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Ontario and Prairie Region

Proceedings of the Regional Peer Review of the Recovery Potential Assessment for Lake Whitefish (*Coregonus clupeaformis*), Lake Opeongo large-bodied Designatable Unit and Lake Opeongo small-bodied Designatable Unit

Meeting dates: March 2–4, 2021
Location: Virtual Meeting

Chairperson: Todd Morris
Editors: Margaret Goguen and Adam Rego

Fisheries and Oceans Canada
Great Lakes Laboratory for Fisheries and Aquatic Science
867 Lakeshore Road
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June 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.

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Aussi disponible en français :

*MPO. 2022. Compte rendu de l'examen régional par les pairs de l'évaluation du potentiel de rétablissement du grand corégone (*Coregonus clupeaformis*), unité désignable des individus de grande taille du lac Opeongo et unité désignable des d'individus de petite taille du lac Opeongo; du 2 au 4 mars 2021. Secr. can. des avis sci. du MPO. Compte rendu 2022/026.*

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SUMMARY

A regional Canadian Science Advisory Secretariat peer-review meeting was held on March 2–4, 2021 via the online platform Microsoft Teams. The purpose of this meeting was to assess the recovery potential of Lake Whitefish (*Coregonus clupeaformis*) in Lake Opeongo (large-bodied and small-bodied Designatable Units [DUs]), to provide advice that may be used for the listing decisions under the *Species at Risk Act* (SARA), development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits and agreements. Participants included Fisheries and Oceans Canada, Ontario Ministry of Natural Resources and Forestry, Ontario Ministry of Environment, Conservation and Parks, U.S. Geological Survey, and academic experts.

Lake Whitefish in Lake Opeongo (large-bodied and small-bodied DUs) were assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 2018. This species pair is only found in Lake Opeongo, Algonquin Provincial Park, Ontario. Both the large-bodied and small-bodied DUs were assessed as Threatened due to their highly restricted range in Canada and the risk of extinction from introductions of aquatic invasive species.

This proceedings document summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated draft Research Documents. The Proceedings, Science Advisory Report and the supporting Research Documents resulting from this science advisory meeting will be published on the DFO Canadian Science Advisory Secretariat Website.

INTRODUCTION

Fisheries and Oceans Canada (DFO) Science has been asked to assess the recovery potential of the Lake Opeongo Lake Whitefish large-bodied and small-bodied populations (Designatable Units [DUs]) (Mee et al 2015)). As a result, a virtual peer-review meeting was held on March 2–4, 2021 via Microsoft Teams. Participants included DFO (Science, Species at Risk and Fish & Fish Habitat Protection programs, and Policy & Economics), Ontario Ministry of Natural Resources and Forestry (OMNRF), Ministry of the Environment, Conservation and Parks (MOECP), U.S. Geological Survey (USGS), and academic experts (Appendix 1).

The intent of this meeting, as described in the Terms of Reference (Appendix 2), was to provide up-to-date information, and associated uncertainties, to address the Recovery Potential Assessment (RPA) elements in the following categories for the Lake Opeongo Lake Whitefish DUs:

- biology, abundance, distribution, and life history parameters;
- habitat and residence requirements;
- threats and limiting factors to the survival and recovery of Lake Whitefish of Lake Opeongo;
- recovery targets;
- scenarios for mitigation of threats and alternatives to activities; and,
- allowable harm assessment.

The meeting generally followed the agenda outlined in Appendix 3. A representative from DFO’s Canadian Science Advisory Secretariat (CSAS) provided a brief overview of the CSAS science advisory process and the guiding principles for the meeting.

