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Proceedings of the Regional Peer Review of the Recovery Potential Assessment – Northern Brook Lamprey (*Ichthyomyzon fossor*) – Saskatchewan-Nelson River Population

Meeting dates: April 19–21, 2023
Location: Winnipeg, MB, and Virtual

Chairperson: Julia Colm
Editors: Travis Durhack and Zing-Ying Ho

Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, MB R3T 2N6

March 2024

Canada

Foreword

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

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SUMMARY

A regional Canadian Science Advisory Secretariat peer-review meeting was held April 19-21, 2023 as a hybrid meeting, in person at the Freshwater Institute in Winnipeg, Manitoba, and online. The purpose of the meeting was to conduct a recovery potential assessment of Northern Brook Lamprey (*Ichthyomyzon fossor*) in the Saskatchewan - Nelson River Designatable Unit (DU). Advice from this meeting may be used for a listing decision under the *Species at Risk Act* (SARA) and the development of supporting research documents, including a recovery strategy and action plan, and to support decision making in regards to the issuance of permits and agreements within the DU. Meeting participants included experts from Fisheries and Oceans Canada (DFO), Great Lakes Fishery Commission, Manitoba Natural Resources and Northern Development, and academic experts from Canada and the United States.

In 2020, the Northern Brook Lamprey Saskatchewan - Nelson River DU was re-assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and designated as Endangered. The known distribution of Northern Brook Lamprey in the Saskatchewan - Nelson River DU is constrained to the Whitemouth River and its tributary the Birch River in Manitoba. However, due to low targeted sampling and unknown population status, the range of the species distribution within the DU may extend beyond what is currently known. This DU faces threats related to stream flows and increasing temperatures under current and future climates.

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 Saskatchewan - Nelson River Designatable Unit (DU) of Northern Brook Lamprey (*Ichthyomyzon fossor*). As part of the assessment, a hybrid peer-review meeting was held April 19-21, 2023 at the Freshwater Institute in Winnipeg, Manitoba, the Great Lakes Forestry Centre in Sault Ste. Marie, Ontario, and online. Participants included experts from DFO (Science, Sea Lamprey Control Program, Species at Risk Program), Great Lakes Fishery Commission, Manitoba Natural Resources and Northern Development, and academia (Appendix 1).

The intent of the meeting was to review the known information and associated uncertainties to address the Recovery Potential Assessment (RPA) elements of the Northern Brook Lamprey DU, as described in the Terms of Reference (Appendix 2) in the following categories:

- biology, abundance, distribution, and life history parameters;
- habitat and residence requirements;
- threats and limiting factors to the survival and recovery of Northern Brook Lamprey in the Saskatchewan - Nelson River DU;
- recovery targets;
- scenarios for mitigation of threats and alternatives to activities; and,
- allowable harm assessment.

The meeting followed the agenda outlined in Appendix 3. The 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 the Terms of Reference for this RPA.

Northern Brook Lamprey in Canada were originally assessed as a single DU and designated as Special Concern by COSEWIC in 1991. In 2007, COSEWIC split Northern Brook Lamprey into two DUs: a Great Lakes - Upper St. Lawrence DU and a Saskatchewan - Nelson River DU. The Saskatchewan - Nelson River DU assessment was then changed to Data Deficient. In 2020, the Northern Brook Lamprey was re-assessed by COSEWIC, with the Saskatchewan - Nelson River DU designated as Endangered. The known distribution of Northern Brook Lamprey in the Saskatchewan - Nelson River DU is constrained to the Whitemouth River and its tributary, the Birch River in Manitoba, with current estimates based on sampling for other species. However, due to limited targeted sampling for Northern Brook Lamprey in Manitoba, the species distribution may extend farther upstream in the Whitemouth River (and associated tributaries) and downstream into the Winnipeg River.

