Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

C S A S | ***S C C S***

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Proceedings Series 2007/010 | **Compte rendu 2007/010**

Review of the protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA)

Examen du protocole pour la détection et la relocalisation des espèces de moules d'eau douce en péril dans la région des Grands Lacs de l'Ontario (RGLO)

Canada Centre for Inland Waters
Burlington, ON
May 11th, 2007

Centre canadien des eaux intérieures
Burlington (Ont.)
Le 11 mai 2007

K. Martin and T. Morris

K. Martin et T. Morris

Fisheries and Oceans Canada / Pêches et Océans Canada
501 University Crescent
Winnipeg, MB
R3T 2N6

September 2007

septembre 2007

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d’analyses ou d’interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d’indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l’information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

Review of the protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA)

Examen du protocole pour la détection et la relocalisation des espèces de moules d'eau douce en péril dans la région des Grands Lacs de l'Ontario (RGLO)

Canada Centre for Inland Waters
Burlington, ON
May 11th, 2007

Centre canadien des eaux intérieures
Burlington (Ont.)
Le 11 mai 2007

K. Martin and T. Morris

K. Martin et T. Morris

Fisheries and Oceans Canada / Pêches et Océans Canada
501 University Crescent
Winnipeg, MB
R3T 2N6

September 2007

septembre / 2007

ISSN 1701-1272 (Printed / Imprimé)

Published and available free from:
Une publication gratuite de :

Fisheries and Oceans Canada / Pêches et Océans Canada
Canadian Science Advisory Secretariat / Secrétariat canadien de consultation scientifique
200, rue Kent Street
Ottawa, Ontario
K1A 0E6

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

CSAS@DFO-MPO.GC.CA

Printed on recycled paper.
Imprimé sur papier recyclé.

Correct citation for this publication:
On doit citer cette publication comme suit :

DFO, 2007. Review of the protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA), 11 May 2007. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/010.

TABLE OF CONTENTS

SUMMARY

A peer review meeting was held at the Canada Centre for Inland Waters in Burlington, Ontario on May 11th, 2007 to discuss the protocol for the detection and relocation of freshwater mussel species at risk (SAR) in Ontario Great Lakes Area. Participants from Fisheries and Oceans Canada (DFO) Science and Habitat Management, Environment Canada, Lakehead, Trent and North Carolina State University, and Universities of Guelph and Toronto participated in the peer review of the document.

The purpose of the meeting was to ensure a sound scientific basis for the mussel protocol. The protocol provides guidance and standardized methodology on conducting a field survey to detect the presence of mussel SAR, undertaking relocation of mussels and monitoring the effectiveness of the relocation. The protocol is intended to ensure the prohibitions on killing, harming, and harassing mussel species designated as extirpated, endangered or threatened under SARA are not violated by activities occurring in the province.

The proceedings will be published on the Canadian Science Advisory website. The protocol will be published as a Canadian Manuscript Report of Fisheries and Aquatic Sciences (Mackie *et al*., 2007).

SOMMAIRE

Le 11 mai 2007, une réunion d'examen par des pairs a eu lieu au Centre canadien des eaux intérieures, à Burlington en Ontario, réunion au cours de la quelle nous avons discuté du protocole relatif à la détection et à la relocalisation des espèces de moule d'eau douce en péril dans la région des Grands Lacs de l'Ontario. Les personnes qui ont pris part à cet examen par des pairs provenaient du secteur des Sciences de Pêches et Océans Canada (MPO) et de Gestion de l'habitat d'Environnement Canada ainsi que de l'université Lakehead, de la North Carolina State University, de l'université de Guelph et de l'université de Toronto.

Le but de la réunion était de vérifier la solidité du fondement scientifique du protocole sur les moules. Ce protocole donne des orientations et établit une méthodologie normalisée pour les relevés de terrain qui servent à détecter la présence d'espèces de moules en péril, à entreprendre la relocalisation des moules et à assurer un suivi de l'efficacité de la relocalisation. Le protocole fait en sorte que toute activité menée dans la province doit respecter les interdictions de tuer un individu d'une espèce de moule inscrite comme espèce disparue du pays, en voie de disparition ou menacée, de lui nuire et de le harceler, tel que le prévoit la LEP.

Le compte rendu sera publié sur le site Web du Secrétariat canadien de consultation scientifique. Le protocole sera publié en tant que de rapport manuscrit canadien des sciences halieutiques et aquatiques (Mackie *et al*., 2007).

