Keeyask Generation Project

Aquatic Effects Monitoring Plan

Juvenile Lake Sturgeon Population Monitoring Report

AEMP-2019-06

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KEEYASK GENERATION PROJECT

AQUATIC EFFECTS MONITORING PLAN

REPORT #AEMP-2019-06

JUVENILE LAKE STURGEON POPULATION MONITORING, FALL 2018: YEAR 5 CONSTRUCTION

Prepared for

Manitoba Hydro

By

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SUMMARY

Background

The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the Keeyask Generating Station (GS) on the environment. Besides measuring the accuracy of the predictions made and actual effects of the GS on the environment, monitoring results will provide information on how construction and operation of the GS will affect the environment and if more needs to be done to reduce harmful effects.

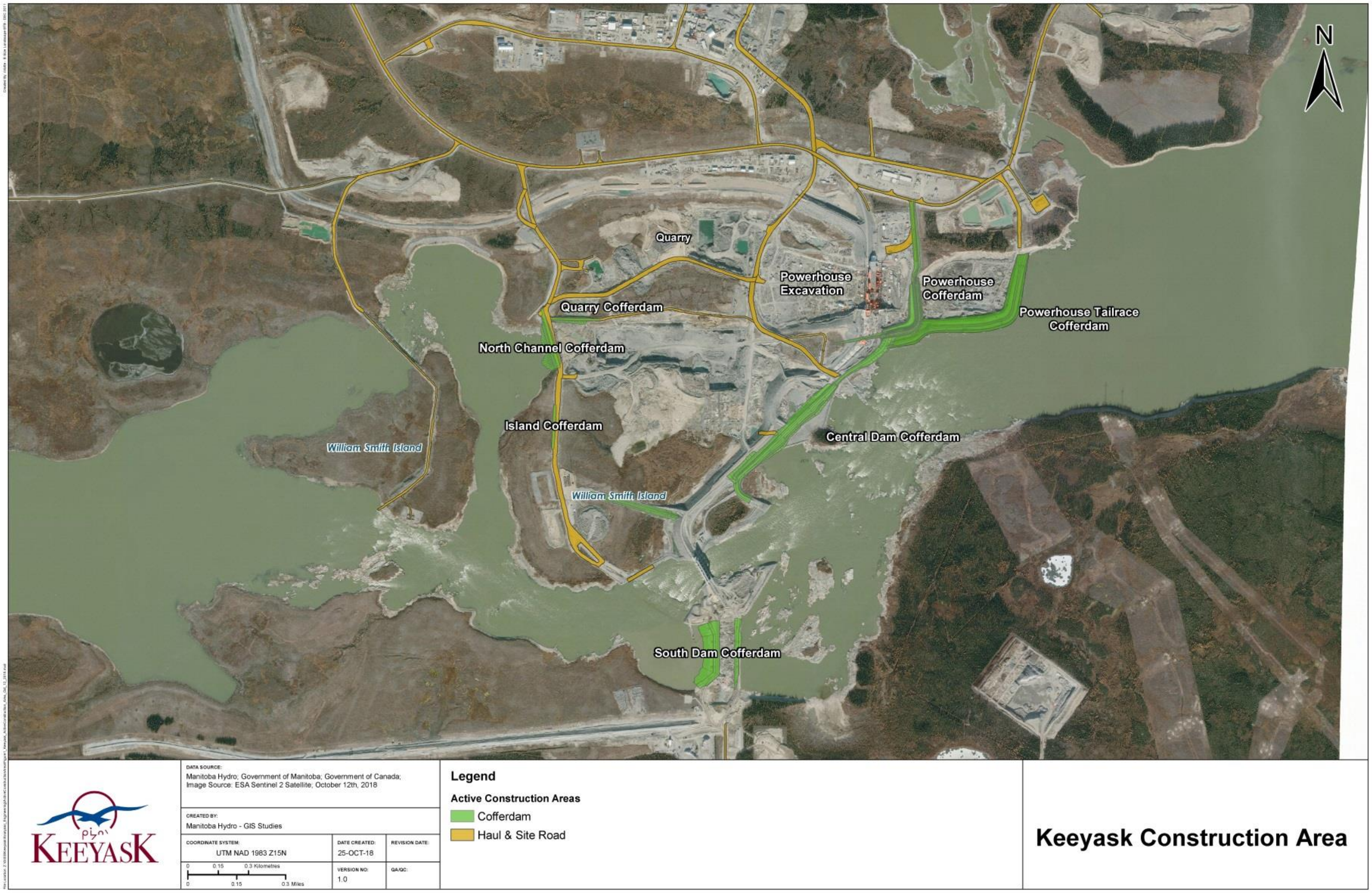
Construction of the Keeyask GS began in mid-July 2014 with the construction of cofferdams that blocked flow in the north and central channels of Gull Rapids (see instream structures map below). During the winter of 2015/2016, the Spillway Cofferdam, which partially blocks the south channel, was constructed. Beginning late in 2016 and continuing in 2017, the Tailrace Cofferdam was constructed. Work was completed in fall 2017 with the exception of an opening that was left to allow fish movement into and out of the cofferdam over the 2017/18 winter. This opening was closed in spring 2018, and the area was dewatered. The spillway was commissioned in August 2018. The South Dam Cofferdam was completed in fall 2018, blocking the channel and forcing the entire flow of the river through the spillway.

Lake Sturgeon were identified as one of the key species for monitoring. They were chosen because they are culturally important to local people, the local populations have been previously impacted, and construction and operation of the GS will change or negatively impact important habitat. The plan to monitor the impacts of GS construction and operation on sturgeon includes several types of studies:

- Estimating the number of adults;
- Estimating the number and growth of juveniles (less than 800 millimetres [mm] in length);
- Identifying spawning locations and numbers of spawning fish; and
- Movement studies to record seasonal habitat use, long distance movements, and movements past barriers (*i.e.*, over GSs or Gull Rapids).

The mitigation and offsetting plan for Lake Sturgeon included a commitment to a long-term stocking program. This plan addressed the loss of spawning habitat at Gull Rapids during the construction and initial years of operation (*i.e.*, before the constructed spawning habitat is fully effective) by releasing young sturgeon into Stephens Lake. Stocking will also support the recovery of the sturgeon populations in Gull Lake, Stephens Lake, and the Upper Split Lake Area. Stocking began in 2014, with locations alternated between years (future Keeyask reservoir and Stephens Lake are stocked with fish born in even years, Burntwood River is stocked with fish born in odd years) and its effectiveness is assessed through juvenile population monitoring.

This report presents results of juvenile Lake Sturgeon population monitoring conducted during fall 2018. Data from juvenile populations in the study area have been collected intermittently since 2007 and the juvenile population monitoring study was conducted for the first time in 2014. The plan is to conduct juvenile population monitoring annually until 2044. Each year, sampling will be conducted using the same capture methods, so that results can be compared between different years and trends can be seen.



Satellite Imagery - October 12th, 2018

Map illustrating instream structures at the Keeyask Generating Station site, October 2018.

Why is the study being done?

Juvenile Lake Sturgeon population monitoring is being done to answer several questions:

Does recruitment of wild sturgeon occur upstream and/or downstream of the GS during construction?

This question is important because if no young sturgeon are born during the seven year construction period, then in the future fewer adult sturgeon will be reproducing.

Is there a change in condition factor and growth of juvenile sturgeon during construction?

This question is important because if sturgeon become fatter or skinnier than they used to be, then something is changing in their environment. If the condition of juveniles decreases, it can also mean that stocking is adding too many fish to the environment and they cannot find enough food. In that case, the stocking plan will be adjusted.

What is the survival rate of stocked sturgeon?

This question is important because if the survival rate is high then the number of fish stocked may be reduced. If the survival rate is low, then the stocking plan would be adjusted (*e.g.*, may change time or location of release).

What is the proportion of hatchery-reared to wild recruits within a birth year (i.e., how successful is the stocking program)?

The answer to this question will also tell us about the effectiveness of the stocking program.

Juvenile (left) and young-of-the-year (right) Lake Sturgeon.

What was done?

Sampling was conducted in the Upper Split Lake Area (including the Burntwood River and Split Lake), the future Keeyask reservoir (the Nelson River between Clark Lake and Gull Rapids), and Stephens Lake in the fall of 2018. Gill nets were used to catch juvenile sturgeon, defined as those that are less than 800 mm in length. The gill nets were set in deep water habitats preferred by juveniles. When a fish was caught, it was measured and weighed. If the fish was not already tagged, then two different tags were applied: an external (Floy®) tag and a small PIT tag to make sure the fish is identifiable if one tag is lost. If the captured fish had already been tagged, then the tag numbers were recorded before the fish was released. Tagging and recapturing fish makes it possible to determine how much a fish grew or the distance they moved. It also makes it possible to estimate how many sturgeon are in a population. An ageing structure (a small piece of fin) was also collected to determine the year that the fish was born.

Captured juvenile Lake Sturgeon in a fish tub (left); measuring (middle); and weighing (right) a Lake Sturgeon after capture.

What was found?

A total of 68 Lake Sturgeon were captured in the Upper Split Lake Area: 11 in the Burntwood River (all juveniles) and 57 in Split Lake (52 juveniles and 5 adults). In the Burntwood River, the presence of sturgeon born every year between 1999 and 2017 since sampling began shows that recruitment is occurring relatively consistently but at low levels. Sturgeon born in 2013 accounted for a large number of the fish caught in Split Lake. No Lake Sturgeon born in 2018 (called young-of-the-year [YOY]) were captured in either area. Of the 68 sturgeon caught, four were wild fish tagged in a previous year and recaptured in 2018: one in the Burntwood River and three in Split Lake. All four fish were recaptured in the waterbody where they were originally tagged. One fish captured in Split Lake was raised at the Grand Rapids hatchery and released in the Burntwood River as a one-year-old in 2014.

A total of 150 Lake Sturgeon (143 juveniles and 7 adults) were captured in the future Keeyask reservoir. Fish born in 2008 continued to be prominent in the catch, as well as fish from the 2016 cohort. One YOY sturgeon was captured, showing that sturgeon successfully reproduced in 2018 (no stocking of YOY took place in this area in 2018 prior to sampling). Eighteen of the 150 sturgeon had been tagged in a previous year (between 2006 and 2017), and an additional 17 were tagged hatchery-reared sturgeon released as one-year-olds in 2015, 2017, and 2018. These fish made up a large proportion of the 2014 (62%) and 2016 (21%) year classes. One of the captured hatchery fish was released 128 km upstream in the Burntwood River in 2018. This is the fourth fish captured in the future Keeyask reservoir that was originally stocked into the Burntwood River since 2014. Analysis of growth between hatchery and wild caught fish showed that young hatchery fish are longer and heavier than wild fish of the same cohort. However, growth of hatchery fish appears to slow around age-4.

In Stephens Lake, 74 Lake Sturgeon (71 juvenile and 3 adult) were captured. The majority of the captures were sturgeon born in 2015 and represent wild fish spawned at Gull Rapids (as no 2015 cohort fish were stocked into Stephens Lake). No YOY (fish born in 2018) were captured in Stephens Lake. Eleven sturgeon tagged in a previous year were recaptured, as well as 17 hatchery-reared sturgeon (released as one-year olds in 2015 and 2017). Three of the hatchery-reared sturgeon were stocked in the future Keeyask reservoir while the remaining 14 were stocked in Stephens Lake. Hatchery fish made up a large proportion of the 2014 (77%) and 2016 (64%) year-classes. As in the future Keeyask reservoir, stocked hatchery fish were longer and heavier than wild fish of the same cohort, but showed slowed growth around age-4.

A computer model was used to generate estimates of population size and survival for wild juvenile Lake Sturgeon in the future Keeyask reservoir and Stephens Lake. Previously, not enough fish had been captured for the model to work, so 2018 was the first year estimates were calculated. In 2018, the future Keeyask reservoir population was estimated at 4,133 fish. Survival in this area was 77%. The Stephens Lake population in 2018 was estimated at 1,101 individuals, and survival was estimated at 88%.

A different model was also used to generate survival estimates for hatchery-reared fish stocked in the future Keeyask reservoir and Stephens Lake. Only enough fish stocked in 2015 (born in 2014) were caught to generate an estimate. Survival of fish stocked in 2015 was estimated at 95% in the future Keeyask reservoir and 86% in Stephens Lake.

As more data are collected and added to the models, the population and survival estimates get more precise and accurate. This is especially true as 2018 was the first time estimates could be calculated. As more fish are recaptured, estimates will become more refined.

What does it mean?

The capture of YOY sturgeon in 2018 shows that, like in 2015–2017, reproduction in the wild is occurring upstream of Gull Rapids during Keeyask construction. No YOY were captured in the Upper Split Lake Area or Stephens Lake but that does not mean reproduction was unsuccessful in 2018. Prior to 2018, sturgeon have been born in each year since construction started (2015–2017) and in each of the three areas (Upper Split Lake, the future Keeyask reservoir, and Stephens Lake).

There were some changes in growth rate and condition between fish caught before construction and fish caught during construction in both the future Keeyask reservoir and Stephens Lake. However, there was no clear pattern and growth curves were similar.

The capture of a large number of hatchery-reared sturgeon released as one-year-olds in the future Keeyask reservoir and Stephens Lake over the last two study years suggests the stocking program is having a positive effect on juvenile numbers in these areas. It demonstrates that stocked sturgeon are surviving in the wild and that they are growing after release. Very few hatchery-raised fish have been captured in the Burntwood River, with similar low numbers captured in Split Lake and the future Keeyask reservoir. This indicates that fish may not stay within the Burntwood River after stocking.

What will be done next?

Monitoring will continue each fall until 2044. Further monitoring will show whether construction is affecting the growth of juveniles in the future Keeyask reservoir and Stephens lakes and whether sturgeon continue to reproduce. Survival, growth, and population size of stocked and wild juveniles will continue to be analysed.

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1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt (MW) hydroelectric generating station at Gull Rapids on the lower Nelson River in northern Manitoba. The Project is approximately 725 kilometres (km) northeast of Winnipeg, 35 km upstream of the existing Kettle Generating Station, where Gull Lake flows into Stephens Lake, 60 km east of the community of Split Lake, 180 km east-northeast of Thompson and 30 km west of Gillam (Map 1). Construction of the Project began in July 2014.

The *Keeyask Generation Project: Response to EIS Guidelines*, completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the aquatic environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs, is provided in the *Keeyask Generation Project Environmental Impact Statement: Aquatic Environment Supporting Volume* (AE SV). As part of the licensing process for the Project, an *Aquatic Effects Monitoring Plan* (AEMP) was developed detailing the monitoring activities of various components of the aquatic environment, including the focus of this report, juvenile Lake Sturgeon populations, for the construction and operation phases of the Project.

For the purposes of this monitoring program, Lake Sturgeon that are 800 mm in fork length or longer are classified as adults and smaller sturgeon are considered juveniles. Although fish greater than 800 mm length may not yet be sexually mature and may not reach sexual maturity for some years, this length was used as the threshold to distinguish between juveniles and adults because the smallest mature fish captured to date has been 809 mm (captured in 2016 in Stephens Lake; Legge *et al.* 2017).

Juvenile population monitoring is a key component of the overall Lake Sturgeon monitoring program. The Project is predicted to affect sturgeon recruitment by altering spawning habitat at Gull and Birthday rapids. Stocking aims to assist the recovery of sturgeon populations in the Upper Split Lake Area (*i.e.*, the Burntwood River and the Nelson River between the Kelsey GS and Split Lake) and in the future Keeyask reservoir and Stephens Lake and is a key component of the offsetting plan, with stocking locations alternating between years (future Keeyask reservoir and Stephens Lake are stocked with even-cohort years, Burntwood River is stocked with odd-cohort years). Results of juvenile population monitoring will determine the impact of the loss of spawning habitat earlier than would be possible using adult population monitoring data, allowing timely adaptive management and mitigation, if required. Results of juvenile population monitoring will also assist in assessing the effectiveness of stocking and identify whether changes to the stocking plan are required. Data collected during juvenile population monitoring will be used to measure population size and cohort strength, identify changes in condition factor, determine whether natural reproduction is occurring, assess the need for young-of-the-year (YOY) habitat creation, and determine whether stocked fish are surviving and growing.

Juvenile Lake Sturgeon studies have been conducted in Gull Lake (the future Keeyask reservoir) and Stephens Lake since 2007. Surveys were initiated in the Burntwood River in 2012 and in the Nelson River downstream of the Kelsey GS and in Split Lake in 2015. These studies have increased the understanding of YOY and juvenile abundance, distribution, habitat use, condition, size, and year-class strength (MacDonald 2009; Michaluk and MacDonald 2010; Henderson and Pisiak 2012; Henderson *et al.* 2011, 2013, 2015; Burnett *et al.* 2016, 2017, 2018). Results from the Burntwood River show that small numbers of juvenile Lake Sturgeon are spread amongst multiple cohorts, indicating that recruitment has occurred fairly consistently in the Burntwood River over the previous 10 years (Henderson and Pisiak 2012; Henderson *et al.* 2013, 2015; Burnett *et al.* 2017, 2018). Catches of juvenile Lake Sturgeon in the Nelson River downstream of the Kelsey GS and in Split Lake are low, but a range of ages is represented. In both Gull and Stephens lakes, recruitment has also occurred fairly consistently over the past ten years, but until recently the cohort-frequency distribution has been dominated by a single cohort produced in 2008 (Henderson *et al.* 2011, 2013, 2015; Henderson and Pisiak 2012; Burnett *et al.* 2017, 2018). It has been shown that the growth of Burntwood River Lake Sturgeon is slower than conspecifics captured in Gull and Stephens lakes (Henderson *et al.* 2013).

Lake Sturgeon stocking is being conducted using wild caught broodstock from the Burntwood River and from the future Keeyask reservoir. To maintain the genetic structure of each population, progeny from each broodstock location are released back into their respective rivers (*i.e*., Burntwood River progeny released back into the Burntwood River and future Keeyask reservoir progeny released back to the Nelson River in Gull and Stephens lakes). Stocking occurred for the first time in 2014 and has occurred annually since with a variety of life stages (larvae, fingerlings, yearlings) being released (Table 1; Klassen *et al.* 2017, 2018, 2019).

This report presents results from the 2018 juvenile population monitoring conducted in the Upper Split Lake Area, future Keeyask reservoir, and Stephens Lake. In 2018, the area downstream of the Kelsey GS was not sampled as part of the Upper Split Lake Area in order to focus on areas where hatchery fish stocked into the Burntwood River may be captured (*i.e.*, the Burntwood River and Split Lake).

Juvenile monitoring is being conducted to address the following key questions relevant during the construction period, as described in the AEMP:

- Does recruitment of wild sturgeon occur upstream and/or downstream of the GS during construction?
- Is there a biologically meaningful (and statistically significant) change in condition factor and growth of juvenile sturgeon during construction?
- What is the survival rate of stocked sturgeon?
- What is the proportion of hatchery-reared to wild recruits within a cohort (*i.e.*, how successful is the stocking program)?

Juvenile population monitoring data will be collected annually until 2044.

2.0 STUDY SETTING

Juvenile population monitoring in 2018 was conducted at three locations: 1) the Upper Split Lake Area (Burntwood River and Split Lake); 2) the future Keeyask reservoir (*i.e.*, the reach of the Nelson River between the outlet of Clark Lake and Gull Rapids), and 3) Stephens Lake.

The Burntwood River flows in a north-easterly direction from First Rapids for approximately 35 km prior to emptying into the western arm of Split Lake (Maps 1 and 3). It is unknown if First Rapids represents a natural barrier to upstream fish passage; however, it is assumed to be under high flow conditions. Hard substrates predominate in the main channel, while loose, fine sediments and associated macrophyte growth occur in many off-current areas.

Split Lake is located at the confluence of the Burntwood and Nelson rivers (Map 1). Due to the large inflows from the Nelson and Burntwood rivers, the lake has detectable current in several locations. Split Lake has maximum and mean depths of 28.0 m and 3.9 m, respectively, at a water surface elevation of 167.0 m above sea level (ASL; Lawrence *et al.* 1999). The surface area of Split Lake was determined to be 26,100 ha (excluding islands), with a total shoreline length, including islands, of 940.0 km (Lawrence *et al.* 1999). The numerous islands in Split Lake represent 411.6 km of the total shoreline.

Birthday Rapids is located approximately 10 km downstream of Clark Lake and 30 km upstream of Gull Rapids (Map 1). The drop in elevation from the upstream to downstream side of Birthday Rapids is approximately 2 m. The 14 km reach of the Nelson River between Birthday Rapids and Gull Lake is characterized as a large, somewhat uniform channel with medium to high water velocities. There are a few large bays with reduced water velocity and a number of small tributaries that drain into the Nelson River.

Gull Lake is a section of the Nelson River where the river widens, with moderate to low water velocity. Gull Lake is herein defined as the reach of the Nelson River beginning approximately 17 km upstream of Gull Rapids and 14 km downstream of Birthday Rapids, where the river widens to the north into a bay around a large point of land (Maps 1 and 5), and extending to the downstream end of Caribou Island, approximately 3 km upstream of Gull Rapids. Gull Lake has three distinct basins, the first extending from the upstream end of the lake downstream approximately 6 km to a large island; the second extending from the large island to Morris Point (a constriction in the river immediately upstream of Caribou Island); and the third extending from Morris Point to the downstream end of Caribou Island.

Gull Rapids is located approximately 3 km downstream of Caribou Island on the Nelson River (Map 1). The rapids are approximately 2 km in length, and the river elevation drops approximately 11 m along its 2 km length. Two large islands and several small islands occur within the rapids, prior to the river narrowing; these features are within the Project footprint and have been substantially altered during construction (Map 2). A summary of construction activities is provided in Section 2.1.

Just below Gull Rapids, the Nelson River enters Stephens Lake (Maps 1 and 7). Stephens Lake was formed in 1971 by construction of the Kettle GS. Between Gull Rapids and Stephens Lake, there is an approximately 6 km long reach of the Nelson River that, although affected by water regulation at the Kettle GS, remains riverine habitat with moderate velocity. Construction has altered the flow distribution immediately downstream of Gull Rapids as all flow now passes via the south channel of Gull Rapids. In August 2018, flow was further constricted when the spillway was commissioned (see Section 2.1).

Construction of the Kettle GS flooded Moose Nose Lake (north arm) and several other small lakes that previously drained into the Nelson River, as well as the old channels of the Nelson River that now lie within the southern portion of the lake. Major tributaries of Stephens Lake include the North and South Moswakot rivers that enter the north arm of the lake. Looking Back Creek is a second order stream that drains into the north arm of Stephens Lake (Map 1). Kettle GS is located approximately 40 km downstream of Gull Rapids.

2.1 CONSTRUCTION SUMMARY

Construction of the Keeyask GS began in mid-July 2014 with the construction of cofferdams in the north and central channels of Gull Rapids (Map 2). These cofferdams resulted in the dewatering of the north and central channels and the diversion of all flow to the south channel. Construction of the Spillway Cofferdam (SWCD), which extends into the south channel of Gull Rapids, was completed in 2015. The rock placement for the inner and outer groins of the Tailrace Cofferdam (TRCD) started in late 2016 and the impervious fill placement was completed in fall 2017. An opening was created to allow fish to move freely over the winter of 2017–2018. The opening was closed in spring 2018 and dewatering of the TRCD occurred in July, at which time a fish salvage was completed. In preparation for commissioning of the spillway, the SWCD was watered-up on both sides of the structure in June 2018. Removal of the SWCD started in early July and continued into August. The spillway was commissioned between August 3 and 7, 2018. Closing the south channel with the upstream South Dam Cofferdam (SDCD) commenced at the beginning of August and river closure was achieved on August 16. This closure and the work that continued to seal the cofferdam forced the entire river flow through the spillway. The downstream SDCD was completed in September and the area between the two cofferdams was dewatered, allowing for fish salvage to be completed by late September 2018. Work continued on the upstream SDCD until it was complete in late fall 2018.

2.2 FLOWS AND WATER LEVELS

From October 2017 to October 2018, Split Lake outflow ranged from about 2,800–4,000 m^3/s. Flow typically fell in the range of about 3,000–3,500 m^3/s, which is near the historical annual median flow of approximately 3,300 m^3/s. Flow was generally higher during the 2017/2018 winter period, gradually declining from about 3,800 m^3/s at the end of February 2018 to about

2,800 m^3/s by the beginning of May. From early May 2018 to the beginning of July, flow gradually increased to about 3,500 m^3/s and remained at that level to the end of July. The flow subsequently declined to about 2,800 m^3/s by the end of September. Water levels varied in conjunction with the flows, ranging from about 153.4–155.2 m ASL on Gull Lake.

3.0 METHODS

3.1 GILLNETTING

A standardized sampling methodology has been developed for sampling juvenile sturgeon in Boreal Shield rivers using data sets collected from several populations in the Hudson Bay drainage basin (McDougall *et al.* 2014). This standardized methodology (described below) is being used to enable comparisons of cohort strength, abundance, growth, and condition among years. The gillnetting methods described below have been used to capture juvenile Lake Sturgeon during environmental studies related to the Keeyask Generation Project since 2008.

Gillnetting was conducted in the Upper Split Lake Area, the future Keeyask reservoir, and the upper 10 km of Stephens Lake. Two locations were sampled in the Upper Split Lake Area, the Burntwood River between First Rapids and Split Lake and Split Lake proper. In previous years, the Nelson River between the Kelsey GS and Split Lake was also sampled. This area was not sampled in 2018 in order to focus effort on the Burntwood River and Split Lake as a means to locate stocked fish. Sites in Split Lake were chosen based on depth (greater than 5 m) to try and target juvenile Lake Sturgeon. Gill nets were composed of five panels of 1, 2, 3, 5, and 6" twisted nylon stretched mesh (25, 51, 76, 127, and 152 mm). Each panel was 25 yards (yd) (22.9 m) long and 2.7 yd (2.5 m) deep. Mesh sizes were staggered in the order of 1, 5, 2, 6, and 3" to capture small and large juveniles across the length of each gang.

Gill nets were set in deep-water habitats (average depth = 11.6 m) since YOY and juvenile Lake Sturgeon have been found to prefer these areas in the Winnipeg, Burntwood, and Nelson rivers (Barth *et al.* 2009; Michaluk and MacDonald 2010; McDougall *et al.* 2013; Henderson *et al.* 2014). Each gillnet set was given a unique identification number, and net locations were recorded using a Garmin Etrex GPS receiver (Garmin International Inc., Olathe, KS). Water depth at each end of the net was measured using a PiranhaMax Series 150 Portable Sonar (Humminbird, Eufaula, AL). Water temperature was measured daily in each area using a hand-held thermometer (±0.5°C). HOBO Water Temperature Pro data loggers (±0.2°C), set approximately 1 m off the substrate, were also used to log water temperature at 6-hour intervals in Gull and Stephens lakes. Gill nets were checked approximately every 24 hours, weather permitting. For comparability among years, similar gillnetting locations were used during juvenile monitoring programs conducted from 2014 to 2018. However, some sites have changed between years depending on water levels and flows. Locations and site-specific physical measurements collected at gillnetting sites in 2018 are found in Appendix 1.

3.2 BIOLOGICAL SAMPLING

All fish captured were counted by species and location. Lake Sturgeon were measured for fork length (FL; ±1 mm), total length (±1 mm), and weight (±5 g using a digital scale, or nearest 25 g for fish greater than 4,000 g).

For age analysis, the first fin ray of the left pectoral fin was removed immediately adjacent its articulation from each juvenile Lake Sturgeon captured for the first time. In cases where Lake Sturgeon had been previously aged, the first fin ray of the right pectoral fin was collected. If fish appeared to have been aged twice before or had deformed pectoral fins, ageing structures were not collected. All collected fin rays were placed in individually numbered envelopes, air dried, and brought back to the North/South Consultants Inc. laboratory for ageing (Section 3.4).

Small samples (1–2 cm^2) were removed from the left pelvic fin of each Lake Sturgeon and preserved in 95% Biological Grade Ethanol for potential future genetic analysis.

Ageing structures and genetics samples were not taken from YOY fish due to concerns of harming the small fish. Ages were inferred based on size (*i.e.*, fish smaller than 150 mm FL).

3.3 TAGGING

Lake Sturgeon greater than 250 mm FL were marked with individually numbered external Floy-GD-94 T-bar (FT) anchor tags (Floy-tag Inc., Seattle, WA). Floy-tags were inserted into the base of the dorsal fin using a Dennison Mark II tagging gun (Avery Dennison Corporation, Pasadena, CA).

Uniquely numbered Passive Integrated Transponder (PIT) tags from Oregon RFID (Oregon RFID Ltd., Portland, OR) were also used to mark Lake Sturgeon. Those measuring greater than 250 mm FL received 12 mm HDX tags (12.0 mm x 2.12 mm; 0.1 g) and those measuring less than 250 mm FL (smallest fish tagged was 99 mm) received 8 mm FDX-B tags (8.0 mm x 1.4 mm; 0.027 g). Each Lake Sturgeon was scanned for an existing PIT tag using an Agrident APR 350 Reader (Agrident Ltd. Steinkippenstrasse, Germany). For each untagged fish, a PIT tag was injected under the third dorsal scute using an Oregon RFID tag injector needle, dipped in Polysporin® to minimize the risk of infection. Tags were injected parallel to the horizontal axis of the fish, into muscle tissue (not the body cavity). Following implantation or upon recapture, the tags were logged, and the last six digits manually recorded. Injector needles were sterilized in boiling water prior to the start of sampling and again upon sampling completion.

3.4 AGEING ANALYSIS

Lake Sturgeon fin rays were hardened in an epoxy resin (Cold Cure) and two 0.7 mm fin sections were cut distally within 5 mm of the articulation using a Struers Minitom (Struers Inc.

Cleveland, OH) low-speed sectioning saw. Fin sections were mounted on glass slides using Cytoseal-60 (Thermo Scientific, Waltham, MA) and viewed at five times magnification under a compound microscope. Annuli (growth rings) were counted by three experienced readers (independently), without prior knowledge of fish length or weight, or ages assigned by other readers. If readers assigned different ages to a fish, either the modal age or the median age was chosen. The rate of three-reader agreement was calculated in percent (percentage). Examples of Lake Sturgeon ageing structures are provided in Appendix 3.

Lake Sturgeon ageing structures exhibit well-defined banding patterns characteristic of repeated summer (fast-growth) and winter (slow/non-growth) periods (McDougall and Pisiak 2014; Appendix A3-1). Ageing structures from hatchery-reared Lake Sturgeon have different banding patterns that complicate the ageing process. During the winter period, when the water temperature remains close to 0°C and growth slows, wild Lake Sturgeon develop a well-defined annulus that is easy to recognize. However, hatchery reared sturgeon are often held at considerably higher and more constant temperatures than those experienced by wild fish (McDougall and Pisiak 2014). The higher temperatures over the first winter of growth cause a weak or missing first annulus. To account for this, current ageing methods add one year to the ages of fish with a weak/absent first annuli (McDougall and Pisiak 2012, 2014; Burnett and McDougall 2015) (see photo Appendix A3-2).

In fish stocked at age-1, the weak annulus is often followed by the presence of a false annulus, not corresponding to slowed winter growth, but instead to stocking and the subsequent establishment period. The false annuli decrease ageing accuracy because they are difficult to distinguish from true annuli. As a result, hatchery fish younger than 3-years-old are often over-aged by one year, as the false annulus is counted. Ageing accuracy has been found to increase with time spent in the wild (Burnett and McDougall 2015; McDougall and Nelson 2016). All age-one hatchery fish are tagged with PIT tags, so ages are known. Of the 35 known hatchery fish captured in 2018, all but one were over-aged by one year. These ages were decreased to their known age for analysis.

In cases where a fish is captured with a weak or missing first annulus but does not have a PIT tag, it cannot be determined whether the fish is hatchery-reared or wild. Weak annuli occasionally occur in wild fish, but more likely, these fish were stocked as yearlings and shed their PIT tags. Therefore, to account for this uncertainty, these fish were not included in analyses of hatchery-reared vs. wild fish but were treated as a separate group (*i.e.*, suspected hatchery fish).

3.5 DATA ANALYSIS

As was done in previous years, data were analysed for all sizes of Lake Sturgeon captured (as opposed to only those measuring less than 800 mm FL). Mesh sizes used select for small Lake Sturgeon but larger fish are also captured; therefore, including all fish in the summary statistics ensures comparability among years.

To better describe sampling locations, relative abundance (CPUE), and fish movements, each sampling area was divided into distinct geographical zones (Maps 3, 5, and 7).

Mean FL (mm), weight (g), and condition factor (K) were calculated for all Lake Sturgeon by location. In Stephens Lake and the future Keeyask reservoir, known hatchery and wild fish were presented separately. Lake Sturgeon not confirmed as being either hatchery or wild (based on ageing structure analysis; described in Section 3.4) were only included in totals. Condition factor was calculated based on the following equation (after Fulton 1911, in Ricker 1975):

$$K = W / (L^3 / 10^5)$$

Where:

W = round weight (g); and

L = fork length (mm).

Ageing structures were only collected for fish measuring < 800 mm FL. Because fish approach this length by age nine, all age analyses were restricted to fish aged 0–9 years as the full range of sizes for older fish would not be included in the sample.

To determine if growth and condition of juvenile sturgeon were affected by construction, mean length-at-age and mean condition factor-at-age were compared using t-tests and Mann-Whitney U-Tests among all fish captured pre-Project (*i.e.*, 2008–2013) and those captured during construction (*i.e.*, 2014–2018[1]). Tagged hatchery fish and suspected hatchery fish were removed from these analyses. Mann-Whitney U-Tests and t-tests were used to compare mean fork length-at age, mean weight-at-age, and mean condition factor-at-age for known hatchery-reared and wild Lake Sturgeon. Statistical comparisons were only conducted where sample sizes were greater than eight individuals. Significance level was set at 0.05 (5%).

A von Bertalanffy growth curve was generated from all age and length data collected during the study, to compare the growth of wild vs. hatchery-reared fish, as well as wild fish captured during baseline vs. construction for fish aged as nine years or less. The curve was calculated using the following equation:

$$L = L_\infty (1 - e^{-k(t - t_0)})$$

Where:

t = age (years)

t_0 = is the theoretical age at which FL is 0;

L = is the fork length (mm) of the fish at age t;

L_∞ = is the theoretical maximum TL that an individual in the population can attain; and

k = growth rate.

[1] Because this analysis includes a compilation of data from all sampling years, multiple captures of the same fish in different study years were included. Fish recaptured in the same sampling year were excluded.

Length-frequency distributions were plotted in 50 mm length class intervals (*e.g.*, 300–349 mm) and length-weight regression equations were derived using least squares analysis on logarithmic transformations of fork lengths and weights according to the following relationship:

$$\ln(W) = \ln(a) + \ln(L)*b$$

Where:

W = weight (g);

L = fork length (mm);

a = Y-intercept; and

b = slope of the regression line.

Cohort frequency distributions were plotted for each location.

Gillnetting hours (*i.e.*, effort) was calculated as the number of sampling hours per 100 m of net set using the following equation:

$$\text{Effort (hours)} = \text{set duration} \times (\text{net length}/100\text{ m})$$

Catch-per-unit-effort (CPUE) was calculated and expressed as the number of fish captured in 100 m of net per 24-h period using the following formula:

$$\text{CPUE} = \sum \#\text{ Lake Sturgeon} / \sum \text{Effort} \times 24\text{ h}$$

Where: Σ = sum of the number of fish or gillnetting hours at all sites.

CPUE was calculated by geographical zone for each study location and study year.

Hatchery-reared Lake Sturgeon are released as larvae, fingerlings, and yearlings. However, without additional analysis (genetics or isotopic signature in fin rays) fish can only be conclusively identified as hatchery-reared based on the presence of a PIT tag, which are exclusive to fish stocked at age-one. All fish not definitively identified as hatchery–reared (based on the presence of a PIT tag) were classified as “wild” in order to facilitate data analysis. The exceptions to this classification are fish that are suspected to be stocked yearlings that have lost their PIT tags based on size and ageing structure features (see Section 3.4), which were noted as “suspected hatchery fish”. As the additional analysis (genetics or isotopic signature in fin rays) has not been undertaken, it cannot be determined if fish belonging to cohorts corresponding to stocking events of larvae or fingerlings (*e.g.*, a YOY captured in the Burntwood River in 2017) originated from the hatchery or a natural spawning event.

3.6 POPULATION ESTIMATE

Mark-recapture population estimates have been calculated for the future Keeyask reservoir and Stephens Lake during the fall of eight different years (2010 and 2012–2018). Only wild Lake Sturgeon classified as juveniles (*i.e.*, fork length less than 800 mm) were included in the population estimate. Juvenile Lake Sturgeon in the future Keeyask reservoir and Stephens Lake have been tagged in studies since 2008. All data for the period 2008–2012 were collected annually as part of environmental studies related to the pre-Project environment, while data from 2014 until 2044 will be collected annually as part of monitoring studies related to the Keeyask GS Project.