Drafts of the two Research Documents (working papers) were provided in advance of the meeting and all participants were requested to complete a critical written review in advance of the meeting. Each Research Document was presented during the meeting, with group discussions following each presentation focusing on the concerns identified during the reviews. This Proceedings document summarizes the main meeting discussions and outlines the major conclusions and changes to the Research Documents agreed upon during the meeting. A Science Advisory Report will also be written based upon the advice from the meeting participants. The working papers reviewed during the meeting will be revised based on the group discussions, and published as Research Documents. All final documents will be published on the Canadian Science Advisory Secretariat (CSAS) website.

INFORMATION IN SUPPORT OF A RECOVERY POTENTIAL ASSESSMENT OF NORTHERN BROOK LAMPREY (*ICHTHYOMYZON FOSSOR*) – SASKATCHEWAN - NELSON RIVER POPULATIONS

Author: Douglas A. Watkinson

Presenter: Douglas A. Watkinson

ABSTRACT

The Northern Brook Lamprey (*Ichthyomyzon fossor*) is a small, non-parasitic lamprey species, and is one of three species of the genus *Ichthyomyzon* found in Canada. Northern Brook Lamprey and the parasitic Silver Lamprey (*Ichthyomyzon unicuspis*) are a closely related species pair. Northern Brook Lamprey are at the northern edge of the species' range in Canada and are distributed in Ontario in the tributaries to the Laurentian Great Lakes, tributaries of the St. Lawrence River in Ontario and Quebec, and Manitoba in the Whitemouth River and upstream, including its tributary the Birch River. In November 2020, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Great Lakes - Upper St. Lawrence populations (DU1) as Special Concern and the Saskatchewan - Nelson River populations (DU2) was designated Endangered. The Saskatchewan - Nelson River populations have a limited known distribution, an assumed decline in the number of mature individuals based on observed reductions in extent of occurrence, area of occupancy, and number of locations, and an inferred decline in quantity and quality of aquatic habitat. The most serious threats to which populations are exposed are decreases in stream flows under current and future climates, and anticipated increases in water temperature. Northern Brook Lamprey, Saskatchewan - Nelson River populations, are currently not listed under Schedule 1 of the Species at Risk Act (SARA); the Great Lakes-Upper St. Lawrence populations are listed as Special Concern. The Recovery Potential Assessment (RPA) provides information and scientific advice needed to fulfill various requirements of SARA for the Saskatchewan - Nelson River populations, including permitting activities that would otherwise violate SARA prohibitions and the development of recovery strategies. The Research Document presented describes the current state of knowledge on the biology, ecology, distribution, population trends, habitat requirements, and threats of Northern Brook Lamprey in the Saskatchewan - Nelson River DU. Information contained in the RPA and this document are intended to inform the development of any recovery strategies and action plans.

BIOLOGY, ABUNDANCE, DISTRIBUTION AND LIFE HISTORY PARAMETERS

Discussion

Following the presentation, the group discussed the level of certainty surrounding the abundance and distribution of the species within the DU described in the document. The author described the large amount of uncertainty surrounding Northern Brook Lamprey in this DU, as most of the sampling completed was not targeted towards this species (i.e., opportunistic sampling). Knowledge of life history parameters such as spawning, age of sexual maturity and substrate requirements are known from other populations of this species and other lamprey species, but distribution and abundance are approximate without further standardized sampling efforts.

A participant suggested more consistency between the introduction and the body of the research document with regards to the COSEWIC population estimates. The participant stated that the introduction seemed to agree with COSEWIC population assessments, while the body of the text seemed to imply that the population assessments were unknown. The author

responded that COSEWIC used currently known distribution data for their population assessment, which relied on limited data collected over the past 10 years. Participants agreed that more context regarding the uncertainty surrounding occurrence and population status due to low sampling, and more documentation of zero catch data from sampling in the area should be included in the final Research Document.

