Fisheries and Oceans Canada | Pêches et Océans Canada
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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2023/044

Ontario and Prairie Region

Proceedings of the Regional Peer Review of the Recovery Potential Assessment for Purple Wartyback (*Cyclonaias tuberculata*)

Meeting dates: October 25–27, 2022
Location: Virtual meeting

Chairperson: Lynn Bouvier
Editors: Ashley Watt, Maja Cvetkovic, and Jenn Diment

Fisheries and Oceans Canada
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December 2023

Canada

Foreword

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

Published by:

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

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

ISSN 1701-1280
ISBN 978-0-660-68818-3 Cat. No. Fs70-4/2023-044E-PDF

Correct citation for this publication:

DFO. 2023. Proceedings of the Regional Peer Review of the Recovery Potential Assessment for Purple Wartyback (*Cyclonaias tuberculata*); October 25-27, 2022. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2023/044.

Aussi disponible en français:

*MPO. 2023. Compte rendu de l'examen par les pairs régional de l'évaluation du potentiel de rétablissement de la mulette verruqueuse (*Cyclonaias tuberculata*); du 25 au 27 octobre 2022. Secr. can. des avis sci. du MPO. Compte rendu 2023/044.*

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SUMMARY

A regional Canadian Science Advisory Secretariat peer-review meeting was held virtually on October 25–27, 2022 via Microsoft Teams. The purpose of this meeting was to assess the recovery potential of Purple Wartyback (*Cyclonaias tuberculata*) in Canada, by providing 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 or agreements. Participants included Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada, the Ontario Ministry of Natural Resources and Forestry (OMNRF), Ausable Bayfield Conservation Authority, Lower Thames Valley Conservation Authority, St. Clair Region Conservation Authority, and academic experts.

Purple Wartyback was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2021. This designation was due to the species' small and restricted range, being known from only three rivers in Ontario (Ausable, Sydenham, and Thames rivers), and it was extirpated from two historically occupied areas (Detroit River and western Lake Erie). In addition, pollution sources such as agriculture and urbanization, climate change (droughts), aquatic invasive species, and dredging activities are all contributing to the decline of habitat quality. Purple wartyback is not currently listed under SARA.

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 was asked to assess the recovery potential of Purple Wartyback in Canada. Thus, a virtual peer-review meeting was held on October 25–27, 2022 via Microsoft Teams. Meeting participants included DFO, Environment and Climate Change Canada, Ontario Ministry of Natural Resources and Forestry (OMNRF), Ausable Bayfield Conservation Authority, Lower Thames Valley Conservation Authority, St. Clair Region Conservation Authority, and academic experts (Appendix 1).

In accordance with the Terms of Reference (Appendix 2), this meeting was intended to provide up-to-date information, along with associated uncertainties, concerning the Recovery Potential Assessment (RPA) for Purple Wartyback which addressed the following categories:

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

An outline of the agenda for the meeting is provided in Appendix 3. On behalf of the Canadian Science Advisory Secretariat (CSAS), the chair provided a brief overview of the CSAS science advisory process and the meeting guidelines. A brief history of Purple Wartyback was provided along with an explanation of how the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Species at Risk Act* (SARA) designation and listing processes work.

Purple Wartyback was assessed by COSEWIC as Threatened in May 2021 (COSEWIC 2021). The Threatened designation was based on the following criteria:

- very small and restricted populations, occupies three known locations; and,
- prone to the effects of declining habitat quality, climate change, aquatic invasive species, and dredging activities.

Before the meeting, two working papers (Research Documents) were provided to all meeting participants, and a review was asked to be submitted prior to the meeting. A supplemental analysis (submitted for primary publication) was also provided to participants to support the modeling working paper. Each working paper was presented briefly, and then a group discussion focused on the main issues identified during the reviews. The Proceedings summarizes the key points discussed during the meeting and presents the main conclusions. A Science Advisory Report will summarize the advice from the meeting. All meeting products, including the working papers that include details supporting the advice will be published as Research Documents and made available on the CSAS website.

