Fisheries and Oceans Canada | Pêches et Océans Canada
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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2016/009

Central and Arctic Region

Proceedings of the regional peer review of the pre-COSEWIC Assessment for Lake Sturgeon Designatable Units 1–6

October 27–29, 2015
Winnipeg, MB

Chairpersons: Kathleen Martin and Tom Pratt
Editors: Lia Kruger and Kathleen Martin

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April 2016

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.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

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

ISSN 1701-1280

Correct citation for this publication:

DFO. 2016. Proceedings of the regional peer review of the pre-COSEWIC assessment for Lake Sturgeon Designatable Units 1–6; October 27–29, 2015. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2016/009.

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SUMMARY

In November 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the eight Designatable Units (DUs) of Lake Sturgeon (*Acipenser fulvescens*) in Canada. COSEWIC is required under the *Species at Risk Act* (SARA) to review the classification of each species at least every 10 years. As a result Lake Sturgeon was included on COSEWIC's fall 2014 Call for Bids to produce a status report. COSEWIC plans to re-assess Lake Sturgeon in April 2017. Fisheries and Oceans Canada (DFO) held a regional peer review meeting to review information relevant to COSEWIC's status assessment for Lake Sturgeon, DUs 1–6 on October 27–29, 2015.

Meeting participants included DFO (Science and Species at Risk programs), University of Manitoba, Manitoba Hydro, SaskPower, Ontario Power Generation Inc., Laval University, Ontario Ministry of Natural Resources and Forestry, Minnesota Department of Natural Resources, Saskatchewan Ministry of Environment, Manitoba Conservation and Water Stewardship, Alberta Environment and Parks, Saskatchewan Water Security Agency, Carleton University, West Virginia University and the three COSEWIC report co-authors.

This Proceedings summarizes the relevant meeting discussions and conclusions from this pre-COSEWIC assessment.

Compte rendu de l'examen zonal par les pairs préalable à l'évaluation du COSEPAC concernant l'esturgeon jaune (*Acipenser fulvescens*), unités désignables 1–6, au Canada

SOMMAIRE

En novembre 2006, le Comité sur la situation des espèces en péril au Canada (COSEPAC) a évalué les huit unités désignables (UD) dans lesquelles se trouve l'esturgeon jaune (*Acipenser fulvescens*) au Canada. En vertu de la Loi sur les espèces en péril (LEP), le COSEPAC doit revoir la classification de chaque espèce au moins tous les dix ans. Par conséquent, le COSEPAC demandait dans son appel d'offres de l'automne 2014 la production d'un rapport sur la situation de l'esturgeon jaune. Le COSEPAC prévoit réévaluer la situation de l'esturgeon jaune en avril 2017. Du 27 au 29 octobre 2015, Pêches et Océans Canada (MPO) a tenu une réunion régionale d'examen par les pairs afin d'examiner les renseignements qui pourraient servir au COSEPAC lorsqu'il évaluera la situation de l'esturgeon jaune, unités désignables 1-6.

Ont participé à la réunion le MPO (Secteur des sciences et programme des espèces en péril), l'Université du Manitoba, Manitoba Hydro, SaskPower, Ontario Power Generation Inc., l'Université Laval, le ministère des Richesses naturelles et des Forêts de l'Ontario, le ministère des Ressources naturelles du Minnesota, le ministère de l'environnement de la Saskatchewan, Conservation et Gestion des ressources hydriques Manitoba, Alberta Environment and Parks, la Water Security Agency de la Saskatchewan, l'Université Carleton, l'Université de West Virginia et les trois coauteurs du rapport du COSEPAC.

Le présent compte rendu résume les discussions et constatations pertinentes de la réunion d'examen pré-COSEPAC.

INTRODUCTION

In November 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the eight Designatable Units (DUs) of Lake Sturgeon (*Acipenser fulvescens*) in Canada. COSEWIC is required under the *Species at Risk Act* (SARA) to review the classification of each species at least every 10 years. As a result Lake Sturgeon was included on COSEWIC's fall 2014 Call for Bids to produce a status report. COSEWIC plans to re-assess Lake Sturgeon in April 2017[1].

The intent of this meeting, as described in the Terms of Reference (Appendix 1), was to peer-review existing information relevant to the COSEWIC status assessment for Lake Sturgeon DUs 1–6, considering data related to the status and trends of, and threats to this species inside and outside of Canadian waters, and the strengths and limitations of the information. The pre-COSEWIC assessment is a science-based peer review that assesses the life history characteristics (including growth parameters, mortality rates, fecundity, generation time, early life history patterns, and specialized niche or habitat requirements), threats to the species and its habitat, describes whether the species has a residence as defined by SARA and reviews designatable units.

Meeting participants (Appendix 2) included DFO (Science, and Species at Risk), University of Manitoba, Manitoba Hydro, SaskPower, Ontario Power Generation Inc., Laval University, Ontario Ministry of Natural Resources and Forestry, Minnesota Department of Natural Resources, Saskatchewan Ministry of Environment, Manitoba Conservation and Water Stewardship, Alberta Environment and Parks, Saskatchewan Water Security Agency, Carleton University, West Virginia University and the three COSEWIC report co-authors. The meeting generally followed the agenda (Appendix 3).

This Proceedings summarizes the relevant meeting discussions and presents the key conclusions reached during the meeting.

ASSESSMENT

Co-Chairs welcomed participants and began a round of introductions. One of the co-Chairs provided an overview of DFO's pre-COSEWIC assessment process, the listing process under the SARA and where DFO Science assessments (i.e., pre-COSEWIC assessment and Recovery Potential Assessment [RPA]) fit within the process. The co-Chair provided COSEWIC's current designations for the Lake Sturgeon DUs and identified whether they were listed under provincial or federal species at risk legislation. The meeting Terms of Reference, guiding principles and agenda were then reviewed. Seventeen presentations were given during the meeting and discussions followed each presentation.

A participant asked if the RPAs would have to be redone if there are no changes to COSEWIC's status designations. If there are no changes in the COSEWIC assessment, then the RPA might stand. Although if changes are made to the DUs, or there is new information relevant to the RPA, there might have to be an RPA update, especially if it affects recovery targets.

Maps of DUs 1–5, with management units (MUs) identified during the RPA process (DFO 2010a–e), are included in Appendix 4.

[1] The COSEWIC assessment date was changed from November 2016 to April 2017 following this meeting.

OVERVIEW OF SPECIES AT RISK ACTIVITIES IN DUs 1–6

Presenter: Ernie Watson

Summary

The *Species at Risk Act* (SARA) is designed as a key tool for the conservation and protection of Canada's biological diversity. The purpose of SARA is to prevent wildlife species from becoming extinct or extirpated (lost from the wild in Canada); help in the recovery of extirpated, endangered or threatened species; and ensure that species of special concern do not become endangered or threatened.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is an independent group of experts that assesses the status of wildlife species and recommends a classification for their legal protection under the federal SARA. In November 2006, the status of Lake Sturgeon (*Acipenser fulvescens*) populations was assessed by COSEWIC. The Western Hudson Bay (Designatable Unit (DU) 1), Saskatchewan River (DU2), Nelson River (DU3), Red–Assiniboine Rivers–Lake Winnipeg (DU4) and Winnipeg–English Rivers (DU5) populations were assessed as "Endangered", and the Lake of the Words–Rainy River (DU6) population, was assessed as "Special Concern".

If COSEWIC determines that a species is at risk, then the federal Cabinet must determine whether to list that species under SARA. To assess the economic and social implications that listing Lake Sturgeon may have on Canadians' lives and livelihoods, DFO has initiated a number of actions, including:

i. a government Response Statement (2007) committing to consultations to determine whether or not these Lake Sturgeon populations should be added to the List of Wildlife Species at Risk (Schedule 1) under SARA;

ii. Recovery Potential Assessment[2];

iii. Socio-economic Analyses (2013), and;

iv. Consultations with affected stakeholders and other groups across the distribution of Lake Sturgeon DUs 1 to 6, including provincial governments (Alberta, Saskatchewan, Manitoba, and Ontario, Quebec), Aboriginal communities and organizations, stakeholders, and the Canadian public that may be impacted by a SARA listing decision.

Consultation and cooperation with Canadians are essential to the protection of wildlife species in Canada. As such, provisions for consultation and cooperation are key elements of SARA. Consultations across all Lake Sturgeon DUs were undertaken in 2007–2008 through workbooks, letters, public notices, meetings and workshops. Additional consultations were undertaken for DUs 1 to 5 in 2011/12 to follow-up and engage 13 Aboriginal communities and stakeholder organizations that responded and could be impacted by a SARA listing decision.

Consultation results revealed that: for Lake Sturgeon DU1, 94% of decided respondents supported listing, and 2% opposed listing as Endangered; for Lake Sturgeon DU2, 69% of decided respondents supported listing, and 3.4% opposed listing as Endangered; for Lake Sturgeon DU3, 92% of decided respondents supported listing, and 1% opposed listing as

[2] A recovery potential assessment for DUs 1 to 5 was organized and completed in 2010 by the Canadian Science Advisory Secretariat and included participation from DFO, provincial governments, Aboriginal experts, academia, and industry. The RPA process provides information and scientific advice required to meet the various requirements of SARA.

Endangered; for Lake Sturgeon DU4, 84% of decided respondents supported listing, and 1.4% opposed listing as Endangered; for Lake Sturgeon DU5, 91% of decided respondents supported listing, and 3% opposed listing as Endangered; for Lake Sturgeon DU6, 81% of decided respondents supported listing, and 1% opposed listing as Special Concern. Additional feedback was received from respondents who were undecided or simply commented without a clear position supporting or opposing a SARA listing within DUs 1 to 6.

While the SARA listing advice for Lake Sturgeon populations in DUs 1 to 6 is under consideration, DFO has taken a number of actions, including:

- Exploring development of SARA Section 11 Conservation Agreement to benefit or enhance the survival of the species.
- Established a team of species experts in 2010 to proactively draft a recovery strategy.
- Supporting ongoing research and studies continue at the federal, provincial, industry, and Aboriginal levels, including 27 projects through the federal Habitat Stewardship Program (HSP) and Aboriginal Funds for Species at Risk (AFSAR). Four projects within DUs 1 to 5 totaling approximately $1.6M were supported by AFSAR funding since 2007.

Should there be an affirmative decision by the federal government to list Lake Sturgeon DU6 populations as Special Concern on Schedule 1 of SARA, a *management plan* would be developed for implementation. If Cabinet decides to add Lake Sturgeon DUs 1 to 5 populations to the List of Wildlife Species at Risk (Schedule 1) of SARA as Endangered, a recovery strategy, critical habitat order, and one or more action plans would be developed.

Recovery Strategies are detailed plans that outline short-term objectives and long-term goals for protecting and recovering species at risk. Action plans are the second element of the Act's two-part recovery planning process, and are used to implement projects and activities to improve species status. Management plans differ from recovery strategies and action plans; they set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but which are not yet considered in danger of becoming extinct. Whenever possible, management plans are prepared for multiple species on an ecosystem or landscape level.

Discussion

A meeting participant asked for clarification on who deferred the listing recommendation for Lake Sturgeon since COSEWIC's 2006 designation. It was deferred within the Species at Risk Program in the Central and Arctic Region in consultation with Ottawa. There was a discussion around moving forward with a listing decision based on the 2006 assessment. Listing recommendations have been developed and are still under consideration. It was unclear what would happen if the overall DU structure changed as a result of COSEWIC's 2016 assessment. RPAs may have to be updated, additional consultations held, and this could impact listing decisions.

OVERVIEW OF 5-YEAR STUDY ON THE SASKATCHEWAN RIVER

Presenter: Michael Pollock

Abstract

The goal of the Water Security Agency's three year project include:

1) develop hydraulic models (River2D) to quantify the impact of flow on Lake Sturgeon habitat;

2) determine the type and location of habitat and migration patterns preferred by Lake Sturgeon (via telemetry), and;
3) quantify Lake Sturgeon health including abundance, diet, age class structure, impact of flow on recruitment and genetic health.

Following three years of study we have reached the following conclusions (2010, 2011 and 2012 results combined below):

River2D Analysis

- River2D analysis on six sites spanning all three rivers (South Saskatchewan, North Saskatchewan and Saskatchewan) indicates a significant relationship between flow and habitat availability.
- Sites sampled on the North Saskatchewan and mainstem of the Saskatchewan River display abundant adult and sub-adult habitat but minimal spawning and fry habitat with the exception of the James Smith site on the mainstem.
- Examination of our final site on the South Saskatchewan River revealed a significant amount of spawning habitat but relatively poor overwintering conditions for adults and sub adults.
- Historic flow records indicate that all habitats, particularly spawning and fry habitat, receive the flows needed approximately one out of two years to create optimal habitat, so though minimal in size, the habitat appears to be frequently available.

Telemetry Summary

- Lake Sturgeon followed similar migration patterns in the three years of data collection.
- The areal extent of habitat used by Lake Sturgeon showed little variation among years.
- Lake Sturgeon used all three rivers (North Saskatchewan, South Saskatchewan and Saskatchewan River mainstem) with The Forks region providing a common and crucial wintering ground.
- The population preference is to migrate (i.e., leave the wintering grounds for the majority of the ice-off season) each year and each Lake Sturgeon migrated at least once in the three year study. Specifically, 30% migrating one of every two years, ~3% migrating one in three years.
- Efforts to radio tag Lake Sturgeon at Wapiti (68 river kilometers (rkms) downstream of The Forks), Saskatoon (269 rkms upstream of The Forks on the South Saskatchewan River), and Borden (214 rkms upstream of The Forks on the North Saskatchewan River) confirmed the importance of The Forks overwintering habitat as the majority of fish tagged at these distant locations returned to The Forks in the fall.
- Home range size analysis focused on all three years of telemetry and found a mean size of 3099.1 ha + 1 SD of 1736.2 ha.

Population Health Summary

- Age structure analysis indicates an age range of 1–37 with no missing age classes at The Forks and 1–31 years at the Borden sampling site (North Saskatchewan River 214 rkms upstream of The Forks).
- 2010 and 2011 sampling at The Forks indicated an abundance of young individuals, thus the population is reproducing successfully. Populations at Borden displayed similar patterns with an abundance of 1–3 year old individuals.

- Genetic analysis of 64 individuals indicates the population is more diverse than one would expect in a diminished population, though the effective population size and number of females contributing to the population in a given year were smaller than expected.
- The number of Lake Sturgeon in the one to ten year age classes was significantly correlated with the occurrence of above median flows (annually and seasonal) in the South, North and Saskatchewan Rivers.

Overall Conclusions

- Though only a single year of sampling occurred at Borden, results indicated representation in all age classes as did The Forks and the potential of a overwintering population.
- While flow is statistically linked to both habitat availability and recruitment it appears current flow regimes have allowed the population to thrive.
- Given the statistical link between flow and Lake Sturgeon recruitment, it may be possible to manipulate flow to increase either habitat availability or recruitment should this be desired in the future.
- Genetic analysis does not indicate that population genetics will hamper population recovery.
- Lake Sturgeon obtain ~85% of their food energy from crayfish.
- Lake Sturgeon make significant migrations (> 100 rkms/year) using all three rivers.
- Home range size is significant for this species (~3000 ha or 30 km2) relative to the size of the river they inhabit. This indicates that any fragmentation may affect the population’s ability to thrive.

Discussion

A question was asked about whether the population estimate was for adults only. Everything that was caught and permanently tagged was counted.

Another participant did not agree with the statement made about just protecting winter habitat. They thought that protecting winter habitat should be site-specific and depend on what river is being considered.

Some participants also didn’t agree with the presenter saying that there were no missing age classes just by interpolation. One needs to be cautious with that relationship without including variability around it. Originally only length data were presented but they were asked to provide ages.

A participant asked about using pectoral spines to age the fish. It was considered, but was not acceptable to local aboriginal groups. Another participant added that age group models are available in Alberta.

The presenter was asked about the April date and what he thought was driving the movement in terms of visible habitat parameters. They looked at correlations and the only one that came out was daylight but it was only from five years of data. There was a lot of variability in flow, temperature and ice off dates over the five years, which included everything from drought to epic flood events. Another participant asked if the lack of correlation between movements and flow could have been because the flow was so different from historical levels. The presenter answered yes, as a major flood occurred during the study.

A participant pointed out that Corixids were listed as a part of the diet but are likely a seasonal item in the fall when they become available en masse. Crayfish feeding was interesting. Crayfish are the majority of the diet but the plot is for pooled habitats. The presenter was asked whether Lake Sturgeon were foraging up into the riffle habitat and then moving back to the pools. The study used radio tags, which can detect smaller scale movements. Lake Sturgeon did undertake daily migrations to and from pools but we don't really know what they were doing. The assumption is that they were eating.

