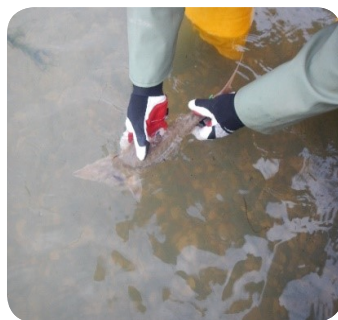




Keeyask Generation Project Aquatic Effects Monitoring Plan

Juvenile Lake Sturgeon Movement Monitoring Report

AEMP-2023-02



KEYYASK GENERATION PROJECT

AQUATIC EFFECTS MONITORING PLAN

REPORT #AEMP-2023-02

JUVENILE LAKE STURGEON ACOUSTIC TRACKING IN THE NELSON RIVER BETWEEN CLARK LAKE AND THE LIMESTONE GENERATING STATION, OCTOBER 2021 TO OCTOBER 2022: YEAR 1 OPERATION

Prepared for

Manitoba Hydro

By

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June 2023



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This report should be cited as follows:

Small, K.D. and C.L. Hrenchuk. 2023. Juvenile Lake Sturgeon acoustic tracking in the Nelson River between Clark Lake and the Limestone Generating Station, October 2021 to October 2022: Year 1 Operation. Keeyask Generation Project Aquatic Effects Monitoring Plan Report #AEMP-2023-02. A report prepared for Manitoba Hydro by North/South Consultants Inc., June 2023. xvii + 146 pp.

SUMMARY

Background

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

Construction of the Keeyask GS began in mid-July 2014 and instream work was completed in 2020. The reservoir was impounded with water levels being 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 was identified as one of the key species for monitoring. They were chosen 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 through the Kettle GS.

Monitoring juvenile sturgeon movement using methods described in 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 just over two years after impoundment (September 5, 2020 to October 10,

2022). 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 2021 to October 2022.

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?

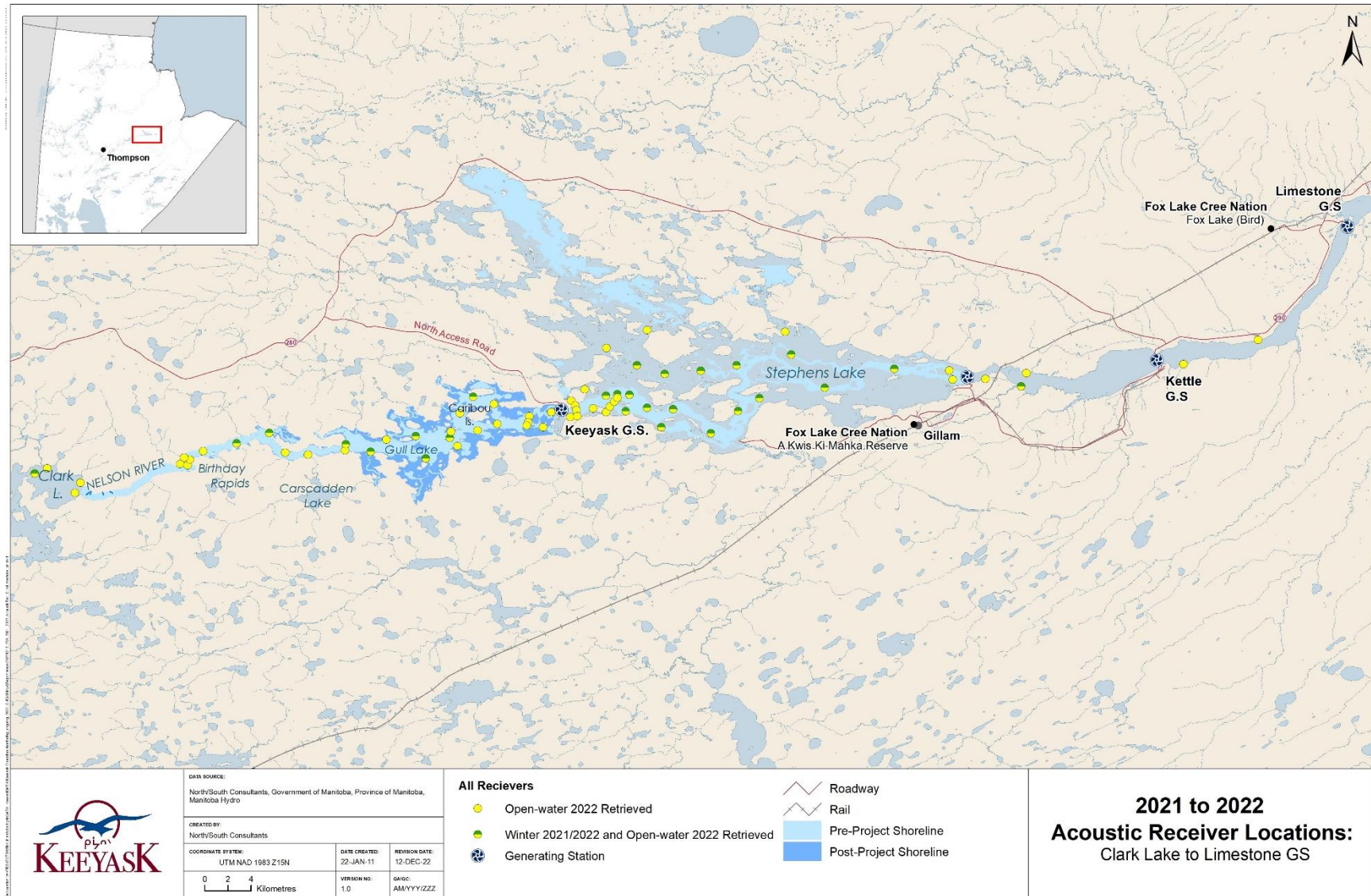
Flooding of the reservoir changed the amount and type of fish habitat. These changes may result in juvenile Lake Sturgeon leaving their usual habitat to seek new areas. Monitoring how far fish move will tell us if they are travelling longer distances than before construction and operation began.

Are fish moving downstream through 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 through 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. This may cause juvenile Lake Sturgeon to move away from where they used to live or to use 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). 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. Since these tags were nearing the end of their battery life in 2017, an additional 40 fish were tagged in September 2017 (20 in Gull Lake and 20 in Stephens Lake) with tags with a 4-year battery life. During fall 2021, an additional 40 tags were applied to juvenile Lake Sturgeon, 20 upstream and 20 downstream of the Keeyask GS. The tags applied in 2017 remained active until June 2022, while the tags applied in 2021 will be active until 2025.



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?

During this study, 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. Because the reservoir was flooded in 2020, more suitable areas for receivers were available (deep areas with low flow) and additional receivers were set in the following winter periods.

Before and during construction, juvenile Lake Sturgeon upstream of the Keeyask GS did not move very far and most lived in 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. Since then, ten fish moved downstream through 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. The increased movements were predicted in the EIS. 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 open-water 2022. After moving past the Keeyask GS, nine of the ten fish moved upstream and downstream in Stephens Lake, showing that they survived passage. During open-water 2022, juvenile movements appear to have returned to the pattern observed prior to impoundment. No juveniles moved downstream past the Keeyask GS after June 2022 and the overall movement range decreased similar to the range observed prior to impoundment.

In Stephens Lake, juvenile Lake Sturgeon continued to show the same general movements as in previous years but spent slightly more time farther from the GS. 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. Three fish moved downstream through the Kettle GS (one fish that was tagged in the Keeyask reservoir and two tagged in Stephens Lake), and this is similar to what has been observed in previous years.

What does it mean?

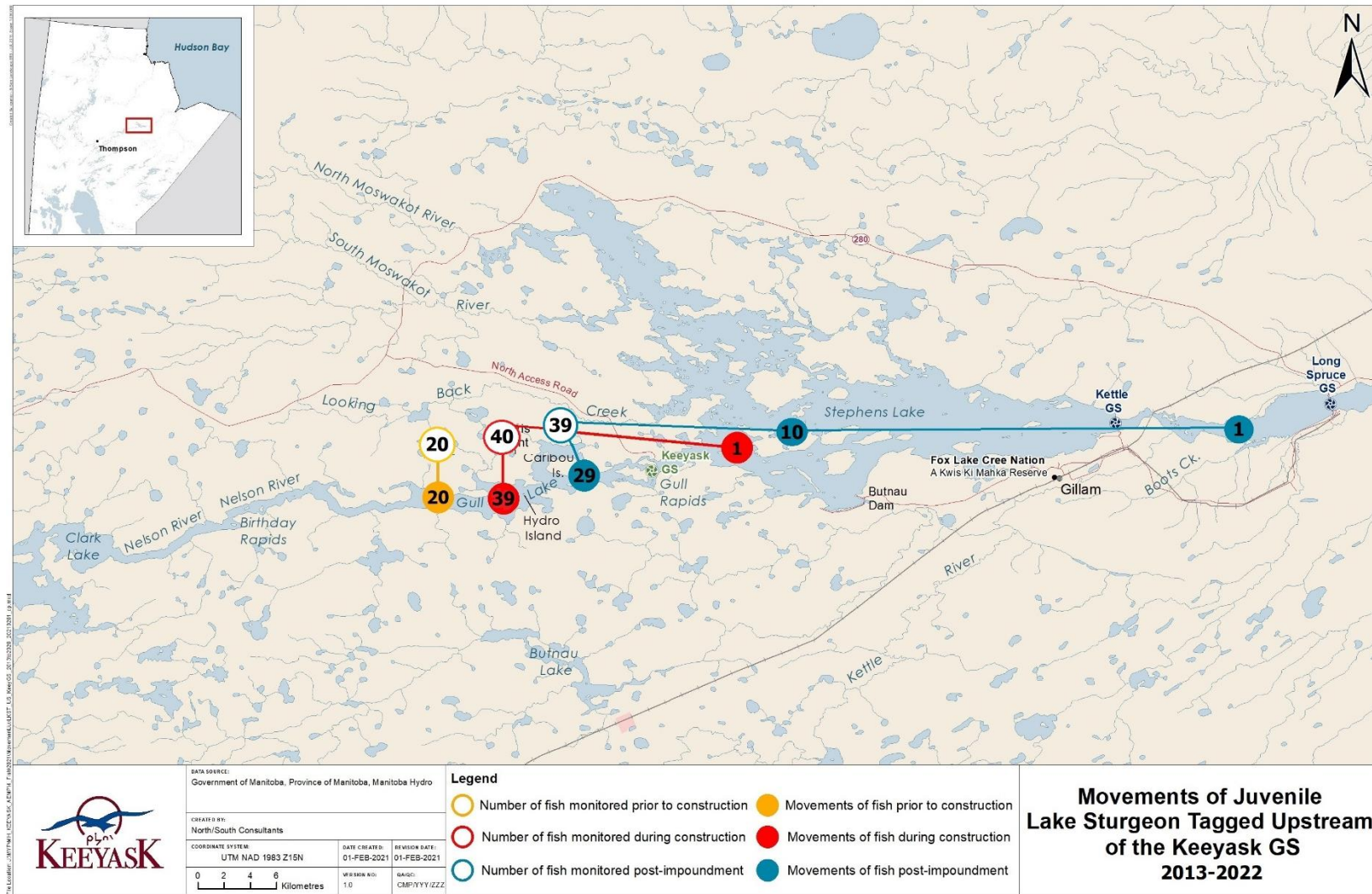
Before the Keeyask GS reservoir was flooded, monitoring upstream of the Keeyask GS showed that each sturgeon tended to stay in the same areas year after year, moving little. Data collected immediately after impoundment in September 2020 and during the winter 2020/2021 showed that these movements didn't change. Data collected during open-water 2021 and winter 2021/2022 suggests that movements of juvenile sturgeon were different than before impoundment. In general, juveniles moved more frequently through the Keeyask GS and moved over longer distances than before flooding. In open-water 2022, movements of juveniles appear to have returned to similar as before impoundment, with fish moving smaller ranges and no fish moving through the Keeyask GS after June 2022.

In Stephens Lake, movement monitoring from 2013–2022 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 through the Kettle GS.

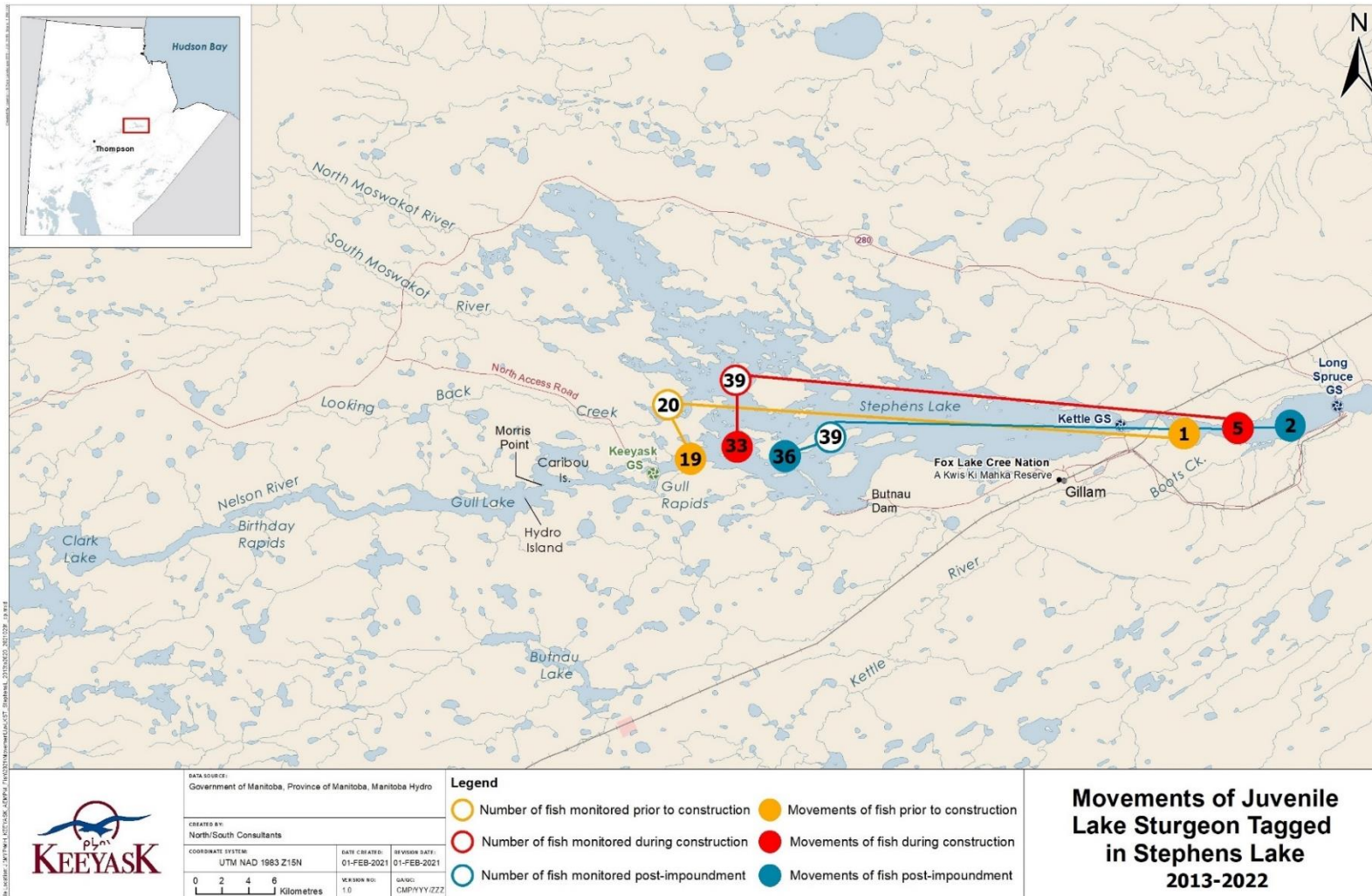
What will be done next?

The original tags applied to juvenile Lake Sturgeon in 2013 are now expired and cannot be tracked by the receivers. Open-water 2022 was the last year that tags applied in 2017 were active but the tags applied in 2021 will last until 2025. 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 continue to change their movements in the Keeyask reservoir.

Because the 2017 tags have expired and 10 juveniles moved downstream through the GS, only 16 tags will be active upstream of the GS in 2023. More fish will be tagged in the Keeyask reservoir in fall 2023 to increase this number.



Map showing how many juvenile Lake Sturgeon moved upstream out of the Keyeyask reservoir, stayed in the Keyeyask 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 through 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.

ACKNOWLEDGEMENTS

We would like to thank Manitoba Hydro for the opportunity and resources to conduct this study.

Grant Connell, Leslie Flett, Patrick Connell, Tyler Kitchkeesik, and Terry Kitchkeesik of Tataskweyak Cree Nation are thanked for their local expertise and assistance in conducting the field work.

The collection of biological samples described in this report was authorized by Natural Resources and Northern Development, Fish and Wildlife Branch, under terms of the Scientific Collection Permit #41767128 (SCP 08-2022).

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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, or downstream through 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, 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) and post-impoundment (September 2020–2022), and operation (2022-ongoing) periods of the Project and to determine if 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 through 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 2022 represents the first 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 September 2021 to October 2022, which is the seventh winter and eighth open-water period of monitoring conducted since construction of the Keeyask GS began in July 2014, and the second 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.

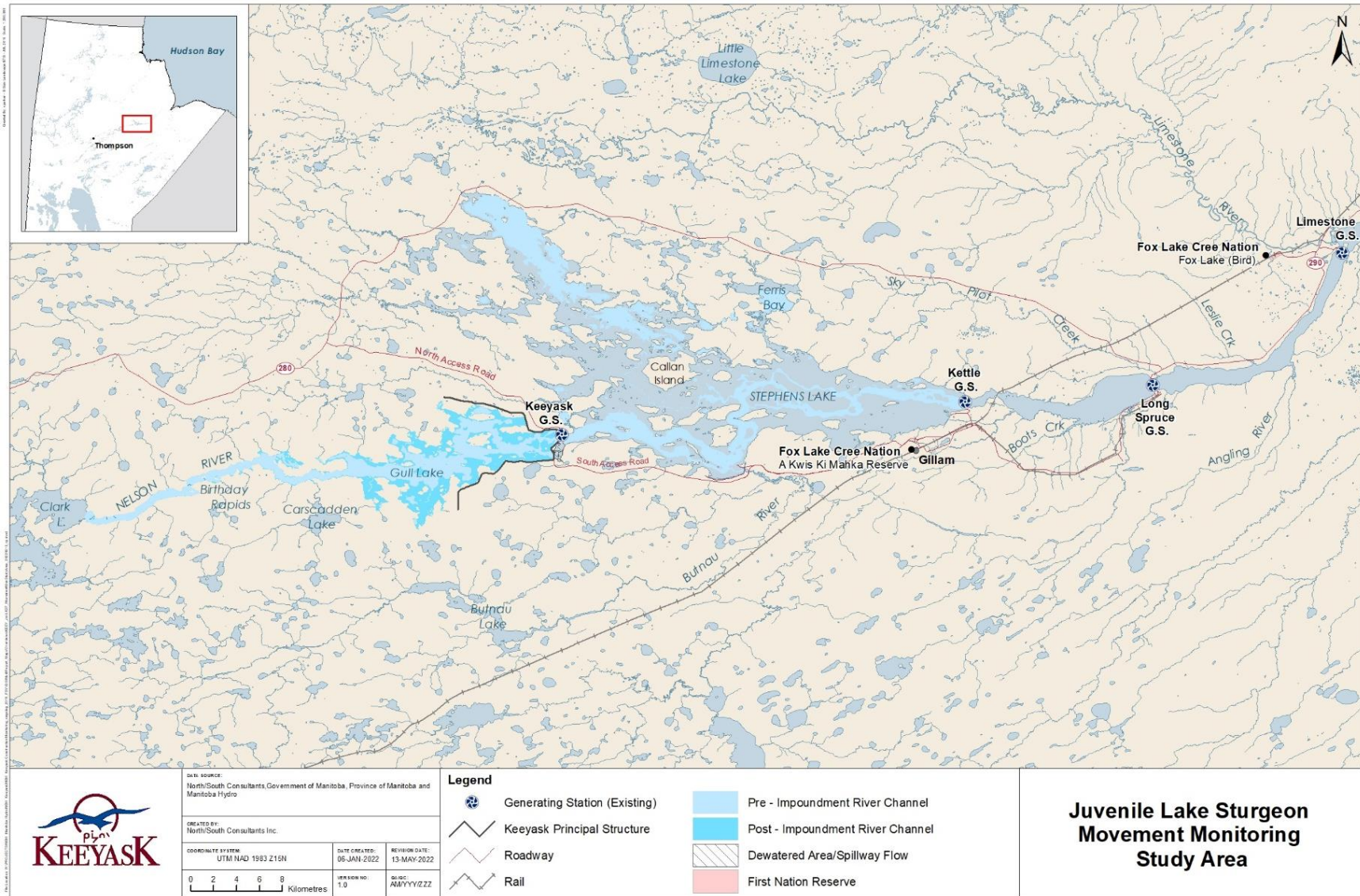
Prior to impoundment, Gull Lake was a widening of the Nelson River, with moderate to low water velocity beginning approximately 20 km upstream the Keeyask GS. Water levels on Gull Lake increased by several metres following impoundment and flooding along the shoreline and small tributaries entering this 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 (Tables 1 and 2). Sturgeon tagged in September 2017 had fork lengths ranging from 360 to 578 mm (Lacho *et al.* 2018). As these tags are nearing the end of their expected battery life, an additional 40 tags were applied to juveniles in September 2021; 20 upstream and 20 downstream of the Keeyask GS (Tables 1 and 2). Sturgeon tagged in September 2021 had fork lengths ranging from 390 to 563 mm. 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 Keyyask GS, from fall 2017 and 2021.

Tag ID	Floy tag #	Date Tagged	Expiry Date	Fork Length (mm)	Total Length (mm)	Weight (g)
31683	106469	12-Sep-17	15-Jun-22	505	579	800
31684	106464	09-Sep-17	12-Jun-22	432	501	600
31685	106460	09-Sep-17	12-Jun-22	410	460	550
31686	106456	09-Sep-17	12-Jun-22	504	584	1100
31687	106454	09-Sep-17	12-Jun-22	545	624	1200
31768	109632	14-Sep-17	17-Jun-22	459	532	700
31769	109633	14-Sep-17	17-Jun-22	462	516	600
31770	109636	14-Sep-17	17-Jun-22	442	511	650
31771	109637	14-Sep-17	17-Jun-22	470	541	600
31772	111031	15-Sep-17	18-Jun-22	518	598	1100
31773	109564	12-Sep-17	15-Jun-22	545	616	1000
31774	109565	12-Sep-17	15-Jun-22	481	559	800
31775	109570	13-Sep-17	16-Jun-22	459	519	600
31776	109571	13-Sep-17	16-Jun-22	410	479	400
31777	109626	13-Sep-17	16-Jun-22	578	662	1350
31778	106475	12-Sep-17	15-Jun-22	435	504	800
31779	109552	12-Sep-17	15-Jun-22	490	549	800
31780	109553	12-Sep-17	15-Jun-22	448	494	650
31781	109554	12-Sep-17	15-Jun-22	468	544	850
31782	109563	12-Sep-17	15-Jun-22	448	506	600
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

Table 2: Acoustic-tag and biological information for each juvenile Lake Sturgeon tagged with an acoustic transmitter in Stephens Lake, fall 2017 and 2021.

Tag ID	Floy tag #	Date Tagged	Expiry Date	Fork Length (mm)	Total Length (mm)	Weight (g)
31688	110782	16-Sep-17	19-Jun-22	436	498	625
31689	112905	15-Sep-17	18-Jun-22	445	515	625
31690	112914	14-Sep-17	17-Jun-22	433	480	525
31691	112917	14-Sep-17	17-Jun-22	487	554	750
31692	112921	14-Sep-17	17-Jun-22	453	529	400
31693	111065	13-Sep-17	16-Jun-22	494	553	900
31694	112919	14-Sep-17	17-Jun-22	390	445	375
31695	112909	15-Sep-17	18-Jun-22	455	521	650
31696	112901	15-Sep-17	18-Jun-22	440	496	700
31697	110795	16-Sep-17	19-Jun-22	433	500	600
31758	110787	16-Sep-17	19-Jun-22	375	429	425
31759	112915	14-Sep-17	17-Jun-22	445	508	575
31760	112924	14-Sep-17	17-Jun-22	363	398	280
31761	111075	13-Sep-17	16-Jun-22	435	507	500
31762	112903	15-Sep-17	18-Jun-22	434	487	525
31763	112904	15-Sep-17	18-Jun-22	457	520	725
31764	112913	14-Sep-17	17-Jun-22	440	503	500
31765	110788	16-Sep-17	19-Jun-22	505	569	950
31766	112918	14-Sep-17	17-Jun-22	360	400	300
31767	110552	15-Sep-17	18-Jun-22	455	505	675
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

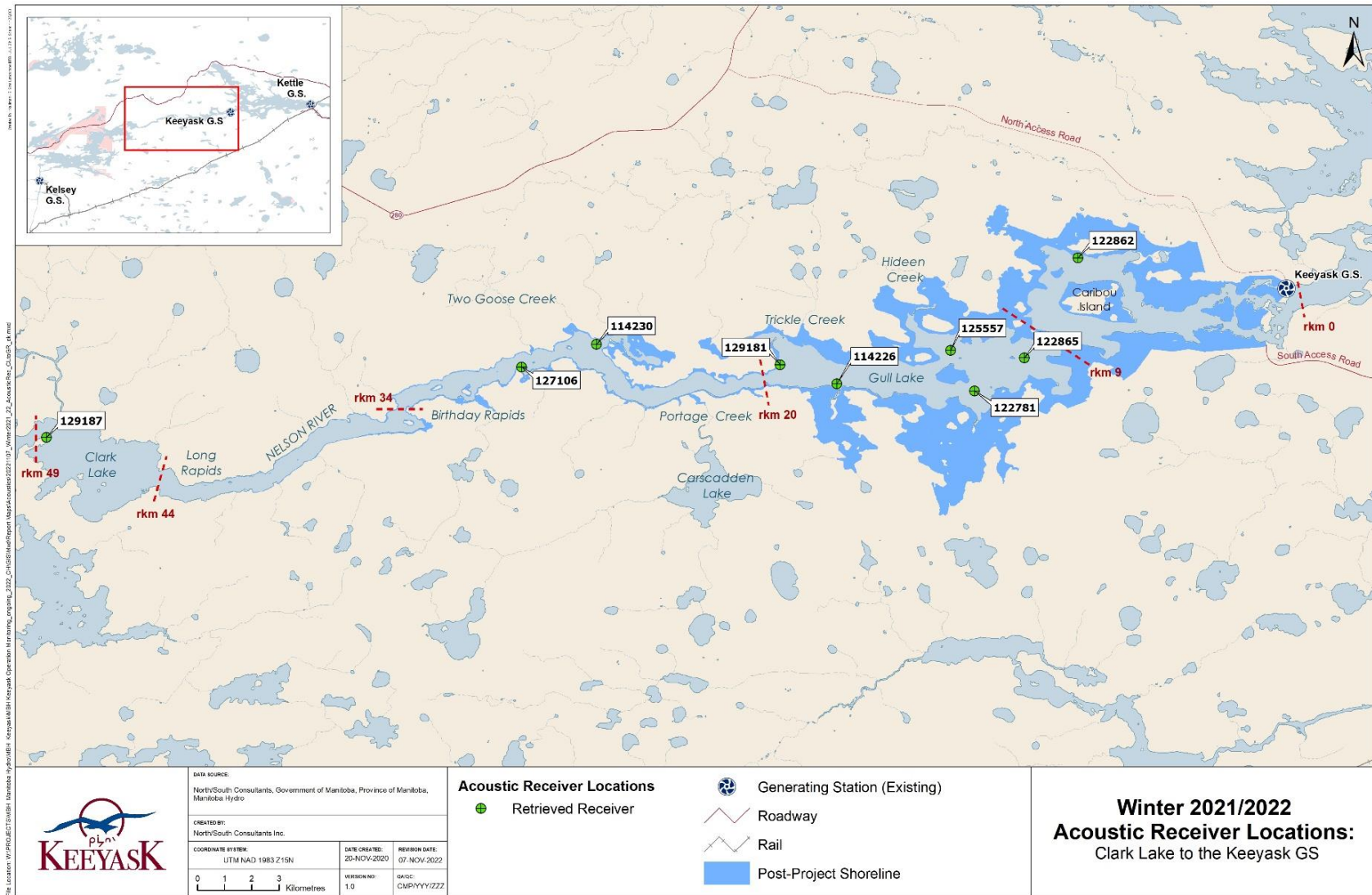
Since 2011, stationary acoustic receivers (VEMCO model VR2W) have been used to continuously monitor tagged adult Lake Sturgeon in the Nelson River between Clark Lake and the Long Spruce GS. In spring 2016, the receiver array was extended to the upper Limestone reservoir, with the placement of two receivers 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 years of the 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).

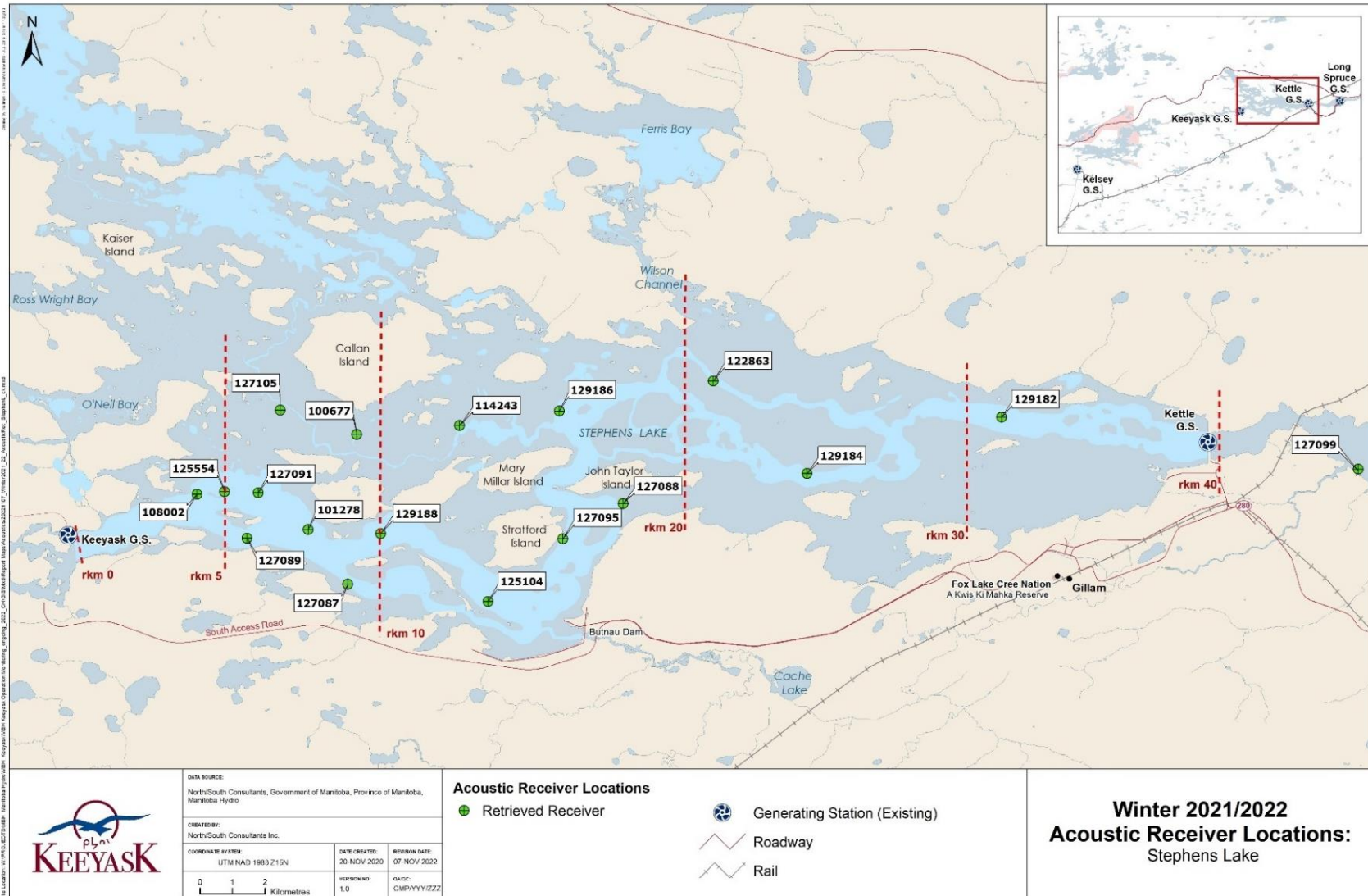
The retrieval of receivers deployed during winter has proven challenging and several were lost in previous winters, likely moved by ice (Hrenchuk and Barth 2013). Because it appears that receivers will only remain safe from ice if deployed in calm areas at depths greater than 10 m, the number of possible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

3.1.2.1 WINTER 2021/2022

The stationary acoustic receiver array for the winter 2021/2022 (October 11, 2021, to May 15, 2022) period consisted of 27 receivers. Nine were set upstream of the Keeyask GS, 17 throughout Stephens Lake, and one in the Long Spruce forebay (Maps 2 and 3). The 2021/2022 winter array was the same that was set during winter 2020/2021.



Map 2: Locations of stationary receivers set in the Nelson River from Clark Lake to the Keeyask GS between September 2021 and May 2022. 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 Keyyask GS to Kettle GS between September 2021 to May 2022. 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 2022

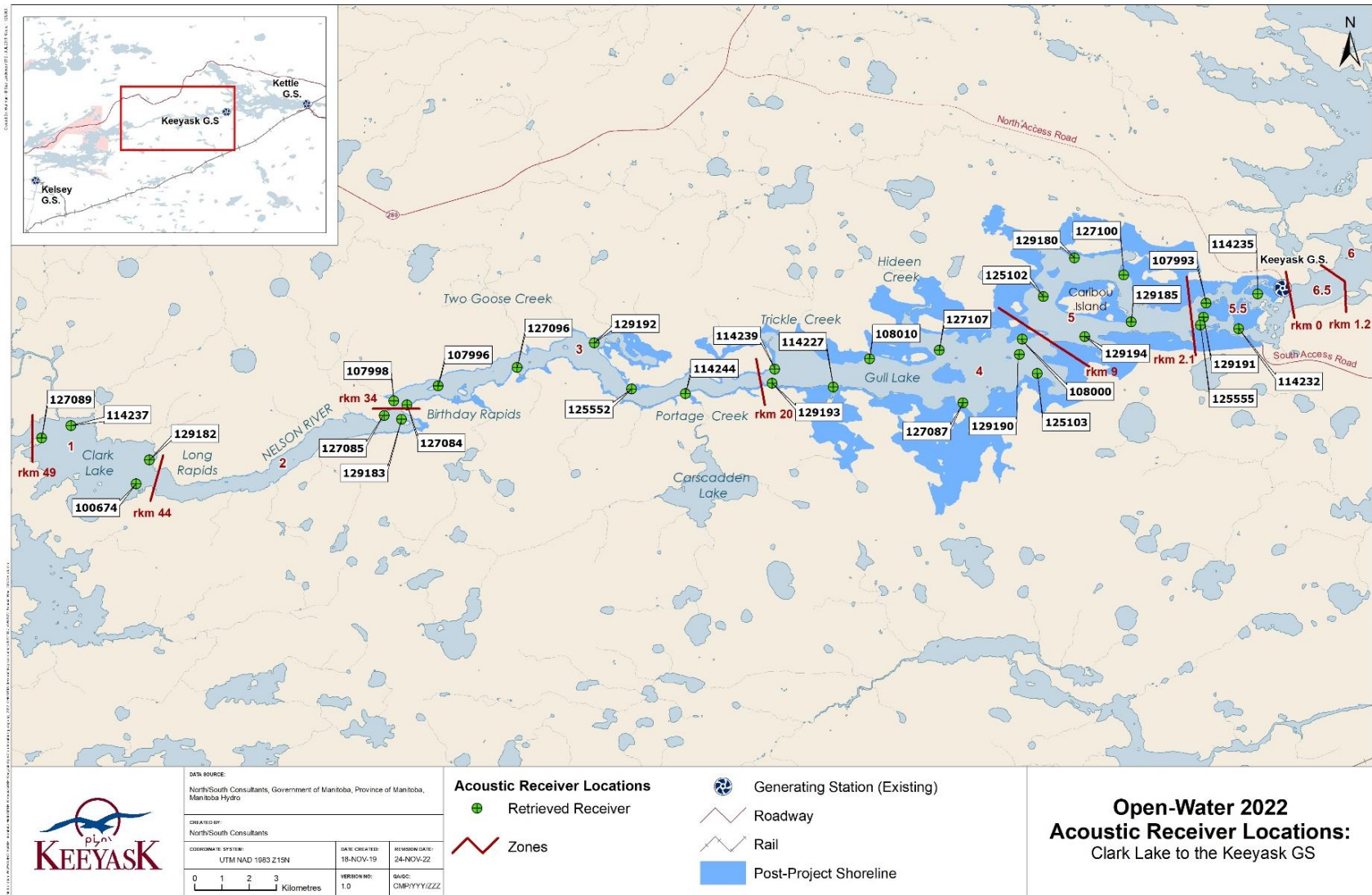
An array of 70 acoustic receivers was used during the 2022 open-water period (defined as May 16 to October 10, 2022). Thirty-two were set upstream of the Keeyask GS, 33 in Stephens Lake, three downstream of the Kettle GS, and two downstream of the Long Spruce GS (Maps 4–6). The 2022 open-water array differed slightly from the array used in 2021. Three receivers (#107993, #129191, and #125555; rkm -2.1) were set as a “gate” (described below) upstream of the GS to detect fish movements close to the station. One (#114232; rkm -0.8) was set immediately upstream of the powerhouse and an additional (#114235; rkm -0.3) was set immediately upstream of the spillway). One receiver (#122779; rkm 1.2) was added in Stephens Lake to create a “gate” downstream of the GS (Map 6).

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.

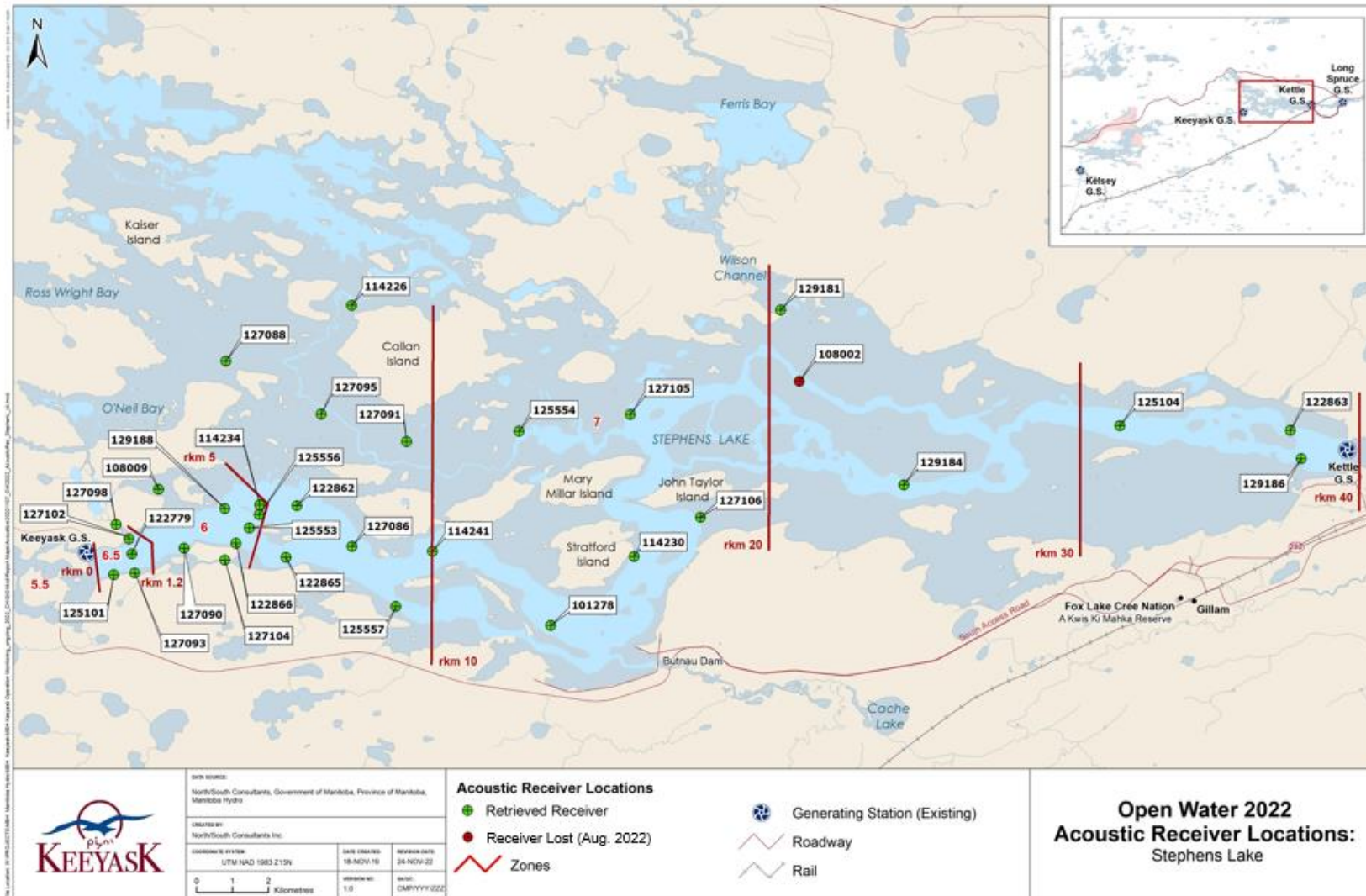
Five gates were established between Clark Lake and the Keeyask GS (44.0, 34.0, 20.0, 9.0, and 2.1 rkms upstream of the GS), dividing the river into six zones (Zones 1, 2, 3, 4, 5, and 5.5; Map 4). Three were established in Stephens Lake (1.2, 4.5, and 40.0 rkms downstream of the GS), dividing the lake 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 through 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.

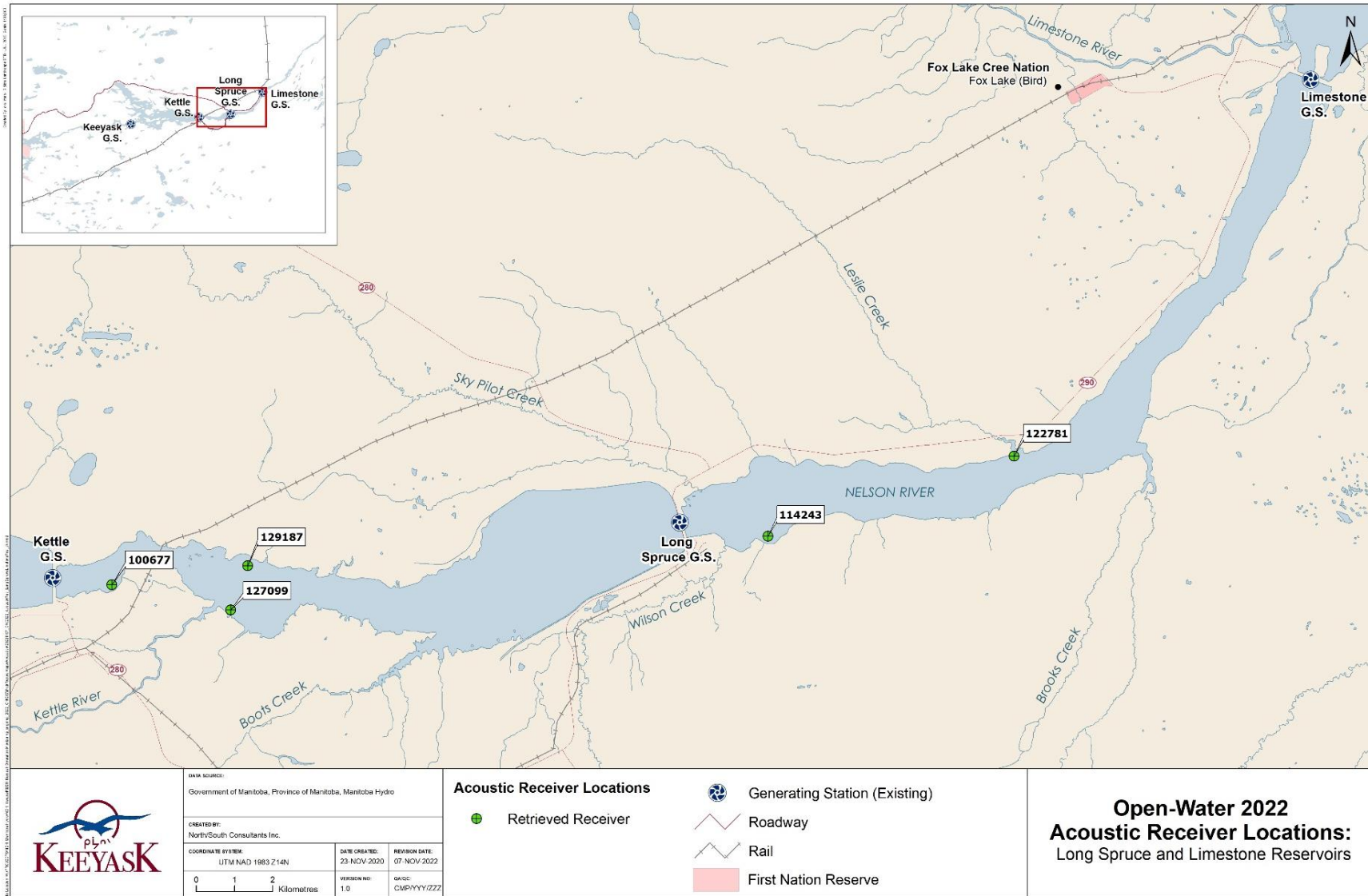
By October 11, 2022, the majority of receivers were removed, and a subset ($n = 32$) were redeployed to monitor movements during winter 2022/2023.



Map 4: Locations of stationary receivers set in the Nelson River from Clark Lake to the Keeyask GS between May and October 2022. 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 2022. 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, May to October 2022.

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 furthest downstream detection location from the location of the furthest 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 mortality or stress. 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.

