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Proceedings of the lake sturgeon recovery planning workshop

Compte rendu de l'atelier de planification du rétablissement de l'esturgeon jaune

28 February to 1 March 2006
Greenwood Inn,
Winnipeg, MB

28 février au 1er mars 2006
Greenwood Inn,
Winnipeg, Man.

Meeting Chairperson
F. N. Hnytka

Président de réunion
F. N. Hnytka

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November 2007
(Updated: August 2008)

Novembre 2007
(Mise à jour : Août 2008)

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d’analyses ou d’interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d’indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l’information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

Lake sturgeon (*Acipenser fulvescens*) populations in Canada have been reduced by harvesting, habitat degradation, and habitat fragmentation. This workshop brought together stakeholders, Aboriginal and First Nations representatives, regulators and recovery planning experts to discuss sturgeon management and recovery issues in anticipation that the species may be listed under the *Species at Risk Act* (*SARA*). Overall, the same factors responsible for decline of the sturgeon populations continue to pose obstacles to population recovery. Participants identified the needs to: 1) fill gaps in scientific knowledge, 2) create partnerships, 3) use scientific and traditional knowledge, 4) mitigate habitat fragmentation/loss, and 5) evaluate recovery success as the highest (listed first) priority issues for species recovery. Actions were recommended in the areas of planning, research, monitoring, management and regulation, and public education and outreach. To properly address the range and depth of the interests involved in recovery of the lake sturgeon, the establishment of a core "Recovery Team" was recommended. Its mandate would be to develop and implement an appropriate recovery plan for the lake sturgeon that is consistent with *SARA*. The Recovery Team would be led by Fisheries and Oceans Canada and include representatives of fish and water management agencies, groups that impact sturgeon populations, existing management boards, and affected communities not represented by these boards. To ensure a workable sized Recovery Team, each member would represent a larger constituency that might be based on a watershed, province, designatable unit, or some other criteria. To accomplish its task the Recovery Team will require political, public, and community support.

SOMMAIRE

Les populations d'esturgeons jaunes (*Acipenser fulvescens*) du Canada ont connu un déclin en raison de la pêche ainsi que de la dégradation et de la fragmentation de l'habitat. Des intervenants, des représentants autochtones et des Premières nations, des responsables de la réglementation et des experts en planification du rétablissement ont participé au présent atelier pour discuter des enjeux en matière de gestion et de rétablissement de l'esturgeon en vue de l'éventuelle inscription de l'espèce en vertu de la *Loi sur les espèces en péril* (*LEP*). De façon générale, les mêmes facteurs responsables du déclin des populations d'esturgeons continuent à faire obstacle au rétablissement de la population. Les participants considèrent qu'il faut de toute urgence : 1) combler les lacunes dans les connaissances scientifiques; 2) créer des partenariats; 3) utiliser les connaissances scientifiques <u>et</u> traditionnelles; 4) atténuer la fragmentation de l'habitat et les pertes d'habitat; 5) évaluer la réussite du rétablissement. On recommande la prise de mesures pour ce qui est de la planification, de la recherche, de la surveillance, de la gestion et de la réglementation ainsi que de l'éducation du public et de la diffusion de l'information. Pour tenir compte adéquatement des nombreux intérêts associés au rétablissement de l'esturgeon jaune, on recommande la mise sur pied d'une « équipe de rétablissement » cadre dont le mandat serait d'élaborer et de mettre en application un plan de rétablissement approprié pour l'esturgeon jaune, conformément aux dispositions de la *LEP*. L'équipe de rétablissement serait dirigée par Pêches et Océans Canada et compterait des représentants d'organismes de gestion des poissons et de l'eau, de groupes qui ont un impact sur les populations d'esturgeons, de conseils de gestion existants et de communautés touchées et non représentées par ces conseils. Pour que l'équipe de rétablissement soit fonctionnelle, chaque membre devrait représenter un plus vaste éventail d'intérêts (un bassin hydrographique, une province, une unité désignable, etc.). Pour accomplir sa tâche, l'équipe de rétablissement aura besoin d'un soutien politique, public et communautaire.

EXECUTIVE SUMMARY

Lake sturgeon (*Acipenser fulvescens*) populations are sensitive indicators of human impacts on the continuity of rivers. The species' slow maturation and very specific spawning requirements make it very vulnerable to damage by human activities. It is also a resource that is predictably available. Populations in Canada have been reduced by harvesting, habitat degradation, and habitat fragmentation. Large commercial harvests were taken from many areas in the late 1800s and early 1900s. Hydroelectric dams have eliminated many of the rapids that provide important spawning habitat, altered the natural flow regimes and the chemical and physical properties of the water, and blocked movements to the remaining spawning habitats. In some rivers, effluents from pulp and paper operations and municipalities have reduced water quality, and thereby reduced the survival of these fish. Despite the elimination of commercial and sport harvests in many areas, populations continue to be stressed by ongoing subsistence harvests and existing developments and activities.

In May 2005, in recognition of the species' depletion and vulnerability, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) tentatively designated lake sturgeon populations in western Canada as "Endangered" (Western Hudson Bay and Saskatchewan-Nelson River drainages) and populations in eastern Canada as "Special Concern" (Southern Hudson Bay and James Bay, Great Lakes-Western St Lawrence). If listed under Canada's *Species at Risk Act (SARA)*, recovery strategies would need to be developed for "Endangered" populations within one year, and management plans developed for populations of "Special Concern" within three years. The Lake Sturgeon Recovery Planning Workshop (the Workshop) was designed to facilitate the required consultations and the recovery planning process.

The Workshop brought together stakeholders, Aboriginal and First Nations representatives, regulators and recovery planning experts to engage in information sharing and dialogue associated with sturgeon management and recovery issues. The objectives of the workshop were to share knowledge on how sturgeon recovery might best be approached, and to enable all parties concerned with sturgeon recovery planning to reach a common understanding of the issues and solutions. Current lake sturgeon recovery approaches, management practices and research were examined, first from a broad geographic and then from a local perspective, with a focus on western Canadian populations. Existing tools, mechanisms and infrastructure were also considered to see how they might best be used within the *SARA* recovery planning process. Participants of the workshop are identified in Appendix 1.

Many common and recurring themes were emphasized in the presentations, despite the fact that the populations identified were often widely separated geographically. The species' late maturation (female age 20–25; male 12-15), long life (> 100 y female), and intermittent spawning (intervals of 1-3 y male, 3-9 y female) make it particularly vulnerable to sustained

exploitation pressures and slow to recover. The specific habitat requirements of the sturgeon have also played a significant role in its depletion. Loss of spawning habitats, which are generally found below cascades or above riffles, and habitat fragmentation are commonly identified threats that have often been associated with hydroelectric developments. Overall, the same factors responsible for decline of the sturgeon populations continue to pose obstacles to population recovery.

New technologies, particularly remote sensing techniques, are improving knowledge of seasonal movements and habitat use by juveniles and adults. As well, advances in genetic techniques are providing new information on how stocks are interrelated. However, much remains to be learned. The need to validate aging techniques, for example, is important for many aspects of population management. Traditional knowledge held by Aboriginal Elders is an important information resource for sturgeon recovery, particularly for the identification of past, present, and potential spawning habitats. However, concern was also expressed that habitat alteration by hydro-electric development has altered the traditional knowledge database. Fishers no longer receive the same natural cues of when and where to harvest fish. This has led to a devaluing of Elders' knowledge in some cases and the need to relearn "traditional knowledge" under the current conditions. However, by listening well to Elders' traditional knowledge of sturgeon scientists can learn how things were and how they might be again.

The large size of the individual fish and the high value of caviar make lake sturgeon attractive to harvesters, and their congregation at spawning sites makes them vulnerable to harvest. The species' broad distribution and importance to subsistence, sport and commercial harvesters also make it difficult to manage effectively. Regulations used for sturgeon management have typically included the elimination or reduction of harvests, either by reducing the open season or the number that can be kept. Size restrictions and gear restrictions have also been used with some success. Commercial harvests have been eliminated first, followed by sport harvests. Current subsistence harvests are poorly known although some First Nations are voluntarily limiting their harvests. The conservation and rehabilitation of sturgeon stocks are a priority to First Nations. Towards that goal, partnerships with other interested parties including governments have been advocated.

Efforts to restore and re-connect sturgeon habitat in both Canada and the United States are underway on a limited basis. The construction of artificial spawning habitats has met with good success in areas with consistent flows and strong currents, but has not worked well in areas where slower currents and clear water enable aquatic plants to establish and interfere with spawning substrates. Natural-type fishways have been constructed below small dams and raised culverts, using rock riprap, to create step-pools and rapids that provide spawning habitat and facilitate fish passage. Bypass fishways may enable sturgeon to pass larger barriers, and work is underway to design fishways suitable for sturgeon. Some hydro-electric facilities have changed their operating regimes to ensure adequate flow during the spawning season. This includes conversion of peaking flow facilities to run-of-the-river flows. Pollution abatement, in systems such as the Rainy River, has demonstrated a close link between sturgeon recovery and improvements in water quality.

Local or regional management boards or committees and their associated management plans are an important component and foundation for species recovery. Management plans were identified for the Saskatchewan, Nelson, Rainy and St. Lawrence rivers, and for lakes Superior and Winnebago. These are generally multi-stakeholder committees that have focussed on developing research programs and identifying recovery goals and objectives for local populations. The goal of the Saskatchewan River Sturgeon Management Board's Management Plan, for example, is to have a sturgeon population that is self-sustaining and capable of supporting traditional use by local Aboriginal people by: 1) stabilizing existing spawning populations in the next 3 years, 2) achieving a measurable increase in spawning populations in the next 20 years, 3) achieving community support for voluntary measures that ensure sustainable harvest levels, and 4) determining a long term population objective and the most effective way to achieve it within the next 5 years. The Nelson River Sturgeon Board has recommended zone and seasonal closure and adopted restricted harvest limits to address exploitation issues. There is only general conformance with these recommendations which highlights the further need to reach out to the communities.

In waters having more robust sturgeon populations the goals are somewhat different. The goals of the Lake Winnebago Management Plan, for example, are to maintain: 1) a robust and healthy sturgeon population and 2) a traditional and viable sturgeon spear fishery by assessing the stock and harvest levels, protecting and enhancing habitat, maintaining annual exploitation at 5% or less using regulations and law enforcement, and working with the public to make the program work. Management of sturgeon populations in the St. Lawrence River in Quebec relies on the issuance of a limited number of commercial licences for specific areas and ensuring that there are fish sanctuaries where no fish are harvested. Fishing is directed at sub-adults (ages 20-25) targeting less than 10% take of the sub-adult population annually. A 2000 Management Plan calls for the progressive reduction in annual harvest from 200 tonnes to 80 tonnes by 2002.

Sturgeon culture techniques are continuing to improve. However, because hatcheries typically rely on a few fish to provide eggs and milt there are concerns about the genetic diversity of hatchery planted stocks. Rehabilitating existing natural stocks is preferable to stocking, particularly when fish from other areas must be used. Introduced fish have survived and grown well in a number of waterbodies, however suitable spawning habitat must be available for these fish to establish self-sustaining populations. Stocked fish generally require some kind of marking to enable follow-up assessment.

Monitoring the success of recovery efforts in the Lake of the Woods area has benefited from a standardized approach to assessment including sampling protocols, gear, and equipment. Ontario's "Fall Walleye Index Netting" (FWIN) program was identified as a good model from which to develop a broader sturgeon monitoring program. It captures juvenile and sub-adult lake sturgeon (40-100 cm TL; age 3 to 20) but may need to be modified to ensure that populations in swift rivers can be sampled reliably over the long term. This approach would avoid the cost of developing a new protocol and could be used to monitor other riverine species, such as walleye, at the same time. It is currently being tested in Ontario.

Threats to sturgeon continue to persist. Exploitation rates are still unknown for most populations. Control of exploitation was universally viewed as essential for population recovery. New hydro-electric developments have been proposed in Ontario and Manitoba on rivers with sturgeon populations. Impoundments should be avoided in areas with sturgeon if their populations are to be maintained. In Quebec, efforts to construct new hydro facilities on the St. Lawrence River have been blocked since the 1980s.

During the strategic planning phase of the workshop, participants identified key issues and actions necessary for sturgeon recovery, and suggested how recovery efforts might best be organized. The top five issues identified for sturgeon recovery, listed in order of decreasing priority, included:

- **Filling gaps in scientific knowledge**
- **Creating partnerships**
- **Using scientific <u>and</u> traditional knowledge**
- **Mitigating habitat fragmentation/loss, and**
- **Evaluating recovery success.**

Actions were recommended in the areas of planning, research, monitoring, management and regulation, and public education and outreach. To facilitate recovery planning it will be important to secure adequate funding, develop an infrastructure to maintain communications, involve all parties with an interest in the species' recovery in setting the overall recovery goal and specific local goals, and to identify the stakeholders and develop effective partnerships to work together towards recovery.

Research is essential for understanding the biology and habitat requirements of the lake sturgeon, identifying potential sources of habitat degradation and loss, and improving understanding of threats to the species. To focus research efforts, the compilation and synthesis of existing scientific and traditional knowledge on lake sturgeon, and identification and prioritization of knowledge gaps was recommended. To fill known gaps, research was recommended to genetically identify populations, validate aging techniques, determine the age of reproductive senescence, identify limiting factors in habitat, and inventory important or critical habitats.

To evaluate the success of recovery efforts the standardization of sampling protocols and development of a population abundance index program were recommended to enable comparisons over time and space. Work to manage and regulate sturgeon populations should foster habitat protection and defragmentation, and evaluate the impacts of current harvests on lake sturgeon populations.

Public awareness and involvement in recovery programs is the key to protecting lake sturgeon habitat and reforming practices that threaten the species over the long term. Recommended actions included the development and implementation of a public awareness strategy (communications plan) to raise the profile of the lake sturgeon; and capacity building to increase local, aboriginal, and scientific participation in the recovery process. Such plans have served the recovery process well and continue to do so.

DFO would take the lead role in organizing recovery of the lake sturgeon but there also needs to be leadership at all levels, particularly from the Provinces and First Nations. To properly address the range and depth of the interests involved in a recovery strategy of this scale, a core "Recovery Team" should be established. In addition to DFO, it should include representatives of fish and water management agencies, groups that impact sturgeon populations, existing management boards, and affected communities not represented by these boards. To accomplish its task the Team must be a workable size. Consequently each member of the team should represent a larger constituency. They would then report to their constituency, which might be based on a watershed, province, designatable unit, or some other criteria.

A recovery team would be led by a chair or co-chairs and supported by a secretariat. It would require adequate funding and support staff to facilitate communications, translation, and public education. Financial or in-kind support should be provided by the Federal and Provincial governments and by users of water, such as the hydroelectric utilities. To accomplish its task the Team will also require political, public, and community support. The mandate of the Recovery Team, as listed in *SARA*, would be to design and implement an appropriate recovery plan for the lake sturgeon.

"In the end we will conserve what we love.
We will love only what we understand.
We will only understand what we are taught."

Baba Dioum

1.0 INTRODUCTION

In May 2005 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) provided a preliminary assessment of lake sturgeon (*Acipenser fulvescens*) populations in Canada. This included a tentative designation of "Special Concern" for eastern populations (Southern Hudson Bay and James Bay, Great Lakes-Western St Lawrence) and "Endangered" for all western populations (Western Hudson Bay and Saskatchewan-Nelson River drainages) (***Figure 1***). Anticipated submission of COSEWIC's assessment to the Minister of the Environment in early 2006, would have initiated the legal listing process and formal consultations under the *Species at Risk Act (SARA).* If listed, recovery strategies would have to be developed for the lake sturgeon within one year for "Endangered" populations and management plans would be required within three years for populations of "Special Concern". The broad geographical distribution of the species, its significance to Aboriginal and First Nations communities as well as other stakeholders, the existence of current lake sturgeon initiatives and recovery efforts, and the limited time prescribed for the development of recovery strategies all made it apparent that significant efforts would be required early on in the recovery planning process for this species. To that end, the "Lake Sturgeon Recovery Planning Workshop" described herein, was organized and designed to bring together stakeholders, Aboriginal and First Nations communities, regulators and recovery planning experts to share information and engage in dialogue related to sturgeon management and recovery issues. The participants of the workshop are identified in ***Appendix 1***, the Agenda is provided in ***Appendix 2***, and comments on the workshop are summarized in ***Appendix 3***.

This report summarizes presentations and strategic planning discussions at the "Lake Sturgeon Recovery Planning Workshop" held in Winnipeg on February 28 and March 1, 2006. The first day and a half of the workshop examined current lake sturgeon recovery approaches, management practices and research, first from a broader geographic area and then from a local perspective. The focus of discussions was primarily directed at "western" populations of lake sturgeon that may be designated as "Endangered" and for which timelines for action would be most critical. This sharing of information, knowledge and experiences was intended to benefit all parties concerned with sturgeon recovery planning, and to enable them to reach a common understanding of the issue and solutions. On the second afternoon participants considered existing tools, mechanisms and infrastructure to see how they might best be used within the *SARA* recovery planning process.

Proceedings for a closely associated "Allowable Harm/Recovery Potential Assessment" (AH/RPA) workshop for western populations of lake sturgeon, which immediately followed the recovery planning workshop, will be summarized in a separate document.

As an addendum, although COSEWIC's assessment was not forwarded to the Minister as anticipated in April of 2006 and was somewhat revised in November 2006, the information, ideas and contacts that resulted from the workshop are still relevant to future recovery planning for the sturgeon and will provide useful guidance for future discussions.

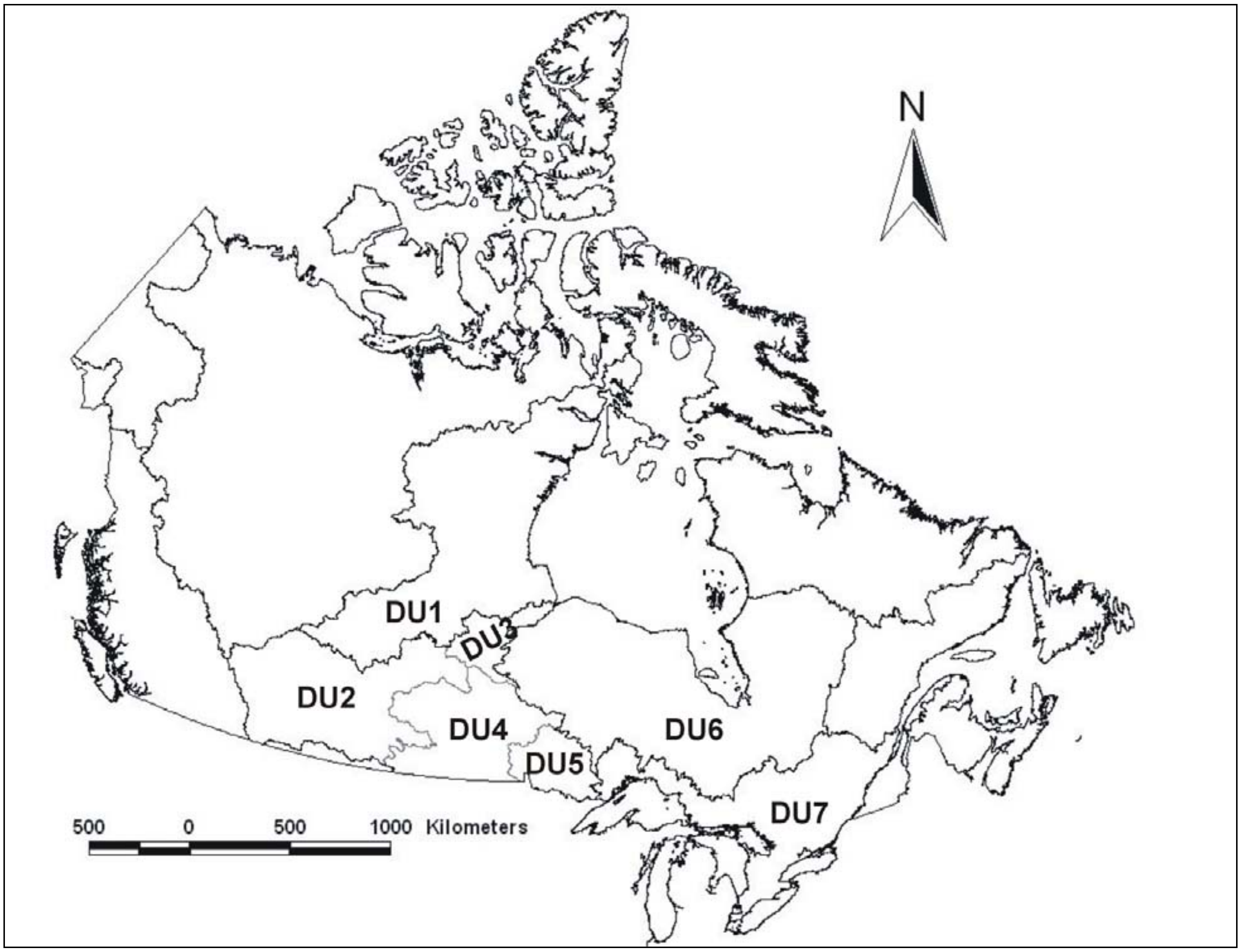

Figure 1. The designatable units used by COSEWIC in their May 2005 assessment (Dick et al. 2005). Dark lines represent divisions between ecozones; light lines represent subdivisions based on genetic information. The "Western population" includes fish in DU1 to DU4 and in the Winnipeg River portion of DU5 downstream from Lake of the Woods; the "Eastern Population" includes fish in the Lake of the Woods-Rainy River portion of DU5, and in DU6 and DU7. DU1 = Western Hudson Bay; DU2 = Saskatchewan River (Saskatchewan-Nelson); DU3 = Nelson River (Saskatchewan-Nelson); DU4 = Assiniboine River and Lake Winnipeg (Saskatchewan-Nelson); DU5 = Winnipeg River (Saskatchewan-Nelson); DU6 = Southern Hudson Bay and James Bay; DU7 = Great Lakes-Western St. Lawrence. [Note: The November 2006 COSEWIC assessment revised these DUs by splitting DU5 in two.]

2.0 PRESENTATIONS

The workshop presentations and discussions that followed have been paraphrased, but every effort has been made to accurately convey the information and intent. The editor apologizes for any errors that were introduced. Presentations are summarized in the order they were presented, and are indexed in the Table of Contents. Each presenter was allowed twenty minutes to make their presentation, followed by a ten minute question and answer wherein participants were asked to take turns with questions and respect others. Questions and answers were only included where they clarified or added significantly to the information. Questioner's names were not included as many did not announce their names and could not be readily identified. Copies of slide presentations and of documents that were prepared specifically for the workshop are appended, and the slides have been numbered for reference. Other documents supplied are cited. Where presentations contained series of slides that built, one point at a time, on a particular theme only the final summary slide was included. Acronyms and technical terms used in text are defined in the Glossary (Section 6.0).

2.1 The Species at Risk Act (*SARA*) and lake sturgeon

Ray Ratynski, Fisheries and Oceans Canada, Winnipeg, MB

Ray's presentation provided context for the workshop and an introduction to the *Species at Risk Act* (*SARA*) and its processes (***Appendix 4***). The purposes of *SARA* are: 1) to prevent wildlife species (which include biota other than bacteria and viruses) from becoming extinct in Canada; 2) to provide for the recovery of extirpated, endangered or threatened species; and 3) to manage species of Special Concern to prevent them from becoming further at risk (***Appendix 4: Slide 3***). The Act encompasses all wildlife species that are at risk in Canada, their critical habitats, and all lands and waters in Canada (***Slide 4***). Under *SARA*, the Minister of Fisheries and Oceans is responsible for all aquatic species wherever they are found, Parks Canada Agency is responsible for species within National Parks, and Environment Canada is responsible for overall administration and for all other species (***Slide 5***).

Basic elements of SARA include a science based species assessment, a formal listing process, and various provisions for species protection including prohibitions against the harm or destruction of individuals of a species, their residences, or critical habitat. In addition, if a species is listed as an extirpated, endangered, or threatened species, the Minister must prepare a strategy for its recovery. Consultations along with stakeholder and Aboriginal involvement are important components of the recovery planning process.

The various elements of the *SARA* process are illustrated in ***Slide 7***. The first part is assessment, which involves the development of species status reports prepared by COSEWIC (***Slides 8 to 10***). These reports incorporate scientific knowledge, community knowledge and Aboriginal traditional knowledge, and assess the risk of extinction of a species. Species may be designated "Not at risk", or assigned one of several ascending risk categories, ranging from

“Special concern” for species that are sensitive to human activities, to “Threatened” for species that require action to reduce the risk of extinction, “Endangered” for species in imminent danger of extinction in Canada, or “Extirpated” for species that no longer exist in the wild in Canada. Where data are insufficient to assess risk the species may be designated as “Data Deficient”.

The Minister of Environment has 90 days after receiving the assessment report to respond on how the government intends to proceed (***Slide 11***). During this time information is provided to the public about the assessment, affected jurisdictions are consulted, and a determination is made about whether extensive consultations may be necessary to decide whether the species should be listed under *SARA.* Following required consultations and feedback, the government must decide whether or not to list the species (***Slide 12***). The basis of the government’s decision is included in a Regulatory Impact Assessment Statement (RIAS) which examines the socioeconomic impact and the economic costs of listing the species. Species are added to *SARA* by virtue of regulations.

If a species is listed as “Endangered”, “Threatened” or “Extirpated”, *SARA* automatically prohibits the killing, harming, harassment or capture of individuals. In addition the species cannot be possessed, collected, bought, sold, or traded either whole or in part (***Slide 13***). Some exemptions may be made under permit to allow for scientific research that may benefit recovery efforts or incidental harvests with other targeted species, provided these activities do not jeopardize recovery efforts (***Slide 14***). Species listed under *SARA* must also be considered in project reviews conducted under the *Canadian Environmental Assessment Act* (***Slide 15***), with steps taken to avoid or lessen any impacts on the species. Exceptions to the prohibitions may be made in the interest of national security; human, plant or animal health and may include ceremonial use and pre-existing collections (***Slide 16***).

Listing under *SARA* also triggers mandatory recovery planning for species designated “as “Threatened”, “Endangered” or “Extirpated” (***Slide 17***). This involves preparation of a Recovery Strategy that identifies population objectives, threats to recovery and, if possible, critical habitat (***Slide 18***). The recovery strategy is drafted by recovery team, which includes technical experts and stakeholders who may be directly affected by the recovery strategy. Posting of the recovery strategy on the public registry provides the opportunity for public comment on the proposed recovery strategy. Implementation of the recovery strategy is afforded through the subsequent development of an Action Plan (***Slide 19***). Species of “Special Concern” require the preparation of a Management Plan (***Slide 20***).

SARA specifies timelines for the development of recovery strategies and action plans (***Slide 20***). A Recovery Strategy must be developed within 1 year of listing a species as “Endangered” or 2 years of listing it as “Threatened” or “Extirpated”. A management Plan must be developed within 3 years of listing a species as “Special Concern”. Listing under *SARA* also creates opportunities for funding to work with the species through initiatives such as the Habitat Stewardship Program (***Slide 21***).

Critical habitat must be identified to the extent possible in the recovery planning process and, once identified is protected under *SARA* (***Slide 22***). Consultations are required before critical habitat is designated.

With respect to the lake sturgeon, a Status Report was prepared (***Slide 24***). COSEWIC reviewed this report at their May 2005 meeting and considered the species to be at risk, with western populations considered “Endangered” and eastern populations “Special Concern”. Normally, the assessment would have been forwarded to the Minister of the Environment within 3 months. However, revisions to the manuscript were required to clarify the **designatable units.** It is scheduled to be reconsidered by COSEWIC at their April 2006 meeting.

Prior to any listing decision, an “allowable harm assessment” and a “socioeconomic analysis” will be prepared to inform consultations on listing - extensive public consultations are expected (***Slides 25 and 26***). Based on all the information, a decision on listing under *SARA* will follow. The time allowed for development of any Recovery Strategy or Management Plan required will be determined by the listing designation. This could see development of a Recovery Strategy as early as April 2009 and of a Management Plan by 2011 (***Slide 27***). These timelines are relatively short given the importance of this species and the work required, so it is important to begin thinking about recovery planning now, at this meeting.

Questions (Q), Answers (A), Comments (C), and Responses (R):

C: Listing should not become political but be based instead on the needs of the species.

R: While science and politics should be separate politicians do have the final decision, which may be based on other considerations. This can result in populations not being listed under *SARA*, despite the COSEWIC recommendation. Some at-risk salmon populations, for example, have not been listed, but the decision not to list them was accompanied by other initiatives to recover the species. This workshop needs to determine what listing may mean. Everyone here is interested in recovering sturgeon populations.

Q: Under *SARA* who is responsible for issuing licenses for scientific research?

A: DFO issues the permits under *SARA* but researchers also require provincial licenses. Arrangements can be made with the provinces to issue permits under *SARA*, and hopefully jurisdictions will take on the requirements for issuing *SARA* permits to streamline the permitting process.

C: Politicians should stay out of resource management because they do not understand the practical situation.

C: Concern was expressed that insufficient time was being allotted for assessment of the species, and about the effects this might have on traditional harvests. In particular, whether listing might have the effect of driving the traditional harvests underground, and how the larger Aboriginal community can be involved and consulted.

R: There are exemptions under *SARA*, and exceptions for traditional use. It is important that everyone work together to recover the species so that they can continue to use and enjoy the resource. There are opportunities for funding through the Habitat Stewardship, Aboriginal Capacity Building, and Critical Habitat Protection programs to help people become involved.

Q: How have consultations been undertaken to date?

A: DFO has requested significant funds to facilitate consultations. A consultation workbook will be posted on the *SARA* website, and notices will be posted in newspapers telling people who to contact in DFO for further information. There will be community meetings to inform people about *SARA* and sturgeon, the implications of species listing, and about funding opportunities to facilitate involvement in the recovery of lake sturgeon. Comments will also be solicited through face-to-face meetings, phone calls, and emails to obtain input with respect to listing the species.

2.2 Workshop backgrounder and organization

Fred Hnytka, Workshop Chair - Fisheries and Oceans Canada, Winnipeg, MB

In setting the stage for the workshop, Fred began by emphasizing some key points of Ray's presentation. First, that an independent assessment undertaken by COSEWIC has determined that western populations of lake sturgeon are likely to be "Endangered" and may face extinction without some form of intervention, and that the eastern populations are likely to be of "Special Concern. Second, that *SARA* was enacted to save species from extinction but before a species is listed the stakeholders, jurisdictions, Aboriginal peoples, and others must be consulted. Consultations are expected in the fall of 2006, and the more dialogue there is before those consultations the better chance we have for a common understanding of what listing may entail. Third, if the sturgeon is listed under *SARA* a recovery strategy, or strategies, may be required. Their development needs to be considered well in advance of the recovery planning process. Fourth, and finally, if the sturgeon is listed under *SARA* automatic prohibitions will be invoked against the killing or harming of sturgeon. *SARA* allows for the exemption of those prohibitions only where it can be demonstrated that the survival or recovery of the species is not jeopardized. The first three points are the environs for this two-day workshop, while the fourth point will be the focus of a separate workshop on the third day.

This workshop is dedicated to sharing information, knowledge and experiences for the benefit of sturgeon recovery. The first day will focus on sturgeon from a global perspective to learn what sturgeon management and recovery might eventually mean. The second day will examine tools, mechanisms, and approaches—including organizational structure, that might be applied to recover lake sturgeon populations. Jurisdictional representatives and representatives of sturgeon management boards will share their knowledge to assist us with considering how sturgeon recovery might best be approached.

This workshop is an educational exercise; the purpose is not to set up a recovery team but to assist a future recovery team with its approach. This is a forum for us to solicit views and to take the collective wisdom and experiences and apply them to developing reasoned and reasonable solutions. It is important to provide the decision makers the best possible information on which to base their decisions by gathering it from a broad spectrum of knowledgeable, interested people, and for stakeholders to understand the basis for subsequent decisions.

The knowledge and advice within this room should lead to solutions. Management boards are a very important resource to draw upon when addressing the problem and accessing funding resources.

2.3 The importance of historical/local Knowledge and science in recovery plans for lake sturgeon

Terry Dick, Department of Zoology, University of Manitoba, Winnipeg, MB

Terry began by emphasizing the importance of the long-term knowledge held by Aboriginal Elders as a resource for sturgeon recovery (***Appendix 5***). He outlined the history of adverse impacts to sturgeon populations related to habitat degradation, habitat fragmentation and harvesting, and how the species' broad distribution, which encompasses many political jurisdictions, and its importance to subsistence, sport, and commercial harvesters make it difficult to manage effectively. He expressed concern that it had not been listed as at risk by COSEWIC in 1987, when the first status report was prepared by Houston (1987).

Terry then presented an overview of his research on sturgeon populations in Manitoba. This work has included population estimates, studies of habitat use and movements, and experiments to improve the success of sturgeon culture. One study site was at Round Lake on the Pigeon River system east of Lake Winnipeg (***Appendix 5, Slide 4***). This site is isolated and relatively pristine although it is accessible by winter road, so some harvesting may occur. Fish were also studied in reaches of the Winnipeg River from Seven Sisters upstream to Slave Falls, from Slave Falls to Pointe du Bois, and from there to Ontario (***Slide 5***). Habitat in the river has been altered and fragmented by a series of hydroelectric dams. First Nations have traditionally harvested sturgeon from the river. Terry sampled the latest commercial harvests from the Cumberland House area of the Saskatchewan River, and from the Sipewisk area of the Nelson River.

Based on catch-per-unit-effort, sturgeon in Round Lake and the Winnipeg River system are not evenly distributed (***Slide 6***). In the Winnipeg River system they were concentrated in the area from Seven Sisters to Slave falls, where they comprised up to 15% of the catch. Population estimates, including kg/ha and % of the total catch, were generated. Age distribution studies showed good recruitment of young fish into the Round Lake population but, due to its small size, the removal of a single large female could have a significant effect on year-class strength (***Slide 7***). Because recruitment in the lower Winnipeg River is variable and localized, local knowledge is important for recovery. Further upstream there is better recruitment.

To enhance sturgeon populations and facilitate habitat and movement studies, sturgeon were cultured to a size that they could be tagged and released (***Slide 8***). The fish were reared using live feed and grew faster than in nature. Terry hopes to transfer his stocking and culture knowledge to First Nations so they can help foster recovery.

Habitat available to sturgeon was characterized using a variety of techniques, and radio-tagged adult and juvenile sturgeons were tracked to study their patterns of habitat use. Bathymetry, substrate, current, and other aspects of habitat were studied (***Slide 9***). Various types of fish tags were used and their advantages and disadvantages were discussed (***Slides 10 and 11***). Some tags were attached externally (***Slide 12***); others were implanted surgically into wild and hatchery fish that were held captive until they were healed (***Slides 13***). The tag sensors provided information on fish depth and location, and on ambient water temperature. Locations were determined by triangulation using VEMCO acoustical receivers, and movement patterns were calculated from time-series location data (***Slide 14***).

In Round Lake, clear patterns were observed in the distribution of both juvenile (100-200 g) and adult sturgeon in relation to current and substrate hardness (***Slides 15 and 16***; the lake inflow is from a rapids on the right and its outlet is on the left in these slides).

Some fish spent 70% of their time in the water column, and individuals can travel 45 km in a single day (***Slide 19***). In Numao Lake on the Winnipeg River, cultured fish followed similar patterns to wild fish (***Slides 21 and 22***). Swimming depth depended upon bottom depth and appeared to vary among locations (***Slide 20***). Location-specific differences in behaviour complicate the development of habitat suitability indices. Cultured fish hosted various parasites after a summer in the wild.

Bottom substrate was mapped by correlating substrate hardness, as determined by remote sensing using an echo sounder, with samples collected using benthic grabs (***Slides 23 to 25***). Substrate selection over space and time was studied in relation to depth (***Slides 27 and 28***).

Doppler technology (***Slide 23***) was used to determine current profiles in Round Lake (***Slides 29 and 30***). Some radio-tagged sturgeon frequented rapids where they can move in currents of 1-2 m/s.

Seven Sisters and Pinawa Channel used to be important sturgeon spawning habitat before construction of the Seven Sisters Hydroelectric Dam. To assess current sturgeon use of habitats below the dam, 56 fish were tagged with sonar tags to follow their movements and habitat use over up to 2 years (***Slides 31 and 32***). This study is to be completed in the summer of 2006. Current profiles (***Slide 33***) and bathymetric and substrate maps (***Slide 35***) have been prepared for the river below the dam, and use of this habitat by tagged fish is being gathered using a network of moored receivers (***Slide 34***). Divers examined rocky areas of the bottom that were difficult to sample using benthic grabs and found clams in softer substrates between the boulders (***Slide 36***). Receivers must be retrieved in the fall (***Slide 37***). Fish move about the area (***Slides 38 and 39***).

Terry concluded his presentation by emphasizing the need for First Nations input to management decisions, and the need to develop capacity for environmental assessment and resource management in First Nations communities (***Slides 40 and 41***). He indicated the need to understand differences in the effects of natural and human made environments and barriers on sturgeon, and suggested that biological data necessary for understanding sturgeon might be gathered in cooperation with First Nations fisheries.

2.4 Passage and habitat restoration for lake sturgeon

Luther Aadland, Minnesota Department of Natural Resources, Fergus Falls, MN.

Luther described work in Minnesota to rehabilitate fish passage in the Red, upper Mississippi, and St. Louis rivers (***Appendix 6: Slide 1***). The St. Louis River is a tributary of the Great Lakes. Copies of a recent paper on changes in the fish assemblage structure of the Red River (Aadland *et al*. 2005) and a popular article on restoration efforts in the Red River (Breining 2003) were provided.

In the United States, sturgeon populations in the Red River declined early, often before records were kept. The earliest fishery survey of the river, conducted in 1893, did not mention sturgeon (***Slide 2***). However, on 8 May 1808, explorer Alexander Henry trapped 120 sturgeon, weighing 60 to 150 lbs each, in a single day on the Pembina River—presumably during the spring spawning run (Henry *et al*. 1897) (***Slide 6***). He also indicated that the there was an important spring fishery for sturgeon in the Red Lake Falls area, at the confluence of the Red Lake and Clearwater rivers, suggesting that this area also provided important spawning habitat. Grand Forks on the Red River was an important overwintering area for sturgeon, and recent tag returns indicate that it is still used. Most of the main tributaries of the Red River were blocked by the 1870s with small dams (***Slide 2***). Dam construction in the US peaked about 1960, and has since fallen off as most of the suitable sites have already been used (***Slide 5***). Sturgeon populations also declined with dam construction and the last reports of sturgeon in the US portion of the Red River basin were in the 1940s. Some very large sturgeon lived in these small prairie rivers (e.g., Roseau River--***Slide 7***).

The US endangered species legislation is often misunderstood. Species such as the sturgeon must be viewed as the “canaries in the coal mine” for human impacts on rivers. They serve as sensitive indicators of how the continuity of rivers has been lost (***Slide 8***).

The importance of migration extends beyond spawning activity. It is critical as well for the recolonization of areas that are subject to freezing, drought, or other seasonal changes or catastrophic events (***Slide 9***). Sturgeons consistently spawn over large substrates at depths of 0.6 to 1.8 m (2 to 6 ft), in areas with water velocities of < 1.22 m/s (< 4 ft/s) (***Slide 10***). Spawning habitats are found below cascades or above riffles. Bedrock outcroppings are associated with many of the sturgeon spawning sites in the Rainy River and Kettle River systems. Fish in these areas spawn directly below a cascade that drives well oxygenated water into the interstices of the substrate (***Slide 11***). This strong oxygenation and cleaning action is necessary to keep the eggs healthy. In the Sturgeon River of Ontario, spawning occurs in a glide at the head of a riffle where the current also keeps the eggs oxygenated. Aeration is very flow sensitive. When flow declines oxygen levels decrease and sediment deposition increases, causing higher egg mortality (***Slide 12***). Fish will move from rapids to rapids seeking suitable spawning habitat, since one rapids may function better at a particular flow rate than another.

Unfortunately for the sturgeon, bedrock outcrops are also sought out for dam construction (***Slides 14 and 15***). Dams have fragmented the Mississippi River into a series of pools and sharp drops (***Slide 16***). Providing fish passage from pool to pool does not mitigate the effects of this fragmentation unless the fish have access to suitable spawning habitat. A dam at the mouth of the St. Louis River prevents fish from accessing miles of cascades that provide classic sturgeon spawning habitat (***Slides 17 to 19***). Fish passage could be provided around the dam but the risk of entrainment to fish moving downstream is unknown.

The Red River mainstem is relatively flat but it too has been fragmented by dam construction (***Slide 20***). By 2020, 85% of all dams in the US will be near the end of their operational lives (***Slide 21***); by 2018, 25% of the reservoirs will be at least half full of sediment (***Slide 22***). These structures will no longer be providing the same benefits and may need to be removed (***Slide 23***). However, just removing the dam does not restore the river. The Pomme de Terre River was re-meandered to re-naturalize habitats after the dam was removed (***Slide 24***). Rapids reappeared after the Sandstone Dam on the Kettle River was removed (***Slide 25***).

Early efforts to provide fish passage involved fish ladders that were constructed based on information from salmonids and were too steep for native species (***Slide 26***). Recent efforts are more sophisticated, but are typically designed to pass common game species—seldom sturgeon (***Slide 27***). The lake sturgeon is not a particularly fast-swimming fish for its size but can pass upstream in water velocities of over 1.5 m/s (5 ft/s) by staying close to the bottom where current is slower and by moving in shallow water (***Slides 28 and 29***).

Efforts are underway to modify barriers created by small dams to facilitate sturgeon passage. Natural-type fishways have been constructed by installing rock-riprap to create step-pools and rapids similar to spawning habitats below small impoundments such as the Midtown Dam (***Slides 34 to 43***). The velocity profiles show very high velocities just where the water comes over the boulders, but these velocities only last for a short distance (***Slide 42***). These changes do not alter the water level above the dam. Similar changes have been made to perched box culverts and at the Breckenridge Lake Dam to enable fish to move upstream in the Ottertail River (***Slides 46 to 48***). Another method of providing fish passage is to create a bypass type fishway of the sort used in Canada by Robert Newbury (***Slides 49 to 54***). These fishways are easy to monitor for fish passage and they pass a wide variety of species, ranging from schools of shiners to large catfish (***Slide 53***) - not just spawning fish but also juveniles and young-of-the-year. The Riverside Dam at Grand Forks, which had severe tailwater erosion, was also built up to stabilize it and create rapids downstream and facilitate fish passage (***Slides 55 to 61***). The parabolic shape of these restorations makes them resilient to flow changes, and facilitates fish passage at a wide range of flows (***Slide 62***). Other remediation projects have been completed near Fargo (***Slide 63***) and on the Pelican River, a tributary of the Ottertail River (***Slides 64 and 65***). Fish moving upstream through these structures do not have to jump, only to burst through gaps between the larger boulders into the next pool. Over fish 40 species have been observed passing these nature-like fishways, and the hope is that sturgeon will too as populations recover. Sturgeon will also spawn in the upper part of these man-made rapids (***Slides 67 to 70***). This is important, as it means that these structures can remediate both habitat fragmentation and loss of spawning habitat.

These habitat restoration efforts are slowly re-connecting habitats on the Red River system (***Slide 71***). Further remediation is planned for dams at Drayton, Christine, and Hickson. Sturgeon are now able to move from the mainstem of the Red River to historical spawning habitats on the tributaries where the beach ridge of Lake Agassiz was located.

Efforts are also ongoing to reintroduce lake sturgeon into the upper Red River (***Slide 72***). Juvenile sturgeons from the Rainy River system were first stocked into the Ottertail River system in 1997-98, prior to most efforts to restore fish passage. Since then there have been over 60 tag returns, many from Lake Winnipeg! These fish seek out deepwater habitats until they need to spawn. Most stocking efforts now use fingerlings raised by Rainy River First Nation, although some fry are being stocked into the Rosseau and Red Lake rivers. The Lockport Dam on lower Red River prevents migration back upstream from Lake Winnipeg.

Questions (Q) and Answers (A):

Q: What is the status of lake sturgeon in Minnesota related to the US. *Endangered Species Act*?

A: Lake sturgeon populations in Minnesota are now recovering but are still of "Special Concern". No harvest is allowed in the inland waters of Minnesota, but some are taken in the Rainy River system. This population has been recovering since the US *Clean Water Act* came into effect. However, tag recovery rates are high, so stock exploitation is very high.

Q: What is the genetic origin of the stocked fish?

A: They are all from the Rainy River population. There may be a few old, large sturgeons still in the upper Red River system but the Rainy River fish were the closest genetic stock that could be used for rehabilitation.

Q: How high a dam can be remediated?

A: The cost of restoration increases very quickly with the height of the barrier. The highest, at Grand Forks, was about 4 m (i.e., 13') and required 80,000 tons of rock at a cost of about $5,000,000. If this had simply been a resource-related project it is unlikely that it would have proceeded, however it was tied to a large flood control project. The alternative is to bypass higher dams.

Q: Large movements were observed, was there any evidence of homing?

A: Homing may be related to the type of system. The stocked fish have not yet reached spawning size, so homing cannot yet be tested. Fish in smaller systems may have to be more flexible than those in larger systems.

2.5 Lake sturgeon rehabilitation efforts in Lake Superior

Henry Quinlan, U.S. Fish and Wildlife Service, Ashland, Wisconsin

Henry Quinlan provided a brief history of the decline of sturgeon in Lake Superior, discussed strategies for rehabilitating these sturgeon populations, and described the current status of the species and ongoing research (***Appendix 7: Slide 2***). He also provided copies of "Research and Assessment Needs to Restore Lake Sturgeon in the Great Lakes" (Holey *et al*. 2000).

While the First Nations around Lake Superior traditionally relied heavily on sturgeon for subsistence, their harvests were sustainable (***Slide 3***). Populations declined following European immigration. The decline began when commercial fishermen attempted to eradicate sturgeon in an effort to reduce damage to their nets, and continued after sturgeon were targeted by a commercial fishery that flourished between ca. 1870 and 1900 (***Slides 4 to 6***). Habitat destruction and degradation by log drives, harbour development, and pollution contributed to the species' decline. Hydropower developments also contributed to the decline by preventing fish passage and fragmenting habitats, altering the flow and thermal regime, and changing sediment transport and productivity (***Slide 7***).

In the 1980s, the lake sturgeon was designated as a "candidate" species for listing under the U.S. *Endangered Species Act* and classified as a species of "special concern". In 1995, "candidate" status was redefined to include only species for which sufficient information was available to evaluate their status, and the lake sturgeon was removed as a species of "special concern". Through the 1980s the rehabilitation of sturgeon populations in the lake was approached piecemeal by individual agencies (***Slides 8 and 9***). This coalesced into a lake-wide effort in 1990, and a Sturgeon Committee was formed with membership from six Tribal organizations, Michigan, Wisconsin, Ontario, U.S federal agencies, and universities. The rehabilitation approach included a review of the history and current status of sturgeon populations, setting goals for population rehabilitation, evaluating regulations, addressing impediments, and evaluating progress (***Slide 10***).

The rehabilitation goal was to have self-sustaining populations in at least 17 Lake Superior rivers that historically supported lake sturgeon (***Slide 11***). To be considered self-sustaining a population had to have at least 1,500 adults, 20 or more year classes, a roughly equal sex ratio, and evidence of annual recruitment. A target exploitation rate of < 5% is recommended (***Slide 12***). At present none of the Lake Superior populations meets these criteria.

Under the current regulations, commercial fishing for lake sturgeon is prohibited, although Tribal commercial fishers are allowed to keep dead sturgeon for home use (***Slide 13***). The three states and Ontario either prohibit sport fishing, or limit the size of fish that can be harvested and the harvest seasons. Most tribes restrict sport and subsistence harvests. Some protect them from harvest (2 Tribes), some have an annual harvest limit of 1 or 2 fish (3 Tribes), and the rest (3 Tribes) have no regulations, although the annual harvest is only estimated at 10 to 15 fish per year. The tribal commercial gillnet fishery does not target lake sturgeon, and releases any live sturgeon captured (***Slide 14***). Commercial fishers support sturgeon rehabilitation and have been assisting with assessment efforts by providing tag returns and collecting biological data. The harvest by First Nations is unknown.

Hydropower developments are one of the impediments to sturgeon rehabilitation that has been approached as part of the rehabilitation process. Over the past decade, three facilities in the U.S were converted from peaking to run-of-the-river flows during the spring spawning season to meet re-licensing requirements (***Slide 15***). At one site in Michigan the number and size of spawners has increased, spawning times have been reduced, and egg and larval losses have decreased all of which increase the potential for recruitment into that population (***Slide 16***). At a site in Wisconsin, an increasing trend has been observed in the number of juveniles and adults downstream (***Slides 17 and 18***). There are still impediments to sturgeon recovery related to hydroelectric power developments. At the Kaministiquia River, in Ontario, the hydro facility diverts flows away from the spawning areas during the critical spawning period in May. The Ontario Ministry of Natural Resources is working with Ontario Power Generation to determine the discharge required to allow spawners to access spawning habitat and for successful reproduction. Two-year trials are under way to assess the effects of different flows that will be kept constant for 5 weeks in May and June.

Some impediments related to water quality have also been addressed (***Slide 21***). The communities of Superior and Duluth constructed a municipal treatment facility to improve water quality in the St Louis River (MN, WI). The physical habitat in the river was adequate for sturgeon, but there were no sturgeon present to recolonize the river. Consequently, Wisconsin and Minnesota stocked the river with fry and fingerlings from 1983 to 2000, with a pause from 1993-96 to arrange a Lake Superior source for eggs. A total of about 800,000 fry and 200,000 fingerlings were released. Since then the abundance of sturgeon in the river and in Lake Superior nearby has increased. The females will soon be mature and there is keen interest in whether they will return to spawn (***Slide 22***).

Genetic research has been conducted, Great Lakes-wide, to gather information to assist sturgeon stock management (***Slide 23***). Fish from rivers in Lake Superior are genetically distinct from sturgeon elsewhere in the Great Lakes (***Slide 24***).

To summarize the progress to date, there has been broad support for rehabilitation efforts, population status and trends are better understood, genetic data are available to assist management decisions, populations are under regulatory protection that is now more conservative, and stocking has successfully increased sturgeon numbers (***Slides 25 and 26***). Some threats persist, particularly related to hydro power in Ontario, where there are at least two new development proposals on tributaries with sturgeon populations. Exploitation rates are still unknown for most populations. Research on habitat requirements and movement and dispersal patterns is ongoing. The bottom line is that there are still no populations that meet the goals we outlined for rehabilitation.

Questions (Q) and Answers (A):

Q: Was there a difference in the survival of fry versus fingerlings?

A: Fingerlings had a better rate of survival, but it is easier to stock more fry. Survival was high after the fish reached 12.5 to 16 cm (5-6”).

Q: How long will the Kaministiquia River tests be conducted? Is the time sufficient to consider spawning periodicity?

A: These tests were originally planned for 2 years at each flow, but discussions with government are ongoing. Spawning periodicity is a problem.

Q: What proportion of Kaministiquia River flow was diverted away from the spawning grounds?

A: I am not sure. At times 100%, but perhaps about 200 m^3/s [Editors Note: see Friday 2004, 2005, 2006].

Q: Have the post-stocking improvements in catch per unit effort been documented in the primary literature?

A: Yes. [Editors Note: see Schram *et al*. 1999]

Q: How has the conversion to run-of-the-river facilities been received by the power utilities?

A: Not well. Re-licensing of the utilities, which typically occurs at 50 year intervals, is one of the only vehicles for obtaining concessions related to aquatic resources. Otherwise unless there is an endangered species ruling the regulatory agencies have little opportunity to make changes to the operation of those facilities.

2.6 Managing the recovery of lake sturgeon in the Ontario-Minnesota border waters

Tom Mosindy, Ontario Ministry of Natural Resources, Kenora, ON

Tom Mosindy described his work over the past two decades assessing lake sturgeon populations in the border waters shared by Ontario and Minnesota, and with the lake sturgeon management plan designed to support the recovery of these populations (***Appendix 8: Slides 1 and 2***). Copies were provided of a report on efforts to manage the recovery of the lake sturgeon in the border waters (OMNR and MDNR 2000).This region includes the Winnipeg River system above its confluence with the English River, including Lake of the Woods, Rainy River, Rainy Lake, Namakan Reservoir, and the Namakan River upstream to Lac la Croix (***Slides 3 and 4***). Historically the lake sturgeon was especially abundant in Lake of the Woods and the Rainy River. The major rapids on the Rainy River at Manitou and Long Sault were a focal point of sturgeon harvest by First Nations people for thousands of years. They also traded isinglass to the Hudson Bay Company in the 1800s. People of the Rainy River First Nation still live at these locations and harvest sturgeon for subsistence (***Slide 5***). They also operate a sturgeon hatchery.

The non-native commercial fishery for lake sturgeon at Lake of the Woods began in the late 1880s and followed the classic pattern of commercial sturgeon fisheries with an abrupt peak and precipitous decline (***Slide 6***). Over 800 tonnes of sturgeon were harvested per year at the peak of the fishery, which collapsed about 1910. The U.S. fishery was closed in 1930, while the Ontario fishery continued at a rate of about 1,000 kg per year from 1925 onwards.

The primary reason for the collapse was overfishing, but the loss of major spawning and rearing habitat on the Rainy River resulting from industrial and agricultural development were also contributing factors. Couchiching Falls at the outlet of Rainy Lake (***Slide 7***), for example, was a major spawning site that was lost (***Slide 8***) when the river was dammed to provide hydroelectric power for pulp and paper development at International Falls and Fort Frances in 1907 and 1914 (***Slide 9***). Pollution from these mills destroyed spawning and early rearing habitat downstream, and were an obstacle for subsequent recovery of this sturgeon population.

The first evidence of recovery in Lake of the Woods sturgeon was an increase in the catch of sturgeon by commercial fishermen in Ontario waters in the late 1970s. Ontario Ministry of Natural Resources (OMNR) conducted an extensive assessment of this population between 1987 and 1990. This assessment included commercial catch sampling, mark-recapture sampling to obtain population estimates (***Slide 10***), and radiotelemetry studies (***Slide 11***). The 26 adult fish that were surgically implanted with transmitters and followed for almost 3 years moved widely in southern Lake of the Woods and the Rainy River (***Slide 12***).