A participant asked why Lake Sturgeon were migrating 150–200 km. Although there are a few spawning sites downstream, good spawning sites seem to be limited. The presenter pointed out that the strongest correlation with migrations was body condition. Lake Sturgeon in poorer body condition were much more likely to migrate.

A participant asked if a dam was put into the river, would it affect the population. Depending on the location, a dam would definitely affect the population. One participant pointed out that the dam currently being considered would be located 16 km downstream of the forks.

A participant asked why Lake Sturgeon congregate at the Forks. It could be due to food, and/or more options of where to migrate in spring. There is nothing special that they can see in terms of habitat at the Forks compared to other areas.

A participant commented that they have been doing surveys just upstream of the dam (in Codette, SK) and there have been no missing age classes in the last 12 or so years. This is very different than what is being found in other populations. There was a nine-fold variation from strong to weak age classes.

One of the meeting participants commented that dams in Manitoba provide good spawning habitat and they asked if this was the case for the Gardiner Dam. There is a weir in the city of Saskatoon, which is 108 km from the dam. Although there is fishway at the weir, it is generally not passable, which likely limits Lake Sturgeon access to the area below the Gardiner Dam. However, there are Lake Sturgeon at Gardiner Dam as ice fishermen sometimes send photographs. Unlike the Manitoba dams, the habitat below the Gardiner Dam has a sandy substrate without rocks. So even if Lake Sturgeon could get to the dam, it's likely not good spawning habitat.

Another participant asked how large the overwintering area was and whether space was an issue for the number of Lake Sturgeon that would need to use the area. Underwater cameras were used at the overwintering site. Lake Sturgeon were stacked on top of each other so crowding doesn't seem to be an issue for them. The pool is about 200 m long and 100 m wide.

SOUTH SASKATCHEWAN RIVER SYSTEM LAKE STURGEON MOVEMENTS AND HABITAT USE

Presenter: Doug Watkinson

Abstract

A Lake Sturgeon movement study was conducted on the South Saskatchewan River drainage in 2010–2014. The study objectives were to understand broad and fine scale fish movements as well as contribute to a population estimate study conducted by Alberta Environment and Parks. Christine Lacho was a Master's student from the University of Lethbridge that focused on the broad scale movement data and Donnette Thayer is a Master's student from the University of Alberta that is focussing on the fine scale movement data.

The study site included the Red Deer River downstream of Hwy 884, Bow River downstream of Bassano Dam, Oldman River downstream of Fort Macleod and the South Saskatchewan rivers

from the confluence of the Bow and Oldman rivers to the upstream end of Lake Diefenbaker at Hwy 4. This study area included 1100 unique river kilometres (rkm) of which 1050 rkm were used by at least one fish during the study period. In total, 123 Lake Sturgeon were tagged with Vemco V16-4H hydroacoustic tags. The fish varied in total length (TL) from 650–1550 mm. Up to 50 VR2W receivers were placed in the study site in the open water season with a reduced set of ~20 receivers remaining during the winter.

The number of detections was higher in the late summer and winter when flows were lower. Tagged fish were detected moving large distances during the study. Often the pattern was regular, following a seasonal pattern, most often in an upstream direction. However, downstream movements were also common. Some fish moved very little or erratically during the study. The Oldman, Bow and Red Deer rivers were almost exclusively used during the open water season with fish overwintering in the South Saskatchewan River. Fish over 950 mm TL tended to use more rkm (mean ~240 rkm) than fish <950 mm (mean ~85 rkm). The difference in movements between fish characterized as adults (>1150 mm) and juveniles (<1150 mm) was significantly different for the rate of movement (km/day), range (rkm), total distance moved (rkm), upstream distance (rkm) and downstream distance (rkm). Fish movement rate was highest in the spring, summer and fall and very low in the winter. Interestingly, the range of movement was only high in the spring and summer. Fish were resident to shorter reaches of the river in the fall and winter. We identified two important overwintering locations. Tagged Lake Sturgeon were more likely to move and be detected at a new receiver or be last heard at a receiver during the night across all months, this was most pronounced from July to October. This coincides with lower average turbidity in the system.

An overwintering reach of the South Saskatchewan River was identified from the broad scale movement data. This reach was surveyed with acoustic equipment (Biosonics-MX) to measure depth and substrate. A SonTek Acoustic Doppler Current Profiler was used to measure water velocities. This data was used to create interpolated habitat maps. In October 2013, 34 VR2W receivers collocated with sync tags were deployed in this reach to form a VEMCO Positioning System (VPS) array. The array was removed from the system in April 2014. During the study period more than 11,000,000 detections were recorded from 33 tags. Over 550,000 of these detections were detected on multiple receivers and had position data calculated for them. Most fish tagged fish occupied a smaller area of the study reach with relatively deep water and slower water velocities. Fish showed high site fidelity during the study period. The results of this thesis will be completed in 2016.

Discussion

There was a discussion about overwintering areas. If one of the wintering holes was removed, it probably would not wipe out the population. There are other overwintering spots in the area and Lake Sturgeon would probably find other overwintering habitats.

A participant commented that overwintering habitat is important. Lake Sturgeon overwinter in deep slow areas to increase their chance of survival particularly because of variability, uncertainty and fluctuating waters in rivers. They asked if it was an unregulated river, would one expect to see the same amount of movement (i.e., extensive movement by larger fish and lack of movement by smaller fish) or is the movement driven by variable flows? There is one dam on the Oldman River that regulates flow and one on the Bow River. The hydrograph is more natural than below the Gardiner Dam further downstream.

If Gardiner Dam would not be there, given an opportunity to travel the extra 800 km, fish would likely be all the way to the next forks of the north and south and vice versa. Do they need to go that far to maintain populations? Probably not. This is apparent throughout their range since they are sometimes found in smaller reaches and where we have made artificially small reaches because of impassible barriers. They have the potential to travel very long distances. When looking at the DU structure in Manitoba, for example, the Red River, Lake Winnipeg and the Assiniboine River are very connected. Tagging studies show Channel Catfish moving through these waterbodies and it is likely that Lake Sturgeon did so as well, at least historically, when their numbers were high.

If there wasn't a dam, you would expect Lake Sturgeon to make use of the whole system. There were detections of Lake Sturgeon above the furthest upstream detections in the Oldman River from this study. Some of the limitations could be temperature related. The dams are bottom-draw so there is an extension of colder water habitat where at certain times of the year previously this might not have occurred. We know that Lake Sturgeon have moved up past that site. In terms of the weir in Lethbridge, it is a barrier under low flows. During average or near average spring freshets the weir is inundated at about 350 cms of discharge, which makes it passable through the notch designed for fish passage, although this has not been confirmed, and also around both sides of the weir.

The co-Chair wondered why the presenter didn't present the population estimate. The presenter wasn't involved in the population calculation. Alberta did send the information to the COSEWIC report authors. The last estimate was from 2012.

NELSON RIVER STURGEON BOARD'S WORK ON THE UPPER NELSON RIVER LAKE STURGEON STOCKS (DU3, MUs 1–3)

Presenter: Don MacDonald

Abstract

The Nelson River Sturgeon Board has been monitoring Lake Sturgeon populations in two reaches of the upper Nelson River since 1992. Both reaches were depleted by historical commercial fisheries. Stocks in Management Unit (MU) 2 declined rapidly throughout the 1990s because of overfishing. This decline was monitored through a mark and recapture tagging program. After a ten year break, a new mark and recapture program was initiated, which has demonstrated an ongoing increase in population. This increase is made up of younger Lake Sturgeon with varying year class strength. Although numbers have recovered, the population demographics have not. In MU 1 stocks were considered near extirpated and conservation stocking of fingerlings was initiated in 1994. Recent population studies show a growing population of young Lake Sturgeon, most of which arise from recent stocking of yearlings. Stocking of yearlings in this area is two orders of magnitude more successful than stocking fingerlings.

Discussion

The co-Chair commented that the population estimate from the presentation didn't have a scale on the axes. Were those mark-recapture estimates or catch-per-unit-effort (CPUE)? They were Jolly-Seber estimates run through POPAN. A Petersen estimate was calculated annually. The Petersen estimates only use those fish tagged one year and caught the next but they have been really consistent with the Jolly-Seber results.

One of the participants asked, which of the double tags were retained better, Floy or PIT tags? The PIT tags appear to retain extremely well. The Floy tags also retain well, although there were some issues with field staff occasionally not liking the look of the Floy tag so they pulled them out and put in a new one. That means we know how many tags we replace, but we don't have a measure of tag loss. We have very few instances where we only have a PIT tag recapture without a Floy tag. Floy tags appear to last a lot longer (a decade) than previously thought.

A participant noted that the presenter mentioned that the Carlin tags weren't holding well, and wondered if while double tagging, were they able to determine the Carlin tag loss to validate recaptures in the 2000s. Carlin tags in the 1990s were run as a separate experiment. Although they recaptured Carlin tags and re-tagged them, because they can't quantify the tag loss, they didn't include the first capture event with Carlin tags. It wasn't just the Carlin tags falling off. There was also a large harvest event that occurred in the late 1990s. We believe that it captured a lot of tagged fish that were not reported. So there was an unknown amount of tag loss, which is why the Sturgeon Board took that break to start the experiment over. All the fish that had Carlin tags are scarred from the age structure fin clips.

Another participant asked where they got their yearling fish. They yearlings are from the Grand Rapids hatchery, which was originally operated by the Province but is currently operated by Manitoba Hydro. Lake Sturgeon are the primary focus of the hatchery now and they now have the capacity to overwinter some fish. So they are stocking 1,000 of these fish per year for the last 3–4 years, which has a far greater impact than the 10,000 fingerlings being stocked annually.

LAKE STURGEON MOVEMENTS IN THE NORTH SASKATCHEWAN RIVER, ALBERTA

Presenter: Owen Watkins

Abstract

In the Alberta section of the North Saskatchewan River, Canada, overharvest, and poor water quality, led to the collapse of the Lake Sturgeon population circa 1940. However, improved water quality beginning in the 1960s, along with the implementation of a zero-harvest regulation in 1997, prompted a Lake Sturgeon population recovery. Lake Sturgeon population viability, however, remains questionable with low abundance and few adult fish, complicated by industrial development and an increasing human population. To further protect Lake Sturgeon and their habitat, I evaluated the current Class 'A' watercourse designations in combination with Lake Sturgeon distribution. Telemetry surveys conducted over a 38-month period of 55 Lake Sturgeon, relocated fish throughout the entire section of the North Saskatchewan River from Drayton Valley, Alberta to the Alberta-Saskatchewan border. I found Lake Sturgeon congregated in 10 primary locations and open water migrations of up to 925 km. Existing provincial Class 'A' watercourse designations protect only 30% of these congregation sites. To protect at least 75% of these sites, I propose 10 new Class 'A' areas, which provide greater protection for Lake Sturgeon and their habitat while reducing the total area of current Class 'A' protection (from 64 to 58 river km).

Discussion

A participant asked if the 70–80 km range was for all sizes of fish or adults only. All sizes were lumped together. There was a problem finding small fish (juveniles and young adults). Small fish were tagged but could not be found afterwards. This led to building signal attenuation models.

CARIBOU FALLS AND WHITEDOG FALLS GENERATING STATIONS MITIGATION PLANS (DU5)

Presenter: Dave Stanley

Summary

Amendments were made to the regulation under ESA in July 1, 2013. There are prescribed requirements for proponents to minimize adverse effects and prepare mitigation plans. This reform in the regulation moved Ontario Power Generation Inc. (OPG) to a more prescribed, self-directed process to compliance.

ESA Mitigation Plan Development focused on Lake Sturgeon (2009 – Present). Efforts were concentrated in Northwest Operations (NWO) and Ottawa St. Lawrence Plant Group (OSPG). Management efforts also taking place in Northeast Operations (NEO) – DU7. OPG registered 11 Mitigation Plans in 2014 and 9 Lake Sturgeon Plans. Multi-year plans (5 Year intervals) focused on adaptive management and implementation of long term mitigation/monitoring programs including; habitat construction/creation, flow regime alterations, streamside rearing/enhanced recruitment measures, spawning assessment, abundance assessment.

Juvenile Population Assessment

- Fall 2014, juvenile inventory completed between Caribou Falls and Whitedog Falls downstream to the Manitoba/Ontario border. Deploying 82 juvenile gangs for a total of 2,060 gillnet hours of effort.
- 56 captures within Ontario reach (72 total catch in MU4).
    - Caribou Falls Generating Station (GS) sector, 41
    - Tetu Lake sector, 10
    - North Boundary Falls sector, 5
    - Whitedog Falls GS, Whitedog Channel/Swan Lake, Halley’s, or South Boundary sectors, 0
    - OMNRF wire Carlin tags, 5 recaptures
- Catch-per-unit-effort was 1.89 in the Caribou Falls sector, 0.58 in the North Boundary sector, and 0.38 in the Tetu Lake sector.
- Recent spawning/recruitment at Whitedog Falls appears low to nil.
- Confirmed recruitment from spawning at Caribou Falls GS in recent years (2007, 2008, 2009, 2013, 2014).
- CPUE values indicate recruitment is occurring at lower rates than in downstream Winnipeg River reservoirs in Manitoba.
    - 2014 Juvenile catch dominated by the 2014 cohort (age-0; 55.6%).
    - 2007–2009 cohorts relatively abundant (7.4–14.8%).
    - 2010 – 2013 cohorts were sparse or absent (0–1.9%).
- Consistent with OMNRF juvenile monitoring. Noting wide variation in Lake Sturgeon recruitment between years (i.e., average, strong, and weak/absent cohorts evident in both datasets).
- Methods employed in 2014 may underestimate abundance of Lake Sturgeon <250 mm FL.
- The abundance of age-0s suggests that the 2014 cohort will be strong.
- Recruitment patterns in MU4 (strong, average and poor recruitment) similar to those observed in downstream reaches (MU5 – Slave Falls Reservoir, MU8 - Great Falls Reservoir, MU9 - Pine Falls Reservoir)

2015 Caribou Falls Spawn Assessment

- 56 large mesh gillnet gangs were deployed downstream of the Caribou Falls.
- 96 Lake Sturgeon captures (89 unique individuals; seven recaptured twice)
- 1,183 gillnet hours of effort, resulting in a catch-per-unit-effort of 1.95 Lake Sturgeon.
- 23 identified as mature fish spawning during the current year; 22 males (7 pre-spawn, 12 ripe, 3 spent) and one pre-spawn female.
- Drift netting downstream of the Caribou Falls GS from May 28 to Jun 15 and from June 22 to June 24.
- 72 Lake Sturgeon eggs and 1 larval fish captured.
- 61% of the eggs captured in DN-1 (n=44) between May 28 and June 2, 2015.
- On June 9, a single larval (yolk-sac) Lake Sturgeon (10.1 mm) captured during this study was observed in a drift net (CTUs 62.5).
- No eggs or larval fish were captured during the June 22 to June 24 sampling period.

2015 Whitedog Falls Spawn Assessment

- Downstream of Whitedog Falls GS a total of 24 Lake Sturgeon gangs were deployed for 521 hours of gillnetting effort.
- In total, 13 Lake Sturgeon (12 unique individuals; one captured twice) were captured, resulting in CPUE of 0.60 Lake Sturgeon.
- 2 captured Lake Sturgeon were identified as mature males; one on May 22 (9.0°C), and the second captured on May 29 (10.9°C).
- Low abundance of mature fish aligns with low/nil recruitment in recent years demonstrated through juvenile study (2014).
- Data collected to date suggest successful spawn downstream of the Caribou Falls powerhouse between May 27 and June 12, 2015 (between 8.8°C and 13.0°C).
- Successful spawn and recruitment in 2007, 2008, 2009, 2013, 2014 and 2015.
- Gillnet catches suggest comparatively modest number of Lake Sturgeon were present downstream of the Caribou Falls GS during spring 2015. Most were likely immature sub-adults (only 18% measured > 1,000 mm FL). Strong 2002 cohort.
- Considering females likely mature at > 1,000 mm, reasonable to infer that a small number of females spawned in 2015 (explaining low quantities of eggs captured).
- Evidence of juvenile recruitment is encouraging from a population recovery perspective.
- Evidence suggests large proportion of observed population will mature in the next 5–10 years.

Discussion

A participant wondered, comparing and contrasting the Whitedog Falls Generating Station (GS) with Caribou Falls GS, is there any one thing or combination of things to explain why we are not seeing recruitment below the Whitedog facility? The presenter indicated that there is spawning habitat below both the Whitedog and Caribou Falls facilities. There is evidence of more harvest on the Winnipeg River system (Whitedog Fall GS) then on the English River system (Caribou

Falls GS) so fish might be removed. There are still existing threats on the system in terms of adult and sub-adult harvest. The Whitedog facility doesn't operate the same as Caribou Falls GS. It has very little upstream storage capacity (few hours). Although it is classified as a peaking station, it largely operates in a spill or flow condition. It is odd that there are not a lot of fish there. Without the gillnetting program at both stations in 2015, we would still be in the dark as to what is happening in the sub-adult demographic. We had low returns on egg matting and drift netting at Caribou Falls but the gill netting illustrated many fish there were in the 950–1,000 mm age class. So increased spawning activity may be another five years away. We caught several males but only one female that was in spawning condition. The juvenile captures are a good sign.

