Keeyask Generation Project

Aquatic Effects Monitoring Plan

Juvenile Lake Sturgeon Movement Monitoring Report

AEMP-2024-02

KEEYASK

Manitoba Environment and Climate Change Client File 5550.00
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2023 -2024

KEEYASK GENERATION PROJECT

AQUATIC EFFECTS MONITORING PLAN

REPORT #AEMP-2024-02

JUVENILE LAKE STURGEON ACOUSTIC TRACKING IN THE NELSON RIVER BETWEEN CLARK LAKE AND THE LIMESTONE GENERATING STATION, OCTOBER 2022 TO OCTOBER 2023: YEAR 2 OPERATION

Prepared for

Manitoba Hydro

By

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June 2024

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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. Monitoring results provide information to assess the accuracy of predictions, information to determine the actual effects of construction and operation of the GS on the environment, and whether more needs to be done to reduce harmful effects.

Construction of the Keeyask GS began in mid-July 2014 and instream work was completed in 2020. The reservoir was impounded, and water levels were raised to full supply level between August 31 and September 5, 2020. Commissioning of the powerhouse turbines was initiated after impoundment. They were brought into service one at a time with the final of seven turbines completed on March 9, 2022.

Lake Sturgeon are one of the key species for monitoring because they are culturally important to partner First Nations, local sturgeon 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
- Recording seasonal habitat use and long-distance movements (*i.e.*, over GS's or rapids) through movement studies.

Movements of juvenile Lake Sturgeon in Stephens Lake were monitored with acoustic transmitters in 2011 and 2012, but because different methods are being used for the current study, the results of the two programs cannot be directly compared. Results of the 2011/2012 study showed that young Lake Sturgeon in Stephens Lake preferred to live in the deep water during the spring, summer, and fall but moved into nearby shallower habitat outside the old river channel in winter. Also, it was unusual for juvenile Lake Sturgeon to travel long distances; instead, they generally stayed in the upstream portion of the lake where water flows decreased downstream of Gull Rapids. No tagged juveniles moved upstream through Gull Rapids or downstream past the Kettle GS.

Monitoring juvenile sturgeon movements using acoustic telemetry as part of the AEMP began in August 2013. Therefore, movements of juvenile Lake Sturgeon have been monitored for 10.5 months before changes to the river (pre-construction), for approximately six years and two months during construction, and approximately three years after reservoir impoundment (September 5, 2020, to October 2, 2023). The original 40 acoustic tags applied in 2013 reached the end of their battery life in 2017, and the 40 acoustic tags applied in 2017 expired during the open-water period

of 2022; therefore, 40 juvenile Lake Sturgeon were implanted with acoustic tags in September 2021 to continue the study. This report provides results of juvenile sturgeon movement monitoring conducted from October 2022 to October 2023.

Why is the study being done?

Monitoring during the time when the Keeyask GS is operational is being done to answer three questions:

How many juvenile Lake Sturgeon are moving through and/or away from the generating station during operation and how far are they going?

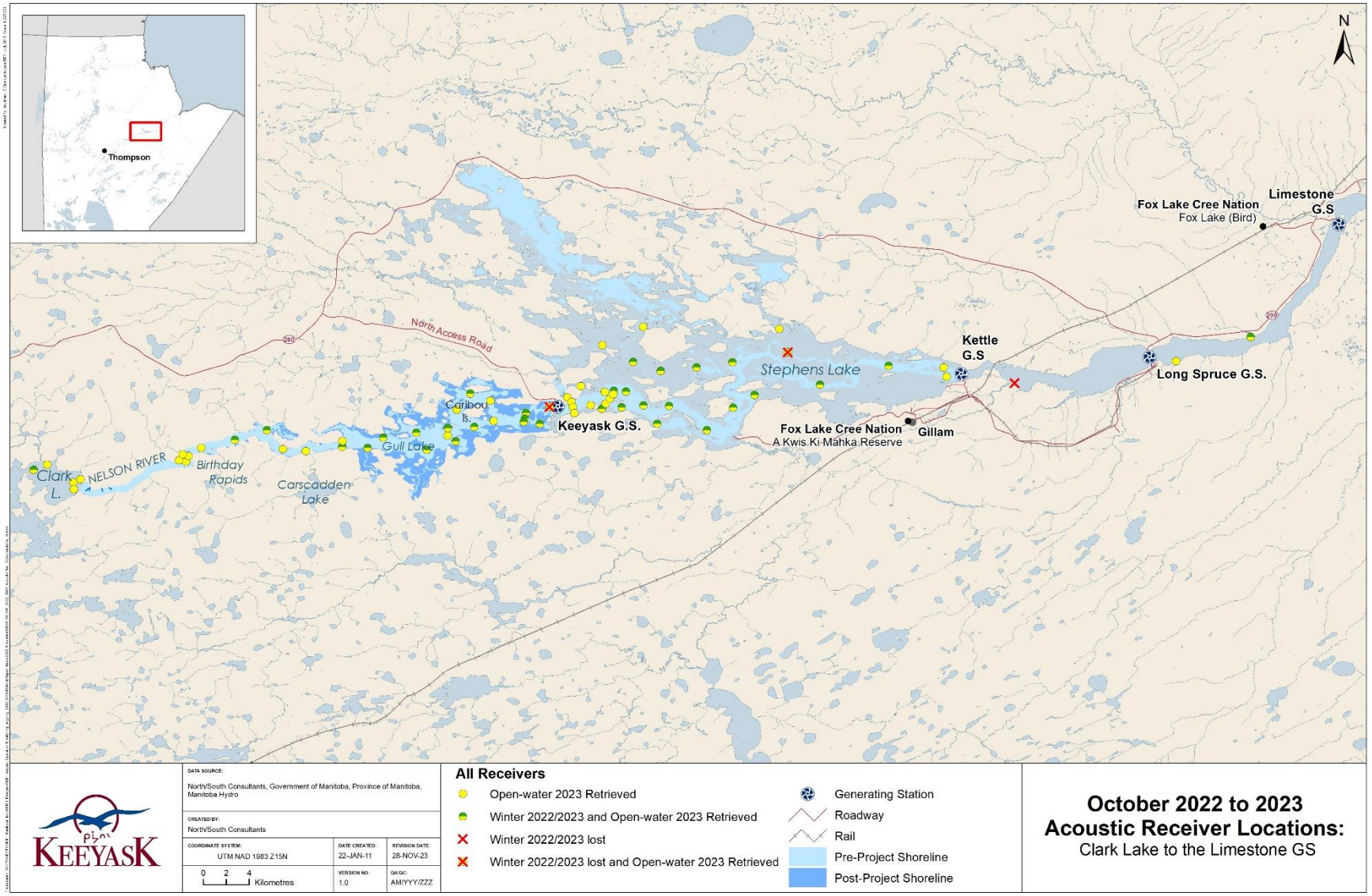
Building the GS, flooding the reservoir, and operating the GS changed the amount and type of fish habitat upstream and downstream. These changes may result in juvenile Lake Sturgeon leaving their usual habitat to seek new areas. Monitoring how far fish move tell us if they leave the area.

Are fish moving downstream past the GS and are these fish surviving passage?

Now that the reservoir is flooded, fish may react to changes in habitat by leaving the area. If they move downstream past the GS (powerhouse or spillway), they cannot move back, and may be injured or killed during passage. This could decrease the number of fish living upstream of the GS.

Did juvenile Lake Sturgeon change where they live after the reservoir was flooded?

Flooding of the Keeyask reservoir has caused changes to available habitat in the area. Juvenile Lake Sturgeon may move away from areas where they used to live. They may spread out or congregate in new or different areas of the river. Monitoring over the next eight years will tell us if these fish change where they live.



Map showing the study area. The dots represent the locations of receivers in the river. The different colours represent receivers that were in the river at different times of the year.

What was done?

The movements of juvenile sturgeon were tracked using acoustic telemetry. This is a technique in which a tag is surgically implanted inside a fish. The tag emits a sound signal (called a “ping”) that is picked up by receivers placed along the Nelson River between Clark Lake and the Limestone GS (see study area map above). Movements of the tagged fish were monitored year-round including in the winter when the river is covered with ice. Monitoring movements in winter is challenging because the ice conditions can damage or move the receivers. For this reason, receivers are left in fewer locations during the winter, making it less likely that sturgeon will be detected. More suitable areas for receivers (deep areas with low flow) became available after the reservoir was flooded in fall 2020 and additional receivers were set in all winter periods since. Movements are normally tracked in the Long Spruce forebay, downstream of the Kettle GS, however, low water levels in 2023 prevented this.

Boat launch downstream of the Kettle GS looking north at the launch (left) and east from the launch (right) showing low water levels observed during open-water 2023. This location was not accessible in 2023.

Each fish is given a tag that transmits a unique ping which can be detected up to 1 km away from a receiver. By looking at the detections that were recorded by different receivers, the movement of each fish can be tracked. The tags are powered by batteries with a four-year lifespan.

During fall 2013, 20 tags were applied to juvenile sturgeon in Gull Lake and 20 were applied to juveniles in Stephens Lake. Forty additional juveniles (20 upstream and 20 upstream) were tagged in each of 2017 and 2021 to account for expiring batteries and allow for continuity in tracking their movements. An additional five fish at each location were tagged in fall 2023 to ensure a sufficient number of fish can are available to be tracked over the 2023/24 ice cover period.

Conducting a surgery (left) on a juvenile Lake Sturgeon to implant an acoustic tag (middle). After surgery, juveniles are released into off-current areas (right).

What was found?

Before and during construction, juvenile Lake Sturgeon tagged in the area upstream of the Keeyask GS did not move very far and most were concentrated in a few small areas within Gull Lake. Immediately after impoundment in fall 2020 and during winter 2020/2021, juvenile Lake Sturgeon did not change their movement patterns. However, beginning in June 2021, juvenile Lake Sturgeon began to move longer distances and were detected in different areas upstream of the Keeyask GS then they have been found in the past.

Since June 2021, ten fish moved downstream past the Keeyask GS which represents an increase from previous years. Between 2013 and 2020, only one fish moved downstream. All movements are shown in the maps below. Of the ten fish that crossed the GS, three fish moved downstream in open-water 2021, four in winter 2021/2022, and three in either winter or early in the open-water period during 2022. After moving past the Keeyask GS, all ten fish moved upstream and downstream in Stephens Lake, showing that they survived passage.

Beginning in open-water 2022, juvenile Lake Sturgeon movements have returned to patterns seen before and during construction where they stay in small areas within the Keeyask reservoir. The overall movement ranges (the difference between how far upstream and how far downstream a fish moves) in 2022 and 2023 were similar to those observed prior to impoundment. Further, no juvenile Lake Sturgeon have moved downstream past the Keeyask GS since June 2022.

In Stephens Lake, juvenile Lake Sturgeon continued to show the same general movements as they have since 2013. Fish tagged in Stephens Lake tend to stay in the main river channel, specifically the part of Stephens Lake where the river channel was flooded when the Kettle GS was built. This has not changed since the Keeyask GS was completed in March 2022. No fish moved downstream past the Kettle GS in 2023.

What does it mean?

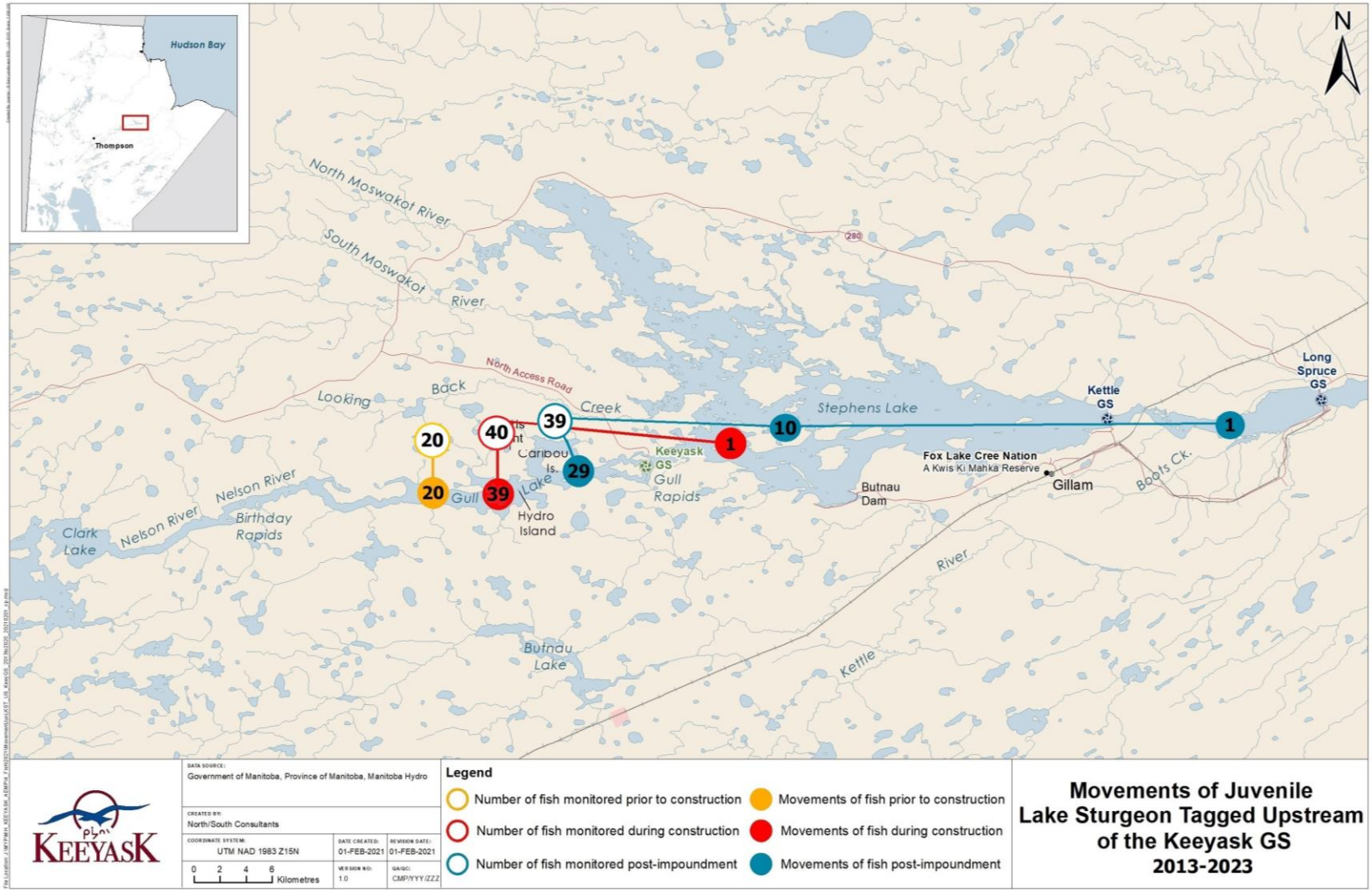
The EIS predicted that once impoundment and GS operation started, areas preferred by juvenile Lake Sturgeon may become unsuitable because of a change in how the water flows through these areas and the associated changes to the sediment on the bottom. This could result in juvenile Lake Sturgeon having to move further to find new areas to live or leaving the area completely. Before

the Keeyask GS reservoir was flooded, monitoring upstream of the Keeyask GS showed that each sturgeon tended to stay in the same areas year after year, moving little. Data collected immediately after impoundment in September 2020 and during the winter 2020/2021 showed that these movements didn't change. In open-water 2021, juvenile Lake Sturgeon started moving farther distances and more moved downstream past the Keeyask GS. However, this was a short-lived trend. In both open-water 2022 and 2023 fish moved less and stayed in the same areas, with none moving downstream past the Keeyask GS since June 2022.

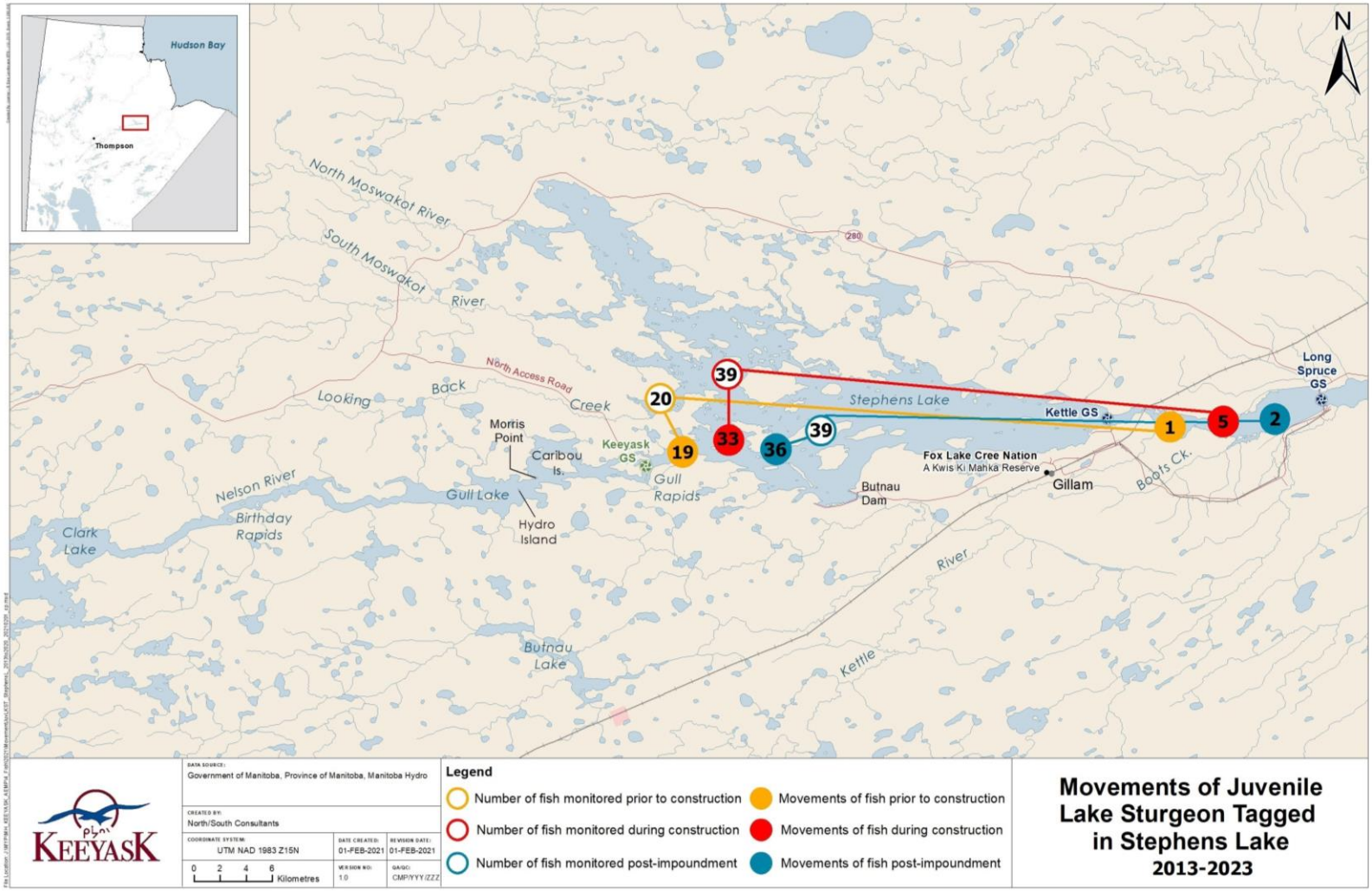
In Stephens Lake, movement monitoring from 2013–2023 suggests that construction and the beginning of operation of the Keeyask GS has not affected movement patterns or habitat use. Juvenile Lake Sturgeon continue to mostly use the southern portion of the Lake, within 10 rkm of the GS, and similar numbers have moved downstream past the Kettle GS.

What will be done next?

Fish tagged in 2021 and 2023 will continue to be tracked. Following the movements of individual fish over a long time will give us a better idea of what kinds of habitats these fish need to use over many years and if fish change their movements again in the Keeyask reservoir.



Map showing how many juvenile Lake Sturgeon moved upstream out of the Keeyask reservoir, stayed in the Keeyask reservoir, and moved into Stephens Lake before construction (yellow), during construction (red), and after reservoir impoundment (blue). Movements of fish due to tagging stress or mortality were not included. Numbers of fish monitored (hollow circles) represent the number of fish tagged while the number of fish movements (solid circles) represent the number of fish detected.



Map showing how many juvenile Lake Sturgeon moved upstream through Gull Rapids (before it was no longer possible in 2018), stayed in Stephens Lake, and moved downstream past the Kettle GS before construction (yellow), during construction (red), and after reservoir impoundment (blue). Movements due to tagging stress and mortality were not included. Numbers of fish monitored (hollow circles) represent the number of fish tagged while the number of fish movements (solid circles) represent the number of fish detected.

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The collection of biological samples described in this report was authorized by Economic Development, Investment, Trade, and Natural Resources, Fish and Wildlife Branch, under terms of the Scientific Collection Permit #57172605 (SCP 19-2023).

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1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt (MW) hydroelectric generating station on the lower Nelson River in northern Manitoba. The GS is approximately 725 kilometres (km) northeast of Winnipeg, 35 km upstream of the existing Kettle Generating Station, 60 km east of the community of Split Lake, 180 km east-northeast of Thompson and 30 km west of Gillam. Construction of the GS began in July 2014 and the seven generating units were all in-service in March 2022.

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 licencing 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 movement for the construction and operation phases of the Project.

Monitoring of juvenile Lake Sturgeon movements was initiated in 2011, but the program was specifically focused on gaining a better understanding of juvenile Lake Sturgeon habitat preferences (water depth, water velocity, and substrate type) within Stephens Lake. As pre-Project studies were not designed to record detailed movement patterns in the Clark Lake to Stephens Lake reach as a whole, results were not directly comparable to the movement data being collected under the AEMP, but they provided valuable insight into the behaviour of this life history stage in Stephens Lake (McDougall *et al.* 2013a, b). Data were collected across three seasons (open-water 2011, winter 2011/2012, and open-water 2012), and results suggested that during periods of open water, juvenile Lake Sturgeon preferred deep-water habitat within the old river channel in the upper 6 km of Stephens Lake, in an area where velocity decreases and substrate transitions from cobble, to gravel, to sand, and silt. During winter, juveniles moved farther downstream. None of the 20 tagged juvenile Lake Sturgeon in this study moved upstream through Gull Rapids, nor downstream past the Kettle Generating Station (GS).

The Keeyask AEMP juvenile Lake Sturgeon movement monitoring program was initiated in August 2013 when 40 juvenile Lake Sturgeon were tagged with acoustic transmitters with a four-year battery life, including 20 in Gull Lake and 20 in Stephens Lake. In Gull and Stephens lakes, Lake Sturgeon are classified as juveniles if they have a fork length measuring less than 800 mm (Henderson *et al.* 2015). The original 40 transmitters were set to expire in August 2017. To continue the study (after the batteries expired in the original 40 transmitters), an additional 40 transmitters were applied to juvenile Lake Sturgeon in September 2017, again with 20 applied in both Gull and Stephens lakes. As these tags were set to expire in 2022, an additional 40 transmitters were applied in September 2021. The original 40 transmitters applied in 2013 are now expired and can no longer be tracked.

The overall aim of this monitoring component is to describe juvenile Lake Sturgeon movement during the pre-construction (2013–July 2014), construction (July 2014-September 2020), post-impoundment (September 2020–2022), and operation (2022-onging) periods of the Project and to determine if the disturbances associated with construction, impoundment, and operation altered habitat use and coarse-scale movement patterns upstream and downstream of the Project.

Impoundment of the Keeyask reservoir was completed on September 5, 2020, and monitoring in the Keeyask reservoir in 2021 represented the first year of monitoring with the reservoir at full supply level. Monitoring in Stephens Lake, however, represented a transition between construction and operation as a considerable portion of the flow was still being passed via the spillway in spring and early summer when only a few units were in-service. All powerhouse units were commissioned by March 22, 2022. Therefore, monitoring in 2023 represents the second year of operation monitoring. Key questions identified in the AEMP relating to operation monitoring include:

- Will the frequency of long-distance movements (and subsequent downstream emigration/entrainment) by Lake Sturgeon increase during construction and operation of the Project?
- Are fish moving downstream past the GS and, if so, is there an indication that they have survived passage?
- Will there be a change in the proportional distribution of juvenile Lake Sturgeon following reservoir creation (*i.e.*, will there be a population level shift in distribution patterns following reservoir creation)?

This report provides results from October 2022 to October 2023, which is the eighth winter and ninth open-water period of monitoring conducted since construction of the Keeyask GS began in July 2014, and the third full year of monitoring following reservoir impoundment.

2.0 STUDY SETTING

The study area encompasses an approximately 110 km long reach of the Nelson River from Clark Lake to the upstream end of the Limestone Reservoir (Map 1). This section of river offers a diversity of physical habitat conditions, including a variety of substrate types, and variable water depths (range: 0–30 m) and velocities. Clark Lake is located immediately downstream of Split Lake, and approximately 42 km upstream of the Keeyask GS. Current is restricted to the main section of the lake, with off-current bays outside the main channel. The Assean River is the only major tributary to Clark Lake and flows into the north side. Downstream from the outlet of Clark Lake, the Nelson River narrows and water velocity increases for a 3 km stretch, known as Long Rapids. For the next 7 km, the river widens, and water velocity decreases. The area between Clark Lake and Birthday Rapids is referred to herein as the upper Keeyask reservoir.

Birthday Rapids is located approximately 10 km downstream of Clark Lake and 30 km upstream of the Keeyask GS and marks the upstream end of major water level changes because of impoundment by the Keeyask GS. The drop in elevation from the upstream to downstream side of Birthday Rapids was approximately 2 m prior to impoundment but is now nearly level, albeit a fast-flowing section of river. The 14 km reach of the Nelson River between Birthday Rapids and Gull Lake was characterized as a large and somewhat uniform channel with medium to high water velocities and a few large bays. This area is now within the Keeyask reservoir, though flooding was limited to mainly shoreline areas, and is referred to herein as the middle Keeyask reservoir.

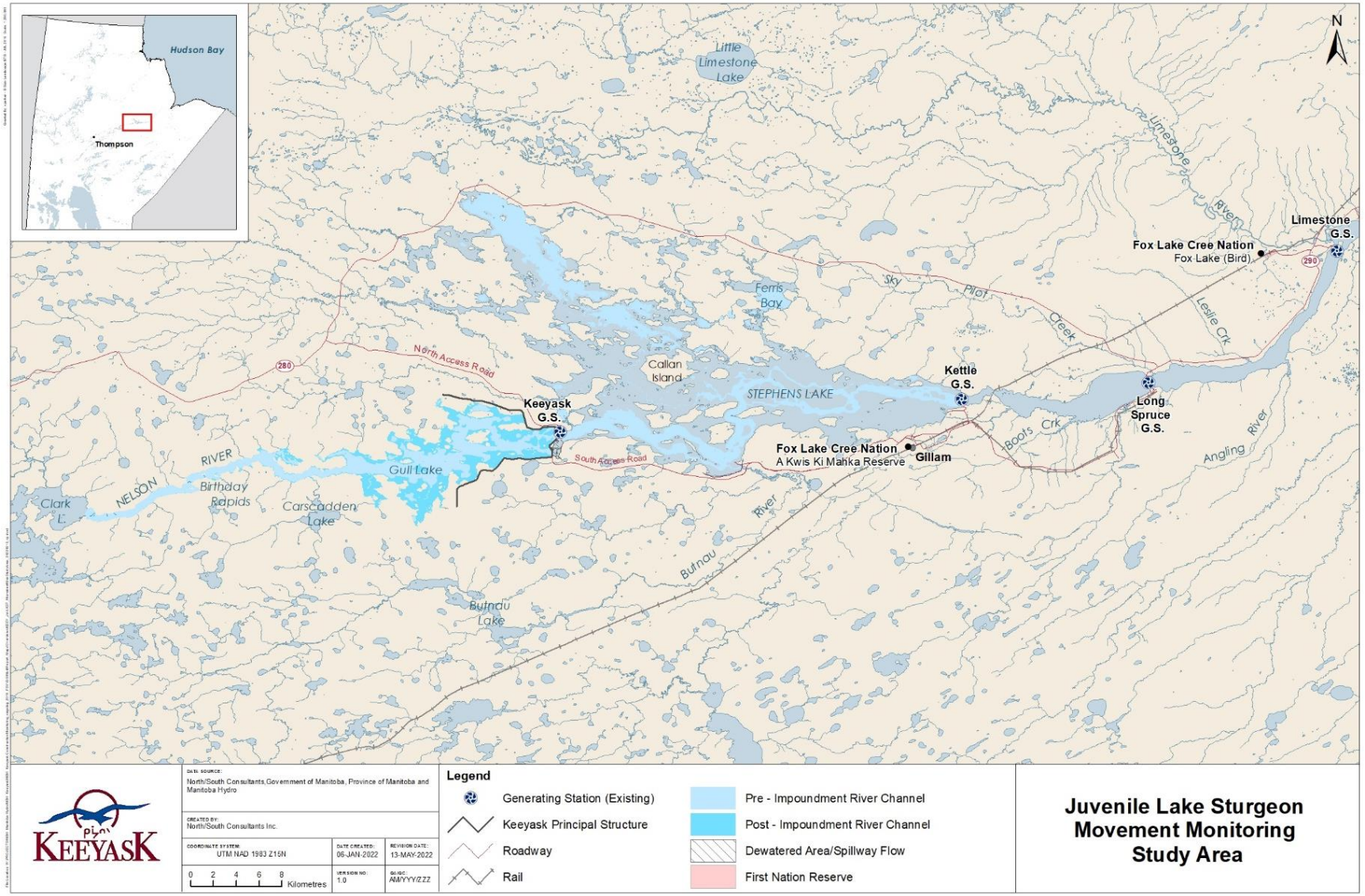
Prior to impoundment, Gull Lake was a widening of the Nelson River, with moderate to low water velocity beginning approximately 20 km upstream the Keeyask GS. Water levels on Gull Lake increased by several metres following impoundment and flooding along the shoreline and small tributaries entering this reach was extensive. Although this area is larger than prior to impoundment, the portion of the Keeyask reservoir is referred to herein as Gull Lake.

Just below the Keeyask GS, the Nelson River enters Stephens Lake. Stephens Lake was formed in 1971 by construction of the Kettle GS. Construction of the Keeyask GS has altered the flow distribution immediately downstream of the station.

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. Kettle GS is located approximately 40 km downstream of the Keeyask GS.

The Long Spruce reservoir was formed in 1979 by the construction of the Long Spruce GS. It is a 16 km reach of the Nelson River extending from Long Spruce GS upstream to Kettle GS (Manitoba Hydro Public Affairs 1999). Kettle River and Boots Creek are the only major tributaries flowing into the Long Spruce reservoir, with both tributaries entering the reservoir on the south shore.

The Limestone reservoir was formed in 1990 by the construction of the Limestone GS. It is a 23 km reach of the Nelson River extending from Limestone GS upstream to Long Spruce GS. Four tributaries of the Nelson River enter the reservoir; Wilson Creek and Brooks Creek enter from the south, and Sky Pilot Creek and Leslie Creek enter from the north. Aquatic habitat within the reservoir ranges from a riverine environment in the upper reach, to more lacustrine conditions just upstream of the Limestone GS.



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

3.0 METHODS

3.1 ACOUSTIC TELEMETRY

Acoustic telemetry involves tracking movements of fish surgically implanted with internal acoustic transmitters (tags). Each transmitter emits a unique signal, recognizable by stationary receivers. When tagged fish come into the detection range of a receiver (generally within 500 m to 1 km, depending on conditions), the transmitter code number, as well as the date and time, are stored in the receiver.

3.1.1 ACOUSTIC TRANSMITTER APPLICATION

Acoustic transmitters (Vemco V13-1x, estimated 1,480-day battery life) were first applied to 40 juvenile Lake Sturgeon (fork lengths: 450–668 mm) in August and September 2013; 20 upstream and 20 downstream of what is now the Keeyask GS (Hrenchuk and Barth 2014). These transmitters expired during the fall of 2017. To continue juvenile Lake Sturgeon movement monitoring with a similar sample size, 40 tags (estimated 1,737-day battery life) were applied to juveniles in September 2017; 20 upstream and 20 downstream of the Keeyask GS. These transmitters expired during the spring of 2022.

An additional 40 tags were applied to juveniles in September 2021: 20 upstream and 20 downstream of the Keeyask GS (Table 1). A detailed description of acoustic transmitter application can be found in Hrenchuk and McDougall (2012).

Table 1: Acoustic-tag and biological information for each juvenile Lake Sturgeon tagged with an acoustic transmitter in the Nelson River upstream of the Keeyask GS and in Stephens Lake, fall 2021.

Tagging Location	Tag ID	Floy tag #	Date Tagged	Expiry Date	Fork Length (mm)	Total Length (mm)	Weight (g)
Keeyask reservoir	48280	121193	19-Sep-21	18-Sep-25	413	471	450
	48281	121192	19-Sep-21	18-Sep-25	414	466	500
	48286	121284	20-Sep-21	19-Sep-25	510	592	700
	48287	121285	20-Sep-21	19-Sep-25	419	481	475
	48292	121287	20-Sep-21	19-Sep-25	440	510	550
	48293	121286	20-Sep-21	19-Sep-25	449	510	575
	48297	121238	18-Sep-21	17-Sep-25	436	485	475
	48298	121292	20-Sep-21	19-Sep-25	489	555	900
	48299	121294	20-Sep-21	19-Sep-25	474	540	750
	48302	121191	19-Sep-21	18-Sep-25	492	551	775
	48303	121183	19-Sep-21	18-Sep-25	450	509	500
	48304	121298	20-Sep-21	19-Sep-25	466	521	600
	48305	121296	20-Sep-21	19-Sep-25	449	505	600
	48308	121232	18-Sep-21	17-Sep-25	471	539	650
	48309	121239	18-Sep-21	17-Sep-25	467	525	550
	48310	121188	19-Sep-21	18-Sep-25	489	545	675
	48311	121178	19-Sep-21	18-Sep-25	446	506	500
	48315	121231	18-Sep-21	17-Sep-25	497	578	675
	48316	121179	19-Sep-21	18-Sep-25	470	529	600
	48317	121189	19-Sep-21	18-Sep-25	445	499	600
Stephens Lake	48276	121392	17-Sep-21	16-Sep-25	525	610	1000
	48277	121394	17-Sep-21	16-Sep-25	414	484	450
	48278	121398	17-Sep-21	16-Sep-25	465	529	750
	48279	121327	17-Sep-21	16-Sep-25	390	446	475
	48282	121391	17-Sep-21	16-Sep-25	440	505	750
	48283	121395	17-Sep-21	16-Sep-25	405	465	400
	48284	121397	17-Sep-21	16-Sep-25	420	486	525
	48285	121328	17-Sep-21	16-Sep-25	438	504	525
	48288	120054	17-Sep-21	16-Sep-25	416	475	475
	48289	118812	17-Sep-21	16-Sep-25	517	592	1000
	48290	121399	17-Sep-21	16-Sep-25	456	509	625
	48291	121396	17-Sep-21	16-Sep-25	427	485	525
	48294	121333	16-Sep-21	15-Sep-25	457	513	525
	48295	121331	16-Sep-21	15-Sep-25	496	561	875
	48296	117678	16-Sep-21	15-Sep-25	504	577	900
	48300	121334	16-Sep-21	15-Sep-25	458	520	720
	48301	117682	16-Sep-21	15-Sep-25	431	596	540
	48306	121330	16-Sep-21	15-Sep-25	530	617	950
	48307	113277	16-Sep-21	15-Sep-25	563	632	1125
	48312	121329	16-Sep-21	15-Sep-25	394	456	400

3.1.2 ACOUSTIC RECEIVERS

Since 2011, stationary acoustic receivers (VEMCO model VR2W) have been used to continuously monitor tagged adult Lake Sturgeon in the Nelson River between Clark Lake and the Long Spruce GS. In spring 2016, the receiver array was extended to the upper Limestone reservoir, with the placement of two receivers downstream of the Long Spruce GS. The intent of adding these receivers was to determine whether fish that had moved into the Long Spruce reservoir had continued to move downstream.

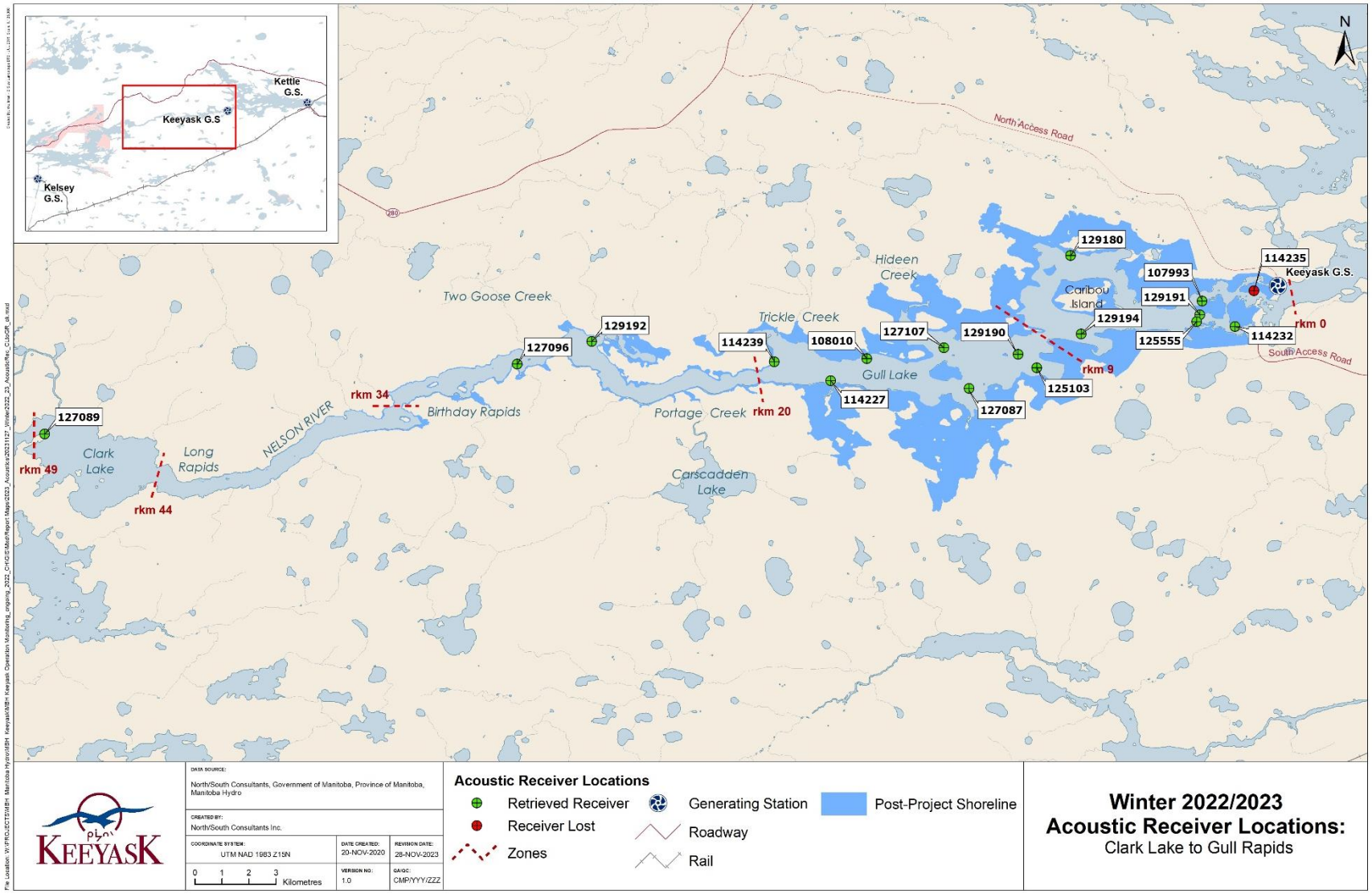
During the six-year construction phase of the Project (beginning in July 2014), receivers were deployed at the same sites as those established during the pre-construction phase (2011–2013). During the open-water period, receivers were deployed in calm water with a flat bottom free of large debris to maximize detection range and spaced along the main river channel throughout the study area to maximize spatial coverage. In Stephens Lake, receivers were placed at locations within pre-flood river channels, based on the observation that sturgeon tend to stay within river channels, even in flooded environments. At constrictions within the river channel, a series of receivers were deployed to create “gates” with the intent of recording all fish that passed by the river cross-section (described in Section 3.1.2.2).

