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Proceedings of the Regional Peer Review of the Recovery Potential Assessment – Lake Sturgeon, *Acipenser fulvescens*, Designatable Units 1 (Western Hudson Bay Populations) and 2 (Saskatchewan-Nelson River Populations)

Meeting dates: March 12–13, 2019
Location: Winnipeg, MB

Chairpersons: Tom Pratt and Chantelle Sawatzky
Editor: Chantelle Sawatzky

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Canada

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 March 12–13, 2019 in Winnipeg, Manitoba. The purpose of the meeting was to assess the recovery potential of the Western Hudson Bay populations (Designatable Unit [DU] 1) and Saskatchewan-Nelson River populations (DU2) of Lake Sturgeon (*Acipenser fulvescens*), to provide advice that may be used for the listing decision, development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits and agreements. Participants included DFO Science, Species at Risk, and Policy programs, Alberta Environment and Parks, Manitoba Conservation and Water Stewardship, Manitoba Hydro, Ontario Ministry of Natural Resources and Forestry, Ontario Power Generation Inc., Saskatchewan Ministry of Environment, Saskatchewan Water Security Agency, SaskPower, academics, and environmental consultants.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Lake Sturgeon in DUs 1 and 2 as Endangered in 2017. The distribution and abundance of mature individuals in DU1 have declined dramatically, largely as the result of harvesting, and habitat loss and alteration due to dams. Similarly, in DU2 harvesting and dams have caused historical declines and although some populations appear to be recovering, this species is not yet clearly secure.

This proceedings report summarizes the relevant discussions from the meeting and presents recommended revisions to be made to the associated research documents. The Proceedings, Science Advisory report, and Research Documents resulting from this science advisory meeting are published on the DFO Canadian Science Advisory Secretariat (CSAS) website.

INTRODUCTION

Fisheries and Oceans Canada (DFO) has been asked to assess the recovery potential of Lake Sturgeon, *Acipenser fulvescens* (Western Hudson Bay populations, Designatable Unit [DU] 1; and Saskatchewan-Nelson River populations, DU2). As a result, a peer review meeting was held on March 12–13, 2019 in Winnipeg, MB. Participants included DFO Science, Species at Risk, and Policy programs, Alberta Environment and Parks, Manitoba Conservation and Water Stewardship, Manitoba Hydro, Ontario Ministry of Natural Resources and Forestry, Ontario Power Generation Inc., Saskatchewan Ministry of Environment, Saskatchewan Water Security Agency, SaskPower, academics, and environmental consultants (Appendix 1).

The intent of this meeting, as described in the Terms of Reference (Appendix 2), was to provide up to date information, and associated uncertainties, to address the following elements of the Lake Sturgeon Recovery Potential Assessment (RPA):

- biology, abundance, distribution, and life history parameters;
- habitat and residence requirements;
- threats and limiting factors to the survival and recovery of this species;
- recovery targets;
- scenarios for mitigation of threats and alternatives to activities; and
- allowable harm assessment.

The meeting generally followed the agenda (Appendix 3). The rapporteur for this meeting was Justin Shead. One of the meeting chairs provided a brief overview of DFO's Canadian Science Advisory Secretariat's (CSAS) Science Advisory Process and the guiding principles for the meeting.

The Proceedings summarizes the relevant meeting discussions and presents the key conclusions reached during the meeting. The advice from the meeting will be summarized in a Science Advisory Report. The Research Documents (Lacho et al. 2021; van der Lee and Koops 2021) that include the technical details supporting the advice will be revised based on the information from this meeting. All reports will be published on the DFO Canadian Science Advisory Secretariat (CSAS) website.

INFORMATION IN SUPPORT OF A RECOVERY POTENTIAL ASSESSMENT OF LAKE STURGEON (DU1 AND 2)

BIOLOGY, ABUNDANCE, DISTRIBUTION AND HABITAT REQUIREMENTS

Presenters: Cam Barth and Patrick Nelson

Abstract

The Lake Sturgeon is a large cartilaginous fish found exclusively in North America. In Canada, it is found as far west as the North Saskatchewan River in Alberta, east to the St. Lawrence River estuary, north to the Churchill River, and south to rivers and lakes that border the United States. Like most sturgeon species, Lake Sturgeon populations were affected by historical overharvesting, and habitat loss and alteration. In most areas in its range, Lake Sturgeon populations exist at a fraction of their historical abundance.

The status of the Lake Sturgeon in Canada was assessed by COSEWIC in 2017. Lake Sturgeon populations were divided into four designatable units (DUs) primarily following previously identified Canadian freshwater fish biogeographic zones: Western Hudson Bay (DU1), Saskatchewan-Nelson River (DU2), Southern Hudson Bay-James Bay (DU3), and Great Lakes-Upper St. Lawrence (DU4). The Lake Sturgeon population in DU1 was classified as Endangered because the distribution and abundance of mature individuals had declined significantly. Similarly, Lake Sturgeon in DU2 were classified as Endangered as harvesting and dams have caused historical declines and populations were still not considered secure. Populations in DU3 were classified as Special Concern as populations mainly exist in pristine rivers, although some are impacted by harvesting and dams. Populations in DU4 were classified as Threatened as populations have been impacted by dam construction and historical overharvesting; some populations seem to have not been greatly impacted and others are recovering but not yet secure.

A RPA is developed by Fisheries and Oceans Canada (DFO) to provide information and scientific advice needed to fulfill requirements of the *Species at Risk Act* (SARA), including informing both scientific and socioeconomic elements of the listing decision and permitting activities that would otherwise violate SARA prohibitions, and the development of recovery strategies. This Research Document describes the current state of knowledge of the biology, ecology, distribution, population trends, habitat requirements and threats to Lake Sturgeon populations in DU1, DU2, and DU4. The information contained in this document may be used to inform the development of recovery documents and for assessing permits, agreements and related conditions, as per sections 73, 74, 75, 77, 78, and 83(4) of the SARA as well as to prepare for the reporting requirements of SARA section 55. The scientific information for the RPA also serves as advice to the DFO Minister regarding the listing of the species under the SARA and is used when analyzing the socio-economic impacts of adding the species to the list as well as during subsequent consultations, where applicable. This assessment updates and consolidates the available scientific data pertaining to the recovery of Lake Sturgeon (DU1, DU2, and DU4) in Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. Information pertaining to DUs 1 and 2 will be reviewed at this meeting. As Recovery Potential Assessments are not developed for species of Special Concern, Lake Sturgeon in DU3 are not specifically discussed in this document.

