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Proceedings of the Regional Recovery Potential Assessment (RPA) of Carmine Shiner

15-16 March 2011
Winnipeg, MB

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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

In June 2003, the Carmine Shiner (*Notropis percobromus*) was added to Schedule 1 of the *Species at Risk* Act (SARA) as Threatened. COSEWIC re-assessed the species as Threatened in April 2006. A recovery strategy was finalized in February 2008. Fisheries and Oceans Canada (DFO) Science was asked to undertake a Recovery Potential Assessment (RPA) to inform development of an action plan and to support decision-making with regards to SARA agreements and permits. A Science advisory meeting was held on 15-16 March 2011 to conduct the RPA. Meeting participants were from DFO Science, the province of Manitoba, Manitoba Hydro and an independent fish consultant from Minnesota. Two working papers were distributed prior to the meeting. During the meeting, participants discussed the best available information and knowledge gaps for Carmine Shiner on a range of topics related to species biology, population and distribution, habitat requirements, threats to survival or recovery, potential mitigation measures and allowable harm. The working papers were revised to reflect the discussions and conclusions reached.

This Proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meeting. The Science Advisory Report and two supporting Research Documents, resulting from this advisory meeting, are published on the DFO Canadian Science Advisory Secretariat (CSAS) Website.

Compte rendu sur l’évaluation du potentiel de rétablissement (ÉPR) de la tête carminée; les 15 et 16 mars 2011

SOMMAIRE

I En juin 2003, la tête carminée (*Notropis percobromus*) a été inscrite comme menacée à l'annexe 1 de la *Loi sur les espèces en péril* (LEP). Le COSEPAC a réévalué le statut de l'espèce comme étant menacé en avril 2006. Un programme de rétablissement était prêt en février 2008. On a demandé au secteur des Sciences de Pêches et Océans Canada (MPO) d'entreprendre une évaluation du potentiel de rétablissement (EPR) afin de servir de base à l'élaboration d'un plan d'action et d'appuyer la prise de décisions concernant les permis et les ententes en lien avec la LEP. Une réunion de consultation scientifique s'est tenue les 15 et 16 mars 2011 afin de mener l'EPR. Des représentants du Secteur des sciences du MPO, de la province du Manitoba, de Manitoba Hydro et un spécialiste des poissons indépendant di Minnesota ont participé à la réunion. On a distribué de documents de travail avant la réunion. Durant la réunion, les participants ont discuté de la meilleure information disponible et des lacunes dans les connaissances concernant la tête carminée et tout ce qui a trait à sa biologie, à ses populations et à son aire de répartition, à ses exigences en matière d'habitat, aux menaces pesant sur sa survie ou son rétablissement, aux mesures d'atténuation possibles et aux dommages admissibles. Les documents de travail ont été révisés pour rendre compte des discussions et des conclusions.

Le présent compte rendu résume les discussions tenues et expose les révisions à apporter aux documents de recherche connexes. L’Avis scientifique et les documents de recherche à l’appui découlant de la présente réunion de consultation scientifique seront publiés sur le site Web du Secrétariat canadien de consultation scientifique du MPO.

INTRODUCTION

In November 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the status of the Carmine Shiner (*Notropis percobromus*) as Threatened because it occurs in an extremely restricted area of Manitoba. The major threat to the species is the alteration in water flow as a result of stream regulation and species introductions. In June 2003, the Carmine Shiner was added to Schedule 1 of the *Species at Risk* Act (SARA) as Threatened. COSEWIC re-assessed the species again as Threatened in April 2006. A recovery strategy was finalized in February 2008. To inform development of an action plan and to support decision-making with regards to SARA agreements and permits, a Recovery Potential Assessment (RPA) was conducted on 15-16 March 2011.

The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to evaluate the recovery potential of Carmine Shiner. The RPA is a science-based peer review that assesses the current status of Carmine Shiner and possible recovery targets, what is known about its biology, habitat and threats, the scope for human-induced mortality and potential mitigation measures, alternatives and enhancements. (Full details about the RPA process are available on the Canadian Science Advisory Secretariat (CSAS) website in DFO 2007a, b)

Meeting participants (Appendix 2) included DFO Science sector, the province of Manitoba, Manitoba Hydro and a fish expert from St. Paul, Minnesota. DFO drafted two working papers to serve as the basis for the RPA. They were distributed to participants in advance of the meeting. Appendix 3 shows the agenda generally followed during the meeting.

This Proceedings report summarizes the relevant meeting discussions and presents the key conclusions reached. Science advice resulting from this meeting is published in the CSAS Science Advisory Report (SAR) series and the supporting data analyses are published in the Research Document series.

DISCUSSION

The Chair provided an overview of the processes by which the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) makes wildlife designations, the federal government lists species under the *Species at Risk Act* (SARA) and DFO conducts RPAs. An overview of the COSEWIC assessment of the Carmine Shiner and an explanation of the purpose for, and contents of, an RPA were provided. The RPA will include key information about habitat that can be used by recovery planners to define critical habitat in the recovery strategy or action plan.

Two working documents were reviewed during the RPA meeting: a modelling paper that provided information related to recovery targets and times, minimum area for population viability and allowable harm, and a paper that contained all other information relevant to an RPA. Participants began by discussing the non-modelling paper.

