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Proceedings of the Zonal Recovery Potential Assessment of Hickorynut (*Obovaria olivaria*) in Canada

29-30 January 2013

Centre for Inland Waters, 867 Lakeshore Road, Burlington, ON

Chairpersons: Lynn Bouvier and Todd Morris

Editor: Lynn Bouvier

Fisheries and Oceans Canada
Great Lakes Laboratory for Fisheries and Aquatic Sciences
867 Lakeshore Rd.
Burlington ON L7R 4A6 Canada

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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 zonal Science peer-review meeting was held on 29-30 January 2013 in Burlington, Ontario. The purpose of the meeting was to assess the recovery potential of Hickorynut (*Obovaria olivaria*) 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) met in May 2011 and recommended that Hickorynut be designated Endangered. This was their first assessment of Hickorynut.

In support of listing recommendations for this species by the Minister, DFO Science was asked to undertake a Recovery Potential Assessment (RPA). 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 the Species at Risk Act (SARA). The advice generated via this process will also update and/or consolidate any existing advice regarding this species.

This report will be published in the Canadian Science Advisory Secretariat (CSAS) Proceedings Series on the CSAS website. The working papers presented at the workshop will be published in the form of CSAS Research Documents. The advice from the meeting will be published as a CSAS Science Advisory Report.

Compte rendu de l'évaluation du potentiel de rétablissement de l'obovarie olivâtre (*Obovaria olivaria*) au Canada

SOMMAIRE

Une réunion zonale d'examen scientifique par les pairs s'est tenue les 29 et 30 janvier 2013 à Burlington, en Ontario. L'objectif de cette réunion était d'évaluer le potentiel de rétablissement de l'obovarie olivâtre (*Obovaria olivaria*) d'après les 27 étapes présentées dans le cadre national de Pêches et Océans Canada (MPO). Le Comité sur la situation des espèces en péril au Canada (COSEPAC) s'est réuni en mai 2011 et a recommandé que l'obovarie olivâtre soit désignée comme étant en voie de disparition. Il s'agissait de la première évaluation de l'obovarie olivâtre par le comité.

Pour appuyer les recommandations en matière d'inscription de cette espèce par le ministre, on a demandé au secteur des Sciences d'effectuer une évaluation du potentiel de rétablissement (EPR). L'avis donné dans l'EPR peut servir à informer sur les aspects scientifiques et socioéconomiques de la décision relative à l'inscription à la liste, de même qu'à élaborer un programme de rétablissement et un plan d'action, ainsi que pour appuyer la prise de décisions en ce qui concerne la délivrance de permis, les accords et les conditions connexes, conformément aux articles 73, 74, 75, 77 et 78 de la *Loi sur les espèces en péril* (LEP). L'avis découlant de ce processus permettra également de mettre à jour ou de consolider les avis déjà formulés

Ce rapport sera publié dans la série des comptes rendus du Secrétariat canadien de consultation scientifique (SCCS), sur son site Web. Les documents de travail présentés lors de l'atelier seront publiés sous la forme de documents de recherche du SCCS. L'avis découlant de la réunion sera publié en tant qu'avis scientifique du SCCS.

INTRODUCTION

In May 2011, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Hickorynut (*Obovaria olivaria*) as Endangered. The reason for the designation was as follows: This freshwater mussel lives in mid-sized to large rivers in southern Ontario and Quebec. There has been an historical decline in the species' distribution with losses of the populations in the Detroit and Niagara rivers. Other locations are threatened by the continuing invasion of dreissenid mussels. In addition, the one known host of this mussel, the Lake Sturgeon (*Acipenser fulvescens*), has been listed as Threatened by COSEWIC, and may be declining in some locations where the mussel is known to still occur. The species is also affected by degraded water quality in many freshwater systems in southern Ontario and Quebec.

This was COSEWIC's first assessment of Hickorynut. Hickorynut was also listed as Endangered under Ontario's *Endangered Species Act, 2007* in January 2012.