The meeting Chair provided an overview of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and *Species at Risk Act* (SARA) designation and listing processes and a brief history of the Lake Opeongo Lake Whitefish species pair. The Lake Opeongo Lake Whitefish large-bodied and small-bodied DUs were assessed by COSEWIC as Threatened in 2018 (COSEWIC 2018). Note that during the COSEWIC assessment, the name Opeongo Lake was used; however, both names are accepted and the name preferred by meeting participants was Lake Opeongo. Additionally, COSEWIC referred to the large-bodied and small-bodied forms as “populations”; however, “Designatable Units” was preferred by meeting participants and is discussed later. The Threatened designation for both DUs was based on the following criteria (COSEWIC 2018):

- very small and restricted population, occupies a single location; and,
- prone to the effects of invasion of non-native aquatic species, which are capable of driving the DUs to extinction over a short period of time.

Drafts of the two Research Documents (working papers) were provided in advance of the meeting and all participants were required to complete a critical written review in advance of the meeting. An overview presentation of each working paper was provided and then group discussions focused on main issues identified during the reviews. The Proceedings summarizes the relevant meeting discussions and presents the key conclusions reached during the meeting. The advice from the meeting will be summarized in a Science Advisory Report. The working papers that include the technical details supporting the advice will be revised based on the information from this meeting, and published as Research Documents. All meeting products will be published on the CSAS website.

INFORMATION IN SUPPORT OF A RECOVERY POTENTIAL ASSESSMENT OF LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*), LAKE OPEONGO LARGE-BODIED AND SMALL-BODIED DESIGNATABLE UNITS

Authors: Julia E. Colm and D. Andrew R. Drake

Presenter: Julia Colm

ABSTRACT

The Lake Whitefish (*Coregonus clupeaformis*) is a coldwater benthivore with a broad distribution and highly variable ecological and morphological traits across Canada. A species pair of Lake Whitefish in Lake Opeongo, consisting of a large-bodied and small-bodied form, was first discovered in 1940. Both forms (now considered separate Designatable Units, DUs) were assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 2018. The reason for this designation was that both DUs are known only from Lake Opeongo, Algonquin Provincial Park, Ontario, and the introduction of aquatic invasive species could disrupt the unique ecological processes that drove divergence and maintains the species pair (COSEWIC 2018). The Recovery Potential Assessment provides background information and scientific advice needed to fulfill various requirements of the federal *Species at Risk Act*. This research document provides the current state of knowledge of the species pair including its biology, distribution, population trends, habitat requirements, and threats, which will be used to inform recovery plans. Limited information exists to adequately assess the status of either DU, particularly the small-bodied form. A threat assessment identified the greatest threats to the large-bodied and small-bodied DUs of Lake Whitefish in Lake Opeongo as aquatic invasive species, climate change, and human disturbances; however, the impacts of these threats are not well understood. Mitigation measures and alternative activities related to the identified threats are presented, as appropriate. Important knowledge gaps remain regarding population trends, as well as differences in niche occupancy and impacts of current and anticipated threats on the two DUs.

BIOLOGY, ABUNDANCE, DISTRIBUTION AND LIFE HISTORY PARAMETERS

Discussion

There was discussion in the group around appropriate terminology for the species pair, whether the large-bodied and small-bodied forms should be referred to as “populations” or as “DUs”. The working papers both used “population” to refer to the two forms, consistent with the terminology used by COSEWIC. The group agreed that “DU” should be used throughout all documents to avoid confusion around population structure.

A participant shared unpublished data on Lake Opeongo Lake Whitefish collected by the OMNRF in the 1980s that had not previously been shared with the group. These data were extensive including information on abundances, egg counts, diet through time, gill raker counts, and age-at-length data for what was identified in the data as a normal form (i.e., large-bodied DU) and dwarf form (i.e., small-bodied DU). These data suggested that the small-bodied form grew larger and lived longer than what was observed in other surveys historically (i.e., 1930s; Kennedy 1943) and recently (i.e., 2010s; OMNRF unpublished data). Different hypotheses for explaining this discrepancy were discussed. There was significant discussion regarding these data including the uncertainties associated with many aspects of the data collection (e.g., site location, gear type, method of differentiating the two forms). One of the authors stated that more context around how the data were collected would be needed before these data could be incorporated into the working papers and the models. The author felt that the working papers were using the best available and most recent data. A participant noted that the most recent data from the 2010s (OMNRF unpublished data) did not include information on diet or gill raker counts so the 1980s data would represent the most recent diet and gill raker information. The participant felt that the 1980s data could help to fill in data gaps. Without additional information regarding the context and collection methods of the 1980s data, the group agreed that these data should not be incorporated into the models but should be acknowledged in both working papers, and the impact the data would have on the population models should be described. Additionally, it was agreed that the lack of recent diet and gill raker count data should be detailed earlier on in the working paper and not included solely in the uncertainties section as it was in the current draft.

