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Proceedings of the regional Recovery Potential Assessment of Lilliput (*Toxolasma parvum*)

24 September 2013
Burlington, ON

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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 science peer-review meeting was held on 24 September 2013 in Burlington, Ontario. The purpose of the meeting was to assess the recovery potential of Lilliput (*Toxolasma parvum*) based on the 27 steps outlined in the Fisheries and Oceans Canada (DFO) National Frameworks. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated Lilliput as Endangered (May 2013). The mussel currently is not listed on the *Species at Risk Act* (SARA) or the Ontario *Endangered Species Act*. The Science Advisory Report resulting from this Recovery Potential Assessment (RPA) will provide the information and scientific advice to inform the SARA listing decision. If listed, this scientific advice will also be needed to fulfill SARA requirements, including the development of a recovery strategy, and to support decision-making with regards to SARA agreements and permits. Meeting participants included experts from DFO, the Niagara Peninsula Conservation Authority, the Grand River Conservation Authority, the University of Guelph, the Royal Botanical Gardens and the Ontario Ministry of Natural Resources. This proceedings report summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated research documents.

The Proceedings, Science Advisory Report and Research Document resulting from this science advisory meeting are published on the DFO Canadian Science Advisory Secretariat (CSAS) website.

Compte rendu de l'évaluation du potentiel de rétablissement (ÉPR) à l'échelle régionale du toxolasme nain (*Toxolasma parvum*)

SOMMAIRE

Une réunion régionale d'examen scientifique par les pairs s'est tenue le 24 septembre 2013 à Burlington, en Ontario. L'objectif de cette réunion était d'évaluer le potentiel de rétablissement du toxolasme nain (*Toxolasma parvum*) d'après les 27 étapes présentées dans les cadres nationaux de Pêches et Océans Canada (MPO). Le Comité sur la situation des espèces en péril au Canada (COSEPAC) a désigné le toxolasme nain comme étant menacé (mai 2013). À l'heure actuelle, cette moule ne figure pas sur la liste de la *Loi sur les espèces en péril* (LEP) ou de la *Loi sur les espèces en voie de disparition* de l'Ontario. L'avis scientifique découlant de cette évaluation du potentiel de rétablissement (ÉPR) fournira les renseignements et les avis scientifiques nécessaires pour prendre des décisions éclairées concernant l'inscription de cette espèce en vertu de la LEP. Si l'espèce est inscrite, cet avis scientifique sera également nécessaire afin de satisfaire aux exigences de la LEP, telles que l'élaboration d'une stratégie de rétablissement, et appuiera la prise de décisions concernant les ententes et les permis en lien avec la LEP. Parmi les participants à la réunion figuraient des experts des entités suivantes : MPO, Niagara Peninsula Conservation Authority, Grand River Conservation Authority, Université de Guelph, Royal Botanical Gardens, ainsi que le ministère des Ressources naturelles de l'Ontario. Le présent compte rendu résume les discussions pertinentes de la réunion d'examen par les pairs et présente les modifications qui seront apportées aux documents de recherche connexes.

Le compte rendu, l'avis scientifique et le document de recherche qui découlent de la présente réunion de consultation scientifique sont publiés sur le site web du Secrétariat canadien de consultation scientifique du MPO.

INTRODUCTION

In May 2013 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Lilliput as Endangered. The reason for the assessment was as follows: “This species has a fairly restricted range in Canada, confined to tributaries of Lake St. Clair, Lake Erie, and Lake Ontario. Populations once found in the open Canadian waters of Lake St. Clair, Lake Erie and the Detroit River have disappeared. Overall, the species has lost 40% of its former range in Canada. The invasion of freshwater habitat by the exotic Zebra and Quagga mussels, combined with pollution from urban development and sedimentation are the main cause of populations disappearing and the range shrinking.” Lilliput is currently not listed on the *Species at Risk Act* (SARA) or the Ontario *Endangered Species Act,* 2007 (ESA).