This assessment and later studies demonstrated the close link between sturgeon recovery and improvements in water quality. The introduction of the US *Clean Water Act* in 1970, and similar regulatory measures passed in Ontario between 1970 and 1986, reduced the amount of wood fibre, bark, and dissolved organic material discharged into the Rainy River by the two paper mills by 90% and thereby improved the survival of young sturgeon in the river (***Slide 13***) [Note: BOD = biological oxygen demand which is an indicator of the amount of organic matter in water]. OMNR, Minnesota Department of Natural Resources (MDNR) and the Rainy River First Nation completed a mark-recapture estimate of the population in the spring of 2004 and 2005, the population of adult and subadult fish, 1 m or longer, had more than tripled from 15,000 fish in 1990 to over 50,000 fish in 2005. Very few of the fish caught were older than age 40, but all age groups age 1 to 38 were well represented in the sample. [Editor's Note: Female sturgeon in Lake of the Woods spawn at intervals of 4 to 9 years (T. Mosindy, pers. comm. 2007)]

The same factors responsible for decline of the sturgeon populations also pose obstacles to population recovery. To foster sturgeon recovery a committee consisting of representatives from OMNR, MDNR, Rainy River Fist Nation, and Voyageur's National Park developed a "Border Waters Lake Sturgeon Management Plan" (OMNR and MDNR 1996). Since its release in 1996, this plan has provided the direction for sturgeon assessment and work in the border waters. It outlined management priorities and costs, and set up an implementation schedule. Its goal was: "*To re-establish and maintain self-sustaining stocks of lake sturgeon in all suitable habitat in the Minnesota-Ontario border waters. These stocks should provide for subsistence and limited commercial and recreational fisheries, with opportunities to encounter large trophy fish (> 183 cm).*" (***Slide 15***).

Because sturgeon populations can respond dramatically to habitat remediation, the first tasks were to identify and prioritize habitat needs and the steps needed to address them (***Slide 16***). The identification of past, present, and potential spawning habitat was the first priority. This was accomplished through assessment research and consultations with long time residents, particularly First Nations resource users. The Rainy River First Nation has taken a lead role in sturgeon habitat rehabilitation. Under the Rainy River Watershed Stewardship Program it has successfully rehabilitated spawning habitat on the Sturgeon River. It has also improved habitat conditions at a number of smaller Rainy River tributaries by encouraging better agricultural practices, such as keeping cattle out of the streams.

Flow in many of the border waters is now regulated by water control structures. Both the quantity and quality of spawning and rearing habitat is directly affected by fluctuations in water levels and flow rates. In the Rainy River, for example, low flow conditions combined with the biological oxygen demand of organic materials deposited in the river can lead to a reduction in the dissolved oxygen content of the water. Maintaining stable water levels and flow conditions is important for sturgeon,, particularly during the spawning and incubation period from 1 May to 30 June. It is also important to establish minimum flow rates, particularly at the three major spawning sites on the Rainy River, below the Calm Lake Dam on the Seine River, and below Squirrel and Kettle Falls at the outflow of Namakan Lake into Rainy Lake (***Slide 17***). The committee works closely with the Rainy Lake Board of Control and Lake of the Woods Control Board to recommend favourable flow rates over these areas during these critical periods. Studies have been conducted to identify minimum flow requirements and to look at the impacts of peaking flows on critical habitats. Peaking flow remains an outstanding issue with respect to sturgeon recovery.

Evidence of population recovery was followed closely by demand for increased harvest opportunities (***Slide 18***). Lake sturgeon can only support limited harvests; primarily due to the species' limited reproductive capacity. Control of exploitation is essential for population recovery. The commercial fishery in Ontario waters expanded rapidly in the 1980s as equipment was modernized, but harvests were capped at 5,800 kg/y. This harvest level was maintained until 1995, when there was a buyout of non-native commercial licenses on Lake of the Woods. Since then, commercial licenses have been bought out on Rainy and Namakan lakes. Subsistence fishing continues on the Rainy, Seine, and Namakan rivers and on Lac la Croix. The only remaining commercial licence is held by the Rainy River First Nation. It has been held in moratorium since 1995 to speed recovery efforts.

A large sport fishery has grown up on the Minnesota side of the Rainy River. Current harvests of this growing fishery are estimated at 5,000 kg/y. The committee has recommended closure of both the sport and commercial fisheries from May 1 to June 30 to protect spawning fish (***Slide 19***). It has also recommended changing the catch and possession limit from 1 sturgeon/angler/day to 1 sturgeon/angler/y, and the implementation of sturgeon tag or licence system to facilitate enforcement of this regulation. To afford greater protection to large mature fish, particularly females, upper size limits were also recommended. Various size-limit prescriptions were evaluated, and a harvest slot size of 114 to 140 cm was recommended as optimal for maintaining the largest number of reproducing adults in the population (***Slide 20***). Since then, Minnesota has incorporated all of these changes into its sturgeon angling regulations, and will be introducing sturgeon harvest tags in the spring of 2006. Ontario is considering implementing similar regulations as part of the current effort to streamline of angling regulations throughout the province.

The management plan also addressed the issue of stocking sturgeon from hatcheries or by moving wild fish from other areas (***Slide 21***). The committee recommended that: 1) most populations within the border waters area be managed for natural reproduction, 2) supplemental stocking be avoided where populations are already reproducing naturally, 3) stocking products come from local populations to protect genetic integrity of populations within a watershed, and that 4) stocked fish be marked to enable follow-up assessment of stocking success.

The committee's work has benefited from a standardized approach to assessment (***Slide 22***). Such an approach would benefit recovery efforts in other areas. Working together as an interagency group the committee has also been able to prioritize areas for joint study and to pool resources of collaborative projects. They meet regularly to exchange information and use standardized sampling protocols, gear, and equipment. A gear inventory has been established that is transferable among jurisdictions, as has a tagging inventory.

One of the highest priority items identified in the recovery plan was the need for a communications plan to educate public about the past importance of the lake sturgeon, its life history, status, and requirements for population recovery ***(Slide 23***). Fact sheets and an information brochure were prepared and distributed to disseminate this information. These communications have served the recovery process well and continue to do so.

Questions (Q), Answers (A), Comments (C), and Responses (R):

C: This group should consider what the makeup of a perfect recovery committee might be.
Q: How were fish marked?
A: Fish are tagged with numbered Floy tags that are attached with monel wire beneath the dorsal fin, and last well.
Q: Are you weaning off stocking, and is there some indicator being used as to when this should occur?
A: We have relied almost entirely on natural reproduction, with the exception of a ceremonial release of some fry by the Rainy River First Nation's soon after they first successfully hatched out fish.
Q: Are recent changes in recruitment related to changes in BOD (***Slide 13***)?
A: No. They are likely a sampling artefact related to bias of the gear toward larger fish. Successful reproduction is occurring annually, and has occurred annually since ca. 1969.
Q: Why is the hatchery operating when recovery efforts are focusing on natural reproduction?
A: It supplies products for stocking other areas such as the Red River basin in Minnesota and Winnipeg River downstream of the Norman Dam. It also has value as a tourist attraction and educational facility.
Q: How have recovery efforts, such as managing water flows, affected other species?
A: Management has likely benefited other species overall, but there will be some trade-offs.
Q: How does current population estimate of about 50,000 compare with the historical population?
A: It is likely only a small fraction of the original population, considering its annual yield in the 1890s. The annual harvest of 800,000 kg would have represented 40,000 fish weighing 20 kg apiece. We are currently examining whether Couchiching Falls was an historical barrier to sturgeon movement. If not, then historically the sturgeon population would have been able to access resources in a much larger area.

2.7 Lake sturgeon status and management in Québec waters of the St. Lawrence River

Pierre Dumont, Ministère des Ressources naturelles et de la Faune du Québec, Longueuil, QC.

Pierre described work by a team of biologists, wildlife technicians, and engineers on sturgeon in Quebec waters over the past 25 years. An English summary paper of this work, most of which is only available in French, was provided to workshop participants and is appended (***Appendix 9***). Workshop participants were encouraged to contact the authors for additional information. The presentation first put the populations in historical context and then described their biology, limiting factors, efforts to conserve and improve habitat, and the future of these populations (***Appendix 10: Slide 2***).

There are two genetically different populations of sturgeon in Quebec, one in the eastern James Bay area, the other in the St. Lawrence (***Slide 3***). Use of the James Bay population is reserved for First Nations under the *James Bay Agreement*. Fish in this population are slow-growing relative to those in the St. Lawrence. The St. Lawrence population has been heavily exploited for over a century with yields of over 1.5 kg/ha, and annual landings of 15,000 to 30,000 fish (***Slide 4***). Increasing demand for sturgeon products in the 1980s, particularly for export to the New York market, led to a need for better information on the biology and habitat requirements of these sturgeon populations and for conservation measures (***Slide 5***).

There are no dams on St. Lawrence from Lake St. Louis near Montreal to Quebec City, just upstream of the brackish waters (***Slide 6***). The distribution of Atlantic sturgeon (*Acipenser oxyrinchus*) extends to and overlaps that of the lake sturgeon in the upper estuary, between Lac Saint-Pierre and Orleans Island downstream of Quebec City. The Lake St. Francis population, upstream, is shared with Ontario and the USA and was almost lost due to dam construction at both ends of this widening of the St. Lawrence River. Sturgeon habitat in the Ottawa River has been fragmented by dams and these populations will be discussed by Tim Haxton of OMNR.

Fish in the St. Lawrence have a high growth rate and long life cycle (***Slide 7***). They live up to 96 y and grow to 90 kg. The median age at first maturation for females is age 26. Mature males spawn at intervals of 1 to 3 years and the females may spawn at intervals of over 4 years. Fecundity is high, >12,000 eggs/kg, or 180,000 eggs for an “average” female of 130 cm.

Extensive studies of juvenile diet have been undertaken to identify habitat characteristics so that these habitats can be protected from dredging projects along the river (***Slide 8***). The juvenile diet is very diverse. It includes over 74 invertebrate taxa, at least 50 of which have a rate of occurrence of over 5%. Lake and Atlantic sturgeon prey on the same invertebrates but in inverse proportions. There is little overlap of feeding habitats, since the Atlantic sturgeon feed primarily in the estuary. The juvenile lake sturgeon show positive selection for drifting prey, mainly amphipods. They feed over the bottom, not on the bottom. There is a high occurrence of plant debris in their diet but the biological significance of this is unknown. Zebra mussels (*Dreissena polymorpha*) are consumed but not selected for. The density of benthic invertebrates in the St. Lawrence River is high (~2,400 organisms/m²) compared to that in the Mattagami and Groundhog rivers (< 100 organisms/m²).

Over 15,000 sturgeons have been tagged (***Slide 9***). Fish movements are restricted except during spawning. In the St. Lawrence, the largest fish are found furthest upstream (***Slides 10 and 11***). This may be explained by fish spawning mostly near Montreal, the young drifting downstream, and then gradually working their way back upstream as they approach maturity. Spawning habitat is limited (***Slide 12***). The Rivière des Prairie spawning ground, which is located downstream of a Hydro Quebec dam site, has been described in the literature (***Slide 13***). In the 1990s, during the spawning period, sturgeon abundance decreased from more than 9,000 fishes of which 1,135 were spawning females, to about 4,200 fishes of which about 500 were spawning females. A large spawning area (3.6 ha) was identified recently in the Lachine Rapids (> 12 sq. km) offshore Montreal with the cooperation of the Mohawk people of Kahnawake (***Slide 14***). A stratified random sampling program was used over a two year period to identify the spawning site. Eggs were collected using concrete blocks placed on the bottom and wrapped in furnace filter material. This is the first large spawning ground identified in the St. Lawrence proper. All of the other known sites are in the tributaries. These smaller sites have anywhere from a few to about 300 spawning fish.

The spawning period is earlier in the tributaries (2nd to 4th wk of May @12-17°C) than in the St. Lawrence (4th wk of May to 3rd wk of June @ 11-14°C) (***Slide 15***). Current on the spawning grounds ranges from 0.1 to 1.9 m/s, depth from 0.1 to at least 6 m, and substrate from fine to medium-sized gravel to boulders. Larval drift is observed over a 14 to 40 day period, from the 3rd week of May to the 3rd week of June. Recruitment occurs annually but is highly variable (***Slide 16***). Year class success has been correlated with hydrological and thermal factors during the period of incubation and larval drift. Catching age 0 and age 1 fish, using multi-mesh nets and trawls, has proven difficult.

Key anthropogenic factors limiting the St. Lawrence populations include habitat fragmentation, water pollution, and overexploitation (***Slide 17***). Until the 1960s sturgeon from the St. Lawrence River population had access to the Great Lakes. Now their habitat in the St. Lawrence watershed is fragmented by over 100 hydroelectric dams (***Slides 18 and 19***). Fishways, such as the Vianney-Legendre Fishway on the Richelieu River are only a partial solution (***Slide 20***). This structure, which has operated since 2001, allows passage of sturgeon up to 150 cm long. It is used by 35 fish species. Fish ladders are not a good method of habitat compensation; rather they are used to mitigate the effects of pre-existing projects. Since the mid-1980s efforts to construct new hydro projects on the St. Lawrence have been blocked, and the intention is to block future proposals (***Slide 21***).

Management of the St. Lawrence River sturgeon fishery relies on the issuance of a limited number of commercial licences for specific areas to ensure that the fish have sanctuaries where they are not harvested (***Slide 22***). Sport fishing is not important at present but there is increasing interest. Fishing is directed at sub-adults, age 20 to 25. Historically the management strategy was to harvest less than 10% of the subadult population annually, and to protect spawners through the use of highly selective gears (20 cm gill nets) and closed seasons. The initial sturgeon management plan that was developed ca. 1987, failed to stop overfishing (***Slides 23 and 24***). Declines were also observed in the catch-per-unit-effort of legal-sized sturgeon, the contribution of younger fish in the commercial catch, and year class strength (***Slides 25 to 27***). At the Rivière des Prairies spawning ground the number of spawning females decreased from 1,200 to less than 500 over a 5 y period (***Slide 28***). In 2000, a new management plan was implemented. It was designed to progressively reduce the annual harvest from 200 tonnes in 1999 to 80 tonnes (~10,200 fish) in 2002 (***Slide 29***). Fishermen were given individual quotas of tags. The fishing season, which had already been moved away from the spawning period, was shortened to reduce mortality during the warm summer period ***(Slide 30***).

Over the past 25 years efforts have been made to protect and improve the quality of sturgeon habitat (***Slide 31***). These efforts included the restoration of spawning beds in the des Prairies, Ouareau, Saint-Maurice, Saint-François and Saint-Lawrence rivers, new water regulation criteria, dredging project management, and the reduction of toxic loading. Habitat improvement downstream of the 50 MW Rivière des Prairies hydro station consisted of an 8,000m² enlargement of the spawning bed in mid-channel using stone from construction, and the optimization of spillway discharges to both support spawning and reduce night poaching from the shore (***Slide 32***). Since this work was completed and quotas were reduced the survival rate and number of larvae in the river have increased (***Slide 33***). Efforts to create a spawning ground downstream of the Beauharnois Hydro station were unsuccessful, likely because of high periphyton growth in the spring that interferes with egg deposition (***Slide 34***).

A predictive habitat model incorporating biological processes and a two-dimensional hydrodynamic model suggests a positive relationship between increased flows and lake sturgeon (***Slides 35 to 37***). Chemical contaminants may affect lake sturgeon but the effects are difficult to determine. Fish in the Rivière des Prairies had a moderate to severe liver pathology (adults), a higher prevalence of fin deformities (larvae), and lower concentration of liver and intestinal retinoids (adults) than those at a reference site (***Slide 38***). In the L'Assomption River a marked increase in larval production was observed the year after waste water treatment began (***Slide 39***). This coupled with strong year classes in recent years, increasing abundance of subadult fish in Lac Saint-Louis, and positive comments from fishermen are encouraging signs that the sturgeon population is recovering (***Slide 40***).

To continue this process it will be important to prevent further fragmentation of sturgeon habitats in the St. Lawrence River, to intensify efforts to reduce pollution in the Great Lakes and St. Lawrence River system, and to continue and enforce conservative management practices (***Slide 41***). Work must also be continued to improve habitat and knowledge of the biology of this population, and it must be continued over many decades.

Questions (Q), Answers (A):

Q: What two dimensional hydrodynamic model was used in the predictive habitat model?

A: The model was developed in Quebec City by Jean Morin of Environment Canada and Michel Le Clair of the Institut nationale de la recherche scientifique (INRS).

2.8 Factors affecting lake sturgeon in a large fragmented river

Tim Haxton, Ontario Ministry of Natural Resources, Kemptville, ON

Tim presented a study he has been working on for the past 3 or 4 years in cooperation with Scott Findlay of the University of Ottawa (***Appendix 11 Slide 1***). The objectives of the study are to determine: 1) what explains the most variation in lake sturgeon abundance among river reaches in a fragmented river, and 2) the effects of different water management regimes on lake sturgeon (***Slide 2***). The study is taking place in the Ottawa River (***Slide 3***). The river is a relatively large waterbody. It extends about 1,200 km upstream from the St. Lawrence River, with a watershed area of 146,000 km², depths of up to 150 m, widths of up to 3 km, and mean annual flows of 1,900 to 2,000 m³/s. The lake sturgeon is believed to have colonized the river from Lake Huron following the retreat of the Wisconsin Glacier.

The lake sturgeon was abundant in the Ottawa River (***Slide 4***), but large harvests in the 1890s and early 1900s reduced the population (***Slide 5***). The river is managed by the Federal Government and the provinces of Ontario and Quebec, which makes it difficult to obtain all of the commercial harvest data and form a clear picture of the fishery. The current commercial fishery takes between 700 and 1,200 kg of fish annually. Development on the waterbody began in the 1880s with the construction of pulp and paper mills and sawmills, and expansion of the City of Ottawa along the shoreline (***Slide 6***). Historically, industrial and municipal waste effluents were discharged into the river. This practice was not addressed until the 1970s. The establishment of numerous hydroelectric dams starting ca. 1925 also caused significant changes to sturgeon habitat in the Ottawa River (***Slide 7***).

The influence of these three main stressors, namely commercial harvest, contaminants and waterpower management, on sturgeon abundance was assessed (***Slide 8***). Relative abundance was determined using trapnets (1.8 and 2.4 m), following the Nearshore Community Index Netting (NSCIN) protocols developed by Ontario. This involved 24 h net sets at 40 to 80 randomly chosen locations in each reach of river, in the late summer or fall at temperatures between 20° and 15°C. It was also assessed using gillnets (2.5 to 15.2 cm stretched mesh) following the Fall Walleye Index Netting (FWIN) protocols developed by Quebec. This involved 24 h sets at 24 to 48 randomly chosen locations throughout each river reach, stratified by two depths (2-5 m and 5-15 m). To address problems with gear selectivity, additional sampling was carried at spawning grounds below dams and at natural reaches, and using large mesh gillnets (17.8 to 30.5 cm stretched measure) (***Slide 10***).

In total, 325 lake sturgeon were sampled in gillnets, 446 in trapnets, and 233 on the spawning grounds (***Slide 11***). In some reaches 1 to 3 fish were caught per net set, while in others few were caught (***Slide 12***—upstream left). Lake sturgeon were found in all reaches of the river, but this sometimes required additional netting. Seventy-three fish were sampled for sex and maturity. The total length at 50% maturity was 113.2 cm for females (n = 36; age 20 to 25) and 105.7 cm for males (n = 37; age 18 to 20). The gillnets tended to select for small fish while the trap nets tended to catch larger fish (***Slide 13***). The lake sturgeon were completely vulnerable to gillnets at 80 cm TL and to trapnets at 82 cm TL; the gillnets caught mostly juveniles while the trapnets caught both juveniles and adults.

The catch of sturgeon per unit of sampling effort was higher in reaches that were commercially exploited than in those that were not (***Slide 14***). Screening of somatic tissues from 48 fish for mercury and a range of organic contaminants found elevated mercury and low concentrations of polychlorinated biphenyls (PCBs) and pp-DDE (***Slide 15***). No significant differences in mercury levels were found among fish populations in different reaches of the river, but there was a positive relationship between fish weight and mercury concentration (***Slide 16***). Mercury concentrations were in the mid-range of healthy North American lake sturgeon populations and are unlikely to be limiting the population. Significantly more sturgeon were captured in both gillnets and trapnets in natural reaches of the Ottawa River than in the managed reaches (***Slide 17***). This indicated that waterpower management is having a significant negative effect on the lake sturgeon populations (***Slide 18***).

To corroborate these results, the effects of waterpower management on seven reaches of the river were examined for sturgeon and seven other fish species (***Slide 19***). Results from natural reaches of the river were compared with those from reaches with winter reservoirs, where water is stored for winter use and drawn down over the winter, and reaches with run-of-the-river hydroelectric facilities (***Slide 20***). A vertical drawdown of up to 4 m occurs over the winter in the reservoirs, dewatering large areas of sturgeon feeding habitat (***Slide 21***). This exposure negatively affects benthic macroinvertebrate populations so the abundance, condition, growth, and recruitment of sturgeon populations in these areas should decline (***Slide 22***). Other benthivores (e.g., channel catfish *Ictalurus punctatus* and suckers *Moxostoma* spp.) should be similarly affected, while fish eating species should be similar to those in natural reaches. Run of the river reaches have somewhat lower spring flows and higher winter flows, but were not flooded and do not experience large winter drawdowns (***Slide 25***). While flow in the channel is relatively natural, the habitat is fragmented by the dams, which block migrations. Areas immediately downstream from the dams are subjected to variable flows and temperatures due to the peaking flow regime, whereby flows are altered in response to the demand for power. Lake sturgeon recruitment and abundance in these reaches should be lower than in the natural reaches, but growth and condition should be similar. Other fast-water spawners (lithophils) should follow a similar pattern, while nest or flooded vegetation spawners should not be affected.

In fact, sturgeon populations showed a strong negative correlation to both types of water management projects (**Slide 26**). In the winter reservoir reaches, no sturgeon were captured by the index netting and only 3 were captured by additional netting, too few for a biological assessment (***Slide 27***). As predicted the relative abundance of sturgeon in these reaches is lower than under natural conditions, as is that of another benthivore, the channel catfish. The abundance of *Moxostoma* spp. did not change as much as predicted and was similar to that of the natural reaches while piscivores were more abundant. In the run-of-the-river reaches the sturgeon abundance and recruitment were lower than under natural conditions (***Slides 28 to 30***). The size distributions were skewed toward older, larger fish, growth was about the same but the fish were in better condition than those in the natural reaches. The recruitment of other fast water spawners was also lower but not strongly skewed toward larger fish, and the abundance of other species was lower.

Variations in the abundance of sturgeon in the Ottawa River can be explained by waterpower management (***Slide 31***). The observed differences were consistent with the predictions, namely that abundance in the winter reservoir reaches is limited by the negative effects of drawdown on prey availability, and in the run-of-the-river reaches by suitable spawning habitat. The negative impacts of the winter reservoirs could be mitigated by altering the water management regime (***Slide 32***). However, large alterations to this regime may be unlikely due to the important role these reservoirs play in winter power generation and spring flood control. If the regime remains unchanged managing these reaches for sturgeon is not worthwhile. Impoundments should be avoided in areas with sturgeon if their populations are to be maintained. The negative impacts of the run-of-the-river facilities could be mitigated by enhancing spawning areas and ensuring that flows are suitable during the spawning period.

As a final note, the high value of sturgeon caviar (***Slide 33***; $1,000/jar) is likely to place increasing pressure on sturgeon stocks, so biologists may need to be careful about publishing the location of spawning areas.

Questions (Q), Answers (A):

Q: Is there any sturgeon habitat upstream from the reservoirs?

A: Yes. There is a population in Lake Temiscaming that may provide stock for downstream.

Q: Are the tributary streams contributing to recruitment?

A: Most of the tributaries are dammed. There are about 43 dams on the Ottawa system. Spawning may occur in the Gatineau River; otherwise most of the main spawning areas that have been located are in the Ottawa River.

Q: Has hydro development altered the Madawaska River?

A: It has altered the Madawaska River. Sturgeons were found there historically but are not found there now. The river may not have been prime habitat.

Q: Have temperature effects been observed on sturgeon from the reservoir discharges?

A: There is a hypolimnetic draw from some of the upstream dams. There is slower growth below these dams but it does not appear to affect recruitment. High flow has a greater effect on the spawning grounds, which will be abandoned and revisited as late as early July—normally spawning occurs from the last week of May until mid-June.

Q: Can you define what is meant by "run-of-the-river?

A: A hydro facility that operates in equilibrium, whereby flows above and below the facility are essentially equal. [Editors Note: Like peaking facilities, run-of-the-river dams typically impound water upstream to create the hydraulic head necessary for power generation. They do not, however, alter the seasonal flow regimes or rely on draw-down of large upstream reservoirs to meet flow requirements for winter power generation.]

2.9 Lake sturgeon management – Lake Winnebago system, Wisconsin

Ron Bruch, Wisconsin Department of Natural Resources, Oshkosh, WI.

Ron described how sturgeons are managed in the Lake Winnebago system of Wisconsin, and provided copies of Bruch (1999). There is a winter spear fishery for lake sturgeon in Lake Winnebago (***Appendix 12; Slide 1***). The life history characteristics of the Lake Winnebago population are similar to those reported from other areas (***Slide 2***). Females have a life expectancy of about 100 y, mature at age 20 to 25, and spawn intermittently thereafter at intervals of 3 to 5 y. Males have a life expectancy of about 40 y, mature at age 12 to 15, and spawn every 2 y, although fish in good condition sometimes spawn annually. There is concern that pectoral fin readings may be significantly underestimating the age of these fish.

Wisconsin is in the middle of the North American lake sturgeon distribution. It has good sturgeon populations in lakes Superior and Michigan/Green Bay; in the St. Croix, Mississippi, Chippewa, Flambeau, Menominee and Wisconsin rivers. There are fall angling fisheries in the last four rivers (***Slide 4***—blue), and the Lake Winnebago system supports a winter spear fishery. Lake Winnebago (56,000 ha) supports one of the largest lake sturgeon populations in North America (***Slide 5***). The river downstream draining Lake Winnebago into Green Bay drops about 42 m (140') in elevation in about 66 km (40 mi). Historically it descended in a series of rapids which have been replaced by 14 or 15 dams. The annual spear harvest begins in mid-February and lasts either 16 days or until the harvest cap is reached, whichever comes first. The harvest cap is based on population size, with a maximum exploitation rate of 5% and caps for adult females, juvenile females and males. In the upstream lakes, there was a 2 day season every 5 years. This is being changed for 2007 to an annual lottery with a limit of 500 tags.

There are four legs to the management program, the population harvest assessment, habitat management, public involvement, and law enforcement (***Slide 6***). The population assessment/spawning stock assessment takes place at about 50 sites on the Wolf and Fox rivers. Data have been collected annually on the size distributions, sex ratios, spawning interval, spawning stream and site fidelity, and spawning migration patterns over the periods 1954-64 and 1975 to the present. The fish come close to shore and are easy to capture using dipnets, or to observe for behaviour. Behavioural observations have been published in Bruch and Binkowski (2002). Spawning adults are tagged when they are captured; typically about 1,500 fish are tagged annually and a long-term tag-recapture database has been developed. Males will spawn more than once during a spawning year. After spawning the first time they will wait on the spawning grounds for up to a month to spawn again, and may also do so at other locations as they return to the lake. Eggs are taken for lake sturgeon recovery and research programs in other states (***Slides 8 and 9***). This is done manually, using the "Bruch stroke", rather than surgically by caesarean section as was the practice in the past (***Slide 9***).

Tagging studies, using sonic and radio tags, have shown that fish preparing to spawn in the spring leave the lakes the previous fall to stage in the rivers (***Slide 10***). This changes the sex ratio of the fish that remain in Lake Winnebago such that more females are vulnerable to the winter spear fishery (i.e., ¾ of the females remain in the lake and only ½ of the males). This makes it important to know where the fish are at different times of the year. Sturgeon fingerlings that were stocked in the upper Fox River moved downstream quickly at water temperatures > 1-2°C, but slowly in colder water. This may have important implications for imprinting sturgeon on particular reaches of river so they will return to spawn. Russian literature suggests that imprinting may occur at first feeding. Stream-side rearing, whereby fish are reared in the water of the stream where they are to be released, is also being tried in Wisconsin tributaries of the Great Lakes to try and imprint fish on particular tributaries.

VEMCO data loggers are being used to track pre- and post-spawning movements and distribution of tagged sturgeon (***Slide 11***). Adult fish (n = 51 in 2004, n = 91 in 2005) have been tagged using surgically implanted tags that transmit for 4 to 5 y, juveniles (n = 50) with smaller, shorter-lived tags (80-120 d). This study will yield useful information on spawning periodicity. Much of this equipment was provided by a local sportsman's club.

Harvest data are available from 1941 onwards (***Slide 12***). Before mandatory registration came into force in 1955 the annual harvest was estimated from creel census data; after 1955 the harvest data are based on actual counts. Data have also been collected since 1955 on spearer demographics and fishing effort and, since 1991, on the sex and maturity of harvested fish (***Slide 13***). Following the spearer demographics is important as their licence fees pay for management of the fishery. The sex and maturity data enabled managers to verify that the adult females were being overexploited.

The habitat management component has focussed primarily on spawning site development (***Slide 14***). There are some natural sites, such as the "Cowyard Ribs" on the Embarrass River, but most sites are manmade. Fish will use manmade sites that have a water velocity of about 0.5 m/s and the proper substrate. The best sites have lots of interstitial areas in the rock substrate and are adjacent to relatively deep water where the fish can stage before spawning. “Eureka Rapids” is an example of a manmade site that is well used.

“Sturgeons for Tomorrow” is a citizen’s advocacy group that was formed in 1977 to promote sturgeon management and propagation, and to protect fish from poaching (***Slide 15***). The group was originally formed to promote fish stocking but their efforts have since been directed more towards habitat rehabilitation and public education, as the value of stocking is limited if the habitat is not suitable. The stock is managed in cooperation with the Winnebago Citizen’s Sturgeon Advisory Committee, an alliance of representatives from about 30 fishing, hunting, and conservations groups in the region. There is also a volunteer sturgeon guard program in the spring to protect spawning fish.

A project is also underway to document the history of sturgeon fishing in the Lake Winnebago area (***Slide 16***). Prior to 1903 the sturgeon fishery was unregulated; an 8 lb (3.6 kg) minimum size limit was introduced in 1903; and all harvest was banned in Wisconsin between 1915 and 1931 (***Slide 17***). Harvesting was permitted with set lines from 1932-51 on the 3 smaller lakes upstream, on the river using hook and line from 1932-59, and in Lake Winnebago using spears since 1932.

Key management issues are assessing the stock and harvest, protecting and enhancing habitat, maintaining annual exploitation at 5% or less using regulations and law enforcement, and working with the public to make the program work (***Slide 18***). Liberal harvest regulations allowed the stock to be overexploited in the 1950s (***Slides 19 and 20***). Tightening up of the regulations late in the decade helped reduce harvests as did poor water quality conditions. High turbidity and algal growth in the 1960s to 1980s resulting from point-source pollution (e.g., septic system failures) clouded the water making the fish difficult to see and spear (***Slide 21***). This led to excellent growth of the sturgeon population. In the 1990s the lake waters cleared as measures to reduce pollution took effect and record harvests were taken (***Slide 22***). Nearly half of the harvest was composed of adult females due to a high minimum size limit which was raised from 102 cm (40”) to 114 cm (45”). By the1990s few fish over 45.4 kg (100 lbs) were taken annually, and the public value of the fishery was devalued as the effort required to harvest fish increased (***Slide 23***).

The Winnebago Citizen’s Sturgeon Advisory Committee was formed in 1992, in response to these declines in the fishery (***Slide 24***). Since then its members have worked to developed 17 new rules and laws, in particular those to: 1) prohibit angling in a spearing shack (1993); 2) reduce the minimum size limit to 91 cm (36”), 3) implement a harvest cap whereby the season is closed 24 h after 80% of any one of three pre-set harvest caps is reached (1999), 4) reduce the spearing day by 66% (2002), 5) increase the annual spearing license fee $20 for residents and $100 for non residents (from $10 and $50, respectively; 2003), and 6) ensure that all spearing license funds be used only for the Winnebago sturgeon program (2003). These regulatory changes have reduced the overall exploitation (***Slide 25***), shifted the sex ratio of the harvest towards males (***Slide 26***), and increased the proportion of large fish (> 45 kg or 100 lbs) in the harvest and at the spawning grounds (***Slides 27 and 28***).

New rules were passed in 2006-07 to enable immediate closure of the Lake Winnebago winter spear fishery if the harvest cap is reached, and to implement an annual lottery fishery limited to 500 tags in the lakes upstream (***Slides 29 and 30***). Future plans are to continue standardized population and harvest estimates, inventory and evaluate spawning habitat, determine seasonal movements and habitat use areas (natural vs. stocked), and to continue with strong enforcement (***Slide 31***). Managers will continue to work closely with the citizen's advisory group and to document the history of the Lake Winnebago sturgeon fishery.

There is also a need to validate aging techniques, since current data indicate that age estimates based on pectoral fin rays significantly underestimate the age of the sturgeon (***Slide 32***). Bomb calorimetry will be used to examine the otolith cores for carbon-14 released in the 1950s by bomb testing. The maximum annual exploitation rate also needs to be re-evaluated to determine whether 5% is appropriate. Exploitation rates of over 10% are definitely too high. There is also the need to explore other methods for estimating population size, to reassess the average size of maturity for females, and to examine long term trends in growth and condition factor.

The two main population management goals are to maintain: 1) a robust and healthy sturgeon population and 2) a traditional and viable sturgeon spear fishery (***Slide 33***). These goals are closely linked to one another.

Questions (Q), Answers (A):

Q: What level of mortality is associated with the spear fishery and why is there a spear fishery?

A: Spearing was the preferred method. It was picked up by European Settlers from the Aboriginal peoples and continues today. Few fish pull off the spears, so there are few losses. When size limits were higher between 10 and 30% of the small fish were kicked off the spears. Lowering the size limit has effectively eliminated this practice.

Q: The lake was turbid with algal blooms in 1960s to early 1990s. Was this caused by point source or non-point source pollution? Were invading zebra mussels responsible for helping to clarify the water?

A: About 90% of the pollution was from non-point sources. The water cleared before the zebra mussel invaded ca. 1998. The zebra mussel population has exploded and may help to maintain water clarity. Simultaneously, there was a crash in the chironomid (midge) population and a decline in the condition of the sturgeon. The relationship between these changes and the zebra mussel population has not been examined.

Q: Why are hook and line fisheries not allowed in the fishing in shanties?

A: When the water was turbid some fishers were using dead gizzard shad as bait to hook sturgeon so they could pull them up and spear them. This led to higher than normal harvests and was banned for that reason.

2.10 Manitoba Hydro and lake sturgeon

Shelley Matkowski, Manitoba Hydro, Winnipeg, MB

Shelly described work that Manitoba Hydro has been doing on the lake sturgeon. The mandate of this Crown Corporation is to provide for the continuance of a supply of power adequate for the needs of the province and to promote economy and efficiency in the generation, distribution, supply and use of power (***Appendix 13: Slide 2***). As part of its sustainable development policy the corporation is committed to protecting essential ecological processes and biological diversity (***Slide 3***). Conservation and recovery of lake sturgeon is of particular interest to Manitoba Hydro, since the species occurs in a number of waterbodies that form the basis for Manitoba's hydroelectric generation system (***Slide 4***).

Manitoba Hydro has six generating stations on the Winnipeg River that were developed in the first half of the 20th century (***Slide 5***). There is a thermal generating station at Brandon, on the Assiniboine River, and another at Selkirk on the Red River. The Grand Rapids hydro site is located at the outlet of the Saskatchewan River into Lake Winnipeg and there are five more generating stations on the Nelson River, which drains Lake Winnipeg into Hudson Bay. They were developed in the latter half of the 20th century. There are plans to develop several more stations on the Nelson River system: Wuskwatim, Conawapa, and Keeyask (***Slide 5***—blue dots). The upper Nelson extends from Lake Winnipeg downstream to the Kelsey Generating Station (GS); the middle Nelson extends from there downstream to the Kettle GS, including Split and Stephens lakes; and the lower Nelson, which extends from the Kettle GS downstream to Hudson Bay. The two newest generating stations, Long Spruce and Limestone are located on the lower Nelson. On the Churchill River system, there are two small generating stations on the Laurie River, and several control structures (***Slide 5***—blue triangles). Sturgeon research has also been conducted on the Gods, Hayes, Fox, and Pigeon rivers.

Manitoba Hydro has participated in sturgeon studies since the 1980s (***Slide 6***). It has funded research and development, participated in sturgeon management boards, incorporated sturgeon studies as a component of post-project monitoring studies (Limestone), and as a component of environmental baseline studies for future developments—primarily at Keeyask and Conawapa.

Lake sturgeon population studies have focussed primarily on locating spawning areas, following movements and estimating abundance using mark-recapture, and on following seasonal movements using acoustic and radio telemetry (***Slides 7 to 11***). Some of this work has been conducted through funding to the Nelson River Sturgeon Co-management Board (NRSB); the rest has been conducted by environmental studies programs associated with existing or planned hydro facilities—much of it since 2001. Work has been conducted in the upper Nelson River between Sipiwesk Lake and the Kelsey GS; at Split, Gull, and Clark lakes; in the Stephens Lake and Gull Rapids area; in the lower Nelson including the Long Spruce and Limestone reservoirs and the river downstream of the Limestone GS; in an isolated reach of the Fox River between Great and Rainbow falls; in the lower Hayes River to locate fish moving from the Nelson River; Burntwood River; in the Churchill River near the mouth of the Little Churchill River; and in the Saskatchewan River, in cooperation with the Saskatchewan River Sturgeon Management Board

(SRSMB). Research and development programs conducted by Dr. Terry Dick in the Pigeon and Winnipeg rivers were also supported.

Harvest studies conducted in the Nelson River by the NRSB and in the Saskatchewan River by the SRSMB have been funded by Manitoba Hydro (***Slide 12***). It has also funded or supported habitat and habitat utilization studies in the Pigeon (T. Dick), Winnipeg (T. Dick and S. Peake), Saskatchewan (SRSMB) and Assiniboine (M. Abrahams) rivers, and on the upper (NRSB) and lower Nelson River (Keeyask, Limestone, and Conawapa studies).

Sturgeon enhancement work has involved the collection of eggs from fish in the Landing and Weir rivers for culture by the NRSB and also collection of eggs for the SRSMB (***Slide 13***). Manitoba Hydro has supported the culture of sturgeon by the provincial hatcheries at Grand Rapids and in the Whiteshell for the NRSB, SRSMB and S. Peake, and stocking programs on the upper Nelson, Saskatchewan, Winnipeg, and Assiniboine rivers. Academic research into sturgeon culture and culture techniques, juvenile behaviour following stocking, swimming performance, fish passage, and habitat preferences has also been supported (e.g., S. Peake) (***Slide 14***). Manitoba Hydro has provided funding and assistance to the NRSB and SRSMB, and is actively participating in the new Winibiig Ziibi Numao Board (WZNB) (***Slide 15***).

The past 20 years have seen some positive developments. The sturgeon management boards have been created; more information is available on sturgeon distribution and abundance and on the condition of sturgeon populations, and some critical habitats have been identified (***Slide 16***). New information is available of the species' life history requirements and behaviour, culture techniques have improved, populations have been enhanced through stocking, and public awareness of the importance and vulnerability of sturgeon has grown (***Slide 17***). Manitoba Hydro recognizes that this work must continue. It plans to continue work related to developing new facilities and operating existing facilities in a manner consistent with sustaining lake sturgeon populations (***Slide 18***). The corporation plans to continue participating in sturgeon management boards, culturing sturgeon at the Grand Rapids Hatchery, supporting academic research, and improving public awareness through programs like the sturgeon in the schools program (***Slide 19***).

Questions (Q), Answers (A):

Q: The NRSB has been ongoing for 10 y. Why did hydro not start collecting baseline data on sturgeon earlier? Where is the information that has been collected?

A: The studies for Conawapa and Keeyask have involved about 5 years of work and the data are still being analyzed. Population estimates are being worked out now. Hydro doesn't start baseline studies for its projects until those projects reach a certain stage in the planning process.

Q: Why was so little data presented? Does hydro not have data of its own to present? For example, what about the lower Hayes?

A: It would have taken too long to present all the data. During index netting in the lower Hayes River in 2005, 26 sturgeons were tagged and many more juveniles were captured. It is too early yet for a population estimate.

2.11 Lake sturgeon research at the Canadian Rivers Institute Manitoba Field Station: past, present and future

Steve Peake, Canadian rivers Institute, University of New Brunswick, Fredericton, NB.

Steve described research and plans for future research on lake sturgeon behaviour, physiology and biochemistry, habitat use and ecology on the Winnipeg River system. He is one of a group of professors at the University of New Brunswick that constitute the Canadian Rivers Institute (CRI). The institute's mandate is to carry out multi-disciplinary basic and applied research focusing on river ecosystems, including their land-water linkages, for the purpose of conservation and habitat restoration (***Appendix 14: Slide 2***). More information is available on the internet at http://www.unb.ca/cri .

The CRI has a field station on the Winnipeg River, near Pinawa, Manitoba (***Slide 3***). Past research projects there have included work on a variety of topics. Studies of the substrate preferences of juvenile lake sturgeon showed they had a strong preference for sand substrates (***Slide 4***). Studies of vulnerability to DDAC, a fungicide commonly used by the forest industry, found that sturgeon had a mortality curve for this contaminant (***Slide 5***). The reaction of sturgeon was similar to that of walleye (*Sander vitreus*) but they were more vulnerable than northern pike (*Esox lucius*). The LC_{50} of about 0.5 mg/l was quite concentrated so problems are not expected with this chemical.

The locomotory performance, behaviour and physiology of fish in relation to their passage through fishways and culverts have also been studied on species such as walleye and smallmouth bass (*Micropterus dolomieui*) (***Slide 6***). In the fishway, a 180° turn discouraged about 50% of the walleye from passing upstream. Laboratory estimates of swimming performance for smallmouth bass significantly underestimated their swimming performance in a real fishway (***Slide 7***).

Blood chemistry studies have been undertaken on sturgeon to assess their stress level after they are captured by gillnet or tagged with a Floy tag (***Slide 8***). Levels of cortisol, glucose, and lactate were elevated following capture by gillnet, but less than for salmonids (***Slide 9***) These stress indicators returned to normal within 3 days after capture. The impacts of suspended sediment on stress and behaviour have been studied in **mesocosms** using Johnny darters (*Etheostoma nigrum*). Studies of the use of natural food sources for sturgeon rearing found that feeding sturgeon fry blackfly larvae (F. Simuliidae) for 2 to 3 weeks facilitates the transition from brine shrimp and bloodworm (***Slide 11***).

Funding from Manitoba Hydro has enabled the CRI to begin a number of new projects. One of these is a study of the impacts of habitat and hydraulics on the survival, growth and behaviour of age 0 and 1 lake sturgeon. Mesocosms are being used to study how substrate type and turbidity affect egg adherence at a given velocity, how water velocity affects egg adherence on a given substrate, and whether adherence is necessary for egg development (***Slide 12***). CRI is also examining how substrate type and turbidity affect survival of yolk-sac fry and their ability to transition to exogenous feeding, and how substrate type and water velocity affect drifting behaviour of yolk-sac larvae (***Slide 13***).

The ecology of and habitat use by juvenile lake sturgeon in the Winnipeg River will be studied by Cam Barth (***Slides 14 to 21***). Various techniques will be used to quantify benthic habitat and habitat use, including standard techniques such as benthic dredges, benthic sleds with various types of mounted equipment, remotely operated video cameras, time lapse photography, and mark-recapture techniques. Another study will examine the swimming performance and locomotory behaviour of the lake sturgeon in fishways and culverts, using the raceway and fish ladder in the Pinawa Channel (***Slides 22 and 23***). Changing baffle types and configurations will be manipulated to learn how best to facilitate sturgeon passage around a large dam in an engineered structure. In the future, with funding from Manitoba Hydro, there are also plans to examine the ecology of and habitat use by adult lake sturgeon using acoustic telemetry (***Slide 24***).

The effectiveness of hatchery stocking as a mitigative tool will be assessed as it relates to lake sturgeon conservation in the Winnipeg and Assiniboine rivers—the latter in conjunction with Dr. Mark Abrahams at the University of Manitoba (***Slides 25 and 26***). Dr. Garry Anderson at the University of Manitoba will also be taking the initial stress physiology data collected on lake sturgeon and examining it in greater detail to learn how current management practices (e.g., tagging and stocking) might be modified to minimize handling stress to sturgeon (***Slide 27***). The quantitative benefits of facilitating fish passage past dams into upstream reservoirs or of actively transporting fish past these barriers will be examined using tagged fish (***Slide 28***). Studies of habitat remediation as a mitigative strategy for enhancing sturgeon populations in the Winnipeg River are planned further in the future (***Slide 29***).

Questions (Q), Answers (A), Comments (C):

Q: When will the studies of sturgeon swimming performance begin?

A: A graduate student will begin swimming performance studies in the fish ladder in 2006 and continue with studies in the raceways in 2007. Underwater cameras will be used in both structures to follow behaviour, and physiological studies will be conducted on the fish after they pass through the structures.

Q. Are studies of the downstream passage of sturgeon planned?

A: Downstream fish passage of sturgeon may be studied in the future. North/South Consultants Inc. may be planning or conducting studies of downstream fish passage, but whether this work involves sturgeon I do not know. They are interested in the frequency of turbine-related injuries to fish. Don MacDonell, at North/South is the person to ask for more information.

C: There is a study at the Kelsey Generating Station on walleye, northern pike, and whitefish (*Coregonus* sp.).

Q: Is the whole Winnipeg River under study?

A: No. Our work is taking place mostly between Seven Sisters and Slave Falls.

Q. Are Aboriginal peoples involved in your studies?

A: At present there is little Aboriginal involvement in our work. I would be happy to talk about involving Aboriginal people.

2.12 Lake sturgeon in Alberta

Matt Besko, Alberta Sustainable Resource Development (ASRD), Edmonton, AB and Terry Clayton, ASRD, Lethbridge, AB.

Sturgeon occur in the North Saskatchewan, Red Deer, South Saskatchewan, Bow, and Oldman rivers of Alberta (***Appendix 15: Slide 2***). They occur upstream to at least Rocky Mountain House on the North Saskatchewan River, to the Oldman Dam on the Oldman River, and to Drumheller on the Red Deer River. Movement of fish from Saskatchewan was limited by construction of the Gardiner Dam on the South Saskatchewan River in 1967.

The lake sturgeon fishery in Alberta was closed to sport and commercial fishing in 1940 due to the low population (***Slide 3***). The Aboriginal harvest at that time was unknown. When the sport fishery reopened in 1968, fishermen were required to obtain a special license and could only harvest 2 sturgeons annually of any size. A minimum size limit of 90 cm was introduced in 1974, and metal tags were issued with each license beginning in 1982. The minimum size was increased to 100 cm in 1984, to protect younger age classes of sturgeon. In 1997, the special license requirement was dropped for catch and release fisheries. In 1997, limits on the South Saskatchewan River were changed to 1 fish/y between 16 June and 31 March, with a minimum size of 130 cm; the North Saskatchewan River was open year-round but only for catch and release. In 2004, both fisheries were changed to catch and release only.

Population estimates were developed for sturgeon in the Alberta portion of the South Saskatchewan in 1968, 1986, and 2003 (***Slide 4***). All three studies relied on angling, set lines and electrofishing to sample the population and estimated the populations using "bootstrapping" methodology. Haugen (1969) estimated the population at 2,900 fish in 1968; R.L. & L. (1991) estimated it at 3,700 fish in 1986; and Roger Corth (Univ. of Alberta, pers. com.) estimated the population at 4,400 fish in 2003. The confidence limits of these estimates vary, and no trend can be established from the data. The sturgeon population in the Alberta portion of the North Saskatchewan River has been estimated at 1,900 fish by Daryl Watters (ASRD Edmonton), based on angling estimates over a 9 y period.

The largest lake sturgeon reported from Alberta waters was a 48 kg (105 lb) fish taken in 1981 from the South Saskatchewan River (***Slide 5***—left panel). Large fish were still present in the river in 2001, when a 40 kg sturgeon was caught (***Slide 5***--right panel). The percentage of the sturgeon catch that was kept declined between 1974 and 2003, largely due to regulatory changes (***Slide 6***). The catch peaked in 1996, at 1500 fish, 10% of which were kept. The number of lake sturgeon angling licenses issued peaked in 1992/93 and declined gradually until 2002/03 (***Slide 7***). Each peak and valley corresponds to a regulatory change. The number of licenses issued serves as an index of interest in harvesting the lake sturgeon.

Potential sturgeon management issues in Alberta are limited (***Slide 8***). In Alberta lake sturgeon do not occur in any waters that have commercial fisheries. There are only 5 guides on the South Saskatchewan River, 2 on the North Saskatchewan River, and none on the Red Deer River. Some recreational fishers still target lake sturgeon for catch and release. There are perhaps

200 to 300 anglers on the South Saskatchewan River that fish over 5 times per year for sturgeon. There are no licensed private aquaculture facilities.

The primary sturgeon management issues are related to water quality, quantity and discharge, particularly on the South Saskatchewan River where water withdrawals for irrigation and industrial and local use can be significant. Dam construction may have limited the upstream movement of sturgeon in the Oldman River, but the species' historical upstream range is unknown.

Questions (Q), Answers (A):

Q: Why does the sturgeon distribution in the Red Deer only extend upstream to Drumheller?

A: It actually extends a bit further upstream to Big Valley. Only about 5% of the sturgeon population in the South Saskatchewan River uses the Red Deer River, so fish are only caught infrequently in the Drumheller area.

Q: Are there any barriers on the Red Deer River between the South Saskatchewan River and Drumheller?

A: There are no barriers but low water may limit fish passage

Q: How important were the First Nations fisheries along those rivers?

A: The Blackfoot Nation hunted mostly bison and made little use of fish. There may have been more use by First Nations further north and west of Edmonton.

Q: What was the size distribution of sturgeon in the population estimates and are you reconsidering the status of these populations?

A: The Alberta lake sturgeon population may be increasing, and it may be worthwhile to reconsider their status as "Endangered" in Alberta. The minimum size of sturgeon caught during the abundance sampling was about 70 cm.

Q: Are there sturgeon in the Athabasca River?

A: No.

Q: Do you have any idea of the historical size of the sturgeon population in Alberta?

A: We do not have that information for either river but we suspect that historically there were more sturgeon.

2.13 State of the resource reporting framework for lake sturgeon in Ontario

Scott Reid, Ontario Ministry of Natural Resources, Peterborough, ON

Scott described how the framework was developed for state of the resource reporting of lake sturgeon in Ontario. He discussed the context and rationale for the framework, the workshop process used to develop it, and the results of a sampling program to test the framework (***Appendix 16: Slide 2***).

The lake sturgeon is widely but sporadically distributed in Ontario (**Slide 3**). As in other regions there was a decline in the abundance Ontario sturgeon populations in the late 1800s and early 1900s, and population recovery has been hampered by the construction of dams, pollution, and shoreline alterations.

The need to develop a province-wide monitoring framework for sturgeon was prompted by a number of ongoing initiatives that affect the management of lake sturgeon in Ontario (***Slide 4***). One of these is *SARA*, which has specific requirements that vary depending upon the status designation and include formal status reviews by COSEWIC at least every 10 years (***Slide 5***). Another initiative is Ontario's "State of the Resource Reporting", which is designed to provide the public with information on the state of the fisheries resources, including population and fisheries trends at a landscape level (***Slide 6***). To meet these needs requires clearly stated objectives prior to developing monitoring protocols. Ontario is also in the process of streamlining its sport fishery regulations (***Slide 7***). This requires information on sturgeon.

A standardized assessment process has been recommended to evaluate the effectiveness of any regulatory changes and monitor population recovery. Assessments were previously designed to address local needs related to exploitation and impact assessment, and used a variety of methods (***Slide 8***). Consequently, there was a need to standardize the approach to these local assessments and thereby facilitate province-wide assessments of the status and trends in sturgeon populations.

The first step in developing a monitoring framework was to send experts a pre-workshop questionnaire (***Slides 9 and 10***). It solicited information on their activities related to lake sturgeon and advice on how to define a lake sturgeon population, on defining the area to be monitored, what population assessment metrics to use (e.g., number of spawners, population abundance estimates), and how best to capture sturgeon for assessment. Participants in the workshop that followed were given guidance as to what was required, in particular that the recommendations be: 1) consistent with provincial "State of the Resource Reporting" requirements and initiatives to streamline recreational fishing regulations, and 2) applicable across Ontario (***Slide 11***). Recognizing that time and resources are limited, they were asked to recommend a practical, low-cost approach with a reporting time of 10 years.

The questionnaires identified a wide variety of monitoring activities (***Slide 12***). Monitoring was being conducted to assess population trends; to learn about life history and demographic characteristics; to examine habitat use, how habitats are being protected and what is working; for impact assessment (hydro-electric, dredging); for population modelling in support of regulations; and as part of fish community assessments. Indicators of past recruitment that had been used for monitoring included variously, counts of spawners, adult and sub-adults, juveniles and sub-adults, larvae, and all life stages (***Slide 13***). Other potential indicators that were identified included: growth and mortality rates, age and length at maturity, habitat availability, and commercial catch.

Based on the results of the workshop, juvenile and sub-adult sturgeon were chosen for monitoring (***Slide 14***). These fish provide a good indicator of recruitment and therefore of future population status. They offer a broad range of ages for assessing year class strength, and are readily captured in the gill nets used by existing provincial monitoring programs. Quite a variety of gear is used to sample the various life stages of sturgeon at different seasons (***Slide 15***). The Fall Walleye Index Netting" (FWIN) program has been effective at capturing lake sturgeon and was chosen as the sampling method to be tested for monitoring purposes (***Slide 16***). Juveniles and sub-adults between 40 and 100 cm long and age 3 to 20 are vulnerable to the sampling gear. There is a good correlation between abundance and probability of capture (i.e., catch-per-unit-effort). This approach also avoids the cost of developing a new protocol and can be used to monitor other riverine species, such as walleye, at the same time.