Population Status Assessment

The group discussed if the Relative Abundance Index ranking of “Medium” was appropriate for the large-bodied DU. The group agreed this was appropriate based on comparisons to other lakes in Algonquin Provincial Park where Lake Whitefish are present, but that text needed to be added to the working paper to clarify that the context and protocols (methods/gear) were comparable between lakes.

The group did not agree that the Certainty of the Relative Abundance Index and the Population Trajectory of the large-bodied DU should be ranked as “3–Expert Opinion”. The group agreed that “3–Expert Opinion” was appropriate for the small-bodied DU as very little data are available for that DU, but decided that it should be changed to “2–CPUE (Catch Per Unit Effort) or standardized sampling” for the large-bodied DU as CPUE data are available.

The group decided that the Relative Abundance Index for the small-bodied DU should be changed from “Low” to “Unknown”. The group felt that the abundance of the small-bodied DU in Lake Opeongo was not known due to size selectivity issues of gear used in previous surveys and the potential for differing habitat use between the two DUs that may have led to the small-bodied DU being under sampled. The change in Relative Abundance Index to “Unknown” resulted in the Population Status of the small-bodied DU to change from “Poor” to “Unknown”.

HABITAT AND RESIDENCE REQUIREMENTS

Discussion

Habitat Requirements and Functions, Features, and Attributes Table

A participant noted that the Functions, Features, and Attributes (FFA) table is missing the age-0 life stage, which occurs between the larval–fry and juvenile stage. The group agreed that this life stage should be added to the FFA table and discussed how best to incorporate it in the table. Two options were presented: 1) to add a separate row for the age-0 stage and 2) to add text to the already existing juvenile row to capture the age-0 stage. The author noted there is very little information known about the specific habitat features and attributes of this life stage so the information in the table would be very general and not specific to Lake Opeongo. Option 2 was not supported as the group felt it did not clearly indicate that this was a separate life stage. The group decided that Option 1 was the best approach despite the lack of available information and that the table should be populated with as much information as possible, even if general.

THREATS AND LIMITING FACTORS TO THE SURVIVAL AND RECOVERY OF LAKE WHITEFISH

Discussion

A participant felt that an important element of threat impact was missing by presenting the threats individually and not considering potential compounding impacts of multiple threats. The author clarified that the threat assessment framework is set up in a way that requires each threat to be considered individually. The group felt that it was important to include wording in the text of the working paper to highlight the potential for cumulative impacts from multiple threats that may not be captured in the threat assessment. The authors agreed to include a cumulative threats section.

A participant questioned whether it was correct to discuss "the risk of extinction" or if it should be considered "the risk of extirpation" since Lake Whitefish occur outside of Lake Opeongo. The group agreed that in other lakes, extirpation would be appropriate since Lake Whitefish do occur outside of Lake Opeongo but, due to the DU structure determined by COSEWIC, the Lake Opeongo Lake Whitefish represent wildlife species, and the loss of one or both of the DUs would represent extinction. The participant questioned whether rescue effect, which was not included in the models, was possible for the Lake Opeongo Lake Whitefish. The group agreed that due to the DU structure, rescue effect was not possible for the Lake Opeongo Lake Whitefish. Based on this discussion, no changes to the models or text were required.