The Jolly-Seber model (POPAN formulation; Arnason and Schwarz 2002), as implemented within MARK, was used to estimate the annual abundance of juvenile Lake Sturgeon in the future Keeyask reservoir and in Stephens Lake. Detailed methods can be found in Appendix 5. Estimates are reported as a mean with 95% confidence intervals (CI).

A Cormack-Jolly-Seber model was used to calculate a survival estimate for hatchery-reared juvenile Lake Sturgeon cohorts with a minimum number of recaptures (n = 25) stocked in both the future Keeyask reservoir and Stephens Lake, using the probability of recapture in each year. To date, only yearlings stocked in 2015 (*i.e.*, the 2014 cohort) have had sufficient recaptures to conduct this analysis. The survival estimate was used to calculate the number of individuals from the 2014 hatchery cohort in both the future Keeyask reservoir and Stephens Lake in each year.

4.0 RESULTS

Biological and tagging information for Lake Sturgeon captured in 2018 are provided in Appendix 2.

4.1 UPPER SPLIT LAKE AREA

Water temperature in the Upper Split Lake Area ranged from 16.0°C to 9.0°C over the course of the study (September 9 to 20, 2018; Appendix A1-1).

4.1.1 BURNTWOOD RIVER

Six fish species (n = 49) were captured at 19 sites in the Burntwood River between September 12 and 17, 2018 (Tables 2 and 3; Map 3). Lake Sturgeon (n = 11; 22.4%) were the second most abundant species captured after Longnose Sucker (n = 24; 49.0%) (Table 3). Gillnet site data as well as biological and tagging information for all Lake Sturgeon captured in the Burntwood River are provided in Appendices A1-1 and A2-1. Eleven juvenile Lake Sturgeon were captured in 426.3 gillnet hours, producing an overall CPUE of 0.62 LKST/100 m net/24 h (Table 4). No Lake Sturgeon mortalities occurred during sampling. Gill nets were set in all three zones of the Burntwood River below First Rapids; six sites in BWR-A, five sites in BWR-B, and eight sites in BWR-C (Map 3). CPUE values by zone were as follows:

- 1.03 LKST/100 m net/24 h in Zone BWR-A;
- 0.44 LKST/100 m net/24 h in Zone BWR-B; and
- 0.40 LKST/100 m net/24 h in Zone BWR-C (Table 4).

Annual CPUE values for the Burntwood River catch since 2011 are presented in Table 5.

4.1.1.1 YEAR-CLASS STRENGTH

Ageing structures were collected from ten of 11 juvenile Lake Sturgeon. Three-reader agreement for age assignment was 90% (n = 9). The modal age was used for one fish (age 8), aged one year lower or higher by a single reader. Aged Lake Sturgeon ranged from 1 to 19 years old, with the 2010 (n = 2; age 8), 2015 (n = 2; age 3), and 2016 (n = 2; age 2) cohorts each accounting for 20% of the catch (Figure 1). No YOY (2018 cohort) Lake Sturgeon were captured. Several other cohorts (2000–2001, 2003–2009, 2011, and 2014) were not present in the catch. Cohort frequencies for all juvenile Lake Sturgeon captured in the Upper Split Lake Area from 2011 to 2018 are presented in Table 6. Every cohort between 1999 and 2017 has been present in the catch since studies began.

4.1.1.2 GROWTH AND CONDITION

Captured Lake Sturgeon had a:

- Mean FL of 455 mm (n = 11; standard deviation [StDev] = 191 mm; range 205–764 mm);
- Mean weight of 950 g (n = 11; StDev = 1,043 g; range 25–3,000 g); and
- Mean condition factor of 0.62 (n = 11; StDev = 0.23; range 0.20–0.87) (Table 7).

Lake Sturgeon in the 250–299 mm (n = 2), 350–399 mm (n = 2), and 450–499 mm (n = 2) FL intervals were captured most frequently, each representing 18.2% of the total catch (Figure 2). The length-weight relationship for Lake Sturgeon captured in the Burntwood River during fall 2018 was similar to those captured in other areas and is presented in Figure 3.

There were not enough baseline data on condition factor and growth available from this area to make cohort-specific statistical pre- and post-construction comparisons of mean condition factor-at-age or fork length-at-age (Figures 4 and 5).

4.1.1.3 RECAPTURES

One previously tagged juvenile Lake Sturgeon was captured in the Burntwood River (Table 8; Appendix A4-1). The fish was originally caught in 2017 and was recaptured 0.41 km downstream of its original tagging location.

4.1.2 SPLIT LAKE

Twelve fish species (n = 187) were captured at 21 sites between September 9 and 20, 2018 (Tables 2 and 3; Map 3). There were 52 juvenile and five adult Lake Sturgeon caught in 606.9 gillnet hours, producing an overall CPUE of 2.25 LKST/100 m net/24 h (Table 4). Lake Sturgeon were the most abundant species captured (n = 57; 30.5%; Table 3). Four juvenile (7.7%) and no adult mortalities occurred during sampling. It is unclear why the number of mortalities was slightly high. Gillnet site data as well as biological and tagging information for all Lake Sturgeon captured in Zone SPL-A (Map 3) are provided in Appendices A1-1 and A2-1. Annual CPUE values for the Split Lake catch since 2015 are presented in Table 5.

4.1.2.1 YEAR-CLASS STRENGTH

Ageing structures were collected from all 52 of the juvenile Lake Sturgeon caught in Split Lake. Three-reader agreement for age assignment was 96% (n = 50). Aged Lake Sturgeon from Split Lake ranged from 1 to 15 years old and represented the 2003, 2005–2008, and 2010–2017 cohorts (Figure 6). No YOY (*i.e.*, 2018 cohort) fish were captured. The 2013 cohort was the most abundant year-class, accounting for 50% (n = 26) of the catch. Lake Sturgeon from the 2011 cohort were also caught relatively frequently (n = 9; 17%; Figure 6). Cohort frequencies for all juvenile Lake Sturgeon captured in Split Lake from 2015 to 2018 are presented in Table 6.

Every cohort since 2003, with the exception of the 2004 and 2018 cohorts, has been present in the catch.

4.1.2.2 GROWTH AND CONDITION

Captured Lake Sturgeon had a:

- Mean FL of 583 mm (n = 57; StDev = 151 mm; range 230–996 mm);
- Mean weight of 1,816 g (n = 57; StDev = 1,428 g; range 25–7,350 g); and
- Mean condition factor of 0.75 (n = 57; StDev = 0.14; range 0.21–1.46) (Table 7).

Lake Sturgeon from the 500–549 mm FL interval (n = 16; 28.1%) were the most frequently captured size-class (Figure 2).

There were not enough baseline data available on condition factor and growth from this area to make cohort-specific statistical pre- and post-construction comparisons of mean condition factor-at-age or fork length-at-age (Figures 4 and 5).

4.1.2.3 RECAPTURES

Three previously tagged wild Lake Sturgeon were recaptured in Split Lake during sampling in 2018 (Table 8; Appendix A4-1). All three fish were originally tagged in Split Lake and were recaptured between 3.1 and 3.8 km downstream of their original capture location.

One hatchery-reared Lake Sturgeon released in the Burntwood River was captured (Table 9; Appendix A4-2):

- PIT #900043000102957 was released as a one-year-old at stocking site 2 (Map 4) on October 2, 2014, and was captured in Zone SPL-A on September 20, 2018, 32.3 km downstream from where it was released (Zone BWR-B). It has not been captured previously during juvenile sampling. The fish grew 255 mm in length and 995 g in weight since release (Appendix A4-2).

4.2 FUTURE KEEYASK RESERVOIR

Ten species (n = 401) were captured at 50 sites between September 9 and 19, 2018 (Tables 2 and 3; Map 5). Water temperature decreased from 12.0°C to 9.0°C during sampling (Appendix A1-2). Lake Sturgeon (n = 150; 37.4%) were the second most abundant species captured behind Longnose Sucker (n = 158; 39.4%; Table 3). Gillnet site data as well as biological and tagging information for all Lake Sturgeon captured are provided in Appendices A1-2 and A2-2.

In total, 143 juvenile and seven adult Lake Sturgeon were captured in 1376.8 gillnet hours, producing an overall CPUE of 2.61 LKST/100 m net/24 h (Table 4). Three juvenile (2.1%) and no adult mortalities occurred during sampling. Gill nets were set throughout Gull Lake (*i.e.*, in zones GL-A, GL-B, and GL-C), as well as the first zone upstream of Gull Lake (*i.e.*, BR-D) (Map 5). CPUE values by zone, from upstream to downstream, were as follows:

- 0.89 LKST/100 m/24 h in Zone BR-D (n = 4 sites);
- 1.30 LKST/100 m/24 h in Zone GL-A (n = 11 sites);
- 3.00 LKST/100 m/24 h in Zone GL-B (n = 18 sites); and
- 3.65 LKST/100 m/24 h in Zone GL-C (n = 17 sites; Table 4).

Total CPUE values recorded in the future Keeyask reservoir since 2007 are presented in Table 5. CPUE values in 2018 were slightly lower than 2017 but were within the range recorded in other years.

Of the 150 Lake Sturgeon captured, 17 were known hatchery-reared fish (*i.e.*, stocked as age-1 and marked with PIT tags; discussed in further detail in Section 4.2.5). Five fish could not be accurately identified as hatchery-reared or wild fish as they had an ageing structure typical of a hatchery-reared fish but no PIT tag (not included in wild or hatchery calculations; described in Section 3.4). These fish CPUE values for wild and hatchery-reared Lake Sturgeon were as follows:

- 2.23 LKST/100 m/24 h (n = 128) for wild Lake Sturgeon; and
- 0.30 LKST/100 m/24 h (n = 17) for hatchery-reared Lake Sturgeon (Table 10).

4.2.1 YEAR-CLASS STRENGTH

Ageing structures were collected from 140 of the 143 juvenile Lake Sturgeon. Ageing structures were not collected from two juveniles, that had ageing structures previously removed from both pectoral fins (described in Section 3.2), and one YOY (2018 cohort). Three-reader agreement for age assignment was 95% (n = 133). The modal age was used for 7 fish that were aged one year lower or higher by a single reader (age 4 [n = 1], age 5 [n = 1], age 8 [n = 1], age 9 [n = 1] and age 10 [n = 3]). Lake Sturgeon ranged from 0 to 12 years (2006–2018 cohorts; Figure 7).

Of the 140 aged Lake Sturgeon, 118 were considered wild fish (did not exhibit weak annuli). An additional two recaptured fish did not have an ageing structure taken in 2018 but were aged when they were previously captured. These two fish were older than the age of any stocked fish (*i.e.*, age–7 and age–10) and were therefore considered wild fish. An additional YOY captured was considered wild, as it was captured prior to the release of fingerlings into the future Keeyask reservoir in fall, 2018. Overall, 121 fish were classified as wild. An additional 17 fish were classified as known-hatchery (as they had PIT tags) and five were classified as suspected hatchery fish (exhibited weak annuli but no PIT tag).

Of the five suspected hatchery fish (*i.e.,* not PIT tagged), two fish identified as being from the 2014 cohort, two fish from the 2015 cohort, and one fish from the 2016 cohort exhibited weak/absent first annuli, characteristic of hatchery reared-fish. If these were hatchery-reared fish that shed their PIT tags, the fish identified as belonging to the 2015 cohort would likely belong to the 2016 cohort because, as discussed in Section 3.4, hatchery fish are sometimes aged one year above their true age (Figure 7). Based on when stocking has occurred, the two suspected hatchery fish identified as being from the 2014 cohort and the one fish from the 2016 cohort were likely aged correctly.

Of the 121 wild and 17 known hatchery-reared aged Lake Sturgeon, the 2016 cohort was captured most frequently (n = 43; 31.2%). The 2008 cohort was also relatively abundant in the catch, accounting for 23.9% (n = 33); however, this is likely an underestimate of the cohort. Individuals from the 2008 cohort are now 10 years old, and some are likely > 800 mm FL. Ageing structures are not collected from individuals > 800 mm FL, thus more may have been present in the adult catch but were not aged. Each cohort since 2006 was present in the catch. One YOY fish (*i.e.*, 2018 cohort) was captured in Zone GL-C. Known hatchery-reared fish accounted for 61.5% and 20.9% of the 2014 and 2016 cohorts, respectively (Figure 7).

Wild fish from all cohorts since 1998, with the exception of the 2002 cohort, have been represented in the catch since studies began (Table 6).

4.2.2 POPULATION ESTIMATE

The 2018 population estimate for the future Keeyask reservoir was 4,133 wild juvenile Lake Sturgeon (95% CI: 2,955–5,780) (Figure 8; Appendix A5-1). This was above the 95% confidence limits of the 2012 and 2017 estimates, but within the 95% confidence limits of 2010 and 2013–2016. The estimated annual survival rate was 77%.

Annual survival of the 423 hatchery-reared Lake Sturgeon stocked into the future Keeyask reservoir in 2015 (*i.e.*, the 2014 cohort) was estimated at 95% (Appendix A5-3). Based on this estimate, 346 of these fish remained in the future Keeyask reservoir in 2018.

4.2.3 GROWTH AND CONDITION

In 2018, 128 wild (including adult size fish) and 17 known hatchery-reared Lake Sturgeon were captured. Length-weight relationships for hatchery-reared and wild Lake Sturgeon are presented in Figure 3.

Wild Lake Sturgeon had a:

- Mean FL of 524 mm (n = 128; StDev = 206 mm; range 87–1,031 mm);
- Mean weight of 1,565 g (n = 127; StDev = 1,634 g; range 50–8,500 g); and
- Mean condition factor of 0.73 (n = 127; StDev = 0.13; range 0.32–1.30) (Table 7).

Wild Lake Sturgeon in the 300–349 mm FL interval were captured most frequently, representing 19.5% (n = 25) of the wild catch (Figure 11). Fish measuring 700–749 mm were also frequently captured representing 13.3% (n = 17) of the wild catch (Figure 11).

Mean condition factor-at-age was not significantly different at any age for Lake Sturgeon captured during construction (*i.e.*, 2014–2018) and baseline (*i.e.*, 2008–2012) studies (Mann-Whitney U test and t-test, $p > 0.05$; Figure 9). Mean FL-at-age was significantly lower for age-7 and age-2 Lake Sturgeon but was higher for age-1 fish captured during construction than during baseline studies (Mann-Whitney U test, t-test, $p < 0.05$) (Figure 10). A comparison of the von Bertalanffy growth curves indicated that fish captured during baseline and construction grew at similar rates (Figure 13).

Hatchery-reared Lake Sturgeon had a:

- Mean FL of 396 mm (n = 17; StDev = 57 mm; range 255–479 mm);
- Mean weight of 394 g (n = 17; StDev = 148 g; range 100–700 g); and
- Mean condition factor of 0.60 (n = 17; StDev = 0.05; range 0.53–0.72) (Table 7).

Hatchery-reared Lake Sturgeon in the 400–449 mm FL interval were captured most frequently, representing 41.2% of the hatchery catch (n = 7) (Figure 11).

Mean FL-at-age for all four age classes (ages 1–4) were significantly higher for hatchery-reared Lake Sturgeon when compared to wild fish (Mann-Whitney U test, $p < 0.05$; Figure 12). Mean weight-at-age was significantly higher in age-1 and age-2 hatchery fish and significantly lower in age-4 hatchery fish when compared to wild fish (Mann-Whitney U test, $p < 0.05$; Figure 12). Mean condition factor-at-age was significantly lower for age-1, age-3, and age-4 hatchery-reared fish when compared to wild Lake Sturgeon (Mann-Whitney U test, $p < 0.05$; Figure 12).

A comparison of von Bertalanffy growth curves between hatchery and wild fish showed that young hatchery fish are longer and heavier than wild fish of the same cohort. However, growth of hatchery fish appears to slow around age-4 (Figure 14).

4.2.4 RECAPTURES

Eighteen Lake Sturgeon tagged in previous years were captured (Table 8; Appendix A4-1). All fish were originally tagged in the future Keeyask reservoir: one in 2006, one in 2010, one in 2011, one in 2013, seven in 2014, three in 2016, and four in 2017.

Recaptured fish moved varying distances from their original capture locations:

- Five moved less than 1.0 km;
- Twelve were recaptured within 1.0–9.2 km; and
- One was recaptured 21.2 km downstream of its original capture location in Zone BR-D.

4.2.5 HATCHERY CAPTURES

Seventeen known hatchery fish (*i.e.,* those PIT tagged and stocked as age-1) were caught in 2018, representing 11% of the total catch (Table 9; Appendix A4-2). None of the hatchery-reared fish had been captured during previous sampling. An age breakdown of all the hatchery-reared fish captured between 2014 and 2018 is presented in Table 11.

Of the 17 hatchery fish:

- Eight were stocked in Gull Lake in 2015 (Table 9):
  - Three were stocked at Site 1 on June (Zone GL-C; Map 6) and were caught between 2.72 and 2.80 km downstream.
  - One was stocked at Site 2 on June 22 (Zone GLC; Map 6) and was captured 0.39 km downstream.
  - Four were stocked at Site 6 on September 15 (Zone GL-B; Map 6). Three were captured less than 0.5 km from their release location and one was captured 3.92 km downstream.
- Eight were stocked on June 8, 2017 in Zone GL-A (Site 1; Map 6):
  - Three were caught in Zone GL-A less than 2.7 km from their release location.
  - Four were caught in Zone GL-B between 8.5 and 9.2 km downstream.
  - One was caught in Zone GL-C, approximately 12 km downstream of its original release location.
- One was stocked in the Burntwood River on June 7, 2018 (Site 2, Map 4). The fish was captured on September 19, 2018, in Zone GL-C, 127.8 km downstream of its release location. The fish grew 62 mm in length and 53 g in weight since release.

4.3 STEPHENS LAKE

Nine fish species (n = 430) were captured at 49 gillnetting sites in upper Stephens Lake between September 9 and 21, 2018 (Tables 2 and 3; Map 7). Lake Sturgeon (n = 74; 17.2%) were the third most abundant species captured, after Longnose and White suckers (Table 3). Gillnet site data, as well as biological and tagging information for all Lake Sturgeon captured in Stephens Lake, are provided in Appendices A1-3 and A2-3.

In total, 71 juvenile and 3 adult Lake Sturgeon were captured in 1,599.0 gillnet hours, producing an overall CPUE of 1.11 LKST/100 m net/24 h (Table 4). No mortalities occurred during sampling. Gill nets were set in both zones located within the upper 10 km of Stephens Lake (Map 7). CPUE values by zone were as follows:

- 0.79 LKST/100 m/24 h in Zone STL-A (n = 17 sites); and

- 1.29 LKST/100 m/24 h in Zone STL-B (n = 32 sites; Table 4).

CPUE values for the Stephens Lake sturgeon catches since 2007 are presented in Table 5. CPUE in Stephens Lake was lower than in 2017 but was similar to other construction monitoring years (2014–2016).

Of the 74 Lake Sturgeon, 17 were known hatchery fish (*i.e.*, stocked at age-1 and marked with PIT tags; discussed in further detail in Section 4.3.5). Five fish could not be accurately identified as hatchery or wild fish as they had an ageing structure typical of a hatchery-reared fish but no PIT tag (not included in wild or hatchery calculations; described in Section 3.4). CPUE values for wild Lake Sturgeon and hatchery-reared Lake Sturgeon were as follows:

- 0.78 LKST/100 m/24 h (n = 52) for wild Lake Sturgeon; and
- 0.26 LKST/100 m/24 h (n = 17) for hatchery-reared Lake Sturgeon (Table 10).

4.3.1 YEAR-CLASS STRENGTH

Ageing structures were collected from 66 of the 71 juvenile Lake Sturgeon captured in Stephens Lake. Ageing structures were not taken from three fish that had ageing structures previously removed from both pectoral fins, one fish that had deformed fins, and one fish that was identified as a hatchery-reared fish in the field and therefore its age was known. Three-reader agreement for age assignment was 93.9% (n = 62). The modal age was used for 4 fish aged one year lower or higher by a single reader (age 2 [n = 1], 4 [n = 1], 5 [n = 1], 10 [n = 1]). Aged juvenile Lake Sturgeon ranged from 1–10 years. Of the 70 aged Lake Sturgeon (including 66 aged in 2018, three aged in previous years, and one known-age hatchery fish), 48 were considered wild fish (did not exhibit weak annuli), 5 were classified as suspected hatchery fish (exhibit weak annuli but no PIT tag), and 17 were known hatchery fish (with PIT tags).

Five fish without hatchery implanted PIT tags exhibited weak/absent first annuli, characteristic of hatchery-reared fish. Of the five fish, four were aged as three-year-olds and one was aged as a five-year old. It is likely these fish were stocked as yearlings and shed their PIT tags. As a result, the four three-year-old fish have likely been over-aged and are believed to belong to the 2016 cohort (age-2 fish) and not the 2015 cohort (Figure 15). Similarly, the one five-year old fish likely belongs to the 2014 cohort (age-4) and not the 2013 cohort (age-5).

The 2015 cohort (age-3) was the most frequent in the catch accounting for 28.6% (n = 20) of the aged fish (Figure 15). The 2014, 2016, and 2013 cohorts (ages 4, 2 and 5) were the next most abundant age-classes, representing 18.6 % (n = 13), 15.7% (n = 11), and 12.9% (n = 9) of the catch, respectively (Figure 15). Known hatchery-released fish accounted for the majority of fish caught from the 2014 (76.9%; n = 10) and 2016 (63.6%; n = 7) cohorts (Figure 15). In 2018, all cohorts from 2011–2017 were present in the catch. However, all cohorts between 2000 and 2017 have been represented in the catch since studies began (Table 6).

4.3.2 POPULATION ESTIMATE

The 2018 population estimate for Stephens Lake was 1,101 juvenile Lake Sturgeon (95% CI: 749–1,620) (Figure 16; Appendix A5-2). This was above the 95% confidence limits of the 2014 and 2016 estimates, but within the 95% confidence limits of 2010–2013 and 2017. The estimated annual survival rate was 88%.

Survival of the 418 hatchery-reared Lake Sturgeon stocked into Stephens Lake in 2015 (*i.e.*, the 2014 cohort) was estimated at 86% (Appendix A5-3). Based on this estimate, 233 of these fish remained in Stephens Lake in 2018.

4.3.3 GROWTH AND CONDITION

In 2018, 52 wild (including adult size fish) and 17 known hatchery-reared Lake Sturgeon were caught. Length-weight relationships for hatchery-reared and wild Lake Sturgeon are presented in Figure 3.

Wild Lake Sturgeon had a:

- Mean FL of 488 mm (n = 52; StDev = 158 mm; range 222–837 mm);
- Mean weight of 1,172 g (n = 52; StDev = 1,254 g; range 50–4,925 g); and
- Mean condition factor of 0.72 (n = 52; StDev = 0.10; range 0.46–0.90) (Table 7).

Wild Lake Sturgeon in the 400–449 mm FL interval were captured most frequently accounting for 28.8% (n = 15) of the wild catch. The 500–549 mm and 300–349 mm FL intervals were also caught frequently and accounted for 15.4% (n = 8) and 13.5% (n = 7) of the wild catch, respectively (Figure 11).

Mean condition factor-at-age was significantly lower for age-3 Lake Sturgeon captured during construction (*i.e.,* 2014–2018) than during baseline (*i.e.*, 2009–2012) studies (Mann-Whitney U test, $p < 0.05$; Figure 17). Mean FL-at-age was significantly higher for age-3 fish and significantly lower for age-4 fish caught during construction when compared to baseline studies; however, due to small sample sizes, only age 2, 3, and 4 fish could be compared (Mann-Whitney U test; $p < 0.05$; Figure 18).

Hatchery-reared Lake Sturgeon had a:

- Mean FL of 432 mm (n = 17; StDev = 64 mm; range 346–503 mm);
- Mean weight of 596 g (n = 17; StDev = 239 g; range 275–900 g); and
- Mean condition factor of 0.69 (n = 17; StDev = 0.08; range 0.48–0.85) (Table 7).

Hatchery-reared Lake Sturgeon in the 400–449 mm FL interval were captured most frequently (47.1%; n = 8) (Figure 11). Fish in the 350–399 mm FL interval were also frequently caught (29.4%; n = 5).

Mean FL-at-age was significantly higher for age-1, age-2 and age-3 hatchery-reared Lake Sturgeon than for wild fish (Mann-Whitney U test, $p < 0.05$; Figure 19). Mean weight-at-age was significantly higher for age-1 hatchery fish but was significantly lower in age-3 hatchery fish when compared to wild fish (Mann-Whitney U test, $p < 0.05$; Figure 19). Mean condition factor-at-age was significantly lower for age-3 and age-4 hatchery-reared Lake Sturgeon than for wild fish (Mann-Whitney U test, $p < 0.05$; Figure 17).

A comparison of von Bertalanffy growth curves between hatchery and wild fish showed that young hatchery fish are longer and heavier than wild fish of the same cohort. However, growth of hatchery fish appears to slow around age-4 (Figure 20)

4.3.4 RECAPTURES

Eleven Lake Sturgeon tagged in a previous year were recaptured in Stephens Lake (Table 8; Appendix A4-1). Of these: one was tagged in 2011, one in 2014, two in 2015, three in 2016, three in 2017, and one in spring of 2018.

Recaptured fish moved varying distances from their original capture locations:

- Ten fish were originally captured in Stephens Lake. All were recaptured close to their original capture locations.
    - Five were recaptured within 1.1 km.
    - Five were recaptured between 2.3 and 3.1 km.
- One fish (Floy #96513) was tagged in the future Keeyask reservoir (Zone GL-C) 15.0 km upstream as an age-2 in 2014 and has been caught multiple times since. It was recaptured in 2015 in the future Keeyask reservoir (GL-C), in 2017 in Stephens Lake (STL-A), and in 2018 in Stephens Lake (STL-B). It increased in size by 188 mm and 775 g since its initial capture in 2014. This fish represents one of only three wild fish from the future Keeyask reservoir captured downstream in Stephens Lake (Burnett *et al.* 2018).

4.3.5 HATCHERY CAPTURES

A total of 17 hatchery-reared Lake Sturgeon released as one-year-olds were captured in Stephens Lake in 2018, representing 23% of the total catch (Table 9; Appendix A4-2). None of the hatchery-reared fish had been captured during previous sampling. An age breakdown of all the hatchery-reared fish captured between 2014 and 2018 is presented in Table 11.

Of the 17 hatchery captures:

- Fourteen were stocked in Stephens Lake:

  - Two were stocked on June 22, 2015, at Site 3 (Zone STL-B; Map 8). One was captured 1.8 km downstream and one 2.3 km upstream of the original release location.
  - Five were stocked on September 14, 2015.
    - Three were stocked in Zone STL-A (Site 5; Map 8) of which one was caught 0.7 km upstream and two were caught 0.7 km downstream.
    - Two were stocked in Zone STL-B (Site 4; Map 8) and were captured 0.9 km and 3.3 km upstream.
  - Seven were stocked at the Keeyask downstream boat launch (Site 1; Map 8) on June 15, 2017. All seven were captured in Zone STL-B, 1.7 to 4.0 km downstream.
- Three were stocked in the future Keeyask reservoir:
  - One was stocked on June 22, 2015, in Zone GL-B (Map 6) and was captured 15.0 km downstream.
  - Two were stocked on September 16, 2015.
    - One was released at Site 6 (GL-B; Map 6) and was captured 13.1 km downstream.
    - One was released at Site 7 (GL-C; Map 6) and was captured 11.2 km downstream.

5.0 DISCUSSION

5.1 JUVENILE ABUNDANCE

In 2018, an increase in gillnetting effort resulted in an increase in the number of sturgeon captured in Split Lake compared to previous years. It is not known whether these fish were hatched in the Burntwood or Nelson rivers, although fish captured along the south shore of Split Lake are in the main flow of the Nelson River and are more likely to have originated there. The CPUE and number of juvenile Lake Sturgeon captured in the Burntwood River in 2018 was lower than in previous years; however, catches have been variable with no clear trend since the program started. Inter-annual variation in flow also has a substantial effect on where nets can be set; in 2018, 19 gill nets were set (compared to 24 in 2017) due to a reduced number of suitable sites and the presence of debris.

In both the future Keeyask reservoir and Stephens Lake CPUE was slightly lower in 2018 (2.61 and 1.11 LKST/100 m/24 h) compared to 2017 (2.74 and 1.98). Environmental factors may have influenced juvenile capture, as Nelson River flows were lower (~2,800 m^3/s) during the 2018 study period than in the previous two years (> 4,000 m^3/s). Although flow fluctuates on a seasonal and yearly basis, the juvenile catch in both areas was higher in years of high flow (*i.e.*, 2016 and 2017). It is possible that high flows reduced suitable habitat areas, concentrating juvenile Lake Sturgeon into smaller areas and making them easier to catch. In Stephens Lake, juvenile Lake Sturgeon captures may also have been impacted by changes to flows caused by the Keeyask Spillway commissioning in August 2018. Juvenile Lake Sturgeon tagged with acoustic transmitters spent more time in the area closer to Gull Rapids after the spillway was commissioned in August than in any previous study year (Lacho and Hrenchuk 2019). Similarly, in the current study, fewer juvenile Lake Sturgeon were captured in sites fished in previous years and more were captured closer to the construction site. However, this observation was also coincident with declining flows on the Nelson River (Section 2.2).

Mark recapture data was used to generate a population estimate of wild juvenile Lake Sturgeon in the future Keeyask reservoir and Stephens Lake for the first time in 2018. The 2018 estimate was 4,133 individuals (95% CI: 2,955–5,780) for the future Keeyask reservoir and 1,101 individuals (95% CI: 749–1,620) for Stephens Lake. Survival was slightly lower (77%) in the future Keeyask reservoir than in Stephens Lake (88%). As this was the first year that the sample sizes were large enough to calculate an estimate, these numbers will likely change as data are added to the model and estimates are refined.

5.2 RECRUITMENT

Benchmarks set in the Keeyask AEMP for juvenile Lake Sturgeon year-class strength relied on comparing CPUE to the Sea Falls to Sugar Falls reach of the Nelson River. When the AEMP was written, there was little information on juvenile Lake Sturgeon in the lower Nelson River, therefore benchmarks were chosen to compare to Sea Falls, where more was known. In recent years, successful stocking in the Sea Falls reach has led to a dramatic increase in numbers of juvenile Lake Sturgeon, thus, the two areas are no longer comparable. The early warning trigger for juvenile Lake Sturgeon year-class-strength has been revised to be the absence of wild juvenile Lake Sturgeon ≤3 years of age in the catch in a single year. The absence of wild fish ≤3 years of age in the catch for two consecutive monitoring years will be considered the ecologically significant benchmark. These new thresholds were selected based on the observation that sturgeon less than three years old have been observed in the Upper Split Lake Area, the future Keeyask reservoir and Stephens Lake in all recent years. In 2018, 85 wild Lake Sturgeon aged between 0–3 were caught: eight in the Upper Split Lake Area, 50 in the future Keeyask reservoir, and 27 in Stephens Lake.

Based on similarities in cohort frequency data as well as genetic evidence (Gosselin *et al*. 2016), Henderson *et al*. (2015) hypothesized recruitment to the Stephens Lake population was mainly due to spawning upstream of Gull Rapids (*i.e.*, in the future Keeyask reservoir). However, more recent results indicate the cohort frequency distribution in Stephens Lake differs from that in the future Keeyask reservoir. The 2015 cohort continues to be strong in Stephens Lake, representing 27% of the wild catch in 2017 and 42% of the wild catch in 2018. The same cohort made up only 7% of the wild catch in the future Keeyask reservoir in both 2017 and 2018. Burnett *et al.* (2018) hypothesized that if these fish had been spawned upstream of Gull Rapids and drifted downstream, a larger proportion would have remained upstream. It is likely that spawning at Gull Rapids contributed to the 2015 cohort in Stephens Lake. This observation is consistent with the recent increase in the number of mature males captured during spring adult surveys below Gull Rapids (Legge *et al*. 2017; Holm and Hrenchuk 2019).

Hatchery-reared Lake Sturgeon released as yearlings are also contributing to a large portion of the 2014 and 2016 cohorts in both the future Keeyask reservoir and Stephens Lake. These hatchery fish made up 62% of the 2014 cohort and 21% of the 2016 cohort in the future Keeyask reservoir, and 77% of the 2014 cohort and 64% of the 2016 cohort in Stephens Lake. As noted earlier, hatchery raised sturgeon released as larvae or fingerlings may also contribute to the total cohorts, but these cannot be distinguished from the wild fish without additional testing.

5.3 HATCHERY FISH

The stocking program began in 2014, with regular stocking events in the Burntwood River, the future Keeyask reservoir and Stephens Lake since then. In the spring of 2018, 739 age-1 (PIT tagged) Lake Sturgeon were released in the Burntwood River bringing the total number of stocked age-1 fish in this area to 1,357 at the time of the current study. A total of 886 and 1,138 age-1 Lake Sturgeon were stocked in the future Keeyask reservoir and Stephens Lake, respectively, prior to 2018. Hatchery-reared (*i.e.*, age-1 fish marked with PIT tags) Lake Sturgeon continued to make up a large proportion of the catch in both the future Keeyask reservoir (11%) and Stephens Lake (23%) in 2018.

Despite large number of hatchery captures in the future Keeyask reservoir and Stephens Lake, few hatchery-reared fish have been captured in the Burntwood River. In total, six hatchery-reared fish (0.4% of stocked fish) have been captured in the Upper Split Lake Area: one in 2014, one in 2016, three in 2017, and one in 2018. Only four of these fish were captured in the Burntwood River itself. Four yearlings stocked in the Burntwood River have been captured in the future Keeyask reservoir, which suggests the majority of yearlings stocked in the Burntwood River are not remaining there, but are likely moving downstream. Additional sites were added to Split Lake in 2018 in an attempt to capture hatchery fish, but only a single hatchery-reared Lake Sturgeon was captured. This fish was captured in the southern portion of Split Lake approximately 32 km downstream of where it was stocked (GN-38; Map 3; Appendix A1-1).

Some fish stocked in the future Keeyask reservoir have moved downstream into Stephens Lake. In 2017, 65% (n = 20) of the captured yearlings originally stocked in the future Keeyask reservoir were captured in the future Keeyask reservoir, and 35% (n = 11) were captured in Stephens Lake. In 2018, 84% (n = 16) of the captured yearlings originally stocked in the future Keeyask reservoir were captured in the future Keeyask reservoir and 16% (n = 3) were captured in Stephens Lake. This pattern of downstream movement is not found in recaptured wild fish, as only three wild juvenile Lake Sturgeon tagged in the future Keeyask reservoir have ever been captured in Stephens Lake. Additionally, no juvenile Lake Sturgeon tagged with acoustic transmitters have moved downstream through Gull Rapids during five years of study (Lacho and Hrenchuk 2019). Burnett *et al.* (2018) hypothesized that observed downstream movements of hatchery fish in 2017 may have been at least partially due to extreme flows. Future monitoring will determine whether future cohorts stocked in less extreme flow events continue to move downstream.

Similar to 2017, several Lake Sturgeon in 2018 (n = 10) had ageing structures characteristic of hatchery-reared fish (*i.e.*, weak or missing first annuli) but did not have hatchery implanted PIT tags. Although the ages of PIT tagged hatchery fish are known, obtaining the correct age from pectoral fin rays has proven difficult. Of the 34 known-age hatchery-reared fish captured in the future Keeyask reservoir and Stephens Lake in 2018, all (three-reader agreement at 88.2%) were over-aged by one year due to the presence of a weak first annuli in combination with the use of a correction for the missing first annulus (see Section 3.4). Ageing structure analysis suggests PIT tag loss is occurring due to the high number of suspected hatchery fish in the catch. In the future Keeyask reservoir, suspected hatchery fish accounted for 13% of the 2014 year-class and 18% of the 2015 year-class (which is likely the 2016 year class). In Stephens Lake, suspected hatchery fish accounted for 10% of the 2013 year-class (likely 2014 year class) and 17% of the 2015 year-class (likely 2016 year-class).

5.4 KEY QUESTIONS

The AEMP identified key questions for juvenile Lake Sturgeon monitoring, four of which are relevant to the construction period and are addressed in the discussion below.

Does recruitment of wild sturgeon occur upstream and/or downstream of the GS during construction?

In 2018, one wild YOY sturgeon was caught in the future Keeyask reservoir and none were caught in Stephens Lake. While the presence of one YOY sturgeon in the future Keeyask reservoir indicates successful spawning occurred upstream of Gull Rapids, the absence of YOY in Stephens Lake does not necessarily mean recruitment was unsuccessful downstream of Gull Rapids. YOY are often underrepresented in the catch due to their size and the gear used does not adequately target YOY fish. All other cohorts spawned since construction started (*i.e.*, 2015–2017) have been present in the catch in both areas.

Is there a biologically meaningful (and statistically significant) change in condition factor and growth of juvenile sturgeon during construction?