In the questionnaires, researchers identified various monitoring units for studying sturgeon populations (***Slide 17***). Some studied spawning runs, others looked at habitat use or focused on individual rivers, yet others separated populations on the basis of their conservation status or genetics. On the secondary question of how best to group populations for comparison, watersheds, conservation status, eco-regions, collections of discrete spawning sites, and genetics were all suggested.

Based on the workshop, the monitoring study design selected was a mix of index sites and randomly selected sites (***Slide 18***). Regular sampling at the index sites will be used to identify population trends over time. Sites selected randomly across watersheds will be sampled less frequently, perhaps every 5 years, to assess the species' status over larger areas. There was no consensus on the geographical boundaries of individual monitoring units. Secondary watershed boundaries are one option; another is the National Ecological Areas Classification used by COSEWIC.

The next steps were to test the FWIN sampling protocols in rivers with lake sturgeon, to evaluate the two monitoring unit options, and to identify non-population based metrics that might be useful for assessing the status of lake sturgeon (***Slide 19***). The latter could be habitat based on based on stressors such as the number of dams or pulp mills on a river.

In the fall of 2005, sampling was conducted in seven rivers with contrasting habitats to evaluate the FWIN protocols (***Slide 20***). The protocols used to evaluate riverine sturgeon populations were often similar to those used for evaluating walleye populations in lakes (***Slide 21***). They used the same set duration (24 h) and type of net; netting was conducted in the fall at water temperatures of 10 to 15°C; and both programs used a random stratified approach for placing nets. There were also differences between the programs. The sturgeon program did not stratify sampling by depth because the rivers typically do not offer the same range of depths as the lakes, nets were oriented towards shore, the entire net was placed in the water, and the gillnet mesh was constructed of different twine.

The nets caught a range of species, of which sturgeon constituted about 3% (***Slide 22***). Relevant to the choice of sampling protocols, the nets were effective at catching juvenile sturgeon over a wide size-range and sturgeon abundance varied among the rivers (***Slide 23***).

There were a number of lessons learned that can be applied to future sampling (***Slide 24***). The FWIN nets were too long and deep for most rivers, so the largest and smallest mesh panels may be removed in future and the net height reduced by half. The twine width was also too large and offered too much resistance to the current. In the fall the nets were often clogged with debris, such as fallen leaves; this may necessitate a change in the sampling season. Changing the orientation of the nets to the shore (i.e., perpendicular, parallel, diagonal) had a significant effect on catches. Juvenile fish were found concentrated in pools and river bends, at deltas where rivers enter lakes, and in deeper run pool areas below chutes and rapids.

Scott McAughey, Ontario Ministry of Natural Resources, Kenora, ON

Scott McAughey described his work on the Winnipeg River, from Lake of the Woods downstream to the Manitoba border, and on the lower 40 km of the English River above the Caribou Dam. About 140 km of the English River in the Northwest Ontario District is accessible to sturgeon and historically supported sturgeon populations. Remnant populations probably remain. The Winnipeg River section is about 70 km long and supports an intense walleye fishery. Sturgeon were not caught in about 150 FWIN net sets over the past 6 years in this portion of the Winnipeg River, or in 70 FWIN nets set in the English River in 1997 and 1998. Fishing with large mesh gillnets (8-12”) and set lines has also been unsuccessful at capturing sturgeon for tagging.

A review of the Winnipeg River stock by Northern Bioscience in Thunder Bay (Harris *et al*. 2000) suggested that the remnant population was likely so small that it would not recover. It recommended transferring adults from the Rainy River system. Instead, over 100,000 sturgeon fry have been stocked into the system over the past two years. While the change in status of sturgeon may improve opportunities for future work, the prospects for sturgeon populations in these rivers are uncertain. Peaking hydro-electric facilities cause annual fluctuations of up to 3 m and this is unlikely to change in the near future. Sport and subsistence harvests at these rivers are not an issue at present, although there may be some subsistence harvest in the lower English River.

Questions (Q), Answers (A), Comments (C):

Q: Were any habitat studies conducted before sturgeon were stocked into the Winnipeg River?

A: The hope was to locate spawning areas through tagging studies of large, remnant fish to learn whether spawning beds are being dewatered. However this effort was unsuccessful.

Mike Schillemoore, Ontario Ministry of Natural Resources, Red Lake, ON

The people of Pikangikum, an isolated First Nations community north of Red Lake have been involved in the Northern Boreal Initiative with other First Nations communities in northern Ontario. During this land use planning process OMNR became aware of a sturgeon population in Berens Lake and River system. Mikaiami Falls, which is situated on the river about 13 km east of the lake is a barrier to sturgeon. Elders indicated that there was large lake sturgeon population in this system until a large commercial fishery in 1952. The population was reduced by this fishery but did recover. Until about 30 years ago spear fishing from the shore was quite productive. In June of 2003, a number of sturgeons were captured and 12 were radio-tagged. The fish ranged in age from 6 to 37, and in size from 0.5 to 13 kg. The fish were tracked until March of 2004. Egg sampling was attempted in 2005, and there are plans to resume radio-tracking and egg sampling to locate spawning sites. There is vehicle access to the lake. However, local people harvest mostly walleye and there is no evidence of a sturgeon sport fishery. The Pikangikum elders indicate there is little subsistence harvest of sturgeon at present.

Future population management issues include delineating the size of the population and how to deal with harvesting issues as forestry operations expand and access improves.

Questions (Q), Answers (A), Comments (C):

Q: Are there any records of sturgeon in the Jacuni River or Lac Seul?

A: No. There are no documented records upstream of Manitou Falls. There are angling records from the Black Sturgeon River, which has not been affected by hydro-electric development. It is one of the few tributaries of the Winnipeg River that may offer natural sturgeon spawning habitat.

C: Mark Gendron has used double-hung 60 mm mesh (~2") nets, 50 cm deep and under 100' long, with heavy weights and large floats to sample juvenile sturgeon in the Rupert River of Quebec. These nets could be hung across the current and might be worth considering for your sampling protocols.

C: Altering the FWIN nets for use in the sturgeon sampling program will mean that the results are not comparable with those from the FWIN index netting program. The larger FWIN nets may work well in larger rivers.

2.14 History, biology and studies for the Saskatchewan River Sturgeon Management Board

Rob Wallace, Saskatchewan Environment, Saskatoon, SK

Rob described ongoing efforts by the Saskatchewan River Sturgeon Management Board (SRSMB) to manage sturgeon populations in the Saskatchewan River, one of two river basins in Saskatchewan that support sturgeon—the other being the Churchill River. The North Saskatchewan and South Saskatchewan rivers flow from Alberta into Saskatchewan and then join together to form the Saskatchewan River, which drains into Lake Winnipeg in Manitoba. The Saskatchewan River has a low gradient from the Tobin Rapids downstream to Grand Rapids, in Manitoba (***Appendix 17: Slide 2***).

The SRSMB area extends from the E.B. Campbell Dam downstream to the dam at Grand Rapids, concentrating on the river itself and not on Cedar Lake (***Slide 3***). Warning signs that the sturgeon population was in decline became apparent in the 1970s through monitoring of commercial fisheries (***Slides 4 and 5***). From the 1960s to 1970s the age of the oldest fish caught dropped from 64 to 38 and the mortality rate rose from 4.8 to 18.9%. The initial decline coincided with the loss of rapids spawning habitats to hydro-electric developments, and the loss of large spawning fish (see Wallace 1991 for details). These observations, coupled with concern about the state of sturgeon populations in Manitoba prompted formation of the SRSMB in 1994.

The SRSMB is comprised of representatives of communities, resource agencies, and power utilities (***Slide 6***). The Cumberland House Cree Nation (CHCN), Opaskwayak Cree Nation (OCN), Cumberland House Fisherman's Cooperative (CHFC), Opaskwayak Commercial Fisherman's Cooperative (OCFC), Saskatchewan Environment (SE) formerly Saskatchewan Environment and Resource Management (SERM), Saskatchewan Watershed Authority (SWA), Saskatchewan Northern Affairs (SNA), Manitoba Conservation (MC), Manitoba Water

Stewardship (MWS), SaskPower, Manitoba Hydro, and Fisheries and Oceans Canada (DFO) are all represented. Rob is a biological advisor to the SRSMB but not a member.

During the initial four year period, 1994 to 1997, one of the first reports completed was a retrospective assessment of the risk to lake sturgeon in the lower Saskatchewan River (Findlay *et al*. ca. 1994) (***Slide 7***). Other work included spawning and habitat assessments, tagging, radio-tracking, index fishing, and the application of traditional knowledge to development of a spawning habitat model (Wallace 1999b; Wallace and Leroux 1999). Recent work on lake sturgeon includes a review of procedures for index fishing (Wallace 1999c), growth chronologies (LeBreton *et al*. 1999), population genetics of sturgeon in the Saskatchewan and Winnipeg Rivers (Robinson and Ferguson 2001), Saskatchewan River lake sturgeon harvest surveys (North South Consultants Inc. 2003), and the SRSMB ten year management plan (North South Consultants Inc. 2002).

The Bigstone Rapids provides important spawning habitat for sturgeon in the Saskatchewan River between the dams (***Slide 9***). At the rapids the river is about 300 m wide and shows obvious standing waves and small back-currents alongshore. Simulations of instream conditions at a few spawning sites were done, but not discussed.

Four studies were examined in more detail. Spawning habitat between the E.B. Campbell Dam and Tearing River was studied between 1994 and 1997 (Wallace 1999a) (***Slide10***). Efforts were made to catch spawners and drifting fry, daily water temperatures were taken, and water flow was modelled. Spawners could not be observed in the water due to its high turbidity. Fry were only caught once, at the Torch River. Suitable spawning temperatures were observed during mid to late May in the Torch River, but not until early June below the E.B. Campbell Dam. How this difference might affect the success of any future habitat restoration below the dam is uncertain. Suitable spawning sites may include the tailrace of the dam, Torch River, Bigstone Rapids, and possibly in the Tearing River. There are none in the Manitoba section of this reach of the Saskatchewan River. Fry from the Grand Rapids hatchery have been stocked at The Pas, Manitoba (***Slide 11***); these fish were tagged with a fancy batch mark (***Slide 12***).

Juvenile habitat between Bigstone Rapids and Summerberry (157 km, 4 sections) has been characterized (Bretecher and MacDonell 2001) (***Slide 13***). Data were collected on water depth and velocity, and on bottom substrate. Habitat in the upper section was shallow, mostly < 3 m, with relatively high water velocities (up to 1.2 m/s) and rockier bottoms. The middle section was deeper, averaging about 5 m, with slower current and a sandy/silty bottom. The lower section, downstream from The Pas, was deeper (frequently > 3 m), with a variety of flows and bottoms. Bigstone Rapids appears to be the only suitable spawning site within this stretch of river. A few juveniles were caught in the reach from the Tearing River to Big Bend. The reach from The Pas to Summerberry provides suitable habitat for all life stages. The survey data should be suitable for river modelling. Fishing conducted in Saskatchewan in 2003 only caught juveniles near the Manitoba border. Because nets clog with debris, hooks are also used to catch sturgeon during index fisheries (***Slide 14***).

Aboriginal harvests were assessed at The Pas in June to August of 2001 and 2002, and at Cumberland House (SK) in June to September 2002 (***Slide 15***). Anglers were interviewed and the numbers and sizes of the harvested fish were recorded. Household interviews were also conducted at the Opaskwayak Cree Nation. The total estimated harvest by the two communities was at least 319 fish, which represents 3 to 12% of the population (see below).

Index fishing was conducted from 1996 to 2005 (***Slide 16***). In Saskatchewan it was conducted at traditional fishing areas from the Torch River to the Manitoba border; and in Manitoba at assigned fishing areas from Big Bend to Summerberry. Sturgeon were tagged with serial numbered, **PIT** (passive integrated transponder), or visual tags (T-bar and wing). The results of the tagging and recapture program have been presented annually at the SRSMB meetings. Tagging was conducted in Saskatchewan by project workers and in Manitoba by staff (***Slide 17***). Fish caught in Saskatchewan (n = 1,906) averaged 10.7 kg (24 lbs) and ranged in size from 0.7 to 33.6 kg; fish in Manitoba (n = 394) averaged 5.1 kg (11 lbs) and ranged in size from 0.5 to 26.5 kg (***Slide 18***). Abundance estimates based on the mark-recapture data suggest that the combined Saskatchewan and Manitoba population of medium to large sturgeon averaged about 1,000 fish over the period 1996 to 2005 (***Slide 19***). The population abundance is not increasing but whether it is decreasing has not been established.

The objective of the SRSMB's Management Plan is to have a Saskatchewan River lake sturgeon population between the E.B. Campbell Dam and Grand Rapids Dam that is self-sustaining, and capable of supporting traditional use by local Aboriginal people (***Slide 20***) (North/South Consultants Inc. 2002). The goals of the management plan are to: 1) stabilize the existing spawning populations in the next 3 years, 2) achieve a measurable increase in the spawning population in 20 years, 3) achieve community support for voluntary measures that ensure harvest levels are sustainable, and 4) within the next 5 years to determine the long-term population objective and the most effective way to achieve it.

Lennard Morin, Saskatchewan River Sturgeon Management Board and Cumberland House Fisherman's Cooperative, Cumberland House, SK

Lennard described the effects of flooding and hydro-electric development on the Saskatchewan River and its sturgeon population. In 2005, flooding damaged many of the outfitting camps on the Saskatchewan River, and affected the fisheries. Fishermen caught an unusually large number of adults and fry on the river, possibly due to downstream movement of fish passing through E.B. Campbell dam. Flooding also reduced sandbars and enabled fishermen to travel the river more easily and to set nets in areas that traditionally were fished but now are often dry. There was significant fish mortality related to flooding but no dead sturgeon were seen.

Since dam construction, the water level at many of the traditional sturgeon spawning sites has been low. The E.B. Campbell Dam also creates daily and hourly fluctuations in water level. In the Saskatchewan River, at the mouth of the Torch River, it has fluctuated up to 2.4 m (8') in 24 h. DFO regulations that require a minimum flow of 75 m^3/s have improved flows and reduced fluctuations below the dam. They have improved conditions for both the fish and the people. The Cumberland House Fisherman's Cooperative appreciates the efforts and funding provided by the various agencies involved in the SRSMB, and hopes that DFO will work to recover the sturgeon population.

Questions (Q), Answers (A):

Q: How well are the SRSMB's recovery goals being met? –Rob referred this question to the Board members present at this workshop.

A: The SRSMB meets twice annually. It plans to review the 10 year management plan soon to assess what needs to be focused on in future. The SRSMB has done a good job collecting data on the sturgeon population. Now more effort has to be directed towards public education, through development of a website and other tools for disseminating information. Traditional knowledge also needs more attention.

2.15 Lake sturgeon in Manitoba

Don Macdonald, Manitoba Water Stewardship, Thompson, MB

Don introduced the Province of Manitoba presentation. Sturgeons are widely distributed in the province; most of the provincial program delivery is through regional staff, whose presentations followed.

Doug Leroux, Manitoba Water Stewardship, Lac du Bonnet, MB

Doug described sturgeon management activities in the eastern and central regions of Manitoba. Most work conducted in the eastern region has been on population assessments of the Winnipeg River in the Numao Lake area, between the dams at Slave Falls and Seven Sisters (***Appendix 18: Slides 1 to 3***—red bars denote hydro dams). Index netting and tagging studies were initiated in 1983 and are ongoing (***Slide 4***). Reaches between the other dams on the river, from Lake Winnipeg to the Ontario border, have also been sampled sporadically. Catch per unit effort data in the Numao Lake area indicates a declining trend. Jolly-Seber estimates average ~9,000 fish, based on the past 15 years. These estimates are based on tagging studies that used as variety of tagging techniques, and should be used with caution as the rates of tag loss are unknown. PIT tags have been used for the past 2 yeas and their use will be continued to reduce this uncertainty in the estimates. Discussions on approaches to sturgeon management have been ongoing with Sagkeeng First Nation since the early 1990s. Sagkeeng is the community most affected by changes in sturgeon management. More recently, Fisheries Branch has begun working with the new Winibiig Ziibi Numao Board (WZNB) to protect and enhance lake sturgeon and the Winnipeg River ecosystem.

In the central region, the sturgeon populations in the Red River and Lake Winnipeg were depleted by fisheries in the early 1900s and remain low. Some fish are captured by commercial fishermen and there are some tag recaptures, particularly of fish tagged in Minnesota that have moved downstream into Manitoba.

Ian Hagenson, Manitoba Water Stewardship, Dauphin, MB and
Bruno Bruederlin, Manitoba Water Stewardship, Brandon, MB

Ian and Bruno described sturgeon management activities in the western region of Manitoba (***Slide 7***). Sturgeon were historically resident in the Assiniboine River and its tributaries (***Slides 8***

to 10). They were valued for food and for their oil, which was used to fuel lamps and soften homespun wool. In fact, the steamboats sometimes burned sturgeon to heat their boilers! Large sturgeons were harvested in the early 1900s at the old Brandon Electric Light Company Limited dam on the Little Saskatchewan River, and in the late 1930s from the Assiniboine River at Waggle Springs, near Shilo.

There are few rapids on the Assiniboine River suitable for sturgeon spawning because the river is wide, meandering and shallow. The Little Saskatchewan River may have provided spawning habitat but it has been fragmented by the construction of dams at Rivers, Rapid City, and Minnedosa. From 1996 to 2004, the Assiniboine River, at Brandon, was stocked with 8,578 sturgeon fingerlings or fry (***Slides 11 to 13***). These fish are surviving, and catch and release sturgeon fishing is becoming popular in Brandon. To date there have been over 400 recaptures recorded within about a 25 km radius of Brandon, with the largest being about 1.12 m long (44”). To become self-sustaining, fish in this population must be able to access suitable spawning habitat. This will require the construction of structures to facilitate fish passage past barriers.

Grant McVittie, Manitoba Water Stewardship, The Pas, MB

Grant described sturgeon management activities in the northwest region of Manitoba (***Slide 14***). Much of this work has been related to the SRSMB and was discussed earlier by Rob Wallace (***Slides 15 and 16***). Monitoring data from 2002 suggest that the there were only about 1,300 sturgeon (> 8 kg) in the population between the E.B. Campbell Dam in SK, and the Grand Rapids Dam in Manitoba (***Slide 17***). This estimate suggests that the population has been reduced by 80 to 92% from levels ca. 1960. Tagging and monitoring of sturgeon in the Saskatchewan River delta is continuing under the auspices of the SRSMB to gain understanding of sturgeon populations, movements, habitat, spawning areas, and harvest rates by Aboriginal fishers (***Slide 18***).

Don Macdonald, Manitoba Water Stewardship, Thompson, MB

Don described sturgeon management activities in the northeast region of Manitoba, where the Churchill, God’s, Hayes, and Nelson rivers support sturgeon populations (***Slide 19***).

In the Churchill River, populations in the upper reaches were likely depleted by historical fishing (***Slide 20***). The extent of these fisheries is difficult to ascertain because harvests were often described by the shipping or collection point rather than the harvest location. The railhead at The Pas, for example, was an important collection site. Bloodstone Falls, upstream of Pukatawagan, was historically an important harvesting site for First Nations who would harvest sturgeon there in the spring. These fish were so abundant that the rocks would run with blood—hence the name. Sturgeon populations in the lower Churchill River, below Southern Indian Lake, have been affected by the Churchill River Diversion, which since 1976 has diverted a large portion of the summer flow into the Nelson River (***Slide 21***). In the Churchill River downstream of Southern Indian Lake, summer flows decreased from about 850 m^3/s (30,000 cfs) to 14 m^3/s (500 cfs). This has substantially dewatered that stretch of the river, and one might expect the sturgeon population to have declined. However, test netting by the NRSB and Manitoba Hydro has found that some areas still have a significant number of sturgeons.

Sturgeon populations in the upper Nelson River were likely depleted by commercial harvesting about the same time as Lake Winnipeg (***Slide 22***). Sipiwesk Lake, below Whitemud Falls and above the Kelsey Generating Station was the most productive sturgeon fishery during 1950s and in the 1970s. The lower Nelson River was also productive but was less depleted by harvesting.

Sturgeon stocks in the Gods and Hayes rivers also have not been depleted by commercial harvesting (***Slide 23***). These stocks are assumed to be in good condition but their overall production is low. The Fox and Bigstone rivers are also being tested for sturgeon.

Commercial fisheries for lake sturgeon in Manitoba were closed between ca. 1960 and 1970. While the intent of these closures was to enable the Nelson River sturgeon fishery to recover, all of the fisheries in the province were subsequently re-opened. This included commercial fisheries on the Churchill River system and on the Gods/Hayes system. The post-1970 fisheries met with little success, possibly due in part to the nets used. Commercial fisheries on the Nelson River were closed starting with Sipiwesk in 1992, and the last in the system closed in 1998. The angling limit for sturgeon was reduced to zero in the early 1990s. Sport fisheries can continue but sturgeon must be released. The only harvests now ongoing in Manitoba are for subsistence by Treaty Indians.

Questions (Q), Answers (A), Comments (C):

Q: Where were fish taken in the Churchill River?

A: Mostly near the mouth of the Little Churchill River, where there is sufficient flow from tributary inflows and a deep hole.

Q: How much data exists for rivers that are “off the beaten path” such as the Seal and Black Sturgeon rivers? Is the lake sturgeon being classified as endangered prematurely based only on areas that have been impacted by development? Should it be regional?

A: **Designatable units** will be discussed tomorrow. There is a fairly extensive record for the Nelson River proper, likely because this was the most important area for sturgeon harvesting.

C: COSEWIC listing is not based on just one river system. For the lake sturgeon, each designatable unit includes many systems.

C: Perhaps these fish should be called river sturgeon and not lake sturgeon considering that they are often found in rivers. Commercial fishing for sturgeon and other species has declined in the Split Lake area since the mid 1960s.

Trevor Smith, Manitoba Water Stewardship

Trevor described provincial efforts to culture sturgeon at the Grand Rapids hatchery (***Slides 24 and 25***). The optimum number of sturgeon to rear annually at the Grand Rapids Hatchery is about 10,000. The problem is obtaining spawning females—the hatchery is lucky to obtain one or two each spring. The eggs are taken in 5 minutes but hatch over a period of 3 days. The last fish to hatch are typically the weakest and are released first so that subsequent efforts can be focussed on the healthier fish (***Slide 26***). Optimally, about 15,000 larvae are retained from the first day of hatching for rearing to fingerling size by September. The larvae are born with a little plug in their gut and once it is passed feeding must begin. The sac fry larvae are fed first with *Artemia* that are hatched from cysts (platinum grade $120-$140/lb) in 4 hatching units that operate round the clock (***Slide 27***). Two people are employed collecting native plankton for supplementary feeding. As they grow their diet is switched to larger foods, first to frozen bloodworm ($10/lb or ~$450/d) or frozen adult *Artemia* ($5/lb), then to frozen *Mysis* ($8/lb) and later to frozen krill ($3/lb) (***Slide 28***). A minimum of four people, not including the manager, are required to rear the fish; for optimal fish growth and health shifts should run from 7am to 9 pm (***Slide 29***). Counting staff time and fish food, it costs $3.00 to $4.50 to rear a sturgeon fingerling until September (***Slide 30***). This cost varies depending on the year and success of getting the fish to switch feeds when the time is right.

Questions (Q), Answers (A):

Q: What is the cost of rearing fry?

A: The cost of rearing fry is very low if they are released quickly. The main cost is obtaining females at the spawning sites.

Q: Are there any genetic concerns with the stocking program being based on the progeny of just a few individuals?

A: Yes. But opportunities to collect eggs and milt are limited. Sometimes there are problems with fertilization as well. Sturgeon populations in the Landing, Weir, and Winnipeg rivers are the main sources of eggs and milt.

2.16 Nelson River Sturgeon Co-management Board (NRSB)

Hubert Folster, Nelson River Sturgeon Co-management Board, Norway House, MB

Hubert has been a member of the NRSB since its inception in 1992 (***Appendix 19: Slide 1***). He offered the perspective of native people in the Norway House area on the sturgeon and its use. Sturgeon fingerlings were stocked into the Norway House area in 1994, and there is always the concern that these tiny fish are just providing food for northern pike (*Esox lucius*) in the area. Several juveniles caught in 2000 suggest that some of these fish may have survived. Sturgeon have become so uncommon in the area that the young people who caught the fish did not recognize them.

Whisky Jack Narrows about 10 km upstream of the Jenpeg Dam was a traditional harvesting site for sturgeon. A very large fish (~300 lbs) was taken there about 1997. Historically the harvesters would follow the fish downstream from Jenpeg to the Warren's Landing area. However, Two-Mile Channel, which was cut by Manitoba Hydro in the Warren's Landing area, affected a spawning area in the Playgreen Lake area, which seems to have been abandoned. An Elder suggested that silt eroded from the channel may have covered the spawning habitat. [Editor's Note: the silt plume from this channel is clearly visible by satellite http://home.cc.umanitoba.ca/~gmccullo/LWmod050821&22.jpg]

Habitat alteration by hydro development has altered the Traditional Knowledge database of where sturgeon may be found. The fishers no longer receive the same natural clues of when and where to harvest fish. This has devalued the Elders' knowledge. It is as if a chapter of the book is missing. People must now relearn their "traditional knowledge". Scientists must listen well to the Elders' traditional knowledge to learn how things were and how they might be again.

Don Macdonald, Manitoba Water Stewardship, Thompson, MB

Don described work programs that the NRSB has been involved with since its inception in 1992. Seven communities are involved in the NRSB, Norway House, Cross Lake, Wabowden, Thicket Portage, Pikwitonei, York Landing, and Split Lake (***Appendix 19: Slide 2***). Both First Nations and Non-First Nations communities are involved, but the population is predominately Aboriginal. The Bay Line communities of Wabowden, Thicket Portage, and Pikwitonei have a strong connection with the historical sturgeon fishery and still have residents who would fish for sturgeon. They are not First Nations Communities and do not have the same financial resources as the larger First Nations communities. Consequently, funding has been necessary to ensure that representatives of all of the affected communities can gather to identify key sturgeon management issues and to suggest approaches and solutions. This process has worked well.

People in these communities have a long tradition of harvesting sturgeon for subsistence and for commercial sale, but it is now more difficult and less productive to fish for sturgeon (***Slides 3 and 4***). One of the questions faced by the NRSB was how traditional and cultural ties to sturgeon can be maintained when most people no longer fish for sturgeon. The NRSB has focussed its efforts on the stretch of the Nelson River downstream of Cross Lake, below Whitemud Falls and above the Kelsey Generating Station (***Slide 5***). This stretch is about 250 km long (150 mi.) and does not have any barriers to prevent sturgeon movement. Sturgeon spawning occurs in the Nelson River mainstem except at the Landing River, which is the only tributary where a spawning site has been identified (***Slide 6***). The Landing River once had a significant sturgeon run. Concern over the depletion of this run in the early 1990s was one of the catalysts for forming the NRSB. Because the river is shallow and clear, it is a good place to study sturgeon and obtain spawning products for culture. Bladder Rapids is an important area of the Nelson River for sturgeon spawning (***Slide 7***). However it is a difficult place, logistically, to study sturgeon. It is in an area that is strongly affected by the Jenpeg Generating Station. There is often substantial dewatering in the summer months, but relatively constant flows are maintained during the spawning period.

One reason for NRSB establishment was that before the "Sparrow Decision", fishing was prohibited before June 15^{th}. Afterwards it was open season and a few individuals took many fish. The NRSB has recommended closed zones, seasonal closures (i.e., in the spring prior to 15 June) and harvest limits (1 fish /year) (***Slide 9***). However, these are recommendations only, and have no legal backing. Most people comply with these recommendations but a few do not, and that is why efforts to reach out into the communities must continue.

Two of the first questions the NRSB asked were: how many fish are there, and how many can be harvested? Field crews were hired from the communities to conduct a spring and early summer gillnetting program (***Slide 10***). Data were collected on the length, weight, and age of the fish which were collected using standardized nets, tagged and released alive. Carlin tags attached with wire were applied initially (***Slide 11***). These tags lasted well but damaged the fish when they were not applied properly. PIT tags with normal Floy T-bars are now being used.

Running Peterson and Jolly-Seber population estimates based on adult fish (i.e., fish caught in an 8" or larger net) show a decline over the period from 1992 to 2000, from an average of 2,939 to 692 fish (***Slide 12***). This decline matches the level of harvest seen in the subsistence fishery.

Most of the fish caught had been born after the Kelsey Generating Station was constructed, so clearly it did not eliminate sturgeon spawning (***Slide 15***). However, relatively few were taken after Jenpeg was constructed, suggesting that its construction or operation eliminated sturgeon spawning habitats. Sturgeon growth rates in 1990s were similar to those in the 1950s, suggesting that food resources are not limiting the current sturgeon population (***Slide 14***). This does not mean that feeding habitats have not been affected.

Another important question asked by the NRSB was how hydro development had affected sturgeon habitat. Because information on habitat requirements was lacking, research examined sturgeon populations for symptoms of change. Most of the fish sampled were born after Kelsey Generating Station was constructed, so clearly it did not completely eliminate sturgeon spawning (***Slide 15***). Jenpeg was built over a decade later and because the fish sampled are typically limited to adult sizes; there was not a wide enough range of ages in the sample to determine whether or not there was an impact from Jenpeg yet. Sturgeon growth rates in 1990s were similar to those in the 1950s, prior to hydro development, suggesting that food resources are not limiting the current sturgeon population (***Slide 14***). This does not mean that feeding habitats have not been affected, only that there are sufficient for the current reduced population.

Sturgeon spawn has been collected in most years since 1994 for the hatchery culture of sturgeon (***Slide 15***). A temporary rearing facility has also been established at the Jenpeg Generating Station (***Slide 16***). It is not required for rearing capacity, but plays an important role in educating people about sturgeon, particularly people from Cross Lake and Norway House who may not see the facility at Grand Rapids. The fingerlings are not marked. They are released in a depleted upstream area of the Nelson River near Cross Lake, upstream of Whitemud Falls, where significant survival should be reflected in an increase in population numbers

Ultrasonic telemetry studies were begun at Sipiwesk Lake in 2004/5, using 10 receivers and 29 tagged fish (***Slide 18***). Little downstream movement was observed, and even the high flows in 2005 did not appear to wash sturgeon downstream, suggesting that few fish are lost over the Kelsey Generating Station.

The NRSMB is doing this work to ensure that future generations retain their cultural links with the sturgeon (***Slide 19***). Another 5 year tagging program will be initiated in the future for comparison with the earlier estimates.

Comments (C) and Responses (R):

C: Fin aging errors may be affecting your correlations of fish year class strength with hydro-electric developments.

A: Dramatic under aging would certainly be a concern. However, there continues to be steady recruitment of fish younger than the Kelsey Generating Station into the population.

C: Water is now much higher at the Landing River than prior to hydro development. The Nelson River mainstem used to be 15 m (50') below the rock on the right hand side of the Landing River photo (***Slide 6***). The dewatering at Bladder Rapids is visible in the upper left pane of the Bladder Rapids photo (***Slide 7***). It is not easy for the NRSB to limit subsistence harvesting rights. The hope is to restock the system and bring it back to support future harvesting.

2.17 Wiinibiig Ziibi Numao Board

Marissa Fontaine, Sagkeeng First Nation, Manitoba

Marissa presented the position of the Sagkeeng First Nation with respect to sturgeon management and rehabilitation. The Sagkeeng First Nation's traditional territories encompass the Manitoba areas of the Winnipeg River and extend into the northern United States. There are six hydroelectric dams in this area. The First Nation does not want sturgeon stocks in the area to be further damaged by hydroelectric development or sport fishing, and wants stocks conserved and rehabilitated. It is advocating partnerships between itself and other interested parties, including the Federal and Provincial governments, to accomplish stock rehabilitation. Marissa emphasized that territorial ownership by the Sagkeeng First Nation has not been extinguished, and that Sagkeeng takes a holistic view of the world and is working with other First Nations toward natural resource conservation.

Jeff Courchene and Kirk Guimond, Sagkeeng First Nation, Manitoba

Jeff and Kirk described the Sagkeeng First Nation's proposal for work on lake sturgeon in the Winnipeg River system, and the formation of the Wiinibiig Ziibi Numao Board. Their presentation was distributed at the meeting and is included as ***Appendix 20***.

Victor Courchene, Sagkeeng First Nation, Manitoba

Victor, who is a Sagkeeng elder, spoke of the need for people to respect their environment. The Anishinabe people believe that God made people last, and that all living things are our grandfathers. He emphasized that people must be careful how they harvest and handle their resources, which all have the right to exist. People must speak for the sturgeon and for the Winnipeg River because sturgeon cannot speak for themselves. The people at Sagkeeng were concerned by the indiscriminate harvest of fish from the Winnipeg River as early as 1891, and are concerned about the state of the river and its fishery resources today. Because Sagkeeng is situated at the tail end of the Winnipeg River it receives all the garbage entering the river. People need to respect the environment and Mother Earth the giver of life and work to restore the sturgeon population.

Questions (Q), Answers (A), Comments (C):

Q: Why was the Wabaseemoong Independent Nation the only other Aboriginal group in the Winnipeg watershed invited to join the Wiinibiig Ziibi Numao Board?

A: Other First Nations are welcome to come forward to join the Wiinibiig Ziibi Numao Board. Sagkeeng First Nation territory extends into the areas of Treaties 1, 3 and 5. It is trying to get interest from other First Nations in the United States.
C: Grassroots involvement by communities in sturgeon conservation, restoration, and management is changing the face of resource management.

2.18 The Lower Nelson River First Nation Coalition

James Wastasecoot, Lower Nelson River First Nation Coalition.

James outlined the concerns of communities on the lower Nelson River related to hydroelectric development and sturgeon management (No copy of his presentation is available). The communities of York Factory, War Lake, and Fox Lake have established a Natural Resources Secretariat to address these concerns. This coalition may expand in the future to include other communities such as Split Lake. These communities have few economic development opportunities, high poverty and social problems.

The coalition does not believe that the Nelson River Sturgeon Co-Management Board has been as effective during its 10 years of operation as it could have been. Administrative weaknesses in prioritization, accounting, planning, budgeting and reporting were cited, as was lack of communication and outreach. Concern was also expressed about the social and environmental impacts of hydroelectric, mining, and forestry development on the lower Nelson River, and about the inequitable distribution of economic benefits from these northern resource developments. The need to build community capacity through training and education, partnerships in environmental studies and monitoring, public administration, and sustainable economic development was identified. The communities want meaningful partnerships in resource management—to be part of decision making process, not just the boat drivers—and are working to train their members.

The goals of this coalition are to: enhance and promote northern Cree's Treaty and Aboriginal Rights, to protect species and the environment, and to develop a comprehensive ecosystem protection and recovery strategy. Studies to document traditional knowledge were identified as a particularly important means of setting a baseline against which changes can be measured. Once the Secretariat is staffed, one of its tasks will be to ensure there is respectful use of traditional knowledge.

2.19 Use of a man-made sturgeon spawning area downstream of the La Gabelle Generating Station, St. Maurice River (Quebec)

Richard Verdon, Hydro-Québec, Montréal, QC

Richard described his research on the effectiveness of artificial spawning habitats constructed downstream from hydroelectric developments as a means of habitat remediation (***Appendix 21: Slide 1***). This work was conducted in Quebec at the La Gabelle Generating Station on the St.

Maurice River, a tributary of the St. Lawrence River (***Slides 2 and 3***). Its objectives were: 1) to assess use by lake sturgeon and other species of a newly created spawning area (1999), and 2) to compare use of the site under high (2000) and low flow (2001) conditions ***(Slide 4***). Sturgeon spawning in the St. Maurice River contributes to the St. Lawrence River population. La Gabelle is a run-of-the-river hydroelectric station. Until 1993, the discharge of logs past the dam via a sluice (***Slide 12***) may have disrupted sturgeon spawning.

The artificial spawning habitat was created in 1999 by adding material to the downstream edge of an existing spawning shoal below the generating station (***Slides 5 and 6***). The existing shoal was not particularly suitable for spawning as it is exposed to high flow velocity and has bare rock substrate that does not provide shelter for eggs. The new habitat was 1,300 m^2 in area and required about 800 m^3 of material to build. It included 30 micro-sites on the top of the spawning area, each consisting of 2 to 4 large blocks (1-3 m^3) with 6 to 10 m^2 of spawning material (30-400 mm diameter) downstream. The micro-site design was based on observations of existing sturgeon spawning sites in Rivière des Prairies, QC. The blocks provide shelter against current in an area where the water is well aerated, and the substrates provide shelter for the eggs.

The artificial spawning habitat was constructed during the low flow period in August. Initially rock fill (<1 m diameter) was placed in the river downstream of the existing habitat to build up the bed (***Slides 7 to 15***). Then the micro-sites were constructed on the top of the raised bed. The placement of material at the micro-sites was guided by a diver because the heavy equipment operator was unable to see what was happening under the water.

The large shelter blocks (***Slides 13 and 14***) stayed in place during very high runoff in 2000. While the turbine flows relatively constant in May and early June (~800-860 m^3/s) the spillway flows vary widely (0-1,532 m^3/s) (***Slides 17 to 21***). White-water prevented sampling at the spawning ground early in the season (***Slide 17 and 18***). Flow in the spillway during the spawning season is typically about 500 m^3/s on average (***Slide 19***). In 2000, water velocity on new spawning sites under a spill flow of 294 m^3/s ranged from 1.33 to 1.36 m/s; 0.6-1.2 m/s at no spill (***Slide 22***). Higher velocities were observed on the existing shoal. The optimum velocity for sturgeon spawning is 0.8 to 1 m/s. Sites were sampled using gillnets, egg collection trays, and drift nets (***Slide 23 to 25***) [Note: nets used for sturgeon had larger mesh than those listed in ***Slide 23***]. Pairs of egg collection trays were placed on existing shoals, on the new spawning sites, and downstream. Water velocity was also measured at locations positioned by GPS (± 2 m). Flow was about 25% higher than the 20 year average (1977-96) in 2000, and about 50% lower than average in 2001 (***Slide 26***).

The catch per unit of sampling effort was higher in 2000 than in 1990 (***Slide 27***). However, the conditions in 1990 were somewhat different, with low flow volumes (675 m^3/s) and log discharges. The population had been over-harvested in the 1980s and the higher catches in 2000 may reflect the ongoing recovery. In 2000, the sex ratio strongly favoured males (***Slide 28***). The sturgeon spawning season is typically over within two weeks, and the peak lasts about a week (***Slide 29***). In 2000 it occurred between the 18th and 29th of May, peaking between the 21st and 25th. In 2001, when the flow was lower, spawning peaked about a week earlier (May 13-19) (***Slide 30***). Peak spawning occurred at a lower temperature in 2000 (10°C) than in 2001 (12°C) (***Slide 31***). The peak in high egg densities was brief in both years (***Slides 29 and 30***). The average catch of eggs-per-unit of sampling effort was about 10 times greater in 2000 than in 2001 (***Slide 35***). Similar egg densities were observed on both natural and man-made shoals in 2001 (***Slides 35 and 36***). However, in 2000, much higher egg densities were observed on new spawning habitat than on the natural habitat. These differences are likely related to the higher flow in 2000. The egg densities observed in 2001 were comparable to those observed at Rivière-des-Prairies in 1997. In 2000, densities of up to 3,000 eggs/per m² were observed. At this density egg mortality may rise due to crowding. It may be even greater at some sites, since the egg trays were lifted at 24 h intervals.

The St. Maurice spawning habitats are also used by other species in the spring, mostly by longnose sucker (*Catostomus catostomus*) but also by white sucker (*Catostomus commersoni*) and walleye (*Sander vitreus*) which spawn before the sturgeon (***Slide 37***). Smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), and mooneye (*Hiodon tergisus*) also spawn at this site.

The artificial spawning site is used by lake sturgeon and other spring spawning species during both high and low flow conditions (***Slide 38***). It is used more during high flow conditions when it provides a larger area of more suitable spawning habitat than the upstream shoal. In 2000, some sites may have been saturated with eggs.

Questions (Q), Answers (A):

Q: What was to cost of constructing the spawning shoal?

A: About $60,000 for the construction, not including monitoring.

Q: Was there any problem with egg predation?

A: Experiments were not designed to measure egg predation rates.

Q: What were the main findings of this research?

A: The main conclusions were that surgeon used the artificial spawning habitat, especially during high flow conditions, and that these habitats work well below spillways when spill is occurring. Similar habitats constructed below another hydro station where there was no spillage were less successful because the substrate was soon covered by plant growth.

Q: Were any effects observed on juvenile recruitment?

A: The effect on recruitment was not tested at La Gabelle but, based on studies of larval drift at Rivière-des-Prairies, there was a 5-fold increase in survival from eggs to larvae after construction of the man-made spawning shoal.

C: It is difficult to separate the effects of these improvements on recruitment from effects of changes in harvest regulations and other factors. Predation of lake sturgeon eggs by other species is not typically high.

Q: Was there any weed growth on the artificial spawning beds?

A: Little weed growth has been observed. It is limited by scouring of the substrates during spring runoff.

Q: Has spawning habitat been limiting for this sturgeon population?

A: Conditions in the areas where these sturgeons were spawning in the 1990s did not appear to be ideal, so egg survival may have been reduced.

3.0 STRATEGIC PLANNING

Following the presentations, there was a discussion designed to generate a vision of what needs to be done to recover the lake sturgeon, how a sturgeon recovery board might be designed, and what impediments and opportunities exist related to species recovery.

3.1 Key issues

Participants were divided into seven teams and asked to identify important issues with respect to sturgeon recovery (***Table 1***). Each participant was then asked to identify the issue that they considered to be most important. The issues were ranked in ***Table 1*** in descending order of importance, based on the number of individuals who considered them to be important. Issues that were not selected as most important by anyone are listed in no particular order. Many of the issues that were not selected can be considered subsets of those that were selected. “Determining the baseline population state” or “standardizing scientific techniques”, for example, are subsets of the most important issue, namely to “fill gaps in scientific knowledge”.

3.2 Action statements

After identifying key issues related to sturgeon recovery, the teams were asked to prepare Action Statements that described the work efforts they considered to be necessary for species recovery. These items fall into five broad categories: 1) Planning, 2) Research, 3) Monitoring, 4) Management and Regulatory Actions, and 5) Education and Outreach. The actions are listed under each of these categories in no particular order.

3.2.1 Planning

To develop and implement a comprehensive, well-organized, and efficient recovery strategy for the lake sturgeon requires planning. To facilitate proper planning it will be important to:

- secure long-term funding for the infrastructure and people necessary to recover the lake sturgeon;
- develop an umbrella organization to maintain communications and act as a sort of information clearing house (e.g., Great Lakes Sturgeon Trust);
- involve all parties with an interest in the species’ recovery in setting the overall recovery goal and specific local goals, and to
- identify the stakeholders and develop effective partnerships to work together toward recovery.

3.2.2 Research

Research is essential for understanding the biology and habitat requirements of the lake sturgeon, identifying potential sources of habitat degradation and loss, and improving understanding of threats to the species. To make proper use of existing information and focus research efforts, two actions were recommended:

- compile and synthesize existing scientific and traditional knowledge on lake sturgeon; and
- identify knowledge gaps that are relevant to the Recovery Strategy and prioritize them for filling.

Table 1. Important issues with respect to lake sturgeon recovery.

Issue	Rating
Fill gaps in scientific knowledge—need better understanding of lake sturgeon ecology--especially spawning and rearing habitat requirements, of different life histories, migration patterns, and discrete population units	12
Partnerships—diverse groups working together in new ways toward shared objectives	10
Scientific and Traditional Knowledge use	5
Mitigate habitat fragmentation/loss—need to reconnect feeding and spawning habitats	4
Evaluating recovery—need monitoring using appropriate metrics to set the baseline and evaluate recovery performance over time	3
Habitat concerns—loss, fragmentation, protection, restoration and reconnection of habitat	3
Diagnose problem—use science and traditional knowledge to correctly identify the factors limiting sturgeon populations	2
Need information on factors limiting recovery—needed to correctly frame the problem, need information on total and age-specific mortality rates	2
Establish clear long-term goals—look at what/who will benefit from or use the sturgeon resource that is recovered—"conservation fishing", focus recovery efforts	2
Uncertainty with SARA process—how it will be applied, who has jurisdiction, who will be permitting	2
Focus on sturgeon issues--look forward not backward	1
Use of resources/benefits	
Hatcheries/Stocking—economic or community development activities that would overlap with conservation objectives	
Genetic concerns—related to the origins and genetic diversity of stocked fish, need to map genetic diversity among stocks and preserve this diversity	
Ensure active involvement of all stakeholders at the outset of recovery planning—similar to partnerships	
Appropriate and adequate assessment	
Funding—resources are limited and there are many interacting objectives, who will do the work	
Increased pressure on local stocks of sturgeon due to global decline in sturgeon populations	
Standardize scientific methods—needed to establish comparable baselines of stock status and abundance, and for comparable long-term monitoring	
Determine baseline population states—need assessments using standardized methods to inventory populations, determine their distribution and relative abundance, and facilitate comparisons,	
Harvest regulation—an important part of recovery and a challenging issue	
Flow management in rivers—seasonal water quantity is critical to recovery	
Contaminants and water quality	
Short and long term commitment to recovery process—necessary to ensure that the recovery process is sustainable for communities and stakeholders that depend upon it	
Need information on total mortality rates	
Artificial propagation vs. natural spawning—are stocking programs as effective as the creation of artificial spawning habitats for remediating populations	
Communication, public education, and awareness	
Community capacity building	
Jurisdictional challenges—among the Government of Canada, Provincial governments, First Nations, and the United States.	
Understanding of compromise—there needs to be give and take among interests, in that while dams destroy sturgeon habitat they also provide the electricity needed for modern living	

Information gaps that were already apparent to the participants, and which were recommended as actions included the:

- analyses of genetic stock structure to identify populations;
- validation of aging techniques to ensure that age determinations used in population studies and modelling are accurate;
- determination of the age of **reproductive senescence**;
- identification of limiting factors in habitat; and the
- inventory of the distribution of important or critical habitats.

3.2.3 Monitoring

Effective monitoring is necessary to establish long-term trends in sturgeon populations and to evaluate the success of recovery efforts. Recommended actions related to monitoring included the:

- development of a population abundance index program to facilitate comparisons over time and among regions; and
- standardization of assessment methods through the development of protocols (sampling gear, methods) that can be easily adapted for use in a wide range of conditions.

3.2.4 Management and regulatory actions

Management and regulatory actions related to sturgeon recovery included the needs to:

- work toward habitat protection and defragmentation, and to
- evaluate the impacts of current harvests on lake sturgeon populations.

3.2.5 Public education and outreach

Public awareness and involvement in recovery programs is the key to protecting lake sturgeon habitat and reforming practices that threaten the species over the long term. Recommended actions included the:

- development and implementation of a public awareness strategy (communications plan) that uses education to raise the profile of the lake sturgeon; and
- capacity building to increase local, aboriginal, and scientific participation in the recovery process and empower communities so that they participate effectively in the recovery process.

3.3 Organization

The third task set for the workshop participants was to consider how best to organize and operate a Recovery Board for the lake sturgeon. In particular, who should take the lead role, who to involve, what support will be required, what its mandate should be, and how it should operate.

3.3.1 Who should take lead role?

DFO is legally obligated to take the lead role in recovery of the lake sturgeon on the part of the Government of Canada but there also needs to be leadership at all levels, particularly from the Provinces and First Nations.

3.3.2 Who to involve?

To properly address the range and depth of the interests involved in a recovery strategy of this scale, a core “Recovery Team” should be established. In addition to DFO, it should include representatives of fish and water management agencies, of the groups that stress sturgeon populations, of the existing management boards, and of affected communities not represented by these boards. To accomplish its task the Team must be a workable size. Consequently each person on it should represent a larger constituency. They would then report to their constituency, which might be based on a watershed, province, designatable unit, or some other criteria.

The Government of Canada (habitat, *SARA*, science); First Nations not represented by a management board (e.g., God’s River, Gods Narrows, Oxford House, Shamattawa, Pukatawagan); the Provincial Governments of Alberta, Saskatchewan, Manitoba, Ontario and possibly Quebec (i.e., fisheries and water management agencies); users of water (e.g., hydro-electric utilities, pulp and paper companies, agricultural, recreational); conservation associations (e.g., World Sturgeon Conservation Society see http://www.wscs.info/); harvesters; existing sturgeon management boards; expert scientists; and international organizations (e.g., USFWS) should all be involved in the recovery planning and process. These organizations need to make firm commitments regarding their long-term participation. The large scale of this recovery strategy precludes local stakeholder involvement at the Recovery Team level, but local participation is vital if the strategy is to be effective.

3.3.3 What support will it need?

To do its work the Recovery Team should have a full-time Chair supported by a Secretariat. It will require adequate funding and support staff to facilitate communications, translation, and public education. Financial support should be provided by the Federal and Provincial governments and by users of water, such as the hydroelectric utilities. To accomplish its task the Team will also require political, public, and community support.

3.3.4 Mandate?

The mandate of the Recovery Team, as listed in *SARA*, would be to design and implement an appropriate recovery plan for the lake sturgeon.

3.3.5 How should it operate?

The Recovery Team should be broad-based but small enough to be a workable size. It must be inclusive and respectful of all interests but participants must recognize that it may be difficult to get consensus. The Team should meet to prioritize issues with input from traditional and scientific knowledge. The roles of each member need to be clearly defined. Information should be brought to the table to focus discussions on the identification of critical habitat, species' biology, mitigation needs, and threats and other topics pertinent to the species' recovery. The Team will have an important role in the dissemination of information to constituency groups

The Team should operate with teams or working subcommittees (e.g., science and traditional knowledge; technical; education; environmental impact; socioeconomic). It should have clear timelines for final plan development and implementation, and mechanisms for disseminating information via each representative to their constituency. A database of pertinent scientific and traditional knowledge should be maintained and an inventory of stakeholders should be compiled.

Sturgeon stocks should be dealt with individually or on a watershed basis, not overall due to local differences and other constraints. A template might be prepared for application on a watershed basis to ensure that the required information is available for consideration.

4.0 ACKNOWLEDGEMENTS

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6.0 GLOSSARY

6.1 Acronyms

ASRD = Alberta Sustainable Resource Development, a department of the Alberta Provincial Government.

BOD = biological oxygen demand which is an indicator of the amount of organic matter in water.

CRI = Canadian Rivers Institute, a research program associated with the University of New Brunswick.

DFO = Fisheries and Oceans Canada, a department of the Government of Canada

FL = fork length, the length of a fish from the tip of the snout to the fork in the tail

FWIN = fall walleye index netting program

OCFC = Opaskwayak Commercial Fisherman's Cooperative

OCN = Opaskwayak Cree Nation, in northern Manitoba

CHCN = Cumberland House Cree Nation, in northern Saskatchewan

CHFC = Cumberland House Fisherman's Cooperative

COSEWIC = Committee on the Status of Endangered Wildlife in Canada

MC = Manitoba Conservation, a department of the Government of Manitoba

MDNR = Minnesota Department of Natural Resources

MWS = Manitoba Water Stewardship, a department of the Government of Manitoba

NRSB = Nelson River Sturgeon Co-management Board

OMNR = Ontario Ministry of Natural Resources

PIT = passive integrated transponder. PIT tags are tiny identification chips that are injected into specimens for permanent identification.

RIAS = Regulatory Impact Assessment Statement

SARA = *Species at Risk Act*, a Canadian legislation that protects biota at risk throughout Canada

SE = Saskatchewan Environment, a department of the Saskatchewan Government, formerly refereed to as Saskatchewan Environment and Resource Management (SERM)

SERM = Saskatchewan Environment and Resource Management, formerly a department of the Saaskatchewan Government, renamed Saskatchewan Environment (SE)

SNA = Saskatchewan Northern Affairs, a department of the Saskatchewan Government

SRSMB = Saskatchewan River Sturgeon Management Board

SWA = Saskatchewan Watershed Authority

TL = total length, the length of a fish from tip of the snout to the tip of the tail

WZNB = Winibiig Ziibi Numao Board. This is the board formed to address sturgeon management in Manitoba reaches of the Winnipeg River.

6.2 Definitions

Allowable harm is a scientific assessment of the level of harm--including human induced mortality, that a species can withstand without jeopardizing the survival or recovery of that species.

Critical habitat is the habitat that is necessary for the survival or recovery of a listed species and that is identified as the species' critical habitat in a recovery strategy or action plan.

Designatable units are significant and irreplaceable units of biodiversity that are recognized on the basis of: 1) established taxonomy, 2) genetic evidence, 3) range disjunction, and 4) biogeographic distinction.

Endangered species are in imminent danger of extinction

Extirpated species no longer exist in the wild in a particular area.

A **hypolimnetic** drawdown occurs when water is taken from the deep water layer of a waterbody, below the density gradient that separates colder bottom waters from warmer surface waters.

A **mesocosm** is an experimental apparatus or enclosure designed to approximate natural conditions, and in which environmental factors can be manipulated.

The age at **reproductive senescence** is the age at which an animal is no longer capable of reproducing.

Species of "**Special Concern**" are sensitive to human activities.

Threatened species require action to reduce the risk of extinction.

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Appendix 2. Agenda for the Lake Sturgeon Recovery Planning Workshop.