One participant asked how this compares to Mary Duda's work with the Ontario Ministry of Natural Resources and Forestry (OMNRF) from 4–5 years ago. This study compliments Mary's study. Mary's study had identified a very strong 2002 year class. We may now be seeing a lot of those sub-adult fish now downstream of Caribou Falls GS in the spawning window.

The participant also asked if the facility operations had been modified. Operations have not been modified at all. There may be a little more spill now as there is less demand for power in Northwest Ontario. Overall river flows however have not changed. In terms of modified flow, 2014 was a high flow year and 2015 was a normal year, but operators were flipping flows back and forth from the spill to the generating station a fair bit in spring 2015 due to grid demands. The Atikokan Station is a biomass station, which adds complexity to the grid.

Another participant noted that the presentation indicated that juvenile CPUEs on the Ontario side of the border were lower than those observed downstream on the Manitoba side of the border. Were these data collected in a way to make them comparable to the rest of the data downstream in the Winnipeg River? Are the comparisons made anywhere or is it impressions based on catch rates? The same consultants did the work for the juveniles on the whole system (basin wide). It is the consultant's proven study design so results are congruent. Juvenile catches are acknowledged to be lower than at the Manitoba Hydro stations downstream. There are some years with absent year classes.

A participant asked if there are more Lake Sturgeon in the Ontario section would you expect to see numbers like below Pointe du Bois? The habitat is similar. The main difference between Manitoba and Ontario sections is that in Manitoba there is a conservation closure for the harvest of Lake Sturgeon. In Ontario, there is no limit on subsistence harvest. There is removal of adults and sub-adults in Ontario, whereas in Manitoba there is not.

A spawning study (egg matting) is affected by the overall abundance of Lake Sturgeon. There are a large number of sub-adult fish now below Caribou Falls and if this continues, spawning studies below Caribou Galls will be more effective, and the results more meaningful, in another 5–10 years.

Another participant asked if the nets were set where the fish were (targeted) or if they were set randomly. Netting wasn't a big part of the program and it wasn't quantitative. They were used to ensure that mats were located where there were spawning fish for context with the egg matting results. Population estimates were not an objective of the study.

Mary Duda had done a lot of sampling before finding locations with juveniles. Is that where you concentrated your juvenile netting? For the juvenile study, other work in the Winnipeg River had identified that juveniles preferred deep water and won't venture into shallow water. They are exclusively in the thalweg deep-water habitat. These were the habitats targeted and (in many cases) were similar to the sites Mary had identified.

A participant asked if they caught fewer or more Lake Sturgeon than expected. They caught more young-of-the-year (YOY) than ever before until they sampled YOY at Pointe du Bois that fall. They were surprised at the number of YOY. In terms of total quantity, the numbers were in-line with what was expected. The Ontario Ministry of Natural Resources and Forestry (OMNRF) work had indicated high variability in recruitment occurring downstream of Caribou Falls. There was no expectation of densities being as high as they are further downstream. They thought they would have seen more year classes and more fish than they did based on some of the previous work. Not considering the especially high representation of the 2014 year class, they didn't see many fish at all.

A participant commented that this was the first time they had seen recruitment data for the year 2014. That year had near record flow. Going back to Mary's study, there was a correlation between recruitment and spill years at Caribou Falls. It is great to see that they have a high recruitment on such a high flow year. Was there the same high recruitment in the other North South Consultant assessments in other reaches on the Winnipeg River system in 2014? The only datasets are from Caribou Falls and below Pointe du Bois. It was a good year in both places. In 2015, which was an average year in Pointe du Bois, they caught three times the number of YOY than in 2014.

There was a discussion about flow and everyone agreed that more than just flow was involved in recruitment. A participant noted that you would want to see what the survival was for the age class after their first winter. Surviving winter is always a challenge.

Will the report authors be contrasting the juvenile netting in the upper part of the river with that in the lower river to identify the relative strength of sections? That was concluded in the report to Ontario Power Generation (OPG) but they would not likely be publishing it. The COSEWIC status report authors were asked if this would be included in the COSEWIC status report but they indicated that they were not yet sure.

Juvenile netting was undertaken in fall 2014 and fall 2015. In 2015, there were two weeks of gillnetting conducted by the OMNRF. In 2015, eight gillnet lifts caught 12 juvenile Lake Sturgeon, four yearlings, and one YOY. A comment was made that although 2015 is considered an average flow year, there seemed to be excessive spill coming out of the English River system. This year (2015) was highly variable at Caribou Falls. Flows were being flipped aggressively back and forth from spillway to generation station and back again to manage grid demands in Northwest Ontario.

2014 SURVEY RESULTS OF THE WINNIPEG RIVER, NUTIMIK/NUMAO REACH

Presenter: Derek Kroeker

Abstract

The population size of Lake Sturgeon in the Nutimik Lake and Numao Lake portions of the Winnipeg River (DU5, MU6) has been monitored through various tagging efforts since 1984. The contemporary population estimate uses PIT tags and analysis with program MARK on fish captured from 2006 to 2014. The catch-per-unit effort yielded 12 fish per net night (all sizes) and 2.43 fish per net night for adults. Population estimates for Lake Sturgeon of all sizes in 2014 were 28,207 (95% CI 18,870 – 37,542) and 6,289 adults (95% CI 1,385 – 11,193). The population estimate for all Lake Sturgeon is similar to the estimate in 2012– 29,391 (previous sampling event), but the 2014 estimate of adult fish is considerably higher than in 2012 – 3,810. A lack of individual fish movement between Nutimik and Numao lakes as well as differences in growth rates suggest that these two lakes, although close in proximity, should be treated separately in estimation of population size. Staffing and financial challenges exist within Provincial Fisheries Branch staff to continue this program.

Discussion

There isn't a population estimate for MU 7 as there was only one recapture from 2013–2015.

A participant asked if there is a difference in growth between Lake Sturgeon in Nutimik and Numao lakes and if so, did they recommend managing them as separate DUs? There is a difference in growth between the two lakes but there are no recommendations to manage separately. It is important to recognize that even though there is something different happening between the two lakes they are very close together (6 km). So it would be very hard to treat the two locations differently from a management perspective.

Do they spawn at different locations? There are spawning locations at Sturgeon Falls (Nutimik Lake), and at Slave Falls Generating Station. The Nutimik Lake fish can spawn at Sturgeon Falls, which is a natural waterfall or rapids. It separates the more riverine portion of Numao Lake and Nutimik Lake, however Sturgeon Falls is passable.

Are the fish genetically discrete? There is no genetic information.

The netting locations were chosen because they were places nets could be set consistently year-to-year regardless of water level. They were originally part of a randomly selected set but a lot of the places that were selected had to be removed because they could not be fished any longer. The nets are set annually. The variation that has been observed among years could be due to variation in flows and habitat changes within the river.

A participant pointed out that it was interesting that the adult numbers increased and decreased substantially when there is no harvest and not much recruitment in the system. In one year you go from 3,000 to 6,000 adults. The presenter suggested that it may be that there were a large number of sub-adults a few years ago, which have just broken into the adult size range. They set a fixed size to designate when a fish becomes an adult.

The presenter would have liked to do a high intensity marking effort but, they don't have the resources at this time. They now have a cohort that is vulnerable to the 5.5″ mesh and it would be helpful to fully tag this cohort. This would increase the reliability of the data for the next 20 years.

A participant pointed out that the CPUE is about an order of magnitude higher here than in Ontario. A participant wondered if the conservation closure was the key to this or is the habitat that much better and is the condition factor different. The presenter indicated that they felt the conservation closure has a large impact in terms of current numbers. They still have a strong recreational fishery in Manitoba, which is not the case on the Ontario side. The positive trajectory of MUs 6, 7 and 5 (below Pointe du Bois with the highest density of Lake Sturgeon) may be attributed to the fish not being harvested.

Another participant asked how many fish are harvested below Caribou Falls per year. Harvest is happening but there is no way of knowing how many fish are harvested. The presenters have received a significant number of tag returns over the years. For context the telemetry project tagged 53–54 Lake Sturgeon in 2010 and they have 4–5 returns back from harvested fish. They have Floy tagged about 600 juvenile/sub-adults from 2007–2012 and a few in 2015 and have about 20 tags returned. Those are the ones we know. Another participant noted that from a report in 2012 or 2013 about 80 adults had been tagged and about 20 had been returned, 17 of which were still sub-adults. He suggested the reason why they are not seeing as many adults is because a lot of the larger fish (1 m+) are being harvested.

Another participant pointed out that OPG has done one year of adult netting in 2015 while OMNRF has netted from 2007–2012 and tag returns from First Nations subsistence harvest indicates that they are harvesting mostly juvenile and sub-adult fish. None of the tag returns came from fish older than 18 years. They are not harvesting larger fish because they are using 4.5–6″ mesh. There are other adults in that system but they may not have been on the spawning grounds where netting occurred.

A presenter indicated that there are sections of the river where the trajectory is positive and densities are fairly high. However, particularly between MUs 5 and 4 where there is a dam separating one population that is extremely dense from another one where there are essentially no fish management is difficult. It is hard to tell people that they are endangered in one place and not the other. As a manager it would be helpful to have controlled harvest in places where it is feasible.

A participant noted COSEWIC (2006) indicated few (<100) fish in MU7, but now the trajectory is looking positive. There has been a lot of research in this section of the river by Manitoba Hydro, consultants and academics. The state of knowledge is much better now than even five years ago.

INVESTIGATING THE SPATIAL ECOLOGY OF LAKE STURGEON ON THE WINNIPEG RIVER USING BIOTELEMETRY

Presenter: Dan Struthers

Abstract

Impoundments of free-flowing rivers for hydropower generation often confine fish to relatively small reaches that can restrict movement, limit habitat availability, and alter life history strategies. Lake Sturgeon are often confined to impoundments placed in sequence due to hydropower infrastructure. Acoustic telemetry was used to describe the seasonal habitat use, swimming activity rates, and depth use for Lake Sturgeon within an impounded reach on the Winnipeg River, Manitoba. Lake Sturgeon were distributed in different habitat types likely for spawning, foraging, and overwintering. The tagged Lake Sturgeon were more active with increasing water temperatures, and when residing in habitat types located farther upstream, but were minimally active during the winter season throughout the impounded reach. Lake Sturgeon utilized deeper waters as depth availability increased with habitat located further downstream, which is a backwater area associated with the downstream dam. Overall, these results provide information on the seasonal habitat use and biological responses to environmental cues for Lake Sturgeon that will enhance management and ecological understanding for populations that are confined to impounded reaches.

Discussion

A participant asked given there is potential for stranding below the spillway portion of Seven Sisters Generating Station and what you know of the timing of Lake Sturgeon use of the area, do you have any management recommendations for when Manitoba Hydro should spill that would benefit Lake Sturgeon. During the spawning period in May and June, a high residency period, is one of the obvious times although it is also a peak flow period. Also through the fall, during the day when they're foraging it is appropriate to remain consistent with spilling. Fish are moving into shallow depths in the early morning and moving out of the areas during the day. Maintaining spill would allow fish to move away from the spillway and prevent them from becoming trapped and stranded.

Another participant wondered if the hydrokinetic turbine was operating the entire time of the study. Turbines were operating very intermittently in spring, summer and fall. Another chapter of the presenter's thesis involves a risk assessment of Lake Sturgeon and walleye in the tailrace environment when turbines are operating. It appears that Lake Sturgeon would be most susceptible during the spring when using the tailrace. Operation information was limited so the area around one turbine was studied. It operated in the fall when Lake Sturgeon were not in the area.

A participant wondered if the presenter saw any tags go missing. They didn't see any Lake Sturgeon mortality, tags expelled or any disappearances from poaching.

A participant, interested in fine scale movement, made a comment about tailrace use by Lake Sturgeon. Their movement is directional movement. When a Lake Sturgeon decides to go into the tailrace, they move upstream out of the array and closer to the powerhouse and then drop back down out of the tailrace. There was not a lot of residency directly in the tailrace itself, except during the spawning period. This was unlike Walleye that live in the tailrace. Lake Sturgeon could be in that area of Seven Sisters but are milling around off the edges of the tailrace in the river.

LAKE STURGEON IN MANITOBA: POPULATIONS, HABITAT, LIFE HISTORY AND ECOLOGY SINCE 2006

Presenters: Stephanie Backhouse, Cheryl Klassen, Warren Coughlin

Abstract

Following rapid and severe population declines during the past 150 years, increasing focus has been placed on recovering Lake Sturgeon (*Acipenser fulvescens*) populations in Manitoba. Since approximately 1990, many parties including Manitoba Hydro, Manitoba Conservation and Water Stewardship, Department of Fisheries and Oceans, severalLake Sturgeon management groups, and multiple academic institutions have been involved in research and recovery efforts. Particularly within the past 15 years, the ecological understanding of Lake Sturgeon in Manitoba has improved considerably, and more is known about the status and trajectory of some of the most vulnerable populations. While Lake Sturgeon recovery initiatives in Manitoba are ongoing, the breadth of knowledge has increased substantially and is summarized in Manitoba Hydro's "Lake Sturgeon in Manitoba: A Summary of Current Knowledge, 2015". This presentation provides an overview of that summary document, with a focus on information gained since completion of the 2010 Lake Sturgeon RPA documents.

Discussion

The presentation is publically available (Part 1 and Part 2).

A participant asked a question about the accelerated maturity schedule that has been seen in the Winnipeg River system. There have been 8 year old males seen that are 600 mm long that are mature. Often times, early maturity is a sign of stress and a participant wondered if this was the case in this area and whether that should be a cause for concern. That area has a really high density of fish and therefore is a slow growing population. There are similar densities in the Pointe du Bois du Bois to Slave Falls reach, but they don't see those same small mature males. It's possible that it is some kind of evidence of genetic difference. There is structure in the Winnipeg River, Slave Falls was a barrier and maybe those fish that were resident between Pointe du Bois and Slave Falls were predisposed to mature earlier. If it was a stress response they would probably see this in other reaches of the Winnipeg River as well.

Forty-two percent of fish 12 years and under show annuli patterns characteristic of early maturity and they were milting. They capture the fish with smaller mesh nets. Another participant commented that they are not sure if genetics can be the reason for the early maturity given there is 15% downstream passage. They might expect it to carry to the downstream population. The presenter thought they might be witnessing a contemporary effect. What happens at the Slave Falls Generating Station in terms of passage is there is some bottom draw regulating gates that the fish seem to be drawn to and they go through these gates at a high rate and that seems to be the explanation for the high rate of passage. The station doesn't seem to have the characteristics that seem to limit movement. Other areas along the Winnipeg River have shallow areas limiting passage. Here, if they come into the forebay there is a high chance they are going to exit through the regulating gates and move downstream.

A participant commented that there was a high percentage of stocked fish in the Sea Falls area that were PIT tagged. They asked if they were all the same age and what was the purpose of the stocking. Lake Sturgeon was extirpated in that area. Stocking is an initiative of the Nelson River Sturgeon Board to re-populate the area. Stocking (including yearling stocking) began in 2008 (2007 cohort fish) and has continued annually. So there are lots of cohorts tagged and counted in those data. The first age 1 cohort (2007) did particularly well (survival has been estimated at 60% based on recapture rates). All were PIT tagged but the complicating factor is that some of the tags malfunctioned. Linking back considers some growth chronology interpretation. Fish that grow in the hatchery over winter don't lay down a jagged first annuli as they do in the wild. When they are recapture these fish they can link them back to their cohort and the stages that they were stocked at, which is considered in the estimate.

There was a question about movements and about the sections in between dams with no adults but with juveniles and some recruitment. Is the recruitment coming from that stretch or is it possibly from immigration from upstream areas? They haven't done any genetic testing and don't have any tag returns so they don't know for sure if it is recruitment or immigration. Presenters would like to replicate the genetic work done on the Nelson River on the Winnipeg River.

Another participant commented that this is a key question. You see all life stages in a section of the river, but is it self-sustaining or is it being sustained by immigration? It would be useful to take a genetic approach to addressing this. You need to take the SNP approach, as microsatellites would not work. The presenter agreed and said that is what they are hoping to do this on the Winnipeg River.

A participant asked about the Nelson River mainstem. The participant noted that there hasn't been any Lake Sturgeon spawning documented below generating stations and they wondered if that is due to limited habitat or lack of sampling. The question relates to Keeyask where there is no other potential habitat within that reach except below the generating stations. What are the chances of successfully maintaining a population except by stocking? The population is about to be isolated. The presenter responded that there are not a lot of fish in the Nelson River, whether that's a function of commercial fishing or development. Lake Sturgeon are spawning at depth so can't be easily observed. It could be a function of generating stations not providing the habitat. However for Keeyask, they are putting a lot of effort into providing suitable habitat (substrate, depth, flows, timing of flows).