A comparison of juvenile Lake Sturgeon condition factor between baseline and construction monitoring studies found significant differences in several age classes; however, as in 2017, there is not a consistent trend by location or age-class. In the Upper Split Lake Area, no statistical comparisons could be made due to a lack of baseline data. A qualitative examination of the data suggests no obvious differences in condition factor- or FL-at-age.

Although no clear trends in FL-at-age and condition factor-at-age could be seen among sampling years, differences appear to be consistent between reporting years. However, these differences may be due to small baseline sample sizes and not be biologically significant. For example, age-7 Lake Sturgeon captured in the future Keeyask reservoir have been significantly shorter during construction than baseline since 2015. However, only 10 age-7 fish were captured during baseline, compared to a much larger sample (n = 82) during construction.

A comparison of growth curves of wild fish captured in the future Keeyask reservoir during baseline and construction was conducted for the first time in 2018. Growth during both time periods was similar. Too few juveniles were collected in Stephens Lake prior to construction to support a pre/post analysis.

Two questions related to the stocking program are addressed below:

- *What is the survival rate of stocked sturgeon?*; and
- *What is the proportion of hatchery-reared to wild recruits within a cohort (i.e., how successful is the stocking program)?*

As noted previously, only sturgeon stocked as yearlings can be distinguished from wild fish and the following discussion considers only fish stocked as yearlings. In 2018 the annual survival rate of stocked sturgeon was estimated as 95% in the future Keeyask reservoir and 86% in

Stephens Lake. As the number of recaptures increases over subsequent study years, the survival rate will be adjusted to account for newly captured fish.

The proportion of hatchery-reared Lake Sturgeon captured in both the future Keeyask reservoir and Stephens Lake in 2018 remained high. In the future Keeyask reservoir, hatchery-reared Lake Sturgeon made up 2% of the catch in 2015, 7% in 2016, 12% in 2017, and 11% in 2018. Hatchery-reared fish tend to make up a larger proportion of the catch in Stephens Lake: 7% in 2015, 8% in 2016, 34% in 2017, and 23% in 2018. In Stephens Lake, the 2014 and 2016 cohorts were dominated by hatchery-reared fish, 77% and 64%, respectively.

The recapture of stocked fish with PIT tags indicates hatchery-reared sturgeon are growing and surviving in the wild. Statistical analyses of FL-, weight-, and condition factor-at-age as well as von Bertalanffy growth curve analysis suggest that hatchery-reared Lake Sturgeon in both areas may be growing differently than wild fish. Hatchery fish were both longer and heavier at release than wild fish of the same age, and this “headstart” appears to persist until age-4 (when the accelerated growth rate tapers off). However, to date, the oldest hatchery-reared Lake Sturgeon stocked into both the future Keeyask reservoir and Stephens Lake are 4 years old (2014 cohort). Continued monitoring of these fish will determine if these differences persist as the fish grow.

5.5 NEXT STEPS

The juvenile Lake Sturgeon population monitoring program will be repeated in 2019. Sampling locations in the Burntwood River will remain similar to previous years, but will reflect the change made in 2018 to focus sampling effort on Split Lake and not the reach of the Nelson River immediately downstream of the Kelsey GS. Increased netting effort in Split Lake (downstream of the Nelson and Burntwood rivers) will identify whether a large number of unidentified juveniles occur in the lake, and may also aid in locating juveniles stocked in the Burntwood River that have moved downstream. Focus in Split Lake will be on sites not sampled in 2018, as well as those in the vicinity of where the single hatchery fish was captured. The number of sites in the Burntwood River will be increased in order maintain similar effort as in previous sampling years. Sampling in the future Keeyask reservoir and Stephens Lake will remain similar to previous years.

Comparative analysis of juvenile Lake Sturgeon growth rate prior to and during construction was conducted for the first time in 2018 and will continue to be assessed as more data is added. Growth of hatchery fish will continue to be monitored using von Bertalanffy growth curves with growth estimates likely to become more refined as the length of time hatchery fish will have spent in the wild increases. Population estimates were also generated for the first time in 2018 and will be continually updated as more mark recapture data becomes available in subsequent study years.

6.0 SUMMARY AND CONCLUSIONS

- Sampling locations in the Burntwood River, the future Keeyask reservoir, and Stephens Lake remained similar to previous years; however, the number of sampling locations decreased in 2018 due to flows and the presence of debris. Sampling was not conducted in the Kelsey GS area, as effort was shifted to Split Lake in an attempt to captured stocked fish.
- Sixty eight Lake Sturgeon were captured in the Upper Split Lake Area: 11 in the Burntwood River (426.3 gillnet hours, CPUE of 0.62 Lake Sturgeon/100 m net/24 h) and 57 (52 juvenile and 5 adult) in Split Lake (606.9 gillnet hours, CPUE of 2.25 Lake Sturgeon/100 m net/24 h). One of the five recaptured fish was a hatchery-reared fish released into the Burntwood River in 2014 (2013 cohort; captured in Split Lake). No YOY (2018 cohort) were caught in the Upper Split Lake Area in 2018.
- In the future Keeyask reservoir, 150 (143 juvenile and seven adult) Lake Sturgeon were captured in 1,376.8 gillnet hours for a total CPUE of 2.61 Lake Sturgeon/100 m net/24 h. Aged Lake Sturgeon (n = 143) ranged from 0 to 12 years old with two-year-old fish (2016 cohort) the most prevalent in the catch (n = 44; 30.8%). Eighteen Lake Sturgeon tagged in previous years and 17 stocked yearlings were captured. One of the hatchery fish was released in the Burntwood River in 2014 (2013 cohort), and was caught 127.8 km downstream of its release location. Eight of the captured stocked yearlings were released into Gull Lake in 2015 (2014 cohort) and eight were released in 2017 (2016 cohort).
- In Stephens Lake, 74 (71 juvenile and 3 adult) Lake Sturgeon were captured in 1,599.0 gillnet hours for a total CPUE of 1.11 Lake Sturgeon/100 m net/24 h. Lake Sturgeon ages ranged from 1 to 10 with the 2015 cohort (age-3) captured most frequently (n = 24; 34.3%). Eleven Lake Sturgeon tagged in a previous year and 17 stocked yearlings were captured. Three of the stocked yearlings were released in the future Keeyask reservoir in 2015 (2014 cohort) and 14 were released in Stephens Lake (7 in 2015 [2014 cohort] and 7 in 2017 [2016 cohort]).
- Abundance estimates were calculated for wild juvenile Lake Sturgeon in the future Keeyask reservoir and Stephens Lake for the first time in 2018. The population estimate in 2018 was 4,133 wild juvenile Lake Sturgeon (95% CI: 2,955–5,780) for the future Keeyask reservoir and 1,101 (95% CI: 749–1,620) for Stephens Lake. Survival was estimated as 77% in the future Keeyask reservoir, and 88% in Stephens Lake.
- Ageing structures collected from stocked yearlings have unique banding patterns increasing the likelihood of over-ageing hatchery fish. Hatchery implanted PIT tags are crucial in determining the known ages of stocked yearlings but it appears PIT tag loss can be high. Additional analysis (genetic or fin-ray micro-chemistry) may provide a useful tool for discriminating hatchery fish from wild caught sturgeon in the case of PIT tag loss.

- The key questions, as described in the AEMP, for juvenile Lake Sturgeon population monitoring during construction of the Keeyask GS are as follows:
  - *Does recruitment of wild sturgeon occur upstream and/or downstream of the GS during construction?*

    In 2018, one wild YOY sturgeon was caught in the future Keeyask reservoir and none were caught in Stephens Lake. In both areas, wild Lake Sturgeon spawned during construction have been captured in all monitoring years (2015–2017) and wild sturgeon from these cohorts continue to captured during the 2018 monitoring, indicating that recruitment continues to occur during construction.
  - *Is there a biologically meaningful (and statistically significant) change in condition factor and growth of juvenile sturgeon during construction?*

    A comparison of mean condition factor- and FL-at-age for juvenile Lake Sturgeon collected during baseline and construction monitoring studies found significant differences in several age classes in both the future Keeyask reservoir and Stephens Lake. However, due to the lack of consistent findings in both FL-at-age and condition factor-at-age across years and waterbodies, the observed differences are not considered biologically meaningful. Growth curves for fish captured in the future Keeyask reservoir were similar during baseline and construction monitoring studies.
  - *What is the survival rate of stocked sturgeon? What is the proportion of hatchery-reared to wild recruits within a cohort (i.e., how successful is the stocking program)?*

    The survival rates of stocked sturgeon in the future Keeyask reservoir and Stephens Lake were 95% and 86%, respectively. The proportion of stocked fish in the catch from the future Keeyask reservoir and Stephens Lake remained high in 2018. In Stephens Lake and, to a lesser extent, the future Keeyask reservoir, the 2014 and 2016 cohorts were dominated by hatchery fish.

    Analysis of growth between hatchery and wild caught fish showed that, in both areas, young hatchery fish are longer and heavier than wild fish of the same cohort. However, growth of hatchery fish appears to slow around age-4.

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TABLES

Table 1: Summary of Lake Sturgeon stocking since 2014. Numbers of stocked fish are from Klassen *et al.* 2019.

Year[a]	Burntwood River			Future Keeyask Reservoir[b]			Stephens Lake		
	Larvae	Fingerlings	Age-1	Larvae	Fingerlings	Age-1	Larvae	Fingerlings	Age-1
2014	-	-	595	152,926	4,656	-	-	-	-
2015	-	-	-	-	-	423	-	-	418
2016	-	-	23	192,167	780	-	184,134	799	-
2017	71,740	3,765	-	-	-	463	-	-	720
2018	-	-	739	-	(933)[c]	-	-	(1,010)[c]	-
Total	**71,740**	**3,765**	**1,357**	**345,093**	**6,369**	**886**	**184,134**	**1,809**	**1,138**

a – Stocking year.

b - From Birthday Rapids to Gull Rapids.

c - numbers in parentheses were stocked after the 2018 juvenile survey.

Table 2: Summary of start and completion dates for juvenile Lake Sturgeon monitoring during fall, 2018, by location.

Location	Start Date	Completion Date	# Sites
Upper Split Lake Area			
Burntwood River	12-Sep-18	17-Sep-18	19
Split Lake	09-Sep-18	20-Sep-18	21
Future Keeyask Reservoir	09-Sep-18	19-Sep-18	50
Stephens Lake	09-Sep-18	21-Sep-18	49

Table 3: Number (n) and frequency of occurrence (%), by species and sampling location, of fish captured during juvenile Lake Sturgeon monitoring, fall 2018.

Species	Scientific Name	Upper Split Lake Area				Future Keeyask Reservoir		Stephens Lake		Total n	Total %
		Burntwood River		Split Lake							
		n	%	n	%	n	%	n	%		
Burbot	*Lota lota*	2	4.1	13	7.0	0	0.0	49	11.4	64	6.0
Lake Chub	*Couesius plumbeus*	0	0.0	0	0.0	1	0.2	0	0.0	1	0.1
Lake Sturgeon	*Acipenser fulvescens*	***11***	***22.4***	***57***	***30.5***	***150***	***37.4***	***74***	***17.2***	***292***	***27.4***
Lake Whitefish	*Coregonus clupeaformis*	0	0.0	3	1.6	2	0.5	12	2.8	17	1.6
Longnose Sucker	*Catostomus catostomus*	24	49.0	32	17.1	158	39.4	180	41.9	394	36.9
Northern Pike	*Esox lucius*	0	0.0	1	0.5	6	1.5	0	0.0	7	0.7
Sauger	*Sander canadensis*	3	6.1	25	13.4	15	3.7	5	1.2	48	4.5
Shorthead Redhorse	*Moxostoma macrolepidotum*	0	0.0	2	1.1	9	2.2	2	0.5	13	1.2
Spottail Shiner	*Notropis hudsonius*	0	0.0	1	0.5	0	0.0	0	0.0	1	0.1
Trout-perch	*Percopsis omiscomaycus*	0	0.0	2	1.1	8	2.0	4	0.9	14	1.3
Walleye	*Sander vitreus*	2	4.1	27	14.4	5	1.2	15	3.5	49	4.6
White Sucker	*Catostomus commersoni*	7	14.3	21	11.2	47	11.7	89	20.7	164	15.4
Yellow Perch	*Perca flavescens*	0	0.0	3	1.6	0	0.0	0	0.0	3	0.3
Total		**49**	**100**	**187**	**100**	**401**	**100**	**430**	**100**	**1067**	**100**

Table 4: Lake Sturgeon catch-per-unit effort (CPUE; # fish/100 m net/24 h) by location and zone, for gill nets set during juvenile Lake Sturgeon monitoring, fall, 2018.

Location	Zone	# of Sites	Effort (gillnet hours)	# of Lake Sturgeon	CPUE (#LKST/100m/24h)
Burntwood River	BWR-A	6	139.9	6	1.03
	BWR-B	5	108.0	2	0.44
	BWR-C	8	178.4	3	0.40
Total		**19**	**426.3**	**11**	**0.62**
Split Lake	SPL-A	21	606.9	57	2.25
Total		**21**	**606.9**	**57**	**2.25**
Future Keeyask Reservoir	BR-D	4	135.2	5	0.89
	GL-A	11	314.8	17	1.30
	GL-B	18	480.1	60	3.00
	GL-C	17	446.7	68	3.65
Total		**50**	**1376.8**	**150**	**2.61**
Stephens Lake	STL-A	17	576.5	19	0.79
	STL-B	32	1022.5	55	1.29
Total		**49**	**1599.0**	**74**	**1.11**

Table 5: Lake Sturgeon catch-per-unit-effort (CPUE; #fish/100 m net/24 h) for gill nets set to target juvenile Lake Sturgeon between 2007 and 2018. Grey highlighted rows indicate construction monitoring.

Location	Year	Start Date	Completion Date	Mesh Size	# Sites	Effort (gillnet hrs[a])	# Lake Sturgeon[b]	CPUE
Upper Split Lake Area								
Burntwood River	2012	29-Aug	08-Sep	1" - 6"	37	767	33	1.03
	2014	08-Sep	16-Sep	1" - 6"	28	734	42	1.37
	2015	29-Aug	04-Oct	1" - 6"	28	858	35	0.78
	2016	07-Sep	18-Sep	1" - 6"	24	594	26	1.05
	2017	06-Sep	12-Sep	1" - 6"	24	660	34	1.24
	2018	09-Sep	20-Sep	1" - 6"	19	426	11	0.62
Kelsey GS Area[c]	2015	29-Aug	04-Oct	1" - 6"	7	248	7	0.68
	2016	07-Sep	18-Sep	1" - 6"	9	203	8	0.95
	2017	14-Sep	15-Sep	1" - 6"	10	232	6	0.62
Split Lake	2015	29-Aug	04-Oct	1" - 6"	9	192	9	1.13
	2016	07-Sep	18-Sep	1" - 6"	7	193	6	0.75
	2017	05-Sep	13-Sep	1" - 6"	8	175	19	2.60
	2018	09-Sep	20-Sep	1" - 6"	21	607	57	2.25
Future Keeyask Reservoir[d]	2007	28-Sep	03-Oct	8mm - 5"	26	165	0	0
	2008	12-Sep	27-Sep	1.5"- 8"	15	3072	126	0.98
	2010	21-Sep	29-Sep	1" - 5"	27	851	69	1.95
	2011	18-Sep	24-Sep	1" - 5"	25	662	121	4.39
	2012	29-Aug	09-Sep	1" - 6"	30	745	101	3.25
	2014	08-Sep	16-Sep	1" - 6"	30	765	112	3.51
	2015	11-Sep	20-Sep	1" - 6"	34	912	139	3.66
	2016	12-Sep	23-Sep	1" - 6"	37	997	96	2.31
	2017	09-Sep	19-Sep	1" - 6"	51	1551	177	2.74
	2018	09-Sep	19-Sep	1" - 6"	50	1377	150	2.61
Stephens Lake	2007	19-Sep	23-Sep	2" - 5"	15	48	0	0
	2008	11-Sep	18-Sep	3.75"-8"	12	295	8	0.65
	2009	14-Sep	20-Sep	1.5" - 5"	18	634	23	0.87
	2010	22-Sep	29-Sep	1" - 5"	18	611	32	1.26
	2011	21-Sep	01-Oct	1" - 5"	30	974	37	0.91
	2012	11-Sep	23-Sep	1" - 6"	19	1193	87	1.75
	2014	18-Sep	28-Sep	1" - 6"	94	921	47	1.23
	2015	22-Sep	02-Oct	1" - 6"	44	1154	54	1.12
	2016	12-Sep	23-Sep	1" - 6"	37	1384	66	1.14
	2017	09-Sep	19-Sep	1" - 6"	40	1796	148	1.98
	2018	09-Sep	21-Sep	1" - 6"	49	1599	74	1.11

a - Gillnet set durations were standardized to 100 m of net and then summed to calculate the total gillnet hours for each study.

b - Does not include Lake Sturgeon recaptured more than once in the same study.

c – Removed from sampling in 2018.

d - Birthday Rapids to Gull Rapids.

Table 6: Number of wild Lake Sturgeon captured from 2008 to 2018, from which ages and cohorts were determined. Grey highlighted columns indicate cohorts spawned during Keeyask GS construction and red values indicate cohorts not present in the corresponding study year. The Kelsey GS area was not samples and more sampling sites were added to Split Lake in 2018 in an attempt to locate hatchery-reared fish stocked in the Burntwood River.

Location	Cohort Year																				
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Upper Split Lake Area																					
Burntwood River																					
2011 Study Year	0	2	5	3	5	15	6	0	2	1	4	0	0	0	-	-	-	-	-	-	-
2012 Study Year	0	2	1	4	0	4	0	1	5	3	1	0	3	7	1	-	-	-	-	-	-
2015 Study Year	0	0	0	1	0	1	1	1	3	1	2	0	0	5	4	4	0	0	-	-	-
2016 Study Year	0	1	0	0	0	1	1	0	0	0	1	0	4	5	0	7	2	0	1	-	-
2017 Study Year	0	1	0	0	1	2	1	0	0	0	2	1	5	2	0	2	3	1	7	3	-
2018 Study Year	0	1	0	0	1	0	0	0	0	0	0	0	2	0	0	1	0	2	2	1	0
Total	**0**	**7**	**6**	**8**	**7**	**23**	**9**	**2**	**10**	**5**	**10**	**1**	**14**	**19**	**5**	**14**	**5**	**3**	**10**	**4**	**0**
Present in the Catch	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Split Lake																					
2015 Study Year	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	4	1	0	-	-	-
2016 Study Year	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	-	-
2017 Study Year	0	0	0	0	0	1	0	0	1	1	3	1	3	1	0	2	0	0	3	0	-
2018 Study Year	0	0	0	0	0	1	0	2	2	1	1	0	3	9	1	26	2	1	2	1	0
Total	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**3**	**3**	**6**	**1**	**7**	**11**	**1**	**32**	**4**	**2**	**5**	**1**	**0**
Present in the Catch	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Kelsey GS																					
2015 Study Year	0	0	0	0	0	1	0	0	0	0	0	0	2	3	0	0	0	0	-	-	-
2016 Study Year	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	0	0	0	-	-
2017 Study Year	0	0	0	0	0	0	0	1	0	0	2	0	0	1	1	0	0	0	0	0	-
Total	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**1**	**1**	**0**	**2**	**0**	**2**	**5**	**1**	**1**	**0**	**0**	**0**	**0**	**-**
Present in the Catch	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**-**
Future Keeyask Reservoir																					
2008 Study Year	0	0	0	0	0	0	0	0	12	2	14	-	-	-	-	-	-	-	-	-	-
2010 Study Year	1	0	1	0	0	6	3	1	3	5	18	0	0	-	-	-	-	-	-	-	-
2011 Study Year	0	1	0	0	0	5	2	2	7	5	94	1	2	0	-	-	-	-	-	-	-
2012 Study Year	0	0	0	0	0	2	2	2	12	6	60	3	1	4	0	-	-	-	-	-	-
2014 Study Year	0	0	0	1	0	1	0	1	6	2	58	3	4	7	3	9	0	-	-	-	-
2015 Study Year	0	0	0	0	0	0	1	3	10	7	71	1	1	3	6	11	3	4	-	-	-
2016 Study Year	0	0	0	0	0	0	0	1	15	0	29	2	1	5	6	13	6	4	4	-	-
2017 Study Year	0	0	0	0	0	1	1	0	6	3	56	2	2	11	7	20	10	10	10	1	-
2018 Study Year	0	0	0	0	0	0	0	0	3	4	33	5	3	6	4	9	5	9	34	5	1
Total	**1**	**1**	**1**	**1**	**0**	**15**	**9**	**10**	**74**	**34**	**433**	**17**	**14**	**36**	**26**	**62**	**24**	**27**	**48**	**6**	**1**
Present in the Catch	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 6: Number of wild Lake Sturgeon captured from 2008 to 2018, from which ages and cohorts were determined. Grey highlighted rows indicate construction monitoring and red values indicate cohorts not present in the corresponding study year (continued).

Location	Cohort Year																				
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Stephens Lake																					-
2009 Study Year	0	0	1	1	0	0	1	3	1	0	2	0	-	-	-	-	-	-	-		-
2010 Study Year	0	0	0	0	1	3	0	1	5	7	14	0	0	-	-	-	-	-	-		-
2011 Study Year	0	0	0	0	0	1	0	0	0	2	28	2	0	1	-	-	-	-	-		-
2012 Study Year	0	0	0	0	0	0	0	0	7	4	49	1	2	2	0	-	-	-	-		-
2014 Study Year	0	0	0	0	0	1	1	0	5	4	25	1	4	5	0	0	0	-	-		-
2015 Study Year	0	0	0	0	0	0	0	0	4	3	19	1	1	3	0	4	2	11	-		-
2016 Study Year	0	0	0	0	0	0	1	0	4	4	31	0	0	2	1	3	4	8	0		-
2017 Study Year	0	0	0	0	0	0	0	0	0	0	19	2	0	3	0	11	4	20	9	5	-
2018 Study Year	0	0	0	0	0	0	0	0	0	0	4	0	0	4	1	9	3	20	4	3	0
Total	**0**	**0**	**1**	**1**	**1**	**5**	**3**	**4**	**26**	**24**	**191**	**7**	**7**	**20**	**2**	**27**	**13**	**59**	**13**	**8**	**0**
Present in the Catch	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**

Table 7: Mean length, weight, and condition factor of Lake Sturgeon captured during juvenile Lake Sturgeon monitoring, fall 2018.

Waterbody	Fork Length (mm)				Weight (g)				Condition Factor			
	n[a]	Mean	Std[b]	Range	n	Mean	Std	Range	n	Mean	Std	Range
Upper Split Lake Area												
Burntwood River	11	455	191	205-764	11	950	1,043	25-3,000	11	0.62	0.23	0.20-0.87
Split Lake	57	583	151	230-996	57	1,816	1,428	25-7,350	57	0.75	0.14	0.21-1.46
	68	**562**	**164**	**205-996**	**68**	**1,676**	**1,403**	**25-7,350**	**68**	**0.73**	**0.17**	**0.20-1.46**
Future Keeyask Reservoir												
Wild	128	524	206	87-1,031	127	1,565	1,634	50-8,500	127	0.73	0.13	0.32-1.30
Hatchery	17	396	57	255-479	17	394	148	100-700	17	0.60	0.05	0.53-0.72
	150[c]	**504**	**197**	**87-1,031**	**149[c]**	**1,391**	**1,566**	**50-8,500**	**149[c]**	**0.71**	**0.13**	**0.32-1.30**
Stephens Lake												
Wild	52	488	158	222-837	52	1,172	1,254	50-4,925	52	0.72	0.10	0.46-0.90
Hatchery	17	432	64	346-503	17	596	239	275-900	17	0.69	0.08	0.48-0.85
	74[d]	**469**	**139**	**222-837**	**74[d]**	**994**	**1,092**	**50-4,925**	**74[d]**	**0.71**	**0.09**	**0.46-0.90**

a – Number of fish measured.

b – Standard deviation.

c – Total includes an additional 5 fish that were not conclusively identified as either wild or hatchery fish.

d – Total includes an additional 5 fish that were not conclusively identified as either wild or hatchery fish.

Table 8: Recapture summary for wild Lake Sturgeon caught in the Keeyask Study Area between 2008 and 2018.

Recapture Location	Sampling Year	Tagging Location		
		Upper Split Lake Area	Future Keeyask Reservoir	Stephens Lake
		n[a]	n[a]	n[a]
Upper Split Lake Area	2011	0	0	0
	2012	2	0	0
	2014	2	0	0
	2015	2	0	0
	2016	2	0	0
	2017	3	0	0
	2018	4	0	0
Future Keeyask Reservoir	2008	0	9	0
	2010	0	2	0
	2011	0	4	0
	2012	0	8	0
	2014	0	17	0
	2015	0	20	0
	2016	0	11	0
	2017	0	17	0
	2018	0	18	0
Stephens Lake	2009	0	0	0
	2010	0	0	0
	2011	0	0	0
	2012	0	0	11
	2014	0	0	8
	2015	0	0	7
	2016	0	0	14
	2017	0	3	17
	2018	0	1	10

a – Number of Lake Sturgeon.

Table 9: Number (n) and percentage (%) of catch of hatchery-reared Lake Sturgeon caught in the Keeyask Study Area between 2014 and 2018.

Capture Location	Sample Year	Release Location: Burntwood River n	Release Location: Burntwood River % of Catch	Release Location: Future Keeyask Reservoir n	Release Location: Future Keeyask Reservoir % of Catch	Release Location: Stephens Lake n	Release Location: Stephens Lake % of Catch	Total	% of Total Catch
Upper Split Lake Area	2014	1	2.4	0	0.0	0	0.0	1	2.4
	2015	0	0.0	0	0.0	0	0.0	0	0.0
	2016	1	2.5	0	0.0	0	0.0	1	2.5
	2017	3	5.1	0	0.0	0	0.0	3	5.1
	2018	1	1.8	0	0.0	0	0.0	1	1.8
Future Keeyask Reservoir	2014	1	0.9	0	0.0	0	0.0	1	0.9
	2015	1	0.7	2	1.4	0	0.0	3	2.2
	2016	0	0.0	7	7.3	0	0.0	7	7.3
	2017	1	0.6	20	11.6	0	0.0	21	11.9
	2018	1	0.7	16	10.7	0	0.0	17	11.3
Stephens Lake	2014	0	0.0	0	0.0	0	0.0	0	0.0
	2015	0	0.0	0	0.0	4	7.4	4	8.5
	2016	0	0.0	1	1.5	4	6.1	5	7.6
	2017	0	0.0	11	7.4	40	27.0	51	34.5
	2018	0	0.0	3	4.1	14	18.9	17	23.0

Table 10: Catch-per-unit-effort (CPUE; # fish/100 m net/24 h) for hatchery and wild caught Lake Sturgeon in Stephens Lake and the future Keeyask reservoir, Fall 2018.

Location	Effort (gillnet hours)	# of Lake Sturgeon	CPUE (#LKST/100m/24h)
Future Keeyask Reservoir			
Wild	1,376.8	128	2.23
Hatchery	1,376.8	17	0.30
	Total	**150[a]**	**2.61**
Stephens Lake			
Wild	1,599.0	52	0.78
Hatchery	1,599.0	17	0.26
	Total	**74[b]**	**1.11**

a – total includes an additional 5 fish that were not conclusively identified as either wild or hatchery fish.

b – total includes an additional 5 fish that were not conclusively identified as either wild or hatchery fish.

Table 11: Number and ages of hatchery-reared Lake Sturgeon released as age-1 fish and captured during juvenile Lake Sturgeon studies since 2014.

Monitoring Year	Capture Location		
	Burntwood River	Future Keeyask Reservoir	Stephens Lake
2014	1 (1 year old)	1 (1 year old)	-
2015	-	3 (2 were 1 year old) (1 was 2 years old)	4 (All were 1 year old)
2016	1 (3 years old)	7 (All were 2 years old)	5 (All were 2 years old)
2017	3 (All were 4 years old)	21 (9 were 1 year old) (11 were 3 years old) (1 was 4 years old)	51 (33 were 1 year old) (18 were 3 years old)
2018	1[a] (1 was 5 years old)	17 (1 was 1 years old) (8 were 2 years old) (8 were 4 years old)	17 (7 were 2 years old) (10 were 4 years old)

a – fish released in the Burntwood River but caught in Split Lake.

FIGURES

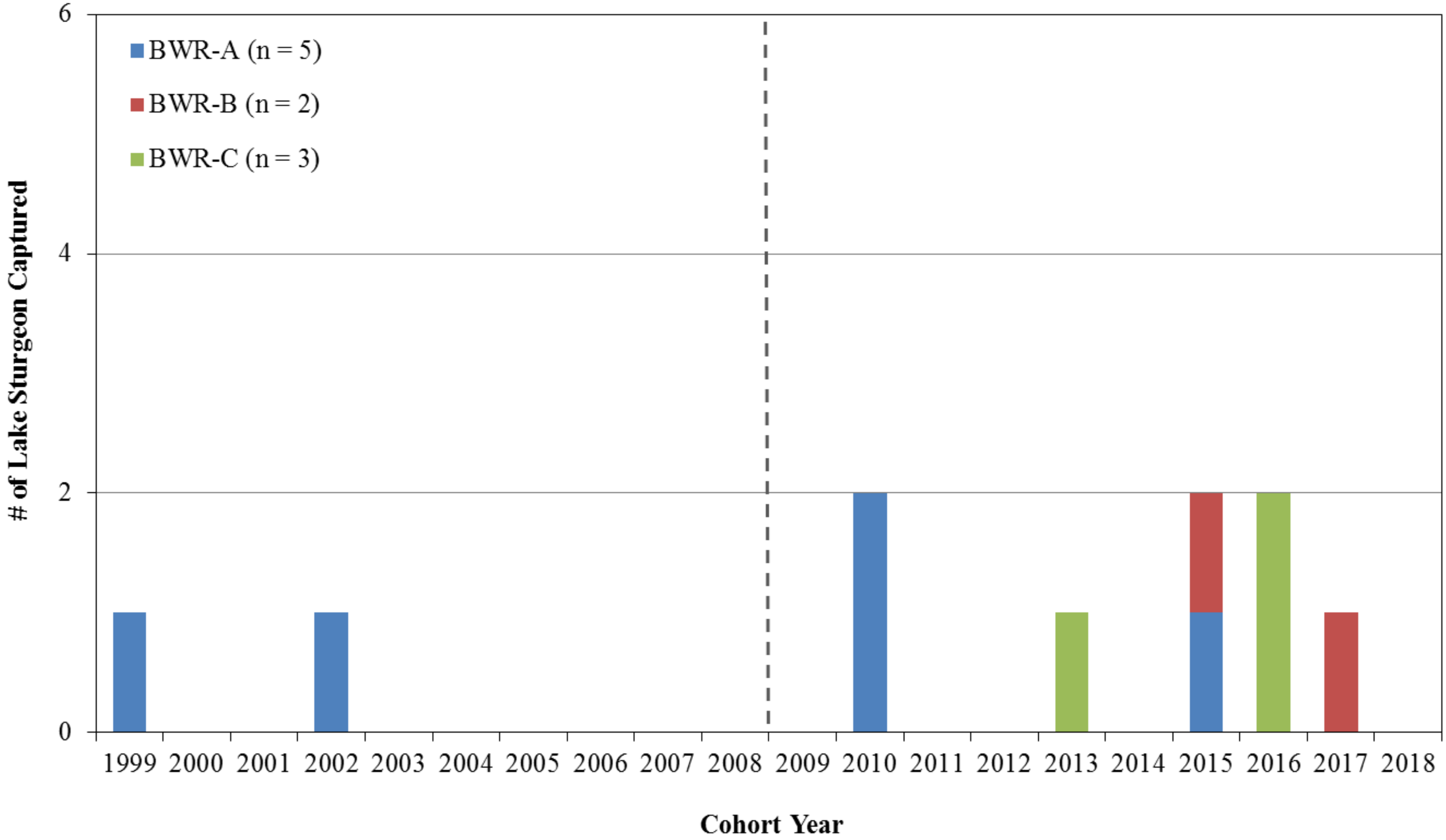


Figure 1: Cohort frequency distribution by zone, for all aged Lake Sturgeon captured in the Burntwood River, fall 2018. Cohorts prior to 2009 (*i.e.*, age-9 fish) are not fully represented as ageing structures are not collected from fish > 800 mm fork length (indicated by vertical dashed line).

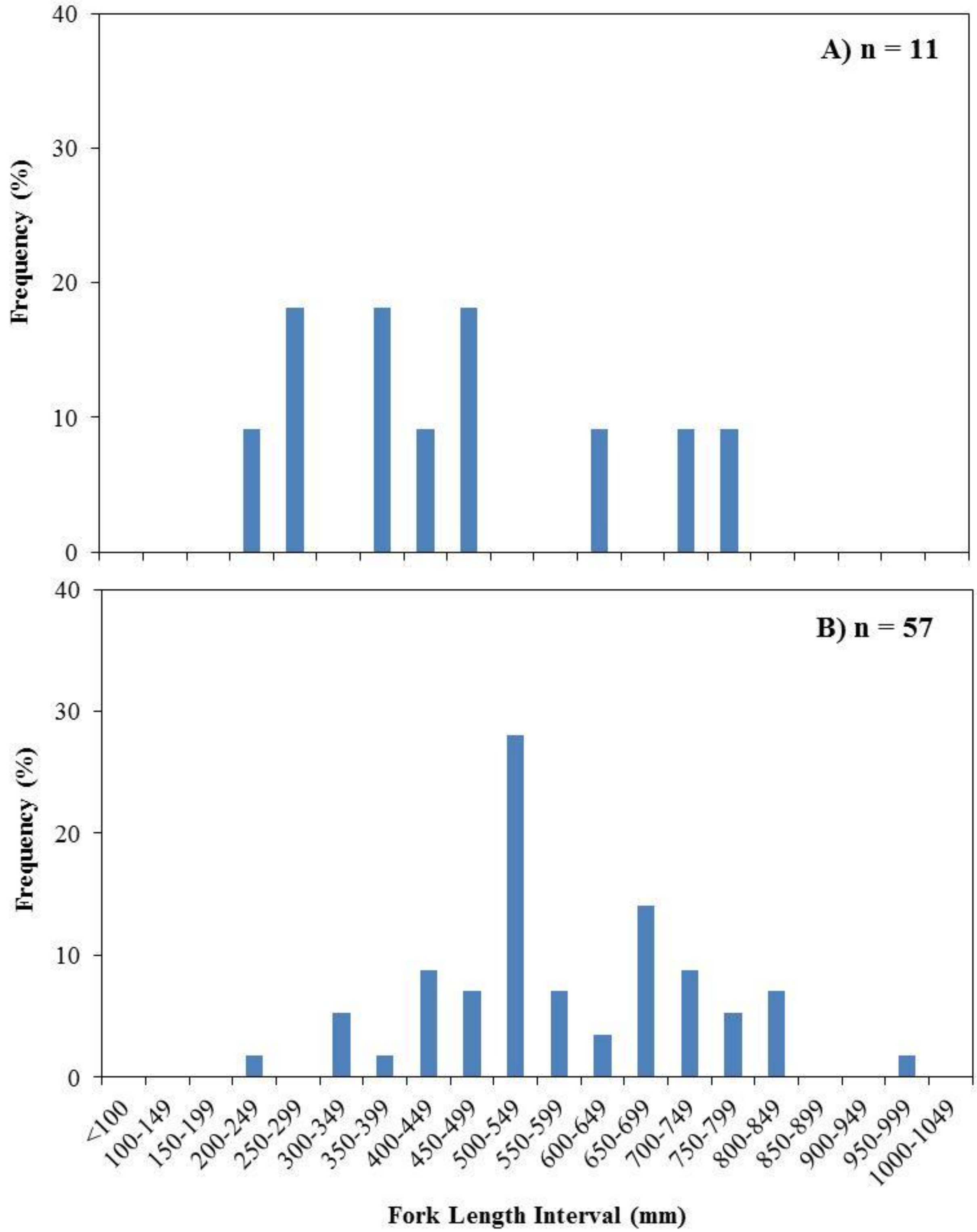


Figure 2: Length-frequency distributions for Lake Sturgeon captured in gill nets set in the Upper Split Lake Area: A) the Burntwood River and B) Split Lake, fall 2018.

