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Proceedings of the Regional Recovery Potential Assessment (RPA) of Rocky Mountain Sculpin (*Cottus sp.*)

March 22-23, 2011
Lethbridge, AB

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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 2006, two populations of Rocky Mountain Sculpin (*Cottus* sp.) – also referred to as "Eastslope" Sculpin – from the St. Mary and Milk river systems of Alberta were officially listed as Threatened under the Species at Risk Act (SARA). A regional advisory meeting was held on 22 and 23 March 2011 in Lethbridge, Alberta. The purpose of the meeting was to provide science advice on the recovery potential of Rocky Mountain Sculpin based on the Fisheries and Oceans Canada (DFO) Recovery Potential Assessment (RPA) framework. Advice resulting from the RPA meeting may be used to inform the development of recovery documents, and to support decision-making with regards to SARA agreements and permits. Meeting participants included DFO Science and Habitat Management sectors of the Central and Arctic Region, and specialists from Alberta Environment and Sustainable Resource Development, Alberta Environment, and the University of Tennessee.

This Proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meeting. Detailed information about Rocky Mountain Sculpin which supports the assessment is published as Research Documents and the advice from the meeting is published as a Science Advisory Report on the DFO Canadian Science Advisory Secretariat (CSAS) .

Compte rendu de l'évaluation du potentiel de rétablissement (EPR) à l'échelle régionale du chabot des montagnes Rocheuses (*Cottus* sp.) ; les 22 et 23 mars 2011

SOMMAIRE

En 2006, deux populations de chabots des montagnes Rocheuses (*Cottus* sp.) – connu aussi sous le nom de « chabot du versant est » – des réseaux hydrographiques des rivières St Mary et Milk, en Alberta, ont été inscrites officiellement à la liste des espèces menacées en vertu de la *Loi sur les espèces en péril* (LEP). Une réunion de consultation scientifique régionale s'est tenue les 22 et 23 mars 2011 à Lethbridge, en Alberta. La réunion avait pour but de fournir des avis scientifiques sur le potentiel de rétablissement du chabot des montagnes Rocheuses à partir du cadre d'évaluation du potentiel de rétablissement (EPR) de Pêches et Océans Canada (MPO) Les avis découlant de cette réunion d'EPR peuvent servir de base à l'élaboration de documents en matière de rétablissement et à la prise de décisions concernant les permis et les ententes en lien avec la LEP. Parmi les participants à la réunion, on comptait les secteurs des Sciences et de la Gestion de l'habitat de la région du Centre et de l'Arctique ainsi que des spécialistes du ministère du Développement durable des ressources de l'Alberta, du ministère de l'Environnement de l'Alberta et de l'Université de Tennessee.

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

The Rocky Mountain Sculpin (*Cottus* sp.) was added to Schedule 1 of the *Species at Risk* Act (SARA) as Threatened in August 2006. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) had assessed the status of the Rocky Mountain Sculpin as Threatened due to its very restricted area of occurrence in the St. Mary and Milk river systems in Alberta where it has been impacted by habitat loss and degradation from water diversion, conditions that have been exacerbated in recent years by drought. 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 March 22-23, 2011.

The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to evaluate the recovery potential of the Rocky Mountain Sculpin. The RPA is a science-based peer review that assesses the current status of the Rocky Mountain Sculpin and possible recovery targets, what is known about its biology, habitat and threats to the species or its habitat, and potential mitigation measures or alternatives to the threats and scope for human-induced mortality from threats. (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 and Habitat Management sectors, Alberta Environment, Alberta Environment and Sustainable Resource Development and a fish expert from the University of Tennessee. DFO drafted two working papers, that later became Research Documents, 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 Rocky Mountain Sculpin and an explanation of the purpose for, and contents of, an RPA was provided.

Two working documents were reviewed during the RPA meeting: a modelling paper that provides information related to recovery targets and times, minimum area for population viability and allowable harm, and another paper that contains all other information relevant to an RPA. Participants began by discussing the non-modelling paper; no formal presentation was given.

Working Paper: Information in Support of a Recovery Potential Assessment of Rocky Mountain Sculpin (*Cottus* sp.) in Alberta

Authors: D. Watkinson and D. Boguski

Abstract[1]

In Canada, the Rocky Mountain Sculpin (*Cottus* sp.) is distributed east of the Rocky Mountains in the St. Mary and Milk river systems, Alberta, and west of the Rocky Mountains in the Flathead River system, British Columbia. In August 2006, the two populations of Rocky Mountain Sculpin

[1] Updated following the meeting incorporating comments and reanalysis.

from the St. Mary and Milk river systems of Alberta – also referred to as “Eastslope” Sculpin – were officially listed as Threatened under the *Species at Risk Act* (SARA). In December 2007, this species, identified as the St. Mary Shorthead Sculpin, was similarly listed as Threatened under Alberta’s *Wildlife Act*. This small, bottom-dwelling fish is considered to be at risk of extinction in Alberta due to its very restricted area of occurrence in the St. Mary and Milk river systems where it has been impacted by habitat loss and degradation from water diversion, conditions that have been exacerbated in recent years by drought. Fisheries and Oceans Canada (DFO) has undertaken a Recovery Potential Assessment that summarizes our current understanding of the distribution, abundance, and population trends of Rocky Mountain Sculpin, Eastslope populations, in Alberta. Identification of threats to both sculpin 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

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.

SPECIES INFORMATION

In Canada, this species used to be referred to as the Eastslope Sculpin but was changed to Rocky Mountain Sculpin, after it was realized that its range covers both the west and east slopes of the Rocky Mountains in British Columbia and Alberta, respectively. COSEWIC only assessed the populations in Alberta perhaps because this species was Data Deficient in British Columbia. No DNA or genetics analysis was available at the time of the COSEWIC assessment in 2005 to determine whether the *Cottus* in the Flathead River was the same as the *Cottus* that reside in the St. Mary River. Later research, some from Montana, revealed they are the same species. Regardless, this recovery potential assessment focuses only on the Alberta designatable unit (DU) which is composed of the populations found in the St. Mary and Milk rivers systems. According to current COSEWIC definitions for DUs, this species would likely be designated as three DUs (Flathead, St. Mary and Milk) if assessed by COSEWIC now.

TAXONOMY

The taxonomy of sculpins in western Canada is complex and still unresolved. Genetic analyses using mitochondrial DNA and three nuclear genes have revealed that sculpins west of the Continental Divide are distantly related to other North American sculpins (D. Neely, pers. comm.). A large group of eastern taxa and several western taxa form a large clade; relationships within the clade appear to have radiated recently over a short time span. Morphological differences are the primary evidence of the considerable divergence between recognized and unrecognized taxa. Rocky Mountain Sculpin is part of the Mottled Sculpin (*C. bairdii*) group which contains all the eastern sculpins but the Spoonhead Sculpin (*C. riceii)*. There is a phylogenetic break between this group and the group of western sculpins that is distantly related. Rocky Mountain Sculpin samples used for the ongoing analysis were taken from the Flathead, St. Mary and Milk rivers. It is anticipated that the results of this genetic investigation will be published by the end of 2013.