Human Intrusions and Disturbances

Discussion occurred around the impacts of recreational fishing in Lake Opeongo on Lake Whitefish. The group agreed the current text discussing boat traffic in the working paper should be reduced as the impact of this threat on Lake Whitefish in Lake Opeongo is likely very low. One participant provided quantitative creel survey data on the number of Lake Whitefish caught and released or harvested by the recreational fishery on Lake Opeongo. It was determined that, while Lake Opeongo has the largest recreational fishery of lakes in Algonquin Provincial Park, the impact of it is negligible on Lake Whitefish as this species is not targeted, infrequently harvested, and incidental bycatch is minimal. The group agreed that the status of the Lake Opeongo recreational fishery and the potential for indirect impacts to Lake Whitefish (i.e., as bycatch) should be detailed while ensuring it is made clear that the impact on Lake Whitefish would be very low. The group agreed that additional text should be added to indicate that while the impact is low for both DUs, the impact may be even lower for the small-bodied DU as their smaller size reduces the chance of being caught by an angler.

A participant asked if logging occurred near Lake Opeongo. A participant stated that while logging does occur in the Lake Opeongo watershed, it is not permitted to occur within 120 m of the shoreline so no threat from forestry activities is expected for the Lake Opeongo Lake Whitefish. The group agreed that logging/forestry activities did not need to be included as a threat.

A participant shared that they had updated numbers regarding visitor information in Algonquin Provincial Park. The author agreed to update the information in the working paper with these numbers.

Invasive and Other Problematic Species and Genes

There was discussion around the Likelihood of Occurrence of potential new invasive species, specifically in regards to the timeframe that should be considered. A participant provided information on the proximity of *Bythotrephes* to Lake Opeongo and Algonquin Provincial Park and the timeframe over which the invasions in nearby lakes occurred. The participant noted that

Bythotrephes has been present in lakes nearby Algonquin Provincial Park for 20–30 years and, as confirmed by OMNRF and MOECP staff, it has still not been documented in Lake Opeongo or any lake fully within Algonquin Provincial Park boundaries. The group agreed that it would be informative to include this additional information regarding the occurrences of *Bythotrephes* in relation to Algonquin Provincial Park and surrounding areas in the working paper. Another participant noted that the Lake Opeongo creel survey data could also serve as an early warning system for new aquatic invasive species.

One participant felt that the current Level of Impact of “Medium” for both DUs was too low knowing that *Bythotrephes* likely led to the extinction of both Lake Whitefish forms in another location. Another participant felt that “Extreme” was too high since the invasion of Cisco into Lake Opeongo did not lead to the extinction of one or both Lake Whitefish DUs, providing evidence that not every invasive species may have an extreme impact on the Lake Opeongo Lake Whitefish DUs. The group agreed that “High” was the appropriate Level of Impact with text added to the working paper to detail the potential range in impact from an invasive species, which could be minimal (e.g., Smallmouth Bass, Cisco) to extreme (e.g., *Bythotrephes*, Rainbow Smelt).

One participant felt that the Causal Certainty of “3–Medium” was too low since there is a lot of evidence from other locations showing that Lake Whitefish species pairs are impacted by invaders. Another participant reiterated that the Lake Whitefish pair did not disappear in Lake Opeongo after Cisco was introduced so it should not be assumed that all invaders will result in the same outcome of a loss of one or both DUs. It was agreed that “1–Very High” could not be used as this indicates the threat is currently occurring. The group agreed to change the Causal Certainty from “3–Medium” to “2–High” for both DUs as there is evidence from other lakes (e.g., Como Lake) that the invasion of *Bythotrephes* and Rainbow Smelt could cause population decline or jeopardize the survival/recovery of the DUs.

A participant questioned why the Population-Level Threat Occurrence (PTO) of “Anticipatory” was not included for the “Invasive and other problematic species and genes” threat for either DU since the text highlighted the risk of new invasive species for both DUs. Another participant stated that the COSEWIC designation of Threatened using the D2 criteria requires the potential of anticipated threats from invasive species for this criterion to be met. The group agreed that “Anticipatory” should be added to the table in order to capture the potential of future species invasions; the table should now include the three categories for PTO (historical, current, and anticipatory).