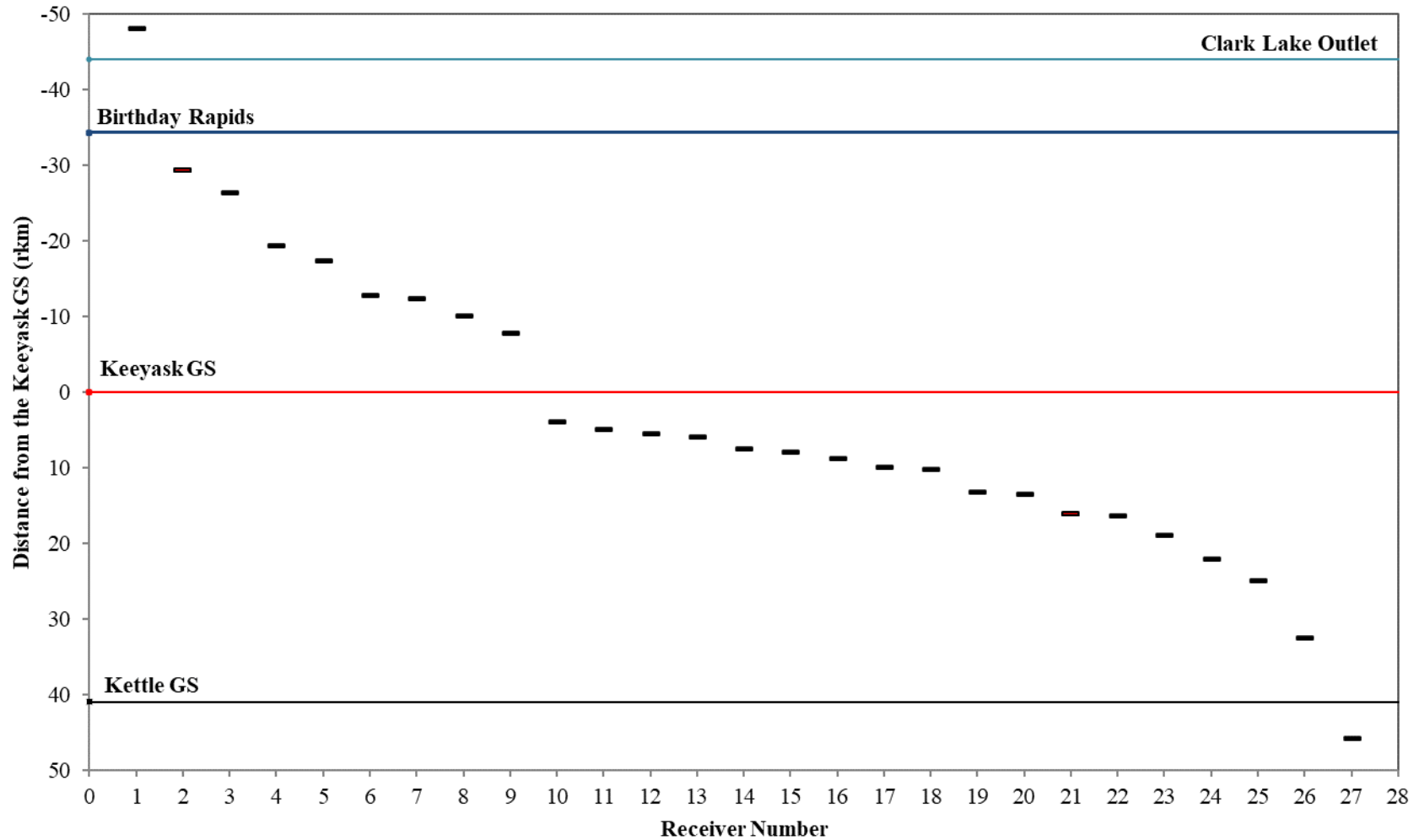


Figure 1: Locations of stationary acoustic receivers (dashes) in relation to the base of the Keeyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Kettle GS between October 2021 and May 2022.

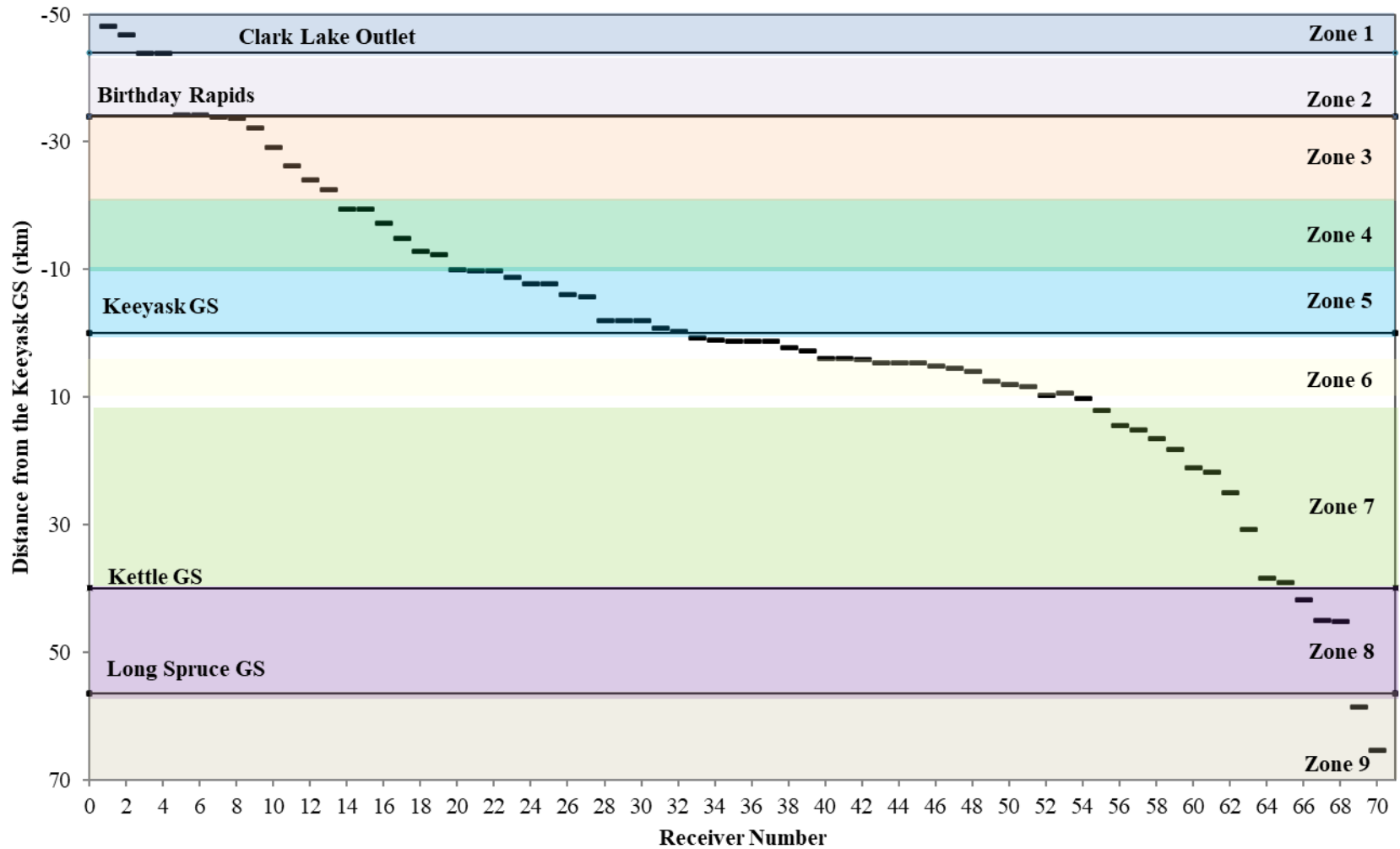


Figure 2: Locations of stationary acoustic receivers (dashes) in relation to the base of the Keyyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake (Zone 1) and the Limestone GS (Zone 9) between May and October 2022. River zones are indicated by different colours.

4.0 RESULTS

4.1 2017-2022 RESULTS SUMMARY

4.1.1 UPSTREAM OF THE KEEYASK GS

Twenty juvenile Lake Sturgeon were tagged in Gull Lake in September 2017, followed by an additional 20 in September 2021. Since then, four tagged juvenile sturgeon have moved downstream through the Keeyask GS.

- #31778 was tagged in Gull Lake on September 12, 2017. It was first detected in Stephens Lake on June 25, 2019, and displayed upstream and downstream movements in the lake, indicating that it survived passage past the Keeyask GS (Appendix A2-16). Due to a lack of detections, this fish is now considered missing (described below in Section 4.1.2).
- #31685 was tagged in Gull Lake on September 9, 2017. It was first detected in Stephens Lake on July 21, 2021, and displayed upstream and downstream movements in the lake, indicating that it survived passage past the GS (Appendix A2-3).
- #31780 was tagged in Gull Lake on September 12, 2017. It was first detected in Stephens Lake on August 5, 2021, and displayed upstream and downstream movements in the lake, indicating that it survived passage past the GS (Appendix A2-18).
- #31687 was tagged in Gull Lake on September 9, 2017. It was first detected in Stephens Lake on August 19, 2021, and displayed upstream and downstream movements in the lake, indicating that it survived passage past the GS (Appendix A2-5).

There were 36 juvenile Lake Sturgeon available to be detected upstream of the Keeyask GS at the beginning of the winter 2021/2022 season.

4.1.2 STEPHENS LAKE

Twenty juvenile Lake Sturgeon were tagged in Stephens Lake in September 2017, followed by an additional 20 in September 2021. Since that time, six fish moved downstream out of Stephens Lake through the Kettle GS and into the Long Spruce reservoir. All six fish displayed upstream and downstream movements, indicating they survived passage through the Kettle GS.

- #31689 was last detected in lower Stephens Lake on January 8, 2018 after moving steadily downstream from the upper portion of the lake starting on December 28, 2017. It was first detected in the Long Spruce reservoir on June 18, 2018 (Appendix A3-2).

- #31690 was last detected in Stephens Lake on December 4, 2017 after moving steadily downstream starting on November 26, 2017. It was first detected in the Long Spruce reservoir on June 12, 2018 (Appendix A3-3).
- #31691 moved downstream past the Kettle GS nine days after being tagged in September 2017. It was first detected in the Long Spruce reservoir on September 24, 2017 (Appendix A3-4).
- #31692 was last detected in Stephens Lake on February 22, 2019 and was first detected in the Long Spruce reservoir on May 26, 2019 (Appendix A3-5).
- #31764 was last detected in Stephens Lake on November 28, 2017 at rkm 24.7. It was first detected in the Long Spruce reservoir on November 30, 2017. Due to a lack of detections, this fish is now considered missing (Appendix A3-17).
- #31762 was last detected in Stephens Lake on January 25, 2020 and was detected in the Long Spruce reservoir on August 14, 2020 (Appendix A3-15).

An additional three fish are missing (*i.e.*, have not been detected for more than a year). It is possible that some of these fish moved downstream through the Kettle GS.

- #31693 was last detected in lower Stephens Lake on November 30, 2017 (Appendix A3-6).
- #31761 moved steadily downstream immediately after tagging in upper Stephens Lake on September 13, 2017. It was last detected on September 19, 2017, immediately upstream of the Kettle GS (Appendix A3-14).
- #31778 crossed the Keeyask GS and was first detected in Stephens Lake on May 25, 2019. This fish was then detected the following day moving between rkms 5.2 and 9.4. The only other detection of this fish occurred at rkm 9.4 on July 6, 2019 (Appendix A2-16).

Accounting for the six fish that moved downstream out of Stephens Lake through the Kettle GS, the three that are missing, and the four that moved into Stephens Lake through the Keeyask GS, 35 juveniles were available to be detected in Stephens Lake at the beginning of winter 2021/2022.

4.2 WINTER 2021/2022

4.2.1 UPSTREAM OF THE KEEYASK GS

All nine receivers deployed between Clark Lake and the Keeyask GS during the 2021/2022 winter period were retrieved. Twenty-five of the 36 juvenile Lake Sturgeon (69%) were located a total of 302,452 times (range: 140–67,792 detections per individual). Fish were detected on 3 to 210 days of the 217-day winter period (1–97% of the time) for an average of 72 days, or for 33% of the study period (standard deviation [StDev] = 46 days). The farthest upstream detections occurred at rkm -26.4 (by one fish; 4%). Four fish (#31684, #31775, #48286, and #48299) moved

downstream through the Keeyask GS into Stephens Lake. Not including these fish, the farthest downstream detections occurred in lower Gull Lake at rkm -7.9 (by 13 fish; 52%) and the average movement range was 2.8 rkm (range: 0.0–9.5 rkm) (Figures 3 and 4; Appendix A2-1).

The majority of detections were logged by receivers located in the lower portion of the reservoir, north of Caribou Island at rkm -7.9 (n = 170,651; 57%; Figure 5). Movements were as follows:

- Seven fish (28% 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 -10.1.
- Eight (32%) remained within the lower Gull Lake portion of the reservoir and were detected exclusively at rkm -7.9.
- Five (20%) moved between both upper and lower Gull Lake.
- One (4%) was detected exclusively in the middle Keeyask reservoir at rkm -26.4.

Four (16% of detected fish) moved downstream through the Keeyask GS into Stephens Lake. All four fish displayed upstream and downstream movements in Stephens Lake, indicating they survived passage.

- #31684 was tagged in lower Gull Lake (rkm -9.0) on September 9, 2017. It was consistently detected in this portion of the river until 2020. Following impoundment in fall 2020, it was detected moving farther distances, as far upstream as -24.2 (the middle Keeyask reservoir). It was last detected in the reservoir at rkm -10.1 on October 13, 2021.
 - It was detected in Stephens Lake for a single day on December 29, 2021, between rkm 4.9 and 10.2. But displayed additional upstream and downstream movements during the open-water period (see Section 4.3.2).

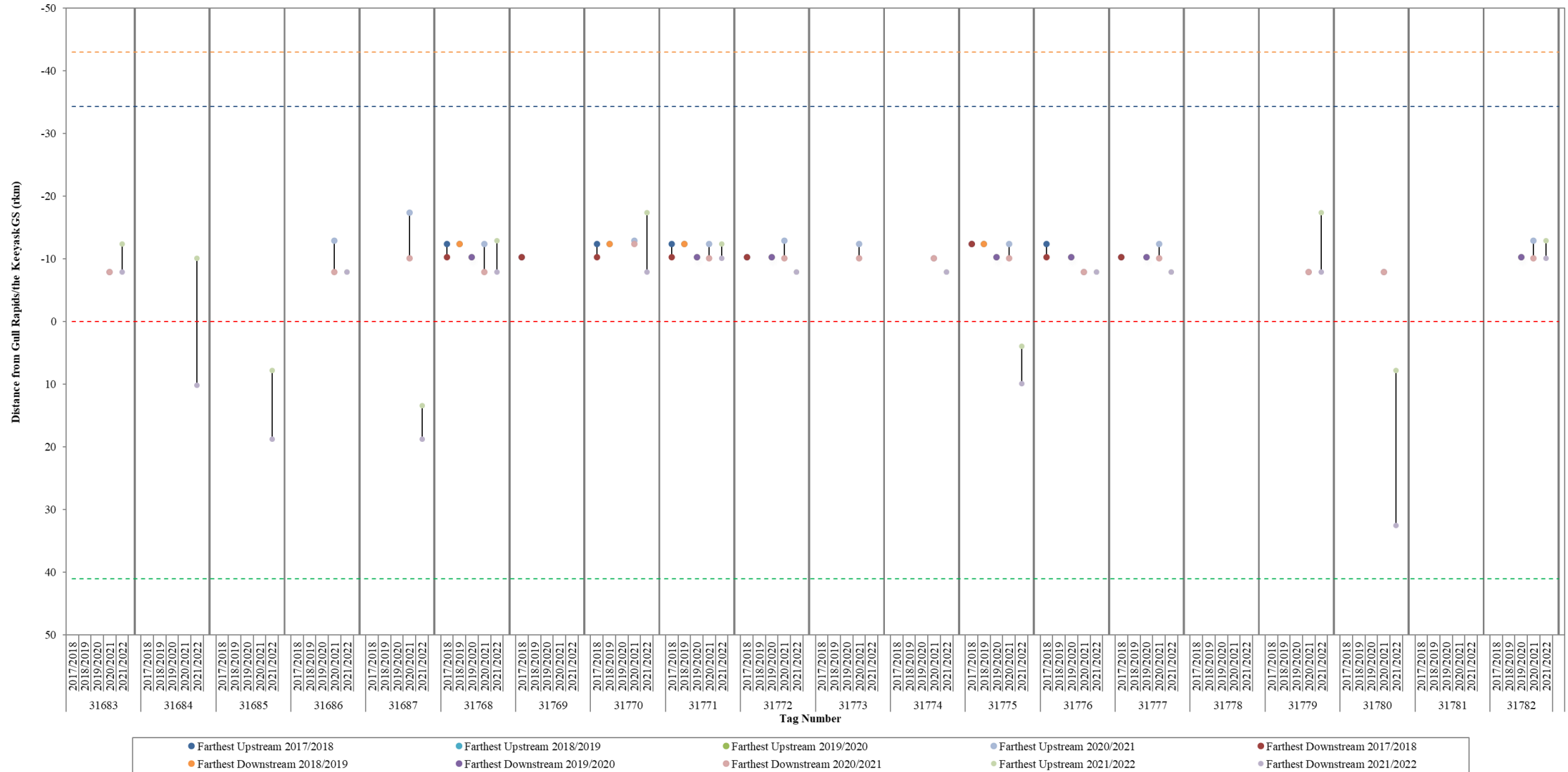


Figure 3: Winter period (2017 to 2022) detection ranges of juvenile Lake Sturgeon acoustic tagged in 2017 upstream of the Keyyask GS. Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keyyask GS; green = Kettle GS).

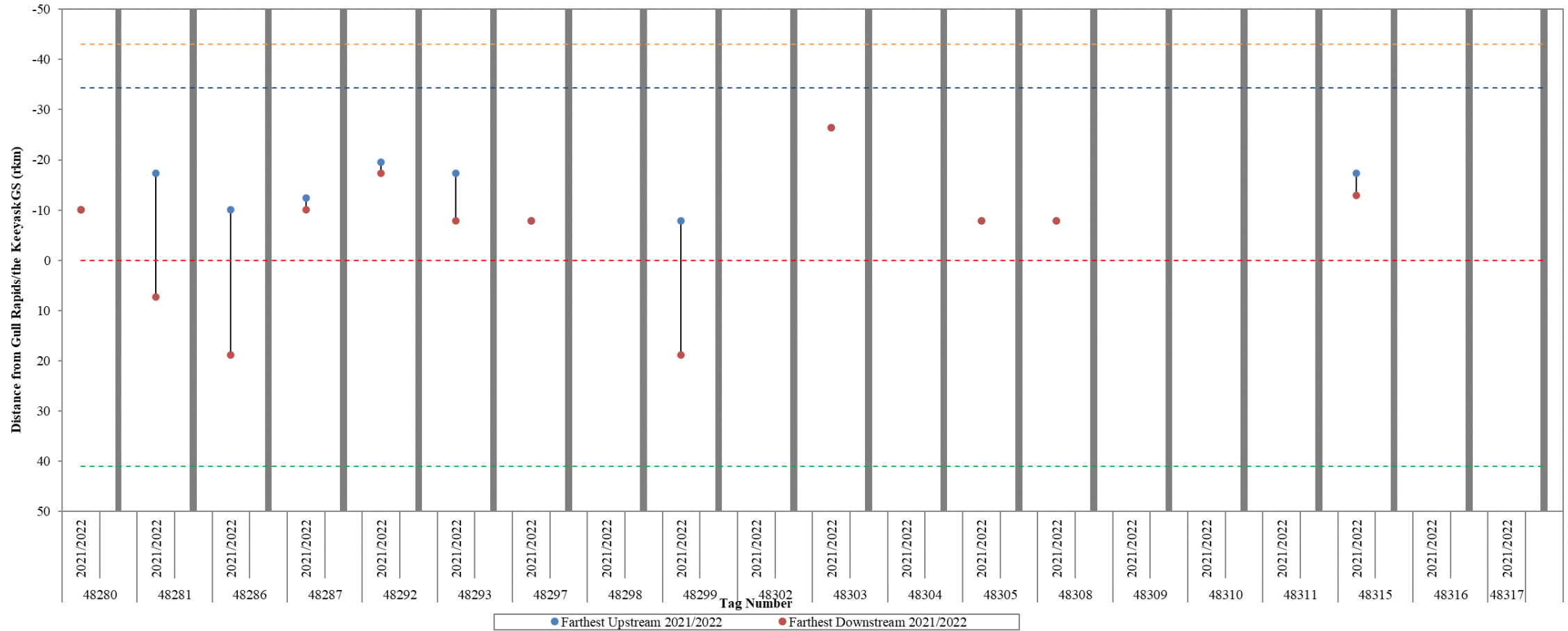


Figure 4: Winter period (2022) detection ranges of juvenile Lake Sturgeon acoustic tagged in 2021 upstream of the Keyyask GS. Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keyyask GS; green = Kettle GS).

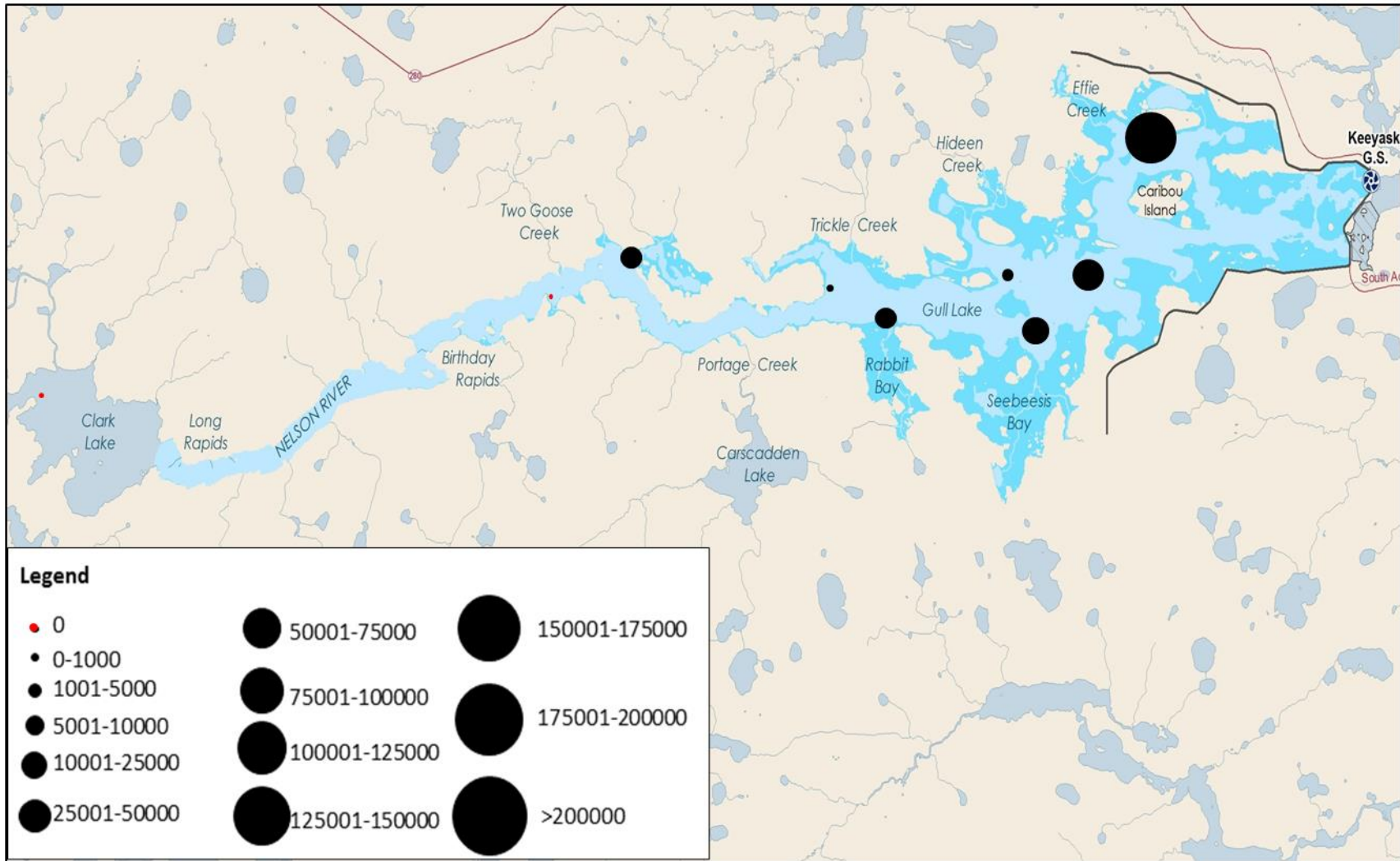


Figure 5: Relative number of detections at each acoustic receiver set between Clark Lake and the Keeyask GS during winter 2021/2022 (October 11, 2021 to May 15, 2022). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.

- #31775 was tagged on September 13, 2017, in Gull Lake (rkm -10.7). It was consistently detected in this portion of the reservoir until 2021. It was then detected moving farther distances, as far upstream as Birthday Rapids. It was last detected in the Keeyask reservoir at rkm -2.2 on September 26, 2021.
 - It was detected in Stephens Lake at rkm 3.9 on January 1, 2022. It moved downstream and remained at rkm 7.5 until the end of the winter period.
- #48286 was tagged in upper Gull Lake (rkm -14.2) on September 20, 2021. It was consistently detected in this portion of the river until December 5.
 - It was first detected in Stephens Lake on January 16, 2022 at rkm 3.9. It moved downstream and was detected between rkm 16.1 and 18.8 for the remainder of the winter period.
- #48299 was tagged in lower Gull Lake (rkm -7.4) on September 20, 2021. It was consistently detected in this portion of the river until December 15.
 - It was first detected in Stephens Lake on January 2, 2022, at rkm 3.9. It then moved downstream and was detected between rkm 16.1 and 18.8 for the remainder of the winter period.

4.2.2 STEPHENS LAKE

All of the 17 receivers deployed in Stephens Lake during the 2021/2022 winter period were retrieved. Twenty-nine of the 35 juvenile Lake Sturgeon (83%) were located a total of 569,212 times (range: 16–96,991 detections per individual) (Appendix A2-1). Fish were detected on one to 212 days of the 217-day winter period (0–98% of the time) for an average of 106 days, or for 49% of the study period (StDev = 67 days). The farthest upstream detections occurred at rkm 3.9 (by 10 fish; 34%). One fish (#48300) moved downstream through the Kettle GS. Not including this fish, the farthest downstream detections occurred at rkm 32.5 (by one fish; 3%) and the total movement range was 6.2 rkm (StDev = 5.8 rkm; range = 0.0–24.7 rkm) (Figures 6 and 7).

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 16.1 (n = 101,372; 18%), 5.4 (n = 98,928; 17%), and 10.2 (n = 83,418; 15%) (Figure 8). Movements were as follows:

- Thirteen fish (46%) remained exclusively in upper Stephens Lake, moving no farther downstream than rkm 10.2.
- Five (18%) moved between upper and lower Stephens Lake and were detected as far upstream as rkm 3.9 and as far downstream as rkm 32.5.
- Ten (36%) remained farther downstream and were detected between rkm 10.2 and 24.9.

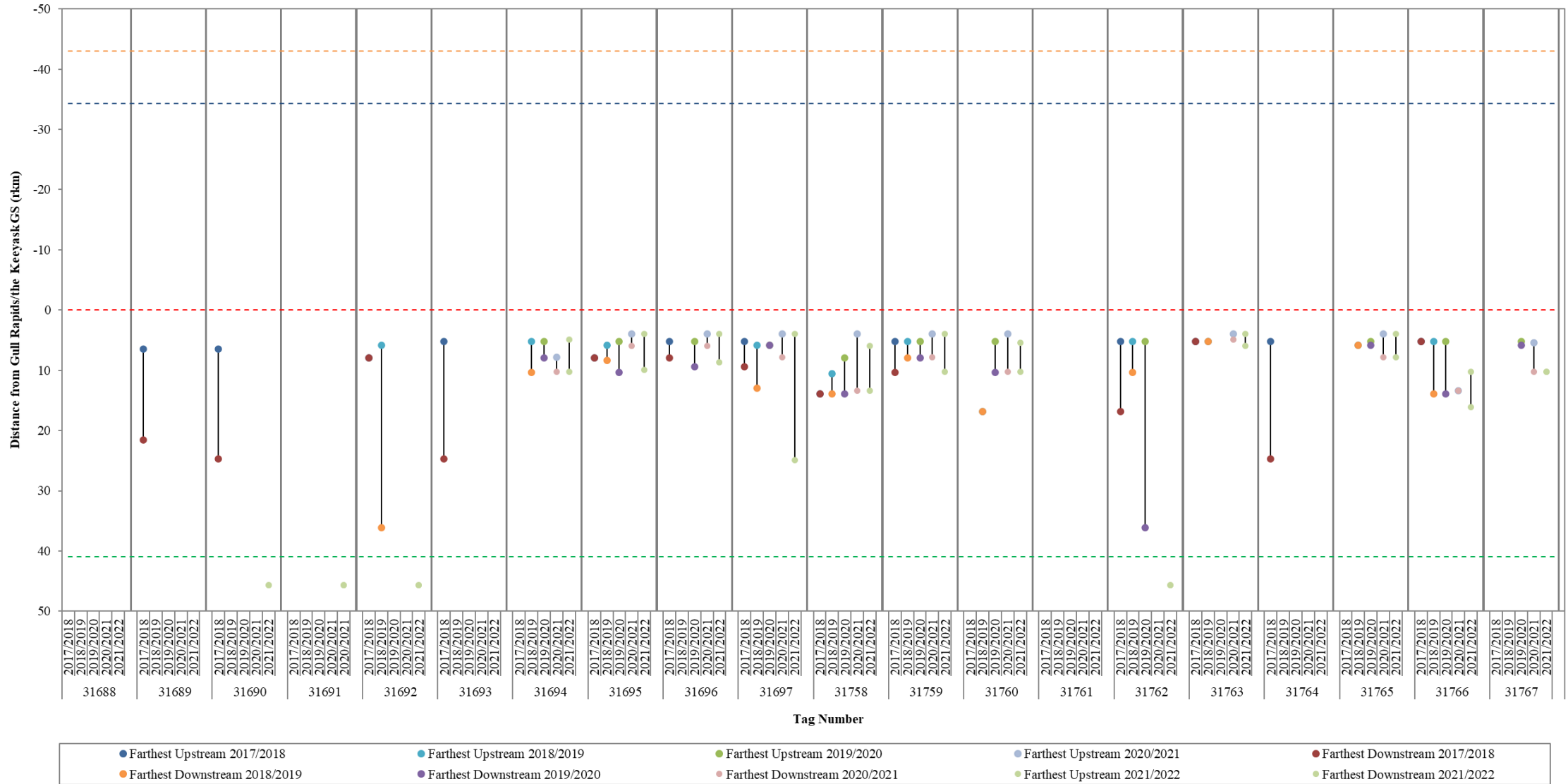


Figure 6: Winter period (2017 to 2022) detection ranges of juvenile Lake Sturgeon acoustic tagged in 2017 in Stephens Lake. Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keyyask GS; green = Kettle GS).

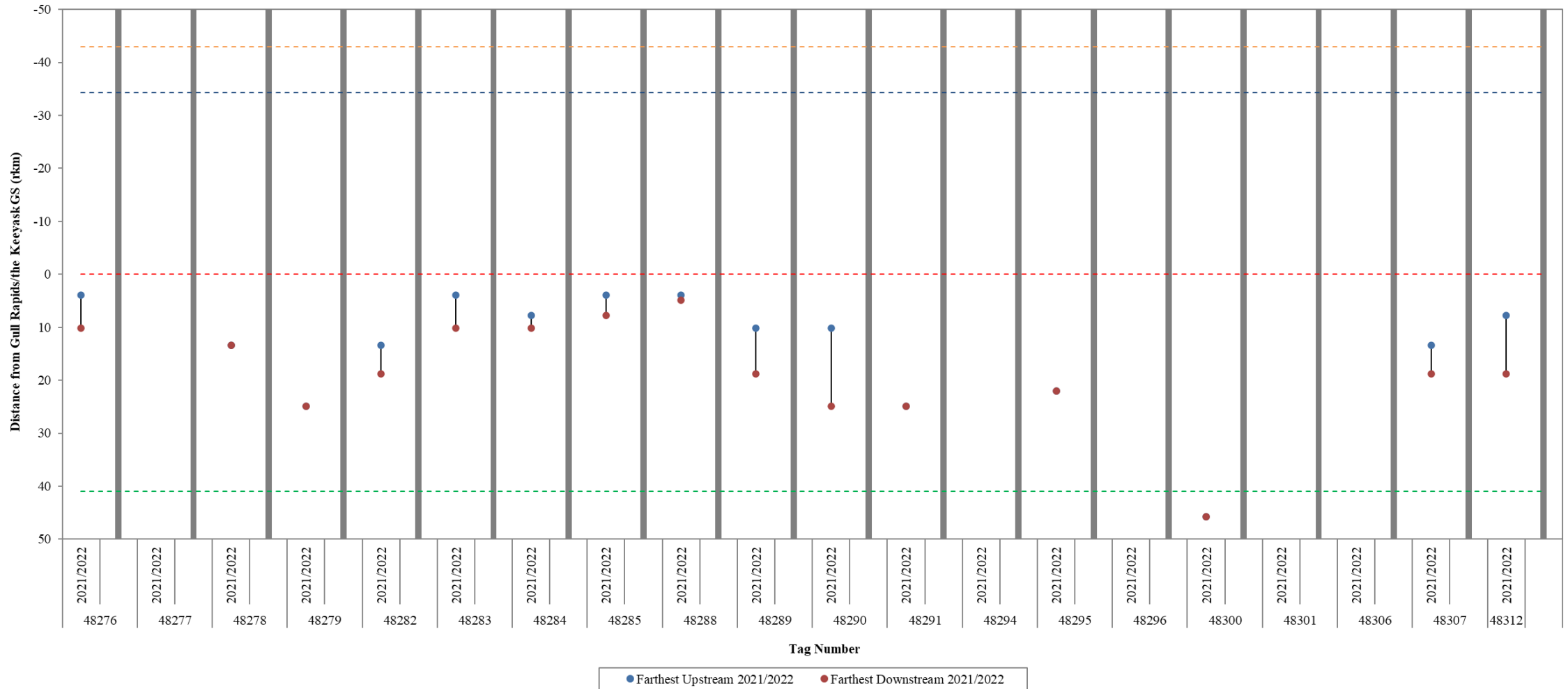


Figure 7: Winter period (2022) detection ranges of juvenile Lake Sturgeon acoustic tagged in 2021 in Stephens Lake. Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keyyask GS; green = Kettle GS).

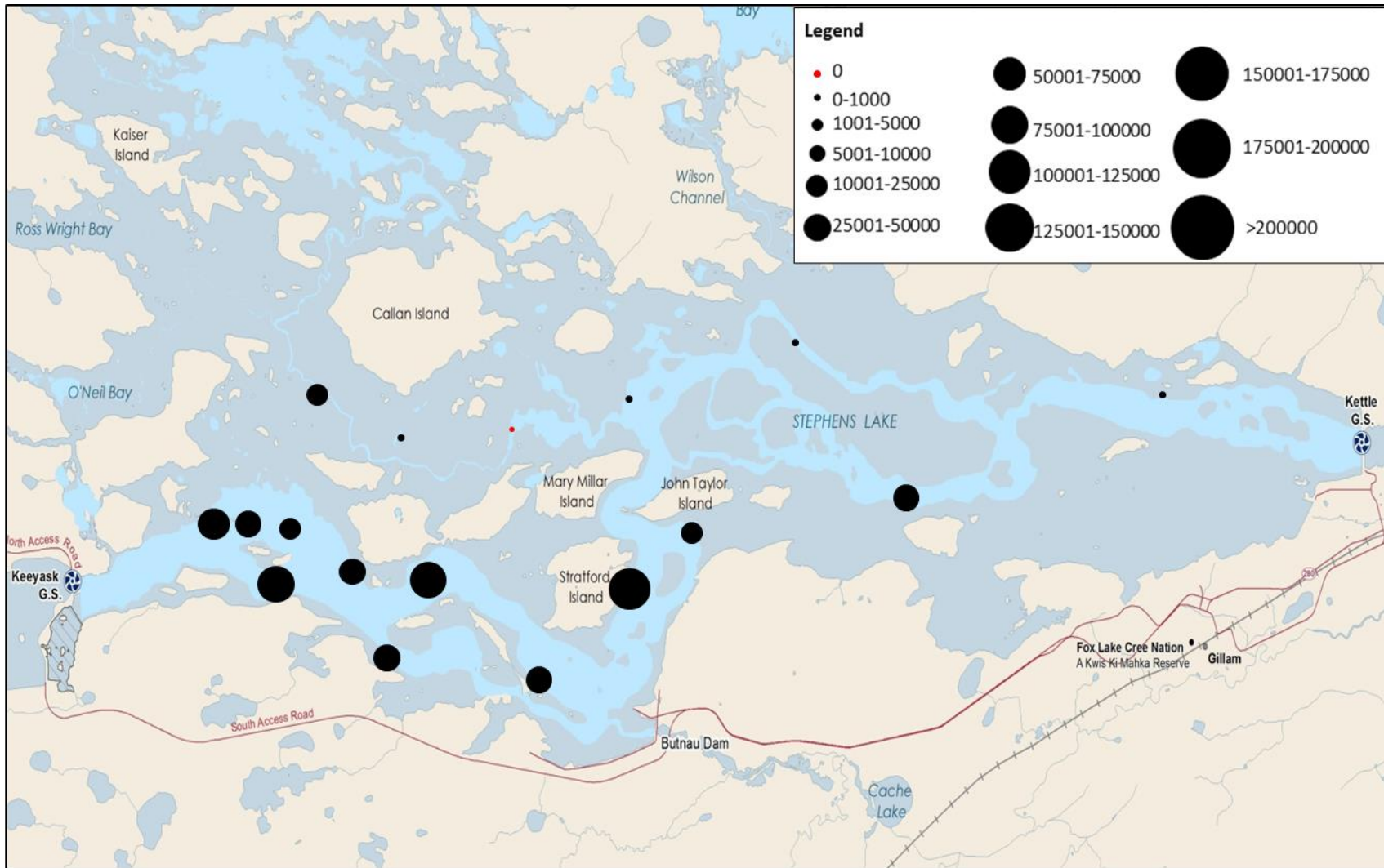


Figure 8: Relative number of detections at each acoustic receiver set in Stephens Lake during winter 2021/2022 (October 11, 2021, to May 15, 2022). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.

One fish (#48300) moved downstream through the Kettle GS.

- It was tagged in upper Stephens Lake (rkm 3.9) on September 16, 2021. It moved downstream through the Kettle GS and was first detected in the Long Spruce reservoir on October 19. It was detected for a single day, and it is unclear if this fish survived passage.

Individual movement graphs can be found in Appendix 2.

4.2.3 LONG SPRUCE RESERVOIR

The one receiver (#127099; rkm 45.7) deployed in the Long Spruce reservoir during the 2021/2022 winter period was retrieved. Prior to winter 2021/2022, six fish had moved downstream through the Kettle GS. Of these, one (#31764) is considered missing and one (#31689) moved downstream through the Long Spruce GS into the Limestone reservoir during open-water 2021.

Four juvenile Lake Sturgeon were located a total of 79,509 times (range: 31–66,771 detections per individual). Fish were detected on 5 to 191 days of the 217-day winter period (2–88% of the time) for an average of 98 days, or 45% of the study period (StDev = 76 days).

4.3 OPEN-WATER 2022

4.3.1 ACOUSTIC RECEIVER RETRIEVAL

All stationary acoustic receivers deployed upstream of the Keeyask GS (n = 32), downstream of the Kettle GS (n = 3), and downstream of the Long Spruce GS (n = 2) during the 2022 open-water period were successfully retrieved (Maps 4–6). One of the 33 receivers deployed in Stephens Lake (#108002; rkm 21.7) went missing part way through the open-water period. No data were retrieved from this receiver after August 19, 2022 (Map 6).

4.3.2 UPSTREAM OF THE KEEYASK GS

Prior to open-water 2022, four fish moved downstream through the Keeyask GS (#31684, #31775, #48286, and #48299) (discussed in Section 4.2.1). Accounting for these four fish, 32 juvenile Lake Sturgeon were available to be detected upstream of the Keeyask GS at the beginning of the 2022 open-water period.

Thirty-one of the 32 (97%) juvenile Lake Sturgeon available for detection upstream of the Keeyask GS were located during the 2022 open-water period. Thirteen of these fish (42%) were tagged in 2017, and their transmitters expired one month into the open-water period, between June 14 and 22. These fish were detected between 26 and 5,656 times on four to 29 days (average = 21 days, StDev = 7 days). Fish tagged in 2021 were detected between 4,898 and 25,652 times on 39 to

122 days of the 149-day open-water period (26–82%) (average = 89 days [60%], StDev = 26 days).

Three fish (#31777, #48298, and #48304) moved downstream through the Keeyask GS into Stephens Lake. Not including these fish, the farthest downstream detections occurred in lower Gull Lake at rkm -0.3 (by one fish; 3%) and the average movement range was 5.4 rkm (range: 0.0–18.0 rkm) (Figures 9 and 10). The majority of detections were logged the middle Keeyask reservoir (Zone 3) at rkm -26.4 (n = 66,427; 28%) (Figure 11).

The one fish not detected (#31781) was tagged in Gull Lake (rkm -9.3) on September 12, 2017. It was regularly detected moving within lower Gull Lake until June 30, 2021, when it was last detected at rkm -3.8. This tag was set to expire in June 2022 but it is possible that this tag expired early.

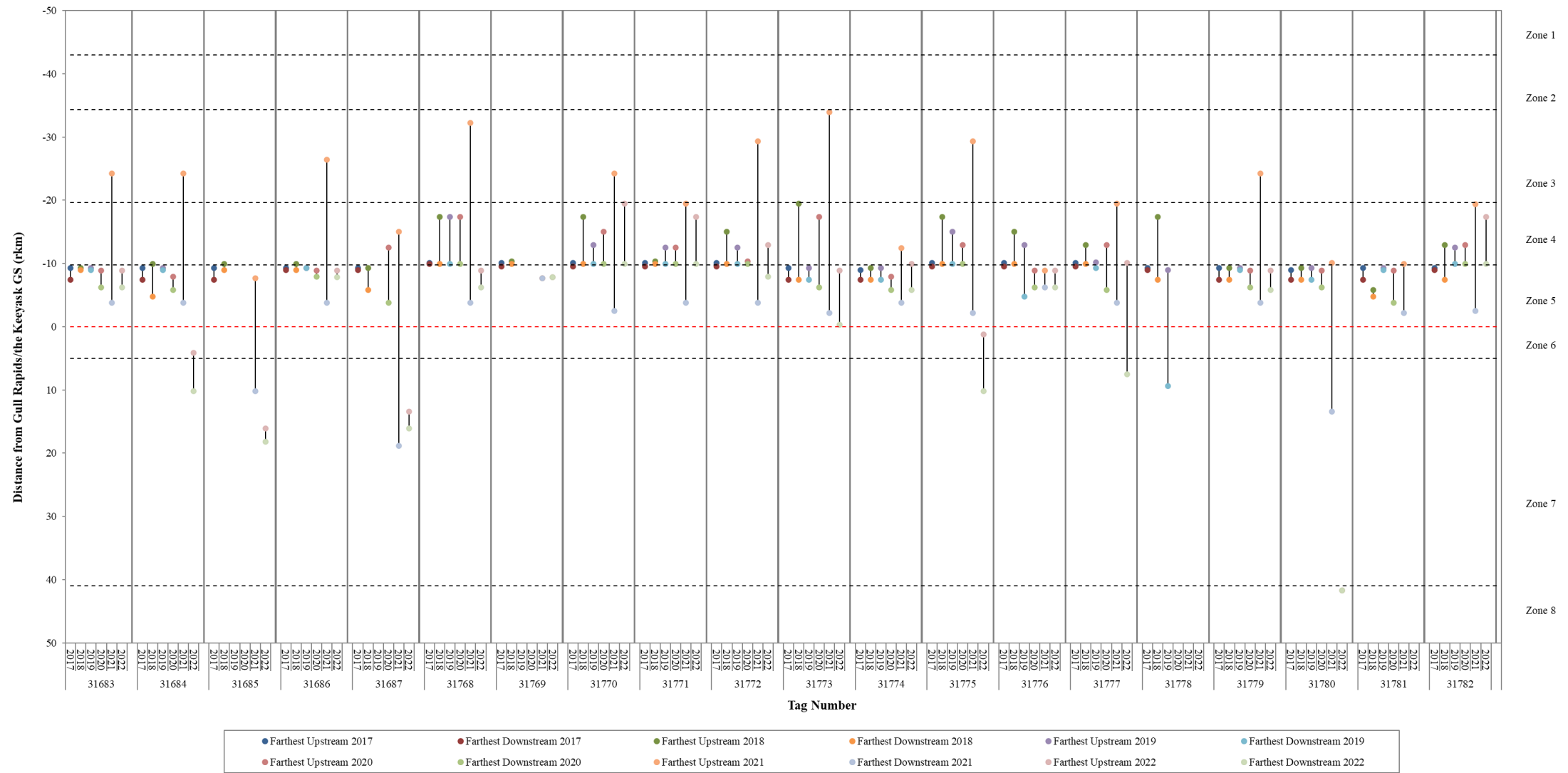


Figure 9: Detection ranges for individual juvenile Lake Sturgeon tagged in 2017 with acoustic transmitters upstream of the Keyyask GS during the open-water period (2017–2022). Horizontal dotted lines demarcate zones with the red line representing the Keyyask GS.

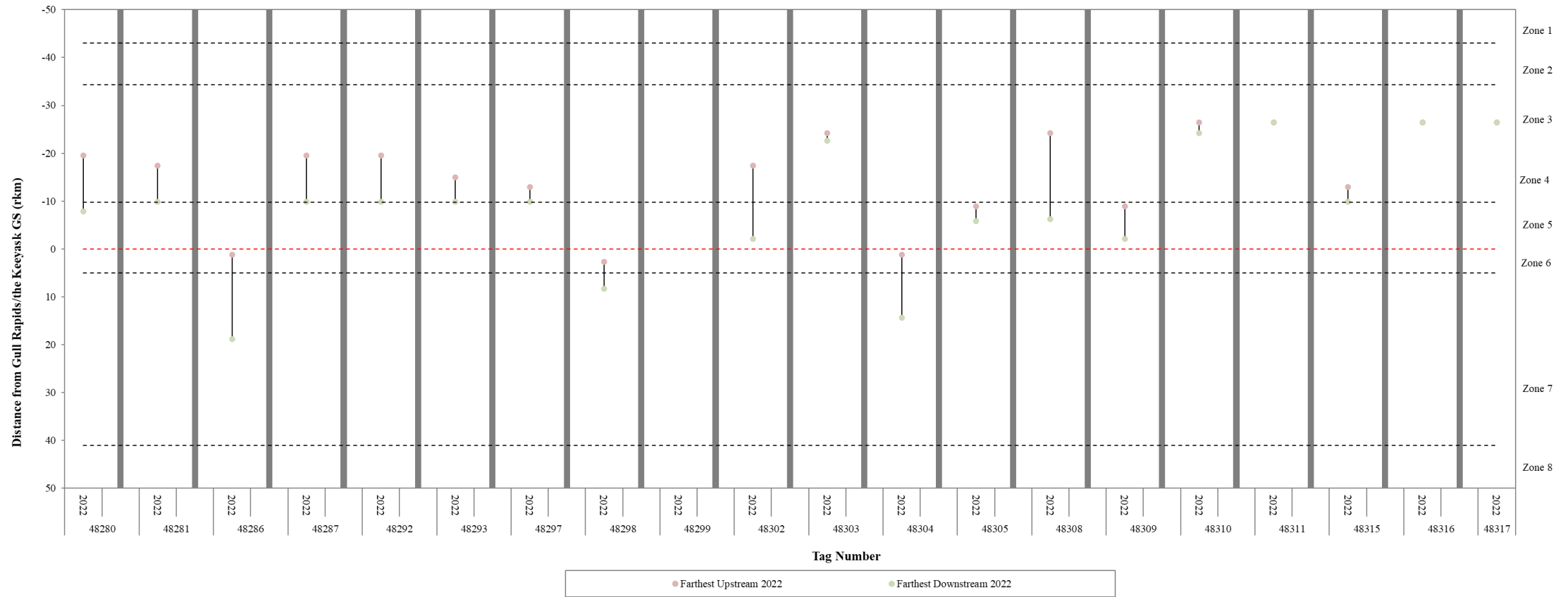


Figure 10: Detection ranges for individual juvenile Lake Sturgeon tagged in 2021 with acoustic transmitters upstream of the Keyask GS during the 2022 open-water period. Horizontal dotted lines demarcate zones with the red line representing the Keyask GS.