Rocky Mountain Sculpin occur from southern Alberta through the upper Missouri River drainage in Montana and Wyoming. On the basis of museum specimens, there is a large range disjunction between where the Judith River enters the mainstem downstream of Great Falls in Montana and the next closest populations in the Missouri River drainage in the state of Missouri, roughly 2,800 river km downstream. This is consistent with the biogeographic or biogenetic

break between those taxa. The only discrepancy is a recent record from 2000 or 2001 of a single juvenile or young-of-the-year (YOY) sculpin taken in a dip net below Lake Oahe in South Dakota by researchers sampling rainbow smelt. The specimen was not retained.

Participants discussed the potential for hybridization. The Spoonhead Sculpin is found in the St. Mary River downstream of the St. Mary Reservoir while Rocky Mountain Sculpin occur above the St. Mary Reservoir. Prior to dam construction, which began in 1948, there may have been overlap between the two species. The nearby Old Man and Belly rivers have Spoonhead Sculpin in them but there are mountain ranges between them and the St. Mary River that would prevent movement. Regardless, it is unlikely that Rocky Mountain Sculpin could hybridize with Spoonhead Sculpin because of differences in habitat preference and their high degree of unrelatedness. No extensive introgression has been found in sculpins. The Spoonhead Sculpin is also sympatric with the Slimy Sculpin (*C. cognatus*) across most of its range yet there is no evidence of hybridization. Slimy Sculpin occur in the Flathead River in British Columbia in the same area as Rocky Mountain Sculpin. As reported in the working paper, hybridization has occurred there between the two species in an area of altered thermal regimes and habitat structure below a hydroelectric dam.

SPECIES BIOLOGY AND ECOLOGY

Participants raised questions and made a number of editorial changes to this section. The text was reorganized for better flow. Common names for fishes were capitalized. The range of Spoonhead Sculpin was clarified and its characteristics will be added for comparison with Rocky Mountain Sculpin. The working paper cites Roberts 1988 for a description of the biology and life history of Rocky Mountain Sculpin in the St. Mary River. Need to verify whether Roberts' research was conducted in the St. Mary River or Lee Creek, a tributary of the river, and revise the working paper as necessary. The minimum number of females with whom a male will spawn was revised from 1.5 to 1.

Fish length and numbers of eggs were discussed. The working paper stated that fecundity ranges from 68 to 368 eggs per female (57-87 mm total length (TL)) in the St. Mary River. Participants thought the numbers of eggs indicated are likely an underestimate given that earlier in the document it says Rocky Mountain Sculpin in the Milk River can grow to at least 114 mm TL. Whether the length information is from the Milk River or North Milk River needs to be verified. A record length of 141 mm TL was measured from a specimen taken from the Lowline Irrigation Canal off the Gallatin River in Gallatin County, Montana (Montana State University #3248). There doesn't appear to be much variation in the maximum length of this species between rivers. A participant reported that there are subtle differences in the length of Rocky Mountain Sculpin between the Flathead, St. Mary and Milk rivers but that may reflect the low sample sizes (only about 30 individuals were collected from each waterbody). Another participant said that those caught in the St. Mary River (≤ 100 mm TL) appear to be smaller than those from the Flathead River, which average around 99 mm Standard Length (SL), and from the North Milk River. There is a formula that converts SL measurements to TL. The SL/TL conversion factor calculated for a sample of 100 Rocky Mountain Sculpin collected in Montana was 86.0%. The rest of the text in the working paper related to reproduction, sexual maturity, age and growth was discussed but no revisions were made.

The ecological role/habits section was renamed diet to better reflect the content. Several editorial changes were made to this section. Participants asked the author of the working paper to provide more details, including total sample size and location, for the sentence that describes 88% of the food items consumed by Rocky Mountain Sculpin. He thought the sample size was about 30 or 40 fish from the St. Mary River. Participants also wanted clarification on the life stage(s) of Longnose Dace (*Rhinichthys cataractae*) and Rainbow Trout (*Oncorhynchus mykiss*)

that Rocky Mountain Sculpin prey on. The author will check his notes and the literature to determine the extent of information available on maximum prey size for this species. A Trout-perch (*Percopsis omiscomaycus*) (40-50 mm TL) was found in the stomach of one fish and three Plecopteran nymphs in another. A participant remembered reading that Rocky Mountain Sculpin can eat objects as large as 40% of their size. The working paper reports gape widths, from fish sampled in Montana, in terms of its proportion relative to SL. These data can be converted to gape widths relative to TL using the 0.86 conversion rate mentioned earlier.

Participants asked what fish species occur in the St. Mary and Milk rivers. There about 19 species in the Milk River and about 14-15 in the St. Mary River. In addition to minnows, other species that occur in St. Mary and Milk river include Burbot (*Lota lota*), Longnose Dace, Bull Trout (*Salvelinus confluentus*), Rainbow Trout, Mountain Whitefish (*Prosopium williamsoni*), Cutthroat Trout (*Oncorhynchus clarkii*), Walleye (*Sander vitreus*), Northern Pike (*Esox lucius*), White Sucker (*Catostomus commersonii*), Longnose Sucker (*Catostomus catostomus*), Mountain Sucker (*Catostomus platyrhynchus*) and Lake Chub (*Couesius plumbeus*).Trout-perch was likely introduced through the St. Mary canal. Bull Trout (*Salvelinus confluentus*) is one of the major predators in the St. Mary River but does not occur in the Milk River. There are probably no major fish predators of Rocky Mountain Sculpin in the upstream end of the North Milk system. Farther downstream, Sauger (*Sander canadensis*) likely overlaps with Rocky Mountain Sculpin.

HISTORIC AND CURRENT DISTRIBUTION AND TRENDS

Participants recommended adding a better map and description that shows the overall range of this species, connectivity of water basins and place names mentioned in the text. A participant suggested adding Figure 1, and a written description contained in the Environmental Setting section, from the Recovery Strategy.

The working paper indicated that tributary use in the Milk River system has not been observed. A participant reported that in 2010 the Alberta Conservation Association collected one or two sculpins in a tributary that flows into the North Milk River; it could have been either Mackie Creek or Lonely Valley Creek (Figure 1 in Watkinson and Boguski 2013). The conditions were so wet in 2010 that those ephemeral streams were flowing. The text was changed to say that most tributaries of the North Milk River are ephemeral but may be used opportunistically.