AGENDA

Lake Sturgeon Recovery Planning Workshop
February 28 – March 01, 2006
Greenwood Inn, Winnipeg

<u>February 28 (The Big Picture)</u>

08:30	**Registration - Coffee**	
09:00	**Welcome – Introductions - Workshop Facilitation**	**Hnytka/Thompson**
09:30	**Presentation** ***"Species at Risk Program"***	**Ray Ratynski**
10:00	**Break**	
10:15	**Workshop Backgrounder and Organization**	**Fred Hnytka**
10:30	**Presentation** ***"The Importance of Historical/Local Knowledge and Science in Recovery Plans for Lake Sturgeon."***	**Terry Dick**
11:15	**Presentation** ***"Passage and Habitat Restoration for Lake Sturgeon"***	**Luther Aadland**
12:00	**Lunch**	
13:00	**Presentation** ***"Lake Sturgeon Rehabilitation Efforts in Lake Superior"***	**Henry Quinlan**
13:30	**Presentation** ***"Managing the Recovery of Lake Sturgeon in the Ontario-Minnesota Border Waters"***	**Tom Mosindy**
14:00	**Presentation** ***"Lake Sturgeon Status and Management in Quebec Waters of the St. Lawrence River"***	**Pierre Dumont**
14:30	**Presentation** ***"Factors Affecting Lake Sturgeon in a Large Fragmented River."***	**Tim Haxton**
15:00	**Break**	
15:15	**Presentation "** ***"100 Years of Sturgeon Management – History of the Winnebago Sturgeon Program"***	**Ron Bruch**
1545	**Presentation** ***("Manitoba Hydro and Lake Sturgeon")***	**Shelly Matkowski**
16:15	**Presentation** ***"Lake Sturgeon Research at the Canadian Rivers Institute Manitoba Field Station: Past, Present and Future."***	**Steve Peake**
16:45	**Summary, Preview of Day 2, Business**	**Thompson/Hnytka**
17:00	**Closing and Adjournment**	

<u>March 1 (The Local Scene - Programs and Tools)</u>

08:30	**Registration – Coffee**	
08:45	**Welcome Recap from Day 1**	**Thompson/Hnytka**
09:00	**Presentation - Alberta**	**Besko/Clayton**
09:15	**Presentations – Ontario** ***"State of the Resource Reporting Framework for Lake Sturgeon in Ontario"***	**Scott Reid /others**
10:00	**Break**	
10:15	**Presentation Saskatchewan** ***"Saskatchewan Sturgeon Management Board"***	**Rob Wallace/others**
10:45	**Presentation - Manitoba**	**Various/ T. Smith**
11:15	**Presentation** ***"Nelson River Sturgeon Management Board"***	**Macdonald/Folster**
12:00	**Lunch**	
12:45	**Presentation Wiinibiig Ziibi Numao Board (Sagkeeng)**	**Jeff Courchaine**
13:00	**The Lower Nelson River First Nation Coalition**	**James Wastasecoot**
13:15	**Presentation** ***"Use of a Man-Made Sturgeon Spawning Area Downstream of the La Gabelle Generating Station, St. Maurice River (Quebec)"***	**Richard Verdon**
13:45	**Overview of Presentations**	**Thompson/Hnytka**
14:00	**Discussion – Strategic Planning** **Recovery Vision and Approaches** **Organizational Structure** **Impediments/Opportunities**	**All**
15:00	**Break**	
15:15	**Discussion – Cont'd**	**All**
16:45	**Summary, Preview of Day 3, Business**	**Thompson/Hnytka**
17:00	**Closing and Adjournment.**	

Appendix 3. Summary of feedback comments on the Lake Sturgeon Recovery Planning workshop.

At the end of the workshop, participants were asked to respond to six questions to provide feedback on their experience at the workshop. Twenty people completed the forms, and their responses are summarized below:

Question 1. What I liked most….

The common thread of all 20 respondent's comments was that they appreciated the participation from so many groups with different interests and the broad range of experience and ideas that were presented and exchanged. They appreciated the opportunity to meet others with an interest in sturgeon management, particularly from other jurisdictions, and to learn about the range of interests related to sturgeon recovery. The workshop format and organization, particularly the clearly defined objectives, were well received. The facilitator was praised for keeping the discussions relaxed, on time and on track. Several people commented favourably on the food quality.

Question 2. What I liked least…

Four respondents disliked posturing, off topic presentations. Several indicated that the workshop was too long. One respondent would have liked more time to network with others. Another suggested that the subject areas were too rigid and should be more open and interactive; that each group should have a facilitator so that discussions were not dominated by a few people. Jargon could have been better explained. Mechanisms for obtaining input on populations and threats could be improved, possibly by having core groups visit each management board. Comments on the start time (too early), meeting room furnishings and food were also received. Five respondents had no dislikes.

Question 3. Please do more…

Two respondents suggested having more open forum discussions; two others recommended placing greater emphasis on traditional knowledge—possibly through a workshop organized by Indian and Northern Affairs Canada on behalf of DFO. Group mixing, perhaps at a banquet were recommended to provide more opportunities to meet people from other jurisdictions and cultures. Individuals wanted more detailed presentations on field studies instead of overviews, more information on what others are doing to rehabilitate populations, more hands on workshops, breaks and workshop days, and better presentation equipment. Six respondents had no comments, and one echoed an earlier comment on the need to meet with management boards. Recommendations on improving food variety were also provided.

Question 4. Please do less…

Thirteen respondents had no comment. Several people want less sitting and more time to stretch their legs. One wanted fewer coffee breaks, another more presentations but over a shorter time-frame, and a third person found the technical and bureaucratic terms difficult to understand.

Question 5. Where should we go from here…

A common thread of the comments (9) was the need to keep information flowing by providing a synopsis of the meeting and to have a follow up conference/workshops/meetings. Others were to compile existing information to provide background for recovery efforts (3), and to explain what will happen next in the recovery process and plan for the establishment of a recovery team(s) (3). Individuals identified the need to develop a consistent, quantifiable method for ranking population status within or among waterbodies; to conduct tests on the importance of particular stressors with respect to sturgeon recovery, and to meet with the First Nations in their communities.

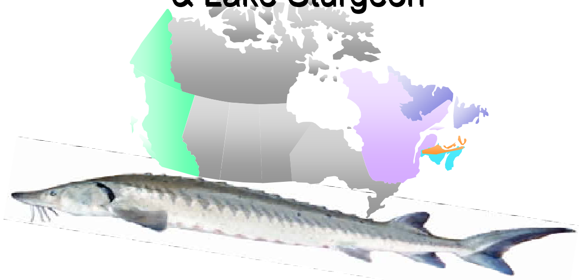
Question 6. General comments:

Eleven of the respondents indicated that the workshop was well-organized and worthwhile, and a good start to a complicated process; one of them appreciated that DFO was using this approach to consult with stakeholders. The remaining respondents (9) had no further comments.

Appendix 4. Presentation Ray Ratynski, Fisheries and Oceans Canada, Winnipeg, MB.

Slide 1

Department of Fisheries & Oceans:
Species at Risk Act (SARA)
& Lake Sturgeon



Lake Sturgeon Recovery Planning Workshop: February 28 – March 01, 2006. Greenwood Inn, Winnipeg Winnipeg, MB

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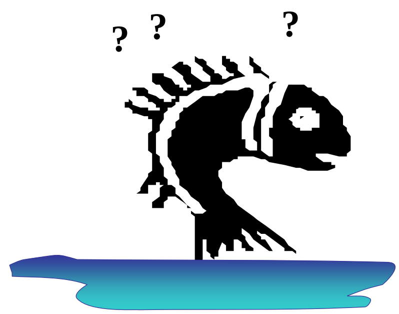
Why are we here?



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Basic Elements of the SARA
Purpose

The Species at Risk Act exists

- *To prevent wildlife from becoming extinct in Canada*
- *To secure the recovery of Extirpated, Endangered or Threatened species*
- *To manage Special Concern species to prevent them from becoming further at risk*

4

Basic Elements
Scope

Covers:

- *all wildlife species at risk nationally*
- *their critical habitats*
- *all lands & waters in Canada*

5

Basic Elements of the SARA
Responsibility

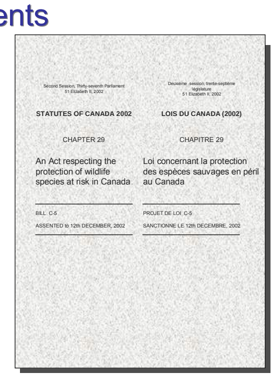
1. Fisheries & Oceans	⇨	*marine species and freshwater fishes*
2. Canadian Heritage	⇨	*species in National Parks, etc*
3. Environment Canada	⇨	*all other species, overall administration*

6

Basic Elements
Contents

Key elements:

- *science-based assessments*
- *listing process*
- *species protection*
  - *individual*
  - *residence*
  - *critical habitat*
- *mandatory recovery planning*
- *public involvement*



Second Session, Thirty-seventh Parliament
51 Elizabeth II, 2002

STATUTES OF CANADA 2002

CHAPTER 29

An Act respecting the protection of wildlife species at risk in Canada

BILL C-5

ASSENTED to 12th DECEMBER, 2002

Deuxième session, trente-septième législature
51 Elizabeth II, 2002

LOIS DU CANADA (2002)

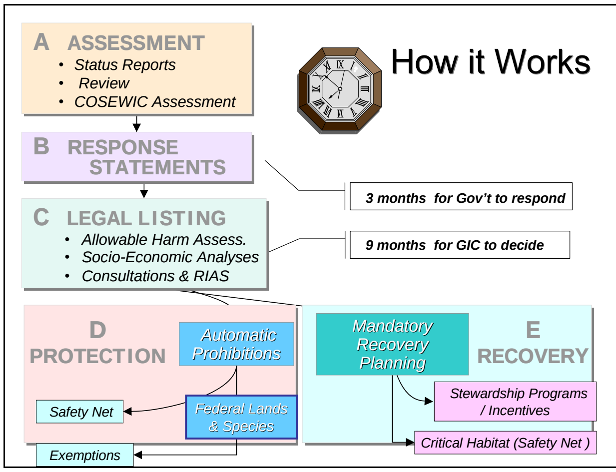
CHAPITRE 29

Loi concernant la protection des espèces sauvages en péril au Canada

PROJET DE LOI C-5

SANCTIONNE LE 12th DECEMBRE, 2002

Slide 7



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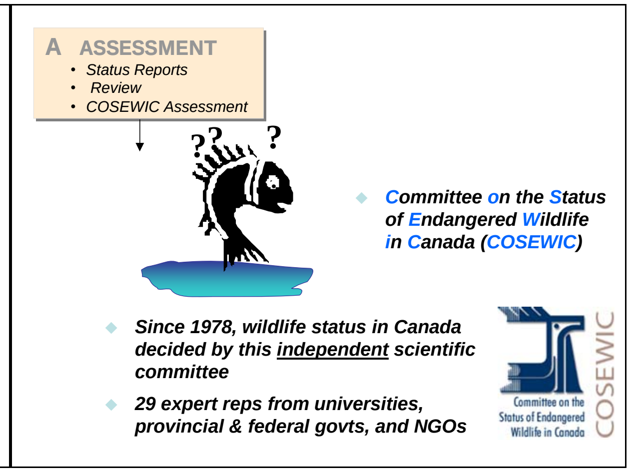

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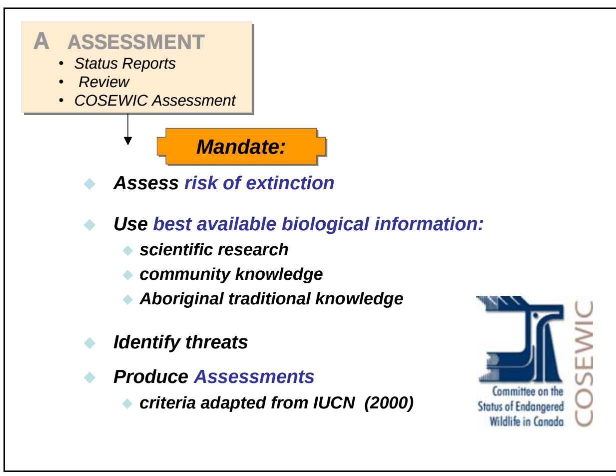

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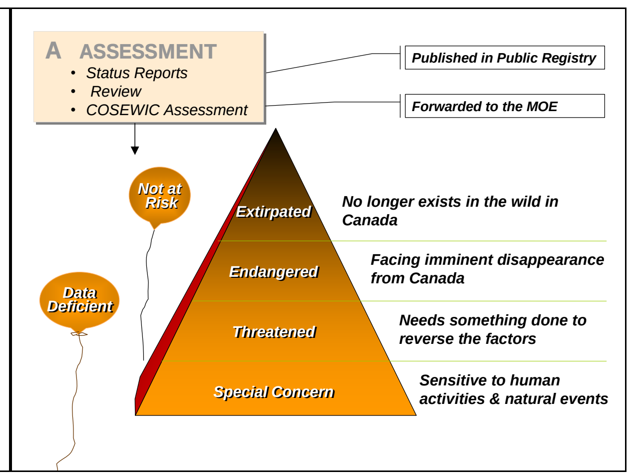

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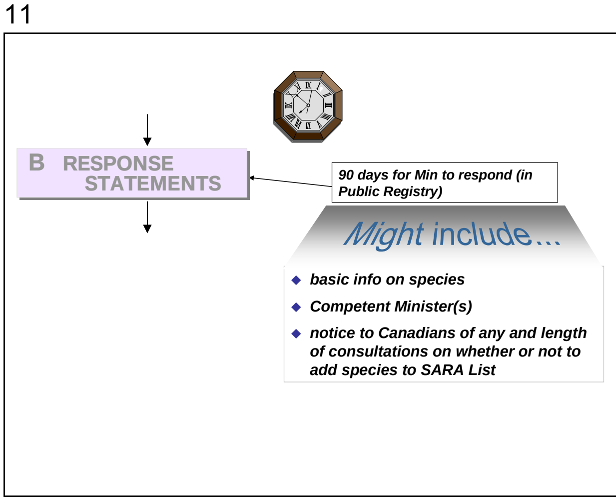

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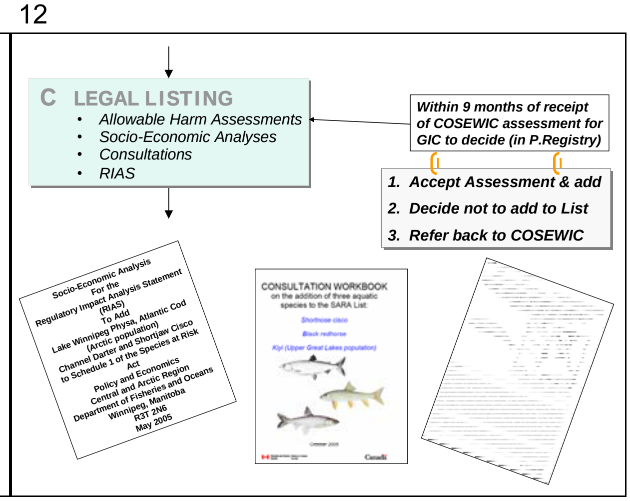

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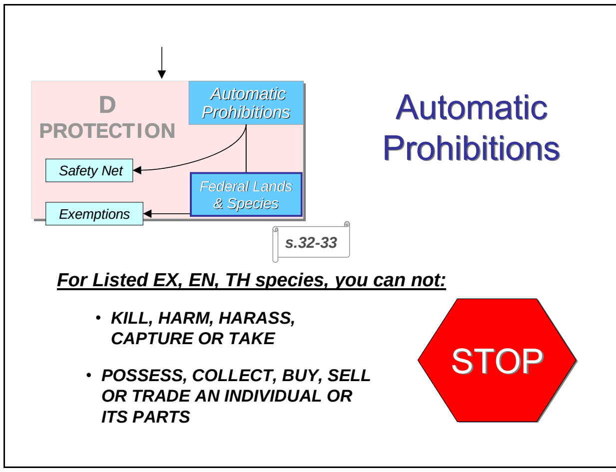

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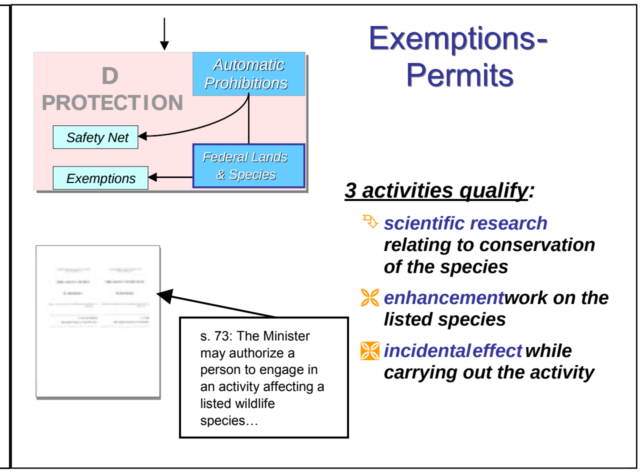

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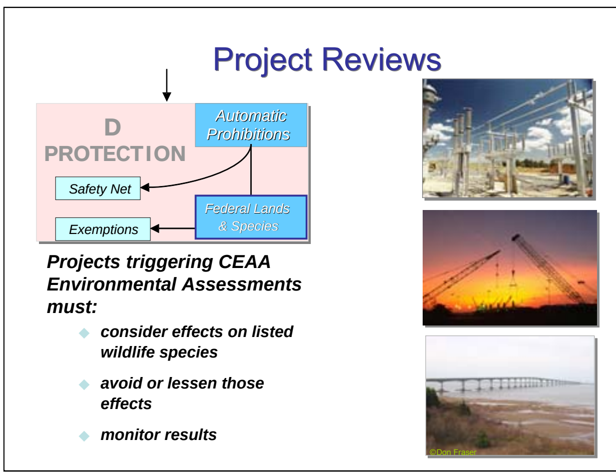

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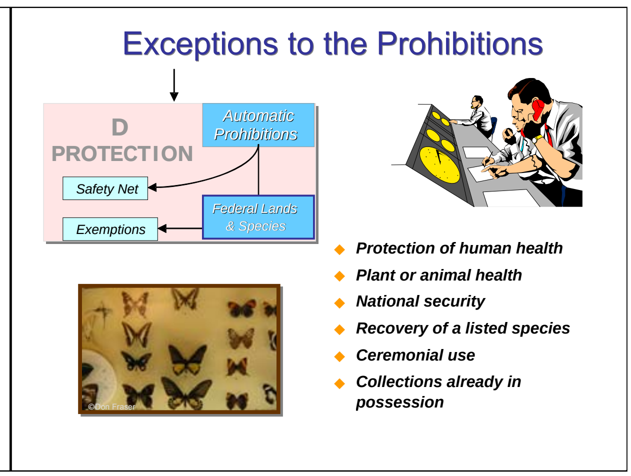

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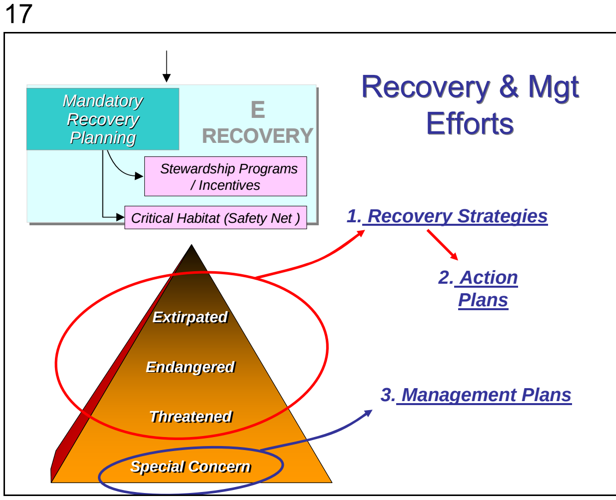

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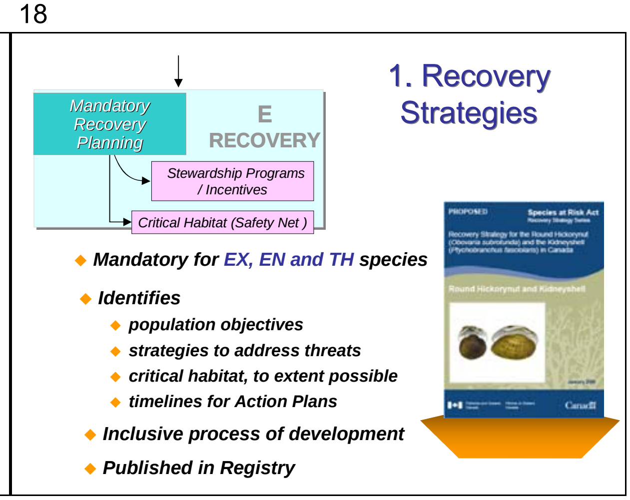

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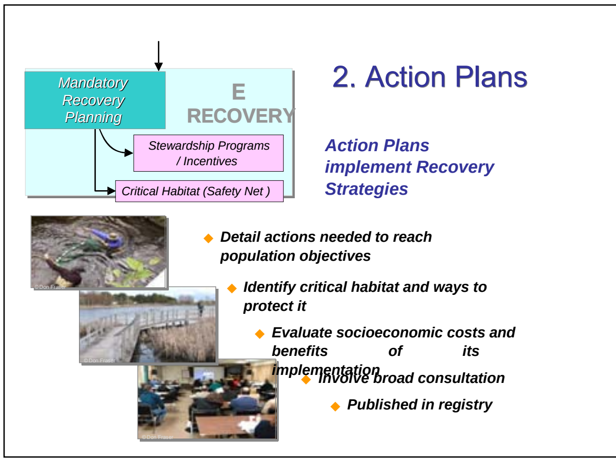

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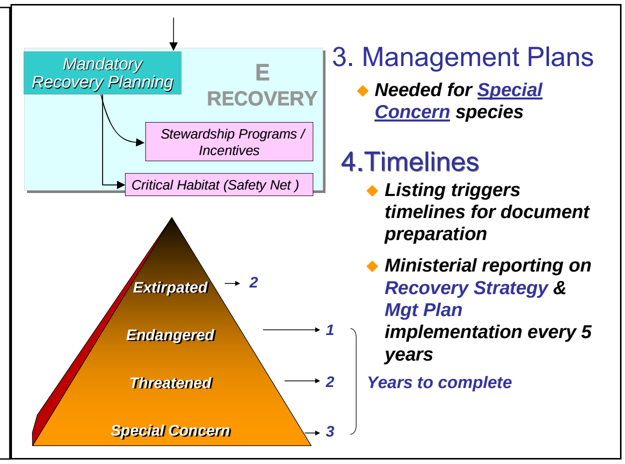

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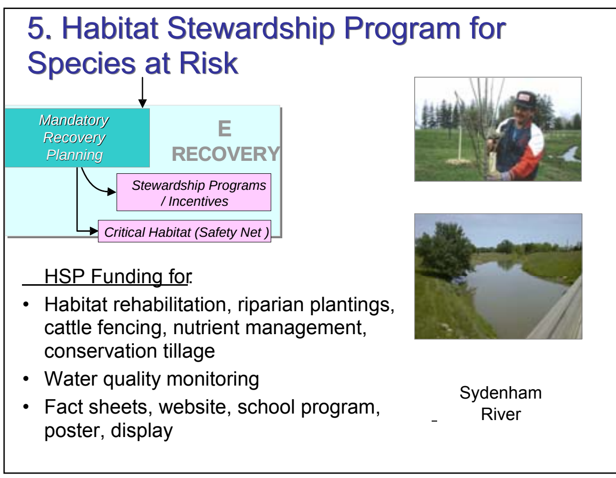

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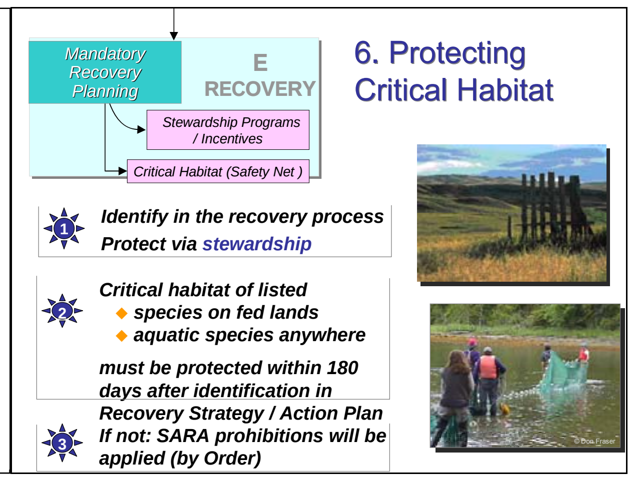

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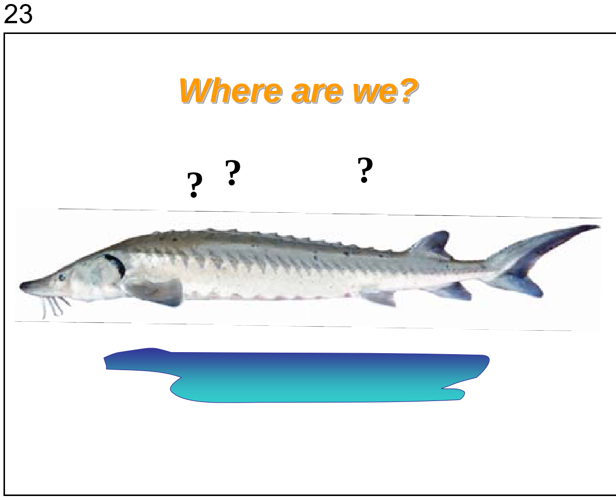

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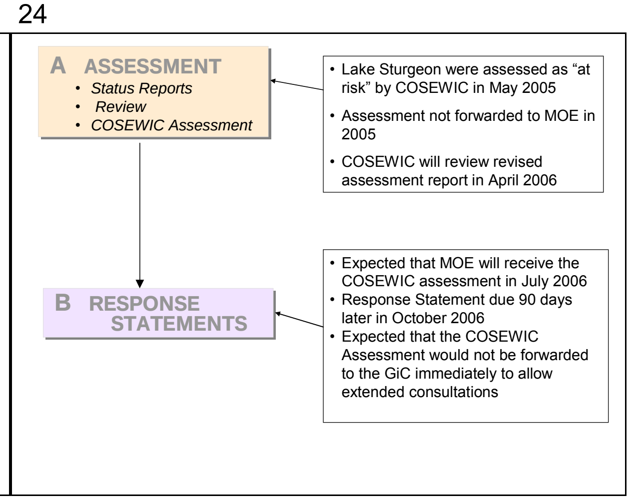

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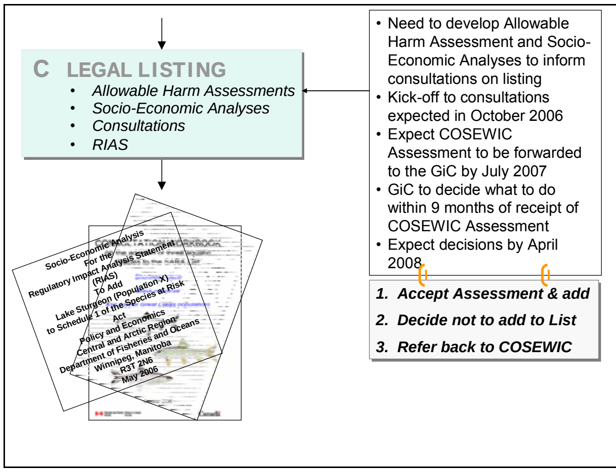

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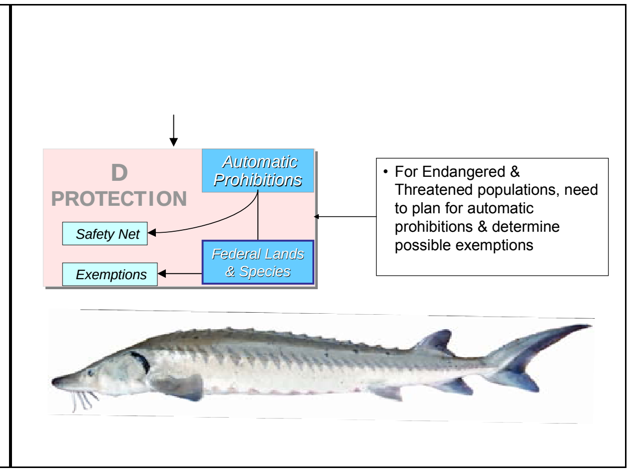

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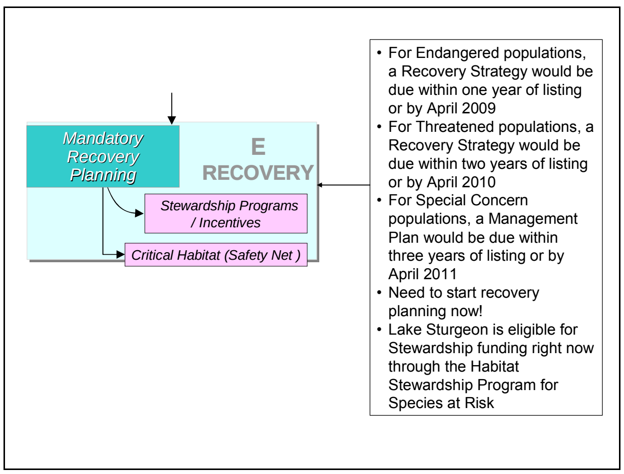


Appendix 5. Presentation by Terry Dick, University of Manitoba, Winnipeg, MB.

Slide 1

2

BACKGROUND

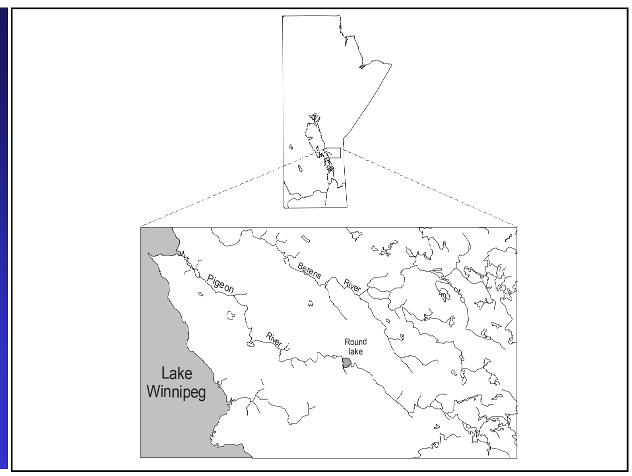
1. TIED TO FIRST NATION COMMUNITIES
2. COMMERCIAL EXPLOITATION IN THE PAST
3. HABITAT DEGRADATION
4. NEGLECT
5. POLITICAL JURISDICTIONS
6. CONFLICTS: SUBSISTENCE, SPORTS, COMMERCIAL FISHERIES
7. HOUSTON (1987) STATED THAT LAKE STURGEON WAS NOT A CONCERN IN CANADA

3

METHODS

- STUDY SITES
- POPULATION ESTIMATES
- CULTURE
- MOVEMENTS
- SUBSTRATE
- CURRENTS

4



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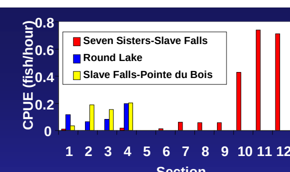
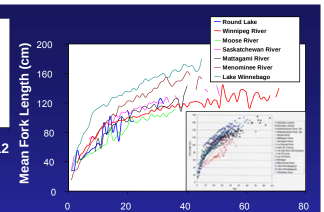


Catch per unit effort (CPUE) for lake sturgeon.

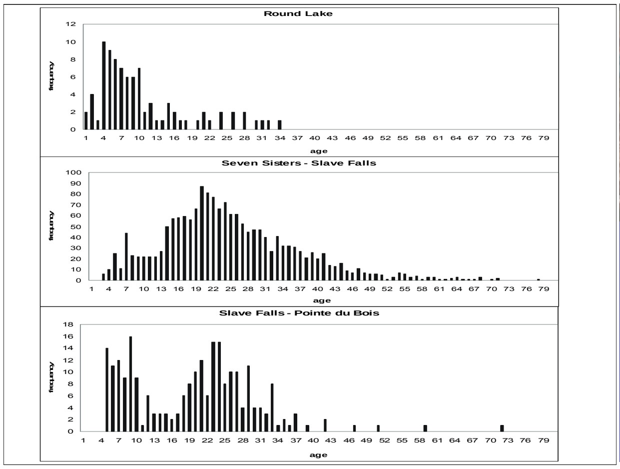


Comparisons among growth rates of several populations of lake sturgeon, including populations in Round Lake and the Winnipeg River. Inset illustrates the growth of 17 of the best sampled lake sturgeon populations in North America.

Population data for lake sturgeon taken from three study sites.

Study area	Population	Kg/ha (fish/m³)	% total catch
Round Lake	1000	12 (5.49*10-7)	9
Seven Sisters-Slave Falls	2000	10 (2.57*10-7)	15
Slave Falls-Pointe du Bois	1000	8 (0.827 *10-7)	14

Slide 7



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Early growth of lake sturgeon: 215 fish per replicate, diet particle size 400 to 700 microns.

	Weight (grams)					
Treatment	Duration (days)	Initial	Final	Final length	SGR	Survival
Live feed	28	0.15 ± 0.03	0.53 ± 0.12	5.34 ± 0.45	4.52	93
Experimental[1]	28	0.14 ± 0.02	1.71 ± 0.48	7.33 ± 0.81	8.93	93
Experimental[2]	28	0.13 ± 0.02	1.27 ± 0.44	6.49 ± 1.38	7.64	93
Commercial	28	0.13 ± 0.02	1.45 ± 0.37	7.03 ± 0.65	8.60	93

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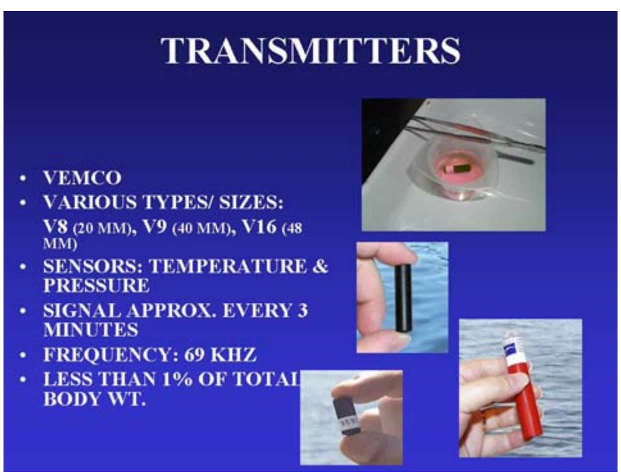

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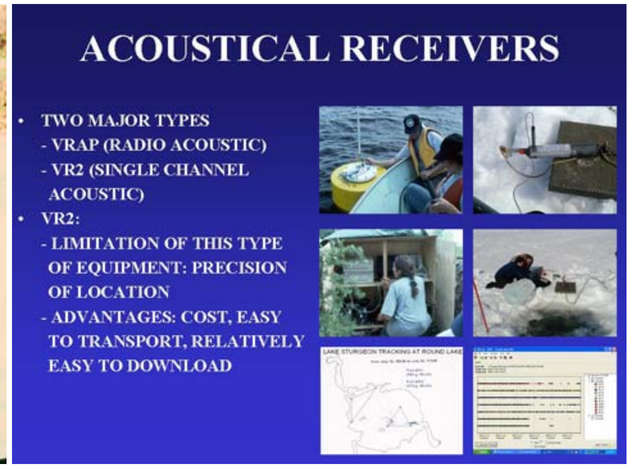

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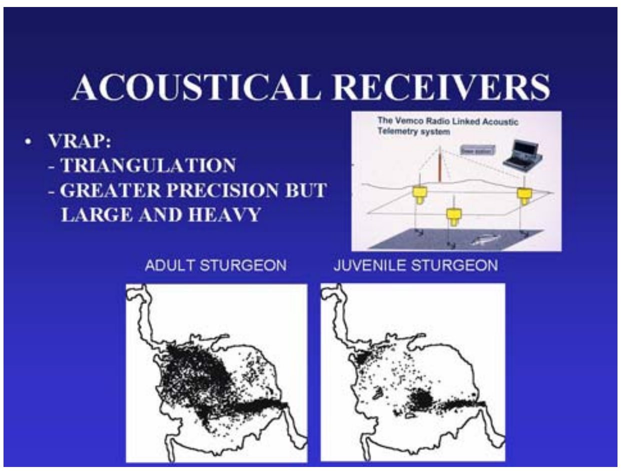

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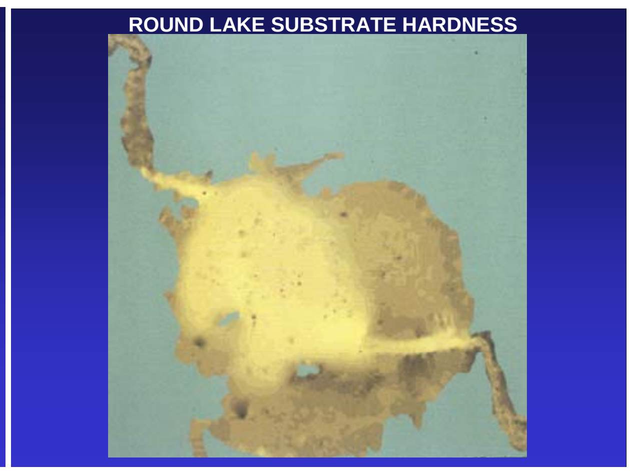

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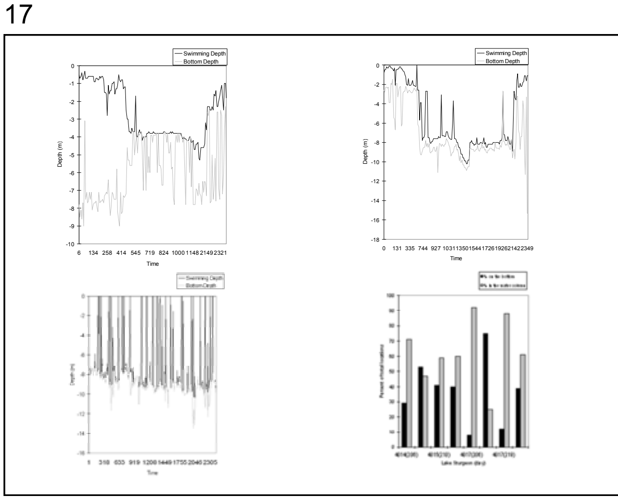

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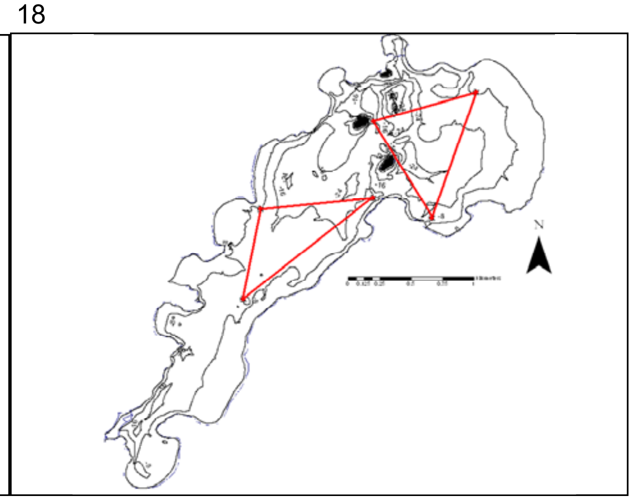

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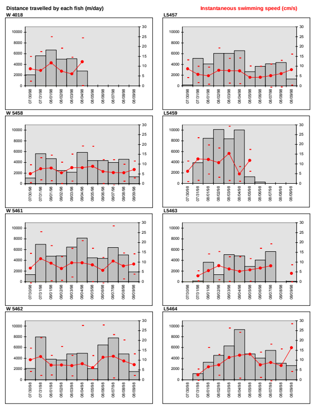

Distance traveled and instantaneous swimming speed of tagged lake sturgeon in the Winnipeg River. W= wild sturgeon and L= laboratory raised or cultured lake.

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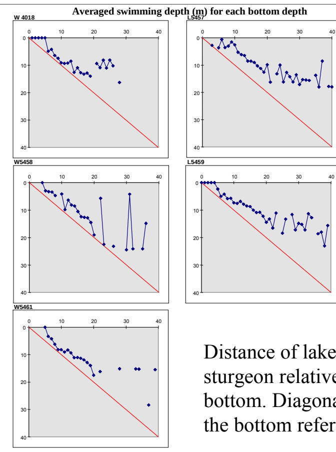
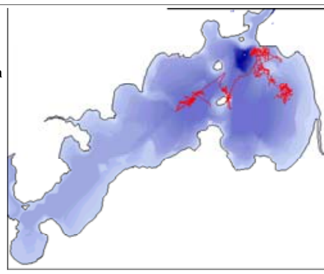
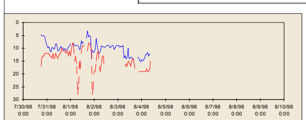


Distance of lake sturgeon relative to the bottom. Diagonal line is the bottom reference.

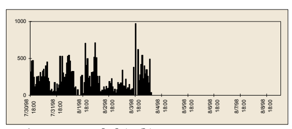
21

Track of the wild fish 4018 on the digital elevation model (max. depth 43 m)





Swimming depth in blue and bottom depth in red

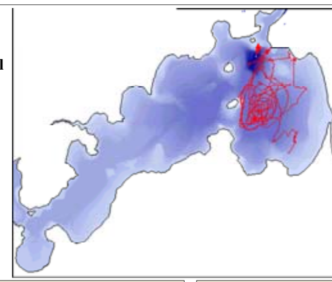


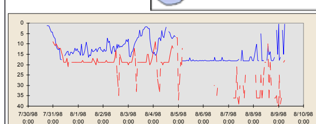
Distance traveled (m/h)

Pattern of movement, distance traveled and swimming depth relative to bottom of wild fish 4018.

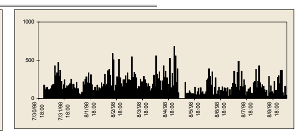
22

Track of the laboratory fish 5457 on the digital elevation model





Swimming depth in blue and bottom depth in red



Distance travelled (m/h)

Pattern of movement, distance traveled and swimming depth relative to bottom of lab fish 5457.

23

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Slide 25

Sediment classification scheme for Round Lake.

Phi	Particle Size (mm)	Category	Hardness
9	<0.0039	clay	95
5,6,7,8	0.0039 – 0.0625	silt	100
4	0.00625 - 0.125	Very fine sand	105
3	0.125 – 0.25	Fine sand	110
2	0.25 – 0.5	Medium sand	115
1	0.5 - 1	Coarse sand	120
0	1 – 2	very coarse sand	125
-1,-2,-3	2 – 16	gravel	130
-4,-5	16 - 64	Pebble	135
-6,-7	64 - 256	Cobble	140
-8	>256	Boulder	145

Lake sturgeon data for the acoustic tagged fish.

Number	Total length(cm)	Fork Length(cm)	weight(g)	age
4010	54	48	632	
4013	49	44	572	
4011	49	45	562	
4012	48	43	506	4
4014	143	128	16900	
4015	125	117	13250	
4016	138	126	14750	31
4017	119	113	11620	
4009	101	95	6790	22

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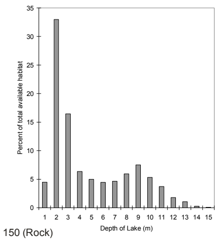
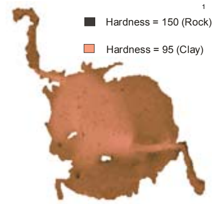
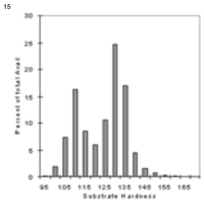


Depth availability of Round Lake



Hardness map of Pigeon River at Round Lake obtained from sonar data.



Hardness (substrate) availability in Pigeon River at of Round Lake.

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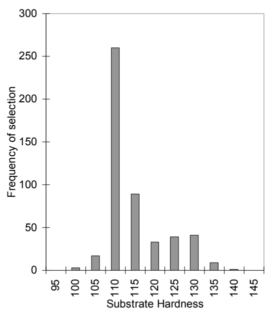
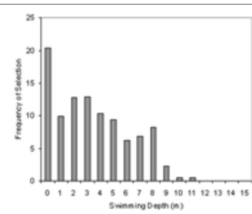
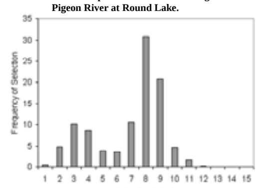


Substrate selection of lake sturgeon in Round Lake.



Overall depth selection of lake sturgeon in Pigeon River at Round Lake.



Depth selection of lake sturgeon when in contact with the substrate.

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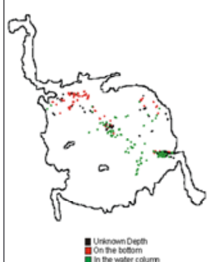
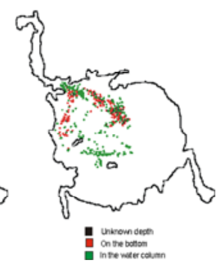


Movements and depth selection of lake sturgeon 4014.

Movements and depth selection of lake sturgeon 4015.



Movements and depth selection of lake sturgeon 4017.

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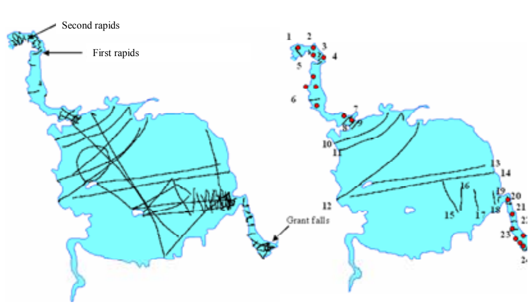

Transects for the current profile measurements in the Pigeon River at Round Lake. **A** are the transects throughout the lake and **B** includes transects where current profiles are presented in this report with additional transects and current profiles also shown. ● = radio tagged lake sturgeon were in these areas for extended periods of time.

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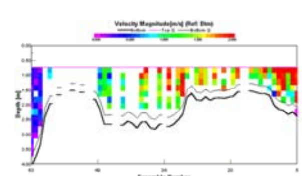
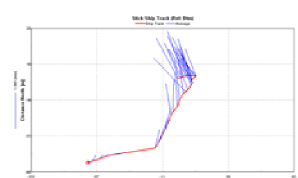
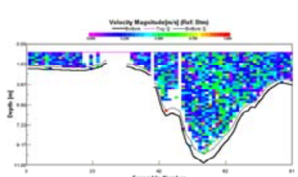
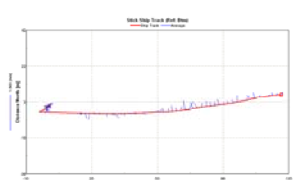




Round Lake transect 5.





Pigeon River transect 6.

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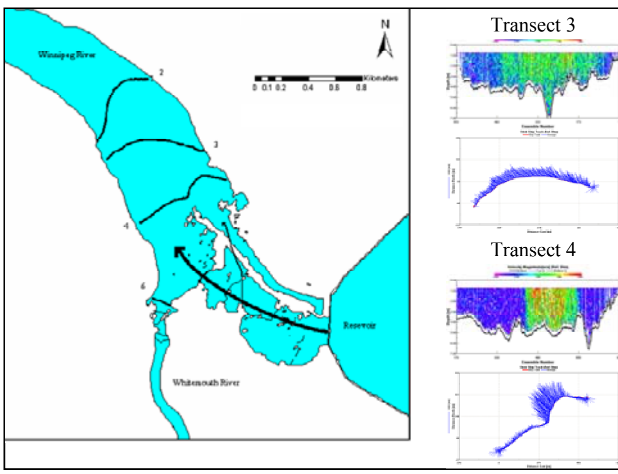

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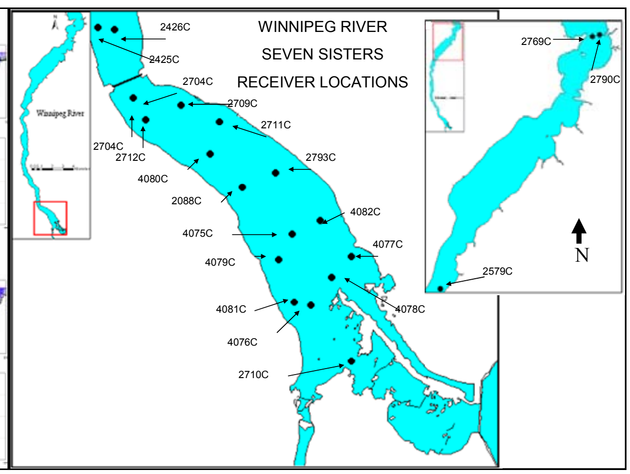

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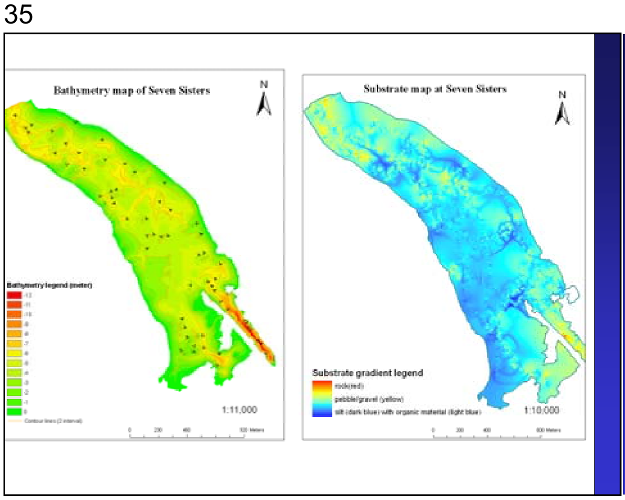

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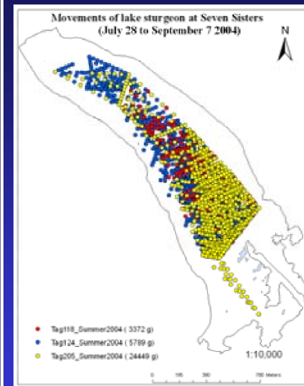

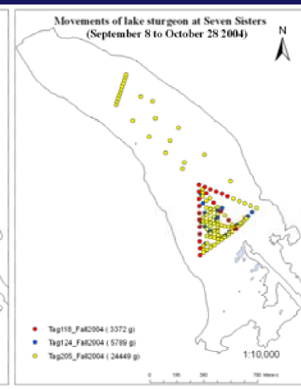

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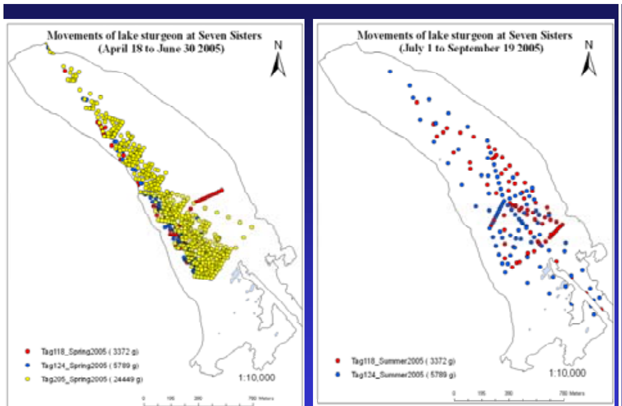

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PRESENT & FUTURE

1. TRADITIONAL, HISTORICAL AND LOCAL KNOWLEDGE WILL BE AN INTEGRAL PART OF RECOVERY STRATEGIES FOR LAKE STURGEON. MOST OF THIS KNOWLEDGE RESIDES IN FIRST NATION COMMUNITIES
2. DIFFERENCES BETWEEN NATURAL AND HUMAN MADE ENVIRONMENTS AND BARRIERS NEEDS TO GET SORTED OUT.
3. FIRST NATIONS AND ABORIGINAL COMMUNITIES WILL HAVE MAJOR INPUT TO RECOVERY PLANS AND DIRECT INPUT TO MANAGEMENT DECISIONS
4. URGENT NEED TO DEVELOP CAPACITY FOR ENVIRONMENTAL ASSESSMENT AND RESOURCE MANAGEMENT IN FIRST NATION COMMUNITIES

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PRESENT & FUTURE CONT'D

5. SOURCE OF BIOLOGICAL DATA FOR RECOVERY AND MANAGEMENT?
6. NUMBERS OF LAKE STURGEON IN THE LOCAL ENVIRONMENT? Juveniles, subadults, adults, spawners?
7. PERMITTING
8. ALLOWABLE HARM ?
   - Traditional use view
   - Biologists view
   - Developer view (electricity, cottages etc.)
9. CONSERVATION FISHING
10. ENVIRONMENTAL CREDITS
11. SHARING INFORMATION

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ACKNOWLEDGEMENTS

- Henry Letander, L. Letander, K. Guimont, J. Courchene, C. Gerard, V. Courchene (Sagkeeng), Henry Mackay and W. Desbarat (Berens River), J. Beardy (York Landing) John Carriere and family (Cumberland House).
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- T. Haxton, T. Mosindy and L. Mohr (Ontario Natural Resources)
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- Dr. R. Campbell COSEWIC
- Manitoba Hydro (D. Windsor, R. Bukowski)
- Commercial fishers from the Nelson River (Sipiwesk Lake) and Saskatchewan River (Cumberland House)
- From TD lab: T, deVos, A. Choudhury, M. Lu, X. Yang, D. Block, A.Yang , C. Gallagher
- Funding, NSERC, Department of Fisheries and Oceans, Environment Canada, Manitoba Hydro, Tembec Paper Co., Manitoba Model Forest, Conservation Manitoba.

Appendix 6. Presentation by Luther Aadland, Minnesota Department of Natural Resources, Fergus Falls, MN.