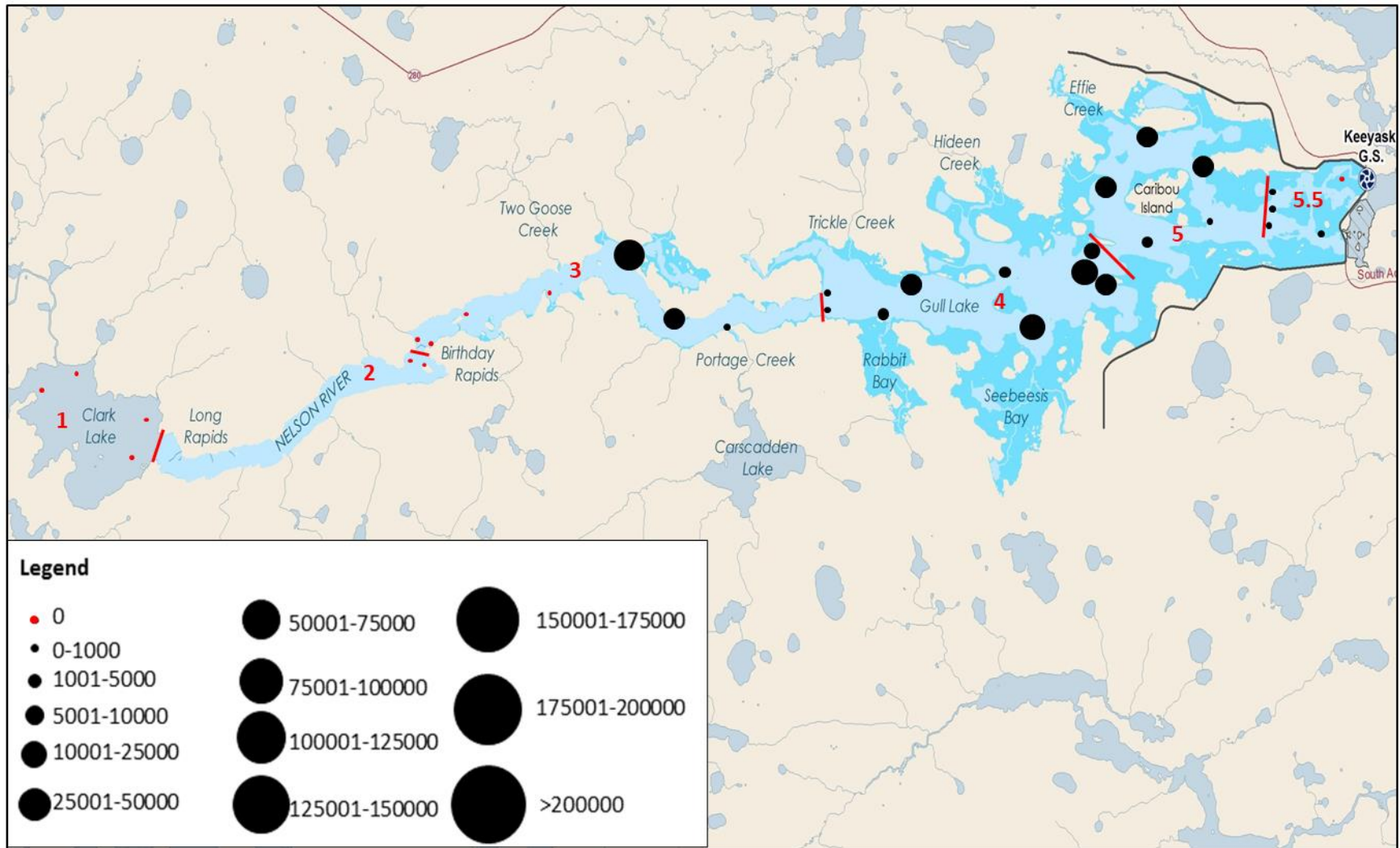


Figure 11: Relative number of detections at each acoustic receiver set in the Nelson River between Clark Lake and the Keeyask GS during the 2022 open-water period (May 16 to October 10). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into five "zones" based on placement of receiver "gates."

4.3.2.1 PROPORTIONAL DISTRIBUTION

Transmitters applied in 2017 expired early in the 2022 open-water period, so proportional distributions were calculated separately for fish tagged in 2017 and 2021. Juvenile Lake Sturgeon tagged in 2017 and remaining upstream of the GS spent more time in the downstream portion of the reservoir than in previous years. Fish spent an average of 64% of the study period in Zone 5 (lower basin of Gull Lake) and 32% in Zone 4 (upper basin of Gull Lake) (Table 3; Figure 11). The remaining time (3.7%) was spent immediately upstream of the GS in Zone 5.5.

Not including the three fish that moved downstream through the Keeyask GS, juvenile Lake Sturgeon tagged in 2021 spent more time farther upstream, spending an average of 32% of the open-water period in the middle Keeyask reservoir (Zone 3) and 53% of the period in the upper basin of Gull Lake (Zone 4).

Table 3: 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), and 2022 (May 16 to October 10) open-water periods.

Year Tagged	Study Year	Upstream of the Keeyask GS ¹						Stephens Lake		
		1	2	3	4	5	5.5	6.5	6	7
2013	2014	0.0	0.0	0.0	63.4	36.6	-	-	42.1	57.9
	2015	0.0	0.0	1.9	44.6	53.4	-	-	51.0	49.0
	2016	0.0	0.0	0.0	73.2	26.8	-	-	46.7	53.2
	2017	0.0	0.0	0.0	77.8	22.2	-	-	42.7	57.3
2017	2018	0.0	0.0	0.0	48.8	51.2	-	-	46.6	53.4
	2019	0.0	0.0	0.0	44.8	55.2	-	-	40.7	59.3
	2020	0.0	0.0	0.0	44.7	55.3	-	-	46.5	53.5
	2021	0.0	0.0	0.7	38.5	60.7	-	-	30.4	69.6
	2022	0.0	0.0	0.0	32.1	64.1	3.7	0.9	12.7	86.4
2021	2022	0.0	0.0	31.6	53.1	14.5	0.8	1.5	35.1	63.3

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.

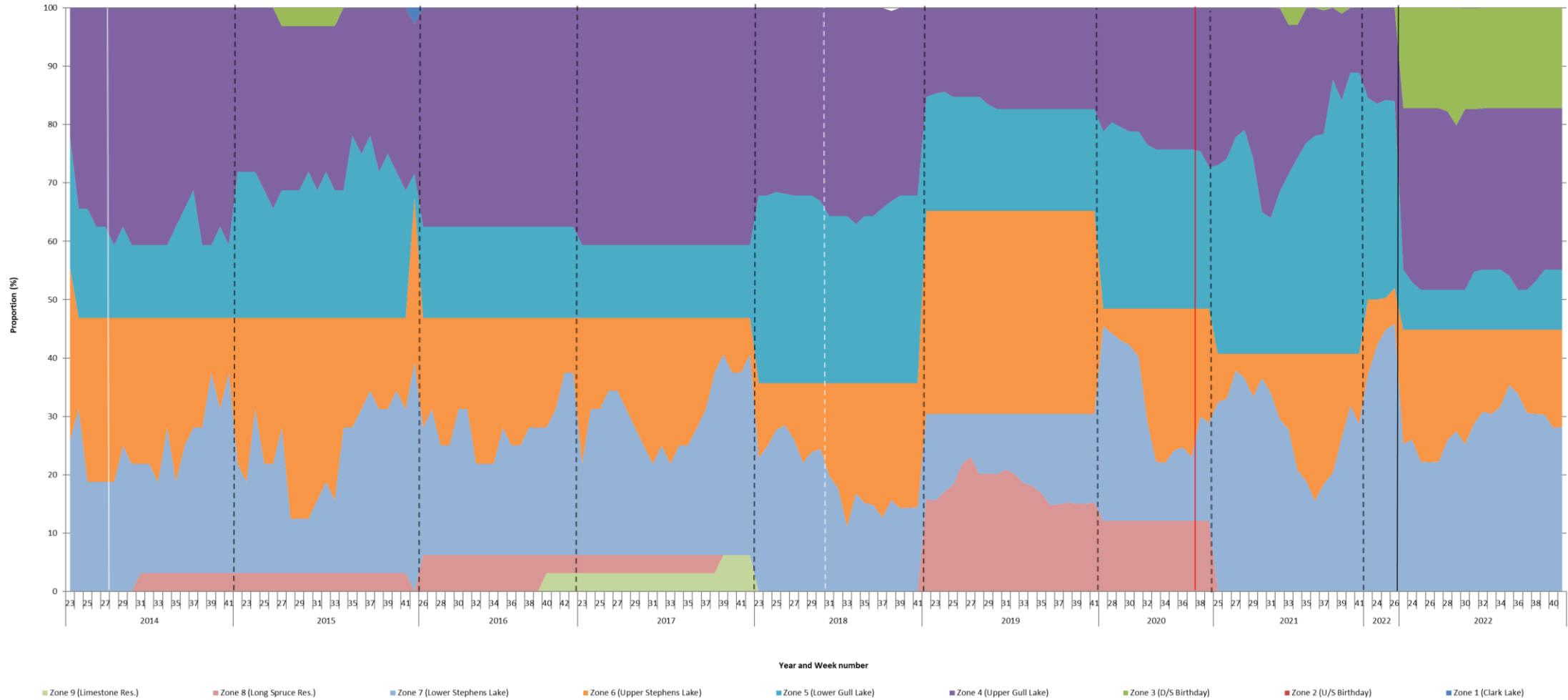


Figure 12: Proportional distribution by zone, for juvenile Lake Sturgeon tagged with acoustic transmitters in 2013, 2017, and 2021 in the Keyyask GS Area during a portion of the 2013 2014 (June 4 to October 3), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16) 2018 (June 6 to October 10), 2019 (June 2 to October 7), 2020 (July 3 to September 23), 2021 (May 1 to October 10) and 2022 (May 16 to October 10) open-water periods. Black dashed lines indicate study years. Solid white line indicates start of Keyyask construction. Dashed white line indicates spillway commissioning. Solid red line indicated beginning of the operation period.



4.3.2.2 MOVEMENT PATTERNS

Of the 31 fish detected, 22 remained within Gull Lake for the entire open-water period.

- Nine were detected only in the lower portion (Zone 5) moving no farther upstream than rkm -8.9.
- Nine were detected only in the upper portion (Zone 4), as far upstream as rkm -19.5 and as far downstream as rkm -9.9.
- Four (#31772, #31774, #48280, and #48302) moved between both zones.

Five fish (#48303, #48310, #48311, #48316, and #48317) remained in the middle Keeyask reservoir (Zone 3). All five fish were tagged in 2021 in this portion of the reservoir.

One fish (#48308) moved extensively within the reservoir, as far upstream as the middle Keeyask reservoir (rkm -26.4) and as far downstream as rkm -6.4 in lower Gull Lake.

Three fish (10% of all detected) moved downstream through the Keeyask GS into Stephens Lake. All three fish moved extensively within Stephens Lake, indicating they survived passage.

- #31777 was located within Gull Lake between rkms -10.1 and -7.8 until mid-June 2022. It then moved downstream and was last detected in the reservoir at rkm -2.1 on June 16.
 - It was first detected in Stephens Lake on June 17 at rkm 1.2. It was last detected in northern Stephens Lake at rkm 7.5 on June 21.
- #48298 was tagged in Gull Lake 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. It moved between rkm 4.6 and 8.3 for the remainder of the open-water period.
- #48304 was tagged in Gull Lake on September 20, 2021 and was detected here until October 7. It was next detected in Stephens Lake at rkm 1.2 on May 27, 2022. It moved between rkm 1.2 and 14.4 for the remainder of the open-water period.

All movements out of the Keeyask reservoir since 2013 are outlined in Table 4 and Figure 13.

Table 4: Number and proportion of tagged juvenile Lake Sturgeon that have moved downstream through 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 Site									Kettle GS								
	Total Movements ¹			Tagging Stress/Mortality ²			Adjusted Movements ³			Total Movements			Tagging Stress/mortality			Adjusted Movements		
	Total Fish	Total Move	% ³	# Fish Tagged	Total Move	% ⁴	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

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.

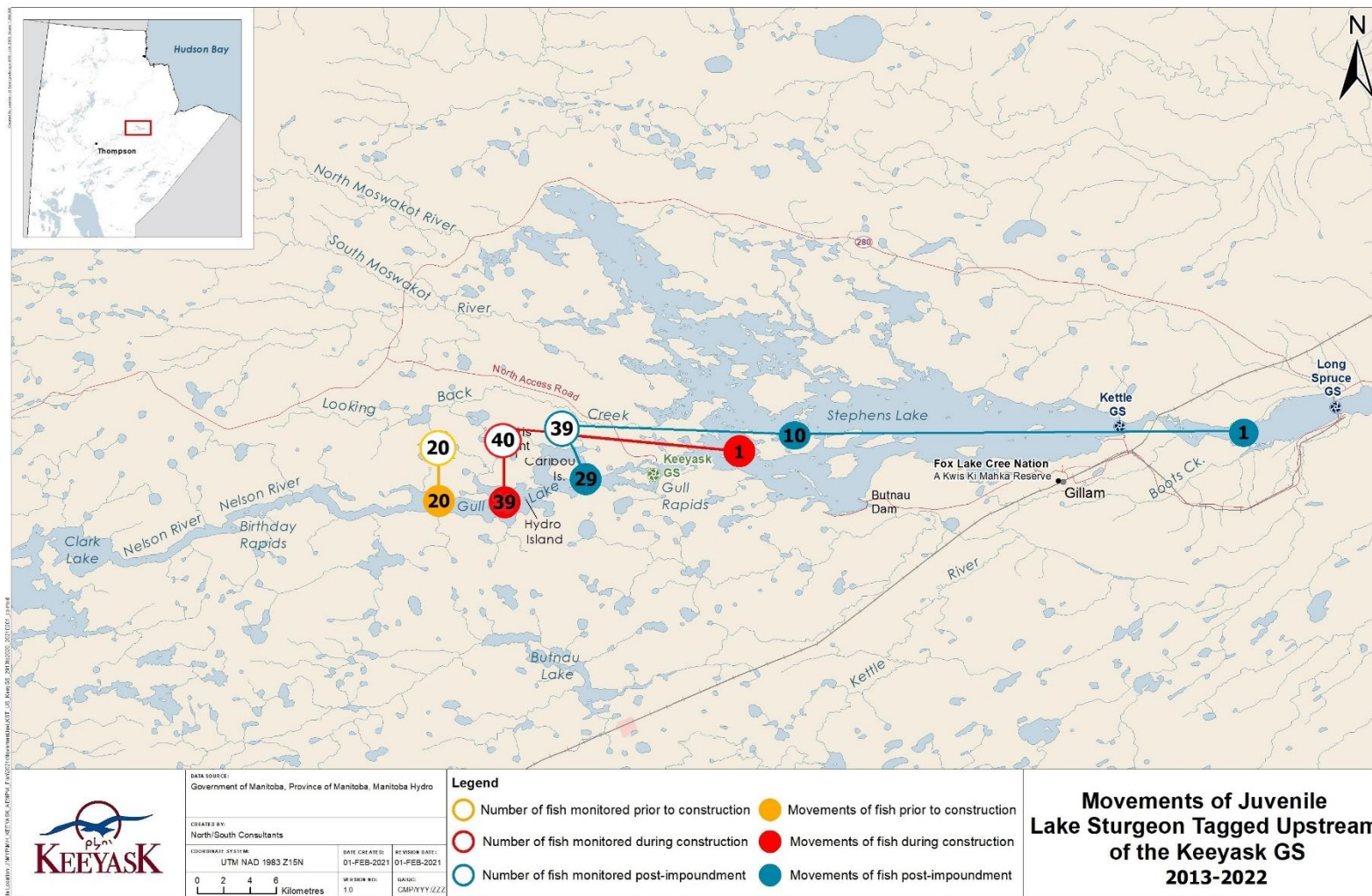


Figure 13: Map showing how many juvenile Lake Sturgeon moved upstream out of the Keeyask reservoir, stayed in the Keeyask reservoir, moved into Stephens Lake, and moved downstream through the Kettle GS before construction (yellow), during construction (red) and after reservoir impoundment (blue). Movements 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

One fish (#48300) moved downstream through the Kettle GS during winter 2021/2022 (described in Section 4.2.3) while four moved downstream through the Keeyask GS (described in section 4.2.1). Therefore, 38 fish were available to be detected in Stephens Lake during open-water 2022.

Twenty-seven of the 38 (71%) juvenile Lake Sturgeon available for detection were located during the 2022 open-water period. Thirteen of these fish were tagged in 2017, and their transmitters expired one month into the open-water period, from June 16 to 19. These fish were detected between 425 and 6,968 times on nine to 36 days (average = 26 days, StDev = 8 days). Fish tagged in 2021 were detected between 3,073 and 54,740 times on 17 to 140 days (11–94%) (average = 106 days [71%], StDev = 34 days) of the 149-day open-water period.

The average total movement range for all fish was 7.5 rkm (StDev = 4.6 rkm; range: 0.8–17.6 rkm per individual). Five fish (19% of detected fish) were detected as far upstream as rkm 1.2, and one (4%) was detected as far downstream as rkm 24.9 (Figures 14 and 15). The majority of detections were logged in upper Stephens Lake between rkms 2.4 and 4.6 (n = 182,480; 61%) (Figure 16).

All three fish that moved downstream through the Keeyask GS during the open-water period of 2021 were detected. Two were exclusively detected in the southern portion of Stephens Lake (#31685 and #31687), while the other (#31780) continued travelling downstream and was detected in the Long Spruce reservoir (see Section 4.3.4).

Of the 11 fish that were not detected:

- Seven 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.
- Three have remained near the Keeyask GS in upper Stephens Lake since being tagged in in 2017.
 - Two regularly moved within upper Stephens Lake travelling no further downstream than rkm 13.4.
 - #31697 moved further downstream and was last detected at rkm 24.9 on March 22 (see Section 4.2.2).
 - #31765 moved as far downstream as rkm 18.8 in July 2021, and subsequently moved upstream and was last detected at rkm 3.9 on February 2, 2022.
 - One (#31688) has consistently been detected at rkm 1.2 and was last located here on June 2, 2021.
- One (#48299) was tagged in Gull Lake in 2021 and passed through the Keeyask GS during winter 2021/2022. It was last detected in February 2022 at rkm 18.8 (see Section 4.2.1).

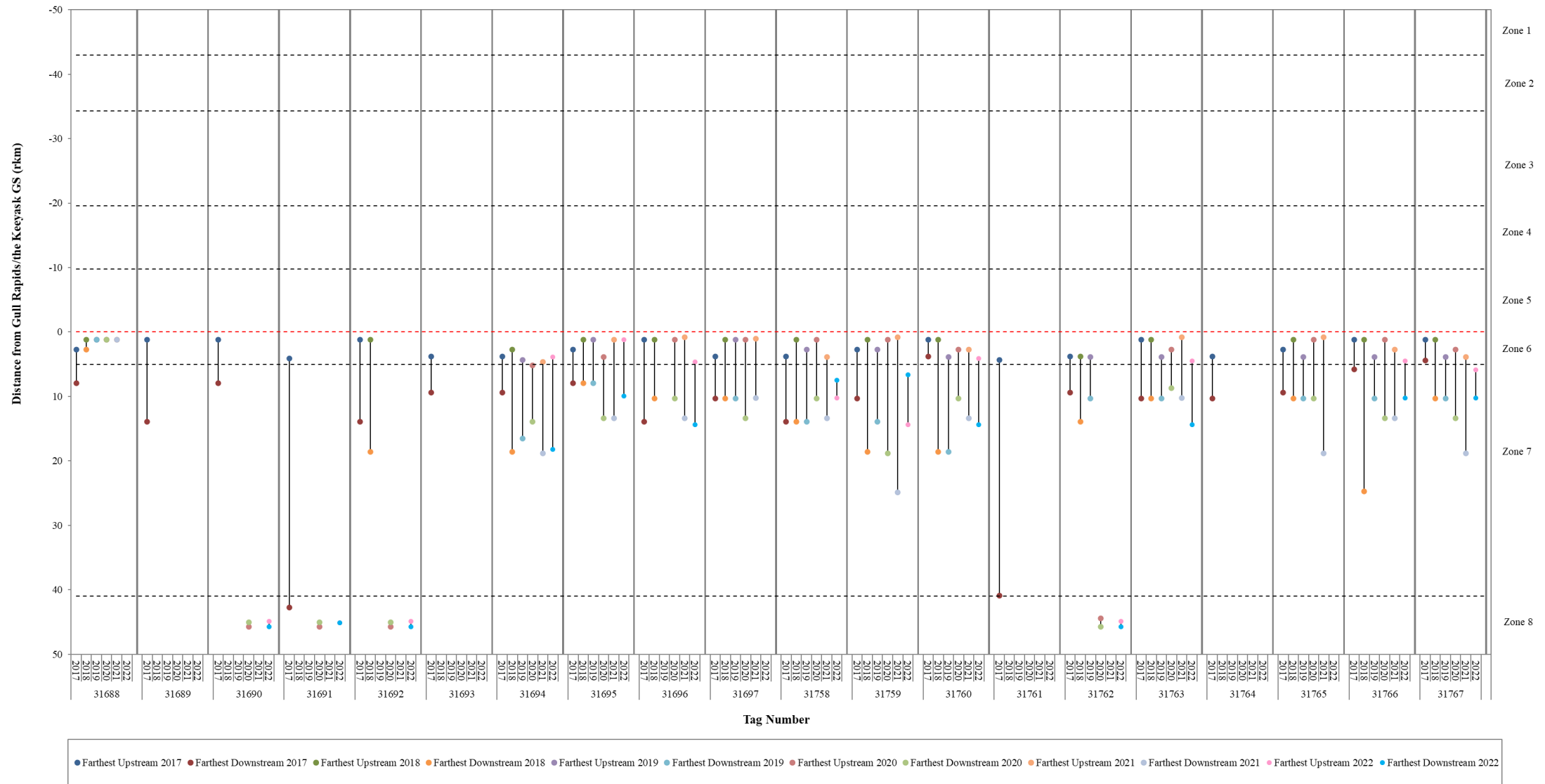


Figure 14: Detection ranges for acoustic tagged juvenile Lake Sturgeon tagged in 2017 in Stephens Lake during the open-water period (2017–2022). Horizontal dotted lines demarcate zones with the red line representing the Keyyask GS.



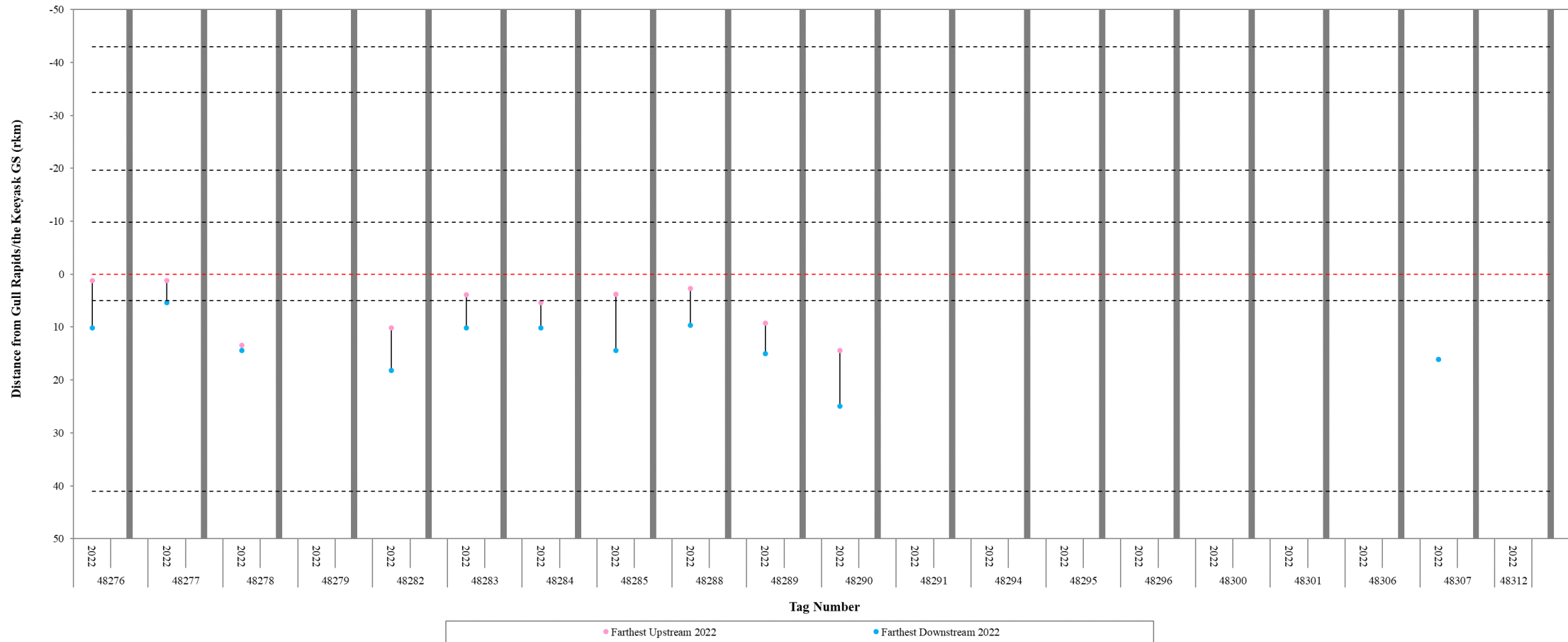


Figure 15: Detection ranges for acoustic tagged juvenile Lake Sturgeon tagged in 2021 in Stephens Lake during the 2022 open-water period. Horizontal dotted lines demarcate zones with the red line representing the Keeyask GS.

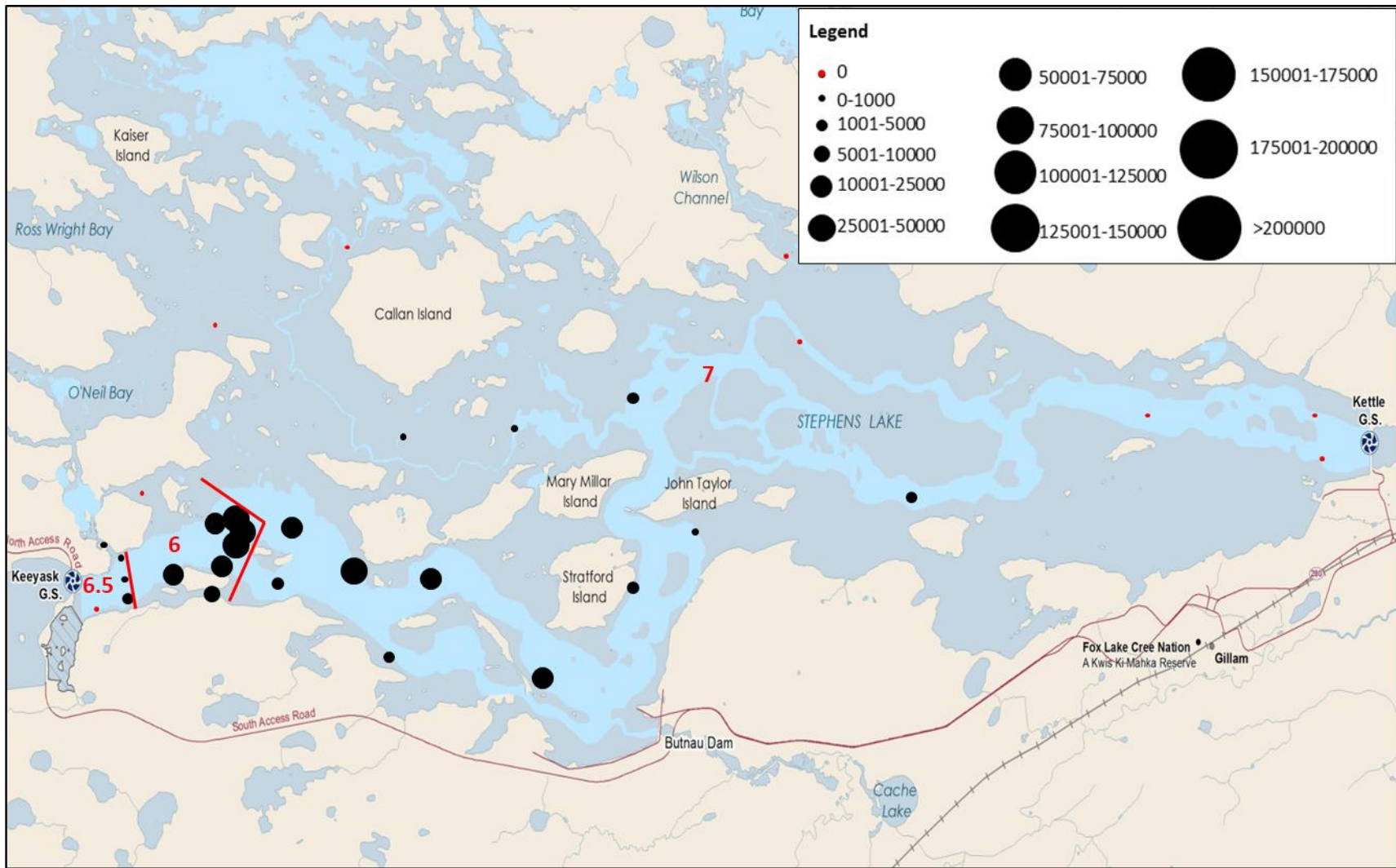


Figure 16: Relative number of detections at each acoustic receiver set in Stephens Lake during the 2022 open-water period (May 16 to October 10). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into three "zones" based on placement of receiver "gates."

4.3.3.1 PROPORTIONAL DISTRIBUTION

Transmitters applied in 2017 expired early in the 2022 open-water period, so proportional distributions were calculated separately for fish tagged in 2017 and 2021. Juvenile Lake Sturgeon tagged in 2017 spent more time in the zone farthest from the GS in 2022 than in all previous years. These fish spent an average of 13% of the study period in Zone 6 (closer to the GS) and 86% in Zone 7 (farthest from the GS). The remaining time (0.9%) was spent immediately downstream of the GS in Zone 6.5 (Table 3).

The same is true for fish tagged in 2021. These fish spent an average of 63% of the study period in Zone 7 (farther from the GS) and 35% in Zone 6 (closer to the GS) (Table 3). The remaining time (1.5%) was spent immediately upstream of the GS in Zone 6.5.

4.3.3.2 MOVEMENT PATTERNS

Of the 27 fish detected during the open-water period, 12 remained in upper Stephens Lake moving no farther downstream than rkm 10.2.

- One (#31695) moved briefly into the northern portion of Stephens Lake and was detected at receiver #127095 (rkm 7.5).

Six fish remained exclusively in lower Stephens Lake, moving as far upstream as rkm 9.3 and as far downstream as rkm 24.9.

- Two were detected in northern Stephens Lake; #48289 between rkms 9.3 and 15.0, and #48282 briefly at receiver #127105 (rkm 15.0).

Seven fish moved between upper and lower Stephens Lake and were detected as far upstream as rkm 1.2 and as far downstream as rkm 18.8.

Two fish moved downstream through the Kettle GS.

- #31780 was tagged in Gull Lake on September 12, 2017. It was first detected in Stephens Lake on August 5, 2021, and displayed upstream and downstream movements in the lake, indicating that it survived passage past the Keeyask GS.
 - It was last detected in Stephens Lake at rkm 32.5 on February 14, 2022.
 - It was detected from June 8 to 18 downstream of the Kettle GS. No upstream movements were observed, and it is unclear whether it survived passage through the 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 from May 31 to the end of the study period on October 10. It made multiple upstream and downstream movements indicating it survived passage through the GS.

All movements out of Stephens Lake since 2013 are outlined in Table 4 and Figure 17.

4.3.4 LONG SPRUCE RESERVOIR

Five fish were available to be detected in the Long Spruce reservoir in open-water 2022. Four of these fish (80%) were located during the 2022 open-water period. All four fish were tagged in 2017, and their acoustic transmitters expired during the 2022 open-water period. Fish were detected 12,546 times on one to 34 days. One fish (17%) was detected as far upstream as rkm 41.7, and five (83%) were detected as far as rkm 45.7 downstream. Most detections occurred near the mouth of the Kettle River at rkm 44.9 (n = 24,415; 64%). Four fish (#31690, #31692, #31762) moved between rkms 44.9 and 45.7 and one (#31691) was detected exclusively at rkm 45.7.

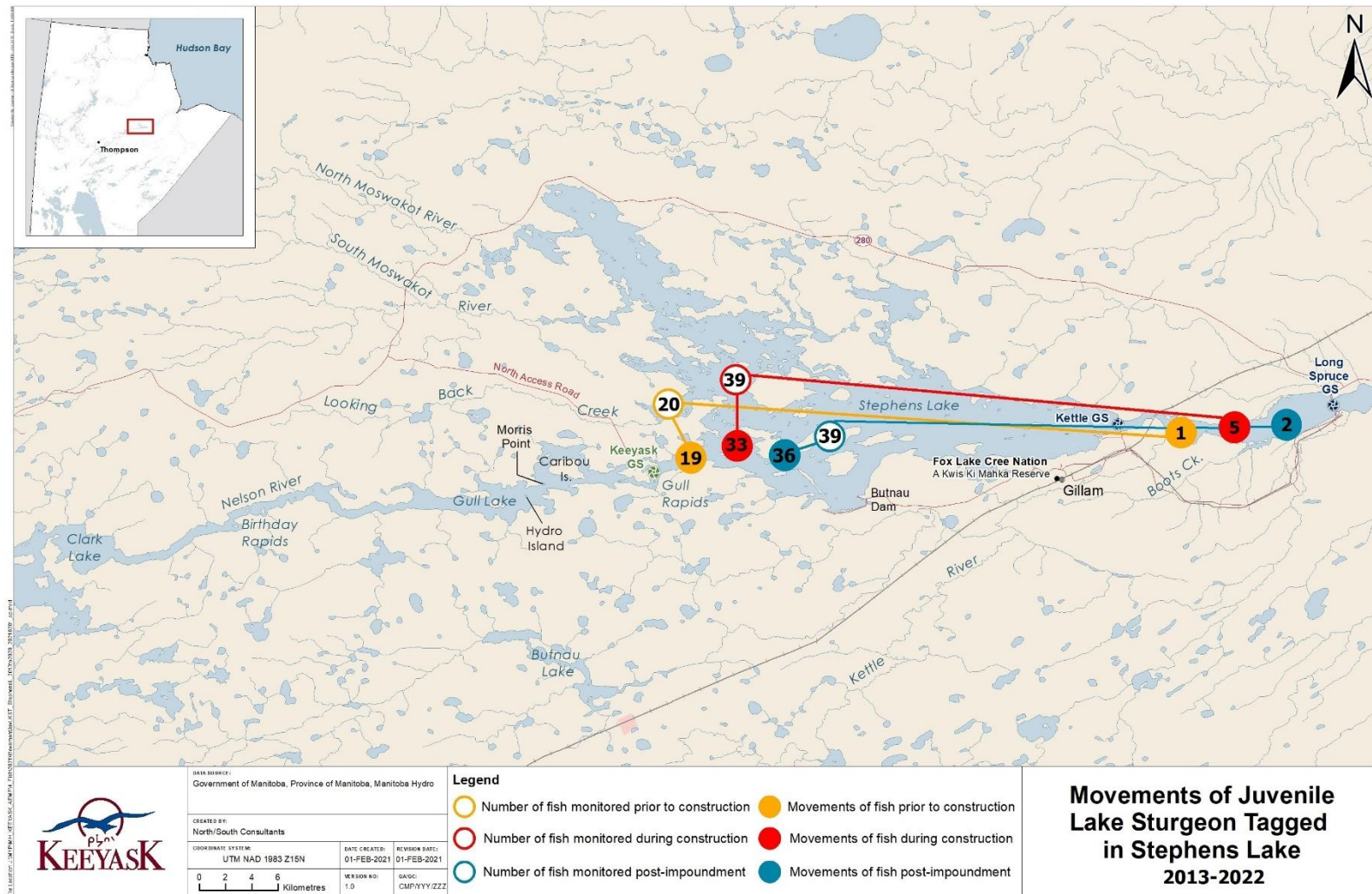


Figure 17: Map showing how many juvenile Lake Sturgeon stayed in Stephens Lake and moved downstream through the Kettle GS before construction (yellow), during construction (red), and after reservoir impoundment (blue). Movements of fish due to tagging stress or mortality were not included. Numbers of 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 would alter 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

The movement patterns and habitat use of juvenile Lake Sturgeon make them an ideal species and life stage to study using acoustic telemetry. 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. Excluding the fish whose transmitters expired early in the open-water period, fish tagged upstream of the Keeyask GS were detected, on average, on 60% of the days during the 2022 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 71% of the days during the 2022 open-water period (46–78% in previous years). Further, 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

Commissioning of the Keeyask GS was completed in March 2022, when all powerhouse units became operational. Therefore, 2022 represents the first year of monitoring during the operation period. 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 ranged from 2.6 rkm (in 2019) to 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 Lake Sturgeon moved downstream through the Keeyask GS spillway

in 2019. Other than these movements, prior to impoundment (2013 to 2020), all the tagged fish remained in Gull Lake where they were initially captured and tagged.

During the initial years of Project operation, the EIS predicted 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 began to move 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 have moved downstream through 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) sometime between fall 2021 and open-water 2022.

During open-water 2022, however, juvenile movements appear to have returned to the pattern observed prior to impoundment. No juveniles moved downstream past the Keeyask GS after June 2022 and the overall movement range decreased to 5.4 rkm, similar to the range observed prior to impoundment. Continued monitoring data will provide an understanding of how juvenile Lake Sturgeon move in the post-impoundment environment, whether movements out of the Keeyask reservoir will continue, or if those movements were atypical and occurred as a response to impoundment.

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). Since 2014, average open-water movement ranges have been between 9.3 rkm (in 2020) and 12.1 rkm (in 2021). Three juvenile Lake Sturgeon moved downstream through the Kettle GS since impoundment in September 2020, one in winter 2021/2022 and two during the open-water period in 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 through the Kettle GS between 2014 and 2020, including three in 2017. Continued monitoring will determine the extent to which juveniles move downstream out of Stephens Lake.

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 through the Keeyask GS may lead to 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.

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)?

Not including the fish that moved downstream through the Keeyask GS, juvenile Lake Sturgeon tagged in 2017 continued to spend the majority of time in Gull Lake (Zones 4 and 5). During the construction period (2014–2020), fish spent 45–78% of each open-water study period in Zone 4 and 22–55% of each open-water period in Zone 5. In the two years since reservoir impoundment, fish spent 32–39% of the time in Zone 4 and 61–68% of the time in Zone 5.

Fish tagged in the Keeyask reservoir in 2021 spent an average of 32% of the 2022 open-water period in the middle Keeyask reservoir (Zone 3) and 53% of the period in upper Gull Lake (Zone 4). These data are not directly comparable to data collected from the Lake Sturgeon tagged in 2017 due to different tagging locations.

In Stephens Lake, fish continued to spend a greater proportion of the open-water periods farther downstream from the GS than in previous years. During the construction period, fish spent 49–59% of the time in the zone farther from the Keeyask GS (Zone 7). Fish spent 70% of time in Zone 7 in the first year following impoundment (2021) and 63% of the time in Zone 7 the first year following completion of the Keeyask GS (2022).

6.0 SUMMARY AND CONCLUSIONS

- Juveniles (n = 40) implanted with acoustic transmitters in 2017 were tracked for the fifth and final year, as these tags expired one month into the 2022 open-water period. The original 40 transmitters implanted in 2013 are no longer active. The additional 40 acoustic transmitters applied in fall 2021 were tracked for a full year.
- 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 has increased during the two years following reservoir impoundment. In total, ten fish (25% of all tagged fish) have moved downstream through the Keeyask GS into Stephens Lake since impoundment of the reservoir. Three (33% of all detected fish) moved downstream in open-water 2021, four (16%) in winter 2021/2022, and three (10%) between fall 2021 and open-water 2022. This represents a substantial increase compared with pre-impoundment data (2014–2020) when only one of 40 tagged juveniles moved downstream through the Keeyask GS over a six-year period (2014–2020). No downstream movements were observed after June 2022.

The movement range observed for juvenile Lake Sturgeon tagged in Stephens Lake has changed little since the study began, ranging from 9.3 rkm (in 2020) to 12.1 rkm (in 2021). Three Lake Sturgeon moved downstream through the Kettle GS since impoundment in September 2020, one in winter 2021/2022 and two during the open-water period in 2022. This does not represent a substantial increase over pre-impoundment years. Prior to impoundment, six tagged juveniles moved downstream through the Kettle GS between 2014 and 2020, including three in 2017. Continued monitoring will determine the extent to which juveniles move downstream out of Stephens Lake.

- *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.

- *Will there be a statistically significant 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)?*

Not including the fish that moved downstream through the Keeyask GS, juvenile Lake Sturgeon tagged in 2017 continued to spend more time in the lower portion of the reservoir (Zone 5) than in previous years. In contrast, fish tagged in the Keeyask reservoir in 2021 spent more time in the middle Keeyask reservoir (Zone 3) and upper Gull Lake (Zone 4). These data are not directly comparable to data collected from the Lake Sturgeon tagged in 2017 due to different tagging locations.

In Stephens Lake, fish continued to spend a greater proportion of the open-water periods farther downstream from the GS than in previous years. During the construction period, fish spent 49–59% of the time in the zone farther from the Keeyask GS (Zone 7). Fish spent 70% of time in Zone 7 in the first year following impoundment (2021) and 63% of the time in Zone 7 the first year following completion of the Keeyask GS (2022).

- An array of acoustic receivers was deployed at the end of the open-water period in 2022 to continue monitoring movements.
- Following the 2022 open-water period, 16 active tags remain in the Keeyask reservoir and 26 in Stephens Lake. Additional tags will be applied in fall 2023 to increase the number of fish tracked in the reservoir and to continue to monitor fish movements through the operation period.
- During the initial years of Project operation, the EIS predicted 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 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 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. 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 through the Keeyask GS may lead to 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. However, in 2022, juvenile movements appear to have returned to the pattern observed prior to impoundment. No juveniles moved downstream past the Keeyask GS after June 2022 and the overall movement range decreased to 5.4 rkm, similar to the range observed prior to impoundment.

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APPENDICES

APPENDIX 1: DETECTION SUMMARIES FOR JUVENILE LAKE STURGEON TAGGED AND MONITORED BETWEEN 2014 AND 2022

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 40 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored upstream of the Keeyask GS during the 2017/2018 (October 17, 2017 to April 30, 2018), 2018/2019 (October 11, 2018 to April 30, 2019), 2019/2020 (October 8, 2019 to April 30, 2020), 2020/2021 (September 24, 2020 to April 30, 2021), and 2021/2022 (October 11, 2021 to May 15, 2022) winter periods.....	55
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 40 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored in Stephens Lake during the 2017/2018 (October 17, 2017 to April 30, 2018), 2018/2019 (October 11, 2018 to April 30, 2019), 2019/2020 (October 8, 2019 to April 30, 2020), 2020/2021 (September 24, 2020 to April 30, 2021), and 2021/2022 (October 11, 2021 to May 15, 2022) winter periods.....	56
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 40 juvenile Lake Sturgeon tagged and monitored upstream of Keeyask GS during the open-water 2017 (May 1 to October 16), 2018 (May 1 to October 10), 2019 (May 1 to October 7), 2020 (1 May to September 23), 2021 (1 May to October 10), and 2022 (May 16 to October 10) periods.	57
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 10) periods.	58

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 40 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored upstream of the Keeyask GS during the 2017/2018 (October 17, 2017 to April 30, 2018), 2018/2019 (October 11, 2018 to April 30, 2019), 2019/2020 (October 8, 2019 to April 30, 2020), 2020/2021 (September 24, 2020 to April 30, 2021), and 2021/2022 (October 11, 2021 to May 15, 2022) winter periods. Tag ID highlighted purple = moved downstream through Keeyask GS.