Discussion

Species Biology and Ecology

A participant noted that peak larval drift occurs at night and this should be added to the document.

A participant asked if there is any evidence of reproductive senescence (i.e., do they have a post-reproductive period) and whether fish will resorb their eggs. One participant replied that even very old sturgeon can have large numbers of eggs, another confirmed that egg resorption does occur.

The co-chair commented that there are major data gaps concerning age at maturity and spawning periodicity and these impact the modelling efforts. Participants were asked if they could provide information from different populations. The presenter noted that these data are difficult to obtain without killing the fish. A participant commented that it may be possible to use elementary structures to get this information without killing fish, but this science is novel and there are uncertainties tied to it. Research is being conducted to refine the methods.

Historical and Current Distribution, Abundance and Trends (DU1)

A participant asked how the population abundance bins (> 5,000 = high, 1,000–5,000 = medium, and 10–1,000 = low abundance) could be used for management areas. The presenter recognized this issue, particularly for DU2 where there is a population with 2,000 individuals likely at carrying capacity, but it is classified as Medium. A participant indicated that the modelling is based on population persistence likelihood. The presenter stated that the report authors did not make qualitative decisions when population estimates were available. A participant asked if there are any populations of Lake Sturgeon that are considered pristine. The presenter replied that, to the best of his knowledge, there are no pristine populations in this DU. A participant stated that they knew of some high abundance populations that would be considered healthy; however, they are not considered pristine.

It was noted that the population estimate for MU3 should read adult and large juvenile rather than adult and juvenile. A participant asked how an adult was defined in the document. Adults were defined as ≥ 800 mm, but there is variability across the landscape.

A participant asked about historical and present harvesting in DU1. Harvesting of Lake Sturgeon was significant in some areas around Churchill, some of which was fly-in harvesting. Currently, locals access part of the river near Churchill (upstream of the weir) to harvest Lake Sturgeon, however they cannot get beyond Swallow Rapids. A participant asked if the authors are confident in the information on historical abundance before industry and development. They are generally confident in the decline in abundance based on the information they collected.

The co-chair asked if participants were comfortable with the bins being used for adult abundance. A participant stated that historical levels are difficult to aim for because sometimes they are not obtainable.

A participant asked if MU3 should be divided based on barriers. Missi Falls is an historical break based on genetic evidence (likely a natural barrier to post-glacial colonization in an upstream direction). Another participant commented that designating MUs based on barriers would probably make sense because the populations are not able to mix.

A participant commented that it is likely better to base the abundance bins on extinction risk rather than on carrying capacity. Carrying capacity is important for understanding population dynamics, but being at carrying capacity does not guarantee that a population has a low risk of being lost. A high risk of being lost is usually associated with low abundance, regardless of carrying capacity. Another participant agreed with this, but expressed concern about how this would impact management decisions – the focus would be on increasing abundance. The co-chair asked what the model would suggest if we took this approach. Defining the lower abundance interval might be difficult. This categorization is used throughout the document and is not DU-specific. A participant commented that the recovery goal can include context, such as population abundance is low and is vulnerable to certain events. There may be no ability to increase population abundance due to limited habitat availability.

The presenter commented that the three areas identified in MU3 based on barriers may be passable to fish and that the MU was broken up for the purposes of the document in order to show that all of the fish were collected in one area. The co-chair asked about the population trajectory of MU3 between the Fours and Swallow Rapids, specifically how Stable was arrived at and the data this was based on. The presenter indicated that the Stable classification was not based on any criteria. They cannot say the population is increasing or decreasing. A participant asked if there should be criteria. The co-chair agreed that criteria were needed to substantiate the trajectories.

A participant commented that abundance greater than 5,000 (high category) would have a probability of persistence in the 90–95% range in the model. The abundance range of 1,000–5,000 (medium category) would have a slightly elevated risk of extinction close to the COSEWIC threshold. The low abundance category (10–1,000) would definitely have an elevated risk of extinction/extirpation. Below 1,000 individuals, the probability of persistence is in the 75–90% range based on the minimum viable population values across different growth curves. The values in the document are close to the modelling results for population persistence. These values should be used as the rationale for the population status assessment bins. The values are being used to highlight probability of persistence. Limits in the data can be highlighted in the tables (i.e., population at carrying capacity) and text for relevant MUs. A participant asked how 5,000 in the Great Lakes could be classified as high when this is nowhere near high. The co-chair explained that this is a risk assessment which indicates that the probability of persistence is high (not that the abundance is necessarily high) and that it should be framed this way in the document (i.e., risk of extirpation). It was suggested to include a footnote and/or a note in the text for populations in which the abundance is classified as high, but is not high enough to reach management targets. Participants discussed how to add the probability of persistence information to the document. Questions were raised about changing the tables in the document. Participants were reminded that the purpose of this meeting is to assess the recovery potential for Lake Sturgeon in DUs 1 and 2, not to set recovery targets.

Participants agreed that the population estimates, qualitative abundances, and population trajectories for MUs 1 and 3 would be presented for the sub-areas (Table 1 in the research document will remain the same), and would be rolled up for the population status assessment (Table 3 in the research document).

Historical and Current Distribution, Abundance and Trends (DU2)

A participant asked if a population with stocked Lake Sturgeon could be classified as increasing due to stocking. The presenter replied that it is the wild population that is increasing. Populations that are increasing due to stocking are noted in the research document.

A participant asked if there are commercial catch records for the Saskatchewan River MUs. There appears to be no commercial catch data for Alberta. Saskatchewan has historical records. Commercial fishing in Saskatchewan was stopped around 1990.

A participant asked about movement between the three sub-areas of MU1. There is movement, but only by a few fish out of hundreds that were floy tagged. The co-chair asked if splitting MU1 into three areas was reasonable. We are lacking a designation smaller than MU, so perhaps the sub-areas should be individual MUs. A participant noted that tagged fish tended to stay in the local area with only a few exceptions where fish moved across provincial boundaries. At what point do we decide that a fish is part of a population in a range of space? The fact that a fish stays in the same local area for a few years is meaningless considering the long lifespan of Lake Sturgeon. A consistent approach for designating MUs should be followed and this should be explained in the document. It was suggested to roll up the three sub-areas in MU1 and report one population assessment for the MU. A participant expressed concern about this because the population estimates were not independent of each other and abundance in the MU may not actually exceed 5,000. A participant indicated confidence intervals should be presented.

