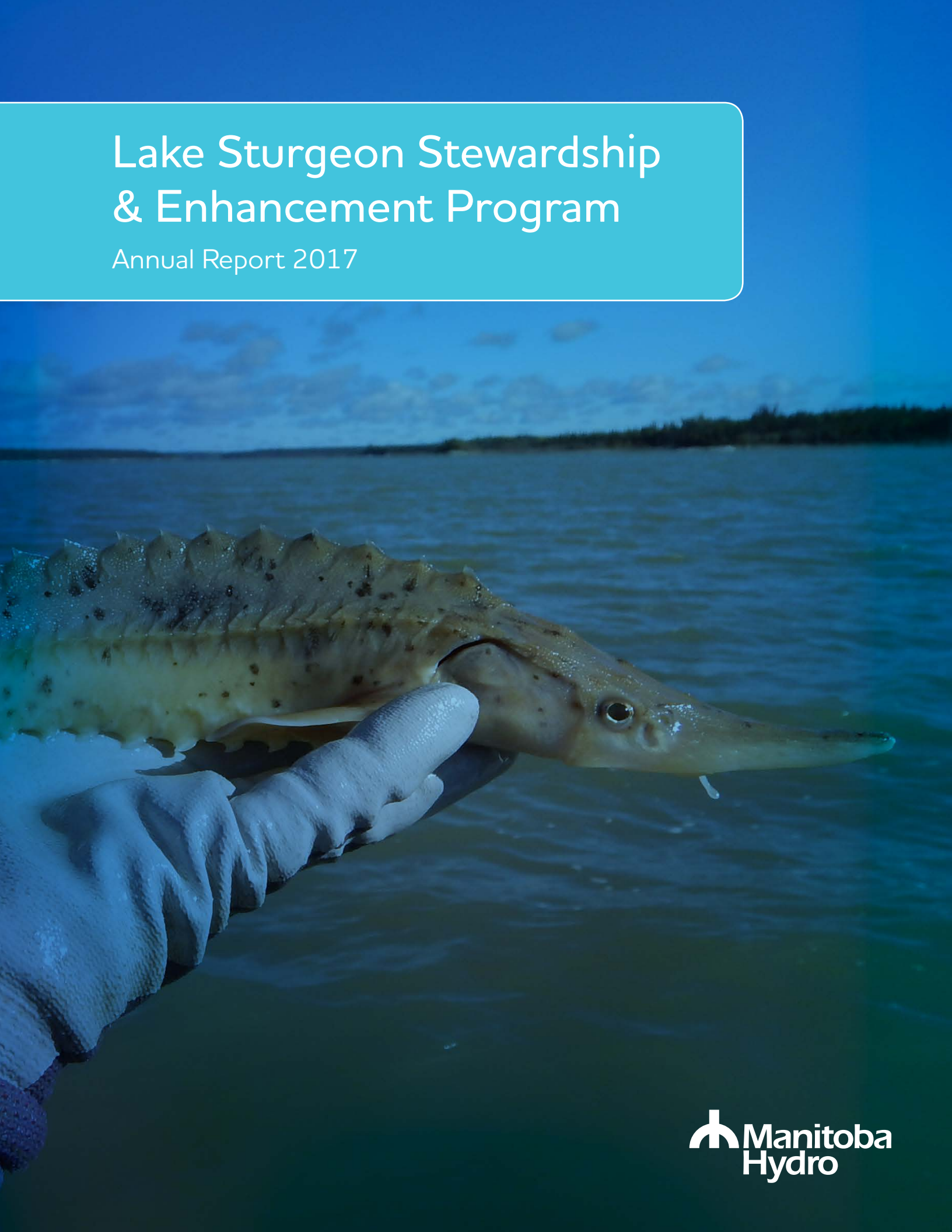
Lake Sturgeon Stewardship & Enhancement Program

Annual Report 2017



Manitoba Hydro

The Lake Sturgeon Stewardship & Enhancement Program (LSSEP) was established in 2008 to consolidate Manitoba Hydro's Lake Sturgeon stewardship efforts. The vision of the program is "to maintain and enhance Lake Sturgeon populations in areas affected by Manitoba Hydro's operations, now and in the future." Manitoba Hydro's LSSEP is contributing to Lake Sturgeon conservation in Manitoba by increasing our knowledge of populations, advancing our understanding of local ecology, supporting stocking programs, and initiating research to improve the effectiveness of conservation efforts.