The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to assess the recovery potential of Lilliput. The Recovery Potential Assessment (RPA) is a science-based peer review process that assesses the current status of the species by addressing the 27 steps in the National Frameworks outlined in the Revised Protocol for Conducting Recovery Potential Assessments (DFO 2007). The current state of knowledge about habitat requirements, threats to both habitat and Lilliput, and measures to mitigate these impacts are included in the Science Advisory Report. A peer-review meeting was held at the Canadian Centre for Inland Waters, Burlington, Ontario, on 24 September 2013 to discuss the Lilliput RPA.

Meeting participants included Fisheries and Oceans Canada, the Niagara Peninsula Conservation Authority, the Grand River Conservation Authority, the University of Guelph, the Royal Botanical Gardens and the Ontario Ministry of Natural Resources (Appendix 2). The meeting followed the agenda outlined in Appendix 3.

This proceedings report summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated research document. The Research Document (Bouvier et al. 2013) is the working paper presented at the workshop and provides the current understanding of the distribution and habitat requirements of this species, along with recovery targets and times to recovery, while considering various management scenarios.

DETAILED DISCUSSION

The meeting co-chair provided the participants with an introduction to the Science advisory process and the COSEWIC and SARA listing processes. He explained how the RPA would be used, as well as the objectives of the meeting. A draft research document had been developed by DFO and provided to the participants in advance of the meeting. The draft research document was the basis for discussion; the participants were encouraged to add to or change the material as needed to ensure that the best, most accurate information was included.

Species description

Presenter: Lynn Bouvier

The presentation included descriptions of Lilliput and two similar species: Rayed Bean (*Villosa fabalis*) and Salamander Mussel (*Simpsonaias ambigua*). It also covered Lilliput age and growth estimates, diet and North American distribution.

The presenter noted that two resources for the species description listed contradicting characteristics for Lilliput, with one stating that the species had rays and the other stating that it was rayless. A participant clarified that juveniles tend to have rays whereas adults commonly do not.

In the review of Lilliput diet, the presenter stated that no species-specific information on feeding exists; the description given was for Unionids in general.

To add to the overview of North American species distribution, a participant mentioned that the conservation organization NatureServe had mapped the distribution of mussels by watershed. Another participant expressed reservations about the accuracy of the information; however, the participant affirmed that the U.S. distribution had been vetted by state experts. The presenter made a note to look into this resource.

Another participant suggested that the age and growth estimates of four to five years and 25 mm average shell length might be low. They offered to send the presenter data from recent samples, which the presenter would incorporate into the research document, if possible. It was noted that the reason for the lower estimates might be due to a limited number of samples, all from the Royal Botanical Gardens (the only site with a large enough population to allow for the calculation).

No further changes were proposed for this section of the document.

Population status

Presenter: Lynn Bouvier

The presentation on population status included population categorization, distribution, abundance and trajectory, as well as the certainty that the researchers had of the information's accuracy.

The group agreed that there was not enough information available to assign trajectories for Lilliput populations. One participant noted that the habitat is not easily sampled; in addition, most historical work had been conducted for commercially viable species, and exploratory work tended to focus on riverine habitat. Until recently, the species was not known to exist in the drainage of Lake Ontario. These facts explained some of the lack of information.

Habitat requirements

Presenter: Lynn Bouvier

The presentation included a description of the Lilliput's life cycle and the habitat requirements for three life stages: glochidium (including a review of host fishes), juvenile, and adult.

The habitat descriptions were described in terms of functions, features and attributes. Due to a lack of information, adult and juvenile habitat descriptions were grouped together under the assumption that the habitat does not change between the two life stages.

In the review of adult/juvenile habitat attributes, the presenter noted that current records indicated the presence of Zebra Mussel shells in Baptiste Creek, where a live Lilliput had been recorded. They asked if Zebra Mussel was present in any other Lilliput habitat; several participants replied that they were present in the Grand River up to the Dunnville dam. This information would be added to the Functions, Features and Attributes table.