The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to assess the recovery potential of Hickorynut in support of listing recommendations by the Minister for the Species at Risk Act (SARA). 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 (DFO 2007a, b). The current state of knowledge of habitat requirements, threats to both habitat and Hickorynut, and measures to mitigate these impacts is included in the Science Advisory Report. A peer-review meeting was held at the Centre for Inland Waters, Burlington, Ontario, on 29-30 January 2013 to discuss the Hickorynut RPA.

Meeting participants included Fisheries and Oceans Canada, Ministère des Ressources naturelles et de la Faune du Québec, the Ontario Ministry of Natural Resources, the University of Guelph, the Canadian Museum of Nature, Central Michigan University and Bishops Mills Natural History Centre (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 documents. The Research Documents (Bouvier and Morris 2013, Young and Koops 2013) provide information on the working papers presented at the workshop; the Science Advisory Report summarizes the current understanding of the distribution and habitat requirements of this species, along with recovery targets and times to recovery, while considering various management scenario (DFO 2013).

DISCUSSION

The meeting co-chair provided the participants with an introduction to the Science Advisory and SARA listing process. He explained how the RPA would be used, as well as the objectives of the meeting. Two working research documents were developed by DFO and were provided to participants in advance of the meeting. The draft research documents were the basis for discussion and 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 a description of Hickorynut; descriptions of three similar species: Round Hickorynut (*Obovaria subrotunda*), Round Pigtoe (*Pleurobema sintoxia*), and Mucket (*Actiononaias ligamentina*); and Hickorynut adult age, diet and distribution across North America.

In the discussion of diet, a participant noted that Hickorynut may be deposit feeders, as they have cilia on their feet to direct particles towards their mouths. No other information was added to the presentation.

POPULATION STATUS

Presenter: Lynn Bouvier

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

There was some discussion around differentiating between populations. The presenter posed the question of whether or not groups found in different locations are genetically different, and if not, whether or not host fish can move between locations. The participants confirmed that there was no existing genetic information on Hickorynut, so the discussion focused on barriers to the movement of the host fish, specifically Lake Sturgeon (*Acipenser fulvescens*), in the water bodies discussed in the presentation. No changes were made to the designation of populations.

In the discussion of the Ottawa River, the presenter noted that it was highlighted in the report that more diving surveys were needed in the Ottawa River. It was decided that a map of the sampling efforts for the Ottawa River would be created.

It was noted that dams were missing from the maps in the presentation, and that their inclusion would be helpful. The presenter agreed to add dams to the local river-specific maps.

A participant noted that there was a need for deliberate surveys for Hickorynut, and that the information provided in the presentation did not necessarily represent the true species distribution. The presenter agreed to add text to the report about the lack of deeper water sampling for Hickorynut, and also to indicate that the maps were not meant to represent distribution, but only the recorded samples of the species. However, the maps do represent the current known distribution of the species based on all records collected to date.

In the discussion of the St. Lawrence River, the presenter noted that, until recently, not many live specimens had been collected in the area. Sampling difficulties, including limited time due to tidal water fluctuations, resulted in limited size information. A participant offered to measure Hickorynut shells from museum collections.

During the review of population abundance and trajectory a participant asked how relative abundances were decided on. The presenter responded that they were based on the relative numbers of live individuals recorded, adding that it was difficult to decide on rankings. After some discussion it was decided that the abundance rankings would stay the same, with a note added to the text that explained that the rankings were based on only a few records. Another participant reminded the group of an article that discussed sampling in the Ottawa River. It was agreed that the article would be double-checked for information that might assist with the assessment of Hickorynut.

HABITAT REQUIREMENTS

Presenter: Lynn Bouvier

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

In the review of adult habitat requirements the question of preferred water depth arose. The presenter noted that the depths recorded for the St. Lawrence were taken at low tide, making it hard to quantify the true depth range in which Hickorynut are found. A participant noted that the reports used by Science give the depths of the water when the samples are collected; they may not be the depths at which Hickorynut actually occur. It was stressed that the differentiation needed to be made clear in the report and recorded under the sources of uncertainty section of the research document.