A participant asked what time of the year does Manitoba Hydro close new dams to fill reservoirs resulting in reaches becomes isolated? Could this be a factor in why there are so few fish in some areas even though they are not subjected to harvesting? All Nelson River builds happened a long time ago. Maybe there was not a lot of habitat use to begin with. Maybe there was seasonal habitat use so if the fish were not in the area when the dam was closed and the reservoir filled, they would not be there afterwards even though now there may be suitable habitat. Overwintering habitat in the lower Nelson may have been limiting. The fish may not have been in the areas when they were closed off and couldn't get back up there. They did see a lot of fish move out of the reservoirs shortly after they were impounded. Habitual movement, once a dam stops movement of fish upstream, then those fish are lost from that section of the river forever. This could explain why some reaches have no fish.

What Manitoba Hydro is doing now is to study the influence of dam construction on behaviour of Lake Sturgeon through long-life acoustic tag studies on Lake Sturgeon at Keeyask. They will monitor Lake Sturgeon behaviour during construction and impoundment.

The co-Chair acknowledged the large amount of work undertaken over the past ten years represented by the presentation and that would now be captured in the COSEWIC status report.

VARIATION IN ABUNDANCE, RECRUITMENT AND GROWTH OF LAKE STURGEON ACROSS ONTARIO

Presenter: Tim Haxton

Abstract

The objectives of this study were to:

i) assess the variation in relative abundance of Lake Sturgeon subjected to various man-induced stresses and physical characteristics at a landscape scale across Ontario, and;

ii) ascertain the factors that explain the variability observed among rivers using a multivariate approach.

A standardized index netting program targeting juvenile and adult Lake Sturgeon was conducted over two field seasons at 22 river sites across Ontario. Each river had unique or different human induced stresses and physical characteristics. Relative abundance of Lake Sturgeon varied in rivers across the Ontario landscape. A principal component analysis was conducted using site physical characteristics with the associated anthropogenic stressors. The CPUE for juvenile and adult Lake Sturgeon were then regressed with the scores of principal components having eigenvalues greater than 1. The variation observed was best explained by the negative relationship observed between CPUE and the presence of hydroelectric generating stations. Historical commercial fisheries also had an effect on Lake Sturgeon abundance whereas subsistence fisheries seemed to focus on rivers that were not regulated and where Lake Sturgeon numbers were greater. Research and recovery efforts should focus on minimizing the impact of hydroelectric generation on Lake Sturgeon while achieving socioeconomic goals. Recruitment was highly variable in both regulated and unregulated systems, whereas recruitment failure was more evident in regulated systems, particularly in peaking systems.

Variation in Lake Sturgeon growth was assessed across a broad area, using graphical and statistical modelling techniques to explore and summarize important influences. Total length at age 12 (TL12) was used as an index of growth rate for each of the 37 populations studied. Environmental variables were tested for their influence on variation in growth. Length over all ages, in relation to the same environmental variables, was also explored using mixed effect models (site as random effect, total length as response and age along with other environmental variables as the fixed covariates). The most important influences on growth were waterbody type (lake or river), growing degree days (GDD) and presence of a hydroelectric facility. Lake populations displayed faster growth than river sites. As GDD increased, growth rate increased, with sites in the St. Lawrence drainage showing slightly slower growth than Hudson Bay drainage sites for comparable GDD, which suggests that growth could be genetically determined. The effect of dam presence was only pronounced among riverine populations within the same minor drainage basin. Lake Sturgeon from all three basins showed approximately a 12% faster growth at the impounded sites than unimpounded sites.

Discussion

A participant asked if the same person aged all 5,000 fish. It was not the same person aging all the fish, so they went with length at age 12 (ageing errors reduced by this age).

A participant asked for clarification of one of the graphs. At similar growing-degree-days, the fish were growing substantially faster in the Missourian versus the Mississippian drainage.

A participant commented that dams in Manitoba seem to do different things in terms of reproduction and in terms of their use. But in this presentation all dams were lumped together as part of the principle components. Is there a difference between peaking systems (produce hydro when needed and have storage capacity), run of the river (flow in flow out) and winter reservoirs (draw the water down)? Was there a lot of variability between use? Yes, in a regulated river the abundance was significantly lower than in an unregulated river. Abundance was greatest in run-of-the-river followed by peaking and then in winter reservoir systems. Dams were separated in the analysis but this was not part of this presentation because it didn't explain the variation that was the focus of this talk.

A participant commented that they are finding a lot of variation in growth that may or may not have to do with latitude and sometimes temperature but mostly correlated with the habitat type that the population is coming from even within the same DU. Lake Sturgeon in a lake are fatter at length than in rivers even on the same system. The participant wondered if they were finding the same thing in Ontario. The presenter was finding that as well. Growing-degree-days as a power function came out as having a big influence and dams (presence of lakes) was also significant.

A participant noted that in Wisconsin, as the Lake Sturgeon mature, they catch up in growth and they wondered if the presenter looked at that. The presenter did not look at that although there is still a lake effect versus river and dam presence or absence. A participant noted that they did a similar analysis looking at density and velocity as factors and both were factors in growth. The work in Ontario did not include velocity or density because they didn't have the data for all the populations.

A participant commented that when dams are constructed there is often a lot of harvest by the construction workforce, depleting the population. The presenter responded that they lumped all of this within commercial harvest. There are no legal harvests in Ontario except for subsistence fisheries. Subsistence fisheries did not come out as a big factor in the principle component analysis.

A participant asked about how they differentiated a regulated river and a winter drawdown system as they are one and the same. Every river with a hydro station gets drawn down in the winter. The presenter clarified that they are both considered to be regulated.

WATER QUALITY

Presenter: Dan Gibson

Abstract

While many Lake Sturgeon populations across North America remain threatened and imperiled, some populations are demonstrating modest signs of recovery. As such, where recovery is evident and data are available, it is important to examine these successes to determine where repeatable and transferable management strategies exist. For these reasons this study sought to investigate the role of water quality improvements on two recovering Lake Sturgeon populations. The objective of this study was to assess Lake Sturgeon abundance as a biological response to improved water quality in two regulated rivers in northern Ontario with similar industrial histories

(Kaministiquia River and Kapuskasing River). As such, long-term industrial effluent loading records were contrasted with records of Lake Sturgeon abundance over time (1970–2012). The relationship between Lake Sturgeon abundance (based on CPUE data) and improved water quality conditions (caused by reductions in effluent loadings) were explored and discussed. The results of this study suggest that in both cases Lake Sturgeon has demonstrated a positive response to significant reductions in industrial effluent loadings since the 1970s and 1990s. The results support time-order, consistency of replication, and coherence tests for causality with generally known stress response relationships identified in the literature and other cases involving Lake Sturgeon recovery. While available data may be limited, the authors contend further studies should be explored to discern the long term contribution of water quality changes to the original decline of the Lake Sturgeon as well as its subsequent and ongoing recovery.

Discussion

A participant asked if there were population estimates for the Mattagami system. The population assessment is estimated to be around 10,000–12,000 contributing adults in the Mattagami study area, but we have low confidence in this number as some of the fish are being lost from the original study area. The presenter will provide the data.

A SNAPSHOT OF SPAWNING LAKE STURGEON IN THE RAINY RIVER BELOW THE INTERNATIONAL FALLS DAM

Presenter: Tom Pratt

Abstract

Fisheries and Oceans Canada partnered with the University of Waterloo to assess the effects of a water management strategy implemented in 2000 on Lake Sturgeon below the barriers at Fort Francis and International Falls on the Rainy River. Three-hundred and eighty-five Lake Sturgeon were captured during the spawning season in 2012 and 2013. The fish were biologically processed, marked and released. Captured Lake Sturgeon mean length was 127.7 cm, mean weight was 15 kg, and mean age was 20 years. Von Bertalanffy growth parameters indicated a relatively fast growing population (L_{max} = 141.9; K = 0.14; T_0 = -0.25). Estimates of annual survival were high (94% in 2012, 96% in 2013), and simple Schnabel mark-recapture estimates showed large numbers of spawners in both years (2012 spawning estimate: 2635 (95% CI 1363–4818); 2013 spawning estimate: 3157 (95% CI 1139–6210). Stable isotope analysis indicated that Lake Sturgeon had a higher trophic feeding position than expected, likely indicating that they consume fish eggs as a significant proportion of their diet at certain times of the year. Lake Sturgeon in the Rainy River appear abundant, and are supported by a diverse food base. The water management changes have not negatively affected the Lake Sturgeon population downstream of Fort Frances/International Falls.

Discussion

A participant asked if the stable isotope results accounted for seasonal variability. Would the results be different if they had done the study during a different season (i.e., winter). You might expect to see some differences but the study used fin tissues and a muscle plug for the stable isotope analysis to infer the diet. They discussed and debated why such a high proportion of the diet appeared to be coming from fish eggs. You would expect Lake Sturgeon to eat some but you wouldn't expect it to be that important. Stable isotopes typically integrate a longer time frame. Another participant noted that using blood for stable isotope analysis provided a seven day window between something being eaten and showing up in the blood signature. If there was blood in the tissue being analysed this may have accounted for some of these results.

There was a comment made about resource subsidy caused by suckers spawning and how quite a few species will come in and track the suckers spawning and rely heavily on those eggs. Fish eggs also seem to be a major subsidy for spring. Another study noted one in five Lake Sturgeon coming in to spawn in an area and the remainder stayed in the lower reaches of the water to forage. Hence, fish eggs were an important diet component. In Lake Superior the presenter pointed out that many salmonids, including whitefish and cisco, are fall spawners and their eggs make up much of the winter diet of Lake Superior fishes.

A participant commented that larval drift has a strong time signature and that peaking may cause lowered water levels during the time flow is needed for larval drift. The presenter indicated that both years had high water levels so it may not have been the best for looking at effects of peaking.

There was a question about ageing accuracy in the system. The presenter felt comfortable up to a certain age. They have two or three agers that come to consensus. It is a system with enough tags and aging structures from young fish that it may now be possible to verify ages by going back and taking a second aging structure. The system also doesn't have a lot of variation in year class strength (e.g., ten-fold difference in year classes) compared to other species.

The water management rule change was implemented in 2000. Another participant asked if there would be impacts in that short of time given the longevity of Lake Sturgeon. The presenter responded that you may just be starting to see impacts. They are not yet seeing missing year classes.

2014 LAKE OF THE WOODS–RAINY RIVER LAKE STURGEON POPULATION ESTIMATE

Presenter: Tom Heinrich

Abstract

Lake Sturgeon *Acipenser fulvescens* in the Lake of the Woods-Rainy River system have been recovering from over-exploitation, and the effects of environmental degradation, since the mid- to late-1960s. Population estimates made in 1989 and 2004 documented increasing abundance of Lake Sturgeon longer than 999 mm. After the 2004 population estimate a Lake Sturgeon management plan was produced, which recommended conducting population estimates on a 10-year frequency to monitor recovery of this population. In 2014, the Chapman modification of the Petersen estimator was used to estimate the number of Lake Sturgeon longer than 999 mm. The 2014 study design was based on the design used in 2004 allowing for direct comparison of abundance and size structure between time periods. The 2014 estimate documented the continued increase in the abundance of Lake Sturgeon. Since 1989, the population of Lake Sturgeon (>999 mm) has grown steadily from 16,910 fish (1989) to 59,050 fish (2004) to the current population of 92,286 fish (2014). Additionally, a greater proportion of "large" Lake Sturgeon was sampled in 2014 than in 2004, further suggesting continuing recovery of the population.

Discussion

A participant asked if there was any work on the juvenile segment. They did some work this year and have tried in the past. They were able to catch them, but not convinced that they were getting a representative sample (because of flows).

Another participant asked about the 2 m long fish in recovery goals. There is not a hard end point to recovery, but this is something to aim for although it seems optimistic. A participant wondered if they expect to get back to historic population levels and sizes of Lake Sturgeon. They didn't expect to get back to historic levels. The large fish (2 m+) were likely rare in the past and will still be rare. They were looking for a size distribution that would top-out at 2 m.

The group went on to discuss the sampling design. The deeper more open portion of the lake had some of the lowest catch rates. It was about three times higher in the shallows along the lake shore. The highest catch rate was in Ontario but it was concentrated in one bay where they caught 40–60 Lake Sturgeon per day. That drove the overall catch rate. There was another area with a sand bar with very high catch rates. Catches were not uniformly distributed even in the nearshore area. Relative catch rates changed quite a bit between 2004 and 2014 population estimates; in 2004 there were much higher catches in the river. There seems to be fewer Lake Sturgeon in the river since 2004 when you used to be able to see lots jumping.

A participant asked how confident the presenter was with the population estimate with only six recaptures. The netting was done the same way in both 2004 and 2014. They were just looking for general trends. They looked at the mortality estimates even if the population estimate had not gone up, the mortality rates would have gone from 3% up to 7%, so they are still at a relatively low level of mortality.

A participant wondered what was preventing people from filling the tags (i.e., using the tags that are distributed). It was likely the weather and most anglers are not locals. A participant asked if the Lake Sturgeon tag system was to go out and target Lake Sturgeon. You can target, catch and release fish without a tag. The only time you need a tag is if you want to keep the fish. Sometimes tags are purchased and the fisher still released the fish.

The slot size is 45–50″ (1,143–1,270 mm). The tags are also issued to the individual, not to a party. Some people are out looking for a state record fish and are not concerned about the slot size.

A participant asked if they were catching fish that have been tagged in 2004. They did catch quite a few, but they weren't quite sure how to incorporate those estimates. They considered incorporating some of the fish DFO (Tom Pratt's presentation) tagged as well.

CHURCHILL, HAYES AND NELSON WATERSHEDS LAKE STURGEON POPULATION GENOMICS

Presenter: Thierry Gosselin

Abstract

Sturgeons, and other Acipenseriformes, have a worldwide distribution and problem. They have roamed earth's lakes, rivers, seas and oceans for millions of years, but the last two centuries of anthropogenic threats has critically reduced their numbers. The conservation concerns of these evolutionary relicts have stimulated numerous studies using traditional and putatively neutral molecular markers, but as for other polyploids and species with weak genetic structure, these resulted in mixed success. Here, genotyping-by-sequencing (GBS) was used to discover and characterize a large panel of reliable markers to conduct fine scale genetic structure and assignment analysis in the polyploid Lake Sturgeon (*Acipenser fulvescens*). Paralogy and artifacts, intrinsic to highly duplicated genomes, were managed by our bioinformatic workflow to focus on the diploid part of the genome. We also used cloud computing to address the computational challenges faced by small laboratories studying non-model species.
The landscape covered in this study is characterized by heterogeneous geographical features, watersheds with anthropogenic and natural barriers, promoting asymmetric gene flow and environmental disturbances. We show that understanding the evolutionary dynamics and historical and contemporary demography is paramount to untangle the different footprints of selection and potential threats of fragmenting populations. When applied in an ecosystem-based

management context, the new genomic tools have great potential to assist in the conservation, protection and recovery strategies of endangered populations or species, like the Lake Sturgeon.

Discussion

A participant wondered how long it took to run COLONY. For the Gull Cohort (190 individuals – large), it took 20 days and for the others (smaller) it took about one day; some took hours. Another participant asked if they used SOLOMON. They did, but the problem was that they got too many false assignments.

A participant asked about the breeding individuals and if that number represents what would be breeding at any given year. It's explaining the cohort. The participant wondered if they can extrapolate the number of breeders from the cohort to perhaps what is being seen from the population estimates from adult individuals given the periodicity of spawning, does it match up? Kim Scribner's lab has published a paper about the correlation between the number of breeders and how that relates to the overall effective population size (Ne) and the estimate seems to be comparable when they do that in Lake Sturgeon. Based on the effective number of breeders here the N_e values are about 1/5 of what we are estimating the adult population size to be for certain populations. The lower Nelson is different. The others represent actual cohorts but on the Lower Nelson it is just what we had for juveniles so it probably represents up to 13 cohorts.

A participant indicated that they would be reluctant to extrapolate from the number of breeders because the number that show up, the type of breeding system, and the variation in reproductive success will all skew the results. You may find a correlation under some conditions, but it is not a reliable predictor. The presenter agreed. To have an effective population size estimated through cohorts, you would need a different cohort from the same population. Another participant added that the effective population size is going to be much different from your field population estimate. It is often much lower.

The other things people are trying to do for a number of breeders is if you have a cohort for a particular year class, but don't know the generation time for the species of interest, you combine the different year classes to try to pull out, for the generation, the effective population size or number of breeders. How you combine this varies from system to system and how much the generations overlap, etc.

A participant asked about the historic and contemporary fish movements. What sort of time frames are you referring to? The presenter said historic movements would be thousands of years. Contemporary movements would be between first and second generation migrants.

