population and thought this proposed project would be unlikely to increase the risk to Medium (11-30% change in population). The participant who raised this concern agreed that the threat level should remain at Low. An author indicated that if the Roberts Bank Port Expansion project is approved, there will be monitoring and habitat offset requirements that may help to mitigate any increased threat caused by the increased port footprint.

Agriculture and Aquaculture

Marine and Freshwater Aquaculture

A participant shared recent research on linkages between fish farms in the Discovery Islands and incidence of disease in Chinook Salmon (Shea et al., 2020). They indicated that the previous research indicating the fish farms propose little threat to migrating Sockeye Salmon does not apply to Chinook. This new research indicates that there is active exchange of pathogens from farmed Chinook to wild Chinook, particularly along the West Coast of Vancouver Island.

Biological Resource Use

Fishing and Harvesting Aquatic Resources

A participant wondered why the exploitation rates have not declined further given recent fishery management actions for both commercial and recreational fisheries. An author indicated that the rates in 2019 have declined due in large part to the reductions in the Haida Gwaii troll and Haida Gwaii recreational fisheries and COVID related reductions in overall fishing effort. However, the 2020 exploitation rates were higher than the recent average due to increased First Nation food, social, and ceremonial (FSC) catches near the Thompson confluence with the Fraser River.

A participant thought the threat ranking for DU13 (Low) should be increased to Low-Medium as the run timing overlaps with the South Thompson Summer 5.2 run, which saw an exploitation rate more than double the target (12-15% vs a target of 5%). An author indicated that these stocks are on the early side of the South Thompson Summer 5.2 and are a part of the South Thompson Spring 5.2 Stock Management Unit which has a more restricted fishery. Another participant indicated that these populations are assessed over three generations and annual

exploitation rates are not necessarily suitable to determine the level of impact. Consideration of future fishery management approaches is outside of the scope of this work.

A participant noted that in DU15, there has previously been an FSC fishery at the mouth of the Nicola River, but the 2021 floods introduced a gravel bar to this area which may curtail future fisheries at this location.

Natural Systems Modifications

A participant suggested an additional threat category be created: “Removing or reducing human maintenance”. In the context of DU6, ongoing human maintenance of the spawning areas is needed to sustain this DU, however there is no appropriate threat category to discuss this threat. This suggestion may be considered for inclusion in future COSEWIC threat workshops.

Dams and Water Management

A participant wondered how old dams were incorporated into the threats assessment and if they were considered to be a threat to recovery if no fish ladders are in place. An author indicated that dams are considered to be historical threats and as there are no plans to build new dams in these systems that these old dams do not factor into this threat rating.

Other Ecosystem Modifications

A participant shared some of the history of DU6. They indicated that this DU has seen significant changes through time and that Maria Slough is likely to be filled in over time as it is no longer experiencing seasonal flushing. The spawning areas were artificially created and are unlikely to remain as suitable spawning habitat without intervention. The participant believes this DU is likely not self-sustaining and will need future mitigation to remain viable. As well, there was discussion on how connecting the slough to the Fraser River would require a great deal of engineering effort and may result in a negative impact to the habitat.

Invasive & Other Problematic Species & Genes

A participant noted that the threat of disease is likely to decline with the removal of fish farms in the Discovery Islands, however, the threat of disease is also likely to increase with elevated marine and freshwater temperatures due to climate change. They asked for the authors to clearly disentangle these two conflicting but related trends in the Research Document.

Invasive Non-Native/Alien Species

Updated information on pathogens and parasites affecting Chinook has been brought to the attention of the authors since the threats workshop that indicates a link between open net pen aquaculture and endemic disease in Chinook. A population model spanning ten years was created to explore the relationship between infection and annual variance in survival for Chinook and identified vectors of marine and freshwater survival. A participant involved in this research also indicated that fish farms are using mechanical methods to remove sea lice, which also removes the mucous from the skin which can host pathogens. The wastewater from this mechanical removal procedure is released into the marine environment where it poses a risk to Chinook. Additionally, while hatcheries can control disease in hatchery fish, there can also be high levels of disease in released hatchery fish, which then comingle with wild fish and pass along disease. This new information will be incorporated into the text for this section however, the threat ranking was not recommended to be changed.

Problematic Native Species

A participant noted that the most recent pinniped population abundance information may not have been used in this report. The authors agreed to ensure the most recent information is incorporated and referenced.