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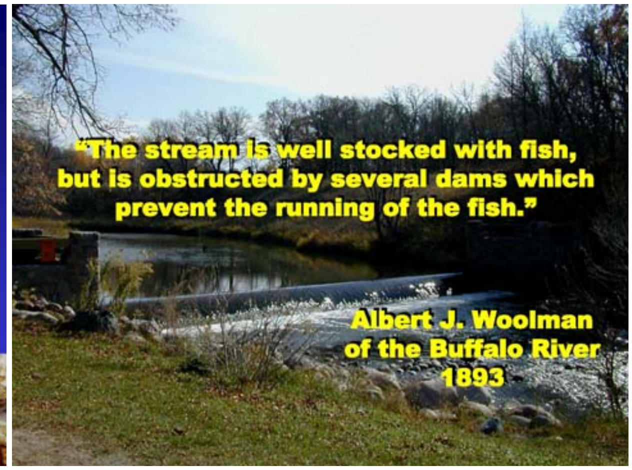

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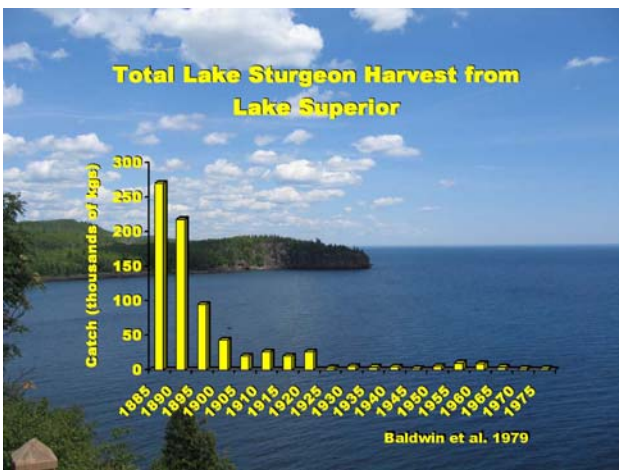

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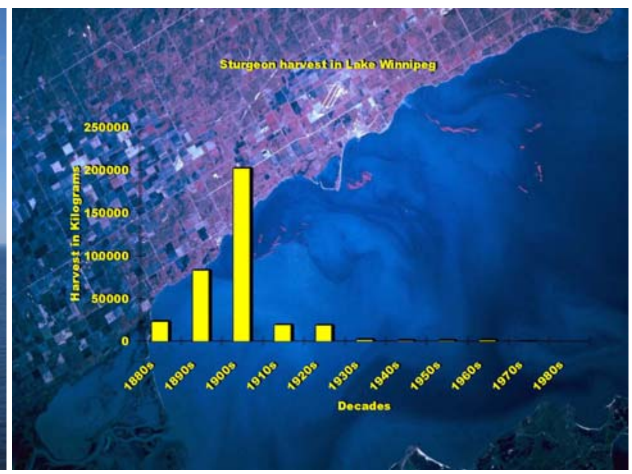

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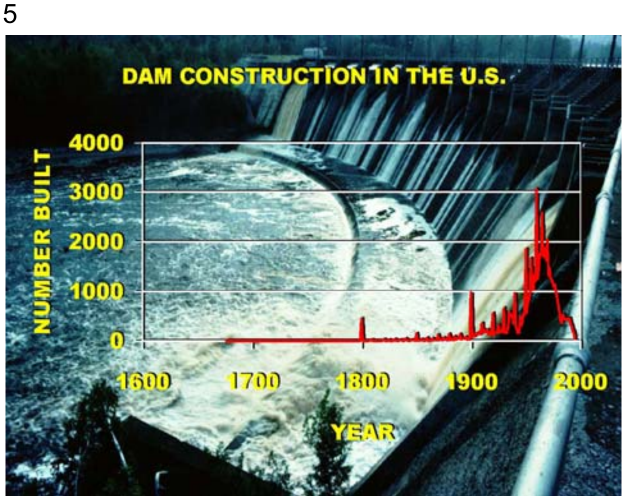

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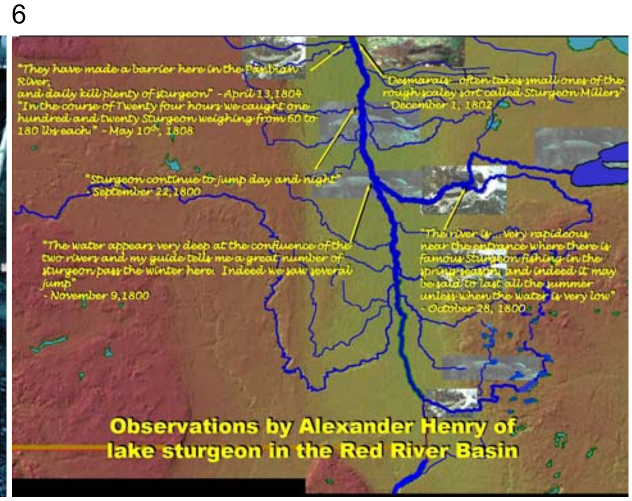

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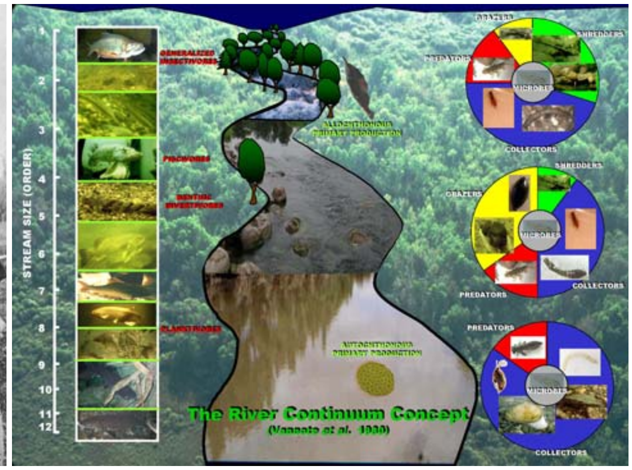

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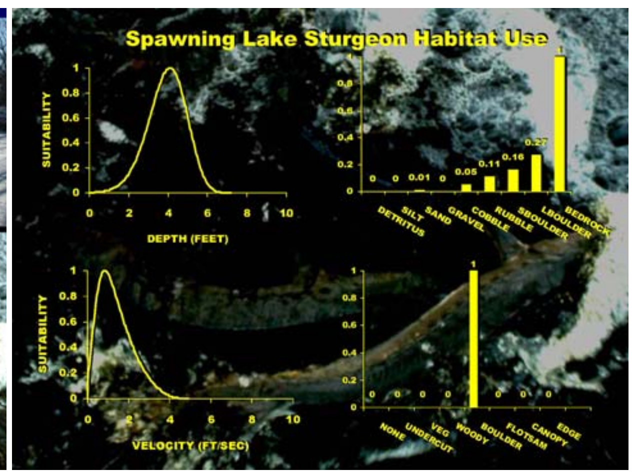

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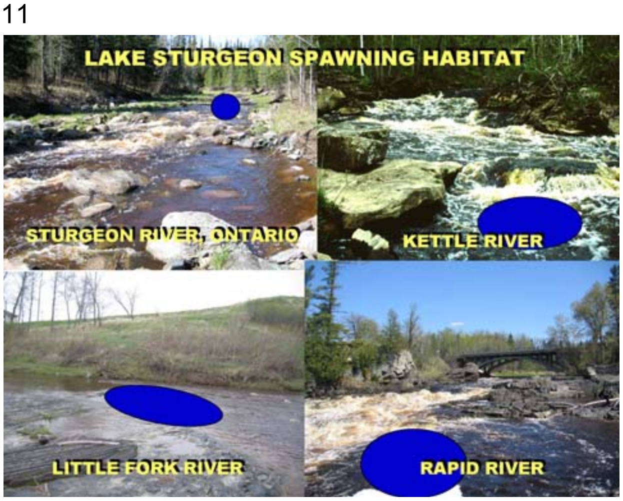

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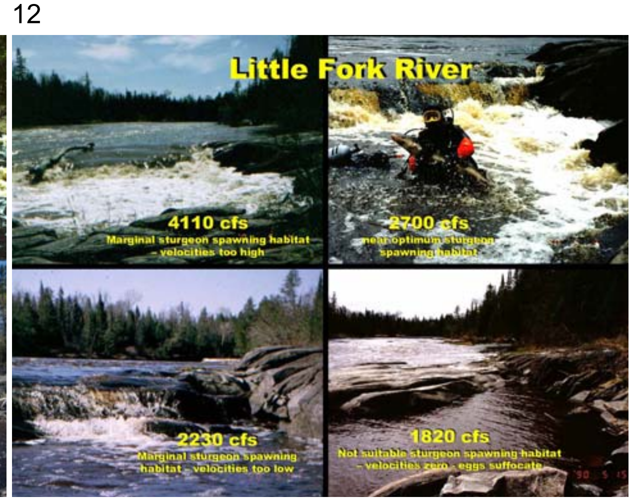

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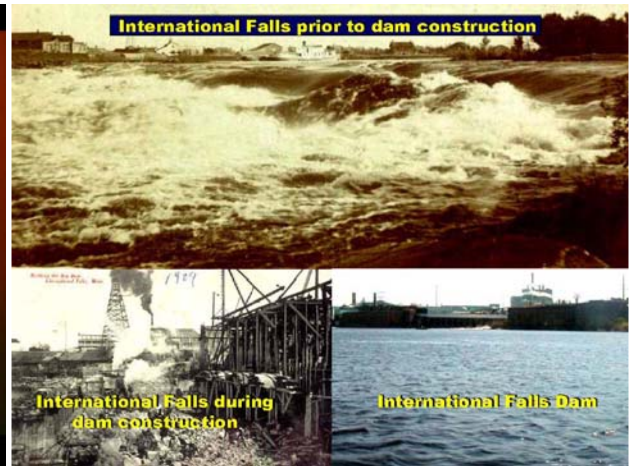

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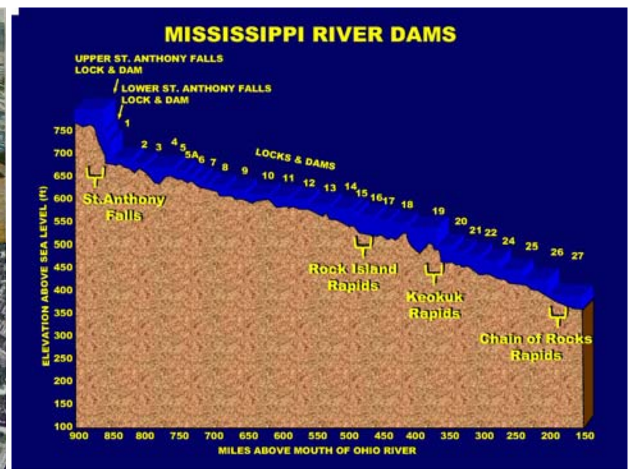

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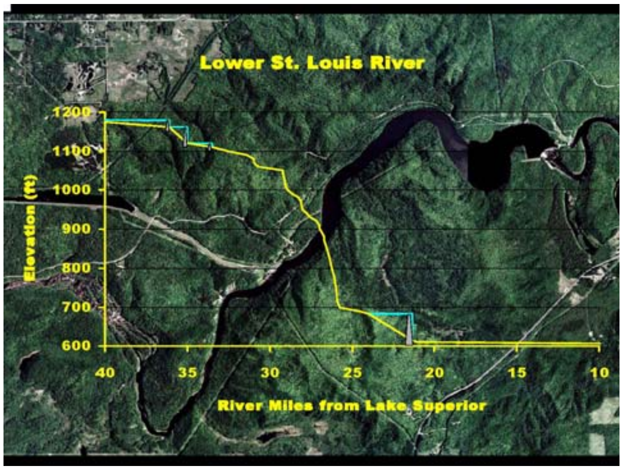

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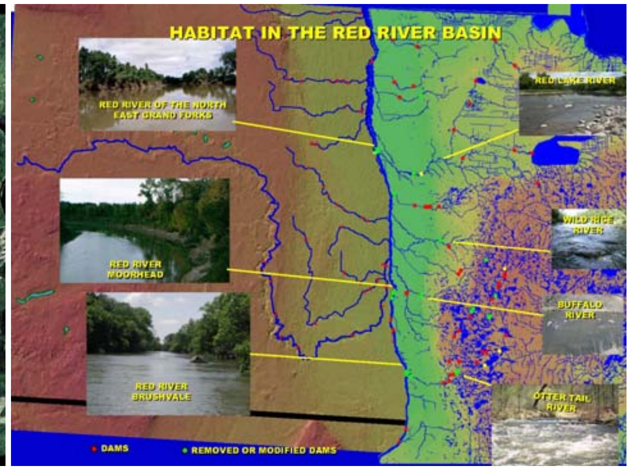

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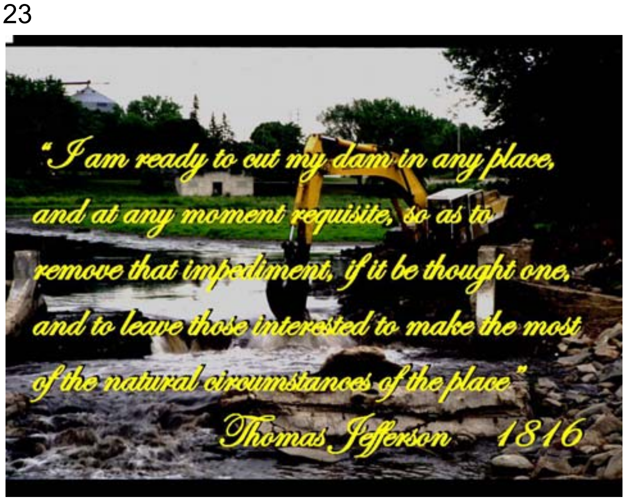

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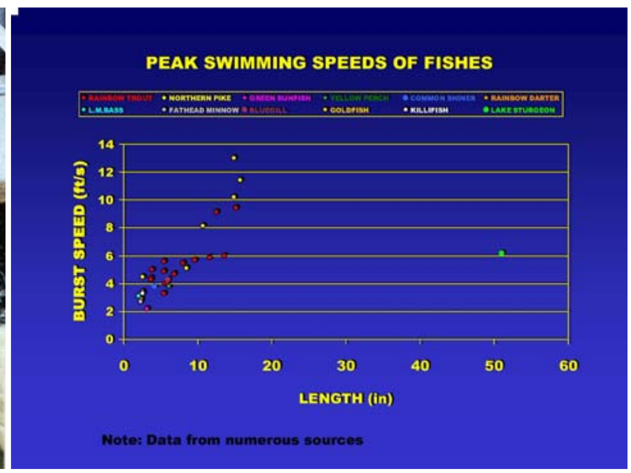

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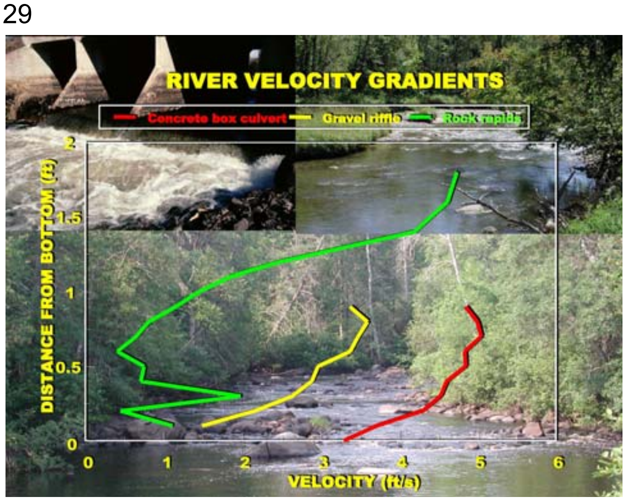

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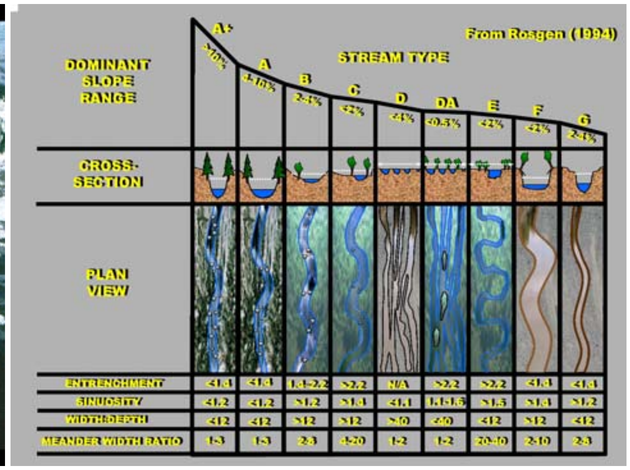

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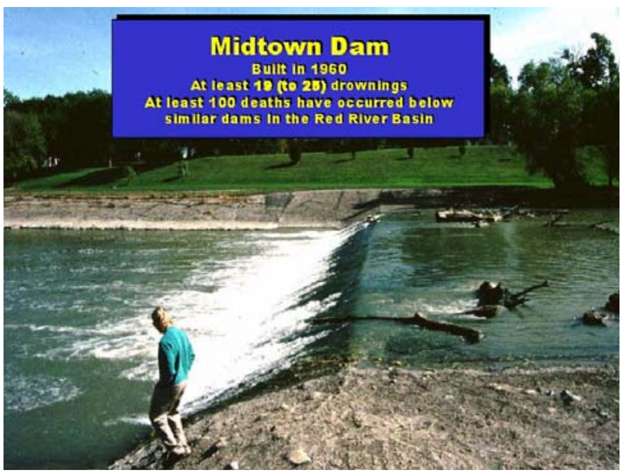

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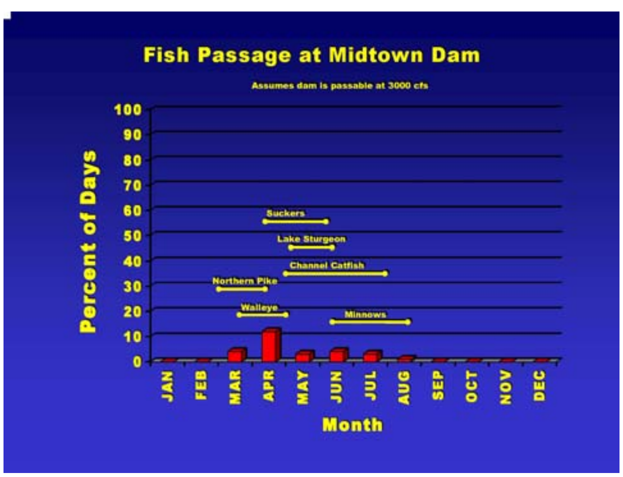

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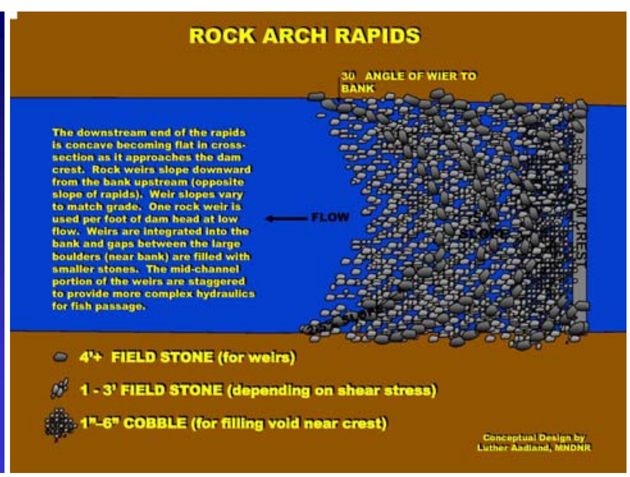

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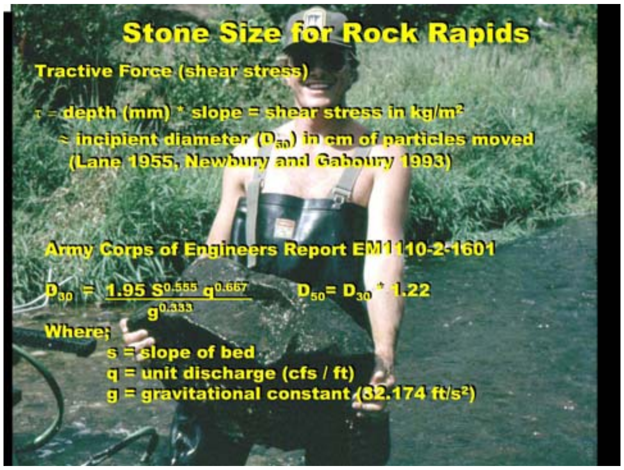

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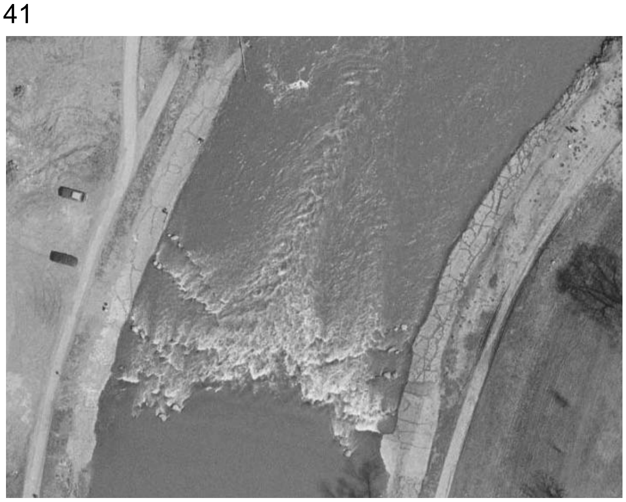

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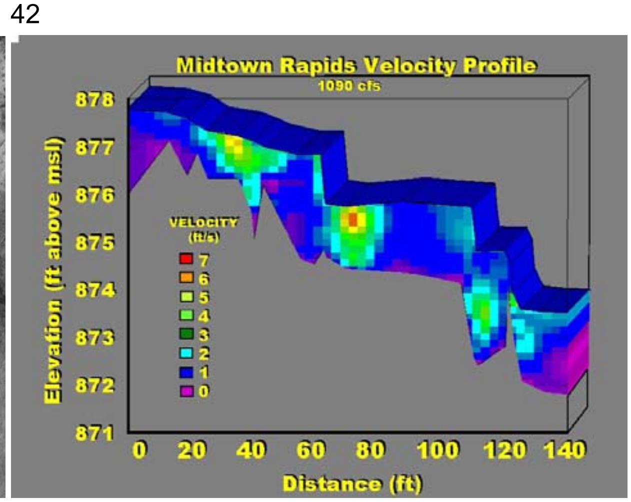

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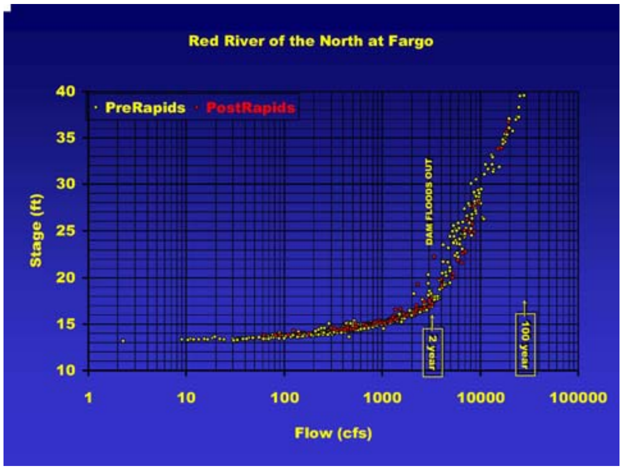

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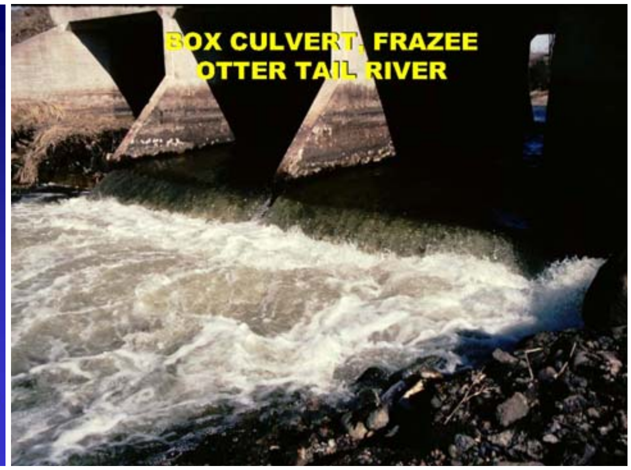

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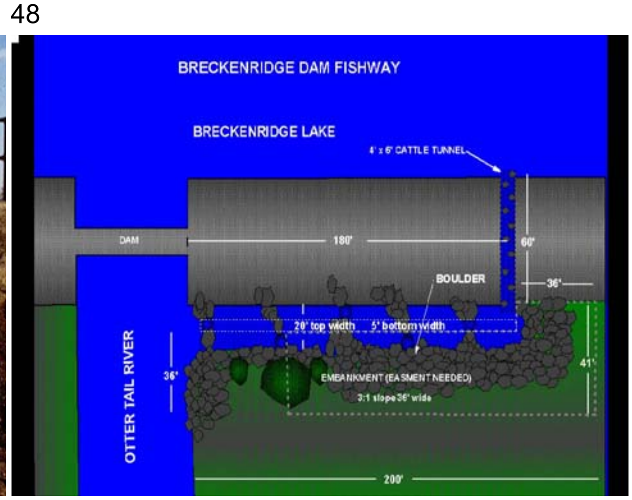

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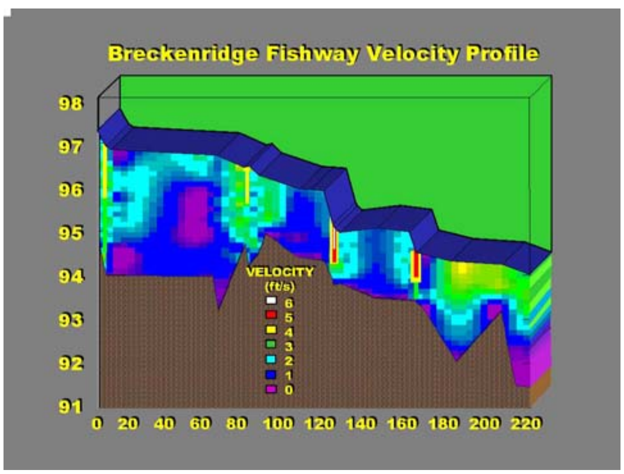

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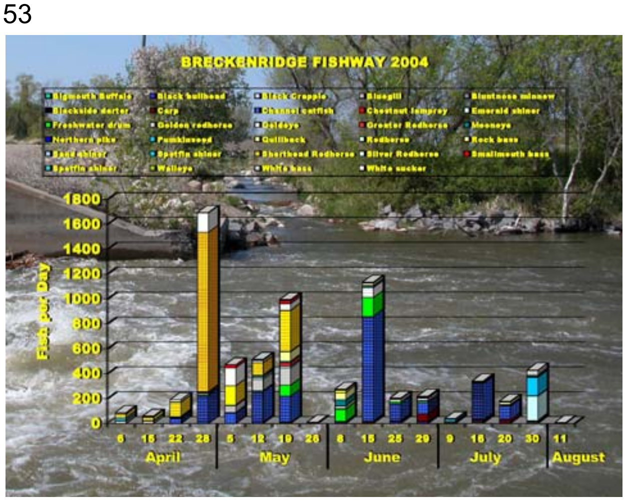

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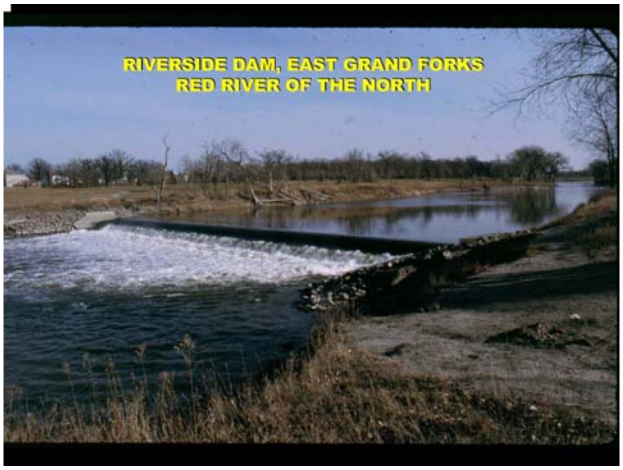

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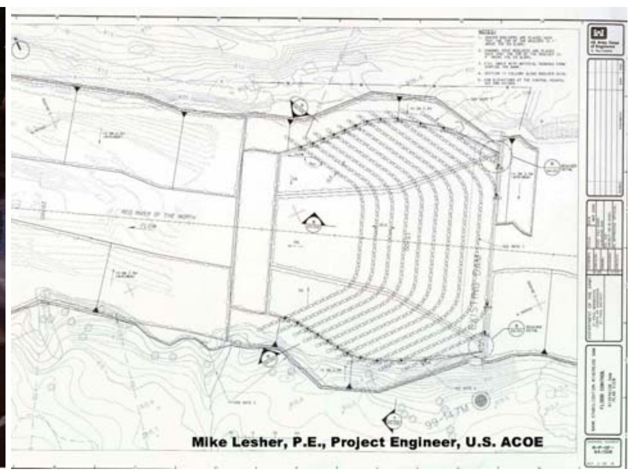

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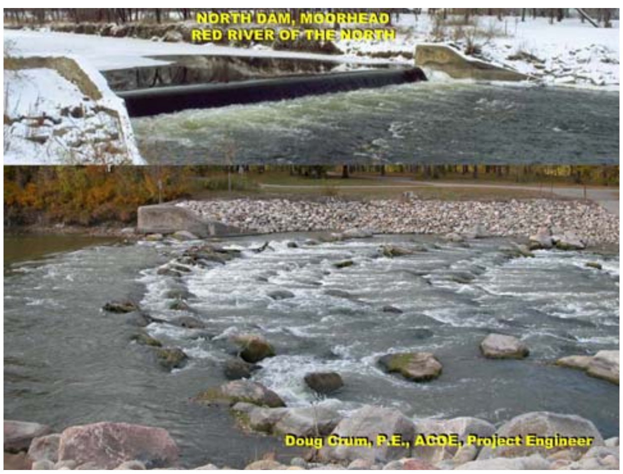

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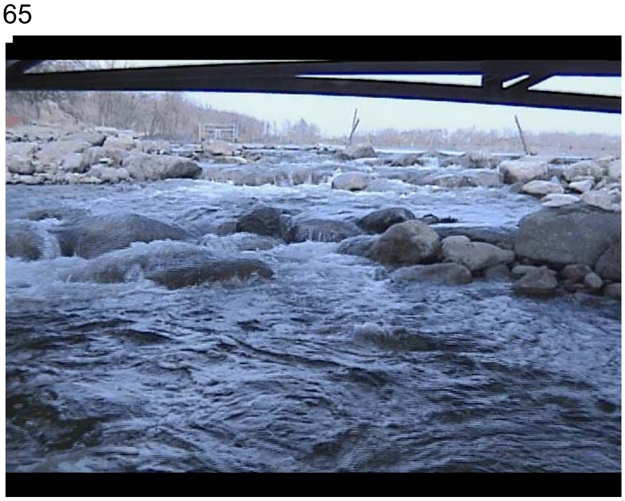

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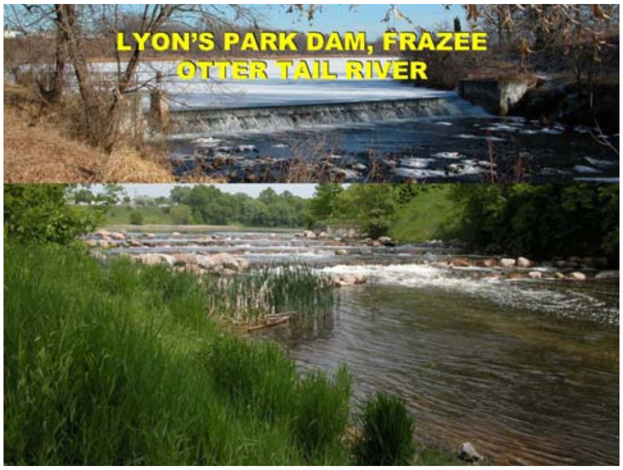

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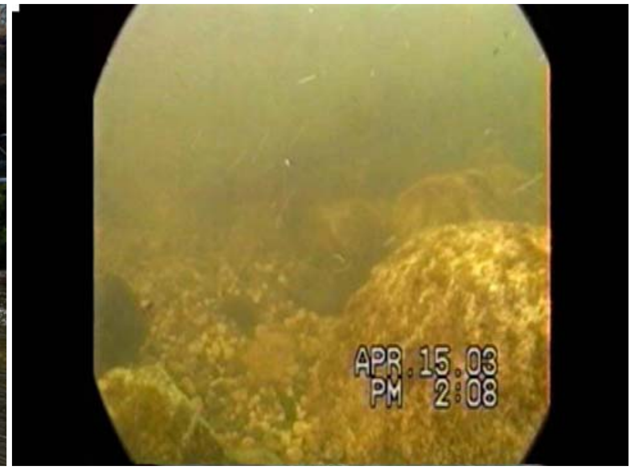

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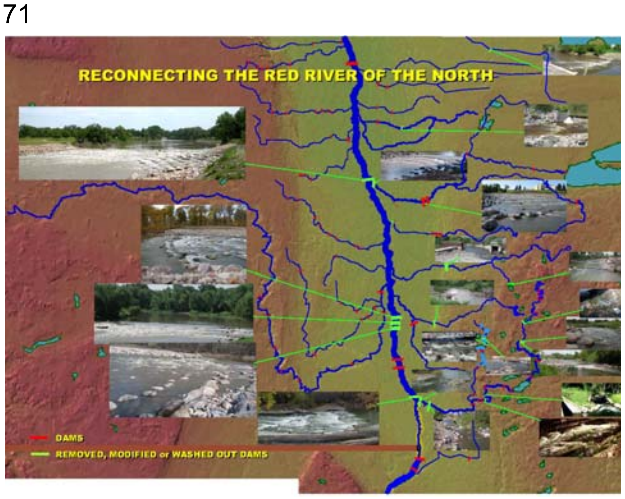

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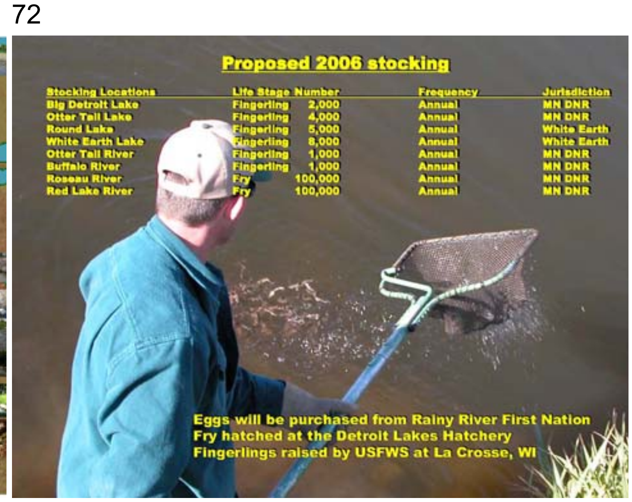

Appendix 7. Presentation by Henry Quinlan, U.S. Fish and Wildlife Service, Ashland, Wisconsin.

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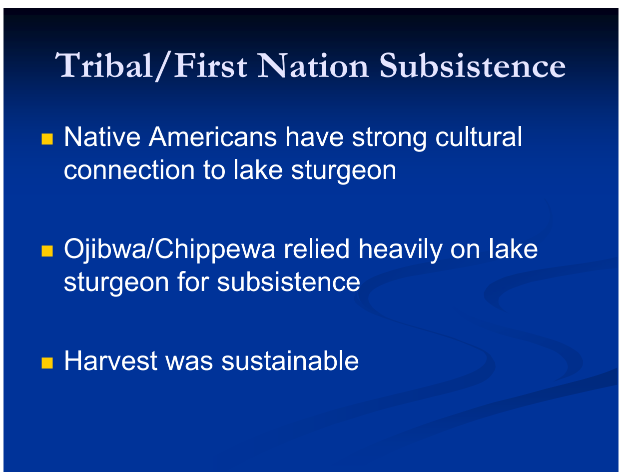

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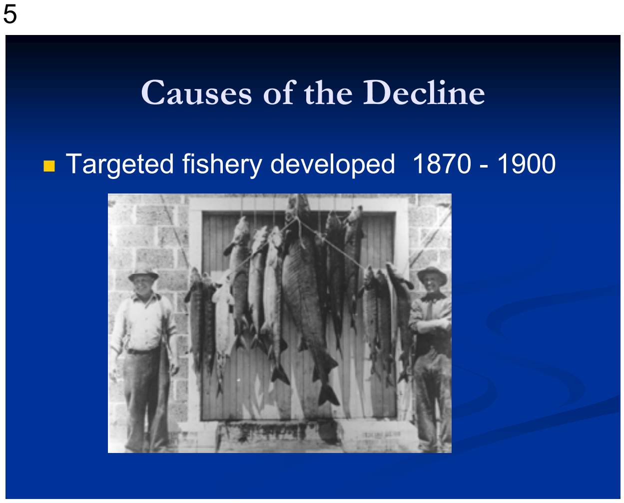

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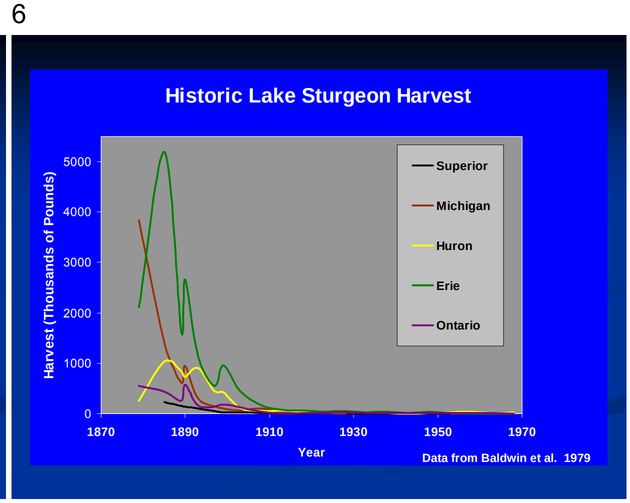


Slide 7

Causes of the Decline

- Hydropower development
  - Prevent fish passage
  - Alter flow and thermal regime
  - Changes sediment transport and productivity

8

Endangered Species Act - 1973

- Petition in 1982 resulted in federal designation as a “candidate” species for listing
  - “Candidate” - Insufficient information to make listing decision
  - Federal status as species of special concern until 1995
  - “Candidate” category redefined to include only species for which sufficient information is available

9

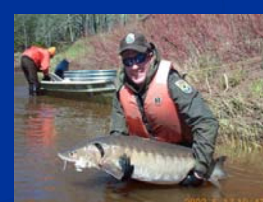
Rehabilitation Approach

- Individual agency rehabilitation - 1980s
- Lake-wide effort – 1990
- Sturgeon Committee formed
  - Membership: 6 Tribes/Tribal Organizations, 3 States, Province of Ontario, U.S. federal agency, and Universities

10

Rehabilitation Approach

- Review history & current population status
- Set goal for population rehabilitation
- Evaluate regulations
- Address impediments
- Evaluate progress



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Rehabilitation Goal

Self-sustaining populations in at least 17 Lake Superior rivers that historically supported lake sturgeon

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Self-Sustaining Population

- Minimum of 1,500 adults
- 20 or more year classes of adults
- Roughly equal sex ratio
- Annual recruitment
- Exploitation rate <5%
- ***No Population Meets Above Criteria***

Slide 13

Strategy – Evaluate Regulations

- Commercial fishing for lake sturgeon prohibited
  - Tribal home use of dead sturgeon allowed
- States / Province restrict or prohibit sport fishing
  - Size limit increases and season closures
- Most Tribes restrict sport / subsistence harvest
  - Protected from harvest (2 Tribes)
  - 1-2 fish per year limit (3 Tribes)
  - No regulations (3 Tribes)
    - Harvest estimated at 10 – 15 fish per year

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Strategy – Evaluate Regulations
Tribal Commercial

- Commercial gill net fishery
  - Targets lake trout, whitefish, lake herring
  - Live sturgeon released
  - Fishers support sturgeon rehabilitation
- Assist assessment efforts
  - Tag returns, collect biological data
- First Nation harvest unknown
  - Strong conservation ethics

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Rehabilitation Approach

- Hydropower re-licensing in U.S.
  - 3 Peaking facilities changed to seasonal run-of-river flow
    - inflows = outflows

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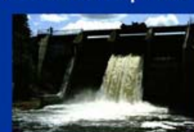
Result

- Michigan hydropower facility - ROR
  - Number and Size of spawning adults increase
  - Spawning duration reduced
  - Potential for egg and larvae loss decreased
- Increased potential for recruitment



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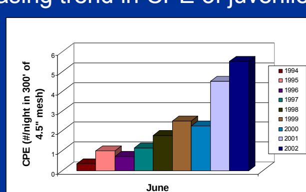
Result

- Wisconsin hydropower facility - ROR
- Increasing trend in CPE of juveniles



Great Lakes Indian Fish and Wildlife Commission data from Lake Superior near the mouth of the Bad River

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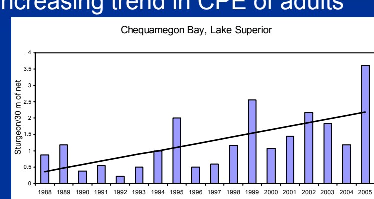
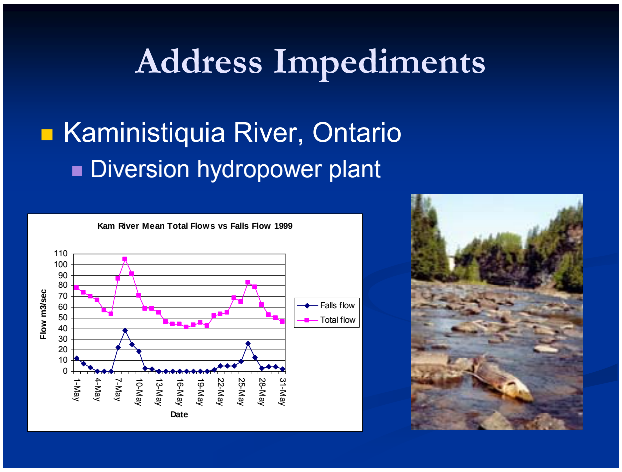
Result

- Wisconsin hydropower facility – ROR??
- Increasing trend in CPE of adults



Wisconsin DNR 8" and 10" mesh gill net set in June

Slide 19



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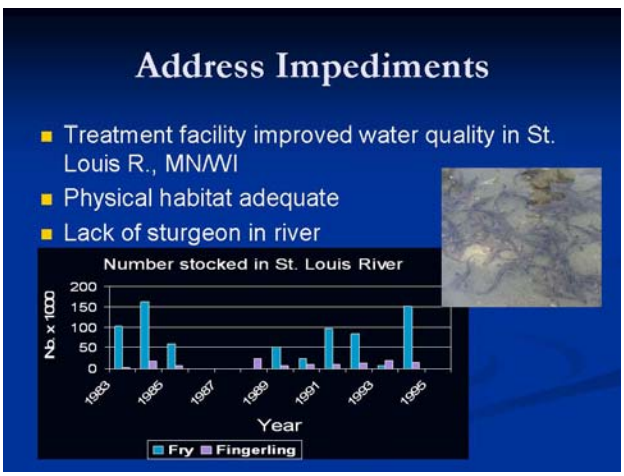

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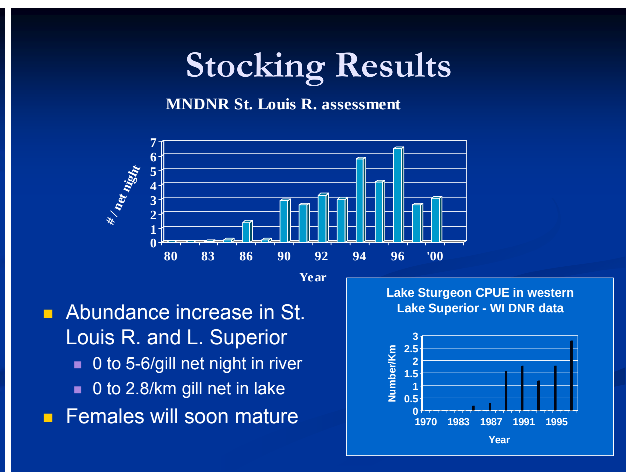

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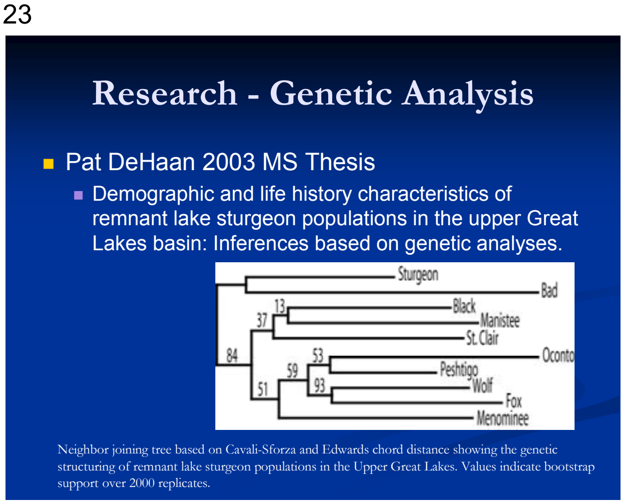

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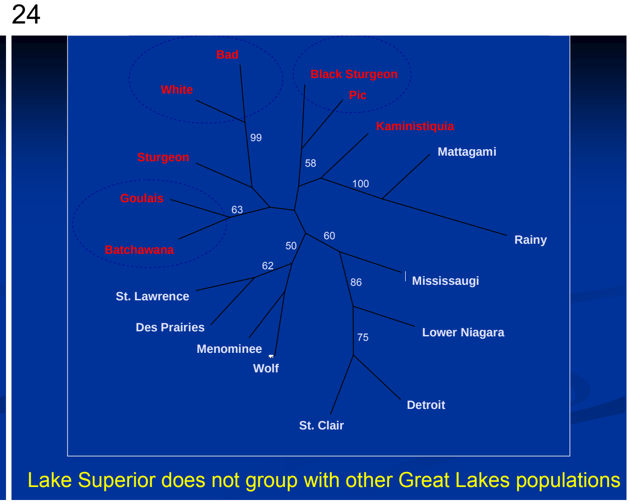

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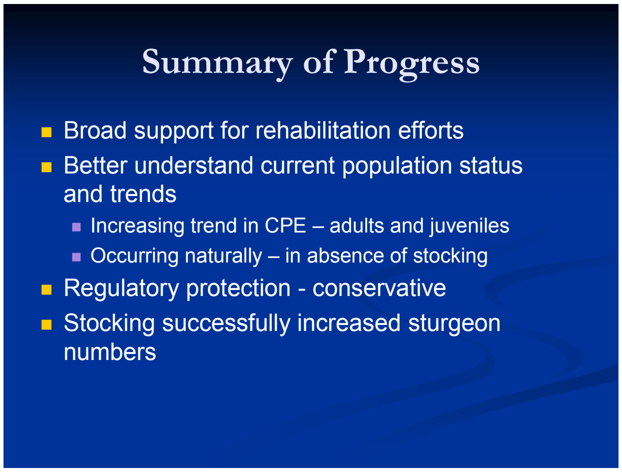
Summary of Progress
Broad support for rehabilitation efforts
Better understand current population status and trends
Increasing trend in CPE – adults and juveniles
Occurring naturally – in absence of stocking
Regulatory protection - conservative
Stocking successfully increased sturgeon numbers

26


Summary of Progress
Despite some success, hydropower problems / threats persist – Ontario
Genetic data is available to assist management decisions
Harvest / exploitation rates are unknown for most populations
On-going research on habitat requirements and movement and dispersal patterns
No Lake Superior population meets self-sustaining criteria

Appendix 8. Presentation by Tom Mosindy, Ontario Ministry of Natural Resources, Kenora, ON.

Slide 1

Managing the Recovery of
Lake Sturgeon
in the Ontario – Minnesota
Border Waters

Tom Mosindy
Ontario Ministry of Natural Resources
Kenora, ON

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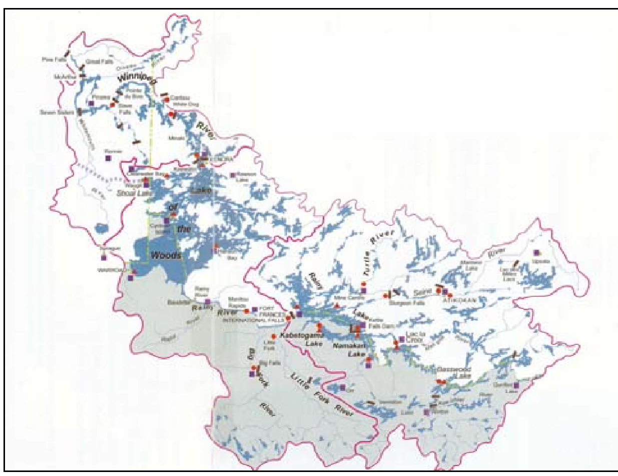

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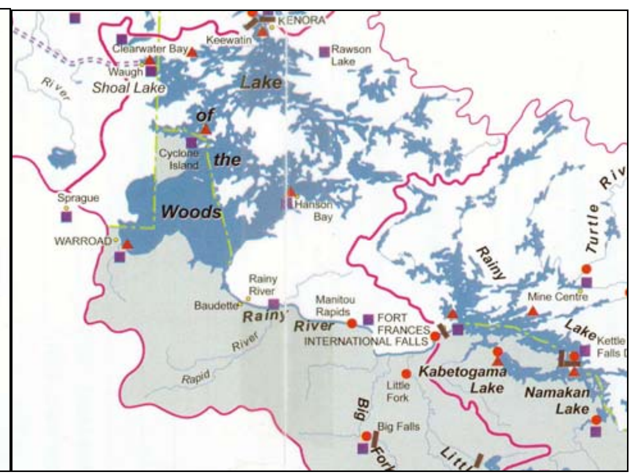

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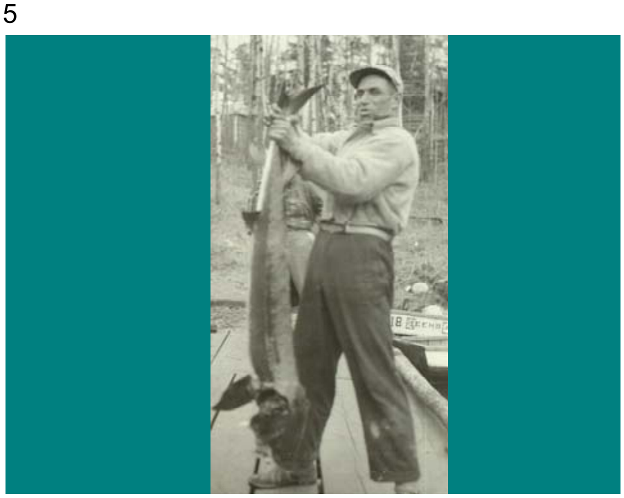

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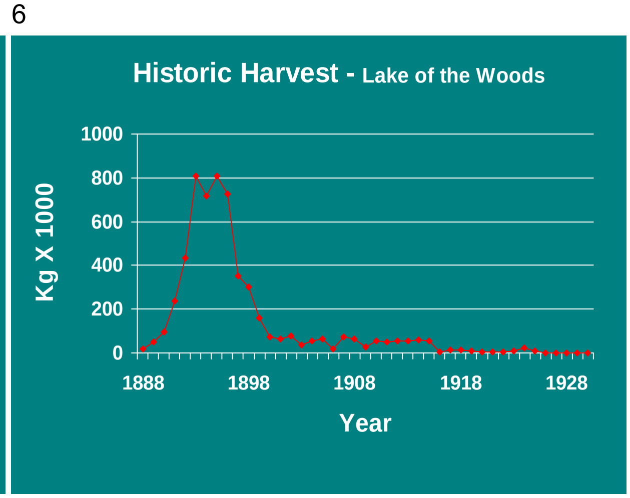

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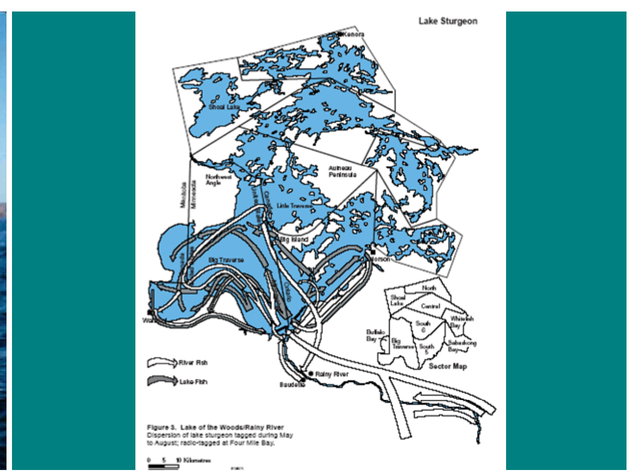

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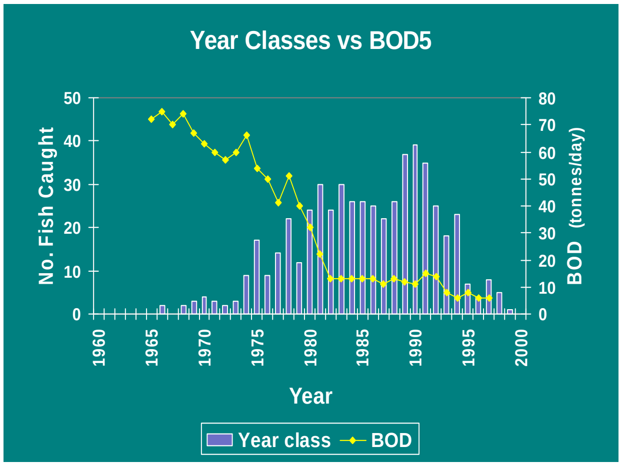

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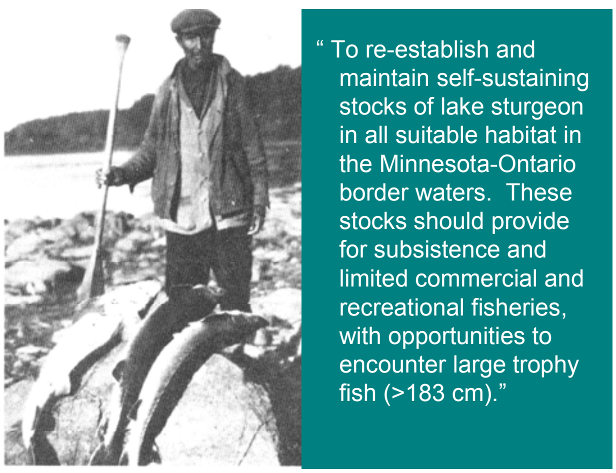

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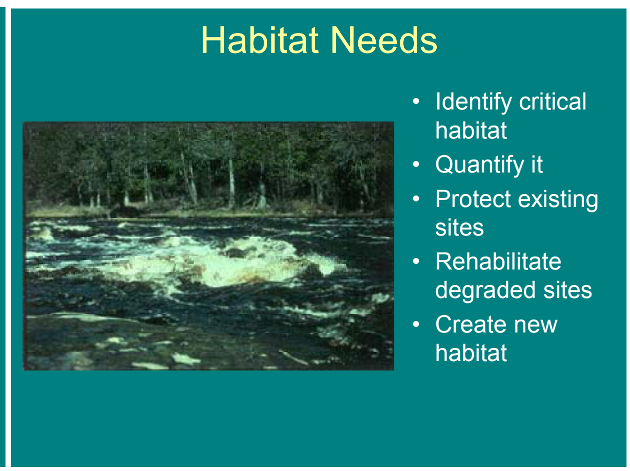

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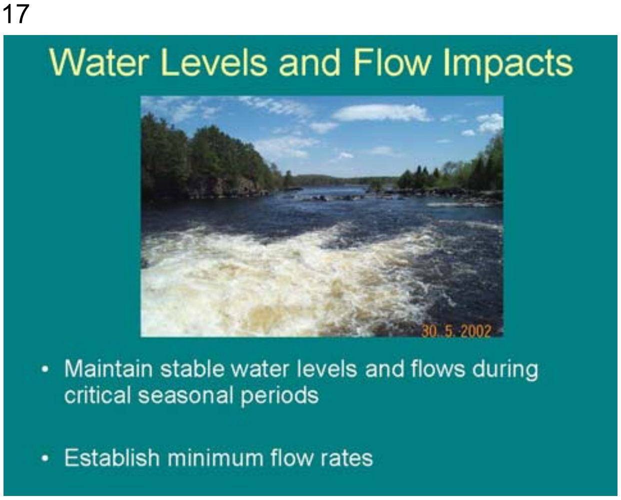

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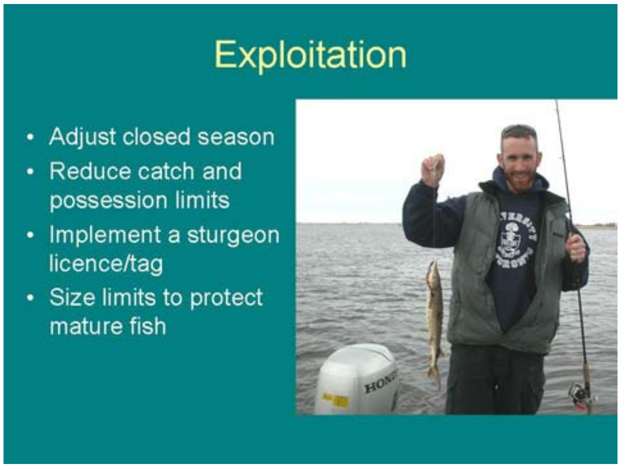

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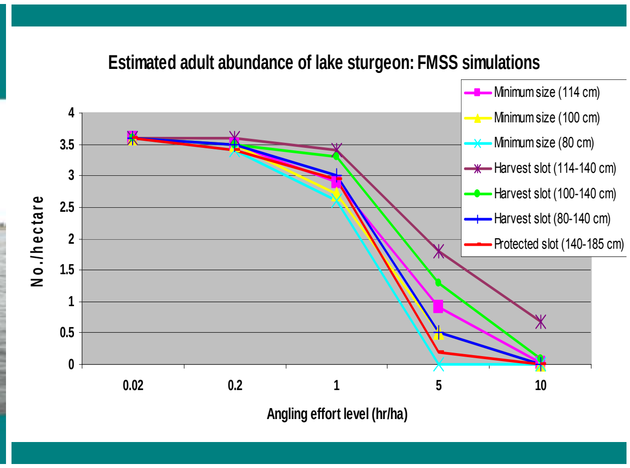

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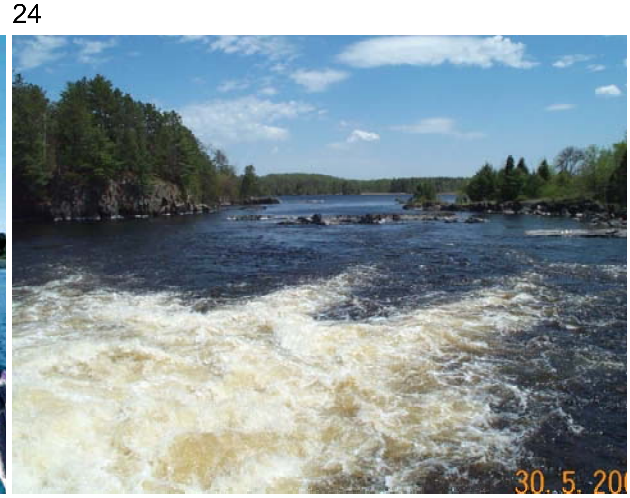

Appendix 9. The biology, status and management of lake sturgeon (*Acipenser fulvescens*) in the Québec part of the St. Lawrence River: a summary (Dumont *et al*. 2006).

