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Proceedings of the regional recovery potential assessment of Plains Minnow (*Hybognathus placitus*) in Canada

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Foreword

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

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SUMMARY

A regional Science peer-review meeting was held on December 12, 2012 to assess the recovery potential of Plains Minnow (*Hybognathus placitus*) in Canada based on the Fisheries and Oceans Canada (DFO) national Recovery Potential Assessment (RPA) framework. In May 2012, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that Plains Minnow be designated Threatened. It was their first assessment of Plains Minnow which is now being considered for listing under the *Species at Risk Act* (SARA). The Science Advisory Report resulting from this assessment will provide the information and scientific advice to inform the SARA listing decision. If listed, this scientific advice will also be needed to fulfill SARA requirements, including the development of a recovery strategy, and to support decision-making with regards to SARA agreements and permits.

Meeting participants included DFO (Science, Species at Risk, Habitat and Policy), Parks Canada Agency, Saskatchewan Government and a fish expert from Montana State University. 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 Website.

Compte rendu sur l'évaluation du potentel de rétablissement du méné des plaines (*Hybognathus placitus*) au Canada.

SOMMAIRE

Une réunion régionale d'examen scientifique par les pairs s'est tenue le 12 décembre 2012 pour évaluer le potentiel de rétablissement du méné des plaines (*Hybognathus placitus*) au Canada à partir du cadre national d'évaluation du potentiel de rétablissement (EPR) de Pêches et Océans Canada (MPO). En mai 2012, le Comité sur la situation des espèces en péril au Canada (COSEPAC) a recommandé que le méné des plaines soit désigné espèce menacée. Il s'agissait de la première évaluation de la situation du méné des plaines, dont on envisage actuellement l'inscription en vertu de la *Loi sur les espèces en péril* (LEP). L'avis scientifique découlant de cette évaluation fournira les renseignements et les conseils scientifiques nécessaires pour éclairer la prise de décisions concernant l'inscription de cette espèce en vertu de la LEP. Si l'espèce est inscrite, cet avis scientifique sera également nécessaire afin de satisfaire aux exigences de la LEP, telles que l'élaboration d'un programme de rétablissement, et d'éclairer la prise de décisions concernant les ententes et les permis en lien avec la LEP.

Parmi les participants à la rencontre, on comptait le MPO (secteurs des sciences, des espèces en péril, de l'habitat et des politiques), l'Agence Parcs Canada, le gouvernement du Saskatchewan et un spécialiste des poissons de la Montana State University. 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

A meeting of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2012 recommended that Plains Minnow (*Hybognathus placitus*) be designated Threatened. The reason given for this designation was that Plains Minnow "has a very limited distribution in Canada at only one or two locations, both of which are small streams subject to drought. The species requires long stretches of flowing water to complete its life cycle. Further threats to water supply from additional irrigation dams and excessive drought would increase risks to this species" (COSEWIC 2012). This was the first assessment of the species. Plains Minnow is being considered for listing under the *Species at Risk Act* (SARA). To inform possible development of a recovery strategy and to support decision-making with regards to SARA agreements and permits, a Recovery Potential Assessment (RPA) was conducted on 12 December 2012.

The intent of this meeting, as described in the Terms of Reference (Appendix 1), was to assess the recovery potential of Plains Minnow using the RPA framework (DFO 2007a, b). The RPA is a science-based peer review that assesses the current status of a species and possible recovery targets, what is known about its biology, habitat and threats to it or its habitat and potential mitigation measures or alternatives to the threats, and scope for human-induced mortality from threats.

Meeting participants (Appendix 2) included DFO (Science, Species at Risk, Habitat Management and Policy programs), Parks Canada Agency, the Saskatchewan government and a fish expert from Montana State University. DFO drafted two working papers, one modelling and one non-modelling paper, to serve as the basis for the RPA. They were distributed to participants in advance of the meeting. The meeting generally followed the agenda (Appendix 3).

This Proceedings report summarizes the relevant meeting discussions and presents the key conclusions reached. Science advice resulting from this meeting is published on the DFO Canadian Science Advisory Secretariat website in the Science Advisory Report series. The technical details supporting the advice included in the two working papers presented at the meeting are published in the Research Document series. The complete list of references for material cited in this report can be found in the two Research Documents.

DISCUSSION

The Chair provided an overview of the SARA-related processes beginning with COSEWIC's assessment and designation of Plains Minnow, then DFO's recovery potential assessment, and finally the listing process by the federal government. Two working documents were reviewed during the RPA meeting: a modelling paper that provided information related to recovery targets and times to recovery, and a non-modelling paper that contained information on the species biology, habitat preferences, current status, threats, and mitigations and alternatives. Participants began by discussing the non-modelling paper.