A participant commented that you cannot get a better dataset than this (1,000s of markers) and that the limitation of assignment for migrants is going to be at most four generations. First generation migrants should show up as an outlier within a system. If they then breed and you have a second generation migrant, you should be able to see individuals with equal assignment between two different genetic groups. With every generation you cut that in half. By generation four, they will be at the limit of the resolution even with thousands of markers. The risk of a false positive overrides the resolution. If you allow ancestry from multiple genetic groups you have the possibility of non-zero membership in multiple groups. You cannot get past 95% membership and still allow other groups to potentially contribute.

In terms of recent generations, the presenter is not seeing the full run of the river. But the allele frequencies for the steps, it looks like a continuous system. There could be a historical gene flow. They couldn't get up past impassable barriers but there would be more or less continuous downstream flow. When talking about movements, it is limited to the past few generations.

Presenters are interpreting the results to mean there was, in general, downstream gene flow from Jenpeg Generating Station to Gull Rapids. Membership proportions in lower Limestone River, Weir River and Angling River are not being picked up. Those ancestries are not represented with the exception of individual migrants, which are contemporary. So we think there was a break there.

A participant clarified that you are trying to find the number of internally cohesive or consistent genetic groups in this type of analysis. This will be limited to last the few generations. It allows you to solve for how many genetic groups could be present. The software gives you the solution you are looking for and then you have to decide on what is relevant based on the probability (or improbability) of the different solutions. When you have the lower number of genetic groups the Nelson is one system and then you are able to get increasingly fine resolution.

The presenter replied that is why the simulation based approach is interesting as they take into account current nucleotide diversity, and then go back in time to take into account mutation, allele frequency, type of mating system, generation time, etc. So you can then say when the split occurred. A participant commented that the last time the Fox and the upper Nelson were connected continuously was probably around 7,400 years ago.

A participant asked if there were any hydro stations between the Grass River and Burntwood River or are there any natural barriers where they would expect to see genetic differences showing up? Why are they different if there is still potential for Lake Sturgeon to move between those areas? The presenter suggested that there may be a spawn-drift-settle cycle in an established habitat sequence so the juveniles aren’t really moving anywhere so there is no opportunity to mix. Mixing tends to occur at the drift stage. At lower Nelson, there are three pretty good spawning sites but all of those larvae funnel into one or two areas remaining together for most of their lives. They don’t have a chance to diverge. Burntwood and Kelsey drift into separate areas of upper Split Lake. There is the entire volume of Split Lake before the next spawning population. Even though the fish move back and forth, there is not necessarily substantial dispersal over time.

There was discussion about the Jenpeg samples being different from the rest. Jenpeg seems to be a mix of Landing and Grass. There is still a unique signature and the distance between the population is far (genetically).

Stocking has been going on in the upper Nelson, so it is possible that some of the fish they are including as adults were stocked from the Landing River back into the Upper Nelson 20 years ago. That is why there is a hard Landing River signature. They could re-run the analysis removing these, which might be informative.

A participant noted that it is different with Lake Sturgeon than with other fish species, because they are dealing with such a unique life history, so any of the genetic differences pre-date the construction of the generating stations. It’s not the physical barrier that was built by Manitoba Hydro that is creating these genetic differences. The presenter agreed that they are talking about hundreds (possibly thousands) of years for that kind of genetic make-up. The presenter clarified that in terms of migrants the program is looking at up to four generations. For discriminating among the units it is looking at a strong historical signal (hundreds and hundreds of years).

A participant asked why the migrants don’t show up in the clustering analysis. Cluster analysis shows both historical and contemporary (individual fish are contemporary, blocks of colour are historical). Only adults were used in the analysis. If juveniles were used, they would see more. A participant mentioned that they also have tag-recapture data as well and there were two fish tagged in the Nelson River that were subsequently caught in the Gods River and Hayes River and one has since returned back to the Nelson.

A participant asked about the level of upstream contribution. There is some variation in this. There haven't been any tag returns from Lake Sturgeon yet, but there have been tag returns from other species showing downstream movement.

The research group is also looking at larval dispersal. By using Sibship they were able to show individuals in Gull Lake that have siblings in other areas. The presenter gave an overview of the parentage analysis graph. They also have tag returns from Landing River downstream of Kelsey. There is movement from juveniles, drift and adults. Sea Falls is stocked and that is why there are so many full sibs. The final report for this research isn't done yet, but as soon as it is, it will be available. A participant commented that there is Gull Lake then Gull Rapids (assumed barrier) then Stephens Lake then a dam then Long Spruce and therefore siblings must have come from upstream initially.

DUs 1–6 LAKE STURGEON POPULATIONS GENETIC STRUCTURE AND DIVERSITY

Authors: Chris Wilson, Jenni McDermid, Shawna Kjartanson, Kristyne Wozney, and Tim Haxton

Presenter: Chris Wilson

Abstract

The genetic structure and diversity of contemporary populations of Lake Sturgeon strongly reflect historical patterns from Pleistocene glaciations and postglacial recolonization during the early Holocene. Comparison with other species has showed that Lake Sturgeon show remarkably little mitochondrial DNA variation, reflecting both their evolutionary history and long generation time. Although previous genetic analyses had largely focused on genetic patterning within the Great Lakes, analysis of Lake Sturgeon populations across Canada using microsatellite DNA markers showed evidence of two phylogeographic lineages originating from separate Mississippian and Missourian glacial refugia. Lake Sturgeon populations in DUs 1 to 6 were almost exclusively colonized from the Missourian refugium, and are recognizably distinct from Great Lakes populations, which are descended from a Mississippian source. Despite their separation since postglacial time, there was relatively little evidence of genetic divergence among populations within DUs 1[3] to 3. Lake Sturgeon populations in DUs 5 and 6 were colonized from western Canada, and show little to no evidence of Mississippian ancestry despite their proximity to the Great Lakes basin. Populations in DU5 show Missourian ancestry comparable to the other western DUs, consistent with colonization via Glacial Lake Agassiz, whereas populations in DU6 show some differences that may reflect a different colonization history (related secondary refugium or different wave of colonization). The longevity and generation time of Lake Sturgeon appear to have partially buffered genetic diversity within populations against the effects of habitat alterations and population declines, as many populations exhibit substantial diversity several generations after fragmentation or population declines have occurred. Despite this, Lake Sturgeon populations in fragmented river systems show reduced effective population size (N_e) estimates compared to unfragmented systems, as well as sharp reductions over a small number of generations.

Discussion

A participant asked how many DUs the presenter would recommend based on the genetic structure. The presenter would be reluctant to subdivide contiguous watersheds. There are two evolutionarily significant units (ESUs). The genetics is showing the historical connections and shared colonization history rather than where can these fish move around now.

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[3] DU1 samples were analysed following the meeting and the results are reflected in this abstract.

Another participant commented that Lake Sturgeon are poorly adaptable to change, yet they exist in a variety of habitats and seem to do well if left alone. They wondered how this matches up to the idea that they have a hard time adapting. Adaptation is a population responding to some selective pressure and it is a heritable change through time. Flexibility is coping. They are flexible and so have the ability to do well in a variety of habitats, but that is not the same as a hard response to a selective pressure. In the discussion about SNPs, looking at the amount of variation you could see, some that behave as neutral markers, some could show directional selection or stabilizing selection, but most of them will likely act as neutral in terms of responding to real selective pressures, beyond the plastic response. It is how quickly can a population change over time measuring the time as generations. Lake Sturgeon have four generations in a century and therefore can't adapt to something that is happening over the span of a few years. The only option at that point is reproductive failure.

The presenter was asked about the PCoA ordination slide. A participant had a preconceived notion that DUs 4, 5 and 6 might be relatively easy to collapse into a single DU. What is going on with DU4 (only one data point), but it is far away from DUs 5 and 6? Even DU6 seems to be the most different outside of DU8 (the other glacial refuge).

DU4 (Berens Lake and Berens River samples) is on the bottom extreme for ordination. It is a smaller population and smaller sample size so it is going to show more drift away from the others. DU6 may have been a subgroup also in the Mississippian refugium, so there was more than one refuge population. There may have been more than one movement episode. Deglaciation was mostly a steady pattern of retreat and then Lake Superior and most of Lake Michigan filled in again with ice. It was a system in flux. If you look at DUs 5 and 6 together, there is sub-structuring within them but they are not drastically different. The presenter was not convinced of the merit of keeping them separate versus bringing them together. It was pointed out that the DU4 samples were not very small sample sizes just within sample diversity was very low.

A participant noted that the DU4 sample is closest to the Saskatchewan and Nelson rivers, which are just part of the larger Lake Winnipeg watershed.

In the structure plot with just DUs 5 and 6, the solution is either two or three groups. When it was three groups, Lake of the Woods pulled out with DU5 even though it is part of DU6 and the Rainy River system was different from Lake of the Woods.

No samples from DU1 were included in this analysis. Can you get samples from DU1 and add them to this analysis? The presenter is hoping to add DU1 samples to the analysis now that they are available. The presenter's expectation is that it would fall in with the grouping and would be very similar to DUs 2 and 3.

A participant asked if there were any phenotypic differences with the groupings. The genetics research doesn't have phenotypic data. Another participant noted that he had looked at growth difference but could also look at condition as he has these data. Another participant noted that in addition, age at maturity and maximum longevity would be worth looking at, although this may not be possible. The samples for maturity are just not available. North/South has a decent handle on size at maturity (growth curves across Manitoba). There is less confidence in ages above 15–20. There are differences between populations more so than differences between DUs. Downstream of Point du Bois, 800 mm is used to denote an adult. Elsewhere on the Winnipeg River, 800 mm is not mature. The variation in DUs may overwhelm differences between DUs. In Ontario, 800 mm is just too small to be considered mature. It may be worth looking into these data and possibly combine databases.

Another participant added that it is unlikely that we would be able to find broad patterns that would support genetic differences.

COSEWIC DESIGNATABLE UNITS AND LAKE STURGEON

Presenter: Tom Pratt

Abstract

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recognizes that the conservation of biological diversity requires protection for taxonomic entities below the species level; these units of conservation are termed designatable units (DUs). To qualify as DUs, the conservation units should involve taxonomically defined sub-species, or involve sub-populations that are discrete and evolutionarily significant. Some of the criteria do not apply to Lake Sturgeon, but two discreteness criteria (Criterion 1, Evidence of genetic distinctiveness including, but not limited to, inherited traits (e.g., morphology, life history, behaviour) and/or neutral genetic markers (e.g., allozymes, DNA microsatellites, DNA restriction fragment length polymorphisms (RFLPs), DNA sequences); and Criterion 3, Occupation of differing eco-geographic regions that are relevant to the species and reflect historical or genetic distinction, as may be depicted on an appropriate biogeographic zone map), and a single significance criterion (Criterion 1, Evidence that the discrete population or group of populations differs markedly from others in genetic characteristics thought to reflect relatively deep intraspecific phylogenetic divergence) are relevant for Lake Sturgeon. Based on genetic evidence demonstrating only two genetic groupings based on microsatellite data, and the presence of Lake Sturgeon in four biogeographic zones, it was suggested that the number of DUs be reduced from eight in the 2006 status report to four in the upcoming report: DU1 Western Hudson Bay, DU2 Saskatchewan Nelson River, DU3 Southern Hudson Bay James Bay and DU4 Great Lakes Upper St. Lawrence.

Discussion

A participant suggested that DU1 stays as a separate DU. Microsatellite results indicate it is different than DU3 (Nelson River). It is not the whole area, which is the biogeographic region, but just the Churchill River. Although there is a significant freshwater plume that goes all the way down the coast from the Seal River to the Churchill River so they can go out into what looks like the estuary but is actually freshwater. The same applies to the Nelson. Churchill was the first river to separate with SNPs analysis. It is also in a separate biogeographic region. The group was in agreement that DU1 should remain as a separate DU.

Another participant commented that DUs 1, 7 and 8 should remain a DUs based on geographic zones.

The presenter asked the group whether there is a need to further subdivide DUs. Are there areas where there is enough differentiation either genetically, ecologically or geographically to warrant splitting DUs further?

One of the meeting participants said they were struggling with the management consequences. Within each DU, populations require different management approaches depending on their stock status. They would like to see these considered when determining DUs and the status of DUs. The co-Chair agreed that there will be management consequences, but added that the discussions during the meeting are based on science and not the consequences of the decision.

There was a discussion about the differences within some of the DUs and how these DUs should be assessed by COSEWIC. Within a single DU there could be a range of populations from extirpated to special concern. What happens if you combine DUs, some of which were last assessed as Special Concern to Endangered? Following the last COSEWIC assessment, the

Recovery Potential Assessments spent a lot of time dividing the DUs up into management units where you needed to use different management techniques to get some level of recovery. This is likely to happen following this assessment as well. To come up with the DUs, we are supposed to use the DU criteria, not the status of the current DUs.

Participants were asked if there were other species assessed by COSEWIC where you have a broad geographic range and 40–60 spawning populations within a DU, some in rough shape and others healthy. Freshwater fishes seem to be problematic. They often have many isolated populations, some are considered biologically vulnerable (e.g., Lake Trout) but there are thousands of populations. For Lake Whitefish under each criterion there were dozens of special cases. The closest parallel was Shortjaw Cisco but with many fewer populations. Lake Sturgeon is unique.

A participant noted that from a status assessment perspective a DU doesn't mean that it is necessarily a homogeneous group within the DU. If a DU is considered irreplaceable then a population within the DU could be replaceable by another population within the DU. The difference is recognizing the discreetness and significance for the status. Management is then a whole other thing. Lake Sturgeon isn't unique for freshwater fishes but it may be extreme.

It is not the meeting participant's role to decide on the status of the DUs and the report authors may recommend the status but it is COSEWIC that decides this. They follow a set of rules for decision making. It is independent of the DU discussion.

It was also pointed out that DU structure transcends provincial boundaries as well.

Participants noted it was helpful to see the DU criteria. Based on the genetics data and especially the neutral markers, there is evidence for some level of genetic distinctiveness at least between some of the existing DUs. It gets tricky in the significance section – so how significant is that? We are beginning to get to the point in genomics where we might be able to start answering, from a genetic perspective, if there are adaptive differences because there are likely not deep phylogenetic differences within Hudson Bay. Were there any SNPs that were outlying that appeared to be under selection that could hint at any adaptive differences between populations?

Most of the SNPs recovered were neutral. Depending on the software between 20 and 300 SNPs (out of 5,000 markers) were adaptive, influenced by directional selection.

Another participant indicated that something else to factor in if you are trying to identify anonymous markers that may reflect selection and hopefully adaptation, is that a good number are going to be statistical artefacts. You are really looking at the distribution of single locus F_{ST}[4] values. There have to be some extreme ones and most of those will be by chance. These populations are probably at most 400 generations apart from those colonized from the same refugial ancestral populations. Until two centuries ago these populations were largely interconnected (at least within the Great Lakes) and would have had very large effective population sizes. If adaptive divergence happens as a response to a combination of selective pressure and effective population sizes, any divergence as a result of local adaptation would have had to have very strong selective pressures to see populations diverge from each other through selection and not drift.

In the last COSEWIC assessment DUs 5 and 6 were split. Is there any reason to keep the split given the criteria? The group decided they needed a more complete picture, more genetic information from the English River, before combining DUs 5 and 6. A participant noted that for

[4] Fixation index F_{ST} is a measure of population differentiation due to genetic structure.

Lake Sturgeon, genetic changes are happening slowly. When they look at DUs 5 and 6, there is some genetic divergence, but it is hard to say where they are headed.

Based on the genetics, DU5 would fit well within DU4 and they make sense being combined from a watershed perspective. From the genetics you could argue two divisions easily and beyond that you are subdividing based on contemporary watersheds. There has been splitting that is not based on the science.

A participant commented that the only evidence the group has is genetics and biogeographic zones and based on this there are only four DUs or five at most if DUs 5 and 6 are split. The group discussed the DUs further. The co-Chair reminded the group that at this point they are looking at DU structure only, not the status of them. A meeting participant commented that the report writer's job would be to provide COSEWIC with the data needed to make the decision.

A participant noted that in the criteria[5], it indicates that faster evolving markers like microsatellites wouldn't weigh in that heavily. What is unusual about Lake Sturgeon is that microsatellites carry much longer-term genetic ancestral information. Because of their longevity and generation time, Lake Sturgeon in general seem to have lower mutation rates, and the microsatellites are carrying deeper ancestral history than is normal for most vertebrates.

A participant noted that as there was only one population sampled from DU4, it may be premature to say what is happening there. There is a good amount of distinction between DUs 5 and 6. But what is distinct enough? DUs 2, 3 and 5 look pretty similar and could be grouped. DUs 2–6 are in the same biogeographic zone.

It was noted that SNPs pick up finer scale structure. How do you determine significance? You may have evidence for distinctiveness but what is the evidence for significance?