Tag ID	Date tagged	2017/2018					2018/2019					2019/2020					2020/2021					2021/2022				
		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)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
31683	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1021	94	-7.9	-7.9	0.0	5949	44	-12.4	-7.9	4.5	
31684	9-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	140	3	-10.1	10.2	20.3	
31685	9-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17805	119	7.8	18.8	11.0	
31686	9-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6162	43	-12.9	-7.9	5.0	4470	56	-7.9	-7.9	0.0	
31687	9-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10789	128	-17.4	-10.1	7.3	1611	74	13.4	18.8	5.4	
31768	14-Sep-17	5506	35	-12.4	-10.3	2.1	2	1	-12.4	-12.4	0.0	4882	35	-10.3	-10.3	0.0	39654	201	-12.4	-7.9	4.5	494	33	-12.9	-7.9	5.0
31769	14-Sep-17	37229	117	-10.3	-10.3	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
31770	14-Sep-17	7414	54	-12.4	-10.3	2.1	17898	76	-12.4	-12.4	0.0	-	-	-	-	-	18725	206	-12.9	-12.4	0.5	12765	88	-17.4	-7.9	9.5
31771	14-Sep-17	14272	61	-12.4	-10.3	2.1	33	12	-12.4	-12.4	0.0	3357	38	-10.3	-10.3	0.0	247	12	-12.4	-10.1	2.3	164	5	-12.4	-10.1	2.3
31772	15-Sep-17	34442	111	-10.3	-10.3	0.0	-	-	-	-	-	42031	149	-10.3	-10.3	0.0	36405	156	-12.9	-10.1	2.8	14768	81	-7.9	-7.9	0.0
31773	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5095	154	-12.4	-10.1	2.3	-	-	-	-	-	
31774	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	3	-10.1	-10.1	0.0	4566	65	-7.9	-7.9	0.0	
31775	13-Sep-17	1045	29	-12.4	-12.4	0.0	17883	97	-12.4	-12.4	0.0	74	10	-10.3	-10.3	0.0	23015	199	-12.4	-10.1	2.3	7774	65	3.9	9.9	6.0
31776	13-Sep-17	108	22	-12.4	-10.3	2.1	-	-	-	-	-	20667	104	-10.3	-10.3	0.0	46555	213	-7.9	-7.9	0.0	67792	210	-7.9	-7.9	0.0
31777	13-Sep-17	30754	98	-10.3	-10.3	0.0	-	-	-	-	-	4336	53	-10.3	-10.3	0.0	14328	151	-12.4	-10.1	2.3	1152	38	-7.9	-7.9	0.0
31778	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
31779	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45391	216	-7.9	-7.9	0.0	37289	156	-17.4	-7.9	9.5	
31780	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46997	212	-7.9	-7.9	0.0	2296	55	7.8	32.5	24.7	
31781	12-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
31782	12-Sep-17	-	-	-	-	-	-	-	-	-	-	17203	114	-10.3	-10.3	0.0	5968	147	-12.9	-10.1	2.8	10217	89	-12.9	-10.1	2.8
48280	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1196	33	-10.1	-10.1	0	
48281	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30675	119	-17.4	-10.1	7.3	
48286	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14749	61	-10.1	18.8	28.9	
48287	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27419	120	-12.4	-10.1	2.3	
48292	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7370	101	-19.5	-17.4	2.1	
48293	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7770	69	-17.4	-7.9	9.5	
48297	18-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12404	48	-7.9	-7.9	0	
48298	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48299	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4601	64	-7.9	18.8	26.7	
48302	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48303	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17440	49	-26.4	-26.4	0	
48304	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48305	20-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9398	64	-7.9	-7.9	0	
48308	18-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6521	86	-7.9	-7.9	0	
48309	18-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48310	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48311	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48315	18-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3143	34	-17.4	-12.9	4.5	
48316	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48317	19-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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 40 juvenile Lake Sturgeon implanted with acoustic transmitters and monitored in Stephens Lake during the 2017/2018 (October 17, 2017 to April 30, 2018), 2018/2019 (October 11, 2018 to April 30, 2019), 2019/2020 (October 8, 2019 to April 30, 2020), 2020/2021 (September 24, 2020 to April 30, 2021), and 2021/2022 (October 11, 2021 to May 15, 2022) winter periods. Tag ID highlighted yellow = lost tags. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	2017/2018					2018/2019					2019/2020					2020/2021					2021/2022				
		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)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)	n	# Days	Farthest U/S (rkm)	Farthest D/S (rkm)	Range (rkm)
31688	16-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31689	15-Sep-17	1301	12	6.5	21.6	15.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31690	14-Sep-17	1303	6	6.5	24.7	18.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7474	107	45.7	45.7	0	0
31691	14-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	5	45.7	45.7	0	0
31692	14-Sep-17	9	3	7.9	7.9	0.0	1338	29	5.8	36.1	30.3	-	-	-	-	-	-	-	-	-	5233	87	45.7	45.7	0	0
31693	13-Sep-17	1726	30	5.2	24.7	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31694	14-Sep-17	-	-	-	-	-	51477	165	5.2	10.3	5.1	5278	82	5.2	7.9	2.7	39657	164	7.8	10.2	2.4	14217	125	4.9	10.2	5.3
31695	15-Sep-17	7	2	7.9	7.9	0.0	5887	78	5.8	8.4	2.6	29347	163	5.2	10.3	5.1	18559	80	3.9	5.9	2.0	9175	75	3.9	9.9	6.0
31696	15-Sep-17	25955	133	5.2	7.9	2.7	-	-	-	-	-	33261	130	5.2	9.4	4.2	17029	72	3.9	5.9	2.0	31065	193	3.9	8.7	4.8
31697	16-Sep-17	65106	187	5.2	9.4	4.2	9831	99	5.8	13	7.2	1248	29	5.8	5.8	0.0	66054	219	3.9	7.8	3.9	32580	140	3.9	24.9	21.0
31758	16-Sep-17	35901	171	13.9	13.9	0.0	1260	40	10.6	13.9	3.3	62576	189	7.9	13.9	6.0	63903	205	3.9	13.4	9.5	34562	188	5.9	13.4	7.5
31759	14-Sep-17	7747	100	5.2	10.3	5.1	16397	130	5.2	7.9	2.7	26340	190	5.2	7.9	2.7	19791	106	3.9	7.8	3.9	53541	187	3.9	10.2	6.3
31760	14-Sep-17	-	-	-	-	-	101	8	16.8	16.8	0.0	5791	91	5.2	10.3	5.1	26595	198	3.9	10.2	6.3	32478	176	5.4	10.2	4.8
31761	13-Sep-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31762	15-Sep-17	3135	70	5.2	16.8	11.6	29754	140	5.2	10.3	5.1	9616	59	5.2	36.1	30.9	-	-	-	-	-	66771	191	45.7	45.7	0.0
31763	15-Sep-17	2604	24	5.2	5.2	0.0	32	2	5.2	5.2	0.0	-	-	-	-	-	16798	114	3.9	4.9	1.0	117	4	3.9	5.9	2.0
31764	14-Sep-17	3526	32	5.2	24.7	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31765	16-Sep-17	-	-	-	-	-	53	5	5.8	5.8	0.0	71	10	5.2	5.8	0.6	29008	185	3.9	7.8	3.9	10066	64	3.9	7.8	3.9
31766	14-Sep-17	22	1	5.2	5.2	0.0	15271	88	5.2	13.9	8.7	35373	131	5.2	13.9	8.7	3657	48	13.4	13.4	0.0	9249	133	10.2	16.1	5.9
31767	15-Sep-17	-	-	-	-	-	-	-	-	-	-	479	28	5.2	5.8	0.6	35733	175	5.4	10.2	4.8	5579	145	10.2	10.2	0.0
48276	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38925	164	3.9	10.2	6.3	6.3
48277	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48278	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18927	129	13.4	13.4	0	0
48279	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	128	1	24.9	24.9	0	0
48282	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5928	59	13.4	18.8	5.4	5.4
48283	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14948	142	3.9	10.2	6.3	6.3
48284	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5158	79	7.8	10.2	2.4	2.4
48285	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63052	212	3.9	7.8	3.9	3.9
48288	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14883	69	3.9	4.9	1	1
48289	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6213	75	10.2	18.8	8.6	8.6
48290	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47973	144	10.2	24.9	14.7	14.7
48291	17-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	2	24.9	24.9	0	0
48294	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48295	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	1	22	22	0	0
48296	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48300	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	110	1	45.7	45.7	0	0
48301	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48306	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48307	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96991	210	13.4	18.8	5.4	5.4
48312	16-Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1613	9	7.8	18.8	11	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 40 juvenile Lake Sturgeon tagged and monitored upstream of Keeyask GS during the open-water 2017 (May 1 to October 16), 2018 (May 1 to October 10), 2019 (May 1 to October 7), 2020 (1 May to September 23), 2021 (1 May to October 10), and 2022 (May 16 to October 10) periods. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	Tag Location	2017			2018			2019			2020			# Potential Detection Days	2021					2022				
			n	# Days	Range (rkm)	n	# Days	Range (rkm)	n	# Days	Range (rkm)	n	# Days	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)
31683	12-Sep-17	-	4718	33	1.9	31943	133	0.3	40792	136	0.3	11757	79	2.7	-	22634	137	-24.2	-3.8	-161.2	3660	23	-8.9	-6.2	2.7
31684	9-Sep-17	-	5706	34	1.9	36007	109	5.1	28126	125	0.3	540	5	2.1	-	8079	106	-24.2	-3.8	-130.2	3096	22	4.1	10.2	6.1
31685	9-Sep-17	-	12846	35	1.9	4022	38	0.9	-	-	-	-	-	-	22618	102	-7.7	10.2	-109.7	1636	19	16.1	18.2	2.1	
31686	9-Sep-17	-	9918	34	0.3	40702	107	0.9	38228	128	0.0	4237	63	1.0	-	5698	97	-26.4	-3.8	-123.4	3779	21	-8.9	-7.8	1.1
31687	9-Sep-17	-	9880	32	0.3	10221	49	3.5	-	-	-	3429	47	8.7	-	13063	71	-15.0	18.8	-86.0	425	9	13.4	16.1	2.7
31768	14-Sep-17	-	1050	14	0.2	27068	130	7.5	31550	120	7.5	14996	70	7.5	-	7543	122	-32.2	-3.8	-154.2	3582	23	-8.9	-6.2	2.7
31769	14-Sep-17	-	18816	28	0.6	16493	34	0.4	-	-	-	-	-	-	5	2	-7.7	-7.7	-9.7	26	4	-7.8	-7.8	0.0	
31770	14-Sep-17	-	17899	31	0.6	5455	87	7.5	4929	58	3.0	1566	56	5.1	-	8734	109	-24.2	-2.5	-133.2	2151	27	-19.5	-9.9	9.6
31771	14-Sep-17	-	13740	31	0.6	78420	141	0.4	36862	115	2.6	13940	69	2.6	-	7339	90	-19.5	-3.8	-109.5	1090	18	-17.4	-9.9	7.5
31772	15-Sep-17	-	9198	30	0.6	78858	137	5.1	67609	140	2.6	48333	87	0.4	-	30382	131	-29.3	-3.8	-160.3	2522	19	-12.9	-7.9	5.0
31773	12-Sep-17	-	5954	32	1.9	24849	108	12.1	16674	114	1.9	12206	74	11.2	-	33172	121	-33.9	-2.2	-154.9	1389	14	-8.9	-0.3	8.6
31774	12-Sep-17	-	8289	33	1.6	42167	134	1.9	22305	106	1.9	4290	34	2.1	-	23830	126	-12.4	-3.8	-138.4	3803	19	-9.9	-5.8	4.1
31775	13-Sep-17	-	8804	17	0.6	2681	27	7.5	2859	62	5.1	12963	97	3.0	-	12035	92	-29.3	-2.2	-121.3	2417	23	1.2	10.2	9
31776	13-Sep-17	-	14995	31	0.6	49473	131	5.1	29508	105	8.1	19917	79	2.7	-	23080	149	-8.9	-6.2	-157.9	2713	25	-8.9	-6.2	2.7
31777	13-Sep-17	-	18412	31	0.6	29917	98	3.0	39441	131	0.9	13228	53	7.1	-	25968	143	-19.5	-3.8	-162.5	1969	20	-10.1	7.5	17.6
31778	12-Sep-17	-	12574	33	0.3	42749	119	10.0	566	3	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31779	12-Sep-17	-	11059	33	1.9	47302	133	1.9	47534	135	0.3	18722	77	2.7	-	23433	158	-24.2	-3.8	-182.2	5656	28	-8.9	-5.8	3.1
31780	12-Sep-17	-	5304	30	1.6	33306	132	1.9	38052	137	1.9	11764	77	2.7	-	15513	135	-10.1	13.4	-145.1	1999	11	41.7	41.7	0.0
31781	12-Sep-17	-	10304	33	1.9	173	13	1.0	5945	43	0.3	3483	46	5.1	-	1383	17	-9.9	-2.2	-26.9	-	-	-	-	-
31782	12-Sep-17	-	13002	33	0.3	42404	119	5.5	44580	126	2.6	15995	78	3.0	-	14188	121	-19.4	-2.5	-140.4	3887	29	-17.4	-9.9	7.5
48280	19-Sep-21	-10.0	-	-	-	-	-	-	-	-	-	-	-	-	21	3023	14	-10	-9.9	0.2	4898	109	-19.5	-7.8	11.7
48281	19-Sep-21	-10	-	-	-	-	-	-	-	-	-	-	-	-	21	2842	17	-15	-7.7	7.3	9207	63	-17.4	-9.9	7.5
48286	20-Sep-21	-14.2	-	-	-	-	-	-	-	-	-	-	-	-	20	3521	13	-15	-9.9	5.1	14197	124	1.2	18.8	17.6
48287	20-Sep-21	-14.2	-	-	-	-	-	-	-	-	-	-	-	-	20	2797	13	-17	-12.5	4.9	6208	83	-19.5	-9.9	9.6
48292	20-Sep-21	-14.2	-	-	-	-	-	-	-	-	-	-	-	-	20	110	4	-17	-15	2.4	5854	55	-19.5	-9.9	9.6
48293	20-Sep-21	-14.2	-	-	-	-	-	-	-	-	-	-	-	-	20	1158	16	-15	-9.9	5.1	6449	52	-15	-9.9	5.1
48297	18-Sep-21	-10	-	-	-	-	-	-	-	-	-	-	-	-	22	2685	19	-9	-6.2	2.7	18762	116	-12.9	-9.9	3
48298	20-Sep-21	-7.4	-	-	-	-	-	-	-	-	-	-	-	-	20	3519	17	-6	-3.8	2	54740	135	2.7	8.3	5.6
48299	20-Sep-21	-7.4	-	-	-	-	-	-	-	-	-	-	-	-	20	2228	18	-9	-3.8	5.1	-	-	-	-	-
48302	19-Sep-21	-10	-	-	-	-	-	-	-	-	-	-	-	-	21	100	9	-10	-7.7	2.2	21289	101	-17.4	-2.1	15.3
48303	19-Sep-21	-26.5	-	-	-	-	-	-	-	-	-	-	-	-	21	460	9	-26	-24.2	2.2	5583	39	-24.2	-22.6	1.6
48304	20-Sep-21	-7.4	-	-	-	-	-	-	-	-	-	-	-	-	20	5283	18	-6	-3.8	2	10526	90	1.2	14.4	13.2
48305	20-Sep-21	-7.4	-	-	-	-	-	-	-	-	-	-	-	-	20	2087	17	-6	-3.8	2.4	14578	122	-8.9	-5.8	3.1
48308	18-Sep-21	-11	-	-	-	-	-	-	-	-	-	-	-	-	22	1455	14	-9	-7.9	1	5201	68	-24.2	-6.2	18
48309	18-Sep-21	-10	-	-	-	-	-	-	-	-	-	-	-	-	22	486	13	-10	-7.7	2.4	13604	116	-8.9	-2.1	6.8
48310	19-Sep-21	-26.5	-	-	-	-	-	-	-	-	-	-	-	-	21	314	11	-24	-24.2	0	9731	91	-26.4	-24.2	2.2
48311	19-Sep-21	-26.5	-	-	-	-	-	-	-	-	-	-	-	-	21	257	12	-24	-24.2	0	25652	91	-26.4	-26.4	0
48315	18-Sep-21	-11	-	-	-	-	-	-	-	-	-	-	-	-	22	2281	20	-10	-2.2	7.9	22941	105	-12.9	-9.9	3
48316	19-Sep-21	-26.5	-	-	-	-	-	-	-	-	-	-	-	-	21	560	13	-24	-24.2	0	24735	116	-26.4	-26.4	0
48317	19-Sep-21	-26.5	-	-	-	-	-	-	-	-	-	-	-	-	21	123	7	-24	-24.2	0	7083	99	-26.4	-26.4	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 10) periods. Tag ID highlighted yellow = lost tags. Tag ID highlighted red = moved downstream through Kettle GS.

Tag ID	Date tagged	Tag Location	2017			2018			2019			2020			# Potential Detection Days	2021					2022				
			n	# Days	Range (rkm)	n	# Days	Range (rkm)	n	# Days	Range (rkm)	n	# Days	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)
31688	28-May-17	-	30	1	5.2	27068	74	1.5	27193	117	0.0	23635	81	0.0	-	9	1	1.2	1.2	0.0	-	-	-	-	-
31689	28-May-17	-	30	1	12.7	-	-	-	-	-	-	-	-	-	-	121	3	65.3	65.3	0.0	-	-	-	-	-
31690	27-May-17	-	32	1	6.7	-	-	-	-	-	-	4524	33	0.0	-	-	-	-	-	-	3131	34	44.9	45.7	0.8
31691	27-May-17	-	7	0	38.6	-	-	-	-	-	-	709	23	0.0	-	-	-	-	-	-	3	1	45.1	45.1	0.0
31692	28-May-17	-	32	1	12.7	17702	100	17.4	-	-	-	22	8	0.0	-	-	-	-	-	-	2087	26	44.9	45.7	0.8
31693	28-May-17	-	33	1	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31694	28-May-17	-	32	1	5.6	13155	81	15.9	15913	124	12.2	1688	33	8.7	-	11768	125	4.6	18.8	14.2	4123	30	3.9	18.2	14.3
31695	28-May-17	-	31	1	5.2	47506	123	6.7	52297	140	6.7	11028	77	9.5	-	21009	115	1.2	13.4	12.2	4796	21	1.2	9.9	8.7
31696	28-May-17	-	31	1	12.7	43099	154	9.1	43128	127	9.1	11844	114	9.1	-	36691	125	0.8	13.4	12.6	3247	32	4.6	14.4	9.8
31697	28-May-17	-	30	1	6.5	97400	153	9.1	22941	130	10.3	15485	98	12.2	-	27834	143	1.0	10.2	9.2	-	-	-	-	-
31758	30-May-17	-	28	1	10.1	18719	141	12.7	30068	119	11.2	13830	101	9.1	-	22387	153	3.9	13.4	9.5	6968	36	2.7	10.2	7.5
31759	30-May-17	-	32	1	7.6	37102	126	17.4	29872	137	11.2	17055	116	17.6	-	17005	107	0.8	24.9	24.1	4329	32	7.8	14.4	6.6
31760	30-May-17	-	17	1	2.6	25510	119	17.4	17664	117	14.7	13837	115	7.6	-	31426	147	2.7	13.4	10.7	3367	31	4.1	14.4	10.3
31761	30-May-17	-	6	0	36.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31762	29-May-17	-	30	1	5.6	39066	154	10.1	50261	142	6.4	15989	40	1.3	-	-	-	-	-	-	7325	27	44.9	45.7	0.8
31763	31-May-17	-	31	1	9.1	25869	130	9.1	32315	131	9.1	7019	90	6.0	-	20453	139	0.8	10.2	9.4	5145	30	4.5	14.4	9.9
31764	31-May-17	-	32	1	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31765	31-May-17	-	30	1	6.7	35362	125	9.1	26941	101	9.1	11978	79	9.1	-	29700	155	0.8	18.8	18.0	-	-	-	-	-
31766	30-May-17	-	31	1	4.6	16440	104	23.5	13002	104	15.9	14695	105	12.2	-	12619	126	2.7	13.4	10.7	3153	35	4.5	10.2	5.7
31767	30-May-17	-	24	1	3.2	30261	123	9.1	22366	124	12.7	3782	53	10.7	-	11098	125	3.9	18.8	14.9	2632	18	5.9	10.2	4.3
48276	17-Sep-21	2.6	-	-	-	-	-	-	-	-	-	-	-	-	23	267	15	1.3	3.8	2.5	42448	130	1.2	10.2	9
48277	17-Sep-21	2.6	-	-	-	-	-	-	-	-	-	-	-	-	23	1013	21	0.8	1.3	0.5	20825	107	1.2	5.4	4.2
48278	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	6553	15	3.9	10.2	6.3	14702	101	13.4	14.4	1.0
48279	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	1701	14	3.9	18.8	14.9	23496	122	44.9	45.7	0.8
48282	17-Sep-21	2.6	-	-	-	-	-	-	-	-	-	-	-	-	23	6244	16	3.8	10.2	6.4	3073	70	10.2	18.2	8
48283	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	5464	15	1.3	7.8	6.5	30393	136	3.9	10.2	6.3
48284	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	2685	15	4.1	8.7	4.6	14564	130	5.4	10.2	4.8
48285	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	1568	19	1.2	4.6	3.4	28713	140	3.8	14.4	10.6
48288	17-Sep-21	2.6	-	-	-	-	-	-	-	-	-	-	-	-	23	719	19	0.8	2.7	1.9	24785	130	2.7	9.7	7
48289	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	3715	15	3.9	13.4	9.5	9316	82	9.3	15	5.7
48290	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	2641	15	3.9	13.4	9.5	9495	92	14.4	24.9	10.5
48291	17-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	23	3269	16	1.2	10.2	9	-	-	-	-	-
48294	16-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	24	4304	14	3.8	32	28.2	-	-	-	-	-
48295	16-Sep-21	2.6	-	-	-	-	-	-	-	-	-	-	-	-	24	4148	14	1	8.7	7.7	-	-	-	-	-
48296	16-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	24	4470	17	0.8	10.2	9.4	-	-	-	-	-
48300	16-Sep-21	3.9	-	-	-	-	-	-	-	-	-	-	-	-	24	1834	11	1.3	32	30.7	-	-	-	-	-
48301	16-Sep-21	4.1	-	-	-	-	-	-	-	-	-	-	-	-	24	2714	15	0.8	16.3	15.5	-	-	-	-	-
48306	16-Sep-21	2.4	-	-	-	-	-	-	-	-	-	-	-	-	24	3716	16	0.8	8.7	7.9	-	-	-	-	-
48307	16-Sep-21	4.6	-	-	-	-	-	-	-	-	-	-	-	-	24	4019	18	0.8	18.8	18	4121	17	16.1	16.1	0
48312	16-Sep-21	2.4	-	-	-	-	-	-	-	-	-	-	-	-	24	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 2017 TO OCTOBER 2022

Figure A2-1: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31683) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.	63
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Figure A2-11: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31773) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.73

Figure A2-12: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31774) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.74

Figure A2-13: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31775) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.75

Figure A2-14: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31776) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.76

Figure A2-15: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31777) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.77

Figure A2-16: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31778) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.78

Figure A2-17: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31779) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.79

Figure A2-18: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31780) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.80

Figure A2-19: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31781) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.81

Figure A2-20: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31782) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022.82

Figure A2-21: 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 10, 2022.83

Figure A2-22: 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 10, 2022.84

Figure A2-23: 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 10, 2022.85



Figure A2-24: 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 10, 2022.86

Figure A2-25: 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 10, 2022.87

Figure A2-26: 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 10, 2022.88

Figure A2-27: 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 10, 2022.89

Figure A2-28: 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 10, 2022.90

Figure A2-29: 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 10, 2022.91

Figure A2-30: 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 10, 2022.92

Figure A2-31: 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 10, 2022.93

Figure A2-32: 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 10, 2022.94

Figure A2-33: 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 10, 2022.95

Figure A2-34: 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 10, 2022.96

Figure A2-35: 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 10, 2022.97

Figure A2-36: 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 10, 2022.98



Figure A2-37: 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 10, 2022.99

Figure A2-38: 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 10, 2022. 100

Figure A2-39: 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 10, 2022. 101

Figure A2-40: 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 10, 2022. 102

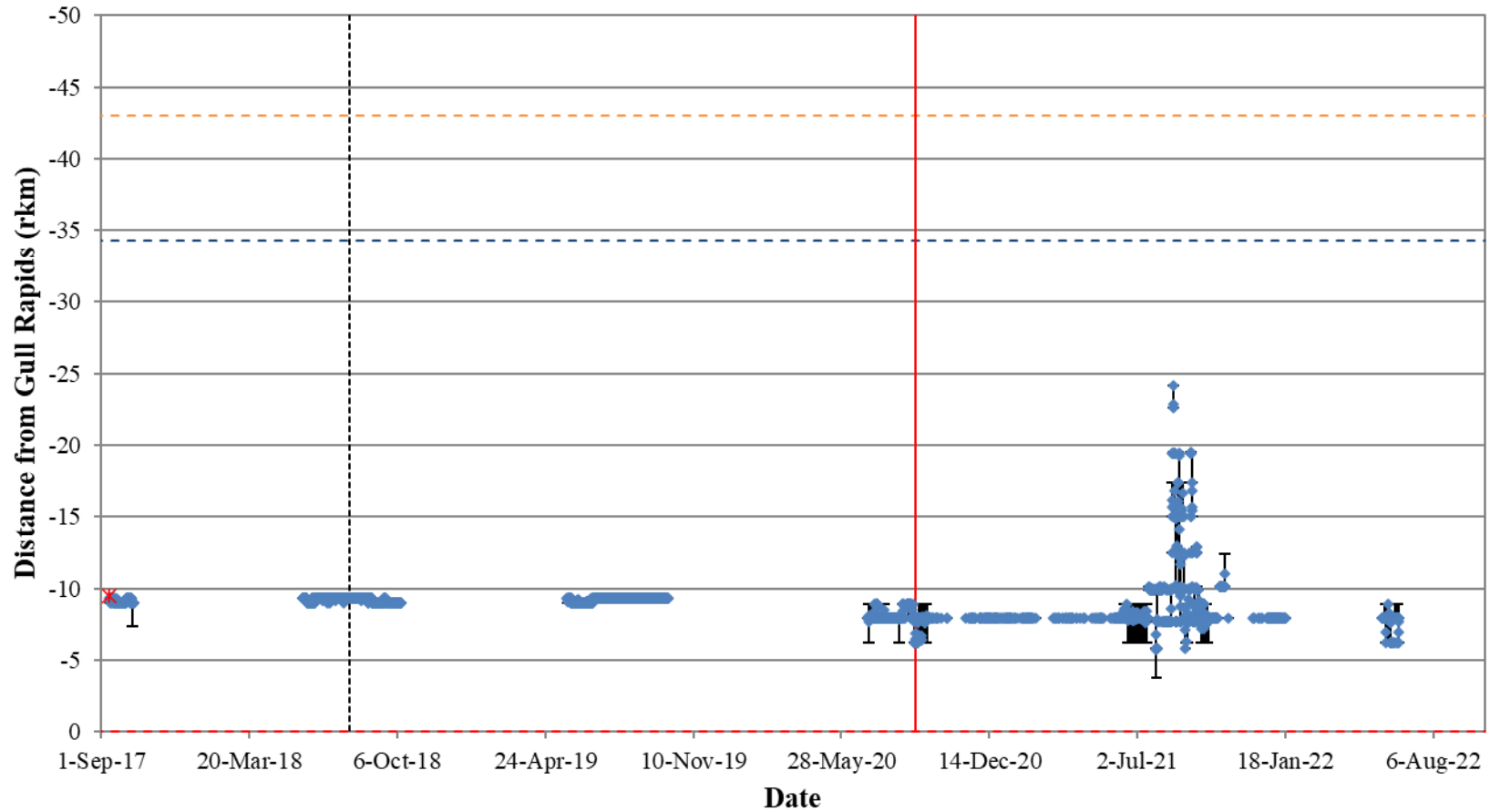


Figure A2-1: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31683) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

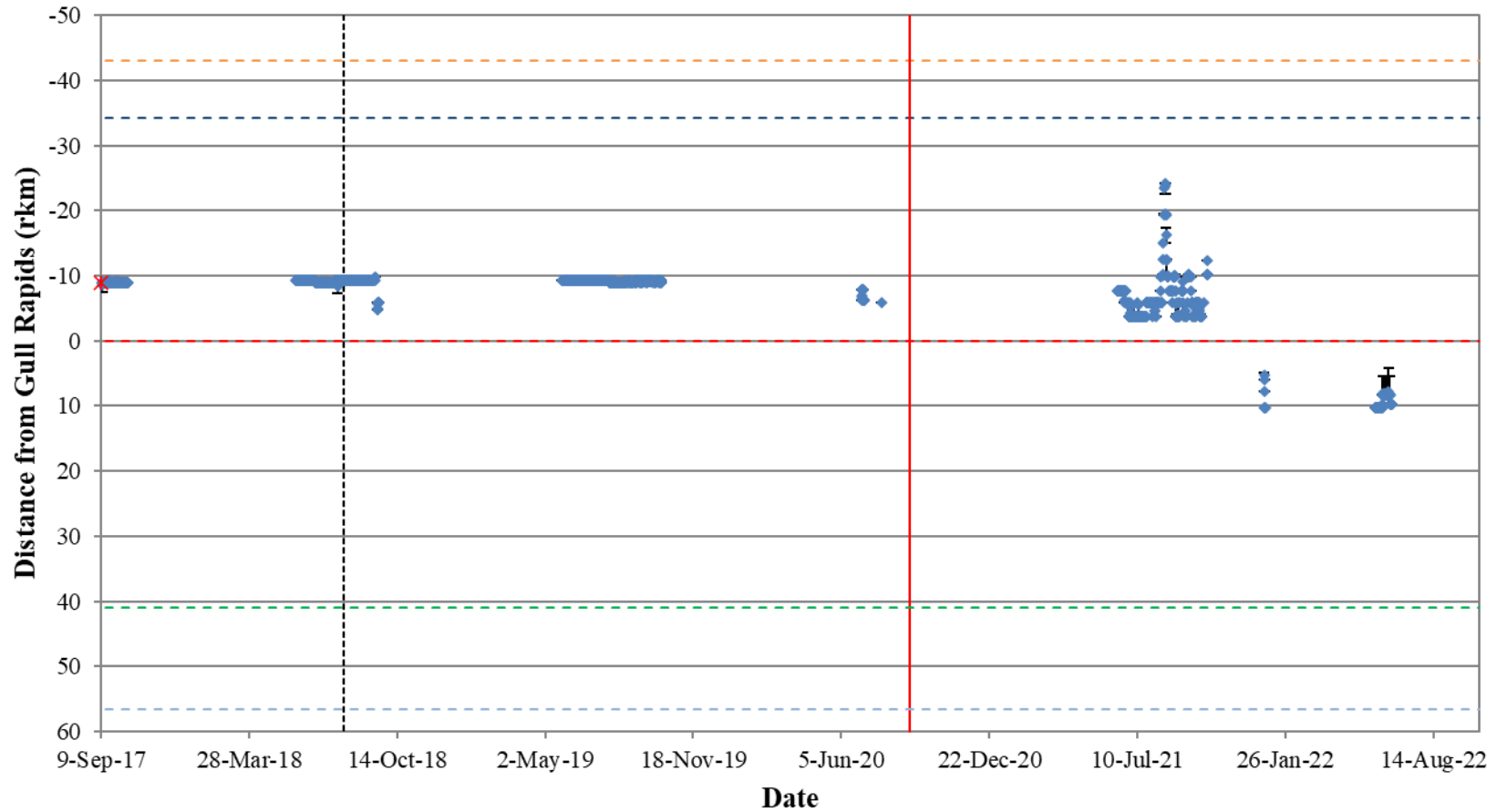


Figure A2-2: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31684) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

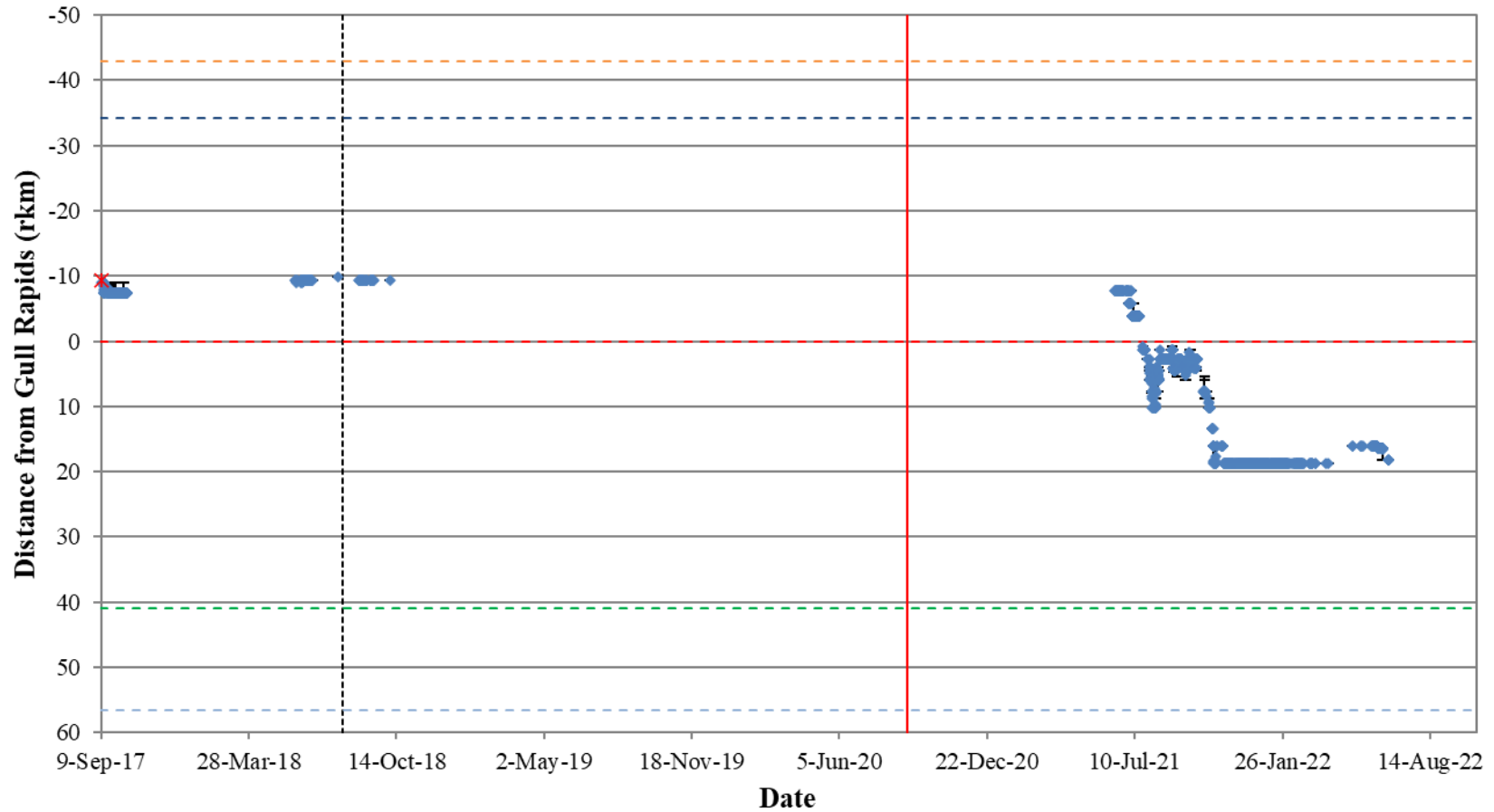


Figure A2-3: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31685) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

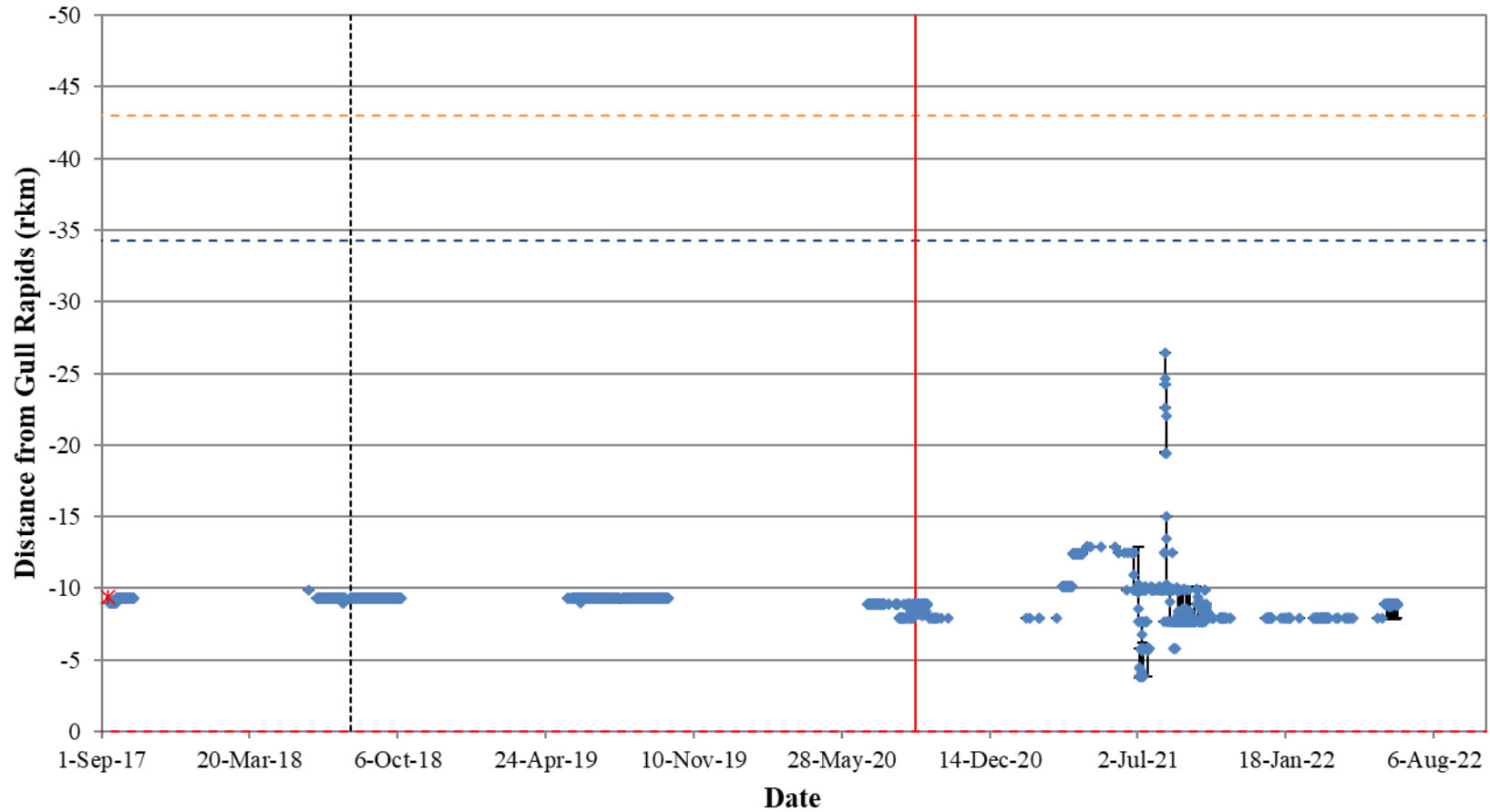


Figure A2-4: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31686) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

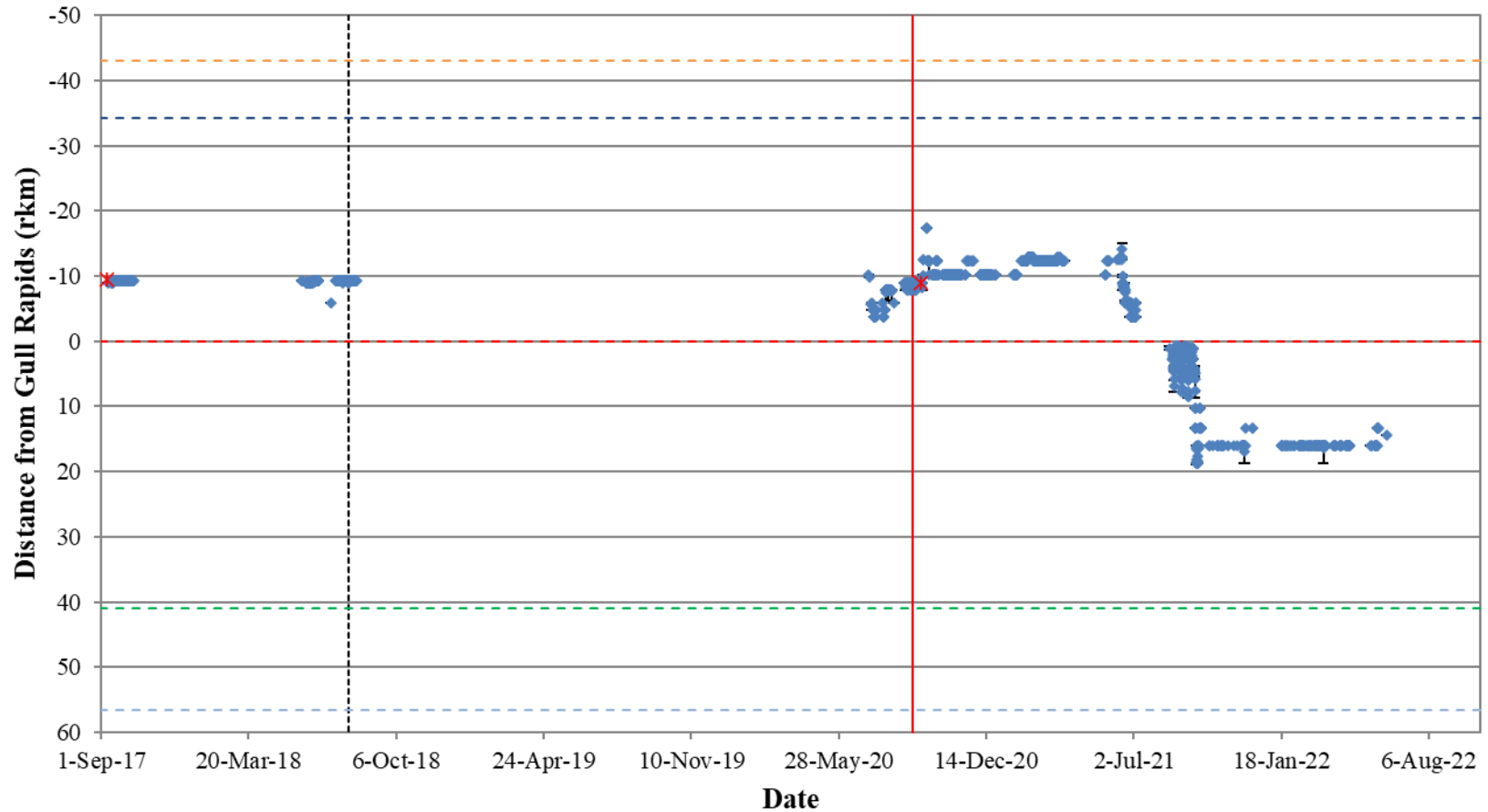


Figure A2-5: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31687) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging and subsequent recapture are indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

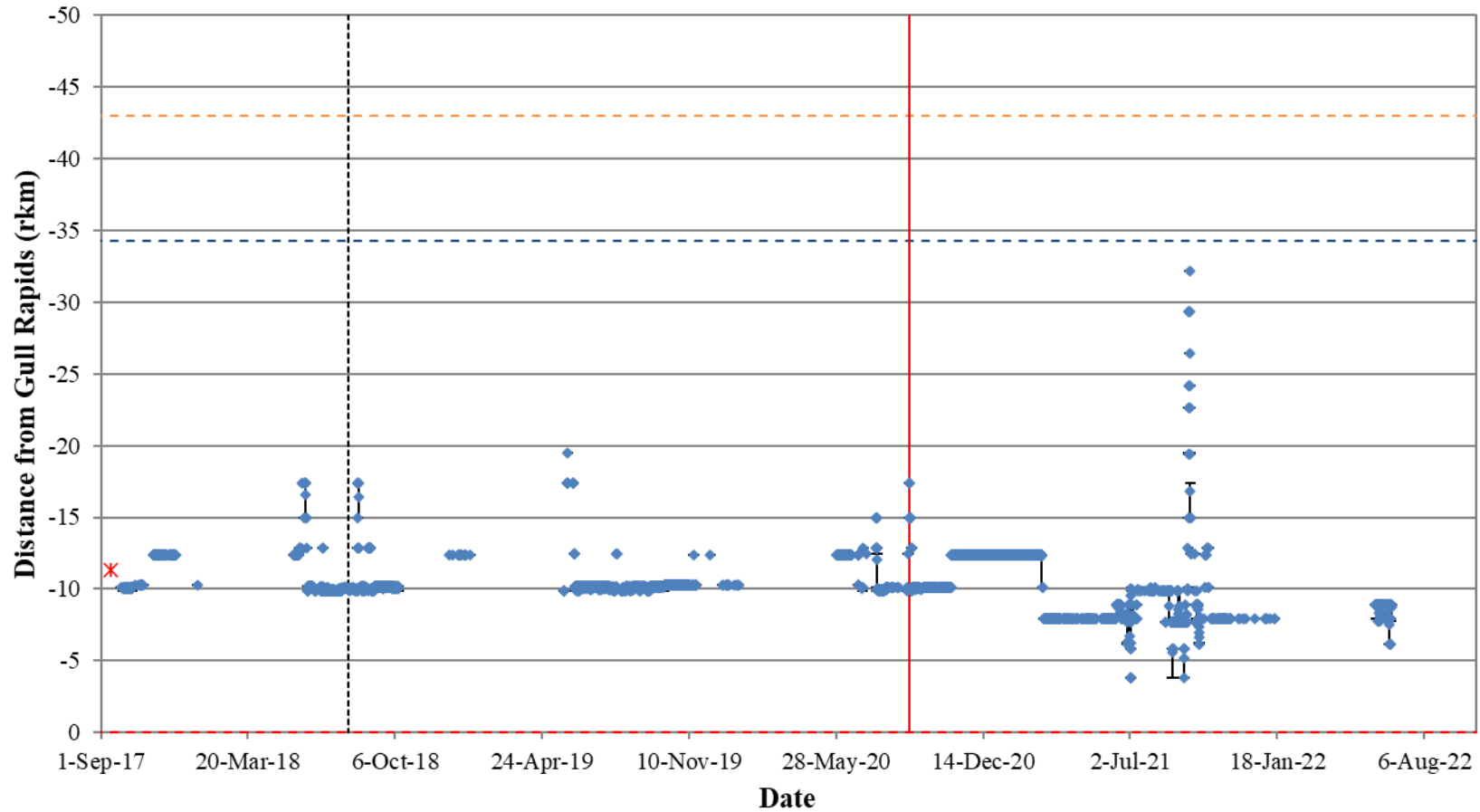


Figure A2-6: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31768) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

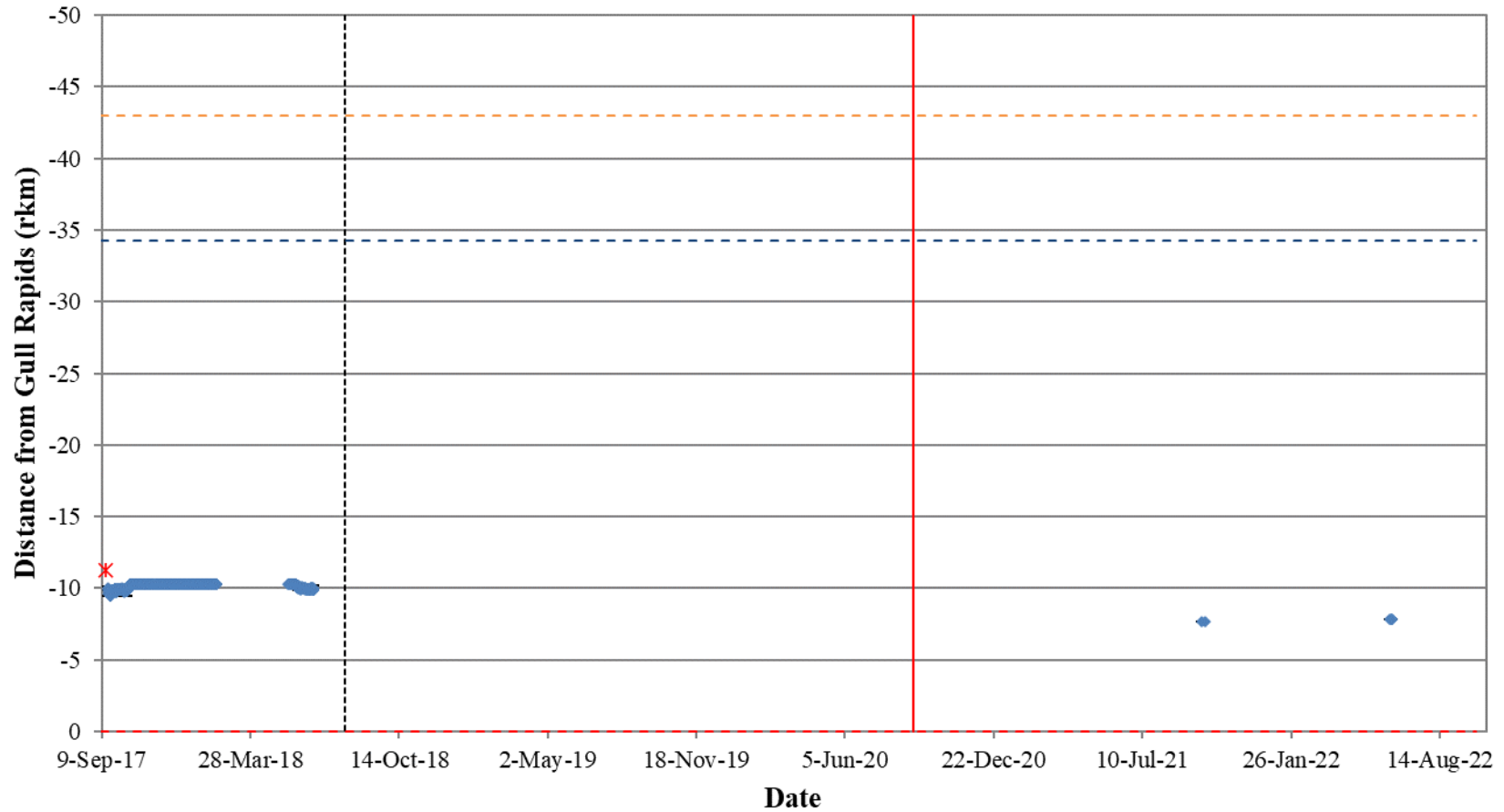


Figure A2-7: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31769) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