Working paper: Information in support of a Recovery Potential Assessment of Plains Minnow (*Hybognathus placitus*) in Canada

Author: C. Sawatzky and D. Watkinson

Presenters: D. Watkinson and C. Sawatzky

Abstract[1]

In Canada, the Plains Minnow is distributed in two small streams in Saskatchewan. In May 2012, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that Plains Minnow be designated Threatened. They considered the species to be at risk of extinction in Canada because of its very limited distribution. Plains Minnow needs long stretches of flowing water to complete its life cycle however threats to the water supply from irrigation dams and excessive drought put the species at risk. This was COSEWIC's first assessment of Plains Minnow which is now being considered for listing under the *Species at Risk Act* (SARA).

Fisheries and Oceans Canada (DFO) has undertaken a Recovery Potential Assessment that summarizes our current understanding of the distribution, abundance and population trends of Plains Minnow in Canada. Identification of threats to both Plains Minnow and its habitat, and measures to mitigate these impacts, are also reported. This information may be used to inform the development of recovery documents, and to support decision-making with regards to the issuance of permits, agreements and related conditions under the SARA.

Discussion

Discussions related to each topic are described below.

SPECIES DESCRIPTION, BIOLOGY AND ECOLOGY

An overview of Plains Minnow species information including their main morphological characteristics was presented. Differences between Plains Minnow, Western Silvery Minnow (*H. argyritis*) and Brassy Minnow (*H. hankinsoni*) were described. The Plains Minnow and Western Silvery Minnow are similar in appearance although genetic analysis confirms they are distinct species. A question was asked about how to identify the different species in the field. Both the presenter and the fish expert from Montana said they have seen enough of both species that they feel confident distinguishing fish greater than 50 mm total length (TL). In Montana, most biologists lump these two species together. In Canada, they occur in separate locations.

HISTORIC AND CURRENT DISTRIBUTION AND TRENDS

Sampling conducted in North America and Grasslands National Park was discussed. A participant commented that there are two new areas to the north of the National Park that have been added to the Park but had not been added to the map in the working paper. He would send the authors the Geographic Information System (GIS) file with the park boundaries updates to add to the report. The author of the working paper was also asked to add a map of the watershed to the document. The Frenchman River watershed was sampled closer to the United States border but they did not collect any Plains Minnow. The only Plains Minnow found were in Rock Creek and Morgan Creek.

Rock Creek flows downstream to the confluence with the Milk River in the United States. One participant noted that the names for Morgan and Rock creeks should be switched on the map in

[1] Updated following the meeting incorporating comments.

the working paper so that the mainstem has the same name along its length[2]. Horse Creek is the name of the creek to the west of Wetherall Creek. The map in the working document will be updated accordingly.

Plains Minnow was first found in Canada in 2003. Subsequent sampling in 2006 and 2007 revealed that only a small portion of the distribution of this species occurs in Canada. Plains Minnow has only been documented over 26.5 km of river length (rkm) in the Rock Creek system: 15.5 river rkm in lower Rock Creek and 11.0 rkm in lower Morgan Creek. In the Rock Creek system, there seems to be a transition in habitat. The upstream sampling location has clearer water with some emergent vegetation (marshy) compared to farther downstream which is more turbid. There may be a habitat limitation preventing Plains Minnow from extending farther upstream. A participant noted that there is a bank slide part-way down the creek that may be the transition point. More sampling is required farther upstream to confirm the species' distribution. This would require hiking to sampling sites as road access is limited.

Wetherall and Horse creeks also require more sampling. Invertebrate sampling was conducted in both creeks and some fishes were caught. The collections should be checked to see if they include Plains Minnow. It was noted there was virtually no flow in Wetherall Creek in 2007. There can be flow farther upstream in some of these waterbodies yet no flow by the time it reaches the United States border.

There are data for Plains Minnow in Montana from a 2008 publication which reports collections farther east in Beaver Creek and in the east fork of Poplar Creek. There may be Plains Minnow in Canadian portions of these systems east of the current distribution shown in the Grasslands National Park map.

Historic and Current Abundance and Trends

All sampling for Plains Minnow conducted by the presenter was conducted using a seine net (9.14 m x 1.82 m) with a mesh size (4.76 mm) small enough to collect fish 14 mm fork length (FL) and fully sample those at 20 mm FL. Backpack electrofishing was not used. The group discussed the seasonal sampling and agreed that to date sampling has been inadequate to determine abundance and trends.

Fathead Minnow (*Pimephales promelas*) is caught in much larger numbers relative to Plains Minnow. There are no historical data for Plains Minnow from the Canadian portion of its range. There is the potential for large fluctuations in numbers of Plains Minnow. In the United States, this species is declining in a good portion of its range and much of that is due to impoundments and water diversions. Given the state of the Rock Creek watershed and the lack of diversions and impoundments, the trend in population abundance of Plains Minnow is likely fairly stable. A participant provided hydrological information which showed that only about 2% of the Rock-Morgan creeks system was diverted or controlled. There is a diversion dam on Rock Creek upstream of the confluence with the Milk River in the United States, but biologists are unsure whether it would prevent fish passage. A participant said that Plains Minnow is present in Rock Creek in Montana upstream of the barrier and that about 170 rkm in the Montana portion of Rock Creek is available for Plains Minnow. This species also occurs in the Frenchman River in Montana, closer to the confluence with the Milk River, but not upstream in Saskatchewan. Using Google Earth, a participant determined there is a large mainstem reservoir on the Frenchman River about 33 rkm downstream of the Saskatchewan-Montana border. Plains Minnow is probably found just below that. In Montana, Plains Minnow is found in Battle Creek, Frenchman

[2] This revision was not made because it does not agree with the Canadian Gazetteer.