A participant asked if MUs should be designated for Lake Winnipeg and east side tributaries. The presenter explained that the split was between the fault line that runs up the east side tributaries and that MUs were not assigned in the previous RPA process. The co-chair commented that one potential separation would be the upstream populations on the east side tributaries and asked if the rest of the populations could theoretically mix. In theory, the rest of the populations are able to mix, but likely do not. A participant commented that from the

Red/Assiniboine rivers everything downstream of Lockport combined with downstream of Pine Falls and downstream east side tributaries below impassable barriers could be one MU. Not much movement within the basin has been observed during two years of a movement study, but no barriers to movement are present. The co-chair noted that there are a lot of populations in the Great Lakes that don't mix, but there are no barriers to movement and these are still treated as a large MU. Consistency in our approach is important. It might make the most sense to separate populations upstream of impassable barriers and keep the remaining populations as one MU. MUs were originally designated based on barriers and genetic information with the intent of facilitating decisions to be made at a level that is relevant to Lake Sturgeon.

A participant commented that on the one hand we are happy with MUs because managers can make decisions, yet we have combined all of these areas into one large DU (DU2). The species will be listed under the SARA at the DU level, but this is contrary to how Lake Sturgeon are managed (at the MU level). The co-chair explained that MUs were developed as part of the last RPA process to look at Lake Sturgeon at the level for which we had information. The COSEWIC process is outside of this. The co-chair asked participants if they think Lake Winnipeg as an MU is too large. A participant commented that out of 42 fish tagged with Vemco tags in the Lake Winnipeg basin, one fish moved north past the east side tributaries and then came back south, so there is potential for movement. A participant commented on the difficulties in interpreting movement data. Fish have the opportunity to move around the lake, but this won't be revealed in 1, 3, or 5-year studies. Fish having room to move around is not the population scale though. We have management areas with quotas that are not reflective of the opportunities for fish to move. How can this be reconciled?

A participant commented that this issue is relevant, particularly if the DU is listed under the SARA. The co-chair noted that if the DU is listed, it would be the entire DU not the individual MUs and reiterated that it is important to be consistent for these research documents. A participant commented that if this DU is listed, the people on the ground in certain areas are seeing healthy populations of Lake Sturgeon (i.e., they do not see them as Endangered) and this will lead to public mistrust of the entire process.

A participant commented that it would be a low risk decision to designate the Red River downstream of Lockport, the Winnipeg River downstream of Pine Falls, and the east side tributaries as one MU because we would be combining essentially no data. A participant noted that this is based on opportunities for fish to move rather than on the way they are managed (two different scales working at cross purposes). The co-chair suggested that we can recommend combining the above as an MU, but recognize in the text of the research document that the Lake Sturgeon are likely operating at a different scale than we have put them at and that this issue requires further study.

A participant asked about the east side tributaries upstream of impassable barriers. The co-chair replied that ideally they would be in their own MU, but was uncertain if they should be in one or three MUs. The co-chair suggested that for this exercise, it would be best to capture this in the text of the research document.

The level at which populations are managed versus the level at which a species is listed under the SARA and the intent of listing were discussed. The co-chair reiterated that we are to review the research documents from a scientific perspective without considering management implications. The MUs were designated initially for convenience, to shape how we think about Lake Sturgeon and are not limited to what we have done to date. A participant noted that MUs are misleading because they do not indicate the patchiness of Lake Sturgeon distribution.

The co-chair commented that this was a good discussion and that the document we are reviewing was framed on the MU structure. Consensus was not reached on this issue.

Winnipeg River – English River

A participant indicated that they would look into whether there were any records of Lake Sturgeon in Wabigoon River.

A participant noted that in the presentation the population trajectory for MU7 is listed as stable/increasing, but in the document it is listed as increasing. The presenter will double-check this.

A participant mentioned that MU3 might represent a good case study for Lake Sturgeon reintroduction. There isn't as large an anoxic zone in this region anymore and putting fish back in the system might be beneficial. A participant asked if the population trajectory is in fact unknown. The presenter replied that population estimates for this MU are not available, so yes, it is unknown.

A participant noted that a more recent abundance estimate for MU6 is available which has wide confidence intervals. It should be listed as Medium rather than High.

The co-chair asked how Stable/Increasing was arrived at for MUs 7 and 8 without population estimates and asked that rationale be added to the text. Rationale should also be added to the text for MU4. A participant commented that categories may need to change to ensure consistency if data are not available. For example, unknown should be identified as Unknown rather than Stable/Increasing.

A participant asked about the criteria for Low, Medium and High relative abundance. In some cases, an MU is ranked as Medium, but is actually at carrying capacity.

North and South Saskatchewan River

A participant presented updated Lake Sturgeon population estimates for the North and South Saskatchewan rivers in Alberta. The information was not ready in time to be incorporated into the first draft of the research document, but will be provided to the report authors to include in the final draft. The new population estimate will result in a change to High abundance and Increasing trajectory for MU1.

Lake of the Woods – Rainy River

A participant noted that the population estimate for MU5 was based on a recapture rate of 6 and is therefore incorrect. The population estimate should be around half of the 92,000 in the research document. The participant will send the report authors updated information.

A participant commented that industry (pulp and paper and forestry) has caused negative impacts to Lake Sturgeon in this area.

It was pointed out that the table in the research document and the table in the presentation do not match. All tables will be double checked by the authors.

Nelson River

A participant asked if there is any evidence of population growth in MU6. There was some evidence of recruitment in sampling in 2013.

A participant asked why the population trajectory might be increasing in MU3. The rationale was both stocking and evidence of an increase prior to stocking. It should be made clear in the document that this is based on 3 years of mark-recapture data that showed a slight increasing trend. Stocking practices were discussed. Most fish are reared in the Grand Rapids fish hatchery (some eggs are hatched streamside in MU2). Stock from the Nelson River near Landing River is used and stocks from Burntwood River and Birthday Rapids (alternate year to year) are used in Burntwood River and Gull Lake and Stephen's Lake, respectively. All stocking

is approved by Provincial regulators and Manitoba Hydro used detailed genetic work in the development of this stocking program.