Working paper: Information in support of a Recovery Potential Assessment of Carmine Shiner (*Notropis percobromus*)

Authors: D. Watkinson and C.D. Sawatzky

Abstract[1]

In April 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Carmine Shiner (*Notropis percobromus*) as Threatened because it occurs in an extremely restricted area of Manitoba (COSEWIC 2006). The major threat to the species is the alteration in water flow as a result of stream regulation and species introductions. Carmine Shiner was listed under the *Species at Risk Act* (SARA) as Threatened when the Act came into force in 2003. The Science sector in Fisheries and Oceans Canada (DFO) was asked to undertake a Recovery Potential Assessment (RPA); this Research Document supports the RPA. It describes the current state of knowledge of Carmine Shiner in Manitoba in terms of their biology, ecology, abundance, distribution and trends, habitat requirements, and threats. A recovery goal, mitigation measures and alternatives to threats and the potential for allowable harm are presented, as is information relevant to critical habitat and residence. The information contained in the RPA and this document may be used to inform the development of recovery documents and to support decision-making with regards to the issue of permits, agreements and related conditions under SARA.

Discussion

The document was reviewed, section by section, during the meeting and a number of editorial changes were made. Discussions related to each topic are described below.

RATIONALE FOR ASSESSMENT

Participants discussed the timeline associated with the SARA process for Carmine Shiner and development of the RPA. It was agreed that text should be added to clarify that in contrast to the usual order of events in which the RPA is conducted prior to species listing, the Carmine Shiner has already been listed and a recovery strategy developed. Additionally, text would be added to describe implications of the RPA in terms of on-the-ground management of Carmine Shiner by the provincial government.

TAXONOMY

Genetic studies conducted by Dr. Chris Wilson in 2005 confirmed that Carmine Shiner, Rosyface Shiner (*Notropis rubellus*) and Emerald Shiner (*Notropis atherinoides*) belong to separate taxa. Participants discussed connectivity between the waterbodies where the Carmine Shiner is found. The Whitemouth and Birch rivers are isolated from any waterbodies below Whitemouth Falls. The Birch River drains into the Whitemouth River so there is some connectivity but each may contain a separate population. Carmine Shiner is also present at the base of Whitemouth Falls, at the confluence of the Whitemouth and Winnipeg rivers. In or around the 1950s, the falls located about halfway between the Old Pinawa Dam site and the Bird River, which drains into Lac Du Bonnet, were destroyed. Historically, those falls separated two populations of Carmine Shiner. It is now unclear whether there is one population of Carmine

[1] Updated following the meeting incorporating comments.

Shiner in several locations, several populations in several places or several populations in one place. Participants agreed on the wording of the text in this section.

SPECIES BIOLOGY AND ECOLOGY

The shape of the anal fin in Carmine and Emerald shiners is sufficiently different that they can be distinguished on that basis, though with some difficulty. In Minnesota, habitat and chromatophores on the chin are used to differentiate between the two species. According to Fishes of Wisconsin (Becker 1983), the Emerald Shiner has large chromatophores on the mid-portion of the chin. A statement about this will be added to the RPA.

Some text in this section needs to be checked for accuracy and corrected if needed. The largest Carmine Shiner in Manitoba was collected in the Whitemouth River but whether it had a fork length of 67 mm or 73 mm as reported in the non-modelling and modelling RPA working papers, respectively, needs to be confirmed. The document should indicate whether the dates reported for “ripe and running fish” (13 June and 26 July) were obtained from one year or several. The water velocity given in the text is a mean, not maximum, value. Units of water conductivity need to be checked to see if they are standard units and revised if necessary.

There is evidence from collected specimens that individual Carmine Shiner spawn repeatedly during a single spawning season. Research is needed to confirm this observation and this point should be identified in the Sources of Uncertainty section of the document. The modelling assumed that the reported numbers of eggs represented the maximum number of eggs spawned each year. Fecundity in the model would be affected if individual Carmine Shiner produce that number of eggs more than once per year. Repetitive spawning may also affect the survival estimate in the model though there is uncertainty associated with that parameter already. The total number of Carmine Shiners sampled in Manitoba for the egg counts reported in the two working papers does not match. It should be checked and corrected as necessary, and should be reported as “n” not “N” as the sample only represents a subset of the total population.

In Manitoba, it is unlikely that Carmine Shiner use sunfish nests. The only members of the sunfish family (Centrarchidae) in the area are Rock Bass (*Ambloplites rupestris*) and Smallmouth Bass (*Micropterus dolomieu*). Other sunfish in the area occur in small numbers.

Several suggestions were made regarding text in the diet section. The author of the document agreed to check on several statements in the document and revise as necessary: (1) importance of caddisfly larvae versus dipterans in the diet of Carmine Shiner; (2) if there is enough information available to report on diet preferences of young-of-the-year (YOY) fish; and (3) if YOY fish eat enough insects to warrant mentioning it. The Hoffman (1970) paper needs to be updated to the more recent reference and the number of parasites reported in the working paper confirmed.