The group discussed the density estimates used by Caskenette (2024) and the fact that they were fairly speculative given the limited sampling data available. One participant suggested using Fermi statistics to improve density estimates, and noted the general importance of establishing what is currently known and unknown about the species in order to better direct future collection and sampling design. It was pointed out that the estimated range of density was 1-20 larvae per m^2, which was based on information from other populations and lamprey species. The participant suggested acknowledging this uncertainty numerically and qualitatively in the narrative of the document. The participant questioned whether electrofishing sampling bias would also affect depth and density estimates, since the 4 km^2 of available habitat included areas of deeper and faster water that were not sampled by electrofishing. The participant noted the importance of acknowledging the limited available data, as well as any assumptions in estimating relative abundance and depth given there may be a sampling bias. The author replied that sampling with backpack electrofishing (the preferred sampling method for Northern Brook Lamprey) will always be biased towards shallower slower water due to the nature of the gear, but that the bias is likely small since most of the river reaches are shallower water areas. A participant noted boat electrofishing could be used in areas of deeper water, where it is successfully used in other areas of larval lamprey sampling. Another participant asked if it would be appropriate to use indices of abundance and density estimates extrapolated from other lamprey populations outside of the DU. A participant responded that for native lamprey species in Ontario, the density was, on average, 9 larvae per m^2 in preferred larval habitat, suggesting that the densities reported in the working paper were feasible.

Discussions around Silver Lamprey were held regarding the potential distribution overlap with Northern Brook Lamprey. The author noted that adult Silver Lamprey have never been caught in the Whitemouth River and, therefore, they did not consider the Whitemouth and Birch River populations of Northern Brook Lamprey as co-occurring with Silver Lamprey. Likewise, adult Northern Brook Lamprey have not been caught in the Winnipeg River. The possibility of Northern Brook Lamprey and Silver Lamprey being considered as one species with two different life history strategies was discussed, with participants questioning if protecting them separately would be the best approach if they are eventually ruled to be of the same Linnaean species (as one life history strategy might be more sensitive to perturbations than both strategies would be together, for example). A different participant replied that even if they were eventually deemed the same Linnaean species (i.e., with the same scientific name), in COSEWIC's view they would likely still be separate DUs and species with respect to assessments and protections. The group agreed to put Silver Lamprey overlap as an uncertain in the document, and to describe possible implications of two life history strategies of one species compared to two species.

The discussion moved onto the possible Winnipeg River population, with the author asking for group input on whether it should be left in the document since it is unknown if there is a supported population in the river or if larvae had been washed down the Whitemouth Falls. Lamprey larvae have been caught at the confluence, but since it is not possible to distinguish Northern Brook Lamprey from Silver Lamprey larvae, it is unconfirmed if adult Northern Brook Lamprey exist in the Winnipeg River. Adult Silver Lamprey have been caught in the Winnipeg River near the Whitemouth River confluence, but no adult Northern Brook Lamprey have been caught in the Winnipeg River, with the caveat that targeted sampling has not been completed. The participants agreed that detections of larval *Ichthyomyzon* in the Winnipeg River could

remain, but the Winnipeg River should be removed from the population status table and instead should be included in the sources of uncertainty.

HABITAT AND RESIDENCE REQUIREMENTS

Discussion: Habitat Requirements and Features, Functions, and Attributes Table

Participants were asked for feedback on whether Northern Brook Lamprey burrows, which are used by all life stages, should count as a residence. Participants discussed the purpose and re-use of burrows, with a final decision that although a burrow is used only once, a new burrow is always dug nearby when the lamprey moves. Participants agreed the burrows and the substrate required for the burrows should be considered a residence for the species. Nesting sites were also agreed upon as a residence.