Another participant suggested including the tidal range after the depth of the water at the time of sampling. A note was made to look into tidal records for this purpose.

Hickorynut habitat descriptions were broken down into three categories: functions, features and attributes. The presenter explained that these categories were based on terminology that was specific to the recovery strategy. Due to a lack of information on Hickorynut spawning and fertilization, these stages were listed as having the same habitat requirements as adult Hickorynut.

There was some discussion around habitat requirements during the glochidial stage of the life cycle. A participant emphasized that the physical features of the habitat do not matter at this stage if a host fish is not present. Another participant added that the glochidial stage is really about Hickorynut development because it is solely absorbing food from the host. As a result it was decided to remove the terms “feeding” and “nursery” that had been listed under the functions of glochidial habitat and list only “development” in this category.

There was considerable discussion surrounding the quantity and quality of host fish required by Hickorynut for the glochidial life stage. A participant emphasized that Lake Sturgeon must be present in the habitat at the right time and in the right condition in terms of age, health and immunity. A discussion of possible sampling options followed; ultimately, it was decided that questions of quantity and quality of host fish would be elaborated on in the text of the research document.

A participant asked if juveniles should be separated from adults in the functions, features and attributes table. Another responded that there was not sufficient data to warrant a division at that time.

The question of how to incorporate water flow into the table was discussed at length. A participant asked if a macroscopic measure of the Ottawa River existed in order to calculate the current. Another responded that they could ask if SCUBA divers recorded this information. The participants debated how best to account for flow in the document and decided to add a reference to it under the “Feature(s)” column of the table and expand on the topic in the text.

RECOVERY POTENTIAL MODELING

Presenter: Jennifer Young

The presentation on recovery potential modeling included the presentation of the Hickorynut life cycle model; host-parasite dynamics model; the sensitivity of growth rate and abundance (using both a host-independent and a host-dependent model); and population trajectories. It also

addressed recovery targets, uncertainties and knowledge gaps, allowable chronic and transient harm and the science advice on allowable harm.

The presenter noted that normally modeling would be used to calculate minimum viable population and allowable harm. With so little information about Hickorynut available, such calculations would be misleading at that time.

There was some conversation around glochidia attachment to the host fish. The presenter noted that there was a need to define how many hosts were required by Hickorynut. The modeling presentation highlighted knowledge gaps where both host and mussel abundances were concerned.

During the discussion that followed the presentation a participant raised the question of whether or not there was a direct correlation between Hickorynut abundance and the presence of juvenile Lake Sturgeon in the water body. The modeling and research suggested that there was. The participant noted that there was commercial fishing for Lake Sturgeon in Quebec, which was a problem for Hickorynut, and added that this correlation could provide some direction for mitigation. It was then proposed that Science compare rates of infection by Hickorynut glochidia in different life stages of the Lake Sturgeon.

REVIEW OF THREATS

Presenter: Lynn Bouvier

The presenter reviewed threats to the Hickorynut populations in Canada. In the discussion of contaminants and toxic substances a participant noted the adverse effect of copper on freshwater mussels, adding that there was contamination from an old mine in the upper Saint-François River. The presenter agreed to look into the subject.

Another participant noted that a colleague's work on chlorides had not been referenced in the document; the presenter agreed to add it.

In the review of turbidity and sediment loading a participant raised the issue of urban runoff. Another participant suggested that Science contact the Ottawa Riverkeepers for water readings. A third participant noted that the Ministry of the Environment (MOE) collected some of that data in its water quality studies. The presenter had searched for it without success, but agreed to search again. She also agreed with the proposal to contact the Ottawa Riverkeepers.

During the discussion of habitat removal and alteration a participant noted that dredging would be harmful to Hickorynut. Some steps had been taken already to try to protect the species; however, another participant noted that they had never been consulted about dredging associated with marinas, which could also impact Hickorynut. The presenter agreed to add the subject to the research document.