Introduced Genetic Material

A participant brought the group's attention to a paper by Nelson et al. (2018) that determined there were no negative associations between productivity and enhancement across 20 Chinook stocks. The participant wondered if this research was taken into account in assessing this threat. The authors indicated that this paper had some limitations to how the hatchery origin fish were addressed in the spawning escapements and recruitment estimates. They also pointed out there is an increasing body of literature that indicate wild fish do compete with hatchery fish.

A participant was unsure why DU15 was listed as Med-High for this threat. Authors indicated that the PNI is quite high on the Nicola River, all of the populations except on Louis Creek have been enhanced, and brood take practices have not always taken migration timing into account. As well, new data that have become available since the threats workshop indicate the 2021 escapement consisted of nearly 75% first generation hatchery origin fish and wild-origin fish productivity is declining in this system.

Climate Change

Habitat Shifting and Alteration

A participant asked for more information on how sea level rise will impact DUs 1 and 6, especially considering the sea dams proposed by communities in these areas. The authors will add this information.

Droughts

More information will be added to indicate that summer droughts often result in the loss of access to spawning habitat.

A participant noted that both natural processes and water management contribute to the threat of drought. However, the threat ranking presented under Natural Systems Modification, Dams and Water Management (DU1 High, DU6 Medium, DU13 Medium-High, DU15 High) is different than the threat ranking presented under this threat (all four DUs Low-Medium).

Storms and Flooding

The threats workshop assessed this threat prior to the November 2021 flooding which had significant impacts to DU6 and to the Nicola and Coldwater rivers in DU15. The Nicola and Coldwater rivers in DU15 saw changes to channel width, channel and thalweg migration, increased sedimentation, high turbidity, and changes to water temperature that are likely to have a negative impact on the spawning habitat over the long term. There was also concern that the cold-water refuges may have been impacted by the flood damage. Two cohorts were negatively affected by the floods, the eggs in the gravel from the 2021 brood year and the juvenile Chinook from the 2020 brood year. Considering this and that flood events are likely to occur again in the next ten years, the threat ranking will be increased from Low-Medium to Medium for DU15.

A participant noted that the Province of BC is currently conducting a review of their flood management processes. As well, the assessments of the pre- and post-freshet watershed conditions are in the early stages of being planned.

Elements 9-10 were presented but the information did not generate questions or comments.

ELEMENT 11: KNOWLEDGE GAPS AND DISCUSSION OF THE POTENTIAL ECOLOGICAL IMPACTS OF THREATS FROM ELEMENT 8

Participants were concerned that some of the wording in this section may suggest that little information on these stocks is known. They wanted it to be clear that some populations have been well-studied and that a few populations have well-studied indicator stocks. The authors will ensure the wording is more reflective of the available data.

ELEMENT 12: RECOVERY TARGETS

It was noted that the COSEWIC criteria listed for DU6 was not the same as how COSEWIC designated it. The authors will ensure the listing criteria is the same and ensure the proper nuance is discussed.

A participant was concerned with how the survival and recovery targets can be operationalized. The targets are presented in absolute abundances whereas for many populations only relative abundances are known and some populations have incomplete assessment methods. The authors acknowledged that this is a challenge to address in the RPA process as stock assessment policies are not aligned at the DU level. However, there are forthcoming efforts to better understand population abundances for a number of populations. For example, in DU1, counting fences will be established in the Serpentine and Nicomekl rivers, DU6 will soon be having a more robust mark-recapture program, DU13 have robust counts on Eagle and Salmon rivers, and in DU15 there are six sites with robust counts, and there is the possibility of using existing sonar technology currently being used for Coho counts. Future work needs to be done to calibrate across various methods (e.g., fence counts, stream walks, area-under-the-curve estimates), which would also allow historic data to become more valuable. The participant indicated that if there are not more efforts to distinguish between hatchery and wild fish that the counts will not be meaningful to track wild population recovery.

The authors agreed to make it clear in the Research Document that these recovery targets refer to wild populations only.

Information on PNI targets (Withler et al. 2018) will be added.

A participant asked for DU13 Scotch Creek and Seymour River to be excluded from the habitat model (which generates the survival and recovery target abundances) since there are no plans to collect absolute abundance data at these locations. The authors were able to rerun the model and determined the DU13 survival and recovery targets to be 1000 and 3351 fish respectively with those locations removed (original estimates were 1326 and 5257 fish).