River, Rock Creek and its tributaries, Poplar Creek and Big Muddy Creek (called Beaver Creek in Canada). The West Fork of Poplar Creek does not have records of this species. It was pointed out that Northern Pike (*Esox Lucius*) occurs in Poplar Creek which might account for the absence of Plains Minnow[3]. It is possible that Plains Minnow formerly, or currently, occurred in Lodge and West Fork Poplar creeks, but recent fragmentation by dams and predation by Northern Pike have resulted in their extirpation. In the 2008 report, a number of Plains Minnow were found in the United States portions of Frenchman River and Rock Creek but not upstream in Canada.

Species Biology, Ecology, Habitat and Residence

Longevity in this species is at least two years in Canada and possibly three years in the United States. Fish greater than 100 mm TL in Canada have not been collected while in the United States they have recorded lengths of 120-130 mm TL. Plains Minnow eat very small food particles.

There is little information on spawning habitat for the species. Plains Minnow is a fractional spawner (i.e., spawns more than once in the reproductive season). They move upstream to spawn during periods of high flow and then the eggs drift downstream. A participant indicated that a small fish in a flume, although not a Plains Minnow, was able to move about 50 km over 75 hours. There could be year-class failures in years of low flow. The eggs are entrained in the water column and hatch in 24-48 hours. There may be a minimum stream length necessary to have successful spawning. A recent paper by Perkin and Gido (2011) estimated that the minimum stream length needed is 115 rkm for Plains Minnow. There is 140 rkm in Montana and about 26.5 rkm in Canada so the total amount available is about 166.5 rkm. A participant asked if anyone has checked to see how far the eggs will travel given typical river flow. The presenter responded that river flow is typically about 3 $km \cdot h^{-1}$ and eggs hatch in 24-48 hours, thus Plains Minnow would need about 100 rkm (between 72 rkm and 144 rkm).

Adults often occur in turbid, sandy, silty waters and they are often found in backwater, embayments and mid-channel habitats. Plains Minnow has a relatively high critical thermal maxima and tolerance of low minimum dissolved oxygen. They are resilient fish that can tolerate harsh environmental conditions including warm, mostly standing water. There is little information available on presence/absence of vegetation and its use by Plains Minnow. Riparian vegetation along Morgan Creek includes a mixture of grasses, sedges and shrubs. The Rock Creek-Morgan Creek area was described as mixed grass with some sedges.

The Plains Minnow does not construct residences during its life cycle.

Population Status

The Chair described the approach that would be used to evaluate population status of the Plains Minnow based on rating abundance, trajectory and certainty. Since there is only one "population" of Plains Minnow in Canada, it was ranked as high relative to the only other population for which an abundance estimate has been published (Pecos River, New Mexico). Participants discussed if this comparison to the Pecos River population was appropriate. Based on the sampling results Plains Minnow would not be considered particularly rare or common. Fathead Minnow is a common species. Plains Minnow is an introduced species in the Pecos River. Sampling south of the United States border in Montana provided some estimates of abundance contiguous with the Canadian distribution. Seining data produced a maximum of

[3] During the post-meeting document review stage a meeting participant noted that Northern Pike also occur in Battle and Big Muddy creeks where Plains Minnow is found.

about 2,000 Plains Minnow per rkm and a minimum of 1 fish per rkm. For three tributaries in the Rock Creek drainage, 2,000, 800 and 600 Plains Minnow were caught per rkm. In Rock Creek, about 300 Plains Minnow were caught per rkm. More detailed estimates would be provided following the meeting and the working paper revised accordingly. Based on these numbers, the abundance estimate was considered High. Population Trajectory was rated as Unknown. This resulted in a Population Status of Fair. The group agreed this rating was reasonable given the available data.

Habitat Functions, Features and Attributes

There is no information available on optimal habitat for this species. Participants reviewed the essential functions, features and attributes for each life stage of Plains Minnow (Table 6 non-modelling working paper). For spawning, participants agreed that “backwater” should be removed from the working paper. It is unlikely that Plains Minnow would use “backwaters” for spawning although they would use them for feeding and typical habitat. The literature indicates Plains Minnow needs flowing water for spawning. If Plains Minnow is an obligate drifting egg spawner backwaters would not be appropriate. The authors were asked if there were data that would show flow relative to year class. Flow data are hard to get because not all streams have stream gauges. This led to the suggestion that another uncertainty is whether Plains Minnow can recruit in years/areas of poor flow.