LSSEP PROJECTS

POPULATION INVENTORIES/ESTIMATES

Bladder Rapids Adult Lake Sturgeon Inventory

The Nelson River flows through Cross Lake and through multiple channels into Sipiwesk Lake. Bladder Rapids is located about halfway between these two lakes. Commercial harvest in this area from the 1900s until 2000 resulted in a major decline of the Lake Sturgeon population. Currently, subsistence harvest is ongoing in the area. Studies completed by Nelson River Sturgeon Board (NRSB) between 2000 and 2008 indicated a declining abundance. This study was designed to evaluate the number of adult Lake Sturgeon currently spawning at Bladder Rapids, and to mark captured individuals to contribute to a future population estimate in the area. Unfortunately, extreme high flows on the Nelson River resulted in the postponement of this study until 2018.

Landing River Population Study

LSSEP partnered with the Nelson River Sturgeon Board to conduct a gillnet study in the reach of the Nelson River extending from the mouth of Sipiwesk Lake downstream to the Kelsey Generating Station. This was undertaken to provide additional information on the distribution, abundance, and cohort strength of juvenile Lake Sturgeon occupying this reach of the river, and to compare results to those collected in the same area during fall 2013. From September 13-24, 2017, a total of 97 juvenile Lake Sturgeon gillnet gangs with variable mesh were fished for 2,453 gillnet hours, resulting in a catch of 124 Lake Sturgeon (CPUE of 1.1 LKST/100m/24hr). For the first time in the Landing River area, age-0 Lake Sturgeon (n = 2) were captured. Thirty-two previously tagged sturgeon were recaptured, all of which had been initially tagged within the study area. Age analysis of the consolidated 2013 and 2017 inventories suggest that erratic recruitment has occurred in this population over approximately the previous 12 years. For cohorts highly susceptible to capture (i.e. of an appropriate size) in both the 2013 and 2017 inventories, cohort frequency distributions were similar, with the 2011, 2009 and 2006 cohorts standing out as strong.

Upper Churchill River Population Inventory

To address a paucity of data on the Lake Sturgeon population in the upper Churchill River, a population inventory was proposed near Leaf Rapids in the fall 2017. Due to extreme high flows in the Churchill River, and a lack of information resulting from the preliminary assessment undertaken by Manitoba Sustainable Development (which was also confounded by high flows), this study was postponed to a subsequent year.

Population Inventory in Billard Lake, Fidler Lake and at the Churchill Weir

To address concerns regarding the potential for redistribution of Lake Sturgeon in the lower Churchill River (at the confluence with the Little Churchill River) during unprecedented high flows in the spring of 2017, and the risk of subsequent stranding during receding water levels, Lake Sturgeon surveys were undertaken at multiple locations on the lower Churchill River above and below the confluence with the Little Churchill River (Confluence). From September 13 – 20, 2017, 16 large mesh gangs and two juvenile gangs were fished in Billard Lake (upstream of the Confluence) for a total of 432 and 46 gillnet hours, respectively, yielding zero Lake Sturgeon. Eleven large mesh gangs and one juvenile gang were fished in Fidler Lake (upstream of the Confluence) for a total of 280 and 21 gillnet hours, respectively, yielding zero Lake Sturgeon. Ten large mesh gangs were fished at the Churchill River Weir forebay (downstream of the Confluence) in conjunction with the Coordinated Aquatic Monitoring Program (CAMP). In 214 gillnet hours, zero adult Lake Sturgeon were captured. However, two juvenile Lake Sturgeon were captured in CAMP index gillnets. The lack of captures in large mesh gangs (despite suitable conditions) suggests that adult abundance was very low at the time of the study. These areas were targeted because they contain some of the more lacustrine and deeper habitats available on the lower Churchill River, and as such would be logical aggregation points for fish that may have redistributed from the population core area at the Confluence during or in response to the 2017 flood. All things considered, there was no evidence of a mass redistribution followed by an overwinter stranding scenario, which bodes well for the health of the population that utilizes the Little Churchill River confluence reach.

Tag and Data Support

LSSEP funded the tagging (using Passive Integrated Transponder Tags) of Lake Sturgeon captured during annual Fish Community sampling conducted through the Coordinated Aquatic Monitoring Program, as well as time spent reconciling tagging data from multiple sources.