INFORMATION IN SUPPORT OF A RECOVERY POTENTIAL ASSESSMENT OF PURPLE WARTYBACK (*CYCLONAIAS TUBERCULATA*) IN CANADA

Authors: Julia E. Colm and Todd J. Morris

Presenter: Julia Colm

ABSTRACT

The Purple Wartyback (*Cyclonaias tuberculata*) is a long-lived species of freshwater mussel currently found in three watersheds in Canada from lower Lake Huron through Lake St. Clair. The species was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2021 as Threatened, owing to a small number of extant locations and a continuing decline of habitat quality throughout its range. The species is considered extirpated from two historical locations. The Recovery Potential Assessment provides background information and scientific advice needed to fulfill various requirements of the *Species at Risk Act* (SARA). This research document provides the current state of knowledge on the species including its biology, distribution, population trends, habitat requirements, and threats. Purple Wartyback is a short-term brooder that is thought to use North American catfishes (Ictaluridae) as hosts for completing its life cycle. It is found in relatively deep, medium to large rivers with moderate to swift currents and occasionally lentic areas over sand, gravel, and cobble substrates. Long-term standardized sampling data suggest that at least two of the three populations in Canada may be healthy; however, more years of data are required to span a full generation of this species. A threat assessment identified the greatest threats to Purple Wartyback in Canada as pollution from agricultural and urban sources, climate change (notably droughts), aquatic invasive species including dreissenid mussels and Round Goby (*Neogobius melanostomus*), and dredging. Limited information exists evaluating the impacts of these threats on Purple Wartyback specifically. Mitigation measures and alternative activities regarding habitat-related threats are presented. Important knowledge gaps remain surrounding the full extent of its distribution within known watersheds, habitat preferences by life stage, mussel-host interactions, and physiological tolerances to environmental conditions and pollutants.

BIOLOGY, ABUNDANCE, DISTRIBUTION AND LIFE HISTORY PARAMETERS

Discussion

A participant asked whether sampling efforts were comparable between the three rivers (Ausable, Sydenham, and Thames) and how samples were collected in each. In response, an author gave a quick summary of the sampling approaches and what they would each inform (e.g., timed-search surveys can inform distribution). The participant wanted further clarification on whether variability between quadrats was averaged and what the variability of the subsamples was. An author explained that Purple Wartyback abundance varied across sites with some sites having a high abundance and others a low abundance. The participant asked if mean density of 0.26 individuals/m^2 meant that there was less than one animal in each sub-quadrat, based on the data presented. In agreement with the participant's assumption, the author noted that there were sites with many zeros but that there were also sites with many detections. For clarification, the participant requested that a more detailed explanation of time ranges and sampling methods be provided in the document. The authors agreed to add more description to the working paper.

Abundance

In response to Table 1 and the population estimate (originally from the COSEWIC assessment), a participant expressed concern about scaling up of mean densities at more productive sites to make population estimates and asked for clarification. An author explained that the values overestimate population size and clarified that they were meant to inform relative population estimates and to bound a maximum population size. Other participants expressed that the estimates provided in the modelling paper were more appropriate, but the authors noted these were only reflective of site-scale abundance so underestimate the full population size. To make better comparisons between rivers, another participant suggested using an area estimate of sampleable habitat. Despite liking the approach, the author stated that they were limited by available data on sampleable habitat size in each watershed. Another participant suggested that instead of making projections, to refer to the relative amount of habitat. It was clarified by an author that the distribution section included an estimate of occupied river length, and everyone was reminded that the population estimates were intended to make a relative comparison. The authors advocated to keep the estimates in with appropriate caveats, but the group ultimately decided the population estimates should be removed from the document. In response to this suggestion, other participants expressed concerns about how best to make inferences of relative population size, and issues with transparency around not including available estimates. It was agreed that a footnote would be added to the working paper explaining why the estimates had been removed.

CURRENT STATUS

It was asked by a participant why Black Creek was not shown on the distribution map and whether it is considered occupied habitat. An author responded that this habitat is not considered occupied currently but that it was missed on the map and will be included in the revised map.

POPULATION ASSESSMENT

Several participants asked for clarification regarding the wording in Table 2 (abundance and trajectory) that classified the Ausable River Population Trajectory as “unknown (declining)”. Authors of the working paper explained that the limited data available suggested the population may be declining at some sites, but wanted to capture the uncertainty. Several participants suggested removing the term “declining” until further analyses (e.g., population growth rate) were available as the data did not strongly support a decline, which the authors accepted.