Available data indicate that Carmine Shiner occur in shallow clear-water streams, suggesting a narrow ecological niche in addition to a narrow bio-geographical niche. Participants agreed that this suggests Carmine Shiner have limited adaptability. In Minnesota, one population has become extirpated (at the border with Iowa) but Carmine Shiner are able to withstand short periods of turbidity (e.g., in Red Lake Minnesota following a storm). This information will be added to the habitat section of the document.

A better map is needed to show the distribution of Carmine Shiner in Manitoba.

HISTORIC AND CURRENT DISTRIBUTION AND TRENDS

The "Old Pinawa Channel" was replaced in the text with "Lee River just downstream of the Old Pinawa Dam". The second paragraph in the abundance section pertained to the distribution so it was moved into this section and reviewed. Participants discussed whether there is upstream connectivity in the system for Carmine Shiner. It was thought unlikely given that larger fish (e.g., Sauger) do not occur in the Whitemouth and Birch rivers because they are not able to swim upstream through Whitemouth Falls, even in high water years, thus it less likely for Carmine Shiner downstream movement may be possible. Though they occur in several waterbodies, within the known Manitoba range, it is unclear if they belong to a single or multiple populations. Regardless, for the purposes of the RPA Carmine Shiner was treated as a single population.

HISTORIC AND CURRENT ABUNDANCE AND TRENDS

Typically RPA documents report indices of relative abundance if available. Carmine Shiner has been studied in the Whitemouth River for less than fifteen to twenty years; there is no historic information for comparison. Given the longevity of Carmine Shine, this period only covers a few generations. There is no evidence of a significant decrease or increase in population size, suggesting it may be stable, however the timeframe is too short to determine trends. The current status of this species could be fragments of a once-larger population which may now be stable or a population with a constant distribution over time at carrying capacity. We don't know if there are habitat or biological constraints on this species or if the current limited distribution and abundance have always been this way. Participants concurred that there are insufficient data currently available to justify including a population status matrix in the RPA as has been done for small fishes in southern Ontario. Instead, participants agreed to add the following statement to the working paper: "In the last ten years, there is no evidence for an upward or downward trend in the population."

RECOVERY TARGETS, RECOVERY TIMES AND MINIMUM AREA FOR POPULATION VIABILITY

Authors J. Young and M. Koops

Presenter J. Young

Abstract

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) had assessed the Carmine Shiner (*Notropis percobromus*) as Threatened in Canada (2006). Here we present population modelling to assess allowable harm, determine population-based recovery targets, and conduct long-term projections of population recovery in support of a recovery potential assessment (RPA). Our analyses demonstrated that the dynamics of Carmine Shiner populations are very sensitive to perturbations that affect fecundity, and survival of young-of-the-year (YOY). Harm to these portions of the life cycle should be minimized to avoid jeopardizing the survival and future recovery of Canadian populations. Based on an objective of demographic sustainability (i.e., a self-sustaining population over the long term), and assuming catastrophic decline events take place with 10% probability per generation (~8% annually), we propose abundance recovery targets of at least 8,880,000 adult Carmine Shiner (aged 1+), requiring ~3,300 ha of suitable habitat. In the absence of mitigating efforts, additional harm or habitat limitations, we estimate that a growing Carmine Shiner population will take approximately 12 years to reach this recovery target if starting from a population of 20,000 adults. Recovery or preservation strategies which incorporate improvements in the most sensitive Carmine Shiner vital rates will have the greatest effect on population growth.

Discussion

Participants discussed the model assumptions and uncertainties. There is a high level of uncertainty associated with YOY survival; better information is needed. The model is a post-breeding model. It assumes that when a fish reaches its first birthday, it attains sexual maturity and spawns. Information is needed about how protracted the spawning period is during the open-water season. The longer it takes to go through a full spawn, the higher the chance of mortality before they complete their first cycle of spawning, therefore the lower the fecundity at that age. If it took a long period of time to complete the spawning activity, sensitivity in the model would change. The model assumes that harm only occurs for one vital rate. If harm affects more than one vital rate then the level of allowable harm must be lower. A 100-year timeframe is used for shorter-lived species (e.g., Carmine Shiner) and a 250-year timeframe for longer-lived species (e.g., Lake Sturgeon).

Population growth rate and abundance are needed for the model. With a population growth rate of 2.3%, the population would double in 6.5 years. While this growth rate seems high, it is not out of the realm of possibility. The inverse of the normal inherent population growth rate constitutes a catastrophe. For small-bodied fish, catastrophes have a much greater effect than for large-bodied fish. Information is needed about the frequency and magnitude of catastrophes for Carmine Shiner. In the current model, a 3% probability of extinction over 100 years was used although 5% and 10% extinction risks were also examined.

The calculation of minimum area for population viability (MAPV) did not assume specificity of habitat for different life stages. How much space is needed per individual Carmine Shiner is not known. An initial population size of 20,000 adults was used for determining recovery times in Pugnose Shiner. The same starting point was used for Carmine Shiner though it may not be appropriate for that species. For that reason, the recovery times should be regarded as showing relative differences in recovery times, not actual recovery times, that can be expected. Participants noted that the Pugnose Shiner estimate is likely small for Carmine Shiner because it is a bigger system. Other modelling exercises have started with a percentage of the recovered population. Given the paucity of data for Carmine Shiner, a 10% starting point was used. The modelling results show that if enough habitat is available, the Carmine Shiner population would drop below the Minimum Viable Population (MVP) (i.e., the recovery target) only about 7% of the time. However, if only a limited amount of habitat is available, then the population would never reach the MVP.