Population sensitivity to perturbations

Presenter: Jennifer Young

Due to a lack of data, the presenter could not apply standard modeling procedures to their analysis of Lilliput. Instead, they applied an alternative method that had been developed for a similar situation in 2010 (Young and Koops 2011). This approach involved determining patterns of elasticity for four sensitivity groups (three groups and one subset), thereby predicting Lilliput elasticity and classifying it accordingly.

The species was classified as belonging to the “low overall sensitivity” group, a subset of the “adult survival dominant” group. However, the presenter added that this analysis was informed by the scientific knowledge of other Unionids as well as the Lilliput, and that it would be preferable to determine the actual parameter values of the species.

Following the presentation there was a brief discussion of how the information provided by the mathematical analysis translated into the “real-world” protection of the species. The point was made that, because of their smaller size, Lilliput may be more susceptible to threats than other larger mussels, particularly at the juvenile stage. The presenter offered to add a note clarifying the appropriate applications of the model to the real-life scenarios.

Picking up on a comment by an outside source that the species had few conglutinates with relatively few glochidia, a participant noted that increasing the number of conglutinates may have a positive impact on fecundity rates. However, it was determined that this information most likely would not affect the model. The presenter did, however, emphasize the need to study glochidial survival.

Threat status

Presenter: Lynn Bouvier

The presenter reviewed threats to the Lilliput, including contaminants and toxic substances, nutrient loading, turbidity and sediment loading, invasive species, habitat loss and alteration, altered flow regimes, threats to host fish and a general overview of the impacts of climate change.

During the discussion of threats to host fish, a participant asked if any one species predominantly hosted Lilliput. The presenter responded that there was not enough information available to answer that question.

The presenter then discussed climate change, at which point they explained that the category had not been included in the formal threat level assessment; rather, a paragraph had been included in the research document that explained the overarching effects of climate change on the species.

A participant then suggested that the impact of altered water levels, reviewed in the discussion of climate change, might also be included under “altered flow regimes.” They mentioned that a discussion was underway surrounding the possible removal of the Dunnville dam, and asked if that would have an impact on Lilliput. The presenter responded that they did not know, and that they were unsure as to whether or not it was a barrier to the movement of fish. The group could not offer any concrete answer to that question; a participant offered to look into it further.

Next the presenter reviewed the likelihood and impact of threats, as well as the certainty associated with threat impact.

It was established that threat likelihood (TLH) would be categorized as “known” (K), “likely” (L), “unlikely” (U), or “unknown” (UK); threat impact (TI) would be categorized as “high” (H), “medium” (M), “low” (L), or “unknown” (UK). The certainty associated with threat impact (C) would be categorized as 1, or derived from causative studies; 2, or derived from correlative studies; or 3, or expert opinion.

The group first discussed the threats to the population in the Sydenham River. A participant suggested that the presenter separate turbidity and sediment loading since Lilliput is a small mussel and at risk of smothering. The change was made to all the tables in the document, with turbidity rated as UK and sediment loading as H for the Sydenham specifically.

During the review of invasive species, participants discussed the presence and potential impact of both Round Goby (*Neogobius melanostomous*) and Common Carp (*Cyprinus carpio*). It was decided to add the latter to the list of invasive species and categorize it with a TLH of K and a TI of L. A participant then asked if it was clear in the document which species occur in which location. The presenter responded that it was not and proposed inserting this information into a separate table. The group agreed.

Another participant noted that altered flow was unlikely for most of the Sydenham River; the assessment was changed from a TLH of UK to U. Because no one in the group knew of any barriers to fish in the Sydenham, the TLH was also changed from UK to U.

In the review of the impact of invasive species on host fish, a participant asked if the TI should be changed from UK to H since studies showed that Round Goby were negatively impacting Johnny Darter (*Etheostoma nigrum*). The group decided not to make the change because the Lilliput had several host fish and it was not known how the negative impact of Round Goby on Johnny Darter was affecting Lilliput.