A participant asked about the upper limits stated in the Features, Functions, and Attributes (FFA) table, for parameters such as water velocity and temperature. The temperature listed in the document is the Upper Incipient Lethal Temperature (UILT), where water temperature is too high for survival of the species. The participant further suggested that a sub-lethal threshold or preferred thermal range are likely much lower and more important for habitat considerations, and should be included in the document. Further discussion on the listing of only upper tolerances brought about concerns that only having an absolute high value, such as the UILT, could misrepresent suitable conditions for the species that are likely much lower than upper tolerances. It was suggested that using Sea Lamprey (*Petromyzon marinus*) preferred thermal ranges from the Great Lakes region could be an appropriate proxy for Northern Brook Lamprey. Another participant suggested using data from the Great Lakes-Upper St. Lawrence Northern Brook Lamprey DU instead of Sea Lamprey. Participants agreed to share available data from both species with the author for use in the Research Document. Discussion on temperature also noted that all temperature estimates were based on surface water, not temperature at the substrate, which is where Northern Brook Lamprey spend the majority of their life. A participant noted most water temperature estimates were taken during periods of low water, so it is likely that substrate temperatures would be similar. A participant noted habitat sampling completed for the Eastern Sand Darter (*Ammocrypta pellucida*) recorded water temperatures and substrate temperatures and did not find significant temperature differences at different substrate depths (Barnucz et al., 2022). The author agreed to include more information in the text of the document about habitat requirement ranges, such as temperature, dissolved oxygen, and water velocity. Data from the Great Lakes-Upper St. Lawrence Northern Brook Lamprey DU and Sea Lamprey would be included as proxy estimates for this DU. A participant asked if there was an upper temperature that would inhibit spawning for the population. An upper temperature limit was considered to be unlikely, given that Northern Brook Lamprey are spring spawners, and spawn as soon as water temperatures have warmed enough to be suitable. During the discussion, it was considered possible that acute water temperature increases in the spring could affect egg and larvae survival or result in a protracted spawning window.

Discussions continued around the availability of suitable habitat within the 4 km^2 of total available habitat. These questions were not considered to be answerable without future targeted sampling, but the author thought that suitable substrate for burrowing would likely be less than 50% of the available habitat.

A participant asked whether the population status assessment (specifically Relative Abundance Index) are over-stated, and may give the wrong impression of the health of the population given the Endangered status assessment and lack of data. Several participants thought changing the Relative Abundance Index to “unknown” to reflect a lack of data was a better approach. The author agreed to change the Relative Abundance Index to “unknown”.

THREATS AND LIMITING FACTORS TO THE SURVIVAL AND RECOVERY OF NORTHERN BROOK LAMPREY

Discussion

The group discussed whether threats should be considered together instead of as individual threats. A participant thought the “low” ranking of most of the threats other than “Climate change and severe weather” underestimated the cumulative effects multiple threats could have. The Chair pointed out threats in the table need to be considered individually, but the text in the body of the document could cover the possible compounding effects of multiple threats.

Invasive Species and pathogens

Questions were raised regarding the threat level of invasive species and its “low” rating. One participant felt strongly that the level should be moved up to “medium” due to the number of possible aquatic invasive species (AIS) in the area and the potential for complex interactions between new AIS, although there was not necessarily any one species listed in the document that posed the greatest risk. The participant noted that there were many unknowns surrounding the potential impacts of AIS on Northern Brook Lamprey. Another participant asked whether pathogens were considered part of the AIS threat or if they would be separate. The participant mentioned the Eastern North Dakota Alternate Water Supply Project plan in North Dakota of pumping water from the Missouri basin to Hudson Bay basin, which could introduce pathogens and species to the system. The author said novel pathogens were covered under the AIS threat assessment category and they would add in extra text for pathogens and parasites to the document. A participant then asked for clarification on whether the threat of AIS was considered to be current or potential. The meeting chair replied that the threat assessment should cover current and potential AIS that could arrive within the evaluated timeframe (i.e., 10 years). When considering the threat level of AIS, it was best to think about the mechanism of action, and how a species could enter the system or affect Northern Brook Lamprey, and to what degree (e.g., Smallmouth Bass (*Micropterus dolomieu*) or Rusty Crayfish (*Faxonius rusticus*) predation). The group was reminded of the definitions of threat level of impacts and the direct impact, observed or expected, on the Northern Brook Lamprey DU. The group agreed to leave the threat level for AIS in the table at “low” with the noted disagreement of one participant who thought it should be “medium”.

Pollution

There was some discussion around current and possible pollution in the system. The author said the system was generally undeveloped, with some peat mining and agriculture in the area. There was some chance of locally extreme impacts from point source pollution, but these are likely to be infrequent and may not have population-level effects, so would not be considered large enough to change the threat level assessment from “low”.