Good information on the historical distribution of Rocky Mountain Sculpin is not available. Participants wondered whether Rocky Mountain Sculpin occurred in the Milk River system historically, before the St. Mary canal was built. (The Milk River is part of the Missouri River system while the St. Mary River is part of the Saskatchewan River system.) Historically the Milk River was fairly natural (i.e., non-impacted), however it probably did not have good base flows. A participant indicated that Rocky Mountain Sculpin may have lived in small streams with good spring-fed flows on the prairies in Montana (e.g., tributaries of the Musselshell River). He also reported there are two records from Blaine County in Montana east of Havre, one of which is from Clear Creek which empties into the Milk River at least 70 km downstream of the Fresno Reservoir. These records provide supporting evidence that Rocky Mountain Sculpin was native to the Milk River. Before the Fresno Reservoir was built on the Milk River in the late 1930s, Rocky Mountain Sculpin may have been able to swim upstream from Montana into Alberta.

Participants discussed whether this species might expand beyond its current distribution. It does not make use of reservoir habitat and may be out-competed by Spoonhead Sculpin in that setting, thus the St. Mary Reservoir prevents Rocky Mountain Sculpin from expanding downstream into the Old Man River. Upstream of the reservoir, there is habitat available in Lee Creek, a tributary of the St. Mary River, but not all of it is occupied. Habitat is also available in

Rolph Creek, another tributary, but it is unoccupied. Sufficient flow may be lacking to make it attractive to Rocky Mountain Sculpin.

DFO has conducted stratified random sampling on the Milk River targeting Western Silvery Minnow. The sampling was conducted using boat electrofishing which is not well suited to Rocky Mountain Sculpin due to their sedentary nature, bottom distribution and cryptic colour. At one site on the Milk River, 20 or 30 YOY sculpin were caught with a seine net in a backwater.

DFO conducted sampling on the St. Mary River every river kilometre from the Canada/U.S. border to the reservoir. Backpack electro-shocking was combined with dip nets. That approach was better suited to sculpin. Sampling has also been conducted by the Alberta government in summer.

HISTORIC AND CURRENT ABUNDANCE AND TRENDS

The level of precision reported in the working paper for wetted habitat and numbers of fish in the St. Mary River was discussed. The current level of precision reported implies a high degree of accuracy. It was suggested that confidence intervals should be presented. The author said that it is not possible to calculate confidence intervals for wetted habitat without measuring stream widths and correlating sampling periods with densities of fish. Participants agreed the numbers presented in the text should be rounded off.

Text related to the Milk River system was split into the North Milk and Milk rivers. Flow in the North Milk River and Milk River below the confluence is too high in summer, due to augmentation from the St. Mary canal, to conduct proper sampling for Rocky Mountain Sculpin. A participant noted that range reductions in Rocky Mountain Sculpin in the Clark Fork River near Missoula (Montana) have been documented by Schmetterling and Adams. Most sculpin populations drop out downstream of there. A copy of the manuscript will be provided to DFO so that summer movement information can be added to the working paper.

Participants discussed and rated the relative abundance index of Rocky Mountain Sculpin for the five waterbodies: the St. Mary River, Lee Creek, North Milk River, Milk River upstream of the confluence with the North Milk River and the Milk River downstream of the confluence. The North Milk and St. Mary rivers have higher numbers of sculpins per river km than the other three waterbodies. The North Milk River (90 river km) may have more sculpins than the St. Mary River (46 river km) due to differences in river length but the densities of sculpins are within an order of magnitude. Both were ranked High for relative abundance. The Milk River below the confluence was ranked Low to High because it contains a gradient of habitat that transitions from better-quality habitat for Rocky Mountain Sculpin just below the confluence to poorer-quality habitat farther downstream. Only two specimens have been recorded in the mainstem downstream of the Aden bridge, located 100 km below the Town of Milk River. To date little sampling has been conducted in Lee Creek so no abundance or trend data are available, only presence-absence information. The limited targeted sampling that has been conducted in Lee Creek indicates that sculpin abundance declines as one moves upstream into the mountains near the border with Montana. This pattern may be a function of stream width, discharge or gradient but likely not temperature. There are no known barriers to upstream movement so it’s not clear why they do not travel farther upstream. Lee Creek was initially ranked Low to Medium. The Milk River above the confluence with the North Milk River has the lowest abundance; it was ranked Low.

A participant noted there are no barriers between the St. Mary River and Lee Creek, or between the North Milk River and Milk River above and below the confluence, so sculpins in these waters are not genetically-isolated reproducing units. It was agreed they would be referred to as stocks not populations

Population trajectory and population status were discussed and rated. Three decades of varying types of data for the North Milk River stock have not revealed an increase or decrease in sculpin abundance thus participants agreed the population trajectory is best described as Stable, resulting in a population status rating of Good. No between-year differences in sculpin density have been detected in data collected from the St. Mary River over a three-year period, although statistical analyses were not conducted. Modelling analysis, which estimated survival based on a catch curve, suggested there may have been a decline in trend but the confidence interval also encompasses stable or increasing trajectories. So, participants agreed the St. Mary River stock should be rated Stable, which resulted in a population status rating of Good. Using the same approach for the Milk River below the confluence, participants agreed the population trajectory is best described as Stable. Using the mid-point of the Low-High range for relative abundance (i.e., Medium) results in a population status of Fair. Participants thought that was a reasonable assessment. As there has been limited targeted sampling for Rocky Mountain Sculpin in Lee Creek and the Milk River above the confluence, the population trajectory for both waterbodies was rated as Unknown. This rating resulted in a population status of Poor for the Milk River above the confluence. Participants decided that a population status rating of Unknown was more appropriate for Lee Creek than Poor so the relative abundance index was revised to Unknown.

HABITAT REQUIREMENTS

Differences in benthos between waterbodies were discussed. The St. Mary River and Lee Creek have predominately gravel and cobble substrates. Lee Creek is significantly smaller than the St. Mary River. In the last few years, large quantities of *Didymosphenia geminata*[2] have appeared in the St. Mary River close to the reservoir and in Lee Creek. Substrates in the North Milk River are similar to the St. Mary River whereas more fines and sediments, and accompanying turbidity, occur below the confluence of the North Milk and Milk rivers. Little aquatic vegetation is present likely because the bed is mobile and the water flow fluctuates between a trickle and a torrent depending on the season and year. Participants recommended the author add a general habitat description for the St. Mary River.