Another participant asked if the category of “predation” should be added to the table. The presenter explained that the topic of natural predation had been discussed in recent years, and it was decided that it would be eliminated from assessments because human activity could not be proven to have an impact on natural predators. Predation by invasive species, however, was addressed in the table.

Participants made the point that people relocate raccoons to urban marsh areas, making them an invasive species that preys on Lilliput. The presenter proposed an additional paragraph that discussed this phenomenon.

Next the group discussed Baptiste Creek, which is part of the Thames River. Turbidity was given a TLH of K and a TI of UK; sediment loading was given a TLH of K and a TI of M. A participant also noted that work such as channel maintenance was performed nearby, and so the TLH of habitat removal and alteration was changed from U to L.

Next the group discussed the Belle and Ruscom rivers. Turbidity was given a TLH of K and a TI of UK; sediment was given a TLH of K and a TI of M. This assessment remained consistent for the rest of the water bodies.

A participant asked if the water levels of Lake St. Clair could have an impact on Lilliput. The presenter responded that the records were all upstream, so it was unlikely. Another participant asked if there could be populations closer to the mouth of the river; the presenter responded that it was possible, but the analysis had to apply to known populations only. No changes were made to the document as a result of this conversation.

In the discussion of the Grand River the presenter noted that they had received a new research document from the Grand River Conservation Authority that provided updated information on contaminants, nutrient loading and sediment. This reference would be added to the research document; however, because threats were known to occur in the river, it was unlikely that the new information would impact the outcome of the assessment.

The group then reviewed the analysis of the Welland River. The presenter asked for the opinion of one of the participants on the impact of altered flow regime. The participant responded that altered flow regimes occur because of backup from hydro operations and a dam at the Binbrook reservoir. The TLH was therefore changed from U to K.

There was some conversation around the impact that the altered flow regimes would have on Lilliput. Ultimately it was agreed that the TI would remain listed as M while a participant gathered more information on the amount of flow leaving the Binbrook reservoir. A change to the table would be made at a later date, if required.

The presenter asked a participant for input on the presence of invasive species in the Welland River. They responded that Common Carp were present, but they were unsure about Zebra Mussel, Quagga Mussel and Round Goby. The participant offered to check the existing records for the site. Another participant mentioned that a 2007 report listed no Round Goby for the site; however, a 2008 report did list Common Carp among the species present.

The presenter reviewed the analysis of Jordan Harbour. A participant noted that the TI for invasive species was listed as H whereas in the rest of the analyses it was listed as UK. The presenter replied that this entry in the table was a mistake and changed the TI accordingly.

The final water body discussed was Hamilton Harbour and surroundings. A participant mentioned that several proposals had been put forward for infill in the harbour; however, those proposals did not affect areas that were known to be habitat for Lilliput. For this reason no changes were made to the assessment of habitat removal and alteration.

The presenter then told the group that they would run the new classifications through the heat matrix and include the overall threat classifications in the second draft of the research document.

Review of projects and activities in Lilliput habitat

Presenter: Dave Balint

The review of projects and activities in Lilliput habitat gave all work, projects and activities that took place from 2010-2012. Participants discussed whether these activities were likely to increase, decrease or remain the same in the future; they also discussed the impact those activities would have with standard and additional mitigation methods in place.

The presenter began by alerting the participants to the fact that DFO is not always made aware of all works and activities that occur. In addition, many of the sites were not reviewed for species at risk because they were not known to be habitat for Lilliput. For these reasons there may have been projects carried out for which fish salvages and mussel relocation would have been required, but were not conducted.

The presenter asked the group if there were any mitigation options that had not been considered previously. A participant responded by asking if there was any planned infilling work or dredging in Hamilton Harbour. The presenter said that there were infilling projects, but none that were close to any known Lilliput habitat. Dredging was conducted annually in the harbour, but the footprint likely would stay the same.