The retrieval of receivers deployed during winter has proven challenging and several were lost in previous winters, likely moved by ice (Hrenchuk and Barth 2013). Because it appears that receivers will only remain safe from ice if deployed in calm areas at depths greater than 10 m, the number of possible receiver locations during winter is limited, especially in areas upstream of the Keeyask GS.

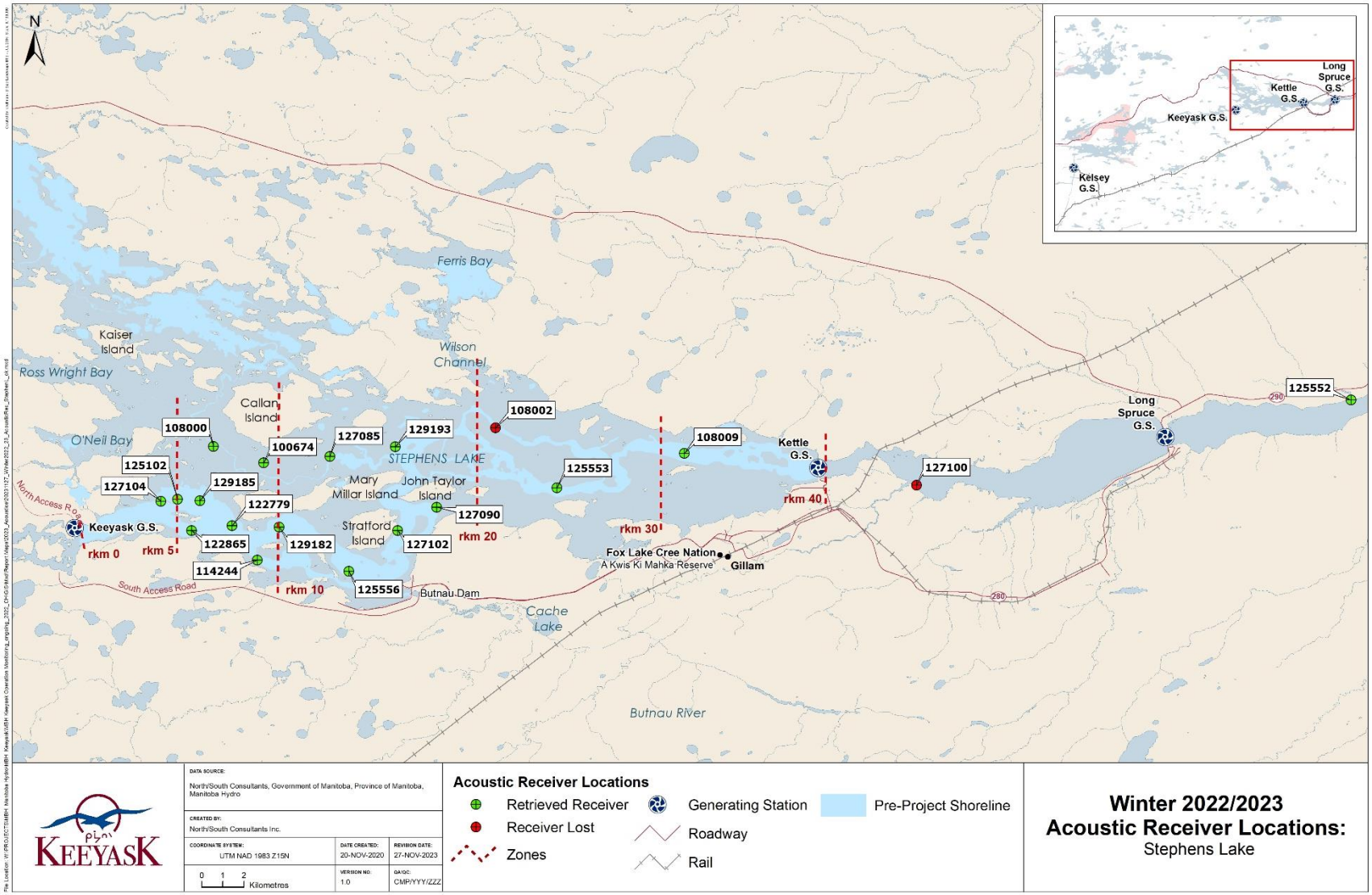
3.1.2.1 WINTER 2022/2023

The stationary acoustic receiver array for the winter 2021/2022 (October 11, 2021, to May 15, 2022) period consisted of 36 receivers. Seventeen were set upstream of the Keeyask GS, 17 in Stephens Lake, one downstream of the Kettle GS, and one downstream of the Long Spruce GS (Maps 2 and 3). The 2022/2023 winter array differed slightly from the array used in 2021/2022. Eight additional receivers were set within Gull Lake to increase over-winter coverage within the Keeyask reservoir at rkms -15.0 (#108010), -9.9 (#125103), -7.8 (#129194), -2.1 (#107993, #129191, and #125555), -0.8 (#114232), and -0.3 (#114235; Map 2). Prior to flooding, these sites were too shallow and fast to be considered suitable locations to deploy receivers during winter.

One additional receiver was set downstream of the Long Spruce GS at the mouth of Leslie Creek (rkm 65.3; #125552, Map 3).



Map 2: **Locations of stationary receivers set in the Nelson River from Clark Lake to the Keeyask GS between October 2022 and May 2023. River kilometer (rkm) distances are indicated with a dotted line. The former (pre-impoundment) river channel is shown in light blue.**



Map 3: **Locations of stationary receivers set in Stephens Lake from the Keeyask GS to Kettle GS between October 2022 and May 2023. River kilometer (rkm) distances are indicated with a dotted line. The former (pre-impoundment) river channel is shown in light blue.**

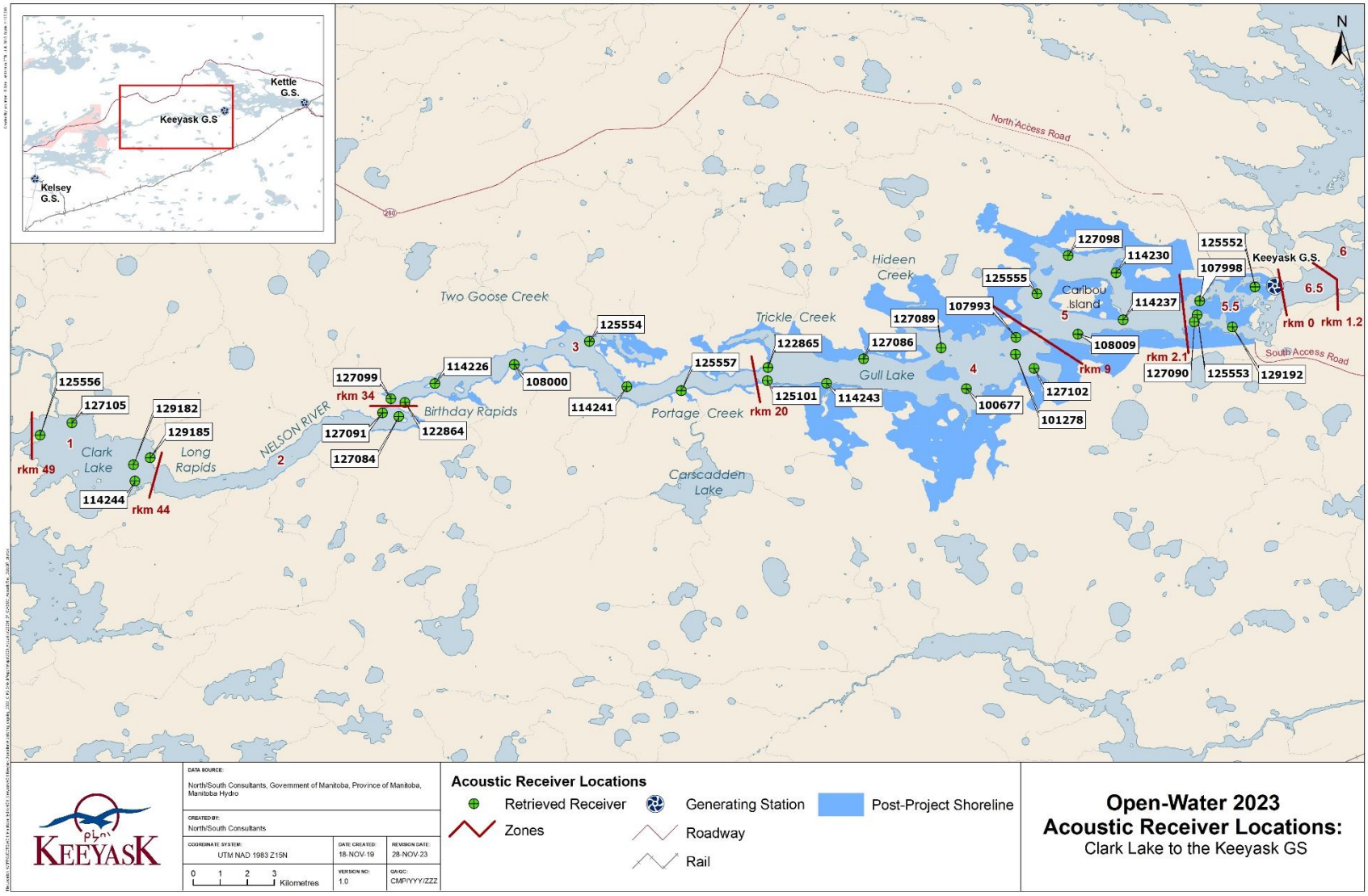
3.1.2.2 OPEN-WATER 2023

An array of 68 acoustic receivers was used during the beginning of the 2023 open-water period (defined as May 16 to October 2, 2023). Thirty-three were set upstream of the Keeyask GS, 33 in Stephens Lake, and two downstream of the Long Spruce GS (Maps 4–6). The 2023 open-water array differed slightly from the array used in 2022. One receiver (#129182; rkm -44.5) was added to the "gate" (described below) at the outlet of Clark Lake (Map 4). Acoustic receivers could not be set in the Long Spruce reservoir during the 2023 open-water period due to low water levels that prevented boat access. The acoustic receiver set in this area during winter 2022/2023 (#129187; rkm 45.1) could not be retrieved.

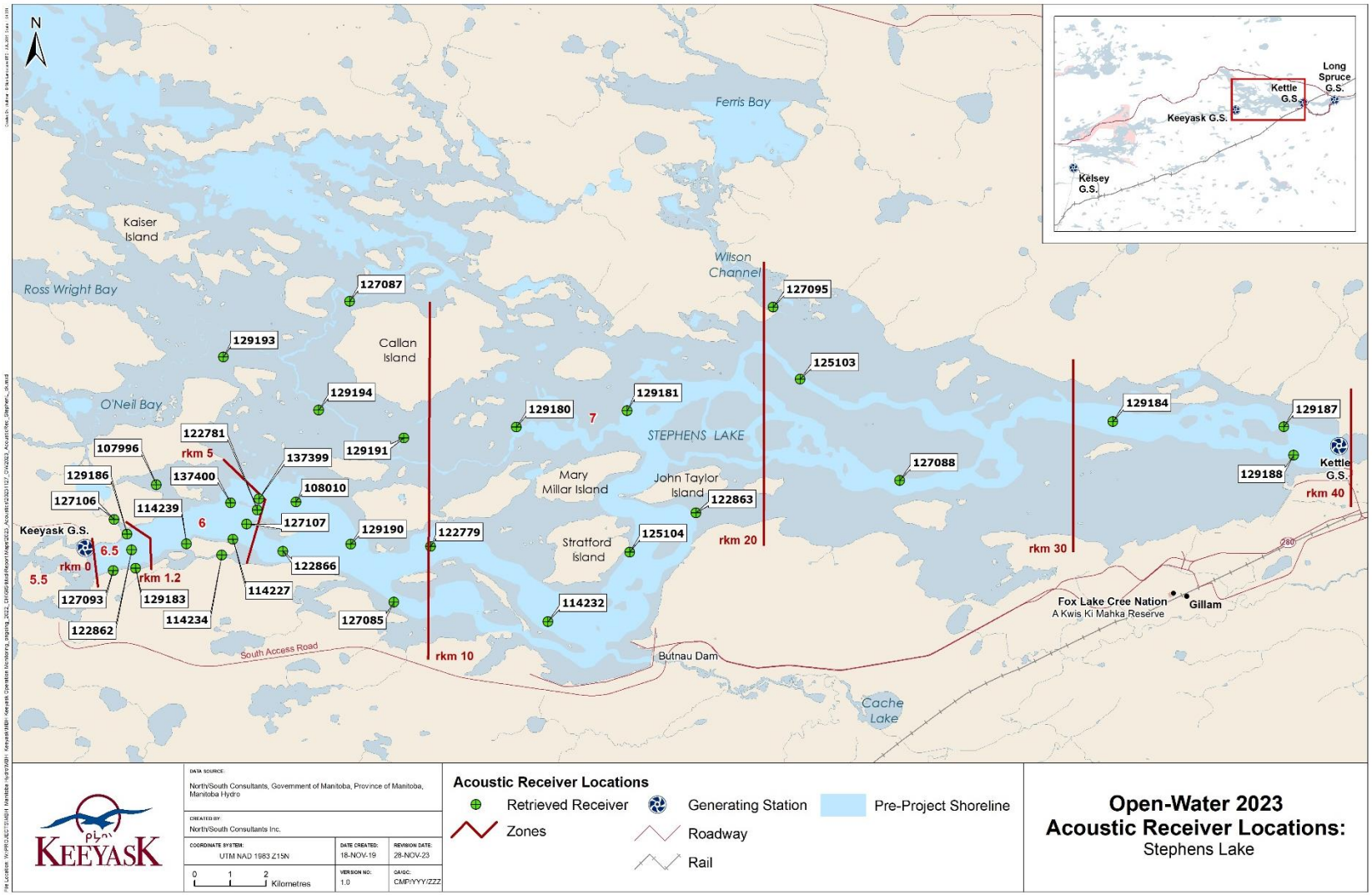
Similar to previous years, receiver "gates" were established in several key areas selected by river morphology (channel restrictions) and habitat characteristics (areas with low velocity adjacent to the main flow of the river). Receiver "gates" consisted of two or more acoustic receivers set parallel to flow to provide complete (or nearly complete) signal coverage of a river cross-section. Areas between the "gates" were referred to as river zones. Receiver gates provide confidence that movements past key points are being detected, which allows for extrapolation of coarse-scale positions (*i.e.*, which zone) during periods when fish remain undetected. When analyzing data, fish detected within a zone that subsequently go undetected for a period of time without passing through a gate, are assumed to be within the zone in which they were last detected.

Five gates were established between Clark Lake and the Keeyask GS (44.0, 34.0, 20.0, 9.0, and 2.1 rkms upstream of the GS), dividing the river into six zones (Zones 1, 2, 3, 4, 5, and 5.5; Map 4). Three were established in Stephens Lake (1.2, 4.5, and 40.0 rkms downstream of the GS), dividing the lake into three zones (Zones 6.5, 6, and 7; Map 5). The location of the "gates" has remained consistent since 2013 except for the two gates closest to the station which were added in 2022 to track movements of fish close to and past the GS.

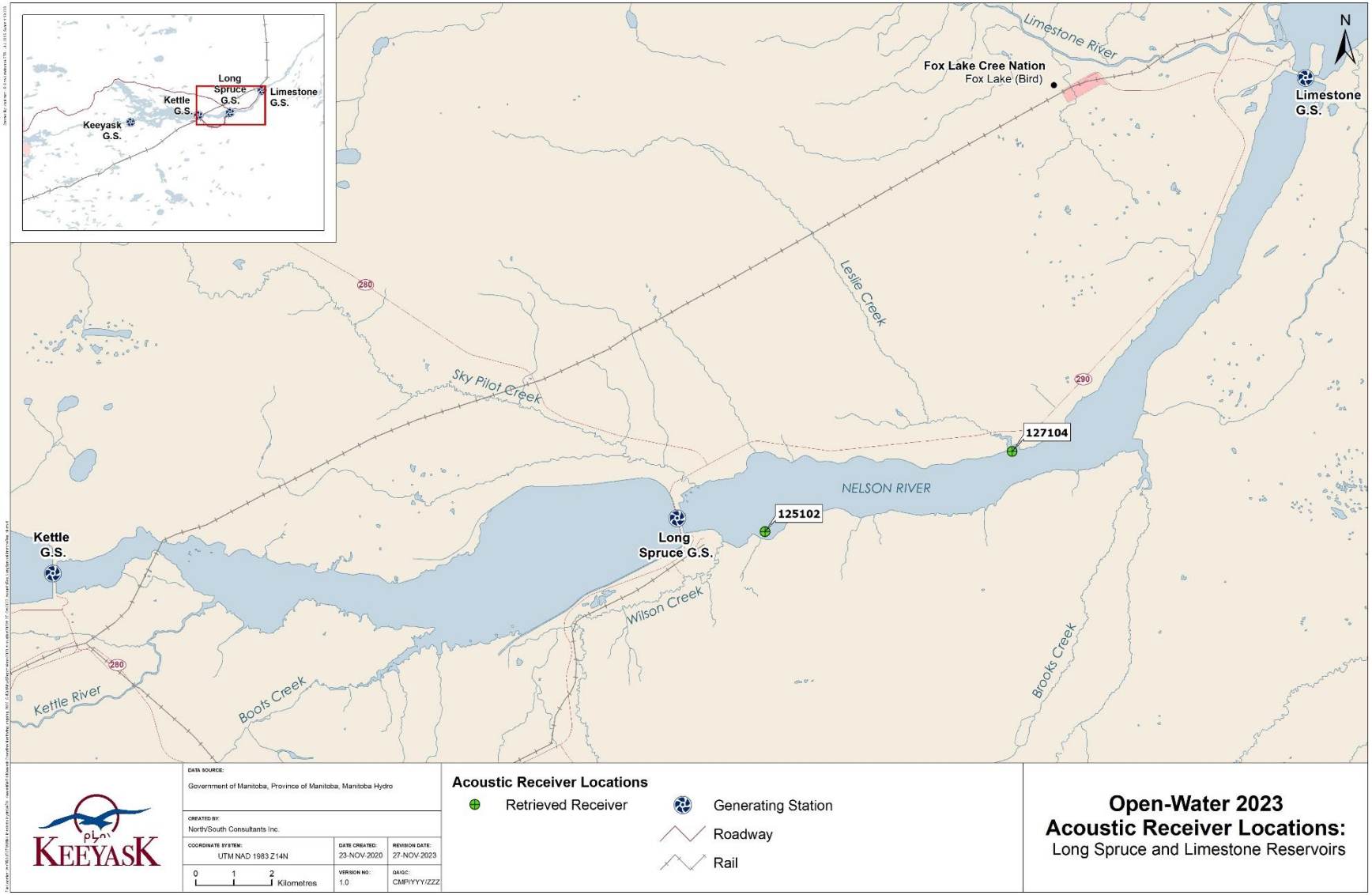
To describe fish movements for reporting purposes, the study area was divided into eleven different zones. The area upstream of the Keeyask GS was divided into six zones (Zones 1–5.5), while Stephens Lake was divided into three zones (Zones 6.5, 6, and 7). The Long Spruce reservoir is referred to as Zone 8 and the Limestone reservoir as Zone 9. Two additional zones were created in 2022 close to the Keeyask GS. Zone 5.5 is located within 2.1 rkm upstream of the GS, and Zone 6.5 is located within 1.2 rkm downstream of the GS.



Map 4: **Locations of stationary receivers set in the Nelson River from Clark Lake to the Keeyask GS between May and October 2023. The river is divided into six "zones" (numbers 1 to 5.5) based on placement of receiver "gates" indicated within the river in red. River kilometer (rkm) distances at zone divisions are indicated in red.**



Map 5: **Locations of stationary receivers set in Stephens Lake between May and October 2023. The river is divided into three "zones" (numbers 5.5 to 7) based on placement of receiver "gates" indicated within the river in red. The pre-impoundment river channel is shown in light blue. River kilometer (rkm) distances are indicated with a dotted red line.**



Map 6: Locations of stationary receivers set between the Kettle and Limestone Generating Stations between May and October 2023.

3.1.3 DATA ANALYSIS

False detections can arise on acoustic telemetry receivers due to code collisions and/or environmental noise (Pincock 2012). To filter out false detections, a fish was required to be detected at least two times within a 30-minute interval at a given stationary receiver. Single detections were filtered and not used in most analyses; however, in instances when fish went undetected for lengthy periods, and/or rapid movements were suspected, raw data were also explored. In no instance did examination of raw data suggest that consideration of a single detection would result in a different behaviour or movement pattern compared with the result when single detections were removed.

Movements were analysed in terms of rkm distance, with the base of the Keeyask GS representing a distance of 0 rkm. The area located downstream of the Keeyask GS (*i.e.*, Stephens Lake and the Long Spruce reservoir) were given positive (+) distance values from the GS, while the area located upstream (*i.e.*, Gull and Clark lakes) were given negative (-) distance values (Figures 1 and 2). The average rkm distance from the GS was calculated over a 4-hour interval and plotted versus time for each fish. Total detection ranges were calculated by subtracting the farthest downstream detection location from the location of the farthest upstream detection. The proportion of time that all fish spent within each river zone during each 4-hour interval was plotted and presented as a percentage of the study period. For example, a fish that spent 44% of the time between May 1 and May 31 within Zone 4 means that the fish was detected within Zone 4 for 44% of the 186 4-hour intervals between May 1 and May 31.

Rapid downstream movements observed within two weeks of tagging were classified as caused by tagging stress or mortality. If the fish made a rapid downstream movement within two weeks of tagging followed by upstream and downstream movements, it was classified as tagging stress. If a fish made a rapid downstream movement within two weeks of tagging and was not detected again or did not display upstream movements, it was classified as a tagging mortality. If a fish was not detected for more than one year, it was classified as missing.

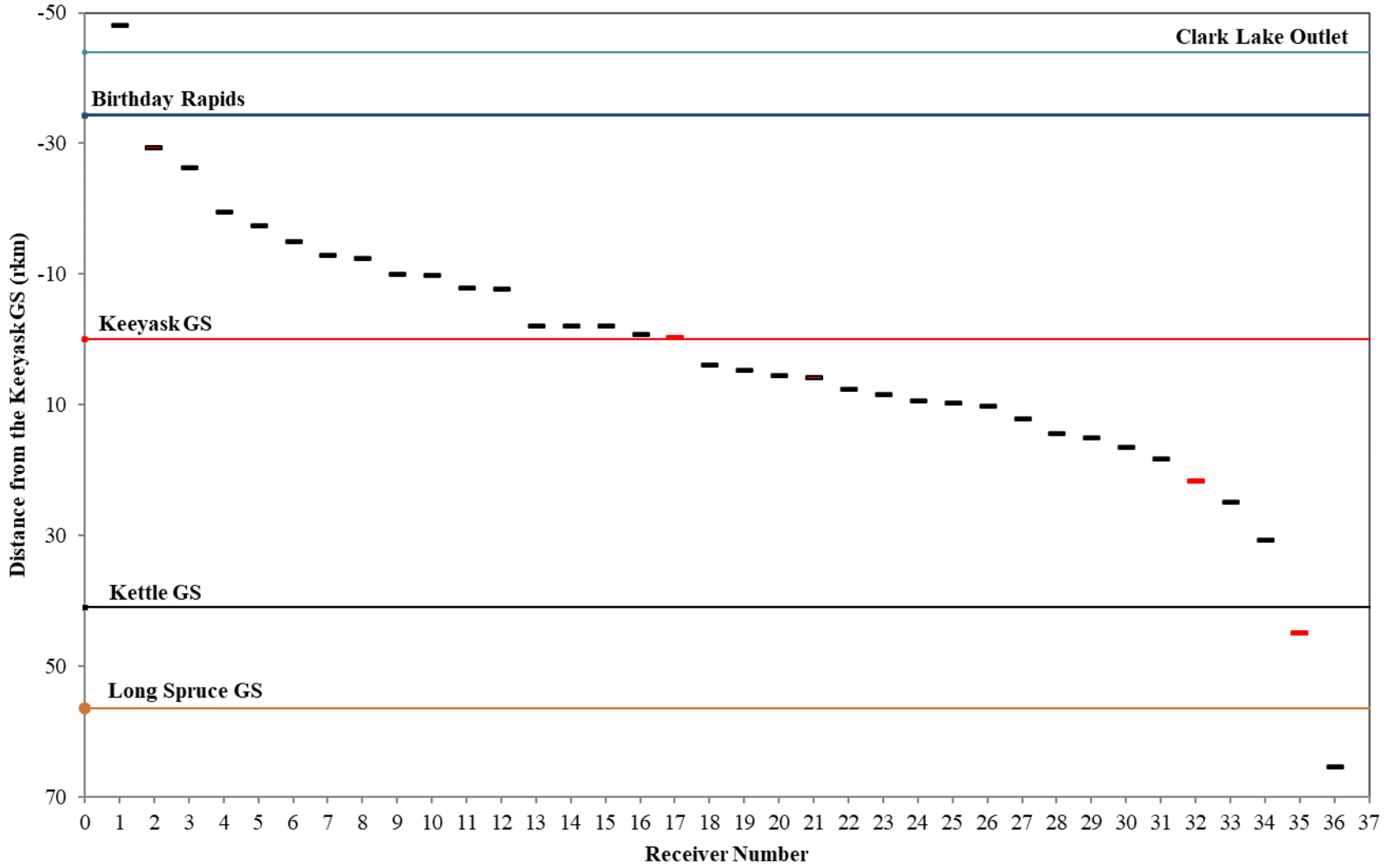


Figure 1: **Locations of stationary acoustic receivers (dashes) in relation to the base of the Keeyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Kettle GS between October 2022 and May 2023. Red dashes indicate receivers that could not be located at the end of the winter 2022/2023 period.**

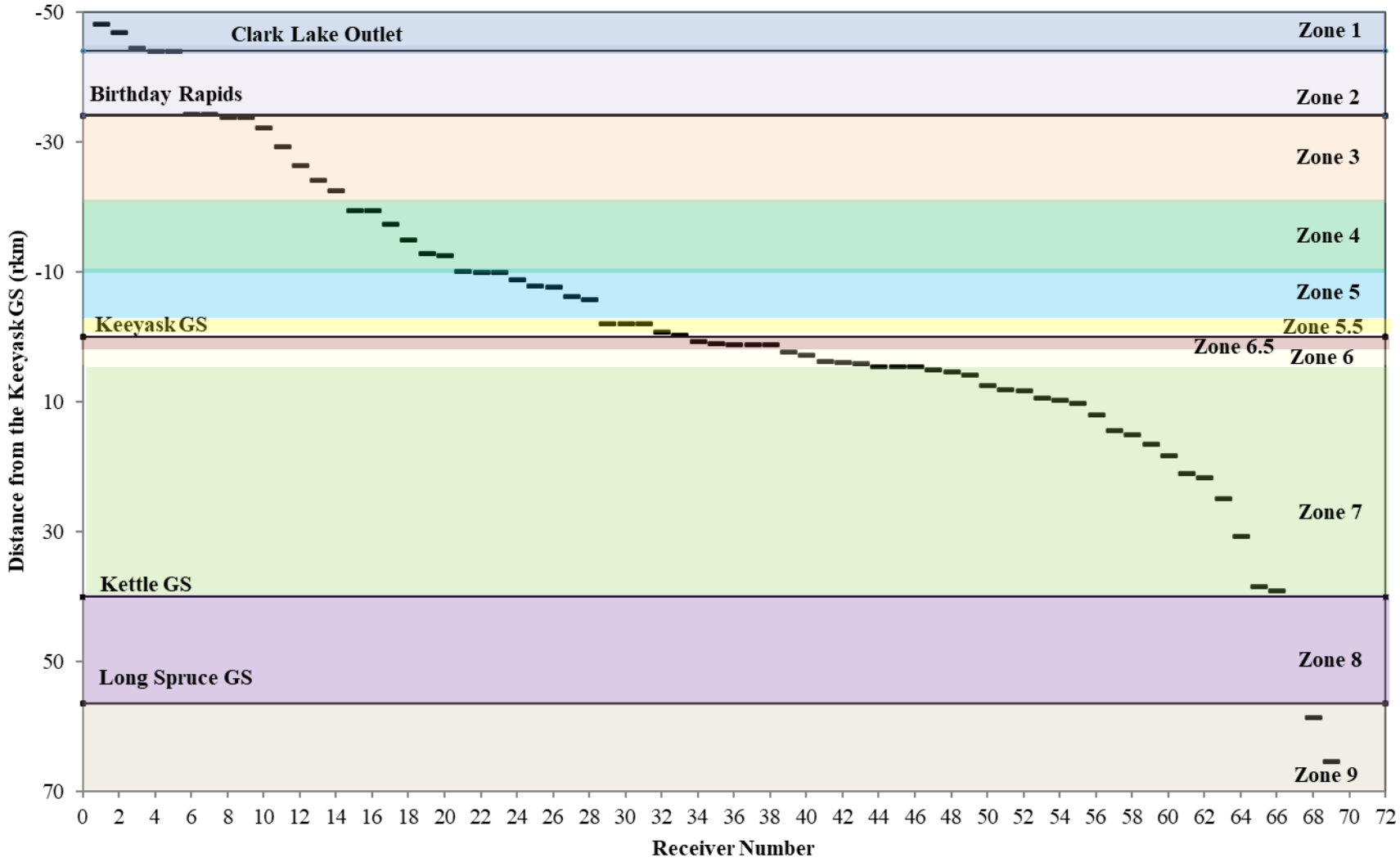


Figure 2: **Locations of stationary acoustic receivers (dashes) in relation to the base of the Keeyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake (Zone 1) and the Limestone GS (Zone 9) between May and October 2023. River zones are indicated by different colours.**

4.0 RESULTS

4.1 2021-2022 RESULTS SUMMARY

4.1.1 UPSTREAM OF THE KEEYASK GS

Twenty juvenile Lake Sturgeon were tagged upstream of Gull Rapids in 2013 and 2017. These transmitters have since expired. Tagging date, date of last detection, and subsequent recaptures for fish with expired tags are outlined in Appendix 4.

Twenty Lake Sturgeon were tagged in the Keeyask reservoir in September 2021 (Appendix A1-1). Since then, four tagged juvenile sturgeon have moved downstream past the Keeyask GS. All four fish displayed upstream and downstream movements in Stephens Lake, indicating they survived passage past the Keeyask GS.

- #48286 was tagged in upper Gull Lake (rkm -14.2) on September 20, 2021. It was consistently detected here until December 5. It was first detected in Stephens Lake at rkm 3.9 on January 16, 2022 (Appendix A2-3).
- #48298 was tagged in Gull Lake (rkm -7.4) on September 20, 2021, and was detected here until October 7. It was next detected in Stephens Lake at rkm 2.7 on May 27, 2022 (Appendix A2-8).
- #48299 was tagged in lower Gull Lake (rkm -7.4) on September 20, 2021. It was consistently detected here until December 15. It was first detected in Stephens Lake at rkm 3.9 on January 2, 2022 (Appendix A2-9).
- #48304 was tagged in Gull Lake on September 20, 2021 (rkm -7.4) and was detected here until October 7. It was next detected in Stephens Lake at rkm 1.2 on May 27, 2022 (Appendix A2-12).

Therefore, 16 juvenile Lake Sturgeon were available to be detected upstream of the Keeyask GS at the beginning of winter 2022/2023.

4.1.2 STEPHENS LAKE

Twenty juvenile Lake Sturgeon were tagged downstream of Gull Rapids in 2013 and 2017. These transmitters have since expired. Tagging date, date of last detection, and subsequent recaptures for fish with expired tags are outlined in Appendix 4.

Twenty Lake Sturgeon were tagged in Stephens Lake in September 2021 (Appendix A1-2). Since then, two fish moved downstream out of Stephens Lake past the Kettle GS and into the Long

Spruce reservoir. One fish displayed upstream and downstream movements, indicating it survived passage through the Kettle GS, while the other was only detected for one day after passing through the Kettle GS.

- #48279 was tagged in upper Stephens Lake (rkm 3.9) on September 17, 2021. It was last detected in Stephens Lake at rkm 24.9 on October 13. It was detected downstream of the Kettle GS on May 31, 2022, at rkm 45.7. It made multiple upstream and downstream movements indicating it survived passage through the GS (Appendix A3-4).
- #48300 was tagged in upper Stephens Lake (rkm 3.9) on September 16, 2021. It moved immediately downstream and was last detected in Stephens Lake at rkm 32.0 on October 1. It was detected downstream of the Kettle GS for a single day on October 19 at rkm 45.7. It is unclear if this fish survived passage through the GS (Appendix A3-16).

An additional seven fish are considered missing (*i.e.*, have not been detected for more than one year). It is possible that some of these fish moved downstream past the Kettle GS. All seven fish made downstream movements after being tagged in Stephens Lake in 2021; five (#48291, #48294, #48295, #48301, and #48312) were last detected in lower Stephens Lake and two (#48296 and #48306) in upper Stephens Lake.

Therefore, accounting for the four fish that moved downstream from the Keeyask reservoir, the two fish that moved downstream past the Kettle GS, and the seven fish that are considered missing, 15 juvenile Lake Sturgeon were available to be detected in Stephens Lake at the beginning of the winter 2022/2023 season.

4.2 WINTER 2022/2023

4.2.1 ACOUSTIC RECEIVER RETRIEVAL

Sixteen of 17 receivers deployed between Clark Lake and the Keeyask GS during the 2022/2023 winter period were retrieved. A single receiver (#114235) set immediately upstream of the Keeyask GS powerhouse could not be located and was likely moved by debris (Map 2). Sixteen of 17 receivers deployed in Stephens Lake were also retrieved. A receiver set in lower Stephens Lake at rkm 21.7 (#108002) could not be located (Map 3). The single receiver set downstream of the Kettle GS (#127100) could not be retrieved due to low water levels that prevented boat access during the 2023 open-water period.

4.2.2 UPSTREAM OF THE KEEYASK GS

Fifteen of the 16 juvenile Lake Sturgeon (94%) were located a total of 211,706 times (range: 204–54,347 detections per individual). Individual fish were detected on 4 to 192 days of the 217-day winter period (2–88% of the time) for an average of 76 days, or for 35% of the study period

(standard deviation [StDev] = 50 days). The farthest upstream detections occurred at rkm -26.4 (by four fish; 27%). The farthest downstream detections occurred in lower Gull Lake at rkm -2.1 (by one fish; 7%) and the average movement range was 2.7 rkm (range: 0.0–7.5 rkm) (Figures 3 and 4; Appendix A2-1). No fish moved downstream past the Keeyask GS.

The majority of detections were logged within the upper portion of Gull Lake at rkm -15.0 (n = 66,871; 32%) and in lower Gull Lake north of Caribou Island at rkm -7.9 (n = 61,845; 29%; Figure 4). Movements were as follows:

- Eight fish (53% of all fish detected) remained within the upper Gull Lake portion of the reservoir, moving no farther upstream than rkm -19.5 and no farther downstream than rkm -9.9.
- Three (20%) remained within the lower Gull Lake portion of the reservoir and were detected between rkm -7.9 and -2.1.
- Four (27%) were detected exclusively in the middle Keeyask reservoir at rkm -26.4.

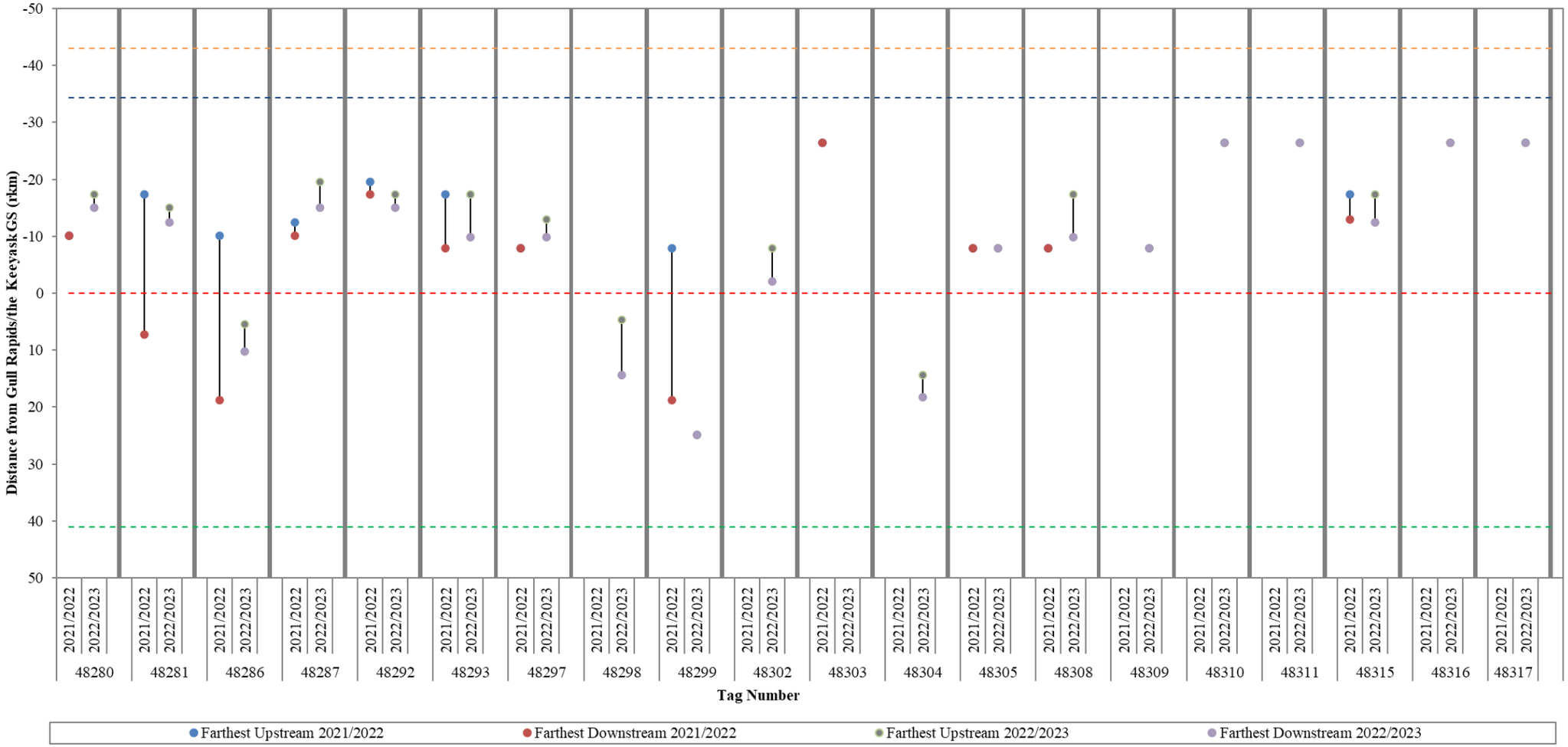


Figure 3: Detection ranges for individual juvenile Lake Sturgeon tagged with acoustic transmitters upstream of the Keeyask GS during the winter period (2021–2023). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS).