RESIDENCE

The chair explained that DFO interprets “residence” as a structure constructed by an organism. A participant reported that Rocky Mountain Sculpin excavate gravel and silt from crevices to create nests and males remain on the site even if disturbed. There is some evidence that the skin of sculpins has anti-microbial properties suggesting that skin contact by the male with the egg mass serves an antifungal function. Males leave the nest after the fry hatch to avoid preying on the young. The fry settle near the nest; they do not appear to have a larval drift period but some certainly get carried downstream. As Rocky Mountain Sculpin construct a nest and maintain it during incubation, and eggs, alevins and fry are critical components of the life cycle, participants agreed this species meets the definition for residence. This section will be updated based on the discussion.

[2] Commonly known as Didymo or Rock Snot, *Didymosphenia geminata* is a species of diatom that blooms in freshwater rivers and streams.

RECOVERY TARGETS, RECOVERY TIMES AND MINIMUM AREA FOR POPULATION VIABILITY

Working Paper: Recovery Potential Modelling of Rocky Mountain Sculpin (*Cottus* sp.) in Canada

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

Presenter: Jennifer A.M. Young

Abstract[3]

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) had assessed the Rocky Mountain Sculpin (*Cottus* sp.) as Threatened in Canada (2005). 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 Rocky Mountain Sculpin populations are particularly sensitive to perturbations that affect survival of immature individuals (from hatch to age 2), and to the collective survival of adults (ages 2-8). 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), we propose a population abundance recovery target of 1,500 – 12,000 adult Rocky Mountain Sculpin, requiring 0.12 – 1.0 ha of suitable habitat. Current vital rate and abundance estimates suggest that the population may be in decline, with an expected time to extinction of ~75 years. Recovery strategies which incorporate improvements in the most sensitive vital rates of the Rocky Mountain Sculpin are most likely to improve the population growth rate; improvements of 10% in survival of all life stages significantly delayed extinction risks, and improvements of 20% had a stabilizing effect on the population.

Discussion

Traditionally, survival has been very difficult to calculate and typically has been estimated using a catch curve. However, the authors have been recently exploring size-dependent mortality so they can extrapolate the catch curve to estimate age-zero survival. It assumes that mortality decreases as the size of fish increases. Adult mortality is a bit more certain than age-0 survival because the latter makes assumptions about correctness of the size-dependent model. The author reported that first year survival, and its corresponding confidence interval, is the most uncertain vital rate for Rocky Mountain Sculpin. Based on four years of sampled data, the lowest estimated survival (0.32) occurred in the Milk River in 2006 and highest estimated survival (1.32) occurred in the St. Mary River the same year. A stable population at equilibrium would have a growth rate of 1.0 so the Milk River had very low survival in 2006. A participant cautioned others not to put too much emphasis on the Milk River data because there were likely biases in the data collection. Sampling focused on acquiring specimens for lab work rather than a more systematic sampling method. Fish were actively selected on the basis of size unlike the St. Mary River where fish passively floated into the net with no active selection by size. Additionally, fish may not have been fully recruited to the netting gear used until age 2. The author noted that the catch curve typically started at age 2 and only fitted to the right-hand slope of the frequency data. The modelling analysis indicated the mean estimate of mortality between hatch and first birthday was 99%.

A sex ratio of 50:50 was assumed for the analysis of fecundity (i.e., number of eggs) given there was no evidence to suggest that survival, age of maturity and/or lifespan in males were vastly

[3] Updated following the meeting incorporating comments and reanalysis.

different than in females. There is a relatively steep positive relationship between size of fish and fecundity. A participant reported that large fish are present in the Milk River system which explains the higher levels of fecundity found there. The modelling results showed that Rocky Mountain Sculpin has a mean population growth rate of 0.86 (range: 0.56-1.77). Although the mean value indicates a declining population trend, given the wide range around the mean the population could also be stable or increasing.

Allowable harm can target any of the vital rates (i.e., survival or fecundity) individually or collectively. Since harms cannot always be prevented, it is necessary to define how much harm the population can withstand without jeopardizing its survival or recovery (i.e., to prevent a population growth rate of less than 1.0). In cases when the population is in decline, there is no scope for harm so it is necessary to determine the minimum recovery efforts needed (i.e., the amount of improvement in rates of survival or fecundity needed to stabilize the population or stimulate population growth to exceed 1.0). The modelling results indicated that when population growth rate is high (i.e., increasing population), juvenile survival is more important and declines rapidly as they age. Fecundity of first-time spawners is more important than fecundity of older fish. The opposite is true when the population is declining. In that case, the importance of survival of all age classes is similar and fecundity is most important in the oldest fish. The most effective strategy for recovery strategy would be to improve survival of the three life stages and fecundity of all adults but if that is not possible then the most effective approach is to improve adult survival. Participants questioned this result. The author explained this is because there are six generation times for adults compared with only two generation times for juveniles so adult survival is more important from a collective perspective. If it were possible to target recovery efforts for a specific age group then it would be most effective to focus on survival of fish 0 to 2 years of age.

The modelling results indicated an average decline in population growth yet this was not observed by DFO in the field, so the author looked at the modelling results for individual years within the available four-year dataset. Population growth was good for two years and poor for the other two. It was possible the poor years were over-represented in the dataset and did not reflect conditions over the long term. So the author examined the longer-term outcome if the frequency of poor years was changed. If poor years occur only once every eight years, then overall the population growth rate is stable. But as the frequency of poor years rises, population growth rate decreases and the recovery effort required to achieve population stability increases.

Participants discussed probabilities of extinction. The authors defined Minimum Viable Population (MVP) to be the population that would result in a 0.1% probability of extinction over a timeframe of 100 years. They selected boundaries for the allowable risk of extinction. The upper boundary selected was 10%, in keeping with COSEWIC's quantitative criteria (E) for Threatened species[4]. The lower boundary selected was a 99.9% probability of persistence, one of the most stringent probabilities reported in the literature. A cumulative distribution of extinction times was calculated which shows the relationship between the probability of extinction as a function of the starting population size. It is an exponentially-decreasing curve that can be fit using a log-log regression. Then one must choose which extinction probability is acceptable in order to choose MVP. A higher MVP would provide more benefit because it has a decreased risk of extinction but a corresponding increased cost to reach the target. The authors chose the point where the tangent of the curve is the same as the slope of the line (i.e., where the decrease in percent extinction risk is equal to an increase in individuals) because that is the point at which there was maximized benefit to the population for recovery effort required. This

[4] Criteria E is concerned with population projections which show the probability of extinction in the wild is at least 10% within 100 years for a species designated as Threatened.

approach is a refinement over the method previously used. In general, the new method gives a risk of extinction of approximately 1% over the 100 year timeframe.