Natural systems modifications

A participant asked about dewatering or irrigation use of water in the system. The author said there was some low-level water use by nearby properties, but not considered substantial enough to increase the threat level from “low”.

Climate change and severe weather

The possible effects of climate change were discussed several times throughout the meeting, with discussions surrounding cumulative effects and reduction in water levels in the Whitemouth and Birch rivers. All participants agreed that climate change was a major threat to the species,

and that more research needed to be done to understand the effects that changes to water temperature, dissolved oxygen levels, and flows may have on Northern Brook Lamprey.

RECOVERY POTENTIAL MODELLING OF NORTHERN BROOK LAMPREY (ICHTHYOMYZON FOSSOR) – SASKATCHEWAN – NELSON RIVER POPULATIONS

Author: Amanda L. Caskenette

Presenter: Amanda L. Caskenette

ABSTRACT

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Saskatchewan – Nelson River populations of Northern Brook Lamprey (NBL, *Ichthyomyzon fossor*) as Endangered. Here population modelling is presented to assess the impacts of harm, determine abundance and habitat recovery targets, and conduct long-term projections of population recovery in support of a recovery potential assessment (RPA). The model incorporated parameter uncertainty, environmental stochasticity, and density-dependence into population projections. The analysis revealed that NBL populations were highly sensitive to perturbations in vital rates that affect recruitment such as survival to the larval stage, fecundity, and survival during metamorphosis, as well as ages 1-3 larval survival. As the population growth rate (λ) increased, the sensitivity of all vital rates to perturbation, except for the survival rates of age 4+ larvae, also increased. Population viability analysis was conducted to determine potential recovery targets with demographic sustainability, defined as a self-sustaining population over 60 years, which was achievable with a population size of approximately 2,569 [95% confidence interval: 1,110, 4,950] adult females. The current population size, growth rates, and density was unknown for these populations; therefore, a range of initial population sizes and growth rates was used to estimate recovery times and minimum area for population viability (MAPV). The mean recovery time for the lowest initial population sizes and growth rates was 51 years, and the mean MAPV was 6.3 km^2 for the lowest density and highest MPV estimates.

RECOVERY TARGETS

Discussion

The presenter described how written comments received from the review of the working paper were addressed. The presenter grouped the comments into five categories: model formulation, parameter values, harm, density and distribution, and general. The presentation provided an overview of the development of the model, parameterization, impact of harm, recovery targets, habitat requirements, recovery timeframe, and key uncertainties.

One participant suggested including all parameters considered in the regression used to define the probability of extinction equation, both significant and insignificant, to show the impact of the number of simulations on significance, and that this could be accomplished with a plot for easy comparisons of parameter influence. It was suggested to have all of the parameters on the y-axis and the estimates, with confidence intervals, on the x-axis instead of p-values. Another participant agreed that showing how the parameter significance fluctuated due to sample size would be worthwhile to include. It was also suggested that confidence intervals could be more useful than standard deviations.

A participant asked if depensatory effects associated with patchy populations could be added to the list of uncertainties. Another participant responded that the quasi-extinction threshold used

in the model accounted for depensatory effects. In past models that have been used, using different quasi-extinction thresholds had strong effects on the minimum viable population.

The presenter addressed a question from a participant on the harm simulation and the focus of the working paper on longer term consequences of harm. The participant described the concept of allowable harm and the timescales over which it is measured. The participant suggested clearly describing the difference in the effects on the population immediately after harm is applied compared to the last 15 years of the simulation.

The presenter discussed the transformation probabilities, and addressed a question from the review of describing the rationale for using this particular transformation probability equation. The presenter explained that the equation chosen for the analysis has been used for lamprey transformation, but is usually based on length, as lamprey are not typically aged. One participant asked about the transformation probability relationship, its derivation from Sea Lamprey, and the text surrounding the use of expert opinion. If there were other data available for Northern Brook Lamprey, the participant suggested applying it to the paper. The presenter responded that much of the data for Northern Brook Lamprey used in the analysis resulted from discussions with subject matter experts. The presenter agreed to refine the text and to describe their derivation, r and explore if adjusting the standard deviation would result in changes to model simulation results.

