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Proceedings of the Regional Peer Review on the Updated Recovery Potential Assessment for Northern Madtom (*Noturus stigmosus*), 2012–2022

Meeting dates: November 29–30, 2022
Location: Virtual

Chairpersons: Roanne Collins and Karine Robert
Editors: Lianna Lopez and Robin Gáspárdy

Great Lakes Laboratory for Fisheries and Aquatic Science
Fisheries and Oceans Canada
867 Lakeshore Road
Burlington, ON, L7S 1A1

February 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 (CSAS) peer-review meeting was held on November 29–30, 2022 via the online platform Microsoft Teams. The purpose of this meeting was to assess the recovery potential of Northern Madtom (*Noturus stigmosus*) in Canada with updated information from 2012–2021, to provide advice that may be used for updating the recovery strategy and action plan, and to support decision making with regards to the issuance of permits and agreements under the *Species at Risk Act* (SARA). A Recovery Potential Assessment (RPA) was previously conducted for this species on March 19, 2012 (DFO 2012), so the focus of the peer-review was on new information and methods since then. Participants included Fisheries and Oceans Canada (DFO), Ontario Ministry of Natural Resources and Forestry (OMNRF), Environment and Climate Change Canada (ECCC), Michigan Department of Natural Resources (MDNR), Ontario Conservation Authorities, U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and academic experts.

Northern Madtom was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November 2002 and again in May 2012 (COSEWIC 2012). The reason given for this designation was that it is one of the rarest freshwater fish in Ontario, being found at only four locations in river systems in southwestern Ontario, and faces substantial and ongoing threats including: siltation, turbidity, exotic species and toxic compounds. Northern Madtom was listed as Endangered under SARA in January 2005.

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 CSAS website.

INTRODUCTION

Fisheries and Oceans Canada (DFO) Science has been asked to re-assess the recovery potential of Northern Madtom in Canada. As a result, a virtual peer-review meeting was held on November 29–30, 2022 via Microsoft Teams. Participants included DFO (Science, Species at Risk and Fish & Fish Habitat Protection Program), Ontario Ministry of Natural Resources and Forestry (OMNRF), Environment and Climate Change Canada (ECCC), Michigan Department of Natural Resources (DNR), Ontario Conservation Authorities, U.S. Fish and Wildlife Service (USFWS), 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 updated information and associated uncertainties, to address the Recovery Potential Assessment (RPA) elements in the following categories for Northern Madtom:

- biology, abundance, distribution, and life history parameters;
- habitat and residence requirements;
- threats and limiting factors to the survival and recovery of Northern Madtom;
- 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 science advisory process and the guiding principles for the meeting.

The meeting Chair(s) 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 Northern Madtom in Canada. The Northern Madtom was first assessed by COSEWIC in 1992 and placed in the Data Deficient category. The species was re-examined in April 1998 and designated as Special Concern. Northern Madtom was re-assessed as Endangered in November 2002 (and again in May 2012) based on the following:

- its restricted range;
- a deterioration in water quality; and,
- interactions with invasive species.

Drafts of the two working papers (i.e., Research Documents) were provided 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 (SAR). 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 AN UPDATED RECOVERY POTENTAIL ASSESSMENT OF NORTHERN MADTOM (*NOTURUS STIGMOSUS*) IN CANDA 2012–2021

Authors: Julia E. Colm, Kristin E. Thiessen, Andrew R. Drake

Presenter: Julia Colm

ABSTRACT

The Northern Madtom (*Noturus stigmosus*) is a small, ictalurid catfish species requiring medium to large streams or rivers with gravel, sand, or cobble substrates and moderate to swift current. In Canada, it is found in the Detroit, St. Clair, and Thames rivers, and Lake St. Clair. It is likely extirpated from the Sydenham River. In April 1993, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) placed Northern Madtom in the Data Deficient category. The species was re-examined in April 1998 and designated as Special Concern. Northern Madtom was re-assessed as Endangered in November 2002 (and again in May 2012) due to its restricted range, a deterioration in water quality, and interactions with invasive species. Subsequent to the 2002 COSEWIC designation, Northern Madtom was listed on Schedule 1 of the *Species at Risk Act* (SARA) in June 2003. The Recovery Potential Assessment (RPA) provides background information and scientific advice needed to fulfill various requirements of SARA including informing the development of recovery documents and for assessing SARA Section 73 permits. This research document describes the current state of knowledge of the biology, ecology, distribution, population trends, habitat requirements, and threats of Northern Madtom, with updated information from 2012 through 2021. A threat assessment identified the greatest threats to Northern Madtom in Canada as aquatic invasive species, various sources of pollution, climate change, and habitat modifications from shipping channel construction and maintenance. Mitigation measures and alternative activities related to the identified threats that can be used to protect the species are also presented. Knowledge gaps remain surrounding population status through time, the status of the species in the Sydenham River and Lake St. Clair, total habitat extent, and the mechanisms and impacts of major threats.