Catastrophe was defined as a single point event that results in a decline in abundance of 50% or more. Since it is unknown how often catastrophes occur, the authors compared different frequencies. Small-bodied fish are particularly susceptible to catastrophes because they tend to have larger MVPs and the effect of a catastrophe on the MVP is typically greater. Participants agreed this is likely because small-bodied fish are shorter lived. Longevity in Rocky Mountain Sculpin is much shorter than in large-bodied species like Lake Sturgeon but still relatively long for a small fish. Therefore, catastrophes will have less importance for Rocky Mountain Sculpin than for a species of similar size that is short lived.

A participant questioned why it is so difficult to determine the frequency of catastrophes given the 50-80 years of recorded data available for some species. There may be relatively few fish studies in the literature that have determined the frequency of catastrophes and their effects. The author noted that the catastrophe information used for this analysis was based on Reed's work on vertebrates where catastrophic events on average occurred 14% per generation. For Rocky Mountain Sculpin the authors compared catastrophic events at frequencies of 10% and 15% per generation. Commercial fish systems are the best studied and they are less susceptible to winter kills or extreme drought. A participant reported that the Tathlina Lake, a large shallow lake in the Northwest Territories, has a Walleye (*Sander vitreus*) fishery that undergoes regular winter kills. Data are available on the fish declines in that lake that might be useful here. DFO first sampled the St. Mary River in 2006. That was five years after a three-year drought (in 1999-2001) during which it is presumed there would have been kill-offs. The author said that could explain the strong recruitment seen driving the catch curve. There is potential for applying the modelling results to real data in the future but not yet given the numbers of years and types of data collected to date. More research on the St. Mary River system, including monitoring catastrophes and their effects on species like Rocky Mountain Sculpin, could address some questions that have been raised (e.g., what forces are driving population growth/decline?) and potentially improve the modelling work for this and other species. RPA documents could be updated in the future if significant improvements in the science information and advice (e.g., population and distribution targets) occur.

All simulations were run assuming catastrophe levels of 10% and 15% and extinction thresholds of two adults (one female and one male), 20 adults and 50 adults over a 100-year timeframe. Participants noted that the general rule of thumb for maintenance of genetic diversity (evolutionary potential) is at least 50 adults over the short term and 500 over the long term. The author stated that MVP is driven by variance. If the parameters are more refined and the environmental variance is less than the variance used in the parameters then two adults might not be an unreasonable number. If the true variance is smaller, the MVP will decrease. Choosing a higher extinction threshold would push MVP back up. So the MVP could end up being similar. Regardless, the other participants thought that two was not a realistic extinction threshold in a free-running river. They asked the authors to report in their working paper MVP values for extinction thresholds of 50 and 500 adults at catastrophe levels of 10% and 15%. The modelling results showed that the MVP increases roughly linearly as one increases the extinction threshold.

Habitat targets (i.e., how much habitat is needed to recover the population) can be set using the abundance targets. As a first approximation, the authors multiplied the MVP by the amount of habitat each individual requires to estimate the total area required. The area per individual is based on an allometry for body size developed by Ken Minns, one for rivers and another for lakes. The larger the size of fish the more space it requires. The YOYs require less space but they are more numerous. There are fewer adults but each requires more space. The total area

calculated for the population as a whole is referred to as Minimum Area for Population Viability (MAPV).

THREATS TO SURVIVAL AND RECOVERY

A number of threats were identified for Rocky Mountain Sculpin in the working document. For each of the six waterbodies, participants evaluated the likelihood and impact of each threat and, using those ratings, determined its status[5]. The spatial extent and temporal extent of each threat were also evaluated. Almost all ratings were based on expert opinion. Those discussions are summarized below.

Species Introductions

Fish and Invertebrate Species

All species introductions were evaluated together, regardless of whether they were intentional or not. Introductions are known to have occurred in all waterbodies except for the Milk River above the confluence. In that waterbody, there have been no known introductions on the Alberta side and on the Montana side the Milk River is located on reservation land where it is also unlikely there have been any species introductions. For those reasons, the Threat Likelihood was rated as Unlikely in the upper Milk River. In the other four waterbodies this threat was rated as Known. Introductions have been widespread in the St. Mary's reservoir. The state of Montana has also stocked various species into the Fresno Reservoir and likely into St. Mary Lake. There are no barriers to upstream movement in the Milk and St. Mary rivers from Montana into Alberta. The likelihood of species introductions in Aetna Creek is Unknown.

The impact of this threat on Rocky Mountain Sculpin would range from Low to High depending on the introduced species. Participants discussed whether the Milk River above the confluence warranted a different rating from the other waterbodies. Environmental conditions in the upper Milk River would likely challenge the abilities of many introduced species (e.g., sport fish) to persist thus the threat impact would be low. However, an introduced species that could kill sculpin on contact (e.g., pathogen) would have a high impact. Participants agreed to rate the impact of this threat the same (Low to High) for all six waterbodies.

The threat level for fish and invertebrate species is Low to High for the St. Mary River, Lee Creek, North Milk River and the Milk River below the confluence. Above the confluence, the threat level is Low to Medium. In Aetna Creek the threat level is Unknown.

The overall effect of this threat was evaluated as Widespread and Chronic.

Didymosphenia geminata

It is unclear whether *Didymosphenia geminata* is introduced or naturally occurring but environmental conditions have changed so that it is now growing to nuisance levels. It is the presence of blooms that is the threat and they are associated with control structures (stabilized flows and temperatures). Blooms have been found in the St. Mary reservoir and, in 2009, in Lee Creek. This species is also known to occur in the Milk River below the confluence. The likelihood of this potential threat was rated as Known in the St. Mary River, Lee Creek and the Milk River below the confluence, and Unknown elsewhere.

[5] Ratings for Aetna Creek were determined by the senior author of the Research Document following the meeting and reviewed by the meeting participants.

To date, no research has been conducted to investigate the direct impact of *Didymosphenia geminata* on sculpins. Research on invertebrates showed that blooms resulted in a shift to chironomids and other smaller-bodied species. Since sculpins typically feed on larger-bodied invertebrates, the presence of *Didymosphenia geminata* could affect the size structure or behaviour of Rocky Mountain Sculpin. However, there is currently no direct evidence that *Didymosphenia geminata* negatively affects Rocky Mountain Sculpin so the threat impact was rated as Unknown for all waterbodies.

The threat level of *Didymosphenia geminata* is Unknown for all six waterbodies.

The overall effect of this threat was evaluated as Local and Chronic.

Habitat Loss/Degradation

Changes in Flow (St. Mary Diversion)

The St. Mary Diversion Canal has significantly altered the seasonal flow regime in the St. Mary River, North Milk River and Milk River below the confluence so the likelihood of this threat was rated as Known for those waterbodies and Unlikely elsewhere.

