Lake Sturgeon Stewardship & Enhancement Program

Annual Report 2021

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 IN 2020/21

POPULATION INVENTORIES/ESTIMATES

Pine Falls and Great Falls Reservoirs Juvenile Population Inventory

The first year of a three-year mark recapture gillnetting study in the Pine Falls and Great Falls reservoirs was completed in Fall 2020. This study is being done to improve the understanding of Lake Sturgeon abundance and population trajectories in these areas.

Gill nets (both juvenile net sets (1, 2, 3, 5, and 6 inch meshes) and large mesh net sets (8, 9, 10 and 12 inch meshes)) were set downstream of generating stations and in proximity to higher velocity constrictions that occur in the reservoirs. A total of 53 Lake Sturgeon (40 juvenile and 13 adult/subadult) were captured in the Great Falls Reservoir, resulting in a CPUE of 1.4 Lake Sturgeon/100m/24h.

In the Pine Falls Reservoir, 387 Lake Sturgeon were captured (347 juvenile and 40 adult/subadult), resulting in a CPUE of 6.2 Lake Sturgeon/100m/24h. Sturgeon captured in the Great Falls Reservoir were determined to be from 5 – 31 years of age, while sturgeon captured in the Pine Falls Reservoir were 1-24 years. Considering both reservoirs, fish five years of age or younger were rare, and only represented by a single age-1 and a single age-2 Lake Sturgeon in the Pine Falls Reservoir (and no fish aged 3,4 or 5 years).

The remaining two study years of this program will allow calculation of a population estimate for both reservoirs, as well as providing additional information on current patterns of recruitment.

Slave Falls Reservoir Adult Abundance

The second year of a three-year mark-recapture study designed to estimate contemporary adult abundance in the Slave Falls Reservoir on the Winnipeg River was completed in 2020. The Lake Sturgeon population in this reservoir is suspected to have been at or very near carrying capacity for the past decade. Combined with recent juvenile monitoring studies, this data will facilitate estimation of Lake Sturgeon biomass and help refine the understanding of Lake Sturgeon carrying capacity in the reservoir.

Large mesh gillnets were set throughout the reservoir (i.e. from the Pointe du Bois to Slave Falls generating stations) in June 2020, resulting in the capture of 551 individual Lake Sturgeon (402 of which were ≥800 mm fork length and considered to be adult size). Overall, CPUE averaged 5.17 Lake Sturgeon/100m/24h, with a mean fork length of 934 mm, weight of 6,896 g and condition factor of 0.79 K. Ages were assigned to 134 fish and ranged from 5 – 23 years. The final year of this three-year program will take place in 2021.

Winnipeg River Lakes Inventory

A gillnetting inventory designed to update the understanding of Lake Sturgeon abundance and distribution in the lower portion of the Seven Sisters Reservoir (Dorothy, Eleanor, Margaret, Sylvia, and Natalie lakes) was completed in October 2020. Though previously studied, no Lake Sturgeon focused research has occurred in this portion of the Winnipeg River for the last decade.

Juvenile and large mesh gill net gangs set from October 10-19 captured a total of 410 juvenile and 233 adult Lake Sturgeon, with CPUE of 5.1 and 5.0 Lake Sturgeon/100m/24h in juvenile and large mesh gillnets respectively, Lake Sturgeon abundance was generally skewed towards the upstream portions of the study area, with 218 Sturgeon captured in juvenile gangs set in the furthest upstream reach (Dorothy Lake, mean CPUE of 7.2), while only two were captured in the furthest downstream reach (Natalie Lake, mean CPUE of 0.3). Differences in length-at-age and condition factor were observed between study reaches. Aged sturgeon were between 4-37 years, with recent cohorts (less than 4 years old) absent from the catch.

Comparing data collected in 2020 with data collected 10-15 years ago suggests an increasing abundance of Lake Sturgeon in the area. Notably, juvenile Lake Sturgeon were captured in the three most downstream sampling reaches (Pinawa area, Pre-Forebay, and Natalie Lake) during fall 2020 where previous (2006 – 2010) gillnetting studies determined Lake Sturgeon to be absent.

ADDRESSING INFORMATION GAPS

NSERC-IRC in Lake Sturgeon Conservation Aquaculture

In 2020 Manitoba Hydro and the Natural Science and Engineering Research Council (NSERC) of Canada renewed the Industrial Research Chair (IRC) in Conservation Aquaculture of Lake Sturgeon for a second five-year term. Building on the success of the research undertaken during the initial term, Dr. Gary Anderson (University of Manitoba)and the rest of the team will focus on five main Research Areas during the renewed IRC:

Research Area 1: Development of palatable diet formulations toward improved growth in developing lake sturgeon

This research uses physiological and behavioural techniques to identify key components of a sturgeon's diet that will promote feeding and therefore growth during early life history. Physiological methods involve measuring how large the olfactory response is to different food odours (essentially how strong the fish smells). This is coupled with behavioural trials to develop diet formulations that illicit strong physiological and behavioural responses.