BIOLOGY, ABUNDANCE, DISTRIBUTION AND LIFE HISTORY PARAMETERS

Discussion

Distribution

Some concerns were raised around the description of the distribution of Northern Madtom in Ontario. A participant inquired about the Sydenham River records, and whether this should be considered a population given the age of the records (and vouchers) and the limited number of detections. The authors responded that there were very few records of this species from anywhere in Ontario until about 10 years ago, and given the difficulties in sampling for this species, it’s likely that more were there but were undetected. The authors felt it was important context to include these records, but agreed to change some of the wording around their status to reflect more uncertainty. Another participant raised that there were Northern Madtom eDNA detections in the Thames River further upstream of its known distribution, and this could have implications for interpreting the Minimum Area for Population Viability (MAPV) values for that system. The authors agreed to note this in the document, but cautioned that without a fish in hand, these results couldn’t be definitively incorporated into the distribution.

Population Status Assessment

The group discussed the Population Status assessment and appropriate rationale. The authors emphasized the limited empirical data and a need for expert input from the group. A participant asked to clarify the reasoning for ranking the Population Status of the Detroit River as Fair while the St. Clair River is ranked as Poor. The authors explained that the differences were driven by the Relative Abundance Index ranking; St. Clair River was ranked as Medium and the Detroit River as High. The authors further explained that, while catch per unit effort (CPUE) is comparable between the two systems, they felt that the amount of available suitable habitat is likely greater in the Detroit River, resulting in a higher Relative Abundance Index. Other participants shared their experiences catching many Northern Madtom in the St. Clair River within U.S. waters (some work also included Canadian waters). One participant mentioned that their work showed a higher CPUE of Northern Madtom in the St. Clair River compared to the Detroit River. Another participant noted that the distribution maps in the working paper show that Northern Madtom is more widely distributed in the St. Clair compared to the Detroit River. A participant explained that this is likely due to sampling design because sampling (trawling) was systematic in Canadian waters of the St. Clair River resulting in good spatial coverage, but many of the detections of Northern Madtom in the Detroit River are incidental captures and limited random sampling had occurred there.

This led to a discussion around how available habitat was quantified in each system, and whether the assumption that additional habitat in the Detroit River was occupied and suitable was valid. A participant raised that bathymetry data were available in the Detroit and St. Clair rivers that could be used to quantify availability of suitable habitat, but authors advocated that depth alone is insufficient to quantify habitat (given the wide range of occupied depths), and flow/velocity and substrate data are needed as well. The authors agreed to include an updated quantification of habitat (following methods in Mandrak et al. 2014) per system, including the caveats that not all habitat may be suitable, and additional suitable habitat may exist beyond the known areas.

A participant also noted that the Thames River had a relatively high CPUE value reported, yet had the lowest Relative Abundance Index rank. The authors clarified this is because of greater knowledge of the distribution of the species in the Thames River, and there has been more sampling targeting the species there; this more focused sampling resulted in fewer zeroes than the other systems. The availability of suitable habitat is also lowest in the Thames River.

Based on this discussion, participants voted to change the Relative Abundance Index of the St. Clair River from Medium to High (therefore, also changing the Population Status from Poor to Fair). The reasoning for this change was based on agreement that the St. Clair and Detroit rivers likely have similar suitable habitat availability and that recent catch data in the St. Clair River support a higher ranking. The authors repeated that Northern Madtom is still a data limited species and this ranking could change as more data become available.