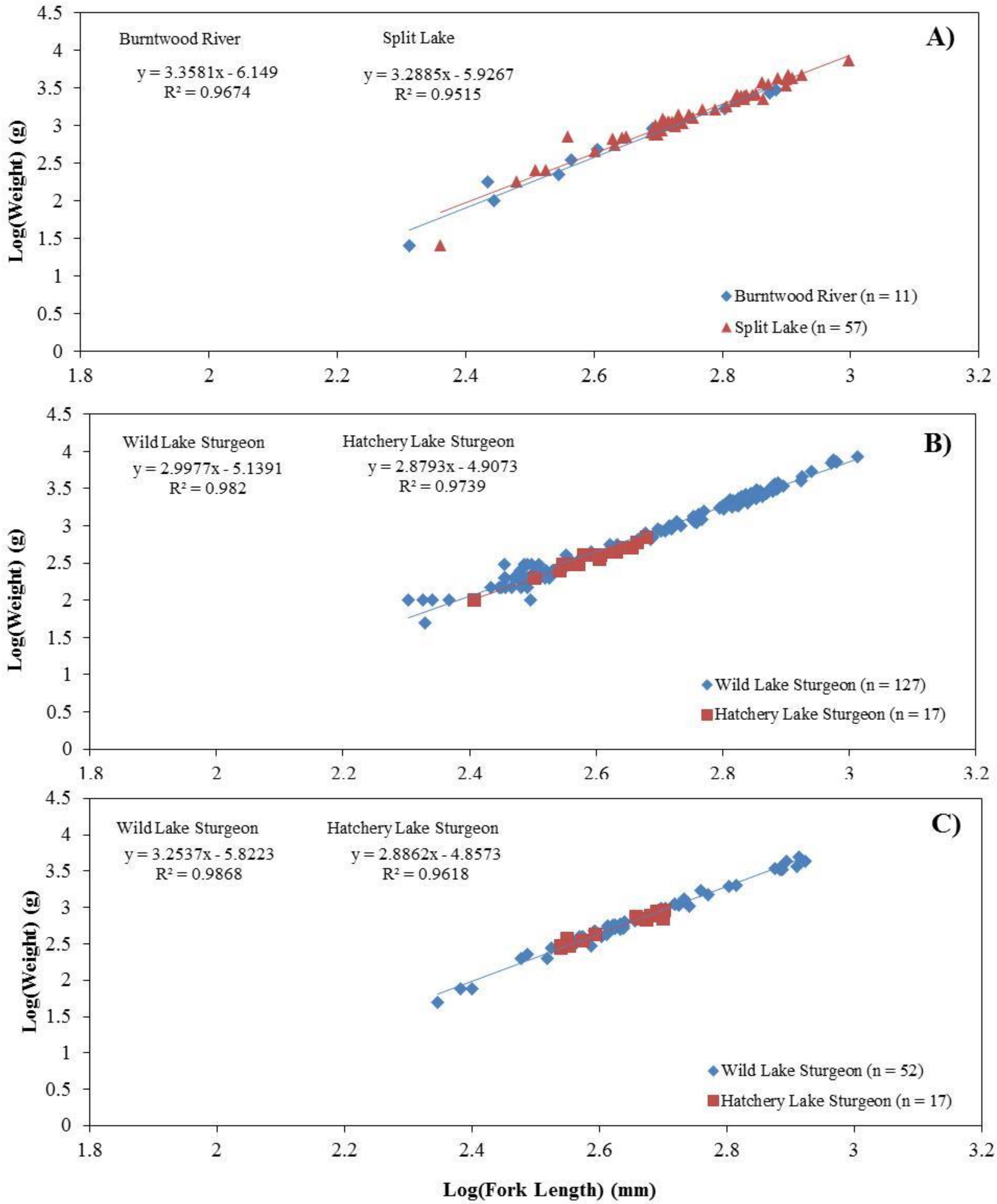


Figure 3: Comparison of weight (g) at-fork length (mm) (log transformed) for Lake Sturgeon captured in: A) the Upper Split Lake Area B) the future Keeyask reservoir and C) Stephens Lake, fall 2018. Only one hatchery-reared Lake Sturgeon was captured in Split Lake therefore hatchery and wild fish were not analysed separately in the Upper Split Lake Area (A).

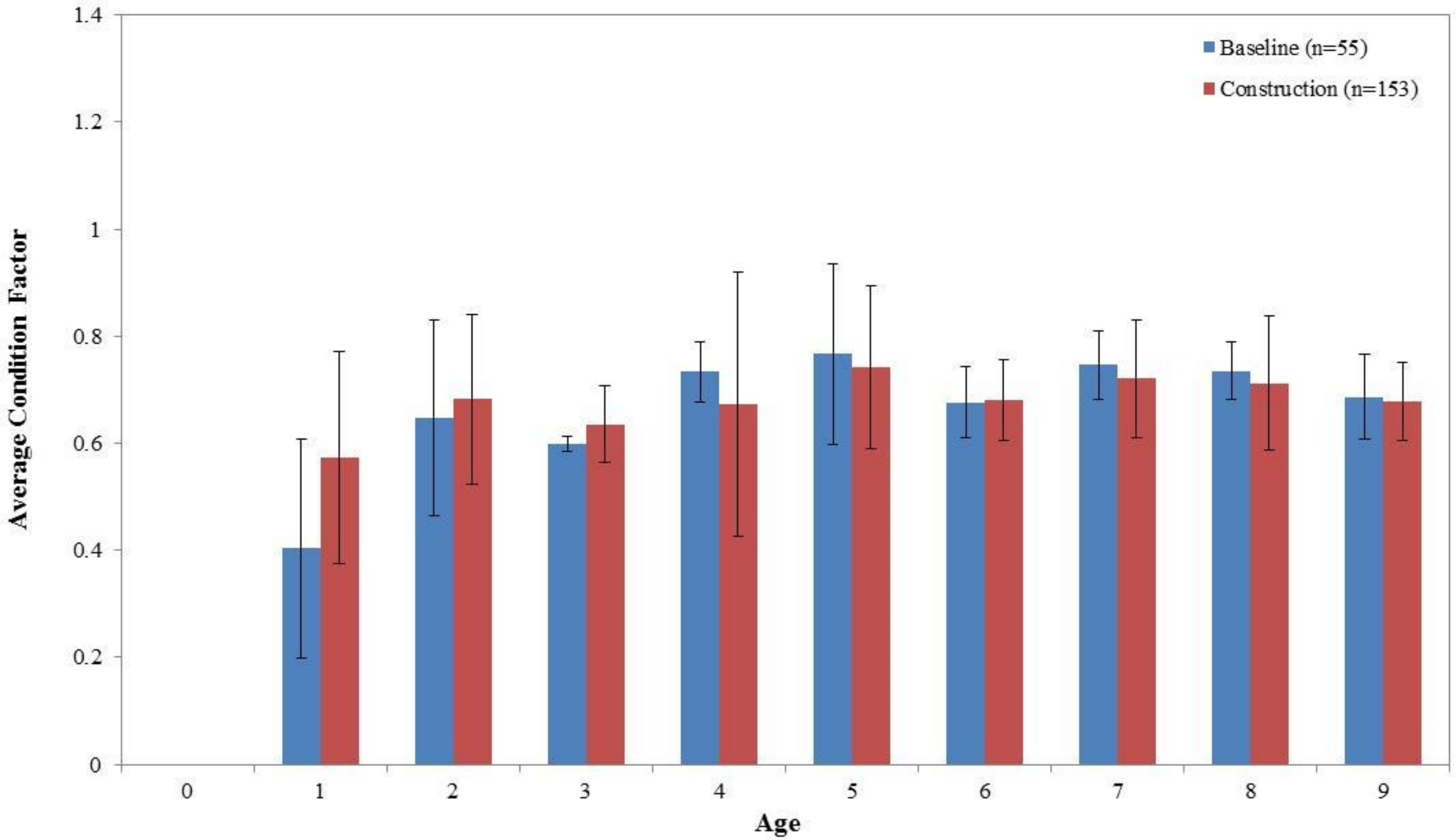


Figure 4: **Mean condition factor-at-age for Lake Sturgeon captured in the Upper Split Lake Area during baseline studies (2011–2013) and during the construction period (2014–2018). Error bars represent standard deviations. There were not enough baseline data to allow for significance testing. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).**

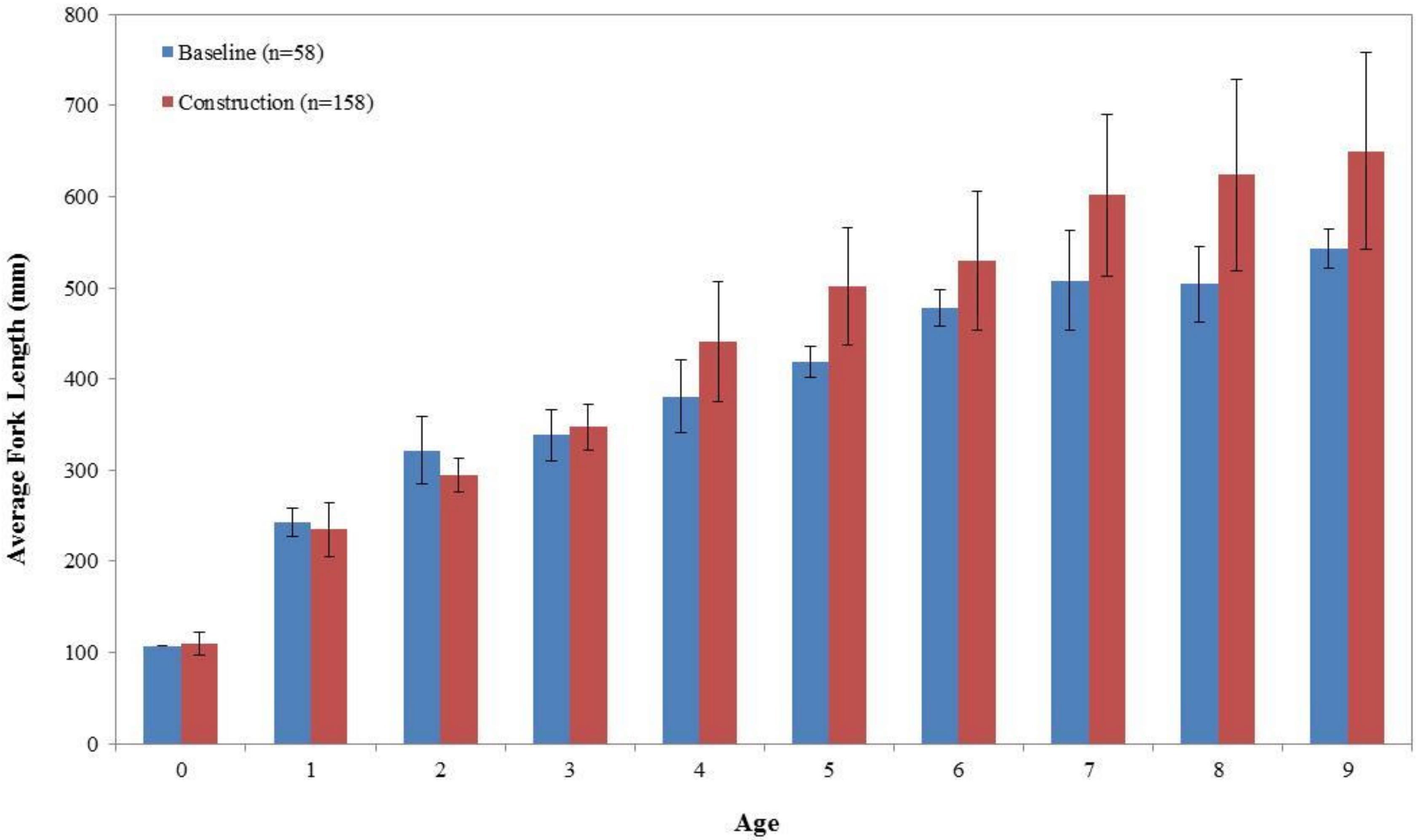


Figure 5: Mean fork length-at-age for Lake Sturgeon captured in the Upper Split Lake Area during baseline studies (2011–2013) and the construction period (2014–2018). Error bars represent standard deviations. There were not enough baseline or construction data to allow for significance testing. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).

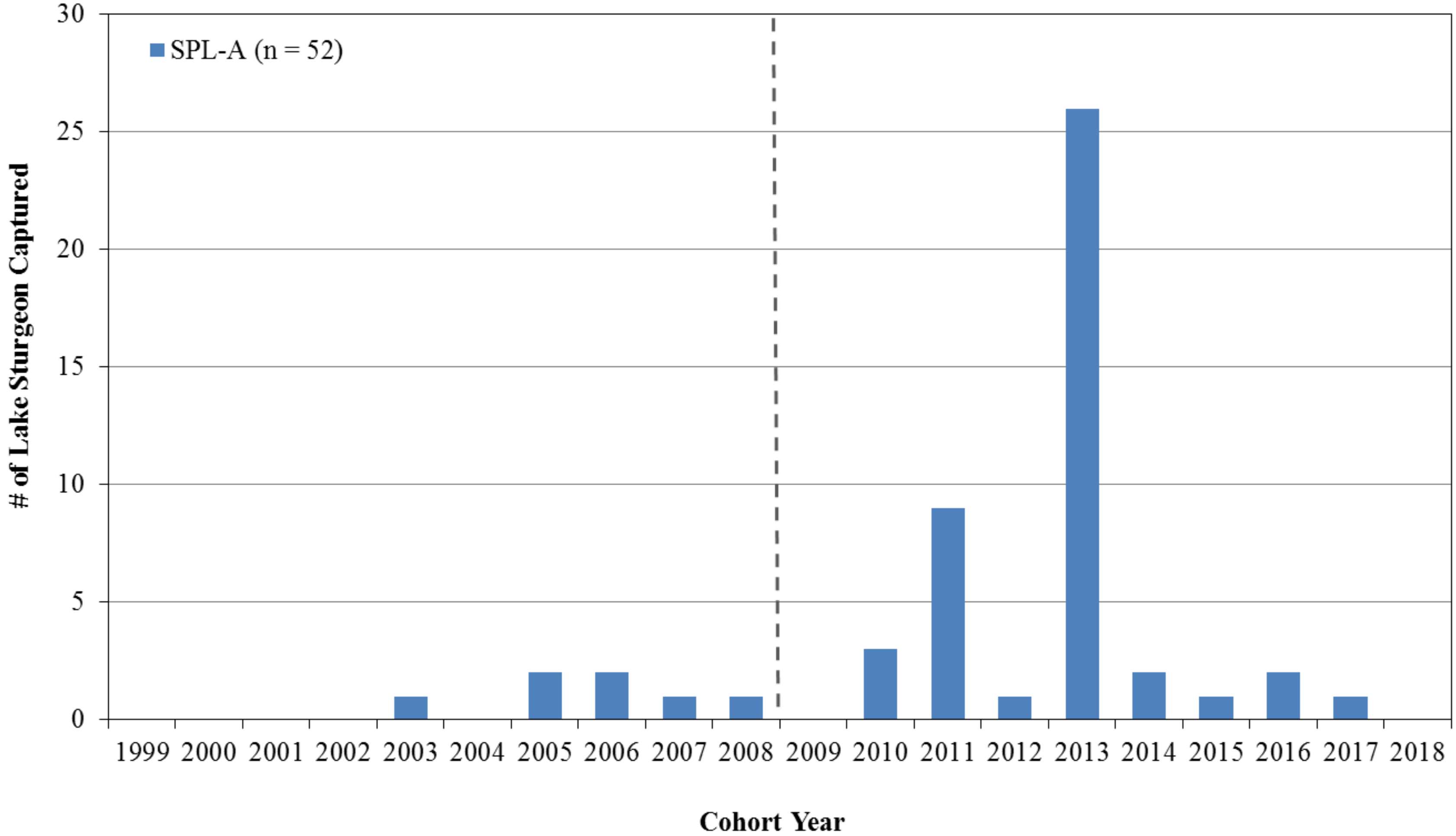


Figure 6: **Cohort frequency distributions for all aged Lake Sturgeon captured in Zone SPL-A of Split Lake, fall 2018. A single hatchery-reared fish captured in Zone SPL-A was included as part of the 2013 cohort. Cohorts prior to 2009 (*i.e.*, age-9 fish) are not fully represented as ageing structures are not collected from fish > 800 mm fork length (indicated by vertical dashed line).**

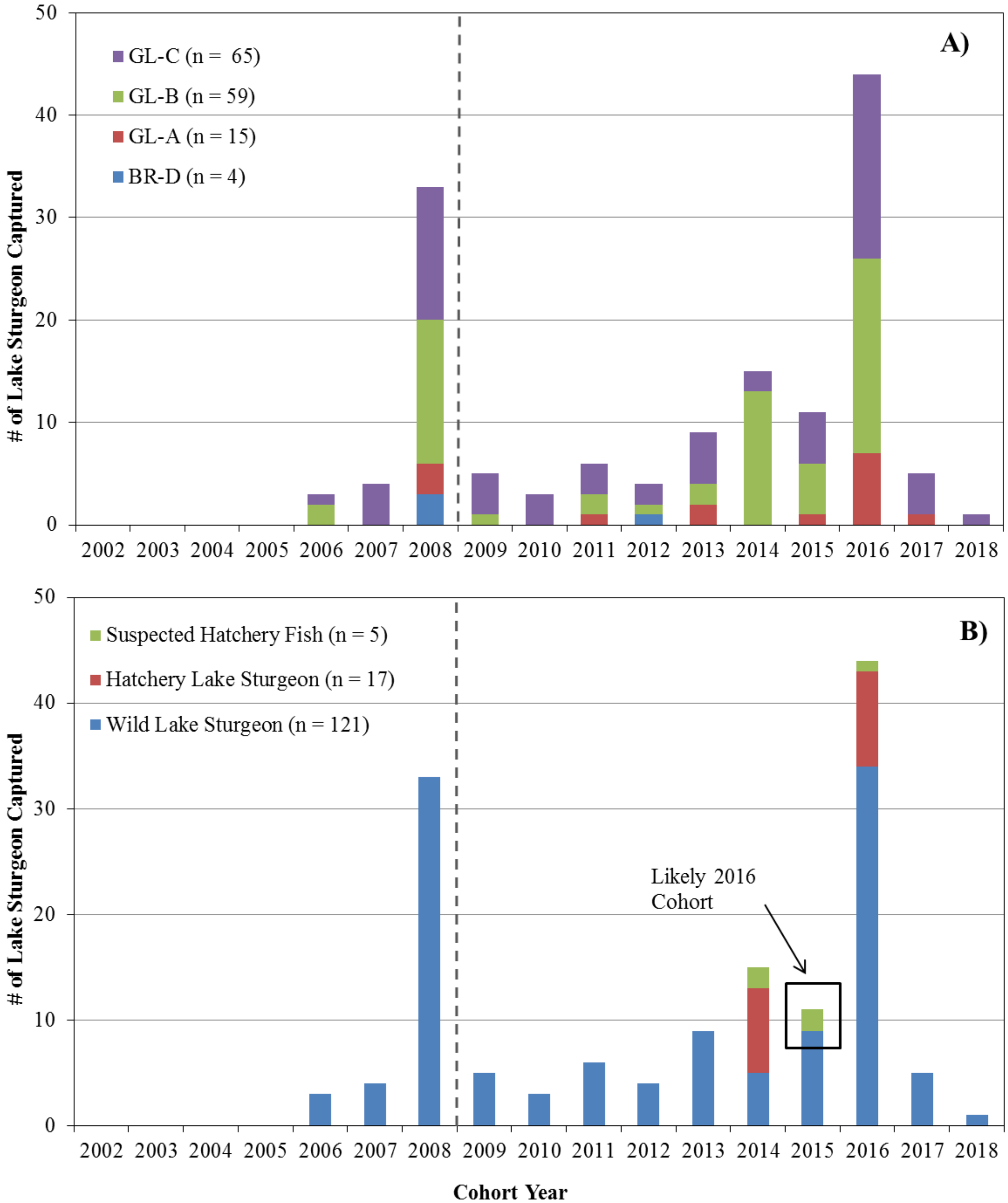


Figure 7: **Cohort frequency distributions for all aged Lake Sturgeon captured by zone in the future Keeyask reservoir (A) and by hatchery and wild Lake Sturgeon (B), fall 2018. Cohorts prior to 2009 (*i.e.*, age-9 fish) are not fully represented as ageing structures are not collected from fish > 800 mm fork length (indicated by vertical dashed line).**

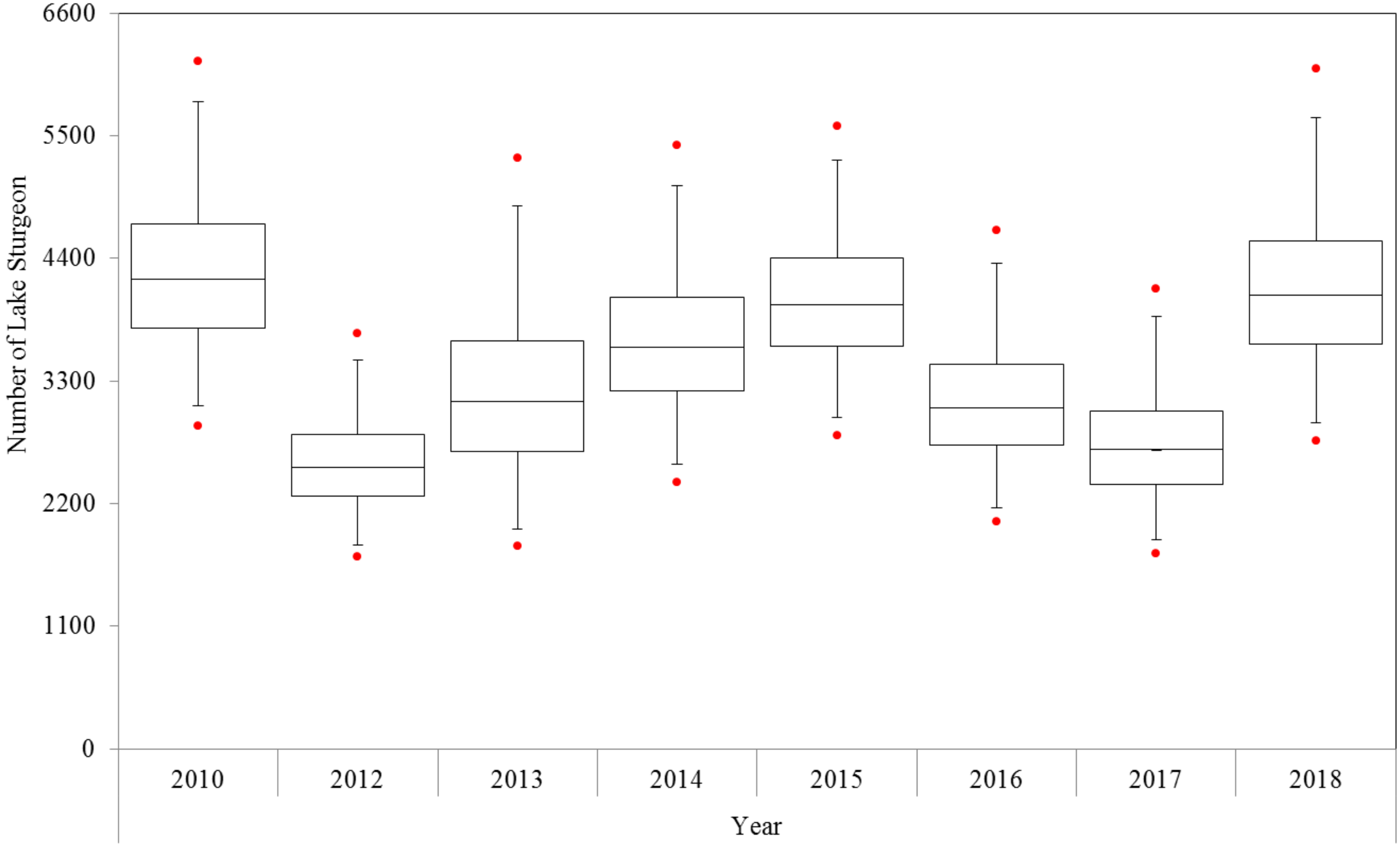


Figure 8. Juvenile Lake Sturgeon abundance (*i.e.*, fish < 800 mm fork length) estimates based on POPAN best model for the future Keeyask reservoir (2010–2018). Horizontal line inside the box represents the estimated abundance (*i.e.*, the number of juvenile Lake Sturgeon), the red dots represent the min and max estimates, and the vertical bar lines represent the upper and lower 95% confidence intervals.

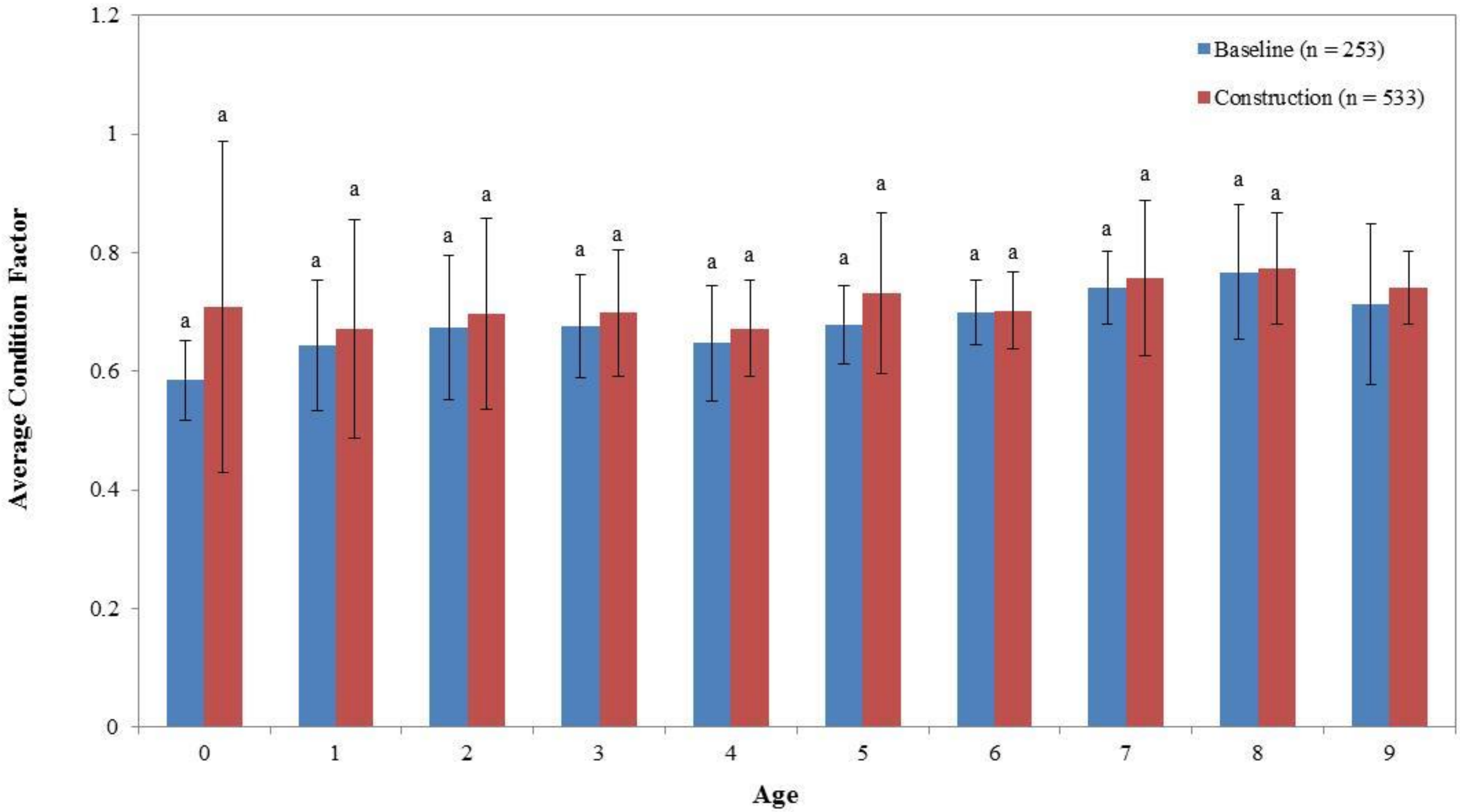


Figure 9: **Mean condition factor-at-age for wild Lake Sturgeon captured in the future Keeyask reservoir during baseline studies (2008–2013) and the construction period (2014–2018). Letters denote significant differences between groups (t-test and Mann Whitney U test, $p < 0.05$). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).**

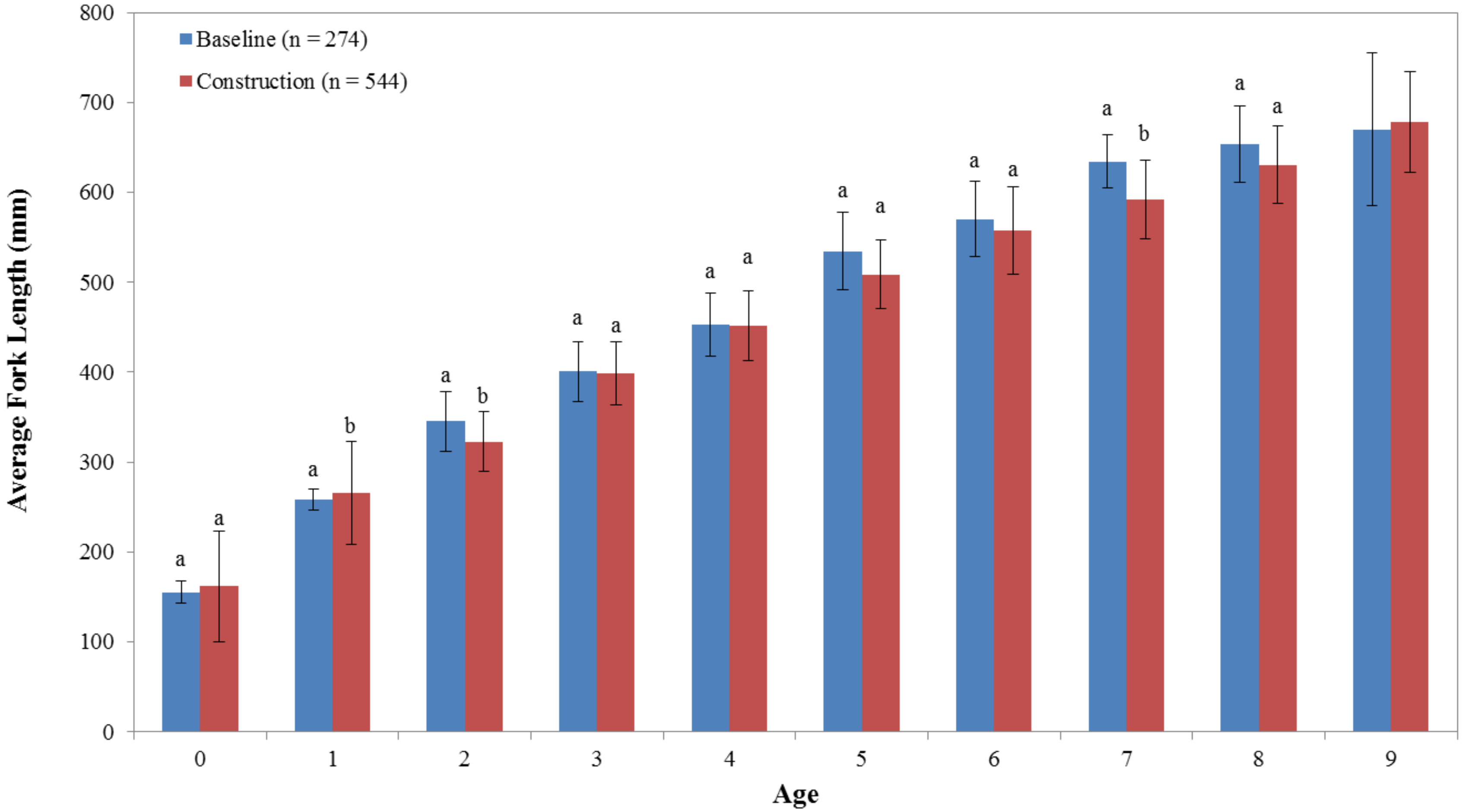


Figure 10: **Mean fork length-at-age for wild Lake Sturgeon captured in the future Keeyask reservoir during baseline studies (2008–2013) and the construction period (2014–2018). Letters denote significant differences between groups (t-test and Mann Whitney U test, $p < 0.05$). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).**

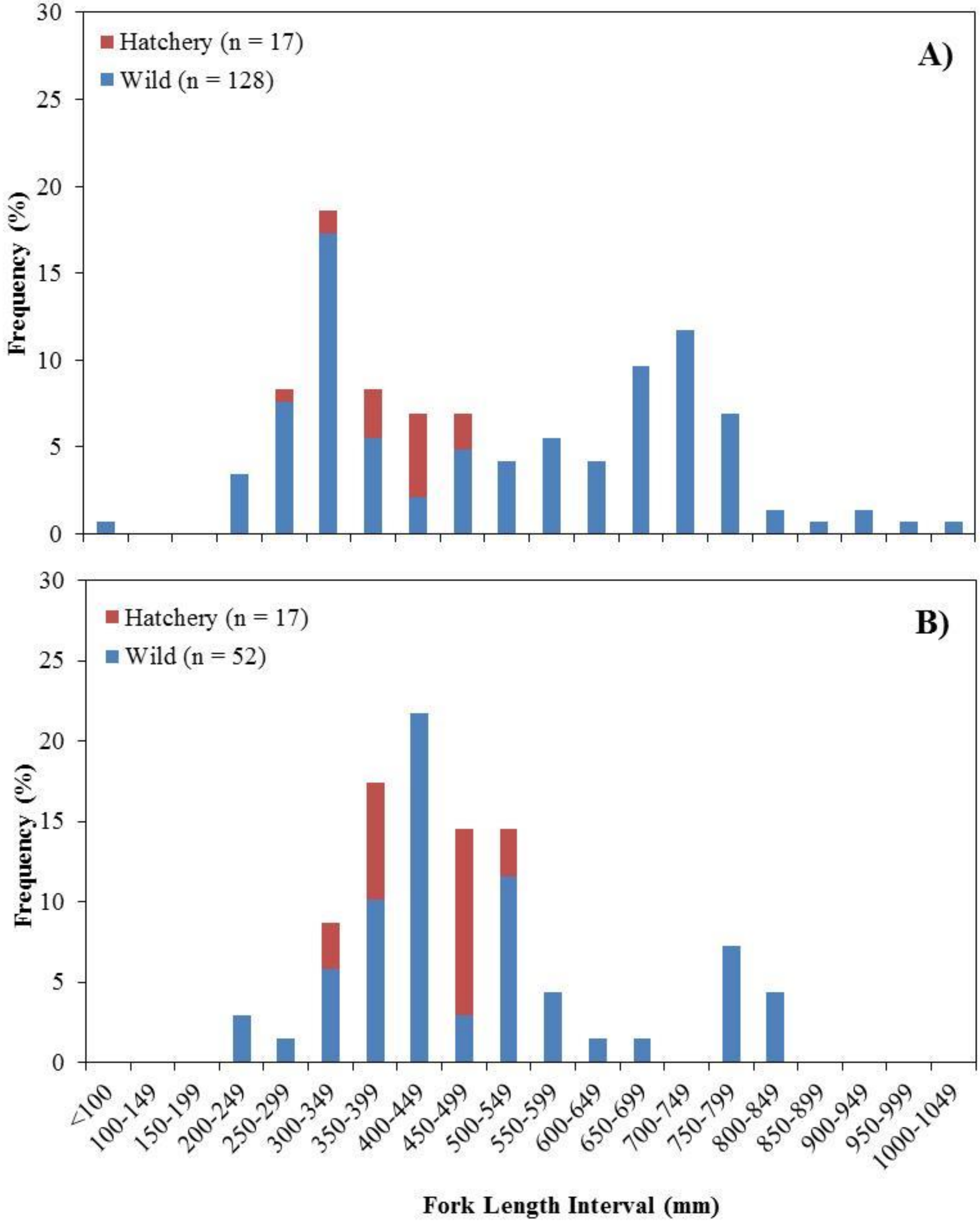


Figure 11: Fork length frequency distributions for Lake Sturgeon captured in gill nets set in: A) the future Keeyask reservoir and B) Stephens Lake, fall 2018.