A question was asked about the amount of effort that has gone into assessing the population in MU5. Less effort has been spent on MU5 than MU4. This information was included in Barth et al. (2018). The authors will add this information to the research document. A participant asked about movement between populations and genetic dispersal. Some data suggests that fish are migrating, but there is no evidence of genetic dispersal, populations seem to be separate. MUs 4 and 5 do not have ideal Lake Sturgeon habitat. It is doubtful that populations greater than 5,000 adults will ever be reached due to the limited habitat available. There is no genetic evidence of recruitment. It is one participant's opinion that there is not enough Lake Sturgeon habitat in these MUs to support a self-sustaining population. A discussion followed about the results of the genetics study that was conducted on Lake Sturgeon in these MUs. The gradient was not habitable before the generating stations were constructed. A participant asked why this is an MU if it was never suitable habitat to begin with. The co-chair suggested that we not remove MUs at this point, but capture this concern in the document by noting that recovery will likely not be feasible in this MU. This highlights the patchiness of the distribution and the issue with MUs.

Habitat Requirements; Features, Functions, and Attributes; and Residence

A participant asked if depth is really a limiting factor. The presenter replied that depth is important for certain life stages if it is available. Juveniles are rarely observed in shallow water if deeper water is available. Across the range, fish can use a range of depths depending on their life stage. Depth has been shown to be important in some populations. It is hard to generalise for Lake Sturgeon because populations are different.

A participant asked if there is a baseline for the cumulative thermal units reported in the features, functions, and attributes table. Five degrees is the baseline. This will be clarified in the table.

A question was asked about substrate in the young-of-the-year (YOY) section of the features, functions, and attributes table – does clay mean a hard clay or loose/sedimentary clay? YOY use substrates other than clay (e.g., mud, gravel, bedrock). This clarification needs to be added to the document.

A participant asked if the larvae and YOY stages should be distinguished in the features, functions, and attributes table because they are distinct life stages. It was agreed that the table would be revised based on this suggestion. A participant noted that larval diurnal drift should be included in the table; information will be sent to the report authors.

A participant noted that Lake Sturgeon tend to not like sunshine and will migrate to deeper areas and return to shallower areas during darker periods. There was discussion about habitat features that make Lake Sturgeon successful compared to features that help them persist (i.e., thrive versus survive) as they are tolerant of a wide range of conditions. It will be difficult to capture this in the research document. The report authors will try to identify potential limiting factors in the document.

Participants agreed that the SARA definition of residence does not apply to Lake Sturgeon.

RECOVERY POTENTIAL MODELLING

Presenter: Adam van der Lee

Abstract

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed the Lake Sturgeon (*Acipenser fulvescens*) across four designatable units (DUs) as Endangered in DUs 1 and 2, Threatened in DU 4 and Special Concern in DU3. Here we present population modelling to determine population-based recovery targets, assess allowable harm, and conduct long-term projections of population recovery in support of a recovery potential assessment (RPA) for locations within each DU and an additional location within DUs 2 and 4. Under most circumstances population growth rate was most sensitive to changes to the survival rate of young adults (age 26–62). The exception was populations that have reduced adult survival; which were most sensitive to changes to survival rate of older juveniles (age 13–25). This indicates the significance of understanding current stresses and the age distribution of a population when considering applying harm or determining what recovery actions to take. To achieve demographic sustainability (i.e., a self-sustaining population over the long-term) under conditions with a catastrophe probability of 0.15/generation and a quasi-extinction threshold of 25 adult females at a 1% probability of extinction over 250 years, population sizes ranging from 1,255 to 5,860 adult females were required. The range in estimates related to the rate of somatic growth and mortality experienced by the population. Populations with more rapid somatic growth and greater mortality required larger population sizes to achieve demographic sustainability. This required between 700 and 16,500 ha of lake habitat and between 162 and 3,800 ha of river habitat (inclusive of both sexes and all age classes). Recovery times depended on initial population size and the rate of population growth with a significant range.

Discussion

The presenter commented that the models are meant to describe the range in responses in Lake Sturgeon populations across the DUs. Maturity information to support the modelling was lacking in the literature.

A participant noted that the maps in the document are not fully labelled – 2a, 2b, 4a, and 4b should be indicated.

A participant questioned the generation times used in the model. The values in the model are, in some instances, half those given in the COSEWIC report. The goal was to develop different scenarios of declining populations. The specific value used is not that important. The COSEWIC generation times were developed by the committee for pristine/unexploited populations of Lake Sturgeon. The generation times used for the modelling exercise were defined as the age at which an individual would replace itself.

A participant asked about the mortality used for the mid-late juvenile stage. Juvenile mortality was assumed to scale with length, such that as length increases, mortality decreases. A participant asked if the model was sensitive to a drastic change in mortality at a certain age (e.g., a dramatic decrease in mortality at age-3). The presenter replied that age-specific values were only used to get an average value for a stage (e.g., age 1–12), so a sharp change within a stage would be accounted for; a dramatic change at a specific age would not be accounted for. The participant indicated that they may be able to provide data which show the age at which Lake Sturgeon have a jump in survival rate. A participant commented that if it was just because of a change in growth rate with the same size-dependent mortality schedule, the results would probably be somewhat similar to what we have now. If the mortality schedule had an abrupt change at a point in time, however, the modelling results would likely change. A participant commented that there might be a certain age or length at which juvenile Lake Sturgeon mortality is the same as that of adults, as in other fish species (e.g., Walleye, *Sander vitreus*). This might impact model results.

Allowable Harm

The co-chair mentioned a paper that had good data on mortality in Lake Sturgeon that had high survival at a young age. How would selecting a mortality value based on size (rather than a mid-range value) impact the modelling results? It is possible that this would change the results. Would a shorter high mortality period be more realistic than a longer high mortality period? The presenter did not believe this would significantly impact the results.

The co-chair noted that there are not many late stage adults (i.e., older than age 60–65) in most/some populations and wondered if the adult stage was split into early and late, would the number of sturgeon in each of the stages impact the results. The presenter replied that the models are based on a constant stable rate and was uncertain how this would apply to recovery potential modelling; it may cause a lag in recovery times.

A participant asked how changing the maturity data would impact the modelling results. It is hard to tell, but it would impact development and generation time. A participant offered to provide additional maturity data to help inform the modelling. If you increase the age at maturity it delays responses. Based on the maturity data discussed, it doesn't seem likely that the results would change significantly. It would be good to have more maturity data to include in the model though. The presenter will determine if the data provided will change the results of the model.

A participant asked if the allowable harm results are based on best case scenarios. The model assumes the population being impacted by perturbations is growing and at a stable state.

A participant expressed concern about model sensitivity to survival or mortality when deviating from the mean. The sensitivity would be the same as the fecundity coefficient because it is proportional within the range.