The presenter discussed the impact of harm and how to quantify the impact of anthropogenic activities on Northern Brook Lamprey populations. The presenter described the chance of harm at different intervals, and its impact depending on frequency, the population size, population growth rates, and life stages affected. One participant noted that harm could disproportionately affect non-mobile life stages of Northern Brook Lamprey, while mobile life stages of Northern Brook Lamprey are able to actively avoid harm. The participant explained that the non-mobile life stages of Northern Brook Lamprey would be more affected by harm due to their uneven distribution, fixed location, and their inability to actively avoid harm. The level of harm was originally applied with a uniform distribution, meaning that all scenarios were equally possible in the model, but could be skewed towards higher population declines if higher declines are expected for non-mobile life stages.

The presenter discussed incorporating density dependence to allow for more realistic recovery times, as recruitment slowed when approaching carrying capacity. One participant noted that density is poorly understood, as density measurements are largely dependent on the type and amount of habitat features they are measured across. The participant suggested that the working papers include text to describe the habitat features present when density was measured. Another participant noted there was more information available for Sea Lamprey densities, and suggested differentiating density in ideal habitat patches versus stream-wide density, as well as from young of year per m^2 versus larger larvae. The participant suggested following previous work done on Sea Lamprey (Slade et al. 2003) to characterize habitat as Type I (ideal larval habitat), Type II (non-preferred habitat), and Type III (uninhabitable habitat). It was suggested that this characterization could be used to determine the proportion of habitat occupied by larval lamprey, and could be used to extrapolate density estimates and the proportion of ideal habitat present in a given area of a stream (based on recent substrate measurements from the field). One participant suggested using a substrate decision tree to assign the Types of habitat for Northern Brook Lamprey and determine the percentage of total suitable habitat. Another participant noted that Type II habitat for larval lamprey tended to be a combination of silt and sand, and inferences could be made on preferred larval habitat for Northern Brook Lamprey.

One participant asked how larval abundance related to minimum viable population (MVP) size. The presenter responded that the stable age distribution was used to estimate the amount of larvae per adult, which resulted in a larger range in the MVP estimate. The MVP could be recalculated to only include adults, but adult densities were not available, and there were no available extinction rates for larvae. The participant suggested adding another axis label on the plot to include the number of adult females.

The presenter addressed general comments received on the working paper. It was agreed that as the presence of Silver Lamprey in the Birch or Whitemouth Rivers was unknown, it should be added to the list of uncertainties. Discussion was held on terminology used in the working paper. It was agreed that juveniles and metamorphosis would be the terms used in the working paper (instead of transformers and transformation). The presenter addressed the wording taken from the COSEWIC assessment that noted declining number of mature individuals, and a comment received during the review of the working paper that this wording could be removed. A participant suggested keeping the wording, as this wording was based on the COSEWIC assessment, which has been finalized. The participant felt that the overall conclusion of the working paper and the RPA is not inconsistent with the COSEWIC report. Another participant described that the reason for the designation in the COSEWIC report is based on the number of occurrences, and the inferred decline in mature individuals.

The Chair asked participants if there were any further concerns with the working paper. No further concerns were raised.

DRAFTING OF THE SCIENCE ADVISORY REPORT

Draft Science Advisory Report (SAR) summary bullets were developed by the authors and presented to the group for discussion following the presentations. The major discussion for the summary bullets revolved around the large level of uncertainty and number of unknowns with respect to Northern Brook Lamprey in this DU. Discussions were had on the level of detail to include in the bullets compared to the body of the SAR, with some participants voicing concern that too little information in the bullets could leave them too open to interpretation from readers. Final agreement within the group was to keep the information in the bullets at a high level, but with enough detail to avoid being vague. A bullet was added to specifically mention the uncertainty regarding species co-occurrence with Silver Lamprey and the potential for an existing population of Northern Brook Lamprey in the Winnipeg River. Threats in bullet 3 were ordered from what the group perceived as the highest threat to lowest, and wording around the “complex interactions” between invasive species was added to address concerns surrounding compounding effects of multiple species of AIS. There was discussion on how best to include results from the population modelling, and whether to include a minimum area for population viability (MAPV) estimate in bullet 6. Due to the high level of uncertainty around an appropriate density estimate (or range of estimates) driving the MAPV, it was decided to not include an MAPV estimate in the summary bullets, and only include estimates with additional detail and proper context in the body of the SAR.