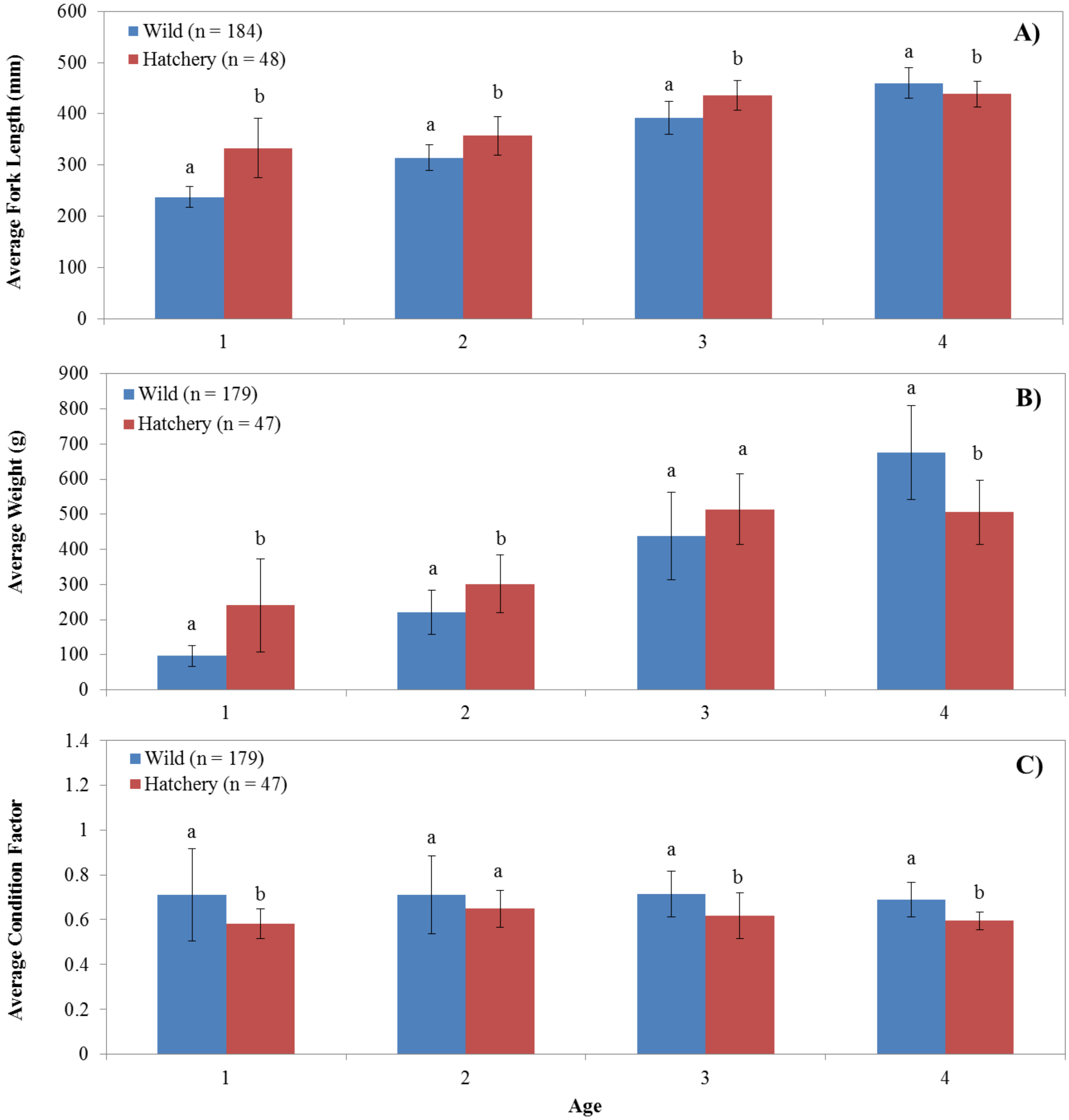


Figure 12: **Fork length-at-age (A), weight-at-age (B), and condition factor-at-age (B) for wild (blue bars) and hatchery (red bars) Lake Sturgeon caught in the future Keeyask reservoir since 2014. Letters denote significant differences between groups (Mann Whitney U test, p < 0.05). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations.**

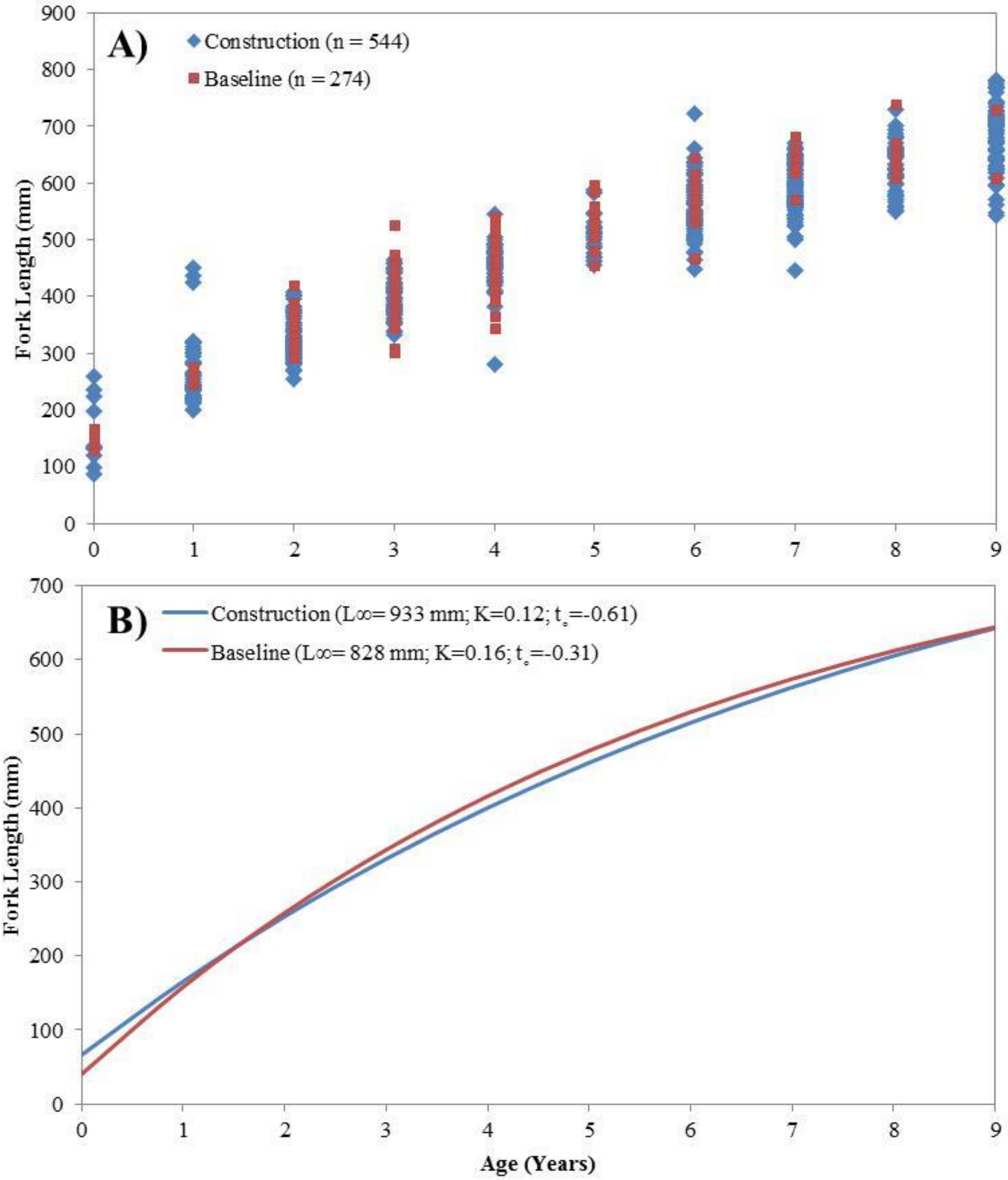


Figure 13. Fork length-at-age (A) and von Bertalanffy growth curve analysis (B) for all Lake Sturgeon caught during baseline (red; 2008–2012) and construction (blue; 2014–2018) monitoring years in the future Keeyask reservoir. Fish older that age-9 were not included in the analysis as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).

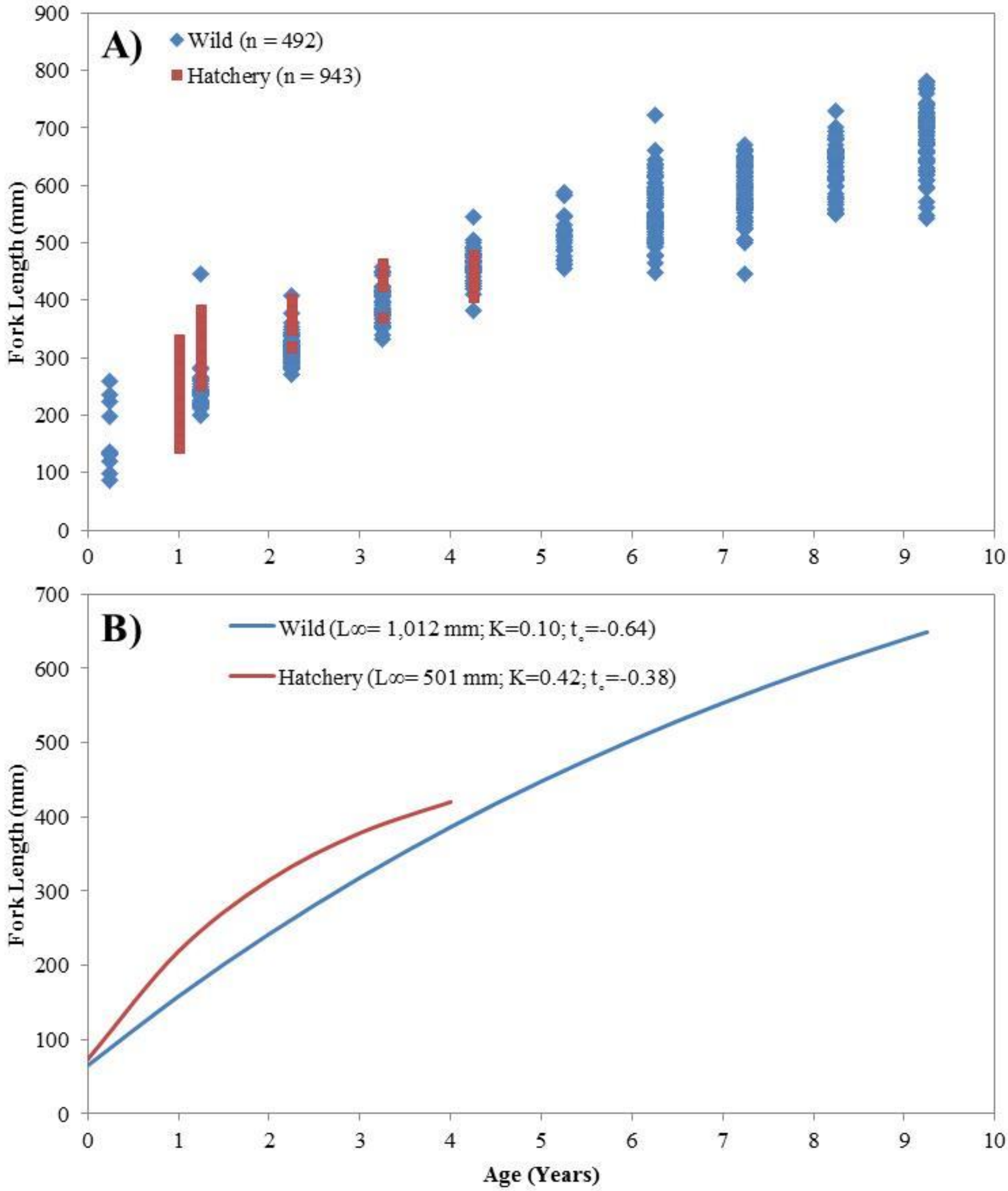


Figure 14. **Fork length-at-age (A) and von Bertalanffy growth curve analysis (B) for all wild (blue) and hatchery-reared (red) Lake Sturgeon released and/or recaptured in the future Keeyask reservoir since stocking began in 2014. Fish older that age-9 were not included in the analysis as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).**

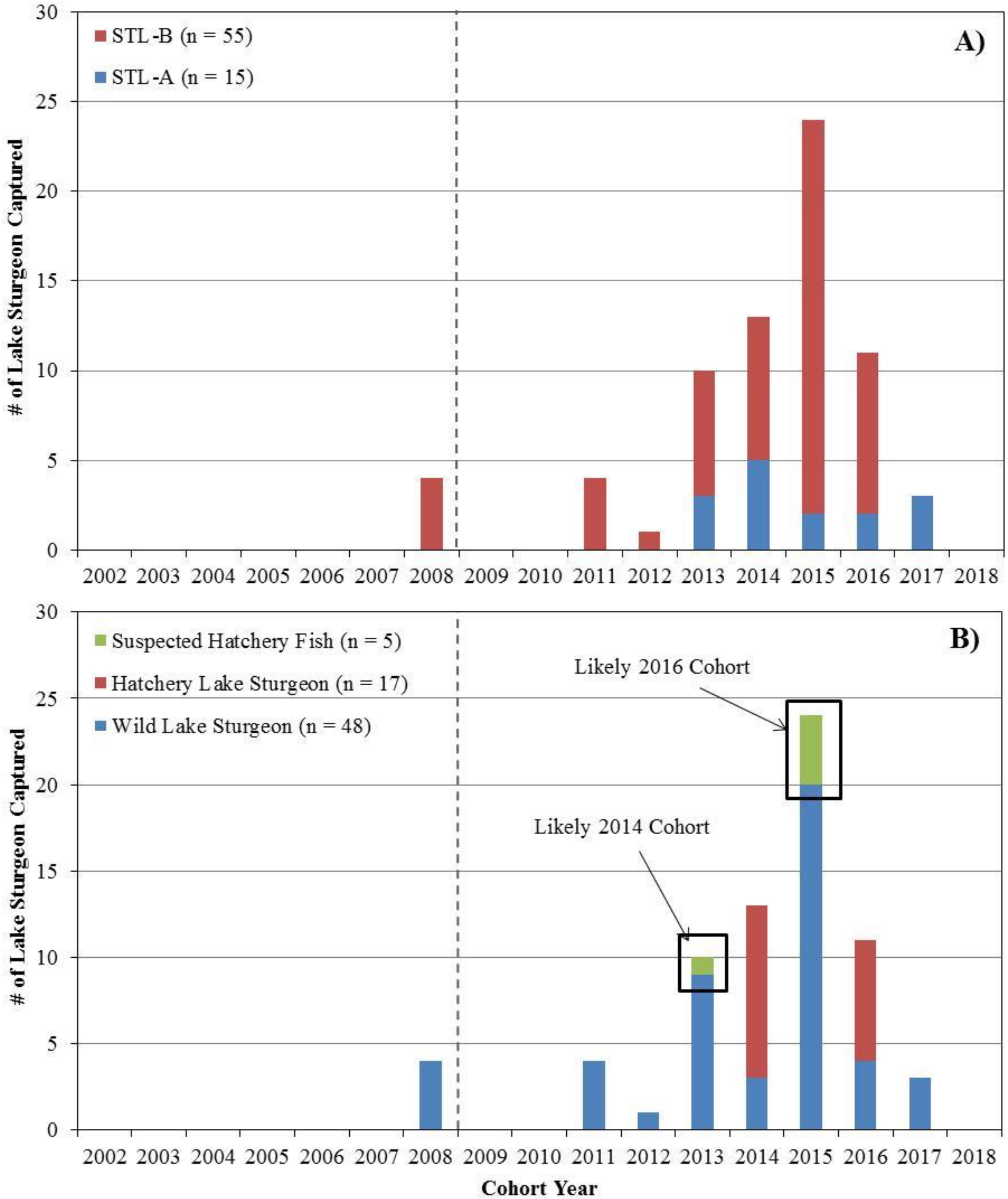


Figure 15: Cohort frequency distributions for all aged Lake Sturgeon captured in Stephens Lake by zone (A) and by hatchery and wild Lake Sturgeon (B), fall 2018. Cohorts prior to 2009 (*i.e.*, age-9 fish) are not fully represented as ageing structures are not collected from fish > 800 mm fork length (indicated by vertical dashed line).

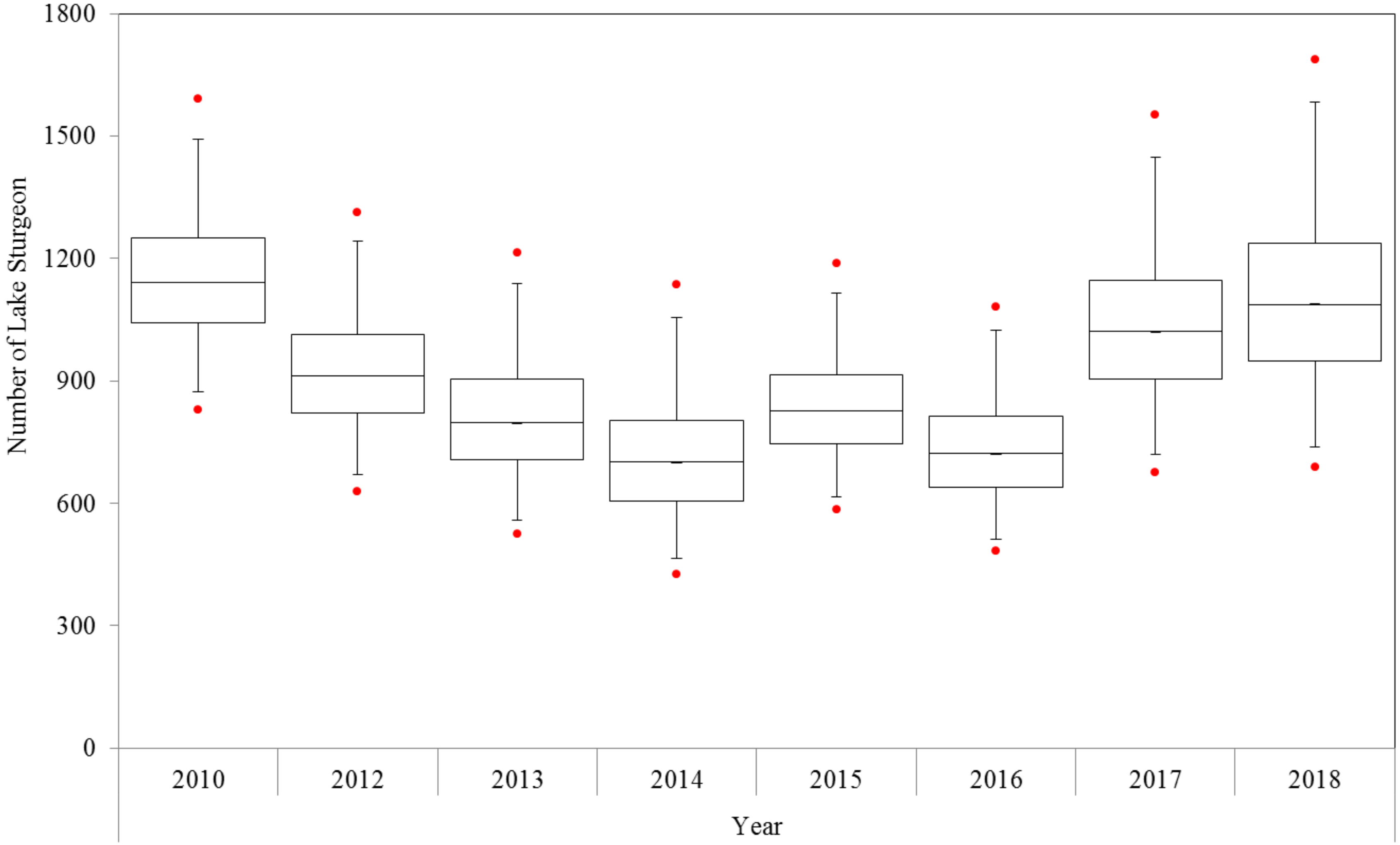


Figure 16. Juvenile Lake Sturgeon abundance estimates based on POPAN best model for Stephens Lake (2010–2018). Results of the POPAN abundance estimate are presented in black. Horizontal line inside the box represents the estimated abundance (*i.e.*, the number of juvenile Lake Sturgeon), the red dots represent the min and max estimates, and the vertical bar lines represent the upper and lower 95% confidence intervals.

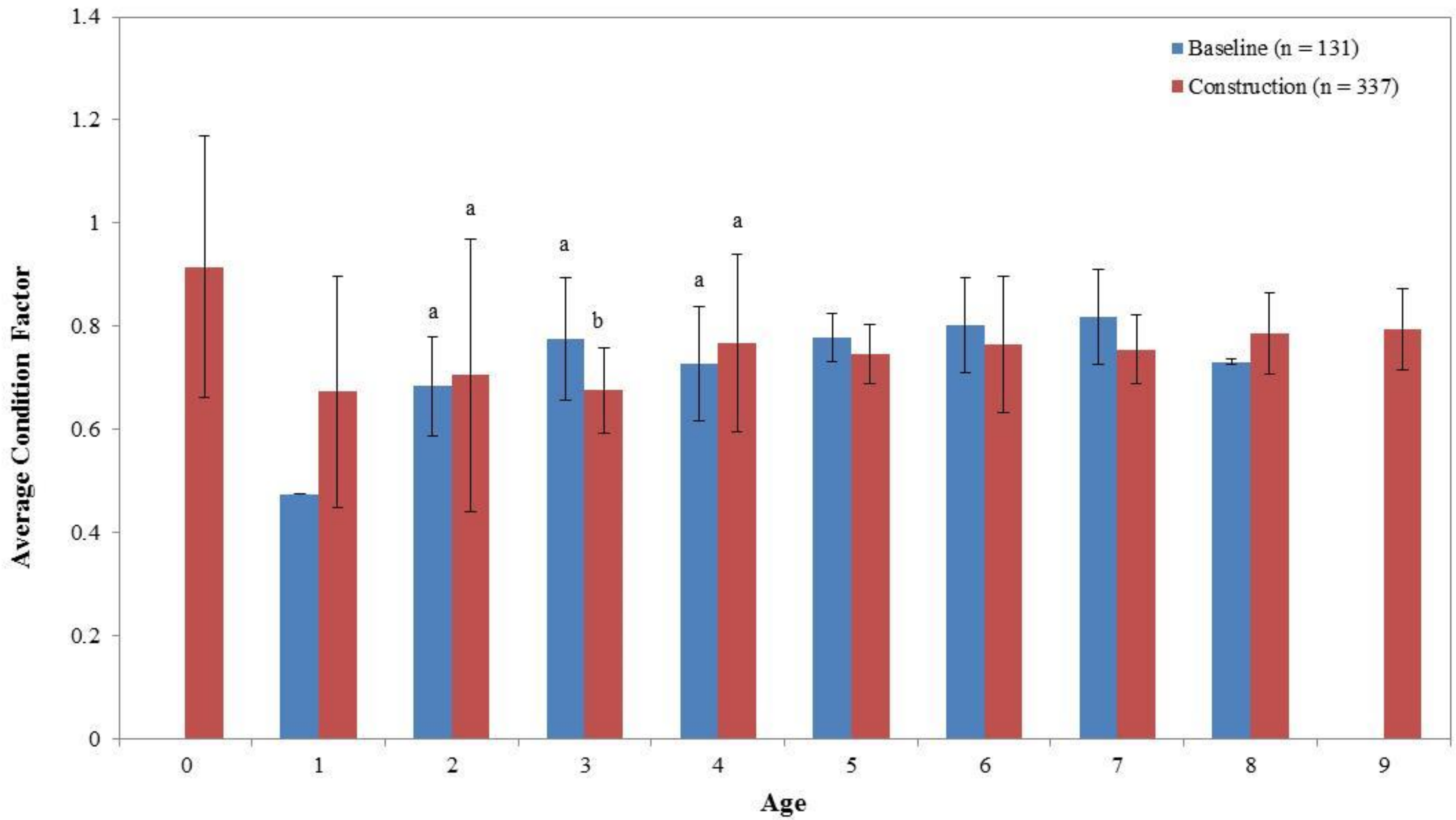


Figure 17: Mean condition factor-at-age for Lake Sturgeon captured in Stephens Lake during baseline studies (2008–2013) and the construction period (2014–2018). Letters denote significant differences between groups (t-test and Mann Whitney U test, $p < 0.05$). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).

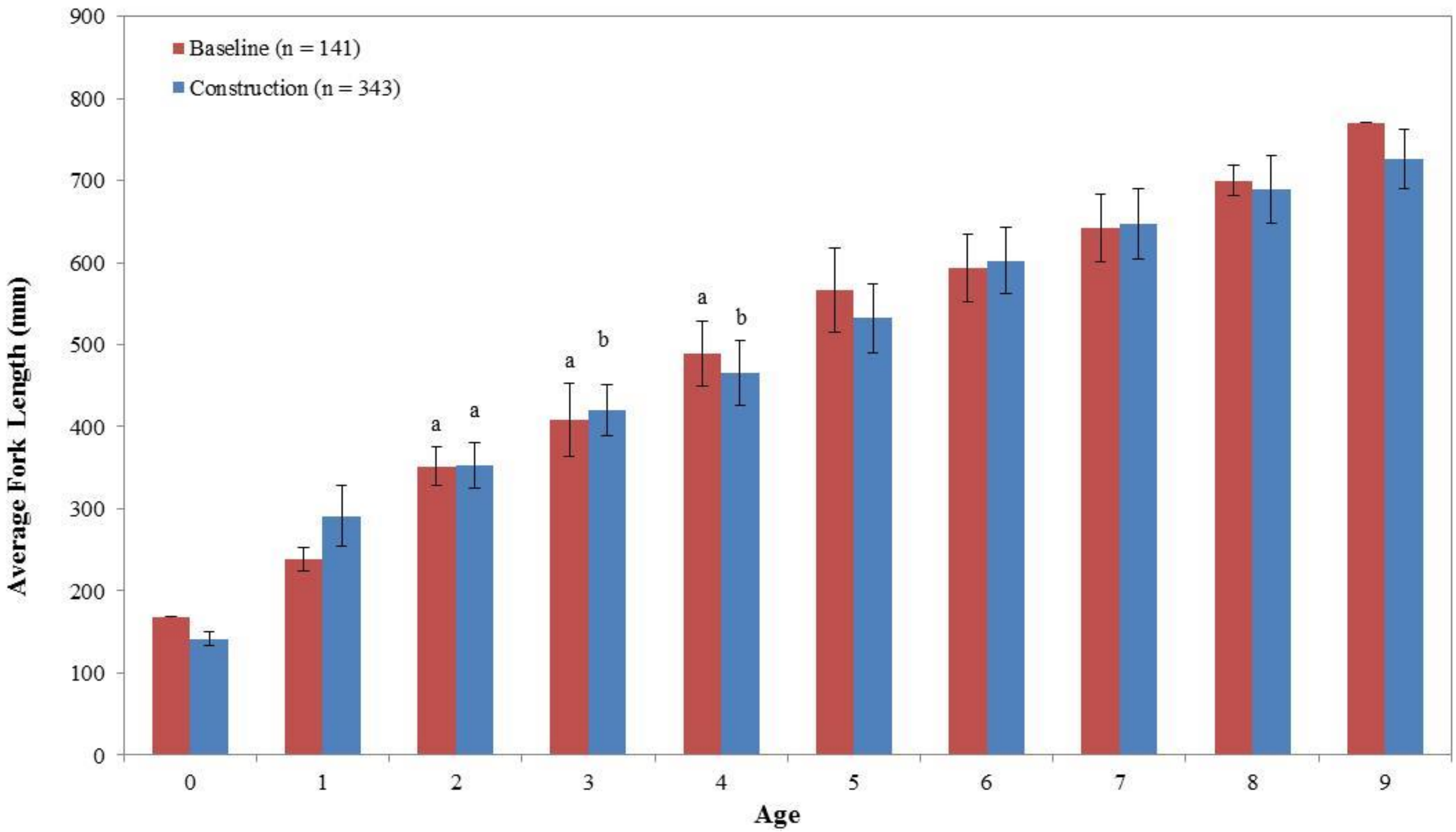


Figure 18: Mean fork length-at-age for wild Lake Sturgeon captured in Stephens Lake during baseline studies (2008–2013) and the construction period (2014–2018). Letters denote significant differences between groups (t-test and Mann Whitney U test, $p < 0.05$). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations. Fish older that age-9 were not included as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).

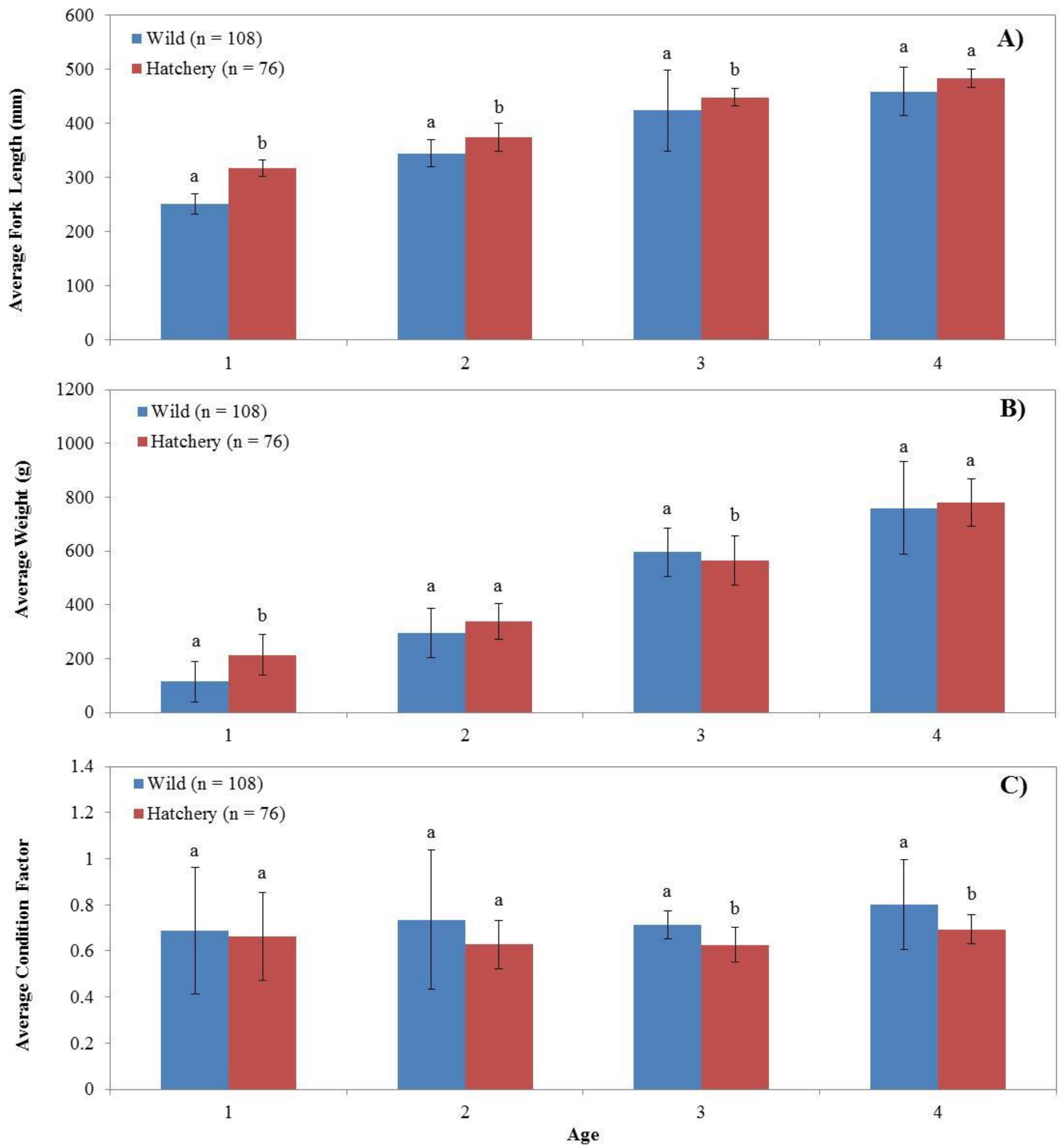


Figure 19: **Fork length-at-age (A), weight-at-age (B), and condition factor-at-age (B) for wild (blue bars) and hatchery (red bars) Lake Sturgeon caught in Stephens Lake since 2014. Letters denote significant differences between groups (t-test and Mann Whitney U test, $p < 0.05$). Statistical comparisons only conducted where sample sizes were greater than eight individuals. Error bars represent standard deviations.**