A participant asked about Figure 13 in the modelling research document. The rarer the fish is in the age and size structures, the greater the sensitivity to perturbations? This is correct. The earlier suggestion of changing the juvenile stage 1 would decrease sensitivity and impact elasticity results. The stage division is very important in the sensitivity analysis. Elasticities can be combined into different groupings (e.g., biologically realistic groups, groups relevant to the threats of concern).

Recovery Targets

It was noted that the population numbers in the minimum viable population (MVP) recovery target analysis need to be updated.

A participant asked if the cumulative extinction probability in the 500 year scenarios was a little high. These are based on isolated stable populations and don't include rescue effects; Lake Sturgeon did not exist here 10,000 years ago.

The co-chair asked about the number of different life stages in Table 10 in the modelling research document. This information is based on the stable distribution from the matrix and back-calculated to the numbers of juveniles and adults shown in Table 10.

The recovery targets are susceptible to the catastrophic event that is chosen to be modelled (i.e., the model is sensitive to the catastrophic event). A participant asked which catastrophic event would have to be modelled to result in a 50% reduction in population size. The catastrophic event can be either natural (not necessarily a threat) or anthropogenic. If there are threats that have the potential to increase the catastrophic event beyond the 50% reduction, we should highlight those in the threats section. When going through the threats we can discuss how the threats may be a catastrophic event versus a shift in normal survival rates and how they link to the model. For example, a drought would be considered a catastrophic event. Climate change may not result in a catastrophic event.

A participant asked about the instances of lower adult numbers in Table 10 in the modelling research document. When adult numbers are lower is this because threats are lower? No, it is because catastrophes are on a per generation basis; as generation time increases, the catastrophe rate decreases. The groups in Table 10 had different mortality schedules and growth curves which impacted mortality and survival. The range of values represent what could be expected in Lake Sturgeon across the range, but may not directly represent reality within the DUs. It was suggested that text be added to the document highlighting the fact that these results apply to the range of Lake Sturgeon and are not directly reflective of DU responses.

A participant asked how recovery targets will be interpreted. The modelling results are general advice for consideration during the development of the Recovery Strategy. MVP analysis should help frame the recovery targets, but not necessarily be the recovery target. A participant asked if the results of the model are incorporated into listing decisions. The model results will be used by DFO Policy for the socio-economic analysis which helps inform the listing process. A participant asked about the range across a DU and the possibility of choosing overly cautious targets. This is possible, but the recovery strategy gets developed with various agencies and stakeholders. Members of the recovery team can bring in useful local information which would help the team decide to be more or less cautious.

The co-chair asked if MVPs are always modelled with stable populations and whether increasing the population size of currently low Lake Sturgeon populations would impact the modelling results. It would have an impact on the results, but the population will not always be growing (carrying capacity will be reached at some point). Using a stable population in the model helps develop a long term target. The point of the model is to simulate a healthy population over the long term. Population density can be included in the model, but this is not always done.

Minimum Area for Population Viability

A participant noted that habitat attributes identified in the functions, features, and attributes table are key habitat components for recovery. It is also important to know the physical space required by the species.

Recovery Times

A participant asked if data on a specific population could be incorporated and tested with the model. The presenter replied that specific population data would help inform a starting point for the model. The participant asked if the model could be used with data for a specific population to inform a recovery plan for that population. Recovery teams have the opportunity to request the development of population-specific models. DFO does not have the capacity to develop models for all MUs for all species being considered. Since the models are published, there is nothing stopping anyone from taking on this exercise themselves. Discussion was had about other examples where the model was used for a particular population of several species. Discussion was also had about datasets available for Lake Sturgeon that would help with such an exercise.

A participant asked about habitat requirements related to reservoirs, as reservoirs are neither lakes nor rivers. Should a value (i.e., area required) be developed for reservoirs? If there was information on Lake Sturgeon density in reservoirs then reservoirs could be modelled. The participant asked if a model could be developed for reservoirs because many of the MUs fall within reservoir environments. A participant suggested the addition of information to the features, functions, and attributes table to address lacustrine habitats (e.g., distance to a river mouth). This addition was supported as it would cover off the reservoir issue. Text will be added to the modelling research document about the lack of information available for Lake Sturgeon

density in reservoirs and that the amount of reservoir habitat required could fall between the values for lakes and rivers, depending on the geomorphology of the reservoir. Lake Sturgeon density and weight data was limited; the model would benefit from the addition of this data.

THREATS TO SURVIVAL AND RECOVERY

Presenter: Cam Barth

Natural and Anthropogenic Threats

A participant noted that young-of-the-year survival and sensitivity is not actually a threat according to the results of the modelling. This will be revised in the research document.

A participant suggested that water temperature for spawning be added as a naturally occurring limiting factor because Lake Sturgeon require warmer water for egg survival and YOY development. This information should also be added to the functions, features, and attributes table if there is confidence in the temperature ranges for different life stages. A participant offered to send data to the research document authors on water temperature and pCO_2 levels. It was also suggested that food availability be added as a natural limiting factor, particularly given ecological shifts in other species.

A participant suggested that parasites and diseases be included in the invasive and other problematic species and genes threat category. A participant asked about the impact of Channel Catfish (*Ictalurus punctatus*) on Lake Sturgeon.

A participant asked if angling mortality information is available for Lake Sturgeon. A participant is working on a catch and release study on the Winnipeg River and so far there is zero mortality related to angling, but there is a physiological impact after catch. There does not appear to be a behavioural impact related to catch. In the first year of the study the Lake Sturgeon were handled for a medium length of time. This year they will be testing the best and worst case handling scenarios. Data from this study will be sent to the research document authors.

The co-chair asked about the impacts of scientific sampling and the lack of mortality data. Scientific sampling might cause close to 2.5–3% mortality for juveniles. Text on scientific sampling mortality will be added to the research document.

A participant commented on the tendency to look at the wide-ranging impacts on Lake Sturgeon of hydroelectric developments in terms of reservoirs and immediately below dams. It is important to note, and should be recognized in the document, that these effects can also extend well below the dam (e.g., water fluctuations 40–50 km downstream from the Limestone Generating Station on the lower Nelson River may limit Lake Sturgeon access to spawning habitat).

It was noted that lack of water within river systems is likely a key factor impacting food, flow, and barriers for Lake Sturgeon. This is related to water diversion and should be captured in the research document. A participant noted that there are many factors that go into water management and it is not just related to hydroelectric facilities. The types of water management activities in addition to hydroelectric facilities should be discussed in the document (e.g., irrigation, diversions, flood mitigation). It was suggested that dams and water management be considered separately in the document.