The author asked the group to weigh in on whether the Population-level Threat Frequency (PTF) should be “Single” or “Continuous” for the invasive species threat; both were listed in the working paper but one must be chosen in the final Research Document. The group agreed that the PTF should be “Continuous” for both DUs.

Climate Change and Severe Weather

The group felt that a timeframe needed to be determined in order to assess the Level of Impact of the “Climate Change and Severe Weather” threat on the Lake Opeongo Lake Whitefish species pair. The group decided on a 10 year/1–2 generation timeframe and agreed that text should be added to the working paper to detail this. Using this timeframe, the group reached the consensus that the Level of Impact should be changed from “Unknown” to “Low” for both DUs.

One participant stated that there is some evidence that observed recruitment failure in coregonines is related to climate change (e.g., reduced ice cover) and a Causal Certainty of “3–Medium” may be more appropriate than “4–Low”. The group agreed the Causal Certainty should be changed to “3–Medium” for both DUs based on the evidence cited by the participant.

SCENARIOS FOR MITIGATION OF THREATS AND ALTERNATIVES TO ACTIVITIES

The group discussed boat wash stations and restrictions on vessel horsepower as possible mitigations to add to the working paper. Lake Opeongo is one of two lakes in Algonquin Provincial Park that has no restrictions on the horsepower of vessels. This increases Lake Opeongo's risk of receiving aquatic invasive species. There was discussion around feasibility and logistics of installing a boat wash station and changing vessel regulations, but participants were reminded that only the scientific merit of the mitigation strategy was to be considered. The group agreed that a boat wash station could be a highly effective mitigation strategy for preventing the invasion of *Bythotrephes* and other invasive invertebrates and diseases into Lake Opeongo. It was decided that "boat wash stations and other restrictions to vessels" should be added to the list of mitigations.

A participant asked if a rapid response plan would be an appropriate mitigation in the event of *Bythotrephes* or Rainbow Smelt invasion. It was stated that feasibility of rapid response actions depends on the taxa, available removal options, and how much effort can be invested.

RECOVERY POTENTIAL MODELLING OF LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*) IN LAKE OPEONGO, CANADA

Authors: Simon R. Fung, Adam S. van der Lee, and Marten A. Koops

Presenter: Simon Fung

ABSTRACT

The COSEWIC has assessed the Lake Opeongo species pair (DU 13 and 14) of Lake Whitefish (LWF, *Coregonus clupeaformis*) in Canada as Threatened. Population modelling is presented to assess the impacts of harm and determine abundance and habitat recovery targets in support of a recovery potential assessment (RPA). This analysis demonstrated that LWF populations of both DUs were most sensitive to perturbations to adult survival. Population viability analysis was used to identify potential recovery targets. Demographic sustainability (i.e., a self-sustaining population over the long term) can be achieved with adult female population sizes of ~450 to ~2,300 for the large-bodied DU or ~1,300 to ~8,700 for the small-bodied DU depending on catastrophe frequency and desired persistence probability. Lake Opeongo has sufficient habitat for populations of both DUs.

RECOVERY TARGETS

Discussion

The group agreed that the models should not be redone using the previously unseen OMNRF 1980s data but text should be added to the working paper to discuss how the results of the models would change based on the different parameters (e.g., longevity, growth) for the small-boded DU as identified in these data.

A participant felt that the current structure of the introduction gave the impression that the working paper was going to challenge whether there are two distinct, reproductively isolated forms of Lake Whitefish in Lake Opeongo. As this was not the case, it was suggested that the introduction be restructured so the uncertainty around the population structure is not the first thing that is presented and is moved towards the end of the introduction.

A participant noted that the von Bertalanffy growth curve suggests that the small-bodied DU has a higher growth rate than the large-bodied DU in the early life stages but the text states that the large-bodied DU has a higher growth rate in every life stage. The author stated this is likely due to the von Bertalanffy curve for the small-bodied DU not fitting well due to limited early life stage data.