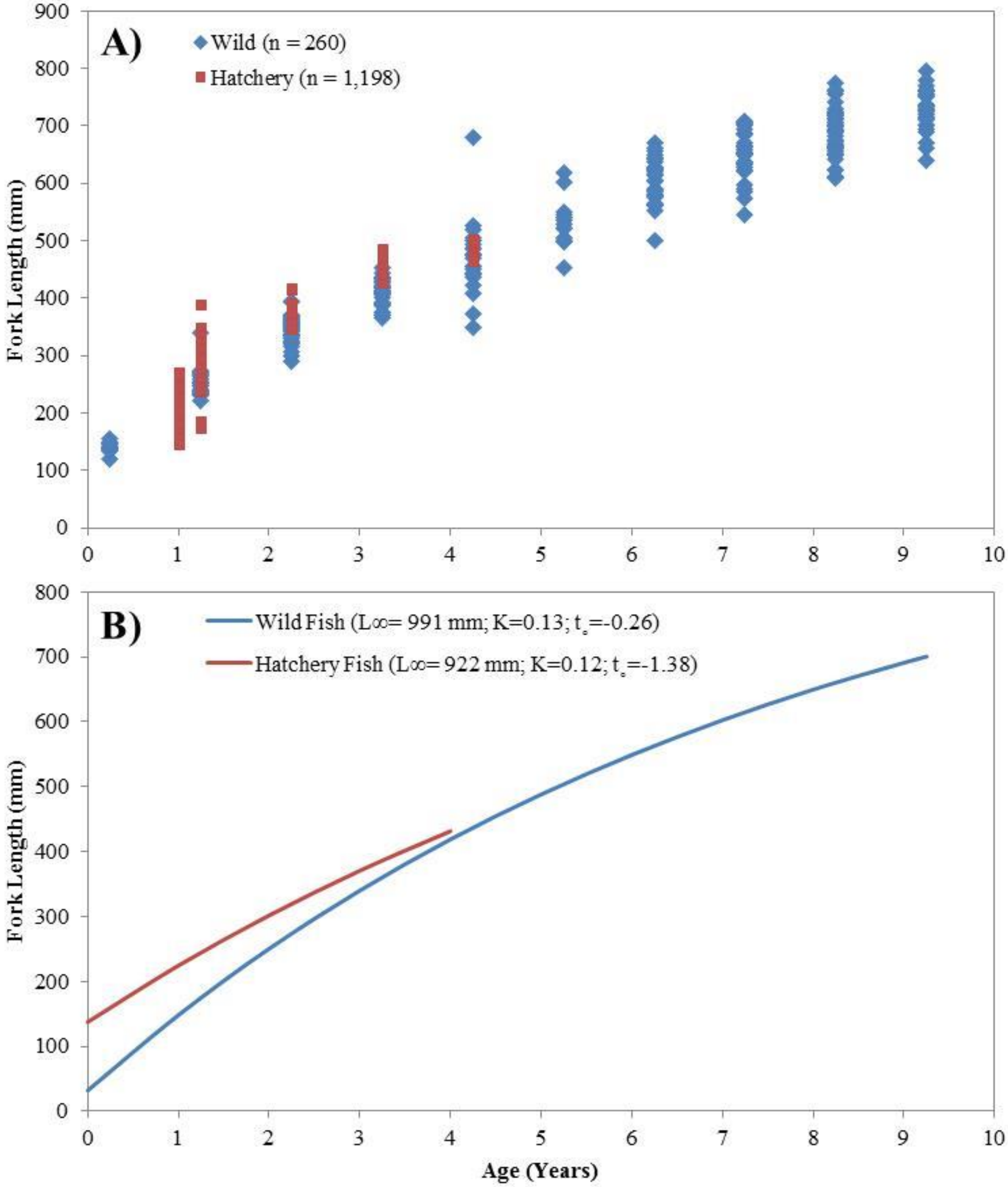
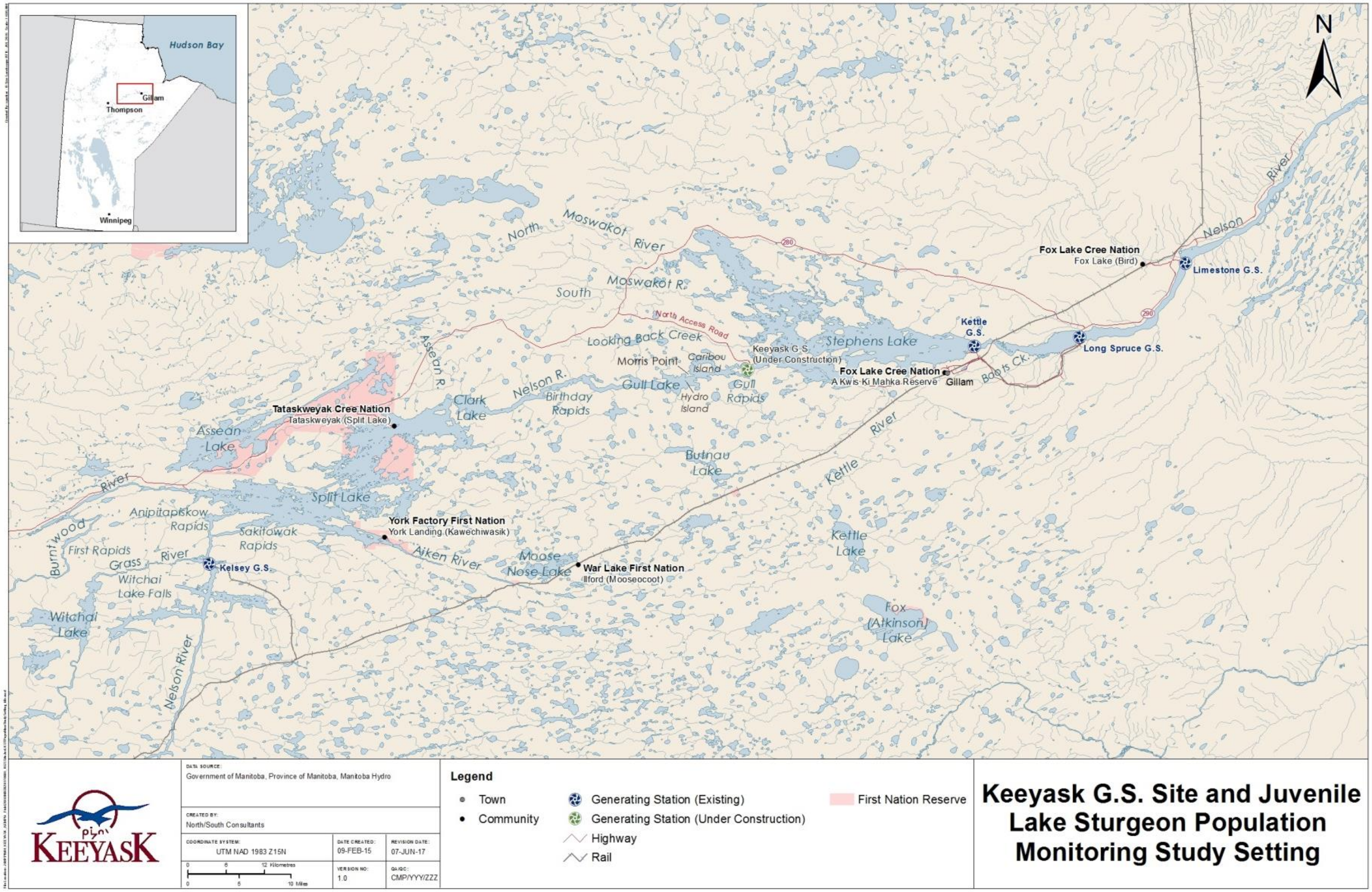
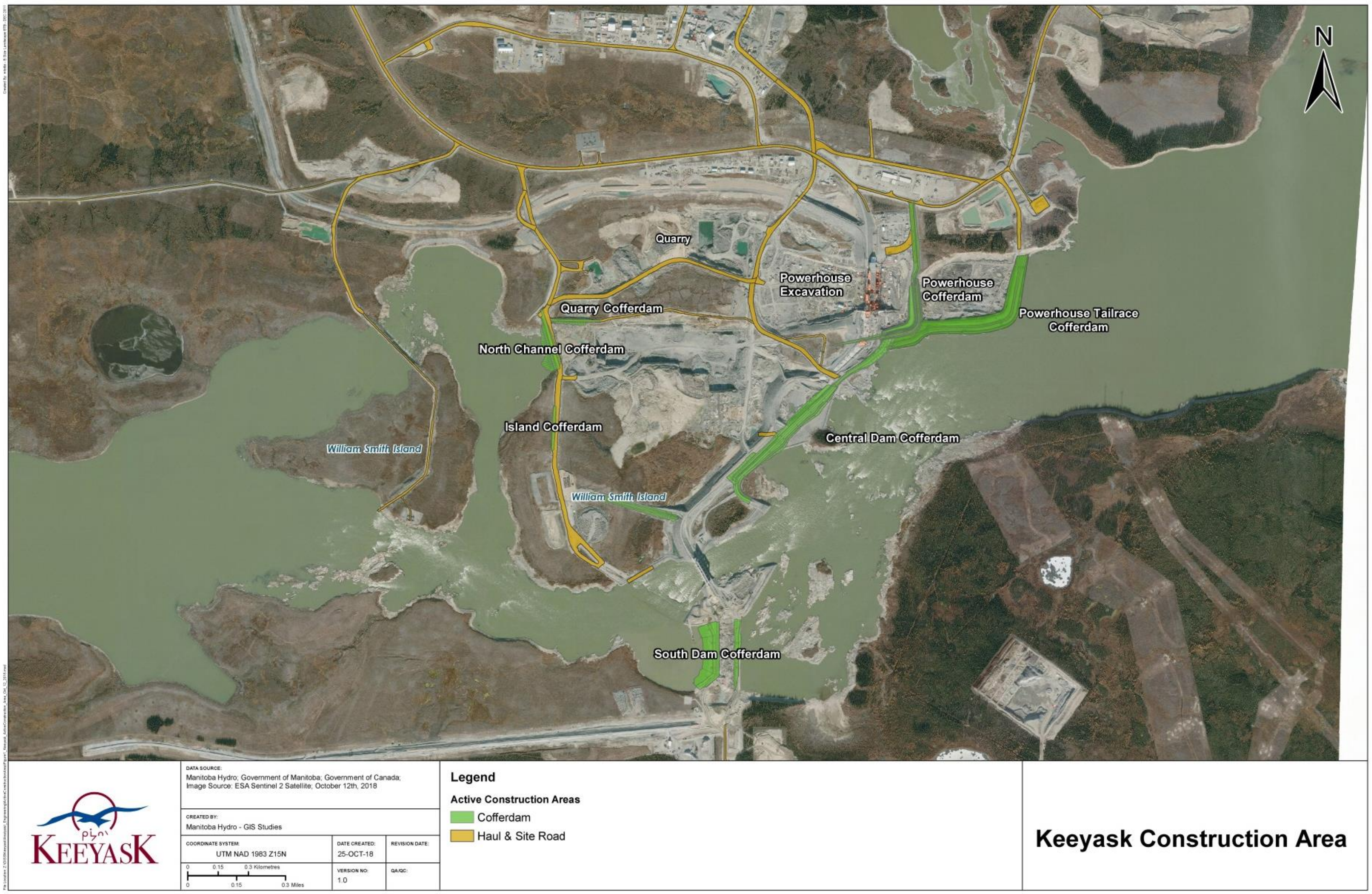


Figure 20. Fork length-at-age (A) and von Bertalanffy growth curve analysis (B) for all wild (blue) and hatchery-reared (red) Lake Sturgeon released and/or recaptured in Stephens Lake since stocking began in 2014. Fish older that age-9 were not included in the analysis as they are not fully represented in the catch (ageing structures are not collected from fish > 800 mm fork length, which corresponds to fish older than age-9).

MAPS

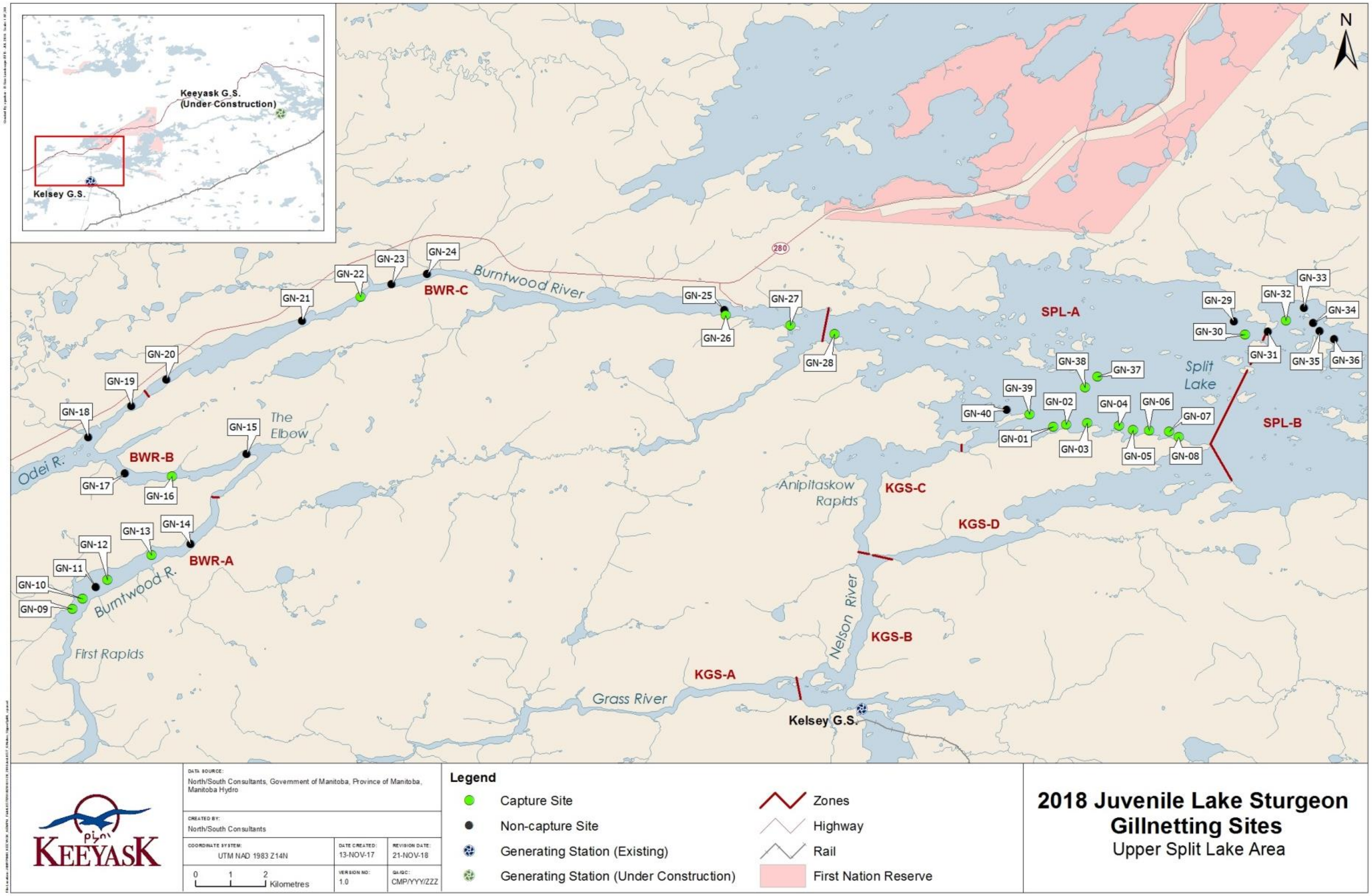


Map 1: Map of Nelson River showing the site of Keeyask Generating Station and the juvenile Lake Sturgeon population monitoring study setting.

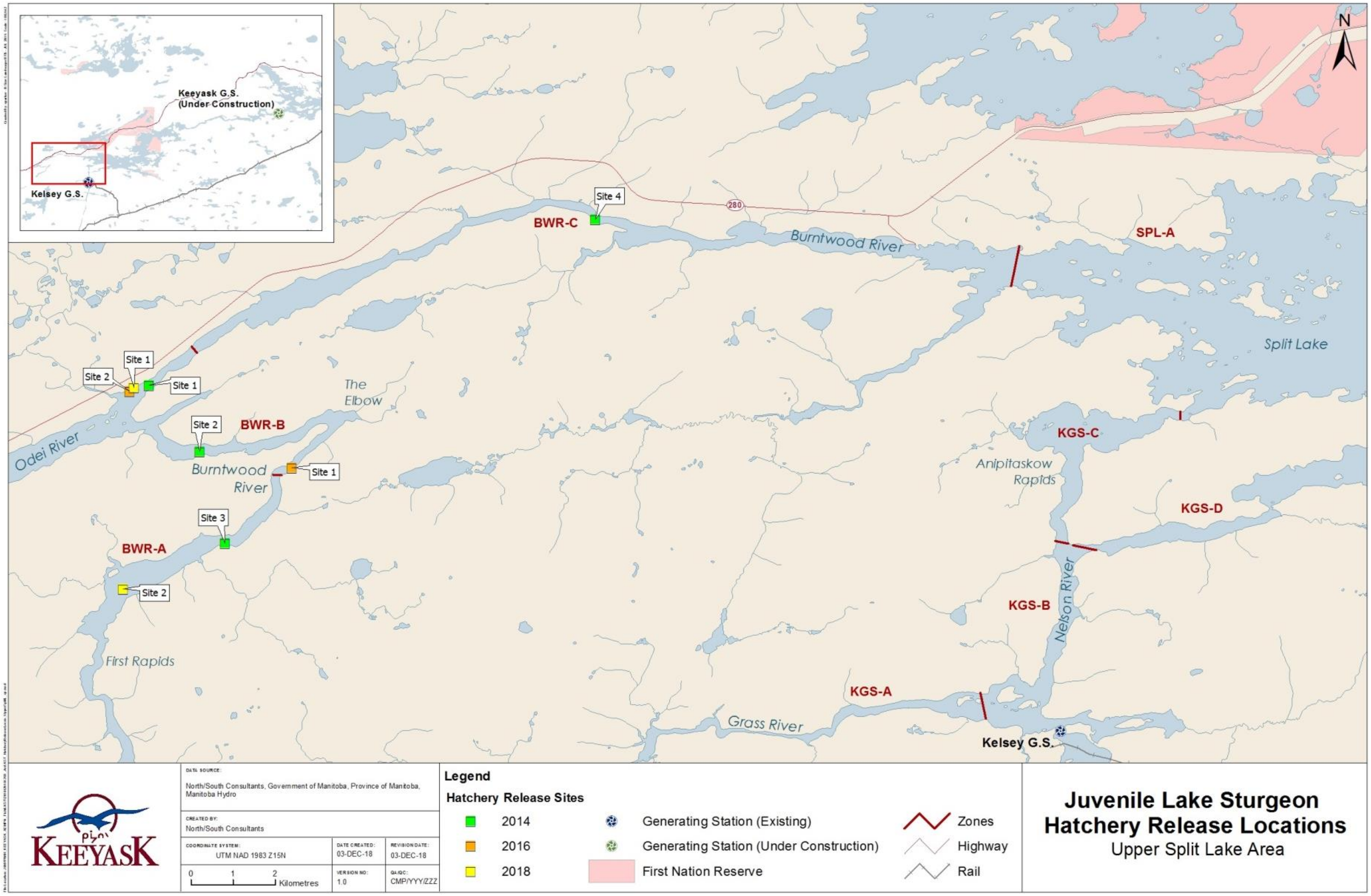


Satellite Imagery - October 12th, 2018

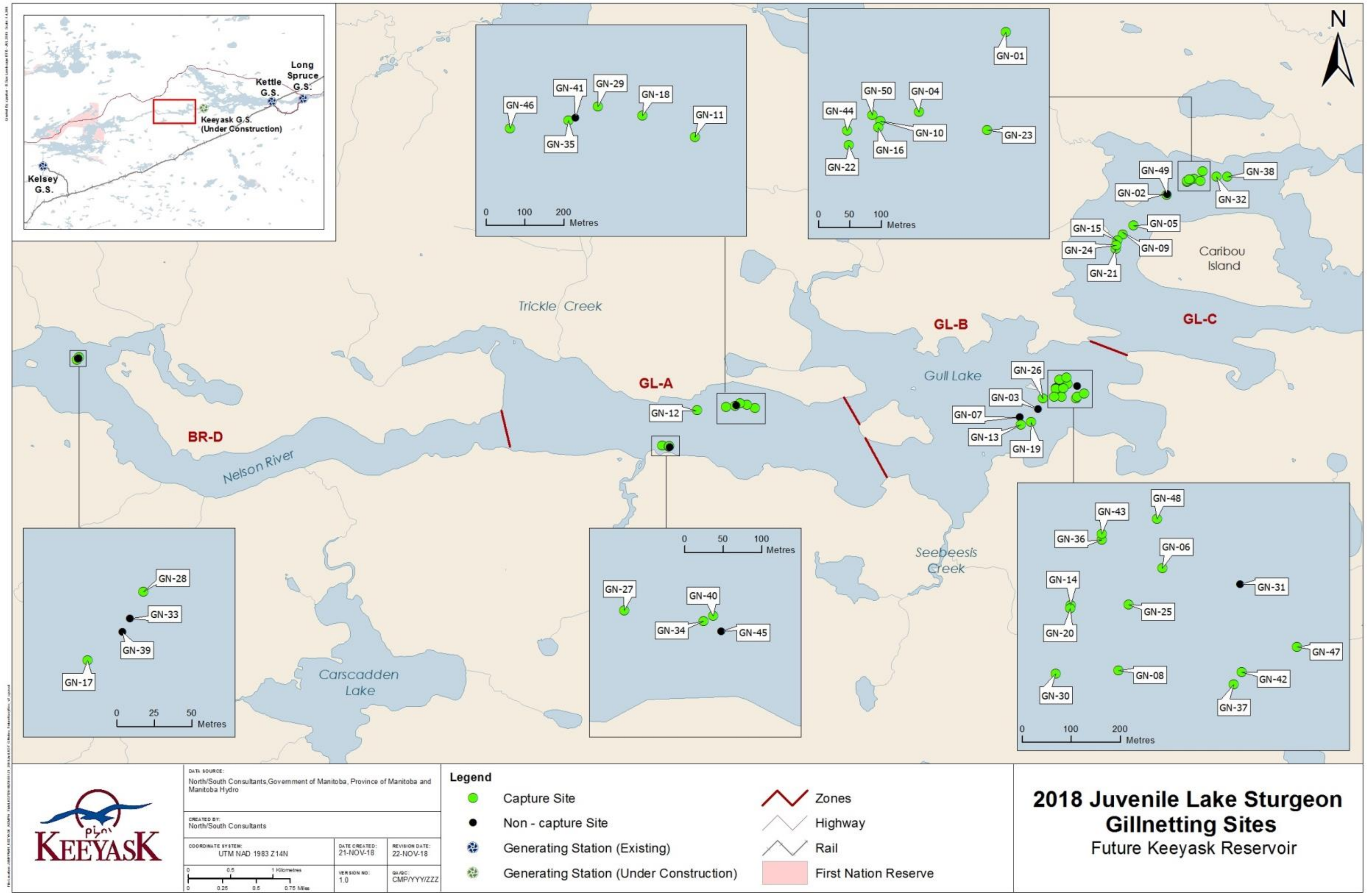
Map 2: Map of instream structures at the Keeyask Generating Station site, October, 2018.



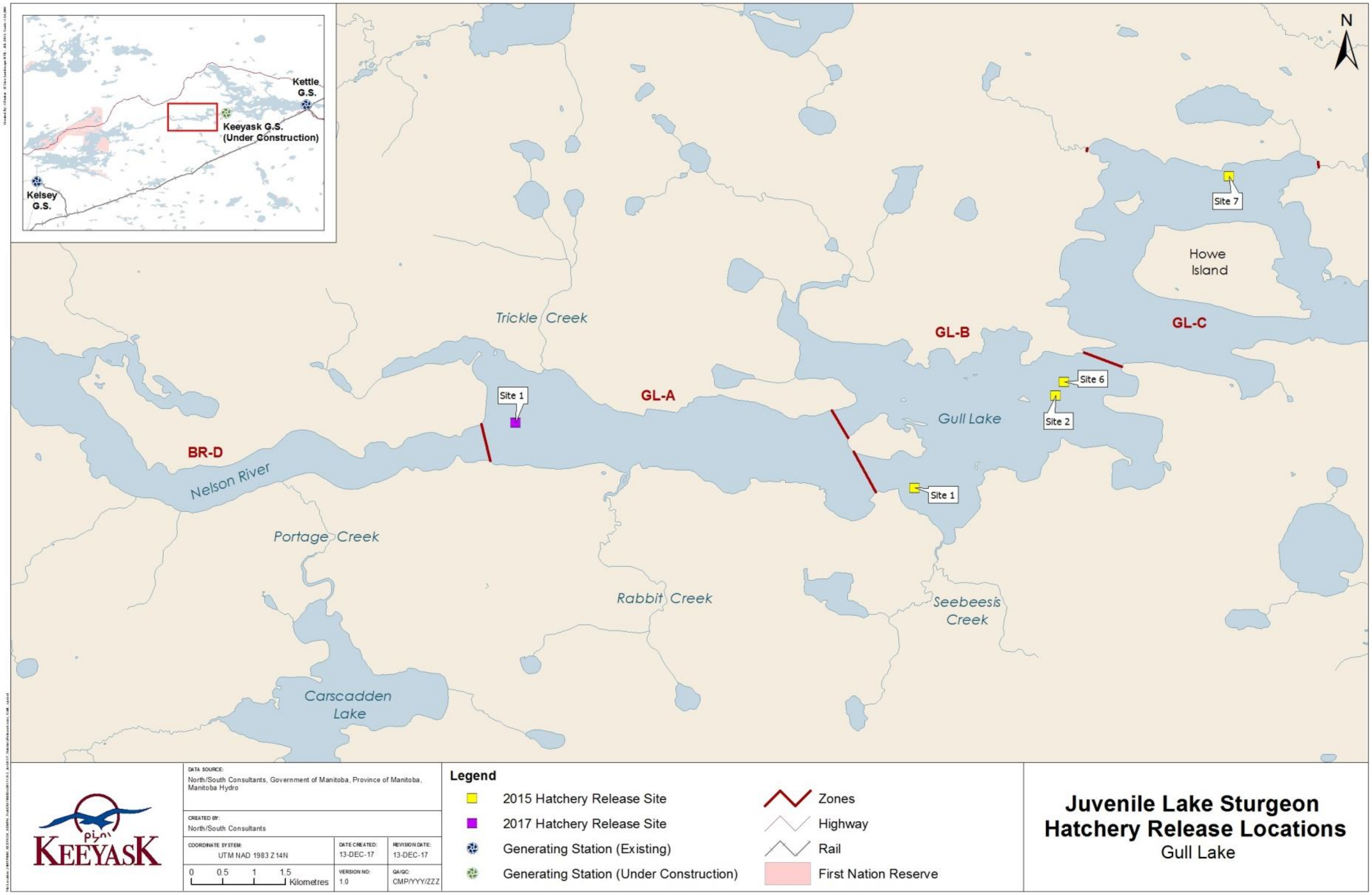
Map 3: Map of sites fished with gill nets in the Upper Split Lake Area (Burntwood River and Split Lake), fall 2018.



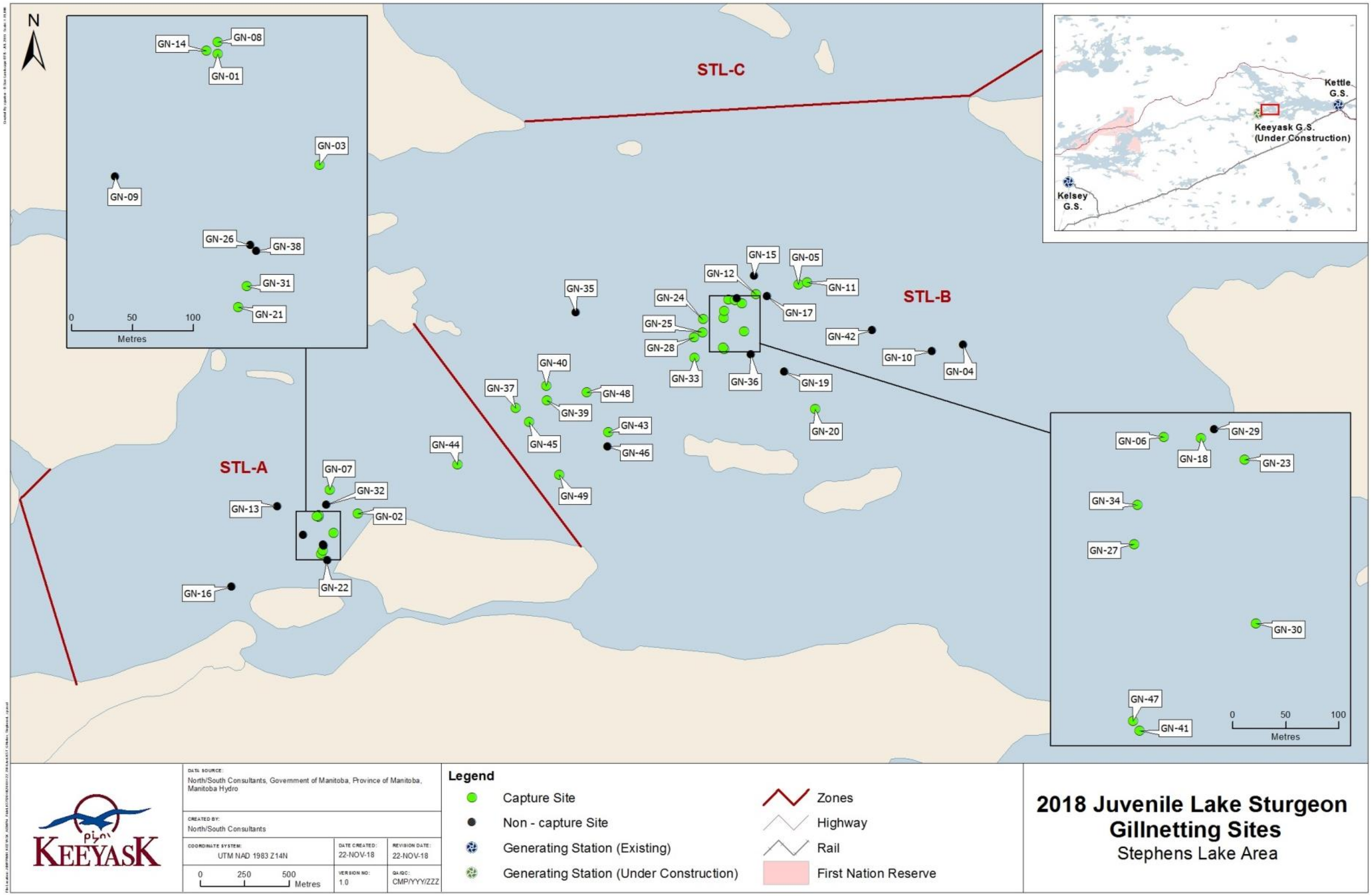
Map 4: Map of Lake Sturgeon yearling stocking sites in the Burntwood River since 2014.



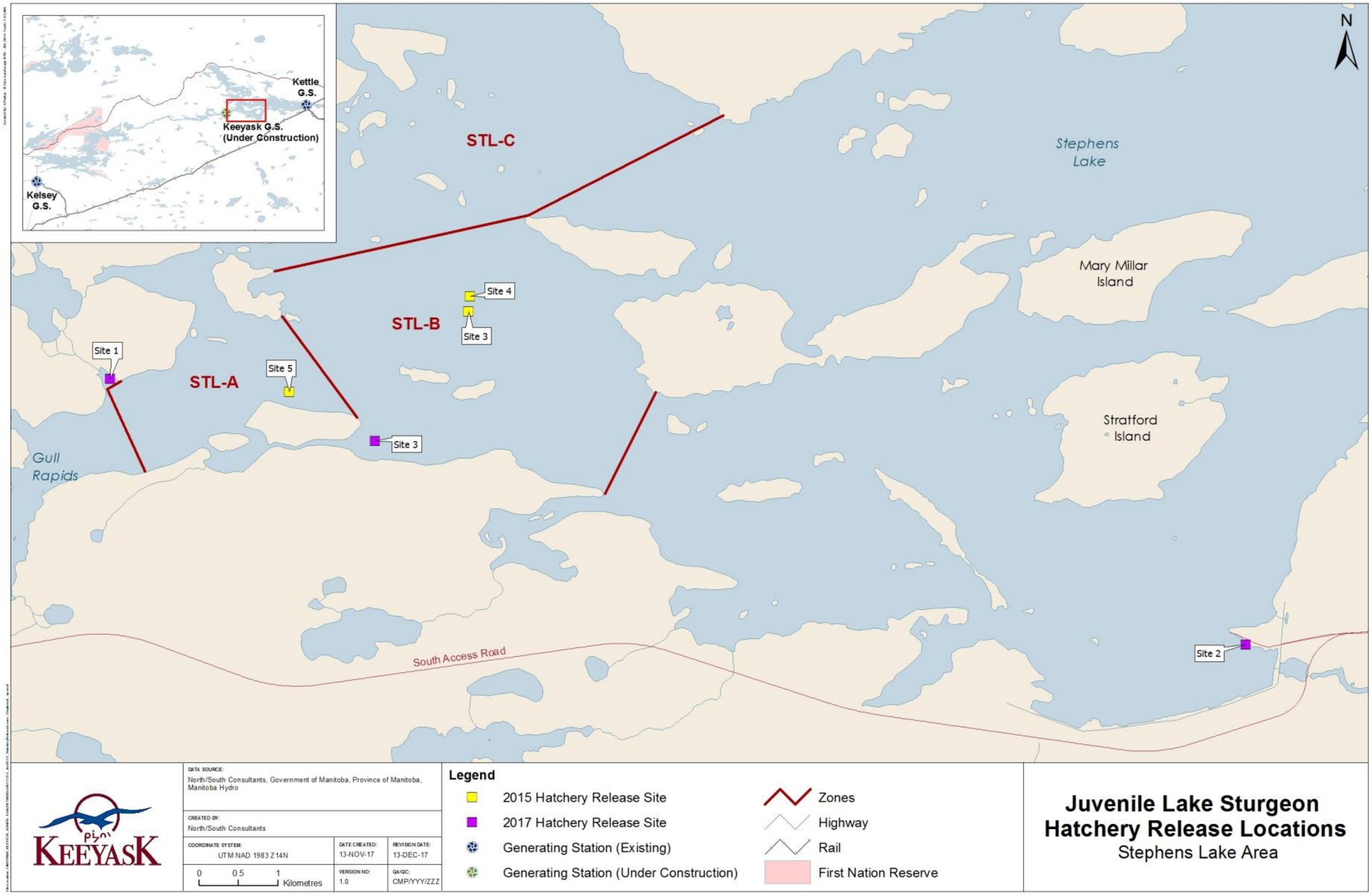
Map 5: Map of sites fished with gill nets in the future Keeyask reservoir, fall 2018.



Map 6: Map of Lake Sturgeon yearling stocking sites in the future Keeyask reservoir since 2014.



Map 7: **Map of sites fished with gill nets in Stephens Lake, fall 2018.**



Map 8: Map of Lake Sturgeon yearling stocking sites in Stephens Lake since 2014.

APPENDICES

APPENDIX 1: LOCATIONS AND SITE-SPECIFIC PHYSICAL MEASUREMENTS COLLECTED AT GILLNETTING SITES, FALL 2018.

Table A1-1: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in the Upper Split Lake Area, fall 2018. Sites set in each region are indicated as follows Burntwood River (BWR) and Split Lake (SPL).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-01	SPL-A	658162	6221849	9-Sep-18	16.0	11-Sep-18	14.5	41.77	12.3	14.1
GN-02	SPL-A	658527	6221941	9-Sep-18	16.0	11-Sep-18	14.5	42.68	11.2	10.9
GN-03	SPL-A	659125	6222047	9-Sep-18	16.0	11-Sep-18	14.5	43.33	13.3	11.0
GN-04	SPL-A	660038	6222051	9-Sep-18	16.0	11-Sep-18	14.5	43.95	9.5	7.1
GN-05	SPL-A	660458	6221950	11-Sep-18	14.5	12-Sep-18	14.5	21.35	8.9	5.5
GN-06	SPL-A	660913	6221977	11-Sep-18	14.5	12-Sep-18	14.5	20.48	8.7	6.2
GN-07	SPL-A	661481	6221993	11-Sep-18	14.5	12-Sep-18	14.5	19.68	9.2	5.7
GN-08	SPL-A	661772	6221876	11-Sep-18	14.5	12-Sep-18	14.5	19.07	11.8	10.0
GN-09	BWR-A	630582	6214209	12-Sep-18	14.5	13-Sep-18	14.5	20.28	5.0	9.8
GN-10	BWR-A	630849	6214517	12-Sep-18	14.5	13-Sep-18	14.5	20.87	5.8	10.2
GN-11	BWR-A	631203	6214878	12-Sep-18	14.5	13-Sep-18	14.5	21.45	11.3	12.2
GN-12	BWR-A	631509	6215121	12-Sep-18	14.5	13-Sep-18	14.5	22.03	10.0	6.4
GN-13	BWR-A	632711	6215939	13-Sep-18	14.5	14-Sep-18	14.5	18.72	12.0	13.9
GN-14	BWR-A	633813	6216352	13-Sep-18	14.5	14-Sep-18	14.5	19.05	11.7	11.9
GN-15	BWR-B	635186	6219049	13-Sep-18	14.5	14-Sep-18	14.5	19.52	10.7	10.0
GN-16	BWR-B	633107	6218234	13-Sep-18	14.5	14-Sep-18	14.5	18.88	9.1	8.3
GN-17	BWR-B	631753	6218195	14-Sep-18	14.5	15-Sep-18	14.5	18.47	10.1	11.2
GN-18	BWR-B	630613	6219142	14-Sep-18	14.5	15-Sep-18	14.5	18.73	10.6	11.2
GN-19	BWR-B	631770	6220142	14-Sep-18	14.5	15-Sep-18	14.5	18.88	8.6	11.2
GN-20	BWR-C	632714	6220975	14-Sep-18	14.5	15-Sep-18	14.5	19.33	10.1	10.5
GN-21	BWR-C	636447	6223001	15-Sep-18	14.5	16-Sep-18	13.5	19.50	10.0	12.7
GN-22	BWR-C	638038	6223836	15-Sep-18	14.5	16-Sep-18	13.5	20.72	10.1	10.5

Table A1-1: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in the Upper Split Lake Area, fall 2018. Sites set in each region are indicated as follows Burntwood River (BWR) and Split Lake (SPL) (continued).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-23	BWR-C	638899	6224266	15-Sep-18	14.5	16-Sep-18	13.5	21.25	13.5	12.7
GN-24	BWR-C	639896	6224640	15-Sep-18	14.5	16-Sep-18	13.5	21.63	8.8	12.4
GN-25	BWR-C	648476	6224358	16-Sep-18	13.5	17-Sep-18	13.0	17.73	5.4	5.5
GN-26	BWR-C	648522	6224225	16-Sep-18	13.5	17-Sep-18	13.0	17.87	6.7	7.3
GN-27	BWR-C	650393	6224088	16-Sep-18	13.5	17-Sep-18	13.0	18.02	3.6	6.0
GN-28	SPL-A	651682	6223960	16-Sep-18	13.5	17-Sep-18	13.0	18.32	5.9	6.2
GN-29	SPL-A	663081	6225306	17-Sep-18	13.0	18-Sep-18	13.0	19.33	10.9	12.1
GN-30	SPL-A	663420	6224966	17-Sep-18	13.0	18-Sep-18	13.0	19.50	10.3	10.4
GN-31	SPL-A	664072	6225094	17-Sep-18	13.0	18-Sep-18	13.0	19.95	12.2	10.4
GN-32	SPL-A	664545	6225463	17-Sep-18	13.0	18-Sep-18	13.0	20.28	12.3	10.2
GN-33	SPL-A	665046	6225865	18-Sep-18	13.0	19-Sep-18	12.0	23.18	9.4	9.7
GN-34	SPL-A	665349	6225459	18-Sep-18	13.0	19-Sep-18	12.0	22.63	9.5	8.8
GN-35	SPL-A	665544	6225245	18-Sep-18	13.0	19-Sep-18	12.0	22.12	9.0	10.0
GN-36	SPL-A	665979	6225051	18-Sep-18	13.0	19-Sep-18	12.0	21.75	10.2	9.2
GN-37	SPL-A	659296	6223392	19-Sep-18	12.0	20-Sep-18	11.5	22.30	5.3	4.6
GN-38	SPL-A	658973	6223049	19-Sep-18	12.0	20-Sep-18	11.5	22.78	5.3	5.8
GN-39	SPL-A	657458	6222149	19-Sep-18	12.0	20-Sep-18	11.5	23.08	10.3	11.1
GN-40	SPL-A	656797	6222205	19-Sep-18	12.0	20-Sep-18	11.5	23.48	4.8	7.9

Table A1-2: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in the future Keeyask reservoir, fall 2018.