A participant asked about the impacts of agricultural runoff and pesticide/herbicide use on Lake Sturgeon. Data will be sent to the report authors for inclusion in the research document. The impacts of mercury should also be added to the pollution section. There is work being done in Alberta on mercury impacts in reservoirs and Manitoba Hydro looked at methylmercury in Lake

Sturgeon and these data are available. The authors will add this information to the research document.

Threats Assessment

A participant noted that on page 66 of the research document (Table 11), the last category should be 'Very Low' rather than 'Unknown' as per DFO (2014). This will be corrected.

A participant asked about the use of the precautionary principle and noted that care must be taken with the use of this term in this work. A discussion was had on the difficulty of assessing threats and limiting factors for Lake Sturgeon at the DU-level because of the variation that is exhibited by this species across its range.

DU1

A participant asked about the level of impact from harvest and dams. With no commercial harvest, what is the data source for the high impact of subsistence harvest? The rationale behind this was the tag return data and a Traditional Knowledge study that was conducted. A discussion was had about how to interpret the threat categories used in the threats assessment (e.g., likelihood of occurrence, level of impact, causal certainty). The meeting chairs pointed out to participants that the level of impact was either a loss of population (% bins) or a threat that would jeopardize the survival or recovery of the population (DFO 2014). It is a mix of quantitative and qualitative aspects. It was agreed that the focus would be on the latter half of the definition for the purposes of this threats assessment. A statement to this effect will be added to the research document. Participants noted that fly-in harvesting and harvesting by locals is occurring.

A participant asked about the source of information for the following statement in the research document: "Historic records from Saskatchewan indicate that overharvest in MU1 may have contributed to a population decline of up to 98% (Cleator et al. 2010)" (pg. 6). This disagrees with Saskatchewan records. The presenter will go back to Cleator et al. (2010) for the source and will update the research document as necessary.

A participant asked if Lake Sturgeon recovery in MU2 would be expected by implementing water flow controls. Perhaps if they were stocked; populations are likely too low to recover on their own. On the other hand, due to gradient changes sections have become impassable for recolonization. Higher water in that system might make barriers passable allowing Lake Sturgeon to recolonize. The whole MU has high quality Lake Sturgeon habitat. It is possible they could repopulate themselves, but this might take hundreds of years. A participant offered to look into impacts in the Churchill River. A participant commented that Lake Sturgeon may have been commercially harvested from the Churchill River historically, but these were relatively small harvests. A participant commented that the records in the Churchill River seem very low and suspects that much of the early catch would have been recorded as Saskatchewan River harvest as it went through The Pas. The commercial harvest may therefore have been much higher than what the records indicate. The historical records do not include subsistence harvest and this is a source of uncertainty. The harvest levels could have been substantial given the current population trends. A participant looked into historical records and found the 1937 harvest was 14,424 kg of Lake Sturgeon on the Churchill system (Dominion of Canada, Department of Fisheries 1938), which represents a substantial summer and winter fishery. A participant asked how long this fishery lasted. This is unknown due to the way historical records were kept and reported (harvests in the Northern District, which included the Churchill and Saskatchewan rivers, were lumped together in the reporting) and this harvest record from 1937 is an isolated data point. The level of impact of dams in MUs 1 and 2 is ranked as Unknown.

Rationale for this ranking will be added to the research document. Climate change should be included as a threat category in DU1. This will be added to the research document.

A participant asked about the time frame considered when categorizing the level of impact. Are we considering a 250 year cycle similar to the population modelling? These are inherent threats that persist through time.

The roll-up of MU threats to the DU-level was reviewed. When rolling up to the DU-level, a precautionary approach is followed and the highest level of risk in a given MU is retained as per DFO (2014). The impact of dams is therefore high. This is justified because dams resulted in the decrease of a large proportion (~ 80%) of flow in this DU. A participant asked why this was not ranked as Extreme for MU3. It was ranked High because the population is not declining, it is stable. The population also occurs at the confluence of a non-regulated river (Little Churchill River).

MUs 1 and 2 likely do not have Lake Sturgeon populations. Threats were assessed considering past impacts, but it might make more sense to assess these as Unknown because we have no data. We do have information on water management though. The co-chair suggested these be ranked as Unknown due to lack of existing or prior knowledge and that this be captured in the text of the research document. Participants agreed to this suggestion.

DU2

The presenter commented that there are more threats to Lake Sturgeon in DU2 compared to DU1. Many threats were assessed as Unknown due to a lack of scientific evidence linking threats to impacts on Lake Sturgeon.

A participant commented that Prussian Carp (*Carassius gibelio*) should be added to the invasive species section. Parasites and diseases should also be added to the Invasive and Problematic Species and Genes threat category. A participant asked what problematic genes referred to. This refers to introduced genetic material.

A participant noted that harvest may increase as populations start to recover and asked if this should be considered when assessing this threat. The co-chair noted that the assessment should be based on the present time. A participant commented that if the threat is high because a small amount of harvest could have a large negative impact (as the modelling results indicate), it should be assessed as high regardless of whether it is happening now or not. The co-chair directed participants back to the definitions provided in DFO (2014). A participant commented that having harvest in MU2 ranked differently than MU3 did not make sense. The report authors agreed with this comment. A participant commented that any level of harvest on small populations is likely to be high risk. It was suggested to express this in the following way in the research document: “Regardless of the size of the population, Lake Sturgeon populations can be put at risk with harvest rates that exceed 4%. This will be easily achieved with a relatively low harvest if the population is small”. A participant commented that DU1 rationales will now have to be revisited for MUs 1 and 2. This will also be applicable throughout DU2.

Dams and Water Management was assessed as High for DU2 based on an assessment of High in MU1 (Saskatchewan River). Concern was raised by a participant about the highest level of risk in a given MU being retained when rolled-up to the DU-level, particularly due to the large geographic size of this DU. The co-chair explained that these instructions are very clear in DFO (2014), but that we could capture this in the text of the research document. The detailed threats assessments by MU in the appendices should also be clearly indicated in the main text of the research document.

A discussion was had about how to address the RPA process issues that participants keep raising. The meeting chairs pointed out that the process is clearly laid out by DFO (2014). A second discussion was had about what this process is used for. Not all participants were clear on this. Concerns regarding the RPA process should be reflected within the meeting documents. Participants raised concerns over the scale at which the DUs have been designated. Other participants pointed out that the DUs have been defined by COSEWIC and are outside the terms of this process. Participants expressed concern about how this RPA advice will be used by the Minister to make a listing decision.