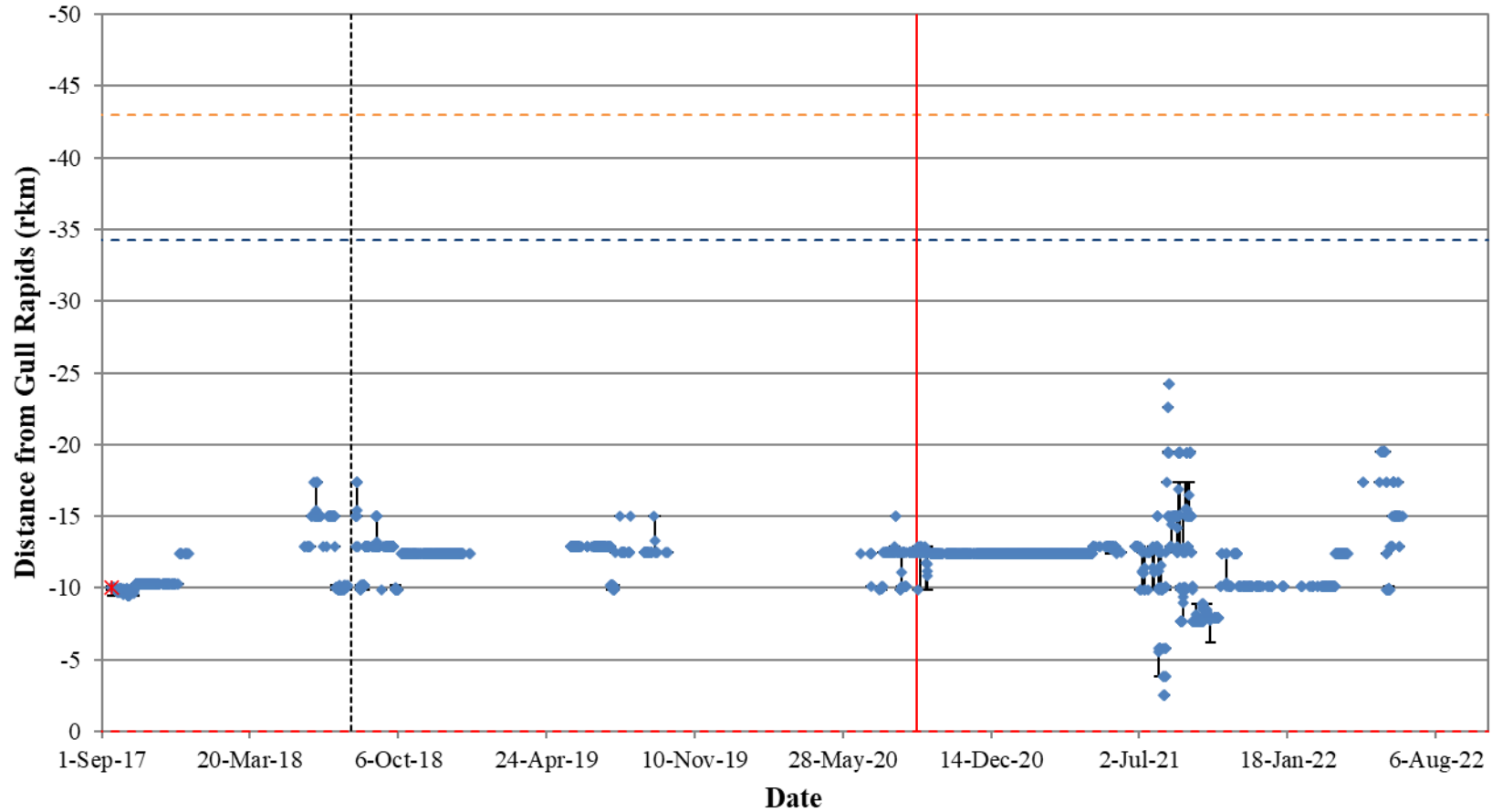


Figure A2-8: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31770) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

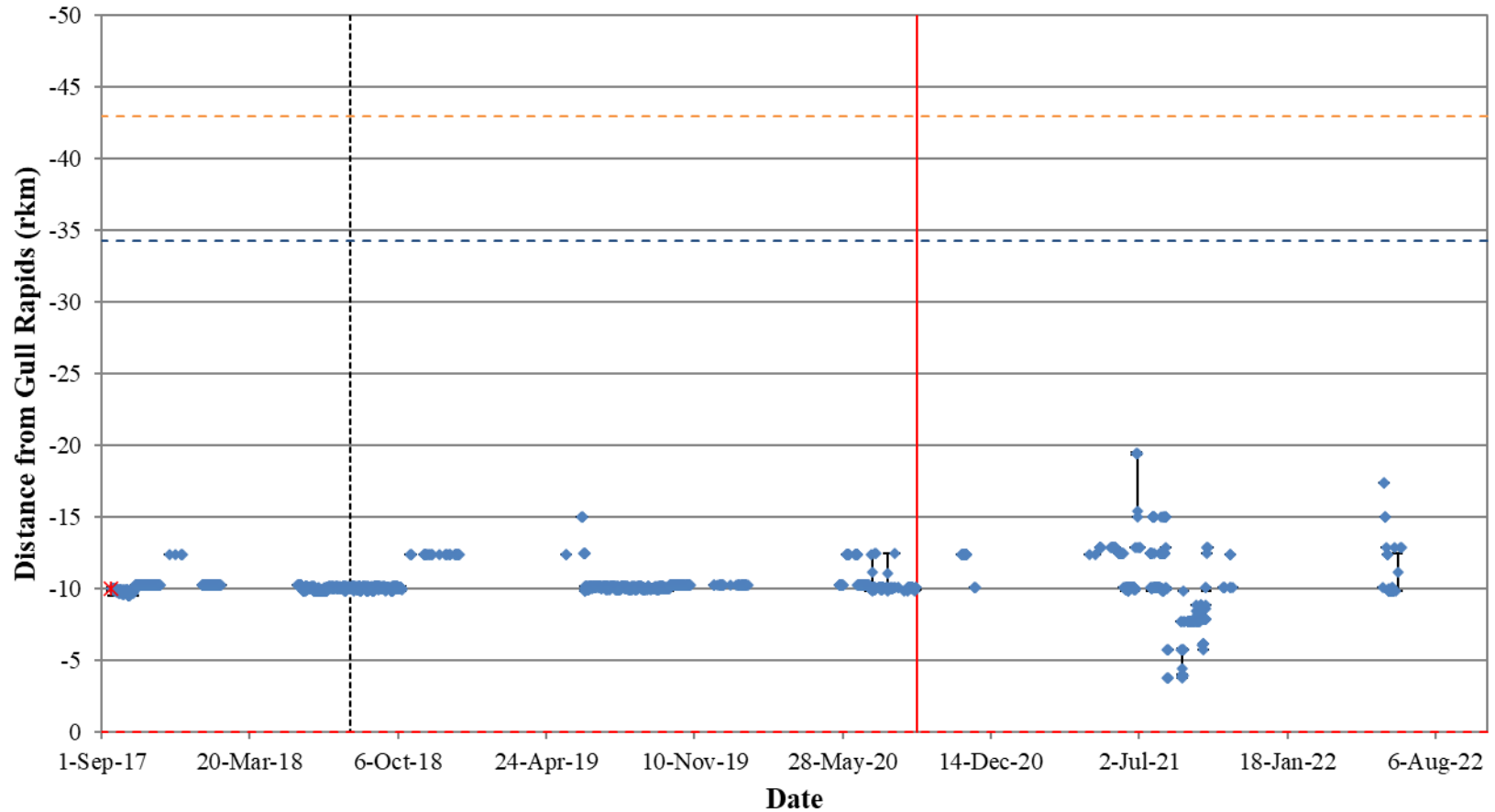


Figure A2-9: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31771) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

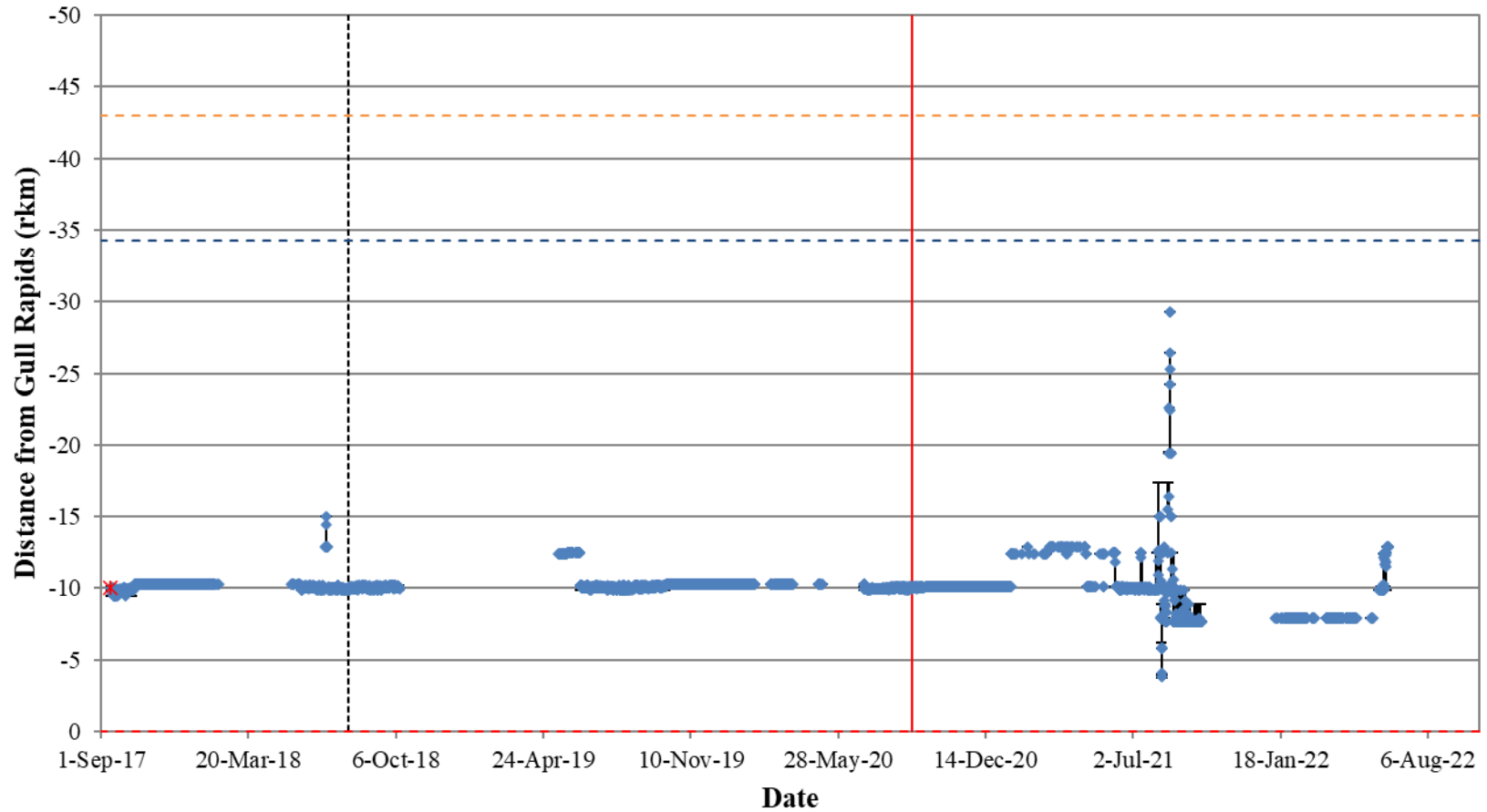


Figure A2-10: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31772) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

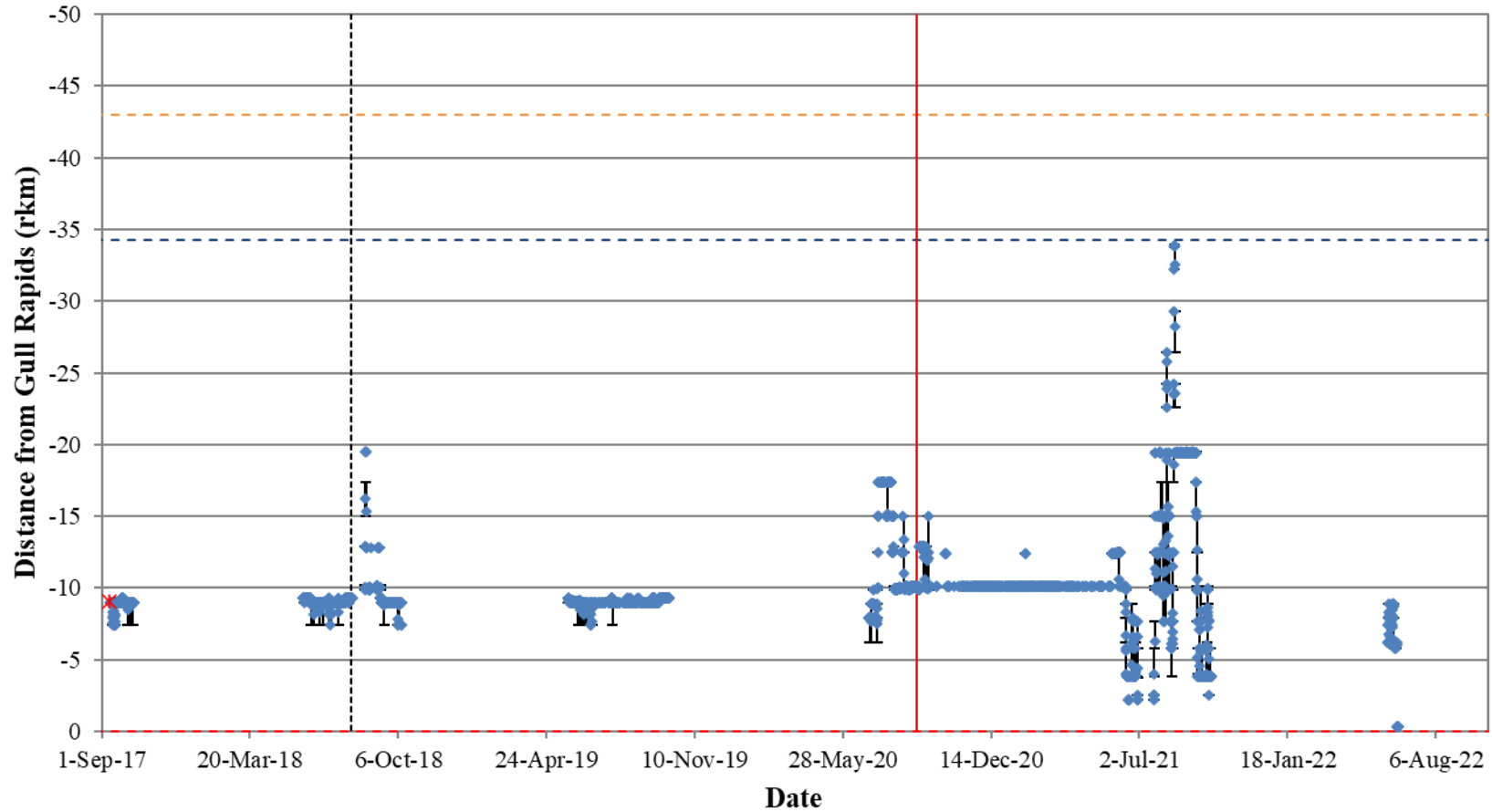


Figure A2-11: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31773) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

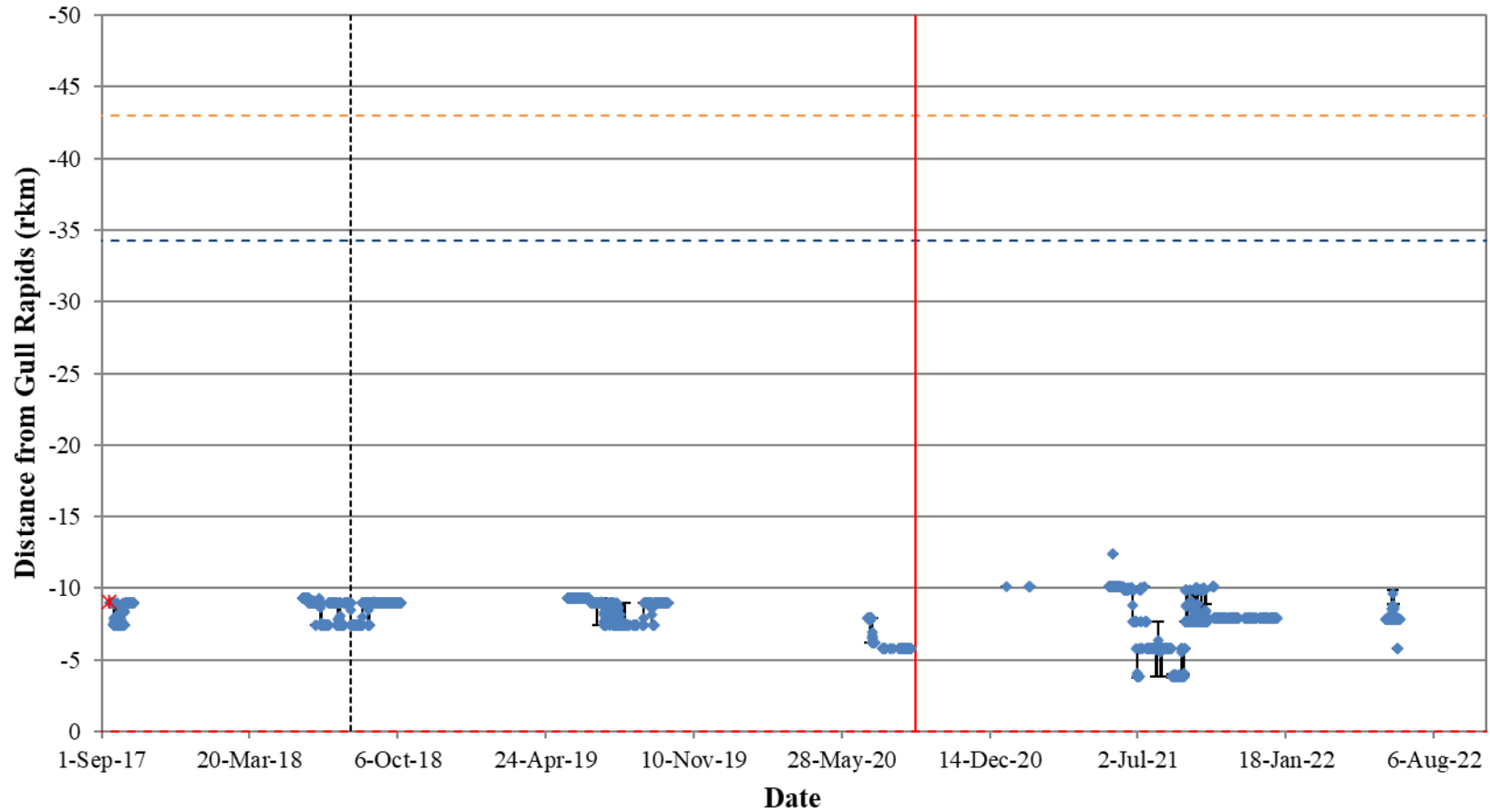


Figure A2-12: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31774) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

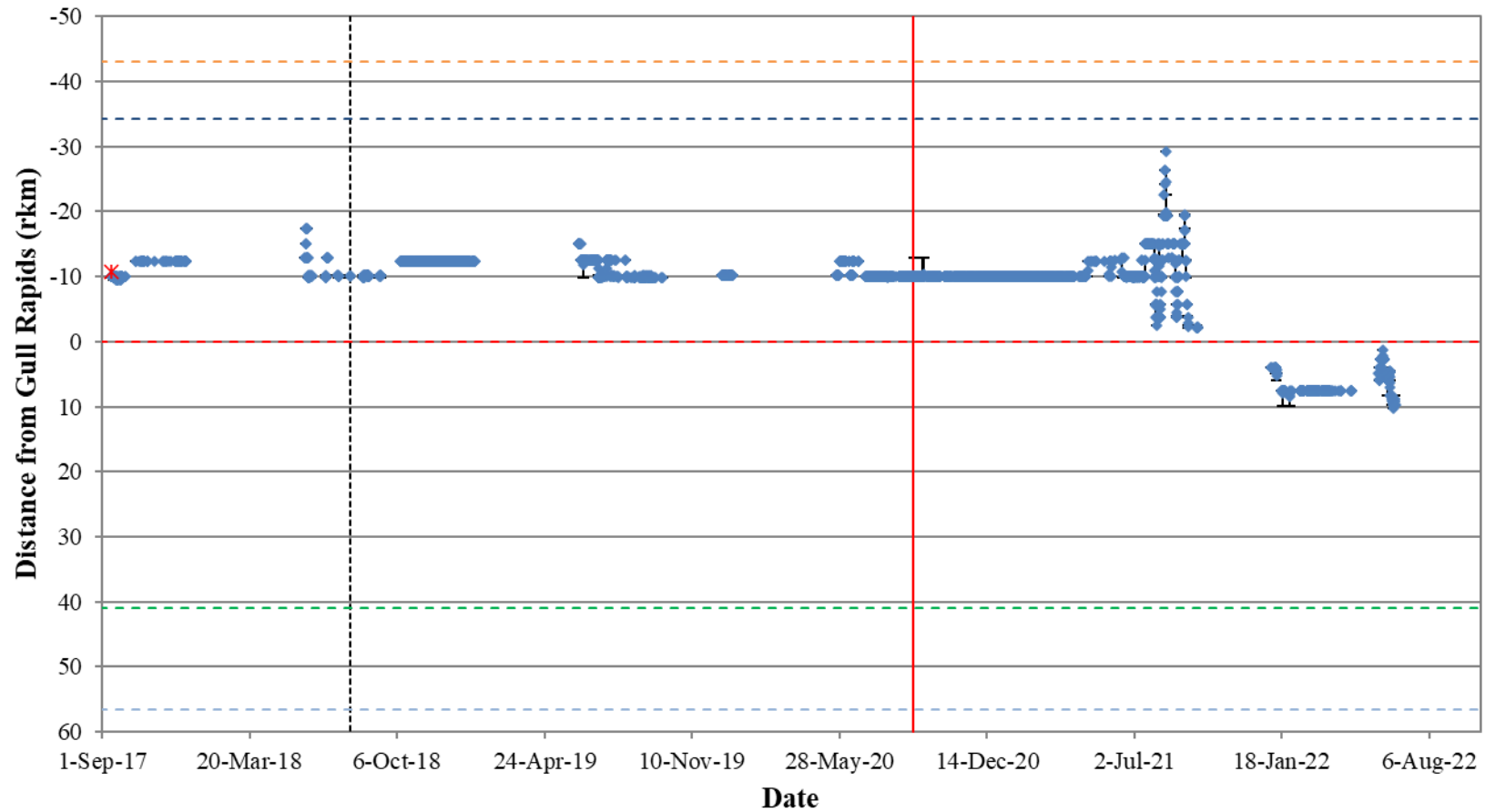


Figure A2-13: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31775) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

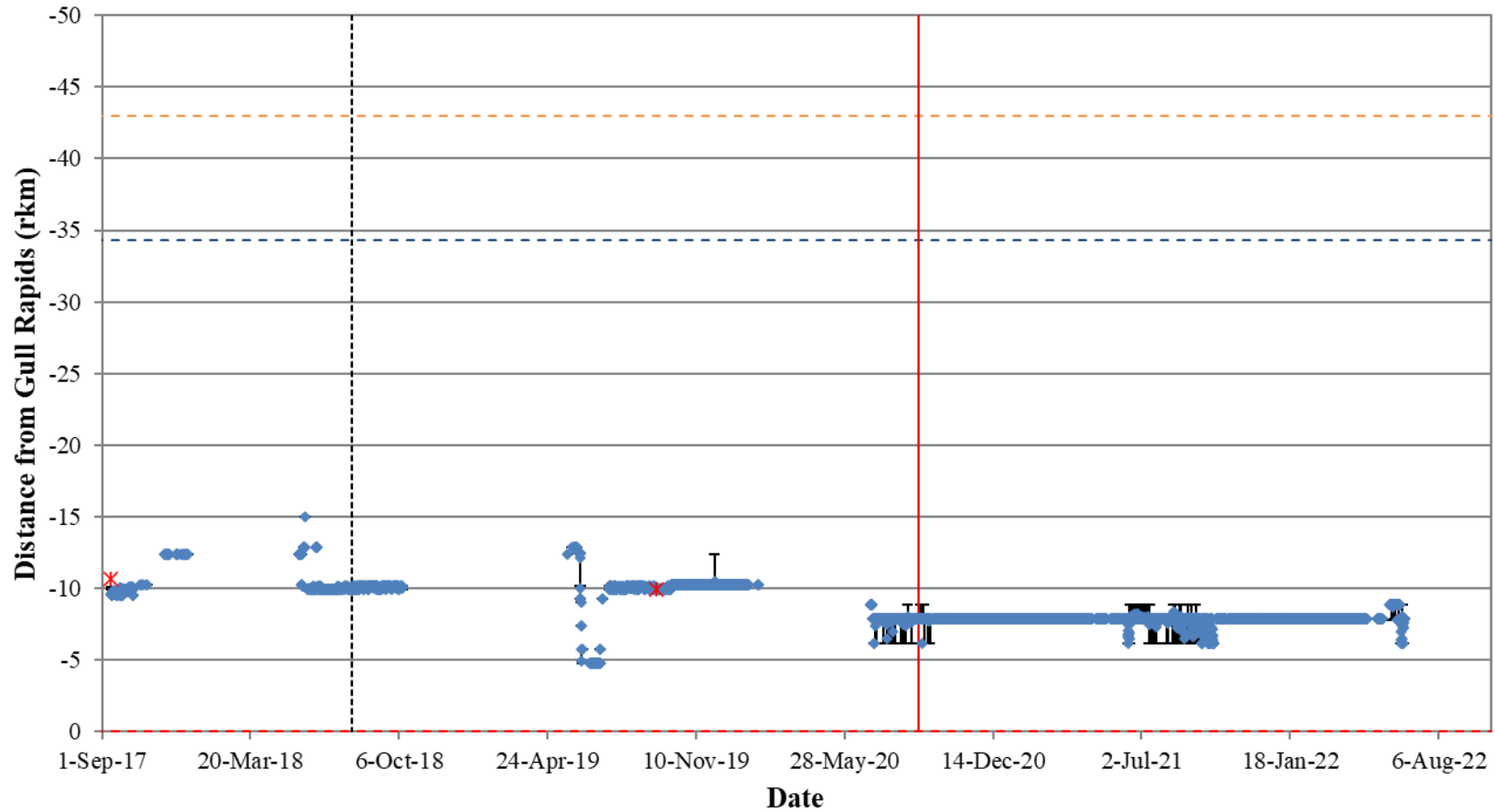


Figure A2-14: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31776) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging and subsequent recapture are indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

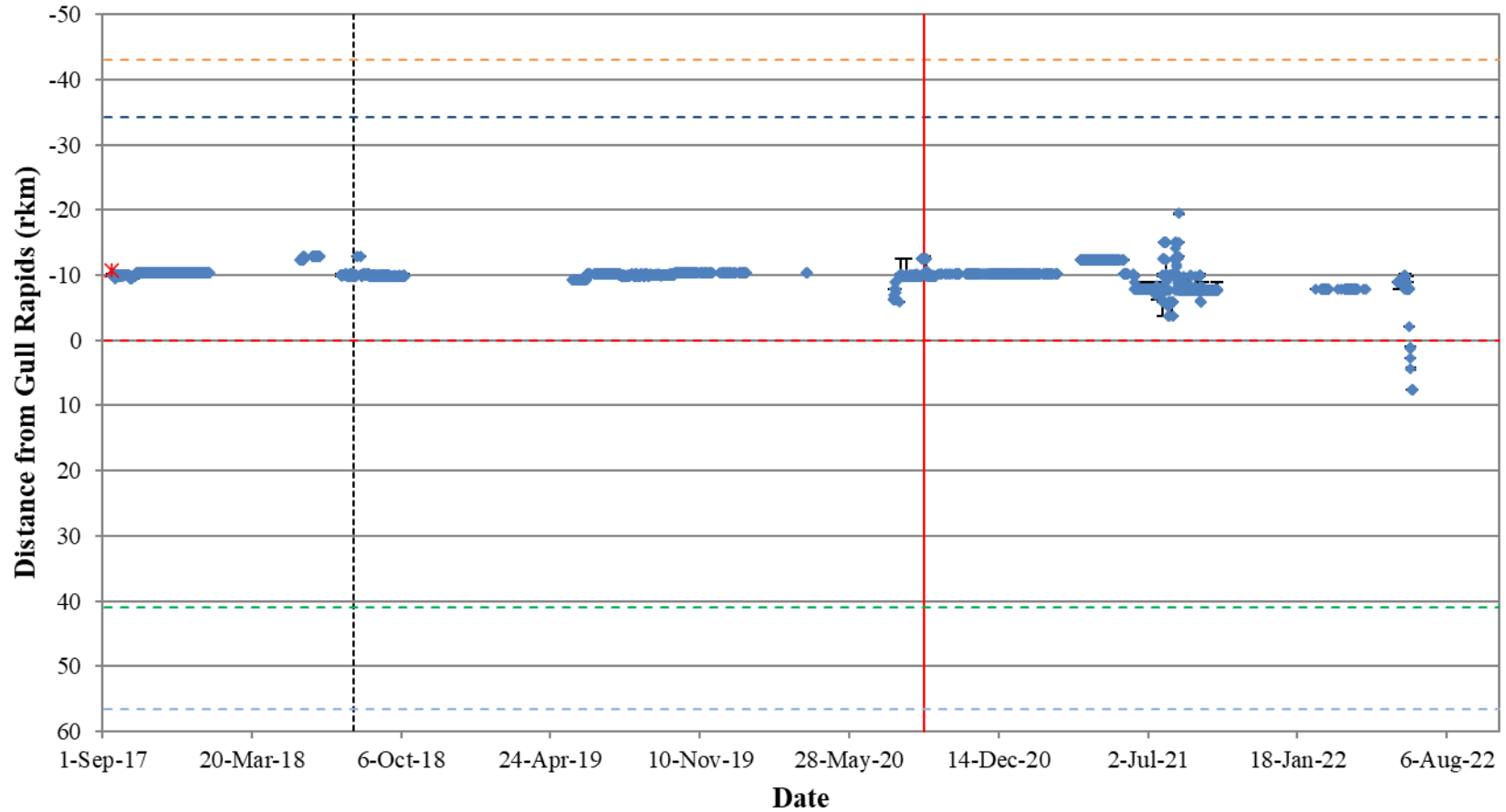


Figure A2-15: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31777) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

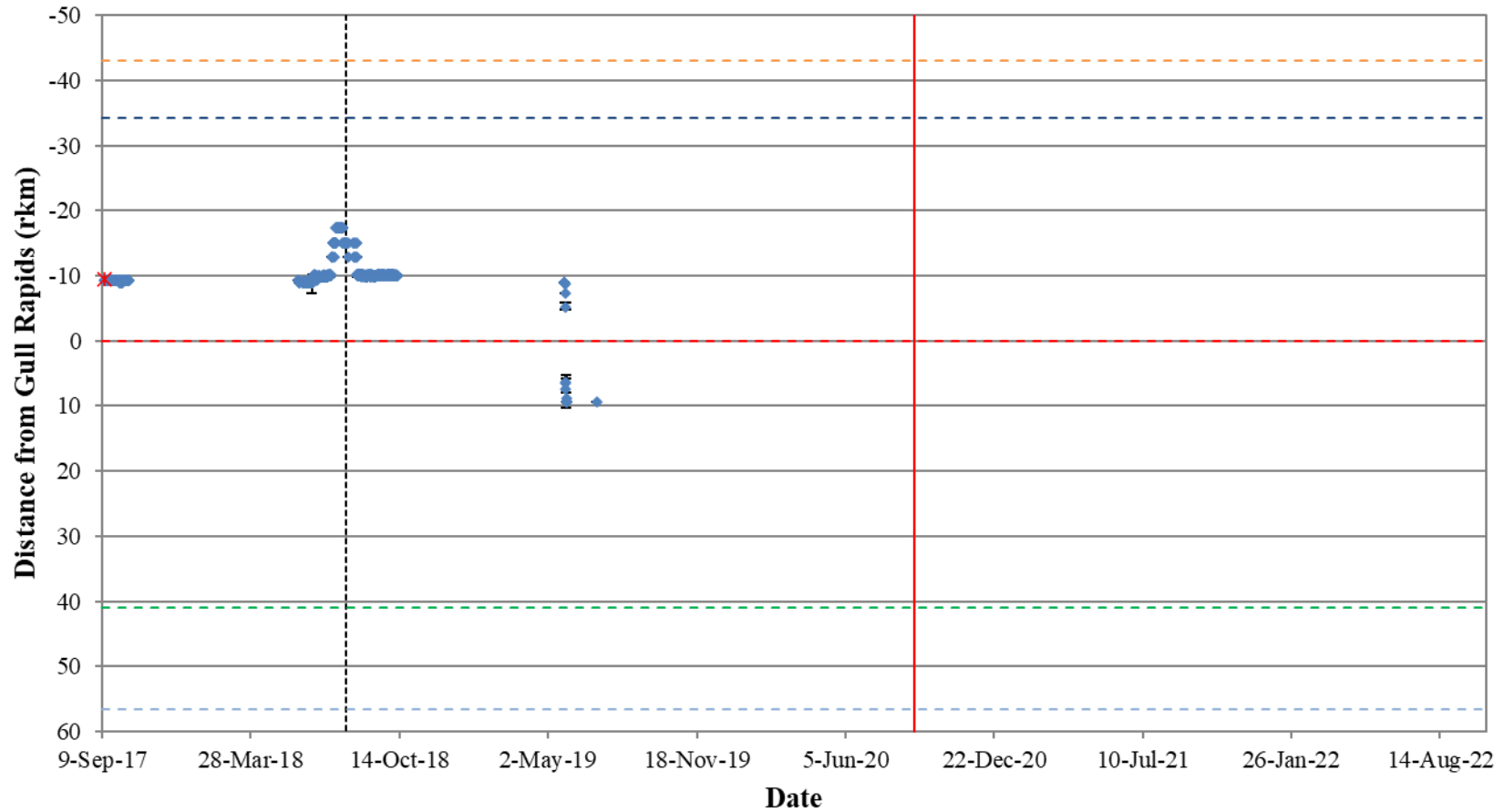


Figure A2-16: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31778) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

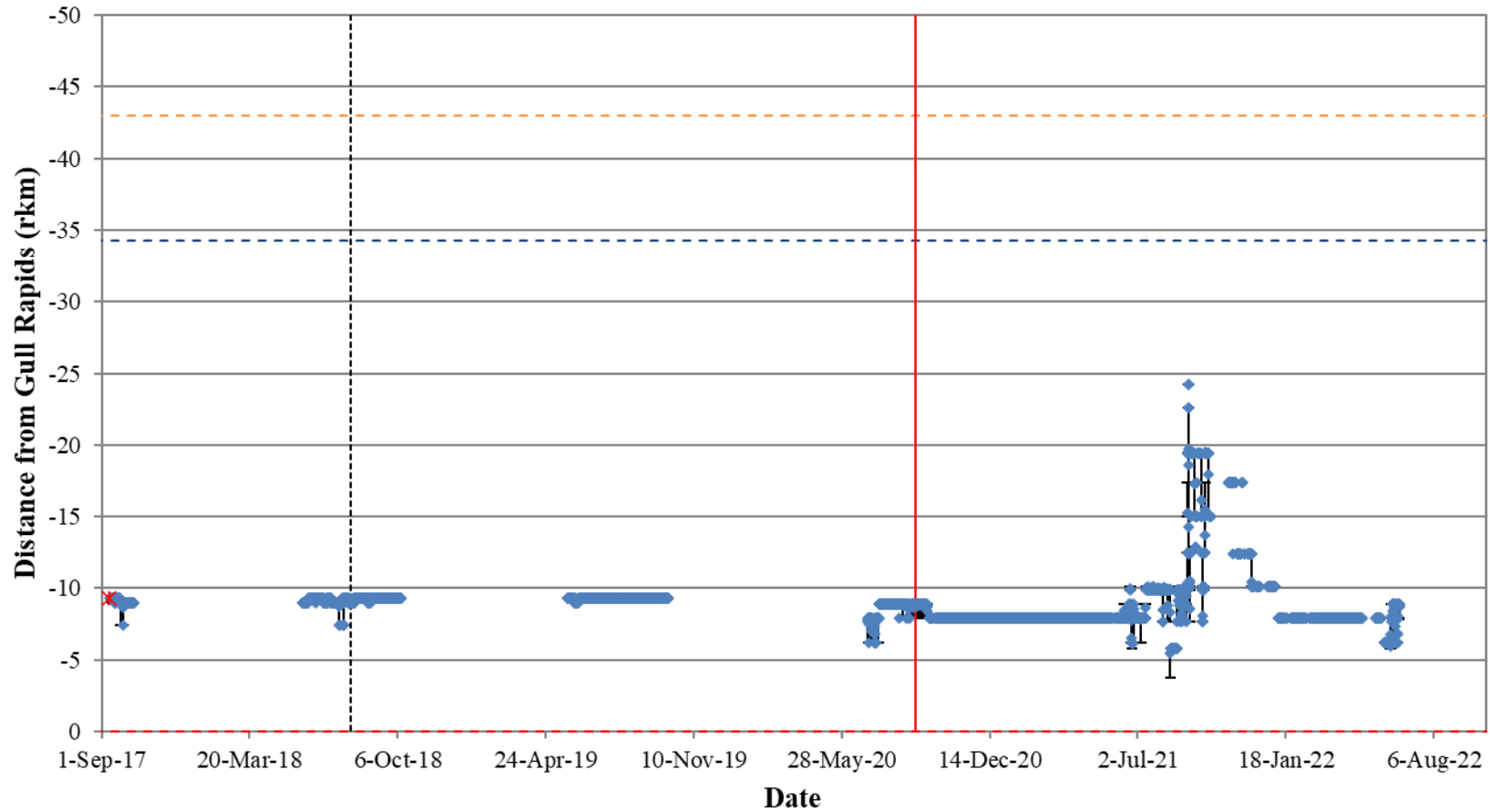


Figure A2-17: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31779) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

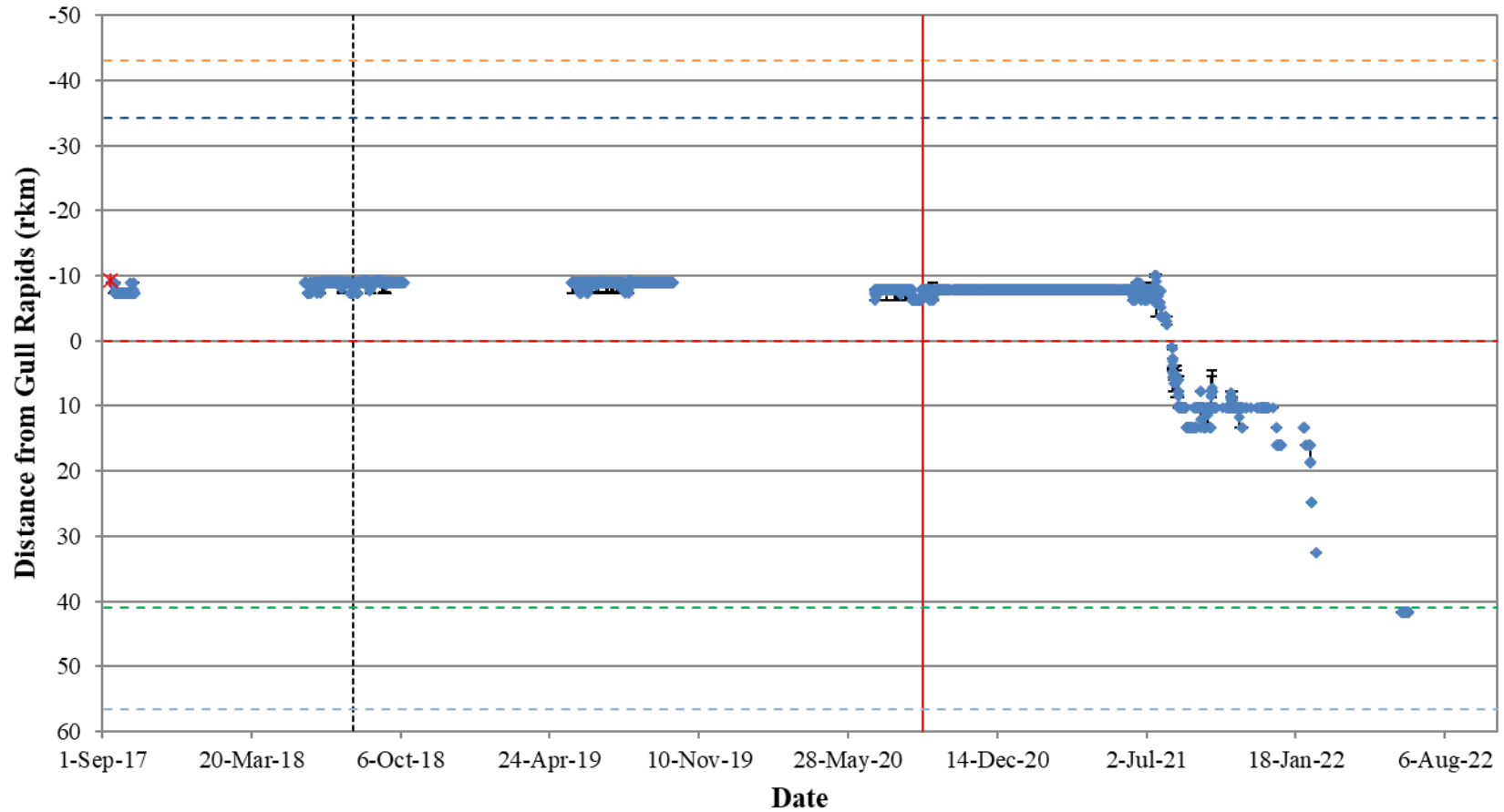


Figure A2-18: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31780) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

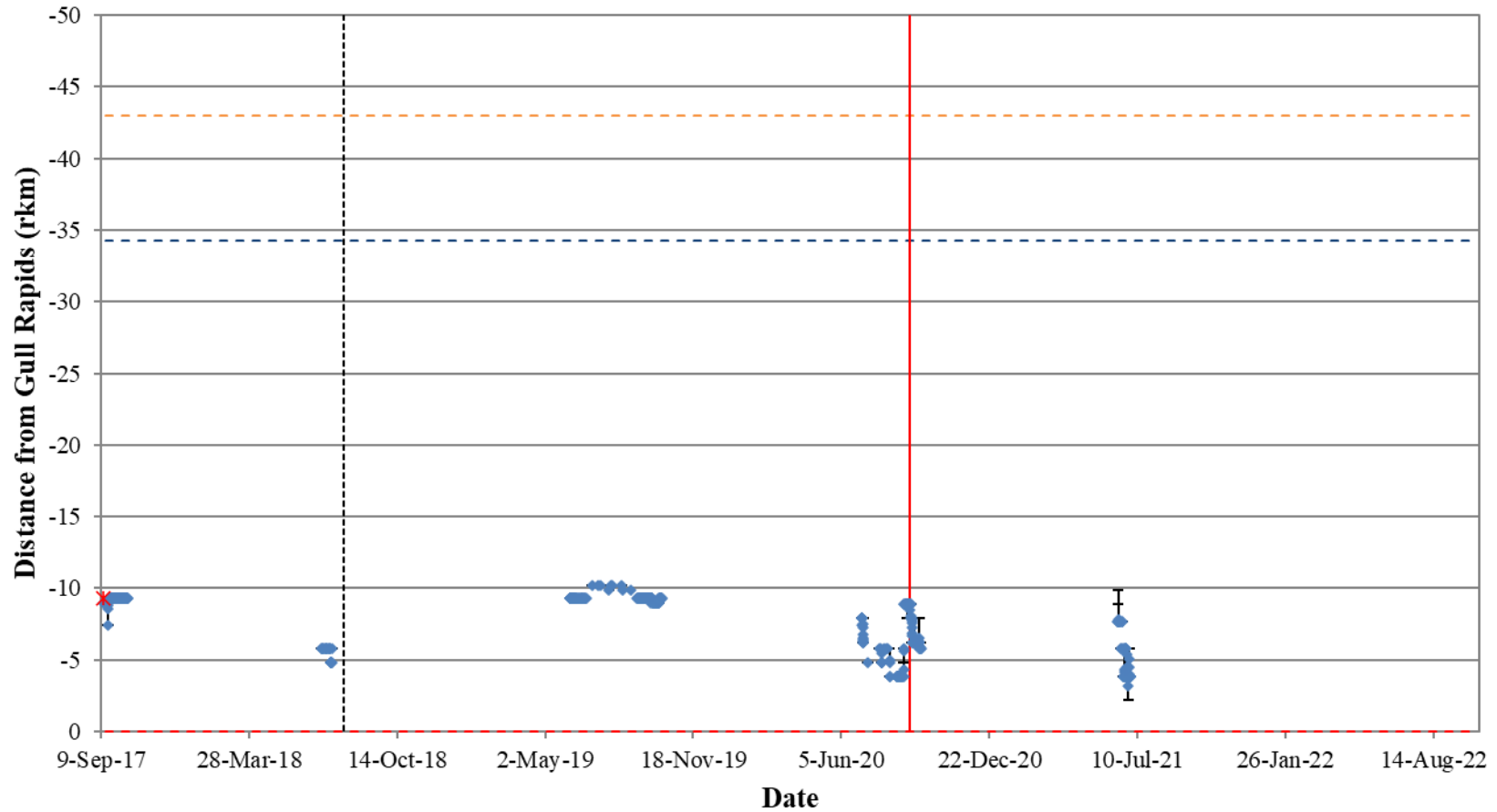


Figure A2-19: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31781) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

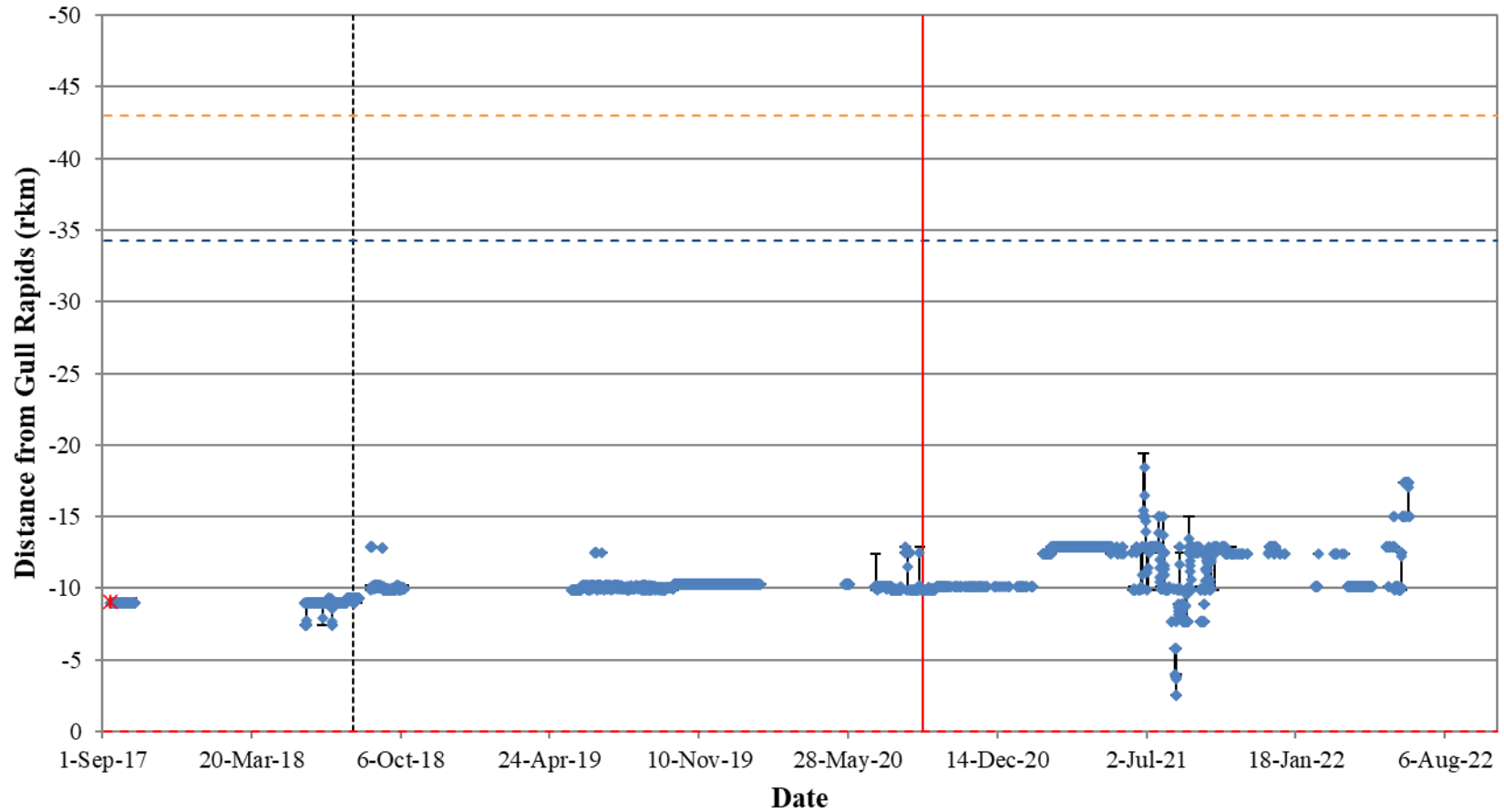


Figure A2-20: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31782) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