HABITAT AND RESIDENCE REQUIREMENTS

Discussion

In the Functions, Features, and Attributes (FFA) table, a participant suggested adding an upper thermal limit or omitting the water temperature range (≥20°C) for the Spawn to Hatch life stage. The participant noted that without an upper thermal limit, this could be misinterpreted as any increase in water temperature above 20°C will benefit Northern Madtom. Authors responded that they are unaware of any published upper thermal limit for this species but will consult the literature again to confirm, but would specify that this temperature only reflects when spawning was initiated. A participant noted that the FFA table contains a mean and range of water temperatures for each life stage, but the authors clarified that Young-of-the-Year (YOY) and juveniles have been found in these temperatures and these do not necessarily represent their thermal limits.

There was also discussion around the description of residence and whether that was appropriate for this species; concerns were raised around management implications if that description was incorrect. The authors described that males construct a nest and then guard (occupy) it for approximately one month during the breeding season, and this is consistent with how it was interpreted in the original RPA. Participants noted that it is unlikely that male Northern Madtom return to the same cavities for spawning each year, given the dynamic nature of the rivers it occupies, and inquired whether this changes the interpretation of residence. Another participant noted that there are ‘hot spots’ where they detect more Northern Madtom nesting each year, but a tagging study to investigate spawning site fidelity returned too few recaptures to make conclusions. The authors agreed to incorporate these considerations/ uncertainties around spawning site fidelity in the description of residence.

A participant offered additional details from observations of Northern Madtom spawning activity in the St. Clair River, noting the timing and temperature when eggs were first observed in nests, and flagging the importance of woody debris for spawning and cover in that system (given the paucity of rocks and other cover types). The authors were pleased to add these recent observations.

THREATS AND LIMITING FACTORS TO THE SURVIVAL AND RECOVERY OF NORTHERN MADTOM

Discussion

The author team presented a detailed account of the threat assessment, including definitions and explaining their rationale for the threat assessment scores. Participants were encouraged to provide input to refine scores. There were changes and discussion around the following areas:

Invasive Species

Threat Frequency was changed from Recurrent to Continuous. Round Goby is considered the most severe threat in this category, and given the spatial overlap of the two species, the potential for negative interactions between these two species would be described as continuous. Recurrent would be more suitable to describe an interaction with a new invasive species that is not yet as abundant or widely established.

Climate Change

Impacts of climate change were discussed, noting declines in water flow (i.e., drought) are the greatest concern for Northern Madtom. The Thames River is more susceptible to flow declines since it is a smaller, flashier, and mostly surface-fed system. In contrast, the St. Clair and Detroit Rivers are deeper and fed by lakes, helping to buffer the effects of climate change. The group discussed whether it was more appropriate to change the Threat Extent or the Level of Impact for the Thames River to reflect this difference in how climate change impacts will be received in different habitat types. It was argued that the Level of Impact should be higher in the Thames because the severity of drought conditions or flow reductions would be greatest there.

In regard to the supporting text around climate change, one participant suggested emphasizing temperature changes when referring to drought conditions. Another participant mentioned that research has found that drought can harden gravel substrates, making it unsuitable to serve as habitat when water levels return to normal. Authors agreed that they will add more text about temperature effects. It was mentioned that although increases in temperature may benefit Northern Madtom in some respects, the combination of increases in temperature and low water levels would not be ideal.

Pollution: Pesticides and Herbicides

The group discussed relevance of various pesticides and how this category should be best scored for each location. The authors noted this category included all pesticides and herbicides, but that granular Bayluscide was the greatest concern, and agreed to clearly state that granular Bayluscide has not been applied in Lake St. Clair but there is a possibility of application in the future for all systems. One participant mentioned that work on the Thames River over 10 years found that there was not a high enough pesticide load to affect fish health. However, in the event of a spill the consequences would be more severe. The authors agreed to mention potential consequences of spill events in the supporting text.

Pollution: Nutrient Loads & Sedimentation

As an additional source of nutrients, a participant suggested that the working paper should mention the number of cattle pastures on the Lower Thames. Livestock is known to have direct access to the tributaries at the watershed's east end. The authors agreed to note that one of the sources of nutrient loading is cattle access to the tributaries. The author explained that the Level of Impact would still be classified as Low since data on direct effects of nutrient loading is unavailable. Another participant suggested discussing how rain after periods of drought can increase runoff and therefore, nutrient loading and sedimentation. Authors agreed to add text regarding how climate change can lead to cumulative impacts and magnify the effects of other threats.

Industrial Effluent

A participant asked if mercury is included in this category since a tributary south of Sarnia is contaminated with mercury. The author confirmed that mercury is broadly included. No changes were suggested.