INTRODUCTION

A peer review meeting was held at the Canada Centre for Inland Waters in Burlington, Ontario on May 11th, 2007 to discuss the protocol for the detection and relocation of freshwater mussel species at risk (SAR) in Ontario Great Lakes Area. This document has been developed by the authors, Gerry Mackie, Todd Morris and Debbie Ming over the past year and half. Once finalized, it will likely become an important tool for use in southern Ontario.

Participants from Fisheries and Oceans Canada (DFO) Science and Habitat Management, Environment Canada, Lakehead, Trent and North Carolina State University, and Universities of Guelph and Toronto participated in the peer review. The meeting participants were invited to review the document because of their knowledge of freshwater mussel species and their experience working with these animals. Participants were asked to provide editorial comments on the manuscript to be incorporated into the text and to point out any relevant references that had been missed from the document. The main focus of the meeting, however, was to ensure a sound scientific basis for the protocol.

The proceedings, with key points, will be available following the meeting and the protocol document will be prepared as a Research Document and published on the Canadian Science Advisory website. Terms of reference for the meeting (Appendix 1) were made available to participants (Appendix 2) prior to the meeting.

BACKGROUND

Fisheries and Oceans Canada is responsible for all aquatic species as defined in the *Fisheries Act* except those located in National Parks. DFO is also responsible for the protection of fish and fish habitat under the *Fisheries Act*. The *Species at Risk Act* (SARA) came into force on June 4th, 2003. DFO Habitat Management is responsible for the protection and enforcement provisions (Sect. 32, 33 and 58) under SARA. These sections of SARA contain prohibitions against killing, harming or harassing listed aquatic species at risk (Sect. 32), damaging or destroying residence (Sect. 33) and destroying critical habitat (Sect. 58).

The protocol is intended to help Habitat Management determine the best way to handle projects for which DFO has regulatory responsibility under the *Fisheries Act* and SARA and which may impact mussel species at risk (SAR) in Ontario. It specifically deals with how to ensure the prohibitions on killing, harming, and harassing species (Sect. 32) designated as extirpated, endangered or threatened under SARA are not violated by activities occurring in the province. The focus for the mussel species at risk is currently southwestern Ontario and into the eastern end of Lake Ontario and the protocol was written to address issues in this area. Habitat management has had to integrate the SARA into existing referral review processes under the *Fisheries Act*. DFO Science and Habitat Management began to develop a mapping tool in 2003 to locate species at risk within the province. Determining where the species at risk are located is the first step in the review process of a development project proposed in and around water. The protocol touches on the existence of the mapping tool with the first step in the decision tree at the start of the document. The mapping tool exists as an intranet screening tool for Habitat Management and it is published and distributed annually as a paper atlas to all Conservation Authorities, Ontario Ministry of Transportation, Ministry of Natural Resources and Parks Canada agency. The maps do not

give point locations nor are they species specific but they are colour coded to indicate where there are Schedule 1 listed extirpated, endangered and threatened species (red segments), where species which have been assessed by COSEWIC but not yet added to Schedule 1 are found (orange segments), and species designated as special concern (purple areas). The red areas are the river segments where prohibitions directly apply. If a project occurs in either red or orange coloured segments, there are species at risk issues which need to be considered and for which the protocol may come into play.

When a project is scoped out using the mapping tool, there are a number of options depending on whether or not it is located within a red zone. If it is outside a red zone, the project may be allowed to proceed without species at risk concerns and would therefore not involve the use the protocol. In some cases however, survey work may be required, either because the area has not been surveyed previously or because there is some information indicating further assessment may be required before proceeding at that site. Another option is to assume that species at risk are present and proceed as if this were the case.

Projects invoking the protocol would be those that do fall within a red zone on the map. For these projects the options, in order from a science perspective, are to not proceed with the project, to relocate the project, to redesign the project so it doesn't impact the species at risk or to mitigate impacts of the project. The option of mitigation would invoke the use of the protocol and relocation is one of the mitigation techniques that can be used in some situations.

The purpose of the protocol document is to provide guidance and standardized methodology on conducting a mussel field survey to detect the presence of mussel species at risk, undertaking relocation of mussels and monitoring the effectiveness of the relocation.

REVIEW AND DISCUSSION

The protocol document is divided into four main sections; survey/sampling, relocating, monitoring and SARA permitting. The section which deals with evaluating the need and applying for a SARA permit is included as guidance for the proponents and is not being reviewed at this meeting as the process is well established.