Another participant added that LaSalle Marina appeared to be potential Lilliput habitat; however, no one had looked for the species there. They added that there was a proposal for an infill break wall at that location, which had implications for multiple species. The participant also said that multiple transportation projects were being planned which could involve in-water works around the nearby outlet to Cootes Paradise, where Lilliput were located.

A participant asked if the transportation projects would harm the Lilliput population in Hamilton Harbour. The response was that it could trigger relocations at short distances. The point was then made that Waterdown, the town on Grindstone Creek, was under massive development; this could present an issue at the Grindstone Marshes. Several participants noted that there were other species at risk in the area, including Eastern Pondmussel (*Ligumia nasuta*), so the impact of the work would be captured in the context of species other than Lilliput.

It was then asked if mussel relocation would be a form of mitigation. A participant responded in the affirmative.

Pathways of effect & non-habitat related threats

Presenter: Lynn Bouvier

The presentation addressed the Pathways of Effect, methods of mitigating harmful effects, and alternatives to activities which cause harm to Lilliput.

In the review of mitigation methods to protect host fish, participants asked whether it was necessary to suggest a management plan for any decreasing fish populations. The reason for this uncertainty was that there were multiple species of host fish, all of which were abundant. However, it was decided that the document would not be changed since this was only a proposed mitigation.

Sources of uncertainty

Presenter: Lynn Bouvier

The presentation addressed sources of uncertainty related to population structure, habitat, host fish, recovery potential modeling, and threats to Lilliput.

In the review of population structure, a participant noted that it would be worthwhile to add the need to expand the length-of-age relationship beyond the one population. The presenter responded that that point was covered in the modeling section. In the section on habitat, the presenter added that the effects of turbidity also needed to be included.

No other changes were made to this section of the document.

Review of Terms of Reference

Presenter: Todd Morris

The terms of reference included assessing the Lilliput and its population status, assessing uses of its habitat, determining the scope for management to facilitate recovery, determining scenarios for mitigation and alternatives to activities, and assessing allowable harm.

The participants reviewed the following criteria:

1. Evaluate present status for abundance and range and number of populations.
   - The participants agreed that they met this need.
2. Evaluate recent species trajectory for abundance (i.e., numbers and biomass focusing on mature individuals) and range and number of populations.
   - The participants covered the range and number of populations; however, they were not able to evaluate the trajectory due to a lack of historical information.

3. Estimate, to the extent that information allows, the current or recent life-history parameters (total mortality, natural mortality, fecundity, maturity, recruitment, etc.) or reasonable surrogates; and associated uncertainties for all parameters.
   - The participants fulfilled this requirement to the extent that the information allowed through the discussion of the model.
4. Estimate expected population and distribution targets for recovery, according to DFO guidelines (DFO 2005, and 2011).
   - The participants could not meet this requirement due to a lack of quantitative information. However, they discussed the reasons for assessment and provided some direction on how to conduct one.
5. Project expected population trajectories over three generations (or other biologically reasonable time), and trajectories over time to the recovery target (if possible to achieve), given current parameters for population dynamics and associated uncertainties using DFO guidelines on long-term projections (Shelton et al. 2007).
   - The participants could not meet this requirement due to a lack of information.
6. Evaluate residence requirements for the species, if any.
   - According to DFO, the term "residence" does not apply to mussels.
7. Provide functional descriptions (as defined in DFO 2007b) of the required properties of the aquatic habitat for successful completion of all life-history stages.
   - This topic was discussed in the review of the Functions, Features and Attributes table.
   - A participant asked if thermal temperature should be included in the description of the habitat. The response was that, in general, this type of analysis should be done; however, it currently is not. Some ongoing studies existed, but not in Lilliput habitat.
   - Another participant asked to what extent Science looks at the tolerance of host fish to environmental perturbations. The presenter responded that the number of unknowns surrounding host fish made it difficult to have that discussion. A third participant added that these questions better apply to the recovery strategy.
8. Provide information on the spatial extent of the areas that are likely to have these habitat properties.
   - Limited information prevented the participants from fulfilling this requirement.
9. Identify the activities most likely to threaten the habitat properties that give the sites their value, and provide information on the extent and consequences of these activities.
   - The participants satisfied this requirement through the threat level assessment and the review of projects in Lilliput habitat.
10. Quantify how the biological function(s) that specific habitat feature(s) provide to the species varies with the state or amount of the habitat, including carrying capacity limits, if any.
    - The participants were not able to satisfy this requirement due to a lack of information.
11. Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.
    - The participants agreed that the discussion of barriers to the movement of fish hosts fulfilled this requirement.