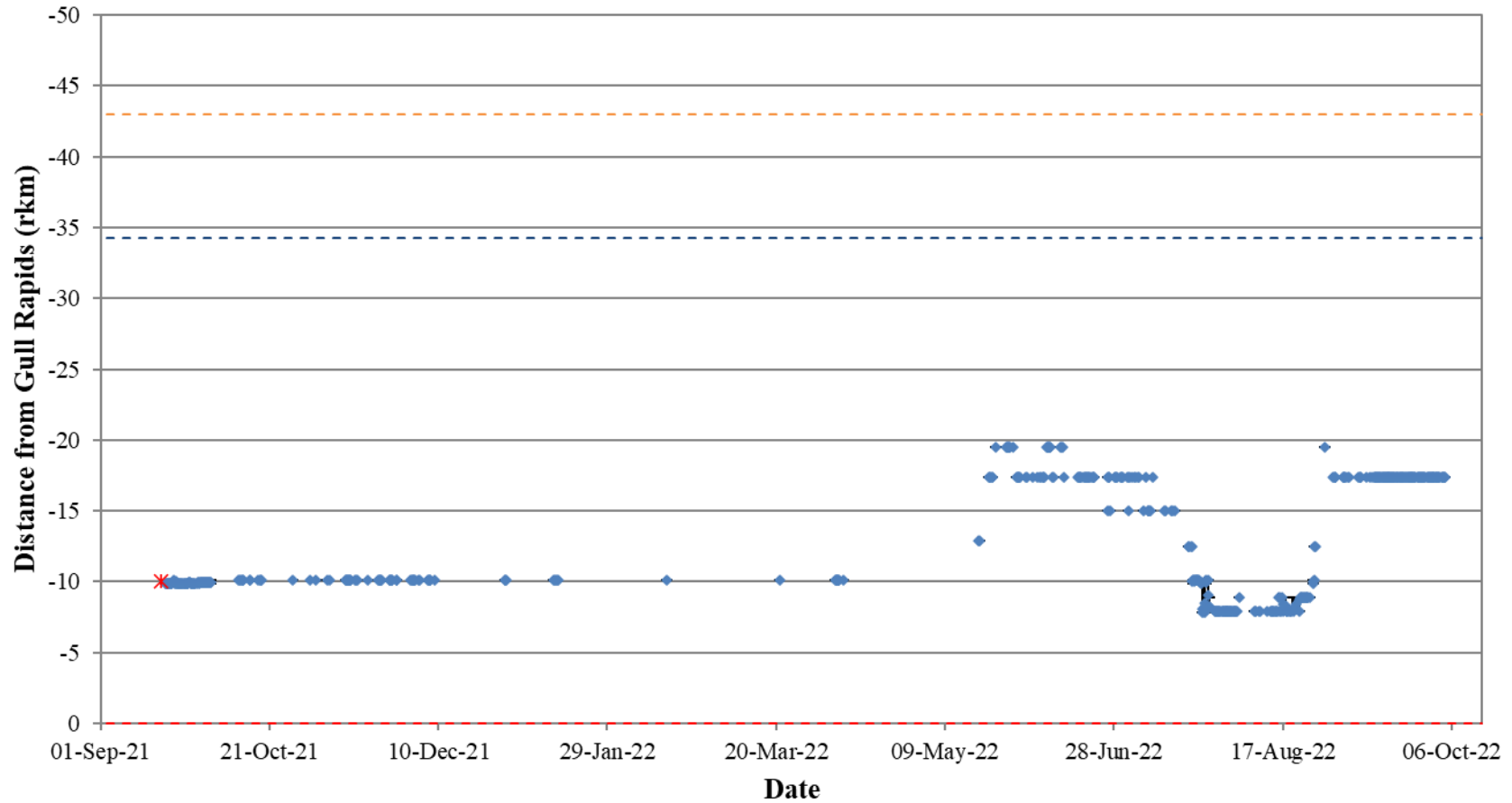


Figure A2-21: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48280) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

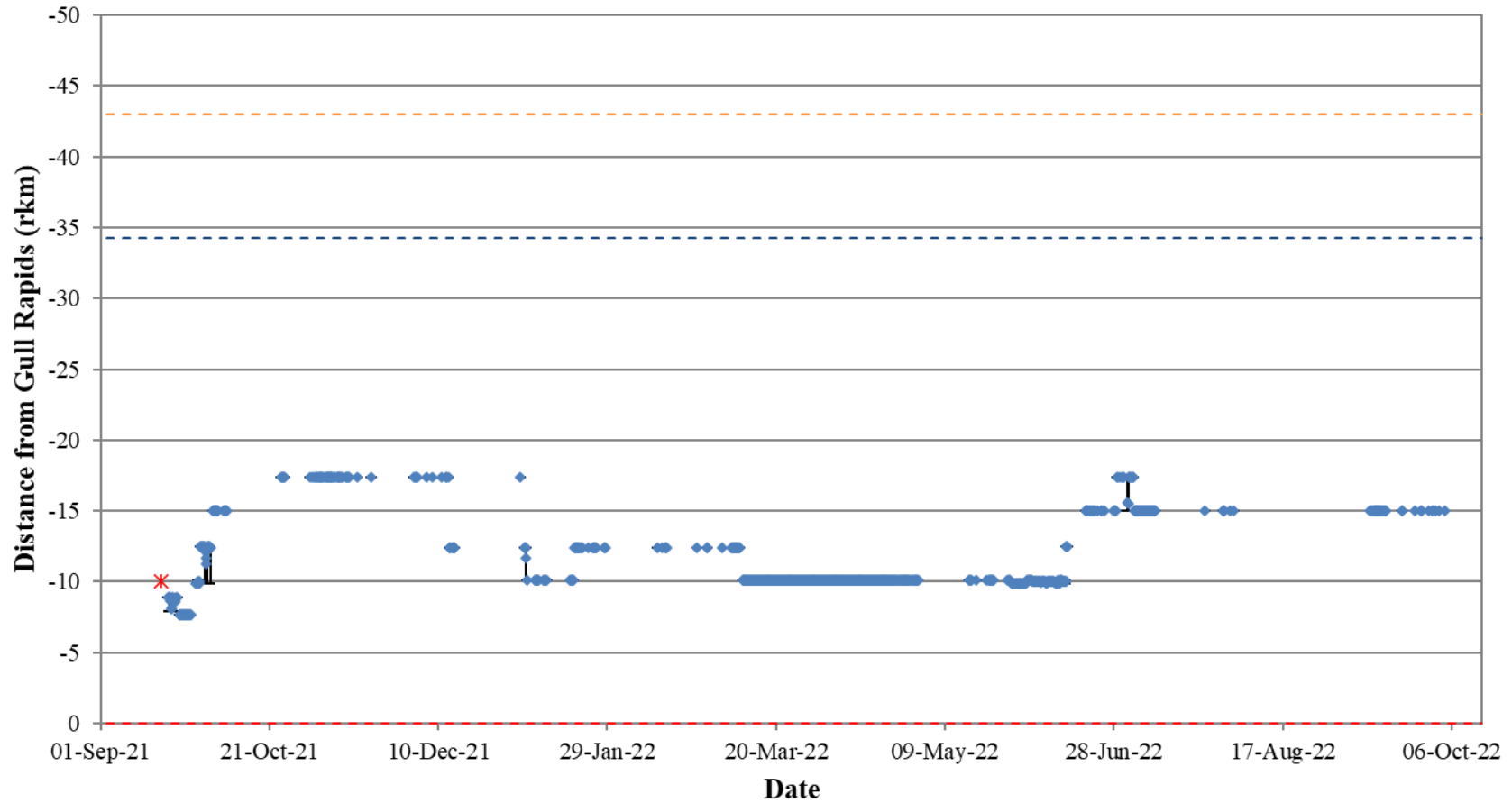


Figure A2-22: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48281) in the Keyeyask reservoir in relation to the Keyeyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

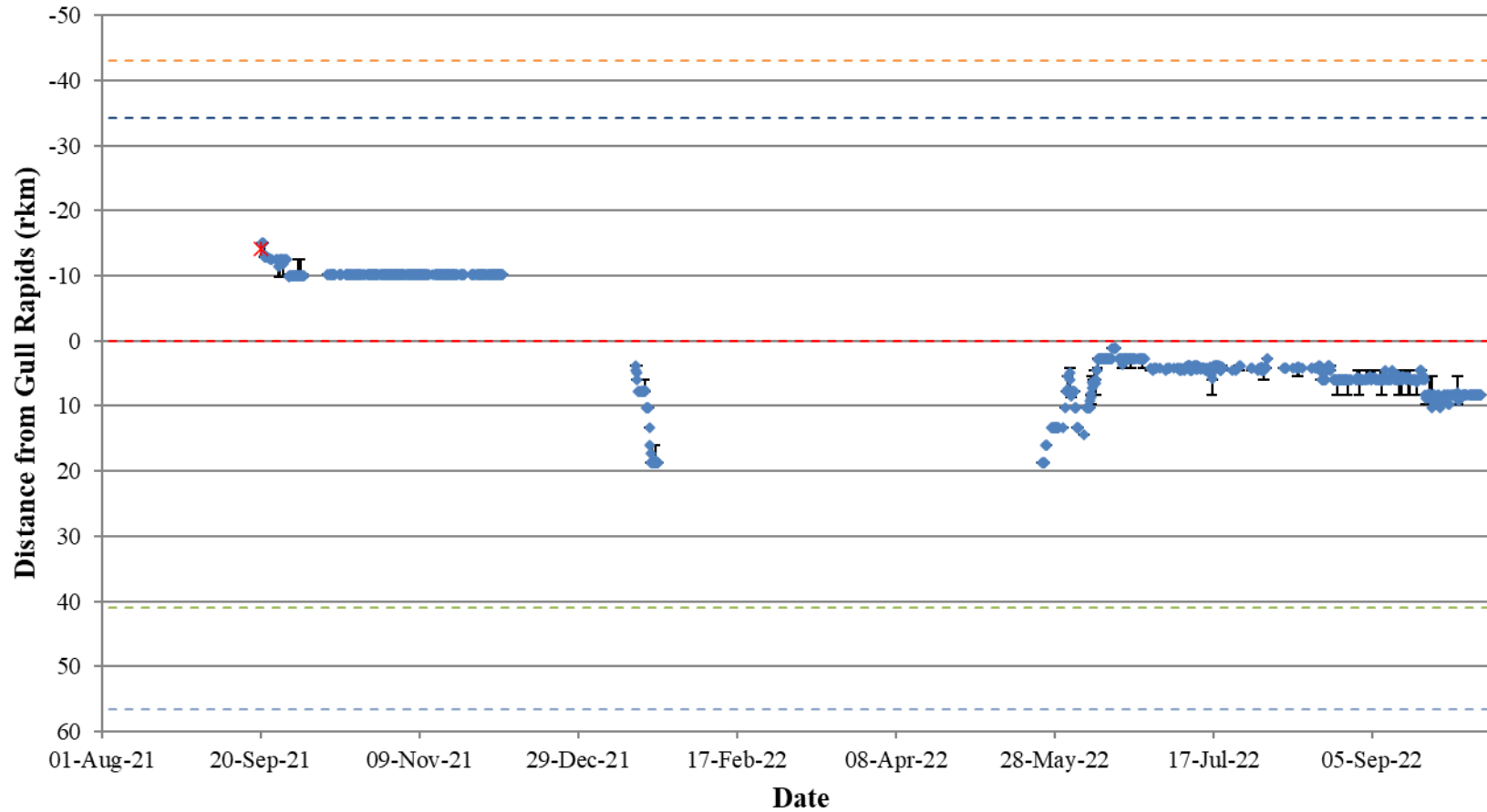


Figure A2-23: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48286) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

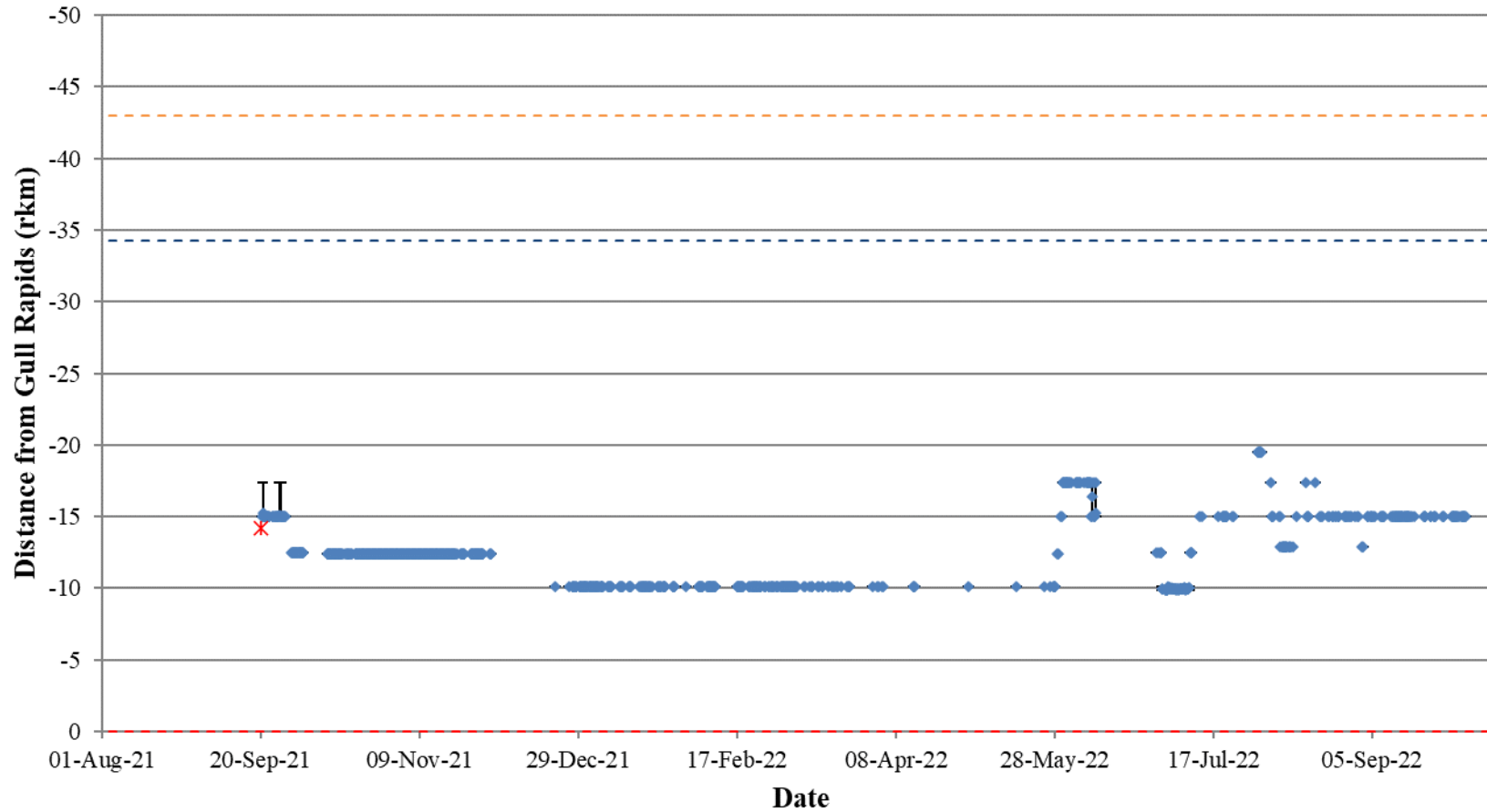


Figure A2-24: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48287) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

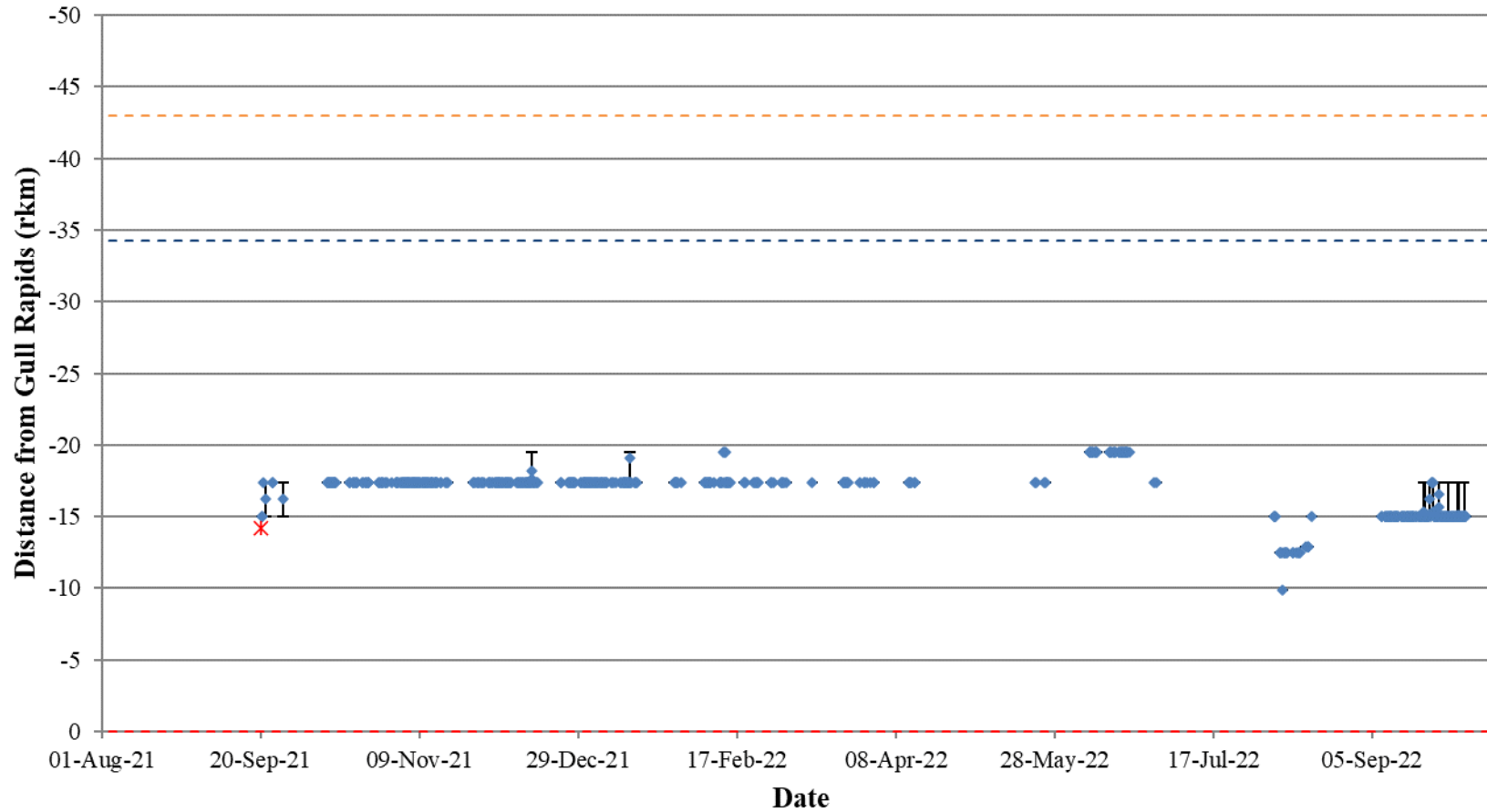


Figure A2-25: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48292) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

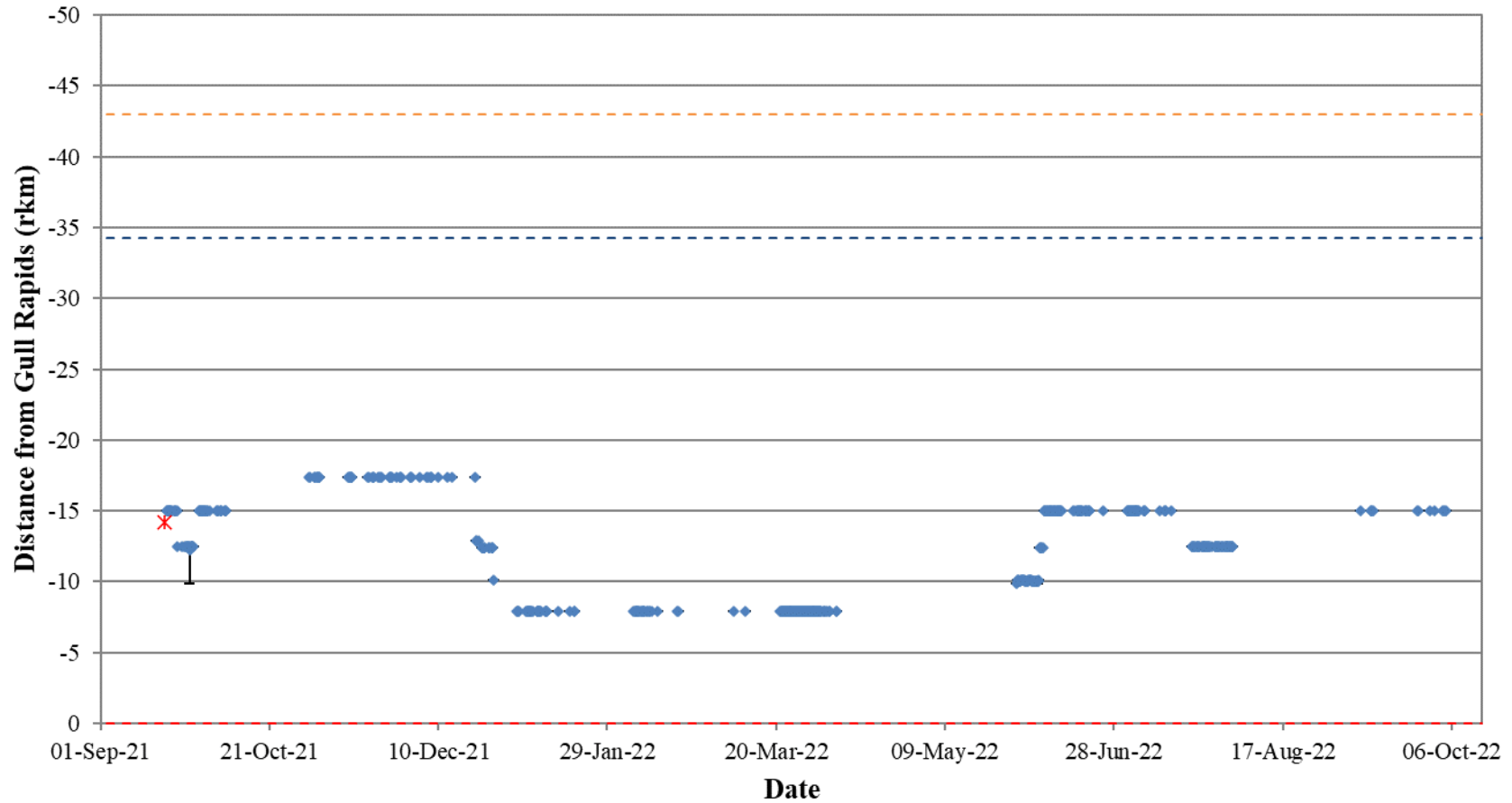


Figure A2-26: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48293) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

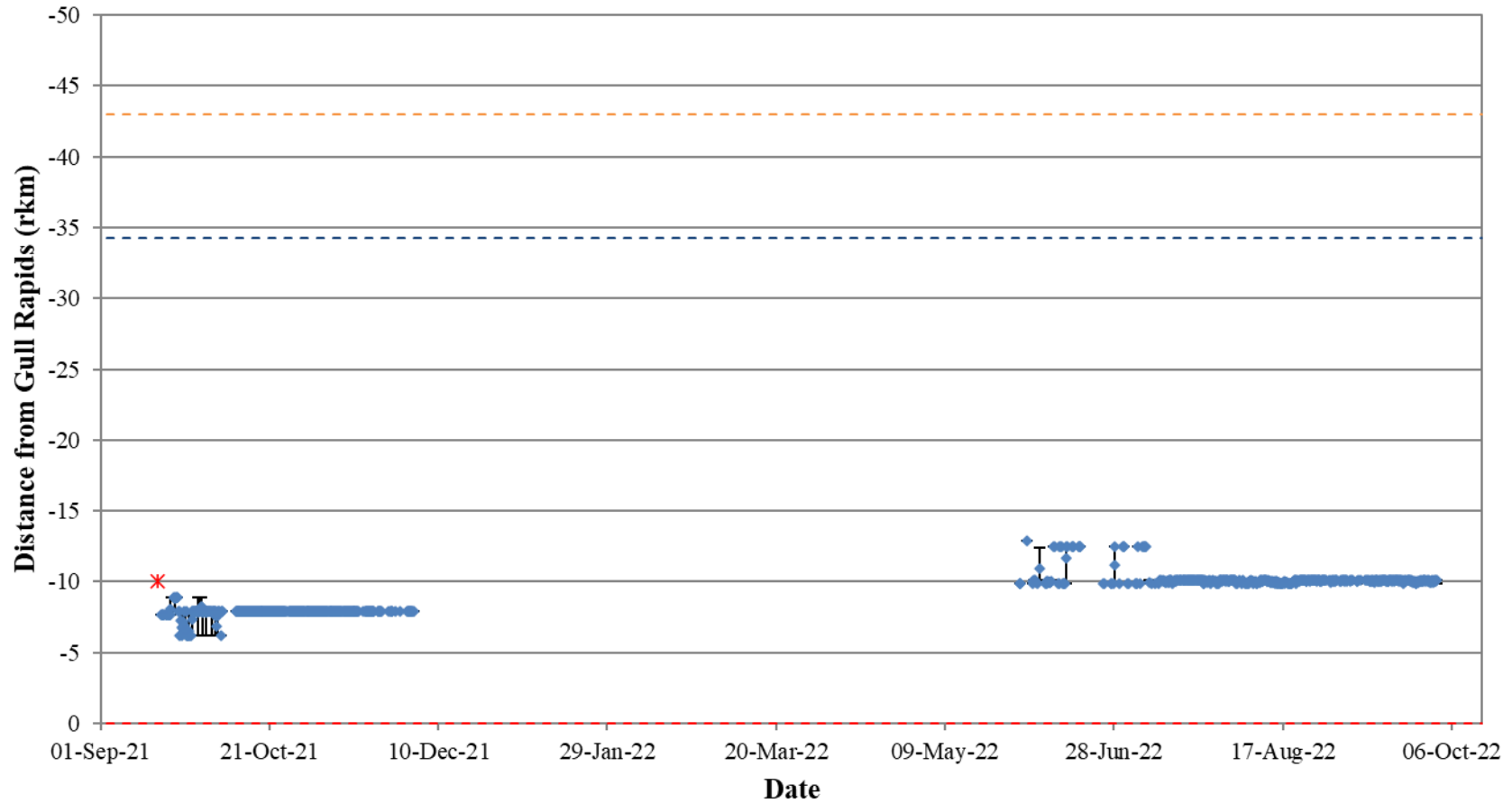


Figure A2-27: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48297) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

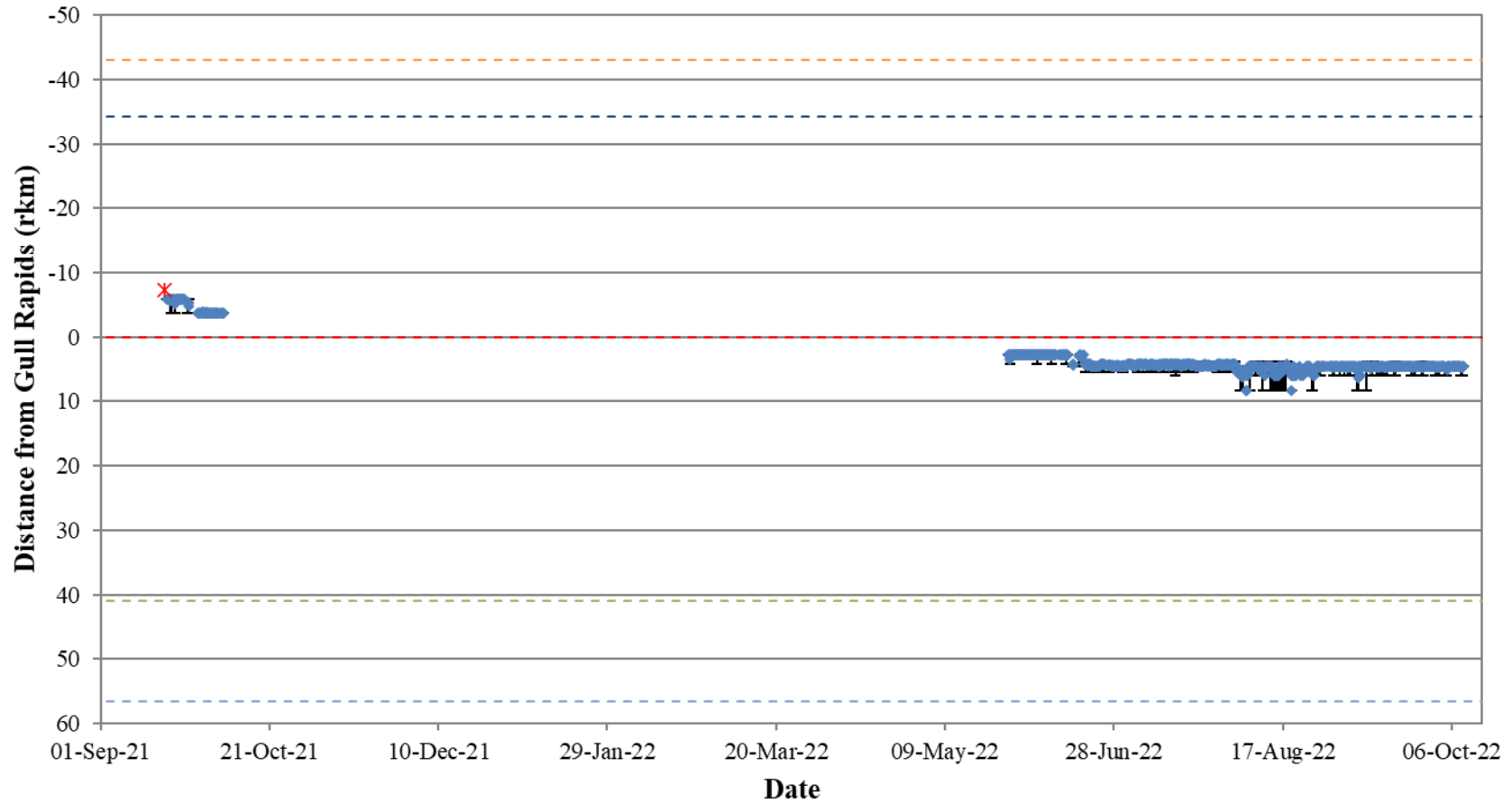


Figure A2-28: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48298) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

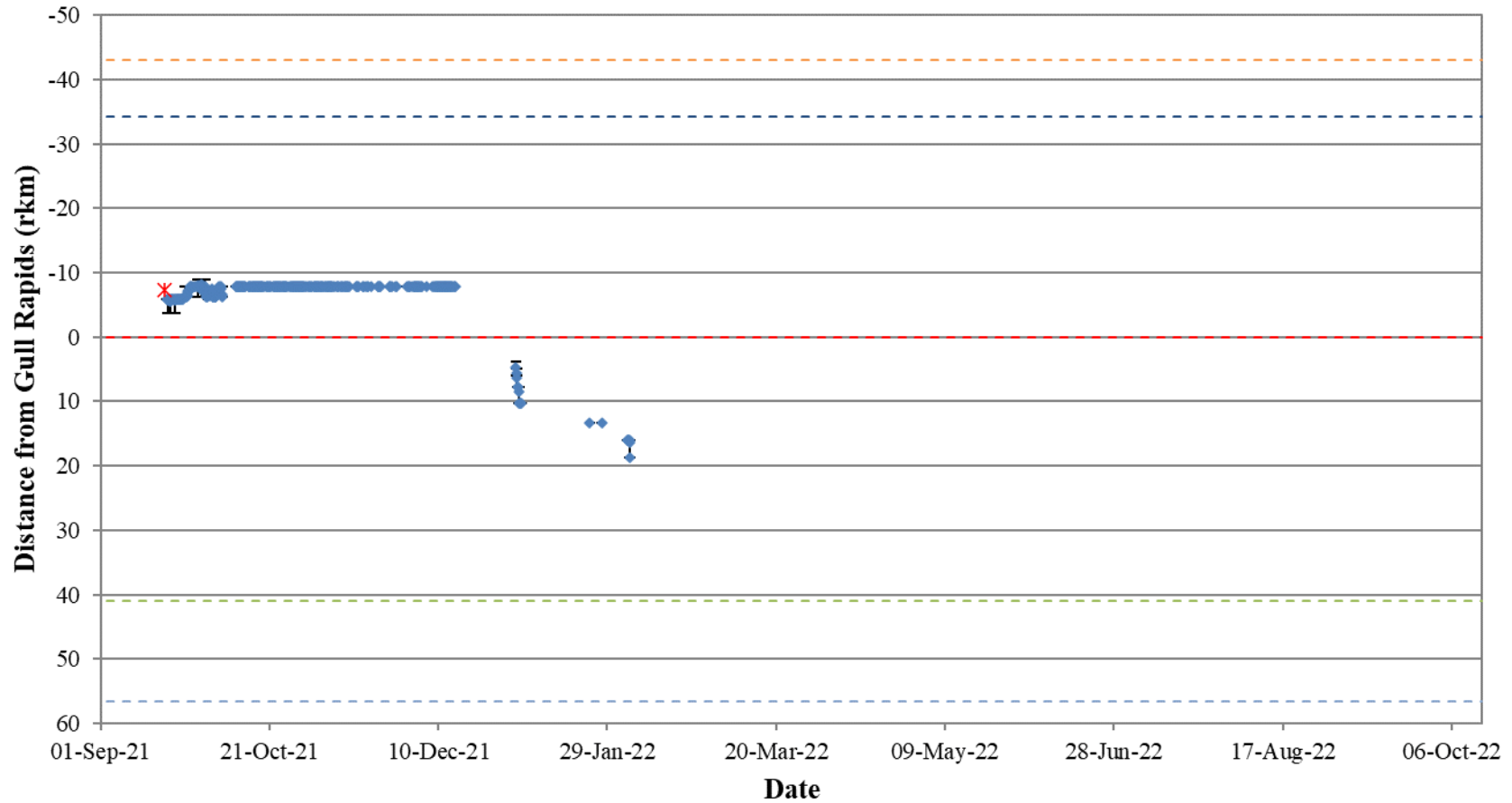


Figure A2-29: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48299) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

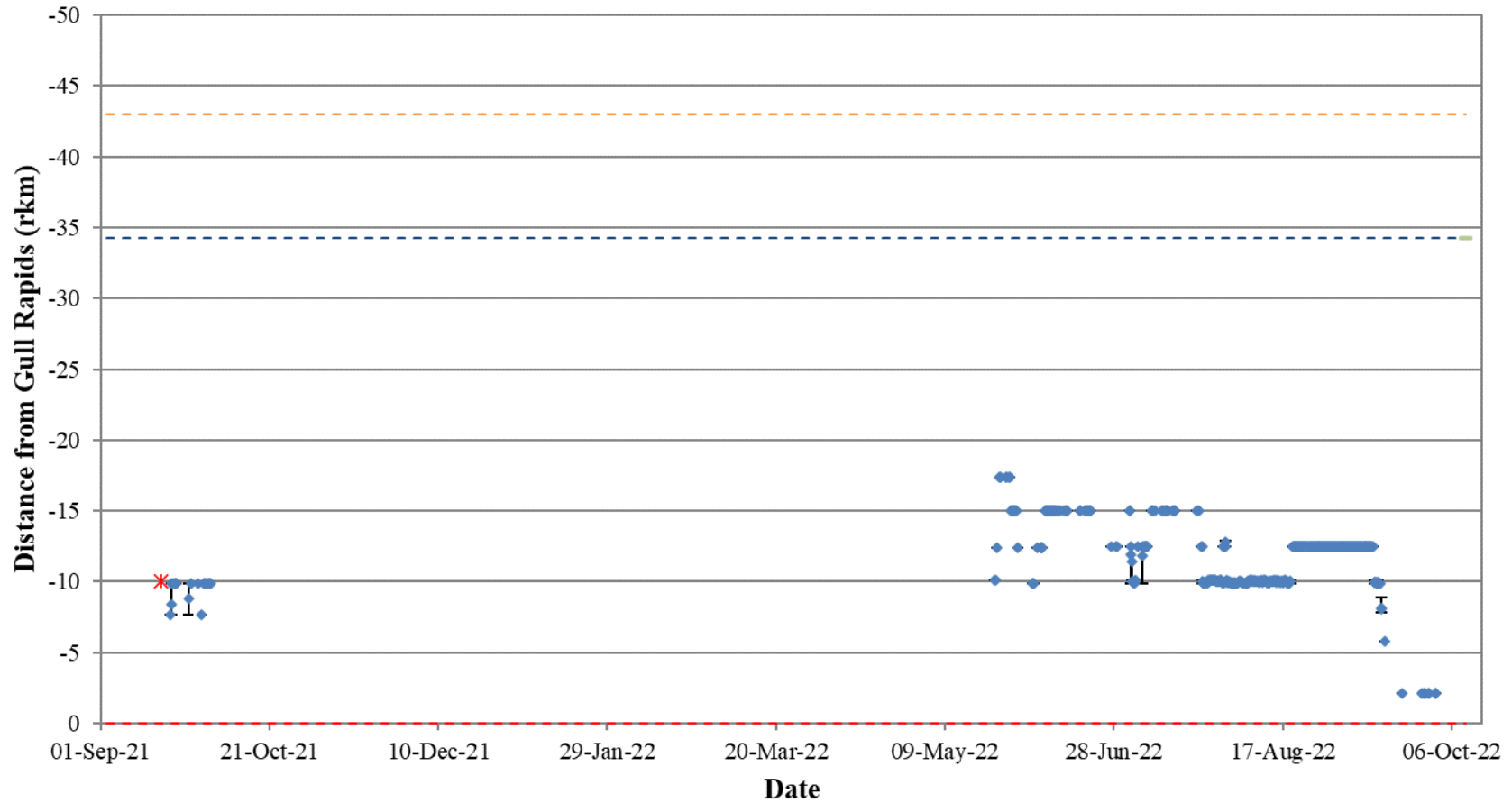


Figure A2-30: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48302) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

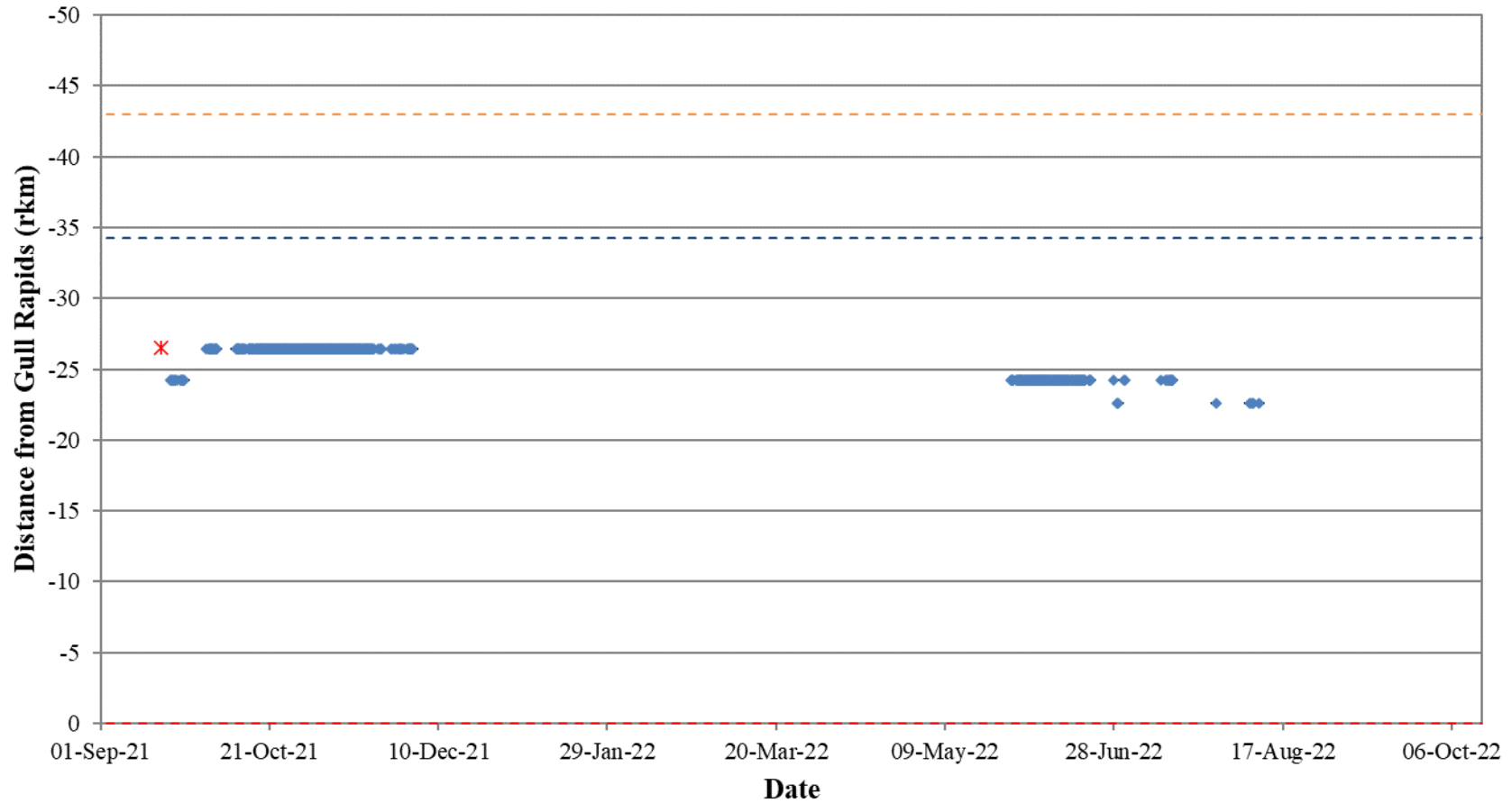


Figure A2-31: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48303) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

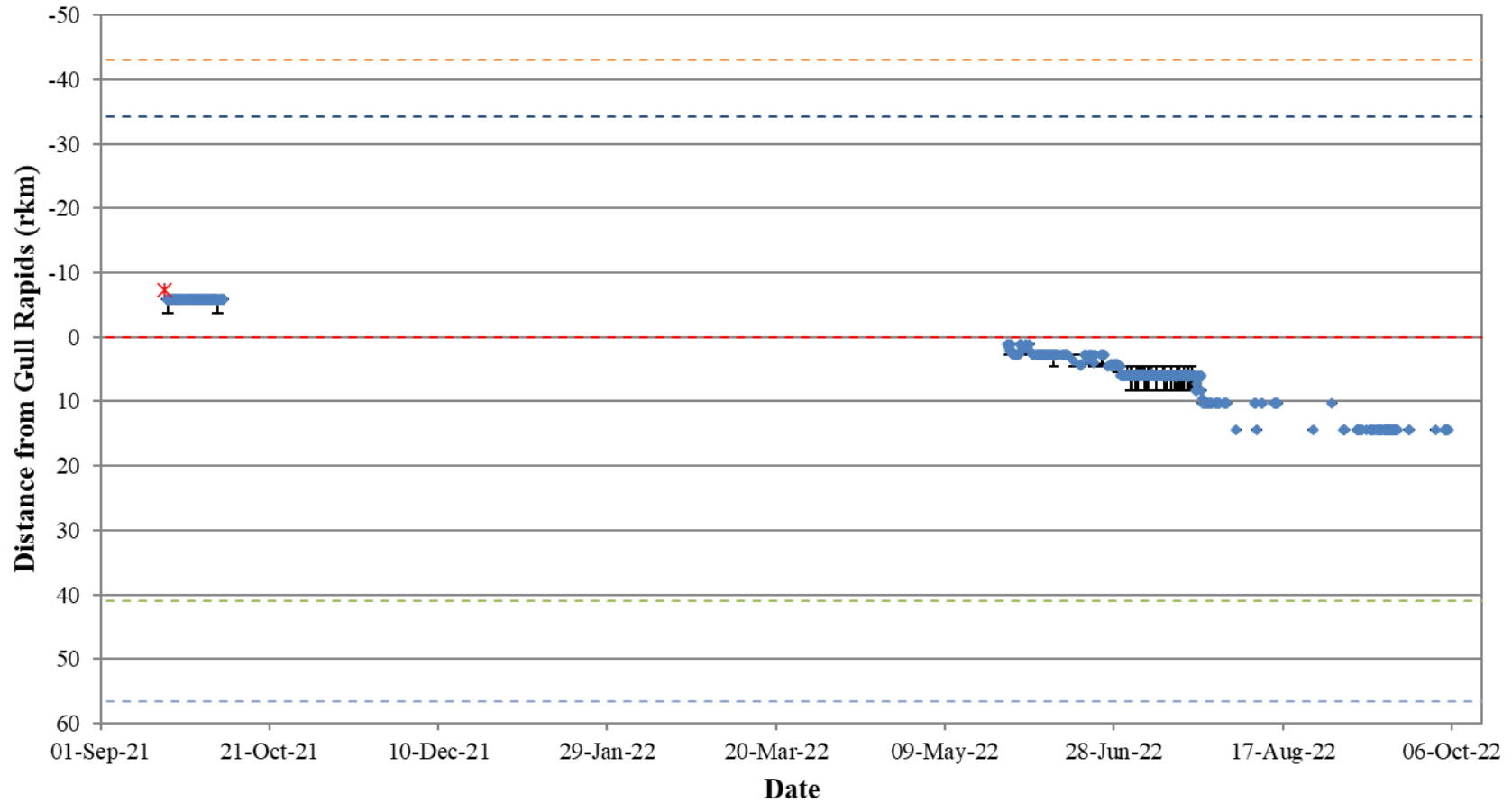


Figure A2-32: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48304) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