In the review of climate change a participant added that ice scouring in the St. Lawrence erodes Hickorynut habitat. While ice scouring occurs naturally, the fluctuation seen over the past year indicated increased movement of ice as a result of climate change. The presenter agreed to add this information to the research document, with a caveat that although this threat is naturally occurring, the cause of its increase in occurrence and magnitude may be related to climate change.

THREAT LEVEL ASSESSMENT

Presenter: Lynn Bouvier

The presentation also covered 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.

Mississagi River

The participants first discussed threats to Hickorynut in the Mississagi River.

In the review of the threat of invasive species a participant asked about calcium levels in the river, noting that they would directly influence whether or not dreissenid mussels could invade the area. Another participant offered to consult MOE data and follow up on calcium levels in the Mississagi.

In the discussion of host fish a participant asked if there were fewer Lake Sturgeon in this river. The presenter had found no information on this subject; another participant offered to look up the population status of Lake Sturgeon in the Mississagi. A conversation about subsistence fishing followed: there had been one instance of exploitation of Lake Sturgeon in the Mississagi River in the last ten years; however, there was still the potential for subsistence fishing. As a result, it was decided that the TLH would be changed from K to L.

The impact of threats to the host fish was then reviewed. It was agreed that, because the Lake Sturgeon population was stable and not overly abundant, it had the potential to be a limiting factor for Hickorynut population. The TI was changed from H to M.

A review of contaminants and toxic substances followed. Because there was not a lot of development in the area, the TI of contaminants was lowered from M to L.

In the discussion of nutrient loading the presenter explained that the vast majority of the area was forested, and that there was no agriculture. It was agreed that, if nutrient loading were to occur, the impact would be low. The TI was changed from M to L as a result. The same change was then made to the TI of turbidity and sediment loading.

In the review of habitat removal and alteration a participant noted that low water levels could lead to dredging in the river. However, the impact of such activity would not be high. The TI was changed from H to M as a result.

The discussion of altered flow regimes concluded the review of the Mississagi River. In it a participant noted that there were at least four dams upstream; however, it was likely that the impact of the dams was mediated at lower stream sections of the river. The TI of altered flow regimes was consequently changed from H to L.

Ottawa River

The threat level assessment of the Ottawa River followed. In the review of invasive species the presenter noted that Zebra and Quagga mussels were known to exist in the river, but not in high abundances. The calcium levels in the river indicated that the other mussels would not pose a significant threat to Hickorynut. The TI was therefore changed from H to L.

No changes were made to the assessment of host fish.

A conversation about contaminants in the Ottawa River followed. A participant stated that the City of Ottawa releases sewage directly into river; however, they added that they did not know any details about the effluence and that this is common practice for cities. It was agreed that a note about urban inputs would be added to the text under the “nutrient” and “contaminant” sections.

The impacts of agriculture, mining and city practices were discussed. The participants agreed that, while there were contaminants entering the river, the size of the water body was so large that it would mitigate their impact. The TI of contaminants and toxic substances was therefore changed from M to L.

Nutrient loading was the next topic of discussion. A participant suggested looking at the number of sewage treatment plants in the area, adding that secondary treatment is required to remove phosphorous and tertiary treatment to remove nitrogen. The presenter responded that few plants in the area have tertiary treatment. The participant then said that would raise the TLH of nutrient loading to K.

The TI was also discussed. The participants decided that, because Hickorynut were found in waters with significant nutrient loading, the TI of L would be left alone; however, the practices of local treatment plants would be explored further and the assessment would be changed if necessary. Some text about urbanization would also be added to the research document.

In the review of turbidity and sediment loading the participants agreed that there did not seem to be much sediment loading in the river and that it would not affect the Hickorynut population. The TLH was therefore changed from L to U.

Habitat removal and alteration was the next topic of discussion. The participants discussed several upcoming projects and ultimately decided that, based on the project reviews, much of the work would be considered low risk and could be mitigated, and the work that was higher risk affected only small areas of the river. The TI was therefore changed from H to L.

The assessment of altered flow regimes remained unchanged with a TLH of K and a TI of H.