There was concern that the habitat model does not take population or DU productivity into account and that productivity as defined in the model may be high for some of these small populations. It is anticipated that the overestimate of productivity would result in overestimates of S_{GEN}. Productivity is a potential source of uncertainty, however more accurate estimates of productivity for the wild populations are not possible given the data. While there is some stock-recruit data from the Nicola River, the authors indicated that there are caveats with the data that need to be addressed prior to using the data for this purpose. Valuable future work would be to update the habitat model to include information on more stocks, potentially completing a leave-on-out analysis to understand the range of errors associated with the model.

ELEMENT 13: POPULATION TRAJECTORIES

The authors showed a table during their presentation that outlined data limitations by DU. At the request of the participants, they will include this in the Research Document.

A participant was concerned that the wording in this section indicate that a large amount of high-quality data are needed to perform a stock assessment, however many types of assessments have provided reliable conservation advice with less information. They suggested the authors put into context how much and of what quality the quantitative data need to be for managers to understand the conservation status advice. The authors agreed that different types of stock assessments require different types and quality of data. Valuable future work would be to evaluate the survival and recovery targets using simulations of different types of temporal variations of productivity (e.g., different age of maturities, gear selectivities by age).

As a follow up to this discussion, a participant mentioned COSEWIC has guidelines to define when DUs are considered ‘data deficient’.

More context was requested around what the survival and recovery targets mean for each DU and information on how likely the DUs are of meeting those targets. Currently the text indicates that the populations are unlikely to recover without mitigation, but it is unclear if this statement is in reference to the survival target or the recovery target and what this means for SARA considerations. The participant noted that DU15 relative escapement abundances exceed the survival targets in most years, however this DU may not meet the positive population growth requirement. Additionally, these targets would benefit from discussion on in-stream PNI values compared to target PNI values. The authors will add more text in this section to indicate if recent trends and data suggest if survival targets and/or recovery targets are likely to be met. As well PNI data will also be added, where it is available.

Some participants were concerned that coded wire tags (CWT) data may become more difficult to obtain given commercial and recreational Chinook fishing restrictions. Even with increased tagging, it may be difficult to obtain fishery-dependent data. The authors said that when determining tagging sample sizes, they do take exploitation rates into account, and can compensate for the reduced recapture rates by increasing the number of tagged fish. Even if fish are not captured by the fishery, they could still be sampled on the spawning grounds. Another participant indicated that in the recreational fishery the minimum allowable sizes results in known hatchery fish being released. There was the suggestion to move to using Passive Integrated Transponder (PIT) tags as they are a fishery-independent method of assessing stocks. An author noted that PIT tags are being used in DU6. Another participant suggested Parental-Based genetic Tags (PBTs) be used, particularly in partnership with community hatcheries in DU1. A participant indicated that DFO has plans to work with those community hatcheries to provide CWT but were unsure if PBT data would be collected.

ELEMENT 15: ABILITY TO ACHIEVE RECOVERY TARGETS UNDER CHANGING CONDITIONS

The text in this section indicates “populations will continue to decline”, however in Element 13 the wording is “populations will level off or decline”. The authors will ensure consistency between these sections by replacing it to be consistent with the language in Element 13.

At the request of a participant the authors will also provide more DU specific information on how the impacts of fishing are likely to impact the chance of recovery.

ELEMENT 16: INVENTORY OF MITIGATION MEASURES AND ALTERNATIVE ACTIVITIES

In the mitigation strategy surveys, catch monitoring and fishery reductions were treated as a single mitigation strategy, however this refers to two distinct strategies. Future iterations of this survey will consider separating these.

A participant asked for additional content on mitigating the impact of impervious surfaces on Chinook. They indicated that work is continuously being done to repair damage to habitat, but not enough is being done to proactively prevent this harm. Another participant involved in restoration work indicated that they were not aware of any mitigation strategies targeted towards reducing the impact of impervious surfaces on watersheds and any welcomed suggestions. It was noted that work to address the impact of impervious surfaces on watershed health would need to involve municipalities, First Nations, industries, the Province of BC, and DFO.

A participant noticed that throughout the document the authors suggest managers adopt a precautionary approach, however under this section the authors suggest adaptive management strategies be used.