The MVP results obtained at an earlier meeting for Pugnose Shiner (1,929 fish) were compared with those calculated for Carmine Shiner. Based on extinction risks of 3%, 5% or 10% and assuming catastrophic decline at a frequency of 5% or 10% per generation, the MVP for Carmine Shiner was estimated as between 53,000 and 8,884,000 fish. Differences in the modelled estimates are largely driven by the magnitude of uncertainty in the parameters used in the model: the higher the uncertainty, the larger the variance which translates into higher MVPs, as seen in the modelled results for Carmine Shiner. If extinction is defined at zero, then the population will reach zero more often with greater uncertainty. Instead of defining mean and variance for each variable in the Pugnose Shiner analyses, the modeller used several different scenarios which were combined into 18 matrices from which random draws were made. The resulting variance approach was very small. Recovery targets in the model do not include the fact that population growth rates are typically higher when densities of fish are lower.

A participant asked if it would be possible to investigate sensitivities in age classes using STELLA, an icon-based dynamic modeling software package, to better understand whether the biology of Carmine Shiner fits the model used. The modeller responded that population growth rate is more sensitive to changes in early survival than adult survival. This was the case for both

Carmine and Pugnose shiners. The ageing results for Carmine Shiner may be unreliable due to preservation techniques. It may be that Carmine Shiner lives to 3 years of age and that the lack of differences in length frequencies between years 1 and 2 is due to ageing issues. The Pugnose Shiner model contained an extra year which increased the population growth rate slightly but mortality was high enough that by age 3 there are few fish left to make a difference. The modeller agreed to rerun the Carmine Shiner data using the same approach taken for Pugnose Shiner so results for the two species could be compared.

Participants thought the differences between Pugnose and Carmine shiner in the modelling results were difficult to understand. They discussed a number of alternate avenues of investigation including whether more information is available for Rosyface Shiner, the Pugnose Shiner is a close enough relative that it could be used as a surrogate for Carmine Shiner and another model (e.g., matrix model) might work better. The Pugnose Shiner has similar characteristics to the Carmine Shiner (e.g., roughly the same size and same number of eggs) so it appears to be a similar fish species. The matrix model is probably the least data demanding so it would likely be best suited to a data-poor species like the Carmine Shiner.

The need for a better sense of validity in the uncertainty was reiterated. Would the results change if the model was rerun using variances at different orders of magnitude? The modeller guessed that the results obtained for Pugnose Shiner and Carmine Shiner were underestimates and overestimates, respectively. The modeller agreed to provide more information, at a later date, on sensitivity of the model to uncertainty. The current recovery target will be adjusted once the model has been reviewed.

Catastrophes and their frequency were discussed.

Table 1 shows survival rates by age class, fecundity rates, age of maturity and maximum age. There is insufficient information currently available to know if Age-0 and adult survival are correct or even close. If survival data were available for the first few months of life, it would be possible to extrapolate.

Despite the need for more work on recovery targets, it is possible to use the current modelling results as a basis so long as the uncertainties are clearly stated. The recovery timeframe used in the model (100 years) was arbitrarily decided. Forty generations could be used, as in other models. Participants thought that if Carmine Shiner have robust annual recruitment, as suggested, then time to recovery should be fairly swift. When a long timeframe is used, the probability of extinction increases. For these reasons, participants recommended trying 20 and 40 generations in the model. The generation time in Carmine Shiner is about 1.3 years. For each new MVP estimate generated, there will be a new MAPV.

The recovery targets section in the non-modelling working paper was removed because it is covered in the modelling paper.

INFORMATION TO SUPPORT IDENTIFICATION OF CRITICAL HABITAT

It is the role of the Carmine Shiner Recovery Team, not the RPA, to define critical habitat. The third paragraph in the habitat section of the non-modelling working paper describes how critical habitat should be defined for Carmine Shiner. Participants agreed this text should be removed from the document.

Habitat requirements of the Carmine Shiner were discussed. This species requires flowing water, thus control structures and dams would have negative effects on their habitat. In Minnesota, this species is rarely found in lakes and in Manitoba they are not found in lower velocity areas, deeper channels or boggy areas. Carmine Shiner is found in flowing, but not exceptionally fast, water. A participant wondered if they live below Whitemouth Falls or appear there because they are washed out of the Whitemouth River. Suitable habitat for Carmine Shiner consists of clean flowing water, including shallow riffles and falls, with rocky substrates (e.g., clean gravel or stone). The habitat at the base of Whitemouth Falls would fit this description. Riparian habitat is probably a necessary functional component of the habitat given a significant portion of their diet includes terrestrial insects. Carmine Shiner is usually intolerant of turbid conditions but some local stocks have demonstrated short-term tolerance to turbidity.