St. Lawrence River

The next water body discussed was the St. Lawrence River. The assessment of invasive species was not changed, nor was the assessment of host fish. However, this topic generated some conversation. A participant noted that the St. Lawrence River was considered to have one of the healthier populations of Lake Sturgeon and asked whether or not that fact would affect the assessment of the TI as H. Another responded that the TI was listed as H because a rise in fishing would jeopardize Hickorynut. The presenter added that a threat to the host fish was the only threat that they knew would have a direct impact on the mussel, and so the TI for host fish was listed as H for each water body. Another participant noted a knowledge gap: if Science knew how many Lake Sturgeon were needed to support a mussel population, then they could assume that, if the Lake Sturgeon population was large, fluctuations would not affect mussels. However, that information was not known. The participant added that, if the host fish population was small, they could assume that affecting the fish would affect Hickorynut.

In the discussion of contaminants and toxic substances a participant mentioned that Environment Canada had found that effluent from Montreal was causing the feminization of mussels. However, the assessment of TLH of L and TI of L remained unchanged.

In the review of nutrient loading and toxic substances a participant noted that agricultural land could have a significant impact on Hickorynut. Another added that, compared to the Ottawa River, the agricultural land was more widespread. The TI was then changed from L to M.

During the discussion of habitat removal and alteration a participant noted that Science did not know if certain projects in the St. Lawrence were going ahead. The presenter offered to pull information from a document provided by one of the participants to show that these development projects were known to occur. Some text would also be added to the research document based on the participant's report.

No changes were made to the assessment of altered flow regimes.

Saint-François River

The last water body discussed was the Saint-François River. The participants reviewed the assessment of invasive species. Dreissenid mussels were not present in the river; however, a reservoir upstream from the current Hickorynut distribution was used for recreational activity and it was likely that, if Zebra Mussels were introduced, they would survive. The TLH was therefore changed from U to L.

All other assessments remained unchanged. The presenter noted that she would see if the Zebra Mussel risk assessment was complete so that it might inform the revisions to the research document.

PROJECTS AND ACTIVITIES

Presenter: Dave Balint

The review of projects and activities in Hickorynut habitat gave all work, projects and activities that took place from 2009-2011. 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.

Feasible mitigation methods were discussed by the group. Options included a relocation program, water regulation for power facilities, flow operating regimes and requirements on dredging. No conclusions were reached at this time.

Future projects in Hickorynut habitat were discussed, as well. A container terminal for the Port of Montréal was raised. It was unclear at that time whether or not the port was habitat for Hickorynut; however, a request had been made for a survey of another species at risk in the area. The participant stated that, if the habitat needed to be protected, a request could be made to modify the project so that it had a lower impact on the species, adding that it may not be possible to move the project to another location.

Other future projects included a proposed hydro development upstream from Nippissing, a bridge at Kettle Island and a tunnel on Montréal Island. A participant also noted that the Saint-François pipeline went under the river. Another responded that crossing beneath a river creates the potential for frack-out and would be a potential threat. Whether or not these projects would affect the population trajectory of Hickorynut was outside the participants' realm of knowledge.

The presenter asked whether the participants felt that the number and scale of projects was likely to change over the next 5 years, or 10 years. The group agreed that dredging would be the main activity that would increase. Two participants recalled experiences where citizens had been unable to distinguish Zebra Mussel from native mussels. A participant volunteered to write a letter to stream clean-up groups about the need to differentiate between Zebra Mussel and native species.

PATHWAYS OF EFFECT

Presenter: Lynn Bouvier

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

The public awareness campaign mentioned at the end of the previous section was added to the list of feasible mitigation methods. A participant proposed quantitative evaluations of calcium levels in the waters to determine Zebra Mussel potential for invasion and establishment. Two participants offered data on pH and calcium levels, which the presenter would include in the "threat" section of the text.

A participant noted that Hickorynut were not mentioned in the recovery plan for Lake Sturgeon. A note was made to inform the Lake Sturgeon recovery teams at the provincial and federal levels that Hickorynut should be considered. Participants also noted that invasive species may affect the host fish, particularly Round Goby (*Neogobius melanostomus*) and Sea Lamprey (*Petromyzon marinus*). This point and an accompanying note were added to the research document.