Domestic and Urban Wastewater

A participant noted that there are sewage overflows from the City of London wastewater system that should be included. Another participant shared a link related to sewage bypasses and overflows in the Thames River. The authors agreed to review the information provided and add text about sewage breaches but clarified that it may not be possible to quantify this threat.

A participant asked the reasoning for classifying the Level of Impact of Domestic and Urban Wastewater as Low, given that there are several studies that examine the impact of various pharmaceuticals on fishes and mussels showing they can lead to reproductive consequences. The authors agreed, but flagged they could not find species-specific or catfish-specific research. Because of the of the lack of specific information of any of these pharmaceuticals (or other contaminants) on Northern Madtom, the Level of Impact was classified as low.

Transportation and Service Corridors: Shipping Lanes

The authors requested information about the frequency of maintenance dredging in the Detroit and St. Clair rivers. One participant mentioned that Canadian Coast Guard dredges boating channels, usually every other year, but recently have done so each year, mainly in the lower Detroit River. Another participant shared a link of the U.S. Army Corps of Engineers dredging schedule. A participant noted that the Fish and Fish Habitat Protection Program (FFHPP) has a Code of Practice for routine dredging required to maintain design depths of navigation channels or other shipping infrastructure and has specific conditions (i.e., it is not permitted in critical habitat, and can only occur in areas that have been previously dredged within the last 10 years;

it does not apply to new dredging projects). The participant suggested consulting the Program Activity Tracking for Habitat (PATH) system to investigate any relevant permit requests from the last 10 or more years. Authors agreed to add details to the working paper about frequency of maintenance dredging based on the information provided.

SCENARIOS FOR MITIGATION OF THREATS AND ALTERNATIVES TO ACTIVITIES

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

RECOVERY POTENTIAL MODELLING OF NORTHERN MADTOM (*NOTURUS STIGMOSUS*) IN CANADA

Authors: Simon R. Fung and Marten A. Koops

Presenter: Simon Fung

ABSTRACT

COSEWIC has assessed Northern Madtom (*Noturus stigmosus*) in Canada as Endangered. Population modelling is presented to assess the impacts of harm and determine abundance and habitat recovery targets in support of a recovery potential assessment.

This analysis demonstrated that Northern Madtom was most sensitive to perturbations to juvenile 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 an adult and juvenile population size of ~97,000 (CI: 29,000 – 230,000) at a 99% probability of persistence over 100 years. Such a population would require ~1,700 hectares in the Detroit River, ~1,900 ha in the St. Clair River and ~1,600 ha in the Thames River.

THE MODEL AND PARAMETERIZATION

Discussion

A participant asked if the authors considered applying a catch curve to the Michigan data used in the Von Bertalanffy Growth Function to estimate mortality. The author responded that a catch curve was applied to the multi-year catch data from DFO to estimate mortality instead but, in retrospect, the two datasets could have been pooled. However, since the Michigan data was subsequently analyzed in Utrup et al. (2023), and their mortality estimate was similar to the mortality estimated from the DFO dataset, the author is confident about the mortality estimate.

A participant asked if the model could better capture uncertainty in age-at-maturity (as fecundity was based on a small sample size) and longevity if they were incorporated as randomized parameters in the model. The author responded that values for parameters such as age-at-maturity and longevity affected many other calculations, and didn’t want to risk incorporating unforeseen computational errors by modelling them as randomized parameters. Instead, the uncertainty on those parameters was dealt with as alternative scenarios. It was noted that fecundity data is very limited, amounting to only ten fish collected in Michigan. A participant mentioned that purposeful lethal sampling to identify age at maturity has not occurred for Canadian populations.

A participant suggested that the maximum population growth rates seemed low for Northern Madtom. Low maximum growth rates are more typical of larger, longer-lived species (e.g., Lake Sturgeon). The author explained that the lower bound of the confidence interval (CI) of the output from the function used to estimate maximum population growth rate was used, rather than the mean, and this was the more conservative approach. The author provided additional examples showing that, at low population sizes, the maximum growth rate chosen was most appropriate.

A participant noted that the variability in the Young-of-the-Year (YOY) survival rates was lower than for juveniles and adults, which was unexpected given that YOY survival is typically more variable than other life stages. The author explained that, because the population is more sensitive to YOY survival, a higher coefficient of variation (CV) causes year to year lambda values to decrease below 0.5. This led to the population crashing just due to variability before introducing harm or catastrophes. Therefore, a CV of 0.05 was chosen for YOY survival to prevent the modelled population from crashing.