Given the current distribution patterns of this species, it is also assumed that longitudinal lateral connectivity is important although this should be investigated. Habitat used by YOY fish is unknown. There may be dissimilarities in Carmine Shiner habitat between the Whitemouth River and Winnipeg River which may reflect size differences between the two systems and/or sampling issues.

Little is known about where or when spawning occurs. We know the habitat where Carmine Shiner have been sampled but not if they were engaged in spawning activity at the time. Although there are similarities between this species and Rosyface Shiner, they may have different habitat preferences. Similarities and differences in the genetic profiles and basic biology of these two species need to be investigated. Rosyface Shiner is known to spawn in the nests of other fish species. Whether Carmine Shiner does the same is unknown at this time. Participants decided there was no additional information available on water temperatures at which spawning occurs than already specified in this section.

The text in this section of the non-modelling working paper was reorganized and updated based on the discussion.

RESIDENCE

Participants agreed that Carmine Shiner do not change their physical environment or invest in any form of structure thus they do not meet the definition of residence as interpreted by DFO.

THREATS TO SURVIVAL AND RECOVERY

The approach for assessing threats was discussed. One suggestion was to divide threats into two groups: catastrophic events (e.g., significant dewatering) versus systemic threats (e.g., riparian removal, channelization) which are more incremental. What would be catastrophic for individual fish may not be catastrophic at the population level given a timescale that is sufficiently long. A species can usually adapt to natural threats (e.g., droughts) if given enough time. But when anthropogenic effects combine with natural threats (e.g., watering cattle in the river because of drought), then it becomes catastrophic at the population or species level. There is a regular cycle of significant water withdrawals in the Whitemouth River for pipeline maintenance. Quantifying the tipping point at which a threat moves into the catastrophic realm is exceptionally difficult. Cyprinids, including Carmine Shiner, do not tolerate drought well.

The Carmine Shiner Recovery Team had previously evaluated threats to this species in Manitoba (Carmine Shiner Recovery Team 2007). They had evaluated the significance of each threat by considering its likelihood and extent of occurrence and severity and immediacy of impact. Clear explanations for the rating levels were not provided. For example, when likelihood of occurrence was rated as high, it means the threat was present. But it is not clear what lower ratings mean.

Participants discussed the approach used during previous RPA meetings for Ontario fishes. Threats that affect the species and/or its habitat in the past, present and/or future were identified. The likelihood of occurrence of each threat and severity of impact were assessed and presented in a matrix. The threat likelihood was rated as known, likely, unlikely or unknown and threat impact was rated as low, medium, high or unknown. Overall threat level is a combination of likelihood and impact. The group agreed to use the same approach for Carmine Shiner.

The Recovery Team evaluated the impacts of threats taking into account any mitigation currently in place. This makes sense from a recovery perspective but not necessarily from a strictly scientific perspective. Typically, the RPA evaluates threats prior to mitigation and then identifies mitigation measures that would reduce impacts. Participants decided to evaluate threats on the basis of mitigations currently in place.

The Team had rated threats for three aquatic systems: Whitemouth River, Bird River and Pinawa Channel. An RPA meeting participant suggested the Birch River could be evaluated too, though Carmine Shiner could probably move between the Birch and Whitemouth rivers. Regardless, the Birch River is more susceptible to flow disruptions. Participants agreed that there isn't enough scientific information available to support evaluating the Whitemouth, Birch, Bird and Lee rivers and Pinawa Channel separately.

The RPA meeting participants thought that all threats identified by the Recovery Team are still valid and no significant anthropogenic changes in the environment have occurred since their table was developed. Threats were discussed individually (see below) and the corresponding text in the non-modelling working paper was updated based on the discussion

Habitat Loss/Degradation

Four separate threats were evaluated under this category: flow alteration, shoreline/riparian development, landscape changes and climate change. The first three threats include turbidity and sediment loading. Although participants discussed whether to present these threats separately because Carmine Shiner is relatively intolerant to them, it was decided not to evaluate them separately from the threats related to habitat loss and degradation.

Flow Alteration

Flow alterations occur within the range of the Carmine Shiner, mostly in response to anthropogenic activities. Whitemouth Lake is the origin of the Whitemouth River and it has a fixed weir dam at the outflow. The Winnipeg River is affected by a number of generating stations. Hydrostatic testing of the pipe near the Birch River every seven years results in significant water drawdown (between 17,000 m^3 to 43,000 m^3). The extent of flow alteration varies according to duration of the test. In 2008, there was thought of putting an outflow control structure on the Whitemouth River. Manitoba Hydro is currently working on the Pinawa Dam which could affect flow at the penstocks. Other activities that affect flow are ongoing within the region (e.g., agriculture, highway development). The likelihood of flow alteration within the range of Carmine Shiner warrants a Known rating. Severity of impact ranges from low to high depending on the cause of the disturbance and its duration.

Shoreline/Riparian Development

This threat encompasses a range of activities in the region including cottage development, the proposed harvest of timber in the riparian buffer to limit spread of disease from trees, piling rocks on shore from channel deepening, clearing agricultural fields, and extensive shoreline development along reaches of the Whitemouth River system and below the Seven Sisters generating station. Most development in the region is terrestrial, rather than in-stream, however development in general is still not as pervasive here as in many other areas. Participants agreed the likelihood of occurrence of this threat is Known but the severity of impact is low to moderate.