The St. Mary Canal was originally designed to handle a flow rate of 24.1 $m^{3} \cdot s^{-1}$ but degradation of the canal has reduced that amount to 18.4 $m^{3} \cdot s^{-1}$. There have been proposals to restore the canal to the full allocation or higher. The canal typically operates from late March to September or October although occasionally it is shut down for siphon maintenance, including two such incidents that occurred in mid-summer. During shut-downs, changes in flow occur as a result of more water being sent down the St. Mary River and less down the North Milk River and the Milk River below the confluence. Participants agreed that the changes in flow resulting from operation of the diversion canal, the proposed increase in flow and shut-downs for maintenance have the potential for high impact on Rocky Mountain Sculpin thus the impact of this threat was rated as High for all six waterbodies.

The overall threat level is High for the St. Mary River, North Milk River and Milk River below the confluence, and Medium for Lee and Aetna creeks and the Milk River above the confluence.

The overall effect of this threat was evaluated as Widespread and Chronic.

Dam Construction

Construction of the St. Mary River Dam began in 1948 and went into operation in the 1950s so the likelihood of this threat was rated as Known for the St. Mary River. As there are no current or anticipated control structures on Lee or Aetna creeks or on the Canadian portion of the North Milk River, the threat likelihood was rated as Unlikely for those three waterbodies. No significant control structures have been constructed, or are likely in the future, on the Milk River above the confluence with the North Milk River. Check dams are common in southern Alberta for livestock watering but many are small or occur on ephemeral tributaries therefore they would cause minimal or no alteration of flow in the mainstem. They could have an impact if every draw along the mainstem had one. It is unknown whether check dams are present along the Milk River above the confluence so participants rated it as Unknown. A dam is proposed for just downstream of the Milk River and North Milk River confluence which would consist of a dam, emergency spillway, tunnel and gate, and would allow regulated flows. One of the purposes of the proposed dam would be to divert some water to the Town of Milk River. Participants decided to rate the likelihood of dam construction on the Milk River below the confluence as Unknown because it is uncertain whether the proposed dam will be built.

Construction of dams and irrigation diversions presents a number of threats to Rocky Mountain Sculpin including changes in habitat and obstructions. There is currently no dam construction in

any of the six waterbodies in Canada. However, on the St. Mary River there is active promotion of another dam; the proposed site is upstream of the town of Kimball. If that dam is built, the reservoir could back up almost to the Canada-U.S. border thus the impact of this threat on Rocky Mountain Sculpin would be high. If the proposed dam on the Milk River below the confluence goes forward the impact of its construction also would be high given the abundant numbers of Rocky Mountain Sculpin that reside in that portion of the Milk River. Participants rated the impact of this threat as High for all six waterbodies.

The threat level for dam construction is High for the St. Mary River, Moderate for Lee and Aetna creeks and the North Milk River, and Unknown for the Milk River above and below the confluence.

The overall effect of this threat was evaluated as Widespread and Chronic.

Dam Operation

The St. Mary River Dam, and its associated reservoir, has been in operation for more than five decades so the likelihood of dam operation was rated as Known for the St. Mary River. Dam operation was rated as unlikely for Lee and Aetna creeks. Participants thought that although dam construction is not anticipated on the Canadian side of the North Milk River, the flow of water in the North Milk River in Montana is heavily controlled so the impact of this threat should be considered and for that reason it was rated as Known. Whether check dams are in operation along the Milk River above the confluence is unknown. Although construction and operation of a dam just downstream of the confluence of the North Milk and Milk rivers is being considered, the likelihood of it going forward is currently unknown. For these reasons, the threat likelihood was rated Unknown for the Milk River above and below the confluence.

Changes in seasonal water flow and in habitat, from riverine to lacustrine, occur in response to dam operation and regulation of the reservoir elevation. The dam and reservoir on the St. Mary River significantly affected the natural flow regime and habitat for Rocky Mountain Sculpin so the impact of this threat was rated as Medium to High. Any future dam operation in the six waterbodies would also pose a Medium to High impact.

The threat level for dam operation is Medium to High for the St. Mary River and North Milk River, Low to Medium for Lee and Aetna creeks, and Unknown for the Milk River, both above and below the confluence.

The overall effect of this threat was evaluated as Widespread and Chronic.

Groundwater Extraction

Groundwater is used for domestic purposes in the St. Mary and Milk river systems and Lee Creek so the likelihood of this threat was rated as Known for those five waterbodies. It is not known whether groundwater extraction occurs in Aetna Creek so it was rated Unknown.

Participants discussed the impacts of groundwater extraction on the St. Mary River. The amount taken is probably relatively low and it is not an ephemeral stream so they rated the impact of this threat as Low. Base flows are significantly lower in the remaining waterbodies, at least during winter and periods of extreme drought, thus the impact of groundwater extraction could be greater there than in the St. Mary River depending on the season and year. For that reason, the impact of this threat was given a range of Low to High elsewhere. Groundwater connectivity testing is currently underway so more information may be available in the future to better assess this threat.

The overall threat level is Low in the St. Mary River, Unknown in Aetna Creek, and ranges from Low to High in the remaining four waterbodies.

The overall effect of this threat was evaluated as Widespread and Chronic.

Surface Water Extraction: Irrigation

This threat is seasonal in nature and is known to occur in five of the six waterbodies. In Lee Creek, for example, water intakes are removing more than 10% of the instantaneous flow for irrigation. So the likelihood of this threat was rated as Known for all waterbodies except for the Milk River above the confluence which was rated as Unknown.

Irrigation occurs upstream of the St. Mary reservoir but current water withdrawals are limited because it is mostly range land so its threat level was rated Low. However, if current grazing lands are turned to crop lands then irrigation demands would increase significantly and the impact of this threat would be High. Lee and Aetna creeks are relatively small bodies of water, therefore the impact of water withdrawals for irrigation on Rocky Mountain Sculpin there ranges from Low to High depending on the volume of water extracted. The North Milk and Milk River below the confluence were rated Low given the current water-sharing agreement between Canada and the U.S. that prevents Canada from legally taking the augmented flow from the St. Mary Canal which is destined for downstream reservoirs in Montana. Additionally, water withdrawals for irrigation would only occur during the period when the flow is augmented. The Milk River above the confluence was rated High because it commonly experiences low flow and receives none of the augmented water, so this threat would have a high impact there.

The overall threat level is Low for the St. Mary River, North Milk River and the Milk River below the confluence, Low to High for Lee and Aetna creeks, and Unknown for the Milk River above the confluence.

The overall effect of this threat was evaluated as Local, as it would have a Low or Unknown impact in most waterbodies, but Chronic.