Participants noted that the report writer's main job is to provide the data to COSEWIC so they can make the final decisions. They should include as much genetic data as there are available. Looking at DU8 for example, with a large number of spawning populations, is there sufficient genetic data to say that despite all the different spawning populations all the data cluster together on a graph? Or if we did more and more populations we would have many different clusters. All the available genetic data should be included so they can be evaluated. Within Lake Sturgeon, with long generation time and likely slow mutation rates, when we are looking for deep phylogenetic significance we would normally look at mitochondrial DNA. Microsatellite differences are just population structure within a DU. The report writers don't have to come up with the final correct DU structure but should have mitochondrial DNA and microsatellite information in the report to allow the COSEWIC sub-committee to interpret the data and evaluate them objectively.

One thing to consider is that in DU8 there are levels of genetic distinctiveness similar to what is being observed among the DUs in Hudson Bay. Does there need to be consistency among the DU designations? There are groups in DU8 that are more divergent then some of the DUs here in Hudson Bay.

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[5] COSEWIC's guidelines for recognizing DUs: Evidence of genetic distinctiveness including, but not limited to, inherited traits (e.g., morphology, life history, behaviour) and/or neutral genetic markers (e.g.,allozymes, DNA microsatellites, DNA restriction fragment length polymorphisms (RFLPs), DNA sequences).
Such differences would typically be manifested as qualitative genetic differences at relatively slow-evolving markers (e.g., fixed differences in mitochondrial or nuclear DNA sequences or fixed differences in alleles at multiple nuclear loci). Quantitative (frequency) differences of shared alleles, especially for rapidly-evolving markers such as microsatellites, generally would not be sufficient to meet this criterion.

There is no deep divergence evident from the mitochondrial DNA. The biggest split is between Hudson Bay and the Great Lakes. There is not much difference within those systems with the mitochondrial evidence. Lake Sturgeon show much slower rates of divergence for their mitochondrial genes. They are the slowest of the teleosts. It is not a fair comparison to compare Sockeye Salmon and Lake Sturgeon. There is not a magic F_{ST} that is meaningful.

The original splitting of DUs was based on very limited data, three microsatellite markers with small sample sizes. It was the best available information at the time. They were significantly distinct using divergence measures, genetic distance and F_{ST}. Now that we have more information this should be revisited as we are in a better position to evaluate what the data suggest. There will be no single defensible threshold for the amount of measurable divergence. It is a statistical measure (i.e., when you are statistically different from zero), dependent on the number of markers, which markers, sample size and what divergence measure you chose.

There is a deep split between the Great Lakes and Hudson Bay. There is fine scale population structure within each.

We don’t know what the functional differences are, whether they are adaptive or going to affect the fitness or evolutionary potential. We don’t have this information.

Participants discussed DUs 5 and 6 in terms of where samples for genetic analysis came from and the genetic results on the dendogram and cluster plots. Lake of the Woods groups better with DU5 than DU6. Samples from Tetu Lake stand out on the cluster plot but are intermediary between DUs 5 and 6 on the dendogram. Tetu Lake may be dominated by the English River signature over the Winnipeg River signature. It was also noted that there was incomplete information for DU4. There is not enough information to separate it but without additional populations there are incomplete data to evaluate the DU.

Lake of the Woods population may be a huge source of Winnipeg River fish with downstream transfer.

Based on the discussions and the direction from COSEWIC, there are four zones based on biogeographic regions (DUs 1, 7, 8 and other DUs combined). They generally match the genetics. DU8 is clearly different based on glacial patterns of recovery and the different refuges. DU1 (Churchill River) was not evaluated using the same genetic tools as the other samples. DU7 and DU8 are distinct DUs. DUs 2, 3, 4 and 5 could be combined based on the genetics. Participants proposed four DUs for the species (DUs 1, 7, 8 and combined DUs 2–5 and possibly 6) with the caveat that additional genetic samples are needed for DUs 4, 5 and 6 to resolve some of the issues with the samples used for genetic analyses. Ordination and clustering would give information on how different the groups are, not just how many groups there will be. Is the current structuring an artefact of sampling? Re-analysis of an additional 300 samples could be analyzed in 2 to 4 weeks. The group agreed that this re-analysis should be done as soon as possible. The report authors have to submit their report by March 2016.

Genetics sub-committee

The group decided that a ‘sub-committee’ should be formed to help with new genetics sample analyses (help screening data and evaluating results). Meeting participants volunteered to be a part of this sub-committee (Chris Wilson, Margaret Docker, Stephanie Backhouse, Thierry Gosselin, Jennifer McDermid, Josh Peacock, Doug Watkinson) to bring context about where samples were collected to discussion of the genetic results. The group will report back on the outcome of the new analyses.

The set of microsatellites being used is the same as those from the Great Lakes. The intention is to pool the datasets to use for the updated COSEWIC status report. The samples from outside of the Great Lakes used the same markers and the same scoring rules.

It was suggested that the report authors move forward assuming four DUs based on biogeographic zones and if things change as a result of new genetic analyses they can subdivide further.

A participant suggested adding Hayes River and possibly Churchill River samples to the batch to be re-analyzed along with samples from DUs 4, 5 and 6.

THREATS AND LIMITING FACTORS

Presenter: Doug Watkinson

Summary

Threats and limiting factors are important for the COSEWIC designation, the listing decision and ultimately the recovery of the species. The presenter provided information on the COSEWIC guidance related to threats and limiting factors. Threats are assessed by DU. He gave an overview of what should and should not be included in the report. Limiting factors apply to the species. He then summarized the limiting factors and threats from COSEWIC (2006) as follows:

Limiting Factors:

1. Slow growth and late maturation
2. Intermittent spawning intervals
3. Specific temperature, flow velocities and substrate requirements to ensure uniform hatching and high survival of eggs
4. High fidelity to spawning areas
5. Early age-0 stage (transition from larvae to exogenous feeding) is a critical life stage for Lake Sturgeon

Threats:

1. Overexploitation
2. Dams
3. Habitat degradation
4. Contaminants
5. Introduced species

Limiting Factors

The group discussed possible limiting factors such as fidelity to overwintering and spawning areas, low effective population size, diurnal cycle in activity and larval drift. There was a lot of discussion and confusions about what was meant by ‘Limiting Factor’.

A participant noted that from the Great Lakes population, where historically large populations have dropped, there is no genetic evidence of a bottleneck so low effective populations size should not be included as a limiting factor.

Participants discussed whether the issue about overwintering and spawning areas was high fidelity to those areas or specific needs for them. Lake Sturgeon have evolved to respond to dynamic flows and seek areas deep enough to avoid stranding. It may be a behavioural response. How critical are wintering areas if there are no drastic drawdowns? Spawning habitat may be limiting. There may be a more dramatic impact to over-wintering areas on large prairie rivers because of dams and the nature of over-wintering holes and how the fish move to those areas. Prairie rivers are very dynamic erosion-deposition type rivers. Overwintering holes are adjacent to feeding areas so the areas are important both for overwintering and feeding. Dams when built create deep sediment layers changing habitat dramatically. This is not the same on shield rivers. There are limited areas on prairie rivers that are maintained as large scour pools used for over-wintering. If there is less over-wintering habitat there may be fewer fish. In the South Saskatchewan discharge can be quite low and some areas will be significantly shallower. These systems are heavily altered.

Several participants questioned whether there was high site fidelity to spawning areas or just specific spawning habitat requirements. Another important factor is access to suitable spawning sites. The arrangement of available habitat does matter and could be limiting. Their seasonal habitat requirements are a limiting factor.

Changes in habitat that relate to the behaviour of the species includes turbidity, which can change from 10–20 cm to 2–3 m Secchi depth. At very low discharge water can become clear. Lake Sturgeon likely don't prefer these conditions as they seem to have an eversion to light. The deep over-wintering holes may also provide darker habitat.

Diurnal cycle in activity or larval drift is tied to how habitat change could impact the species.

It was pointed out that this information is relevant and important to understanding the species, habitat requirements, and the threats to habitat and this would be captured in the report under these sections. Limiting factors are the things about the species itself that limits its potential to increase in abundance or to recover. Limiting factors are intrinsic biological limitations to the species as a whole.

After much discussion, participants agreed to remove points 3 (Specific temperature, flow velocities and substrate requirements to ensure uniform hatching and high survival of eggs), 4 (High fidelity to spawning areas), and 5 (Early age-0 stage (transition from larvae to exogenous feeding is a critical life stage for Lake Sturgeon), as limiting factors. Information on overwintering and spawning areas and changes in habitat will be included in other sections of the report.

It was also pointed out that the whole first year of life is the most sensitive stage in Lake Sturgeon, not just the early age-0 stage and this information should be included under the species biology section of the report.

A participant pointed out that recruitment is erratic. When you have a depressed population and you have erratic recruitment it could limit recovery. Even in some healthy populations you have variable recruitment. Presumably that will limit recovery especially when below a critical mass of Lake Sturgeon. Successful spawning, fertilization and high egg viability (80%) don't always establish a year class.

Slow growth, late maturation and intermittent spawning intervals are unique to Lake Sturgeon but were only successful life history strategies when abundance was high. These characteristics are limiting when the species is under pressure from a stressor. However it was pointed out that the species doesn't have the ability to compensate when they have been stressed by increasing fecundity and growth. Limiting factors have to be tied into the threats.

Another participant noted that Lake Sturgeon are not slow growers and tend to grow faster than most other fishes, they just mature late. The participants agreed to change this to "large size and late maturation".

Threats

Participants discussed the threats that were listed in COSEWIC (2006). The threats are listed in from greatest to least. The presenter commented that parasites and pathogens should be included as well.

Overexploitation

The group agreed that commercial fishing was the most significant factor in causing the historic decline in Lake Sturgeon. Ten years ago it was thought that poaching was occurring on Lake Sturgeon populations. Subsistence and traditional harvest, and scientific sampling are not mentioned in COSEWIC (2006) but should be considered.

Commercial fishing no longer occurs in DUs 1–6. The group discussed whether the subsistence harvest and scientific sampling should be included as overexploitation. There was some discussion about the title “over-exploitation” as it might be more appropriate to call this threat “exploitation”. The group agreed that overexploitation could only occur if the population was sufficiently depressed. Scientific sampling can be controlled through permitting. There is less control over subsistence harvest. A participant suggested that recreational fishing should be included (hooking mortality) and should go between subsistence and scientific sampling (most impact to least impact). The group agreed this section should be changed to “exploitation”.

The question arose then about whether hooking mortality, from the catch-and-release recreational fishery, should be considered exploitation. Another participant pointed out that there is harvest on the shared Rainy River, Lake of the Woods populations by the U.S.

Scientific sampling should be included. Even when it doesn’t cause mortality it is harassment. Gillnetting is harder on fish than angling. It was suggested that sampling mortality rates be added to the COSEWIC report and that this may also be an opportunity to provide some guidelines. One participant though that the scientific sampling mortality from their work was around 1–1.3% with gillnets due to the velocity in the rivers. Another participant reported gillnet mortality of about 1.9% and another reported 2.9% for juvenile sampling.

Participants indicated that poaching still occurs although it has declined.

A participant noted that subsistence harvest in one area was about 2–5%, down from 12–14% over the last decade.

There are no directed commercial fisheries for Lake Sturgeon, but they are caught as bycatch in other fisheries (e.g., Lake Winnipeg commercial fishery). This may be under-reported. However, the bycatch is likely lower in the small mesh net than it used to be in trap nets. There may be some captures along the east side communities but the numbers are limited. People float their nets off the bottom, which likely helps to limit Lake Sturgeon captures. On Tetu–Winnipeg River system, they had a 10% return rate of Lake Sturgeon with transmitters from the subsistence fishery, in addition to Floy tag returns. They were generally sub-adult fish (8–14 years old). Lake of the Woods, English River and Winnipeg River are fully allocated to commercial fishing.

The threats should be quantified with numbers in the report if the meeting participants are willing to share them. Discussion on the relative risk within each DU will be different depending on population size and will be captured in the report and in the Technical Summaries for each DU.

Dams

The threats associated with dams in COSEWIC (2006) focused on spawning. However, the disruption to movement patterns other than while spawning is not captured well. The group agreed that winter drawdowns will affect recruitment. The group agreed that there wasn’t any fragmentation that is not related to dams affecting Lake Sturgeon. Larval dispersion could possibly be included under ramping. The presenter suggested adding predation, and another participant added that there was literature to support that higher velocity can also reduce predation pressure on larval drifters as they will be moving quicker through the system.

It was clarified that it is the responsibility of the COSEWIC report writers to do a thorough review of the literature and provide relevant information about the threat. If there is information to quantify the impacts it should be included (e.g., entrainment levels, mortality). A question was asked about how the authors should treat dams. Each dam is operated differently with different potentials for harm but in the COSEWIC report the authors have to be general about describing potential impacts.

There was some discussion about using flow and peaking to mitigate impacts to Lake Sturgeon. There are some examples in DU6. There is also some work on the Rainy River, International Joint Commission initiative, looking at temperature triggers for spawning and movement coming out soon.

In Saskatchewan, mitigation at the Qu'Appelle River Dam has changed the species composition in the area.

Habitat Degradation

The group discussed habitat degradation and whether suspended sediments are a threat. The group agreed that suspended sediments, nutrients, lampricide, and channelization are not issues in most of DUs 1 to 6. Wood fibre is mainly historic but still relevant.

Erosion is significant in the Nelson River and the system is in flux because of it. Deposition is more of an issue.

It was suggested that the creation of reservoirs should be added as a threat. The presenter thought that maybe this should be included in the Dams section.

Also, water withdrawal should be added as a change in hydrograph threat. It is particularly important in drought years. It was suggested that water withdrawal changes the hydrograph and is a threat. This is most evident in Alberta. Mortality of large (close to adult size) Lake Sturgeon directly related to water withdrawal has been documented in Alberta (South Saskatchewan River). This relates to flow changes. The group needs to decide where this would fit best in the report.

The provincial recovery plan for Alberta includes flow changes related to dam operation and construction, water extraction, fragmentation and other physical disturbances including shoreline development and major pipeline crossings as threats. Mortality of large Lake Sturgeon has also been documented in water intakes (entrainment) in the South Saskatchewan River.

The Assiniboine River has large water withdrawals on a daily basis.

Urban development was not identified as a threat for this species although sewage treatment could be.

Contaminants

A participant commented that for wood fibre, the economic downturn in Ontario negatively impacted the pulp and paper industry and resulted in mill closures. There is a new study showing the recovery of the aquatic systems as a result of these closures.

Another participant noted that endocrine disrupting chemicals are not on the list. They are a concern for other fish species. It is not clear if there are any references documenting impacts for Lake Sturgeon, but this should be investigated.

A participant commented that in DU6, the looming issue is mining development. There is a gold mine under development on a tributary of the Rainy River, and there are mines in Minnesota, and more being proposed. It was agreed that this should be mentioned in this section as point source pollution, potential for spills.

Another participant commented that there have been a few papers from the Great Lakes that show Lake Sturgeon contaminant are lower than they were in the past.

Wood fibre should be captured in terms of historical impacts.

Aquatic Invasive Species

COSEWIC (2006) identified Zebra Mussel, Round Goby and Rainbow Smelt as threats. It is not clear how Rainbow Smelt would compete for food or habitat, prey on eggs, or cause habitat disruptions that might impact Lake Sturgeon. Zebra Mussel impacts in DUs 1 to 6 have the potential to be positive as they are seen as a food source for Lake Sturgeon. The impact of Round Goby was negative as they prey on Lake Sturgeon eggs. Eurasian water milfoil and purple loosestrife were also identified as threats. It is not clear how they lead to habitat disruptions and a reduction in diversity.

Participants agreed with removing Rainbow Smelt as a threat in DUs 1 to 6 but suggested adding Rusty Crayfish (preying on benthos and eggs, and disrupting native crayfish) and Spiny Waterflea (impacts on native zooplankton and YOY Lake Sturgeon). Rusty Crayfish may become a food source for Lake Sturgeon.

The group agreed to remove Eurasian water milfoil and purple loosestrife from the list. Zebra Mussel effects on spawning habitat will be discussed further at the next meeting. They are a new threat to DU4. A participant noted that they are getting an increase in applications to use herbicides in water to control flowering rush. This would be a contaminant but may not impact Lake Sturgeon directly.

Parasites and Diseases

Sea Lamprey is a potential parasite. A meeting participant noted that the highest rates of parasitism are seen on Lake Sturgeon that have been in gillnets for any length of time. Another participant added that Sea Lamprey is not an issue for DUs 1 to 6. Namao virus, a nucleo-cytoplasmic large DNA virus (NCLDv) has been found in Lake Sturgeon in hatcheries and in the wild population. Viral hemorrhagic septicemia (VHS) is not an issue in DUs 1–6.