ELEMENT 22: ALLOWABLE HARM ASSESSMENT

There was significant discussion about the wording "…all future and ongoing human-induced harm should be prevented…". There was some thought that this could mean no fishing, water removals, or sewage disposal should be permitted, however it is highly unlikely that these activities would stop. The wording 'reduced to the greatest extent possible' was suggested but rejected as it would have the same implication for managers and is too vague. Other participants indicated that this is a science only conversation and that the science indicates a strong statement is appropriate, however others indicated that this science has the objective of providing advice to managers and therefore this statement should be meaningful for managers. There was a suggestion to acknowledge uncertainty in the allowable harm assessment by changing the assessment provide some flexibility in assessing jeopardy to survival and recovery on a case-by-case basis, however, the majority of participants supported retaining the original statement. It was decided that a sentence at the end of the allowable harm statement be added: "It is important to note that some activities in support of survival or recovery could result in harm but may have a net positive effect on the population and should be considered." Other participants noted that SARA also has similar statements of potentially harmful activities that can still be considered.

The authors will ensure the wording in the abstract reflects the agreed upon allowable harm statement.

CONCLUSIONS

Meeting participants agreed the working paper satisfied all Terms of Reference objectives. The working paper was accepted with minor revisions (See Appendix E for the Table of Revisions).

ACKNOWLEDGEMENTS

We appreciate the time contributed to the RPR process by all participants. In particular, we thank the reviewers, Laura Tessier (DFO Science) and Dave Scott (University of British Columbia) for their time and expertise. We also thank Ben Davis as Chair of the meeting and Jill Campbell as the Rapporteur.

REFERENCES CITED

Nelson, B., Walters, C.J., Trites, A.W., and McAllister, M.K. 2018. Wild Chinook Salmon productivity is negatively related to seal density, and not related to hatchery releases in the Pacific Northwest. Can. J. Fish. Aquat. Sci 76(3): 447–462.

Shea, D., Bateman, A., Shaorong, L., Tabata, A., Shulze, A., Mordercai, G., Ogston, L., Volpe, J.P., Frazer, L.N., Connors, B., Miller, K.M., Short, S., and Krkosek, M. 2020. Environmental DNA from multiple pathogens is elevated near active Atlantic salmon farms. Proc. R. Soc. B 287: 20202010.

Withler, R.E., Bradford, M.J., Willis, D.M., and Holt, C. 2018. Genetically Based Targets for Enhanced Contributions to Canadian Pacific Chinook Salmon Populations. DFO Can. Sci. Advis. Sec. Res. Doc. 2018/019. xii + 88 p

APPENDIX A: TERMS OF REFERENCE

RECOVERY POTENTIAL ASSESSMENT – SOUTHERN BC CHINOOK SALMON – FOUR DESIGNATABLE UNITS

Regional Peer Review Meeting – Pacific Region

February 22-24, 2022
Virtual Meeting

Chairperson: Ben Davis

Context

After the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required to support implementation of the *Species at Risk Act* (SARA). Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

The following four populations of Southern BC Chinook Salmon (*Oncorhynchus tshawytscha*) were designated as Endangered or Threatened by COSEWIC in 2020 based on population declines (COSEWIC 2020, In press).

1. DU 1, Boundary Bay Ocean Fall population **(Threatened):** Hatchery releases, which are ongoing and have included fish from other populations, have allowed the total population size to increase while threatening the genetic integrity of the remaining wild fish. This fall run of Chinook spawning in Boundary Bay drainages occurs in highly altered marine and freshwater habitats. Low marine survival, bycatch, and fish culture effects are continuing threats to this population.
2. DU 6, Lower Fraser Ocean Summer population **(Endangered):** This summer run of Chinook spawning at a single site (Maria Slough) has declined.
3. DU 13, South Thompson Stream Summer population **(Endangered)**: This summer run of Chinook has declined and is projected to continue declining.
4. DU 15, Lower Thompson Stream Spring population **(Endangered):** From 2013-2018, the number of mature individuals steeply declined and marine survival has been low since 2000.

DFO Science has been asked to undertake a Recovery Potential Assessment (RPA), for these four populations based upon the national RPA Guidance. This will be the first RPA completed for these DUs, as no previous RPA or critical habitat assessment has been done for any of these DUs. Data limitations will prevent advanced population dynamic modelling for these DUs. As such, no forward projections will be produced, but advice will be provided in the form of qualitative assessments of population trajectories. The advice in the RPA may be used to inform both scientific and socio-economic aspects of the listing decision, development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits or agreements, and the formulation of exemptions and related conditions, as per sections 73, 74, 75, 77, 78 and 83(4) of the Species at Risk Act (SARA 2002). The advice in the RPA may also be used to prepare for the reporting requirements of SARA section 55. The advice

generated via this process will update and/or consolidate any existing advice regarding these populations of Southern BC Chinook Salmon.