Due to time concerns, it was agreed to not go through each line of the appendix tables. Participants were asked to review these tables thoroughly and provide comments with justification and rationale after the meeting. The documents will be sent to all participants for a final review after comments have been addressed.

EXISTING PROTECTIONS

The existing protections listed in the document were reviewed. Great Lakes and Upper St. Lawrence populations of Lake Sturgeon in Ontario are listed as Endangered under the Ontario *Endangered Species Act* (ESA). There is also a no-catch restriction for Lake Sturgeon in northern Ontario where they are listed as Endangered (under the Ontario ESA) and a catch and release only restriction in areas where they are listed as Special Concern (under the Ontario ESA). Alberta also has a catch and release only restriction in place for Lake Sturgeon. The document should be updated with this information.

CURRENT AND CANDIDATE MITIGATION MEASURES

Table 17 in the research document is incomplete. Due to the large area under consideration, the search of the PATH database and summarizing of results is a lengthy process. This information will be included in the second draft of the document. The co-chair reviewed the mitigation measures from Coker et al. (2010) that are linked to the activities that will be summarized in Table 17.

Participants were asked for additional mitigation measures. Sturgeon management boards (existing and those being considered for areas, such as the Souris River and Saskatchewan River), conservation closures, and harvest quotas were noted by participants. A participant recommended that any threat that was identified as medium or high risk should have mitigation measures.

SOURCES OF UNCERTAINTY

The presenter reviewed the sources of uncertainty listed in the research document. Comments from participants included: in some cases it is difficult to determine population decline; current occupancy in MUs 1 and 2 of DU1 should be examined; the level of natural fragmentation prior to industrial development should be considered since some of the systems are naturally fragmented; and the obligate needs of Lake Sturgeon concerning movement over distances over their lifespan are uncertain due to the lack of long-term movement studies. A participant asked if any consideration has been given to moving Winnipeg River high density populations to downstream areas. This has been thought of, but is not being considered at this time because the impacts are unknown.

TERMS OF REFERENCE REVIEW

The co-chair reviewed the Terms of Reference. Element 5 was not covered during the meeting but is addressed in the research documents. Element 9 was not directly discussed but was touched upon. Element 13 was discussed, but not explicitly addressed. Elements 16–17 were discussed at the meeting but were not fully addressed due to the incomplete mitigations table. Participants will have a chance to review and comment on the completed mitigation table when the second draft of the research document is distributed.

REFERENCES CITED

Barth, C.C., Burnett, D., McDougall, C.A., and Nelson, P.A. 2018. Information in support of the 2017 COSEWIC assessment and status report on the Lake Sturgeon (*Acipenser fulvescens*) in Canada. Can. Manuscr. Rep. Fish. Aquat. Sci. 3166: vi + 115 p.

Cleator, H., Martin, K.A., Pratt, T.C., and Macdonald, D. 2010. Information relevant to a recovery potential assessment of Lake Sturgeon: Western Hudson Bay populations (DU1). DFO Can. Sci. Advis. Sec. Res. Doc. 2010/080. 26 p.

Coker, G.A., Ming, D.L., and Mandrak, N.E. 2010. Mitigation guide for the protection of fishes and fish habitat to accompany the species at risk recovery potential assessments conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region. Version 1.0. Can. Manuscr. Rep. Fish. Aquat. Sci. 2904: vi + 40 p.

DFO. 2014. Guidance on assessing threats, ecological risk and ecological impacts for species at risk. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/013. (*Erratum*: June 2016)

Dominion of Canada, Department of Fisheries. 1938. Eighth Annual Report of the Department of Fisheries (Seventy-first Annual Fisheries Report of the Dominion) for the Year 1937-38.

Lacho, C.D., Burnett, D.C., Hrenchuk, C.L. Nelson, P.A., Parker, C.M., and Barth, C.C. 2021. Information in support of a recovery potential assessment of Lake Sturgeon, *Acipenser fulvescens* (Western Hudson Bay, Saskatchewan-Nelson River, and Great Lakes-Upper St. Lawrence populations). Can. Sci. Advis. Sec. Res. Doc. 2021/033. vi + 116 p.

van der Lee, A.S., and Koops, M. 2021. Recovery potential modelling of Lake Sturgeon (*Acipenser fulvescens*) in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2021/025. iv + 48 p.

APPENDIX 1: PARTICIPANTS

Name	Organization/Affiliation
Tom Pratt (Co-chair)	DFO, Science
Chantelle Sawatzky (Co-chair)	DFO, Science
Justin Shead (Rapporteur)	DFO, CSAS
Doug Watkinson	DFO, Science
Marten Koops	DFO, Science
Adam van der Lee	DFO, Science
Josh Stacey	DFO, SARA
Colin Gyles	DFO, Policy
Sing-Yee Low	DFO, Policy
Shane Petry	Alberta Environment and Parks
Owen Watkins	Alberta Environment and Parks
Jeff Long	Manitoba Conservation and Water Stewardship
Derek Kroeker	Manitoba Conservation and Water Stewardship
Don MacDonald	Manitoba Conservation and Water Stewardship
Cheryl Klassen	Manitoba Hydro
Stephanie Backhouse	Manitoba Hydro
Mark Reed	Manitoba Hydro
Cam Barth	North/South Consultants
Craig McDougall	North/South Consultants
Patrick Nelson	North/South Consultants
Tim Haxton	Ontario Ministry of Natural Resources & Forestry
Josh Peacock	Ontario Ministry of Natural Resources & Forestry
Dan Gibson	Ontario Power Generation Inc.
Ron Hlasny	Saskatchewan Ministry of Environment
Michael Pollock	Saskatchewan Water Security Agency
Marcy Bast	SaskPower
Gary Anderson	University of Manitoba
Mark Lowdon	AAE Tech Services
Bruce Stewart	Arctic Biological Consultants

APPENDIX 2: TERMS OF REFERENCE

Recovery Potential Assessment – Lake Sturgeon, *Acipenser fulvescens*, Designatable Units 1 (Western Hudson Bay Populations) and 2 (Saskatchewan-Nelson River Populations)

Regional Peer Review Meeting – Central and Arctic Region

March 12-14, 2019
Winnipeg, MB

Chairpersons: Tom Pratt and Chantelle Sawatzky

Context

After the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required to support implementation of the *Species at Risk Act* (SARA). Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of 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 consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

COSEWIC met in April 2017 and recommended that Lake Sturgeon in designatable units (DUs) 1 (Western Hudson Bay populations) and 2 (Saskatchewan-Nelson River populations) be designated Endangered. Lake Sturgeon was previously assessed by COSEWIC in 2006 and prior to that in 1986. The species was divided into eight DUs for the 2006 assessment; five were designated Endangered, one Threatened, and two Special Concern. A Recovery Potential Assessment was undertaken in 2008 for the six DUs designated Endangered and Threatened in the 2006 COSEWIC assessment. The number of DUs has been reduced to four in the 2017 assessment based on the national freshwater biogeographic zones used by COSEWIC and supplemental genetic information. None of the DUs are currently listed under the SARA.