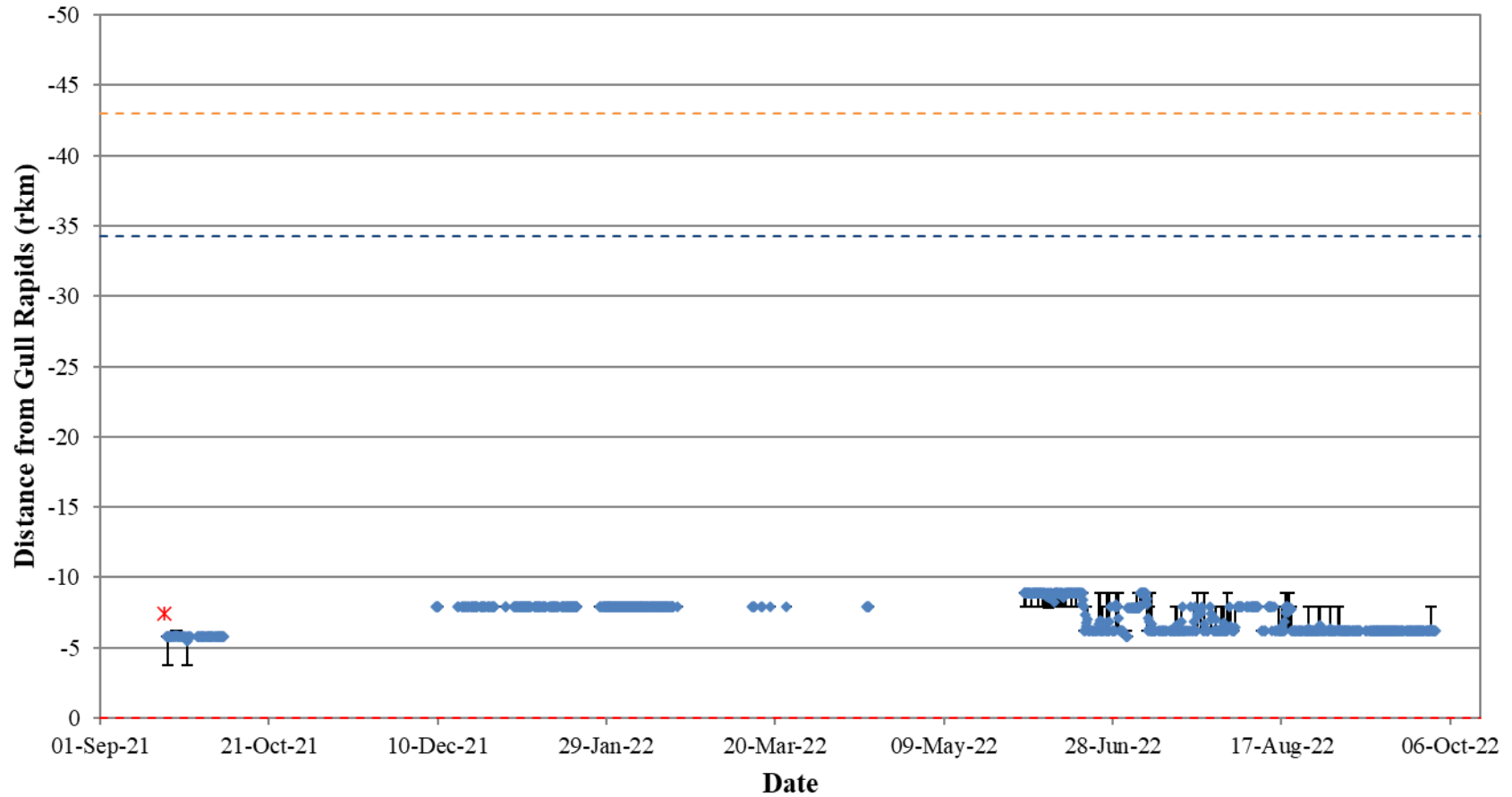


Figure A2-33: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48305) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

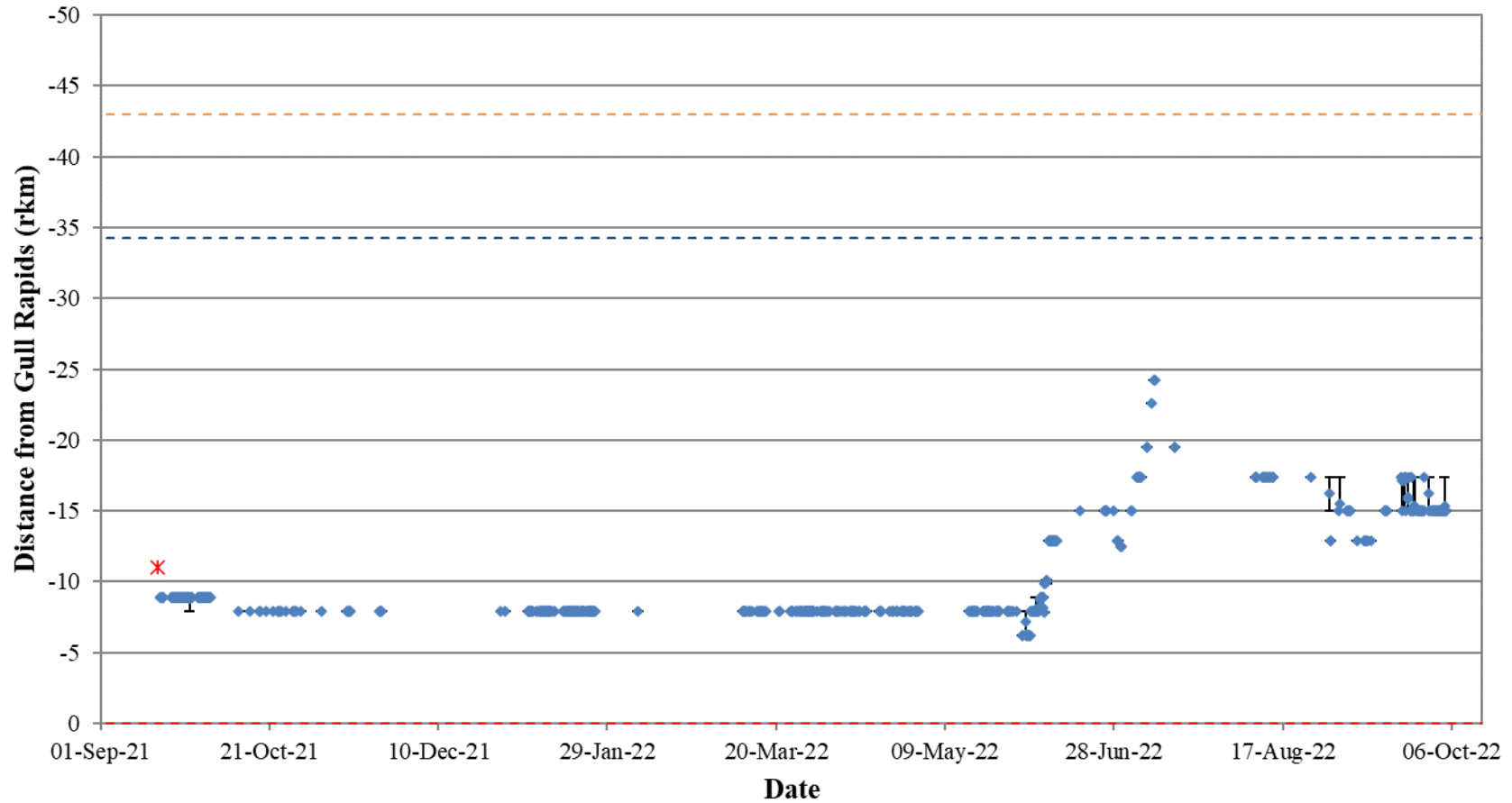


Figure A2-34: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48308) in the Keyyask reservoir in relation to the Keyyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

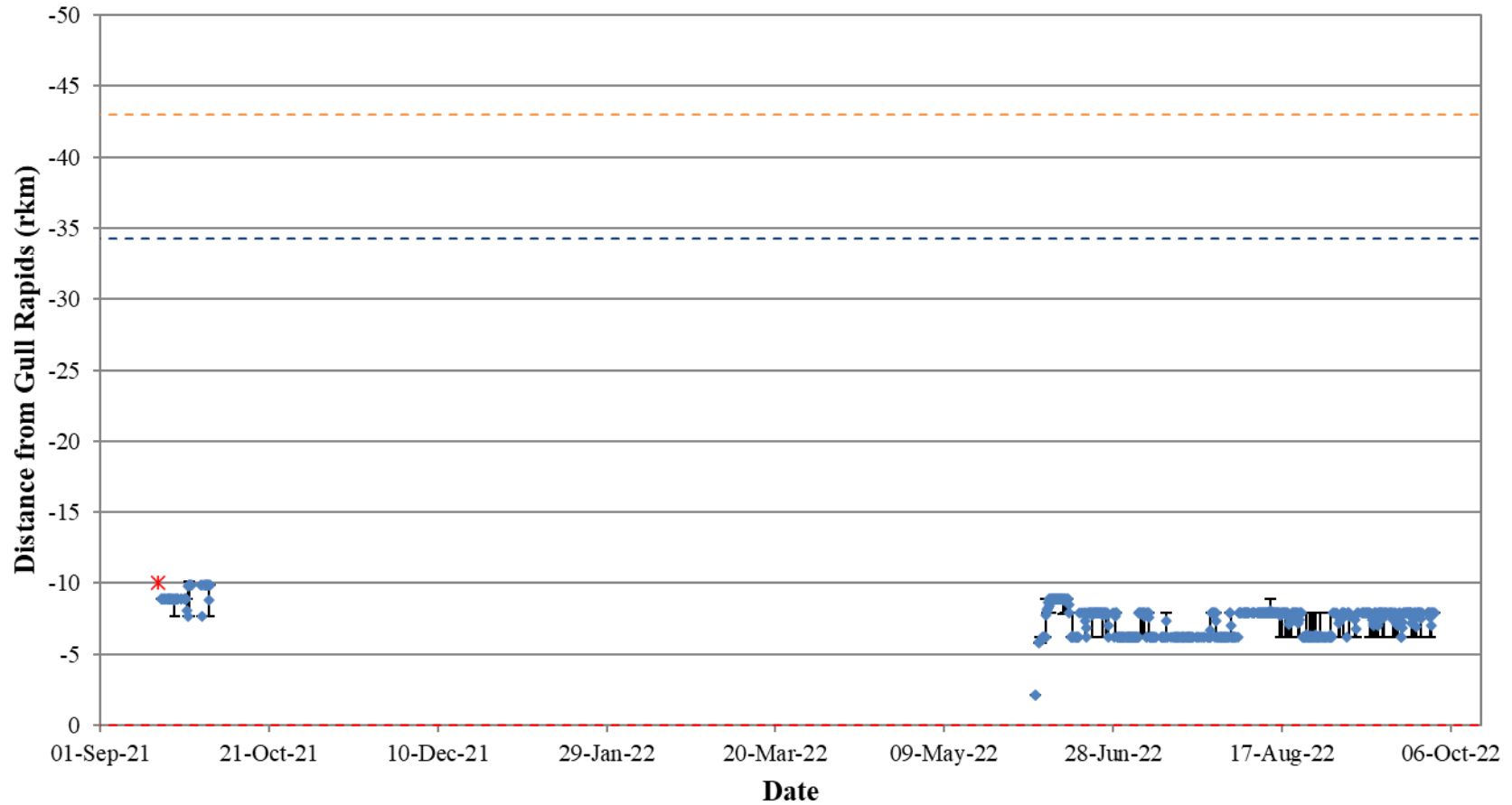


Figure A2-35: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48309) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

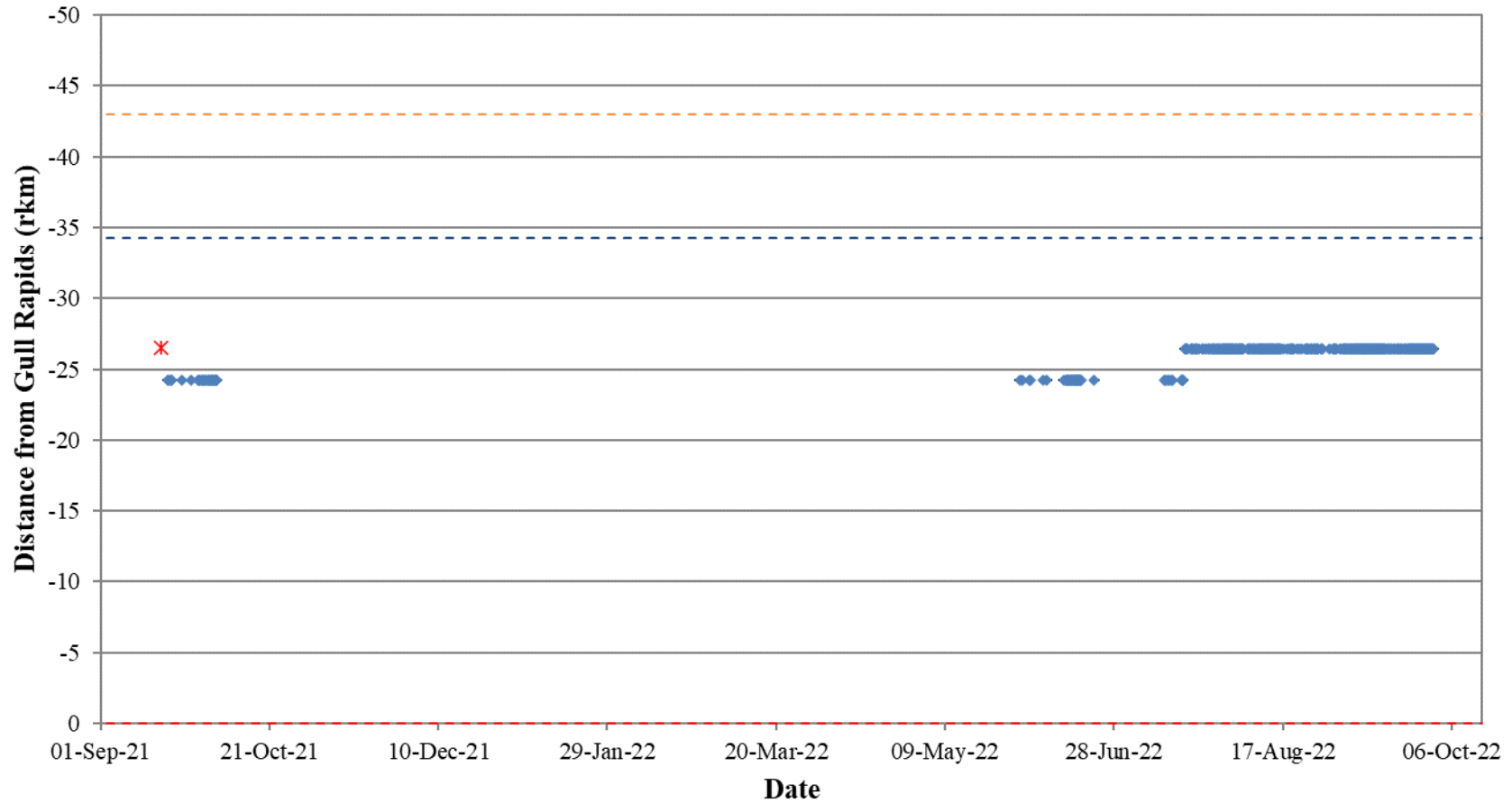


Figure A2-36: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48310) in the Keeyask reservoir in relation to the Keeyask GS (rkm 0), from September 19, 2021 to October 10, 2022. Date and location of tagging is indicated by a red X. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Birthday Rapids (blue), and the entrance to Clark Lake (orange).

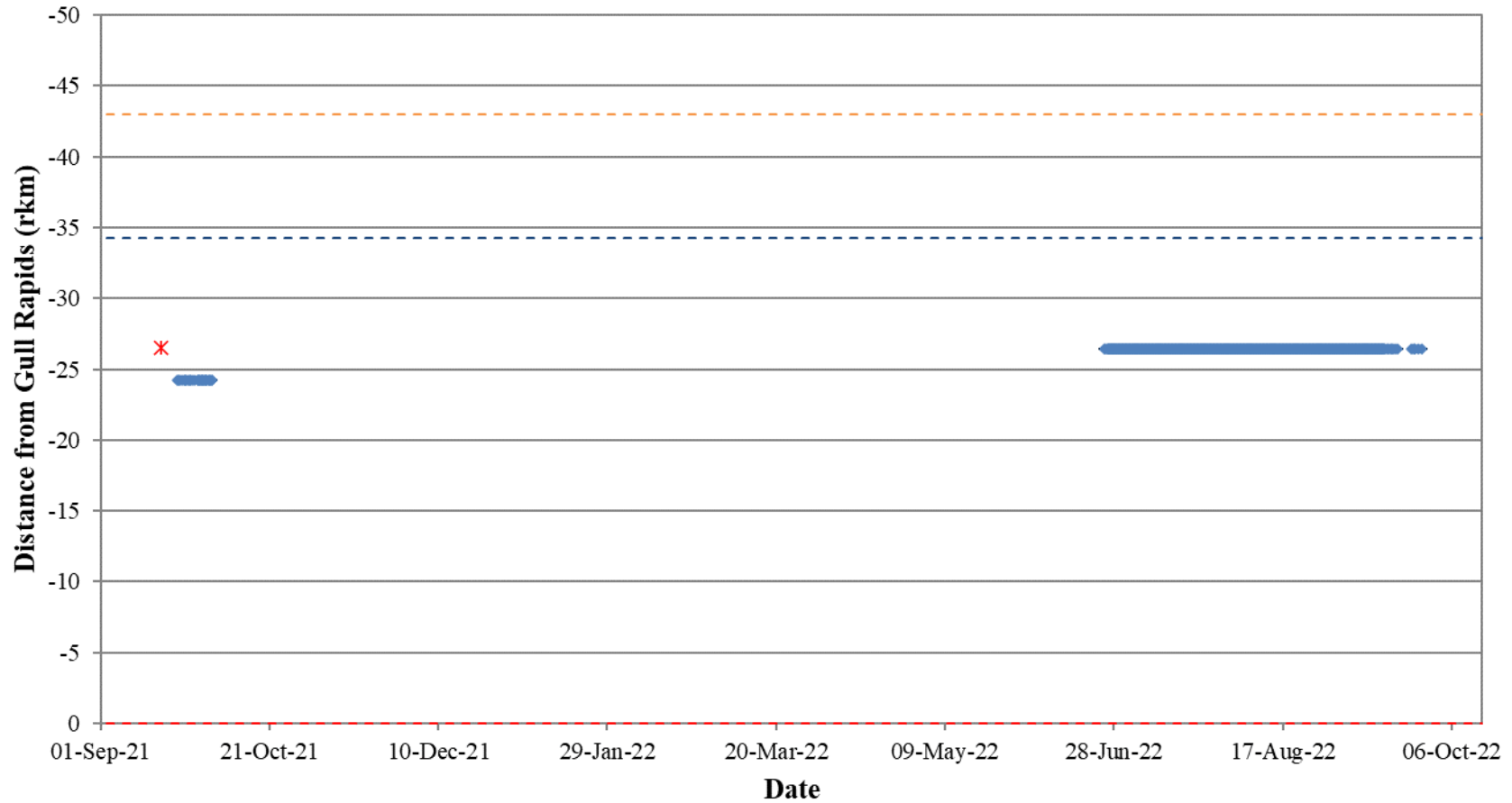


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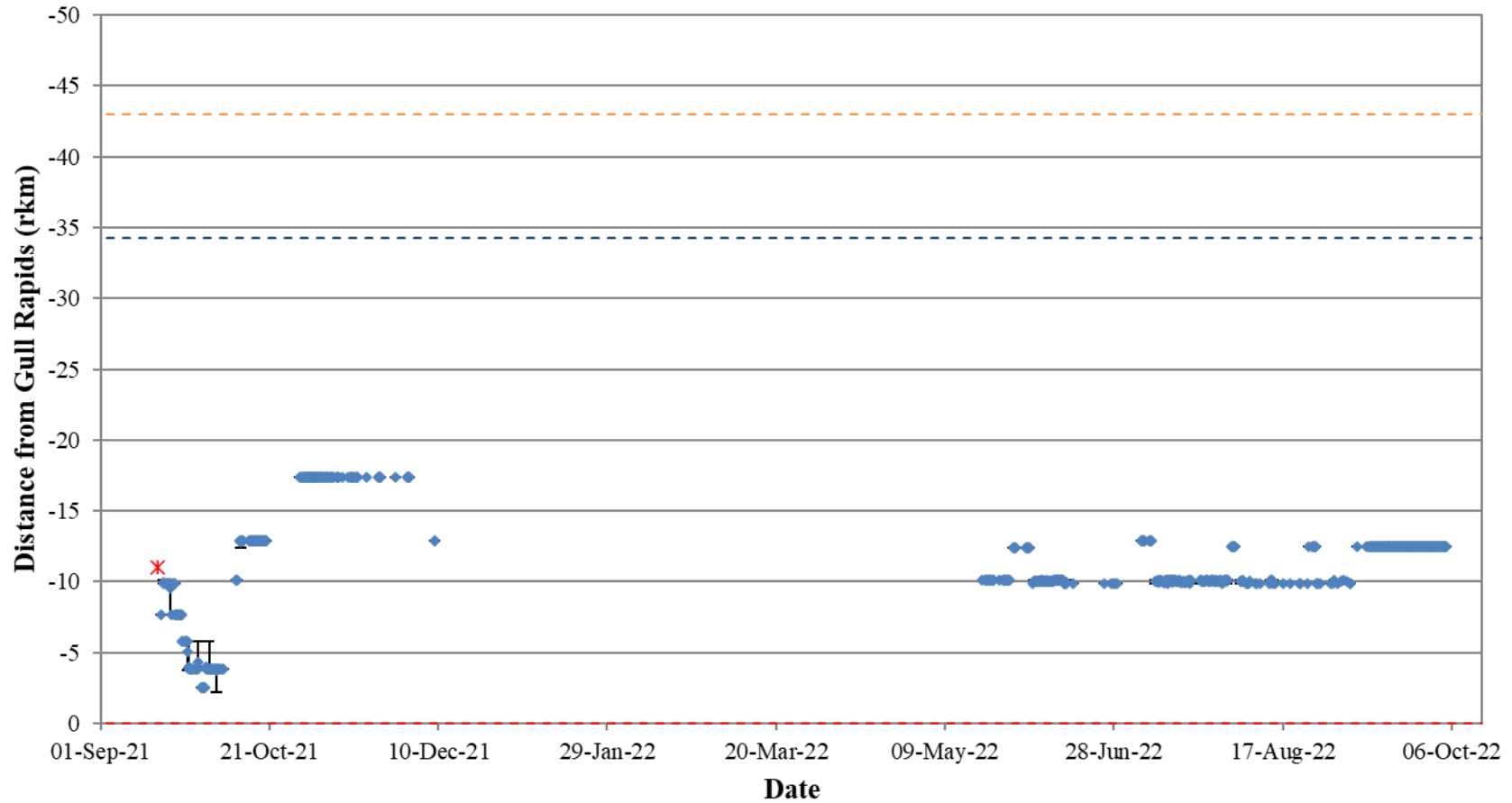


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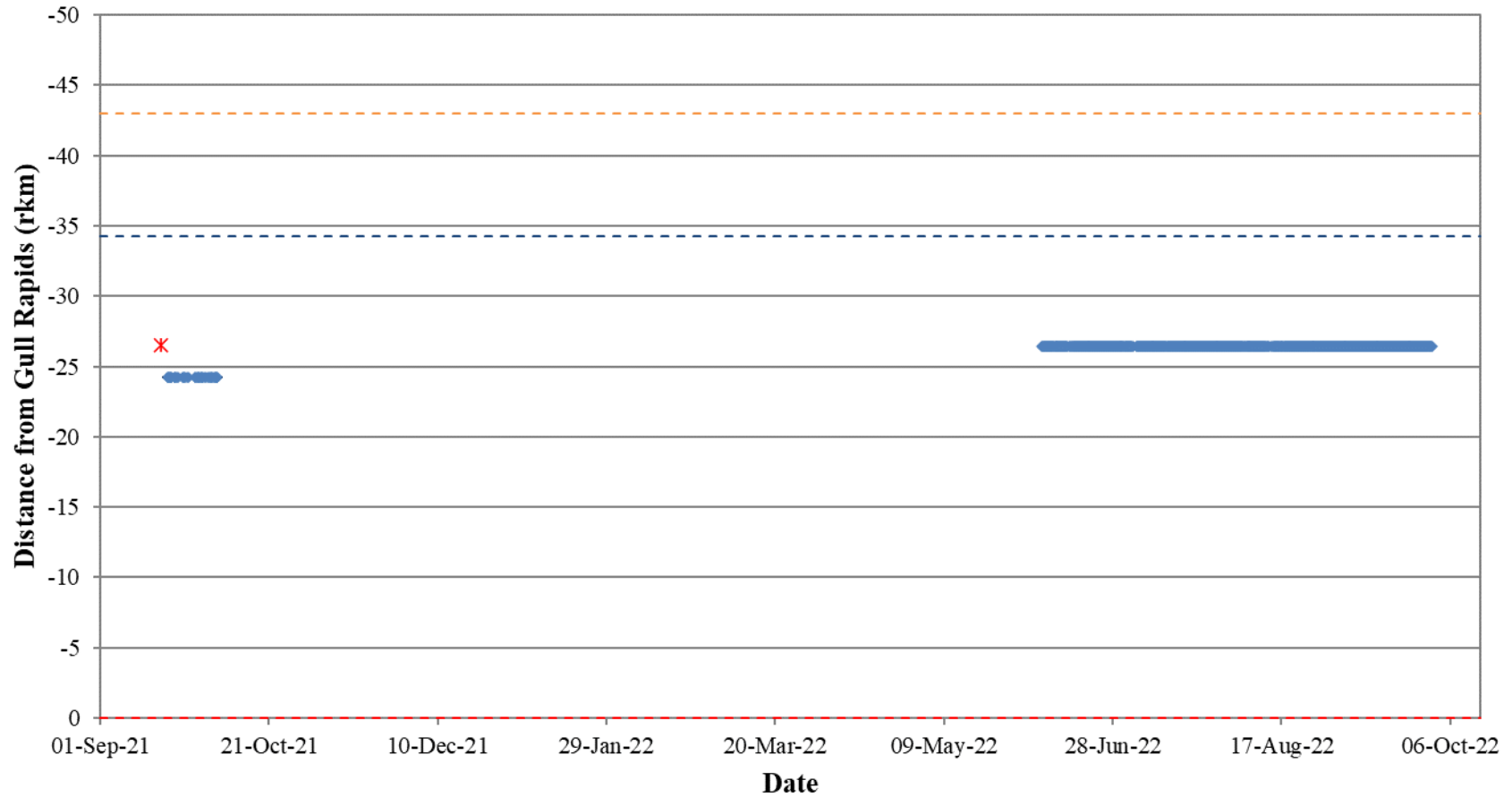


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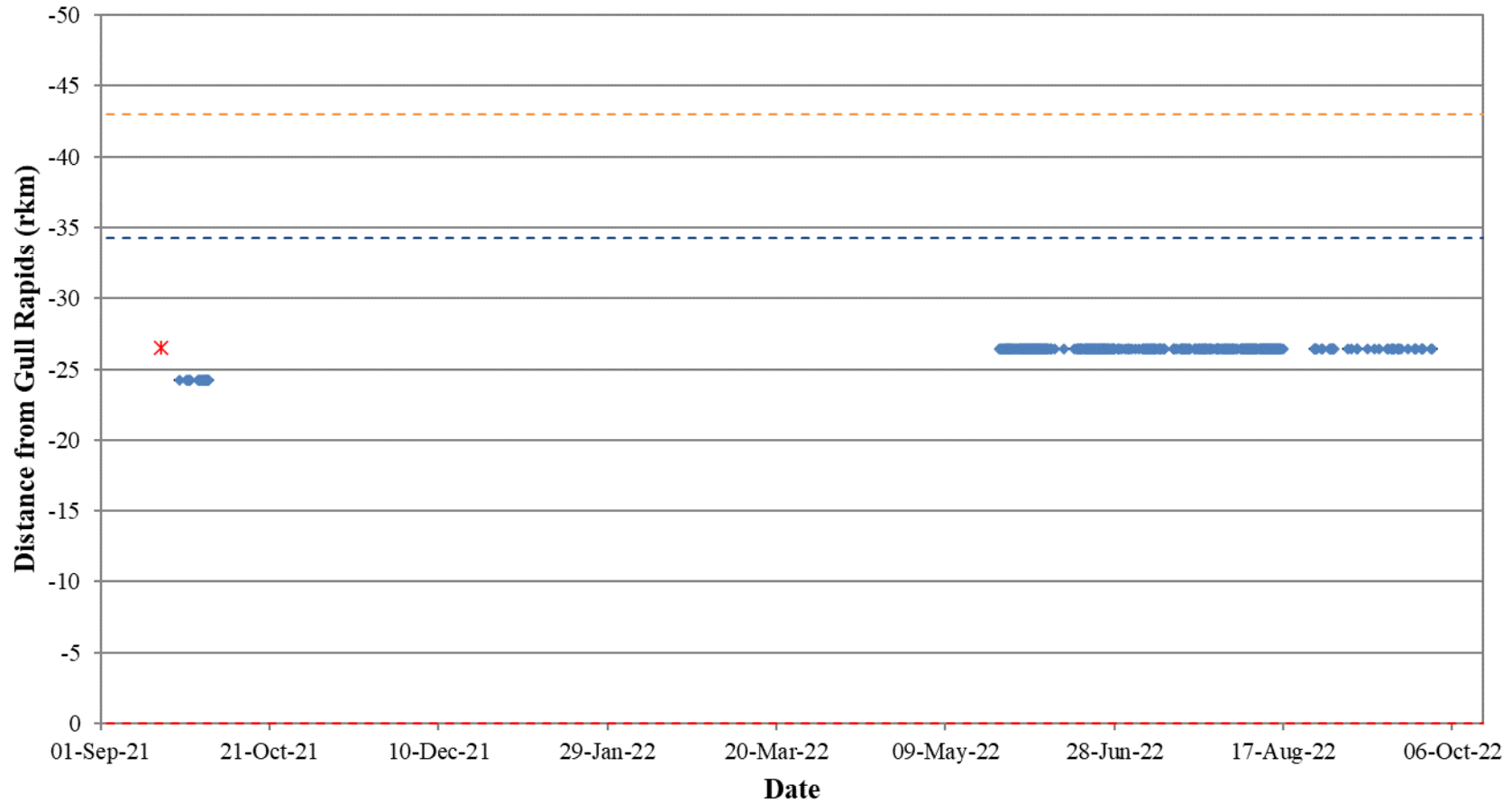


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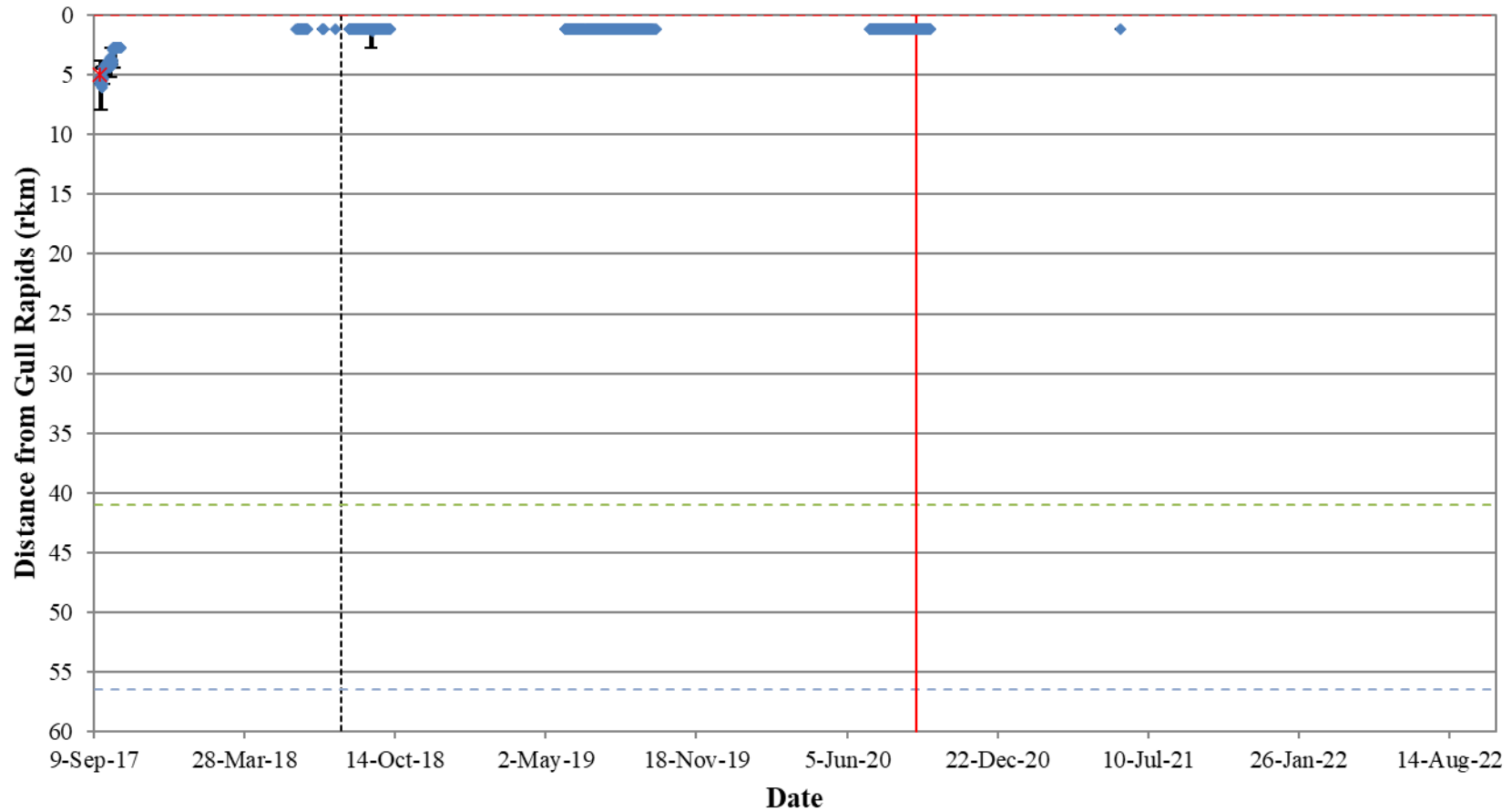


Figure A3-1: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31688) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (blue). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

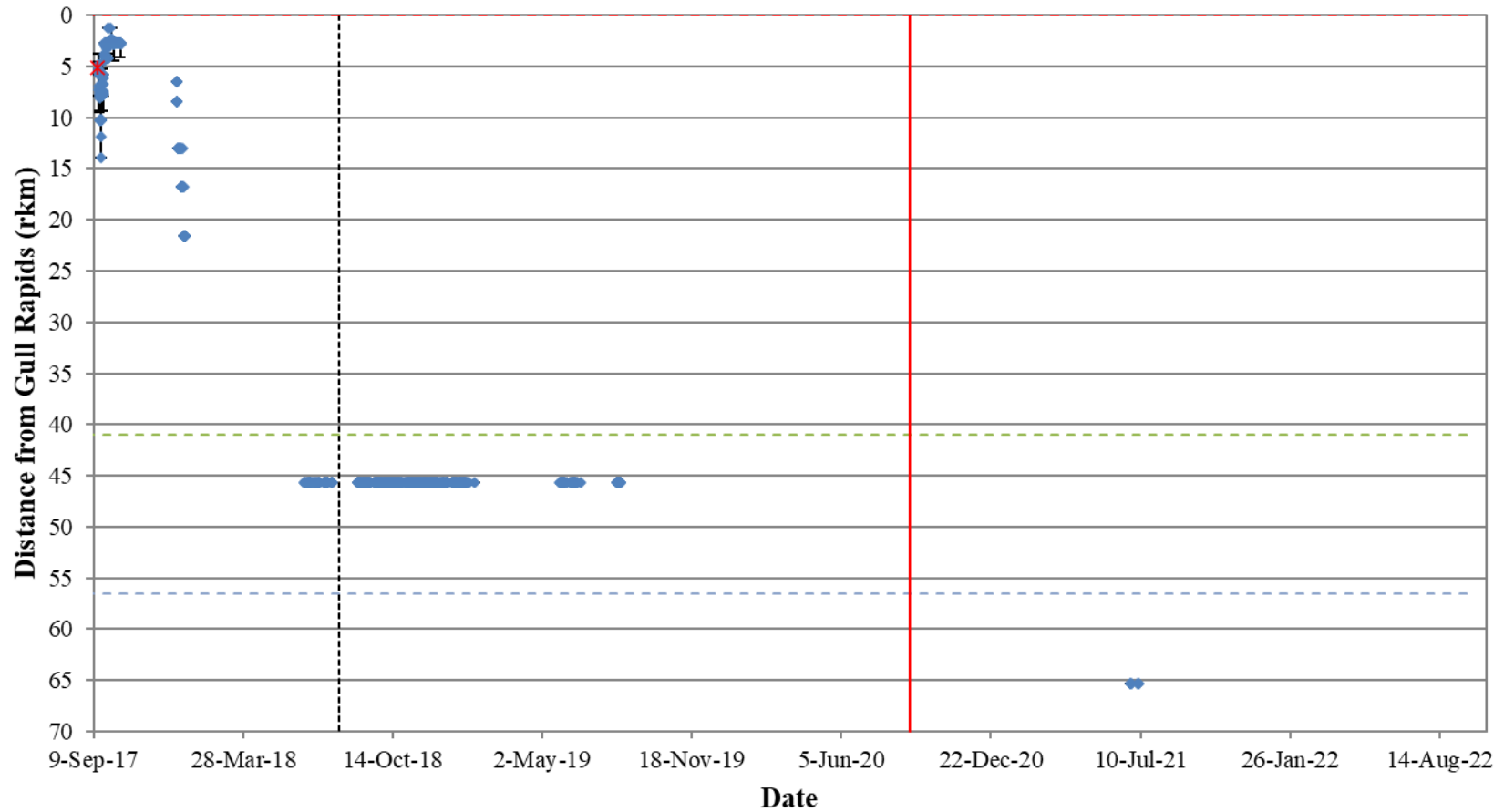


Figure A3-2: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31689) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

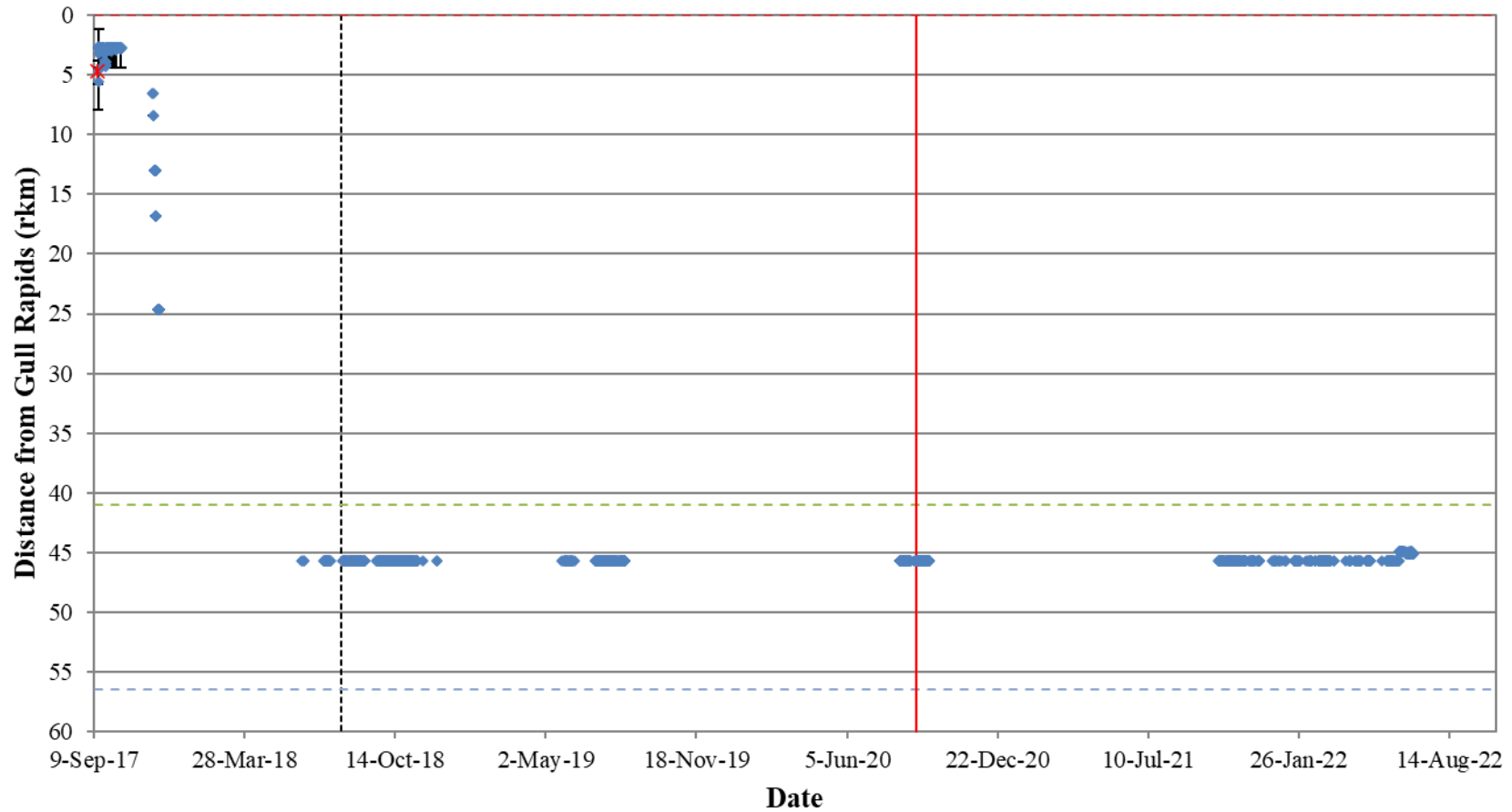


Figure A3-3: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31690) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

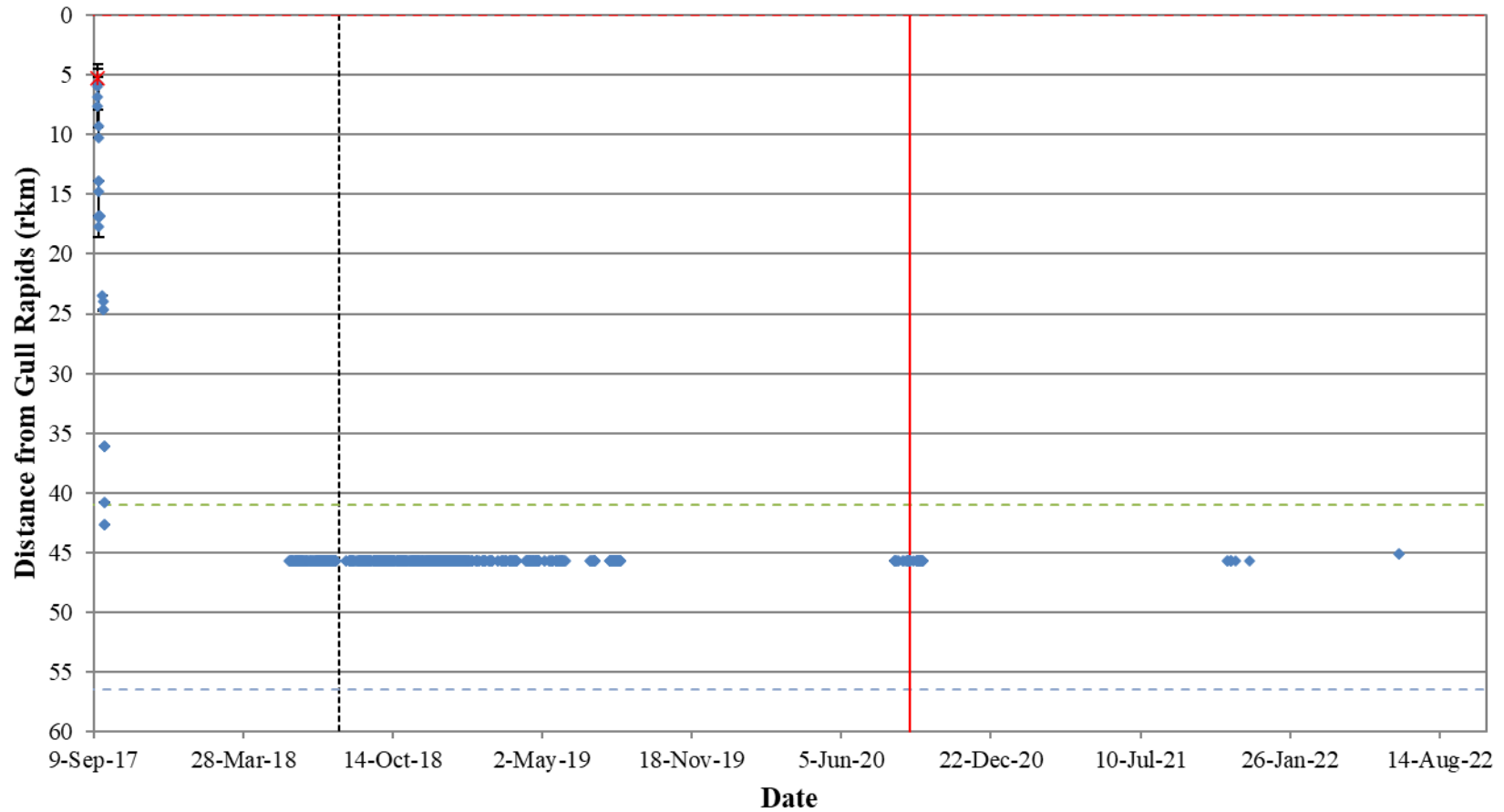


Figure A3-4: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31691) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