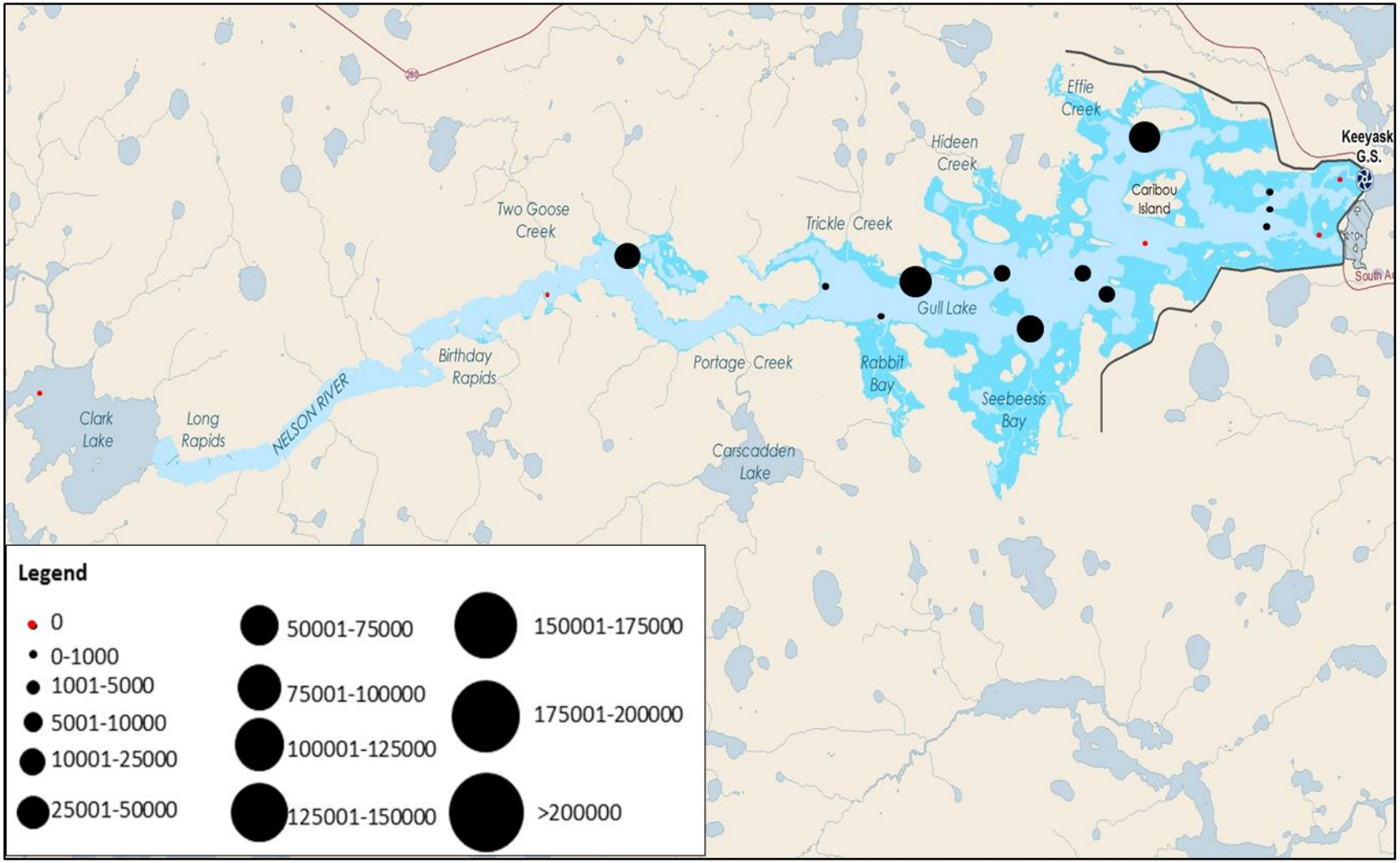


Figure 4: Relative number of detections at each acoustic receiver set between Clark Lake and the Keeyask GS during winter 2022/2023 (October 11, 2022, to May 15, 2023). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.

4.2.3 STEPHENS LAKE

All fifteen juvenile Lake Sturgeon were located a total of 433,071 times (range: 379–90,726 detections per individual) (Appendix A2-1). Fish were detected on two to 208 days of the 217-day winter period (1–96% of the time) for an average of 126 days, or for 58% of the study period (StDev = 68 days). The farthest upstream detections occurred at rkm 3.8 (by four fish; 27%). The farthest downstream detections occurred at rkm 24.9 (by one fish; 7%) and the average total movement range was 4.0 rkm (StDev = 3.1 rkm; range = 0.0–9.8 rkm) (Figure 5).

Lake Sturgeon were detected in both the southern and northern portions of Stephens Lake (Figure 6). The majority of detections were logged in the southern portion at rkms 8.3 (n = 118,150; 27%) and 9.7 (n = 102,463; 24%). Movements were as follows:

- Six fish (40%) remained exclusively in upper Stephens Lake, moving no farther downstream than rkm 10.2.
- Two (13%) moved between upper and lower Stephens Lake and were detected as far upstream as rkm 4.6 and as far downstream as rkm 14.4.
- Seven (47%) remained farther downstream and were detected between rkm 10.2 and 24.9.

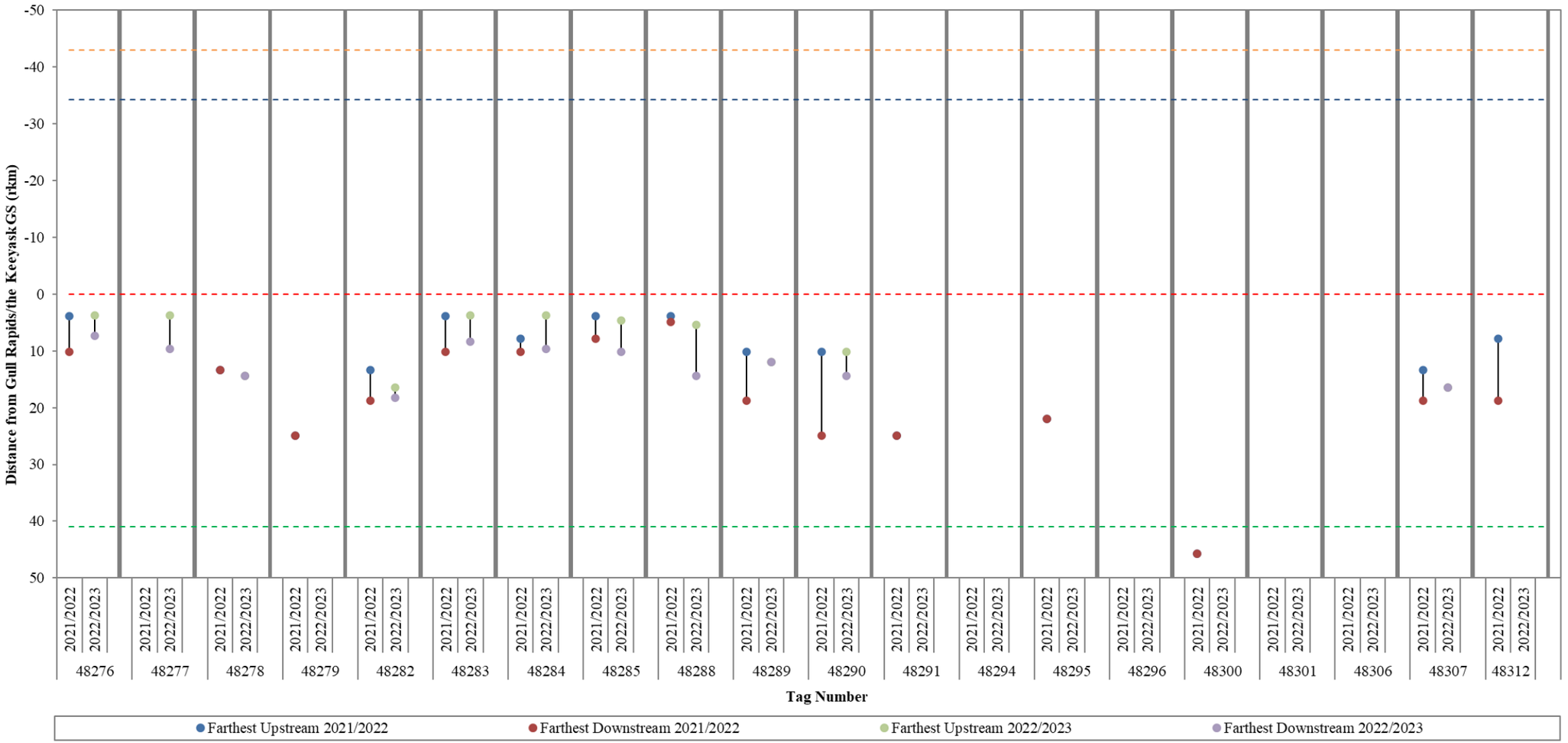


Figure 5: Detection ranges for individual juvenile Lake Sturgeon tagged with acoustic transmitters in Stephens Lake during the winter period (2021-2023). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS).

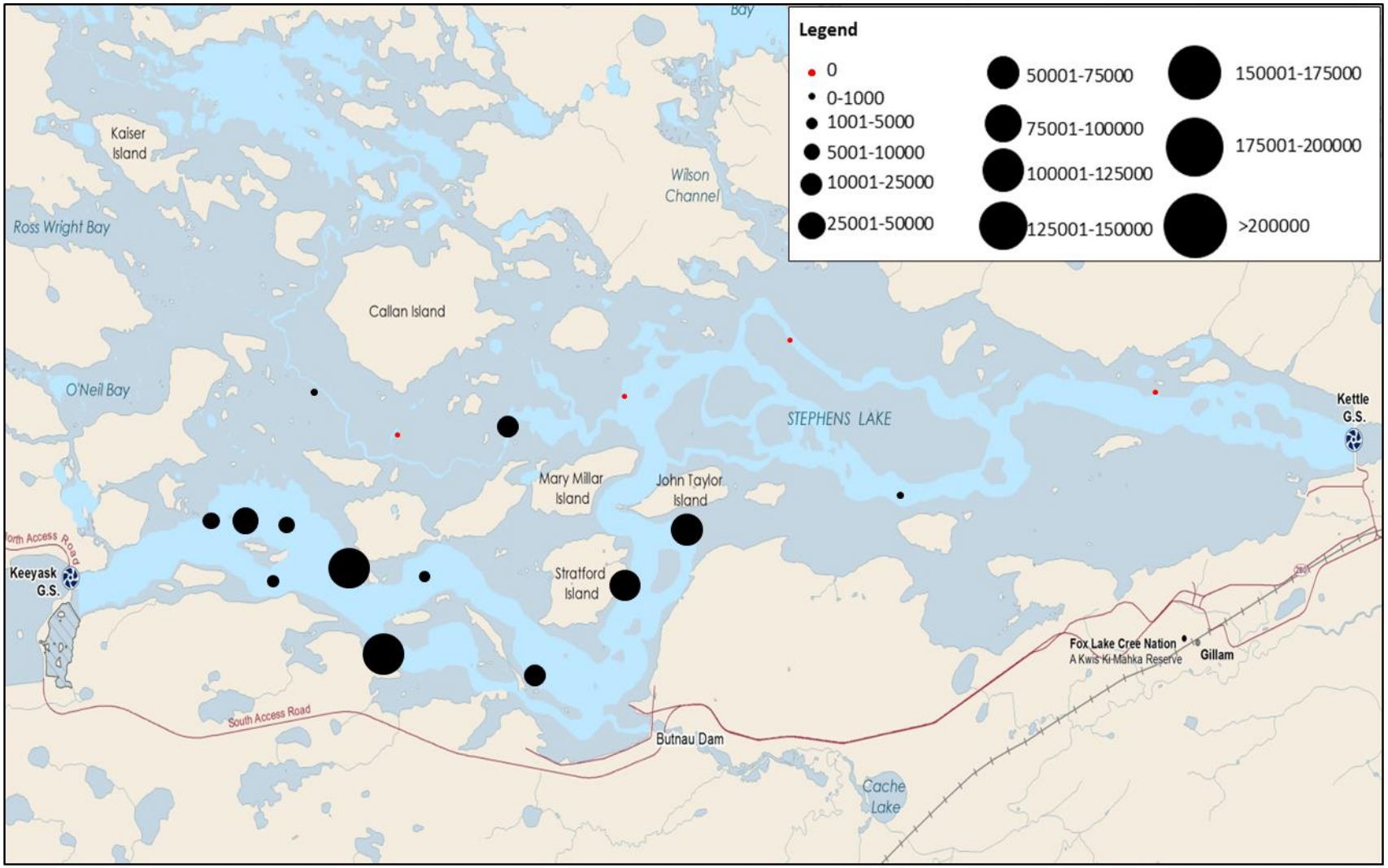


Figure 6: **Relative number of detections at each acoustic receiver set in Stephens Lake during winter 2022/2023 (October 11, 2022, to May 15, 2023). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.**

4.3 OPEN-WATER 2023

4.3.1 ACOUSTIC RECEIVER RETRIEVAL

All stationary acoustic receivers deployed upstream of the Keeyask GS (n = 33), in Stephens Lake (n = 33), and downstream of the Long Spruce GS (n = 2) during the 2023 open-water period were successfully retrieved (Maps 4, 5, and 6).

4.3.2 UPSTREAM OF THE KEEYASK GS

All 16 juvenile Lake Sturgeon available for detection upstream of the Keeyask GS were located during the 2023 open-water period. These fish were detected between 269 and 43,462 times on 22 to 135 days of the 140-day study period (16–96% of the time) for an average of 79 days, or for 56% of the study period (StDev = 34 days). Mean movement range was 7.7 rkm (StDev = 4.5 rkm; range: 0.0–14.8 rkm (Figure 7; Appendix 1). The farthest upstream detections were logged immediately downstream of Birthday Rapids (rkm -33.9) by one fish (6%). The majority of detections were logged by receivers in the middle portion of Gull Lake at rkms -12.5 and -10.2 (n = 28,358; 38%) (Figure 8). The farthest downstream detections occurred 2.1 rkm upstream of the Keeyask GS by four fish (25%). No fish moved downstream past the Keeyask GS.

4.3.2.1 PROPORTIONAL DISTRIBUTION

Juvenile Lake Sturgeon tagged in the Keeyask reservoir spent the majority of the 2023 open-water period in the upper basin of Gull Lake (Zone 4; 57%) and the middle Keeyask reservoir (Zone 3; 25%) (Table 2; Figure 9). Fish spent 11% of the study period in the lower basin of Gull Lake (Zone 5), and 8% in the area close to the Keeyask GS (Zone 5.5).

Table 2: Proportion of time spent in each river zone by juvenile Lake Sturgeon implanted with acoustic transmitters upstream of the Keeyask GS and in Stephens Lake during a portion of the 2014 (June 4 to October 10), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16), 2018 (June 6 to October 10), 2019 (June 2 to October 7), 2020 (July 3 to September 23), 2021 (June 13 to October 10), 2022 (May 16 to October 10), and 2023 (May 16 to October 2) open-water periods.

Year Tagged	Study Year	Upstream of Gull Rapids[1]					
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 5.5
2013	2014	0.0	0.0	0.0	63.4	36.6	-
	2015	0.0	0.0	1.9	44.6	53.4	-
	2016	0.0	0.0	0.0	73.2	26.8	-
	2017	0.0	0.0	0.0	77.8	22.2	-
2017	2018	0.0	0.0	0.0	48.8	51.2	-
	2019	0.0	0.0	0.0	44.8	55.2	-
	2020	0.0	0.0	0.0	44.7	55.3	-
	2021	0.0	0.0	0.7	38.5	60.7	-
2021	2022	0.0	0.0	31.6	53.1	14.5	0.8
	2023	0.0	0.0	24.5	56.9	10.6	8.1

1. Beginning in 2019, Gull Rapids is referred to as the Keeyask GS, and since impoundment in 2020, the area is referred to as the Keeyask reservoir.

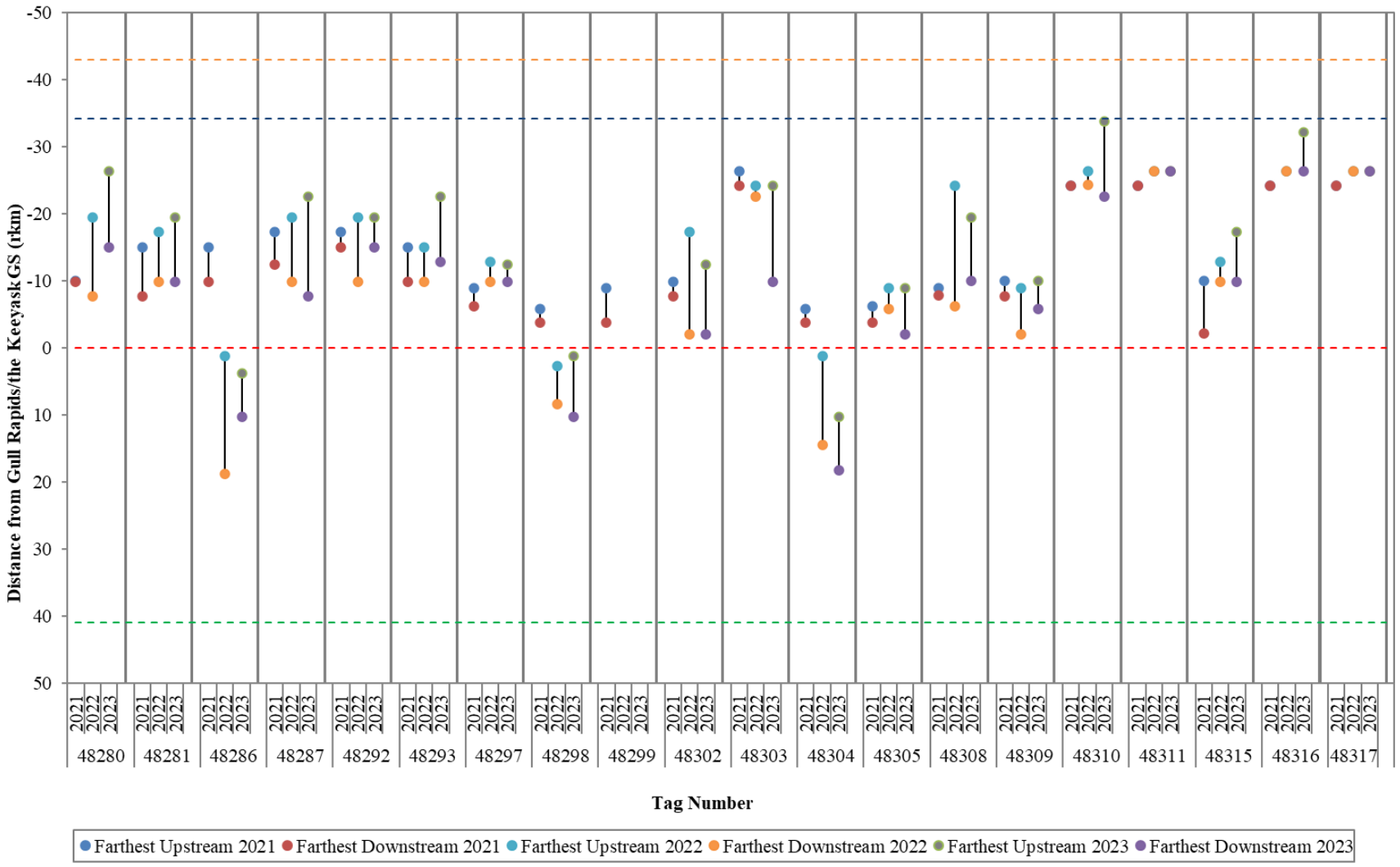


Figure 7: Detection ranges for individual juvenile Lake Sturgeon tagged in 2021 with acoustic transmitters upstream of the Keeyask GS during the open-water period (2021–2023). Horizontal dotted lines demarcate zones with the red line representing the Keeyask GS.

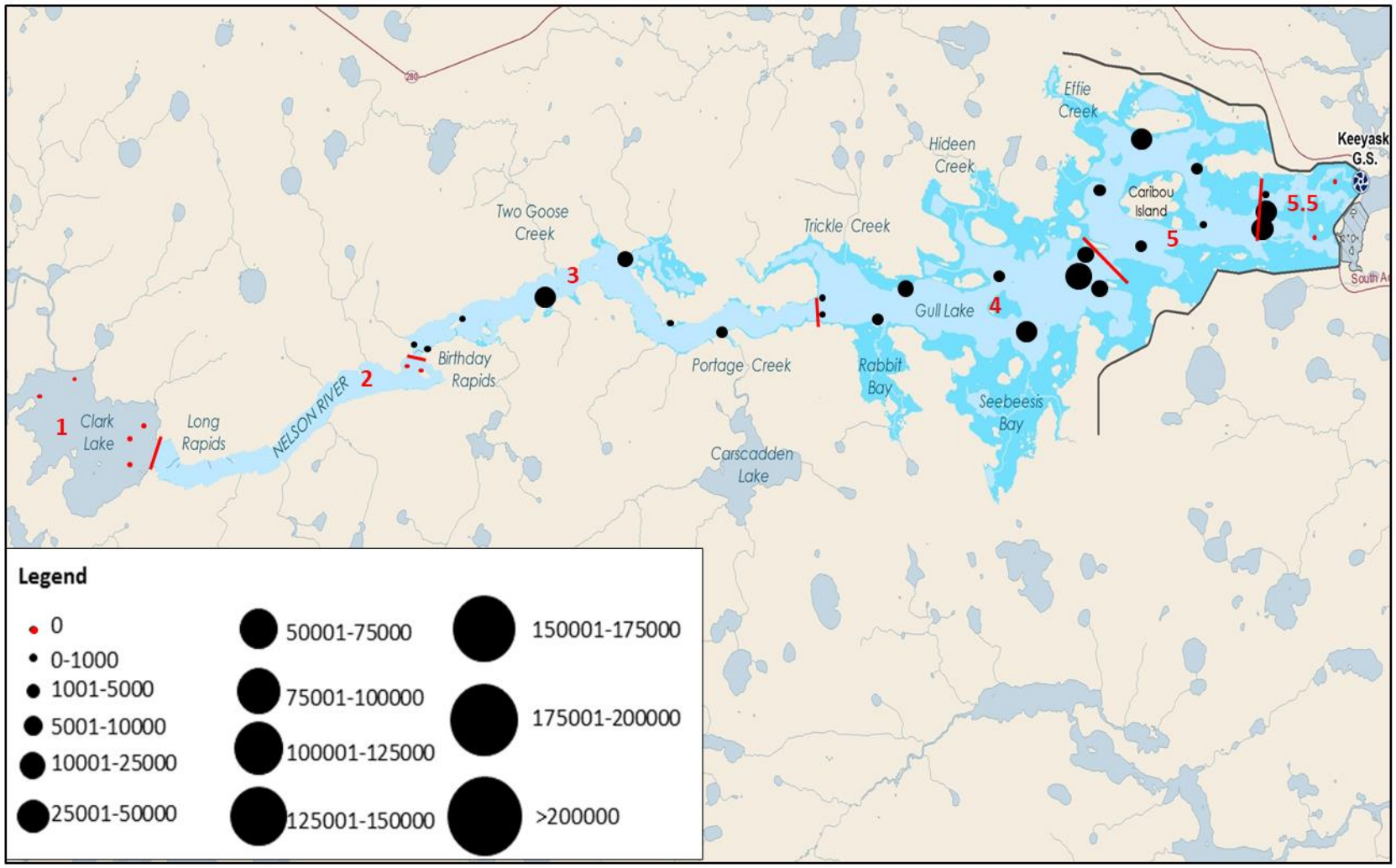


Figure 8: Relative number of detections at each acoustic receiver set in the Nelson River between Clark Lake and the Keeyask GS during the beginning of the 2023 open-water period (May 16 to October 2). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into five "zones" based on placement of receiver "gates".

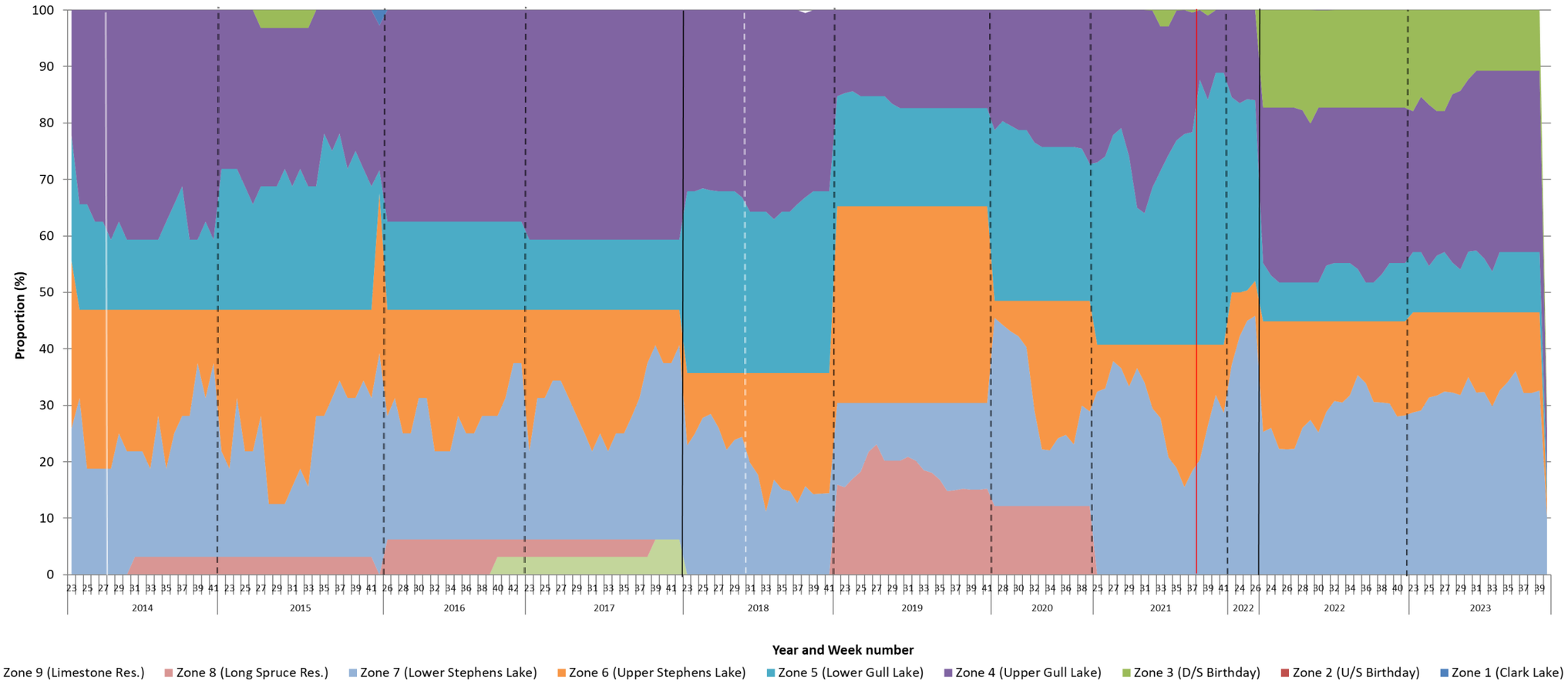


Figure 9: **Proportional distribution by zone, for juvenile Lake Sturgeon tagged with acoustic transmitters in 2013, 2017, and 2021 in the Keeyask GS Area during a portion of the 2014 (June 4 to October 3), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16), 2018 (June 6 to October 10), 2019 (June 2 to October 7), 2020 (July 3 to September 23), 2021 (May 1 to October 10), 2022 (May 16 to October 10), and 2023 (May 16 to October 2) open-water periods. Black dashed lines indicate study years. Solid white line indicates start of Keeyask construction. Dashed white line indicates spillway commissioning. Solid red line indicated beginning of the operation period. Zones 5.5 and 6.5 were created in 2022 but were combined with zones 6 and 5 to remain consistent with previous monitoring years.**

4.3.2.2 MOVEMENT PATTERNS

Of the 16 fish detected, eight remained within Gull Lake for the entire open-water period.

- Five (#48281, #48292, #48297, #48308, and #48315,) were detected only in the upper portion (Zone 4), as far upstream as rkm -19.5 and as far downstream as rkm -9.9.
- One (#48305) was detected only in the lower portion (Zone 5) moving no farther upstream than rkm -8.9.
- Two (#48302 and #48309) moved between both zones.

Four fish (#48310, #48311, #48316, and #48317) remained in the middle Keeyask reservoir (Zone 3). These fish were detected as far upstream as rkm -33.9 immediately downstream of Birthday Rapids and as far downstream as rkm -26.4.

Four (#48280, #48287, #48293, and #48303) moved between Gull Lake and the middle Keeyask reservoir. These fish were detected as far upstream as rkm -26.4 in the middle Keeyask reservoir and as far downstream as rkm -7.8 in lower Gull Lake.

No juvenile Lake Sturgeon moved upstream past Birthday Rapids or downstream past the Keeyask GS in the 2023 open-water period. All movements out of the Keeyask reservoir since 2013 are outlined in Table 3 and Figure 10.

Table 3: Number and proportion of tagged juvenile Lake Sturgeon that have moved downstream past the Keeyask GS site and the Kettle GS each year since studies began in 2013. The total number of movements, the proportion of movements suspected to have occurred due to tagging stress or mortality (*i.e.*, within two weeks of tagging), and the adjusted number of movements (*i.e.*, total movements minus movements due to stress) are provided. Grey highlighting indicates movements that occurred prior to the onset of construction.

Year	Keeyask GS[7] Site									Kettle GS								
	Total Movements[1]			Tagging Stress/Mortality[2]			Adjusted Movements[3]			Total Movements			Tagging Stress/mortality			Adjusted Movements		
	Total Fish	Total Move	%[4]	# Fish Tagged	Total Move	%[5]	Total Fish	Total Move	%	Total Fish[6]	Total Move	%	# Fish Tagged	Total Move	%	Total Fish	Total Move	%
2013	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
2014	19	0	0	0	-	-	19	0	0	19	1	5	0	-	-	19	1	5
2015	19	0	0	0	-	-	19	0	0	18	0	0	0	-	-	18	0	0
2016	19	0	0	0	-	-	19	0	0	18	1	6	0	-	-	18	1	6
2017	19	0	0	20	0	0	19	0	0	37	4	11	20	1	5	37	3	8
2018	20	0	0	0	-	-	20	0	0	15	0	0	0	-	-	15	0	0
2019	20	1	5	0	-	-	20	1	5	15	1	7	0	-	-	15	1	2
2020	19	0	0	0	-	-	19	0	0	13	1	8	0	-	-	13	1	8
2021	19	3	16	20	0	0	19	3	16	13	0	0	20	0	-	13	0	0
2022	32	7	22	0	-	-	32	7	22	38	3	8	0	-	-	38	3	8
2023	16	0	0	0	-	-	16	0	0	14	0	0	0	-	-	14	0	0

1. Includes all downstream movements, including those that are interpreted to have occurred due to tagging stress and mortality.
2. Includes only juvenile Lake Sturgeon that moved downstream within two weeks of tagging. These movements are likely caused by tagging stress or mortality.
3. Does not include fish interpreted to have moved downstream due to tagging stress or mortality.
4. Proportion is calculated as a percentage of the total number of fish available for detection in the current year.
5. Proportion is calculated as a percentage of those tagged in the current year.
6. Includes all fish tagged in Stephens Lake as well as those that moved downstream from the Keeyask reservoir.
7. Referred to as Gull Rapids prior to 2018 when the Keeyask GS spillway was commissioned and the Keeyask GS after.

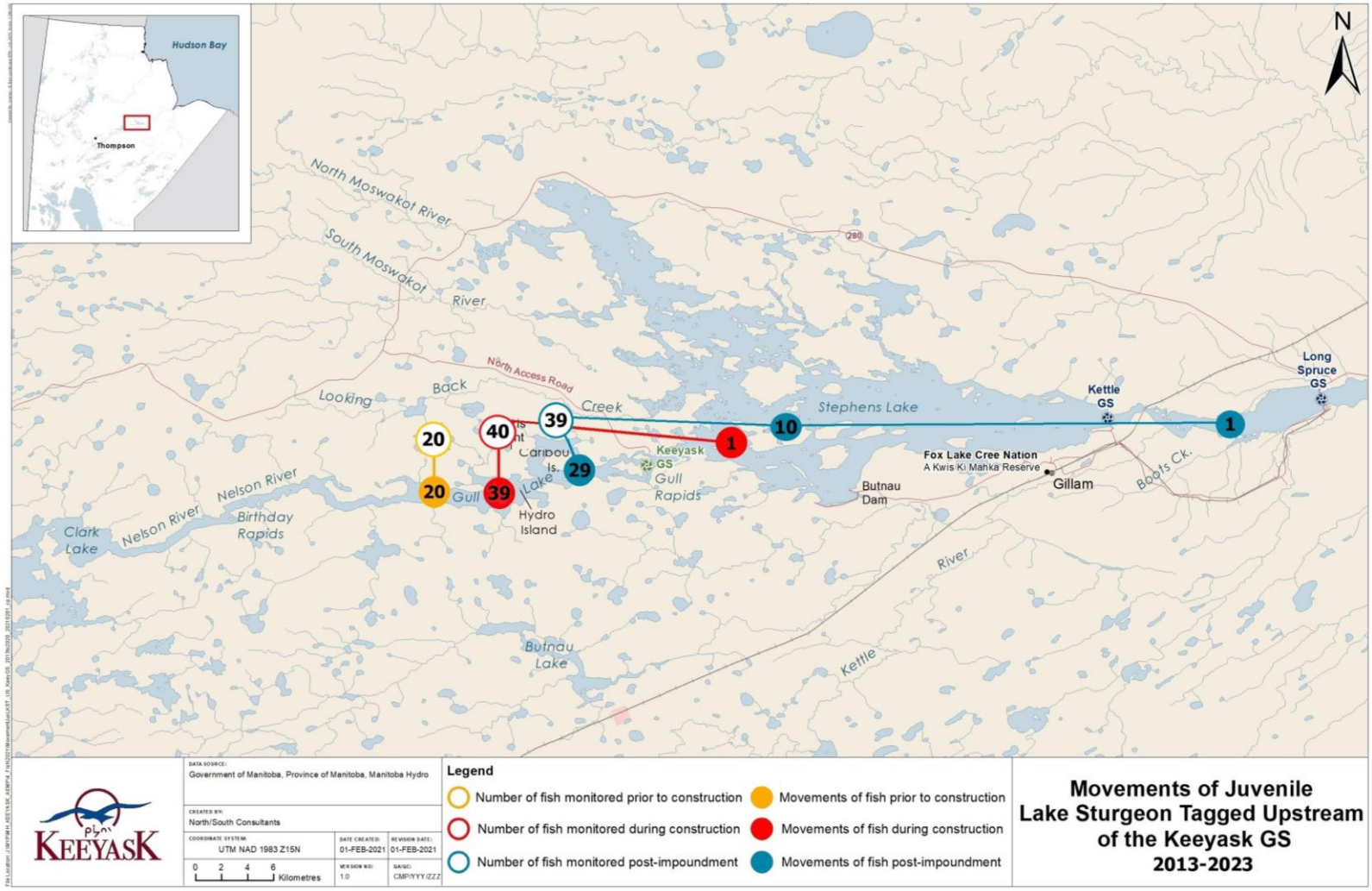


Figure 10: Map showing how many juvenile Lake Sturgeon moved upstream out of the Keeyask reservoir, stayed in the Keeyask reservoir, moved into Stephens Lake, and moved downstream past the Kettle GS before construction (yellow), during construction (red), and after reservoir impoundment (blue). Movements of fish due to mortality were not included. Numbers of fish monitored (hollow circles) represent the number of fish tagged while the number of fish movements (solid circles) represent the number of fish detected.

4.3.3 STEPHENS LAKE

Fourteen of the 15 juvenile Lake Sturgeon (93%) available for detection in Stephens Lake were located during the 2023 open-water period. These fish were detected between 761 and 54,101 times on 32 to 139 days of the 140-day study period (23–99% of the time) for an average of 115 days, or for 82% of the study period (StDev = 33 days). Mean movement range was 7.0 rkm (StDev = 3.7 rkm; range: 0.0–13.7 rkm) (Figure 11; Appendix 1). A single fish (7% of detected fish) was detected as far upstream as rkm 0.7, and three (21%) was detected as far downstream as rkm 18.2 (Figures 12 and 13). The majority of detections were logged in upper Stephens Lake at three receivers located between rkms 4.5 and 4.6 (n = 160,385; 46%) (Figure 12).

The single fish not detected (#48299) was originally tagged upstream of the GS and moved downstream into Stephens Lake in 2021. It was last detected in lower Stephens Lake (rkm 24.9) on November 15, 2022.

4.3.3.1 PROPORTIONAL DISTRIBUTION

Juvenile Lake Sturgeon tagged in Stephens Lake spent 69% of the 2023 open-water period in Zone 7 (farther from the GS) and 30% in Zone 6 (closer to the GS) (Table 4; Figure 9). The remaining time (0.3%) was spent immediately downstream of the GS in Zone 6.5.

Table 4: Proportion of time spent in each river zone by juvenile Lake Sturgeon implanted with acoustic transmitters upstream of the Keeyask GS and in Stephens Lake during a portion of the 2014 (June 4 to October 10), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16), 2018 (June 6 to October 10), 2019 (June 2 to October 7), 2020 (July 3 to September 23), 2021 (June 13 to October 10), 2022 (May 16 to October 10), and 2023 (May 16 to October 2) open-water periods.