The flowchart illustrates the course of action to deal with projects which may impact mussels

- Include deliverables

Comment: The document as a whole would benefit with more citations to back up the message. It should also have a clear statement in each section of the rationale for what we are expecting and the take home message.

- Clarify the rationale and expectations for each section. Include relevant citations to support statements.

<u>Is a sampling program necessary?</u>
Comment: Sect. 2.0 states, "if a species at risk is known to occur within the study area, then sampling to demonstrate its presence is redundant, unless there is evidence that the species may have been extirpated since it was last captured". Who decides if a species becomes extirpated? Extirpation should either be removed in this statement or it should be made clear how this would be determined

- Consensus: Remove the part of the sentence dealing with extirpation.

Sampling/surveying to detect species at risk

A survey to detect the species at risk mussels will generally not be required if it is known that their distribution either includes or excludes the project site based on the mapping tool, if it can be determined, without conducting sampling, that there is a very low probability of the species occurring within the project site (e.g. based on habitat characteristics) or, even if present, there is a very low probability of the species being negatively impacted by the proposed activity. A survey may be required if the project is close to but not in a red zone or if there are downstream effects from the project that would impact a red zone or if there is anecdotal information suggesting their presence. One other situation that may require a survey is if the project is in a red zone but there is some evidence which raises the possibility that the species at risk mussels may not occur within the area of the project.

- Consensus: Remove the reference to study, research or science throughout the document when referring to projects.

- Consensus: If there are specific parts related to relocation then they should be moved to the relocation section.

Comment: Under probability of detection, high flow rates may trigger burrowing which may make it difficult to find mussels.

- Include the effects of high flow rates on mussel behaviour and detection probability in the protocol.

Comment: Delineation of the study area (Sections 4.2) includes information on how to characterize the site the mussels are found.

- Remove “For mussels” from the second paragraph.

Discussion: Zone of Influence (ZOI) is a calculation used by Habitat Management to assess the impact of the project. It is in the document in terms of the prescribed search area, the area of direct impacts and the buffer around that. The zone of influence would vary for different projects and is affected by the approaches taken. Habitat Management’s preference is to provide guidance but still allow some flexibility, however there is little flexibility in the definition as it is written. The Habitat biologist would determine the ZOI and provide this information to the proponent.

Comment: The document does not clearly define how the zone of influence and risk zone are determined and quantified. The description is very vague.

- Clarify how the ZOI is determined with an example. Emphasized that it is determined on a case-by-case basis by the Habitat biologist in charge of the project.

- Clarify that ZOI doesn’t refer to what is happening to the mussels, it refers to the effect that the project has on the physical habitat in the river.

- Clarify the zone of influence could also be on the upstream side.

Comment: The ZOI calculation is provided but is the flow accounted for? What about changes in width of the river for calculating the zone of influence because it can spatially change how much area and how much effort is needed for certain surveys? Ecologically flow may have an affect on what is happening upstream and downstream.

- Clarify that flow should be accounted for in the determination of ZOI.

Comment: Velocity measures in Table 1 don't make sense.

- Consensus: Remove the velocity measures from the table.

Comment: The section on water clarity doesn't tell you how to measure clarity although it was decided that the information would be useful for determining how long it would take to do the sampling.

- Option: The section should either be changed or moved.

<u>Qualitative and quantitative surveys</u>
Comment: Qualitative and quantitative are outlined in the document but the semi-quantitative isn't outline or described (i.e. there is no section on semi-quantitative).
There should be some effort into better defining or clarifying the semi-quantitative, quantitative survey and qualitative surveys. It is confusing both in terms of the definitions and what is expected. For example, "Timed-search surveys in known areas are considered semi-quantitative surveys because they combine qualitative (e.g., timed-search) and quantitative (e.g., known area) methods" uses timed search as both semi-quantitative and qualitative at the same time.

- Consensus: The document should cite Strayer and Smith. Use it as a lead in the document and add it to the list of references.

- Consensus: A section on semi-quantitative methods needs to be added.