A participant asked if the CV was applied to instantaneous mortality and not directly to the survival rate. If it was applied to instantaneous mortality it would have a broader range of survival rates. YOY mortality is much higher than adult mortality so a CV of 0.05 for YOY mortality can be a larger value than a CV of 0.15 for adult mortality. When the mortality is converted to survival rates, this would mean that the fluctuation in YOY survival is still greater than the fluctuation in adult survival, even though the CV for YOY is lower. The author acknowledged this reasoning and agreed to check the model code to see if the CV is applied to the mortality. Another participant asked if the instantaneous mortality values of 0.05 for YOY and 0.15 for juveniles and adults are almost comparable in variability between those two stages. One participant suggested to look at CIs for those to see if appropriate.

RECOVERY TARGETS

Discussion

To address the most frequent comment in the reviews, the authors presented a table of Minimum Viable Population (MVP) values under two additional scenarios, age-at-maturity of 2 (instead of 3) and maximum age of 6 (instead of 5) to address uncertainties in those parameters. The authors noted that the standard scenario produces the most conservative estimate. A participant suggested adding the table showing the MVP values of the additional scenarios and adding text explaining the implications of changing the age-at-maturity or maximum age. (i.e., impact on elasticity values)

A participant asked if the authors kept the empirical density estimates the same for all age classes when they calculated the MAPV from the sampling density estimates. The author confirmed this, noting that empirical density estimates were not age-specific. It was suggested to clarify this approach in the text.

A participant asked how relevant the empirical density estimates are compared to the theoretical density estimates by Randall et al. (1995), considering the disparity in the MAPV results produced using these two density estimates. An author explained that the empirical density estimates were calculated based on available field data, but not all sampling was targeted so these likely underestimate the true density. If these estimates are near carrying capacity for those habitats, then the MAPV values would be about accurate. However, if the empirical densities are lower than carrying capacity, this would result in high MAPV values. The theoretical density estimates, by contrast, are likely overly optimistic (as they assume the populations are maximally productive, which is likely not the case for Northern Madtom); this produces very low MAPV estimates. The author noted that the required MAPV likely falls between the values based on the empirical and theoretical density estimates. Another participant requested that the authors expand on the assumptions made by Randall et al. (1995)

for the theoretical density estimates and to make the uncertainties of these calculations clear in the text.

Participants asked about whether density estimates or population viability analyses have been completed for Neosho Madtom or other rare madtoms of conservation concern that might be useful here. The group discussed that it may be reasonable to use density estimates for other madtom species as a substitute in the MAPV calculations or to help understand where within the range of empirical and theoretical densities we might expect Northern Madtom to fall. A participant shared a link to a paper that calculated preliminary density estimates for the Neosho Madtom. Another participant responded that they are not aware of any population viability analyses for madtom species.

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. Two bullets were combined that discussed habitat and nesting requirements and the information on threats were kept general, only including broad categories. It was clarified that Northern Madtom is a very data limited species and therefore, many uncertainties are associated with the life history, historic abundances, density estimates, amount of suitable habitat available, and substrate and overhead structures required for spawning. The group agreed to keep the final summary bullet that related to sources of uncertainty at a high-level, with additional details expanded in the body of the SAR.

NEXT STEPS

The Chairs 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 Chairs will review the revised documents and confirm that all agreed-to changes had been completed. The group was informed that the Proceedings document and SAR would be sent out to participants for final comments.

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APPENDIX 1. LIST OF MEETING PARTICIPANTS

Name	Affiliation
Dave Balint	DFO - Species at Risk Program
Jason Barnucz	DFO - Science
Justin Chiotti	United States Fish and Wildlife Service - Alpena FWCO
Roanne Collins (co-chair)	DFO - Science
Julia Colm	DFO - Science
Whitney Conard	University of Notre Dame
Andrew Drake	DFO - Science
Simon Fung	DFO - Science
Jan-Michael Hessenauer	Michigan Department of Natural Resources
Marten Koops	DFO - Science
Ashley Lindley	DFO - Fish and Fish Habitat Protection Program
Vicki McKay	Lower Thames Valley Conservation Authority
Emily Morton	DFO - Fish and Fish Habitat Protection Program
Craig Paterson	St. Clair Region Conservation Authority
Karine Robert (co-chair)	DFO - Science
Ed Roseman	United States Geological Survey - Great Lakes Science Centre
Josh Stacey	DFO - Species at Risk Program
Gerald Tetreault*	Environment and Climate Change Canada
Mike Thorn	Ontario Ministry of Natural Resources and Forestry
Jeremy Tiemann	University of Illinois (Urbana-Champaign)
Brad Utrup	Michigan Department of Natural Resources
Adam van der Lee	DFO - Science
Matthew Wagner*	United States Fish and Wildlife Service