Year Tagged	Study Year	Stephens Lake		
		Zone 6.5	Zone 6	Zone 7
2013	2014	-	42.1	57.9
	2015	-	51.0	49.0
	2016	-	46.7	53.2
	2017	-	42.7	57.3
2017	2018	-	46.6	53.4
	2019	-	40.7	59.3
	2020	-	46.5	53.5
	2021	-	30.4	69.6
2021	2022	1.5	35.1	63.3
	2023	0.3	30.4	69.3

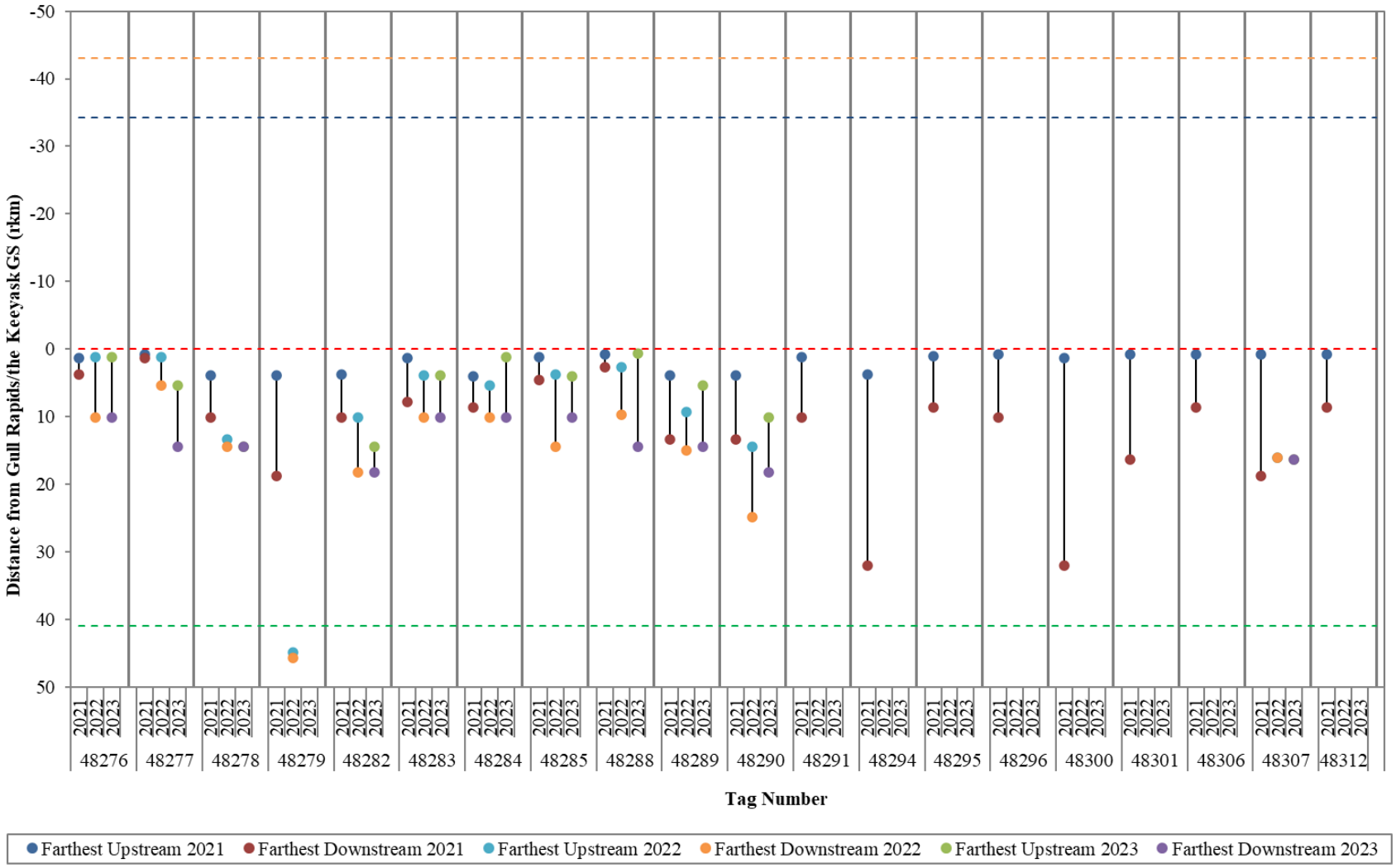


Figure 11: Detection ranges for individual juvenile Lake Sturgeon tagged in 2021 with acoustic transmitters in Stephens Lake during the open-water period (2021–2023). Horizontal dotted lines demarcate zones with the red line representing the Keeyask GS.

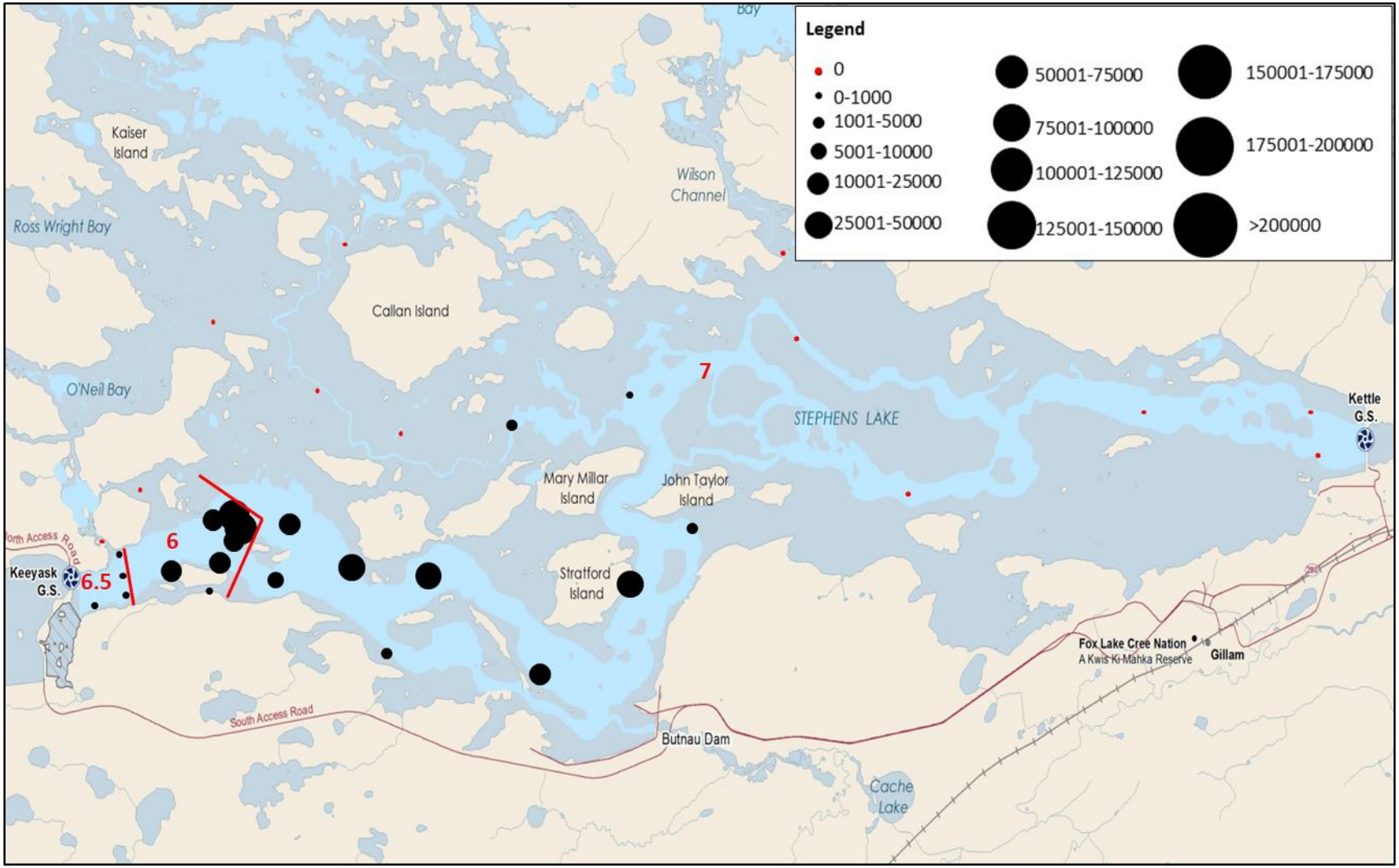


Figure 12: Relative number of detections at each acoustic receiver set in Stephens Lake during the 2023 open-water period (May 16 to October 2). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into three "zones" based on placement of receiver "gates."

4.3.3.2 MOVEMENT PATTERNS

Of the 14 fish detected during the open-water period, six (#48276, #48283, #48284, #48285, #48286, and #48298) remained in upper Stephens Lake moving no farther downstream than rkm 10.2.

Three fish (#47278, #48282, and #48307) remained exclusively in lower Stephens Lake, moving as far upstream as rkm 14.4 and as far downstream as rkm 18.2.

- One (#48282) was detected in northern Stephens Lake at rkm 15.0 (receiver #129181) between September 16 and 24, 2023.

Five fish (#48277, #48288, #48289, #48290, and #48304) moved between upper and lower Stephens Lake and were detected as far upstream as rkm 0.7 and as far downstream as rkm 18.2.

- One (#48289) was detected in northern Stephens Lake at rkm 12.0 (receiver #129180) between June 6 and 25, 2023.

Based on the frequency and location of detections in Stephens Lake, no fish are suspected to have moved downstream past the Kettle GS in 2023. No juvenile Lake Sturgeon were detected downstream of the Long Spruce GS in open-water 2023. All movements out of Stephens Lake since 2013 are outlined in Table 3 and Figure 13.

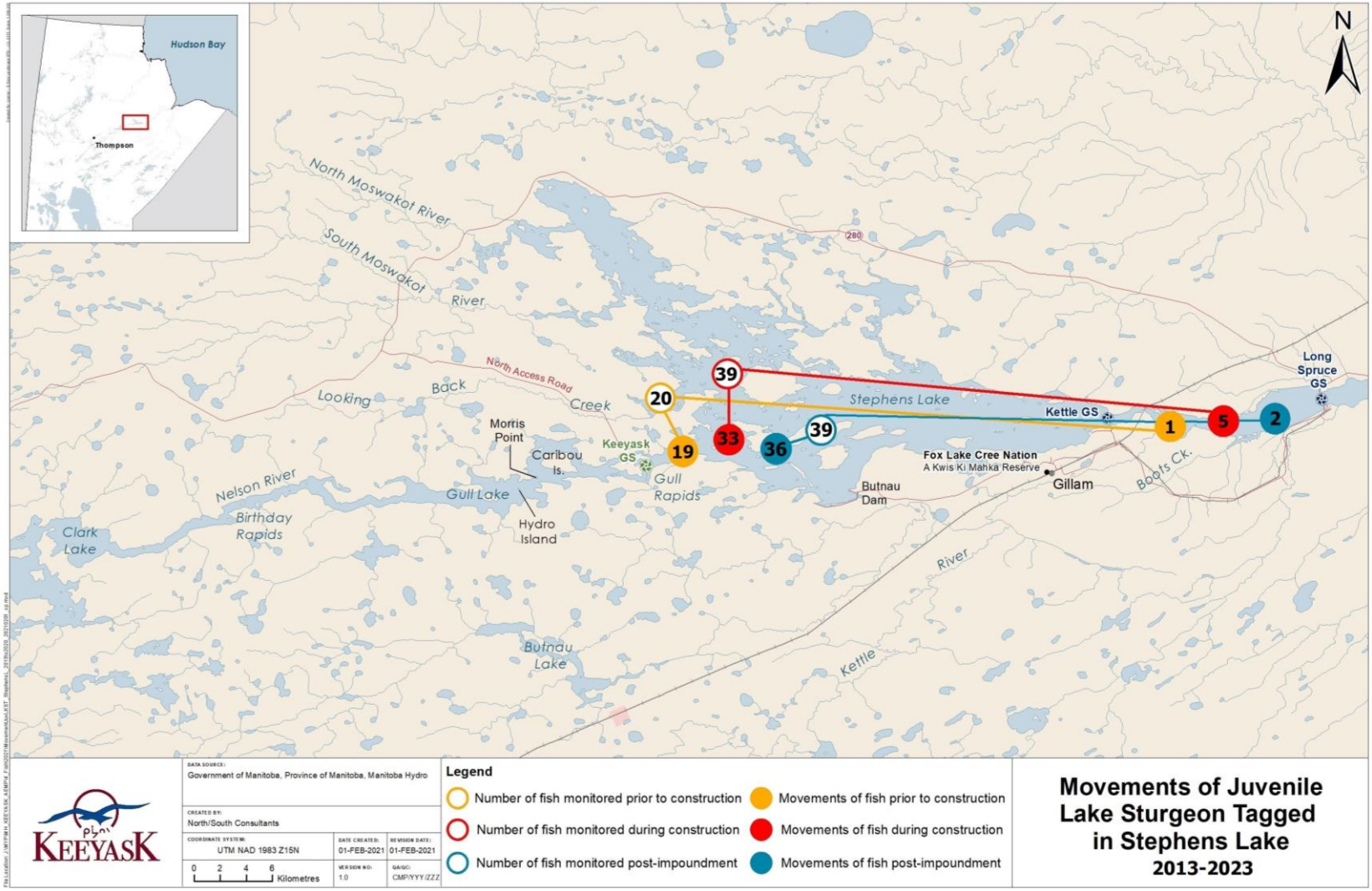


Figure 13: Map showing how many juvenile Lake Sturgeon stayed in Stephens Lake and moved downstream past the Kettle GS before construction (yellow), during construction (red), and after reservoir impoundment (blue). Movements of fish due to tagging stress or mortality were not included. Numbers of fish monitored (hollow circles) represent the number of fish tagged while the number of fish movements (solid circles) represent the number of fish detected.

5.0 DISCUSSION

Juvenile Lake Sturgeon acoustic tracking was initiated in 2013 to describe movements during the pre-construction (2013), construction/commissioning (2014–2021), and operation periods (2022–present) of the Keeyask Project. Monitoring is being conducted to determine if habitat changes associated with construction and operation of the GS have altered habitat use and coarse-scale movement patterns. The discussion below is focussed on the key questions (presented in the AEMP) with respect to potential impacts of construction and operation on juvenile Lake Sturgeon and their movements.

5.1 EVALUATION OF METHODOLOGY

Since monitoring was initiated in 2013, the proportion of tagged fish detected and the number of detections associated with each tagged fish during the open-water period has remained consistently high both upstream and downstream of the Keeyask GS. Fish tagged upstream of the Keeyask GS were detected, on average, on 56% of the days during the 2023 open-water study period (43–66% in previous years). Fish tagged in Stephens Lake tend to be detected more often, and on average were located for 82% of the days during the 2023 open-water period (46–78% in previous years). Few juveniles pass by receiver gates (or receivers) undetected or go missing from the study area. For these reasons, the juvenile Lake Sturgeon acoustic telemetry data set provides a good understanding of movements in the Keeyask Study Area both upstream and downstream of the GS.

5.2 KEY QUESTIONS

Key questions identified in the AEMP relevant to the operation period are addressed below.

Will the frequency of long-distance movements (and subsequent downstream emigration/ entrainment) by juvenile Lake Sturgeon increase during operation of the Project?

Prior to impoundment in September 2020, juvenile Lake Sturgeon movements out of Gull Lake were rare and individual movement ranges were small. Between 2013 and 2020, average movement ranges during the open-water period were between 2.6 rkm (in 2019) and 5.2 rkm (in 2016). A single sturgeon briefly moved upstream out of Gull Lake (in 2016) and returned within the same year, and a single sturgeon moved downstream past the Keeyask GS spillway (in 2019). Other than these movements, all acoustically tagged fish remained in Gull Lake where they were initially captured and tagged prior to impoundment (2013–2020).

During the initial years of Project operation, it was predicted in the EIS that areas used by juvenile Lake Sturgeon prior to GS construction may become unsuitable due to changes in water velocity

and silt deposition, both in the Keeyask reservoir and Stephens Lake, and juvenile Lake Sturgeon would move to other areas. In the months immediately following impoundment (September and October 2020) and winter 2020/2021, juvenile movements remained unchanged. However, beginning in June 2021, juveniles were observed moving over longer distances. During the 2021 open-water period, nine fish (47% of all detected) moved upstream out of Gull Lake into the middle Keeyask reservoir and the average total movement range increased to 19.0 rkm. All nine fish were tagged in 2017 and had not displayed these movements previously. Downstream movements out of the reservoir also increased during this time. Ten fish moved downstream past the Keeyask GS between open-water 2021 and open-water 2022. Three (33% of all detected; all tagged in 2017) moved downstream in open-water 2021, four (16%; two tagged in 2017 and two tagged in 2021) in winter 2021/2022, and three (10%; one tagged in 2017 and two tagged in 2021) between fall 2021 and open-water 2022.

During both open-water 2022 and 2023, juvenile movements appear to have returned to patterns observed prior to impoundment. Overall movement ranges decreased to 5.4 rkm in 2022 and 7.7 rkm in 2023, closer to those observed pre-impoundment (2.6–5.2 rkm). Further, most fish remained within one portion of the reservoir, either in Gull Lake or the middle Keeyask reservoir, rather than moving between the two. No fish moved downstream past the Keeyask GS in either 2022 or 2023.

For juvenile Lake Sturgeon tagged in Stephens Lake, movement range and frequency of downstream movements have changed little since monitoring began. Since 2014, open-water movement ranges have averaged between 7.5 rkm (in 2022) and 12.1 rkm (in 2021). The average movement range in open-water 2023 was 7.0 rkm. Fish continue to be detected in the areas both closer to and farther from the station in similar proportions, spending 30–51% of the open-water period closer to the GS during construction/commissioning, and 30–37% of time in the area during operation.

Three juvenile Lake Sturgeon moved downstream past the Kettle GS since impoundment in September 2020, one in winter 2021/2022 and two in open-water 2022. Two of these fish were originally tagged in Stephens Lake, while one was originally tagged in the Keeyask reservoir and moved downstream into Stephens Lake in 2021. Six tagged juveniles moved downstream past the Kettle GS between 2014 and 2020, including three in 2017. Although no acoustic receivers could be set or retrieved from downstream of the Kettle GS in 2023, no fish are suspected to have moved downstream through the GS into the Long Spruce reservoir.

Are fish moving downstream past the GS and, if so, is there an indication that they have survived passage?

The EIS predicted that juvenile Lake Sturgeon may emigrate out of the Keeyask reservoir following reservoir impoundment and that movements downstream past the Keeyask GS may result in injury or mortality. Ten fish have moved downstream past the Keeyask GS since impoundment of the Keeyask reservoir: three in open-water 2021, four in winter 2021/2022, and three between fall 2021 and open-water 2022. All ten fish displayed multiple upstream and

downstream movements in Stephens Lake indicating they all survived passage. No juvenile Lake Sturgeon have moved downstream past the Keeyask GS since June 2022.

Will there be a change in the proportional distribution of juvenile Lake Sturgeon following reservoir creation (i.e., will there be a population level shift in distribution patterns following reservoir creation)?

Since reservoir impoundment, juvenile Lake Sturgeon tagged upstream of the Keeyask GS continue to spend the majority of the open-water period in Gull Lake. Fish spent 45–78% of each open-water period in Zone 4 during the construction period (2014–2020) and 32–54% post-impoundment. In Stephens Lake, fish continue to spend a slightly greater proportion of the open-water period farther downstream from the GS (Zone 7). Fish spent 49–70% of the open-water period in Zone 7 during construction/commissioning, and 63–76% of time in this area post-impoundment. Overall, there has not been a change in the proportional distribution of juvenile Lake Sturgeon during operation.

6.0 SUMMARY AND CONCLUSIONS

- Acoustic telemetry continues to be an effective method for monitoring juvenile Lake Sturgeon movement and habitat use. Movement monitoring is generally more effective during the open-water period relative to the winter period due to more locations where receivers can be effectively deployed. Juvenile Lake Sturgeon were detected for 35% of the 2022/2023 winter period and 56% of the 2023 open-water period upstream of the GS, and 58% of the winter period and 82% of the open-water period in Stephens Lake.
- The key questions, as described in the AEMP, for juvenile Lake Sturgeon movement monitoring during operation of the Keeyask GS were as follows:
    - *Will the frequency of long-distance movements by juvenile Lake Sturgeon increase during operation of the Project?*

      The frequency of long-distance movements increased in the first two years following reservoir impoundment. In total, ten fish (25% of all tagged fish) have moved downstream past the Keeyask GS into Stephens Lake since impoundment of the reservoir. This represents a substantial increase compared with pre-impoundment data (2014–2020) when only one of 40 tagged juveniles moved downstream though the Keeyask GS over a six-year period (2014–2020). The changes in movement patterns appear to have been short-lived as in both 2022 and 2023, total movement ranges of juvenile Lake Sturgeon in the Keeyask reservoir were closer to those observed pre-impoundment. Further, no juveniles moved downstream past the Keeyask reservoir after June 2022.

      For juvenile Lake Sturgeon tagged in Stephens Lake, movement range and frequency of downstream movements have changed little between pre-construction (2013), construction/commissioning (2014–2021), and operation periods (2022 to present). Three juvenile Lake Sturgeon moved downstream past the Kettle GS since impoundment in September 2020, which does not represent an increase over pre-impoundment years when six tagged juveniles moved downstream Kettle GS. Although no acoustic receivers could be set or retrieved downstream of the Kettle GS in 2023, no juvenile Lake Sturgeon are suspected to have moved past the GS in 2023.

    - *Are fish moving downstream past the GS and, if so, is there an indication that they have survived passage?*

      Ten fish have moved downstream past the Keeyask GS: three in open-water 2021, four in winter 2021/2022, and three between fall 2021 and open-water 2022. All ten fish made multiple upstream and downstream movements in Stephens Lake indicating they survived passage. No additional juvenile Lake Sturgeon moved downstream past the Keeyask GS in 2023.

- *Will there be a change in the proportional distribution of juvenile Lake Sturgeon following reservoir creation (i.e., will there be a population level shift in distribution patterns following reservoir creation)?*

  Since reservoir impoundment, juvenile Lake Sturgeon tagged upstream of the Keeyask GS continue to spend the majority of the time in Gull Lake. In Stephens Lake, fish continue to spend a slightly greater proportion of the open-water period farther downstream from the GS (Zone 7). Overall, there has not been a change in the proportional distribution of juvenile Lake Sturgeon during operation.

- It was predicted in the EIS that areas used by juvenile Lake Sturgeon prior to GS construction may become unsuitable due to changes in water velocity and silt deposition during the initial years of Project operation, both in the Keeyask reservoir and Stephens Lake and that juvenile Lake Sturgeon would move to other areas. In the months immediately following impoundment (September and October 2020) and winter 2020/2021, juvenile movements remained unchanged, however, beginning in June 2021, juveniles began to move longer distances. During the 2021 open-water period, nine fish (47% of all detected) moved upstream out of Gull Lake into the middle Keeyask reservoir and the average total movement range increased from 2.6–5.2 rkm between 2013 and 2020 to 19.0 rkm. The EIS also predicted that juvenile Lake Sturgeon may be lost from the Keeyask reservoir due to emigration following reservoir impoundment and that movements downstream past the Keeyask GS may lead to injury or mortality. Ten fish have moved downstream past the Keeyask GS since impoundment of the Keeyask reservoir. All ten fish displayed multiple upstream and downstream movements in Stephens Lake indicating they survived passage. These changes in movement patterns appear to have been short-lived as in both 2022 and 2023, total movement ranges of juvenile Lake Sturgeon in the Keeyask reservoir were closer to those observed pre-impoundment. Further, no juveniles moved downstream past the Keeyask reservoir after June 2022.
- Following the 2023 open-water period, 16 active tags remain in the Keeyask reservoir and 15 in Stephens Lake. Additional tags were applied in fall 2023 to increase the number of fish tracked in the Keeyask reservoir (n = 5) and Stephens Lake (n = 5) to continue monitoring fish movements during the operation period.

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APPENDICES

APPENDIX 1: DETECTION SUMMARIES FOR JUVENILE LAKE STURGEON TAGGED AND MONITORED BETWEEN 2014 AND 2023

Table A1-1: Number of detections (n), number of days detected, farthest upstream (U/S) and downstream (D/S) river kilometer (rkm) detection sites, and detection range for each of 20 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored upstream of the Keeyask GS during the 2021/2022 (October 11, 2021 to May 15, 2022), and 2022/2023 (October 11, 2022 to May 15, 2023) winter periods. Tag ID highlighted purple = moved downstream through Keeyask GS.

Tag ID	Date tagged	2021/2022					2022/2023				
		n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
48280	19-Sep-21	1196	33	-10.1	-10.1	0	1684	44	-17.4	-15	2.4
48281	19-Sep-21	30675	119	-17.4	-10.1	7.3	4846	69	-15	-12.5	2.5
48286	20-Sep-21	14749	61	-10.1	18.8	28.9	28895	188	5.4	10.2	4.8
48287	20-Sep-21	27419	120	-12.4	-10.1	2.3	30685	82	-19.5	-15	4.5
48292	20-Sep-21	7370	101	-19.5	-17.4	2.1	20277	77	-17.4	-15	2.4
48293	20-Sep-21	7770	69	-17.4	-7.9	9.5	15188	88	-17.4	-9.9	7.5
48297	18-Sep-21	12404	48	-7.9	-7.9	0	21922	142	-12.9	-9.9	3
48298	20-Sep-21	-	-	-	-	-	17157	73	4.6	14.4	9.8
48299	20-Sep-21	4601	64	-7.9	18.8	26.7	379	2	24.9	24.9	0
48302	19-Sep-21	-	-	-	-	-	204	4	-7.9	-2.1	5.8
48303	19-Sep-21	17440	49	-26.4	-26.4	0	-	-	-	-	-
48304	20-Sep-21	-	-	-	-	-	70964	188	14.4	18.2	3.8
48305	20-Sep-21	9398	64	-7.9	-7.9	0	54347	192	-7.9	-7.9	0
48308	18-Sep-21	6521	86	-7.9	-7.9	0	8915	94	-17.4	-9.9	7.5
48309	18-Sep-21	-	-	-	-	-	7438	129	-7.9	-7.9	0
48310	19-Sep-21	-	-	-	-	-	17886	55	-26.4	-26.4	0
48311	19-Sep-21	-	-	-	-	-	300	23	-26.4	-26.4	0
48315	18-Sep-21	3143	34	-17.4	-12.9	4.5	11611	57	-17.4	-12.5	4.9
48316	19-Sep-21	-	-	-	-	-	16176	72	-26.4	-26.4	0
48317	19-Sep-21	-	-	-	-	-	227	17	-26.4	-26.4	0

Table A1-2: Number of detections (n), number of days detected, farthest upstream (U/S) and downstream (D/S) river kilometer (rkm) detection sites, and detection range for each of 20 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored in Stephens Lake during the 2021/2022 (October 11, 2021 to May 15, 2022), and 2022/2023 (October 11, 2022 to May 15, 2023) winter periods. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	2021/2022					2022/2023				
		n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
48276	17-Sep-21	38925	164	3.9	10.2	6.3	5898	100	3.8	8.3	4.5
48277	17-Sep-21	-	-	-	-	-	72971	149	3.8	9.7	5.9
48278	17-Sep-21	18927	129	13.4	13.4	0	425	33	14.4	14.4	0
48279	17-Sep-21	128	1	24.9	24.9	0	-	-	-	-	-
48282	17-Sep-21	5928	59	13.4	18.8	5.4	12867	187	16.4	18.2	1.8
48283	17-Sep-21	14948	142	3.9	10.2	6.3	15600	97	3.8	8.3	4.5
48284	17-Sep-21	5158	79	7.8	10.2	2.4	90726	208	3.8	9.7	5.9
48285	17-Sep-21	63052	212	3.9	7.8	3.9	34099	177	4.6	10.2	5.6
48288	17-Sep-21	14883	69	3.9	4.9	1	7408	70	5.4	14.4	9
48289	17-Sep-21	6213	75	10.2	18.8	8.6	12872	57	12.0	12.0	0
48290	17-Sep-21	47973	144	10.2	24.9	14.7	7025	146	10.2	14.4	4.2
48291	17-Sep-21	116	2	24.9	24.9	0	-	-	-	-	-
48294	16-Sep-21	-	-	-	-	-	-	-	-	-	-
48295	16-Sep-21	16	1	22	22	0	-	-	-	-	-
48296	16-Sep-21	-	-	-	-	-	-	-	-	-	-
48300	16-Sep-21	110	1	45.7	45.7	0	-	-	-	-	-
48301	16-Sep-21	-	-	-	-	-	-	-	-	-	-
48306	16-Sep-21	-	-	-	-	-	-	-	-	-	-
48307	16-Sep-21	96991	210	13.4	18.8	5.4	55785	208	16.4	16.4	0
48312	16-Sep-21	1613	9	7.8	18.8	11	-	-	-	-	-

Table A1-3: Number of detections (n), number of days detected, farthest upstream (U/S) and downstream (D/S) river kilometer (rkm) detection sites, and detection range for each of 20 juvenile Lake Sturgeon tagged and monitored upstream of Keeyask GS during the open-water 2021 (1 May to October 10), 2022 (May 16 to October 10), and 2023 (May 16 to October 2) periods. Tag ID highlighted purple = moved downstream past the Keeyask GS. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	2021					2022					2023				
		n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
48280	19-Sep-21	3023	14	-10.1	-9.9	0.2	4898	109	-19.5	-7.8	11.7	3089	92	-26.4	-15	11.4
48281	19-Sep-21	2842	17	-15	-7.7	7.3	9207	63	-17.4	-9.9	7.5	8351	75	-19.5	-9.9	9.6
48286	20-Sep-21	3521	13	-15	-9.9	5.1	14197	124	1.2	18.8	17.6	46497	138	3.8	10.2	6.4
48287	20-Sep-21	2797	13	-17.4	-12.5	4.9	6208	83	-19.5	-9.9	9.6	5029	30	-22.6	-7.8	14.8
48292	20-Sep-21	110	4	-17.4	-15	2.4	5854	55	-19.5	-9.9	9.6	5029	70	-19.5	-15	4.5
48293	20-Sep-21	1158	16	-15	-9.9	5.1	6449	52	-15	-9.9	5.1	1876	27	-22.6	-12.9	9.7
48297	18-Sep-21	2685	19	-8.9	-6.2	2.7	18762	116	-12.9	-9.9	3	43462	135	-12.5	-9.9	2.6
48298	20-Sep-21	3519.0	17	-5.8	-3.8	2.0	54740	135	2.7	8.3	5.6	33504	131	1.2	10.2	9.0
48299	20-Sep-21	2228	18	-8.9	-3.8	5.1	-	-	-	-	-	-	-	-	-	-
48302	19-Sep-21	100.0	9	-9.9	-7.7	2.2	21289	101	-17.4	-2.1	15.3	13296	91	-12.5	-2.1	10.4
48303	19-Sep-21	460	9	-26.4	-24.2	2.2	5583	39	-24.2	-22.6	1.6	2573	57	-24.2	-9.9	14.3
48304	20-Sep-21	5283.0	18	-5.8	-3.8	2.0	10526	90	1.2	14.4	13.2	13235	105	10.2	18.2	8.0
48305	20-Sep-21	2087	17	-6.2	-3.8	2.4	14578	122	-8.9	-5.8	3.1	17964	106	-8.9	-2.1	6.8
48308	18-Sep-21	1455	14	-8.9	-7.9	1	5201	68	-24.2	-6.2	18	3064	49	-19.5	-10.1	9.4
48309	18-Sep-21	486.0	13	-10.1	-7.7	2.4	13604	116	-8.9	-2.1	6.8	14019	128	-10.1	-5.8	4.3
48310	19-Sep-21	314.0	11	-24.2	-24.2	0.0	9731	91	-26.4	-24.2	2.2	25167	97	-33.9	-22.6	11.3
48311	19-Sep-21	257.0	12	-24.2	-24.2	0.0	25652	91	-26.4	-26.4	0	3708	104	-26.4	-26.4	0.0
48315	18-Sep-21	2281	20	-10.1	-2.2	7.9	22941	105	-12.9	-9.9	3	9014	94	-17.4	-9.9	7.5
48316	19-Sep-21	560.0	13	-24.2	-24.2	0.0	24735	116	-26.4	-26.4	0	269	22	-32.2	-26.4	5.8
48317	19-Sep-21	123.0	7	-24.2	-24.2	0.0	7083	99	-26.4	-26.4	0	1075	94	-26.4	-26.4	0.0

Table A1-4: Number of detections (n), number of days detected, farthest upstream (U/S) and downstream (D/S) river kilometer (rkm) detection sites, and detection range for each of 20 juvenile Lake Sturgeon tagged and monitored in Stephens Lake during the open-water 2017 (May 1 to October 16), 2018 (May 1 to October 10), 2019 (May 1 to October 7), 2020 (May 1 to September 23), 2021 (May 1 to October 10), and 2022 (May 16 to October 2) periods. Tag ID highlighted yellow = lost tags. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	2021					2022					2023				
		n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
48276	17-Sep-21	267	15	1.3	3.8	2.5	42448	130	1.2	10.2	9	54101	133	1.2	10.2	9.0
48277	17-Sep-21	1013	21	0.8	1.3	0.5	20825	107	1.2	5.4	4.2	17278	135	5.4	14.4	9.0
48278	17-Sep-21	6553	15	3.9	10.2	6.3	14702	101	13.4	14.4	1	761	32	14.4	14.4	0.0
48279	17-Sep-21	1701	14	3.9	18.8	14.9	23496	122	44.9	45.7	0.8	-	-	-	-	-
48282	17-Sep-21	6244	16	3.8	10.2	6.4	3073	70	10.2	18.2	8	8973	117	14.4	18.2	3.8
48283	17-Sep-21	5464	15	1.3	7.8	6.5	30393	136	3.9	10.2	6.3	45079	136	3.9	10.2	6.3
48284	17-Sep-21	2685	15	4.1	8.7	4.6	14564	130	5.4	10.2	4.8	20405	137	1.2	10.2	9.0
48285	17-Sep-21	1568	19	1.2	4.6	3.4	28713	140	3.8	14.4	10.6	29343	139	4.1	10.2	6.1
48288	17-Sep-21	719	19	0.8	2.7	1.9	24785	130	2.7	9.7	7	34229	55	0.7	14.4	13.7
48289	17-Sep-21	3715	15	3.9	13.4	9.5	9316	82	9.3	15.0	5.7	7531	118	5.4	14.4	9.0
48290	17-Sep-21	2641	15	3.9	13.4	9.5	9495	92	14.4	24.9	10.5	10371	97	10.2	18.2	8.0
48291	17-Sep-21	3269	16	1.2	10.2	9	-	-	-	-	-	-	-	-	-	-
48294	16-Sep-21	4304	14	3.8	32	28.2	-	-	-	-	-	-	-	-	-	-
48295	16-Sep-21	4148	14	1	8.7	7.7	-	-	-	-	-	-	-	-	-	-
48296	16-Sep-21	4470	17	0.8	10.2	9.4	-	-	-	-	-	-	-	-	-	-
48300	16-Sep-21	1834	11	1.3	32	30.7	-	-	-	-	-	-	-	-	-	-
48301	16-Sep-21	2714	15	0.8	16.3	15.5	-	-	-	-	-	-	-	-	-	-
48306	16-Sep-21	3716	16	0.8	8.7	7.9	-	-	-	-	-	-	-	-	-	-
48307	16-Sep-21	4019	18	0.8	18.8	18	4121	17	16.1	16.1	0	20233	85	16.4	16.4	0.0
48312	16-Sep-21	5851	20	0.8	8.7	7.9	-	-	-	-	-	-	-	-	-	-

APPENDIX 2:
LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED JUVENILE LAKE STURGEON UPSTREAM OF THE KEEYASK GS, SEPTEMBER 2021 TO OCTOBER 2023

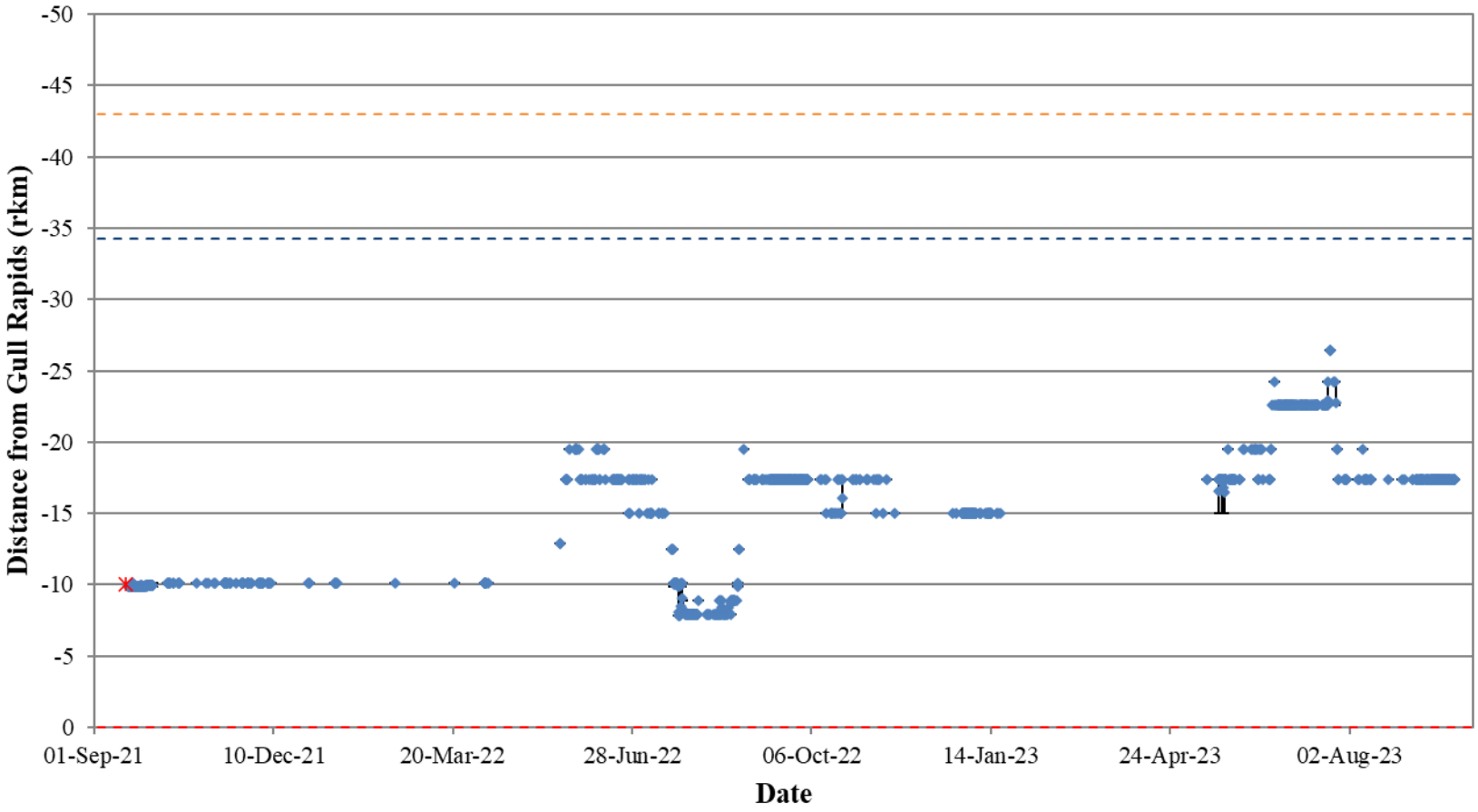

Figure A2-1: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48280) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