Genetic Contamination

Moving fish from the Great Lakes into Manitoba, for example, would be an issue. There would not be a concern moving Lake Sturgeon within a DU and not within MUs within a DU. There is no information on outbreeding depression as a result of stocking on top of a remnant population. Given the similarity within the western DUs, outbreeding depression may not be a significant concern. If you are stocking a small number of families on top of a remaining population you could be diluting what is there. A participant thought that outbreeding (which is the context in which it was included in the previous report) would not be a concern but would still be good to include in the report. A participant commented that proper husbandry for conservation stocking is critical and it is important to capture this. Also, Amy Welsh's paper (Welsh et al. 2010) that discusses stocking recommendations should be cited. Another participant said that the current strategy is to not re-use the same parental stock; each year a different suite of fish from the source population is used to more closely mimic natural spawning.

A participant asked if this is a threat or a management consideration. Change in DU structure would have implications as to whether this would be a threat or not. Realistically, genetic contamination is not a threat unless moving Lake Sturgeon between DUs. Another participant commented that outbreeding and inbreeding are less of a concern for Lake Sturgeon than for salmonids. The life history of Lake Sturgeon is an effective protectant against inbreeding depression as males mature many years earlier than females. Capturing two reproductive adults and crossing them, you are highly unlikely to be mating siblings. Even in finite populations where longevity has protected a lot of the diversity, inbreeding is unlikely, when relying on wild adults. Outbreeding likely is related to the larger genetic groups reflected in the DUs.

Threats by DU

The group discussed threats listed in the technical summary of COSEWIC (2006) specific to each (old) DU. Genetic contamination was identified in the technical summary but not in the main threats section of COSEWIC (2006). Parasites and diseases were not included as a threat in COSEWIC (2006). Introduced species were included in the main text but not in the technical summaries for DUs 7–8. The status report authors do write the technical summary sections.

DU1 (Churchill River Watershed)

The group agreed that Overexploitation, better described as Exploitation, is a valid threat. Exploitation (subsistence fishery) is currently occurring. They also agreed that this is a highly regulated system and dams are still a valid threat. Another participant wondered whether the dams are still considered a threat if there are no fish in an area. If the dam could impede the recovery of the species then it should be included in the report.

Habitat degradation and contamination would be considered low to nil threats; although it is not clear if there are any mines on the system. Introduced species are not a threat. Parasites and diseases could be an issue with stocked fish although Manitoba Hydro has to disease test all fish before stocking.

DUs 2–5

The group agreed that exploitation, dams and habitat degradation are threats. Dams are prevalent throughout the area and would have impacts. Under habitat degradation, erosion and deposition has been identified as an issue. An unpublished report prepared for ONMRF, was identified related to habitat degradation in DU5 at the Kenora Dam (Harris et al. upubl. Rep). There was an extensive water quality study done that considered loading to the system.

Since the area is so large, contaminants should be considered a threat but the authors will need to go into detail in the report. A large portion of the drainage is agricultural. To be considered a threat to the species, the populations have to be impacted by it. There may be work done assessing population health that would speak to this issue. There was a recent study out of the U.S. about sturgeon not avoiding contaminants as a result they had higher body burdens of some contaminants. Catastrophic spills were identified in COSEWIC (2006). What is the likelihood of these occurring? There is more recent mercury data for Lake Sturgeon since the last report. There is likely to be a spike in mercury once a new dam goes in (e.g., Keeyask on the Nelson River).

The meeting participants discussed Zebra Mussel as an introduced species threat. They become an important structural feature when they first invade. There will be Lake Sturgeon areas with vastly changed substrate. There is still speculation around what the impact might be so it should be included.

The group discussed parasites and diseases. Namao virus occurs in the Winnipeg River and Nelson River Lake Sturgeon. Manitoba Hydro tests broodstock and have had cases where the brood stock has tested positive for Namao virus and the offspring test negative. Viruses are always in the fish but are generally not a threat unless the fish is stressed. The Namao virus was associated with mortality of juvenile Lake Sturgeon (Clouthier et al. 2013). The virus is there, but how it is affecting the fish is unknown. They decided that they don't have the right people in the room to discuss this further. Status report authors should talk to Lake Sturgeon disease specialists and look into the literature on the topic. It is not likely a population level threat. Diseases may have been considered as "introduced species" relevant to introductions through stocking programs.

Genetic contamination is not an issue but the description of why this isn't a problem that Chris Wilson provided should be included in the report.

DU6

This DU is upstream of Lake of the Woods and includes the Rainy River. International Falls Dam is a facility on the Rainy River. Both exploitation and dams should be considered as threats. The Ontario *Endangered Species Act* (ESA) designation was primarily based on the risks related to hydro development. Developments are still proposed in DU6.

Habitat Degradation has potential historical affects. Log driving was done historically but not for last 30–40 years and there are still remnants of log shoots. There is no ongoing degradation impacting the population related to logging. Habitat degradation may not be an issue upstream of International Falls.

The group discussed contaminants. One participant thought that mining issues were a threat given the proposed mines on both sides of the border and Steep Rock (historic iron ore mine that is predicted to overtop the dam in the next 30 years). It's one of the top four hazardous sites OMNRF is dealing with in Ontario.

In the discussions on introduced species, Rainbow Smelt came up but was disqualified as a threat in this DU. Rusty Crayfish and Spiny Waterflea are new introduced species, so potentially a threat and Zebra Mussel are very close to Rainy River.

There are no parasites and disease threats in this DU.

Genetic contamination is not considered a threat although if DU6 ends up being kept as a separate DU, different from DUs 2–5, then stocking between these DUs will be a risk. The main concern seems to be moving fish between Mississippian and Missourian drainages.

QUESTIONS OR CLARIFICATIONS?

The COSEWIC status report authors were asked if they had any questions or required further clarification.

The authors would like DU clarifications to happen soon with the updated genetic information. The co-Chair clarified that they are not an official COSEWIC subcommittee and report authors should be included in their discussions. The subcommittee will aim to have the results by the end of December.

REVIEW TERMS OF REFERENCE:

The group reviewed the Terms of Reference highlighting the items discussed during the meeting. For Lake Sturgeon there is a body of knowledge documented in COSEWIC (2006). The discussions over the last two days were looking at new information since the last assessment. Habitat requirements, and growth parameters were briefly touched on and we had a good discussion about DUs. There wasn't much discussion about population abundance and trends but much of this information was captured in the previous COSEWIC report and the current status report authors have collected information on their own for this topic. There was also not a lot of new information discussed on habitat. Threat information was discussed and is also available from the RPAs (DFO 2008, DFO 2010 a, b, c, d, e).

The co-Chair summarized the current DU conclusions. There were four DUs based on biogeographic zones (DUs I, 7, 8, 2–6). If the picture is not clearer with new genetic results participants were in agreement with these four DUs. Currently there are limited data from DU4 and genetic results indicate DU6 is somewhat different from DU5. However, it is not clear whether the differences are sufficient to warrant separation. The hope is that analysis of additional samples will help to resolve this issue and clarify whether DU6 warrants being kept as a separate DU.

Meeting participants were thanked for their input and the meeting was adjourned.

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APPENDIX 1. TERMS OF REFERENCE

PRE-COSEWIC ASSESSMENT FOR LAKE STURGEON DESIGNATABLE UNITS 1-6

Regional Peer Review Meeting – Central and Arctic Region

October 27-29, 2015
Winnipeg, MB

Chairpersons: Kathleen Martin and Tom Pratt

Context

The implementation of the federal Species at Risk Act (SARA), proclaimed in June 2003, begins with an assessment of a species' risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC is a non-government scientific advisory body that has been established under Section 14(1) of SARA to perform species assessments, which provide the scientific foundation for listing species under SARA. Therefore, an assessment initiates the regulatory process whereby the competent Minister must decide whether to accept COSEWIC's assessment and add a species to Schedule 1 ofSARA, which would result in legal protection for the species under the Act. If the species is already on Schedule 1 of SARA, the Minister may decide to keep the species on the list, reclassify it as per the COSEWIC assessment, or to remove it from the list (Section 27 of SARA).

Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species and some freshwater species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken.

The Lake Sturgeon (Acipenser fulvescens) was listed on COSEWIC's fall 2014 Call for Bids to produce a status report, with the following justification:

In November 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the eight designatable units of Lake Sturgeon.COSEWIC is required under SARA to review the classification of each species at least every 10 years. COSEWIC is planning to re-assess Lake Sturgeon in November 2016.

Objectives

The overall objective of this meeting is to peer-review DFO existing information relevant to the COSEWIC status assessment for Lake Sturgeon DUs 1-6, considering data related to the status and trends of, and threats to this species inside and outside of Canadian waters, and the strengths and limitations of the information. This information will be available to COSEWIC, the authors of the species status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee. Publications from the peer-review meeting (see below) will be posted on the CSAS website.

Specifically, DFO information relevant to the following will be reviewed to the extent possible:

1) Life history characteristics

- Growth parameters: age and/or length at maturity, maximum age and/or length
- Total and natural mortality rates and recruitment rates (if data are available)
- Fecundity
- Generation time
- Early life history patterns

- Specialised niche or habitat requirements

2) Review of designatable units

Available information on population differentiation, which could support a COSEWIC decision of which populations below the species' level would be suitable for assessment and designation, will be reviewed. Information on morphology, meristics, genetics and distribution will be considered and discussed.

See COSEWIC 2008 "Guidelines for recognizing Designatable Units below the Species Level".

3) Review the COSEWIC criteria for the species in Canada as a whole, and for each designatable units identified (if any)

COSEWIC Criterion – Declining Total Population

1. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations (taken as mean age of parents). Additionally, present data on a scale appropriate to the data to clarify the rate of decline.
2. Identify threats to abundance— where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity.
3. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and the likely time scales for reversibility.

COSEWIC Criterion – Small Distribution and Decline or Fluctuation: for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

1. Summarise the current extent of occurrence (in km^2) in Canadian waters
2. Summarise the current area of occupancy (in km^2) in Canadian waters
3. Summarise changes in extent of occurrence and area of occupancy over as long a time as possible, and in particular, over the past three generations.
4. Summarise any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.
5. Summarise the proportion of the population that resides in Canadian waters, migration patterns (if any), and known breeding areas.

COSEWIC Criterion – Small Total Population Size and Decline and Very Small and Restricted: for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

1. Tabulate the best scientific estimates of the number of mature individuals;
2. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.

Summarise the options for combining indicators to provide an assessment of status, and the caveats and uncertainties associated with each option.

For transboundary stocks, summarise the status of the population(s) outside of Canadian waters. State whether rescue from outside populations is likely.

4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat

Habitat is defined as "in respect of aquatic species, spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced".

The phrasing of the following guidelines would be adapted to each specific species and some could be dropped on a case-by-case basis if consideredbiologically irrelevant. However, these questions should be posed even in cases when relatively little information is expected to be available, to ensure that every effort is made to consolidate whatever knowledge and information does exist on an aquatic species' habitat requirements, and made available to COSEWIC.

1. Describe the functional properties that a species' aquatic habitat must have to allow successful completion of all life history stages.

   In the best cases, the functional properties will include both features of the habitat occupied by the species and the mechanisms by which those habitat features play a role in the survivorship or fecundity of the species. However, in many cases the functional properties cannot be described beyond reporting patterns of distribution observed (or expected) in data sources, and general types of habitat feature known to be present in the area(s) of occurrence and suspected to have functional properties. Information will rarely be equally available for all life history stages of an aquatic species, and even distributional information may be missing for some stages. Science advice needs to be carefully worded in this regard to clearly communicate uncertainties and knowledge gaps.

2. Provide information on the spatial extent of the areas that are likely to have functional properties.

   Where geo-referenced data on habitat features are readily available, these data could be used to map and roughly quantify the locations and extent of the species' habitat. Generally however, it should be sufficient to provide narrative information on what is known of the extent of occurrence of the types of habitats identified. Many information sources, including Aboriginal Traditional Knowledge (ATK) and experiential knowledge, may contribute to these efforts.

3. Identify the activities most likely to threaten the functional properties, and provide information on the extent and consequences of those activities.

   COSEWIC's operational guidelines require consideration of both the imminence of each identified threat, and the strength of evidence that the threat actually does cause harm to the species or its habitat. The information and advice from the Pre-COSEWIC review should provide whatever information is available on both of those points. In addition, the information and advice should include at least a narrative discussion of the magnitude of impact caused by each identified threat when it does occur.

4. Recommend research or analysis activities that are necessary.

   Usually the work on the other Guidelines will identify many knowledge gaps.

   Recommendations made and enacted at this stage in the overall process could result in much more information being available should a Recovery Potential Assessment be required for the species.

5) Describe to the extent possible whether the species has a residence as defined by SARA

SARA's 2(1) defines Residence as “a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating.”

6) Threats

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur. Guidance is provided in: Environment Canada, 2007. Draft Guidelines on Identifying and Mitigating Threats to Species at Risk. Species at Risk Act Implementation Guidance.

List and describe threats to the species considering:

- Threats need to pose serious or irreversible damage to the species. It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
- Naturally limiting factors, such as aging, disease and/or predation that limit the distribution and/or abundance of a species are not normally considered threats unless they are altered by human activity or may pose a threat to a critically small or isolated population.
- Distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains), which are caused by general activities.
- The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation.

7) Other

Finally, as time allows, review status and trends in other indicators that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWICStatus Reports.

Expected Publication

- Proceedings

Participation

Participation is expected from:

- Fisheries and Oceans Canada (DFO) (Science Sector, and Species at Risk Program)
- COSEWIC status report author
- Members of COSEWIC (Co-Chairs and/or SSC experts)

Participation may also include:

- Relevant provinces
- Industry
- Aboriginal groups
- ENGO’s
- Academia
- Other invited external experts as deemed necessary.

APPENDIX 2. PARTICIPANTS LIST

Name	Affiliation
Gary Anderson	University of Manitoba
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Tom Heinrich	Minnesota Department of Natural Resources
Ron Hlasny	Saskatchewan Ministry of Environment
Cheryl Klassen	Manitoba Hydro
Geoff Klein	Manitoba Conservation and Water Stewardship
Derek Kroeker	Manitoba Conservation and Water Stewardship
Don MacDonald	Manitoba Conservation and Water Stewardship
Kathleen Martin	DFO, Science
Jennifer McDermid	DFO, Science (Moncton)
Craig McDougall	COSEWIC report co-author
Darryl McLeod	Ontario Ministry of Natural Resources and Forestry
Patrick Nelson	COSEWIC report co-author
Jim McNulty	Ontario Ministry of Natural Resources and Forestry
Josh Peacock	Ontario Ministry of Natural Resources and Forestry
Shane Petry	Alberta Environment and Parks
Michael Pollock	Saskatchewan Water Security Agency
Tom Pratt	DFO, Science
Chantelle Sawatzky	DFO, Science
David Stanley	Ontario Power Generation Inc.
Daniel Struthers	Carleton University
Phil Talmage	Minnesota Department of Natural Resources
Doug Watkinson	DFO, Science
Ernest Watson	DFO, SARA
Chris Wilson	Ontario Ministry of Natural Resources and Forestry
Owen Watkins	Alberta Environment and Parks
Amy Welsh	West Virginia University

APPENDIX 3. AGENDA

Pre-COSEWIC Assessment – Lake Sturgeon Designatable Units 1–6 Regional Advisory Meeting – Central and Arctic Region

Location: Large Seminar Room, Freshwater Institute,
501 University Crescent, Winnipeg, MB

Date: 27–29 October 2015
Chairs: Kathleen Martin and Tom Pratt

Day 1-Tuesday October 27, 20015

9:00 Welcome and introductions (Martin)

9:15 Purpose of Meeting and Terms of Reference (Martin)

9:25 Overview of Species at Risk Activities in DUs 1-6 (Watson / Dunn)

9:35 Overview of 5-year study of the Saskatchewan River Lake Sturgeon population (Pollock)

10:00 Lake Sturgeon movements and habitat use in the South Saskatchewan River system (Watkinson)

10:30 *Health Break*

10:45 Lake Sturgeon movements in the North Saskatchewan River, Alberta (Watkins)

11:15 Nelson River Sturgeon Board's work on the upper Nelson River Lake Sturgeon stocks (DU3, MUs 1–3) (MacDonald)

11:45 *Lunch*

1:00 Lake Sturgeon monitoring in DU5 (Winnipeg River - English River) (Stanley)

1:30 Results of the 2014 survey of the Nutimik/Numao reach of the Winnipeg River (Kroeker)

2:00 Investigating the spatial ecology of Lake Sturgeon on the Winnipeg River using biotelemetry (Struthers)

2:30 *Coffee break*

2:45 Lake Sturgeon in Manitoba: populations, habitat, life history and ecology since 2006 (Backhouse, Klassen, Coughlin)

3:45 Variation in abundance, recruitment and growth of Lake Sturgeon across Ontario (Haxton)

4:15 Water quality (Gibson)