Objectives

- Where sufficient information and data exist, provide up-to-date information, and associated uncertainties, to address the following elements:

Biology, Abundance, Distribution and Life History Parameters

Element 1: Summarize the biology of these four DUs of Chinook Salmon.

Element 2: Evaluate the recent species trajectory for abundance, distribution and number of populations.

Element 3: Estimate the current or recent life-history parameters for these four DUs of Chinook Salmon.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that these four DUs of Chinook Salmon need for successful completion of all life-history stages. Describe the function(s), feature(s), and attribute(s) of the habitat, and quantify by how much the biological function(s) that specific habitat feature(s) provides varies with the state or amount of habitat, including carrying capacity limits, if any.

Element 5: Provide information on the spatial extent of the areas in these four DUs of Chinook Salmon's distributions that are likely to have these habitat properties.

Element 6: Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.

Element 7: Evaluate to what extent the concept of residence applies to the species, and if so, describe the species' residence.

Threats and Limiting Factors to the Survival and Recovery of these four DUs of Chinook Salmon.

Element 8: Assess and prioritize the threats to the survival and recovery of these four DUs of Chinook Salmon.

Element 9: Identify the activities most likely to threaten (i.e., damage or destroy) the habitat properties identified in elements 4-5 and provide information on the extent and consequences of these activities.

Element 10: Assess any natural factors that will limit the survival and recovery of these four DUs of Chinook Salmon.

Element 11: Discuss the potential ecological impacts of the threats identified in element 8 to the target species and other co-occurring species. List the possible benefits and disadvantages to the target species and other co-occurring species that may occur if the threats are abated. Identify existing monitoring efforts for the target species and other co-occurring species associated with each of the threats, and identify any knowledge gaps.

Recovery Targets

Element 12: Propose candidate abundance and distribution target(s) for recovery.

Element 13: Project expected population trajectories over a scientifically reasonable time frame (minimum of 10 years), and trajectories over time to the potential recovery target(s), given current population dynamics parameters for these four DUs of Chinook Salmon.

Element 14: Provide advice on the degree to which supply of suitable habitat meets the demands of the species both at present and when the species reaches the potential recovery target(s) identified in element 12.

Element 15: Assess the probability that the potential recovery target(s) can be achieved under current rates of population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Scenarios for Mitigation of Threats and Alternatives to Activities

Element 16: Develop an inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat (as identified in elements 8 and 10).

Element 17: Develop an inventory of activities that could increase the productivity or survivorship parameters (as identified in elements 3 and 15).

Element 18: If current habitat supply may be insufficient to achieve recovery targets (see element 14), provide advice on the feasibility of restoring the habitat to higher values. Advice must be provided in the context of all available options for achieving abundance and distribution targets.

Element 19: Estimate the reduction in mortality rate expected by each of the mitigation measures or alternatives in element 16 and the increase in productivity or survivorship associated with each measure in element 17.

Element 20: Project expected population trajectory (and uncertainties) over a scientifically reasonable time frame and to the time of reaching recovery targets, given mortality rates and productivities associated with the specific measures identified for exploration in element 19. Include those that provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

Element 21: Recommend parameter values for population productivity and starting mortality rates and, where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts in support of the listing process.

Allowable Harm Assessment

Element 22: Evaluate maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- Fisheries and Oceans Canada (Ecosystems and Oceans Science, and Ecosystems and Fisheries Management sectors)

- Province of BC
- Academia
- Indigenous communities/organizations
- Industry
- Environmental non-governmental organizations

References

COSEWIC. 2020. COSEWIC assessment and status report on the Chinook Salmon *Oncorhynchus tshawytscha*, Designatable Units in Southern British Columbia (Part Two - Designatable Units with High Levels of Artificial Releases in the Last 12 Years), in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxxv + 203 pp.