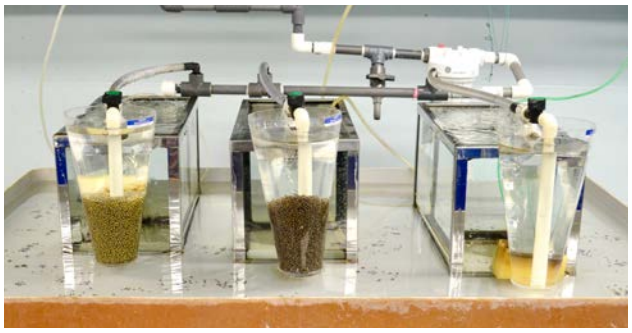
ADDRESSING INFORMATION GAPS

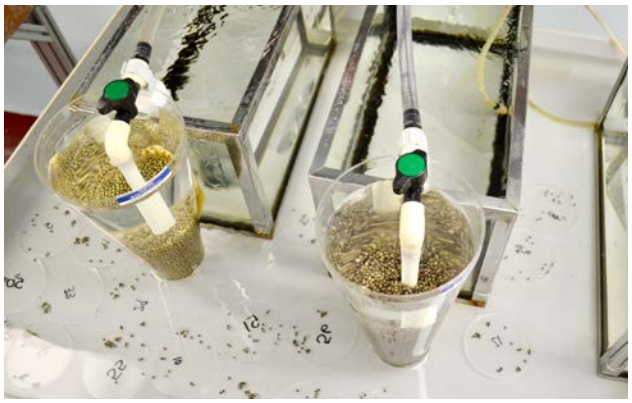
NSERC-IRC in Lake Sturgeon Conservation Aquaculture

In 2015, Manitoba Hydro partnered with the National Science and Engineering Research Council (NSERC) and Dr. Gary Anderson from the University of Manitoba to establish an Industrial Research Chair in Lake Sturgeon Conservation Aquaculture. This five year research program is focused on the influence of genetics and early rearing environment on the development of Lake Sturgeon, with the goal of refining hatchery rearing practices to improve the ability of Lake Sturgeon to survive, grow and reproduce after release for stock recovery and enhancement. The program is divided into three Research Areas, with preliminary results to date summarized below.

Research Area 1: Environment by phenotype interactions during early rearing.

Lake Sturgeon were found to have a plastic response in the development of metabolic phenotypes in relation to temperature, and a clear interaction between environment and phenotype was observed in experiments assessing swimming, growth and acid/base physiology. Research on behavioural responses found Lake Sturgeon heavily favour access to food despite the presence of predation threats during early life history, and research on stress physiology shows juvenile Lake Sturgeon are unable to mount an acute cortisol stress response to a stressful event prior to 15 days post hatch.





Research Area 2: Genotype by environment interactions and effects on phenotypic development.

Work to determine the Critical Thermal Maxima and scope of thermal acclimation of Lake Sturgeon raised at, and subsequently exposed to, different temperatures is underway. This work will assist the Grand Rapids Fish Hatchery in developing protocols for acclimating fish to new temperatures when stocking.

Research Area 3: Development of tools to better determine success of stock enhancement efforts

Initial analysis and development of environmental DNA (eDNA) markers as a method to detect the presence or absence of Lake Sturgeon in the wild is promising, and suggests eDNA could be used as an alternative to traditional (capture) sampling methods. Work on determination of elemental signatures and stable isotope batch marking is also underway. To date, it has been determined that natural elemental signatures arising from the hatchery water source allow reliable discrimination between wild and hatchery fish. Development of a serum-based assay to allow sex identification has also been completed, but found sex identification to only be possible in Lake Sturgeon 4 years or older.

Genomics of Winnipeg River Lake Sturgeon

To improve the understanding of historical (pre-development) and contemporary population structure of Lake Sturgeon on the Winnipeg River (historically a stepped gradient river, now with 6 generating stations in Manitoba and three in Ontario), LSSEP is collaborating with Ontario Power Generation to complete a high-resolution genetic study of the entire Winnipeg River. Application of high resolution genetic tools (Single Nucleotide Polymorphisms or SNP's) developed to assess the population structure of Lake Sturgeon on the Nelson River (Gosselin et. al. 2015, available here https://doi.org/10.5281/zenodo.845491), combined with the long generation time of Lake Sturgeon (meaning pre-development genetic signatures are still present) will allow assessment of the historical population structure of Lake Sturgeon, as well as insights into genetic diversity, effective population sizes, number of breeders, and connectivity in the Winnipeg River. This project will be completed over two years; at the conclusion of 2017/18, data was still being collected.