In support of listing recommendations for Lake Sturgeon by the Minister, DFO Science has been asked to undertake an RPA, based on the national RPA Guidance. The advice in the RPA may be used to inform both scientific and socio-economic aspects of the listing decision, development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits or agreements, and the formulation of exemptions and related conditions, as per sections 73, 74, 75, 77, 78 and 83(4) of SARA. The advice in the RPA may also be used to prepare for the reporting requirements of SARA s.55. The advice generated via this process will update and/or consolidate any existing advice regarding Lake Sturgeon.

Objective

- To provide up-to-date information, and associated uncertainties, to address the following elements relevant to Lake Sturgeon in DUs 1 and 2:

Biology, Abundance, Distribution and Life History Parameters

Element 1: Summarize the biology of Lake Sturgeon.

Element 2: Evaluate the recent species trajectory for abundance, distribution and number of populations.

Element 3: Estimate the current or recent life-history parameters for Lake Sturgeon.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Lake Sturgeon needs for successful completion of all life-history stages. Describe the function(s), feature(s), and attribute(s) of the habitat, and quantify by how much the biological function(s) that specific habitat feature(s) provides varies with the state or amount of habitat, including carrying capacity limits, if any.

Element 5: Provide information on the spatial extent of the areas in Lake Sturgeon's distribution that are likely to have these habitat properties.

Element 6: Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.

Element 7: Evaluate to what extent the concept of residence applies to the species, and if so, describe the species' residence.

Threats and Limiting Factors to the Survival and Recovery of Lake Sturgeon

Element 8: Assess and prioritize the threats to the survival and recovery of the Lake Sturgeon.

Element 9: Identify the activities most likely to threaten (i.e., damage or destroy) the habitat properties identified in elements 4-5 and provide information on the extent and consequences of these activities.

Element 10: Assess any natural factors that will limit the survival and recovery of the Lake Sturgeon.

Element 11: Discuss the potential ecological impacts of the threats identified in element 8 to the target species and other co-occurring species. List the possible benefits and disadvantages to the target species and other co-occurring species that may occur if the threats are abated. Identify existing monitoring efforts for the target species and other co-occurring species associated with each of the threats, and identify any knowledge gaps.

Recovery Targets

Element 12: Propose candidate abundance and distribution target(s) for recovery.

Element 13: Project expected population trajectories over a scientifically reasonable time frame (minimum of 10 years), and trajectories over time to the potential recovery target(s), given current Lake Sturgeon population dynamics parameters.

Element 14: 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 the potential recovery target(s) identified in element 12.

Element 15: Assess the probability that the potential recovery target(s) can be achieved under current rates of population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Scenarios for Mitigation of Threats and Alternatives to Activities

Element 16: Develop an inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat (as identified in elements 8 and 10).

Element 17: Develop an inventory of activities that could increase the productivity or survivorship parameters (as identified in elements 3 and 15).

Element 18: If current habitat supply may be insufficient to achieve recovery targets (see element 14), provide advice on the feasibility of restoring the habitat to higher values. Advice must be provided in the context of all available options for achieving abundance and distribution targets.

Element 19: Estimate the reduction in mortality rate expected by each of the mitigation measures or alternatives in element 16 and the increase in productivity or survivorship associated with each measure in element 17.

Element 20: Project expected population trajectory (and uncertainties) over a scientifically reasonable time frame and to the time of reaching recovery targets, given mortality rates and productivities associated with the specific measures identified for exploration in element 19. Include those that provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

Element 21: 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 in support of the listing process.

Allowable Harm Assessment

Element 22: Evaluate maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

Expected Publications

- CSAS Science Advisory Report
- CSAS Proceedings
- CSAS Research Documents

Participants

- Fisheries and Oceans Canada (Ecosystems and Oceans Science, Aquatic Ecosystems, and Strategic Policy sectors)
- Alberta Environment and Parks; Saskatchewan Ministry of Environment; Saskatchewan Water Security Agency; Manitoba Conservation and Water Stewardship; Ontario Ministry of Natural Resources
- Academia
- Indigenous communities/organizations
- Industry (Manitoba Hydro, Ontario Power Generation Inc., SaskPower)
- Other invited experts (environmental non-government organizations, consultants

References

COSEWIC. 2017. COSEWIC assessment and status report on the Lake Sturgeon (*Acipenser fulvescens*), Western Hudson Bay populations, Saskatchewan-Nelson River populations, Southern Hudson Bay-James Bay populations, Great Lakes-Upper St. Lawrence populations in Canada, 2017. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

APPENDIX 3: AGENDA

Day 1		**Presenter**
9:00	Welcome and Introductions	Tom Pratt
9:10	Purpose of Meeting	Chantelle Sawatzky
9:20	Species Biology and Ecology	Cam Barth
9:45	Historic and Current Distribution and Abundance and Trends (DU1)	Cam Barth
10:00	Population Status (DU1)	Cam Barth
10:15	*Health Break*	-
10:30	Historic and Current Distribution and Abundance and Trends (DU2)	Cam Barth
12:00	Lunch (on your own)	-
1:15	Population Status (DU2)	Cam Barth
2:30	*Health Break*	-
2:45	Habitat Requirements and Residence	Cam Barth
3:15	Habitat Features, Functions, and Attributes	Cam Barth
4:30	End of Day 1	-

Day 2		**Presenter**
9:00	Recovery Potential Modelling	Adam van der Lee
10:30	*Health Break*	-
10:45	Threats to Survival and Recovery	Cam Barth
12:00	*Lunch (on your own)*	-
1:15	Threats to Survival and Recovery	Cam Barth
2:30	*Health Break*	-
2:45	Current and Candidate Mitigation Measures	Cam Barth
2:55	Sources of Uncertainty	Cam Barth
3:30	Presentation: Population structure of Winnipeg River Lake Sturgeon based on SNPs: Preliminary Results	Craig McDougall
4:30	End of meeting	-