The group reviewed the egg to juvenile stage of the table. Participants agreed that this stage should be changed to egg to exogenous feeding. A participant asked about what they need for their diet. Plains Minnow has a complete intestine so they probably eat a range of prey but their diet is unknown. For this category (i.e., egg to exogenous feeding), feeding does not occur so that function is not required.

The group then discussed the juvenile stage. There are only habitat data for the adult stage (age 1+). One suggestion was to add intermittent pools for the juvenile stage because it is an accepted habitat for this species. If flow stops, juvenile fish can still survive. The group agreed that it would be appropriate to identify intermittent pools in the table in addition to flowing water and backwaters.

For the adult stage, low relative abundance of piscivores would be more appropriate and “impassable” impoundments should be added. Another participant recommended “non-impounded river reaches” for wording in the table. Definitions are needed for terms such as “parallel plunges, perpendicular plunges, pools and slackwaters”. Participants agreed that those terms, in the latter portion of the sentence, should be deleted. The size of streams occupied by Plains Minnow should be included for the U.S. references. The Identification of Critical Habitat column will be modified according to the previous wording suggestions.

A fish community list for Rock and Morgan creeks was presented. Fathead Minnow (N=2,859), Lake Chub (*Couesius plumbeus*) (848), Longnose Dace (*Rhinichthys cataractae*) (521) and White Sucker (*Catostomus commersonii*) (444) were more prevalent than Plains Minnow (202). Participants agreed the list should be added to the non-modelling working paper.

Working Paper: Recovery Potential Modelling of Plains Minnow (*Hybognathus placitus*) in Canada

Authors: Jennifer A.M. Young and Marten A. Koops

Presenter: Jennifer Young

One of the authors of the modelling working paper presented the results of their analyses on recovery targets and times and minimum area for population viability.

Abstract

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed the Plains Minnow (*Hybognathus placitus*) as Threatened in Canada (COSEWIC 2012). Here we present population modelling to assess population sensitivity, determine population-based recovery targets, and conduct simulations to estimate the impact of transient (one-time) harm in support of a recovery potential assessment (RPA). Our analyses demonstrated that the dynamics of a growing Plains Minnow population are most sensitive to perturbations that affect the survival of immature individuals. If post-spawning mortality is high, dynamics are also very sensitive to the fecundity of first-time spawners. A stable population, or one experiencing high young of the year (YOY) mortality due to low flow, is equally sensitive to survival of YOY and young adults, and is more sensitive to the fecundity of age 2+ adults than a growing population. Harm to these portions of the life cycle should be minimized to avoid jeopardizing the survival and future recovery of Canadian Plains Minnow. Based on an objective of demographic sustainability (i.e., a self-sustaining population over the long term), and a 15% probability of catastrophic decline per generation, we propose a population abundance recovery targets of approximately 60,600 adult Plains Minnow (age 1+). This abundance requires, at minimum, 12 ha of suitable habitat including >100 km of barrier-free river for development of drifting eggs. Current available habitat in Canada is approximately 12.1 ha supporting 2,400–55,400 adults (COSEWIC 2012). At these abundances, the current risk of extirpation of a stable population is 2% (range 1–69%) over the next 100 years. However, current population trajectories are unknown. Therefore allowable transient harm should not exceed a 12.5% reduction in adult abundance (300 adults), or a 17% reduction in YOY abundance (590 YOY), or a 7.5% reduction in total abundance (260 YOY and 180 adults) within a 7 year period (approximately 3 generations).

Discussion

The authors estimated survival and fertility for each age but they had to force the von Bertalanffy curve because there were no YOY data to estimate mean age at size. One participant suggested that they indicate on the curve where they had to force the relationship. The presenter agreed to make that change in the modelling document.

Using allometry across all species may not yield accurate results for Plains Minnow. That information is used to estimate mortality which usually follows the generalization that the smaller the fish the higher the mortality. It was a low flow year in 2006, so it could be that fish waited another year to spawn. The author assumed that the environmental variation they normally include in the model was sufficient to encompass the Plains Minnow situation. The model has low-flow and high-flow year conditions. The model gave a growth rate that was higher than the maximum rate expected for a fish that size (0.045) so they used the maximum rate instead. Fertility was estimated using Taylor and Miller's (1990) curve. Their estimates might be conservative. In a low-flow year the model assumed that low YOY survival and fertility occurs because fish delay their spawning. It is assumed that they have better survival to age 2. In contrast, in a high-flow year the model assumed a higher YOY survival, original fertility value and higher mortality after they spawn.

In the simulation method, several thousand trials are run. The several thousand population projection matrices incorporate all the uncertainties and sensitivity analyses. Elasticity is a measure of relative changes in population growth rate resulting from proportional changes in vital rates. A participant asked about values of elasticity and if they could be one, two, etc. They could be and the uncertainties are wide. Elasticity analysis was used as the base model with maximum growth rate or with stable growth rate, and high- and low-flow trade-offs for the deterministic model versus the stochastic model. A participant asked if the results reflect the assumptions that went into the model. Is there anything that stands out as surprising or not likely? Mathematically, it holds together but the presenter couldn't comment on whether it makes sense in terms of the biology of Plains Minnow. If the assumptions hold true in terms of the vital rates, then the order of importance of the ranking of the elasticity is fairly robust. The survival of YOY appears to be most important for growing populations. For populations that are stable or declining then the survival and fecundity of adults becomes more important. This general trend is typical for most fish species the author has modelled.