SUPPORT FOR STURGEON BOARDS AND CAMP

Saskatchewan River Sturgeon Board

LSSEP provides funding annually to the Saskatchewan River Sturgeon Management Board (SRSMB). In 2017, the SRSMB completed a juvenile sturgeon inventory in the Saskatchewan River between E.B. Campbell Hydroelectric Station and Cedar Lake, using a standardized protocol established in 2015. In general, there appears to be a healthy population of Lake Sturgeon in this reach of the Saskatchewan River with successful spawning and recruitment having occurred fairly consistently since 2002. However, no young-of-year Lake Sturgeon were captured in 2017 by either the Manitoba or Saskatchewan crews. Additionally, only one fish younger than three years old (2015-2017 cohorts) was caught, indicating recruitment may have been low in the three years since 2014. There appears to be abundant rearing habitat for juvenile Lake Sturgeon throughout the reach of the river, particularly on the Manitoba side upstream of The Pas. LSSEP funding also covers travel costs for board members from Opaskwayak Cree Nation to participate in SRSMB meetings, and the cost of some promotional items for the committee.

Nelson River Sturgeon Board

The Nelson River Sturgeon Board operates a Lake Sturgeon spawn camp annually at Landing River, a tributary of the upper Nelson River. LSSEP provides funding annually to support the cost of hiring Joe Hunter, a sturgeon aquaculture expert from Rainy River, Ontario, who provides advice and improves probability of the successful collection of spawn.

PUBLIC AWARENESS & EDUCATION INITIATIVES

LSSEP maintains a sturgeon aquarium in the Customer Contact Centre at 360 Portage Avenue. The aquarium provides an opportunity for the public to see live Lake Sturgeon and to learn about conservation aquaculture and population recovery efforts throughout Manitoba. LSSEP also continues to place an emphasis on publishing study results that advance the understanding of Lake Sturgeon biology in peer-reviewed literature. In 2017/18, two publications resulting from the NSERC-IRC on Lake Sturgeon conservation aquaculture, and three publications supported by LSSEP, were accepted and published in peer-reviewed journals.

PUBLISHED ARTICLES

McDougall, C.A., P.A. Nelson, D. Macdonald, D. Kroeker, K. Kansas, C.C. Barth and D.S. MacDonell. 2017c.
Habitat quantity required to support self-sustaining Lake Sturgeon populations: an alternative hypothesis. Transactions of the American Fisheries Society. 146(6): 1137-1155

McDougall, C.A., P.A. Nelson and C.C. Barth. 2018.
Extrinsic Factors Influencing Somatic Growth of Lake Sturgeon. Transactions of the American Fisheries Society. 147(3): 459-479

McDougall, C.A., A.B. Welsh, T. Gosselin, W.G. Anderson and P.A. Nelson. 2017.
How do dams affect fish populations? Env. Sci. J. for Teens. http://www.sciencejournalforkids.org/uploads/5/4/2/8/54289603/sturgeon_article.pdf

Deslauriers, D., J.C.C. Svendsen, J. Genz, A.J. Wall, H. Baktoft, E.C. Enders and W.G. Anderson. 2018.
Environmental calcium and variation in yolk sac size influence swimming performance in larval lake sturgeon (Acipenser fulvescens) J. Exp. Biol. 221(7).

Deslauriers, D., G.R. Yoon, M.L. Earhart, C. Long, C.N. Klassen and W.G. Anderson. 2018.
Over-wintering physiology of age-0 lake sturgeon (Acipenser fulvescens) and its implications for conservation stocking programs. Env. Biol. Fishes. 101(4):623-637.

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1. Ambrose, K.M. and C.A. McDougall. 2018.
Results of Lake Sturgeon population studies conducted in the lower Churchill River, Fall 2017. Report #17-01 prepared for Manitoba Hydro by North/South Consultants Inc.

2. Bernhardt, W.J., L.M. Henderson and C.A. McDougall. 2018.
Upper Nelson River Juvenile Lake Sturgoen Inventories, 2017: the Landing River Area. Report #17-02 report prepared for Manitoba Hydro by North/South Consultants Inc.

3. Gosselin, T., P.A. Nelson, C.A. McDougall, and L. Bernatchez. (2015, December 15).
Population Genomics of Lake Sturgeon (Acipenser fulvescens) in the Churchill, Hayes, and Nelson Rivers. A draft report prepared for Manitoba Hydro by Université Laval and North/South Consultants Inc. Zenodo. http://doi.org/10.5281/zenodo.845491

Manitoba Hydro

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Available in accessible formats upon request.