APPENDIX B: WORKING PAPER ABSTRACT

Four Southern British Columbian Chinook Salmon (SBCC) (Oncorhynchus tshawytscha) Designatable Units (DU) were assessed as Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2020 and are currently under consideration for addition to Schedule 1 of the Species at Risk Act (SARA). The Recovery Potential Assessment (RPA) (Elements 1-11) first provides descriptions and status updates for the populations, an overview of biology and habitat requirements, and an assessment of the threats and factors limiting recovery. The major threats impacting DUs were assessed in a workshop with local experts and were determined to be climate change, natural system modifications, fishing, and pollution. All four DUs are considered to be at an extreme threat risk due to the severity and number of threats these DUs are facing. Based on the assessed threats, a population level decline of 71% to 100% is expected for DUs 1, 6, 13 and 15. Alleviating the multiple and complex threats to these DUs will be difficult, especially as many of the threats are exacerbated by climate change. The second half (Elements 12-22) provides potential recovery targets, a discussion of mitigation measures, population projections and a recommendation of allowable harm. Survival and recovery targets for each DU were suggested based on Wild Salmon Policy (WSP) benchmarks, with additional requirements about observed percent change in spawners. Data limitations from incomplete escapement coverage and unknown hatchery influences prevented many quantitative assessments and no modelling was completed. The risks imposed by climate change and continued anthropogenic development add additional uncertainty that was only described qualitatively. Based the qualitative assessment for all four DUs, it is recommended that human-induced mortality and other sources of harm identified in the threats assessment should be significantly reduced and in some cases prevented to provide the best chance for these populations to recover.

APPENDIX C: AGENDA

Recovery Potential Assessment Southern BC Chinook Salmon – Four Designatable Units

February 22 - 24, 2022
Virtual
Chair: Ben Davis

DAY 1 – Tuesday, Feb 22 2021

Time	Subject	Presenter
0900	Introductions Review agenda and administrative details	Chair
0920	Review of the Terms of Reference and CSAS Overview and Procedures	Chair
0940	Presentation of the Working Paper "Recovery Potential Assessment for Southern British Columbian Chinook Populations, Fraser and Southern Mainland Chinook 4 Designatable Units (1, 6, 13 and 15)" – with focus on elements 8-11	Authors
1030	**Break**	-
1045	Written Reviews and Discussion: Elements 8-11	Chair, Reviewers, Authors, RPR Participants
1200	**Lunch**	-
1300	Discussion and resolution of issues: Elements 8-11	RPR Participants
1445	**Break**	-
1530	Consensus on Conclusions: Elements 8-11	RPR Participants
1600	**Adjourn for the day**	-

DAY 2 - Wednesday Feb 23 2022

Time	Subject	Presenter
0900	Introduction to the day. Review outcomes from day 1 as necessary	Chair
0920	Introduction, written reviews, and discussion of elements 12-15	Authors, Reviewers, Chair, RPR Participants
1030	**Break**	-
1045	Continuation, conclusion and consensus on discussion of elements 12-15	RPR Participants
1200	**Lunch**	-
1300	Introduction, written reviews, and discussion on element 16-18	RPR Participants
1430	**Break**	-
1445	Introduction and Discussion of Allowable Harm	Authors, RPR Participants
1545	Consensus on the acceptability of the working paper (Revisions Table; TOR objectives)	Chair
1600	**Adjourn for the day**	-

DAY 3 - Thursday February 24 2021

Time	Subject	Presenter
0830	Introduction to the day. Summary of Day 2	Chair
0845	Science Advisory Report (SAR) Develop consensus on the following for the following: • SAR Summary Bullets • Sources of Uncertainty • Results & Conclusions • Figures & Tables • Additional Advice (as warranted)	Chair
1030	**Break**	-
1045	Next Steps – Chair to provide overview • SAR Review/Approval process and timelines • Research Doc and Proceedings Timelines • Other follow-up and/or commitments	Chair
1200	**Lunch**	-
1300	Additional time to conclude discussions (as needed)	RPR Participants
1600	**Adjourn for the day**	-