Allowable harm is defined as harm to the population that will not jeopardize the survival or recovery of the species. The presenter did not model any chronic harm at the population level because the authors did not trust the population growth rate they had for Plains Minnow. Instead they modelled allowable transient harm which they defined as removal of individuals that does not exceed a pre-determined reduction in population growth rate over a specific time-frame. The authors used 10 years or three generations, which is about seven years for Plains Minnow, whichever is shorter. An acceptable reduction in growth rate depends on population trajectory. The authors chose a 1% reduction in growth rate over the seven years. Four matrices were created with random parameters. Reduce survival in one matrix by *x*% to simulate a one-time removal of *x*% of abundance. They repeated this several thousand times to get a distribution of changes for various removal rates.

The authors calculated that allowable removal should not exceed a 17% reduction in YOY abundance, 12.5% reduction in adult abundance and about 7.5% for both. The lower bound of population trajectory is stable at 2,400 adults. For the base model, about 300 adults could be removed in an entire seven-year period without producing a 1% decline. A participant asked if it matters whether the removal occurs in year one versus year six. The model just removed the fish in the first year; there is no auto-correlation built into the model. The group discussed adding a table that includes different percentages of population decline. A participant asked how they estimated the generation time at 2.4 years. The presenter said the mean age comes from the matrix. The mortality is low as estimated by the growth curve. The author asked the group for advice on what additional information would be useful to include in the working paper regarding transient allowable harm. The group agreed the table should include declines in average population growth rate of 1%, 3% and 5% and explain in the bullets what a 1% decline means. A participant asked if there is a set value for setting recovery goals that establish what parameters should be used for harm. Two participants responded that there was not a set value to establish what parameters should be used for harm.

The author read aloud the bullets they developed for chronic allowable harm and for allowable transient harm. There was a discussion about chronic harm and mitigation measures. The Chair clarified that at RPA meetings, recovery goals are not set nor are the allowable harm limit choices. Those sorts of choices are made by managers. The group provides the best available information in order for the managers to make the best decisions. One participant commented that Parks Canada Agency always chooses measures that will result in absolutely no harm.

The authors considered recovery targets related to abundance and distribution. They decided that distribution targets are not appropriate for Plains Minnow so they provided advice only on abundance targets. Population viability analysis (demographic sustainability) was used as it works well with matrix modelling for data-deficient species. They established a minimum population size for a given probability of persistence and set timeframe. The authors used 100 years for consistency across species. They used a population model to simulate dynamics of populations from various starting points and counted the frequency of extinctions. The upper bound on allowable risk of extinction was set at 10% based on COSEWIC's quantitative criteria and the lower bound at 0.1% based on the most stringent criteria in the literature. The authors incorporated catastrophes (defined as an event that reduces the population by 50%) into the modelling. Catastrophes affect smaller fishes more than larger fishes thus their minimum viable population (MVP) needs to be larger. The authors used 15% probability of extinction per generation, which is close to the 14% used by Reed et al. (2003) for vertebrates. Extinction is defined as less than two adults. The authors chose a quasi-extinction threshold of 50 adults. For 50 adults, the risk of extirpation at current abundance is 0.035 (0.024–1.000) if the chance of catastrophe is 10% per generation or 0.304 (0.227–1.000) if 15% per generation. These numbers are considerably lower for an extinction threshold of two adults. A participant asked if low flow could be considered a potential catastrophe. Anything that kills off 50% of the population would constitute a catastrophe. The author showed several scenarios for MVP. For an extinction threshold of two adults, assuming a 15% chance of catastrophe and extinction risk of 0.01, then 87,350 YOY or 60,646 adult (age 1+) fish are needed.

The group discussed habitat targets. Information is not available on how much habitat is needed to support the Plains Minnow so the authors used allometries instead. A stable stage distribution consists of 59% YOY, 26.8% one-year-olds and 14.2% two-year-olds assuming sampling post breeding. The author presented results for different sets of assumptions. For example, the area per individual for an extinction threshold of two adults with a 15% chance of catastrophe per generation and an extinction risk of 0.01, with an MVP of 60,646 adult fish is 12.0 ha. This is roughly the amount of habitat available for Plains Minnow in Canada. If habitat decreases, then the extinction risk will increase.

Key uncertainties associated with the modelling include lack of information on life history, population growth rate, refined abundance for allowable harm, habitat quality and the frequency and magnitude of catastrophic events.

There was a discussion about what population size was used in the calculations. The author used the estimated population size within Canada only. Plains Minnow is estimated to number over 100,000 in the Montana portion of the Rock Creek basin.