Discussion: Smith's equation is included for determining the area or the effort required to detect species at risk. The four parameters included are population density, detectability, area to be searched and the probability of detection. The level of probability needs to be discussed (Sect. 4.3.4) and if it is 0.85, it would mean that there is an 85% likelihood of detecting a species if it is present at that site. The value 0.85 was given as an example but there needs to be some discussion about what that value should be and the basis for making that decision. Smith's equation will be used to tell a proponent that they have to survey "x" number of square meters to convince DFO that species at risk are not at the site. Surveying less than "x" is insufficient. Density may not be known from the site but can be estimated from nearby areas or a low conservative density for the species in question may be used. The detectability coefficient is associated with the methodology. DFO recommends quantitative excavation because the detectability coefficient approaches one. If a SAR is in the quadrat you would find it with this method. It is possible to use other methods with lower effort but then the detectability coefficient would have to be known. The lower the detectability value, the more effort needs to be expended to find the SAR. However, once the proponent finds a SAR they can stop surveying. It is important to understand that if the probability of detection is anything less than one there is some risk that a SAR will be missed. There are risks associated with missing SAR; the legal risk to our Minister and an

ecological risk to the species so we need to be conservative on both these counts. All agreed that the probability of detection would have to be high. Although we are requiring the undertaking of a quantitative assessment (quadrat excavation type assessment), it would be in the proponent's best interest to layer that initially with a time-search survey of the site that they are going to do the survey in. If one live individual is found then no further survey work would be necessary. The qualitative survey on its own is not sufficient to prove that the mussels are not there. Using a 95% probability would mean surveying about ¼ of the area.

- Consensus: The probability of detection should be 0.95. It is up to the proponent to prove that the SAR is absent and it is not up to DFO to demonstrate that it is present. Proving the absence is different then proving the presence of something. A probability of 95% is a standard statistical level used in most scientific studies.

- Consensus: It should be made clear in the document that, although 0.95 means that in some cases a large area needs to be searched, if the proponent does a quick visual search and a SAR is observed then a quantitative search is not required (i.e. lower total effort required). If a quantitative search is required and a SAR is found in the first quadrat then there is no need to continue the search.

Comment: It should be emphasized that quantitative surveys are only required if the project is located in a white zone (i.e. no SAR records) but evidence exists that SAR are likely present. A survey isn't necessary if the project is located in a red zone because it is known that SAR are present.

- Clarify when surveys are or are not required.

Comment: The layout of the procedure as it is not clear. The first step may be an initial detection (quick timed-search) survey of the site. If you find something with the less intensive timed-search you would then have satisfied the requirements of detection. If you do not find any species at risk mussels, then the next step would be the more rigorous survey approach. It is implied in the document but not clearly presented.

- Clarify the steps in undertaking surveys.

<u>Survey methodology</u>
Comment: There is no mention of snorkeling as a sampling method. Deep water gear is not mentioned, lead lines for scuba (50 m or more) weighted sieves, etc. It should be clear that there are other methods.

Discussion: In terms of methodology there are certain things that have to be done, such as excavation, to get to the juvenile level. They should be told that they have to do that but not how it has to be done. If someone has alternative methods that are defensible and that work, then those methods shouldn't be ruled out.

- Consensus: Limit the detail regarding methods used for mussel surveying; highlight some common ones used in Ontario but mention that other defensible methods may exist and may be used after discussion with DFO. Don't advocate specific methods focus on what they have to do.

Designing the Sampling Program

Comment: It is important to ensure that the timing is consistent throughout the document. There are two timing issues to discuss; one if you are undertaking a survey to see if SAR are at a site, and one if they are being relocated. This needs to be added to the document. Re-location surveys should happen such that you have time to do the one month monitoring survey after re-location; presence/absence surveys should happen well before the project begins. The discussion of timing included discussion of temperature. In the U.S. 61°F is used. There are several issues with temperature; detectability of the mussels, mortality and difficulty in moving the animals. Mussels should not be moved when air temperatures are near or below freezing. It should be clear that monitoring has to be at 15°C or above.

- Consensus: Timing should be given its own section.

- Consensus: A discussion on the timing of relocations should be at the very beginning of the relocation section and then referred to the monitoring section for more detail.

- Consensus: Surveys should occur in June through to September or when water temperatures are at least 15°C (include a citation for this in the document).

- Consensus: Relocations should occur from June to August because you need a buffer for the one month monitoring after relocation – this needs to be added to the relocation section i.e. Section 5.

Comment: It should be clear in the document that the detection survey and relocations are two separate things. The document needs to be clear that just because a survey is being undertaken does not mean that mussels are going to be relocated.

- Consensus: The document indicates that if you are doing a mussel survey this is how it's done; if you are relocating this is how it's done. Section 4 should be surveying; Section 5 should be relocation and they shouldn't be linked i.e. it shouldn't be assumed that relocation is going to happen.