Sources of uncertainty to be included in the body of the SAR were reviewed by the group and discussed. One participant suggested including additional explanatory text to describe why co-occurrence with Silver Lamprey is a source of uncertainty, and its implications for recovery. One participant suggested wording changes of “preferred habitat” to “suitable habitat” for Northern Brook Lamprey. A participant questioned if it was necessary to state that other lamprey species were used to parameterize the model, or if instead the wording in the bullet could be reworded to indicate there was limited information available for Northern Brook Lamprey. A participant noted there was uncertainty surrounding the survey methods and sampling parameters used for

Northern Brook Lamprey, as there were 3 different sampling methods described, but the records were not comparable due to the different techniques used. A participant suggested clarifying the text to describe what is anticipated to be found in additional surveys with respect to connectivity or range expansion. A participant asked if there was any uncertainty surrounding substrate requirements for Northern Brook Lamprey. Another participant responded that the substrate requirements were fairly well understood and could be extrapolated to the species, and did not think this would be a source of uncertainty. A participant suggested adding wording regarding the potential for a patchy distribution of suitable Northern Brook Lamprey habitat. Further discussions focused on the amount of specificity to include in the bullets, and precision in the wording of the bullets.

NEXT STEPS

The Chair described the next steps of the RPA process. The group agreed that the working papers were acceptable with the revisions discussed during the meeting, and could be elevated to Research Documents. The group agreed that the they did not need to conduct another review of the Research Documents following revisions. The Chair informed the group that drafts of the Proceedings and the SAR would be sent to participants.

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APPENDIX 1. LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Amanda Caskenette	DFO – Science, Ontario and Prairie Region
Julia Colm (Chair)	DFO – Science, Ontario and Prairie Region
Andrew Drake	DFO – Science, Ontario and Prairie Region
Travis Durhack (Rapporteur)	DFO – Science, Ontario and Prairie Region
Lee Gutowsky	DFO – Science, Ontario and Prairie Region
Marten Koops	DFO – Science, Ontario and Prairie Region
Tom Pratt	DFO – Science, Ontario and Prairie Region
Justin Shead	DFO – Science, Ontario and Prairie Region
Doug Watkinson	DFO – Science, Ontario and Prairie Region
Camille Macnaughton	DFO – Science, National Capital Region
Kristy Pagura	DFO – Species at Risk Program, Ontario and Prairie Region
Zing-Ying Ho (Rapporteur)	DFO – Species at Risk Program, Ontario and Prairie Region
Fraser Neave	DFO – Sea Lamprey Control Program, Ontario and Prairie Region
Tonia Van Kempen	DFO – Sea Lamprey Control Program, Ontario and Prairie Region
Margaret Docker	University of Manitoba
Darren Gillis	University of Manitoba
Michael Wilkie	Wilfrid Laurier University
Ted Treska	Great Lakes Fisheries Commission
Jeff Long	Manitoba Natural Resources and Northern Development, Fisheries Branch
Derek Kroeker	Manitoba Natural Resources and Northern Development, Fisheries Branch
Scott Reid (written review only)	Ontario Ministry of Natural Resources and Forestry
Tyler Buchinger	Michigan State University

APPENDIX 2. TERMS OF REFERENCE

RECOVERY POTENTIAL ASSESSMENT – NORTHERN BROOK LAMPREY (*ICHTHYOMYZON FOSSOR*) – SASKATCHEWAN - NELSON RIVER POPULATION

Regional Peer Review – Ontario and Prairie Region

April 19-21, 2023
Winnipeg, Manitoba, and Virtual

Chairperson: Julia Colm

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.