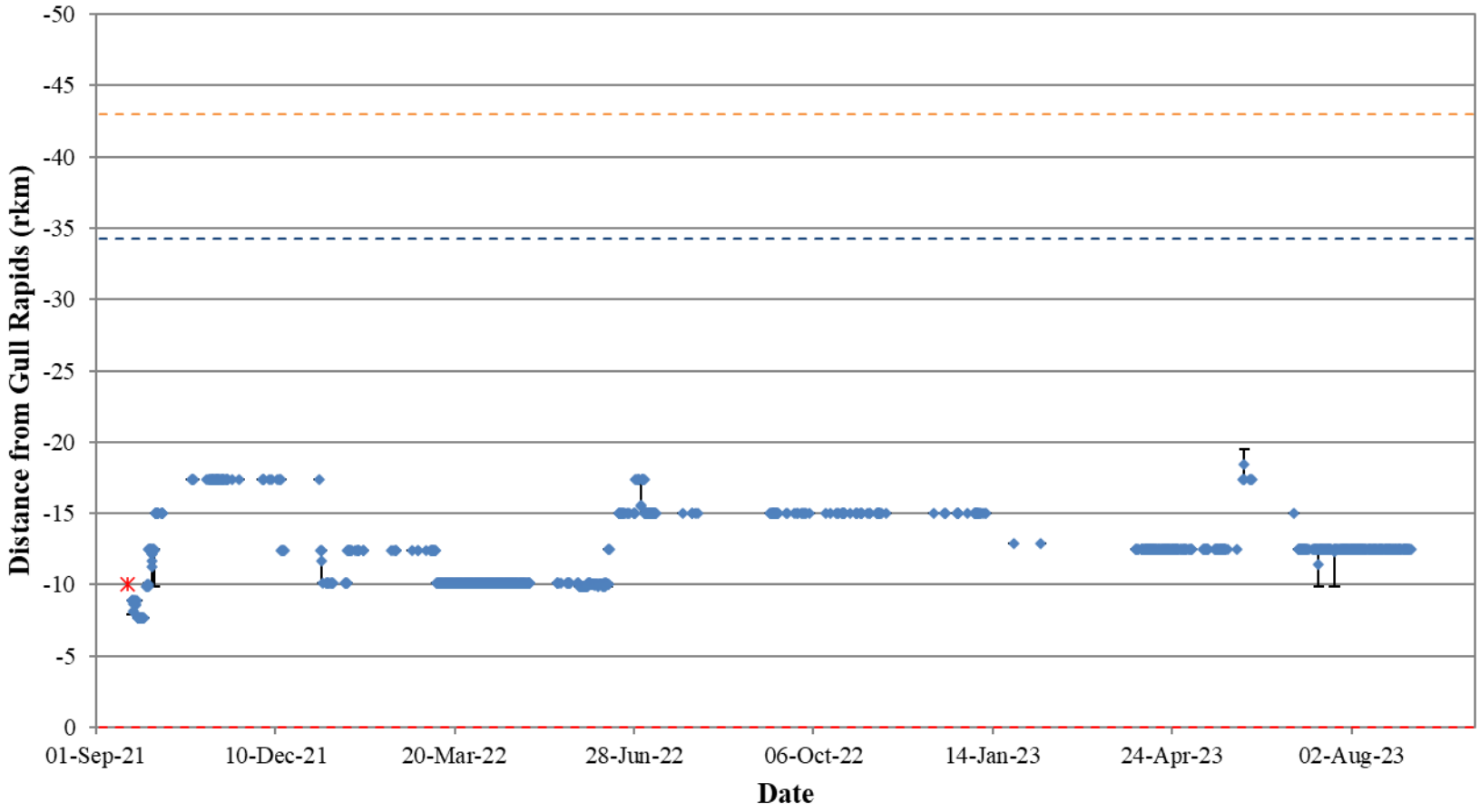

Figure A2-2: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48281) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

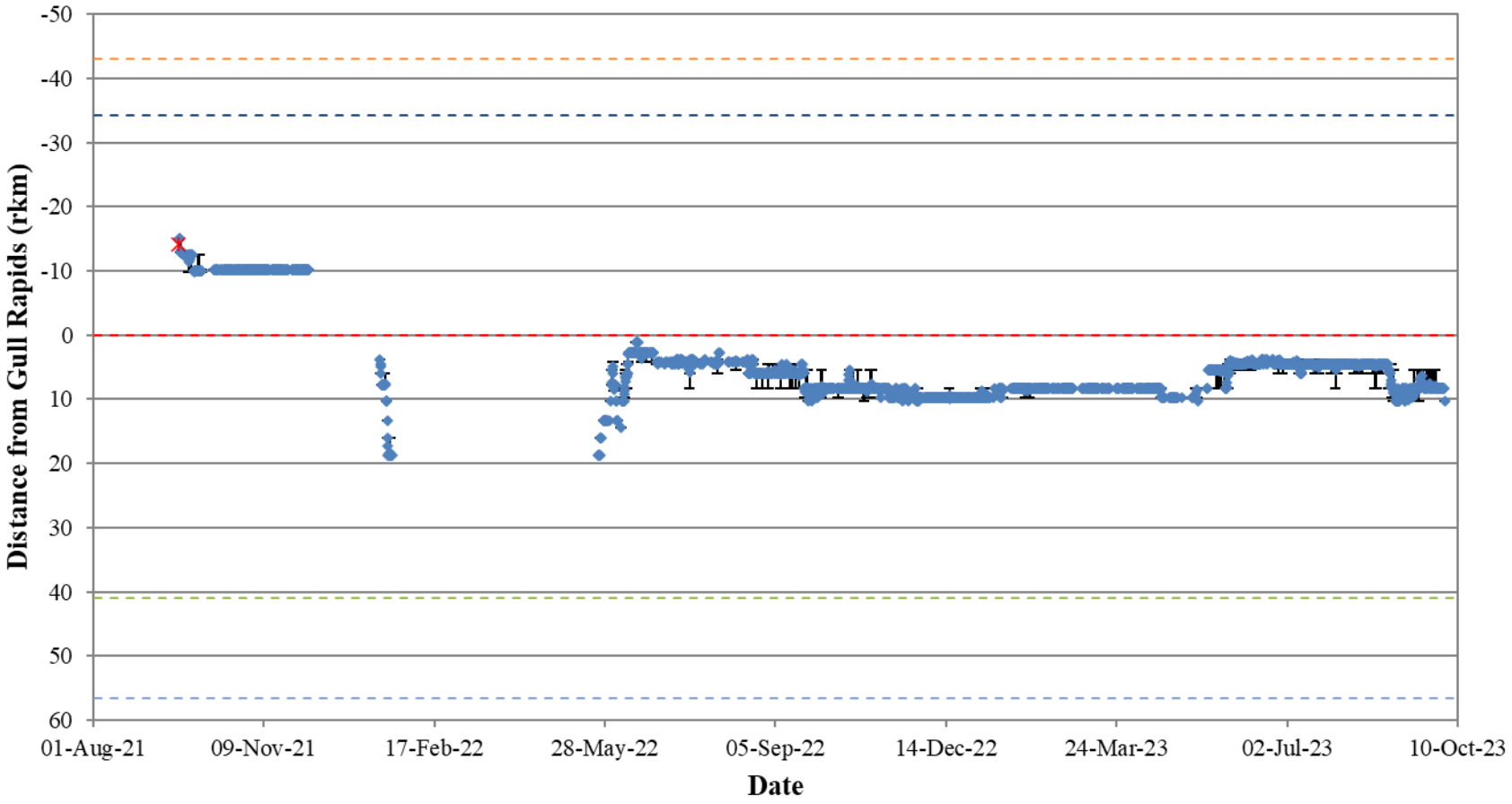

Figure A2-3: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48286) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

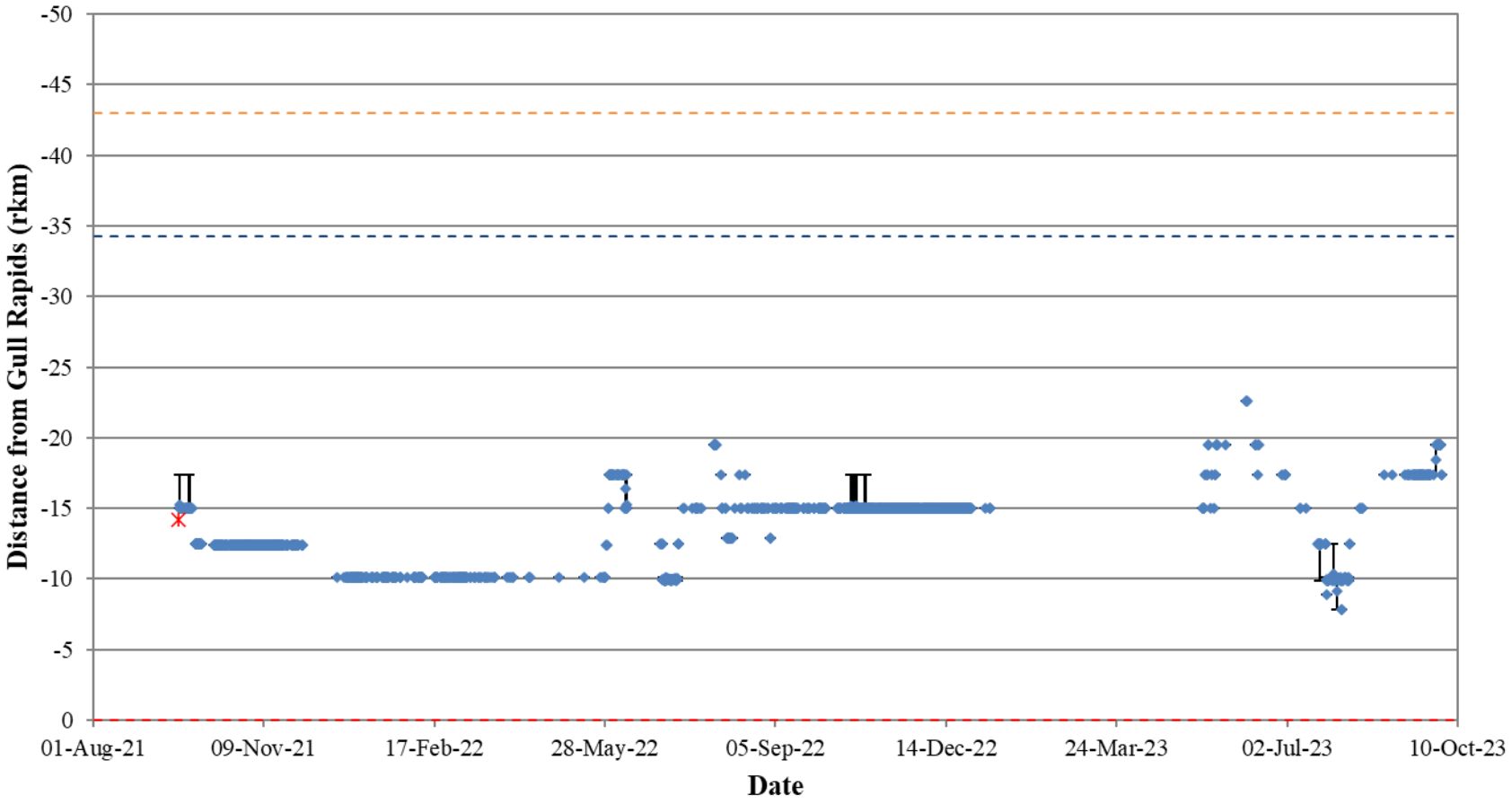

Figure A2-4: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48287) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

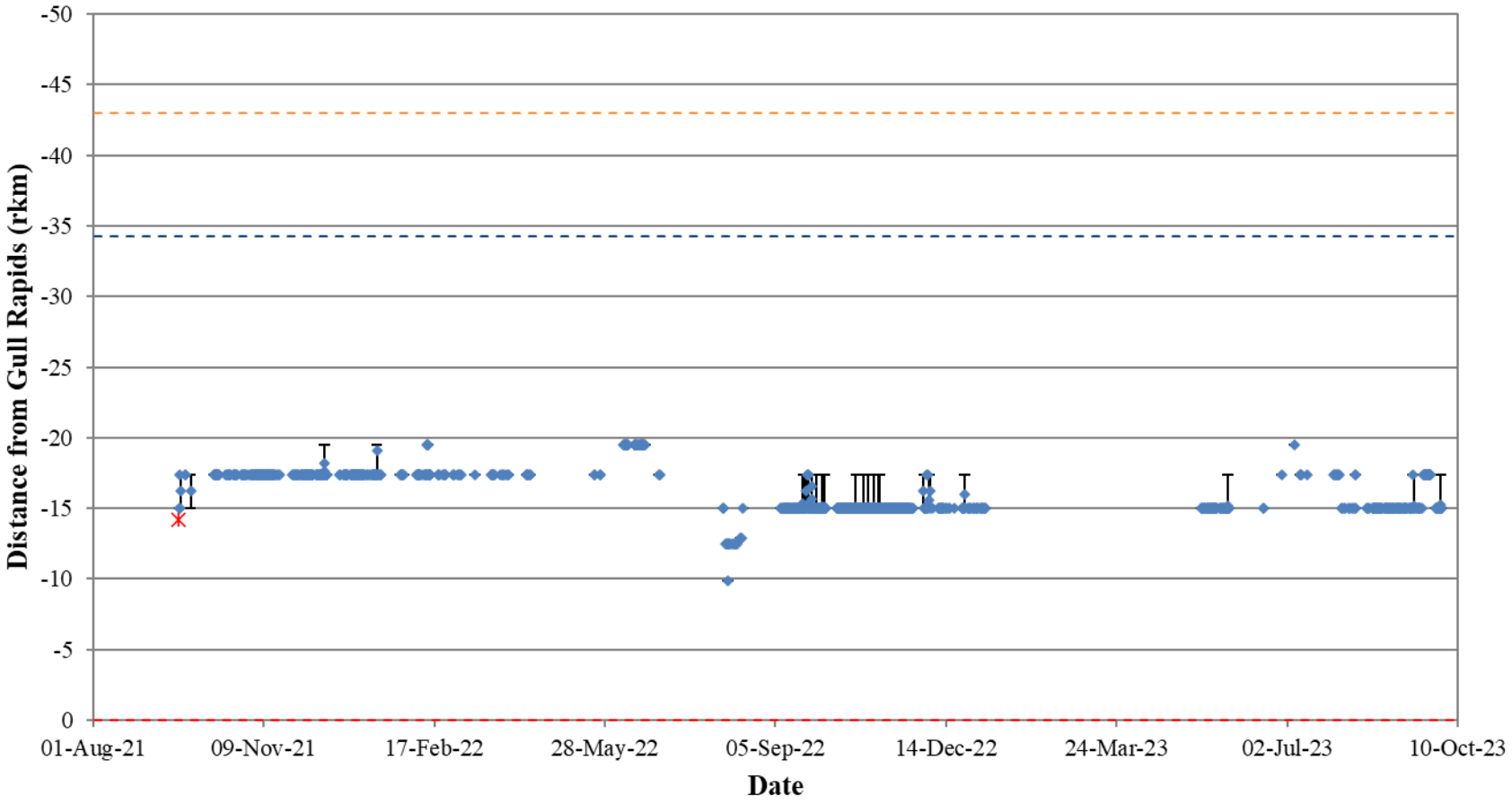

Figure A2-5: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48292) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

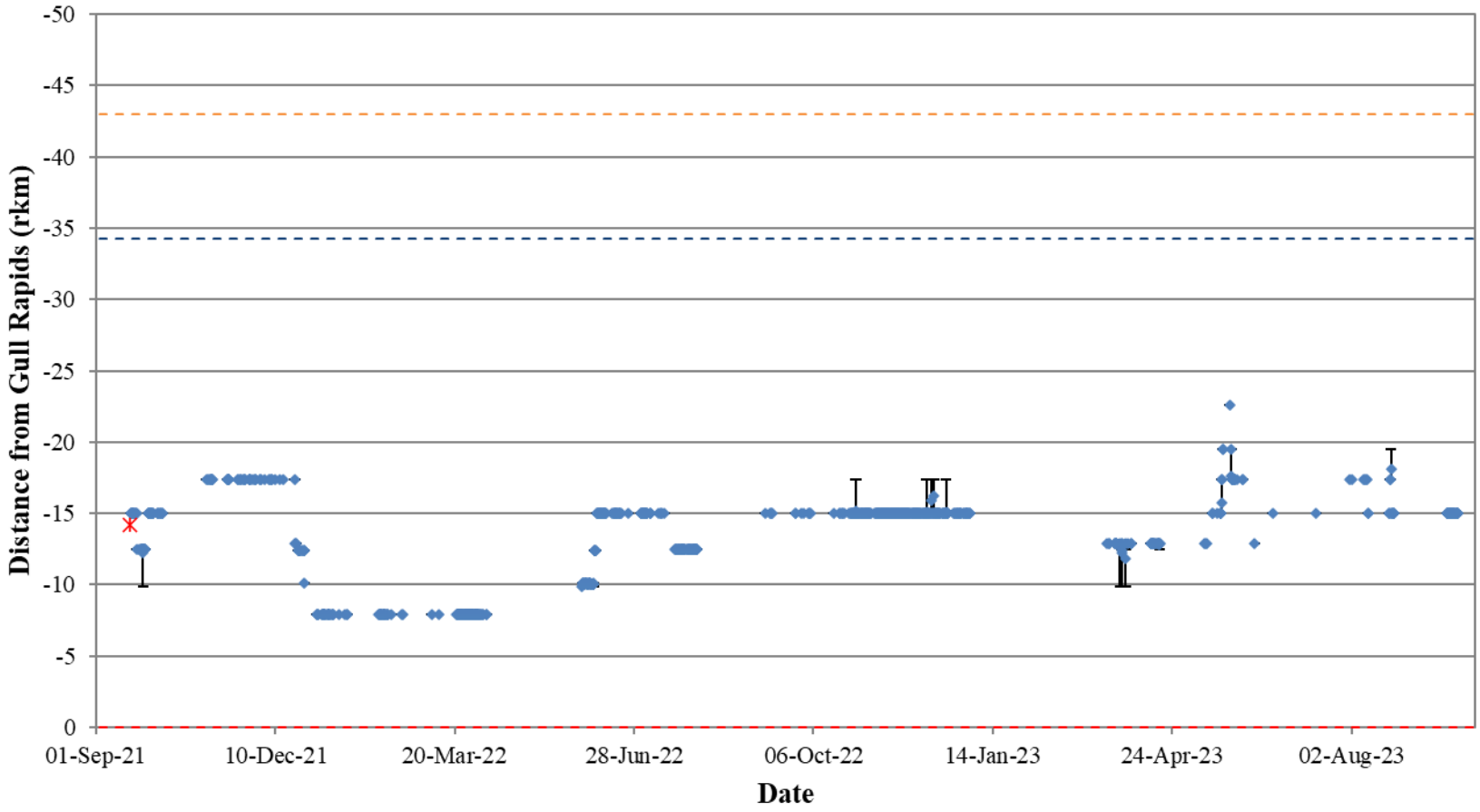

Figure A2-6: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48293) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

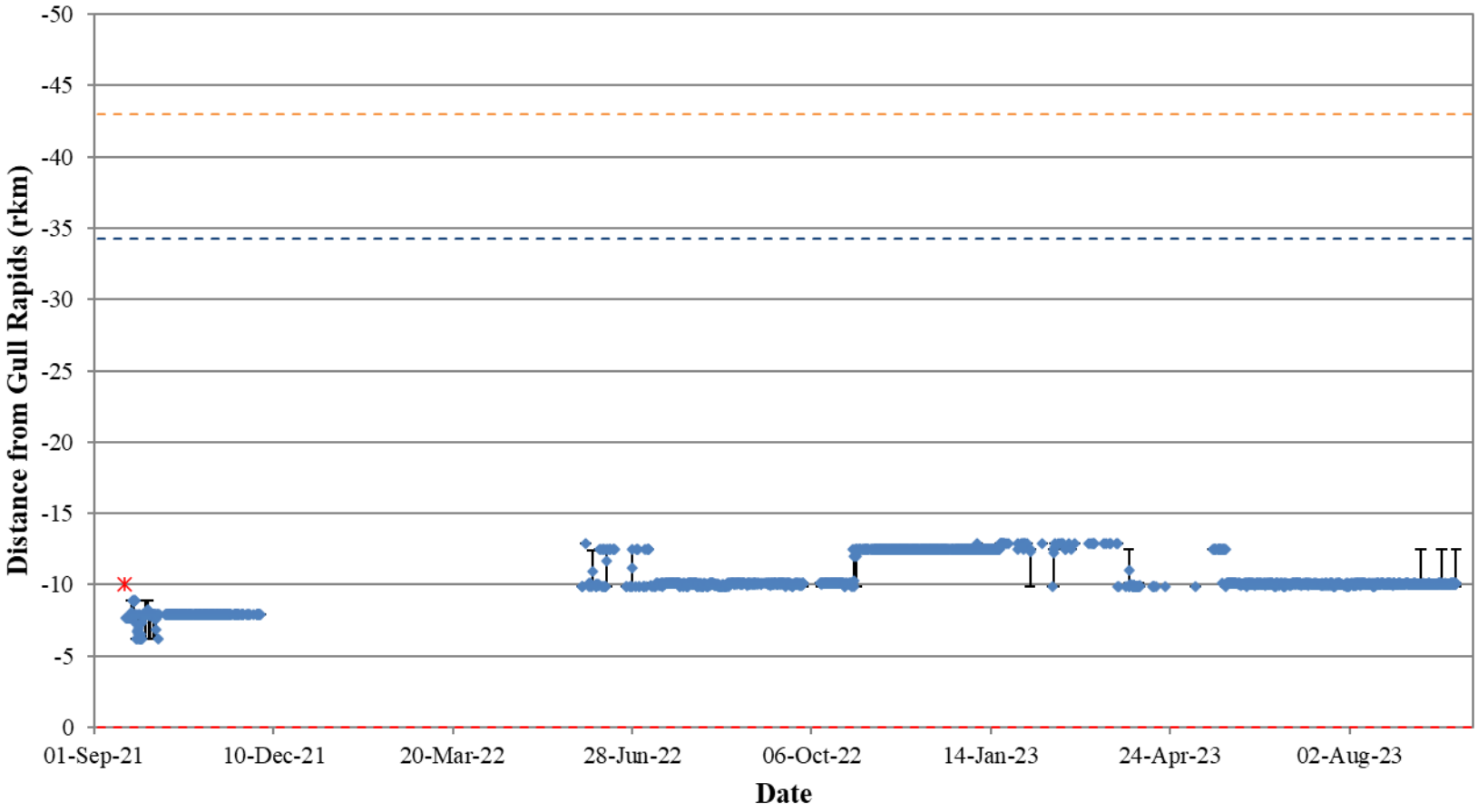

Figure A2-7: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48297) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

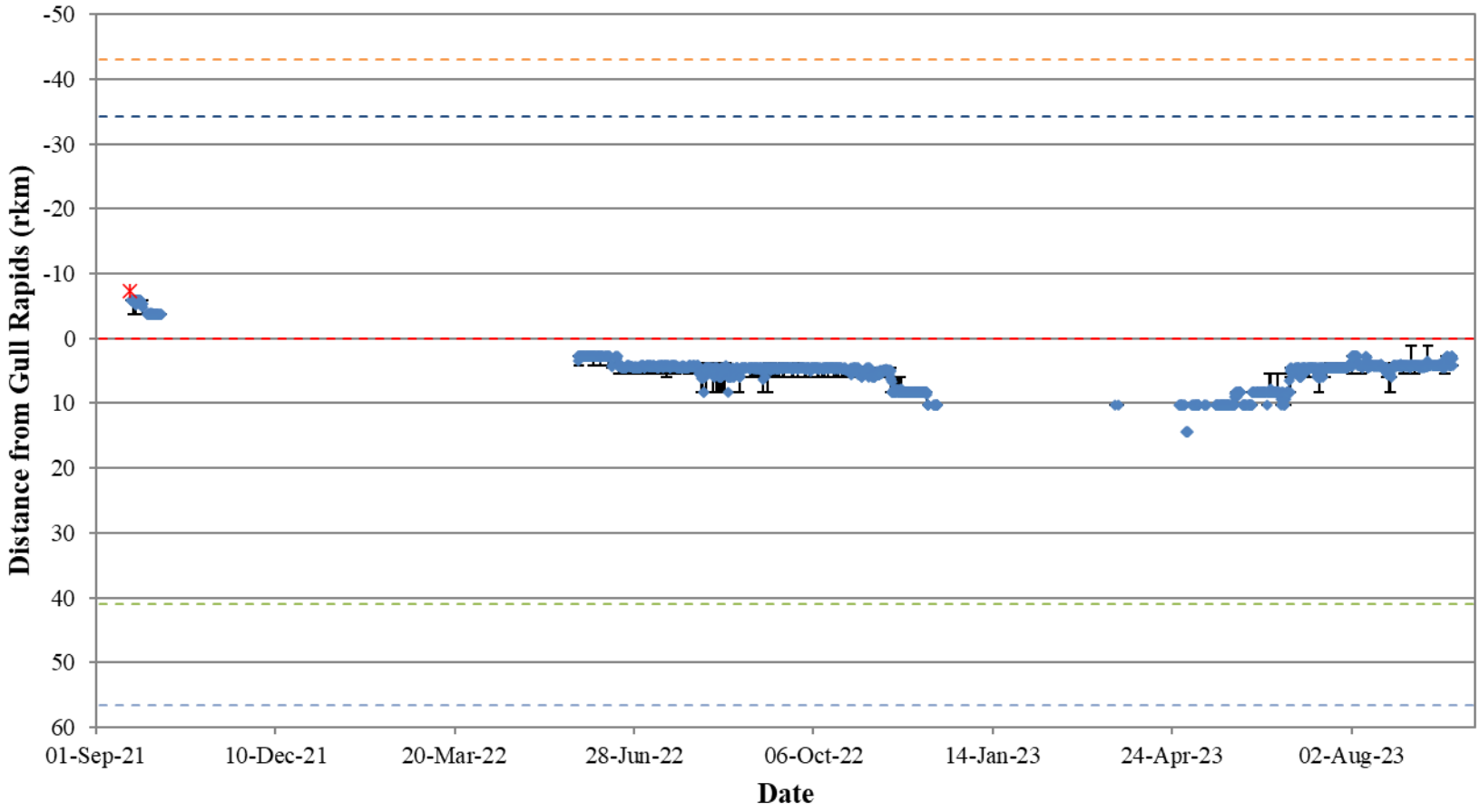

Figure A2-8: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48298) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

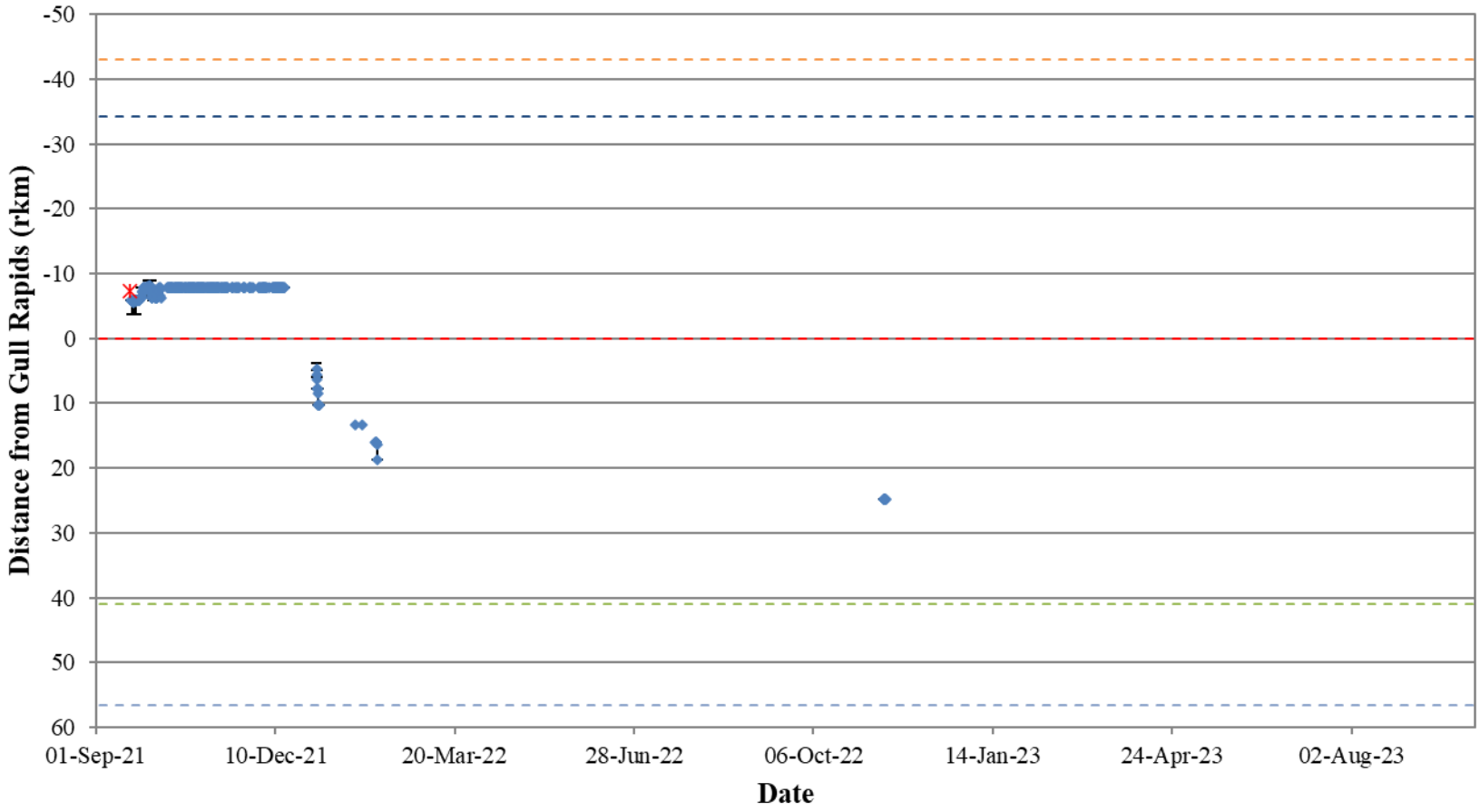

Figure A2-9: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48299) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

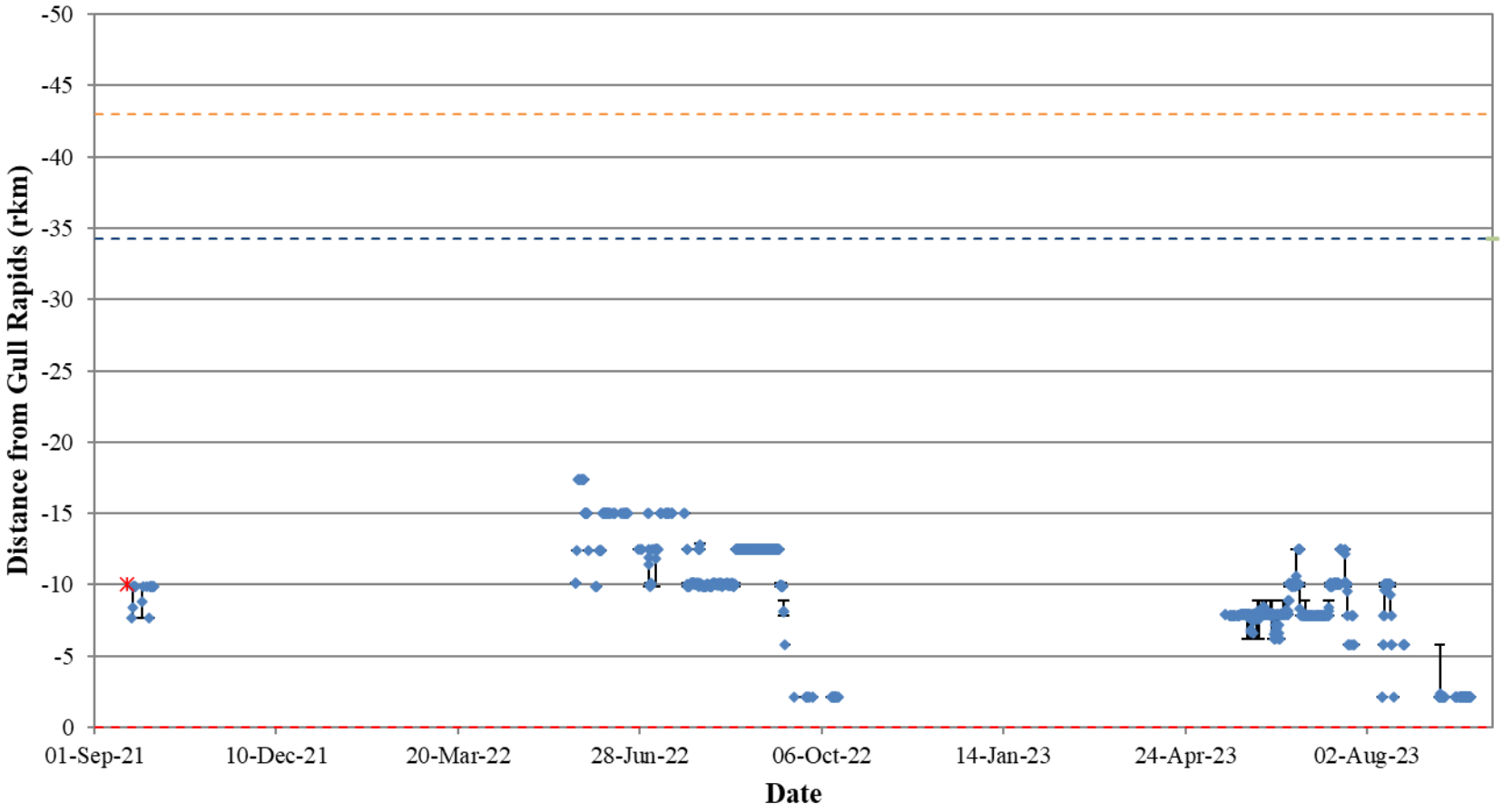

Figure A2-10: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48302) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

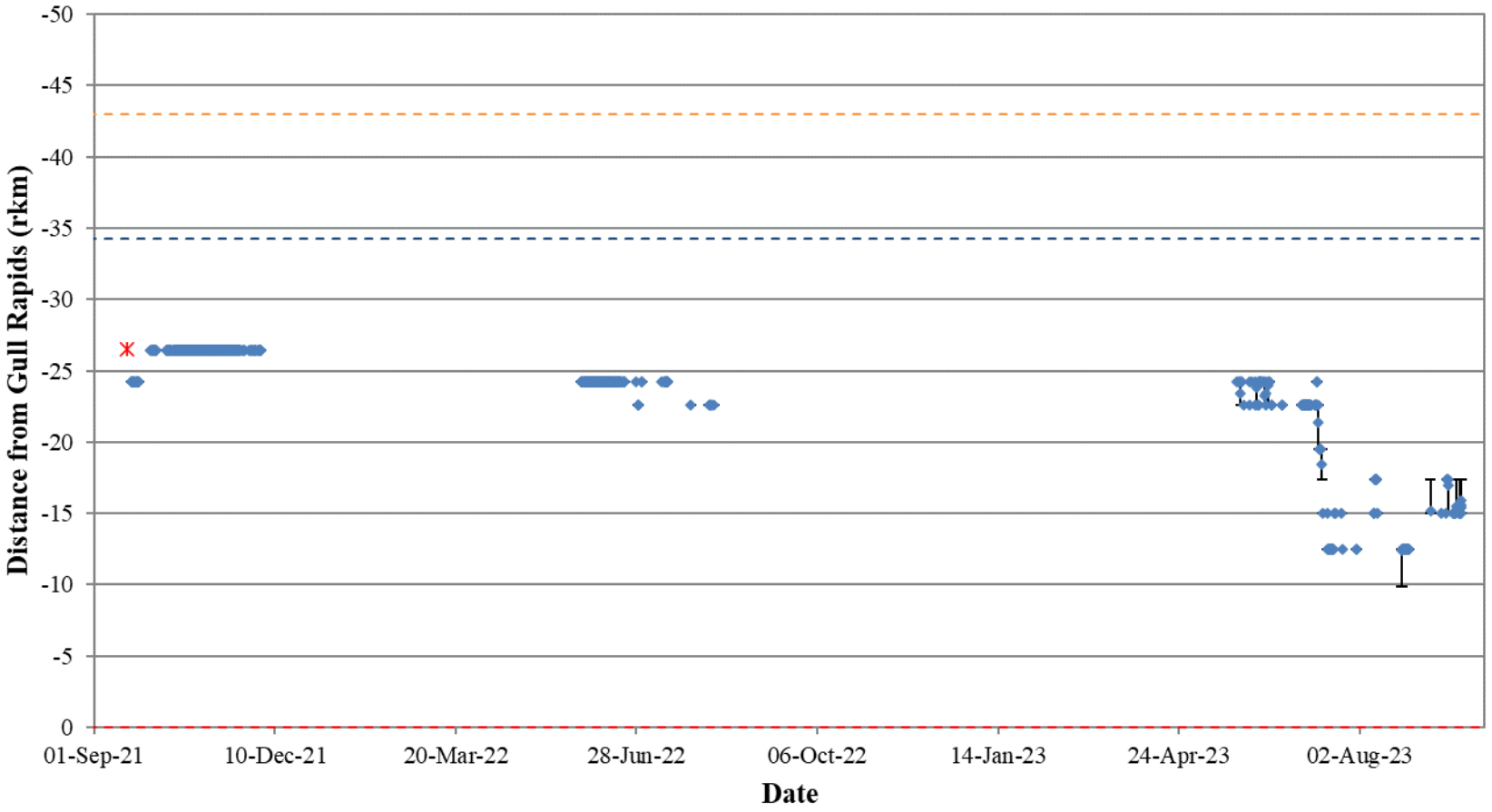

Figure A2-11: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48303) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

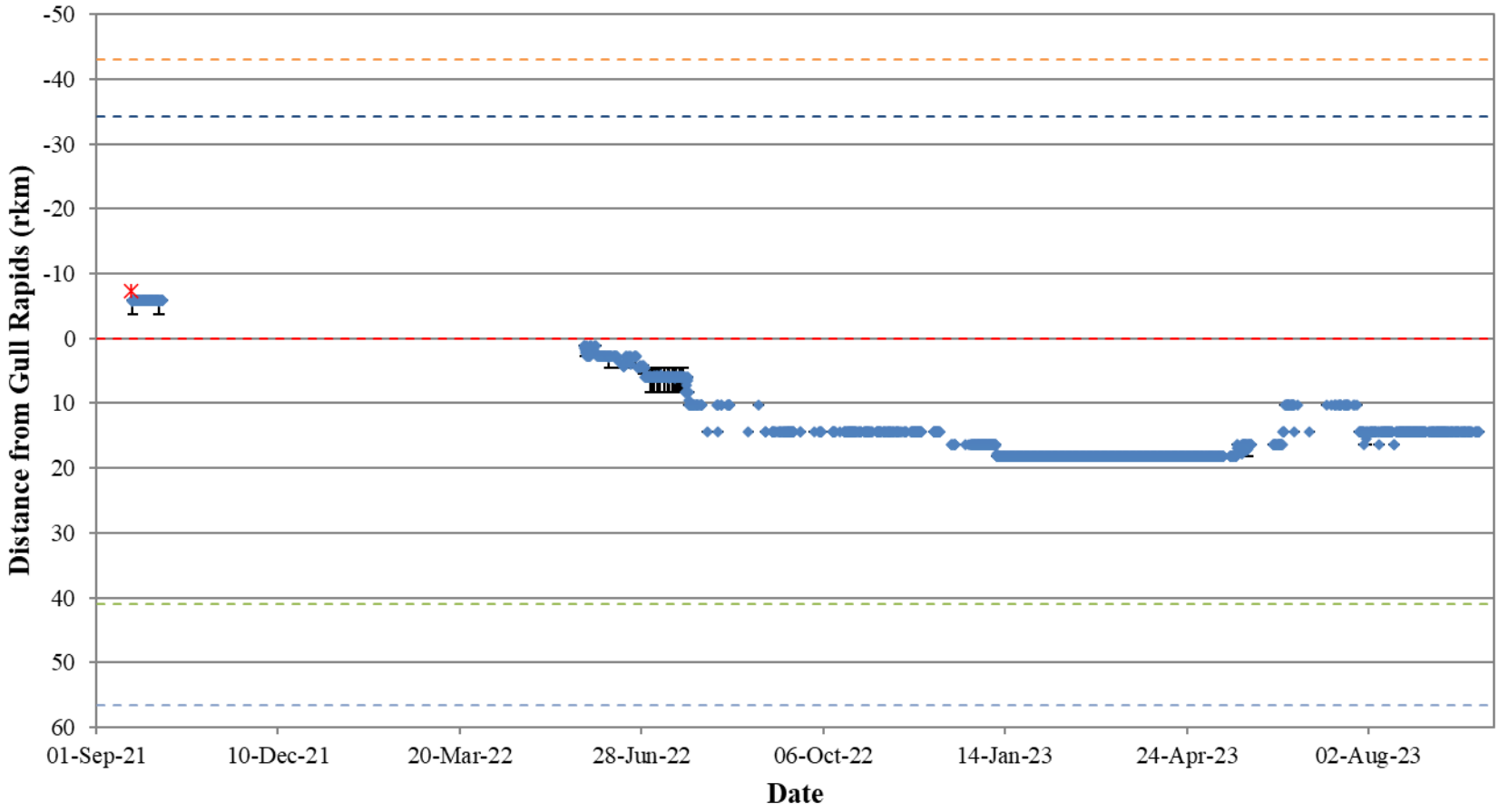

Figure A2-12: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48304) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