12. Provide advice on how much habitat of various qualities / properties exists at present.
    - The participants were not able to satisfy this requirement due to a lack of information.
13. 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 biologically based recovery targets for abundance and range and number of populations.
    - Because the participants could not provide recovery targets, they could not fulfill this requirement at this time.
14. Provide advice on feasibility of restoring habitat to higher values, if supply may not meet demand by the time recovery targets would be reached, in the context of all available options for achieving recovery targets for population size and range.
    - Because the participants could not provide recovery targets, they could not fulfill this requirement at this time.
15. Provide advice on risks associated with habitat "allocation" decisions, if any options would be available at the time when specific areas are designated as critical habitat.
    - The participants were not able to satisfy this requirement due to a lack of information.
16. Provide advice on the extent to which various threats can alter the quality and/or quantity of habitat that is available.
    - The participants were able to satisfy this requirement qualitatively, but not quantitatively.
17. Assess the probability that the recovery targets can be achieved under current rates of parameters for population dynamics, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.
    - Because the participants could not provide recovery targets, they could not fulfill this requirement at this time.
18. Quantify to the extent possible the magnitude of each major potential source of mortality identified in the pre-COSEWIC assessment, the COSEWIC Status Report, information from DFO sectors, and other sources.
    - The participants could not fulfill this requirement because the information required for the threat ranking was not available.
19. Quantify to the extent possible the likelihood that the current quantity and quality of habitat is sufficient to allow population increase, and would be sufficient to support a population that has reached its recovery targets.
    - Because the participants could not provide recovery targets, they could not fulfill this requirement at this time.
20. Assess to the extent possible the magnitude by which current threats to habitats have reduced habitat quantity and quality.
    - The participants were unable to compare the magnitude of threats due to a lack of information.
21. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all feasible measures to minimize/mitigate the impacts of activities that are threats to the species and its habitat (steps 18 and 20).

- The participants satisfied this requirement in the reviews of projects and activities and pathways of effect.

22. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable alternatives to the activities that are threats to the species and its habitat (steps 18 and 20).

- The participants satisfied this requirement in the reviews of pathways of effect and mitigations.

23. Using input from all DFO sectors and other sources as appropriate, develop an inventory of activities that could increase the productivity or survivorship parameters (steps 3 and 17).

- The participants were not able to satisfy this requirement due to a lack of information.

24. Estimate, to the extent possible, the reduction in mortality rate expected by each of the mitigation measures in step 21 or alternatives in step 22 and the increase in productivity or survivorship associated with each measure in step 23.

- The participants were not able to satisfy this requirement due to a lack of information.

25. Project expected population trajectory (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities associated with specific scenarios identified for exploration (as above). Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

- The participants were not able to satisfy this requirement due to a lack of information.

26. 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 of listing the species.

- The participants were not able to satisfy this requirement due to a lack of information.

27. Evaluate maximum human-induced mortality which the species can sustain and not jeopardize survival or recovery of the species.

- The participants were not able to satisfy this requirement due to a lack of information.

The author stated that they would modify the documents from the meeting in accordance with the group’s comments. The group agreed that the small number of changes did not merit a second round of reviews. Instead links would be sent to the participants when the final documents were published online.