In an inquiry regarding Table 4 (Population Status), a participant asked to discuss whether the Ausable population should be listed as “poor”. In a brief discussion, meeting participants exchanged information and data related to the Ausable River population. There was a general question as to whether there were written descriptions of the categories: “poor”, “fair”, and “good” available for reference. An author shared that there were no official definitions, as they were the product of the population status matrix, and these categories were intended to inform relative population status for all RPAs regardless of the amount of available data. The group also discussed the size of the Ausable River population in comparison to those of the Sydenham and Thames rivers. Participants expressed interest in rerunning the model to include the Ausable River. After clarifying that the Ausable data was not available when the data were first analyzed, the author of the second working paper agreed to run the model with the added data.

The chair asked the group how they would rank the Relative Abundance of the Ausable River. The author team explained that the Ausable River had the lowest mean density and smallest occupied area, the Thames River had an intermediate mean density and a large occupied area, while the Sydenham River had a high mean density and medium occupied area. As a result of participant feedback, it was decided that the Ausable River should be kept at “low” Relative

Abundance. The authors agreed to include more information in the text to explain why the Relative Abundance rankings were chosen.

HABITAT AND RESIDENCE REQUIREMENTS

Discussion

Functions, Features, and Attributes Table

Several participants commented that the information presented in the Functions, Features, and Attributes (FFA) table was too general. An author requested input from the meeting participants on how the information presented could be more specific, but it was agreed the species is a habitat generalist and more detailed descriptions or analyses are unavailable.

A participant asked whether habitat data exists to relate to density (and changes in density). It was clarified by the authors that sampling was conducted when conditions were suitable (e.g., summer low flows), so the information does not reflect habitat conditions through the entire year. In addition, an author tried to include habitat co-variables in the population modelling but none were helpful (may be related to non-random site selection). It was agreed that random sampling to better understand habitat associations should be added as a recommendation stemming from habitat uncertainties. Additionally, wording around presumed host fishes was agreed to be added to the glochidial life-stage habitat section.

THREATS AND LIMITING FACTORS TO THE SURVIVAL AND RECOVERY OF PURPLE WARTYBACK

Discussion

A participant requested that the text include a discussion of multiple stressors occurring concurrently. The authors agreed that this was an important aspect to capture in the text, but that the threat assessment required threats be evaluated individually. The participant shared a paper with the group using the chat function of Microsoft Teams.

Pollution

A participant suggested that the appendices for contaminant concentration data include “maximum” values. The authors agreed. The participant also noted that site-scale water quality data for contaminants known to be toxic to mussels would be useful for future evaluations of pollution threats.

A participant raised an issue about whether glyphosate is spatially relevant for Purple Wartyback and asked if it was necessary to keep the statement. Another participant noted that it could come from upstream applications so should remain. A participant asked if Bayluscide applications were a real threat to the Ausable River. The participant also made the recommendation for the wording to be changed from Bayluscide to just pesticides. The authors described the unique case of Bayluscide within the pesticides category but agreed the wording could be changed.

Participants questioned why the Sydenham River relative abundance estimates were so much better than the other rivers given threats there and whether there was a way to categorize threats by magnitude instead. Although the authors noted that the Sydenham watershed has a rich biodiversity, they agreed to include a table on watershed size and the magnitude of threats affecting each watershed, depending on available data.

Dredging and Sedimentation

There was a brief discussion between participants on whether dredging had ever occurred in the main stems of the Sydenham, Ausable, or Thames rivers, or if those activities were restricted to drains (that Purple Wartyback does not occupy). Meeting participants agreed to send the authors information and data on dredging activities (including drains). The authors suggested moving the section on dredging and nesting it under the section on sedimentation. The chair summarized that there would be major revisions to the dredging section.

A participant asked about shipping lanes, saying they were not a concern for Purple Wartyback. An author stated that dredging for shipping lanes was the closest label in the IUCN threat categories that best captured agricultural drain maintenance activities and reminded participants that the entire heading would be removed following the discussed revisions. The authors also requested information on mussel relocation from the meeting participants. A participant inquired if it would be important to consider fish species present alongside drain information stating that they had access to fish data for drains. The authors agreed to consider the information.