Research Area 2: Using fin ray and otolith elemental signatures to understand habitat use and spawning periodicity in Lake Sturgeon

Building on elemental composition work completed in the first term of the IRC, this work aims to understand spawning periodicity in adult fish. In collaboration with Dr. Kim Scribners lab (Michigan State University), a historical dataset from the Black Lake Michigan system (where the history of all spawning adults is known) alongside known water chemistries will be used to describe changes in elemental signatures in the fin rays associated with known spawning events. These data will then be used to model the changes in elemental signatures of fin rays from adults with unknown spawning histories and develop predictive models for spawning periodicity. Such data will be invaluable for managers in understanding cohort strength within a given system.

Research Area 3: Further development of eDNA tools

In the previous IRC term, molecular markers for an eDNA assay were developed, indicating its potential use as a tool to detect the presence or absence of Lake Sturgeon in the wild. During the second term, this tool will be further developed to better understand presence/absence of Lake Sturgeon as well as temporal variation in eDNA signal. Further development of the eDNA technique will provide the necessary confidence in using this tool as a method to provide quantitative assessment of sturgeon stocks in remote regions of the province.

Research Area 4: Assessment of broodstock health and understanding the natural and hatchery ploidy levels in Lake Sturgeon

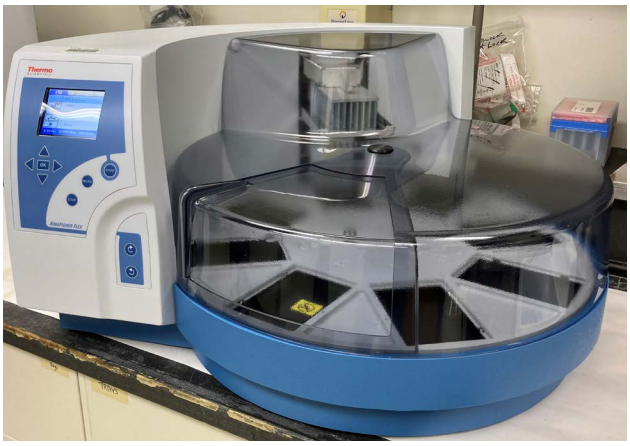
Sturgeon are functional tetraploids with 8 sets of chromosomes (8N). Some stocked sturgeon (primarily White Sturgeon) are known to undergo a process known as autopolyploidy in a hatchery fertilization stetting, where there is a mismatch in cell division and additional chromosomal compliment is incorporated to result in 10N or 12N progeny. Individuals with a 10N ploidy level are known to be infertile, and therefore not suitable for a conservation stocking program. To assess the incidence of autopolyploidy in Lake Sturgeon, this research area will determine the proportion of different ploidy levels in a wild population and compare this with hatchery reared individuals. Experimental fertilization procedures will also seek to understand the conditions that precede the appearance of autopolyploidy in hatchery raised fish.

Research Area 5: Whole genome sequencing

In collaboration with Dr. Andrea Schreier at UC Davis, this project will use cutting edge gene sequencing technology to sequence and annotate the Lake Sturgeon genome. This project will prove particularly challenging given the polyploid nature of the sturgeon genome but will result in an invaluable resource for all sturgeon biologists.

Lake Sturgeon Disease Study

Following symptoms (blisters) observed on sturgeon reared at the Grand Rapids Fish Hatchery, a collaborative research agreement was signed with Dr. Sharon Clouthier (Department of Fisheries and Oceans). The goal of this two-year research project is to determine the probable cause of the blisters, characterize the pathogen and develop a diagnostic test for its detection. Cellular changes (putative cytopathic effect) typically associated with virus amplification were observed in cultured Lake Sturgeon gonad cells infected with tissue samples taken from sturgeon displaying blister-like lesions. DNA sequence from infected tissue was generated using multiple Next Generation Sequencing approaches and bioinformatic analyses revealed the presence of several genes encoding proteins considered to be taxonomic signatures of herpesviruses. Phylogenetic analyses performed using these sequences suggested that the Lake Sturgeon blister virus may be a new member of the Alloherpesviridae family and may represent a new genus within the family. Two qPCR assays targeting the major capsid protein sequence have been developed and validated. One test is specific for the Lake Sturgeon Blister Virus and the other is pan-specific for type 2 sturgeon herpesviruses. Over 1,100 fin tissue samples collected from wild Lake Sturgeon in the Hudson Bay drainage basin are currently being screened using both tests. The results will provide an understanding of the type, prevalence and distribution of these viruses in wild Lake Sturgeon populations across the basin.



Robotic nucleic acid extractor used to prepare DNA from Lake Sturgeon tissue samples infected with a novel herpesvirus

Biological safety cabinet and microscope used to work with and visualize novel Lake Sturgeon viruses

SUPPORT FOR STURGEON BOARDS AND CAMP

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 typically 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. In 2019, LSSEP also undertook a collaborative study with NRSB to better understand the influence discharging effluent from broodstock holding ponds can have on spawning locations of wild fish.