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APPENDIX 1. TERMS OF REFERENCE

Recovery Potential Assessment of Lilliput (*Toxolasma parvum*)

Regional Peer Review Meeting – Central and Arctic Region

September 24, 2013
Burlington, Ontario

Chairpersons: Lynn Bouvier and Todd Morris

Context

When the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designates aquatic species as threatened or endangered, Fisheries and Oceans Canada (DFO), as the responsible jurisdiction under the *Species at Risk Act* (SARA), is required to undertake a number of actions. Many of these actions require scientific information on the current status of Lilliput, threats to its survival and recovery, and the feasibility of its 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 the consideration of peer-reviewed scientific analyses into SARA processes including recovery planning. COSEWIC met in May 2013 and recommended that Lilliput be designated Endangered (COSEWIC 2013). This was their first assessment of Lilliput.

In support of listing recommendations for this species by the Minister, DFO Science has been asked to undertake an RPA, based on the National Frameworks (DFO 2007a and b). The advice in the RPA may be used to inform both scientific and socio-economic elements of the listing decision, as well as development of a recovery strategy and action plan, and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per section 73, 74, 75, 77 and 78 of SARA. The advice generated via this process will also update and/or consolidate any existing advice regarding this species.

Objectives

- To assess the recovery potential of Lilliput (*Toxolasma parvum*).

Assess current/recent species/ status

1. Evaluate present status for abundance and range and number of populations.
2. Evaluate recent species trajectory for abundance (i.e., numbers and biomass focusing on mature individuals) and range and number of populations.
3. Estimate, to the extent that information allows, the current or recent life-history parameters (total mortality, natural mortality, fecundity, maturity, recruitment, etc.) or reasonable surrogates; and associated uncertainties for all parameters.
4. Estimate expected population and distribution targets for recovery, according to DFO guidelines (DFO 2005, and 2011).
5. Project expected population trajectories over three generations (or other biologically reasonable time), and trajectories over time to the recovery target (if possible to achieve), given current parameters for population dynamics and associated uncertainties using DFO guidelines on long-term projections (Shelton et al. 2007).
6. Evaluate **residence requirements** for the species, if any.

Assess the Habitat Use

7. Provide functional descriptions (as defined in DFO 2007b) of the required properties of the aquatic habitat for successful completion of all life-history stages.

8. Provide information on the spatial extent of the areas that are likely to have these habitat properties.
9. Identify the activities most likely to threaten the habitat properties that give the sites their value, and provide information on the extent and consequences of these activities.
10. Quantify how the biological function(s) that specific habitat feature(s) provide to the species varies with the state or amount of the habitat, including carrying capacity limits, if any.
11. Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.
12. Provide advice on how much habitat of various qualities / properties exists at present.
13. 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 biologically based recovery targets for abundance and range and number of populations.
14. Provide advice on feasibility of restoring habitat to higher values, if supply may not meet demand by the time recovery targets would be reached, in the context of all available options for achieving recovery targets for population size and range.
15. Provide advice on risks associated with habitat "allocation" decisions, if any options would be available at the time when specific areas are designated as critical habitat.
16. Provide advice on the extent to which various threats can alter the quality and/or quantity of habitat that is available.

Scope for Management to Facilitate Recovery

17. Assess the probability that the recovery targets can be achieved under current rates of parameters for population dynamics, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.
18. Quantify to the extent possible the magnitude of each major potential source of mortality identified in the pre-COSEWIC assessment, the COSEWIC Status Report, information from DFO sectors, and other sources.
19. Quantify to the extent possible the likelihood that the current quantity and quality of habitat is sufficient to allow population increase, and would be sufficient to support a population that has reached its recovery targets.
20. Assess to the extent possible the magnitude by which current threats to habitats have reduced habitat quantity and quality.

Scenarios for Mitigation and Alternative to Activities

21. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all feasible measures to minimize/mitigate the impacts of activities that are threats to the species and its habitat (steps 18 and 20).
22. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable alternatives to the activities that are threats to the species and its habitat (steps 18 and 20).
23. Using input from all DFO sectors and other sources as appropriate, develop an inventory of activities that could increase the productivity or survivorship parameters (steps 3 and 17).
24. Estimate, to the extent possible, the reduction in mortality rate expected by each of the mitigation measures in step 21 or alternatives in step 22 and the increase in productivity or survivorship associated with each measure in step 23.
25. Project expected population trajectory (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities associated with specific scenarios identified for exploration (as above). Include scenarios which provide as high a

probability of survivorship and recovery as possible for biologically realistic parameter values.