The chair followed up and asked if there were any additional concerns regarding dredging. An author asked participants whether maintenance and construction of bridges should be included in the section on dredging. Participants felt that this should have its own section. An author suggested writing about dredging for agricultural drain maintenance within the sedimentation category first and then discussing bridge construction later (as this had its own IUCN threat category), reminding participants that this change would modify the layout of the threats table. All meeting participants agreed.

Climate Change and Severe Weather

A participant wanted to see additional text around extreme heat waves (i.e., extended periods of very hot weather) associated with climate change, as droughts are not the only concern for mussels. The authors agreed to address this.

Other

An author asked the group if they wanted to see human intrusion by ATV use included in the working paper. There was a brief discussion on whether it was appropriate for the text, given COSEWIC did not consider it a substantial threat to the species. Participants agreed that it should be added in the text.

Threat Assessment Tables

The authors provided more detailed definitions of the threat categories in the tables, and the group discussed the scoring in the tables in more detail. The authors emphasized the challenges around scoring the Level of Impact and Causal Certainty. Two of the populations were growing (and one may be stable), suggesting none of the threats were currently leading to declines in population size. Additionally, there is literature supporting individual- or population-level effects from some of the threats (e.g., pollution best supported in the literature), but there is no evidence that these threats are leading to a decline in Purple Wartyback. The authors cautioned that threats included in the assessment should be severe, and that a medium score is for a threat causing 11-30% decline over ten years.

A participant stated that it was difficult to assess the percentage decline of populations observed in other systems from pollution threats, as it depended on the species and contaminants, and acknowledged the challenge when different pollution types are grouped together. In response, the author suggested adding a separate row in the table for chlorides, ammonia, etc., if warranted. A brief discussion was held about how contaminants affect early life stage mussels more than adults, and these pollutants pose a threat to recruitment. The authors agreed to capture this in the supporting text, but reiterated that the harm modeling found that Purple Wartyback populations are most sensitive to changes in adult survival.

A participant stated that they thought the pollution subcategories were generalized and pointed out the absence of “general runoff or urban runoff”. An author agreed that general runoff was meant to be captured and agreed to add text in the table about general runoff. The participant stated that “industrial effluents” from the City of London were also missing from the table and suggested it be added. The author agreed that it could be added to the table and supporting text if information exists but noted that it was considered as a separate category under IUCN. The author asked the group if they knew of any major industrial sources of input. A few participants offered insight and the suggestion of a second category ‘domestic, industrial, urban wastewater’ was given. The authors summarized that changes to the text would focus on describing the categories further and the impacts on different life stages, and revised scoring in the tables would be circulated to the group following the changes to the text for final comment.

SCENARIOS FOR MITIGATION OF THREATS AND ALTERNATIVES TO ACTIVITIES

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

SOURCES OF UNCERTAINTY

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

EVALUATING THE STATUS AND BIOLOGY OF AN IMPERILLED FRESHWATER MUSSEL, PURPLE WARTYBACK (*CYCLONAIAS TUBERCULATA*) IN SOUTHERN ONTARIO

Authors: Adam S. van der Lee, Margaret N. Goguen, Kelly A. McNichols-O’Rourke, Todd J. Morris, and Marten A. Koops

Presenter: Adam van der Lee

ABSTRACT

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed Purple Wartyback (C*yclonaias tuberculata*) as Threatened in Canada. 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 demonstrated that Purple Wartyback populations were most sensitive to perturbations to adult survival under most circumstances. As population growth rate (λ) increased the sensitivity of juvenile survival to perturbation increased and surpassed adult survival sensitivity when $\lambda > 1.2$. Estimates of the level of harm that would reduce population growth rate to 1 were estimated for populations in the Sydenham and Thames rivers. Population viability analysis was used to identify potential recovery targets. Demographic sustainability, (i.e., a self-sustaining population over 250 years) can be achieved with population sizes of ~2,800 (CI: 1,900-4,000) adults. It was estimated that populations of minimum viable population (MVP) size would require 623.3 m^2 (CI: 251.9-1,396.9) and 2,900 m^2 (CI: 301.5-17,166.3) of habitat in the Sydenham and Thames rivers respectively. Therefore, there is sufficient habitat to support Purple Wartyback populations in both systems.