Due to the Covid-19 pandemic, a decision was made to limit the number of people in spawn camp, and neither of these LSSEP funded initiatives took place.

Saskatchewan River Sturgeon Management Board

LSSEP provides annual funding to the Saskatchewan River Sturgeon Management Board (SRSMB). In 2020, the SRSMB completed an adult sturgeon inventory in the Saskatchewan River between E.B. Campbell Hydroelectric Station and Cedar Lake, with LSSEP funding used for the Manitoba portion of the survey. While typically undertaken in June (post spawn but while water temperatures remain cool), the 2020 survey was delayed until August 26 – September 8, 2020 due to logistical complications related to Covid-19. A total of 123 sturgeon were captured, with 58% classified as adults, 37% as sub-adults and 6% as juveniles. Similar to previous years, the catch rate was significantly higher in the upstream portion of the river, with 89% of the catch (110 individuals) captured in the first two river reaches (from the Saskatchewan Border to approximately 14 river kilometers downstream of The Pas). While a shorter delayed sampling period likely contributed to a reduced catch rate (compared to previous years), the results indicate active recruitment of juveniles into the adult Lake Sturgeon population in the Manitoba portion of the Saskatchewan River.

LSSEP funding is also used to reimburse board members from Opaskwayak Cree Nation, Chemawawin Cree Nation and Misipawistik Cree Nation for travel and participation in SRSMB meetings. Due to the Covid-19 pandemic, no in person meetings were held over 2020/21.

Tag and Data Support

LSSEP funds the tagging (using Passive Integrated Transponder Tags) of Lake Sturgeon captured during annual fish community sampling conducted through the Coordinated Aquatic Monitoring Program.

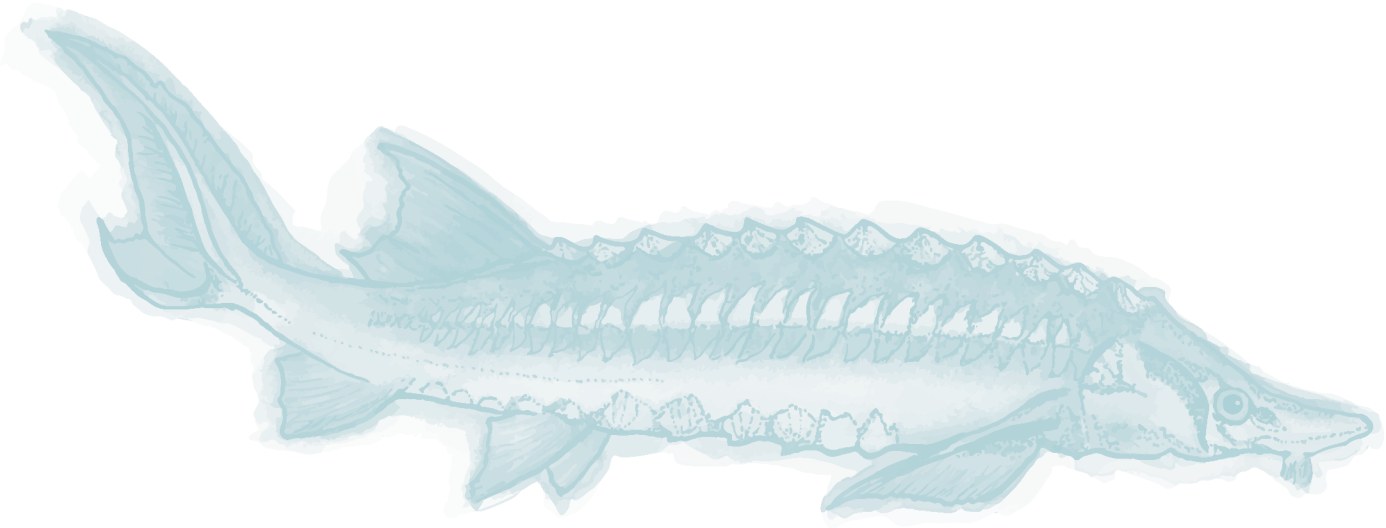
In preparation for a movement study in the Pine Falls Reservoir, a range testing acoustic tag was purchased to determine detection range of acoustic tags in proximity to the Great Falls Generation Station.

In addition, a chest freezer was purchased to ensure appropriate long-term storage of sturgeon genetic samples collected from various programs over the years.

PUBLIC AWARENESS & EDUCATION INITIATIVES

LSSEP typically 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. Due to reduced staffing and traffic at 360 Portage, sturgeon were removed from the aquarium in September 2020.

LSSEP also continues to place an emphasis on publishing study results that advance the understanding of Lake Sturgeon biology in peer-reviewed literature. In 2020/21, two publications supported by LSSEP were either submitted or in the review process for publication in peer-reviewed journals, while an additional 15 publications resulting from the NSERC-IRC on Lake Sturgeon conservation aquaculture were published or accepted in peer-reviewed journals.



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