Surface Water Extraction: Non-irrigation

The extraction of surface water, through Temporary Diversion Licences, for purposes other than irrigation is known to occur in all waterbodies, thus the likelihood of this threat was rated as Known, except for the Milk River above the confluence which it was rated as Unknown

Participants agreed that surface water extraction has the same impact on Rocky Mountain Sculpin regardless of the purpose for which it is used. The impact of this threat was rated the same as for irrigation for the St. Mary River (Low), Lee and Aetna creeks (Low to High), and the Milk River above the confluence (High). Water extraction for irrigation in the North Milk River and Milk River below the confluence only occurs during the growing season when there is augmented flow. However, extraction for purposes other than irrigation could also occur during periods of non-augmented flow. Withdrawals in winter would have a high impact on sculpin so the threat impact was rated Low to High for those two waterbodies.

The overall threat level is Low to High for all waterbodies except the St. Mary River and the Milk River above the confluence which were rated as Low and Unknown, respectively.

The overall effect of this threat was evaluated as Widespread and Chronic.

Livestock Use of Flood Plain

Throughout much of the St. Mary and Milk rivers, including Lee and Aetna creeks, the floodplain is used by livestock therefore the likelihood of this threat was rated as Known in all six waterbodies.

While much of the St. Mary River is accessible to cattle, most of the river shoreline and bed is rocky which protects it from being damaged by livestock, so the impact of this threat was rated

Low. Participants agreed the same threat impact rating (i.e., Low) would also be appropriate for the North Milk River and the Milk River below the confluence. A participant noted that smaller waterbodies are generally more vulnerable to the same level of livestock use as larger waterbodies so Lee and Aetna creeks and Milk River above the confluence were rated as Medium.

The overall threat level is Low for the St. Mary River, North Milk River and Milk River below the confluence and Medium for Lee Creek, Aetna Creek and the Milk River above the confluence.

The overall effect of this threat was evaluated as Local, because it has only a Low impact in three of the six waterbodies, but Chronic.

Anoxia

Anoxia (i.e., total depletion of dissolved oxygen) could seriously effect the survival of Rocky Mountain Sculpin. It is known to occur in the Milk River below the confluence during winter when low dissolved oxygen results from extended periods of cold temperatures, thus the likelihood of this threat was rated as Known. Anoxia also probably occurs in the Milk River above the confluence, thus it was rated as Likely. However, when and where there is continuous flow and possibly open water, anoxia does not seem to be a problem. There are no known occurrences of anoxia in the St. Mary River, Lee and Aetna creeks, and North Milk River but winter surveys are needed to confirm the likelihood of this threat. For now, the likelihood of anoxia in these waterbodies was rated as Unknown.

Although the likelihood of this threat has only been confirmed in the Milk River below the confluence, the impact of anoxia on the sculpin population in all waterbodies would be High.

The status of this threat is Unknown for all five waterbodies.

The overall effect of anoxia was evaluated as Local and Ephemeral.

Drought

As southern Alberta is susceptible to extreme drought conditions, especially in summer and early fall, this threat was rated as Known throughout the St. Mary and Milk river systems.

A drought of sufficient duration could have a significant impact on the sculpin population so the impact of this threat was rated as High for all waterbodies.

The overall level of this threat in all six waterbodies is High.

The overall effect of drought was evaluated as Widespread and Ephemeral although participants noted that drought conditions can prevail for extended periods of time in this region.

Contaminants and Toxic Substances

The title of this subsection was changed from “pollution” to “contaminants”. This threat includes both point source contamination (e.g., accidental spills) and non-point source contamination (e.g., agricultural run-off).

Point Source Contamination

Point source contamination occurs in the St. Mary River, Lee Creek and Milk River below the confluence so its likelihood is Known. In the Milk River above the confluence where there are no feed lots, just free range cattle, this threat is Unlikely. In the North Milk River and Aetna Creek this threat may occur but participants were not sure so they rated its likelihood of occurrence as Unknown.

For most of the sculpin habitat in the St. Mary River, there are no bridges, rail crossings or major pipelines that might lead to the accidental release of contaminants. There is some gas activity in the area, with the potential for leaks, but not to the same extent as near the Milk River. A potential release of untreated sewage from the town of Cardston would likely affect <5% of sculpin habitat. That said, if an accidental spill did occur, the impact of the threat could be high. For these reasons, a range from Low to High was assigned to this threat for the St. Mary River. Participants agreed this range was appropriate for all six waterbodies.

The overall threat level is Low to High for the St. Mary River, Lee Creek and Milk River below the confluence, Low to Medium for the Milk River above the confluence, and Unknown for the North Milk River and Aetna Creek.

The overall effect of point source contamination was rated as Widespread but Ephemeral.

Non-point Source Contamination

Non-point source contamination from overland run-off occurs in all these waterbodies so the likelihood of this threat was rated as Known.

Participants agreed that agricultural run-off would have a low impact on Rocky Mountain Sculpin in the St. Mary River and a moderate impact on Lee and Aetna creeks where there would be less dilution. In the North Milk River and in the Milk River below the confluence the threat impact level would range from Low to High for the augmented and non-augmented flow periods, respectively. Participants were less certain about the impact of this threat in the Milk River above the confluence so it was rated as Low to Medium.

The status of this threat is Low for the St. Mary River, Medium for Lee Creek and Aetna Creek, Low to Medium for the Milk River above the confluence, and Low to High for the North Milk River and Milk River above the confluence.

The overall effect of this threat was evaluated as Widespread and Chronic.

Other Threats

Scientific Sampling

Scientific sampling has occurred throughout the six waterbodies assessed so this threat was rated as Known.

This activity occurs infrequently and the numbers of fish taken are low relative to their abundance. For that reason, the impact of this threat was rated as Low.

The status of this threat is Low for all six waterbodies.

The overall effect of this threat was evaluated as Local and Ephemeral.

Climate Change

Rocky Mountain Sculpin has a limited distribution so that threats related to the effects of climate change (e.g., changes in water temperature, introduced species) could affect this species, but the group agreed not to evaluate climate change as a separate threat.

MITIGATIONS AND ALTERNATIVES

The participants considered potential mitigations and alternatives for each threat using a Pathways of Effects approach developed initially in Ontario. Standard mitigations and alternative have been developed for some threats. Participants discussed their usefulness for Rocky Mountain Sculpin.

Habitat Loss/Degradation

Changes in Flow resulting from the St. Mary River diversion

There are no alternatives available. Mitigation for this threat would be a more naturalized regulated pattern of flow.

Dam Construction

The only alternative to this threat is to not construct dams. There are some minor mitigation measures that could be undertaken but overall the only effective mitigation measure would be offstream storage.

Dam Operation

The only mitigation measure available would be to operate the dam in a way that would mimic natural flow patterns as closely as possible.