**provided written reviews only*

APPENDIX 2. TERMS OF REFERENCE

UPDATED RECOVERY POTENTIAL ASSESSMENT OF NORTHERN MADTOM (*NOTURUS STIGMOSUS*), 2012–2021

Regional Peer Review Meeting – Ontario and Prairie

November 29–30, 2022
Location: virtual (MS Teams)

Chairpersons: Roanne Collins and Karine Robert

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 Northern Madtom (*Noturus stigmosus*) was assessed by COSEWIC as Endangered in 2002 and subsequently listed under Schedule 1 of SARA in January 2005. The species was re-assessed and the status confirmed in May 2012. An RPA was conducted by DFO in March 2012 (DFO 2012) and a Recovery Strategy was finalized in June 2012 (Edwards et al. 2012). The Northern Madtom is known from only four areas in southwestern Ontario and is considered extirpated from a historical area. It faces threats from aquatic invasive species, climate change, and continued decline in habitat quality resulting from siltation, nutrient loading and toxic substances.

In support of listing recommendations for Northern Madtom by the Minister, DFO Science has been asked to undertake an updated 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. New information is available since the 2012 RPA regarding life-history, habitat, and threats. This RPA will address elements for which there is substantial new information or methods; other elements will be revisited as appropriate. Only new information presented will require review. The advice generated via this process will update and/or consolidate any existing advice regarding Northern Madtom.

Objectives

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 Madtom.

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 Madtom.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Northern Madtom 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 Madtom'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 Madtom

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

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 Madtom.

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 Madtom 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 Documents

Participants

In the Terms of Reference posted on the CSAS schedule, include a bulleted list of the groups (not individuals) invited to participate in the meeting. A list of the individuals that attended the RPA meeting will be included in the meeting proceedings. The list of groups may include:

- Fisheries and Oceans Canada (Science, Species at Risk Program, Fish & Fish Habitat Protection Program)
- Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF)
- Ontario Conservation Authorities
- Michigan Department of Natural Resources
- United States Fish and Wildlife Service (USFWS)
- United States Geological Survey (USGS)
- Academia
- Other invited experts

References

COSEWIC. 2012. COSEWIC assessment and status report on the Northern Madtom *Noturus stigmosus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 38 p.

DFO. 2012. Recovery potential assessment of Northern Madtom (*Noturus stigmosus*) in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/051.

Edwards, A.L., Laurin, A.Y., and Staton, S.K. 2012. Recovery Strategy for the Northern Madtom (*Noturus stigmosus*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. viii +42 pp.

APPENDIX 3. MEETING AGENDA

UPDATED RECOVERY POTENTIAL ASSESSMENT OF NORTHERN MADTOM (*NOTURUS STIGMOSUS*) IN CANADA, 2012–2022

CSAS Regional Science Peer Review Meeting
Ontario and Prairie Region

November 29–30, 2022
MS Teams Virtual Meeting
Chair: Roanne Collins and Karine Robert

Day 1 – Tuesday November 29th – 5-hour block (10:00-3:00 EST)

10:00-10:15	Introductions and Roundtable	Chairs
10:15-10:30	CSAS Peer Review Process	Joclyn Paulic
10:30-10:50	Introduction to RPA process and discussion of Terms of Reference	Chairs
10:50-12:00	Presentation: Information in Support of a RPA – working paper	Julia Colm
12:00-13:00	Lunch Break	-
13:00-15:00	Discussion of working paper: Info in Support of RPA	All

Day 2 – Wednesday November 30th – 10:00-3:00 EST

10:00-10:15	Recap Day 1	Chairs
10:15-11:15	Presentation: Recovery Potential Modeling – working paper	Simon Fung
11:15-12:00	Discussion of working paper: Recovery Potential Modelling	All
12:00-13:00	Lunch Break	-
13:00-15:00	Drafting of Science Advisory Report Summary Bullets	All