Relocation of mussels

The discussion did not consider when relocation is permissible as a mitigation strategy. This would be determined by DFO on a project-by-project basis. Relocation may be an option if SARA listed mussels are present and the project can not be redesigned or relocated and if an allowable harm analysis indicates some harm is permissible for the species. There is always some possibility of harm associated with relocating these animals but it would be less than if the animals were not moved and the project proceeded. The goal of relocation is to collect all of the animals within an area and move them in a manner that will result in high survival of transplanted individuals and the resident fauna at the recipient site. There has to be some consideration of whether the relocation is adequate for them to survive. Have the resident population been put at risk? If relocation has taken place within a red zone there is potential for the relocation site to have both relocated and resident mussel species at risk.

Discussion: Where to relocate should be narrowed down. Although the intent was not to rule out the possibility of moving between drainages this may result in too many negative issues. The best approach is to relocate upstream or downstream within the same river segment although going beyond the same segment is not being prohibited. If you are moving mussels in a lake, they should stay in the lake. The best approach is to move as short a distance as possible. There are other issues to consider such as the presence of host species and the

time it would take to move the animals to the relocation site. Stressing the mussels could be an issue if the relocation site is too far away.

Comment: Moving mussels between drainages involves a number of issues including genetics, introduction of exotic or invasive species, etc. Genetics of relocations is not considered in the document. Moving water and mussels between drainages allows for introduction of exotic or invasive species and should be considered in the text. Quarantine may have to be considered.

- Consensus: Remove sentence (after heading 5.0) that mentions moving mussels among drainages. Relocations should occur as close as possible to the original site i.e. in the same river segment (or lake) to avoid issues with genetics and minimize risk of aquatic invasive species (AIS) issues. This needs to be explicitly stated. Indicating why the sites should be close (i.e. genetic similarity, host fish, AIS) should be included.

- Include the definition of the Prescribed Search Area (PSA), relocation site, and collection methods in the discussion of relocations.

- Include some mention of the host fish in the document somewhere as a vital factor in choosing a relocation site (relocation across a barrier may have host fish issues).

- Included mention that mussels should be relocated to areas with similar conditions including community structure whenever possible.

- Consensus: Keep the relocated site as close to the construction site as possible.

Comment: If a relocation site has no SAR present, that doesn't exclude it as a suitable relocation site but it would be preferable if SAR species were already present. Presence of SAR indicates presence of host fish, and suitable habitat. If there were no mussels (SAR or common species) at all at the site than it probably shouldn't be used as a relocation site.

- Clarify that not having SAR present doesn't exclude a site but that not having any mussels probably would.

Comment: There should be some mention of limiting the transfer of exotic species.

- Consensus: Add something about exotic species. If exotic or invasive species are observed or known from the area, care should be taken to limit their spread. (See G. Cope's paper).

Comment: Under the criteria for selecting a site, is there some level of variability that is acceptable to DFO? How is a relocation site determined as suitable? If the same habitat as the original site is not available, how is the relocation site determined and who decides if a relocation site is suitable? Need to clarify, if possible in the document, how to determine if a relocation site is suitable i.e. it is based on very similar habitat characteristics need and/or the expertise of the surveyor. There is paper by Hamilton *et al*. 1997 on the effects of habitat suitability on the survival of relocated freshwater mussels that is not included in the references

- Clarify the description of a relocation site, determining the suitability of a relocation site and the criteria for choosing a relocation site

- Consensus: Add the Hamilton *et al.* 1997 reference to the protocol.

Question: When is the relocation site chosen? Should there be a time-line mentioned?

- Clarify that a site survey is done before the project even begins and that includes a survey for a relocation site.

Comment: Should all mussels be relocated or just the species at risk mussels? If all are moved, do they all need to be tagged?

Discussion: Under SARA only the Schedule 1 mussels are of direct concern. The biological reason to move all the mussels is to keep the community characteristics similar at the relocation site, replicating their original habitat. If the mussels are all being dug up, most of the work is already done so they could easily be moved. It limits the need to worry about identification errors. Some of the mussels moved might end up being considered at risk in the future. Ultimately this is probably a policy decision.

- Consensus: Move all the mussels, tag and measure all SAR; measure all common species and tag a percentage of them.

Question: If mussels are collected at a certain density per area, why are they not relocated in the same density?