Concern was raised around the way the minimum viable population (MVP) models with catastrophic events are run with only a single year of reduced survivorship/reproduction. A participant stated that invasive species are the largest threat to Lake Whitefish in Lake Opeongo and that this threat could have detrimental impacts on survivorship/reproduction for multiple years, not just a single year as modelled. The participant also noted that a DU can be lost very quickly after the invasion of an aquatic species. It was agreed that this was a valid concern but the authors stated that modelling this would be very difficult as many parameters would have to be determined or assumed. The group agreed on adding text to the working paper to discuss how the introduction of an invader could result in a long-term impact or even permanent loss of a DU and not just a short-term reduction in survivorship. The group agreed the models did not need to be changed.

A participant raised a question around the estimated MVP and why it is so much higher for the small-bodied DU compared to the large-bodied DU. The participant noted that the population size of the small-bodied DU may already be below the estimated MVP. It was suggested that this could have to do with differences in life history strategies (e.g., shorter life cycle and generation time of the small-bodied DU) and/or could be due to the difference in susceptibility of the small-bodied DU to the gear and methods used, with their smaller size making them less likely to be captured leading to an underestimation of current population size.

A participant noted that the egg counts for both the large-bodied and small-bodied DUs used in the modelling were estimated from only the large-bodied DU; the participant noted this may not be accurate. Data from the 1980s collected by the OMNRF that was not shared with the group until the meeting suggested that using the same egg count for the two DUs was appropriate.

A participant asked why the density dependence was only applied on the first age class in the models. The authors explained that there is evidence that density dependence works on the early life stages of fish. When density dependence occurs in a population it can be related to the size of the ecosystem, with a smaller system having density dependence occurring later in life. As Lake Opeongo is not a small lake, it was applied only to the first age class.

A participant questioned why the entire area of Lake Opeongo was used to calculate the minimum area for population viability (MAPV) when the entire lake may not be used by either DU (but particularly the small-bodied DU). The authors provided clarification on the MAPV calculation and stated that it is not known how much of the lake the DUs occupy so the entire area of Lake Opeongo was used when estimating density. The group felt this needed to be clarified in the working paper but nothing needed to be changed in the models.

ALLOWABLE HARM ASSESSMENT

Participants did not recommend any changes to this section of the working paper.

SOURCES OF UNCERTAINTY

After the in-depth discussion regarding the OMNRF 1980s data, the group agreed that the lack of information on the collection methods used for these data and the implications for the small-bodied DU (e.g., increased size and longevity) if the data were accurate should be detailed as sources of uncertainty.

The group noted the uncertainties around the relative abundances of the two DUs, specifically the small-bodied DU. The influence of size selectivity of the gear and spatial-temporal patterns of previous surveys is unknown and could have led to the small-bodied DU being under-sampled. The group agreed that this uncertainty should be captured in both working papers.

A participant identified the need to collect more data, especially for the small-bodied DU. Specifically, the need for continued, standardized assessments to make inferences about population abundance and trends was discussed. Updated morphological and diet data would be beneficial as well. The importance of capturing the types of gear and mesh sizes used was highlighted.

The group identified uncertainty regarding whether the large-bodied and small-bodied DUs are reproductively isolated, and how reproductive isolation between the DUs is maintained if they are reproductively isolated. Allozyme data collected in the 1980's was brought up; however, the value of current genetic analyses was emphasized.

A participant noted that the modelling working paper discusses the potential of losing one of the DUs due to stressors/threats but does not explore the potential impact of hybridization between the two DUs. It was agreed that the impacts of hybridization should be added to the uncertainties section of the working paper to discuss how hybridization could result in the loss of the species pair.

The group agreed that in light of the discussion regarding adding the Age-0 life stage to the FFA table, the lack of information on the habitat features and attributes for this life stage represents a source of uncertainty for both DUs.

REVIEW TERMS OF REFERENCE

The Chair reviewed the 22 elements listed in the Terms of Reference to ensure all participants agreed each applicable element had been addressed and a consensus had been reached. Prior to the meeting, Elements 7, 17, and 18 had been determined to not be applicable for the Lake Opeongo Lake Whitefish DUs and Elements 19–21 were not addressed due to lack of available data. The group agreed that all applicable elements were covered during the meeting.