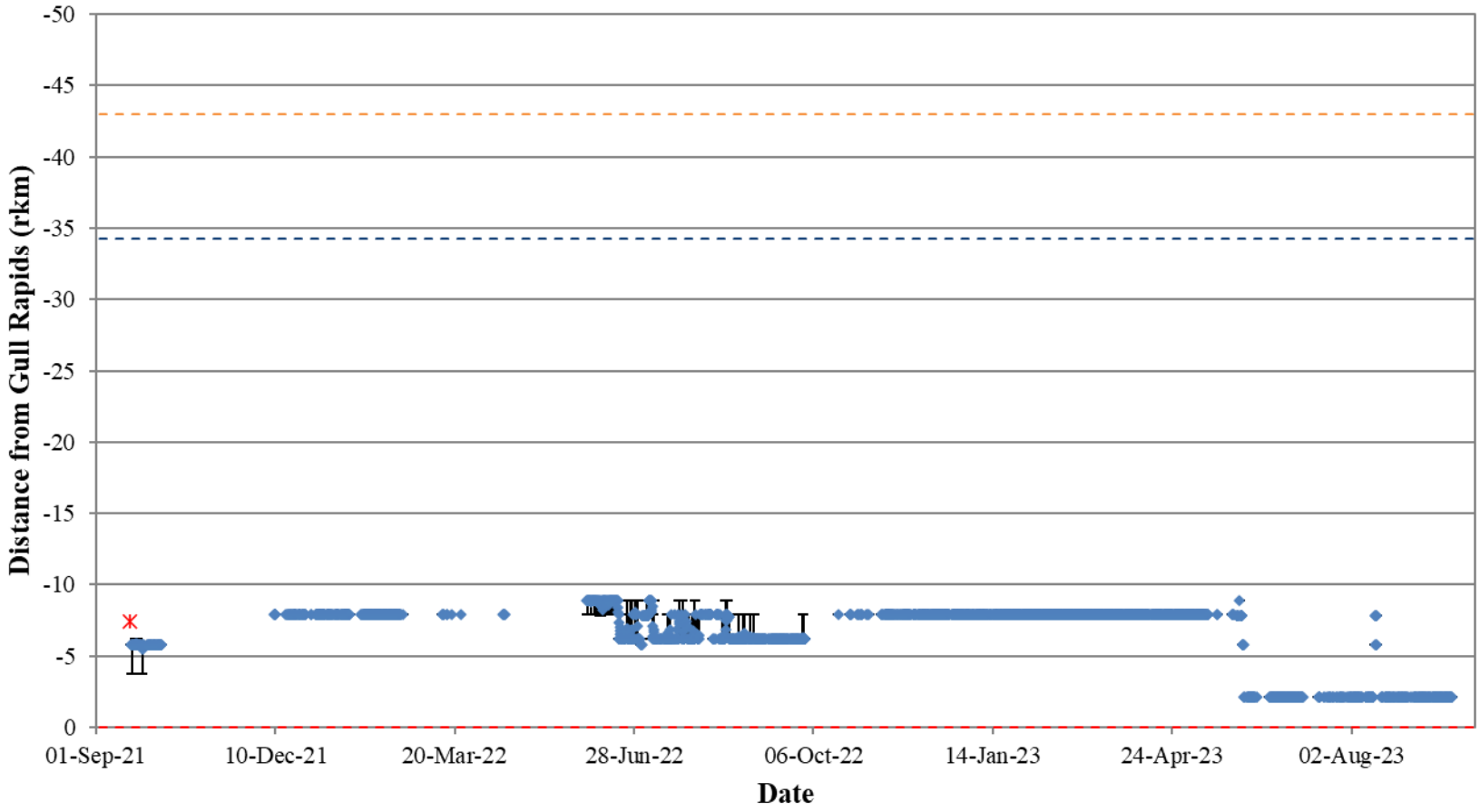

Figure A2-13: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48305) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

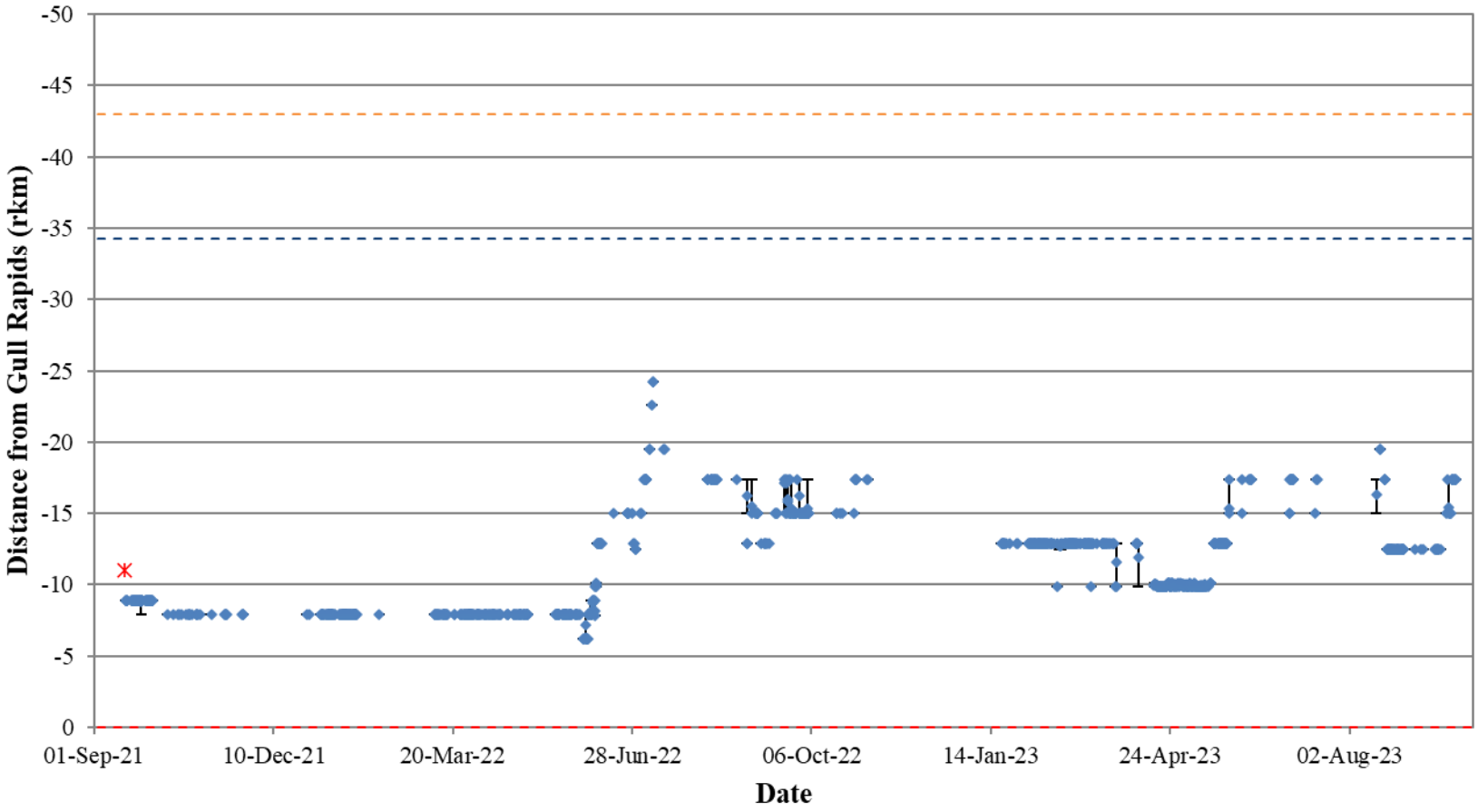

Figure A2-14: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48308) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

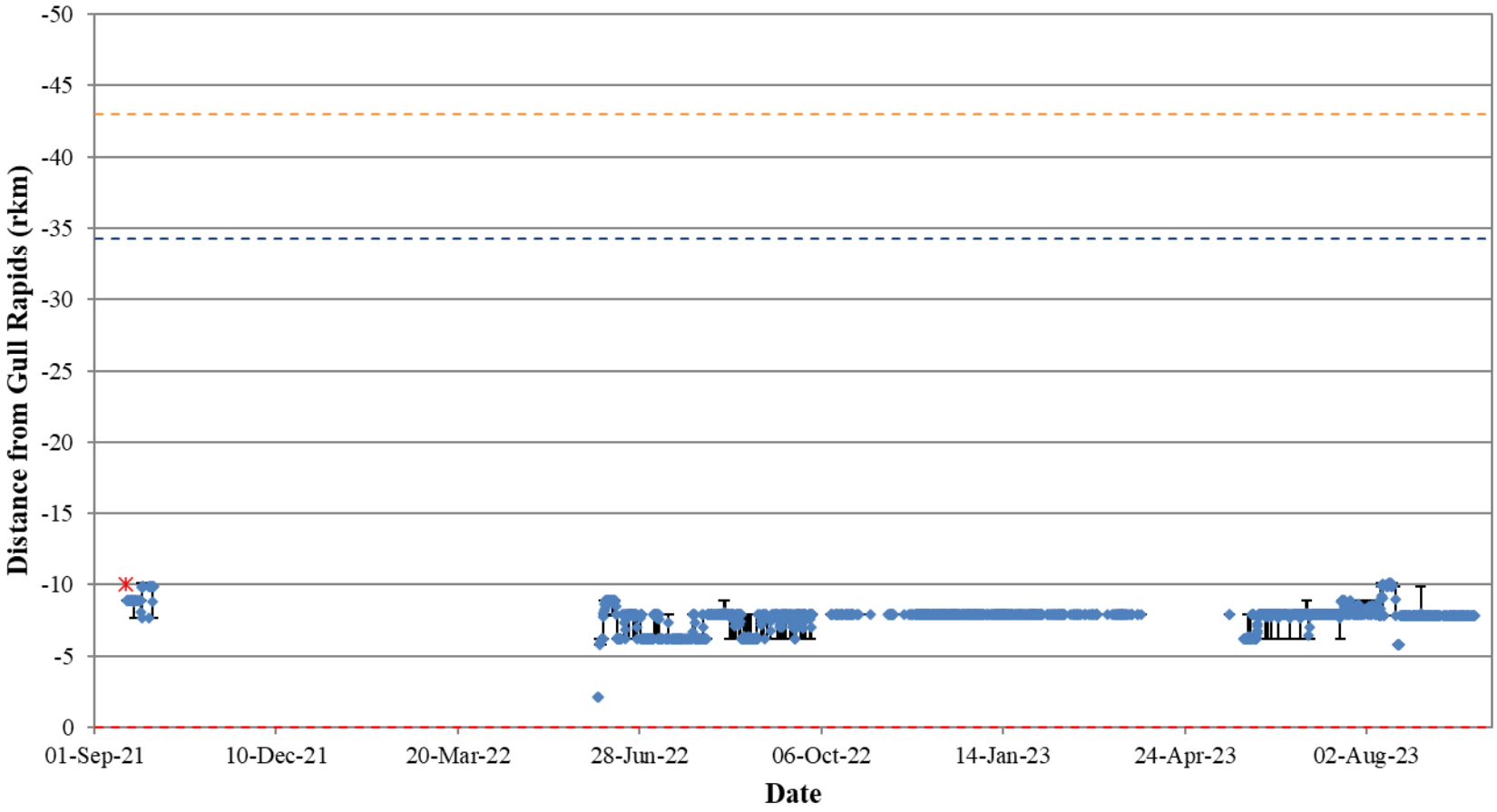

Figure A2-15: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48309) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

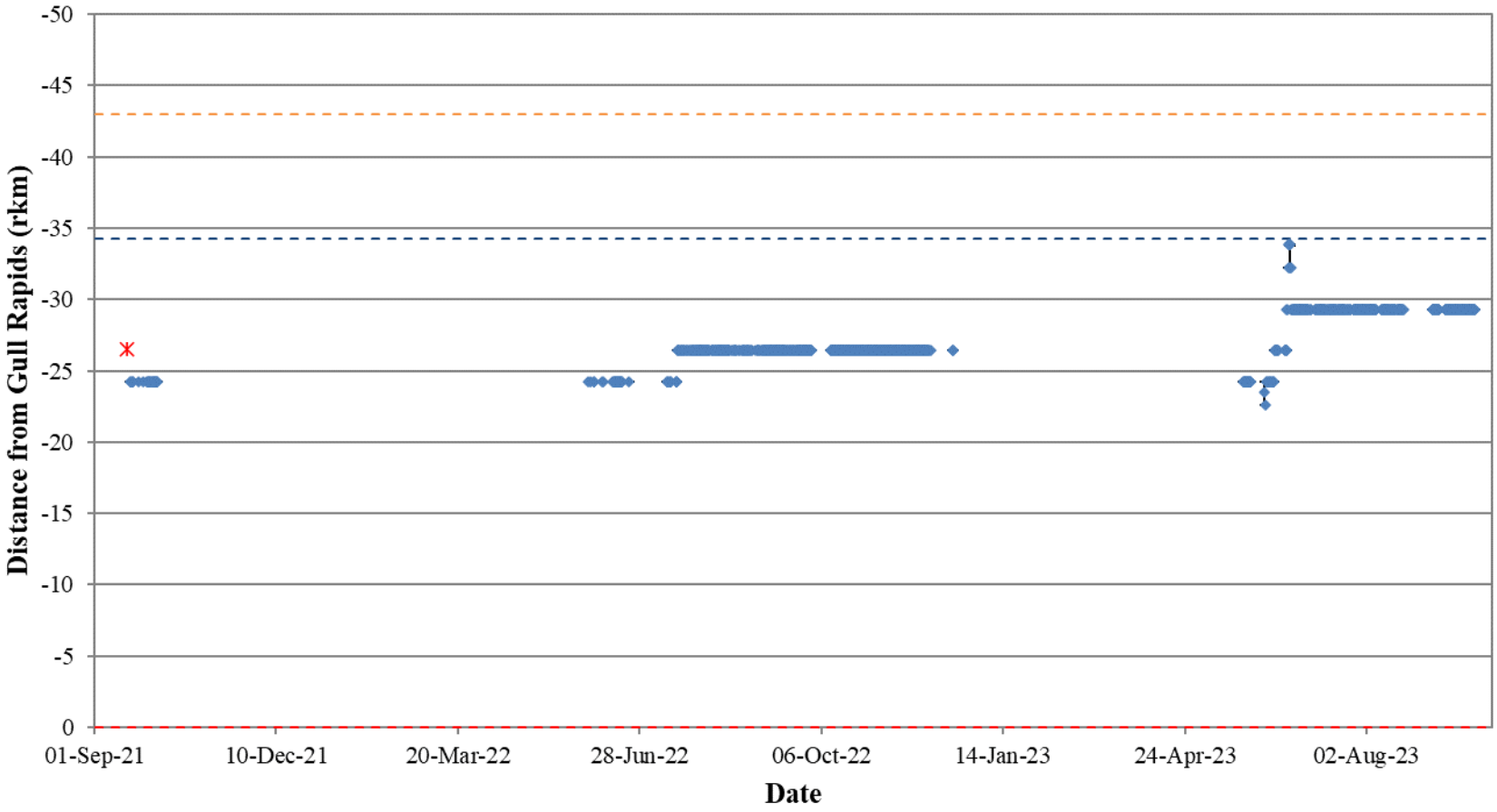

Figure A2-16: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48310) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

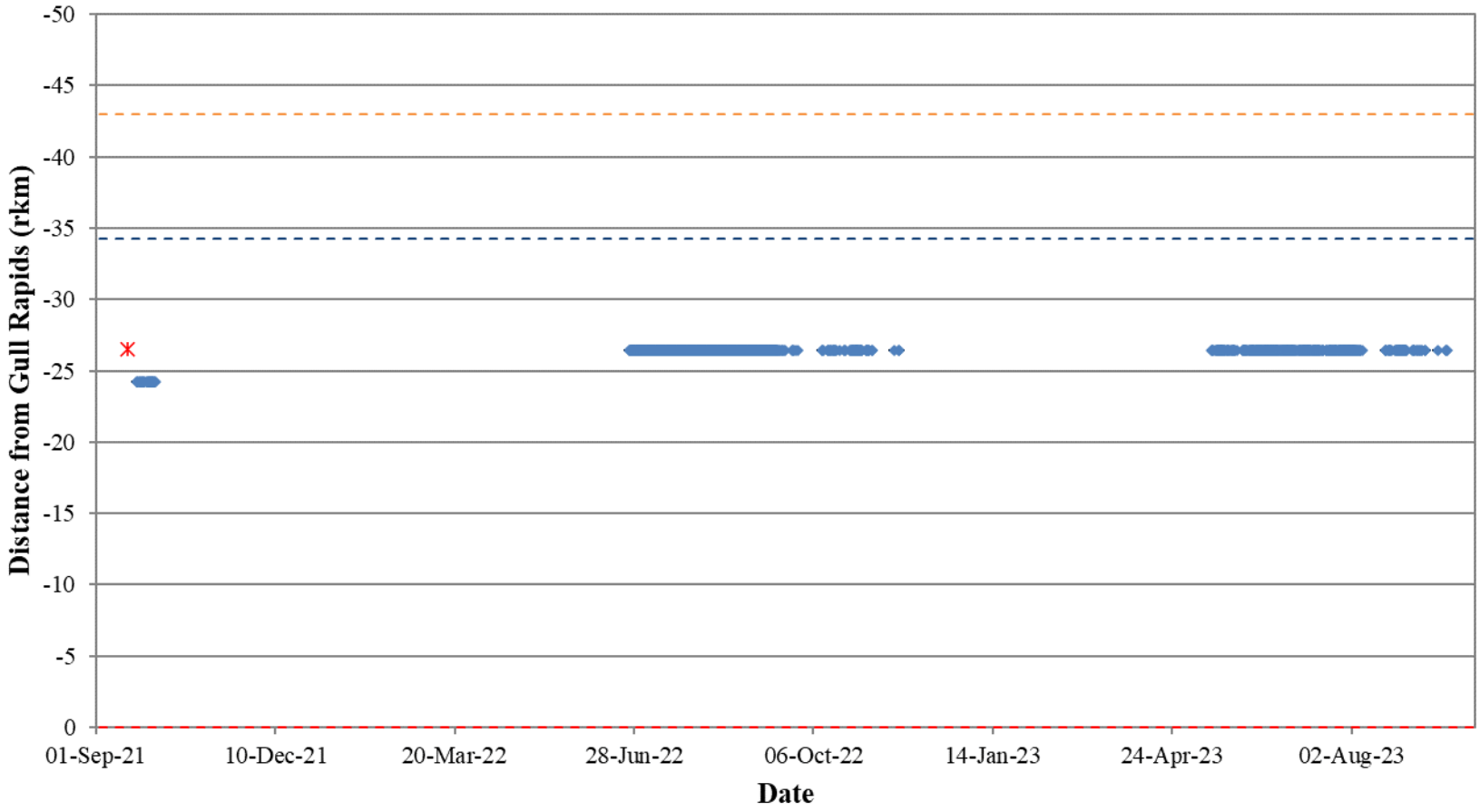

Figure A2-17: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48311) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

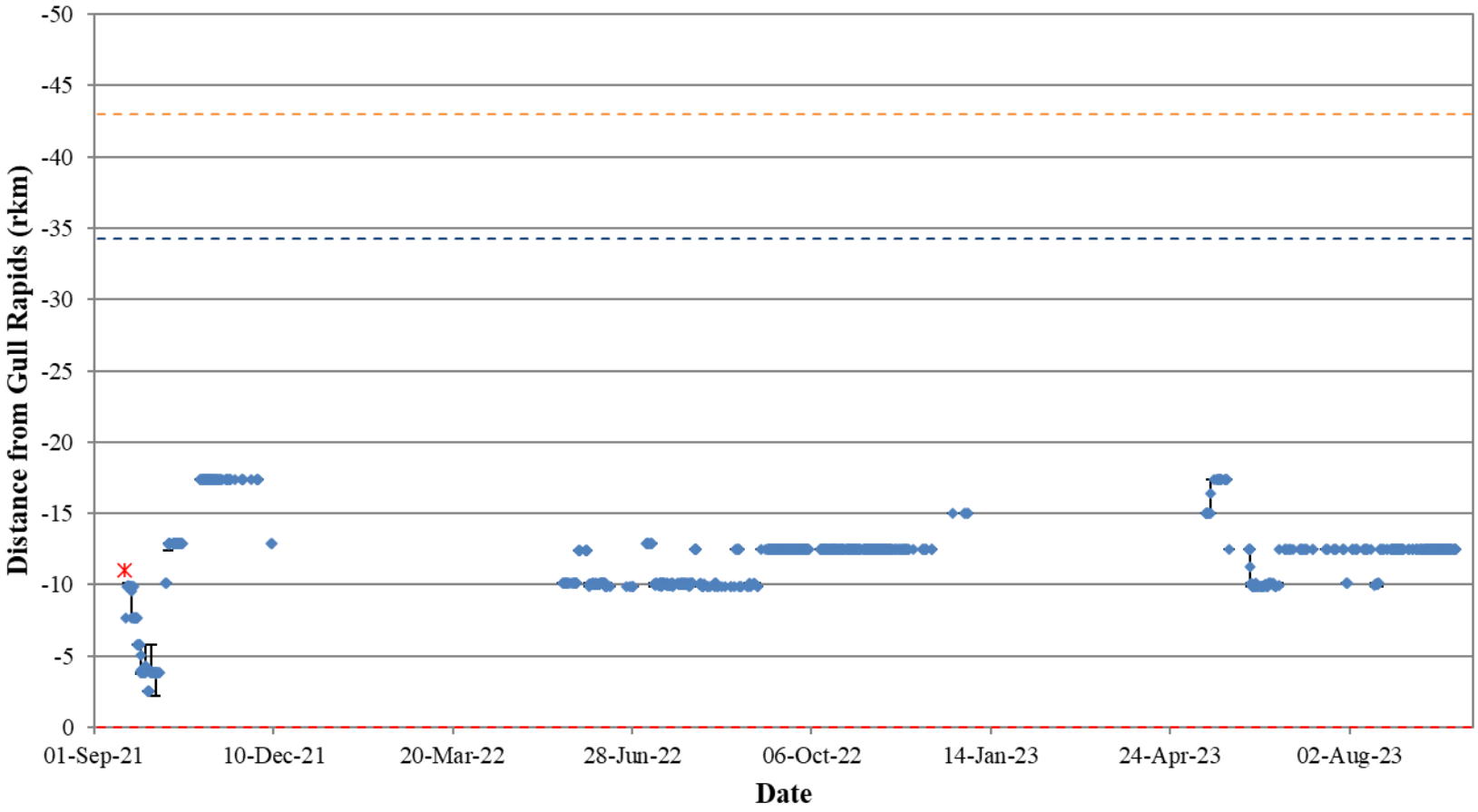

Figure A2-18: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48315) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

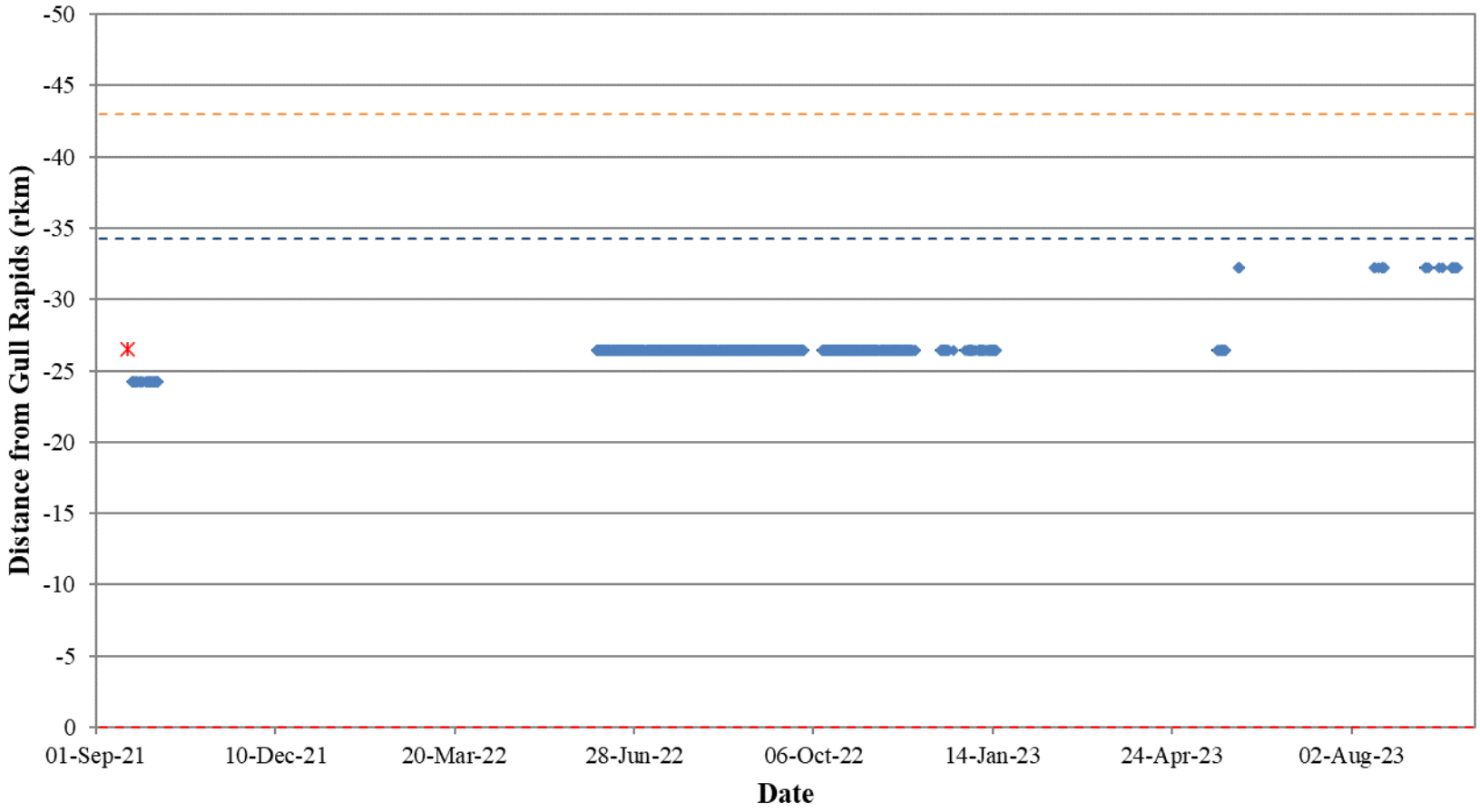

Figure A2-19: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48316) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

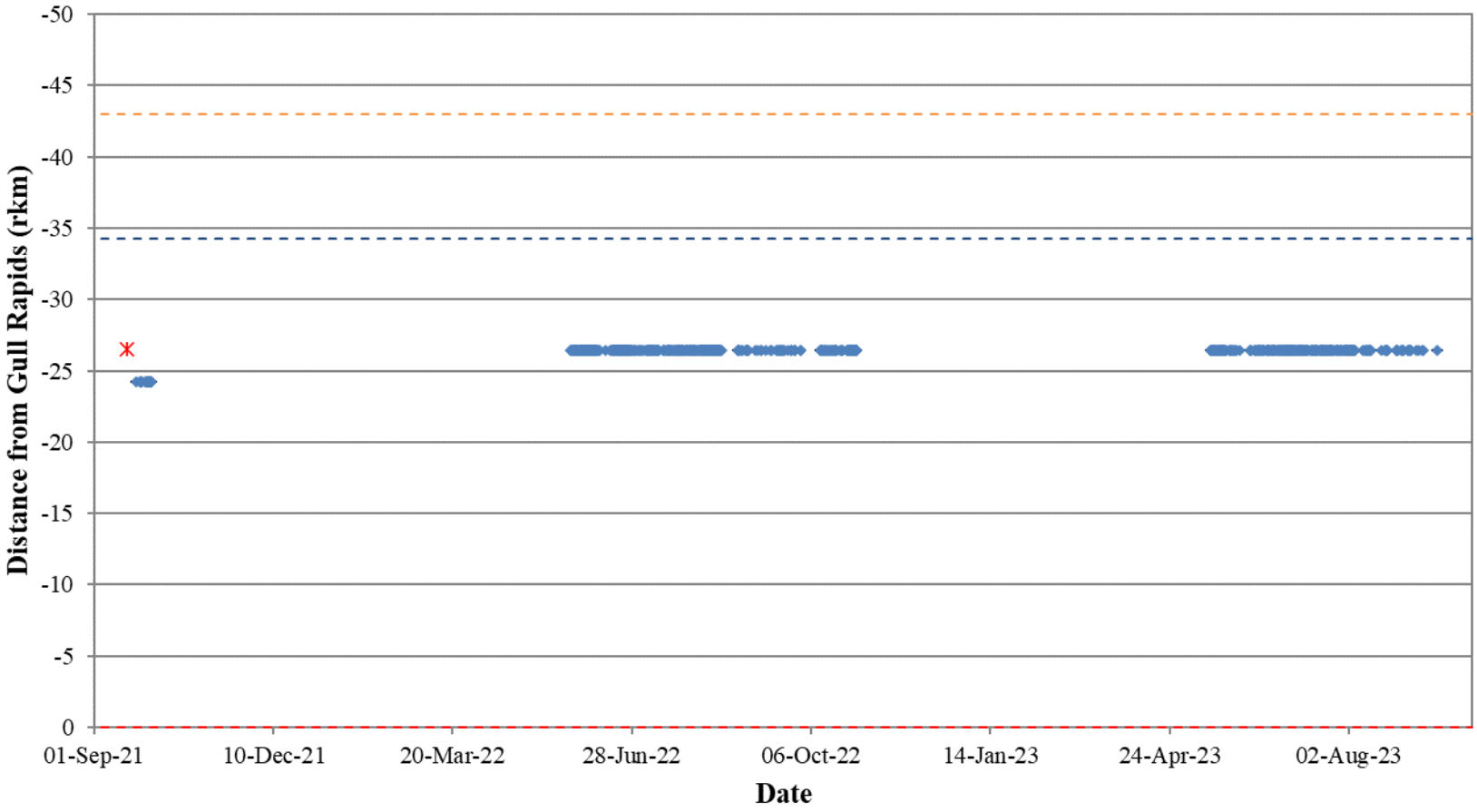

Figure A2-20: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48317) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 2, 2023. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

APPENDIX 3: LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED JUVENILE LAKE STURGEON DOWNSTREAM OF THE KEEYASK GS, SEPTEMBER 2021 TO OCTOBER 2023

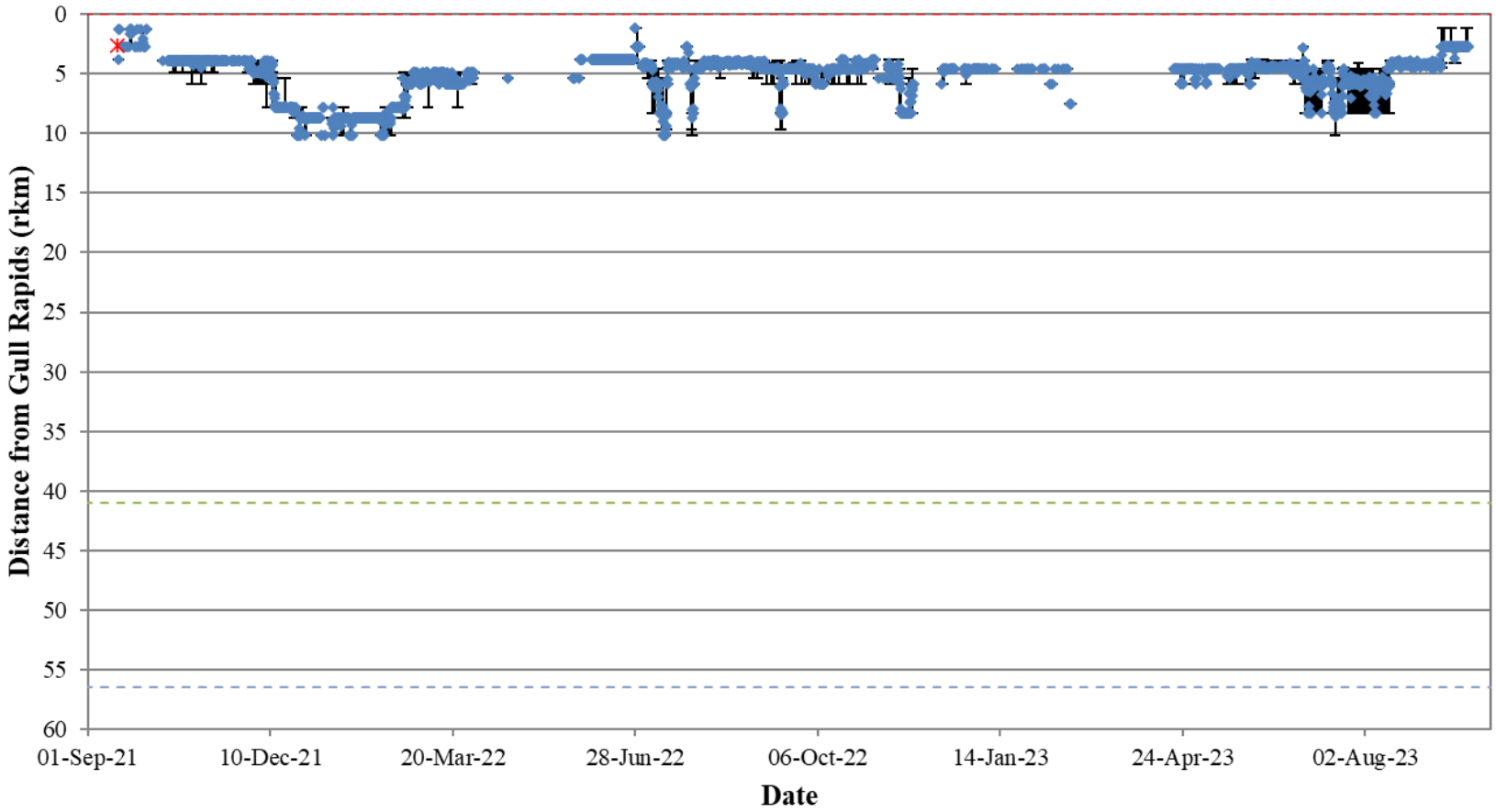

Figure A3-1: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48276) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

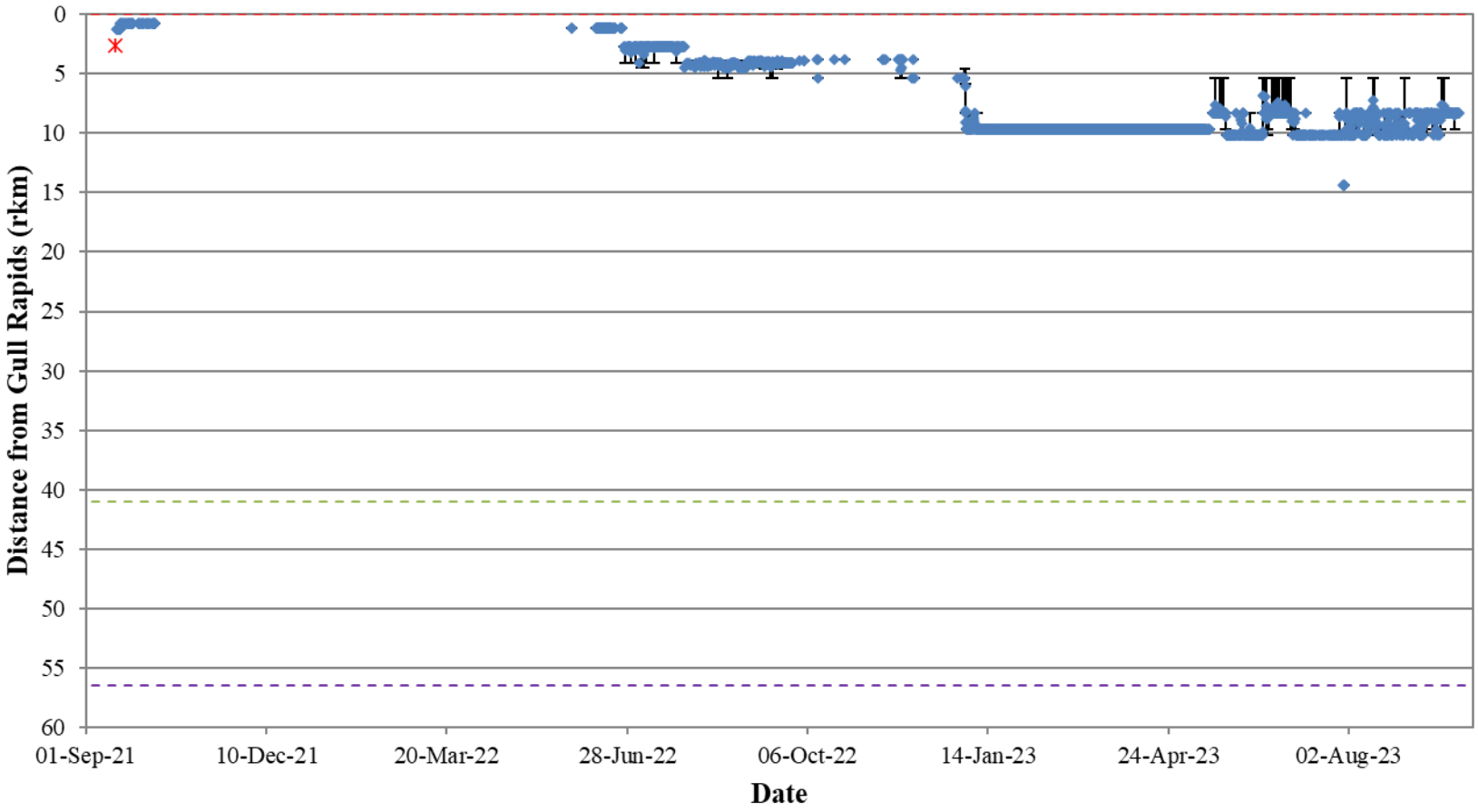

Figure A3-2: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48277) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