Groundwater Extraction

A participant suggested that groundwater extraction could be limited by drawing more surface water during periods of high flow and storing it for later use. Other participants doubted the feasibility of this alternative. Typical mitigation measures for groundwater extraction are monitoring, regulating use and limiting licensing. Landowners in the region are allowed to take up to a set amount for household purposes (at least 6,500 m^3 annually) without a licence. Any additional water taken, including groundwater, would be licenced. Meters are being fitted on wells along at least part of the Milk River to allow the provincial government to monitor how much water is being used.

Surface Water Extraction: Irrigation

There are no reasonable alternatives available. Mitigation for this threat is monitoring, regulating use and limiting licensing.

Surface Water Extraction: Non-irrigation

An alternative for potable water would be to construct a pipeline or use trucks to transport water from Lethbridge to the Town of Milk River. Mitigation for this threat is monitoring, regulating use and limiting licensing.

Livestock Use of Flood Plain

Limiting access through changes in grazing practices (e.g., offstream watering, limited stays, limited densities, rotational grazing, etc.), as advocated by the Alberta Riparian Habitat Management Society (commonly known as “Cows and Fish”), is a reasonable mitigation measure for Rocky Mountain Sculpin in the St. Mary and Milk rivers systems.

Anoxia

No alternatives are available for anoxia but this threat could be mitigated through the practice of maintaining flows.

Drought

No alternatives are available for drought and little, if any, measures can be undertaken to mitigate this threat.

Contaminants and Toxic Substances

Point Source Contamination

There are no reasonable alternatives to point source contamination. Mitigation measures can be undertaken after an accidental spill has occurred (e.g., containment, diverting, filtering).

Non-point Source Contamination

There are no alternatives to non-point source contamination such as agricultural runoff. Mitigation measures aimed at improving farming practices are possible and ongoing. These include the development of beneficial management practices such as the environmental manual for crop producers.

The only threats identified for Rocky Mountain Sculpin that are not included in the Pathways of Effects tables used by DFO are species introductions and scientific sampling. The meeting participants discussed potential mitigations and alternatives for those threats.

Species Introductions

Fish and Invertebrate Species

The only alternative to this threat is to not stock. The national codes for introductions and transfers should be followed for authorized introductions, and only native species should be used. For incidental or unintentional introductions, mitigation measures could include physical removal of the introduced species though this approach has only worked for a few species. The most effective mitigation measures for this threat are those that help to prevent unintentional introductions in the first place, such as monitoring watersheds, prohibiting the use of live baitfish and conducting a public awareness campaign.

In the case of Rocky Mountain Sculpin, stocking of non-native species has occurred in the past in the St. Mary's reservoir but there are no current plans for re-stocking. There are no barriers to movement between Alberta and Montana. It is not known whether the stocking of non-native species is currently underway or planned for the St. Mary or Milk rivers in Montana. If so, the only mitigation available might be negotiations with the government of Montana.

Didymosphenia geminata

Didymosphenia geminata is already known to be present in at least three of the five waterbodies so there are no alternatives to this threat. Blooms are associated with reduced flows and substrate stability, thus effective mitigation measures would be to mimic natural flow patterns, including flooding and scouring by ice.

Other Threats

Scientific Sampling

Alternatives to this threat are to not allow this activity, to sample in different waterbodies, or to live sample. This threat is regulated so controls are in place that will allow mitigation of effects.

REFERENCES CITED

Watkinson, D.A. and Boguski, D.A. 2013. Information in support of a recovery potential assessment of Rocky Mountain Sculpin (*Cottus* sp.), eastslope populations, in Alberta. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/062. v + 32 p.

APPENDIX 1: TERMS OF REFERENCE

Recovery Potential Assessment of Rocky Mountain Sculpin (Eastslope populations)

Central and Arctic Regional Advisory Meeting
Lethbridge, Alberta

8:30 a.m. to 4:30 p.m. (MDT) on 22 March 2011 and
8:30 a.m. to noon on 23 March 2011

Chair: Kathleen Martin

Background

In May 2005, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the status of the Eastslope populations of Rocky Mountain Sculpin (*Cottus* sp.) as Threatened. The reason for this designation is because this DU has a very restricted area of occurrence in the St. Mary and Milk rivers in Canada where it has been impacted by habitat loss and degradation from water diversion, conditions that have been exacerbated in recent years by drought. In September 2006, this DU was added to Schedule 1 of the Species at Risk Act (SARA). Development of a recovery strategy was undertaken.

Fisheries and Oceans Canada (DFO) has been asked to undertake a Recovery Potential Assessment (RPA) for the Eastslope populations of Rocky Mountain Sculpin. 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 Rocky Mountain Sculpin (Eastslope populations). The resulting RPA Science Advisory Report (SAR) will summarize the historic and current understanding of the distribution, abundance and trend of this DU, along with recovery targets and times to recovery while considering various management scenarios. The current state of knowledge about habitat requirements, threats to the Eastslope populations and their habitat, and measures to mitigate these impacts, will also be included in the SAR. At this stage in the SARA process for Rocky Mountain Sculpin, 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 Rocky Mountain Sculpin (Eastslope populations) using the RPA framework outlined in the Revised Protocol for Conducting Recovery Potential Assessments (available at: http://www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_039_e.pdf). 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, Alberta provincial government and academia have been invited to participate in this meeting.

APPENDIX 2: MEETING PARTICIPANTS

Name	Affiliation
Mike Bryski	Alberta Environment and Sustainable Resource Development, Lethbridge, AB
Terry Clayton	Alberta Environment and Sustainable Resource Development, Lethbridge, AB
Holly Cleator	Fisheries and Oceans Canada, Science, Winnipeg, MB
Kathleen Martin	Fisheries and Oceans Canada, Science, Winnipeg, MB
Dave Neely	University of Tennessee, Chattanooga, TN[6]
Shane Petry	Fisheries and Oceans Canada, Species at Risk, Lethbridge, AB[7]
Doug Watkinson	Fisheries and Oceans Canada, Science, Winnipeg, MB
Jennifer Young	Fisheries and Oceans Canada, Science, Winnipeg, MB

[6] Current affiliation: Tennessee Aquarium Conservation Institute, Chattanooga, TN
[7] Current affiliation: Alberta Environment and Sustainable Resource Development, Medicine Hat, AB

APPENDIX 3: MEETING AGENDA

AGENDA

Recovery Potential Assessment for Rocky Mountain Sculpin

DFO office, 704 – 4th Avenue South, Lethbridge, AB

Chair: Kathleen Martin

22 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*

10:20 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*

3:20 Limiting factors for population recovery

3:30 Mitigations and alternatives

4:30 End of day

23 March 2011

8:30 Recap of first day

8:45 Allowable harm

9:45 Data and knowledge gaps

10:00 *Coffee break*

10:20 Sources of uncertainty

10:35 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