Landscape Changes

A range of landscape changes have occurred since the early 1900s. The forest bordering the Pinawa Channel was logged during and following construction of the Pinawa generating station and it has since regrown. The extent and proximity of modern timber harvest is controlled and impacts on the channel should not be significant. Along the Lee River there is extensive cottage and, inland of the river, agriculture development. Cottage development and forestry are the main activities with potential to affect landscape changes along the Bird River and there is potential for mining development in the watershed. Forestry and peat moss are the main developments in the Whitemouth River basin south of Highway 1. To the north of the highway, there are agriculture developments, communities, cottages, permanent homes and peat moss operations near the river. Although no specific landscape impacts were identified, participants agreed that the likelihood of occurrence of this threat warrants a Known rating.

Landscape changes can occur quickly but their significance to Carmine Shiner is unknown. As the spatial extent of this species in Manitoba is relatively small, a landscape change could affect the entire basin. Participants also noted that given the many anthropogenic activities currently ongoing in the region, cumulative impacts and higher-order impacts may be important. The severity of impact of this threat on Carmine Shiner was rated as unknown.

Climate Change

This threat is widespread so the likelihood of it is Known but the severity of impact is unknown.

Species Introductions

The Recovery Team ranked the threat of species introductions to Carmine Shiner as high. Since then, probably a dozen species (microscopic to macroscopic) have been introduced into the region including fishes (e.g., Rainbow Smelt, *Osmerus mordax*), Rusty Crayfish (*Orconectes rusticus*), Spiny Water Flea (*Bythotrephes longimanus*), Zebra Mussel (*Dreissena polymorpha*), pathogens and viruses. Common Carp could present a problem in the future. Common Carp do not yet occur in the Whitemouth River, although they are already present in Lake Winnipeg. Many of these introductions occur as a result of anthropogenic activities (e.g., contaminated boats, fishers moving fish from one area to another) so species introductions are always a possibility. In addition to exotic species, significant increases in the density of indigenous species or prevalence of naturally-occurring disease can also pose a threat (e.g., predation, competition, food web disruption).

The impact of this threat category on Carmine Shiner depends on the species being introduced. Nevertheless, all things considered the participants thought that the occurrence of this threat was Likely and severity of impact of species introductions on Carmine Shiner rated as Low to High.

Pollution

This threat includes point source inputs (e.g., contaminants and toxic substances) and non-point source inputs (e.g., nutrients).

A number of point sources for pollution were identified: hydrostatic testing for the pipeline, the release of orthophosphate from agricultural and cottage developments and tantalum and cobalt from mining operations near the Bird River, and possible leakage of phosphorus from the Pinawa sewage plant. All these pollutants are likely deleterious to this species. The degree of impact would probably depend on where, when and the size of the input; no toxicological test results are available.

Release of nutrients from non-point sources may not be a problem for Carmine Shiner. The Whitemouth-Birch bogs are probably nutrient poor.

Some anthropogenic activities produce a broad spectrum of pollutants. For example, hydrostatic testing using 43,000 m^3 of water on a field will cause erosion of nutrients, herbicides, pesticides and soil into the watercourse. Participants agreed that the likelihood of pollution is Known. There is no evidence of harm from pollutants except for pesticides and herbicides. Some nutrients may actually promote algal growth that, depending on the species, may benefit the diet of YOY. The threats section in the working paper should indicate that pollutants may cause a range of impacts but the threats table should rate the severity of impact on Carmine Shiner as unknown.

Overexploitation

Carmine Shiner could be exploited as a bait fish but the likelihood of this threat occurring is very low, if not zero, for several reasons. Fathead Minnow (*Pimephales promelas*) and Finescale Dace (*Phoxinus neogaeus*) are preferred by commercial baitfishers; they are not abundant in the Whitemouth River. The baitfish fishery is primarily after live bait and Carmine Shiner don't survive capture well. The provincial government does not allow commercial bait fisheries in waters with SARA species. In this region of Manitoba, there is no licensing of frozen baitfishing on game fish waters and no fresh baitfish harvest is allowed in major rivers. Recreational fishers can capture bait fish for their own use but the provincial government is not aware of any non-commercial fishers engaging in that activity in areas where Carmine Shiner occurs. The Recovery Team thought the significance of overexploitation from bait fisheries was low. The RPA meeting participants agreed that the likelihood of occurrence of overexploitation of Carmine Shiner by baitfishers is Unlikely and the severity of impact is low. If provincial legislation and policies changed with respect to baitfishing, these ratings could change.

Other Threats

Scientific Sampling

The likelihood of scientific sampling is Known but the severity of impact is low because it is carefully controlled through the issuance of SARA permits.

MITIGATIONS AND ALTERNATIVES

Participants discussed potential mitigations and alternatives for each threat. The text in this section of the non-modelling paper was developed later based on the meeting discussions.