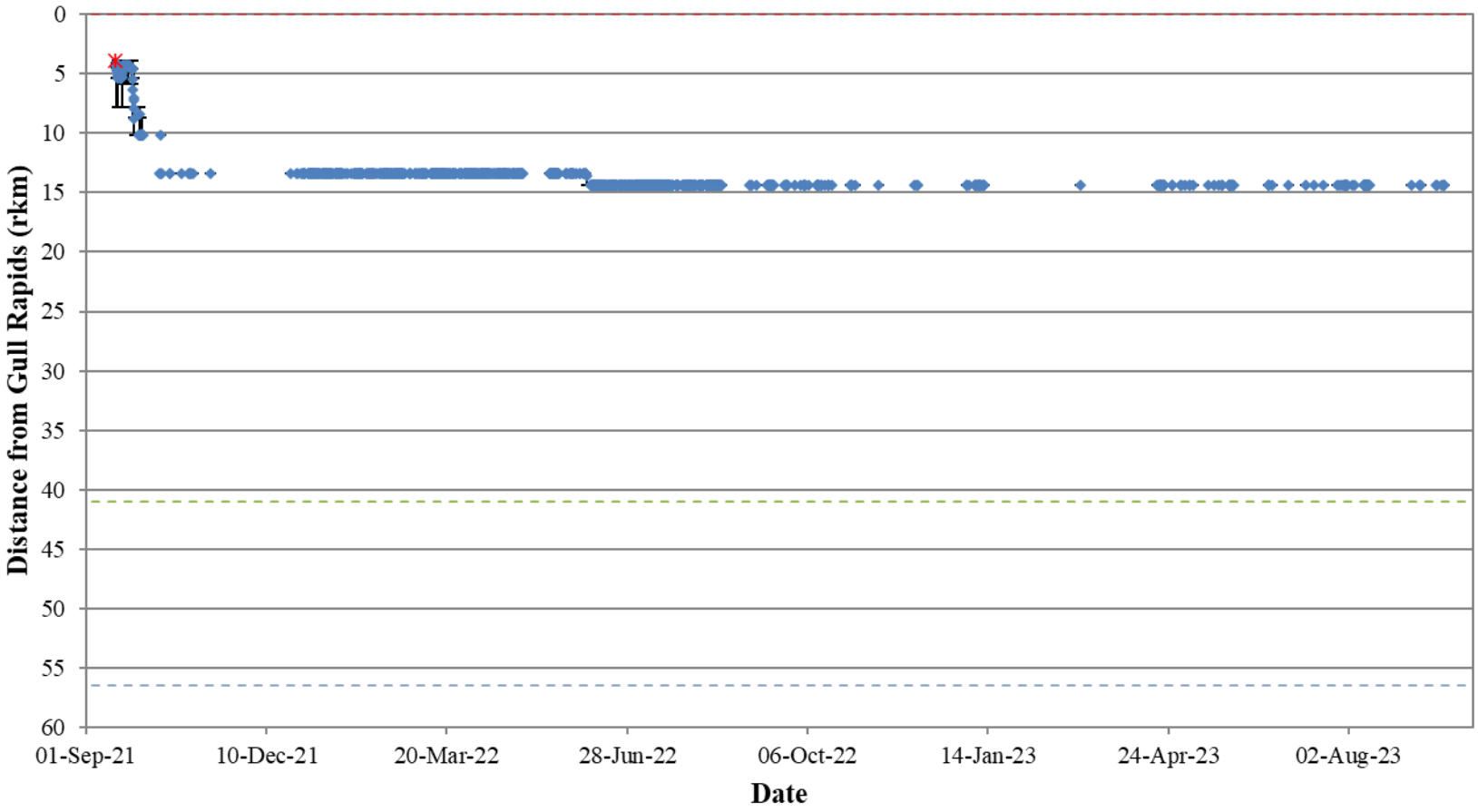

Figure A3-3: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48278) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

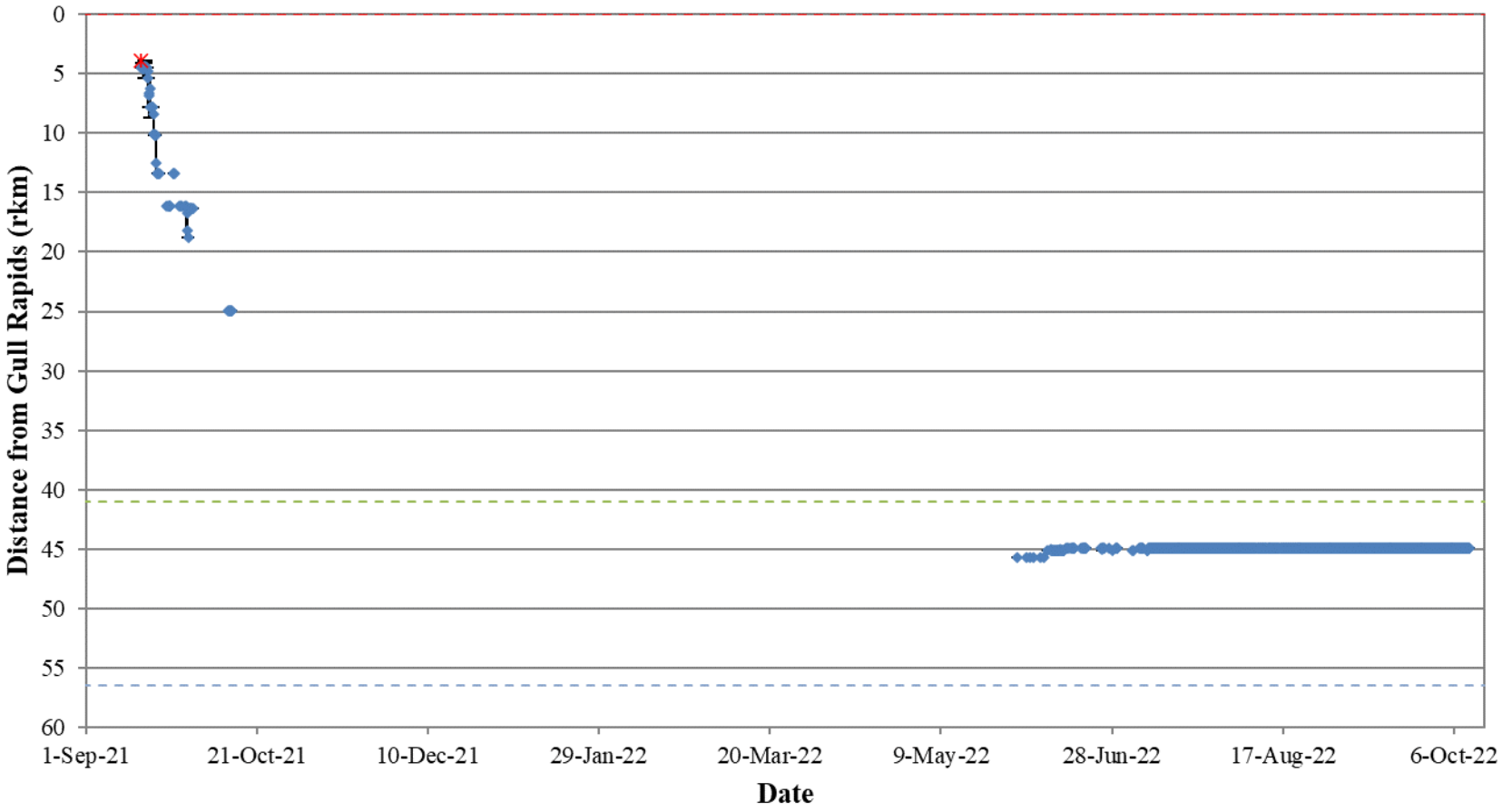

Figure A3-4: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48279) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

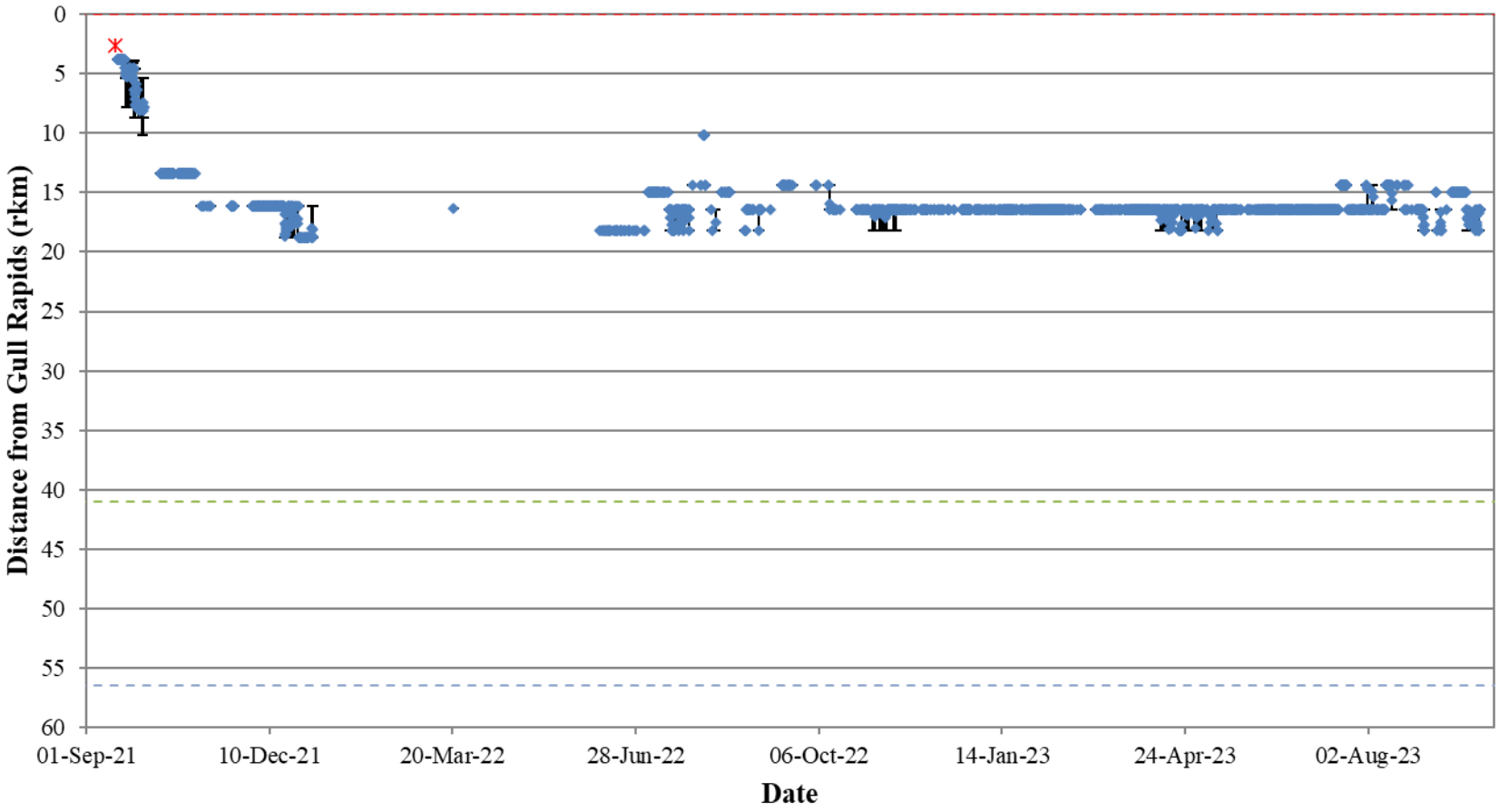

Figure A3-5: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48282) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

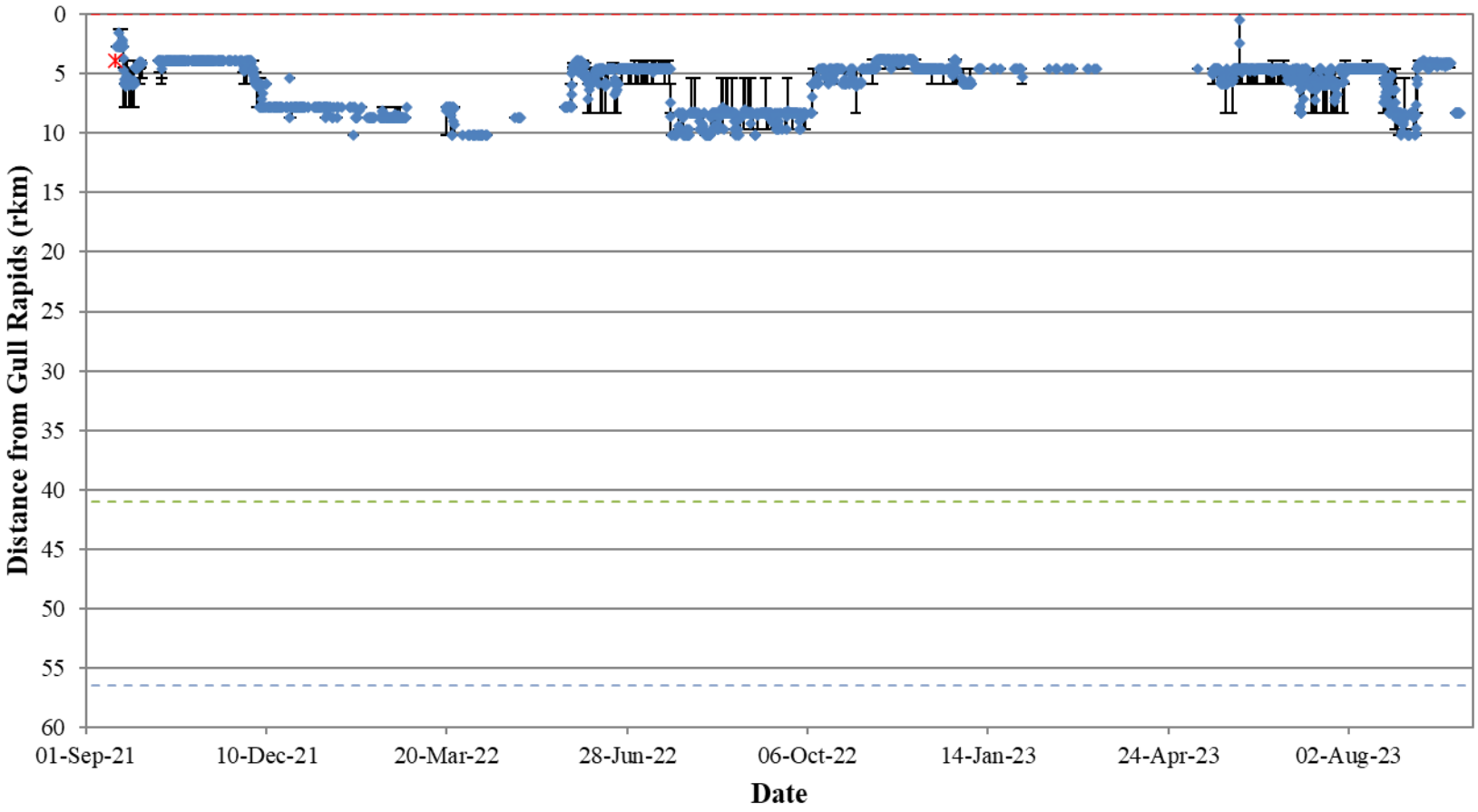

Figure A3-6: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48283) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

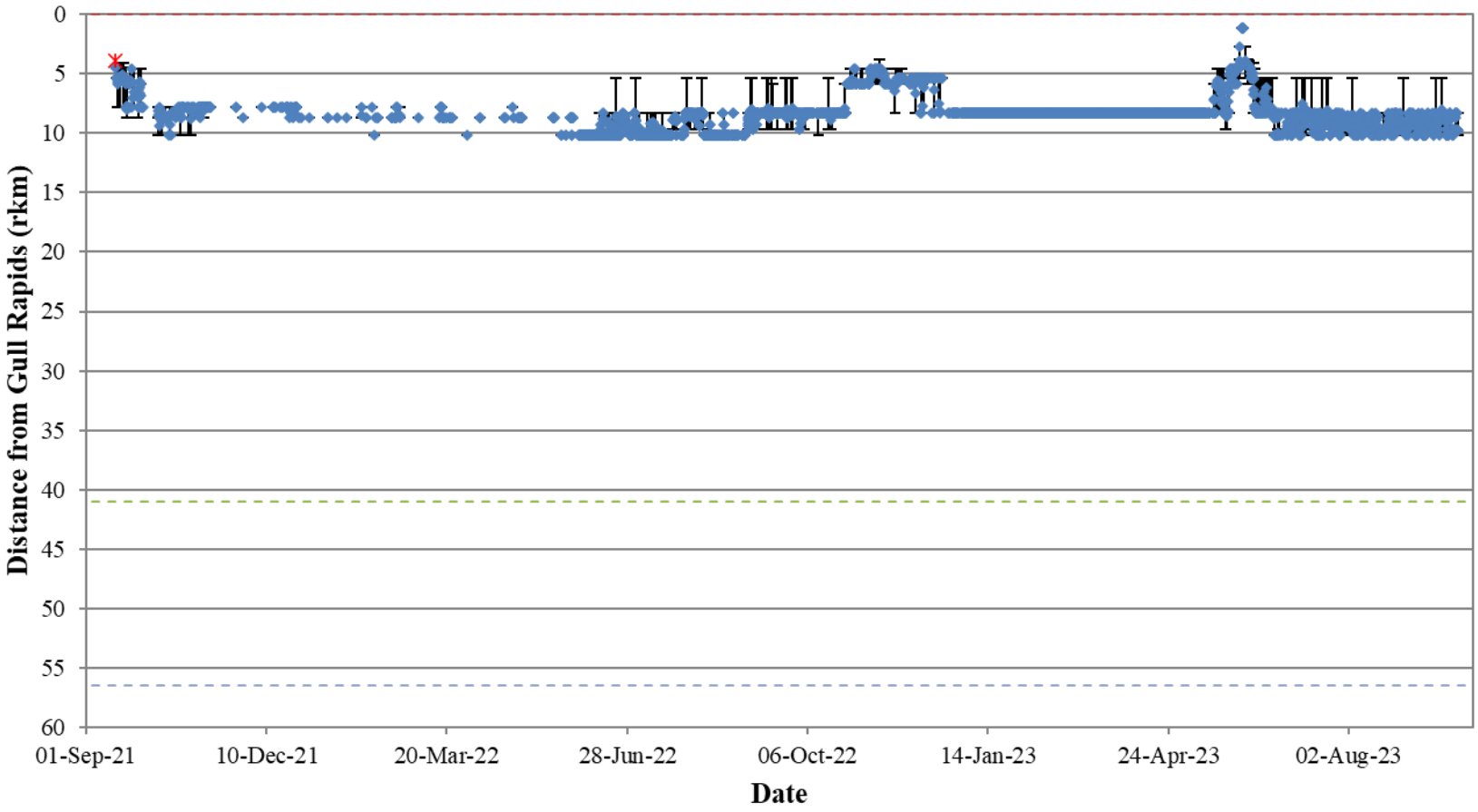

Figure A3-7: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48284) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

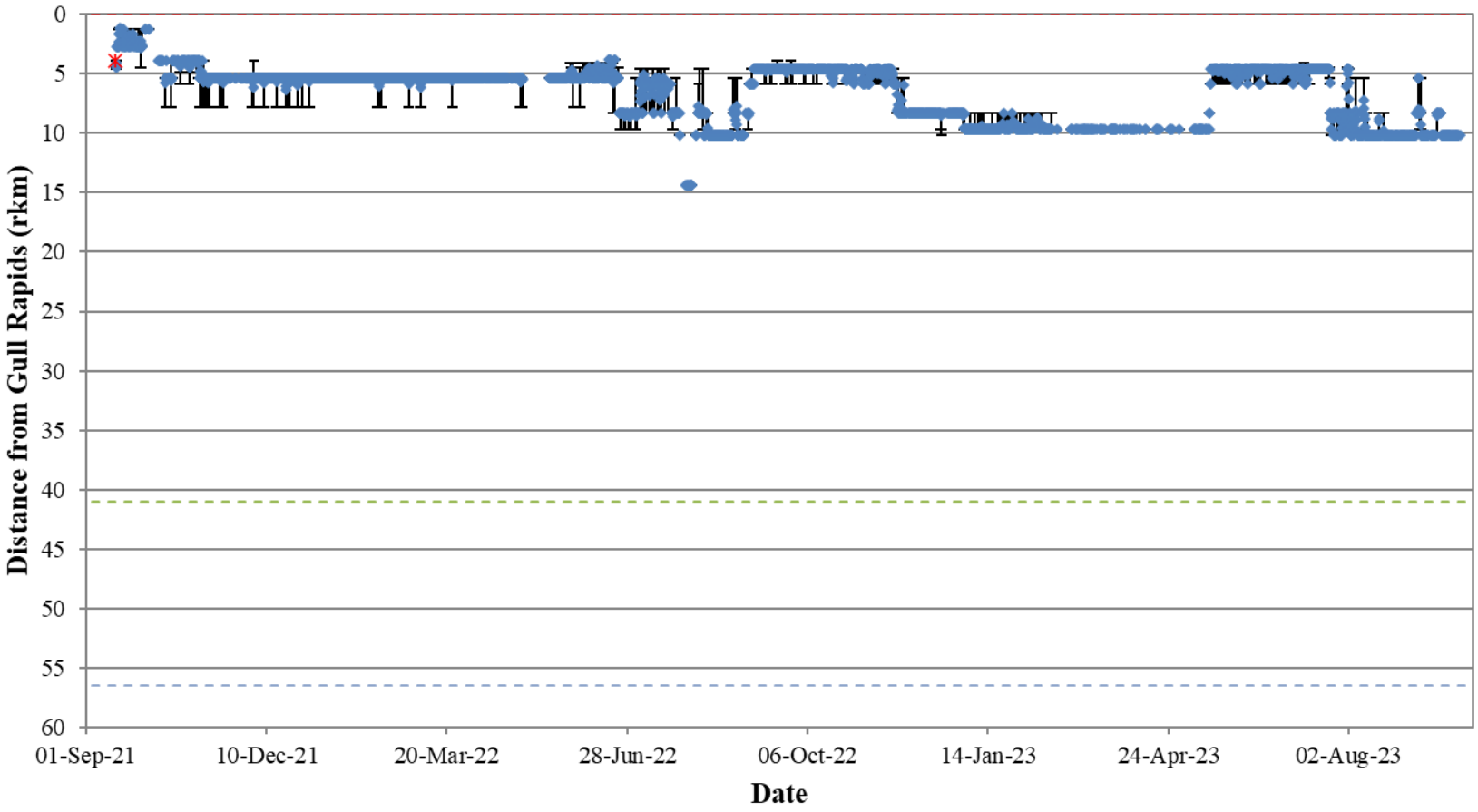

Figure A3-8: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48285) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

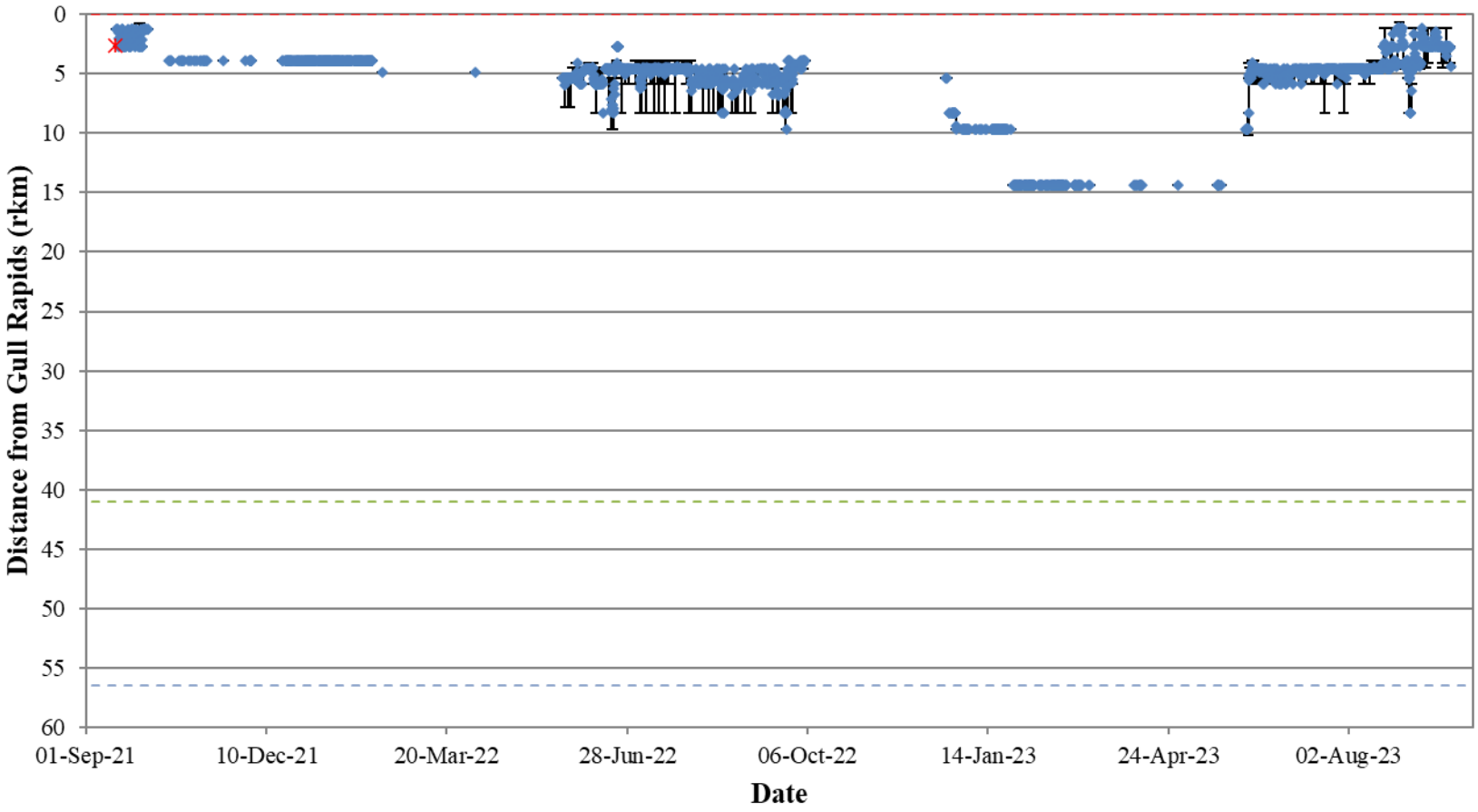

Figure A3-9: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48288) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

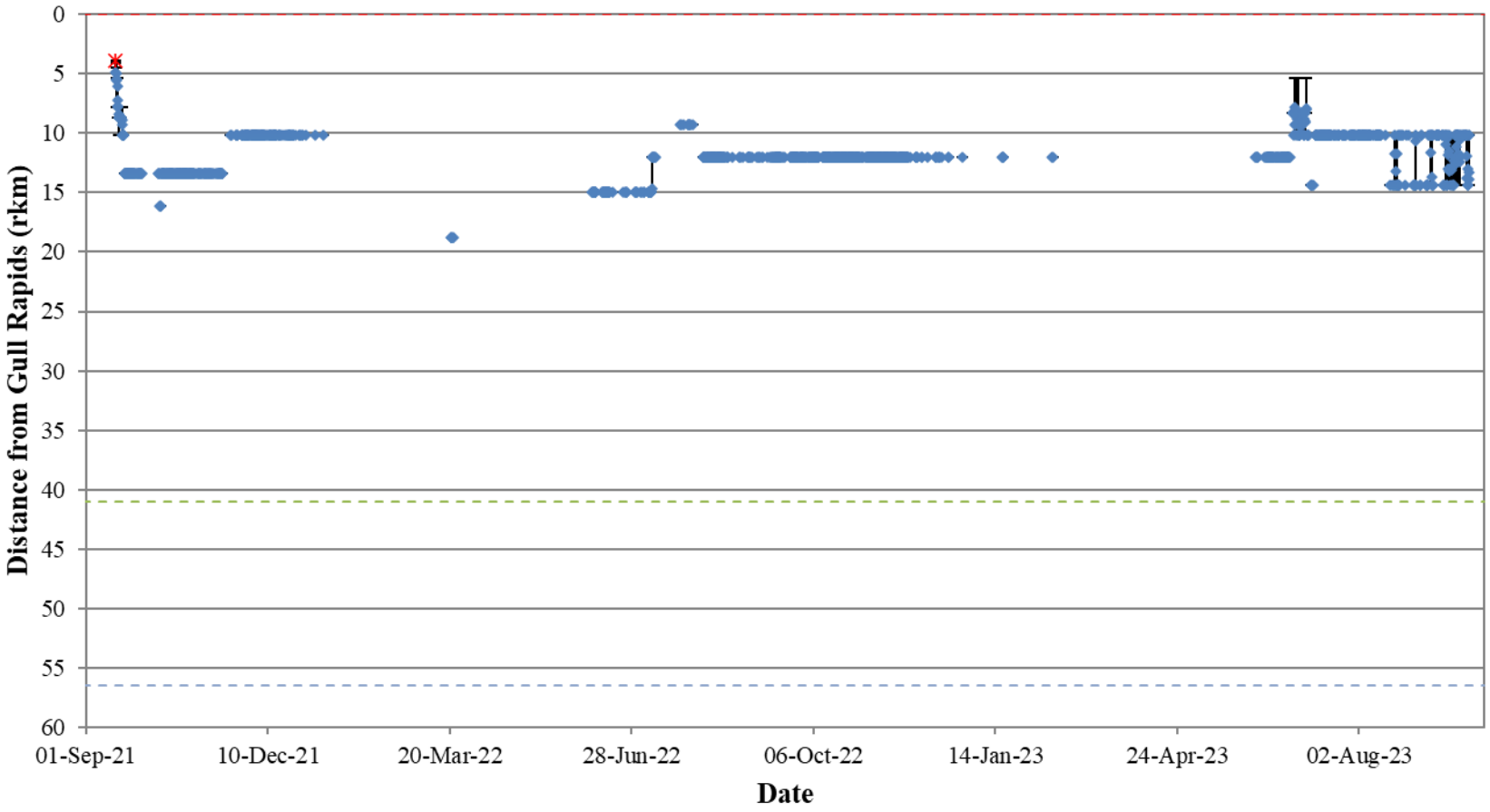

Figure A3-10: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48289) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

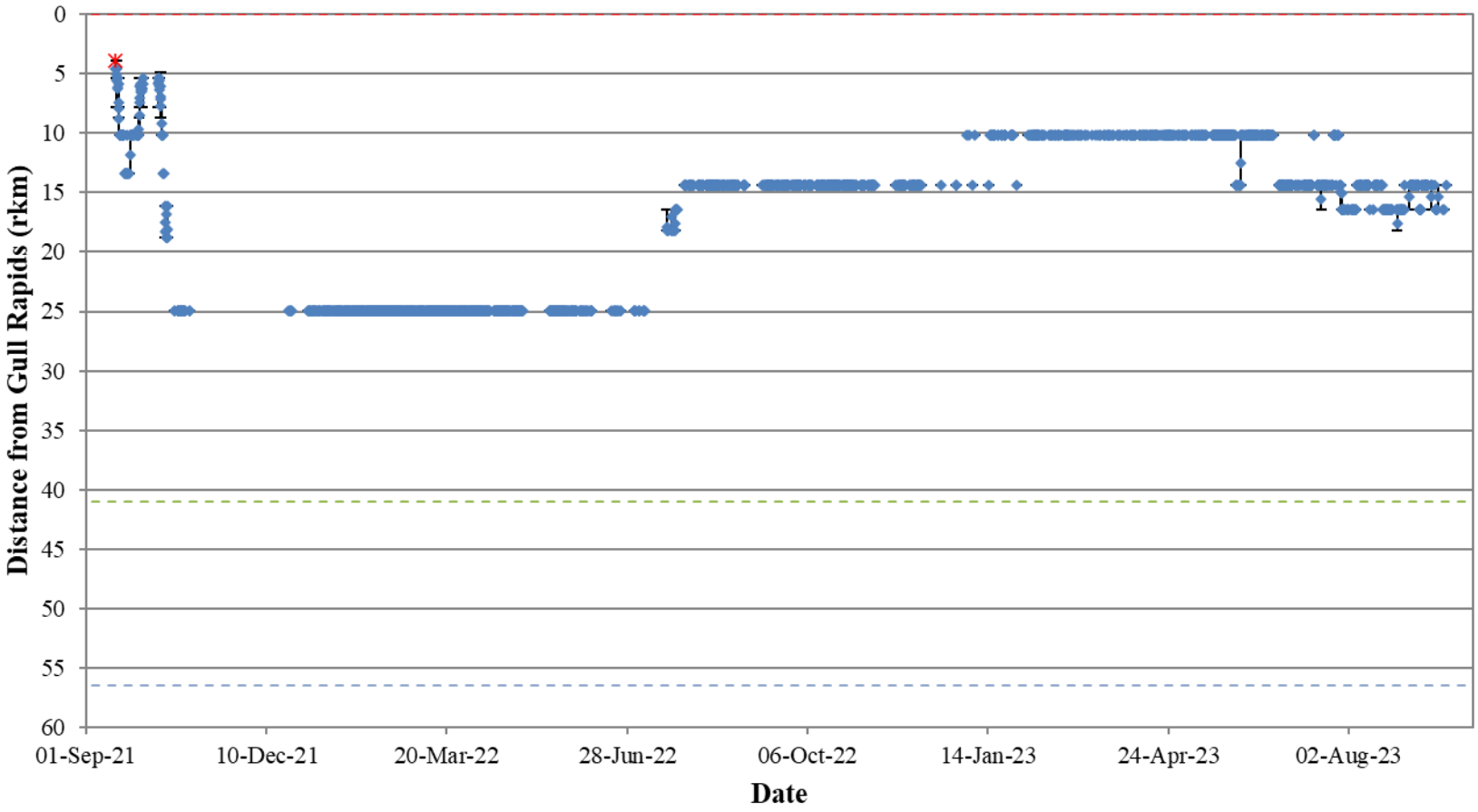

Figure A3-11: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48290) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

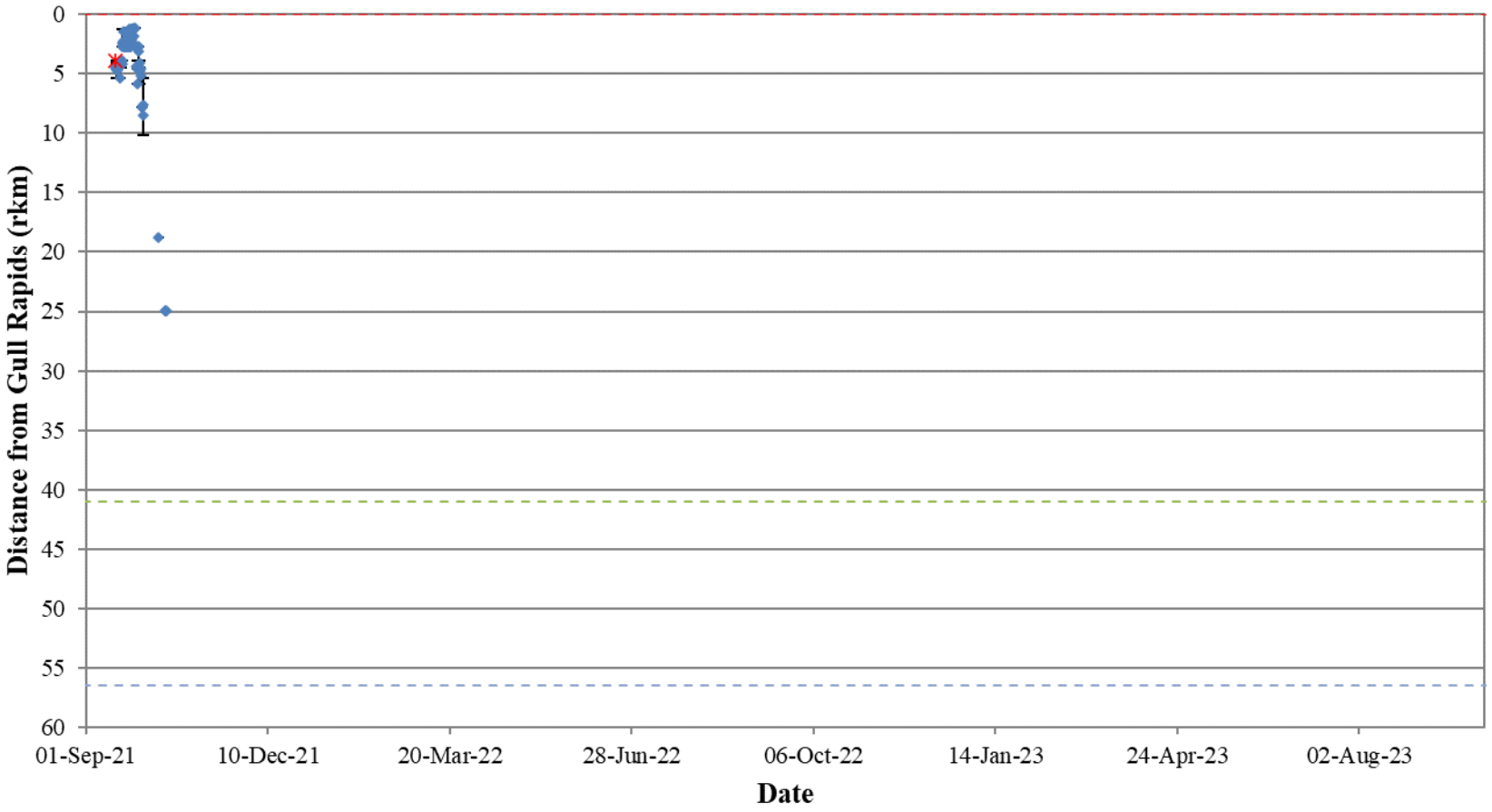

Figure A3-12: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48291) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

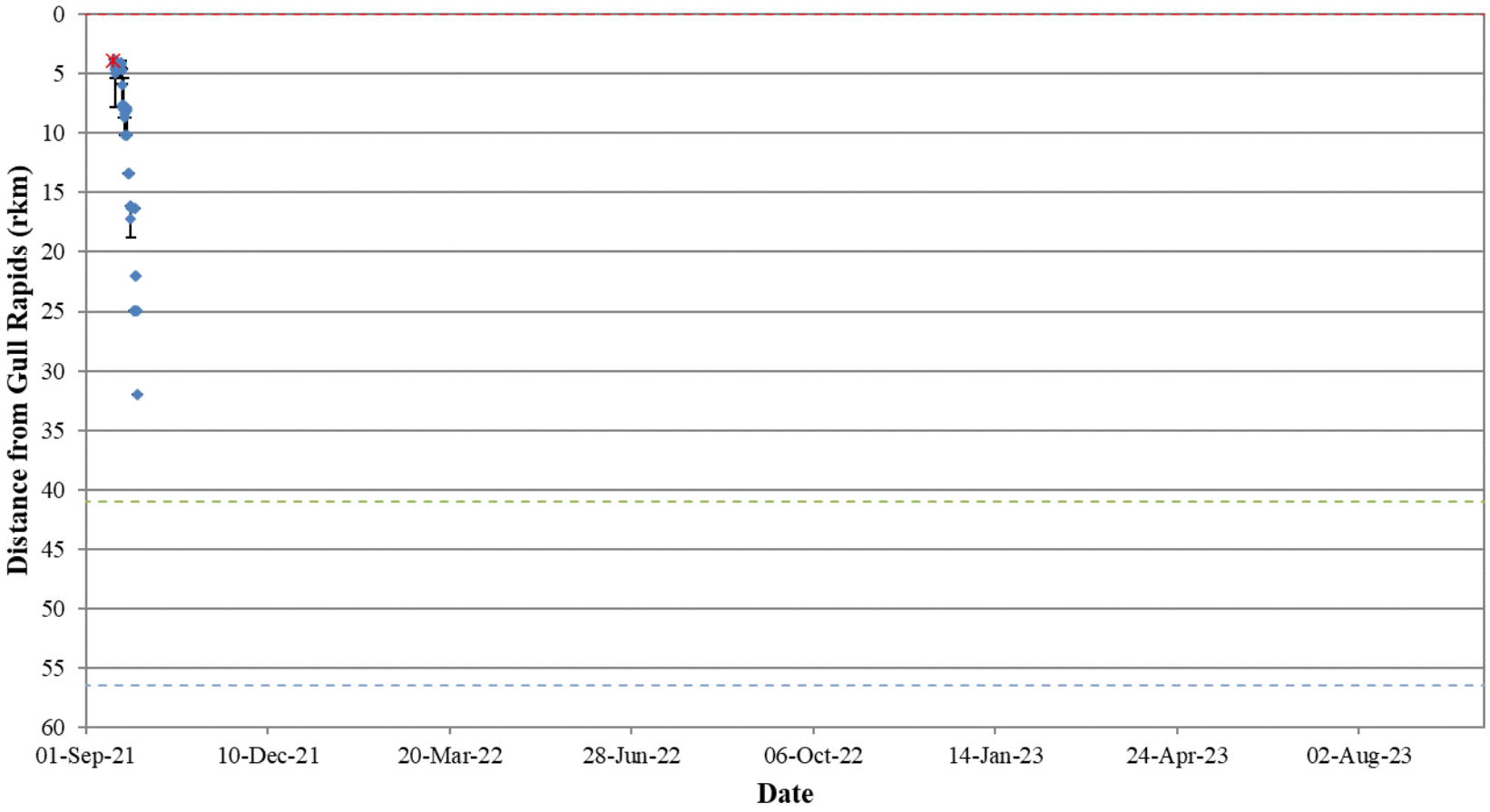

Figure A3-13: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48294) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