Discussion: There should be some discussion about how relocation happens. There have been studies that show that doubling or tripling densities have no effect on the mussels Doubling and tripling mussels into one area however may not provide optimal conditions. Research has shown that some species are distributed with one or two other species whereas others tend to be distributed in groups of as many as 12 species. There may be issue with changing the conditions.

Comment: Part of the purpose of the monitoring is to feed-back into what densities can be supported.

- Consensus: Look at available literature to see what the effects of increased density are on mussels.

- Consensus: Include a citation in the text for the statement about doubling or tripling densities.

- Consensus: The “Surveys to relocate mussels” section should be called “Mussel Relocation”.

Question: Why does the methodology indicate working in the downstream direction as you would always be working in murky water?

Discussion: Survey works better upstream but for relocating mussels, any that are dislodge but not collected are carried downstream and would be picked up as the sampler moved downstream (doubling up).

Coding mussels

Discussion: Researchers provided information on waterproof paper using a laser printer with a very small font. Individual numbers are printed on the paper and are cut out with paper hole-punch at the site. The tags can be glued to the valves with crazy glue or dental glue but care must be taken not to glue the valves closed. One person measures, one marks and one person records. In the relocations carried out to date, some of the mussels from the relocation site have been marked to allow assessment of impacts on them.

- Consensus: Tagging methods should be listed under the relocation section.

- Consensus: Add marking/tagging/coding methods to the coding section discussed as this is not generally available information e.g. tag both valves; using waterproof paper (e.g. Nalgene ® plastic paper) and crazy glue, making sure not to glue the valves shut. Hold mussel dorsal side down so that if the glue runs, it runs towards the hinge.

- Consensus: Tag and measure all SAR; tag a percentage of common species but measure all of them.

- Consensus: Tag a certain percentage of common species to increase the chances of being able to detect growth and survival at the relocation site. The percentage should be a minimum number that you would need to detect changes in survival/growth, etc. The percentage should come from the literature and be added to the documents.

- Consensus: The proponents need to report back the number of each species that were relocated (SAR and common species) and their individual lengths.

Measuring mussels

Comment: The photographs used to illustrate the length and width measurements may result in errors.

- Option: Either use a different species for the illustration (e.g. black sandshell) or have the length and width marked right in the picture so proponents know exactly where to measure on the mussel. “Maximum anterior posterior measure” should match with the arrows.

Discussion: There should be a section included in the document about the proper placement of mussels being relocated into the relocation substrate and how that decision is made, i.e. don’t just dump the bucket. Place individuals, by hand, anterior end down, back at the same depth and location from which they were collected. If individuals were collected at a time when they were displaying then they should be returned to an appropriate position (either burrowed or at the surface as appropriate for the species). Orient the mussels upstream/downstream as they were found. Excavate a hole and put them in rather than pushing them into the substrate.

- Consensus: Include a section between the measuring section and the respect section about the proper placement of mussels being relocated into the relocation substrate and how that decision is made.

Respect for mussels

Question: The minimum temperature should be changed to 15°C but should there be any restriction on hot days with regards to relocating mussels?

- Clarify handling instructions e.g. that mussels should be kept in the water at river temperature and not put them on the bank in a bucket in high air temperatures.

Monitoring relocated mussels

Comment: The sentence about mussel relocation being relatively new in the OGLA dates the document and should be changed.

- Consensus: Remove the statement about mussel relocation being new.

Discussion: Monitoring relocated mussels allows us to determine the success of relocation and its impact on the native community as well. We are starting this process in a data-poor environment and the information from monitoring is needed to allow assessment of relocation as a viable mitigation measure. Follow-up monitoring should consider what effort is required to indicate if the relocation effort is successful. It should also consider what is reasonable with respect to the proponents.

- Consensus: The document needs to distinguish between short-term monitoring to assess the direct effects of the relocation, handling mortality, etc., and long-term monitoring to determine if the species is becoming established at the new site, what community level effects the relocated mussels are having on the original mussel community, etc.

Question: If the proponents are required to do short-term monitoring, shouldn't there be some requirement for them to report back to DFO on what the data are? The authorization given by Habitat Management includes that a written monitoring report be submitted once a year for two years. This is not part of what has to be done when one applies for a SARA permit so the requirement to report needs to be included somewhere.

- Consensus: Make it clear in the document that it is essential that information from monitoring is relayed back to DFO. This is very important information regarding mussel survival etc. and that it is required to ensure DFO relocation methods work. Add a section to the document on reporting and state clearly what is needed from the initial relocation and the follow-up monitoring reports. The SARA permit can make reference to the reporting requirements. There should be a template of a monitoring report included in the document i.e. what data needs to be collected, etc., and it should be part of the example permit in the appendix.