Lake Sturgeon Recovery Planning Workshop, February 28 – March 02 2006, Winnipeg, Manitoba[1]

The biology, status and management of Lake Sturgeon (*Acipenser fulvescens*) in the Québec part of the St. Lawrence River: a summary[1]

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Réjean Fortin
and many graduate students
Département des Sciences biologiques
Université du Québec à Montréal

[1] *Adapted and updated from a presentation at the Lake Sturgeon workshop, September 22-23 2005, Cornwall, Ontario*

With annual catches in the 1980s and 1990s exceeding 150 metric tons and annual yields exceeding 1.5 kg/ha, the commercial fishery of the St. Lawrence River lake sturgeon was one of the most important sturgeon fisheries in North America. In the early 1980s, an increase in demand for commercial fishing licenses led us to study various aspects of the biology, habitat and dynamics of this population, to revise the fishery management plan and to implant various measures of habitat protection and improvement.

Biology

Distribution

Over a 350 km stretch, from Lac Saint-Louis (Montréal) to the brackish waters, downstream of Québec City, lake sturgeon likely form a homogeneous phenotypic and genotypic stock (Guénette et al. 1993). This population was not found significantly different from sturgeon from Lac des Deux Montagnes, in the Ottawa River system. However, the absence of one genotype and its presence in Lac des Deux Montagnes support the hypothesis that sturgeon do not circulate between the two water bodies, as suggested by the results of tagging studies (Fortin et al. 1993) and morphological comparisons (Guénette et al. 1992a). The genetic heterogeneity seemed lower in the St. Lawrence River population than in the James Bay drainage population, likely because this southern population has been more significantly influenced by overfishing and man-made habitat changes over a long period of time (Guénette et al. 1993).

Atlantic (*A. oxyrinchus*) and lake sturgeon co-occur in the Upper estuary, from the outlet of Lac Saint-Pierre to the limits of freshwater.

Movements

In the Québec part of the St. Lawrence River, mark-recapture experiments indicate that, with the exception of spawning migrations which are extensive, movements are restricted (Fortin et al. 1993; Dumont et al. 1987; Magnin and Beaulieu 1960)). In this system, lake sturgeon occur in large numbers in small localized sites and this condition increases their vulnerability to fishing gears and to any intervention on these local habitats (filling, dredging, toxic outflows, etc…). Some sturgeon seem to form very stable groups; for example, at least three occasions, pairs of fish tagged simultaneously were recaptured together (Dumont et al. 1987).

Larval drift downstream of the main spawning ground (des Prairies River, Montréal), size and age distribution of juveniles in the experimental samples (mostly age 2 to 8) and of subadults in the commercial harvest samples suggest that sturgeon are mainly produced in the upper part of the system, they drift downstream towards the lower part and they gradually colonize the river along a downstream-upstream gradient. Most of the juvenile concentrations are found in the lower part, between the Lac Saint-Pierre archipelago freshwaters and the estuarine brackish waters, near Iles d'Orléans (Dumont et al. 2000). In Lac Saint-Louis, males and females are longer, heavier and older and almost half of the females (45%) are maturing. In the most downstream commercial fishing sector, sturgeon are smaller, lighter and younger and only 2.4% of the females are maturing. Intermediate values are observed in the two median fishing sectors (Dumont et al. 1997).

Growth, food and feeding

Growth rate is moderately high (Dumont et al. 1987). Lake sturgeon average backcalculated total length at 5, 10, 15, 20, 25 and 30 years of age is respectively 530, 770, 977, 1165, 1251 and 1338 mm (Fortin et al. 1992). In the past 25 years, maximum age and weight observed in the commercial harvest were 96 years and 90 kg.

Diet of juvenile lake sturgeon is highly diversified and composed of at least 75 taxa, of which more than 50 are of occurrence higher than 5%. This probably reflects both the high diversity and density of the benthic fauna of this system (~2400/m^2 compared for example to < 100 / m^2 in Northern Ontario watersheds (Nilo et al. in press; Beamish et al. 1998)). The most exploited prey are amphipods, aquatic insect larvae, mollusks and oligochaetes. Fish and microcrustaceans are also eaten, but in much smaller proportions (Nilo et al. in press, Mongeau et al. 1982). In the Upper estuary, Atlantic and lake sturgeon use the same major preys in different proportions (Guilbart et al. 2003). A comparative morphometric study of the digestive tract suggests that the thicker gizzard wall of the lake sturgeon facilitates access to hard preys while, for Atlantic sturgeon, a longer intestine and a higher development of the spiral valve favour chemical digestion (Guilbart 2002). Zebra mussel (*Dreissena polymorpha*) is now found in the digestive tract of lake sturgeon but is not selected (Nilo et al. in press, Guilbart et al. 2003; Pierre Dumont, unpublished data).

Reproduction and recruitment

Sexual maturity is delayed, the females median age at first maturity being 26 years (Guénette et al. 1992b). Spawning periodicity is estimated to 1 to 3 years for males and is likely higher than 4 years for females (Fortin et al. 2002). Spawning grounds are generally located in the St. Lawrence tributaries. However, in 2002, a spawning ground of 35 000 m^2 was discovered in the Lachine Rapids : this is the largest known in the Québec waters of the River (La Haye et al. 2003, 2004). Reproduction occurs during the second to the fourth week of May in the tributaries (12-17°C) and between the fourth week of May and the third week of June in the River (11-14° C). These areas are covered of a mix of fine- to medium-size gravel to boulders, under 0.1 to more than 6 m of water and exposed to current velocity between 0.1 and 1.9 m/s. In the des Prairie River, larval drift generally occurs at night and lasts 14 to 20 days, between the third week of May and the third week of June (La Haye et al. 1992, 2003, 2004; Fortin et al. 2002; D'Amours et al. 2001; Garceau and Bilodeau 2004).

Fecundity has been measured on 16 females caught in Québec from the 1940s to the 1970s. It varies between 48,420 eggs to 670,450 for females between 929 and 2009 mm. It is related to length (Log_{10} F=3.70214 Log_{10} TL – 2.62905; R^2 =0,90) and weight (F=11921.2 + 13079.6 W; R^2=0.94) (Fortin et al. 1992, 2002; Cuerrier 1966).

Year-class-strength appears to be determined in the first few months of life. Climatic and hydrological conditions in June, during which larvae drift from spawning grounds and exogenous feeding begins, are critical determinants of year-class strength in the St. Lawrence River (Nilo et al. 1997).

Anthropic limiting factors

Habitat fragmentation

Recent experimental fishing data confirm that the Lac Saint-François sturgeon group, upstream of Lac Saint-Louis, considered as depleted in the 1940s (Cuerrier and Roussow 1951), the 1960s (Joliff and Eckert 1971) and the 1980s (Dumont et al. 1987), is still of very low abundance. Tagging studies in the 1940s indicate that lake sturgeon was then able to migrate along the St. Lawrence River, from the limits of the brackish waters up to at least Brockville (Ontario) (Roussow 1955). Depletion of the Lac Saint-François lake sturgeon group can likely be related to the combine effects of the gradual construction of dams at both extremities of the lake between 1912 and 1958 (Morin et al. 1998) and of the overfishing of the residual stock.

Since the beginning of the 1960s, sturgeon movement between the St. Lawrence River and the Ottawa River is almost completely blocked by the Carillon hydroelectric dam at the head of Lac des Deux Montagnes.

Water pollution

The Lac des Deux Montagnes sturgeon population, which has not been exploited commercially since 1950, has been decimated following a prolonged winter period of anoxia caused by the discharge of untreated domestic and pulp and paper effluents in the Ottawa River watershed. This drastic reduction acted as a population bottleneck. Thirty years later, the restoration of this population was still quite fragmentary while only 7 year classes were identified in the experimental catch. Two (or three) year classes were dominating (1955 and 1960-61) and no individuals born before 1951 were observed (Mongeau et al. 1982).

In the L'Assomption River, a 10-fold improvement in larval production was observed following water treatment installation, while massive egg and larval mortality occurred before sewage-treatment (Dumas et al. 2003).

In an attempt to evaluate the effects of contaminant on lake sturgeon, bioindicators were measured in a sample of lake sturgeon from two sites: des Prairies River, confluent with the St. Lawrence River (Montreal), and a reference site in the upper reach of the Ottawa River in the La Verendrye Park. Negative effects of organics contaminants were suspected, fish taken from the des Prairies River having moderate to severe hepatic pathology (Rousseaux et al. 1995). Among larvae raised in artificial stream, prevalence of fin deformities was highly significantly greater in the progeny of sturgeon sampled in des Prairies River (6.3%) compared with the progeny of sturgeon from the reference site (1.7%) (Doyon et al. 1999). Concentrations of liver and intestine retinoids were also found to be significantly lower (as much as 40 times lower) in the des Prairies River sample (Doyon et al. 1999; Ndayibagira et al. 1995).

Dredging

Dredging and dumping operations conducted for the construction of the navigation channel and the St. Lawrence Seaway in the 1950s and 1960s caused major man-made habitat changes. Channel and harbor maintenance now is of annual occurrence (Dumont et al. 1987, Robitaille et al. 1988) and there is a need to acquire a deeper knowledge about the relationship between habitat characteristics, feeding and distribution of lake sturgeon in the River (Nilo et al. in press).

Fishery

Historical use of lake sturgeon by First Nations people has been well documented in the Quebec distribution area. For example, in the archaeological site of Pointe-du-Buisson, at the confluence of the St. Lawrence River in Lac Saint-Louis, bone fragments of lake sturgeon, channel catfish and catostomids highly dominate in the remnants of meal identified and associated to the Late Woodland period (circa 920-940 A.D.) (Courtemanche 2003). Mohawks people of Kahnawake are still practicing subsistence fishery in Lachine Rapids, at the outlet of Lac Saint-Louis. In Northern Quebec, according to the *James Bay and Northern Quebec Agreement* (1975), sturgeon fishing is reserved to native people.

In Southern Quebec, lake sturgeon is mainly a commercial species. In 1987, the St. Lawrence stock was considered overexploited due to high annual natural and fishing mortality rates of the exploited segment (ages 15 to 30), unbalanced age structure, deficit of reproductive potential and excessive annual yield (Dumont et al. 1987). The number of spawning grounds was found to be limited, most of them being located in the upstream part of the system. Many previously used sites were no longer accessible or utilized because of various types of human interventions (Dumont et al. 1987; La Haye et al. 1992). Three major factors were identified to likely account for the high resilience of this stock: 1. the relatively high productivity of the system; 2. the fact that the intensive commercial fishing was restricted to specific zones, leaving some sectors to act as reservoirs (this "sanctuary" effect is undoubtedly important); 3. the high selectivity of the historically used commercial gill nets (19 to 20 cm stretched mesh).

Between 1987 and 1991 a new management plan was gradually implemented to reduce the catch, provide more protection to the spawners and strengthen law enforcement. The fishing season and the number of fishing licenses were reduced, longlines and seines were banned and gillnets stretched mesh restricted to 20 cm. Sportfishing regulations were also tightened. In the 1990s, research was undertaken to : 1. increase the knowledge on the characteristics of spawning grounds and juvenile habitats; 2. develop an index of year-class strength in order to anticipate the evolution of the fishery, which harvests mainly fish over 15 to 20 years old, and prevent collapse (La Haye et al. 1992; Nilo et al. 1997; Fortin et al. 2002). In 1994, the commercial harvest was sampled again in four fishing sectors. Additional data were collected in 1998. This information led to a new diagnosis of the status of this stock and to revise the management plan of the fishery.

From the beginning of the 1980s to the mid 1990s, growth rate remained about the same. However, for identical lengths, in the four fishing sectors sampled in 1994, sturgeon weights were 7 to 14.8% lower than they were a decade earlier. For most 100 mm length classes well represented in the four samples (800 to 1300 mm), the Fulton condition factor (K) was lower in 1994 (Kruskal-Wallis tests; $P < 0.05$ to $P < 0.01$); the decrease varied between 5% and 21% and was generally over 10%. Catch curves of the commercial harvest showed that annual mortality rates remained high and, moreover, that the peaks of the catch curves, or the apparent age of full recruitment, shifted substantially to older fish in Lac Saint-Louis (from age 16 to 23) and Saint-Pierre (from age 14 to 20). Temporal comparisons of the 20 cm gillnet CPUE showed a reduction of 7% in Lac Saint-Louis from 1994 to 1998 and of 25% from 1984 to 1998 in Lac Saint-Pierre. The annual rate of decrease was similar (1.75%) but only the second decrease was statistically significant (Kruskal-Wallis tests; $P < 0.05$). Juvenile surveys revealed that there has been no rupture in the sequence of cohorts between 1980 and 2001. However, a gradual reduction of 58 % of the year-class strength index was observed from 1984 to 1992 ($r_s = -0.7$; $P = 0.02$) (Dumont et al. 2001). Two comparatively strong year classes were produced in 1993 and 1994; they were followed by one average and one weak year classes. From 1995 to 1999, mark-recapture estimates of the number of mature females on the des Prairies River spawning ground declined by 61%, from 1,231 to 500 fish (Fortin et al. 2002).

Observed trends in age structure of the harvest (15 to 30 years old fish), year-class strength (based on the age distribution of the 2 to 8 years old segment) and abundance of mature females (over age 25) formed a coherent set of observations indicating an overexploitation status that likely began in the mid 1970s. Combined to the fact that, since 1986, the declared commercial catch remained very high (152-259 tons; average, 202 tons) and greatly surpassed the historical landings reported before 1983 (maximum ca 65 metric tons), it is clear that the 1987 management plan failed to inverse the decline. The observed decrease of the condition factor is an unlikely response to the reduction in abundance of lake sturgeon and is possibly related to changes in the trophic conditions of the St. Lawrence River, thus probably decreasing the potential production of the sturgeon population. A 200 tons commercial catch quota has been enforced in 1999, coupled with the obligation to tag each sturgeon carcass. It has then been decreased by 20% in 2000, 2001 and 2002 and is now 80 tons. Since 2000, the fishing season has been shortened by two months (June 14 to July 31 and September 14 to October 15).

Habitat conservation and improvement

The quality and area of two spawning grounds were successfully increased in the des Prairies and Saint-Maurice rivers (Fortin et al. 2002; GDG Conseil 2001). In des Prairies River, the most important spawning ground of the system, eggs-to larvae survival has been increased from an average of 0.8% before the improvement (1995-1996) to 5.4, 3.7 and 2.4% in 1997, 1998 and 1999 (Fortin et al. 2002). As suggested by Russian literature (Khoroshko and Vlasenko 1970) and our own observations, higher survival rates can likely be related to a reduction of egg densities on the spawning beds under 3000-3500 eggs/m^2. Larval production was also increased from 3.9 million (1.2 to 8,6 million) between 1994 and 1996 to 7 million (2 to 12.8 million) between 1997 and 2003 (Fortin et al. 2002; Garceau and Bilodeau 2004). Another spawning ground was artificially created downstream of Beauharnois Power Plan, but this trial has not been successful.

Dredging projects along the navigation channels and in harbor works were analyzed and modified in order to protect juvenile habitats.

In the l'Assomption watershed two sturgeon spawning beds were exposed to raw sewage, land slides and dam-operated water fluctuation. Governemental and non-governemental organizations conducted a five-year study (1998-2002) comparing the sturgeon larval production before and after the construction of sewage treatment facilities on the l'Assomption River while monitoring nearby controls in the Ouareau River. Massive egg and larval mortality occurred before sewage-treatment and a 10-fold improvement in larval production was observed following treatment installation. Study results have raised enthusiasm among authorities and organizations while the species has become a regional symbol. The watershed management corporation has recognized the spawning areas as keys sites for biodiversity and developed plans for their conservation and restoration (Dumas et al. 2003).

In the 1980s, new operating and discharge criteria were tested and applied to ensure access to a spawning ground used before the construction of a dam in 1960 at the confluence of the St. Lawrence River in Lac Saint-Louis.

Each spring since 2001, only a few large lake sturgeon are among the thousands of fish, belonging to at least 35 species, that use the new fishway built at the Saint-Ours dam, on the Richelieu River (Fleury and Desrochers 2004). This single vertically slit ladder, composed of 16 successive large basins (with a difference of level of 15 cm between each basin), was designed to respond to the requirements and characteristics of lake sturgeon, american shad, river redhorse, copper redhorse and american eel (Paradis and Malo 2003).

A study was initiated in 2001 in order to quantify the impacts of water discharge variation on the St. Lawrence River fish community. Habitat modeling emerged from a creative multidisciplinary collaboration with modelers, integrating the physical dimension of the habitat with biological processes in a 2D spatially explicit model. The digital model covered a large part of the lake sturgeon distribution area in the Quebec section of the St. Lawrence River with a high spatial resolution. Surfaces of suitable lake sturgeon habitat, estimated for a broad spectrum of hydrological conditions, were found to increase with discharge. Recommendations concerning fish habitat protection in the fluvial St. Lawrence were presented to the International Joint Commission under the in process evaluation of the regulation criteria of the Lake Ontario – St. Lawrence River system (Mingelbier et al. 2004, 2005ab).

In 2006, an hydroelectric project in the Courant Sainte-Marie, in front of Montreal, was withdrawn in order to protect one of the rare remaining rapid sectors of the St. Lawrence River and to maintain free movements of migratory species (lake sturgeon, american shad, american eel, copper redhorse…) (Dumont et al. 2005). In mid 1980s a similar project was rejected for environmental concerns in another site, the Lachine Rapids about 15 km upstream.

The future

Lake sturgeon is sensitive to habitat degradation and fragmentation, and to overfishing. After a long period of decreasing in the Quebec part of the St. Lawrence River, large and increasing production of larvae in the Des Prairies River, strong year classes appearance, increasing abundance of subadult fish in Lac Saint-Louis and positive comments from commercial fishermen are recent encouraging signs of improvement of the status of the lake sturgeon population. This improvement is likely partly related to our sustained effort of management of this unique population during the past 25 years. In the future, it will be important to prevent additional fragmentation of this 350 km stretch of fluvial habitat, to intensify the efforts of reduction of water pollution in the Great Lakes – St. Lawrence River system, to maintain the application to the fishery of conservative restrictions, measures of control, law enforcement and periodic monitoring, to preserve and, if requested, to improve the quality of the known spawning grounds and to continue to deepen our knowledge of the biology and habitat of this population.

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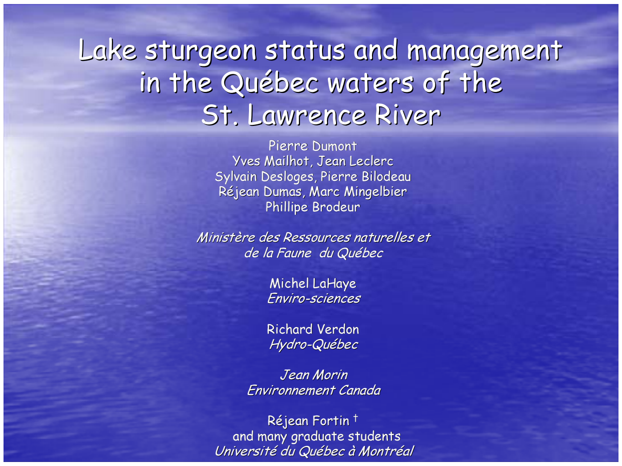
(2006-03-23)

Appendix 10. Presentation by Pierre Dumont, Ministère des ressources naturelles et du la Faune du Québec, Longueille, QC.

Slide 1



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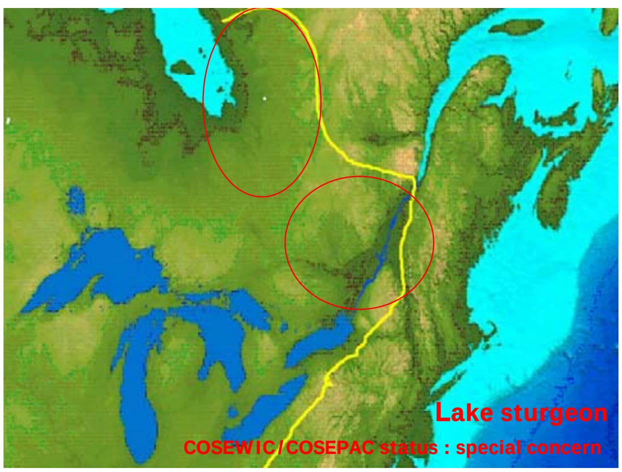

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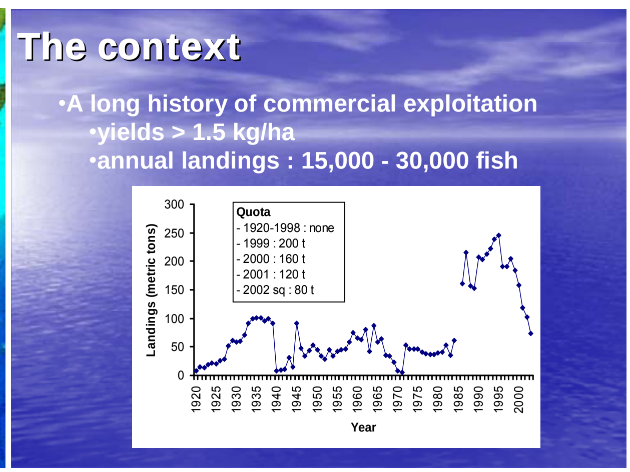

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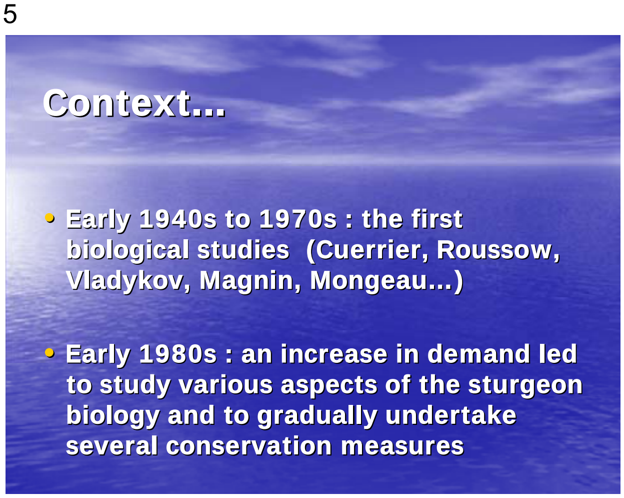

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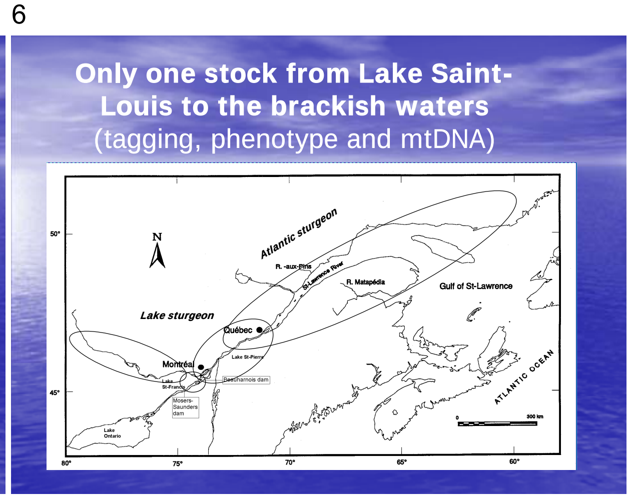


Slide 7

Biological context

- Growth rate is comparatively high
- A long life cycle:
  - up to 96 years and 90 kg
  - median age at first maturation for females: 26 years
  - spawning periodicity
    - males : once every 1-3 years
    - females : > 4 years ???
- A high fecundity
  - > 12,000 eggs / kg
  - or 180 000 eggs for an "average" female of 130 cm

8

Feeding ecology

- Juvenile diet : highly diverse
  - 74 invertebrates taxa
  - at least 50 taxa of significant occurrence
  - low overlap with Atlantic sturgeon in the estuary
  - positive selection for drifting prey (amphipods)
  - high occurrence of plant debris
  - Zebra mussel is consumed but not selected
  - high benthic invertebrates density
    - St. Lawrence River : ~ 2400 / m^2
    - Mattagami and Groundhog rivers : < 100 / m^2

9

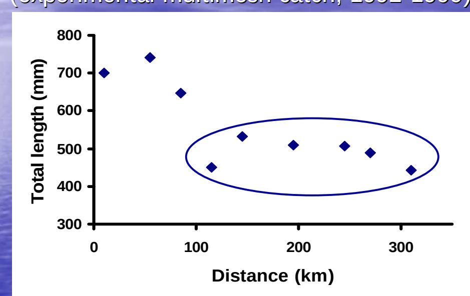
Movements

- Since the 1940s, more than 15 000 sturgeon tagged
- Movements are restricted, except for the spawning migrations
- A slow downstream-upstream migration as sturgeon become older

10

Juvenile size increases from the upper estuary to Lake Saint-Louis

(experimental multimesh catch, 1992-1999)



Lake Saint-Louis → Orleans Island

11

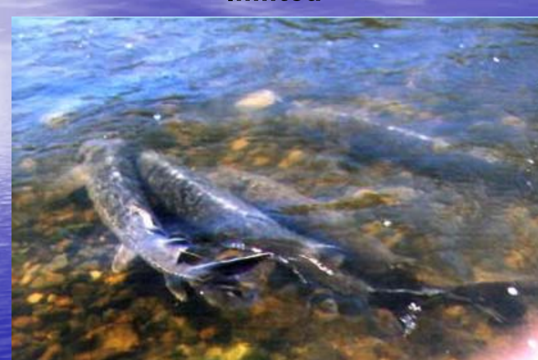
Sub adult and adult size increases from the upper estuary to Lake Saint-Louis

(commercial catch, 1994)

	Lake Saint-Louis	Lake Saint-Pierre archipelago	Upper estuary
Total length (mm)	1065	1001	967
% Males of stage 4 and over	6.1	4.7	1.9
% Females of stage 2 and over	45	12.2	2.4

12

The number of spawning grounds is limited



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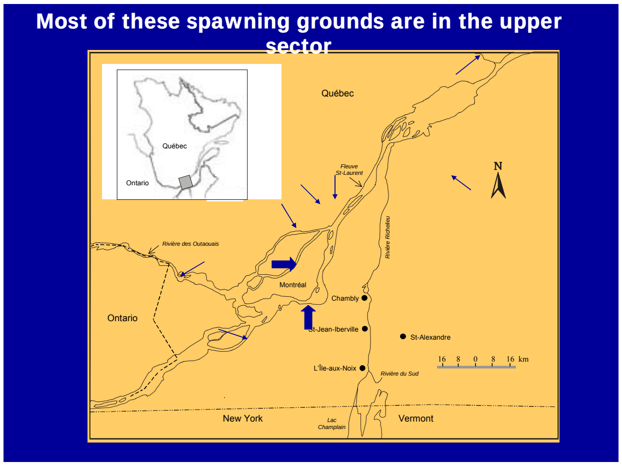

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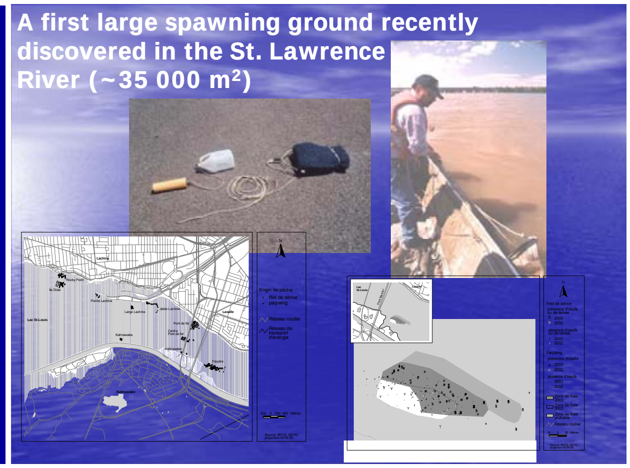

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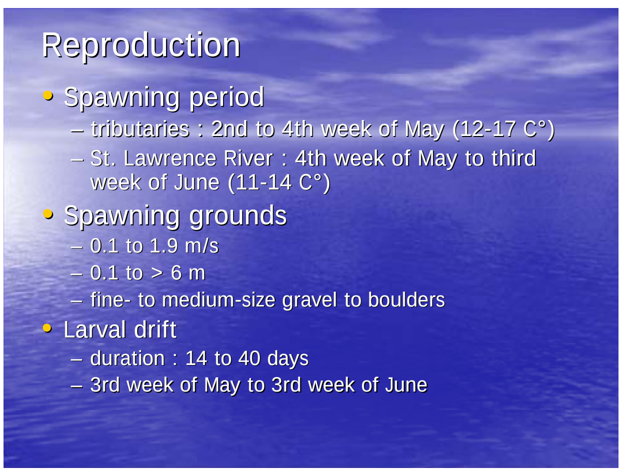

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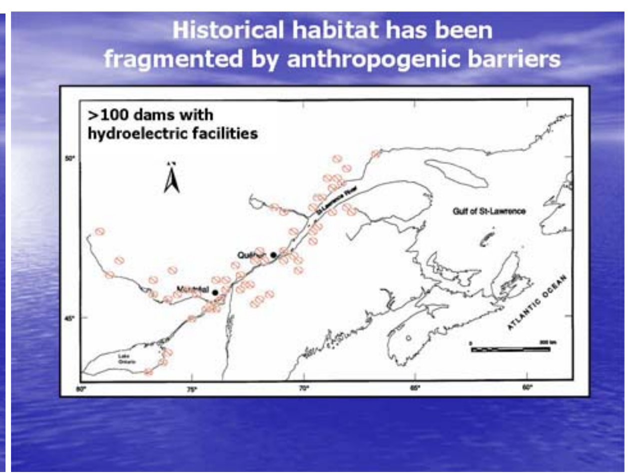
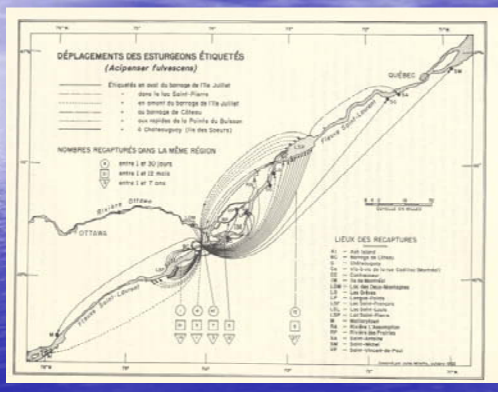


Slide 19

Before the 1960s, the SLR lake sturgeon had an open access to the Great Lakes (Roussow 1955)



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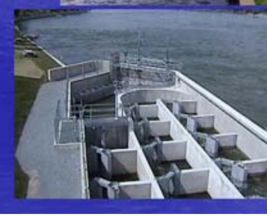
Fishways are partial solutions for sturgeon movements (ex : the Vianney-Legendre fishway on the Richelieu River)

- In operation since 2001
- 16 successive basins with a 15 cm level difference
- A single vertically slit ladder
- More than 35 fish species utilize this fishway (including a few large lake sturgeon)



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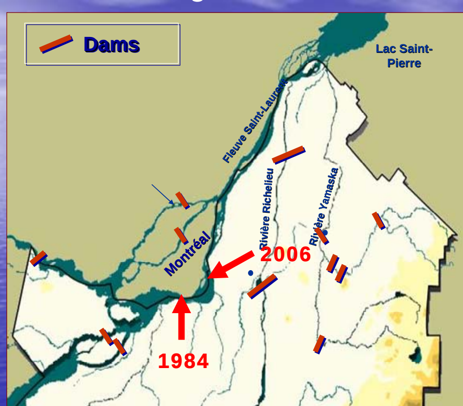
No more dams along the St. Lawrence River!



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The St. Lawrence River Lake sturgeon fishery

- A limited number of fishing licenses is allowed in some specific areas of the River (**a "sanctuary effect" is desirable**)
- Sportfishing is not important
- Fishing is directed on fish between 20 to 25 years of age (sub adults)
- Management strategy was historically based on:
  - the harvest of less than 10% of the sub adults
  - the spawners protection (selective gear and closed season)

23

Stock status

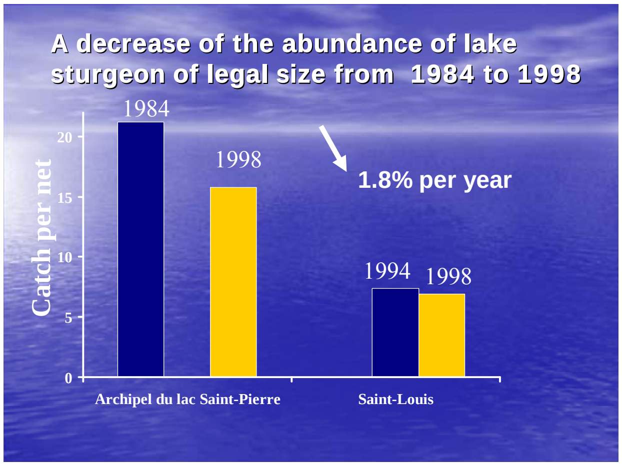
- The stock is considered overexploited since 1987:
  - a very high mortality level (>25% per year)
  - a very high yield (>1,5kg/ha)
  - an insufficient spawning potential
  - Poaching
- New regulations were applied between 1987 and 1993 (shorter fishing period, reduction of the number of fishing licenses, suppression of longlines, gillnet mesh restricted to 20 cm, restrictions on sportfishing regulation, law enforcement...)

24

Stock status

- Since 1994, additional data confirmed:
  - the overfishing diagnosis
  - the inadequacy of the management plan applied since 1987
  - the necessity of a "stronger" management plan based on a 20-25 years perspective

Slide 25



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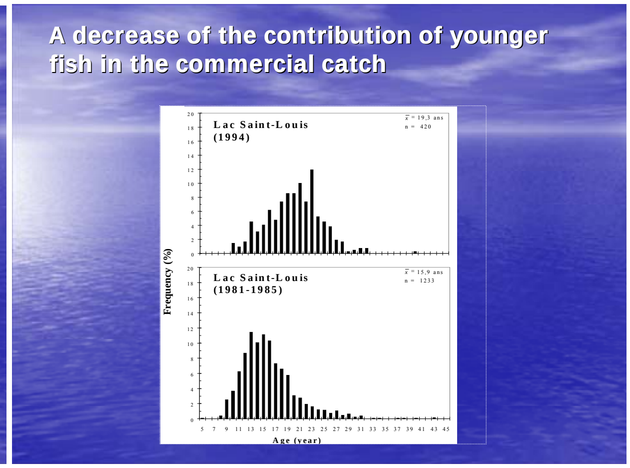

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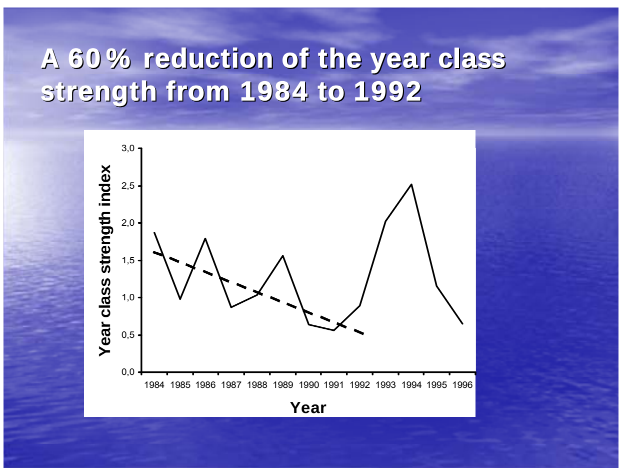

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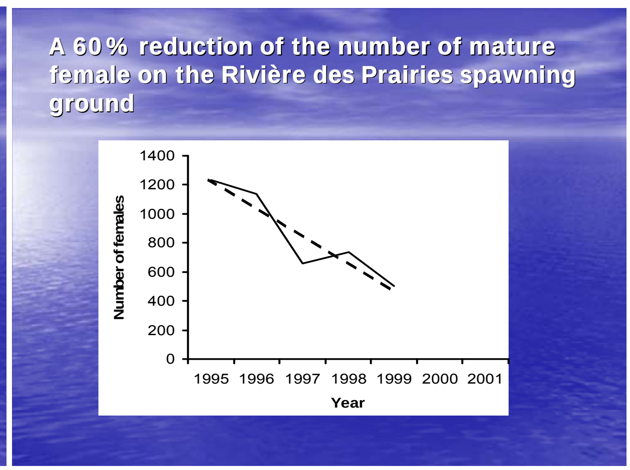

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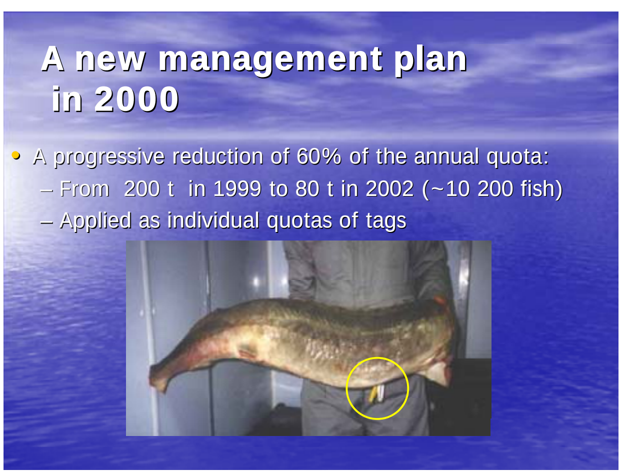

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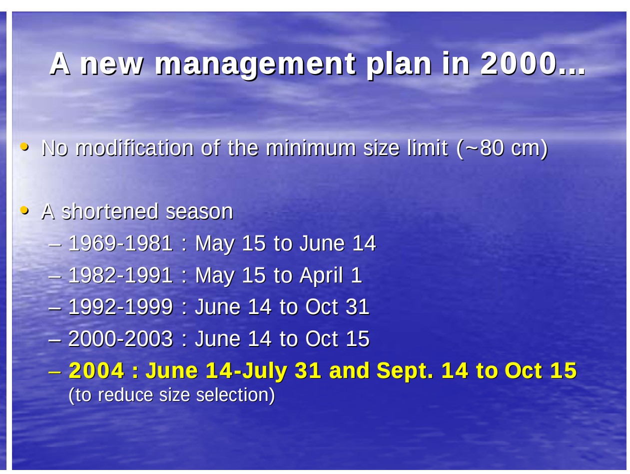

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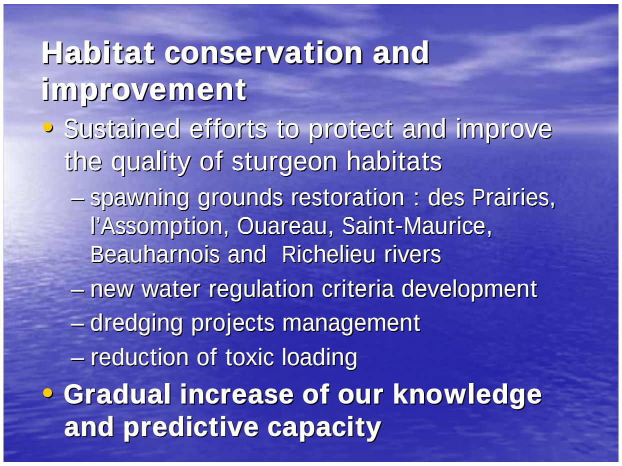

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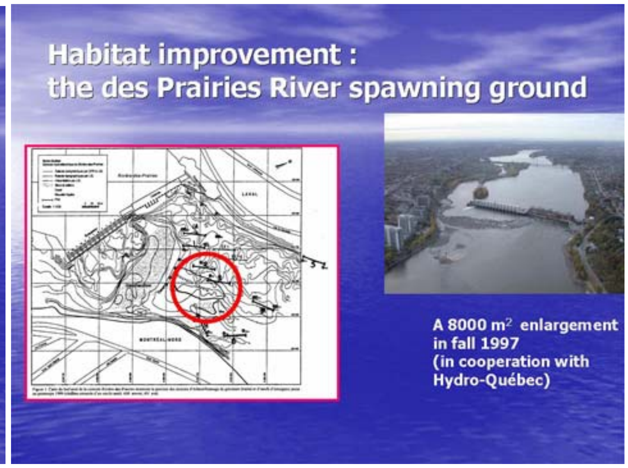

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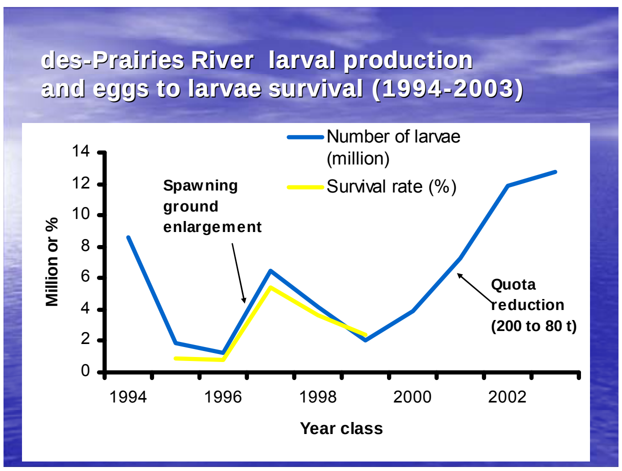

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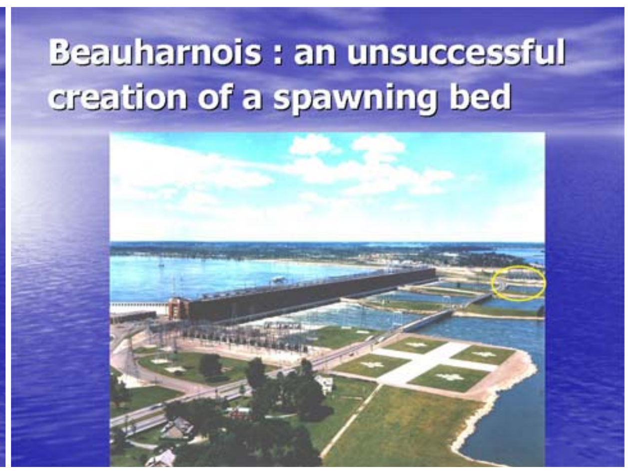

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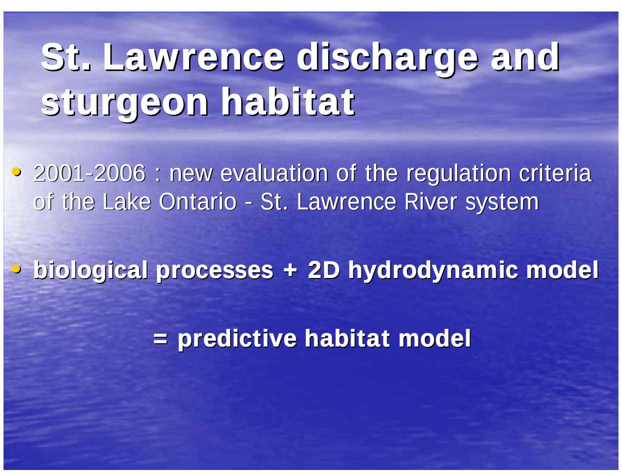

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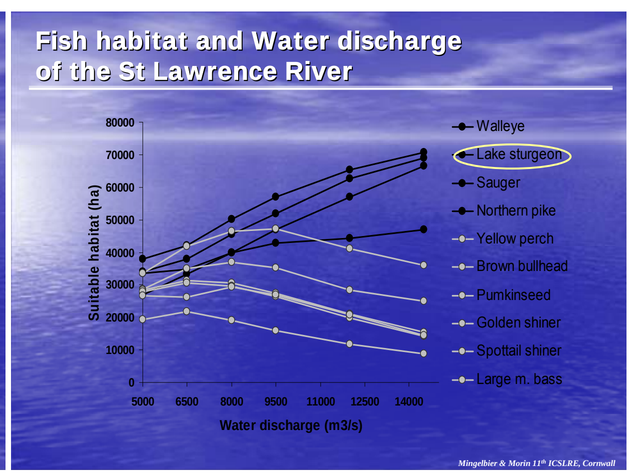

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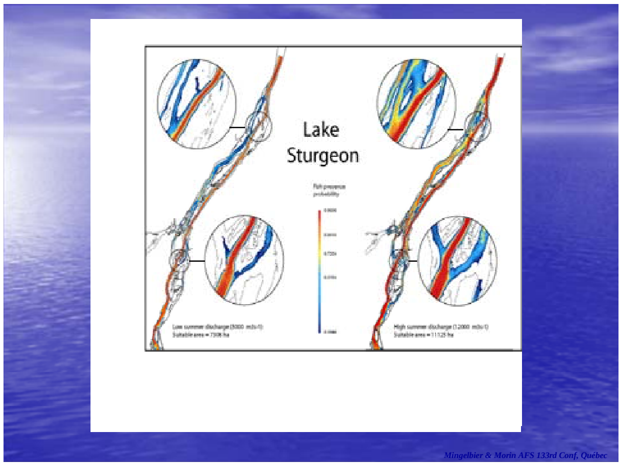

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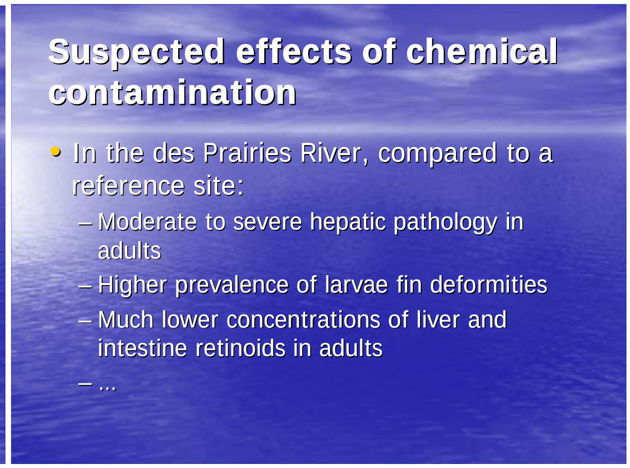

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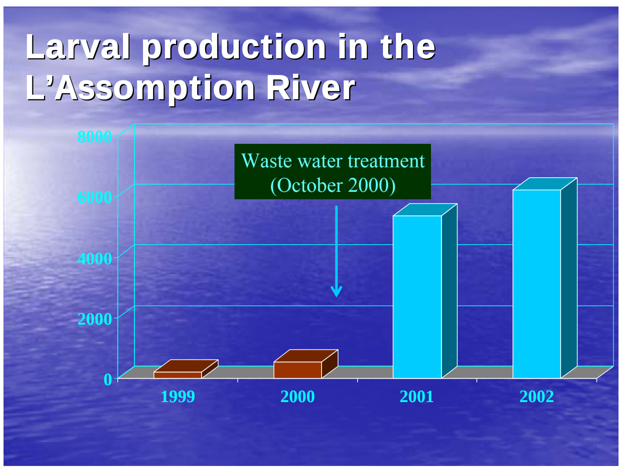

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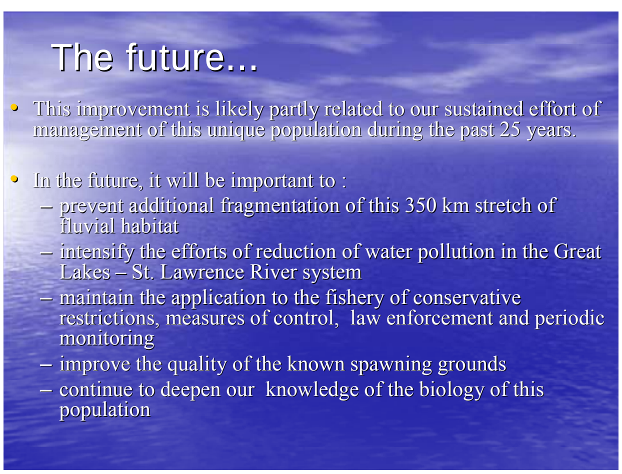

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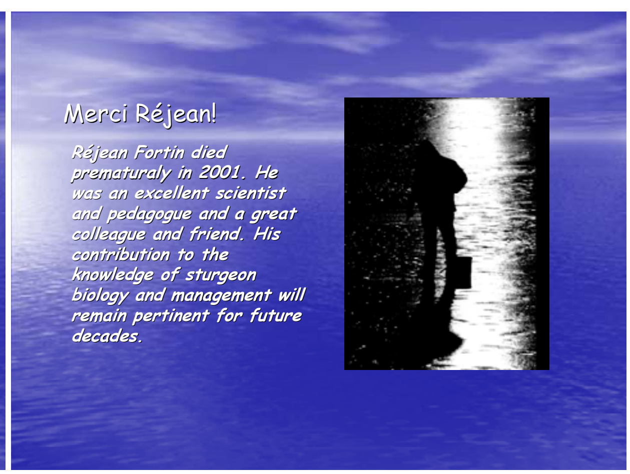
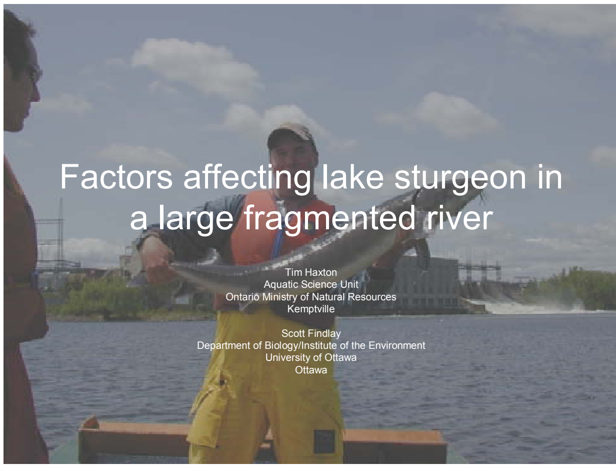


Appendix 11. Presentation by Tim Haxton, Ontario Ministry of Natural Resources, Kempville, ON.