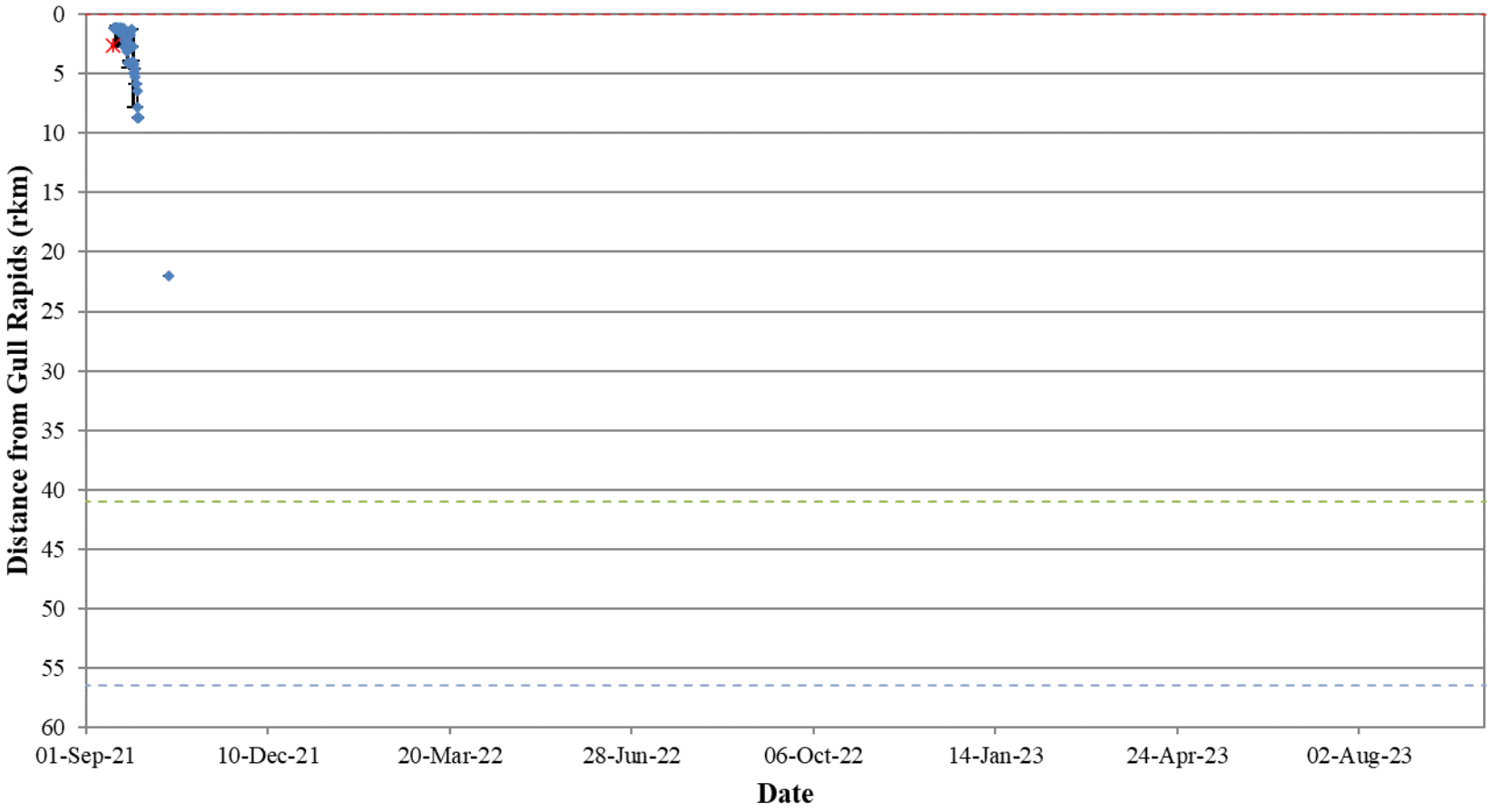

Figure A3-14: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48295) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

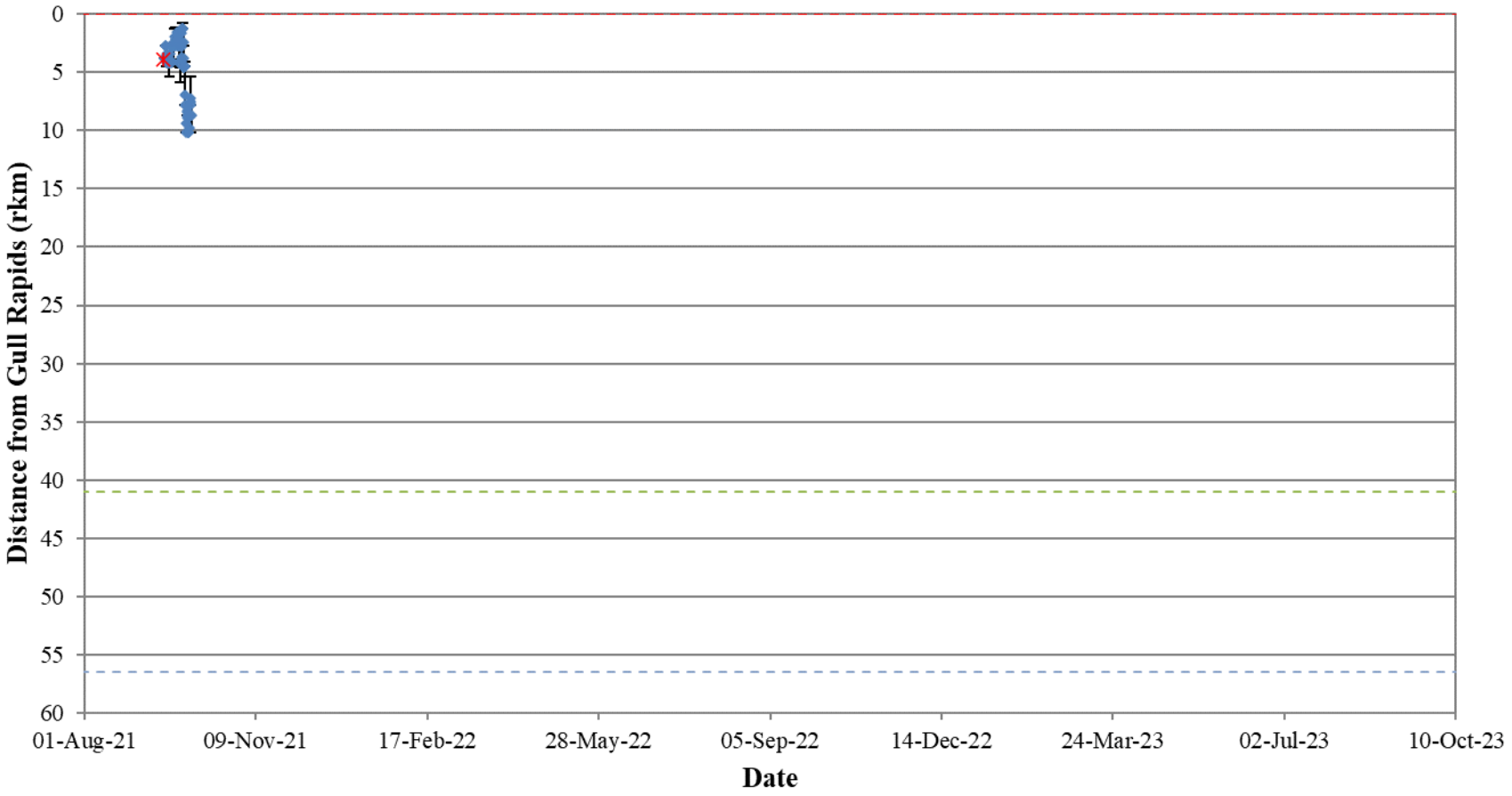

Figure A3-15: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48296) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

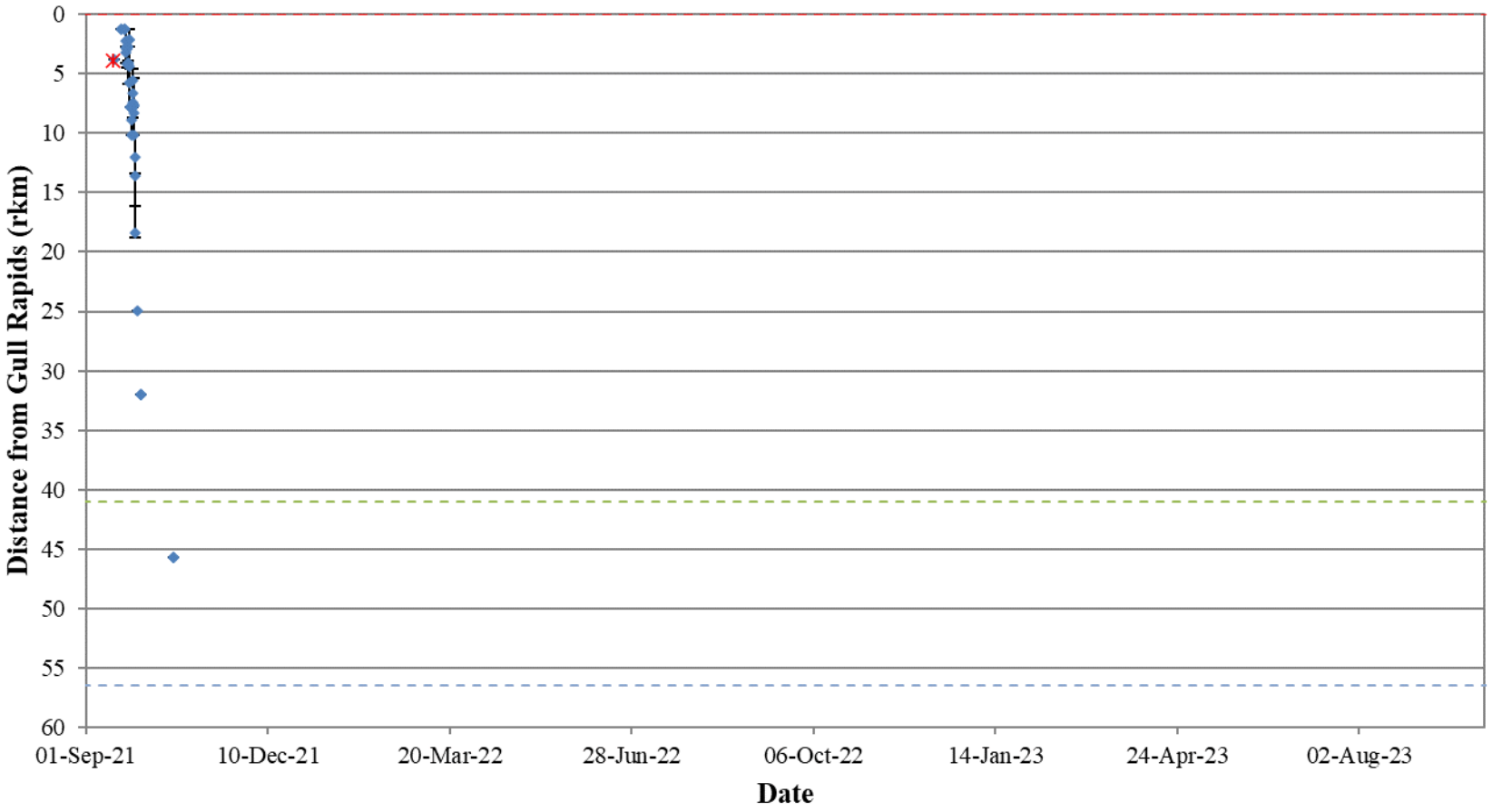

Figure A3-16: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48300) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

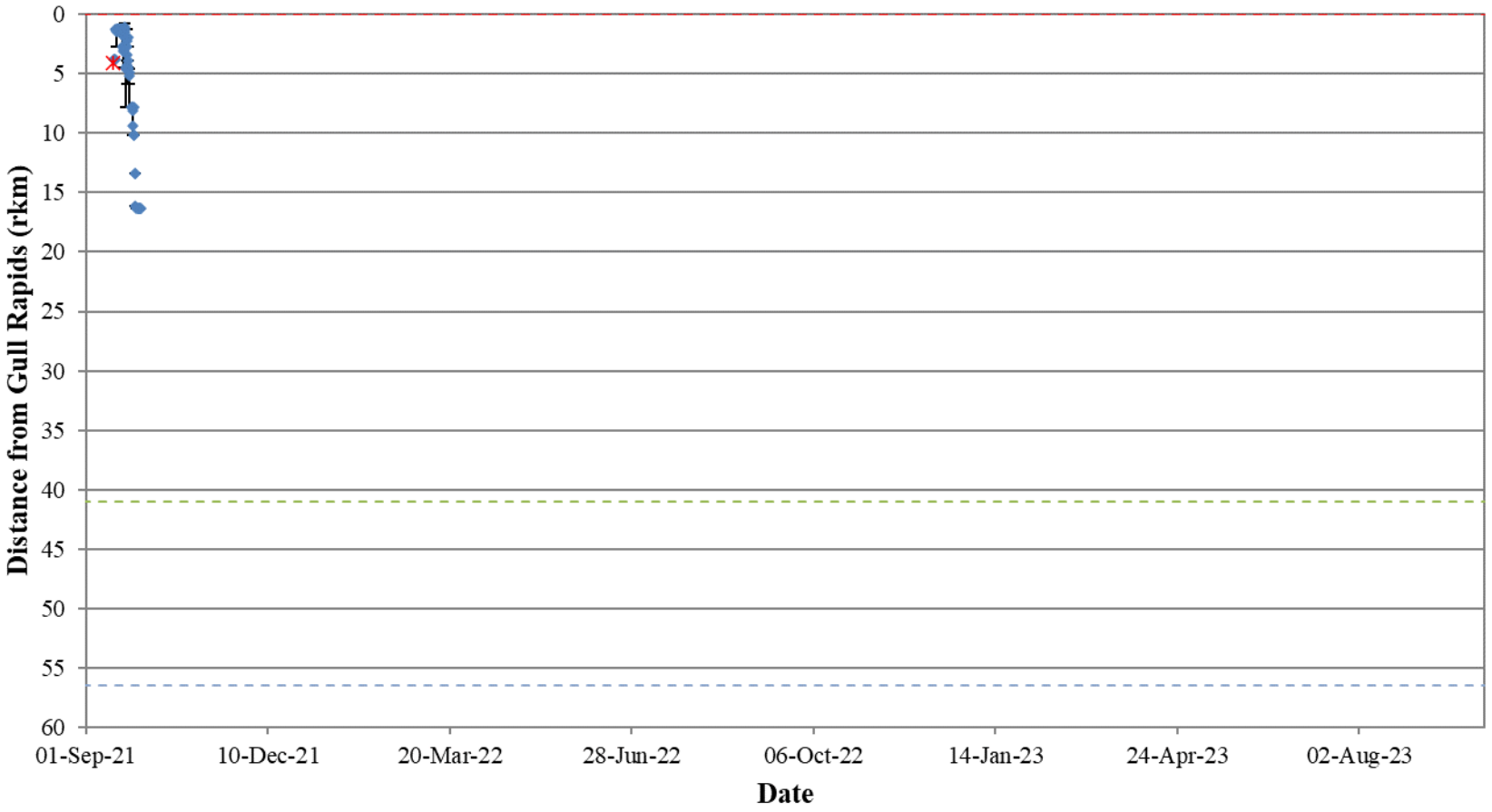

Figure A3-17: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48301) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

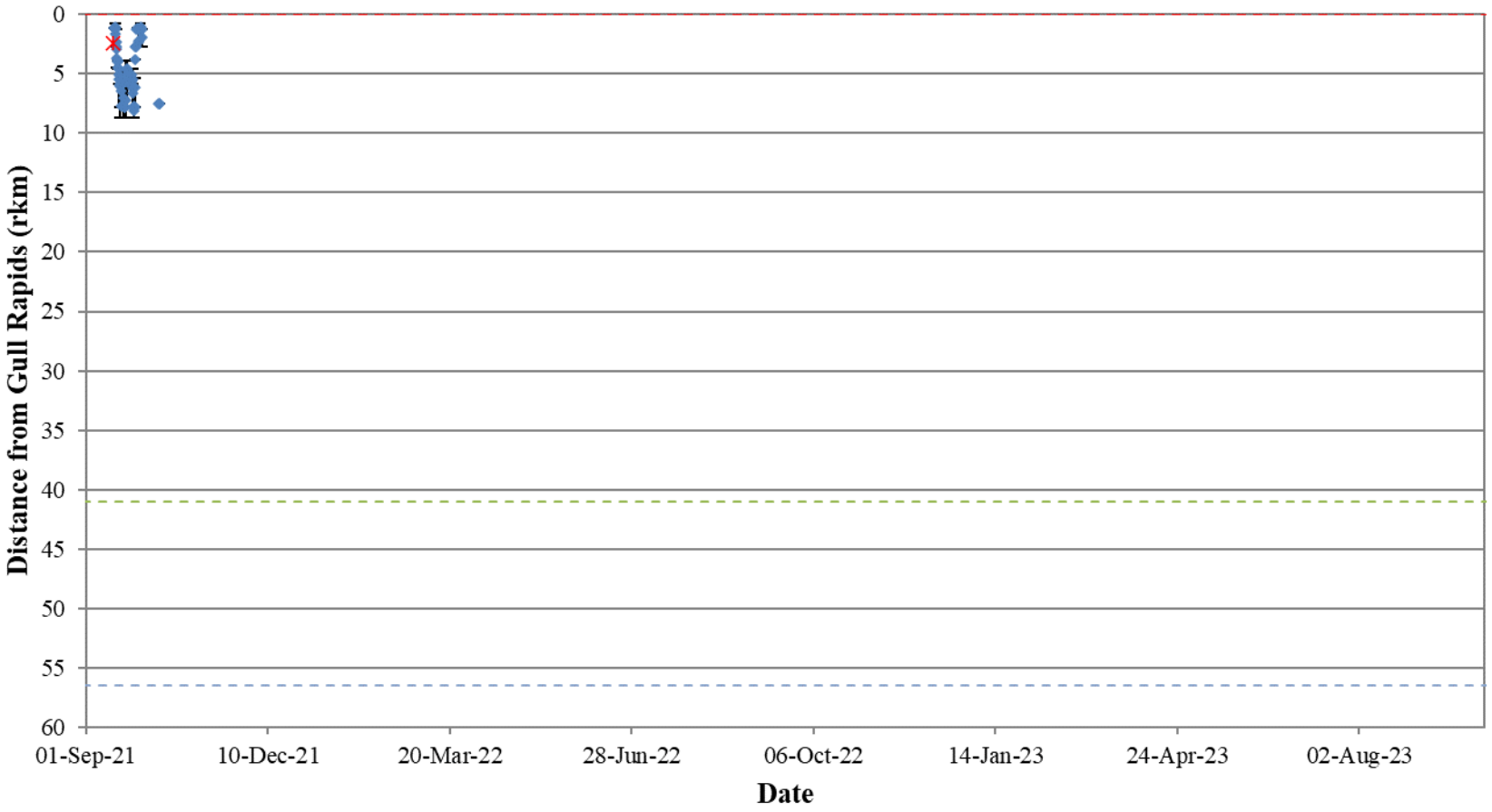

Figure A3-18: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48306) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

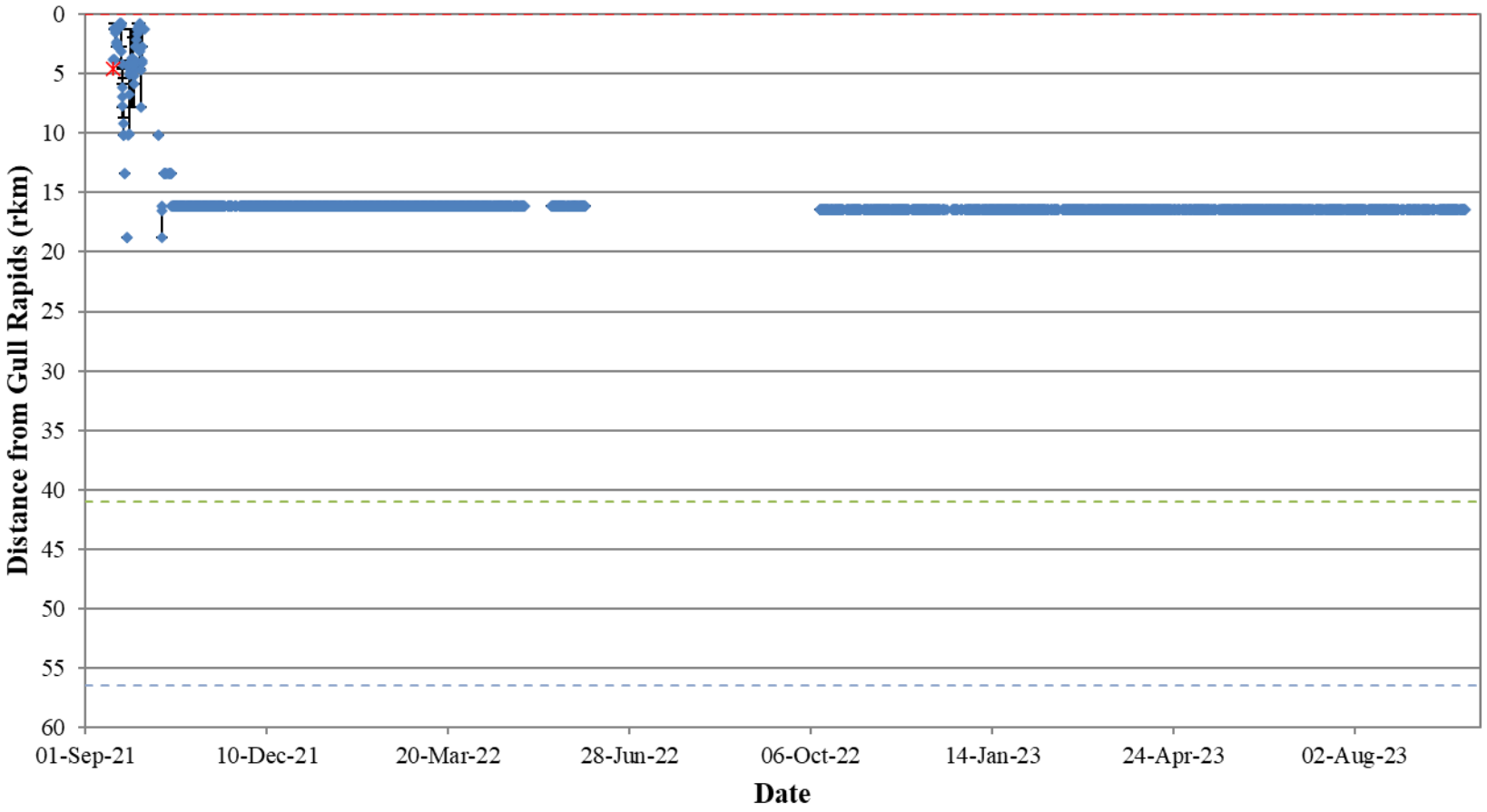

Figure A3-19: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48307) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

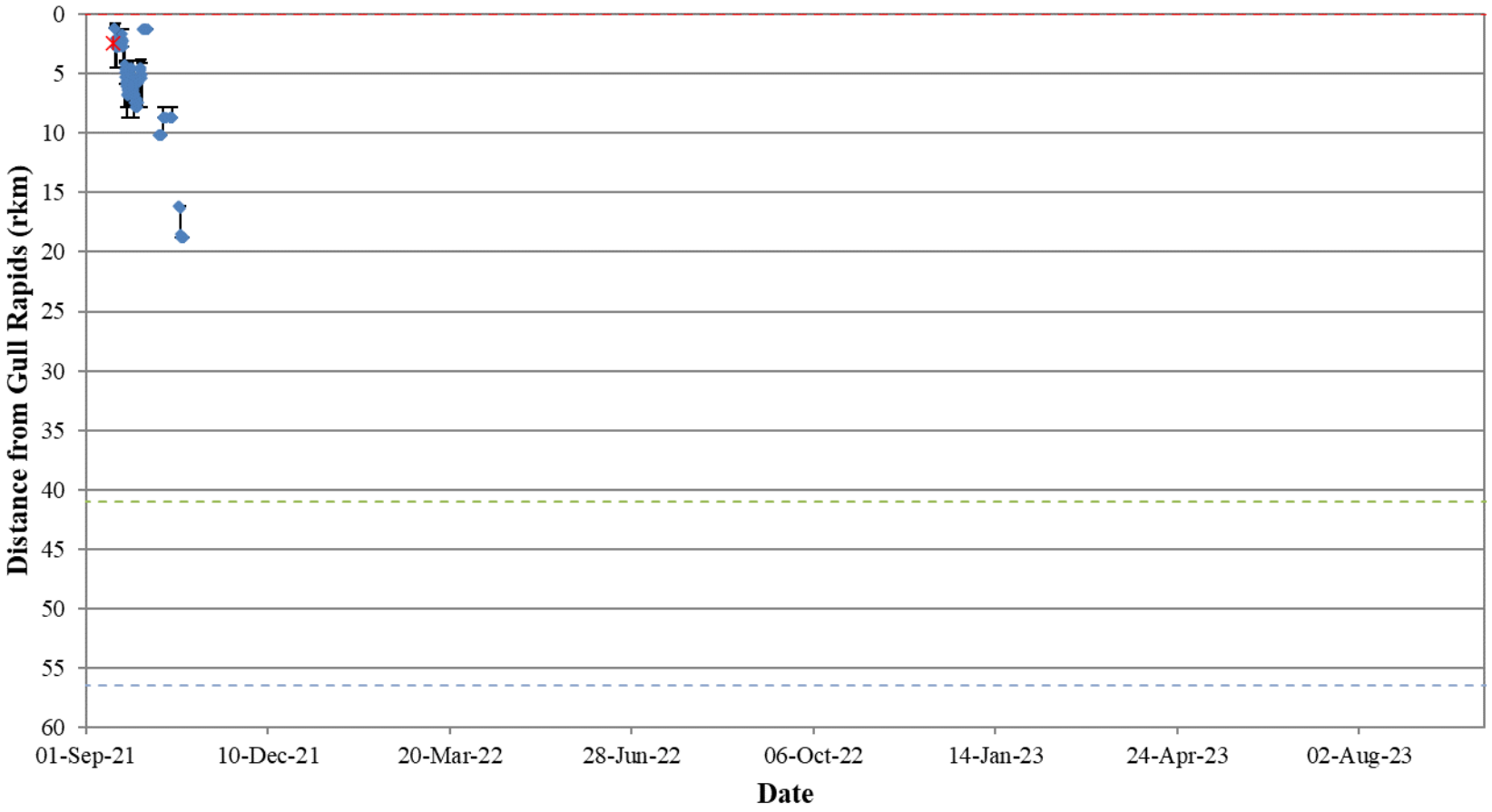

Figure A3-20: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48312) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 2, 2023. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

APPENDIX 4:
TAGGING AND RECAPTURE INFORMATION ASSOCIATED WITH JUVENILE LAKE STURGEON IMPLANTED WITH ACOUSTIC TRANSMITTERS THAT HAVE EXPIRED BETWEEN 2013 AND 2022.

Table A4-1: Tagging, tag expiry, and subsequent recapture information for juvenile Lake Sturgeon tagged with acoustic transmitters in the Keeyask reservoir following tag expiry.

Acoustic Tag	Floy tag	Tagging Date	Estimated Tag Expiry Date	Date of Last Detection	Location of Last Detection	Recapture Dates	Recapture Location	Recapture Program
31683	106469	12-Sep-17	15-Jun-22	07-Oct-21	Gull Lake	13-Sep-18 14-Sep-18	Gull Lake Gull Lake	Juvenile Lake Sturgeon population monitoring, fall 2018: Year 5 Construction (Burnett and Hrenchuk 2019) Juvenile Lake Sturgeon population monitoring, fall 2018: Year 5 Construction (Burnett and Hrenchuk 2019)
31684	106464	09-Sep-17	12-Jun-22	07-Oct-21	Gull Lake			
31685	106460	09-Sep-17	12-Jun-22	02-Oct-21	Stephens Lake	21-Sep-21	Stephens	Juvenile Lake Sturgeon population monitoring, fall 2021: Year 8 Construction (Burnett *et al.* 2022)
31686	106456	09-Sep-17	12-Jun-22	04-Oct-21	Gull Lake			
31687	106454	09-Sep-17	12-Jun-22	01-Oct-21	Stephens Lake	17-Sep-20	Gull Lake	Juvenile Lake Sturgeon population monitoring, fall 2020: Year 7 Construction (Burnett *et al.* 2021)
31768	109632	14-Sep-17	17-Jun-22	07-Oct-21	Gull Lake			
31769	109633	14-Sep-17	17-Jun-22	01-Oct-21	Gull Lake			
31770	109636	14-Sep-17	17-Jun-22	07-Oct-21	Gull Lake			
31771	109637	14-Sep-17	17-Jun-22	03-Oct-21	Gull Lake			
31772	111031	15-Sep-17	18-Jun-22	03-Oct-21	Gull Lake			
31773	109564	12-Sep-17	15-Jun-22	07-Oct-21	Gull Lake			
31774	109565	12-Sep-17	15-Jun-22	03-Oct-21	Gull Lake			
31775	109570	13-Sep-17	16-Jun-22	26-Sep-21	Gull Lake			
31776	109571	13-Sep-17	16-Jun-22	07-Oct-21	Gull Lake	17-Sep-19	Gull Lake	Juvenile Lake Sturgeon population monitoring, fall 2019: Year 6 Construction (Burnett and Hrenchuk 2020)
31777	109626	13-Sep-17	16-Jun-22	03-Oct-21	Gull Lake			
31778	106475	12-Sep-17	15-Jun-22	06-Jul-19	Stephens Lake			
31779	109552	12-Sep-17	15-Jun-22	08-Oct-21	Gull Lake			
31780	109553	12-Sep-17	15-Jun-22	02-Oct-21	Stephens Lake			
31781	109554	12-Sep-17	15-Jun-22	30-Jun-21	Gull Lake			
31782	109563	12-Sep-17	15-Jun-22	05-Oct-21	Gull Lake	16-Sep-21	Gull Lake	Juvenile Lake Sturgeon population monitoring, fall 2021: Year 8 Construction (Burnett and Hrenchuk 2022)
32686	103112	28-Aug-13	16-Sep-17	15-Jul-15	Gull Lake			
32691	103111	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake			
32692	103113	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake	17-Sep-20	Gull Lake	Juvenile Lake Sturgeon population monitoring, fall 2020: Year 7 Construction (Burnett *et al.* 2021)
32693	103114	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake			
32694	103115	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake			
32695	103116	28-Aug-13	16-Sep-17	10-Jul-17	Gull Lake	06-Jun-16 12-Sep-18	Gull Lake Gull Lake	Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2016 (Legge *et al.* 2016) Juvenile Lake Sturgeon population monitoring, fall 2018: Year 5 Construction (Burnett and Hrenchuk 2019)
32687	103117	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake			
32688	103118	28-Aug-13	16-Sep-17	20-Sep-17	Gull Lake			
32689	103119	28-Aug-13	16-Sep-17	26-Sep-17	Gull Lake			
32690	103120	28-Aug-13	16-Sep-17	19-Jun-16	Gull Lake	14-Sep-14	Gull Lake	Juvenile Lake Sturgeon Population Monitoring, Fall 2014: Year 1 Construction (Henderson *et al.* 2015)
32681	103123	29-Aug-13	17-Sep-17	26-Sep-17	Gull Lake	30-Jun-18	Gull Lake	Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2018 (Holm and Hrenchuk 2019)
32682	103124	29-Aug-13	17-Sep-17	26-Sep-17	Gull Lake			
32676	103125	29-Aug-13	17-Sep-17	21-Jun-17	Gull Lake	18-Sep-16	Gull Lake	
32672	103275	29-Aug-13	17-Sep-17	25-Sep-17	Gull Lake			
32677	103274	29-Aug-13	17-Sep-17	27-Sep-17	Gull Lake			
32683	103273	29-Aug-13	17-Sep-17	28-Aug-17	Gull Lake			
32684	103272	29-Aug-13	17-Sep-17	27-Sep-17	Gull Lake			
32678	103270	29-Aug-13	17-Sep-17	7-Sep-17	Gull Lake			
32671	103268	29-Aug-13	17-Sep-17	24-Sep-17	Gull Lake			
32679	103536	29-Aug-13	17-Sep-17	29-Aug-17	Gull Lake			

Table A4-2: Tagging, tag expiry, and subsequent recapture information for juvenile Lake Sturgeon tagged with acoustic transmitters in Stephens Lake following tag expiry.

Acoustic Tag	Floy Tag	Tagging Date	Estimated Tag Expiry Date	Date of Last Detection	Location of Last Detection	Recapture Dates	Recapture Location	Recapture Program
31688	110782	16-Sep-17	19-Jun-22	02-Jun-21	Stephens Lake			
31689	112905	15-Sep-17	18-Jun-22	07-Jul-21	Limestone Reservoir			
31690	112914	14-Sep-17	17-Jun-22	15-Aug-19	Long Spruce Reservoir			
31691	112917	14-Sep-17	17-Jun-22	15-Aug-19	Long Spruce Reservoir			
31692	112921	14-Sep-17	17-Jun-22	12-Aug-19	Long Spruce Reservoir			
31693	111065	13-Sep-17	16-Jun-22	30-Nov-17	Stephens Lake			
31694	112919	14-Sep-17	17-Jun-22	02-Oct-21	Stephens Lake			
31695	112909	15-Sep-17	18-Jun-22	02-Oct-21	Stephens Lake			
31696	112901	15-Sep-17	18-Jun-22	02-Oct-21	Stephens Lake			
31697	110795	16-Sep-17	19-Jun-22	02-Oct-21	Stephens Lake			
31758	110787	16-Sep-17	19-Jun-22	01-Oct-21	Stephens Lake			
31759	112915	14-Sep-17	17-Jun-22	02-Oct-21	Stephens Lake	14-Sep-19	Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2019: Year 6 Construction (Burnett and Hrenchuk 2020)
31760	112924	14-Sep-17	17-Jun-22	02-Oct-21	Stephens Lake	20-Sep-18 24-Sep-20 25-Sep-20	Stephens Lake Stephens Lake Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2018: Year 5 Construction (Burnett and Hrenchuk 2019) Juvenile Lake Sturgeon population monitoring, fall 2020: Year 7 Construction (Burnett *et al.* 2021) Juvenile Lake Sturgeon population monitoring, fall 2020: Year 7 Construction (Burnett *et al.* 2021)
31761	111075	13-Sep-17	16-Jun-22	19-Sep-17	Kettle GS			
31762	112903	15-Sep-17	18-Jun-22	22-Sep-20	Long Spruce Reservoir			
31763	112904	15-Sep-17	18-Jun-22	09-Oct-21	Stephens Lake			
31764	112913	14-Sep-17	17-Jun-22	03-Dec-17	Long Spruce Reservoir			
31765	110788	16-Sep-17	19-Jun-22	02-Oct-21	Stephens Lake	13-Sep-19	Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2019: Year 6 Construction (Burnett and Hrenchuk 2020)
31766	112918	14-Sep-17	17-Jun-22	01-Oct-21	Stephens Lake			
31767	110552	15-Sep-17	18-Jun-22	02-Oct-21	Stephens Lake	14-Sep-17	Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2017: Year 4 Construction (Burnett *et al.* 2018)
32666	103228	16/09/2013	5-Oct-17	15-Oct-17	Stephens Lake			
32696	103229	16/09/2013	5-Oct-17	6-Nov-16	Stephens Lake			
32698	103231	16-Sep-13	5-Oct-17	15-Oct-17	Stephens Lake	17-Sep-17 30-May-18	Stephens Lake Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2017: Year 4 Construction (Burnett *et al.* 2018) Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2018 (Holm and Hrenchuk 2019)
32697	103602	16-Sep-13	5-Oct-17	15-Oct-17	Stephens Lake	19-Sep-14	Stephens Lake	Juvenile Lake Sturgeon Population Monitoring, Fall 2014: Year 1 Construction (Henderson *et al.* 2015)
32670	103233	17-Sep-13	6-Oct-17	12-Sep-17	Stephens Lake			
32699	103235	17-Sep-13	6-Oct-17	13-Nov-13	Stephens Lake			
32661	103237	17-Sep-13	6-Oct-17	28-Jul-17	Stephens Lake	21-Jun-18 22-Jun-21	Stephens Lake Stephens Lake	Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2018 (Holm and Hrenchuk 2019) Adult Lake Sturgeon population monitoring in the Keeyask reservoir and Stephens Lake, 2021 (Loeppky and Hrenchuk 2022)
32667	103238	17-Sep-13	6-Oct-17	22-Jun-16	Stephens Lake			
32662	103239	17-Sep-13	6-Oct-17	5-Oct-17	Long Spruce Reservoir			
32673	103241	21-Sep-13	10-Oct-17	15-Oct-17	Stephens Lake			
32668	103242	21-Sep-13	10-Oct-17	15-Oct-17	Stephens Lake	11-Jun-18	Stephens Lake	Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2018 (Holm and Hrenchuk 2019)
32663	103243	21-Sep-13	10-Oct-17	29-Jul-17	Stephens Lake	21-Sep-17	Stephens Lake	Juvenile Lake Sturgeon population monitoring, fall 2017: Year 4 Construction (Burnett *et al.* 2018)
32700	103244	21-Sep-13	10-Oct-17	15-Oct-17	Stephens Lake			
32674	103245	21-Sep-13	10-Oct-17	4-Oct-16	Stephens Lake			
32669	103246	21-Sep-13	10-Oct-17	15-Oct-17	Stephens Lake	19-Sep-14	Stephens Lake	Juvenile Lake Sturgeon Population Monitoring, Fall 2014: Year 1 Construction (Henderson *et al.* 2015)
32685	103248	22-Sep-13	11-Oct-17	12-Jun-17	Long Spruce Reservoir			
32680	103250	22-Sep-13	11-Oct-17	15-Oct-17	Stephens Lake	14-Jun-22	Stephens Lake	Adult Lake Sturgeon Population Monitoring in the Upper Split Lake and Keeyask Areas, 2022 (Ambrose *et al.* 2023)
32675	103251	22-Sep-13	11-Oct-17	15-Oct-17	Stephens Lake			
32664	103349	22-Sep-13	11-Oct-17	14-Jul-16	Stephens Lake	1-Jun-18	Stephens Lake	Adult Lake Sturgeon population monitoring in the future Keeyask reservoir and Stephens Lake, 2018 (Holm and Hrenchuk 2019)
32665	103348	23-Sep-13	12-Oct-17	15-Oct-17	Stephens Lake			