Habitat Loss/Degradation

Flow Alteration

Mitigation tools available for flow alteration fall under legislated control; a licence is required to take water, direct water, etc. The potential for mitigating flow alteration is high. For example, licensing can stipulate how to conduct a drawdown of the forebay for maintenance of a hydroelectric generating station to reduce turbulence. However, those measures may not mitigate the impact of the draw down on fishes. So, the effectiveness of mitigation measures for this threat is variable. There is no control over naturally-occurring alterations in flow.

Shoreline/Riparian Development

Potential for mitigation is not that high because riparian removal is a provincial recommendation; it is not legislated. Public education, regulatory change, watershed planning and riparian management guidelines may help. Integrated management committees have potential to guide shoreline/riparian development.

Landscape Changes

Environmental licensing offers the potential of mitigation for forestry, mining, agriculture (if a change in zoning occurs), peat extraction changes and cottage developments. The *Fisheries Act* and SARA legislation also provide the means to mitigate activities that would cause negative landscape changes for Carmine Shiner.

Climate Change

Few mitigations and alternative are available for this threat.

Species Introductions

The mitigations and alternative proposed for Ontario Lake Chubsucker (see DFO 2011) would be useful for Carmine Shiner except for the removal of introduced species. Preventing introductions in the first place is easier than removal later. Introduced species have been successfully removed in some small lakes but participants agreed this would be very difficult in rivers.

Pollution

Environmental licensing is the primary mitigation for dealing with pollution as was done to reduce the use of DDT in the 1970s, phosphorus in dishwashing detergents in the 1980s and, more recently, herbicides in lawn treatments in some Canadian municipalities. Additional mitigation measures would include public education and putting plans in place to contain and clean up spills and other releases of pollutants. Alternative measures, such as reductions in pesticides (e.g., organic farming), are market driven.

Overexploitation

No directed fishing for Carmine Shiner is allowed in Manitoba. Incidental catch is largely controlled too. Regulation of the commercial baitfish industry (for both live and dead bait) is in place. The capture of baitfish by recreational fishers is not regulated but none is known to occur in areas where Carmine Shiner are found. If this changes, the provincial government could institute a prohibition and would likely implement public education.

Other Threats

Scientific Sampling

Mitigations for this threat are observational studies or sampling in areas where Carmine Shiner are not protected (e.g., in the United States). No alternatives are available given the need for more, not less, information on Carmine Shiner.

OTHER LIMITING FACTORS FOR POPULATION SURVIVAL OR RECOVERY

The potential for recovery was discussed. A participant thought that it is not possible for Carmine Shiner to reach the recommended recovery target of 8-9 million fish because suitable habitat is too limited to support those numbers. The Whitemouth River system may be sufficiently long but suitable habitat within it appears to be restricted. Another participant said that if suitable habitat is fixed, this may indicate that Carmine Shiner are, and have been, at carrying capacity. The Recovery Strategy indicates there is no evidence of declining numbers or distribution. Thus, this species may be at risk but not need recovery.

Carmine Shiner is at the northern limit of their distribution. Our lack of understanding about their dispersal requirements, such as whether they can survive going over a waterfall or spillway, limits our ability to predict the impact of climate change or other disturbances on the survival and distribution of this species. It is not known whether Carmine Shiner would move to other habitats in response to climate change and, if so, whether there is potential for hybridization with other Cyprinids. The potential for hybridization increases as the number of Carmine Shiner decrease as might occur during a period of extended drought or releases of cold water by a dam. Introduction of a species more likely to hybridize with Carmine Shiner might increase the probability of hybridization, though it could just as likely lead to speciation. In Minnesota there are only six records of hybridization in the minnow family (two for Percobromus). There are no records reported for Manitoba.

SOURCES OF UNCERTAINTY

Knowledge gaps previously identified in the meeting (e.g., survival rates of Age-0 fish) were added to this section of the document. A participant also noted that the carrying capacity of the habitat is unknown. It was suggested that if we knew how much space a Carmine Shiner requires and how much is available then we should be able to calculate the idealized population size (carrying capacity) for the existing habitat.

ALLOWABLE HARM

One of the authors of the modelling working paper presented the results of their analyses on allowable harm.

Allowable harm relates to survival or recovery at the population level not the individual level; this should be clarified in this section of the document. The modellers report the following is recommended for all species at risk, regardless of the sensitivity analysis: (1) if the population is declining there is no scope for harm, (2) if the population trajectory is unknown the scope for harm could only be assessed once population data are collected and (3) that scientific research to advance the knowledge of population data should be allowed. Based on their sensitivity analysis, the modellers concluded the following: (1) in the absence of population abundance estimates no harm should be allowed to the most sensitive rates (i.e., fecundity or survival of YOY), (2) as population growth is very insensitive to the survival of adults who have spawned at least once, harm could potentially be allowed and (3) if population abundance estimates exceed the MVP, then harm could be allowed to the level identified by the modelling. Participants discussed the application of these results. In the absence of a population estimate, a participant wondered if no harm should be allowed or whether limited or minimum harm might be possible if it would provide an overall benefit for the species. The modeller responded that the provision for scientific sampling was intended to cover that off. She noted that the allowable harm results may not change when the model is re-run because the error bars on the elasticities are very small.