Slide 1



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Objectives

1. to determine what explains the most variation in lake sturgeon abundance among river reaches in a fragmented river
2. to determine the effects different water management regimes have on lake sturgeon

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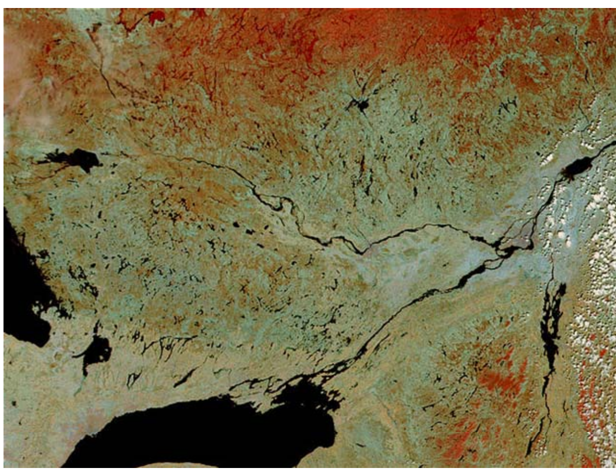

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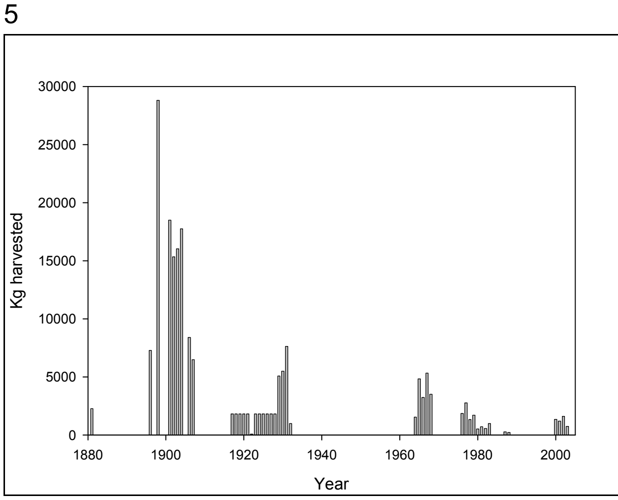

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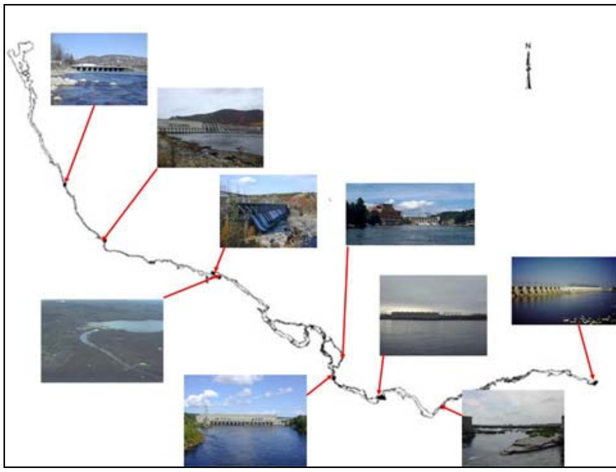

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Variation in sturgeon abundance

- three main stressors – commercial harvest, contaminants, waterpower management
- assess the likelihood these stressors are influencing lake sturgeon abundance
- eg. A_r lake sturgeon ↓ reaches with commercial harvest if primary influence

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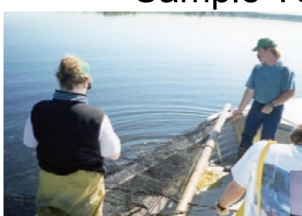
Sample Techniques



Gillnets (2.5 – 15.2 cm)
(FWIN protocol)

Trapnets (1.8 and 2.4 m)
(NSCIN protocol)

10

Additional netting

- Supplemented data with spanning assessment work and large mesh gillnets (17.8 – 30.5 cm)

11

Results

- 325 lake sturgeon sampled by gillnet; 446 by trapnet
- 233 sampled during spawning assessment
- total length @ 50% maturity
  - ♀ 113.2 cm (n = 36)
  - ♂ 105.7 cm (n = 37)
- additional netting – lake sturgeon were sampled in each river reach

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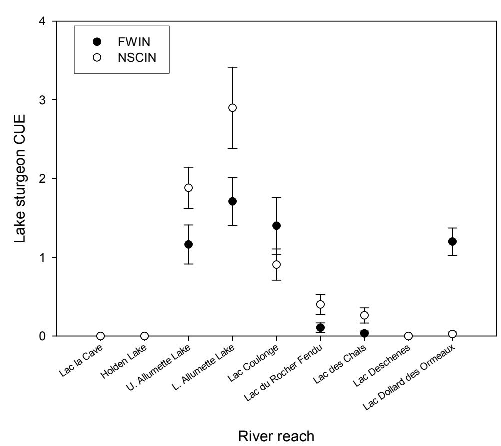

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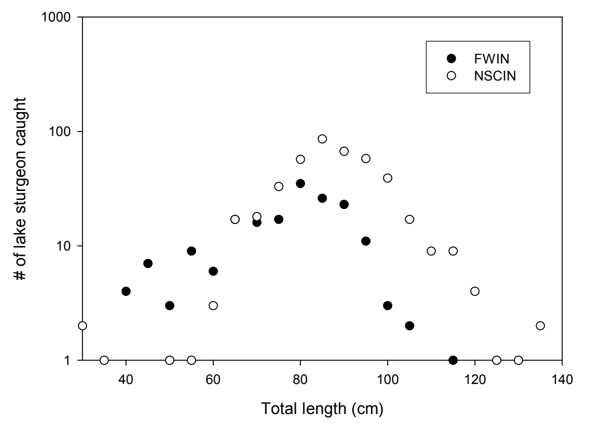

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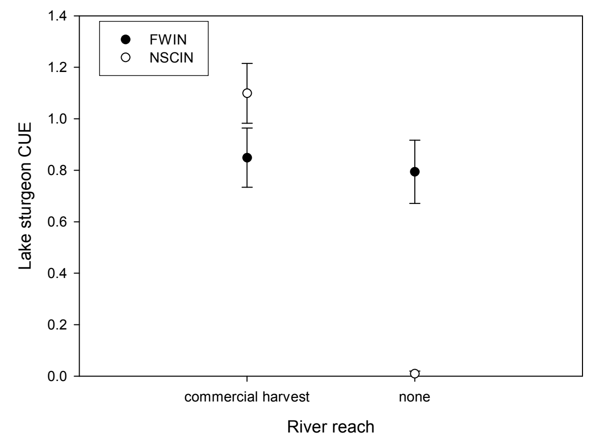

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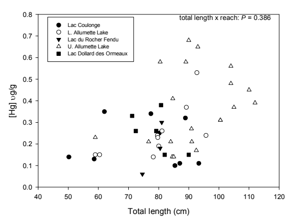
Contaminants

- Tested for:
  - Mercury; PCB's; Heptachlor; Aldrin; Mirex; Photomirex; Hexachlorocyclohane (a-BHC, b-BHC, g-BHC); a-Chlordane; g-Chlordane; Toxaphene; Hexachlorobenzene; Octachlorostyrene; trans-nonachlor; cis-nonachlor; Oxychlordane; op-DDT; pp-DDD; pp-DDT; pp-DDE.
- Hg elevated; PCB's and pp-DDE low; the rest ND



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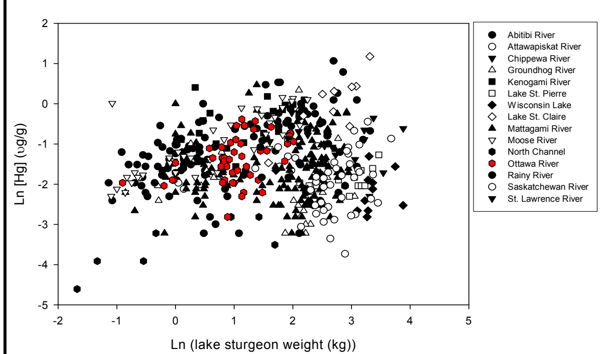

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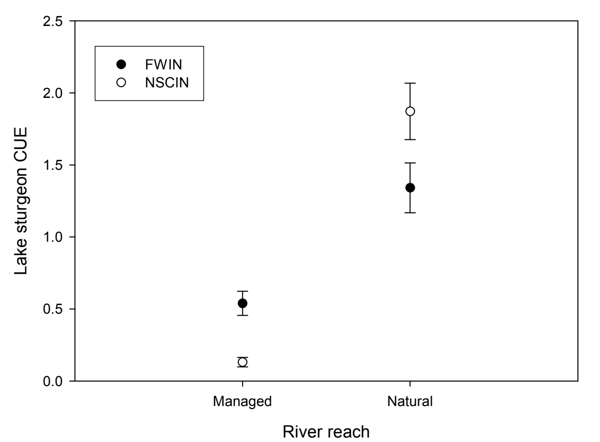

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One way ANOVA

	R^2	
	Gillnet	Trapnet
River reach	0.256	0.310
Managed reach	0.096	0.261
Commercial harvest	0.001	0.076
[Hg]	0.087	0.188

Slide 19

Effects of different water management regimes on lake sturgeon

- *A prior* hypotheses on effects of water management regimes on life history traits of sturgeon; corroborated or refuted by other species with similar or different life history traits

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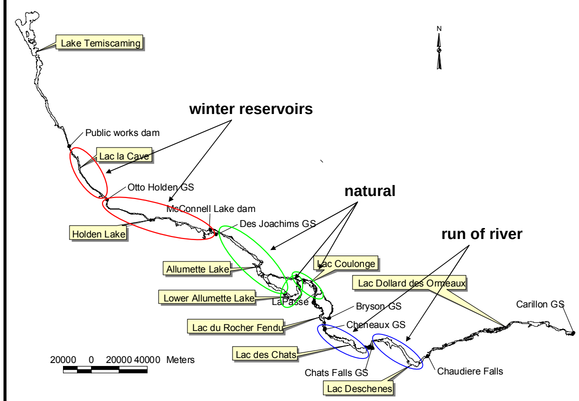

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Winter reservoirs

- Dewatering negatively affects macroinvertebrates (Haxton and Findlay *in prep*)
  - ∴ lake sturgeon abundance ↓
condition ↓
growth ↓
recruitment ↓
- other benthivores should be similar
- piscivores should not be affected (i.e. similar to natural reaches)

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Slide 25

Run-of-the-river

- Reaches relatively natural except flows and migration routes block (i.e. fragmented)

∴ lake sturgeon – recruitment ↓
abundance ↓
growth ≅ natural reaches
condition ≅ natural reaches

- other fast water spawners similar
- nest or flooded vegetation spawners should not be affected

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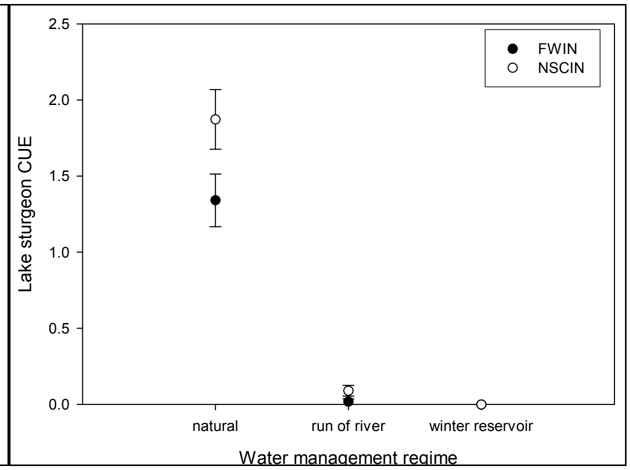

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Results: Winter reservoirs

- No lake sturgeon sampled in winter reservoirs via index netting
- Only 3 sampled by additional netting

∴ unable to assess biological characteristics

- A_r lake sturgeon ↓
- Other benthivores:
  - » Channel catfish ↓
  - » *Moxostoma* sp. ≅ natural
- Piscivores ↑

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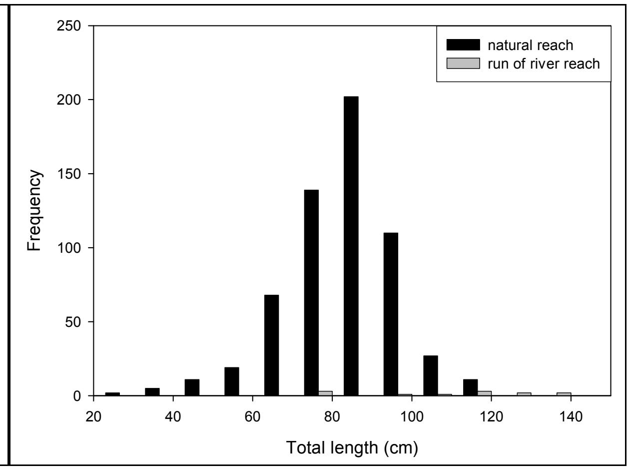

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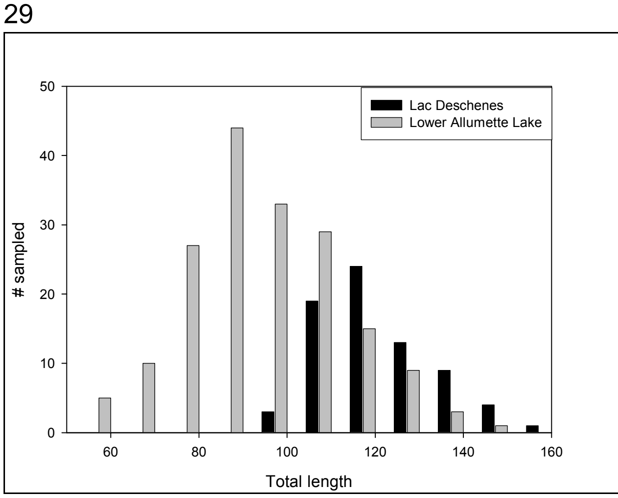

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Results: run-of-the-river

- Sturgeon
  - Relative abundance ↓
  - Size skewed to larger fish
  - Recruitment ↓
  - Growth ≅ natural
  - Condition > natural
- Other lithophils ↓; recruitment not as limited (i.e. distribution not skewed to larger fish)
- Other species ↓

Slide 31

Conclusions

- Waterpower management explains variation in sturgeon abundance
- Observations of water management regimes consistent with predictions
  - » winter reservoir → prey availability
  - » run-of-the river → limits spawning

32

Mitigation

- Winter reservoirs
  - » Alter water management regime
  - » Or, don’t managed for lake sturgeon
- Run-of-the-river
  - » enhance spawning area
  - » ensure suitable flows during spawning period

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Appendix 12. Presentation by Ronald M. Bruch, Wisconsin Department of Natural Resources, Oshkosh, WI.

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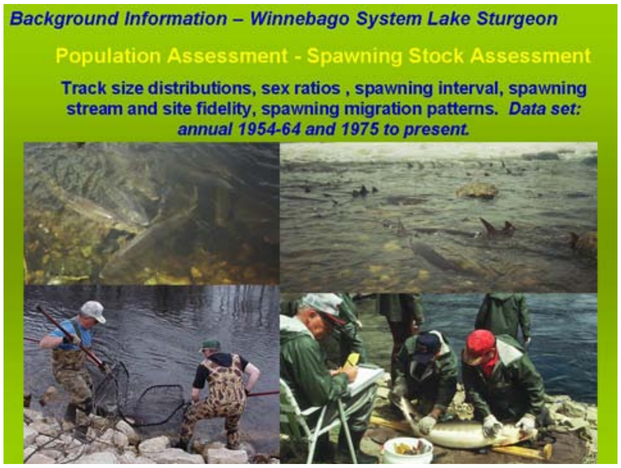

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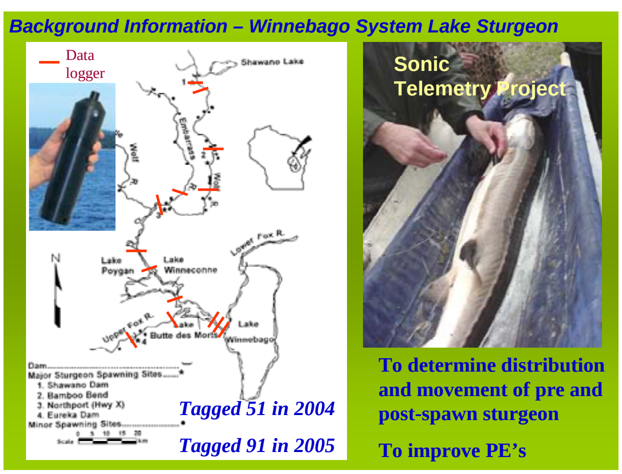

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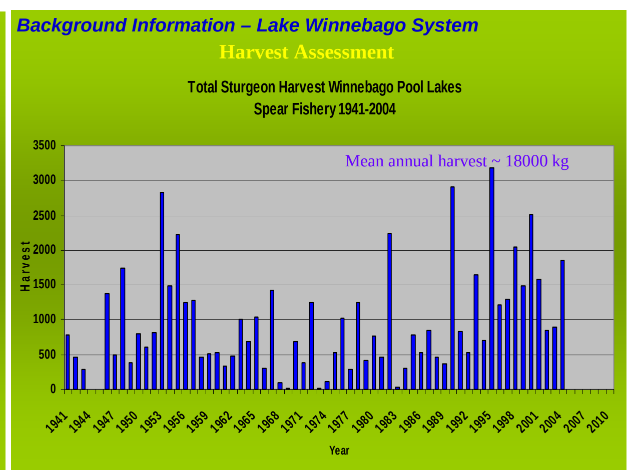

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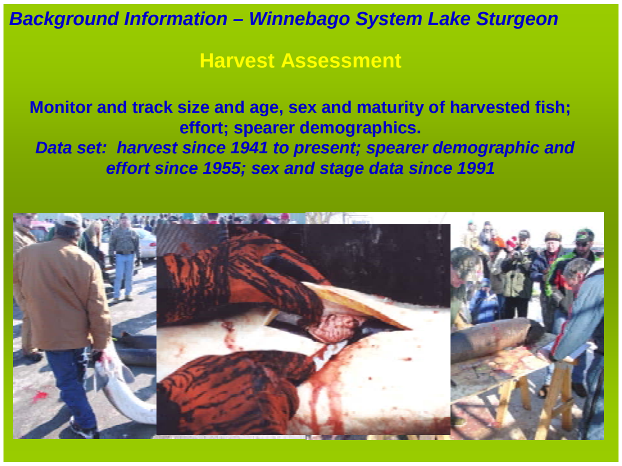

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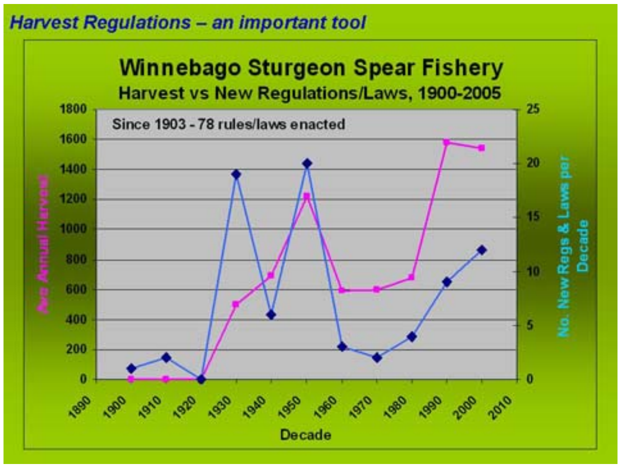

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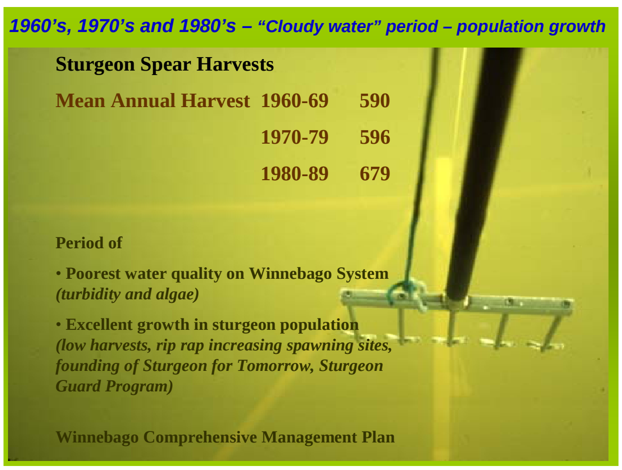

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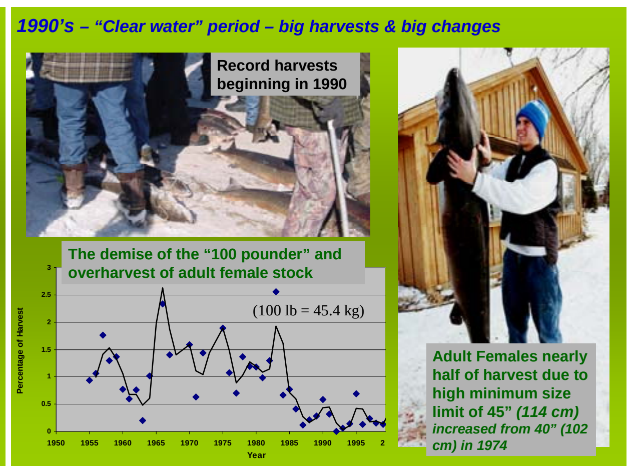

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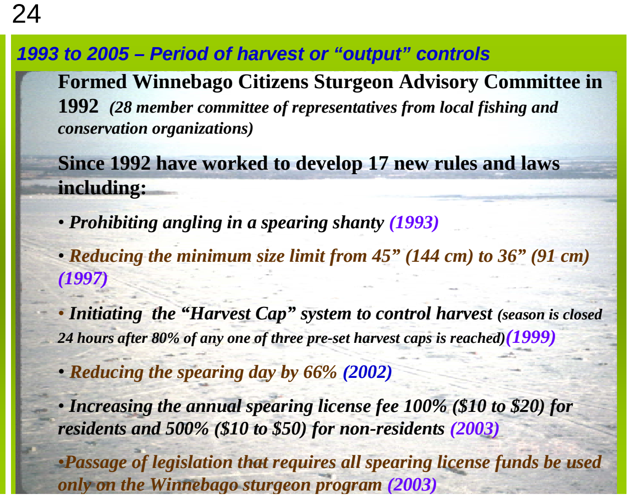

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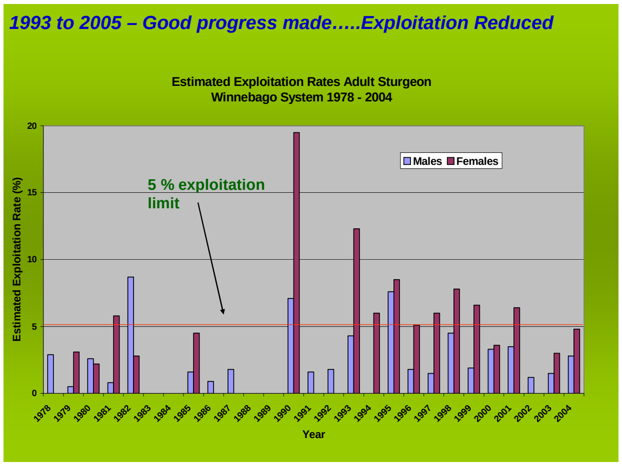

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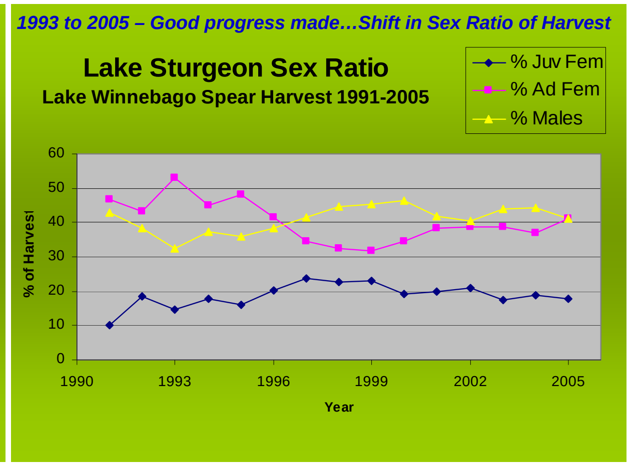

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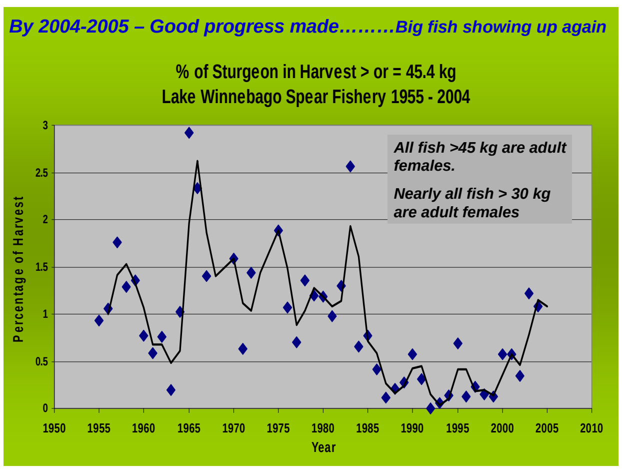

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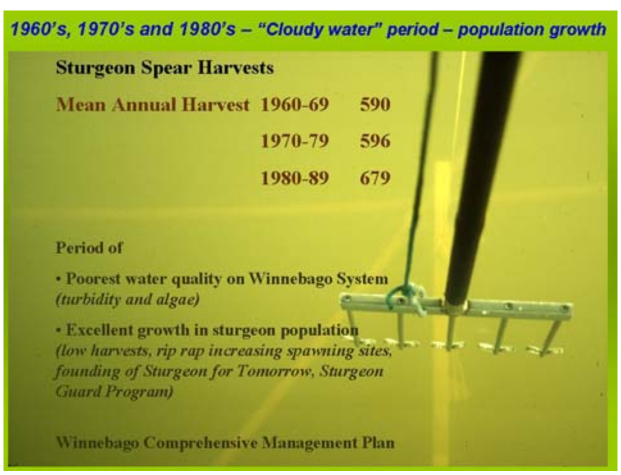

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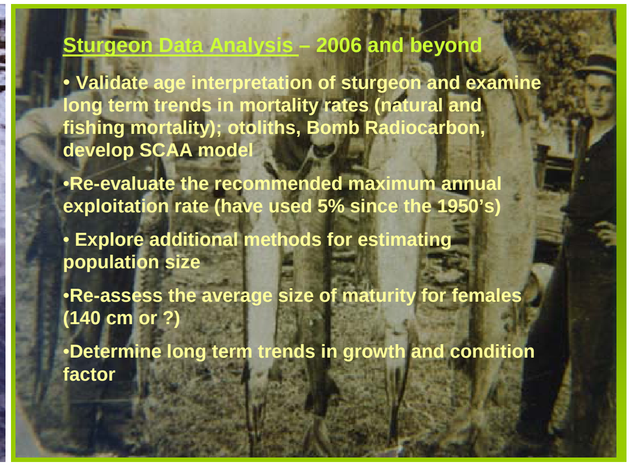

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Appendix 13. Presentation by Shelley Matkowski, Manitoba Hydro, Winnipeg, MB.

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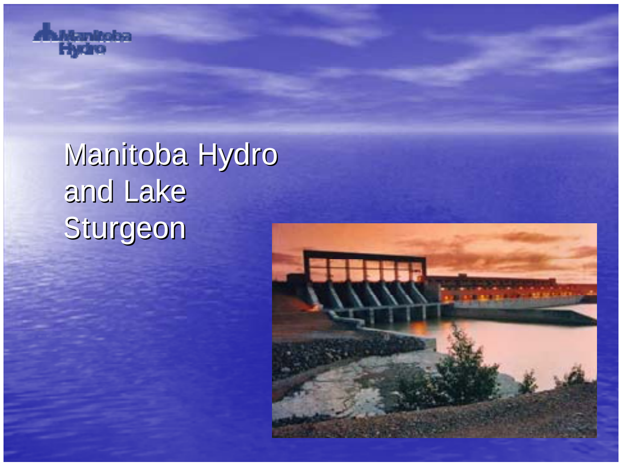

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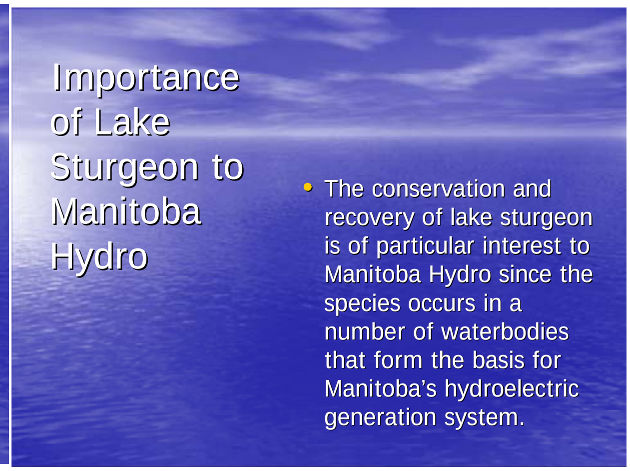

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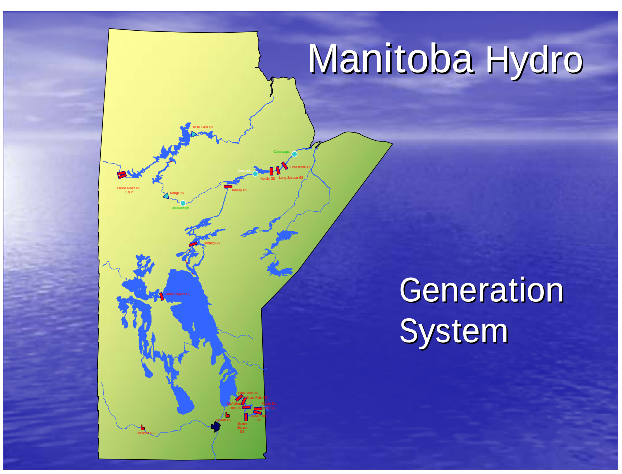

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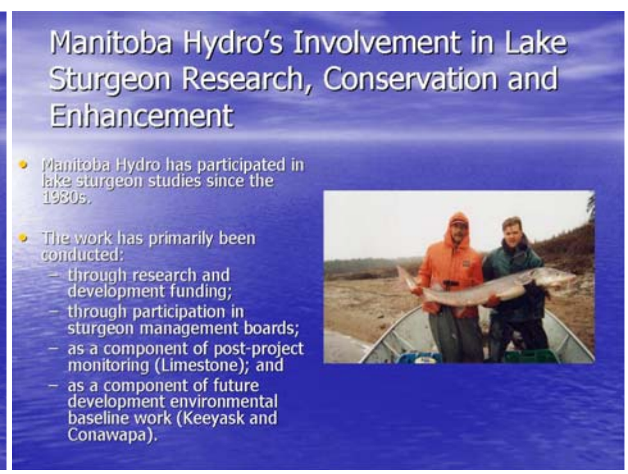

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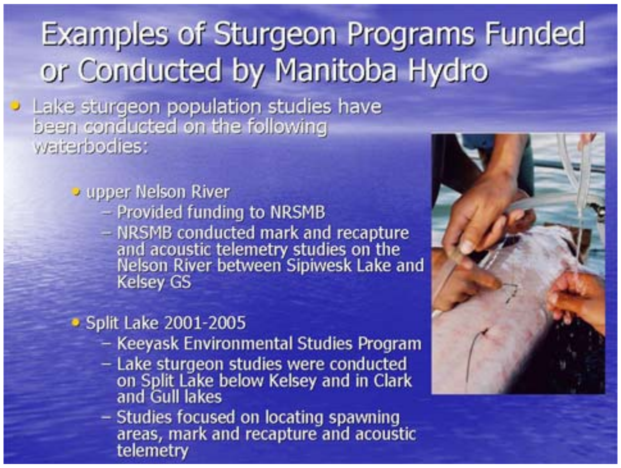

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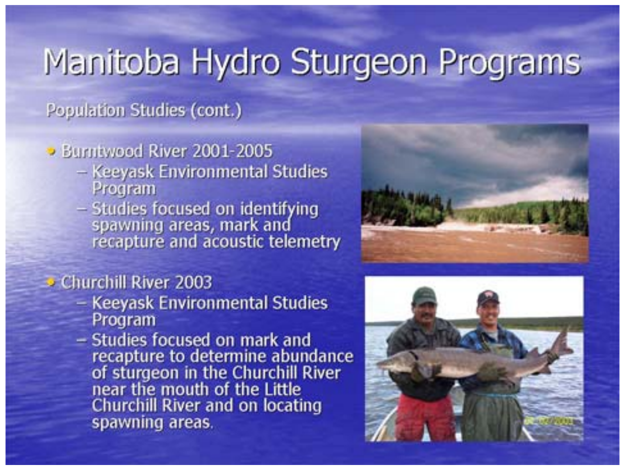

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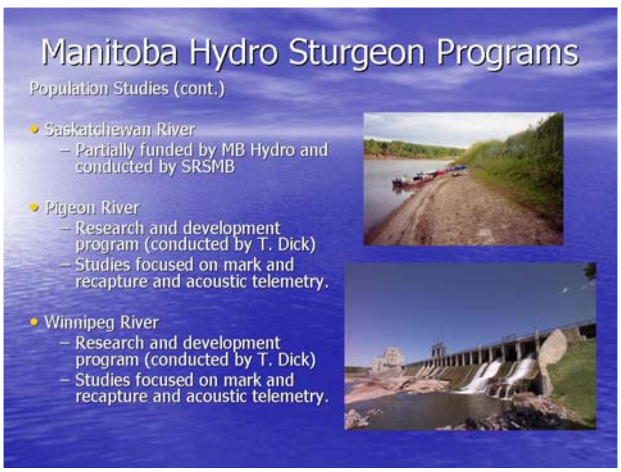

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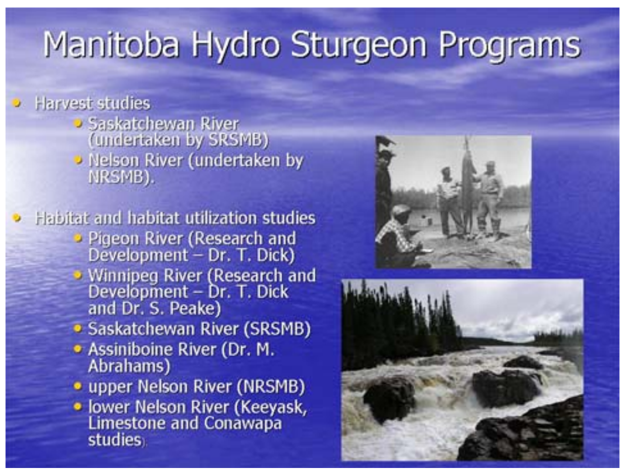

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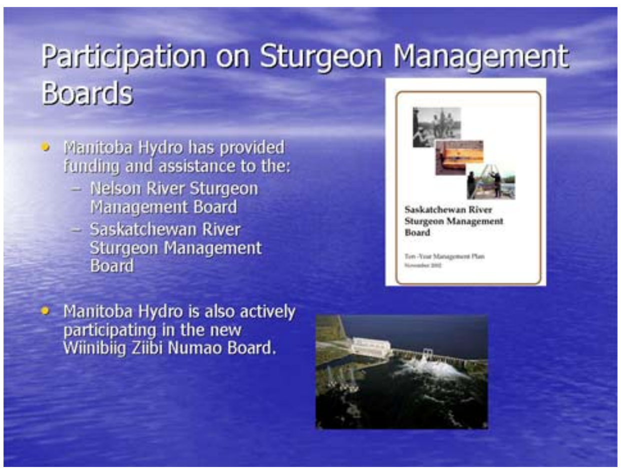

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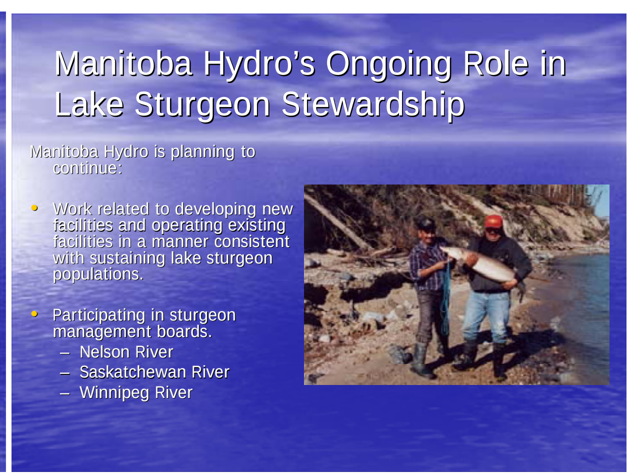

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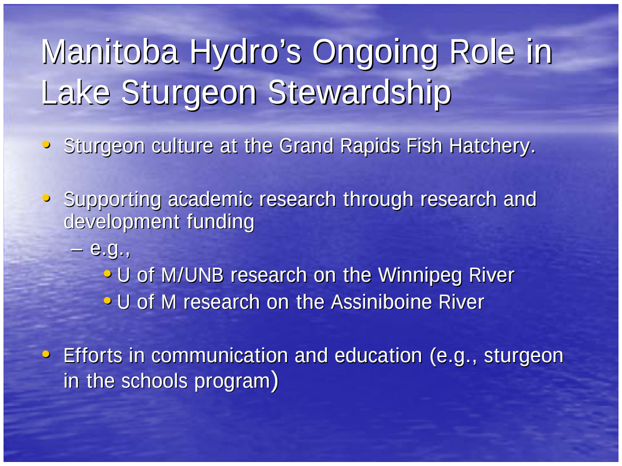
Manitoba Hydro's Ongoing Role in Lake Sturgeon Stewardship
Sturgeon culture at the Grand Rapids Fish Hatchery.
Supporting academic research through research and development funding
– e.g.,
U of M/UNB research on the Winnipeg River
U of M research on the Assiniboine River
Efforts in communication and education (e.g., sturgeon in the schools program)

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Thank you

Appendix 14. Presentation by Steve Peake, Canadian Rivers Institute, University of New Brunswick, Fredericton, NB.

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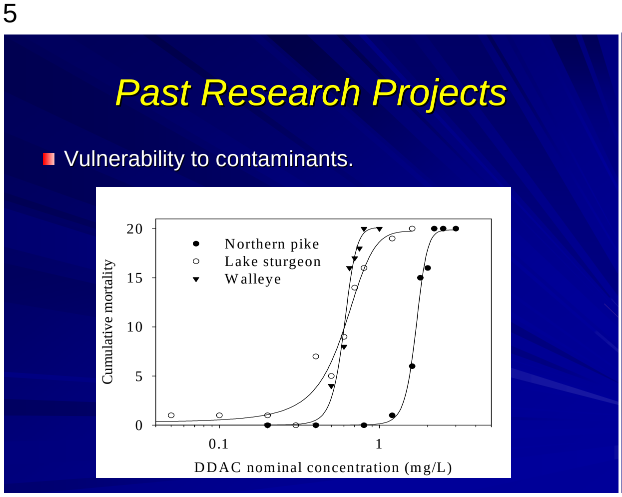

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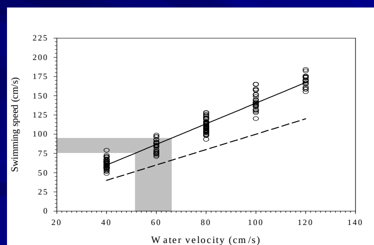
Slide 7

Past Research Projects

- Locomotory performance, behaviour and physiology in relation to passage through fishways and culverts.



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Past Research Projects

- Blood chemistry of lake sturgeon stressed by gill net capture and tagging.

9

Past Research Projects

- Blood chemistry of lake sturgeon stressed by gill net capture and tagging.

	Hematocrit	Cortisol	Glucose	Lactate
Immediately post-capture	**26.4 (±0.7)**	**49.8 (±4.4)**	**9.2 (±0.6)**	**6.5 (±0.3)**
3 days post capture	**25.4 (±1.2)**	**2.35 (±0.2)**	**5.5 (±0.5)**	**0.7 (±0.1)**

10

Past Research Projects

- Impacts of suspended sediment on stress and feeding behaviour.

11

Past Research Projects

- Use of natural food sources for rearing lake sturgeon.

12

Current Research Projects

- Impacts of habitat and hydraulics on survival, growth, and behaviour of age-0 and 1+ lake sturgeon
  - To what degree does substrate type and turbidity affect egg adherence at a given water velocity?
  - To what degree does water velocity affect adherence on a given substrate?
  - To what degree is adherence necessary for normal egg development?

Slide 13

Current Research Projects

- Impacts of habitat and hydraulics on survival, growth, and behaviour of age-0 and 1+ lake sturgeon
  - To what degree does substrate type and turbidity affect survival of yolk-sac fry?
  - To what degree does substrate type and water velocity affect drifting behaviour of yolk-sac fry?
  - To what degree does substrate type and turbidity impact ability to transition to exogenous feeding?

14

Current Research Projects

- Habitat use and ecology of juvenile lake sturgeon in the Winnipeg River.

15

Current Research Projects

- Habitat use and ecology of juvenile lake sturgeon in the Winnipeg River.

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Current Research Projects

- Habitat use and ecology of juvenile lake sturgeon in the Winnipeg River.

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Current Research Projects

- Habitat use and ecology of juvenile lake sturgeon in the Winnipeg River.

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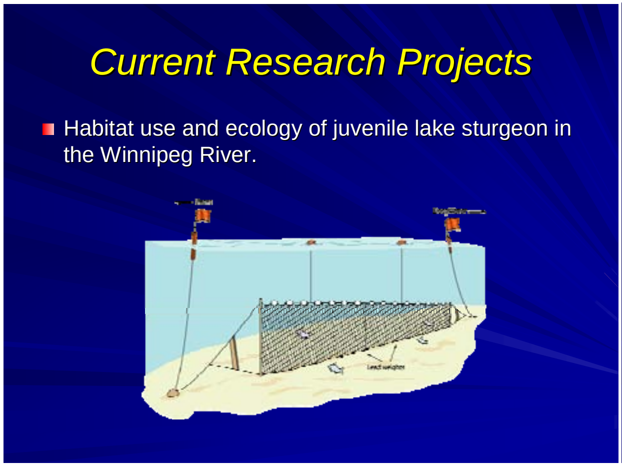
Current Research Projects

- Habitat use and ecology of juvenile lake sturgeon in the Winnipeg River.

Slide 19



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Slide 31

Appendix 15. Presentation by Terry Clayton, Alberta Sustainable Development, Lethbridge, AB.

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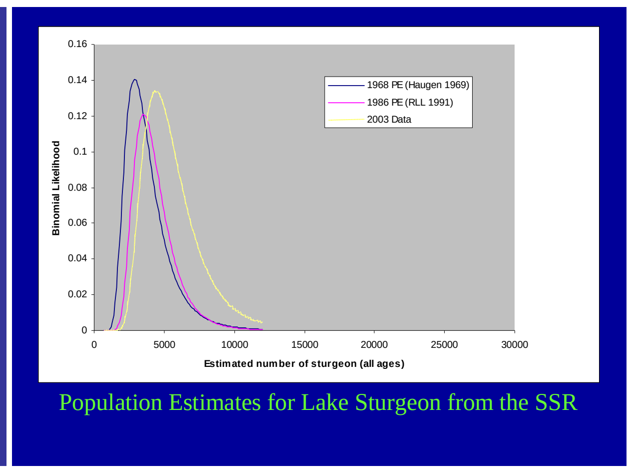

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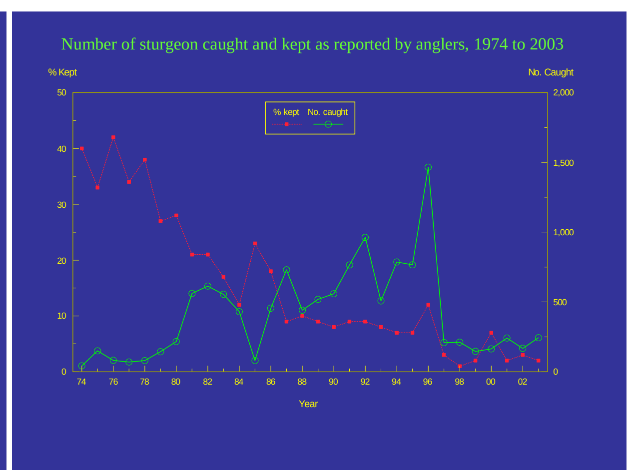

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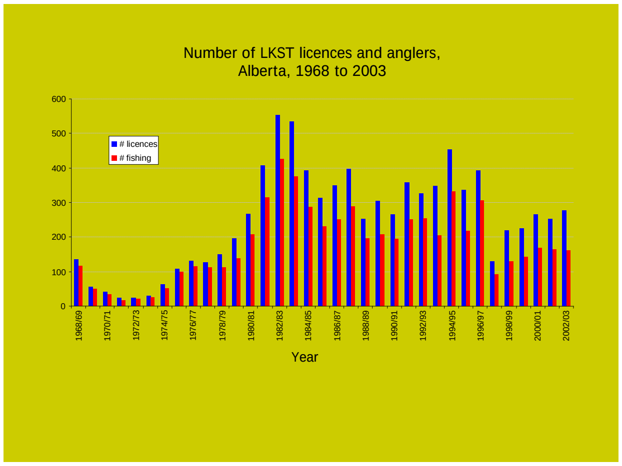

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Potential Issues in Alberta

Fishing Effects

- no commercial fishing in rivers in Alberta,
  except for the far north
  (Peace and tributaries, which have no sturgeon)
- There are approx. 5 guides on
  South Saskatchewan River; 2 on the
  North Saskatchewan and 0 on Red Deer rivers
  - but some anglers still target lake sturgeon

Aquaculture

- no licensed private aquaculture facilities

Volume/Discharge/Quantity

- water withdrawals for irrigation

Hydro - Oldman

- difficult to say how far upstream they moved historically

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Appendix 16. Presentation by Scott Reid, Ontario Ministry of Natural Resources, Peterborough, ON.

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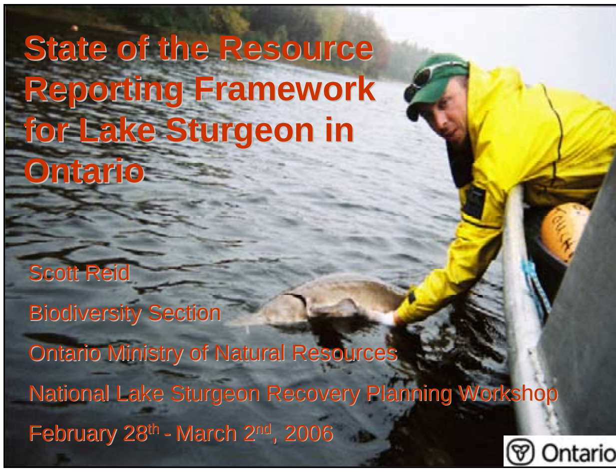

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Introduction

- Context and rationale
- Development of recommendations
- Results from 2005 sampling

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Need for a Framework

- SAR context – status assessment and recovery
- State of Resource Reporting
- Application and evaluation of regulations
- Management of commercial fisheries
- Waterpower impacts and monitoring

5

Implications of SARA Listing

Special Concern – development of a management plan within 3 years; no other implications

Threatened/Endangered – Prohibition on harvest, protection of residence and critical habitat. Requirement for recovery strategy within 2/1 years

- formal review of status at least every 10 years

6

State of the Resource Reporting (SORR)

- Public reporting on the state of the fisheries resources
- Populations and fisheries trends at a landscape scale
- Need clear objectives prior to developing protocols

Slide 7

Lake Sturgeon Management

- Streamline fishing zone boundaries, quotas and seasons
- Describes regulatory options for the management of sport fisheries in Ontario:
  - seasons
  - possession limits
  - size limits
  - sanctuaries
- Recommends standardized assessment to evaluate effectiveness and monitor population recovery

8

Need for a Framework

- Current assessment initiated by local needs
- Exploitation and impact assessment
- Variety of sampling methods
- Not consistent with landscape level approach
- Need standardized approach for reporting province wide status and trends

9

Framework Development

Pre-workshop questionnaire to experts

↓

Workshop to develop framework recommendations

↓

Initial field testing (fall 2005)

10

Framework Development

First Step: pre-workshop questionnaire:

- Activities in Ontario and neighbouring jurisdictions;
- Advice regarding population and monitoring units;
- Identify population assessment metrics; and,
- Identify capture techniques used to assess lake sturgeon populations.

11

Framework Development (con't)

Second Step: Workshop (March 1-2, 2005)

Guidance for Recommendations:

- Consistent with provincial SORR and the recreational fisheries regulation streamlining initiative
- Applicable across Ontario and monitor population trends and status
- Minimum information required to report on the current and changing populations status across Ontario.
- Report timing is 10 years after initiation

12

Lake Sturgeon Monitoring (Questionnaire)

Monitoring in support of a wide variety of objectives:

- Assessing population trends
- Life-history and demographic characteristics
- Habitat use, protection and improvement
- Evaluating rehabilitation initiatives
- Impact assessment (hydro-electric, dredging)
- Population modelling in support of regulations
- Fish community assessment

Slide 13

Population Indicators (Questionnaire)

Past recruitment measures:
- spawners
- adults and subadults
- juveniles and subadults
- larvae
- all life-stages

Other potential indicators:
- growth and mortality rates
- age and length at maturity
- habitat availability
- commercial catch

14

Population Indicator: juvenile and sub-adult

- Good indicator of recruitment and therefore future population status
- Broad age range (identification of strong and weak year classes)
- Readily captured in nets used in existing provincial monitoring programs

15

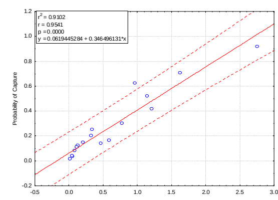
Sampling Methods (Questionnaire)

Lifestage	Gear	Season
Young-of-year	drift nets	mid-May to late July
	beach seines	July through August
Juvenile	beach seines	Summer
	small mesh gill nets	October
	trap nets	
Sub-adult	gill nets	late spring through fall
	set-lines	
	electrofishing	late summer
		May-June (spawning)
	trap nets	late spring and early summer
Adult	large-mesh gill net	Fall
		May-June (spawning)
		late spring through fall
	electrofishing	May-June (spawning)
	set-lines	May-June
	dip-netting	May-June (spawning)
	trap nets	late spring through fall

16

Sampling Technique – FWIN

- Effective in Ontario rivers
- Between 40 and 100 cm and 3 to 20 years, vulnerable to gear
- Correlation between abundance and probability of capture
- Lower cost than a new protocol
- Monitor other riverine species



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Monitoring Units (Questionnaire)

Population Definition:
- spawning groups
- habitat use
- river system
- status
- genetics

Grouping?
- watersheds
- status
- Eco-regions
- collection of discrete spawning sites
- genetics

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Monitoring Units and Implementation

- Index sites: population trends over time
- Randomly selected sites across watersheds: status across larger areas
- Random site assessments every 5 years
- Index sites – more frequent

- No consensus on geographic boundaries of individual monitoring units
- Options? secondary watershed boundaries or the COSEWIC National Ecological Areas Classification

Slide 19

Next Steps

- Testing and refinement of FWIN
- Evaluate secondary watershed boundaries or the COSEWIC National Ecological Areas Classification as monitoring unit boundaries.
- Identify non-population (habitat or stress) based metrics

20

Fall 2005 Sampling

- Evaluate FWIN in 7 rivers
- Contrasting habitats

21

Riverine FWIN vs. lake FWIN

Similarities:

- fall, water temp 10 - 15°C
- 24 hr net sets
- standard FWIN nets
- random sampling within area stratum

Differences:

- stratify by depth
- orientation to shore
- entire net in water
- Namakan 9" multifilament

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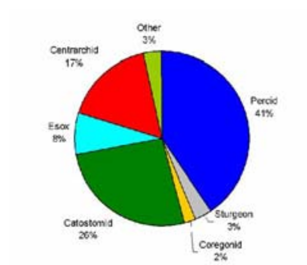
Composition of Catch



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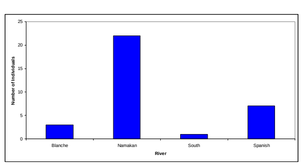
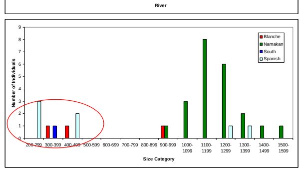
Sturgeon Abundance and Size Distribution





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Lessons from 2005 (FWIN → RIN)

FWIN Nets:

- too deep and long
- remove largest and smallest mesh
- large effect of twine width
- large effect of net orientation
- fall flows and debris can be a problem

Juvenile lake sturgeon hot-spots:

- pools at river bends
- deltas – river/lake interface
- below chutes and rapids

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"Heavy Lifters"
Northeast Science and Information
Northwest Science and Information
Cooperative Freshwater Ecology Unit
MNR Great Lakes Management Units
MNR Fisheries Assessment Units
Southern Science and Information Section
Aquatics Research and Development Section
Department of Fisheries and Oceans

Appendix 17. Presentation by Rob Wallace, Saskatchewan Environment, Saskatoon, SK.