DRAFTING OF THE SCIENCE ADVISORY REPORT SUMMARY BULLETS

Draft Science Advisory Report (SAR) summary bullets were developed by the authors and presented on screen for discussion on the final day of the meeting. Major topics discussed related to the target audience of the SAR and the level of detail that should be included in the bullets versus the body of the text, specifically related to habitat requirements and what differentiates the two DUs. Caution was taken around incorporating details that were known from Lake Opeongo Lake Whitefish versus Lake Whitefish in general. There was also discussion around how best to include results from the population modelling, given the two model scenarios regarding population structure that were presented. It was decided to present results in the summary bullets only from the model scenario that assumed two distinct populations (as per the DU structure) to avoid confusion. There was agreement to keep the final summary bullet related to sources of uncertainty high-level, with additional details expanded on in the body of the SAR.

NEXT STEPS

The Chair informed the group of the next steps regarding finalizing the various meeting products. The group agreed that the revised working papers did not need to be sent to the group for review and would be accepted as Research Documents following minor revisions; the Chair will review the revised documents and confirm that all agreed-to changes had been completed. The group was informed that the Proceedings document and Science Advisory Report would be sent out to participants for final comments.

REFERENCES CITED

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APPENDIX 1. LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Julia Colm	DFO – Science, Ontario and Prairie Region
Andrew Drake	DFO – Science, Ontario and Prairie Region
Simon Fung	DFO – Science, Ontario and Prairie Region
Margaret Goguen (Rapporteur)	DFO – Science, Ontario and Prairie Region
Marten Koops	DFO – Science, Ontario and Prairie Region
Todd Morris (Chair)	DFO – Science, Ontario and Prairie Region
Tom Pratt	DFO – Science, Ontario and Prairie Region
Adam Rego (Rapporteur)	DFO – Science, Ontario and Prairie Region
Adam van der Lee	DFO – Science, Ontario and Prairie Region
Paul Grant	DFO – Science, Pacific Region
Jenni McDermid	DFO – Science, Gulf Region
Luiz Mello	DFO – Science, Newfoundland and Labrador Region
Bill Glass	DFO – FFHPP, Ontario and Prairie Region
Darcy McGregor	DFO – Policy and Economics, Ontario and Prairie Region
Joshua Stacey	DFO – Species at Risk, Ontario and Prairie Region
Alan Bell	OMNRF – Science and Research
Trevor Middel	OMNRF – Science and Research
Scott Reid	OMNRF – Science and Research
Mark Ridgway	OMNRF – Science and Research
Paul Gelok	MOECP – Ontario Parks
Jon Mee	Mount Royal University
Nick Mandrak	University of Toronto Scarborough
Brian Weidel	USGS

APPENDIX 2. TERMS OF REFERENCE

Recovery Potential Assessment – Lake Whitefish (*Coregonus clupeaformis*), Lake Opeongo[1] large-bodied Designatable Unit[2] and Lake Opeongo[1] small-bodied Designatable Unit[2]

Regional Advisory Meeting – Ontario and Prairie Region

March 2–4, 2021
Virtual Meeting

Chairperson: Todd Morris

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.

Lake Whitefish (*Coregonus clupeaformis*) has undergone significant speciation across Canada resulting in a species complex that is difficult to classify. In some lakes, Lake Whitefish has co-evolved as a species pair, usually represented by a larger form and a smaller form. The ecological processes driving this differentiation are unique to each lake and have resulted in local adaptations, which are maintained by geographic isolation from other populations. Species pairs represent evolutionarily significant and discrete forms warranting independent consideration.

COSEWIC assessed two Lake Whitefish Designatable Units (DUs) representing a species pair found in an Ontario lake (Lake Opeongo) as Threatened in April 2018. The species pair, made up of a large-bodied and a small-bodied DU, is threatened by the risk of establishment of aquatic invasive species that could alter the ecological niches that maintain it. Eight other whitefish DUs representing four species pairs were assessed at the same time. Six of these, also assessed as Threatened, occur in Yukon lakes and an RPA was undertaken in April 2020. The other two DUs found in Como Lake in Ontario were assessed as Extinct.