It was noted that the COSEWIC reasons for designation suggest that the status of the species is not likely to improve enough that it would be upgraded to Special Concern. Participants agreed that a more reasonable goal is probably to maintain, not recover, the population given there are Plains Minnow in the United States as well. 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 this species.

The group discussed winter kills for Plains Minnow. No one was aware of any reports of winter kills. One participant commented that there is ice cover during winter throughout the Plains Minnow distribution. Other participants reported that though there may be no flow in winter there is still connectivity to groundwater inputs to pools. If there are no groundwater inputs then winter kill may occur.

THREATS TO SURVIVAL AND RECOVERY

Threats to this species are related to anthropogenic impacts that either change habitat connectivity, and thus Plains Minnow dispersal or migration, or alter flow regimes (e.g., change the habitat from riverine to reservoir), and thus aid the persistence of piscivores. Climate change, scientific sampling, turbidity and sediment loading, nutrient loading, contaminants and toxic substances and barriers to movement are all threats to Plains Minnow given the localized distribution of this species. The Chair explained that threats would be assessed in terms of their Threat Likelihood and Threat Impact, and the certainty associated with Threat Impact would also be identified. Another participant then presented the standard list of threats that have been identified for freshwater fishes and explained the rating choices. The group agreed to include all the threats identified for freshwater fishes in the working document and then identify which ones are actual threats.

The group discussed the threat of Turbidity and Sediment Loading. Cattle grazing occurs in the area and there are signs of cattle trampling along portions of Rock and Morgan creeks. There are no culverts in the Rock Creek system but there are a few ford crossings across creeks. Another participant added that three new stream crossings were installed this past summer. The creek bottom was scraped and fabric was installed and covered with gravel. Although Plains Minnow is tolerant of Turbidity and Sediment Loading, a participant noted there may be thresholds that impact their prey (e.g., too much turbidity could reduce production of diatoms). The group suggested that Plains Minnow is tolerant but not immune from the effects of this threat. Therefore, the threat of Turbidity and Sediment Loading likelihood is Unlikely and threat impact is Medium. The rating of Medium was given in the unlikely event that high levels of chronic Turbidity and Sediment Loading impact the prey of Plains Minnow.

Two participants reported there are no commercial, recreational, aboriginal or baitfish harvests in the region so Incidental Harvest is not a threat and was not included in the working paper.

Climate Change is not rated as a threat as its impacts are speculative. Drought was not discussed for Plains Minnow as it was for the other freshwater prairies fishes like Western Silvery Minnow but it would be included in the text about Climate Change.

Habitat Removal and Alteration was discussed and the group agreed that the likelihood of this threat is Unlikely but the impact would be High with certainty based on correlative studies.

Participants discussed Alteration of Natural Flow Regimes and agreed the likelihood of this threat is Known given there is provincial water licensing that occurs (e.g., for dugouts and dams) in the upstream portions of the waterbody that affects the lower portions of the watershed. One participant commented that dugouts would have relatively low impact while impoundments would likely have a high impact. Another participant noted that there are 11 upstream surface water licenses but currently less than 2% of flow is being held upstream in this watershed for stock watering. There has been no new licensing since 2000. Beaver “dams” occur occasionally, in spite of the fact that only shrubs and wild rose are present, but the structures were very small and raised the water level only about 20-30 cm. The group agreed to rate small impoundments and dugouts separately from large impoundments. The likelihood and impact of Small Impoundments and Dugouts would be Known and Low impact based on expert opinion. The likelihood of Large Impoundments is Unlikely but potentially High impact based on correlative studies.

Introduced Species and Diseases are known to occur because exotic fish species are found in the area. A participant said that Northern Pike, a piscivore, can be a problem in prairie streams like Battle and Big Muddy creeks (tributaries of the Milk River). Northern Pike are not considered native in the Missouri portion of Montana. They are not found in the American portion of Rock Creek but do occur in other tributaries. Non-piscivores like Common Carp (*Cyprinus carpio*), that occur in the Canadian range, could potentially be a direct competitor for food with Plains Minnow. The group agreed that exotic species in general could pose a threat not just exotic piscivores. After much discussion, participants decided to split this threat into two components: (1) All Introduced Species and Diseases except Exotic Piscivores and (2) Exotic Piscivores. For the former threat, expert opinion indicates that likelihood and impact are Known and Low, respectively. For the latter threat, correlative studies indicate that likelihood and impact are Unlikely but High.

Scientific Sampling is not on the standard threats list but was included in the non-modelling working paper. One participant has collected about 220 Plains Minnow to date. If they were to sample another year, they would exceed the allowable harm limit identified by the modelling paper. This information was taken into consideration when evaluating the impact of this threat. Participants agreed the likelihood of this threat is Known but its impact is Low.

Nutrient Loading as a general category also includes Common Carp foraging. Common Carp is known in the Rock Creek system so the likelihood of this threat is Known. Participants discussed whether other types of nutrient loading such as fertilizer release and sewage treatment plant loading also occur. There is a relatively small amount of activities in the watershed that would introduce nutrient loading into this watershed so the impact of this threat was rated as Low with certainty of expert opinion.