In April 1991, the species was considered a single population and was designated Special Concern. In April 2007, the species was split into two populations, including the Saskatchewan - Nelson River population which received a designation of Data Deficient and the Great Lakes – Upper St. Lawrence populations received a designation of special concern. In November 2020, COSEWIC (2020) re-examined the species and recommended the Saskatchewan - Nelson River population be designated as Endangered due to the declining numbers of mature individuals based on "*observed reductions in extent of occurrence, area of occupancy, and number of locations, and an inferred decline in quality and quantity of aquatic habitat*". This population is very sensitive to exposed threats such as reductions in stream flows and anticipated increases in water temperature under current and future climates. Recent targeted sampling, using both conventional and environmental DNA (eDNA) methods, results indicate that this population is at risk of extinction. This is the first recovery potential assessment for Northern Brook Lamprey *(Ichthyomyzon fossor)*.

In support of listing recommendations for Northern Brook Lamprey 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. The advice generated via this process will update and/or consolidate any existing advice regarding the Saskatchewan - Nelson River Northern Brook Lamprey population.

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 Northern Brook Lamprey.

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 Northern Brook Lamprey.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Northern Brook Lamprey 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 Northern Brook Lamprey'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 Northern Brook Lamprey

Element 8: Assess and prioritize the threats to the survival and recovery of the Northern Brook Lamprey.

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 Northern Brook Lamprey.

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 Northern Brook Lamprey 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

- CSAS Science Advisory Report
- CSAS Proceedings
- CSAS Research Document(s)

Participants

- Fisheries and Oceans Canada (Science, Species at Risk Program, Fish and Fish Habitat Protection Program)
- Province of Manitoba
- Academia
- Other invited experts

References

COSEWIC. 2020. COSEWIC assessment and status report on the Northern Brook Lamprey *Ichthyomyzon fossor* (Great Lakes - Upper St. Lawrence populations and Saskatchewan - Nelson River populations) and the Silver Lamprey *Ichthyomyzon unicuspis* (Great Lakes - Upper St. Lawrence populations, Saskatchewan - Nelson River populations and Southern Hudson Bay - James Bay populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xxiv + 156 p.

APPENDIX 3. MEETING AGENDA

Recovery Potential Assessment – Northern Brook Lamprey (Ichthyomyzon fossor) – Saskatchewan - Nelson River Population

CSAS Regional Science Peer Review Meeting
Ontario and Prairie Region
April 19-21, 2023
Virtual Meeting

Chair: Julia Colm

Rapporteurs: Travis Durhack and Zing-Ying Ho

Day 1 – Wednesday April 19th – 9:30-2:30 CST

Time	Subject	Presenter
9:30-9:45	Introductions and Roundtable	Julia Colm
9:45-10:00	CSAS Peer Review Process	CSAS
10:00-10:20	Intro to RPA process (ToR)	Julia Colm
10:20-11:30	Presentation: Information in Support of a Recovery Potential Assessment – working paper	Doug Watkinson
11:30-12:30	Lunch Break	-
12:30-14:30	Discussion of working paper: Information in Support of a Recovery Potential Assessment	All

Day 2 – Thursday April 20th – 9:30-2:30 CST

Time	Subject	Presenter
9:30-9:45	Recap Day 1	Julia Colm
9:45-11:30	Presentation: Recovery Potential Modelling – working paper	Amanda Caskenette
12:30-13:30	Lunch Break	-
13:30-14:15	Discussion of working paper: Recovery Potential Modelling	All
14:15-14:30	To finalize working papers	All

Day 3 – Friday April 21th – 9:30-2:30 CST

Time	Subject	Presenter
9:30-9:45	Recap Day 2	Julia Colm
9:45-11:30	Draft Science Advisory Bullets	All
11:30-12:30	Lunch Break	-
12:30-14:00	Draft Science Advisory Report	All
14:00-14:30	Final Remarks and Next Steps	Julia Colm