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-01	GL-C	356639	6248179	9-Sep-18	12.0	10-Sep-18	11.0	18.33	10.9	10.1
GN-02	GL-C	356053	6247789	9-Sep-18	12.0	10-Sep-18	11.0	18.72	6.7	7.3
GN-03	GL-B	353958	6244298	9-Sep-18	12.0	10-Sep-18	11.0	19.08	10.4	12.5
GN-04	GL-C	356500	6248051	10-Sep-18	11.0	11-Sep-18	11.0	25.22	6.8	6.3
GN-05	GL-C	355513	6247296	10-Sep-18	11.0	11-Sep-18	11.0	24.17	7.0	6.9
GN-06	GL-B	354436	6244711	10-Sep-18	11.0	11-Sep-18	11.0	22.72	13.4	11.4
GN-07	GL-B	353664	6244170	11-Sep-18	11.0	12-Sep-18	11.0	28.17	11.2	11.7
GN-08	GL-B	354346	6244502	11-Sep-18	11.0	12-Sep-18	11.0	27.83	10.7	12.2
GN-09	GL-C	355336	6247142	11-Sep-18	11.0	12-Sep-18	11.0	28.25	11.5	8.6
GN-10	GL-C	356439	6248037	11-Sep-18	11.0	12-Sep-18	11.0	28.42	7.1	7.9
GN-11	GL-A	349351	6244313	12-Sep-18	11.0	13-Sep-18	11.0	20.58	10.3	11.2
GN-12	GL-A	348408	6244278	12-Sep-18	11.0	13-Sep-18	11.0	19.25	12.6	12.1
GN-13	GL-B	353678	6244041	12-Sep-18	11.0	13-Sep-18	11.0	20.75	8.0	9.9
GN-14	GL-B	354249	6244635	12-Sep-18	11.0	13-Sep-18	11.0	20.27	7.5	10.4
GN-15	GL-C	355255	6247050	12-Sep-18	11.0	13-Sep-18	11.0	19.83	11.2	10.3
GN-16	GL-C	356435	6248026	12-Sep-18	11.0	13-Sep-18	11.0	19.67	6.8	7.0
GN-17	BR-D	338303	6245102	13-Sep-18	11.0	15-Sep-18	10.5	48.20	7.2	9.9
GN-18	GL-A	349215	6244368	13-Sep-18	11.0	15-Sep-18	10.5	48.42	11.1	11.7
GN-19	GL-B	353846	6244089	13-Sep-18	11.0	14-Sep-18	11.0	27.75	9.2	9.6
GN-20	GL-B	354247	6244629	13-Sep-18	11.0	14-Sep-18	11.0	26.58	8.4	9.8

Table A1-2: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in the future Keeyask reservoir, fall 2018 (continued).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-21	GL-C	355229	6246908	13-Sep-18	11.0	14-Sep-18	10.5	25.58	8.5	11.4
GN-22	GL-C	356388	6247998	13-Sep-18	11.0	14-Sep-18	10.5	24.42	6.9	8.4
GN-23	GL-C	356609	6248022	14-Sep-18	11.0	15-Sep-18	10.5	19.42	6.0	7.4
GN-24	GL-C	355236	6246973	14-Sep-18	11.0	15-Sep-18	10.5	22.50	9.5	8.6
GN-25	GL-B	354367	6244636	14-Sep-18	11.0	15-Sep-18	10.5	21.25	11.1	12.2
GN-26	GL-B	354040	6244477	14-Sep-18	11.0	15-Sep-18	10.5	20.33	12.8	9.4
GN-27	GL-A	347839	6243704	15-Sep-18	10.5	16-Sep-18	10.0	24.33	10.4	9.8
GN-28	BR-D	338340	6245148	15-Sep-18	10.5	16-Sep-18	10.0	22.50	9.1	7.8
GN-29	GL-A	349102	6244392	15-Sep-18	10.5	16-Sep-18	10.0	22.92	10.1	10.7
GN-30	GL-B	354218	6244495	15-Sep-18	10.5	16-Sep-18	10.0	23.17	11.2	8.9
GN-31	GL-B	354594	6244678	15-Sep-18	10.5	16-Sep-18	10.0	23.08	10.4	12.0
GN-32	GL-C	356871	6248090	15-Sep-18	10.5	16-Sep-18	10.0	23.08	7.7	10.8
GN-33	BR-D	338331	6245130	16-Sep-18	10.0	17-Sep-18	9.5	23.58	9.1	9.9
GN-34	GL-A	347942	6243690	16-Sep-18	10.0	17-Sep-18	9.5	23.25	7.3	12.6
GN-35	GL-A	349026	6244355	16-Sep-18	10.0	17-Sep-18	9.5	23.33	9.5	8.7
GN-36	GL-B	354312	6244769	16-Sep-18	10.0	17-Sep-18	9.5	24.08	7.6	8.3
GN-37	GL-B	354581	6244473	16-Sep-18	10.0	17-Sep-18	9.5	23.08	10.0	10.9
GN-38	GL-C	357044	6248087	16-Sep-18	10.0	17-Sep-18	9.5	23.58	9.1	7.9
GN-39	BR-D	338326	6245121	17-Sep-18	9.5	18-Sep-18	9.0	24.00	10.2	9.7
GN-40	GL-A	347954	6243697	17-Sep-18	9.5	18-Sep-18	9.0	23.83	7.7	10.4
GN-41	GL-A	349044	6244362	17-Sep-18	9.5	18-Sep-18	9.0	23.75	10.3	12.0

Table A1-2: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in the future Keeyask reservoir, fall 2018 (continued).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-42	GL-B	354598	6244499	17-Sep-18	9.5	18-Sep-18	9.0	23.17	9.1	10.5
GN-43	GL-B	354312	6244781	17-Sep-18	9.5	18-Sep-18	9.0	23.08	7.0	8.3
GN-44	GL-C	356386	6248021	17-Sep-18	9.5	18-Sep-18	9.0	23.25	7.3	8.7
GN-45	GL-A	347965	6243677	18-Sep-18	9.0	19-Sep-18	9.0	22.92	5.6	9.4
GN-46	GL-A	348875	6244335	18-Sep-18	9.0	19-Sep-18	9.0	22.83	9.6	9.3
GN-47	GL-B	354710	6244550	18-Sep-18	9.0	19-Sep-18	9.0	22.83	10.7	8.1
GN-48	GL-B	354425	6244811	18-Sep-18	9.0	19-Sep-18	9.0	22.83	10.5	11.3
GN-49	GL-C	356068	6247803	18-Sep-18	9.0	19-Sep-18	9.0	23.33	6.5	7.1
GN-50	GL-C	356426	6248046	18-Sep-18	9.0	19-Sep-18	9.0	23.00	7.5	7.9

Table A1-3: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in Stephens Lake, fall 2018.

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-01	STL-A	366622	6247496	9-Sep-18	12.0	11-Sep-18	12.0	41.33	16.8	-
GN-02	STL-A	366842	6247513	9-Sep-18	12.0	11-Sep-18	12.0	40.50	-	-
GN-03	STL-A	366706	6247405	9-Sep-18	12.0	11-Sep-18	12.0	41.58	-	-
GN-04	STL-B	370233	6148460	11-Sep-18	12.0	12-Sep-18	11.5	23.92	17.0	15.6
GN-05	STL-B	369310	6248795	11-Sep-18	12.0	12-Sep-18	11.5	23.83	17.1	16.2
GN-06	STL-B	368918	6248711	11-Sep-18	12.0	12-Sep-18	11.5	24.00	17.4	14.4
GN-07	STL-A	366686	6247648	11-Sep-18	12.0	12-Sep-18	11.5	24.50	14.3	15.3
GN-08	STL-A	366622	6247506	11-Sep-18	12.0	12-Sep-18	11.5	24.67	15.8	14.6
GN-09	STL-A	366538	6247395	11-Sep-18	12.0	12-Sep-18	11.5	24.33	15.0	16.9
GN-10	STL-B	370059	6248422	12-Sep-18	11.5	13-Sep-18	11.0	27.17	18.0	17.0
GN-11	STL-B	369357	6248807	12-Sep-18	11.5	13-Sep-18	11.0	25.32	17.0	14.0
GN-12	STL-B	369071	6248742	12-Sep-18	11.5	13-Sep-18	11.0	24.92	14.0	15.5
GN-13	STL-A	366392	6247554	12-Sep-18	11.5	13-Sep-18	11.0	21.92	14.6	14.1
GN-14	STL-A	366613	6247499	12-Sep-18	11.5	13-Sep-18	11.0	22.05	15.4	14.4
GN-14	STL-A	366613	6247499	13-Sep-18	11.0	14-Sep-18	-	28.83	15.4	14.4
GN-15	STL-B	369063	6248843	12-Sep-18	11.5	13-Sep-18	11.0	21.92	14.8	18.3
GN-16	STL-A	366138	6247103	13-Sep-18	11.0	14-Sep-18	-	30.08	9.2	14.0
GN-17	STL-B	369134	6248729	13-Sep-18	11.0	15-Sep-18	-	46.42	14.9	14.8
GN-18	STL-B	368953	6248710	13-Sep-18	11.0	15-Sep-18	-	45.17	16.0	15.1
GN-18	STL-B	368953	6248710	15-Sep-18	-	16-Sep-18	-	25.50	16.0	15.1
GN-19	STL-B	369232	6248308	13-Sep-18	11.0	15-Sep-18	-	45.58	16.9	18.0
GN-20	STL-B	369405	6248099	13-Sep-18	11.0	15-Sep-18	-	45.50	15.0	14.0
GN-21	STL-A	366639	6247288	14-Sep-18	-	15-Sep-18	-	20.33	12.9	16.9

Table A1-3: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in Stephens Lake, fall 2018 (continued).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-21	STL-A	366639	6247288	15-Sep-18	-	16-Sep-18	-	23.92	12.9	16.9
GN-22	STL-A	366675	6247251	14-Sep-18	-	15-Sep-18	-	21.00	13.3	18.0
GN-23	STL-B	368994	6248690	15-Sep-18	-	16-Sep-18	-	25.25	16.1	14.5
GN-24	STL-B	368775	6248602	15-Sep-18	-	16-Sep-18	-	22.33	16.2	17.9
GN-25	STL-B	368772	6248527	15-Sep-18	-	16-Sep-18	-	22.25	15.2	17.8
GN-26	STL-A	366649	6247339	15-Sep-18	-	16-Sep-18	-	23.00	18.9	16.9
GN-27	STL-B	368890	6248610	16-Sep-18	-	17-Sep-18	10.0	23.97	17.1	16.3
GN-28	STL-B	368726	6248499	16-Sep-18	-	17-Sep-18	10.0	23.00	13.9	17.1
GN-29	STL-B	368966	6248718	16-Sep-18	-	17-Sep-18	10.0	22.83	-	-
GN-30	STL-B	369005	6248535	16-Sep-18	-	17-Sep-18	10.0	23.00	-	-
GN-31	STL-A	366646	6247305	16-Sep-18	-	17-Sep-18	10.0	23.55	-	-
GN-32	STL-A	366669	6247561	16-Sep-18	-	17-Sep-18	10.0	22.50	-	-
GN-33	STL-B	368729	6248385	17-Sep-18	10.0	18-Sep-18	-	25.25	9.6	14.7
GN-34	STL-B	368893	6248647	17-Sep-18	10.0	18-Sep-18	-	25.92	17.3	16.4
GN-35	STL-B	368064	6248639	17-Sep-18	10.0	18-Sep-18	-	23.38	15.2	15.0
GN-36	STL-B	369044	6248404	17-Sep-18	10.0	18-Sep-18	-	24.25	14.4	13.1
GN-37	STL-A	367725	6248105	17-Sep-18	10.0	18-Sep-18	-	21.22	15.0	15.5
GN-38	STL-A	366654	6247334	17-Sep-18	10	18-Sep-18	-	23.92	18.4	17.4
GN-39	STL-B	367900	6248148	18-Sep-18	-	19-Sep-18	-	27.00	14.8	14.5
GN-40	STL-B	367899	6248228	18-Sep-18	-	19-Sep-18	-	26.67	14.4	15.6
GN-41	STL-B	368895	6248434	18-Sep-18	-	19-Sep-18	-	24.33	16.0	16.6
GN-41	STL-B	368895	6248434	19-Sep-18	-	20-Sep-18	-	22.08	16.0	16.6

Table A1-3: Location and site-specific physical measurements collected at gillnetting sites during juvenile Lake Sturgeon investigations conducted in Stephens Lake, fall 2018 (continued).

Site	Zone	UTM Location		Set Date	Set Water Temp (°C)	Pull Date	Pull Water Temp (°C)	Duration (dec.hrs)	Water Depth (m)	
		Easting	Northing						Start	End
GN-42	STL-B	369724	6248541	18-Sep-18	-	19-Sep-18	-	23.05	20.9	19.6
GN-43	STL-B	368245	6247971	18-Sep-18	-	19-Sep-18	-	23.95	15.9	14.7
GN-44	STL-A	367401	6247789	18-Sep-18	-	19-Sep-18	-	25.13	15.5	14.4
GN-45	STL-B	367802	6248028	19-Sep-18	-	20-Sep-18	-	23.42	15.2	16.2
GN-46	STL-B	368243	6247889	19-Sep-18	-	20-Sep-18	-	21.50	15.9	15.9
GN-47	STL-B	368889	6248443	19-Sep-18	-	20-Sep-18	-	20.30	16.6	16.0
GN-48	STL-B	368125	6248194	19-Sep-18	-	20-Sep-18	-	20.87	16.4	13.4
GN-49	STL-B	367971	6247732	19-Sep-18	-	20-Sep-18	-	20.75	15.8	17.1

APPENDIX 2: BIOLOGICAL AND TAG INFORMATION FOR LAKE STURGEON CAPTURED IN FALL 2018.

Table A2-1: Biological and tag information for Lake Sturgeon captured in the Upper Split Lake Area (Burntwood River and Split Lake), fall 2018.

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Split Lake	GN-01	SPL-A	11-Sep-18	113526	900 226000153713	641	723	1750	5
Split Lake	GN-01	SPL-A	11-Sep-18	113528	900 226000153755	660	747	2200	12
Split Lake	GN-01	SPL-A	11-Sep-18	113529	900 226000153756	660	751	2050	13
Split Lake	GN-01	SPL-A	11-Sep-18	113530	900 226000153738	509	583	850	5
Split Lake	GN-01	SPL-A	11-Sep-18	113531	900 226000153777	400	455	450	5
Split Lake	GN-01	SPL-A	11-Sep-18	113532	900 226000153789	490	551	800	5
Split Lake	GN-01	SPL-A	11-Sep-18	113533	900 1380344522	323	366	250	2
Split Lake	GN-01	SPL-A	11-Sep-18	113534	900 226000153700	500	569	900	5
Split Lake	GN-01	SPL-A	11-Sep-18	-	-	520	587	1000	5
Split Lake	GN-02	SPL-A	11-Sep-18	113535	900 226000153766	534	598	950	4
Split Lake	GN-02	SPL-A	11-Sep-18	113536	900 226000153705	616	692	1600	7
Split Lake	GN-02	SPL-A	11-Sep-18	113537	900 226000153792	841	931	4650	-
Split Lake	GN-02	SPL-A	11-Sep-18	113538	900 226000153780	730	813	3650	8
Split Lake	GN-02	SPL-A	11-Sep-18	113539	900 226000153706	689	762	2550	8
Split Lake	GN-02	SPL-A	11-Sep-18	113540	900 226000153754	522	695	1100	5
Split Lake	GN-02	SPL-A	11-Sep-18	113541	900 226000153701	441	486	675	5
Split Lake	GN-03	SPL-A	11-Sep-18	113543	900 226000153786	528	601	1100	5
Split Lake	GN-03	SPL-A	11-Sep-18	113544	900 226000153776	538	605	1200	5
Split Lake	GN-03	SPL-A	11-Sep-18	113545	900 1380344115	302	341	175	3
Split Lake	GN-03	SPL-A	11-Sep-18	113546	900 226000153742	363	522	700	5
Split Lake	GN-03	SPL-A	11-Sep-18	113547	900 226000153710	515	580	1100	5
Split Lake	GN-03	SPL-A	11-Sep-18	113548	900 226000153793	562	640	1300	5
Split Lake	GN-03	SPL-A	11-Sep-18	113549	900 226000153795	496	564	750	4
Split Lake	GN-03	SPL-A	11-Sep-18	113501	900 226000153729	447	509	700	5
Split Lake	GN-03	SPL-A	11-Sep-18	113502	900 226000153707	426	489	650	5
Split Lake	GN-03	SPL-A	11-Sep-18	113503	900 067000121368	335	375	250	2
Split Lake	GN-04	SPL-A	11-Sep-18	-	-	676	762	2450	7
Split Lake	GN-04	SPL-A	11-Sep-18	-	-	497	552	1000	5
Split Lake	GN-04	SPL-A	11-Sep-18	-	-	540	614	1200	5

Table A2-1: Biological and tag information for Lake Sturgeon captured in the Upper Split Lake Area (Burntwood River and Split Lake), fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Split Lake	GN-04	SPL-A	11-Sep-18	113504	900 226000153733	671	741	2250	7
Split Lake	GN-04	SPL-A	11-Sep-18	113505	900 226000153751	511	585	1200	5
Split Lake	GN-04	SPL-A	11-Sep-18	113506	900 226000153743	505	572	900	5
Split Lake	GN-04	SPL-A	11-Sep-18	113507	900 226000153762	430	494	550	5
Split Lake	GN-04	SPL-A	11-Sep-18	113508	900 226000153721	706	798	2500	7
Split Lake	GN-04	SPL-A	11-Sep-18	113509	900 226000768511	541	613	1250	5
Split Lake	GN-08	SPL-A	12-Sep-18	113510	900 226000153796	666	741	2500	7
Split Lake	GN-07	SPL-A	12-Sep-18	113511	900 226000153718	745	834	3450	7
Split Lake	GN-07	SPL-A	12-Sep-18	113512	900 226000153726	570	633	1250	5
Split Lake	GN-07	SPL-A	12-Sep-18	113513	900 226000153785	712	806	2600	7
Split Lake	GN-07	SPL-A	12-Sep-18	113514	900 226000768550	770	871	4150	12
Split Lake	GN-07	SPL-A	12-Sep-18	79284	900 226000153736	683	779	2200	7
Split Lake	GN-06	SPL-A	12-Sep-18	113516	900 226000768523	732	830	2250	10
Split Lake	GN-06	SPL-A	12-Sep-18	113517	900 226000768598	560	632	1375	6
Split Lake	GN-05	SPL-A	12-Sep-18	113519	900 226000153759	685	753	2450	11
Split Lake	GN-05	SPL-A	12-Sep-18	91364	900 226000548175	996	1160	7350	-
Split Lake	GN-05	SPL-A	12-Sep-18	113520	900 226000153709	805	912	4250	-
Split Lake	GN-05	SPL-A	12-Sep-18	91600	900 226000153775	796	892	4050	13
Split Lake	GN-05	SPL-A	12-Sep-18	113521	900 226000153763	814	916	4150	-
Burntwood River	GN-09	BWR-A	13-Sep-18	88179	900 226000893378	749	822	2650	-
Burntwood River	GN-09	BWR-A	13-Sep-18	113522	900 226000767451	636	712	1650	19
Burntwood River	GN-09	BWR-A	13-Sep-18	113523	900 226000153771	492	563	900	8
Burntwood River	GN-10	BWR-A	13-Sep-18	113525	900 226000153715	764	863	3000	16
Burntwood River	GN-12	BWR-A	13-Sep-18	113725	900 226000153725	367	415	350	3
Burntwood River	GN-13	BWR-A	14-Sep-18	113724	900 226000153757	491	561	900	8
Burntwood River	GN-16	BWR-B	14-Sep-18	113723	972 273000041195	205	228	25	1
Burntwood River	GN-16	BWR-B	14-Sep-18	113722	900 067000121588	351	401	225	3
Burntwood River	GN-22	BWR-C	16-Sep-18	113721	972 273000041200	278	316	100	2
Burntwood River	GN-26	BWR-C	17-Sep-18	113719	900 067000121317	272	308	175	2
Burntwood River	GN-27	BWR-C	17-Sep-18	113718	900 226000153773	403	456	475	5

Table A2-1: Biological and tag information for Lake Sturgeon captured in the Upper Split Lake Area (Burntwood River and Split Lake), fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Split Lake	GN-28	SPL-A	17-Sep-18	113717	900 226000767450	796	882	3400	15
Split Lake	GN-28	SPL-A	17-Sep-18	113716	900 226000768534	501	572	750	5
Split Lake	GN-30	SPL-A	18-Sep-18	113715	900 226000767444	493	584	875	5
Split Lake	GN-32	SPL-A	18-Sep-18	113714	900 226000767493	540	612	1375	5
Split Lake	GN-37	SPL-A	20-Sep-18	113713	900 067000121573	230	263	25	1
Split Lake	GN-37	SPL-A	20-Sep-18	113712	900 226000767441	800	910	4650	-
Split Lake	GN-37	SPL-A	20-Sep-18	113711	900 226000153791	549	617	1050	7
Split Lake	GN-38	SPL-A	20-Sep-18	113710	900 043000102957	520	581	1100	5
Split Lake	GN-39	SPL-A	20-Sep-18	113709	900 226000153761	588	675	1600	8

Table A2-2: Biological and tag information for Lake Sturgeon captured in the future Keeyask reservoir, fall 2018.

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Future Keeyask Reservoir	GN-01	GL-C	10-Sep-18	113001	900 226000327580	725	834	2950	11
Future Keeyask Reservoir	GN-02	GL-C	10-Sep-18	-	900 067000121507	296	336	200	2
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113002	900 226000327570	430	486	550	4
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113003	900 226000327527	429	494	500	4
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113004	900 226000327530	381	441	400	4
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113005	900 226000327508	354	401	300	3
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113006	900 067000112175	353	409	300	2
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113007	900 226000327539	320	323	250	2
Future Keeyask Reservoir	GN-06	GL-B	11-Sep-18	113008	900 067000121578	286	322	200	2
Future Keeyask Reservoir	GN-05	GL-C	11-Sep-18	113009	900 226000327556	786	876	3450	10
Future Keeyask Reservoir	GN-04	GL-C	11-Sep-18	103649	900 226000629219	873	984	5300	-
Future Keeyask Reservoir	GN-04	GL-C	11-Sep-18	106462	900 226000893868	707	797	2450	9
Future Keeyask Reservoir	GN-04	GL-C	11-Sep-18	113010	900 226000327566	715	799	3000	10
Future Keeyask Reservoir	GN-04	GL-C	11-Sep-18	113011	900 226000327555	764	853	3700	10
Future Keeyask Reservoir	GN-04	GL-C	11-Sep-18	113012	900 226000327543	714	815	3000	11
Future Keeyask Reservoir	GN-08	GL-B	12-Sep-18	113013	900 226000327504	716	802	2500	10
Future Keeyask Reservoir	GN-08	GL-B	12-Sep-18	113014	900 226000327572	354	413	400	3
Future Keeyask Reservoir	GN-08	GL-B	12-Sep-18	107115	900 226000768485	955	1084	7100	-
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	113015	900 226000327577	567	648	1350	8
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	113016	900 226000327568	357	395	400	3
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	900 067000121326	285	327	300	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	113017	900 226000327581	315	350	300	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	113018	900 226000327584	323	358	300	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	113019	900 226000327533	307	350	300	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	900 067000121396	293	331	150	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	972 273000041199	282	330	150	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	900 043000103752	282	309	150	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	900 067000121633	269	296	100	2
Future Keeyask Reservoir	GN-09	GL-C	12-Sep-18	-	-	300	338	200	2
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	103116	900 226000768467	767	871	3200	9
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	89658	900 226000327546	770	858	3100	10
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	113020	900 226000327535	752	874	3200	10

Table A2-2: Biological and tag information for Lake Sturgeon captured in the future Keeyask reservoir, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	113021	900 226000327576	309	352	200	2
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	-	900 067000121241	233	262	100	1
Future Keeyask Reservoir	GN-10	GL-C	12-Sep-18	-	-	87	98	-	0
Future Keeyask Reservoir	GN-12	GL-A	13-Sep-18	113022	900 067000059369	349	390	250	2
Future Keeyask Reservoir	GN-12	GL-A	13-Sep-18	113023	900 067000059421	365	419	300	2
Future Keeyask Reservoir	GN-11	GL-A	13-Sep-18	-	-	286	332	150	2
Future Keeyask Reservoir	GN-13	GL-B	13-Sep-18	113024	900 226000327552	677	764	2400	10
Future Keeyask Reservoir	GN-13	GL-B	13-Sep-18	113025	900 226000327588	440	499	500	4
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	94889	900 226000327545	664	750	1900	10
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	113026	900 226000327565	756	839	2950	10
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	113027	900 226000327509	692	768	2350	10
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	113028	900 226000327560	630	717	1850	9
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	113029	900 067000055044	428	497	450	4
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	113030	900 226000327517	336	391	250	3
Future Keeyask Reservoir	GN-14	GL-B	13-Sep-18	-	900 067000121189	295	331	200	2
Future Keeyask Reservoir	GN-15	GL-B	13-Sep-18	113031	900 226000327506	708	802	2450	12
Future Keeyask Reservoir	GN-15	GL-C	13-Sep-18	113032	900 226000327548	499	572	900	5
Future Keeyask Reservoir	GN-15	GL-C	13-Sep-18	113033	900 067000121673	332	372	250	3
Future Keeyask Reservoir	GN-15	GL-C	13-Sep-18	113034	900 226000327564	303	342	150	2
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	82647	900 226000629140	936	1049	7000	-
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	113035	900 226000327574	773	865	3750	10
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	113036	900 226000327599	649	733	2250	8
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	113037	900 226000327505	707	804	2750	11
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	113038	900 226000327583	624	710	1750	7
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	106469	900 226000893798	512	588	850	5
Future Keeyask Reservoir	GN-16	GL-C	13-Sep-18	113039	900 226000327575	391	443	450	3
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113040	900 226000327594	685	786	2600	11
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113041	900 226000327593	713	821	2400	10
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113042	900 226000327503	638	725	1950	10
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113043	900 226000327569	542	608	1000	9
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113044	900 067000055461	424	488	450	4
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	113045	900 226000327579	312	359	200	2

Table A2-2: Biological and tag information for Lake Sturgeon captured in the future Keeyask reservoir, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Future Keeyask Reservoir	GN-22	GL-C	14-Sep-18	-	900 067000121390	214	241	50	1
Future Keeyask Reservoir	GN-21	GL-C	14-Sep-18	113046	900 226000327518	764	886	3300	10
Future Keeyask Reservoir	GN-20	GL-B	14-Sep-18	113047	900 226000327520	463	539	650	5
Future Keeyask Reservoir	GN-20	GL-B	14-Sep-18	113048	900 067000112161	403	458	350	2
Future Keeyask Reservoir	GN-20	GL-B	14-Sep-18	113049	900 226000327559	314	348	100	2
Future Keeyask Reservoir	GN-19	GL-B	14-Sep-18	113050	900 226000327554	699	805	2700	12
Future Keeyask Reservoir	GN-19	GL-B	14-Sep-18	113005	900 226000327537	692	787	2050	10
Future Keeyask Reservoir	GN-23	GL-C	15-Sep-18	113825	900 226000767269	745	842	2950	10
Future Keeyask Reservoir	GN-23	GL-C	15-Sep-18	113824	900 226000768413	708	801	2450	10
Future Keeyask Reservoir	GN-17	BR-D	15-Sep-18	113823	900 226000327586	842	956	4550	-
Future Keeyask Reservoir	GN-17	BR-D	15-Sep-18	113822	900 226000767273	758	862	3450	10
Future Keeyask Reservoir	GN-18	GL-A	15-Sep-18	113821	900 043000103674	486	549	650	5
Future Keeyask Reservoir	GN-26	GL-B	15-Sep-18	113820	900 226000767281	305	354	200	2
Future Keeyask Reservoir	GN-25	GL-B	15-Sep-18	113819	900 226000327549	569	649	1150	7
Future Keeyask Reservoir	GN-25	GL-B	15-Sep-18	113818	900 226000767262	351	386	250	3
Future Keeyask Reservoir	GN-25	GL-B	15-Sep-18	113817	900 226000327598	336	386	200	2
Future Keeyask Reservoir	GN-25	GL-B	15-Sep-18	113816	900 226000327573	325	374	200	2
Future Keeyask Reservoir	GN-25	GL-B	15-Sep-18	113815	900 226000767201	310	346	150	2
Future Keeyask Reservoir	GN-24	GL-C	15-Sep-18	106463	900 226000154225	723	824	2850	10
Future Keeyask Reservoir	GN-24	GL-C	15-Sep-18	113814	900 226000629005	675	764	2450	9
Future Keeyask Reservoir	GN-28	BR-D	16-Sep-18	113813	900 226000327557	759	850	3200	10
Future Keeyask Reservoir	GN-28	BR-D	16-Sep-18	113812	900 226000327547	655	739	1900	10
Future Keeyask Reservoir	GN-28	BR-D	16-Sep-18	113811	900 226000767255	579	665	1450	6
Future Keeyask Reservoir	GN-27	GL-A	16-Sep-18	113810	900 226000327587	727	830	2750	10
Future Keeyask Reservoir	GN-27	GL-A	16-Sep-18	113809	900 226000327590	655	739	2150	10
Future Keeyask Reservoir	GN-29	GL-A	16-Sep-18	112543	900 226000629452	574	651	1100	7[a]
Future Keeyask Reservoir	GN-29	GL-A	16-Sep-18	113808	900 226000767293	504	574	850	5
Future Keeyask Reservoir	GN-30	GL-B	16-Sep-18	113807	900 226000767288	742	836	2950	10
Future Keeyask Reservoir	GN-32	GL-C	16-Sep-18	113806	900 226000327571	519	595	1000	5
Future Keeyask Reservoir	GN-32	GL-C	16-Sep-18	113805	900 226000327562	375	475	350	3
Future Keeyask Reservoir	GN-32	GL-C	16-Sep-18	113804	900 226000327519	316	353	200	2
Future Keeyask Reservoir	GN-32	GL-C	16-Sep-18	-	972 273000041186	219	250	100	1

Table A2-2: Biological and tag information for Lake Sturgeon captured in the future Keeyask reservoir, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Future Keeyask Reservoir	GN-32	GL-C	16-Sep-18	-	900 067000121601	212	240	100	1
Future Keeyask Reservoir	GN-34	GL-A	17-Sep-18	113803	900 226000327526	943	1030	7650	-
Future Keeyask Reservoir	GN-34	GL-A	17-Sep-18	113802	900 226000327538	361	414	350	3
Future Keeyask Reservoir	GN-34	GL-A	17-Sep-18	-	900 043000103776	201	225	100	1
Future Keeyask Reservoir	GN-35	GL-A	17-Sep-18	113801	900 226000327525	630	724	1850	10
Future Keeyask Reservoir	GN-35	GL-A	17-Sep-18	113826	900 226000327591	304	345	200	2
Future Keeyask Reservoir	GN-35	GL-A	17-Sep-18	-	900 067000121534	280	312	150	2
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113827	900 226000327541	741	830	2700	12
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113828	900 226000327531	701	793	2600	10
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113829	900 226000327513	712	795	2350	10
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113830	900 226000327550	670	761	2150	10
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113831	900 067000055689	440	511	500	4
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113832	900 067000055259	405	466	400	4
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	113833	900 067000112140	373	428	300	2
Future Keeyask Reservoir	GN-37	GL-B	17-Sep-18	-	900 067000121476	271	309	150	2
Future Keeyask Reservoir	GN-36	GL-B	17-Sep-18	105691	900 043000103824	668	766	1850	10[a]
Future Keeyask Reservoir	GN-36	GL-B	17-Sep-18	113834	900 226000767217	453	512	500	4
Future Keeyask Reservoir	GN-36	GL-B	17-Sep-18	113835	900 067000058508	453	519	500	4
Future Keeyask Reservoir	GN-36	GL-B	17-Sep-18	113836	900 067000112127	400	463	400	2
Future Keeyask Reservoir	GN-36	GL-B	17-Sep-18	113837	900 226000327521	340	382	250	3
Future Keeyask Reservoir	GN-38	GL-C	17-Sep-18	112502	900 226000893677	669	765	2300	10
Future Keeyask Reservoir	GN-40	GL-A	18-Sep-18	113838	900 226000327558	840	968	4050	-
Future Keeyask Reservoir	GN-40	GL-A	18-Sep-18	113839	900 067000059354	318	365	200	2
Future Keeyask Reservoir	GN-42	GL-B	18-Sep-18	113840	900 226000327536	730	821	2500	10
Future Keeyask Reservoir	GN-42	GL-B	18-Sep-18	-	900 067000121312	285	325	200	2
Future Keeyask Reservoir	GN-43	GL-B	18-Sep-18	113841	900 043000103668	489	556	700	5
Future Keeyask Reservoir	GN-43	GL-B	18-Sep-18	113842	900 226000327522	303	340	200	2
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113843	900 226000327589	569	658	1300	6
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113844	900 226000327514	534	606	1150	6
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113845	900 226000327585	477	558	800	5
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113846	900 226000327592	566	646	1200	7
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113847	900 226000767260	435	506	500	4

Table A2-2: Biological and tag information for Lake Sturgeon captured in the future Keeyask reservoir, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113848	900 067000056730	381	438	400	2
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113849	900 226000327502	325	370	250	2
Future Keeyask Reservoir	GN-44	GL-C	18-Sep-18	113850	900 226000327507	305	345	200	2
Future Keeyask Reservoir	GN-46	GL-A	19-Sep-18	113151	900 226000767272	331	376	200	2
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113152	900 226000327578	633	724	1700	10
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113153	900 067000058648	479	545	700	4
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113154	900 067000055405	462	535	600	4
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113155	900 226000327540	419	473	550	4
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113156	900 226000327561	302	345	250	2
Future Keeyask Reservoir	GN-47	GL-B	19-Sep-18	113157	900 226000327534	310	353	300	2
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113158	900 226000327553	688	805	2350	10
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113159	900 226000327529	584	657	1200	7
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113160	900 226000327528	479	545	750	6
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113161	900 067000055447	448	518	500	4
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113162	900 226000327544	304	345	200	2
Future Keeyask Reservoir	GN-48	GL-B	19-Sep-18	113163	900 226000327512	310	352	200	2
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	91383	900 226000629177	1031	1112	8500	-
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	113164	900 226000327523	654	747	1800	8
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	113165	900 226000327551	590	670	1550	7
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	113166	900 226000327597	524	591	900	5
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	113167	900 226000327532	387	439	400	3
Future Keeyask Reservoir	GN-50	GL-C	19-Sep-18	-	900 067000110427	255	296	100	2

a – Ages assigned based on structures aged in a previous study year.

Table A2-3: Biological and tag information for Lake Sturgeon captured in Stephens Lake, fall 2018.