- Consensus: Relocation/Monitoring reports should include; location of original site and relocation site, date of relocation and monitoring, number and species of all species observed (both species at risk and non-species at risk), length data (at time of relocation, each time monitored) for each mussel (alive and dead), corresponding tag numbers (id) for those mussels tagged and number present (by species), number moved (by species), number alive, number dead.

Comment: Monitoring frequency and the overall length of monitoring needs to be considered.

Discussion: After relocation, what follow-up monitoring is required to assess the success of the relocation? Monitoring provides information on the conditions at the relocation site prior to the relocation occurring, the same site after the relocation occurs and at a control site. In the draft document a two year period following relocation is identified for follow-up monitoring but this only considers survival and not viability of the relocated mussels. From a biological perspective two years is insufficient and monitoring should be three to five years or even longer to be able to assess whether or not the relocated mussels are reproductively viable.

Comment: Maybe monitoring should be more frequent for the first two years, than maybe once a year for the following years. Is it reasonable to expect proponents to come back and monitor after five years?

Discussion: Initial monitoring provides information on the effects of the actual relocation and the suitability of the relocation site. It is important to distinguish between mortality from relocation (handling) and mortality as a result of unsuitable habitat. If the habitat is unsuitable the mussels should be moved. The other issue is that handling mortality may result from improper use of techniques but could also result from improper techniques. Monitoring will help to determine if the relocation methods are effective or whether changes need to be made to the prescribed techniques. There was some discussion about whose role (proponents and/or DFO) it should be to test techniques. In order to allow for this type of mitigation strategy there has to be some compromise from both sides with the goal being to protect the species but also considering that there should not be an undue burden placed on the proponent.

- Consensus: Need to come up with a monitoring time frame that is good for both DFO and the proponent.

Discussion: Should longer-term effects be looked at through DFO research programs? It should be mentioned that mussels are long-lived animals and explain why long-term monitoring is needed. The length of overall monitoring is an important consideration so should we be advocating two years? What is the point of requiring all the juveniles be sifted out of an area and be relocated if there is no monitoring to determine that they are able to survive and become established in the relocation site? Five years would give a better indication of viable survival. Some discussion included the use of a surrogate (non-species at risk) with a faster growth rate to tell if the habitat is suitable and whether you have overburdened the habitat with the mussels that were moved. Proponents will not like the idea of long-term monitoring as it seems more research-oriented.

- Consensus: Short-term monitoring is the responsibility of the proponent while long-term monitoring, which is more research oriented would be undertaken by DFO, academic institutions, etc. if they so choose. Two years is the absolute minimum for monitoring, and after two years, DFO science or other academic institutions may select specific projects for longer term monitoring. This would be done on a case-by-case basis and is dependant on having accurate monitoring data submitted to DFO for all relocation projects.

Question: How frequently should monitoring occur within those two years?

Discussion: The original discussion centred around monitoring at two weeks post-relocation and four weeks post-relocation and then one year later and two years later. The two weeks was to see if any mussels died and the four month sample was to provide data on juvenile growth. The first survey requires a visual inspection to see if the mussels have died. There was some concern that monitoring two weeks after relocation may unnecessarily disturb the mussels. There was concern that by reducing the monitoring too much there would not be sufficient data collected to use to describe juvenile growth. It was decided that these data are very important and must be collected. Discussion turned to when monitoring could occur in the fall as this influenced both the frequency of monitoring and the timing of the initial relocation. Relocation will likely be in July and August but the latest it could occur depended on when the one month monitoring had to be completed.

- Consensus: Monitoring one month after relocation to see if there is initial mortality; one year to see if there is habitat-related mortality; two years to monitor growth, etc.

- Consensus: The latest monitoring of mussels should be done by the first week in October at the latest which means that the relocation had to have occurred one month earlier.

Identification of mussels

Comment: to preserve genetic material, 95% ethanol is the best way to preserve samples and keep them refrigerated. For museum specimens, 95% to start and then cut to 70%.

- Consensus: Include information on preserving mussels for specimens and for preserving genetic material under the identification of mussels section.

- Insert scale bars in photographs in the document and make note of this when referring to taking photographs of mussels.