In support of listing recommendations for Lake Whitefish (Lake Opeongo DUs) by the Minister, DFO Science has been asked to undertake an RPA, based on the national RPA Guidance. 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 SARA. The advice in the RPA may also be used to prepare for the reporting requirements of SARA s.55.

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[1] COSEWIC used Opeongo Lake, both names are accepted.

[2] COSEWIC referred to these as the large-bodied population and small-bodied population. Refer to proceedings for rationale behind using Designatable Units.

The advice generated via this process will update and/or consolidate any existing advice regarding these populations of Lake Whitefish.

Objective

To 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 Lake Whitefish.

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 Lake Whitefish.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Lake Whitefish needs 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 Lake Whitefish's distribution 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 Lake Whitefish

Element 8: Assess and prioritize the threats to the survival and recovery of the Lake Whitefish.

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 the Lake Whitefish.

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 Lake Whitefish population dynamics parameters.

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(s)

Expected Participation

- Fisheries and Oceans Canada (DFO)
- Ontario Ministry of Natural Resources and Forestry (MNRF)
- Academia
- Other invited expert

References

COSEWIC. 2018. COSEWIC Assessment and Status Report on the Whitefish (*Coregonus* spp.) European Whitefish - Squanga Lake small-bodied population (*Coregonus lavaretus*), Lake Whitefish - Squanga Lake large-bodied population (*Coregonus clupeaformis*), European Whitefish - Little Teslin Lake small-bodied population (*Coregonus lavaretus*), Lake Whitefish - Little Teslin Lake large-bodied population (*Coregonus clupeaformis*) European Whitefish - Dezadeash Lake small-bodied population (*Coregonus lavaretus*), European Whitefish - Dezadeash Lake large-bodied population (*Coregonus lavaretus*), Lake Whitefish - Opeongo Lake small-bodied population (*Coregonus clupeaformis*), Lake Whitefish - Opeongo Lake large-bodied population (*Coregonus clupeaformis*), Lake Whitefish - Como Lake small-bodied population (*Coregonus clupeaformis*), Lake Whitefish - Como Lake large-bodied population (*Coregonus clupeaformis*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xxxiv + 42 p.

APPENDIX 3. MEETING AGENDA

Recovery Potential Assessment of Lake Whitefish (*Coregonus clupeaformis*), Lake Opeongo Large-bodied and Small-bodied DUs

CSAS Regional Science Peer Review Meeting
Ontario and Prairie Region
March 2–4, 2021
MS Teams Virtual Meeting
Chair: Todd Morris

Day 1 – Tuesday March 2nd – 4 hour block (10:00–2:30 EST)

10:00	Introductions and Roundtable	Todd Morris
10:15	CSAS Peer Review Process	Justin Shead
10:30	Listing Process and Designation	Todd Morris
10:45	Terms of Reference, RPA Elements	Todd Morris
11:00	Presentation: Information in Support of a Recovery Potential Assessment – working paper	Julia Colm
12:00	Lunch Break	-
12:30	Presentation: Recovery Potential Modelling – working paper	Simon Fung
13:00	Discussion of working paper comments: overview	All
14:30	End of Day 1	-

Day 2 – Wednesday March 3rd – 4 hour block (10:00–2:30 EST)

10:00	Recap Day 1	Todd Morris
10:15	Discussion of working paper : Info in Support of	All
12:00	Lunch Break	-
12:30	Discussion of working paper: Recovery Potential Modelling	All
14:00	To finalize working papers	All
14:30	End of Day 2	-

Day 3 – Thursday March 4th – 4 hour block (10:00–2:30 EST)

10:00	Recap Day 2	Todd Morris
10:15	Draft Science Advisory Bullets	All
12:00	Lunch Break	-
12:30	Draft Science Advisory Report	All
14:00	Final Remarks and Next Steps	Todd Morris
14:30	End of meeting	-