SUMMARY BULLETS FOR SCIENCE ADVISORY REPORT

Summary bullets were drafted by the meeting chair and reviewed by the participants. Some minor changes to wording were made and more controversial bullets were discussed in more detail. Participants agreed that persistence (i.e., maintaining healthy, viable populations in all locations where they currently exist) more accurately reflects the long-term goal for Carmine Shiner than recovery. To reach this goal it is necessary to have a minimum number (or range) of adults and area of suitable riverine habitat. Both numbers (and ranges) will be determined by the modelling re-analysis and the probability of persistence and frequency of catastrophes will be defined. Participants agreed that the most important current threat to Carmine Shiner is habitat degradation and loss, especially as a result of flow alteration. The mitigation measures that would most aid in the long-term persistence of the species are protection of habitat and prevention of mortality. Carmine Shiner is found over habitat containing sand and gravel and also over hard substrate. The available Manitoba data will be re-checked to determine how best to define substrate for this species.

REFERENCES CITED

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

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APPENDIX 1: TERMS OF REFERENCE

Recovery Potential Assessment of Carmine Shiner

Central and Arctic Regional Advisory Meeting

Freshwater Institute, Winnipeg, Manitoba

8:30 a.m. to 4:30 p.m. (CDT) on 15 March 2011 and 8:30 a.m. to noon on 16 March 2011

Chair: Kathleen Martin

Background

In November 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the status of the Carmine Shiner (*Notropis percobromus*) as Threatened. The reason for this designation is because Carmine Shiner occurs in an extremely restricted area of Manitoba. The major threat to the species is the alteration in water flow as a result of stream regulation. In June 2003, the Carmine Shiner was added to Schedule 1 of the *Species at Risk* Act (SARA) as Threatened. COSEWIC re-assessed the species again as Threatened in April 2006. A recovery strategy was finalized in February 2008.

Fisheries and Oceans Canada (DFO) has been asked to undertake a Recovery Potential Assessment (RPA) for Carmine Shiner. DFO Science developed the RPA framework to provide the information and scientific advice required for the Department to meet various requirements of the SARA. The information 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 sections 73, 74, 75, 77 and 78 of SARA.

This advisory meeting is being held to assess the recovery potential of Carmine Shiner. The resulting RPA Science Advisory Report (SAR) will summarize the historic and current understanding of the distribution, abundance and trend of this species, along with recovery targets and times to recovery while considering various management scenarios. The current state of knowledge about habitat requirements, threats to both habitat and Carmine Shiner, and measures to mitigate these impacts, will also be included in the SAR. At this stage in the SARA process for Carmine Shiner, the information in the RPA may be used to inform the development of an action plan and to support decision-making with regards to SARA agreements and permits.

Objectives

The intent of this meeting is to assess the recovery potential of Carmine Shiner using the RPA framework outlined in the Revised Protocol for Conducting Recovery Potential Assessments The advice will be provided to the DFO Minister for her consideration in meeting various requirements of SARA for this DU.

Products

The meeting will generate a proceedings report summarizing the deliberations of the participants. This will be published in the Canadian Science Advisory Secretariat (CSAS) Proceedings Series. There will be CSAS Research Document(s) produced from the working paper(s) presented at the meeting. Advice from the meeting will be published in the form of a SAR.

Participation

Experts from DFO, provincial and U.S. state governments and industry have been invited to participate in this meeting.

APPENDIX 2: MEETING PARTICIPANTS

Name	Affiliation
Holly Cleator	Fisheries and Oceans Science, Winnipeg, MB
Eva Enders	Fisheries and Oceans Science, Winnipeg, MB
Doug Leroux	Manitoba Water Stewardship
Jeff Long	Manitoba Water Stewardship
Kathleen Martin	Fisheries and Oceans Science, Winnipeg, MB
Shelley Matkowski	Manitoba Hydro
Konrad Schmidt	MN Dept of Natural Resources Nongame Fish Specialist (retired), St Paul, MN
Doug Watkinson	Fisheries and Oceans Science, Winnipeg, MB
Jennifer Young	Fisheries and Oceans Science, Burlington ON

APPENDIX 3: MEETING AGENDA

Recovery Potential Assessment for Carmine Shiner

Freshwater Institute, 501 University Crescent, Winnipeg, MB

Chair: Kathleen Martin

15 March 2011

8:30 Welcome and introductions (Martin)

8:40 Purpose of the meeting (Martin)

8:50 Species biology and ecology

9:10 Historic and current distribution and trends

9:25 Historic and current abundance and trends

9:45 Residence

10:00 *Coffee break*

10:15 Information to support identification of critical habitat

11:00 Modelling presentation (Young) and discussion

11:45 *Lunch*

1:00 Recovery targets

2:00 Threats to survival and recovery

3:00 *Coffee break*

3:15 Limiting factors for population recovery

3:30 Mitigations and alternatives

4:30 End of day

16 March 2011

8:30 Recap of first day

8:45 Allowable harm

9:45 Data and knowledge gaps

10:00 *Coffee break*

10:15 Sources of uncertainty

10:30 Abstract and conclusions for Res Doc, summary bullets for Science Advisory Report

11:30 Maps/tables/figures and literature cited

11:45 Concluding remarks / next steps (Martin)

12:00 Meeting adjourns