Appendices

Comment: In section 4 of the guidelines for SARA permits (Appendix 1), it is not clear what the “a”, “b”, and “c” refer to. It seems like they should refer to 4A and 4B following the introductory paragraph but this should be clear and the 4C section should be included.

- Clarify the permit section 4 information and including 4C.

Comment: Standardize how the GPS data is recorded i.e. decimal degrees and record the datum and the GPS error otherwise the sites will be recorded incorrectly. This should be added to the sample field/data sheet that proponents will use (added to appendices). Any data reported should be in decimal degrees should be added to the SARA permits as well.

Consensus: Include a sample field/data sheet in an appendix.

- Consensus: Specify the standard for reporting of GPS data (decimal degrees and recording datum and error) in the method sections. Provide an example on the sample data sheet and on the sample SARA permit.

REFERENCES

Mackie, G., Morris, T.J., and Ming, D. 2007. Protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA). Can. Manuscr. Rep. Fish. Aquat. Sci. 2790: vi +46 p.

Appendix 1. Terms of Reference

Review of the protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA)

Regional Peer Review Meeting
Canada Centre for Inland Waters
Burlington, ON
May 11th, 2007

Terms of Reference

Context

The following freshwater mussel species found in Ontario are listed as Endangered under the *Species at Risk Act* (SARA): Round Hickorynut (*Obovaria subrotunda*), Kidneyshell (*Ptychobranchus fasciolaris*), Northern Riffleshell (*Epioblasma torulosa rangiana*), Snuffbox (*Epioblasma triquetra*), Round Pigtoe (*Pleurobema sintoxia*), Rayed Bean (*Villosa fabalis*), Mudpuppy Mussel (*Simpsonaias ambigua*) and the Wavyrayed Lampmussel (*Lampsilis fasciola*). Two additional species, Rainbow (*Villosa iris*, Endangered) and Mapleleaf (*Quadrula quadrula*, Threatened) have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are currently being considered for listing under SARA.

The Minister of Fisheries and Oceans is responsible for aquatic species, including freshwater fishes and mussels. Once a species is listed under the SARA, it becomes illegal to kill, harass, capture or harm it in any way.

Meeting Objectives

The objective of this meeting is to peer review the manuscript report entitled, “Protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA)”. The purpose of the protocol is to outline and standardize methods to be incorporated into field surveys carried out to detect, relocate and monitor mussel species at risk in Ontario. In addition, the document provides guidance on when a SARA permit is needed and the process for obtaining the permit is also provided. It is designed for use by persons planning projects in and around water that might affect mussel species at risk in Ontario. The peer review of the document is to ensure that the technical content of the report is accurate and the methods are scientifically based and sound.

This protocol does not provide direction on when the relocation of mussels would be an acceptable mitigation strategy for development activities under review by Fisheries and Oceans Canada. The decision to allow a mussel relocation will be made by DFO during the review of the development activity once a proposal has been submitted to DFO. As such, relocation as a mitigation strategy for mussel species at risk is not under review at this meeting although it has proven to be a useful tool under certain circumstances.

The manuscript report will be available to all participants by April 23.

Output of the meeting

The output of the meeting will be a proceedings document which will outline the discussion of the protocol manuscript.

Participation

The participants invited to this meeting include DFO Science, DFO Habitat and Oceans Management, and researchers from Environment Canada, Ontario Ministry of Natural Resources, University of Guelph, University of Toronto, Lakehead University, Trent University and North Carolina State University.

Appendix 2. Participants

Regional Peer Review Meeting

Review of the protocol for the detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (OGLA)

Joseph Carney, Lakehead University	jcarney@lakeheadu.ca
W. Gregory Cope[1], NC State University	greg_cope@ncsu.edu
Ron Dermott, DFO Science	dermottr@dfo-mpo.gc.ca
Amy Edwards, Contractor	aedward@cogeco.ca
Gerry Mackie, University of Guelph	gmackie@uoguelph.ca
Kathleen Martin, DFO Science (co-chair)	martink@dfo-mpo.gc.ca
Daryl McGoldrick, Environment Canada	Daryl.McGoldrick@ec.gc.ca
Debbie Ming, DFO Habitat Management	mingd@dfo-mpo.gc.ca
Todd Morris, DFO Science (co-chair)	morrist@dfo-mpo.gc.ca
Daelyn Woolnough, Trent University	daelynwoolnough@trentu.ca
Dave Zanatta, University of Toronto	dave.zanatta@utoronto.ca

[1] Unable to attend meeting but provided written comments