Discussion

A participant had a question about zero inflation and asked how sampling which leads to almost 90% zeroes in the Thames River is not zero inflated. An author explained that the model could account for the zeroes using a negative binomial distribution. The participant asked for clarification on whether the site data was aggregated or considered replicates. An author confirmed the latter and stated that different model fits were considered. The participant asked for clarification on model fit diagnostics. An author clarified and explained the Bayesian p-value approach used. The participant was satisfied with the response but made the recommendation of adding some of the model selection values and equations in the paper.

A participant wanted to discuss the quadrat model figure presented and asked if the lines were predicted by site. An author explained the figure and clarified that the individual colours were site-specific trends. The participant sought clarification for why there were not numerous lines at zero. An author stated that there were many, though not clearly visible in the figure. The participant then asked whether year was a continuous variable, which was confirmed. The participant suggested doing a time-period analysis (e.g., early vs. late), then inquired if the counts could be plotted on the log scale as they expressed concern over the ability to separate a site and year effect. An author explained that the current model accounted for differences in time between sampling events, where by pooling into early and late time periods, it would equalize the time difference over which the change is being modeled. The participant agreed but felt that the year effect may be biased because of the gap between samples and may not be significant if it was considered as two time-periods instead of a continuous variable. An author maintained that the time between repeat samples does not bias the results and year as a continuous variable gives a better representation of change through time. The participant requested to see the fit of the model when year was considered as a time-period. After brief discussion, the author agreed to run the alternate model.

After reviewing the alternate model results, the participant requested a statement in the working paper indicating that sampling period was also used as a categorical variable and that similar results were found along with an explanation of why a continuous variable was selected (because of biological relevance). The authors agreed.

RECOVERY POTENTIAL MODELLING OF PURPLE WARTYBACK (CYCLONAIAS TUBERCULATA) IN CANADA

Authors: Adam S. van der Lee and Marten A. Koops

Presenter: Adam van der Lee

ABSTRACT

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed Purple Wartyback (C*yclonaias tuberculata*) as Threatened in Canada. 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 demonstrated that Purple Wartyback populations were most sensitive to perturbations to adult survival under most circumstances. As population growth rate (λ) increased the sensitivity of juvenile survival to perturbation increased and surpassed adult survival sensitivity when $\lambda > 1.2$. Estimates of the level of harm that would reduce population growth rate to 1 were estimated for populations in the Sydenham and Thames rivers. Population viability analysis was used to identify potential

recovery targets. Demographic sustainability, (i.e. a self-sustaining population over 250 years) can be achieved with population sizes of ~2,800 (CI: 1,300-5,100) adults. It was estimated that populations of MVP size would require 546.4 m^2 (CI: 176.0-1,595.2) and 2,820.8 m^2 (CI: 248.5-19,660.1) in the Sydenham and Thames rivers respectively. Therefore, there is sufficient habitat to support Purple Wartyback populations in both systems.

PARAMETERIZATION

Discussion

A participant asked if the authors had conducted a sensitivity analysis of the parameters. An author responded that a sensitivity analysis for uncertain parameters was built into the model; parameters that were uncertain were pulled from a distribution of probable values. The outputs let you see which parameters most impacted the results.

Another participant wondered if the authors had tried to run the model with a higher survival rate than what was reported, given the long lifespan of the species (and time spent as an adult). An author responded stating that they had not and it was a fixed variable. The participant suggested it be considered and added a peer-reviewed publication related to the modeling conversation into the chat. The participant also asked about fertility assumptions, and whether greater reproduction at length was more likely. An author stated that greater reproduction at older age classes was more likely but reiterated that the intent was to identify potential bounds as this was uncertain.

IMPACT OF HARM

Discussion

There was a question from a participant about whether the Thames River has a healthier population than the Sydenham River given the higher growth rate. An author clarified that the Sydenham River is likely closer to carrying capacity and has a greater abundance/density. Another participant asked if the model was based on an age-structure similar to those applied to loggerhead turtles. An author explained that the model had a stage-based structure but noted that structurally the two models are similar.