APPENDIX D: PARTICIPANT LIST

Last Name	First Name	Affiliation
Bailey	Richard	DFO retired
Campbell	Jill	DFO Science, Centre for Science Advice Pacific
Christensen	Lisa	DFO Science, Centre for Science Advice Pacific
Davis	Ben	DFO retired
Dionne	Kaitlyn	DFO Science
Doutaz	Dan	DFO Stock Assessment
Earle	Suzanne	DFO Species at Risk Act Program
Foy	Matt	DFO retired
Grant	Paul	DFO Science
Hawkshaw	Mike	DFO Stock Assessment
Henderson	Evan	DFO Species at Risk Act Program
Holt	Carrie	DFO Science
Jenewein	Brittany	DFO Resource Management
Lagasse	Cory	DFO Species at Risk Act Program
Lea	Ellen	DFO Fisheries Management
Lepitzki	Dwayne	Committed on the Status of Endangered Wildlife in Canada
Manson	Murray	DFO Salmonid Enhancement Program
Martin	Sara	DFO Stock Assessment
Maynard	Jeremy	Sport Fishing Advisory Board
McAllister	Murdoch	Sport Fishing Advisory Board
McDuffee	Misty	Raincoast Conservation Foundation
Miller-Saunders	Kristi	DFO Science
Moore	Melanie	Seabird Island First Nations
Mozin	Paul	Scw'exmx Tribal Council
Parken	Chuck	DFO Stock Assessment
Paulson	Lawrence	Commercial Salmon Advisory Board - Area F Salmon Troll
Potyrala	Mark	DFO Fish and Fish Habitat Protection Program
Rachinski	Théa	DFO Stock Assessment
Ritchie	Lynda	DFO Fish and Fish Habitat Protection Program
Ryan	Teresa	University of British Columbia
Scott	Dave	University of British Columbia
Trouton	Nicole	DFO Stock Assessment
Walsh	Michelle	Secwepmec Fisheries Commission
Weir	Lauren	DFO Stock Assessment
Welch	Paul	DFO Salmonid Enhancement Program
Willms	Tom	Nicola Valley Institute of Technology
Wor	Catarina	DFO Science

APPENDIX E: TABLE OF REVISIONS

RPA Element	Topic	Revisions
1	Boundary Bay historical biological information	Incorporate information from Matt Foy that was sent to Joe Tadey to include in element 1
1	Maria Slough historical biological information	Incorporate information from Matt Foy that was sent to Joe Tadey to include in element 1
2	Table 8 caption	Change RPA "wild" trend to "both" and be more explicit about why our methods differ from COSEWIC
2	DU13 trend figure	Reformat figure to have Y axis begin at 0
2	Hatchery PNI values	Insert table of PNI values where available and write details around data caveats
2	Data deficiencies for DU1	Be more explicit/provide more context regarding data issues in DU1, make sure that throughout the document the discussion of trends includes the difference in DU1
3	New information about aquaculture and endemic diseases	K Saunders provided updated information regarding the impacts of pathogens on these DUs and the wording in element 3 needs to be changed to reflect that
3	Proportions vs percentages in Table 13	Alter table to be consistent with % or proportions
8	Sea level rise	More context regarding the threat of sea level rise particularly on DU1
8	Disease and pathogens with regards to climate change and removal of fish farms	Add text to disentangle potential threat of disease/pathogens from climate change and future removal of fish farms
8	Storms and flooding threat	bump threat risk from low-medium to Medium for DU15
12	Scotch and Seymour in element 12	Consideration of the removal of these 2 populations in the context of recovery targets as there are upcoming plans to assess these
12	Operationalization of recovery targets	Recovery targets in absolute abundance but escapement is in relative abundance - discuss how to operationalize in element 12
12	COSEWIC listing/recovery targets	Update and clarify the recovery targets to ensure they are in line with COSEWIC guidelines
12	PNI targets	Insert table from Withler et al 2018
12	Wild vs hatchery spawners	Include the clarification of whether the recovery targets include hatchery and wild or just wild

RPA Element	Topic	Revisions
13	Qualitative trajectories	Adding text regarding current DU15 qualitative trajectories being based on historic data but unlikely to stay that way due to floods and fires
13	Trends in both survival and recovery for qualitative projections	Make sure the trends in element 2 are incorporated better into the discussion of both survival and recovery targets
13	PNI values	Discuss PNI values currently compared to targets in the qualitative trajectories
13	Qualitative trajectories	Ensure text is in context to current status and relative to targets
13	Data limitations	Summary table of by DU data limitations from presentation
13	CWTs	Suggested to add text about decline in fishing rates and potential issues around sample rate
16	Maria Slough - requirement to maintain habitat	Suggestion to add a threat to recognize the need for human maintenance of spawning areas
16	Reconnecting Maria Slough	Potential negative implications of reconnecting the slough
16	Hardened surfaces/Being proactive around habitat	Adding some clarifying language
16	Language around adaptive management for mitigations	Clarification of the wording
22	Allowable harm	Sentence added to the end of the statement to ensure some activities can be considered under SARA