4:45 End of Day 1

Day 2 – Wednesday October 28, 2015

9:00 Welcome and recap of first day (Martin)

9:15 Rainy River Lake Sturgeon (Pratt)

9:45 Lake of the Woods - Rainy River Lake Sturgeon population estimate, 2014 (Heinrich)

10:15 *Health Break*

10:30 Population Genomics of the Lake Sturgeon in the Churchill, Hayes and Nelson Watersheds (Gosselin)

10:50 Genetic Structure and Diversity (Wilson)

11:45 *Lunch*

1:00 Overview of Designatable Units (Pratt)

2:10 *Health Break*

2:30 Designatable Units Discussion (Group)

4:30 End of Day 2

Day 3 – Thursday October 29, 2015

9:00 Welcome and re-cap of Day 2 (Pratt)

9:15 Designatable Units Discussion – Continued (Group)

10:30 *Health Break*

10:45 Threats and limiting factors for Lake Sturgeon (Watkinson)

11:05 Threats and limiting factors by DU discussion (Group)

11:45 *Lunch*

1:00 COSEWIC Report Authors – Clarifications, questions, etc. (Nelson, McDougall, Barth)

2:30 *Health Break*

2:45 Review Terms of Reference / Wrap-up (Martin)

4:00 Meeting Adjourned

APPENDIX 4. FIGURES

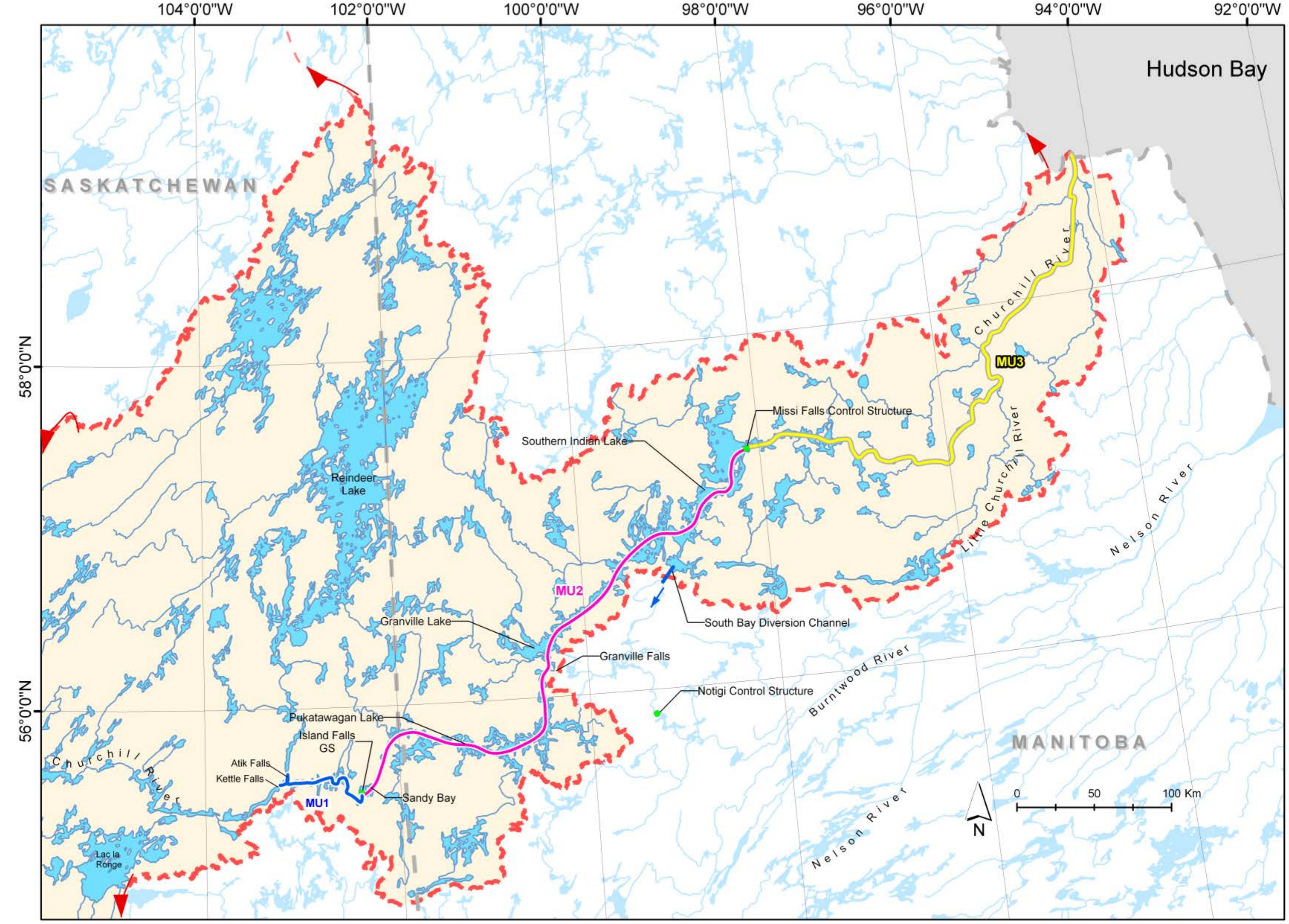

Figure 1. The Churchill River system (shaded) within DU1 showing locations of MUs and place names from DFO (2010a).

Figure 2. The Saskatchewan River system, DU2 (shaded) showing locations of MUs and place names from DFO (2010b).

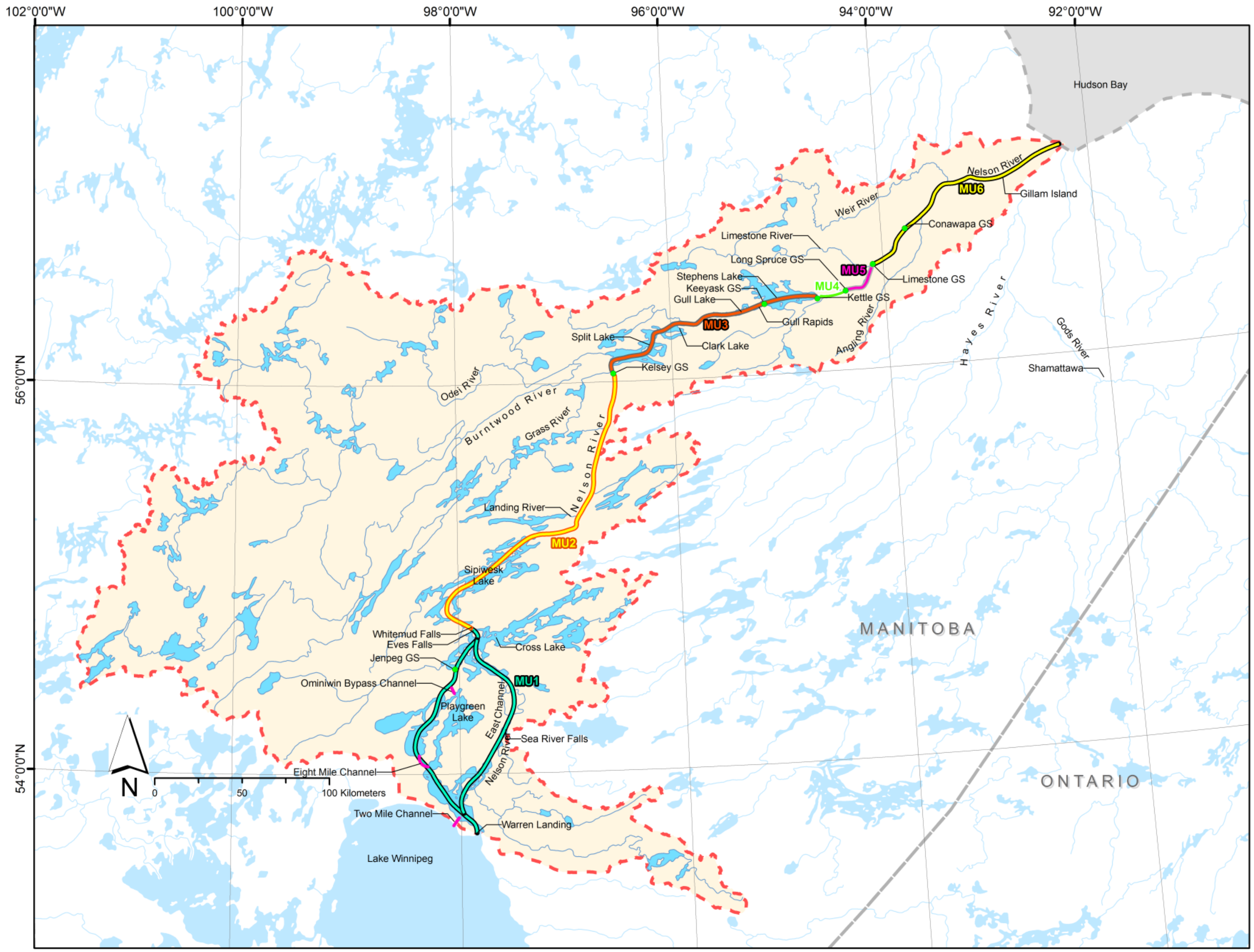

Figure 3. The Nelson River system, DU3 showing locations of Mus and place names from DFO (2010c).

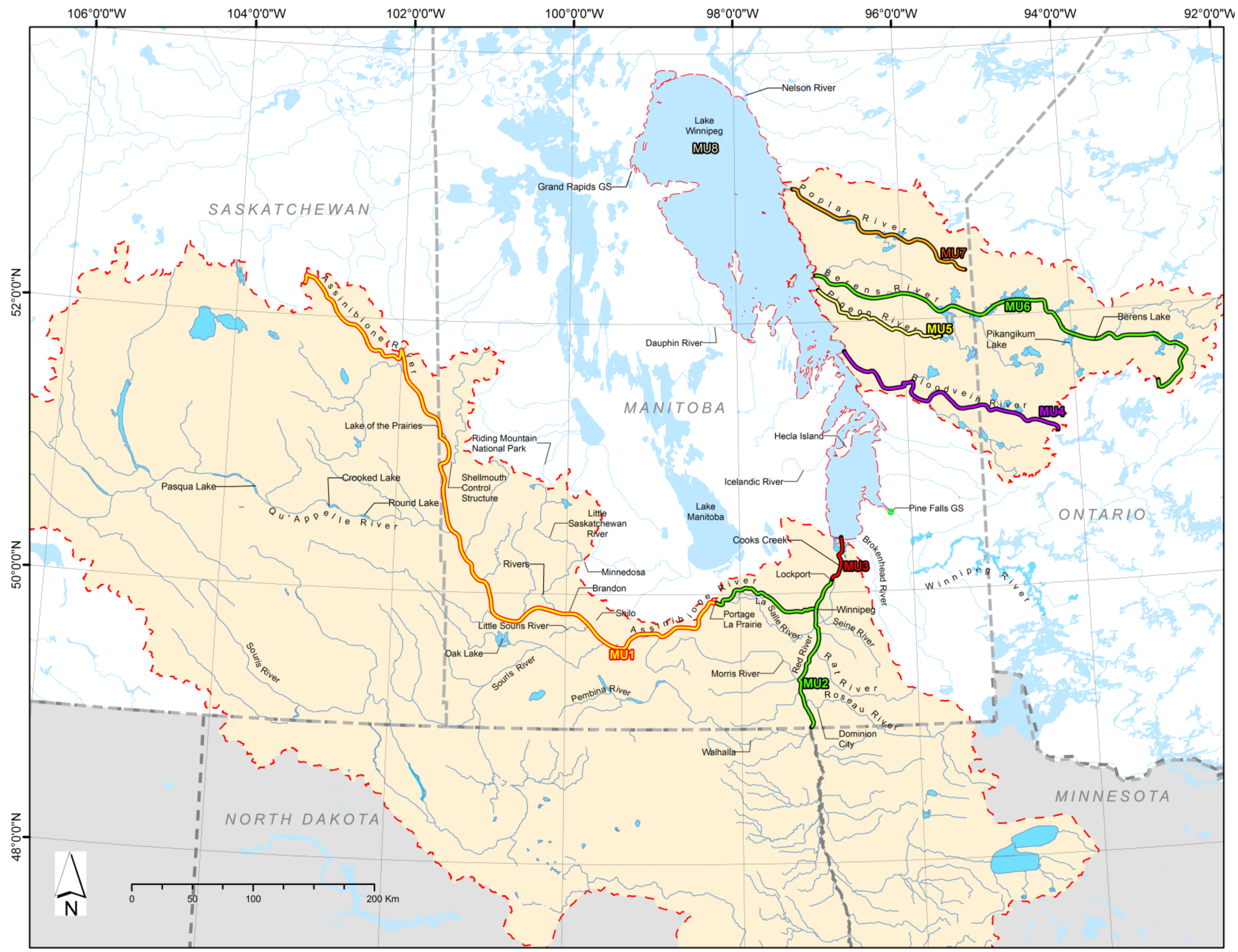

Figure 4. DU4 (shaded, and Lake Winnipeg), showing locations of MUs and place names mentioned from DFO (2010d).

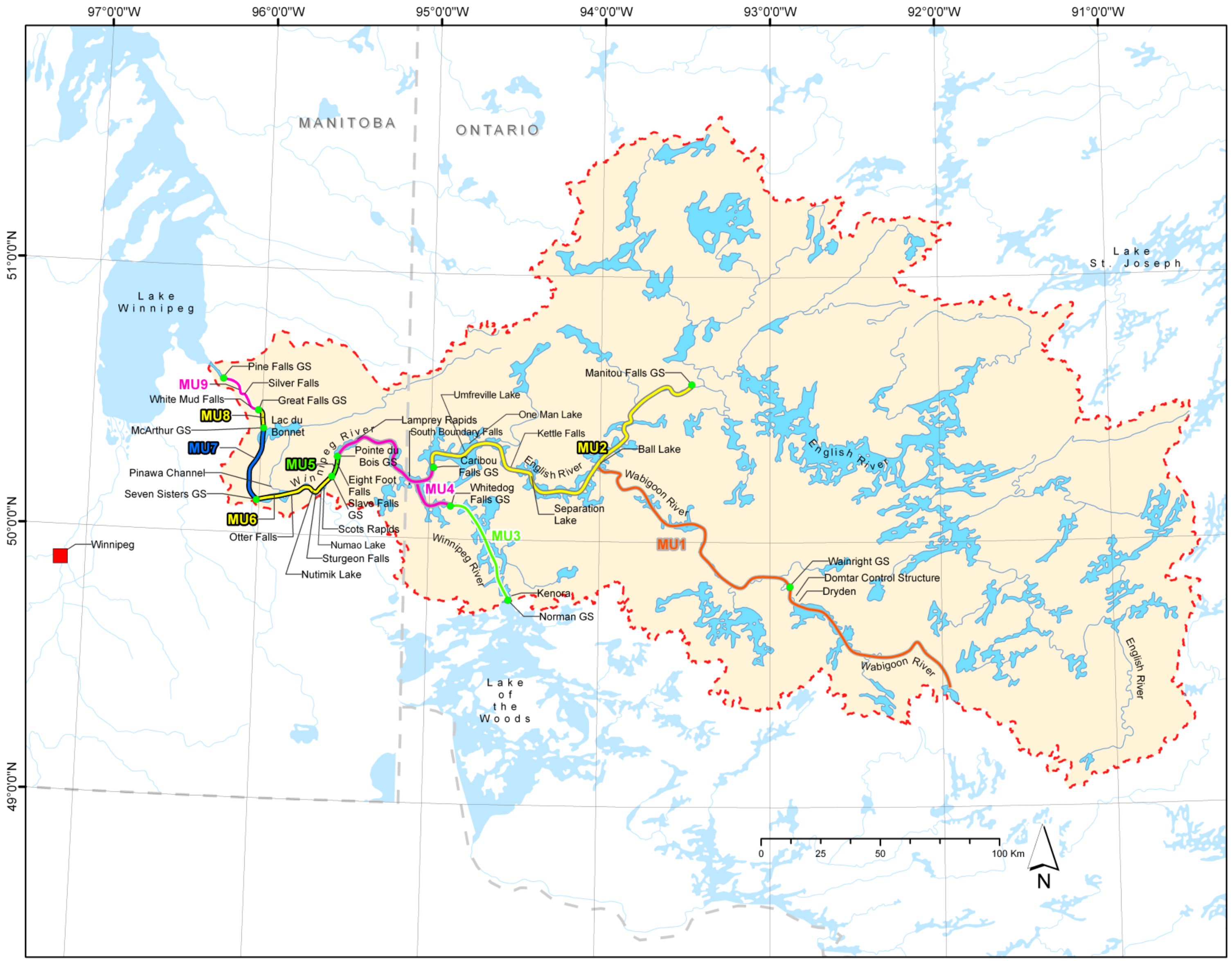

Figure 5. DU5 (shaded) showing locations of MUs and place names from DFO (2010e).