There was a question about parameter sensitivity from a participant regarding the elasticity analysis. The presenter explained that the plots shown highlighted what parameters the model identified as having greatest sensitivity. The participant asked whether a table could be included that identified the different parameters and their sensitivity levels as they felt that this would benefit practitioners. An author briefly explained the potential challenges in running individual parameters (e.g., everything changing together so a specific scenario would need to be chosen) but agreed to a table of sensitivities (if feasible).

RECOVERY TARGETS

Discussion

A participant asked if the authors had considered a catastrophe rate for fish hosts as well as mussels. There was discussion around whether such a catastrophe rate would be additive or multiplicative, or neither given that the mussel and host share the same space. Metapopulation dynamics could influence the model, depending on the type of catastrophe (e.g., a dam), and it may differ depending on whether the mussel is a host-specialist or -generalist. Other participants echoed this point, and the group discussed how host fish dynamics could theoretically be incorporated into a model. Consideration should also be given to whether you would expect the host fish and mussel species to recover at the same time or rate, or if there would be a lag, and how long a mussel population can persist in the absence of a host or with a limited number of hosts (who may develop immunity through time, for example). The authors agreed to add text describing the host fish population dynamics that would affect the model.

A participant wanted to know how many kilometres would be required in each of the rivers. An author stated that they did not have the estimate but rather surface area, stating that the numbers would be higher than what the model proposed given the areas sampled were larger than the MAPV.

A participant was surprised by the long timeframe (>100 years) of catastrophic events and asked whether catastrophes would be more frequent with how varied climate is, and would they influence MVP. An author explained that we have limited information on frequency of catastrophes, so generation time is used for these calculations (and referenced the approach taken). The resulting frequency does not actually consider what is happening in the environment, but longer lived species like Purple Wartyback are generally less sensitive to catastrophic events. The author acknowledged this concern may be more useful in the discussion about host fish catastrophe rates, which may be more limiting given the shorter lifespan of the hosts. A participant made a point that the catastrophes being discussed tended to be environmental and not life history driven and asked whether catastrophes should be predicted based on lifespan or the environment. An author and other participants believed that they would be interlinked. Longer lived species are expected to be more robust and adapted to environmental perturbations, and Purple Wartyback is an equilibrium strategist, adapted to environmental catastrophes experienced normally within its environment. Anthropogenic catastrophes (e.g., spills), however, are likely to be problematic. We might expect shorter-lived species to be more sensitive to catastrophic events because there could be interactions between natural variability in survival and mortality. An author raised the issue that most extinctions seen in unionids were amongst short-lived species. There was some discussion around choosing a different catastrophe rate, perhaps based on recurring environmental cycles, or choosing a target frequency of catastrophes, but there was too much uncertainty on how to bound this.

A participant asked if there was a way to predict climate change effects by including past changes to predict future outcomes. Another participant suggested using ‘scope for growth’ information to predict climate change outcomes. An author explained the relationship between climate change and vital rates is not yet known, but agreed this would be added to the sources of uncertainty section.

DRAFTING OF THE SCIENCE ADVISORY REPORT

Meeting participants were presented a draft of the Science Advisory Report (SAR) summary bullets developed by the author team. The meeting chair reminded participants of the goal of the SAR summary bullet writing session, outlining that there must be a consensus among participants and finalization of the summary bullets within the meeting. Major discussions during the live writing session involved clarifying habitat characteristics, interpreting recovery projections, identifying direct and indirect threats to Purple Wartyback, the relevance of host species (and referring to them as ‘presumed’ host species), sources of uncertainty, and threat assessments. The meeting participants were able to reach an agreement on the final summary bullets.

NEXT STEPS

The meeting Chair informed the group of next steps regarding the finalization of the working documents. Meeting participants agreed that the Information in Support of RPA working paper would be recirculated for review following revisions. The group also agreed that the recovery potential modeling paper would not be sent to the group for review and would instead be accepted as a Research Document following minor revisions. The Chair informed the group that once finalized, the Proceedings document and Science Advisory Report would be sent out to participants for final comments.