26. 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 of listing the species.

Allowable Harm Assessment

27. Evaluate maximum human-induced mortality which the species can sustain and not jeopardize survival or recovery of the species.

Expected Publications

- Science Advisory Report
- Proceedings Document
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) (Science, Ecosystems and Fisheries Management, Policy and Economics sectors, Habitat and Species at Risk programs)
- Ministry of Natural Resources of Ontario
- Conservation Authorities
- Academics
- Other invited experts

References

COSEWIC. 2013. COSEWIC Status Report on Lilliput, *Toxolasma parvum*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. vi + 59 p.

DFO. 2005. A framework for developing science advice on recovery targets for aquatic species in the context of the Species at Risk Act. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/054.

DFO. 2007a. Revised Protocol for Conducting Recovery Potential Assessments. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/039.

DFO. 2007b. Documenting habitat use of species at risk and quantifying habitat quality. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/038.

DFO. 2011. A Complement to the 2005 Framework for Developing Science Advice on Recovery Targets in the Context of the *Species At Risk Act*. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/061.

Shelton, P.A., B. Best, A. Cass, C. Cyr, D. Duplisea, J. Gibson, M. Hammill, S. Khwaja, M. Koops, K. Martin, B. O'Boyle, J. Rice, A. Sinclair, K. Smedbol, D. Swain, L. Velez-Espino, and C. Wood. 2007. Assessing recovery potential: long-term projections and their implications for socio-economic analysis. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/045.

APPENDIX 2. PARTICIPANTS

Lilliput Recovery Potential Assessment

24 September 2013

South Seminar Room, Canadian Centre for Inland Waters

Name	Affiliation
Jeff Adam	Fisheries and Oceans Canada, Policy and Economics
Dave Balint	Fisheries and Oceans Canada, Habitat Management
Amy Boyko	Fisheries and Oceans Canada, Species at Risk
Lee-Ann Hamilton	Niagara Peninsula Conservation Authority
Sarah Hogg	Ontario Ministry of Natural Resources
Marten Koops	Fisheries and Oceans Canada, Science
Gerry Mackie	University of Guelph Emeritus
Kelly McNichols-O'Rourke	Fisheries and Oceans Canada, Science
Wendy Michaud	Note taker
Todd Morris	Fisheries and Oceans Canada, Science
Tys Theysmeyer	Royal Botanical Gardens
Nigel Ward	Grand River Conservation Authority
Jen Young	Fisheries and Oceans Canada, Science
Tony Zammit	Grand River Conservation Authority

APPENDIX 3. AGENDA

Recovery Potential Assessment – Lilliput

Regional Peer Review Meeting – Central and Arctic Region

Location: Canadian Centre for Inland Waters

867 Lakeshore Road, Burlington, ON

and on WebEx

Chairpersons: Lynn Bouvier and Todd Morris

Tuesday, September 24, 2013		**Presenter**
9:00 am	Welcome and Introductions	Todd Morris
	Purpose of Meeting	Todd Morris
	Species Description	Lynn Bouvier
	Population Status	Lynn Bouvier
	Habitat requirements	Lynn Bouvier
	Functions, Features and Attributes Table	Lynn Bouvier
	Population Sensitivity to Perturbations	Jennifer Young
	Threat Status	Lynn Bouvier
	Review of Projects and Activities in Lilliput Habitat	Dave Balint
	Pathways of Effect & Non-Habitat Related Threats	Lynn Bouvier
	Sources of Uncertainty	Lynn Bouvier
	Review of Terms of Reference	Todd Morris
5:00 pm	End of Day	