Participants proposed a seasonal restriction on Lake Sturgeon fishing to protect Hickorynut glochidia. This item was moved from the list of alternatives to the list of mitigations in the document.

A participant mentioned that there were indications of increasing Lake Sturgeon populations in some areas and added that Science needed quantitative surveys of Hickorynut to see if increases in the host fish population affected the mussel. The presenter responded that this type of survey was being conducted at Grondines. No changes were made to the research document.

SOURCES OF UNCERTAINTY

Presenter: Lynn Bouvier

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

In the review of population structure a participant noted that Science needed to be more specific about quantitative sampling, adding that divers may have a hard time identifying juveniles. A note was made to add detailed requirements to the research document.

Another participant noted that the Mattawa River, Lake Nippissing and the French River had not been sampled because they were hard to access. A note was made to discuss other techniques for effectively surveying deep water. Brail was one sampling method mentioned; a participant agreed to send a document by the U.S. Fish and Wildlife Service (USFWS) outlining how to make it.

A participant asked if it would be helpful to age the shells they currently had in their possession. The presenter responded in the affirmative, adding that they were missing age structure in the Hickorynut model and needed data. This suggestion was added to the sources of uncertainty.

Another participant mentioned that it may be helpful to add an educational fact sheet to send as part of their outreach efforts. This addition would be discussed in "sources of uncertainty" under the heading of "habitat."

The discussion of sources of uncertainty surrounding habitat led to a conversation about host fish. A participant emphasized the need to determine whether or not Lake Sturgeon was the

only host available to Hickorynut. The presenter added that studies had been conducted in the U.S., but not in Canada.

A participant emphasized the need to understand the effects of water variation and changes to flow regime on Hickorynut. A note on the importance of natural flow regime would be added to the research document.

In the review of recovery potential modeling a note was made to list the specifics of the life history parameters that needed to be filled in in the model. Those specifics included age at maturity and age and growth estimates. A participant suggested determining the ages of fresh shells in order to get an idea of generation time; they emphasized that age was one of the most important factors in building a population-based model.

Sources of uncertainty related to threats were the final topic of discussion. A participant suggested expanding the point on the threat of invasive species to Hickorynut to include the threat of invasive species to Lake Sturgeon (specifically Round Goby). Another participant found the wording of the second point unclear; it was changed to “quantitative analyses of threats to mussel populations.”

No further changes were recommended by the participants.

REVIEW OF TERMS OF REFERENCE

Presenter: Todd Morris

The terms of reference included assessing Hickorynut 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 addressed the number of Hickorynut populations; however, due to limited information on abundance, they were only able to discuss the range of populations to a certain extent.

2. Evaluate recent species trajectory for abundance (i.e., numbers and biomass focusing on mature individuals) and range and number of populations.

- The participants were not able to discuss this topic 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, 2011).

- The participants could not meet this requirement due to a lack of quantitative information.
- The established objective, then, was to maintain the current distribution and aim for a healthy population showing recruitment and turnover.

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 2007a) 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.

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.
- The presenter noted that the group touched on other north shore tributaries and other water bodies worthy of investigation; however, those water bodies were not mapped.

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 Hickorynut 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 inclusion of dams on the population distribution maps (requested during the discussion of population status) should fulfill this requirement. A note was made to include natural barriers on the maps, as well.

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 not able to satisfy this requirement due to a lack of information.

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 mortality rates and direct threats to Hickorynut were unknown.

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 review 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 review of pathways of effect.

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).

- Because the participants could not quantify the life history parameters, they could not fulfill this requirement at this time.

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 could not fully meet this requirement due to a lack of information about mortality rates. However, they agreed that there was an assumption that mitigations and alternatives would not have residual impacts, and that this assumption could be tested.

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.

- Because the participants did not have the necessary parameter values, they could not fulfill this requirement at this time.