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Stephens Lake	GN-02	STL-A	11-Sep-18	-	-	750	840	3450	-
Stephens Lake	GN-01	STL-A	11-Sep-18	100673	900 067000055481	455	525	750	4
Stephens Lake	GN-01	STL-A	11-Sep-18	115144	900 067000058474	490	562	875	4
Stephens Lake	GN-03	STL-A	11-Sep-18	115145	900 226000327820	574	655	1700	7
Stephens Lake	GN-05	STL-B	12-Sep-18	115146	900 226000893322	330	384	200	2
Stephens Lake	GN-06	STL-B	12-Sep-18	115147	900 226000327949	430	500	500	3
Stephens Lake	GN-06	STL-B	12-Sep-18	115149	900 226000154278	436	501	625	3
Stephens Lake	GN-06	STL-B	12-Sep-18	115150	-	394	451	375	3
Stephens Lake	GN-06	STL-B	12-Sep-18	115148	900 226000327876	300	337	200	2
Stephens Lake	GN-06	STL-B	12-Sep-18	113251	900 226000327847	635	724	1925	7
Stephens Lake	GN-06	STL-B	12-Sep-18	101500	900 226000628170	812	909	3650	-
Stephens Lake	GN-07	STL-A	12-Sep-18	110580	900 067000121406	386	435	300	3
Stephens Lake	GN-07	STL-A	12-Sep-18	-	900 067000121295	222	255	50	1
Stephens Lake	GN-08	STL-A	12-Sep-18	-	900 067000121303	241	275	75	1
Stephens Lake	GN-14	STL-A	13-Sep-18	115826	900 226000154078	837	945	4300	-
Stephens Lake	GN-14	STL-A	13-Sep-18	113252	900 226000327941	418	472	575	3
Stephens Lake	GN-14	STL-A	13-Sep-18	-	972 273000041181	307	344	225	2
Stephens Lake	GN-11	STL-B	13-Sep-18	113253	900 226000327855	765	825	3575	10
Stephens Lake	GN-11	STL-B	13-Sep-18	113255	900 226000327821	820	937	4925	-
Stephens Lake	GN-12	STL-B	13-Sep-18	113256	900 226000327812	435	496	550	3
Stephens Lake	GN-12	STL-B	13-Sep-18	113257	900 226000327851	505	590	975	5
Stephens Lake	GN-18	STL-B	15-Sep-18	113258	900 226000327993	410	466	550	3
Stephens Lake	GN-18	STL-B	15-Sep-18	110994	900 226000548945	522	595	1100	5
Stephens Lake	GN-18	STL-B	15-Sep-18	113259	900 067000055178	503	570	900	4
Stephens Lake	GN-18	STL-B	15-Sep-18	112945	900 226000893689	545	630	1150	5
Stephens Lake	GN-18	STL-B	15-Sep-18	113260	900 226000327828	421	480	575	3
Stephens Lake	GN-20	STL-B	15-Sep-18	92093	-	770	874	3300	10[a]
Stephens Lake	GN-21	STL-A	15-Sep-18	110582	900 067000055566	530	616	1050	5
Stephens Lake	GN-21	STL-A	15-Sep-18	113261	900 067000055526	495	566	850	4
Stephens Lake	GN-21	STL-A	15-Sep-18	113263	900 067000055507	497	566	875	4

Table A2-3: Biological and tag information for Lake Sturgeon captured in Stephens Lake, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Stephens Lake	GN-21	STL-A	15-Sep-18	113264	900 067000055170	480	550	775	4
Stephens Lake	GN-21	STL-A	15-Sep-18	113265	900 067000111882	354	410	375	2
Stephens Lake	GN-24	STL-B	16-Sep-18	113266	900 226000327809	421	480	525	4
Stephens Lake	GN-25	STL-B	16-Sep-18	113267	900 226000327943	500	575	825	4
Stephens Lake	GN-18	STL-B	16-Sep-18	113268	900 226000767617	392	446	475	3
Stephens Lake	GN-23	STL-B	16-Sep-18	96513	900 226000154249	531	602	1075	6[a]
Stephens Lake	GN-28	STL-B	17-Sep-18	113269	900 067000055076	502	568	700	4
Stephens Lake	GN-28	STL-B	17-Sep-18	113270	900 226000327892	498	564	975	5
Stephens Lake	GN-27	STL-B	17-Sep-18	113271	900 067000111990	375	416	350	2
Stephens Lake	GN-27	STL-B	17-Sep-18	113272	900 226000767664	406	450	525	3
Stephens Lake	GN-27	STL-B	17-Sep-18	113274	900 226000327845	335	378	275	2
Stephens Lake	GN-30	STL-B	17-Sep-18	113275	900 226000327926	765	874	3325	10
Stephens Lake	GN-30	STL-B	17-Sep-18	113273	900 226000327963	500	564	900	5
Stephens Lake	GN-31	STL-A	17-Sep-18	113276	900 226000327907	550	610	1050	5
Stephens Lake	GN-37	STL-A	18-Sep-18	113277	900 226000327966	402	451	400	3
Stephens Lake	GN-37	STL-A	18-Sep-18	-	900 043000103587	251	283	75	1
Stephens Lake	GN-33	STL-B	18-Sep-18	111064	900 067000121333	385	430	375	3
Stephens Lake	GN-33	STL-B	18-Sep-18	113278	900 226000327947	652	746	2050	7
Stephens Lake	GN-33	STL-B	18-Sep-18	113279	900 226000767677	435	492	525	3
Stephens Lake	GN-34	STL-B	18-Sep-18	-	900 067000121203	322	367	175	3
Stephens Lake	GN-41	STL-B	19-Sep-18	113280	900 226000327915	371	414	375	3
Stephens Lake	GN-41	STL-B	19-Sep-18	113281	900 226000327919	371	414	400	3
Stephens Lake	GN-41	STL-B	19-Sep-18	113282	900 226000327958	409	467	425	3
Stephens Lake	GN-41	STL-B	19-Sep-18	113284	900 226000327852	413	480	500	3
Stephens Lake	GN-43	STL-B	19-Sep-18	113285	900 067000113506	392	405	425	2
Stephens Lake	GN-39	STL-B	19-Sep-18	113286	900 226000327877	420	479	525	3
Stephens Lake	GN-40	STL-B	19-Sep-18	101994	900 1380344626	430	477	600	4[a]
Stephens Lake	GN-40	STL-B	19-Sep-18	113287	900 226000327881	590	681	1500	7
Stephens Lake	GN-40	STL-B	19-Sep-18	113288	900 226000153878	366	412	325	3
Stephens Lake	GN-44	STL-A	19-Sep-18	113289	900 226000327937	540	609	1300	5
Stephens Lake	GN-47	STL-B	20-Sep-18	113290	900 226000327902	784	890	4325	10

Table A2-3: Biological and tag information for Lake Sturgeon captured in Stephens Lake, fall 2018 (continued).

Waterbody	Site	Zone	Date	Floy-tag #	Pit-tag #	Fork Length (mm)	Total Length (mm)	Weight (g)	Age
Stephens Lake	GN-41	STL-B	20-Sep-18	112924	900 226000768894	410	447	550	3
Stephens Lake	GN-41	STL-B	20-Sep-18	113291	900 226000327980	452	505	650	5
Stephens Lake	GN-48	STL-B	20-Sep-18	113292	900 226000327973	522	594	1125	5
Stephens Lake	GN-48	STL-B	20-Sep-18	113293	900 067000058406	470	535	700	4
Stephens Lake	GN-48	STL-B	20-Sep-18	113294	900 226000327884	391	436	475	3
Stephens Lake	GN-48	STL-B	20-Sep-18	113295	900 067000059240	350	402	300	2
Stephens Lake	GN-45	STL-B	20-Sep-18	100674	900 067000112046	357	411	300	2
Stephens Lake	GN-45	STL-B	20-Sep-18	113296	900 067000055532	472	532	675	4
Stephens Lake	GN-45	STL-B	20-Sep-18	113297	900 067000112569	346	396	275	2
Stephens Lake	GN-45	STL-B	20-Sep-18	113298	900 226000327925	410	468	525	3
Stephens Lake	GN-45	STL-B	20-Sep-18	113299	900 226000327930	375	438	400	3
Stephens Lake	GN-45	STL-B	20-Sep-18	113300	900 067000112320	346	403	300	2
Stephens Lake	GN-49	STL-B	20-Sep-18	113283	900 067000055210	464	532	700	4

a – Ages assigned based on structures aged in a previous study year.

APPENDIX 3: AGEING STRUCTURES OF JUVENILE LAKE STURGEON CAUGHT IN THE KEEYASK STUDY AREA.

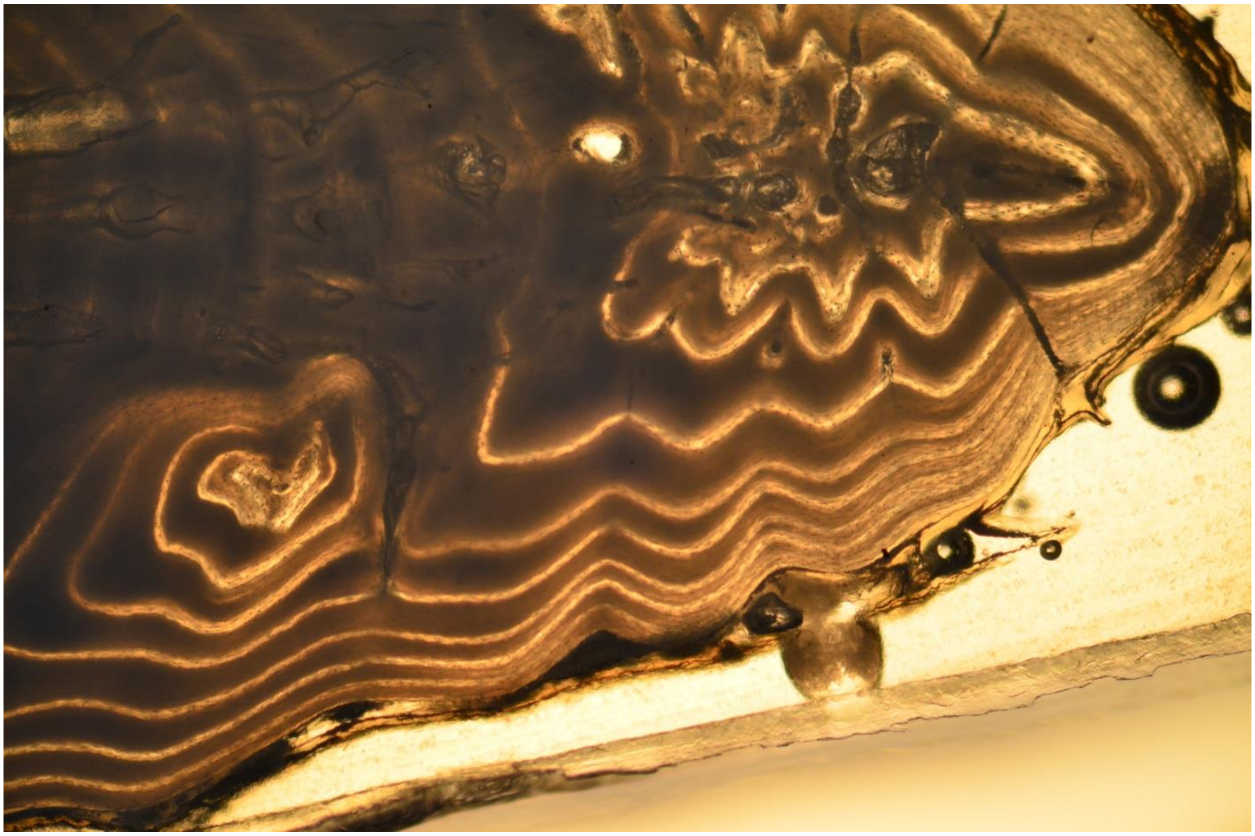


Figure A3-1: Ageing structure from a wild juvenile Lake Sturgeon (8-year-old) caught in Gull Lake.

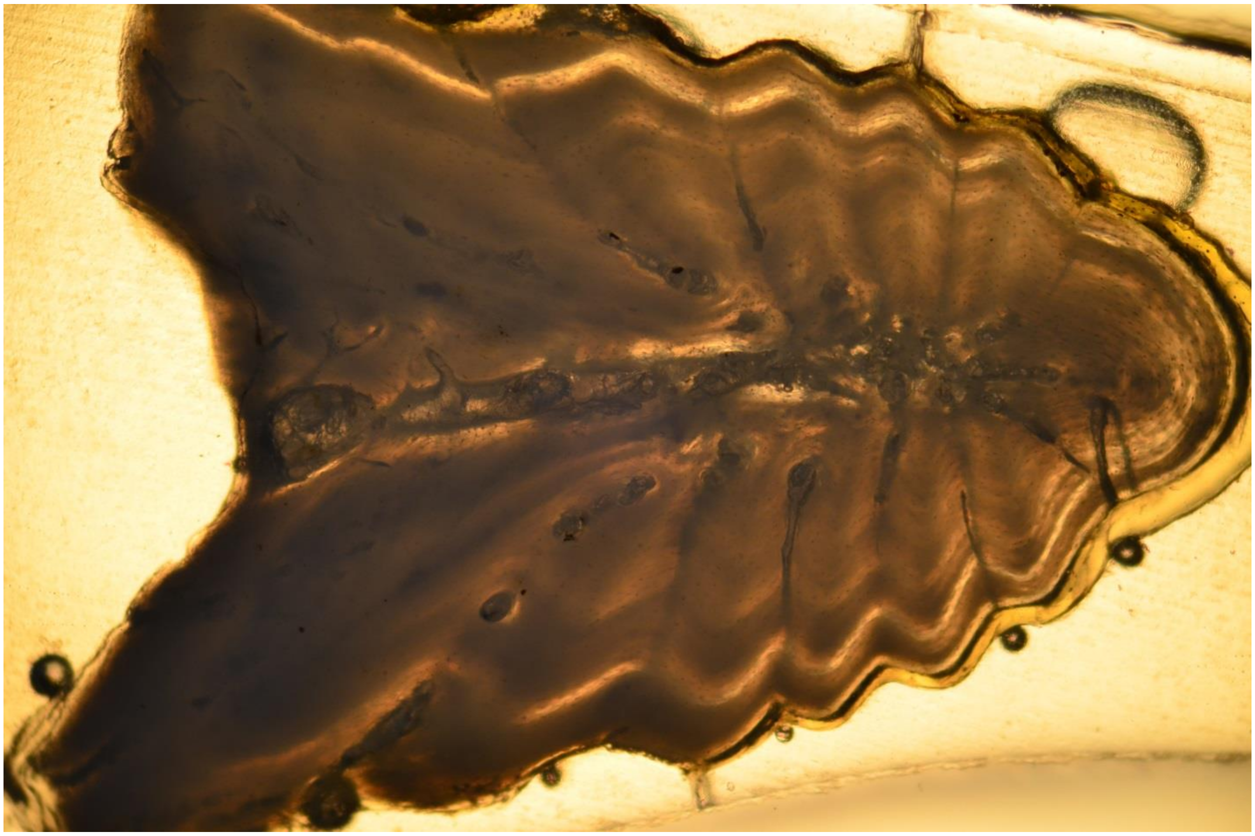


Figure A3-2: Ageing structure from a hatchery reared juvenile Lake Sturgeon caught in Stephens Lake (2-year-old). Agers noted the presence of a weak first annulus and false annuli typically observed in hatchery reared Lake Surgeon.

APPENDIX 4: WILD AND HATCHERY LAKE STURGEON RECAPTURE DATA, FALL 2018.

Table A4-1: Original capture date and biological data for fish recaptured in gill nets, fall 2018.

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Split Lake	79284	900 226000153736	SPL-A	12-Sep-18	683	779	2200	7	3.76	1121
Split Lake	-	-	SPL-A	18-Aug-15	507	579	820	-	-	-
			Growth		**176**	**200**	**1380**			
Split Lake	91364	900 226000548175	SPL-A	12-Sep-18	996	1160	7350	-	3.36	1912
Split Lake	-	-	SPL-A	18-Jun-13	859	962	5670	-	-	-
			Growth		**137**	**198**	**1680**			
Split Lake	91600	900 226000153775	SPL-A	12-Sep-18	796	892	4050	13	3.05	1854
Split Lake	-	-	SPL-A	15-Aug-13	580	652	1300	-	-	-
			Growth		**216**	**240**	**2750**			
Burntwood River	88179	900 226000893378	BWR-A	13-Sep-18	749	822	2650	-	0.41	455
Burntwood River	-	-	BWR-A	15-Jun-17	840	980	2903	-	-	-
					-91[b]	**-158[b]**	**-253[b]**			
Future Keeyask Reservoir	103649	900 226000629219	GL-C	11-Sep-18	873	984	5300	-	1.63	1529
Future Keeyask Reservoir	-	-	GL-C	05-Jul-14	764	844	3600	-	-	-
			Growth		**109**	**140**	**1700**			
Future Keeyask Reservoir	106462	900 226000893868	GL-C	11-Sep-18	707	797	2450	10[a]	0.15	367
Future Keeyask Reservoir	-	-	GL-C	09-Sep-17	700	788	2500	9	-	-
			Growth		**7**	**9**	**-50[b]**			
Future Keeyask Reservoir	107115	900 226000768485	GL-B	12-Sep-18	955	1084	7100	-	7.47	819
Future Keeyask Reservoir	-	-	GL-A	15-Jun-16	900	1100	6350	-	-	-
			Growth		**55**	**-16[b]**	**750**			
Future Keeyask Reservoir	103116	900 226000768467	GL-C	12-Sep-18	767	871	3200	9	0.38	828
Future Keeyask Reservoir	-	-	GL-C	06-Jun-16	620	711	2722	-	-	-
Future Keeyask Reservoir	-	-	GL-C	28-Jul-13	483	555	700	-	-	-
			Growth		**284**	**316**	**2500**			

Table A4-1: Original capture date and biological data for fish recaptured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Future Keeyask Reservoir	89658	900 226000327546	GL-C	12-Sep-18	770	858	3100	10	0.27	2911
Future Keeyask Reservoir	-	-	GL-C	23-Sep-10	347	385	250	-	-	-
			Growth		**423**	**473**	**2850**			
Future Keeyask Reservoir	94889	900 226000327545	GL-B	13-Sep-18	664	750	1900	10	2.76	2546
Future Keeyask Reservoir	-	-	GL-C	24-Sep-11	392	445	350	3	-	-
			Growth		**272**	**305**	**1550**			
Future Keeyask Reservoir	113033	900 067000121673	GL-C	13-Sep-18	332	372	250	3	2.44	360
Future Keeyask Reservoir	-	-	GL-C	18-Sep-17	289	316	150	2	-	-
			Growth		**43**	**56**	**100**			
Future Keeyask Reservoir	82647	900 226000629140	GL-C	13-Sep-18	936	1049	7000	-	7.08	1532
Future Keeyask Reservoir	-	-	GL-B	04-Jul-14	827	911	4536	-	-	-
Future Keeyask Reservoir	-	-	GL-B	23-Aug-06	563	643	726	-	-	-
			Growth		**373**	**406**	**6274**			
Future Keeyask Reservoir	106469	900 226000893798	GL-C	13-Sep-18	512	588	850	5	1.58	366
Future Keeyask Reservoir	-	-	GL-C	12-Sep-17	505	579	800	4	-	-
			Growth		**7**	**9**	**50**			
Future Keeyask Reservoir	113824	900 226000768413	GL-C	15-Sep-18	708	801	2450	10	0.39	830
Future Keeyask Reservoir	-	-	GL-C	07-Jun-16	619	706	2268	-	-	-
			Growth		**89**	**95**	**182**			
Future Keeyask Reservoir	113821	900 043000103674	GL-A	15-Sep-18	486	549	650	5	9.22	1525
Future Keeyask Reservoir	-	-		13-Jul-14	242	272	100	-	-	-
			Growth		**244**	**277**	**550**			
Future Keeyask Reservoir	106463	900 226000154225	GL-C	15-Sep-18	723	824	2850	10	1.77	371
Future Keeyask Reservoir	-	-	GL-C	09-Sep-17	700	800	2850	9	-	-
			Growth		**23**	**24**	**0**			

Table A4-1: Original capture date and biological data for fish recaptured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Future Keeyask Reservoir	113814	900 226000629005	GL-C	15-Sep-18	675	764	2450	9[a]	2.19	1543
Future Keeyask Reservoir	-	-		25-Jun-14	496	570	1000	6	-	-
				Growth	**179**	**194**	**1450**			
Future Keeyask Reservoir	112543	900 226000629452	GL-A	16-Sep-18	574	651	1100	7[*]	5.77	1094
Future Keeyask Reservoir	103463	-	GL-B	18-Sep-15	446	512	539	4[d]	-	-
Future Keeyask Reservoir	103463	-	GL-B	11-Sep-14	399	457	425	3	-	-
				Growth	**175**	**194**	**675**			
Future Keeyask Reservoir	105691	900 043000103824	GL-B	17-Sep-18	668	766	1850	10[*]	0.30	1095
Future Keeyask Reservoir	-	-	GL-B	18-Sep-15	574	661	1100	7	-	-
Future Keeyask Reservoir	-	-	GL-B	02-Jul-14	510	595	1150	-	-	-
				Growth	**158**	**171**	**700**			
Future Keeyask Reservoir	112502	900 226000893677	GL-C	17-Sep-18	669	765	2300	10[a]	1.72	734
Future Keeyask Reservoir	-	-	GL-C	13-Sep-16	622	710	2120	7	-	-
				Growth	**47**	**55**	**180**			
Future Keeyask Reservoir	113841	900 043000103668	GL-B	18-Sep-18	489	556	700	5	4.59	1465
Future Keeyask Reservoir	-	-	GL-C	14-Sep-14	237	271	50	1	-	-
				Growth	**252**	**285**	**650**			
Future Keeyask Reservoir	91383	900 226000629177	GL-C	19-Sep-18	1031	1112	8500	-	21.21	1546
Future Keeyask Reservoir	-	-	BR-D	26-Jun-14	895	1003	5897	-	-	-
				Growth	**136**	**109**	**2603**			
Stephens Lake	101500	900 226000628170	STL-B	12-Sep-18	812	909	3650	10[*]	0.68	1076
Stephens Lake	-	-	STL-B	02-Oct-15	700	763	2400	7	-	-
				Growth	**112**	**146**	**1250**			
Stephens Lake	110580	900 067000121406	STL-A	12-Sep-18	386	435	300	3	2.83	725
Stephens Lake	-	-	STL-B	17-Sep-16	247	280	80	1	-	-
				Growth	**139**	**155**	**220**			

Table A4-1: Original capture date and biological data for fish recaptured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Stephens Lake	115826	900 226000154078	STL-A	13-Sep-18	837	945	4300	-	0.66	94
Stephens Lake	-	-	STL-A	11-Jun-18	825	925	4275	-	-	-
					12	**20**	**25**			
Stephens Lake	110994	900 226000548945	STL-B	15-Sep-18	522	595	1100	5	1.10	825
Stephens Lake	-	-	STL-A	12-Jun-16	343	387	253	-	-	-
			Growth		**179**	**208**	**847**			
Stephens Lake	112945	900 226000893689	STL-B	15-Sep-18	545	630	1150	5	0.30	359
Stephens Lake	-	-	STL-B	21-Sep-17	513	589	1000	4	-	-
			Growth		**32**	**41**	**150**			
Stephens Lake	92093	N/A	STL-B	15-Sep-18	770	874	3300	10[*]	2.89	2191
Stephens Lake	-	-	STL-A	15-Sep-12	461	540	700	4	-	-
Stephens Lake	-	-	STL-B	06-Jul-11	340	398	300	-	-	-
			Growth		**430**	**476**	**3000**			
Stephens Lake	110582	900 067000055566	STL-B	15-Sep-18	530	616	1050	5[a]	3.06	728
Stephens Lake	-	-	STL-B	17-Sep-16	416	471	440	2	-	-
			Growth		**114**	**145**	**610**			
Stephens Lake	96513	900 226000154249	STL-B	16-Sep-18	531	602	1075	6[*]	15.01	1095
Stephens Lake	-	-	STL-A	12-Sep-17	521	585	950	5[*]	-	-
Future Keeyask Reservoir	-	900 043000103672[c]	GL-C	17-Sep-15	382	435	363	3	-	-
Future Keeyask Reservoir	-	-	GL-C	16-Sep-14	343	392	300	2	-	-
			Growth		**188**	**210**	**775**			
Stephens Lake	111064	900 067000121333	STL-B	18-Sep-18	385	430	375	4[a]	2.47	370
Stephens Lake	-	-	STL-A	13-Sep-17	349	387	250	2	-	-
			Growth		**36**	**43**	**125**			

Table A4-1: Original capture date and biological data for fish recaptured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Stephens Lake	101994	900 1380344626	STL-B	19-Sep-18	430	477	600	4[a]	0.49	1090
Stephens Lake	-	-	STL-B	25-Sep-15	230	246	180	1	-	-
				Growth	**200**	**231**	**420**			
Stephens Lake	112924	900 226000768894	STL-B	20-Sep-18	410	447	550	3	2.33	371
Stephens Lake	-	-	STL-A	14-Sep-17	363	398	280	2	-	-
					47	**49**	**270**			

* - Ages assigned based on structures aged in a previous study year.

a – Assigned age in 2018 differed from ageing carried out in a previous year.

b – Measurement discrepancies due to errors in measurement at release or recapture.

c – Original PIT tag has been lost.

d – Aged as 3 years old in both 2014 and 2015.

Table A4-2: Original release date and biological data for hatchery-reared Lake Sturgeon captured in gill nets, fall 2018.

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Split Lake	113710	900 043000102957	SPL-A	20-Sep-18	520	581	1100	5	32.29	1449
Burntwood River	-	-	BWR-B	02-Oct-14	265	297	105			
			Growth		**255**	**284**	**995**			
Future Keeyask Reservoir	113006	900 067000112175	GL-B	11-Sep-18	353	409	300	2	8.79	460
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	216	263	59			
			Growth		**137**	**146**	**241**			
Future Keeyask Reservoir	113022	900 067000059369	GL-A	13-Sep-18	349	390	250	2	2.63	462
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	220	250	63			
			Growth		**129**	**140**	**187**			
Future Keeyask Reservoir	113023	900 067000059421	GL-A	13-Sep-18	365	419	300	2	2.63	462
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	232	271	74			
			Growth		**133**	**148**	**226**			
Future Keeyask Reservoir	113029	900 067000055044	GL-B	13-Sep-18	428	497	450	4	2.72	1179
Future Keeyask Reservoir	-	-	GL-B	22-Jun-15	209	247	53			
			Growth		**219**	**250**	**397**			
Future Keeyask Reservoir	113044	900 067000055461	GL-C	14-Sep-18	424	488	450	4	3.92	1094
Future Keeyask Reservoir	-	-	GL-B	16-Sep-15	295	343	136			
			Growth		**129**	**145**	**314**			
Future Keeyask Reservoir	113048	900 067000112161	GL-B	14-Sep-18	403	458	350	2	8.5	463
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	287	86	-			
			Growth		**116**	**372**	**-**			
Future Keeyask Reservoir	113831	900 067000055689	GL-B	17-Sep-18	440	511	500	4	0.48	1097
Future Keeyask Reservoir	-	-	GL-B	16-Sep-15	318	366	165			
			Growth		**122**	**145**	**335**			

Table A4-2: Original release date and biological data for hatchery-reared Lake Sturgeon captured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Future Keeyask Reservoir	113832	900 067000055259	GL-B	17-Sep-18	405	466	400	4	0.48	1097
Future Keeyask Reservoir	-	-	GL-B	16-Sep-15	291	335	144			
				Growth	**114**	**131**	**256**			
Future Keeyask Reservoir	113833	900 067000112140	GL-B	17-Sep-18	373	428	300	2	9.16	466
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	330	128	-			
				Growth	**43**	**300**	**-**			
Future Keeyask Reservoir	113835	900 067000058508	GL-B	17-Sep-18	453	519	500	4	2.80	1183
Future Keeyask Reservoir	-	-	GL-B	22-Jun-15	215	249	60			
				Growth	**238**	**270**	**440**			
Future Keeyask Reservoir	113836	900 067000112127	GL-B	17-Sep-18	400	463	400	2	8.92	466
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	233	277	72			
				Growth	**167**	**186**	**328**			
Future Keeyask Reservoir	113839	900 067000059354	GL-A	18-Sep-18	318	365	200	2	2.27	467
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	228	266	71			
				Growth	**90**	**99**	**129**			
Future Keeyask Reservoir	113848	900 067000056730	GL-C	18-Sep-18	381	438	400	2	12.8	467
Future Keeyask Reservoir	-	-	GL-A	08-Jun-17	249	290	90			
				Growth	**132**	**148**	**310**			
Future Keeyask Reservoir	113153	900 067000058648	GL-B	19-Sep-18	479	545	700	4	0.39	1185
Future Keeyask Reservoir	-	-	GL-B	22-Jun-15	232	271	75			
				Growth	**247**	**274**	**625**			
Future Keeyask Reservoir	113154	900 067000055405	GL-B	19-Sep-18	462	535	600	4	0.45	1099
Future Keeyask Reservoir			GL-B	16-Sep-15	297	344	130			
				Growth	**165**	**191**	**470**			

Table A4-2: Original release date and biological data for hatchery-reared Lake Sturgeon captured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Future Keeyask Reservoir	113161	900 067000055447	GL-B	19-Sep-18	448	518	500	4	2.78	1185
Future Keeyask Reservoir	-	-	GL-B	22-Jun-15	257	298	93			
				Growth	**191**	**220**	**407**			
Future Keeyask Reservoir	-9999	900 067000110427	GL-C	19-Sep-18	255	296	100	1	127.8	104
Burntwood River	-	-	BWR	07-Jun-18	193	228	47			
				Growth	**62**	**68**	**53**			
Stephens Lake	100673	900 067000055481	STL-A	11-Sep-18	455	525	750	4	11.19	1091
Future Keeyask Reservoir	-	-	GL-C	16-Sep-15	295	349	140			
				Growth	**160**	**176**	**610**			
Stephens Lake	115144	900 067000058474	STL-A	11-Sep-18	490	562	875	4	0.66	1093
Stephens Lake	-	-	STL-A	14-Sep-15	277	322	118			
				Growth	**213**	**240**	**757**			
Stephens Lake	113259	900 067000055178	STL-B	15-Sep-18	503	570	900	4	1.83	1181
Stephens Lake	-	-	STL-B	22-Jun-15	219	250	54			
				Growth	**284**	**320**	**846**			
Stephens Lake	113261	900 067000055526	STL-A	15-Sep-18	495	566	850	4	2.34	1181
Stephens Lake	-	-	STL-B	22-Jun-15	221	258	57			
				Growth	**274**	**308**	**793**			
Stephens Lake	113263	900 067000055507	STL-A	15-Sep-18	497	566	875	4	3.29	1097
Stephens Lake	-	-	STL-B	14-Sep-15	314	360	180			
				Growth	**183**	**206**	**695**			
Stephens Lake	113264	900 067000055170	STL-A	15-Sep-18	480	550	775	4	13.14	1095
Future Keeyask Reservoir	-	-	GL-B	16-Sep-15	350	400	248			
				Growth	**130**	**150**	**527**			

Table A4-2: Original release date and biological data for hatchery-reared Lake Sturgeon captured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Stephens Lake	113265	900 067000111882	STL-A	15-Sep-18	354	410	375	2	1.7	457
Stephens Lake	-	-	STL-A	15-Jun-17	218	255	62			
			Growth		**136**	**155**	**313**			
Stephens Lake	113269	900 067000055076	STL-B	17-Sep-18	502	568	700	4	0.91	1099
Stephens Lake	-	-	STL-B	14-Sep-15	298	344	140			
			Growth		**204**	**224**	**560**			
Stephens Lake	113271	900 067000111990	STL-B	17-Sep-18	375	416	350	2	4	459
Stephens Lake	-	-	STL-A	15-Jun-17	262	300	103			
			Growth		**113**	**116**	**247**			
Stephens Lake	113285	900 067000113506	STL-B	19-Sep-18	392	405	425	2	3.23	461
Stephens Lake	-	-	STL-A	15-Jun-17	240	281	79			
			Growth		**152**	**124**	**346**			
Stephens Lake	113293	900 067000058406	STL-B	20-Sep-18	470	535	700	4	14.99	1186
Future Keeyask Reservoir	-	-	GL-B	22-Jun-15	206	239	52			
			Growth		**264**	**296**	**648**			
Stephens Lake	113295	900 067000059240	STL-B	20-Sep-18	350	402	300	2	3.14	462
Stephens Lake	-	-	STL-A	15-Jun-17	230	270	76			
			Growth		**120**	**132**	**224**			
Stephens Lake	100674	900 067000112046	STL-B	20-Sep-18	357	411	300	2	2.8	462
Stephens Lake	-	-	STL-A	15-Jun-17	230	286	73			
			Growth		**127**	**125**	**227**			
Stephens Lake	113296	900 067000055532	STL-B	20-Sep-18	472	532	675	4	0.66	1102
Stephens Lake	-	-	STL-A	14-Sep-15	288	335	137			
			Growth		**184**	**197**	**538**			

Table A4-2: Original release date and biological data for hatchery-reared Lake Sturgeon captured in gill nets, fall 2018 (continued).

Location	Floy-tag #	Pit-tag No.	Zone	Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Age	Distance (km)	Days Between Capture
Stephens Lake	113297	900 067000112569	STL-B	20-Sep-18	346	396	275	2	2.8	462
Stephens Lake	-	-	STL-A	15-Jun-17	210	245	55			
			Growth		**136**	**151**	**220**			
Stephens Lake	113300	900 067000112320	STL-B	20-Sep-18	346	403	300	2	2.8	462
Stephens Lake	-	-	STL-A	15-Jun-17	232	273	76			
			Growth		**114**	**130**	**224**			
Stephens Lake	113283	900 067000055210	STL-B	20-Sep-18	464	532	700	4	0.7	1102
Stephens Lake	-	-	STL-A	14-Sep-15	274	317	123			
			Growth		**190**	**215**	**577**			

APPENDIX 5: POPULATION ESTIMATE INFORMATION.

Mark-recapture population estimates were been calculated for wild fish in the future Keeyask reservoir and Stephens Lake during the fall of eight different years (2010 and 2012-2018). Only wild Lake Sturgeon classified as juveniles (*i.e.*, fork length less than 800 mm) were included in the population estimate.

Data were analysed using the program MARK (White and Burnham 1999; Kendall 2001; Arnason and Schwartz 2002), which is an industry standard for the analysis of data from marked populations. Program MARK uses binary numbers to represent the encounter history of individuals, and then uses the cumulative pattern of 0's (not-encountered) and 1's (re-encountered live capture) to generate a probability distribution of tag recaptures which form the basis of population estimation. Re-encounters can also be from dead recoveries (*e.g.*, the animal is harvested) in which case the model uses a value of -1. For example, the history "10-1" indicates than an animal was captured for the first time at sampling occasion 1, not encountered at sampling occasion 2, and recovered dead at sampling occasion 3.

Several different population model variants exist, most of which can be classified as either closed or open models. Closed models assume there are no births, deaths, immigration, or emigration between sample periods, while open models assume these processes occur. The Jolly-Seber model (POPAN formulation; Arnason and Schwarz 2002), as implemented within MARK, was used to estimate the annual abundance of juvenile Lake Sturgeon. This is an open model that requires few assumptions and modeled variables, and thus likely provides a reliable estimate of abundance.

Using first-time capture and recapture information, POPAN estimates the survival (*i.e.,* the probability that a fish will survive from one capture to the next), the probability of recapture (p; *i.e.,* the probability that a fish will be recaptured given that the animal is alive and in the study area), and abundance (N; *i.e.,* the number of juvenile Lake Sturgeon in the area during each capture period) (Tables A5-1 and A5-2).

- Model fit for survival was calculated as 77% for the future Keeyask reservoir and 88% for Stephens Lake.
- The probability of recapture varied among years.
    - Recapture rates were split into two groups based on the model for the future Keeyask reservoir: i) 2010 and 2013 (0.02) and ii) 2012 and 2014–2018 (0.03).
    - For Stephens Lake, recapture rates were split into four groups: i) 2010 and 2013 (0.03); ii) 2015 and 2018 (0.05); iii) 2014 (0.06); and iv) 2012, 2016, and 2017 (0.09).
- Abundance estimates for both the future Keeyask reservoir and Stephens Lake are provided for the 2010 and 2012-2018 study years.
- As sampling continues (*i.e.*, year to year) and data is added to the model, the parameters are recalculated. Thus, although survival rates and abundance estimates are calculated for the same time periods, they may differ among reporting periods. This allows the estimates to become more refined and precise over time.

The Cormack-Jolly-Seber model was used to calculate an estimate of survival of hatchery-reared lake Sturgeon in both the future Keeyask reservoir and Stephens Lake between 2015 (when stocking began) and 2018. This model calculates an estimate using the probability of recapture. The probability of recapture differed each year, but were the same for both the future Keeyask reservoir and Stephens Lake (Table A5-2). A survival estimate could only be calculated for fish stocked in 2015 (*i.e.*, 2014 cohort) due to low levels of recapture for fish stocked in other years.

References

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White, G.C. and Burnham, K.P. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46 Supplement: 120–138.

Table A5-1: Results of POPAN analysis of juvenile Lake Sturgeon from the future Keeyask reservoir. Best model was constant survival and variable recapture. Confidence intervals are rounded.

Parameter	Mean	SE	95% Confidence Interval	
			Low	High
Survival (all years)	0.77	0.05	0.67	0.85
2010, 2013 Recapture	0.02	0.00	0.01	0.02
2012, 2014-2018 Recapture	0.03	0.00	0.02	0.04
2010 Abundance	4270	695	3110	5861
2012 Abundance	2553	424	1848	3526
2013 Abundance	3201	755	2029	5050
2014 Abundance	3663	637	2612	5137
2015 Abundance	4029	599	3015	5383
2016 Abundance	3115	557	2200	4410
2017 Abundance	2726	510	1896	3920
2018 Abundance	4133	713	2955	5780

Table A5-2: Results of POPAN analysis of juvenile Lake Sturgeon from Stephens Lake. Best model was constant survival and variable recapture. Confidence intervals are rounded.

Parameter	Mean	SE	95% Confidence Interval	
			Low	High
Survival (all years)	0.88	0.04	0.78	0.94
2010, 2013 Recapture	0.03	0.00	0.02	0.04
2015, 2018 Recapture	0.05	0.01	0.04	0.07
2014 Recapture	0.06	0.02	0.04	0.11
2012, 2016, 2017 Recapture	0.09	0.01	0.06	0.12
2010 Abundance	1152	159	880	1509
2012 Abundance	924	146	679	1257
2013 Abundance	812	147	570	1155
2014 Abundance	713	151	473	1076
2015 Abundance	835	128	619	1126
2016 Abundance	734	131	519	1037
2017 Abundance	1035	185	730	1466
2018 Abundance	1101	219	749	1620

Table A5-3: Results of POPAN analysis of hatchery-reared juvenile Lake Sturgeon from the future Keeyask reservoir (FKR) and Stephens Lake. Best model was constant survival and variable recapture. Confidence intervals are rounded.

Parameter	Mean	SE	95% Confidence Interval	
			Low	High
FKR Survival	0.95	0.26	0.00	1.00
Stephens Survival	0.86	0.24	0.10	1.00
2015 Recapture	0.01	0.00	0.00	0.02
2016 Recapture	0.02	0.01	0.01	0.06
2017 Recapture	0.05	0.04	0.01	0.22
2018 Recapture	0.03	0.04	0.00	0.25
FKR 2014 Cohort (stocked 2015)	423	-	-	-
FKR 2015	402	-	-	-
FKR 2016	382	-	-	-
FKR 2017	364	-	-	-
FKR 2018	346	-	-	-
Stephens 2014 Cohort (stocked 2015)	418	-	-	-
Stephens 2015	361	-	-	-
Stephens 2016	312	-	-	-
Stephens 2017	270	-	-	-
Stephens 2018	233	-	-	-