The Contaminants and Toxic Substances category includes pipelines. These are known in the area. One participant said that pipeline remediation was done along Rock Creek recently so a frack-out is possible. The path of the pipeline was the Frenchman River and Swift Current and Morgan creeks. There were three or four pipeline works identified in the DFO Fish Habitat Management (FHM)[4] activity tracking system. The impact would vary depending on whether it is natural gas or light or heavy crude. Another participant said there are agricultural pesticides used for Leafy Spurge. Participants agreed this category should be split into two components: (1) Contaminants and Toxic Substances except from Pipeline Fractures and (2) Contaminants and Toxic Substances from Pipeline Fractures. The threat likelihood for the former category is Known and the impact is Low, based on expert opinion. For the latter category, the likelihood of a frack-out is Unlikely but the impact would be High, based on expert opinion.

A participant noted that drilling can affect groundwater upwelling so this could be a threat for Plains Minnow during winter, though there was insufficient information to rate this activity.

Within the current range of the Plains Minnow, Barriers to Movement are not known but they are present in the watershed. The group discussed the likelihood of this threat and decided it was Unknown. The impact of this threat would be High based on correlative studies.

The revised list of threats and ratings will be adjusted in Tables 8 and 10 of the working paper based on the discussions. In Table 11 of the working paper the spatial extent of all the threats was rated as Widespread. The temporal extent of Turbidity and Sediment Loading, Scientific Sampling, and Contaminants and Toxic Substances from Pipeline Fractures was rated as Ephemeral. All other threats were rated as Chronic.

CURRENT AND CANDIDATE MITIGATION MEASURES

A meeting participant presented their findings on current projects and new developments in the range of the Plains Minnow. They found existing pipelines in the area. There were no new developments or new impoundments identified in the FHM tracking system. The findings are listed in Table 13 in the working paper and included all the works, projects and activities that have occurred during the period from September 2002 to October 2010. A total of nine projects were found and included watercourse crossings (e.g., bridges, culverts, etc.), trenchless crossing and pipeline remediation, aquaculture, well site remediation in Rock Creek and a research grazing project. Of these nine projects, four were given a letter of advice which means mitigation measures need to be followed to avoid contravening Section 35 of the *Fisheries Act*[5] that was in effect at the time the projects were evaluated. Another four were directed to a Best Management Practice or Operational Statements as they were considered low risk. Only one

[4] As of 2013, DFO FHM is now referred to as the DFO Fisheries Protection Program.

[5] As of 2013, amendments were made to the *Fisheries Act* which may affect future project evaluations.

was authorized under Section 35 of the previous *Fisheries Act*. A Pathways of Effects table which identified activities or stressors and associated threats was presented.

Many works fall under Operational Statements so they may not appear in the database. As Rock and Morgan creeks are small waterbodies and there have been declining staff levels in the province of Saskatchewan, it is possible there are more projects that have taken place but not reported or investigated. The distribution of the Plains Minnow is within a National Park so that affords protection. Outside the Park, landowners may not be aware of this species. With amendments to the *Fisheries Act*, protection now focuses on commercial, recreational and Aboriginal fisheries which are not present in the area and as a result Plains Minnow may not receive protection under the *Fisheries Act* in the future. These creeks will not meet the definition of important waterbodies so from a federal perspective it is unlikely activities/works will be reviewed in the future, though provincial and National Park protection would still be possible.

One participant suggested that timing projects so they avoid important elements of the Plains Minnow's lifecycle elements might be helpful as an additional mitigation measure. Although another participant commented that this approach would be difficult because the information needed to set timing windows is not available.

Sources of Uncertainty

The Sources of Uncertainty section in the working paper should include Plains Minnow abundance given the limited sampling to date. If this species gets listed under the SARA, funding may be available to conduct additional sampling. There is a need for better estimates of population size, trends, and population trajectory. Certain life history characteristics are required to inform Plains Minnow population modelling efforts. More information is needed on growth rate, age at maturity, longevity, fecundity, population growth rate and survival of young of the year. One participant noted that if the spawning season can be extended then this could potentially affect the growth/length of fish depending on when they spawn. The current distribution and extent of suitable Plains Minnow habitat in the area in and around its current Canadian distribution should be the focus of future targeted sampling. The severity of individual threats is unknown so thresholds cannot be determined yet.

SUMMARY BULLETS FOR SCIENCE ADVISORY REPORT

Summary bullets for the Science Advisory Report will be drafted following the meeting based on the working documents and meeting discussions. The Proceedings, modelling and non-modelling Research Documents and the Science Advisory Report will be distributed to participants for review before finalizing.

CONCLUDING REMARKS

A participant asked about the length of time between completion of the Recovery Potential Assessment and a listing decision. The Chair responded that the time interval is 270 days. Once the RPA is finished, DFO Policy will conduct socioeconomic analysis and then the DFO Species at Risk Program will conduct consultations. Afterwards the advice goes to the Minister for a listing decision.