Slide 1

History, biology, and studies for the Saskatchewan River Sturgeon Management Board

2006 March 1
(Rob Wallace)

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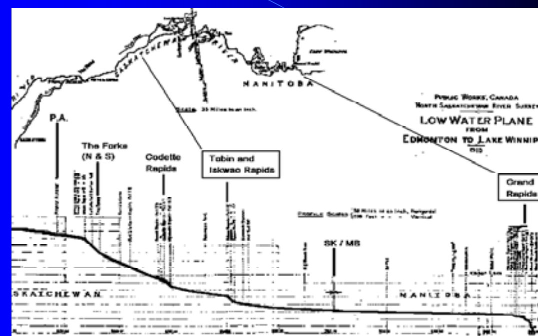
SASK RIVER (THE FORKS TO LAKE WINNIPEG)



"Report of the survey of the North Saskatchewan River from Edmonton to Lake Winnipeg, 1910 - 1915." (Voligny 1917)

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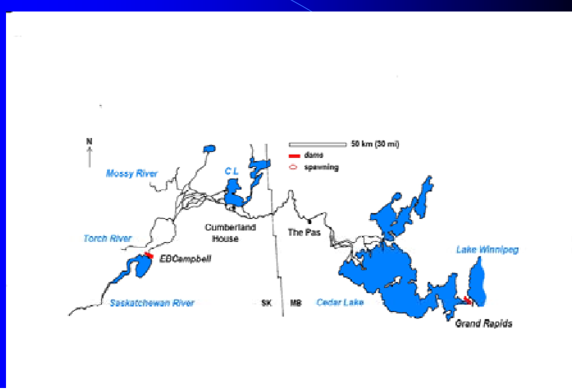
SASK RIVER STURGEON POPULATION (EBCampbell to Grand Rapids)



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STATUS OF POPULATION (1960 to 1990)

Monitored commercial fishing 1958-66, 1975-82, 1990
SK harvests, sizes, & ages (Torch River to border)
MB harvests only (seasons closed previously)

	ABOUT 1960	BY 1970S
AGES	oldest 64 years	oldest 38
MORTALITY	about 4.8 %	about 18.9 %
MATURITY	F at 25 years & 30 lbs	unchanged?
	M at 18 years & 20 lbs	unchanged?
ABUNDANCE	10,000 to 16,000 (over 8.2 kg or 18 lbs)	UNKNOWN
HABITAT	Loss of rapids	…
FISH	Loss of spawners	…

"Species recovery plan for lake sturgeon in the lower Saskatchewan River (Cumberland Lake area)" (Wallace 1991)

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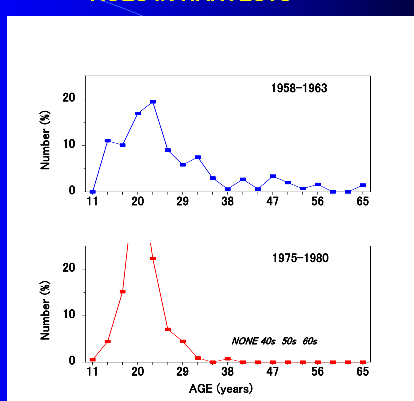
AGES IN HARVESTS



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SASK RIVER STURGEON MANAGEMENT BOARD 1994 to 2005

Representatives of communities, resource agencies, utilities

	SK	MB
First Nations	CHCN	OCN
Fishers	CHFC	OCFC
Resource agencies	SERM / SE SWA & SNA	MC / MWS
Utilities	SaskPower	Manitoba Hydro
Federal	… Fisheries & Oceans …	

Slide 7

STUDIES for SASK RIVER STURGEON MANAGEMENT BOARD

INITIAL 4 YEARS

A retrospective assessment of the risk to lake sturgeon … in the lower Saskatchewan River (Findlay et al 1996?)

Lake sturgeon in the Saskatchewan River: Spawning, habitat, and tagging (Wallace 1999)

Lake sturgeon in the Saskatchewan River: radio-tracking and index fishing (Wallace and Leroux 1999)

Traditional knowledge and new techniques for an old species … spawning habitat models (Wallace 1999)

8

STUDIES … *continued*

MORE RECENT

Background and review of procedures for index fishing (Wallace 1999)

Lake sturgeon … growth chronologies (LeBreton et al 1999)

Lake sturgeon population genetics in the Saskatchewan and Winnipeg rivers (Robinson and Ferguson 2001, updated 2002)

Saskatchewan River lake sturgeon harvest surveys 2001-2002 (North / South 2003)

SRSMB ten-year management plan (North / South 2002)

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SPAWNING HABITAT (1994-1997)

SK: EBCampbell dam to Tearing River
Fishing for spawners and drifting fry, daily temperatures
Water-flow modeling (depths & velocities at 3 sites)

Watching spawners is impossible due to muddiness / turbidity
Caught fry ONCE: Torch River (June 1996)
Suitable temps in Torch River mid / late May *versus* EBC early June

Suitable sites: maybe EBC tailrace, Torch River, Bigstone Rapids, maybe Tearing River, NONE in MB

"Lake sturgeon in the Saskatchewan River: Spawning, habitat, and tagging" (Wallace 1999)
"Traditional knowledge and new techniques for an old species: Lake sturgeon and spawning habitat models (Wallace 1999)

More modeling is underway below EBC, and needed for juveniles

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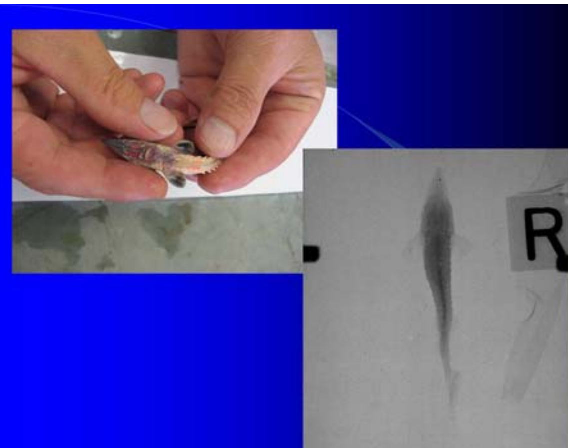

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JUVENILE HABITAT

Bigstone Rapids to Summerberry (157 km, 4 sections)
Depths, velocities, bottom substrates and some fishing

Upper section shallow (most under 3 m), swift (up to 1.2 m/s), rockier
Middle deeper (about 5 m), slower, sandy / silty
Lower deeper (lots over 3 m), diverse flows & bottoms

Bigstone Rapids is only location suitable for spawning
Caught a few juveniles (Tearing River to Big Bend)
The Pas to Summerberry is suitable for all life stages

"Saskatchewan River lake sturgeon habitat investigation …
June, 2000" (Bretecher & MacDonell 2001)

Survey data should be suitable for river modelling
SK fishing in 2003: only caught juveniles near MB border

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RECENT ABORIGINAL HARVESTS

MB: The Pas 2001 (Jun to Aug) *and* 2002 (
SK: Cumberland House 2002 (Jun to Sep)

Interviews of anglers, numbers & sizes of fish

The Pas 2001: 144 groups, all with First Nations angler
57 sturgeon were kept (most under 100 cm & 16 kg)
The Pas 2002: 62 groups, all with First Nations angler
26 of 49 sturgeon were kept (so 47% released)
(smaller than The Pas 2001)
Cumberland House 2002: 58 groups (1/2 anglers, 1/2 domestic)
17 of 21 sturgeon were kept (larger than The Pas)

Total estimated summer harvests at least 319 fish (2 communities)
Total is 3 to 12 % of population

"Saskatchewan River lake sturgeon harvest surveys 2001-2002"
(North / South 2003)

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INDEX FISHING (1996 – 2005)

SK: traditional fishing areas (Torch to border), 8 to 12 crews
tagging by Project Workers
MB: assigned fishing areas (Big Bend to Summerberry), 4 crews
tagging by staff
Tags: Serial numbered, PIT or visual (T-bar and wing)

Analysis for combined tags & recaptures

Results annually to SRSMB autumn meeting

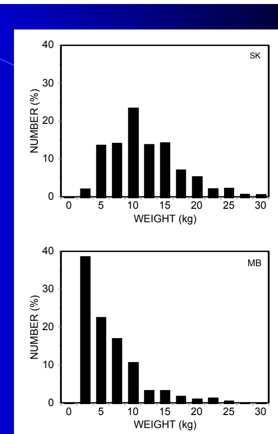
17

18

ROUND WEIGHT (kg)

SK
NUMBER 1906
Minimum 0.7
Maximum 33.6
Average 10.7
(average 24 pounds)

MB
NUMBER 394
Minimum 0.5
Maximum 26.5
Average 5.1
(average 11 pounds)



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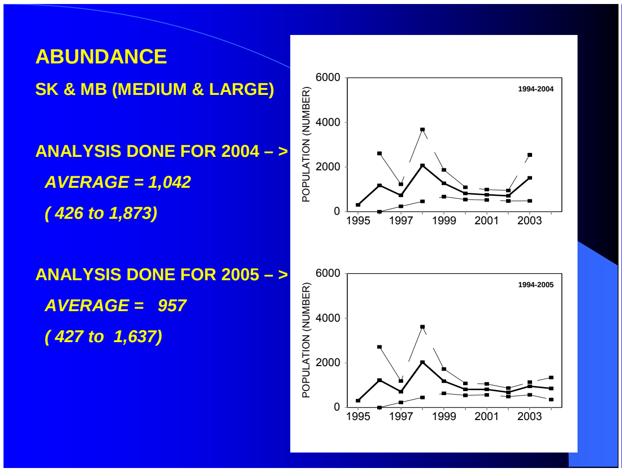

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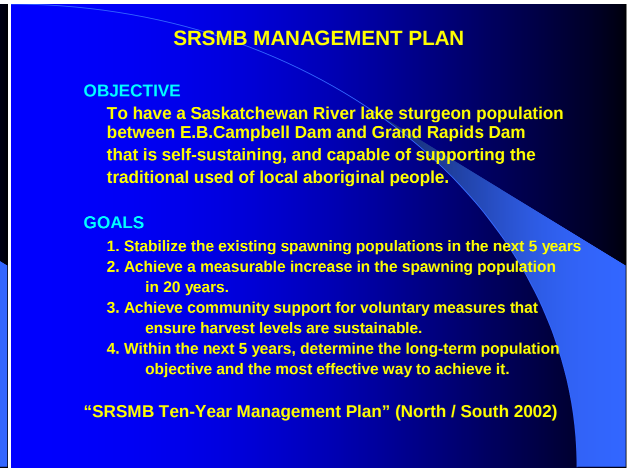

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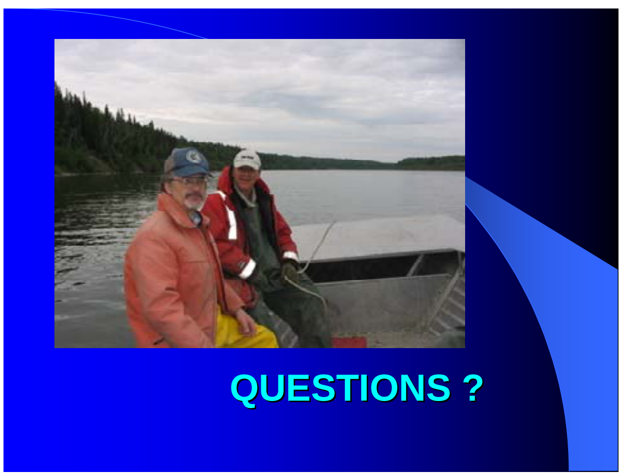

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Appendix 18. Presentation by Manitoba Water Stewardship.

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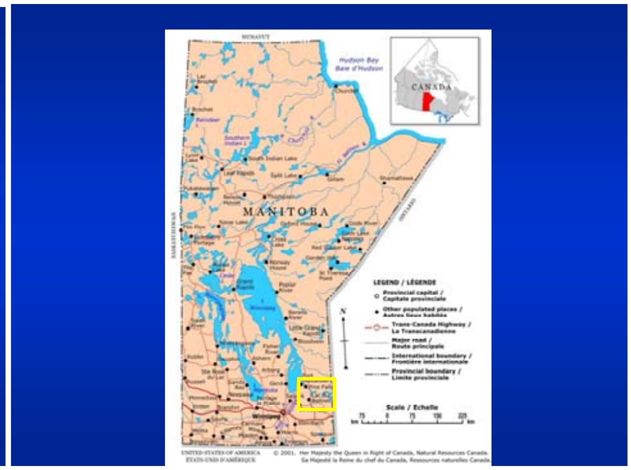

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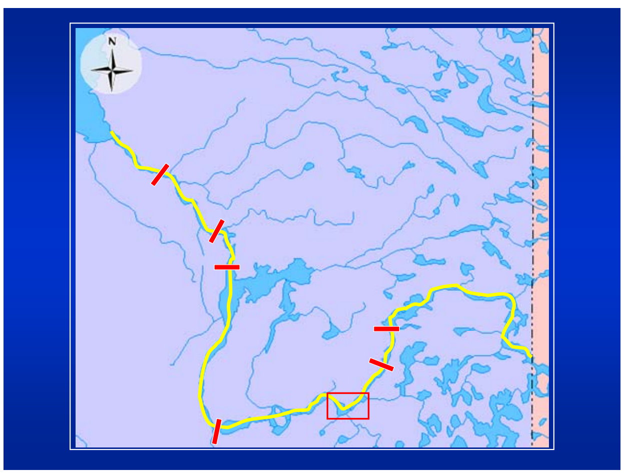

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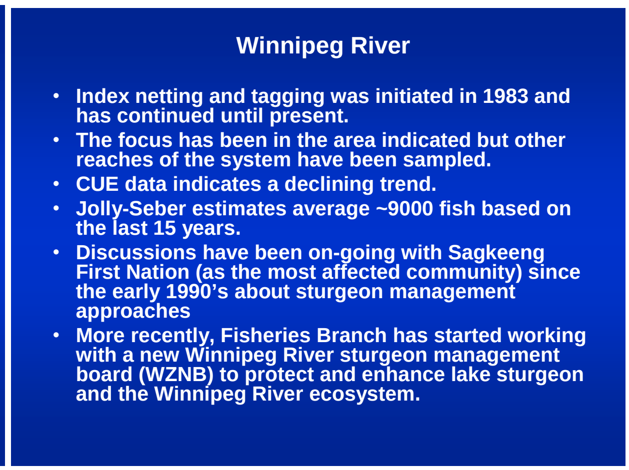

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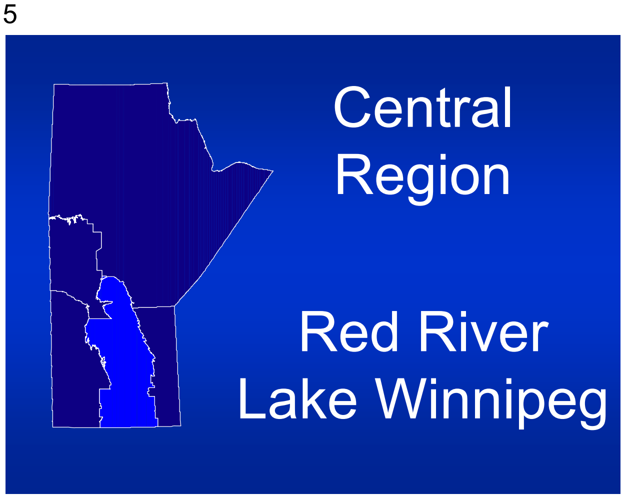

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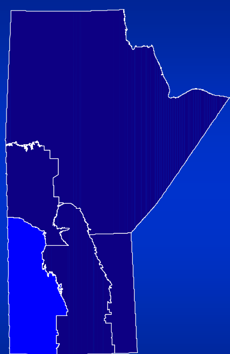

Western Region

Assiniboine River

8

Assiniboine River and Tributaries
Historical Lake Sturgeon Information

- Lake Sturgeon were highly valued, not only for food but for other uses, for instance a 50 lb fish would yield a gallon of oil used for lamps and to soften the homespun wool in handwoven blankets according to early Brandon records.
- An individual in Brandon purchased a mounted lake sturgeon that was caught in 1880 at Tanner's Crossing on the Little Saskatchewan River in Minnedosa.

9

Assiniboine River and Tributaries
Historical Lake Sturgeon Information

- An individual at our office indicated that her grandfather use to catch lake sturgeon in the early 1900, at the old wooden Brandon Electric Light Company Limited dam on the Little Saskatchewan River.
- A Brandon resident indicated that when he was boy in 1938, they use to hook lake sturgeon with large hooks and drag them out of the Assiniboine River at Waggle Springs (Shilo area)

10

Assiniboine River and Tributaries
Historical Lake Sturgeon Information

- An old photo from the steamboat days on the Assiniboine River shows lake sturgeon stacked as cord wood on the deck of a steamboat to be used as fuel for the boats.

11

August 11th, 2000 stocked at Manitoba Hydro Steam Plant

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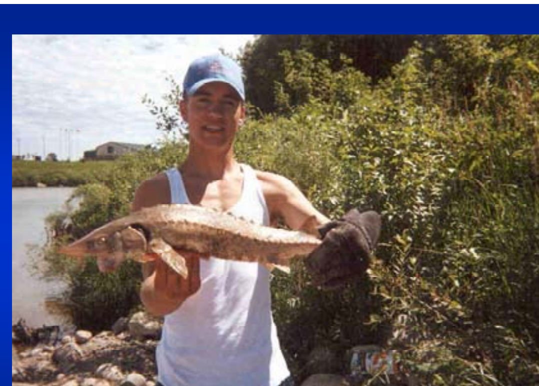

September 26th, 2001 caught and released at Discovery Center in Brandon

Slide 13

Assiniboine River Lake Sturgeon Stocking History (Brandon)

1996	1,000	fingerlings	Winnipeg R.
1997	1,000	fingerlings	Winnipeg R.
1998	-----------	no stocking	--------------------
1999	1,000	fingerlings	Saskatchewan R.
2000	2,000	fry	Saskatchewan R.
2000	1,000	fingerlings	Saskatchewan R.
2001	156	fingerlings	Nelson R.
2002	2,000	fry	Winnipeg R.
2003	160	fingerlings	Winnipeg R.
2003	7*	"adults"	Winnipeg R.
2004	55#	"juveniles"	Winnipeg R.
2004	200	fingerlings	Winnipeg R.
2005	-----------	no stocking	--------------------

* tagged with acoustic transmitters, PIT tags and Floy tags

\# tagged with PIT tags and Floy tags

TOTAL NUMBER STOCKED TO DATE 8578

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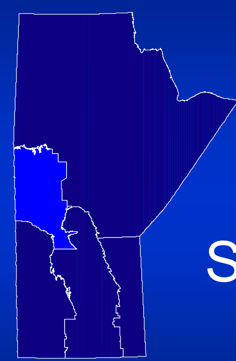

Northwest Region

Saskatchewan River

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- Preliminary assessments and investigations of lake sturgeon in the Saskatchewan River delta area were conducted by Rob Wallace (SERM) and Doug Leroux (MDNR) in the early to mid 1990's.
- As a result of this work and increasing concern over the declining numbers of lake sturgeon in other jurisdictions, an Inter-provincial Steering Committee was formed in the early 1990's.

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The Saskatchewan River Sturgeon Management Board was established in 1998, involving representatives of:

- Cumberland House Cree Nation
- Cumberland House Fishermen's Coop.
- Opaskwayak Cree Nation
- Sask. River Fishermen's Assoc.
- Sask. Government (SERM & SNA)
- Manitoba Government (MDNR)
- SaskPower, MB Hydro
- Government of Canada (DFO)

17

- A 10-year Management Plan was developed by Don MacDonnell (N/S Consultants) for the Sask. R. Sturgeon Management Board in 2002.
- By 2002, recent monitoring data suggested that the sturgeon population in the Sask. River between E.B. Campbell Dam and the Grand Rapids Dam contained only about 1300 individuals (> 8 kg). This was estimated to be a reduction of 80 - 92% from levels of about 1960.

18

- Tagging and monitoring of sturgeon in the Sask. R. Delta is continuing under the auspices of the Sask. R. Sturgeon Management Board in attempts to gain greater understanding of sturgeon populations, movements, habitat, spawning areas and harvest rates by aboriginal fishers.

Slide 19

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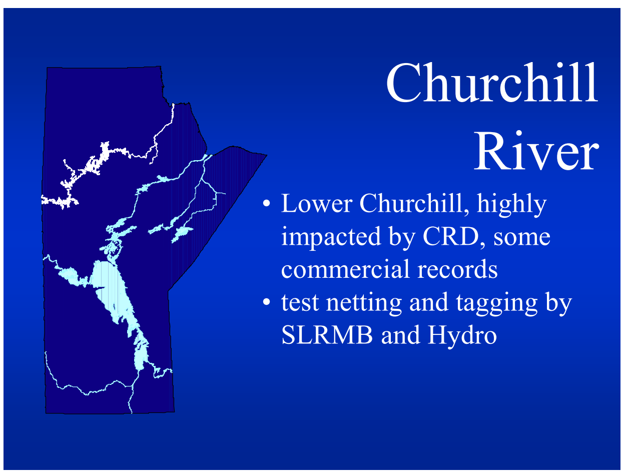

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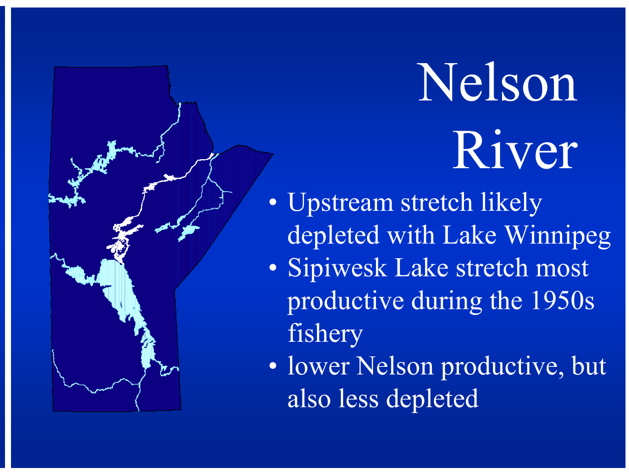

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Slide 25

10,000 Sturgeon

OR How Much Does It Cost To Raise These Fish?

26

What Fish To Save

- If there are 20,000+ larva hatched, separate the first 15,000 larva from the later hatching fry.
- After the plug is passes, stock out the last hatched fry as they will be the slowest growing, hardest to feed and will rob the technicians of time that should be spent on the healthier fish.

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Initial Feeding

- Purchase 5 pounds of Platinum grade Artemia cysts ($120-150/pound)
- Have 4 Artemia hatching units operating 24/7
- At onset of feeding Artemia, have native plankton on hand for supplementary feeding (two persons collecting plankton each day)

28

Secondary Feeding

- 2 choices
- Frozen Bloodworm ($10/lb)
- Frozen adult Artemia ($5/lb)
- After the fry get to the size where they can easily eat the bloodworm or Artemia, switch them to Frozen Mysis ($8/lb) and later to Frozen Krill ($3/lb)

29

Staffing

- Not counting a manager, a minimum of four persons are needed to feed and tend to all of the husbandry aspects of sturgeon rearing.
- To get as much growth as possible, the shifts should start at 7 AM and the last shift end at 9 PM

30

Cost per Fish

- Counting staff time and fish food, expect to spend $3.00 to $4.50 per fish, depending on the year and the success of getting the fish to switch feeds when the time is right.

Appendix 19. Presentation by the Nelson River Sturgeon Management Board.

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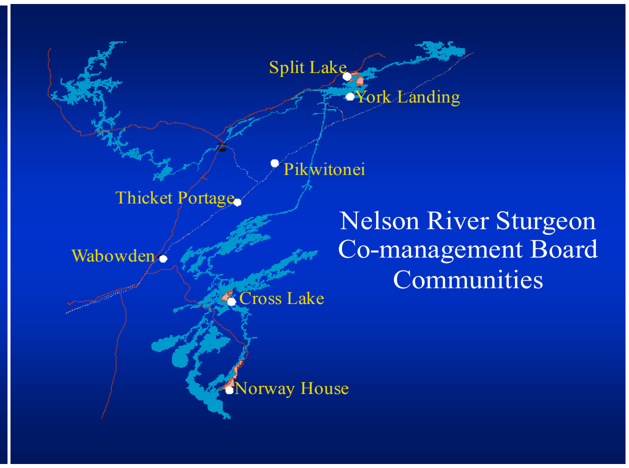

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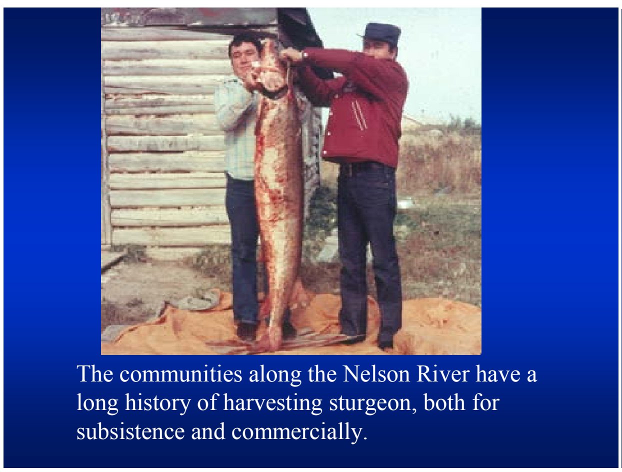

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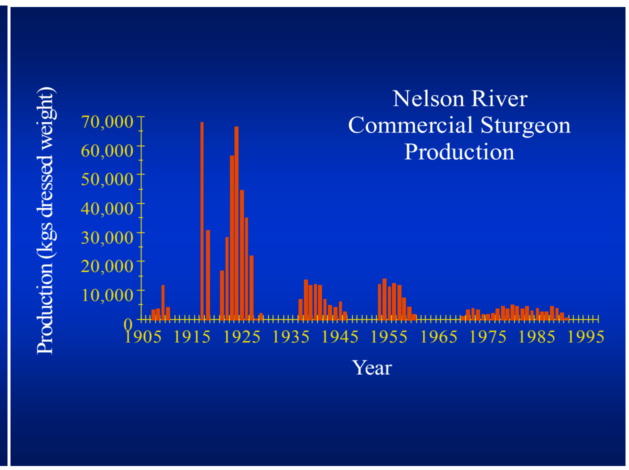

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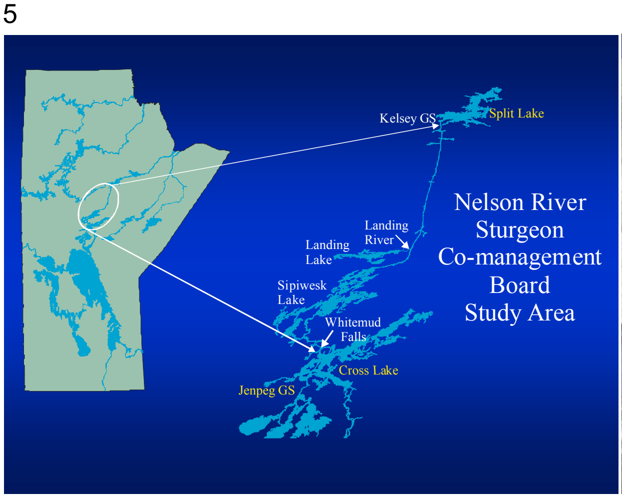

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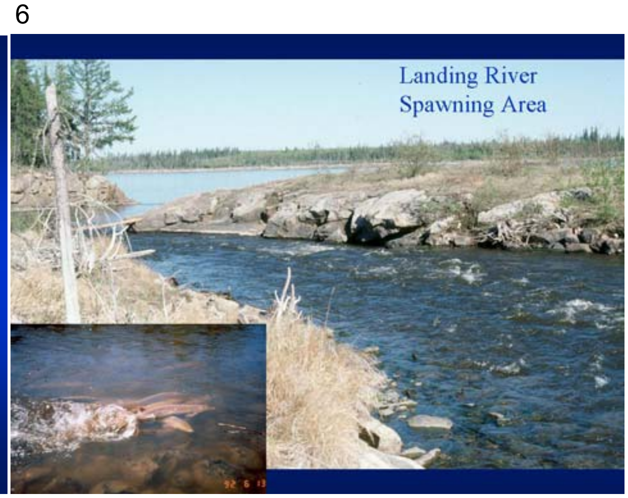

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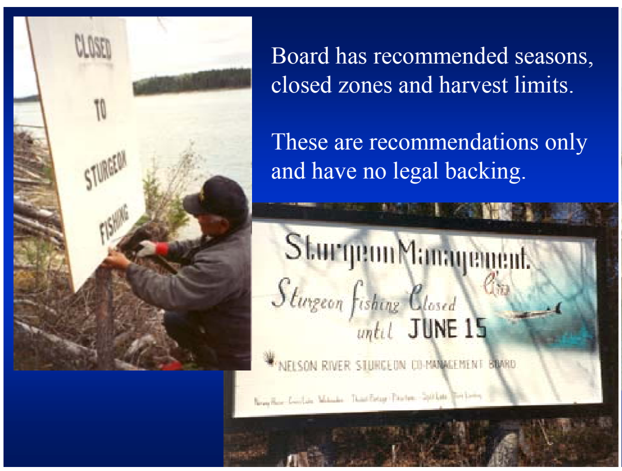

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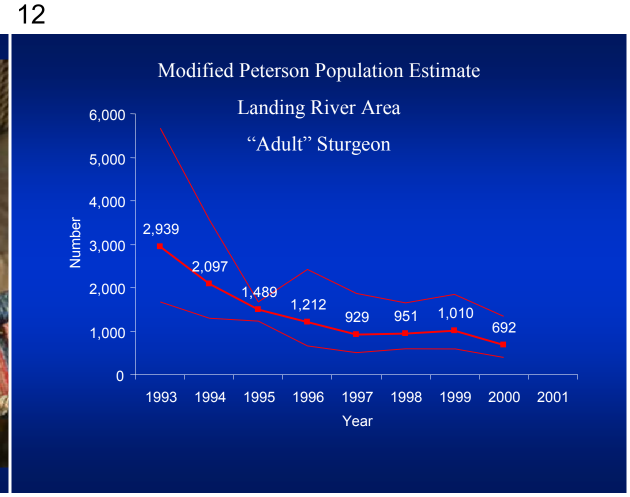

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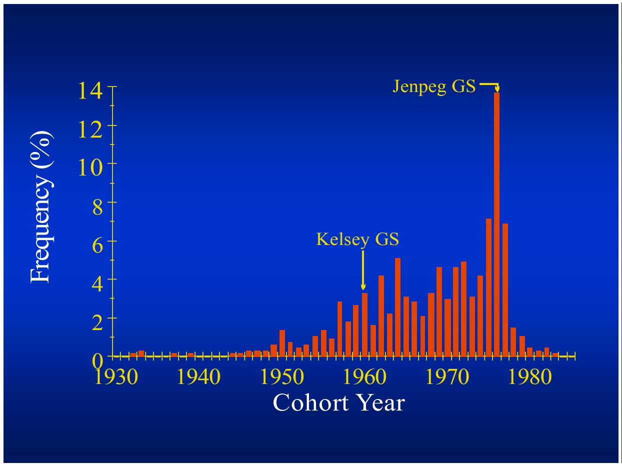

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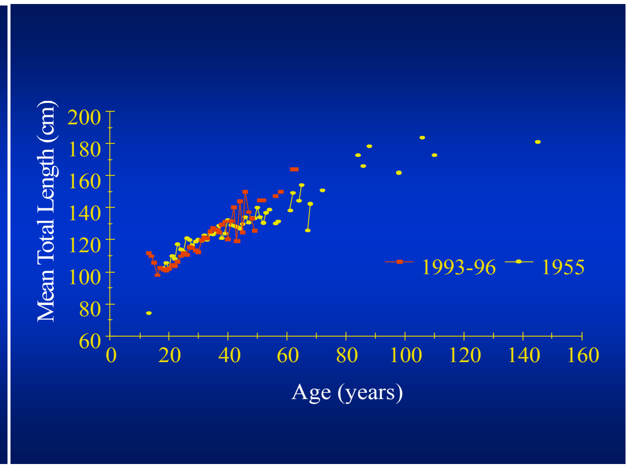

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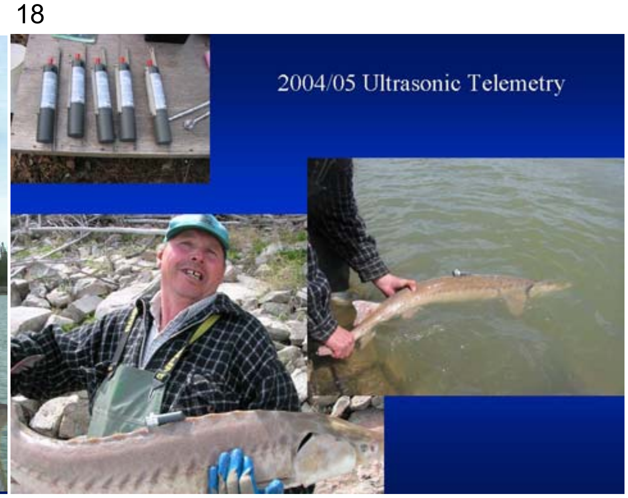

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Appendix 20. Presentation by the Wiinibiig Ziibi Numao Board.

INTRODUCTION

The project was initiated based on the decision of The Committee on the Status of Endangered Wildlife in Canada which recommended that lake sturgeon be listed as endangered in western Canada. Since lake sturgeon are important culturally and as a source of food and medicine to First Nations communities the need to document traditional and historical knowledge is critical to the development of long term management and recovery strategies for this fish. The implications for economic opportunities for First Nation communities are significant since hydroelectric development have and will continue to impact lake sturgeon populations, other human impacts such as increased nutrient loads in Lake Winnipeg and along the Winnipeg River and the transfer of water from Devils Lake will impact on water quality in the Red River basin. There are ways economic opportunities will emerge;

1. Through recovery plans required by federal legislation for an endangered species,

2. The development of aquaculture facilities to culture lake sturgeon for rehabilitation & restoration and

3. Long term environmental monitoring.

All three areas will result in significant employment but unless First Nations are in position to provide some of the knowledge needed for recovery plans their input will be largely symbolic and they will not be treated as the key component in the recovery process.

PURPOSE OF THE PROJECT

The Office of Numao has been mandated by their First Nation government with the responsibilities of initiating and supporting economic development activities of the First Nations. As part of their mandate they have developed an initiative to fulfill two related purposes regarding this project:

- To create an information base regarding Anicinabe values of First Nation people on the Winnipeg River system which will document relevant traditional ecological and cultural knowledge of and how indigenous sturgeon use customs can support appropriate economic opportunities for the First Nation people involved;

- To identify economic opportunities from the documentation of native values for the region. This will emphasize historical knowledge of sturgeon fishery, especially those related to food and medicine which have been customary to the First Nations. The objective here is to define appropriate future economic opportunities where the health of the sturgeon can be sustained.

PRODUCTS

The intent of the project is to illustrate the various aspects of the customs of the members of the first nation people from their own perspective in their own language.

The product of the project will be:

A.) First Nation Territorial library of historical knowledge and special ecological and cultural values of First Nations relating to lake sturgeon. This would include traditional fishing areas, traditional and current uses of lake sturgeon and culturally important sites along the Winnipeg River relating to lake sturgeon.

B.) A written document outlining First Nations role in the recovery of the endangered lake sturgeon that encompasses traditional values, subsistence fishing and novel ideas on how to enhance lake sturgeon populations.

C.) A training program dealing with the collection of lake sturgeon data and its use in management. This will include methods for ageing, assessing maturation of gonads, data entry and analyses, use of Global Information Systems and presentation of information.

D.) An evaluation of the potential in the community for economic benefits. For example 1) employment opportunities related to a comprehensive and a long term recovery plan for lake sturgeon in the Winnipeg River and 2) culturing lake sturgeon for stocking as part of a recovery strategy.

E.) Explore key issues such as access to lake sturgeon in the Winnipeg River when it is endangered and protected by federal legislation. For example, stewardship, protection of spawning sites, collection of spawn for enhancement and protection of key habitats. This would be incorporated into a written document outlining the interests and concerns of First Nations regarding resource management issues in the Winnipeg River System.

Note: B, C, D, E has direct relevance to Sagkeeng First Nations but is also important as a model for other First Nations.

The research products will incorporate the following information:

1. cultural knowledge related to historical and contemporary Ojibway sturgeon and resource use on the Winnipeg River system. The data gathered here will include place names and associated cultural/ecological information linked to places of significance to the members of the First Nation.

2. ecological information related to natural resource use and management with a focus on sturgeon management. This will include information on the historical and contemporary significance of natural resources. The information gathered on this topic will include documenting sites of sturgeon resources that are important to the livelihood and way of life of the members of the First Nation. It will also include recommendations for keeping the sturgeon healthy while still allowing for the harvest of these resources. The project will document recommendations on how First Nations knowledge of sustainable resource management .can be respected by all people working on the Winnipeg River system.

3. Information on the historical and contemporary use of the sturgeon by the First Nation. This information will supplement documentation gathered on First Nation natural resource use and management. It will include information in how sturgeon have been managed and used by the First Nation.

BENEFITS

Key areas where benefits accrue are:

1) increase employment of community members in the short and longer term employment and training in preparation for lake sturgeon recovery plans and for enhancement projects through the culture of lake sturgeon, greater input to the management of the Winnipeg River systems and the employment opportunities necessary for both management and environmental monitoring;

2) access arrangements for lands and resources beyond community control, this is important as the Winnipeg River was historically an integral part of the resource use of Sagkeeng First Nations and especially important for lake sturgeon (culturally, food and medicine);

3) greater utilization of community land and resources (treated water and building space is currently underutilized on community land);

4) Additional investment in communities (equipment for aquaculture facility).

In summary these benefits are regional as they encompass the Winnipeg River System but also there are broader benefits to all First Nations communities that will have to deal with lake sturgeon recovery and traditional use.

The community will benefit by jobs and direct wages. We project the creation of jobs for the residents of the Sagkeeng First Nation. Two of the jobs will be management, both by Sagkeeng residents. The economic benefits to the community will be direct as wages paid earned by people who work on the project but the social benefits will go beyond this to the sense of worth and dignity which employment brings to the community.

Perhaps, when a culturing facility is established, and lake sturgeon has been replenished to viable levels in the Winnipeg River System, the facility could explore the idea of raising/breeding sturgeon for sale of its meat and caviar for export. Another economic aspect of the culturing facility could be the establishing of strategic alliances with the Universities to act as the research station and a training facility. This would provide the facility and community with another stream of economic activity.

The non-economic benefits

1) Include recording traditional and historical knowledge within the community as a base for the development of long term recovery plans for lake sturgeon. This non-economic benefit is highly significant culturally to Canada and First Nations as much of the knowledge resides in the older residents of the community who travelled the Winnipeg River before some of the dams were constructed and

2) Develop leadership at Sagkeeng First Nation in the management strategies needed to establish a recovery plan for lake sturgeon and for the training, in the longer term, of a new generation of qualified person in resource management and environmental monitoring.

Wiinibiig Ziibi Numao Board

As part of the proposal submission a Steering committee was established to assist with the project. The committee consists of Sagkeeng Chief & Council Representative, Four Sagkeeng Elders, Numao, W. Galbraith (INAC), DFO (Andries Blouw), University of Manitoba (Terry Dick). Meetings are held monthly to set goals and to help solve any problems that arise.

At the committee meeting of December 23, 2005, it was discussed and decided by the steering committee that the membership should be expanded to include Wabaseemoong Independent Nations, Black River First Nation, Manitoba Hydro and the Province of Manitoba. Before sending out invitations to participate the committee researched the existence of any other boards that may have existed that were/are dealing with the sturgeon issues. Although there were efforts made to establish a board to look after the sturgeon issue, there appears to have been no success. A letter was then sent to Sagkeeng Chief & Council seeking permission to expand the membership to include the stakeholders of the Winnipeg River regime. The letter also contained a request to change the name of the group to the Wiinibiig Ziibi Numao Board.

Sagkeeng consented to both requests and letters were sent out, all accepted with the exception of Black River First Nation, the first board meeting was January 27, 2006. The mandate of the Wiinibiig Ziibi Numao Board is **TO PROTECT AND ENHANCE LAKE STURGEON AND THE WINNIPEG RIVER ECOSYSTEM**.

The Board is now finalizing a sturgeon Awareness Day at Sagkeeng First Nation and planning for a Sturgeon Awareness Day at Wabaseemoong Independent Nations. The board is also preparing to present the project to the community for validation and preparation for final presentation.

Appendix 21. Presentation by Richard Verdon, Hydro-Québec, Montréal, QC.

Slide 1

USE OF A MAN-MADE STURGEON (*Acipenser fulvescens*) SPAWNING AREA DOWNSTREAM FROM THE LA GABELLE GENERATING STATION, ST. MAURICE RIVER (QUÉBEC)

Richard Verdon (Hydro-Québec)
Michel Bérubé (Hydro-Québec)
Raymond Faucher (Alliance Environnement)

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Objectives

- Assess the use by Lake Sturgeon and other species of a newly created spawning area (1999);
- Compare the use of the site between high flow (2000) and low flow (2001) conditions.

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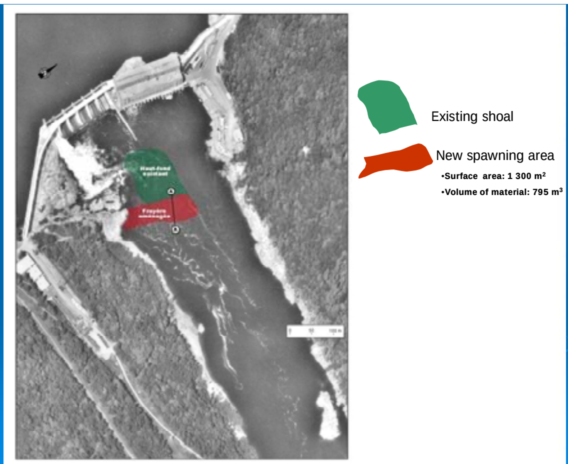

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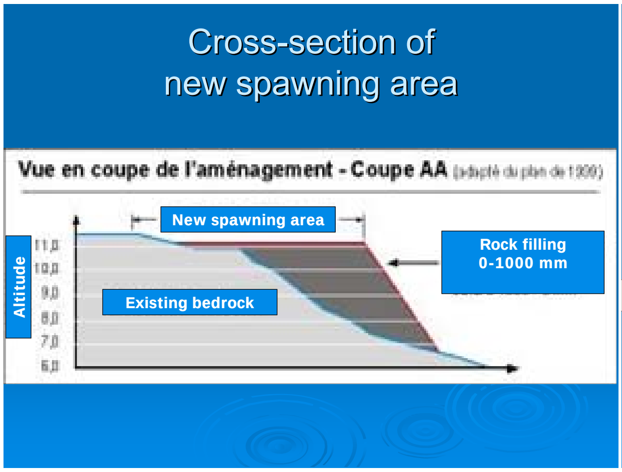
Characteristics of the new spawning site

- Put in place in 1999, at the end of a refurbishing of the generating station (1992-1999);
- Downstream of an existing shoal used by Lake Sturgeon for spawning;
- Surface area: 1300 m^2;
- 30 micro-sites: shelter of 2-4 blocks (1-3 m^3) with 6 to 10 m^2 of spawning material (30-400 mm) downstream;

Slide 7



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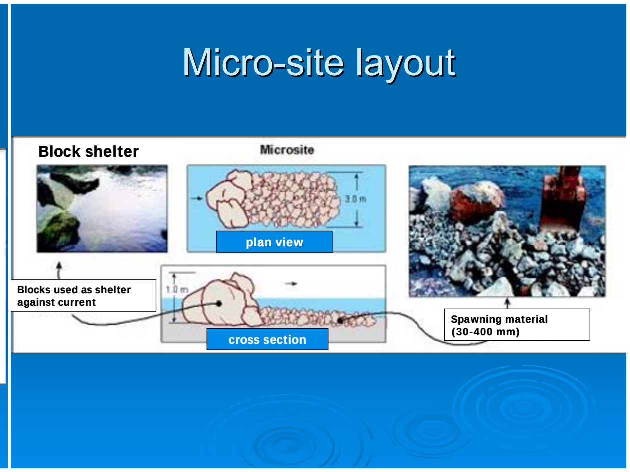

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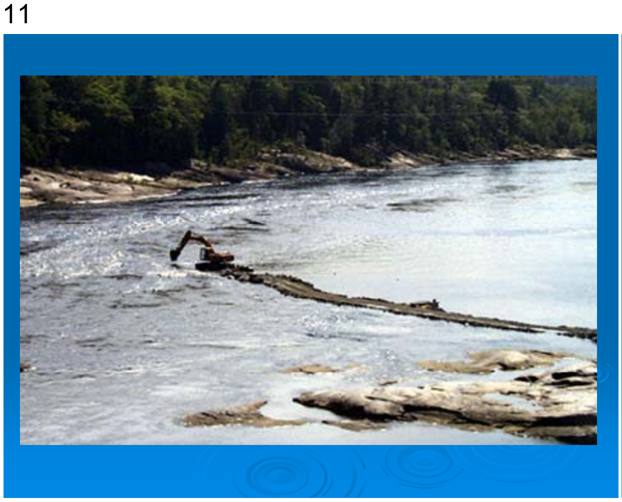

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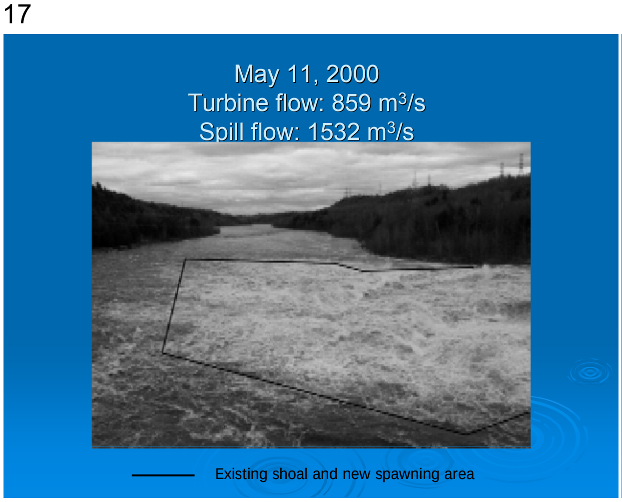

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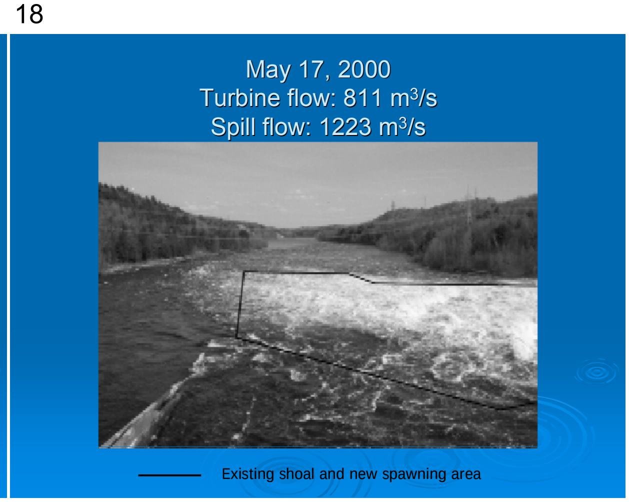

Slide 19

May 21, 2000
Turbine flow: 819 m^3/s
Spill flow: 496 m^3/s

——— Existing shoal and new spawning area

20

May 26, 2000
Turbine flow: 856 m^3/s
Spill flow: 143 m^3/s

——— Existing shoal and new spawning area

21

June 2, 2000
Turbine flow: 769 m^3/s
Spill flow: 0 m^3/s

——— Existing shoal and new spawning area

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Velocity on spawning site vs spill flow in 2000

Spill flow*	Velocity on existing shoal	Velocity** on new spawning site
294 m^3/s	> 1,4 m/s	1,33 -1,36 m/s
0 m^3/s	1,2 -1,4 m/s	0,6 – 1,2 m/s

- *Turbine flow 849 m^3/s and 832 m^3/s
- **Optimum for sturgeon 0,8 m/s to 1 m/s

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Sampling Methods

- Gillnets (2000 - 2001): 7,6 – 10,2 – 17,8 – 22,9 – 24,1 – 30,5 cm mesh sizes
- Egg collection trays (2000-2001): animal fur covered with latex, 46 cm X 46 cm
- Drift nets (2001): 0,495m diameter
- Velocity (Global flow probe FP 101)
- Sampling position with GPS (± 2m)

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Egg collection trays

Slide 25

Drift net

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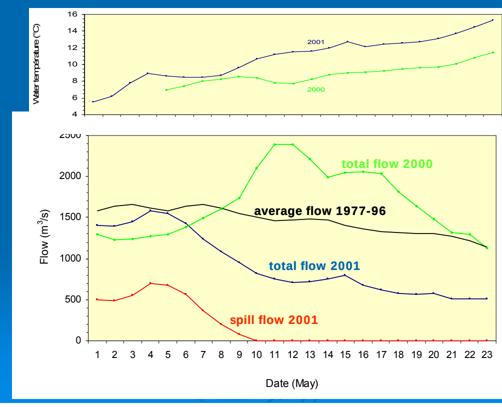
Flow and T° in 2000 et 2001



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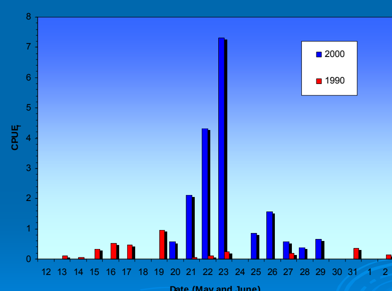
CPUE in gill nets 1990 and 2000



- Conditions in 1990: Low flow (675 m³/s), log floating

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Sturgeon captured in 2000

Sex	N	Mean Length	Min Length	Max Length
Male	101	1081	775	1430
Female	3	1090	809	1290
Unknown	25	1061	840	1360

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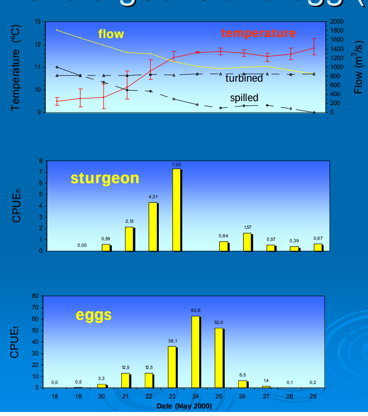
CPUE of sturgeons and egg (2000)



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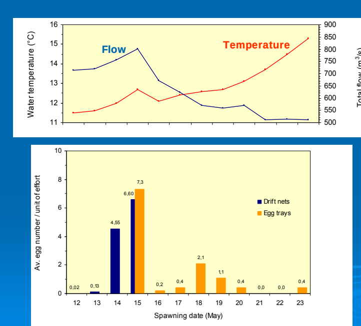
CPUE (Tray and drift net) with water T° and flow in 2001



Slide 31

Spawning conditions 2000-2001

Year	Mean Q * 5th to 23rd of May	Spawning peak	T° at the beginning of spawning peak	CPUE (eggs per tray per night)
2000	1605 m³/s	21-25 mai	10°C	17,6
2001	807 m³/s	13-19 mai	12°C	1,6

* Mean (1977-1996) = 1426 m³/s

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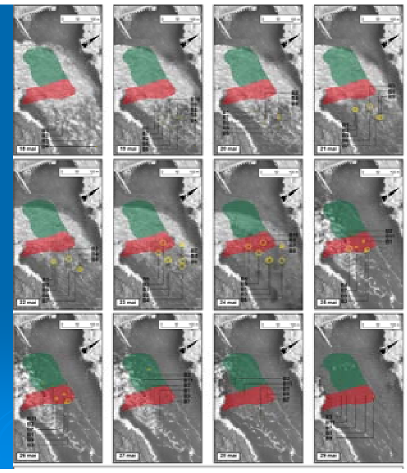
- Egg density per day in 2000



○ >100 eggs/m²
○ 50-100 eggs/m²
○ 10-50 eggs/m²
· 0-10 eggs/m²

Existing shoal

New spawning area

B1 sampling station

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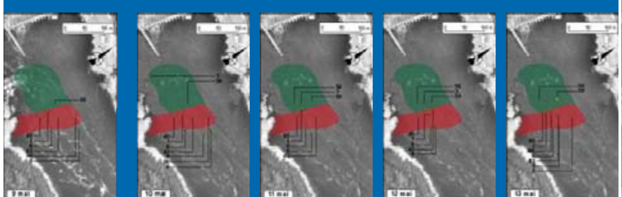
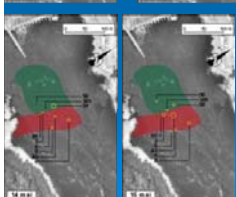
Drift net egg collection: May 9 to 15, 2001

○ 10-15 eggs/1000 m³
○ 5-10 eggs/1000 m³
○ 1-5 eggs/1000 m³
· <1 egg/1000 m³

Existing shoal

New spawning area

B1 sampling station

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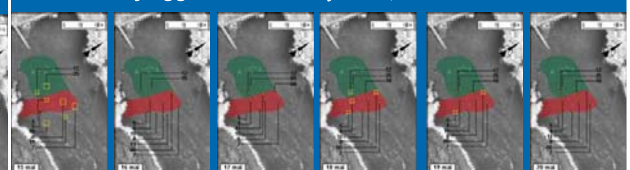
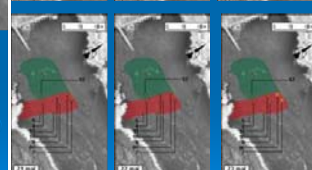
Tray egg collection: May 15-23, 2001

□ >30 eggs/m²
□ 10-30 eggs/m²
▪ 5-10 eggs/m²
· 0-5 eggs/m²

Existing shoal

New spawning area

B1 sampling station

35

Mean CPUE (eggs/tray/night)

Year	Existing shoal	New spawning site	Downstream of new spawning site	Total
2000	1,0	42,8	11	17,6
2001	2,0	1,5	2,5	1,6*

- * Comparable to CPUE at Rivière-des-Prairies in 1997 – 1999 (0, 76 to 3,55)

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Maximum CPUE (eggs/tray/night)

Year	Existing shoal	New spawning site	Downstream of new spawning site	Total
2000	1,8	194,7	29,8	194,7
2001	8,0	7,4	3,5	8,0

- Maximum observed density = 3 072 eggs/m² on new spawning site in 2000

Slide 37

Other species using the new spawning site

- Longnose sucker (*Catostomus catostomus*)
- White sucker (*Catostomus commersoni*)
- Walleye (*Sander vitreus*)
- Smallmouth bass (*Micropterus dolomieui*)
- Rock bass (*Ambloplites rupestris*)
- Mooneye (*Hiodon tergisus*)

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Conclusions

- The new spawning site is used by Lake sturgeon and other spring spawning species;
- Although it is used both during high and low flow conditions, it is more used during high flows, when it provides a more suitable spawning habitat than the upstream shoal;
- In 2000 some sites might have been saturated with eggs

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Questions ?

Hydro Québec