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 partly able to fulfill this requirement during the presentation on recovery potential modeling.
- The knowledge gaps were identified in the presentation, and the group agreed that they could gather information that they needed through consultation. They could also draw from an existing consultation on Lake Sturgeon.

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

- The participants were unable to fulfill this requirement due to a lack of information.

The author stated that she would modify the documents from the meeting in accordance with the group's comments. The participants would review the changes before the final draft was submitted.

REFERENCES CITED

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Young, J.A.M., and Koops, M.A. 2013. Recovery potential modelling of Hickorynut (*Obvovaria olivaria*) in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/022. iv + 14 p.

APPENDIX 1. TERMS OF REFERENCE

Recovery Potential Assessment of Hickorynut (*Obovaria olivaria*)

Zonal Peer Review Meeting – Central and Arctic, and Québec Regions

January 29-30, 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 Hickorynut, 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 2011 and recommended that Hickorynut be designated Endangered. This was their first assessment of Hickorynut.

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 Hickorynut (*Obovaria olivaria*).

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
- Two Research Documents

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
- Ministère des Ressources naturelles et de la Faune du Québec
- Academics
- Canadian Museum of Nature
- Other invited experts

References

COSEWIC. 2011. COSEWIC assessment and status report on the Hickorynut *Obovaria olivaria* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 46 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.

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APPENDIX 2. MEETING PARTICIPANTS

Hickorynut (*Obovaria olivaria)* Recovery Potential Assessment

Zonal Advisory Meeting – Central and Arctic and Québec Regions

Burlington, ON

29-30 January 2013

LIST OF CONFIRMED PARTICIPANTS

Last Name	First Name	Affiliation
Adam	Jeff	Fisheries and Oceans Canada
Balint	Dave	Fisheries and Oceans Canada
Bouvier	Lynn	Fisheries and Oceans Canada
Cyr	Charley	Pêches et Oceans Canada
Desrosiers	Nathalie	Ministère des Ressources naturelles et de la Faune du Québec
Dunn	Shelley	Fisheries and Oceans Canada
Gibson	Scott	Ontario Ministry of Natural Resources
Hardy	Daniel	Pêches et Oceans Canada
Koops	Marten	Fisheries and Oceans Canada
Mackie	Gerry	University of Guelph Emeritus
Madill	Jacqueline	Canadian Museum of Nature
Morris	Todd	Fisheries and Oceans Canada
Paquet	Annie	Ministère des Ressources naturelles et de la Faune du Québec
Schueler	Fred	Bishops Mills Natural History Centre
Young	Jen	Fisheries and Oceans Canada
Zanatta	Dave	Central Michigan University
Support		
Michaud	Wendy	Note taker
Caron	Joseph	Interpreter - Day 1
Farley	Sandra	Interpreter - Day 1
Bickford	Brian	Interpreter - Day 2
Gagnon	Elizabeth	Interpreter - Day 2

APPENDIX 3. AGENDA

Recovery Potential Assessment – Hickorynut

Zonal Peer Review Meeting – Central and Arctic and Québec Regions

Location: South Seminar Room, Canadian Centre for Inland Waters

867 Lakeshore Road, Burlington, ON

Date: 29-30 January 2013

Chairpersons: Lynn Bouvier and Todd Morris

Day 1		**Presenter**
9:00	Welcome and Introductions	Todd Morris
	Purpose of Meeting	Todd Morris
	Species Description	Lynn Bouvier
	Population Status Assessment	Lynn Bouvier
	Habitat Requirements	Lynn Bouvier
	Functions, Features and Attributes Table	Lynn Bouvier
	Recovery Potential Modeling	Jennifer Young
5:00	End of day	
Day 2		**Presenter**
9:00	Threat Level Assessment	Lynn Bouvier
	Projects and Activities	Dave Balint
	Pathways of Effect	Lynn Bouvier
	Sources of Uncertainty	Lynn Bouvier
	Review of Terms of Reference	Todd Morris
	Wrap-Up	Todd Morris
5:00	End of day	