The Chair thanked the group for their input and adjourned the meeting.

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COSEWIC. 2012. COSEWIC assessment and status report on the Plains Minnow, *Hybognathus placitus*, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. ix + 41 p.

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

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APPENDIX 1: TERMS OF REFERENCE

Regional Peer Review Meeting – Central and Arctic Region

December 12, 2012
Winnipeg, MB (WebEx / Teleconference)

Chairperson: Kathleen Martin

Context

When the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designates aquatic species as threatened or endangered, Fisheries and Oceans Canada (DFO), as the responsible jurisdiction under the *Species at Risk Act* (SARA), is required to undertake a number of actions. Many of these actions require scientific information on the current status of Plains Minnow, threats to its survival and recovery, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for the consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

COSEWIC assessed Plains Minnow as Threatened in May 2012. This was the first assessment of the species.

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

Objectives

To assess the recovery potential of Plains Minnow (*Hybognathus placitus*).

Assess current/recent species/status

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

Assess the Habitat Use

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

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

Scope for Management to Facilitate Recovery

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

Scenarios for Mitigation and Alternative to Activities

21. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all feasible measures to minimize/mitigate the impacts of activities that are threats to the species and its habitat (steps 18 and 20).
22. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable alternatives to the activities that are threats to the species and its habitat (steps 18 and 20).
23. Using input from all DFO sectors and other sources as appropriate, develop an inventory of activities that could increase the productivity or survivorship parameters (steps 3 and 17).
24. Estimate, to the extent possible, the reduction in mortality rate expected by each of the mitigation measures in step 21 or alternatives in step 22 and the increase in productivity or survivorship associated with each measure in step 23.

25. Project expected population trajectory (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities associated with specific scenarios identified for exploration (as above). Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.
26. Recommend parameter values for population productivity and starting mortality rates, and where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts of listing the species.

Allowable Harm Assessment

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

Expected Publications

- Science Advisory Report
- Proceedings
- Two Research Documents

Participation

- Fisheries and Oceans Canada (DFO) (Science, Ecosystems and Fisheries Management sectors and Policy and Economics sectors, Habitat and Species at Risk programs)
- Parks Canada Agency
- Province of Saskatchewan
- Academics
- Other invited experts

References

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

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APPENDIX 2: MEETING PARTICIPANTS

Name	Affiliation
Sheri Andres	Fisheries and Oceans Canada, Policy, Winnipeg, MB
Robert Bramblett	Montana State University, Bozeman, MT
Holly Cleator	Fisheries and Oceans Canada, Science, Winnipeg, MB
Pat Fargey	Parks Canada Agency, Val Marie, SK
Lia Kruger	Fisheries and Oceans Canada, Science, Winnipeg, MB
Kathleen Martin (Chair)	Fisheries and Oceans Canada, Science, Winnipeg, MB
Sherry Nugent	Fisheries and Oceans Canada, Habitat, Winnipeg, MB
Ashley Presenger	Fisheries and Oceans Canada, Species at Risk, Winnipeg, MB
Chantelle Sawatzky	Fisheries and Oceans Canada, Science, Winnipeg, MB
Rob Wallace	Saskatchewan Water Security Agency, Saskatoon, SK
Doug Watkinson	Fisheries and Oceans Canada, Science, Winnipeg, MB
Cynthia Wlasichuk	Fisheries and Oceans Canada, Science, Winnipeg, MB
Jennifer Young	Fisheries and Oceans Canada, Burlington, ON

APPENDIX 3: MEETING AGENDA

Recovery Potential Assessment– Plains Minnow

Regional Peer Review Meeting – Central and Arctic Region

Location: Executive Boardroom, Freshwater Institute, Winnipeg, MB

Date: Wednesday December 12, 2012

Chair: Kathleen Martin

		Presenter
9:00	Welcome and Introductions	Kathleen Martin
9:10	Purpose of Meeting	Kathleen Martin
9:20	Species Description	Doug Watkinson
9:25	Historic and Current Distribution and Abundance and Trends	Doug Watkinson
9:35	Species Biology, Ecology, Habitat and Residence	Doug Watkinson
9:45	Population Status	Chantelle Sawatzky
10:15	*Health Break*	
10:30	Habitat Functions, Features and Attributes	Chantelle Sawatzky
12:00	*Lunch*	
1:00	Modelling Presentation and Discussion	Jennifer Young
2:00	Recovery Targets and Allowable Harm	Jennifer Young
2:30	*Health break*	
2:45	Threats to Survival and Recovery	Chantelle Sawatzky
3:15	Current and Candidate Mitigation Measures (including Works/Projects/Activities table)	Sherry Nugent
4:00	Sources of Uncertainty	Doug Watkinson
4:15	Summary Bullets for Science Advisory Report	Group
4:45	Review of Terms of Reference	Kathleen Martin
5:00	Summary and Wrap-up	Kathleen Martin