REFERENCES CITED

COSEWIC. 2021. COSEWIC assessment and status report on the Purple Wartyback (*Cyclonaias tuberculata*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 64 pp.

APPENDIX 1. LIST OF MEETING PARTICIPANTS

Name	Affiliation
Josef Ackerman	University of Guelph
Dave Balint	DFO - Species at Risk Program
Lynn Bouvier (Chair)	DFO - Science
Heather Bowlby	DFO - Science
Julia Colm	DFO - Science
Amanda Conway	DFO - Fish and Fish Habitat Protection Program
Jessica Epp-Martindale	DFO - Species at Risk Program
Patty Gillis	Environment and Climate Change Canada
Kari Jean	Ausable Bayfield Conservation Authority
Marten Koops	DFO - Science
Anita LeBaron	Ontario Ministry of Natural Resources and Forestry
Darcy McGregor	DFO - Policy and Economics
Vicki McKay	Lower Thames Valley Conservation Authority
Kelly McNichols-O'Rourke	DFO - Science
Todd Morris	DFO - Science
Craig Paterson	St. Clair Region Conservation Authority
Scott Reid	Ontario Ministry of Natural Resources and Forestry
Adam van der Lee	DFO - Science
Julia Willsie	University of Windsor

APPENDIX 2. TERMS OF REFERENCE

RECOVERY POTENTIAL ASSESSMEN – PURPLE WARTYBACK (*CYCLONAIAS TUBERCULATA*)

Regional Peer Review Meeting – Ontario and Prairie

October 25–27, 2022
Location: MS Teams

Chairperson(s): Lynn Bouvier

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 May 2021, COSEWIC recommended that Purple Wartyback (*Cyclonaias tuberculata*) be designated as Threatened, due to a limited number of locations at which the species is found and a continuing decline of habitat quality owing to numerous threats, notably pollution and climate change. Two historical populations are considered extirpated. This was the first assessment of Purple Wartyback in Canada.

In support of listing recommendations for Purple Wartyback 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 this Purple Wartyback.

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 Purple Wartyback.

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 Purple Wartyback.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Purple Wartyback 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 Purple Wartyback'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 Purple Wartyback

Element 8: Assess and prioritize the threats to the survival and recovery of the Purple Wartyback.

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 Purple Wartyback.

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 Purple Wartyback population dynamic 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

- Fisheries and Oceans Canada (Science, Species at Risk Program, Fish and Fish Habitat Protection Program)
- Ontario Ministry of Natural Resources and Forestry
- Academia
- Conservation Authorities
- Other invited experts

References

COSEWIC. 2021. COSEWIC assessment and status report on the Purple Wartyback (*Cyclonaias tuberculata*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 64 pp.

APPENDIX 3. MEETING AGENDA

Recovery Potential Assessment of Purple Wartyback (*Cyclonaias tuberculata*) in Canada

CSAS Regional Science Peer Review Meeting

Ontario and Prairie Region

October 25–27, 2022

Microsoft Teams Virtual Meeting

Chair: Lynn Bouvier

Day 1	**Tuesday October 25th**	
10:00–10:15	Introduction and Roundtable	Chair
10:15–10:30	CSAS Peer Review Process	Chair
10:30–10:50	Introduction to RPA Process	Chair
10:50–12:00	Presentation: Information in Support of a Recovery Potential Assessment – Working Paper	Julia Colm
12:00–13:00	Lunch Break	-
13:00–15:00	Discussion of Working Paper Comments	All
Day 2	**Wednesday October 26th**	
10:00–10:15	Recap Day 1	Chair
10:15–11:00	Presentation: Evaluating Status and Biology of Purple Wartyback	Adam van der Lee
11:00–12:00	Presentation: Recovery Potential Modeling - Working Paper	Adam van der Lee
12:00–13:00	Lunch Break	-
13:00–15:00	Discussion of Working Paper: Recovery Potential Modeling	All
Day 3	**Thursday October 27th**	
10:00–10:15	Recap Day 2	Chair
10:15–10:45	Finalize Working Papers	All
10:45–12:00	Draft Science Advisory Bullets	All
12:00–13:00	Lunch Break	-
13:00–14:30	Draft Science Advisory Report	All
14:30–15:00	Final Remarks and Next Steps	Chair