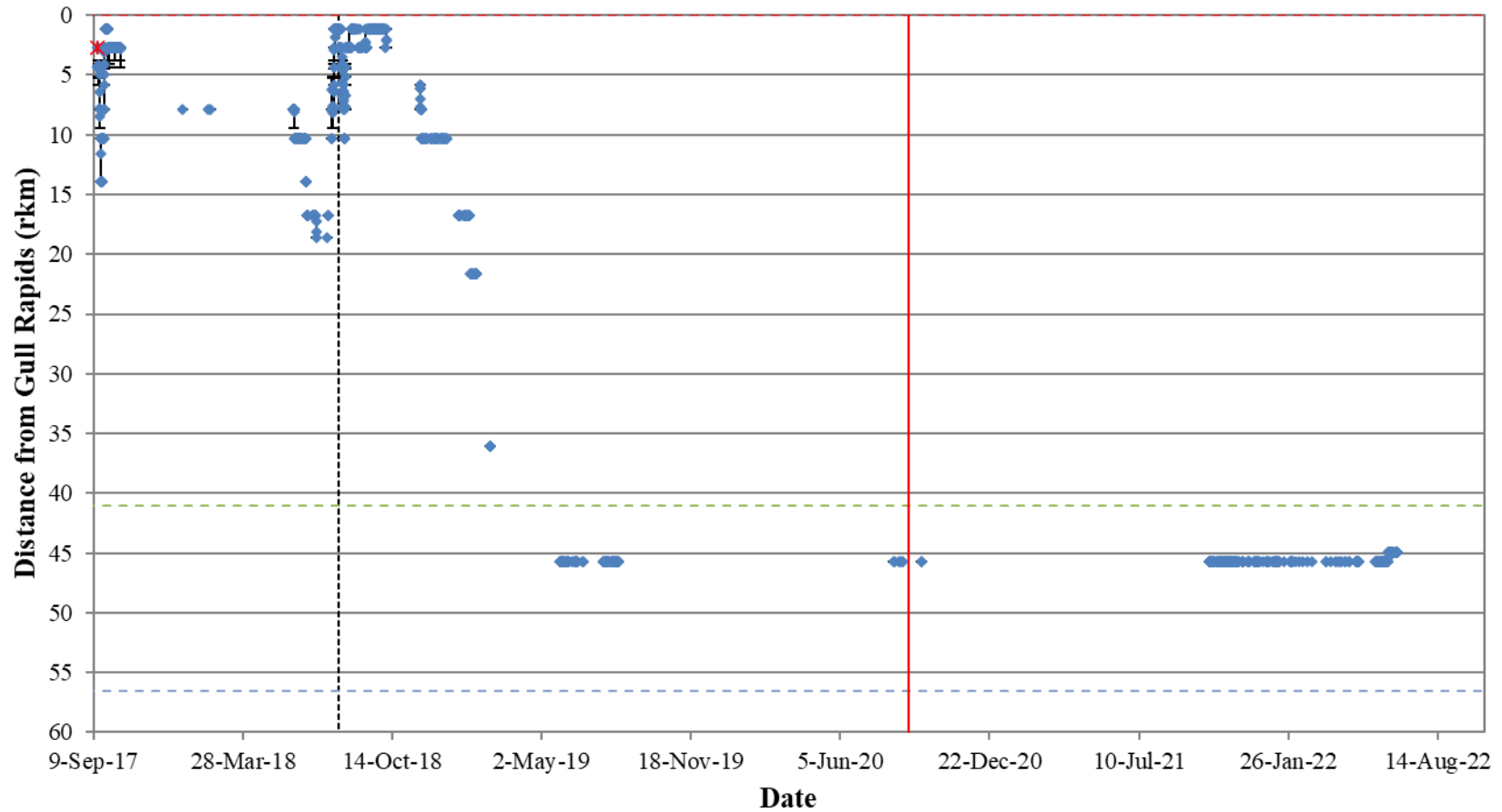


Figure A3-5: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31692) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

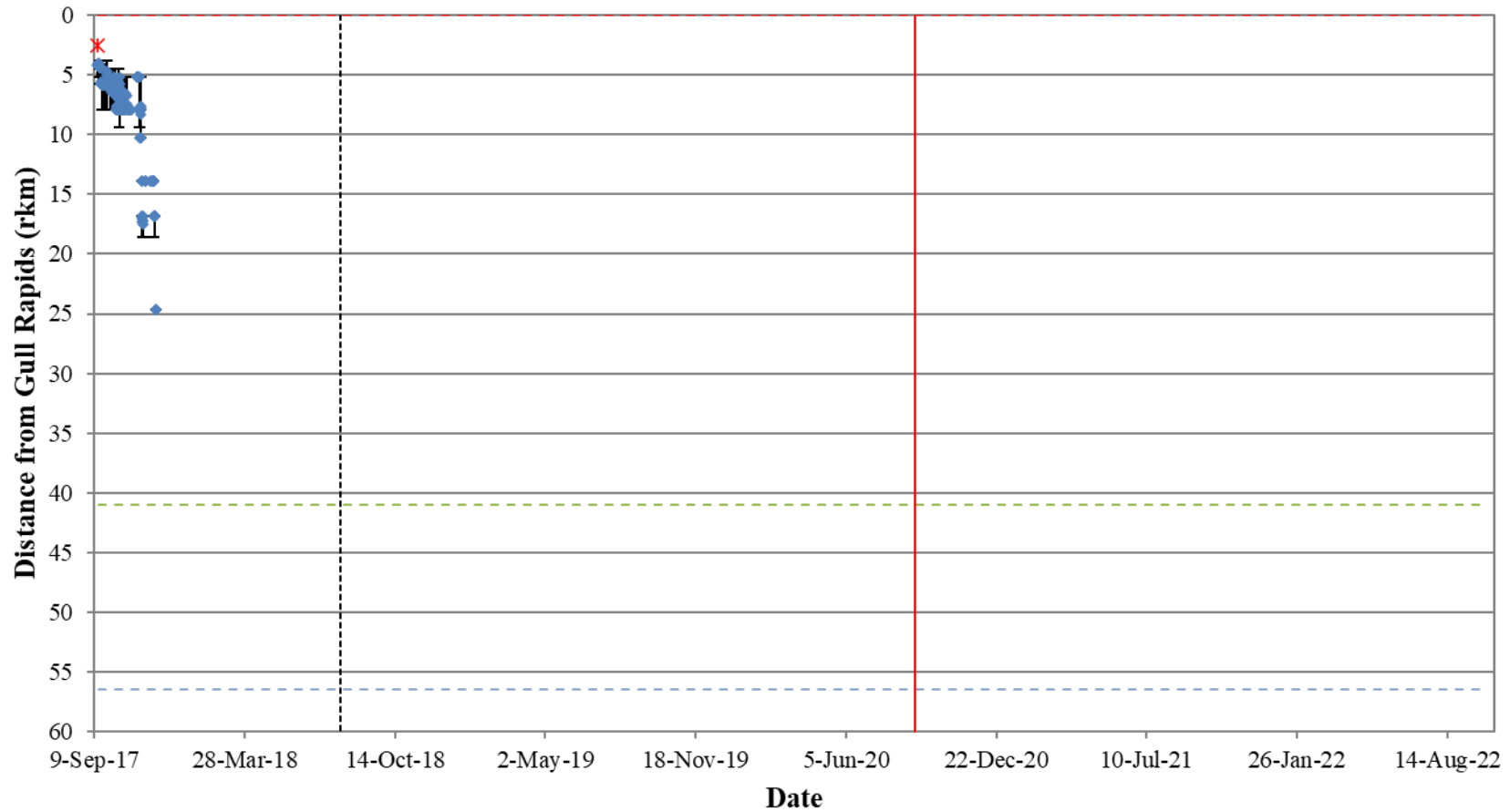


Figure A3-6: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31693) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

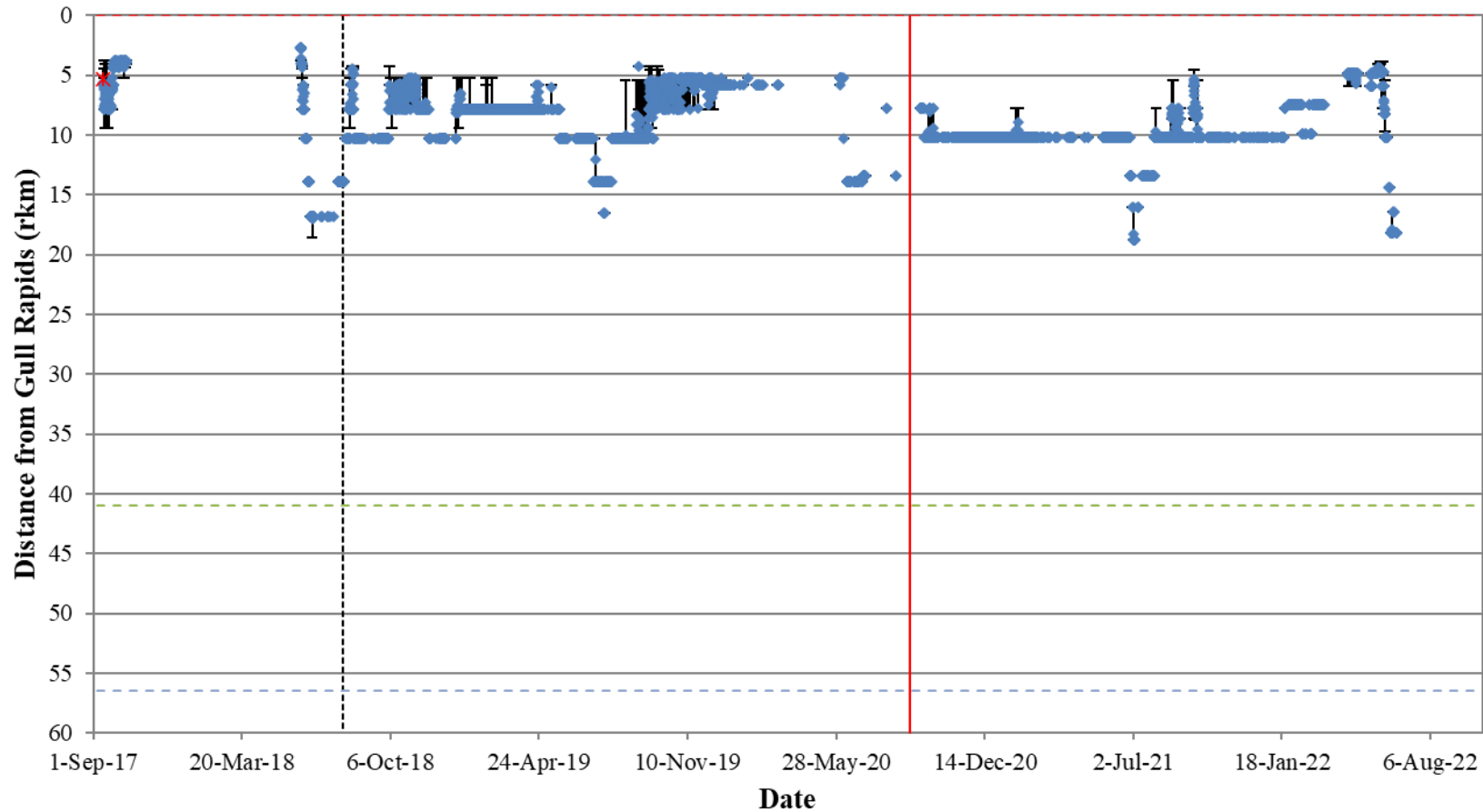


Figure A3-7: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31694) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

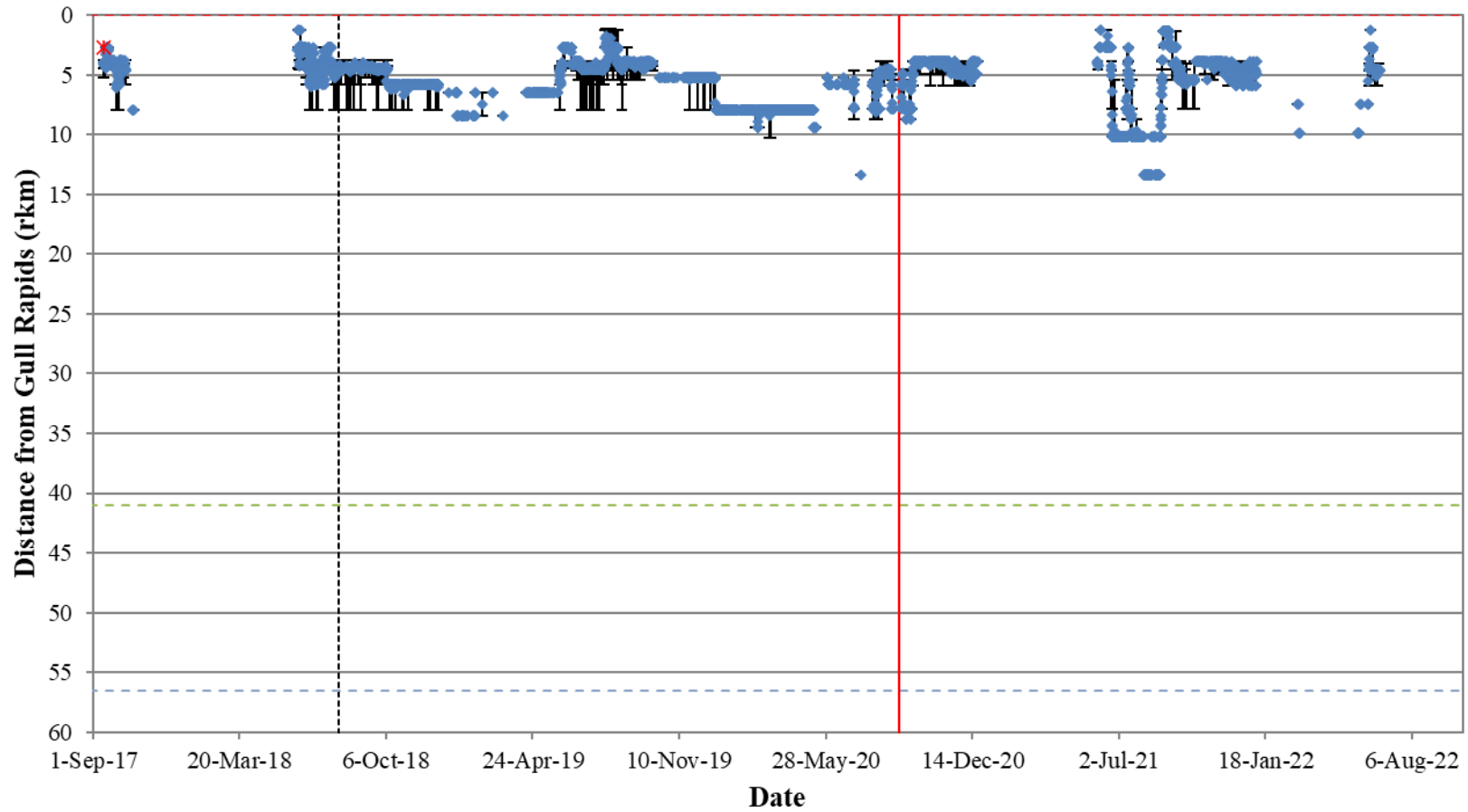


Figure A3-8: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31695) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

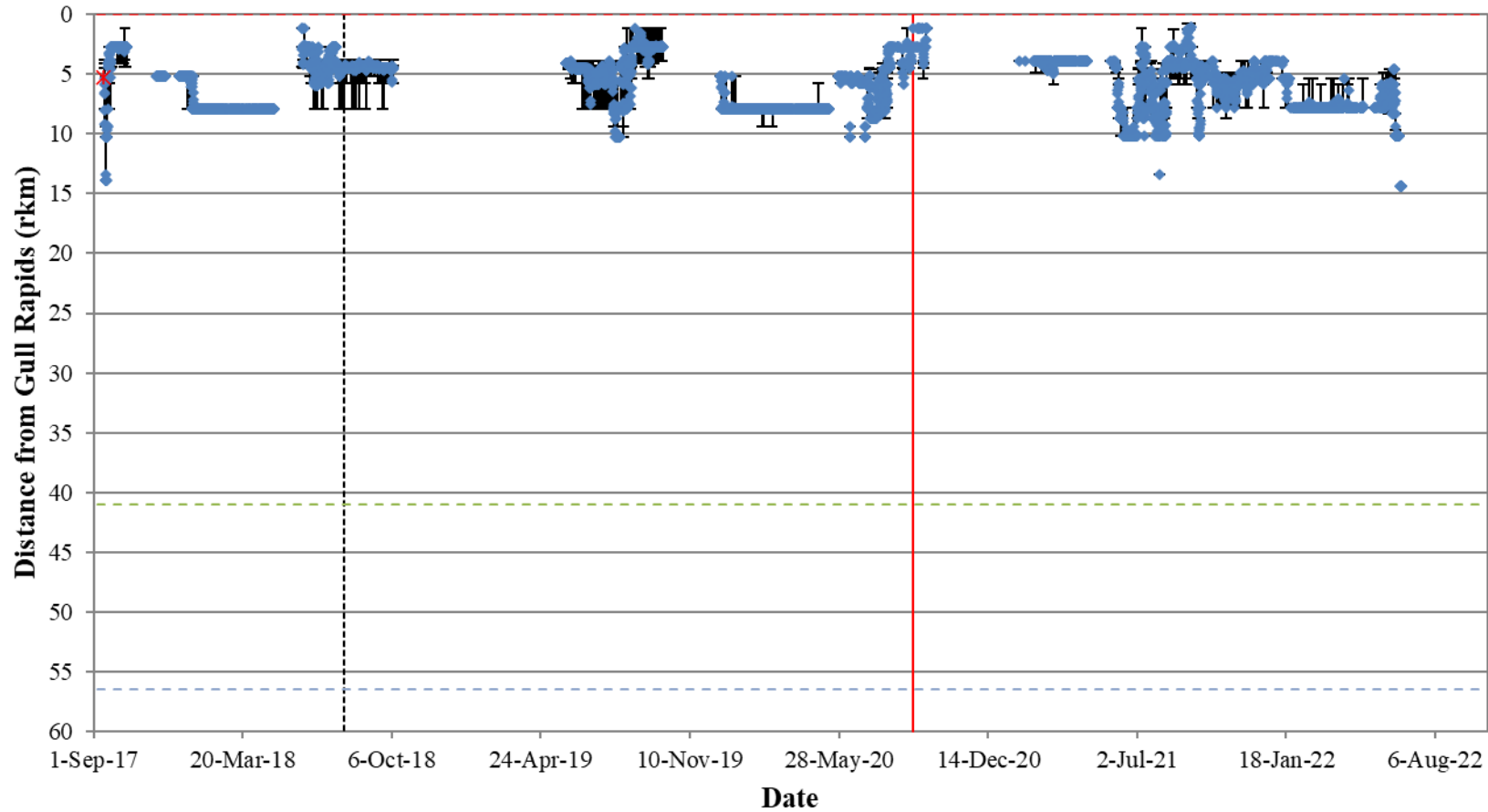


Figure A3-9: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31696) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

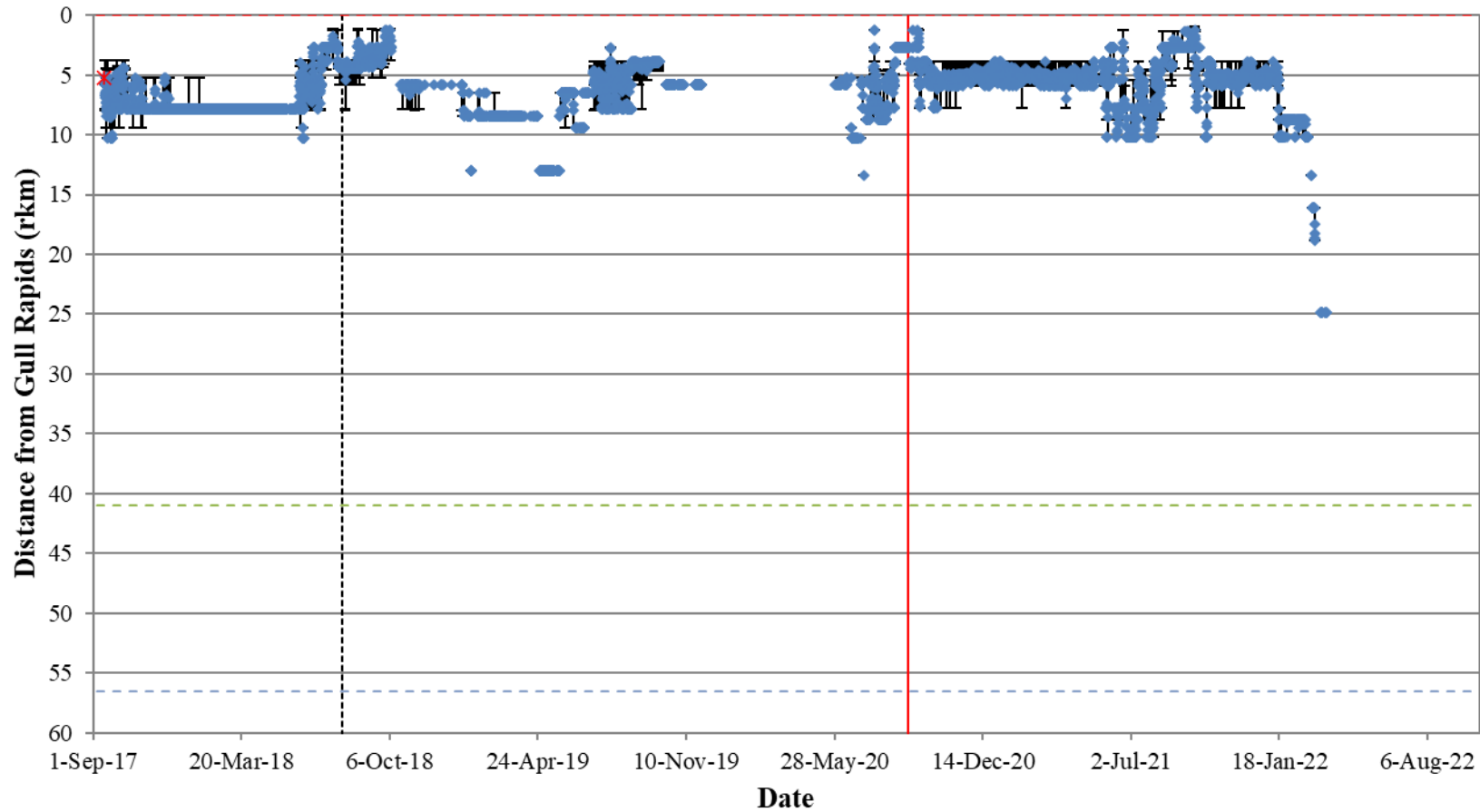


Figure A3-10: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31697) in Stephens Lake in relation to the Keyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

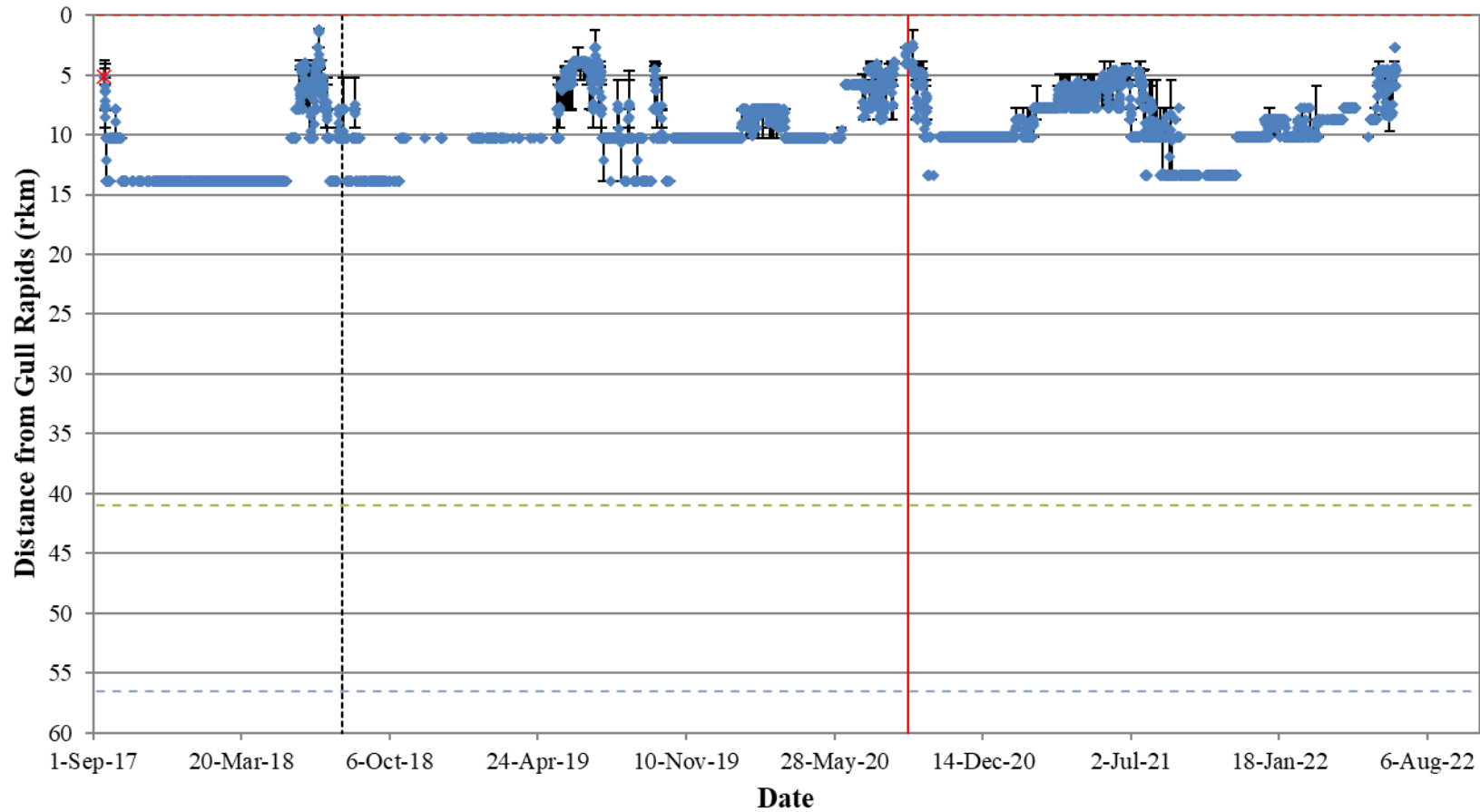


Figure A3-11: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31758) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

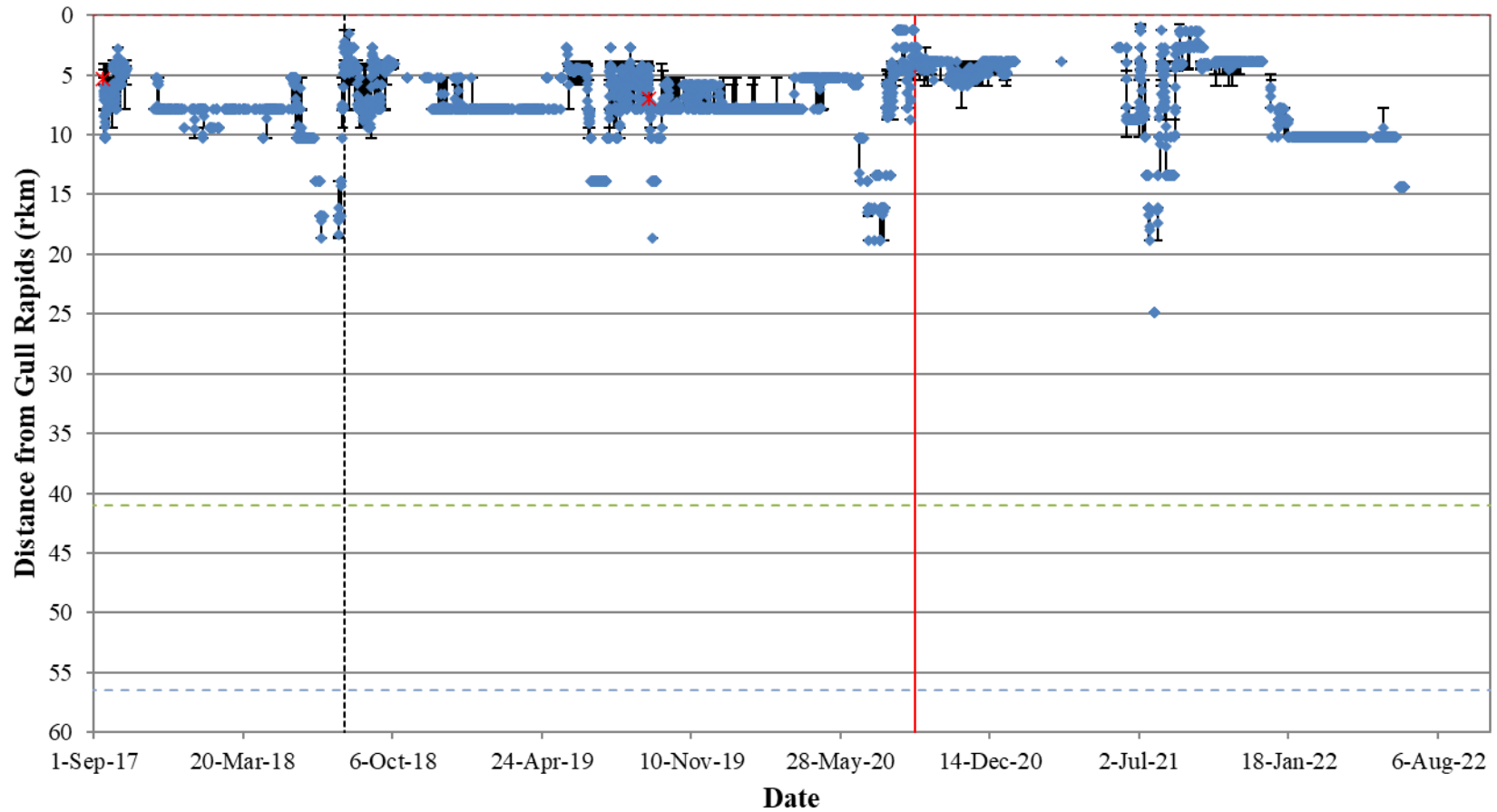


Figure A3-12: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31759) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging and recapture is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

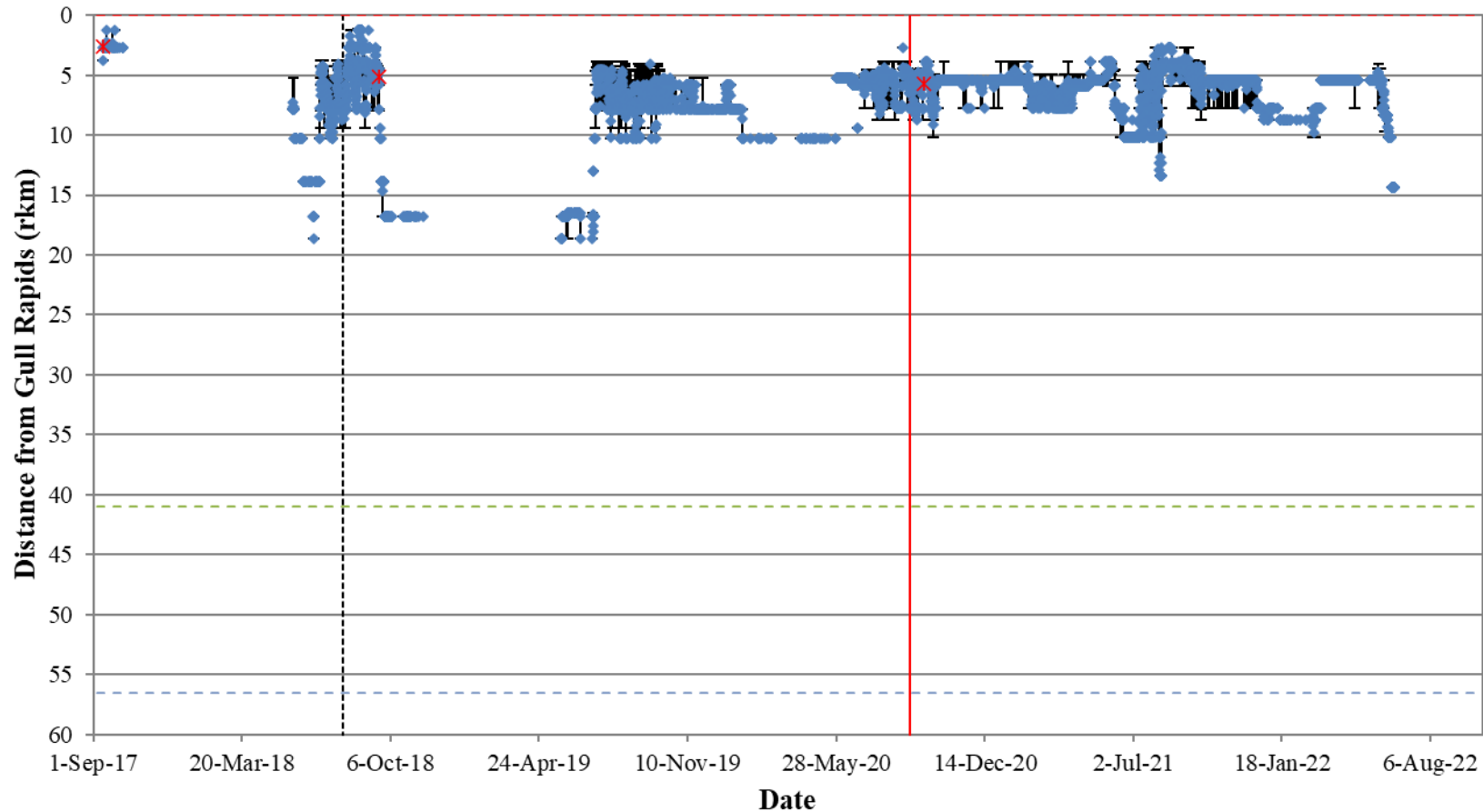


Figure A3-13: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31760) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging and subsequent recaptures are indicated by a red star. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

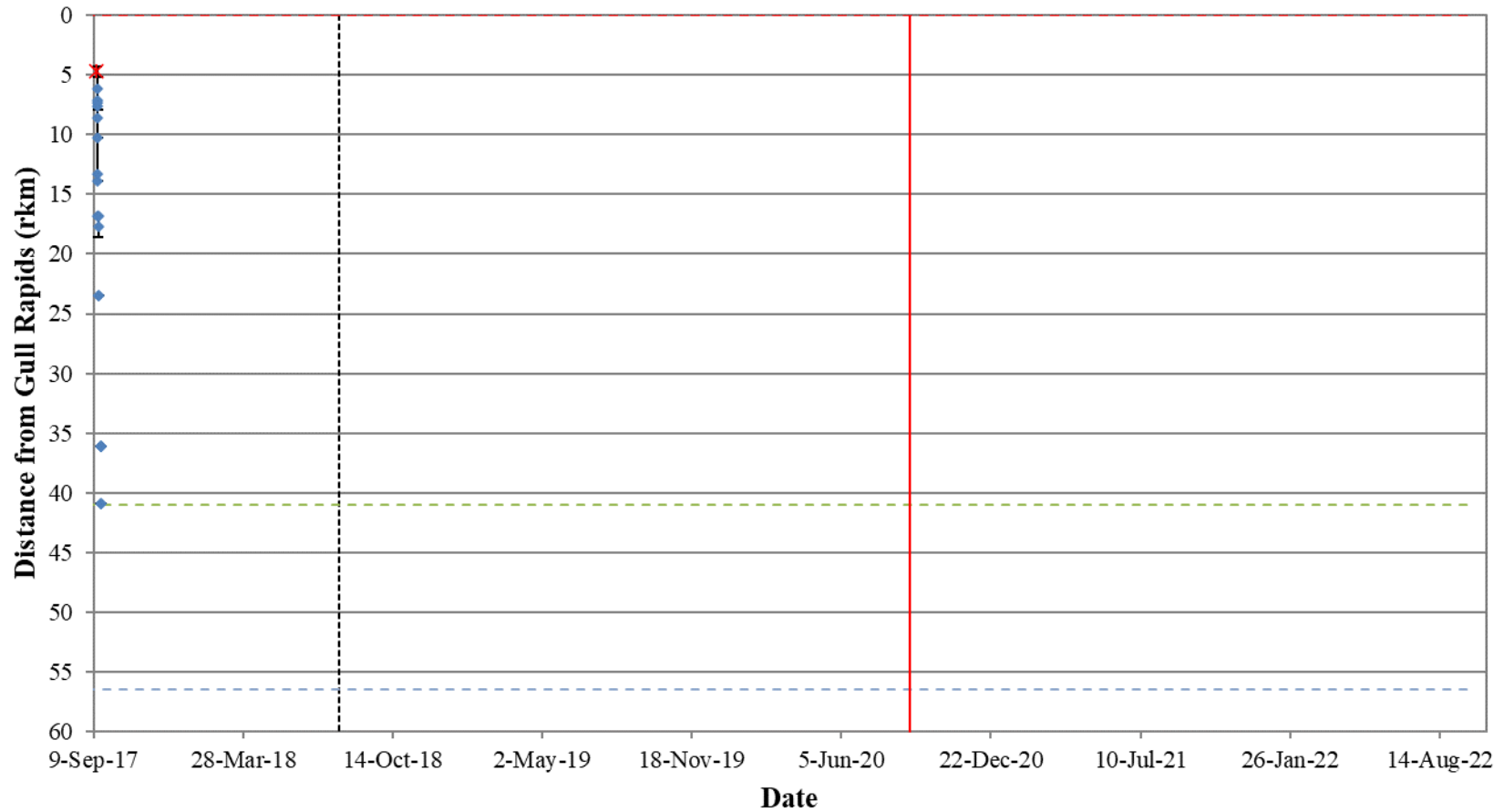


Figure A3-14: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31761) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

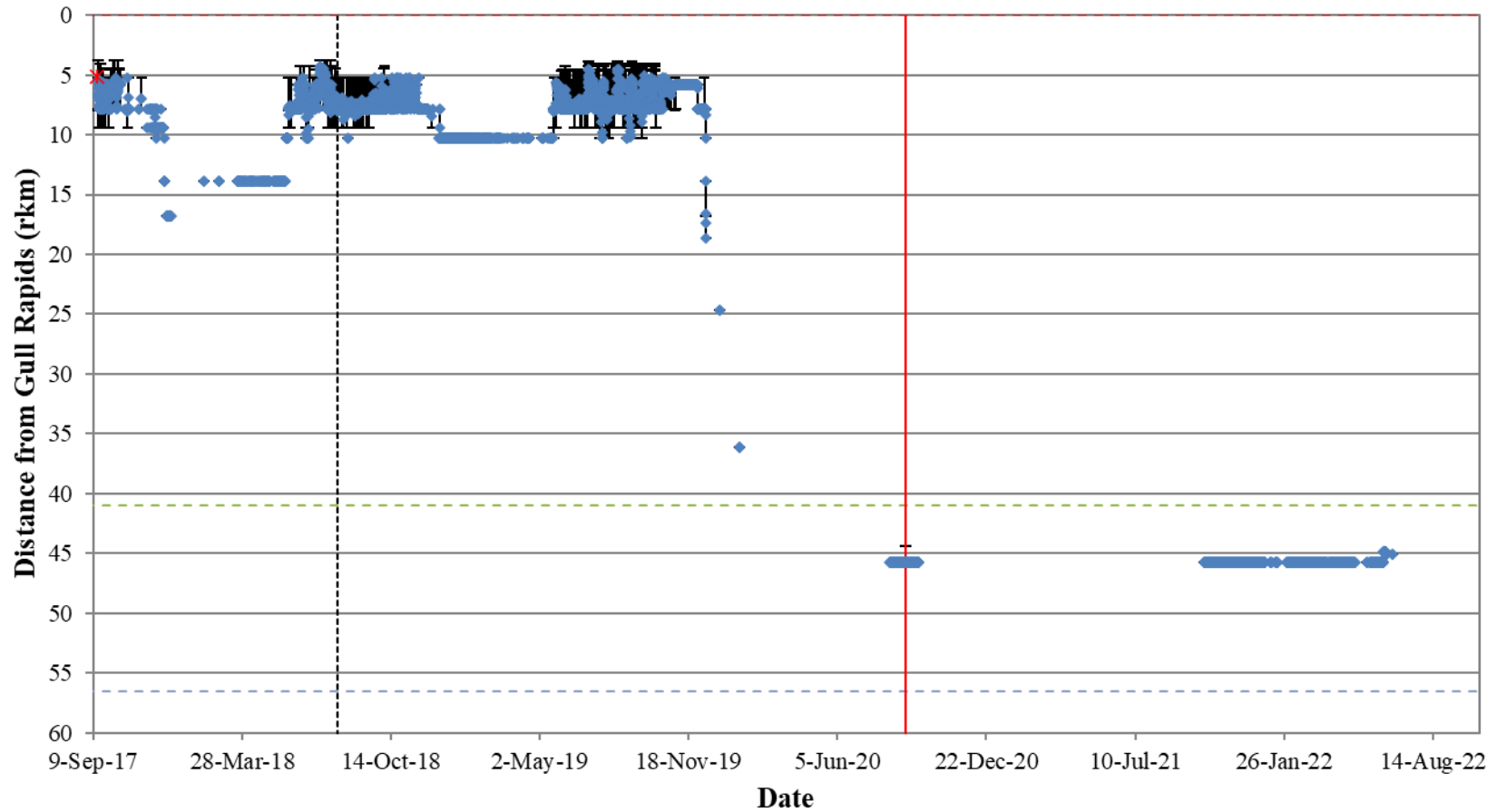


Figure A3-15: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31762) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

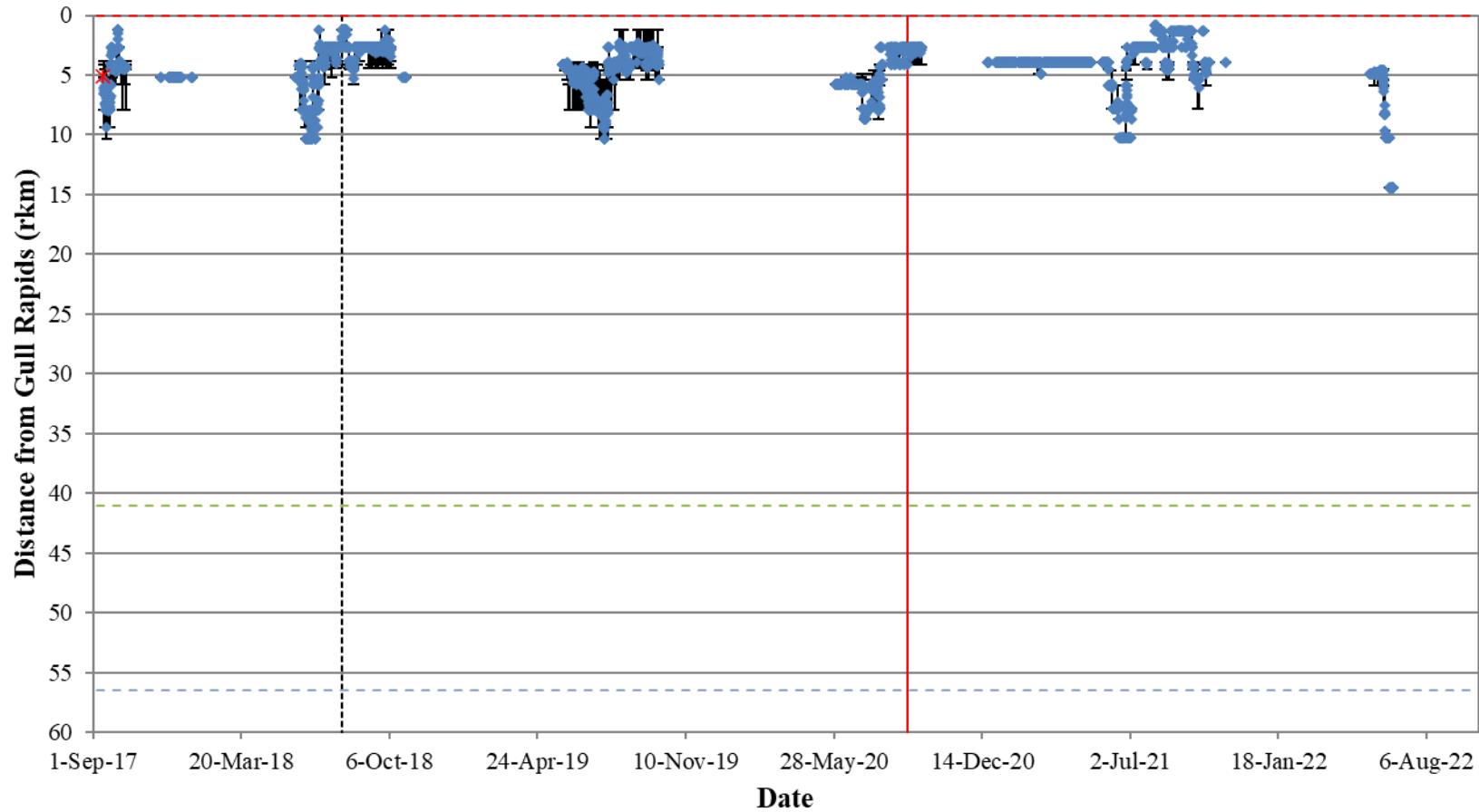


Figure A3-16: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31763) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

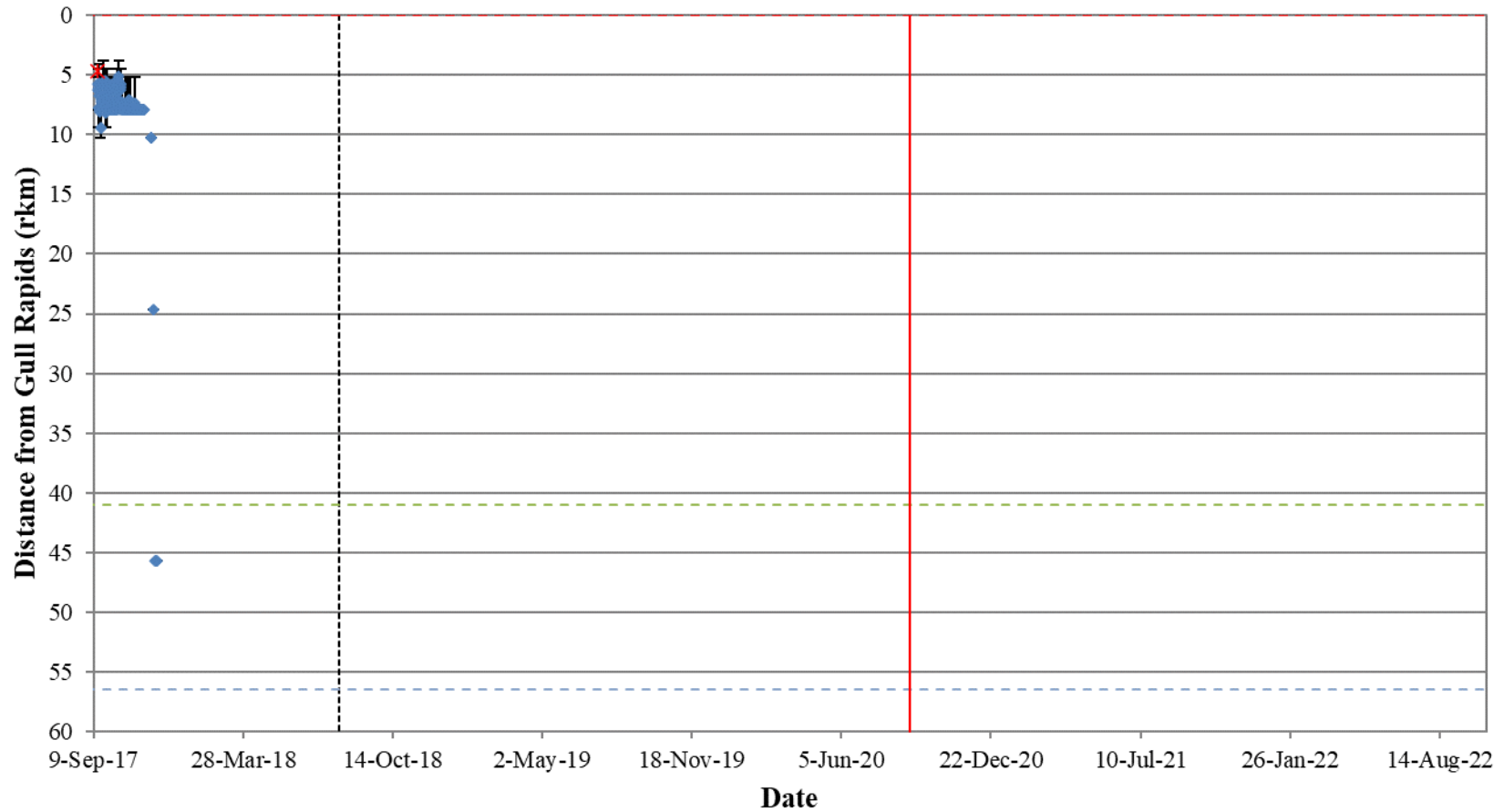


Figure A3-17: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31764) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

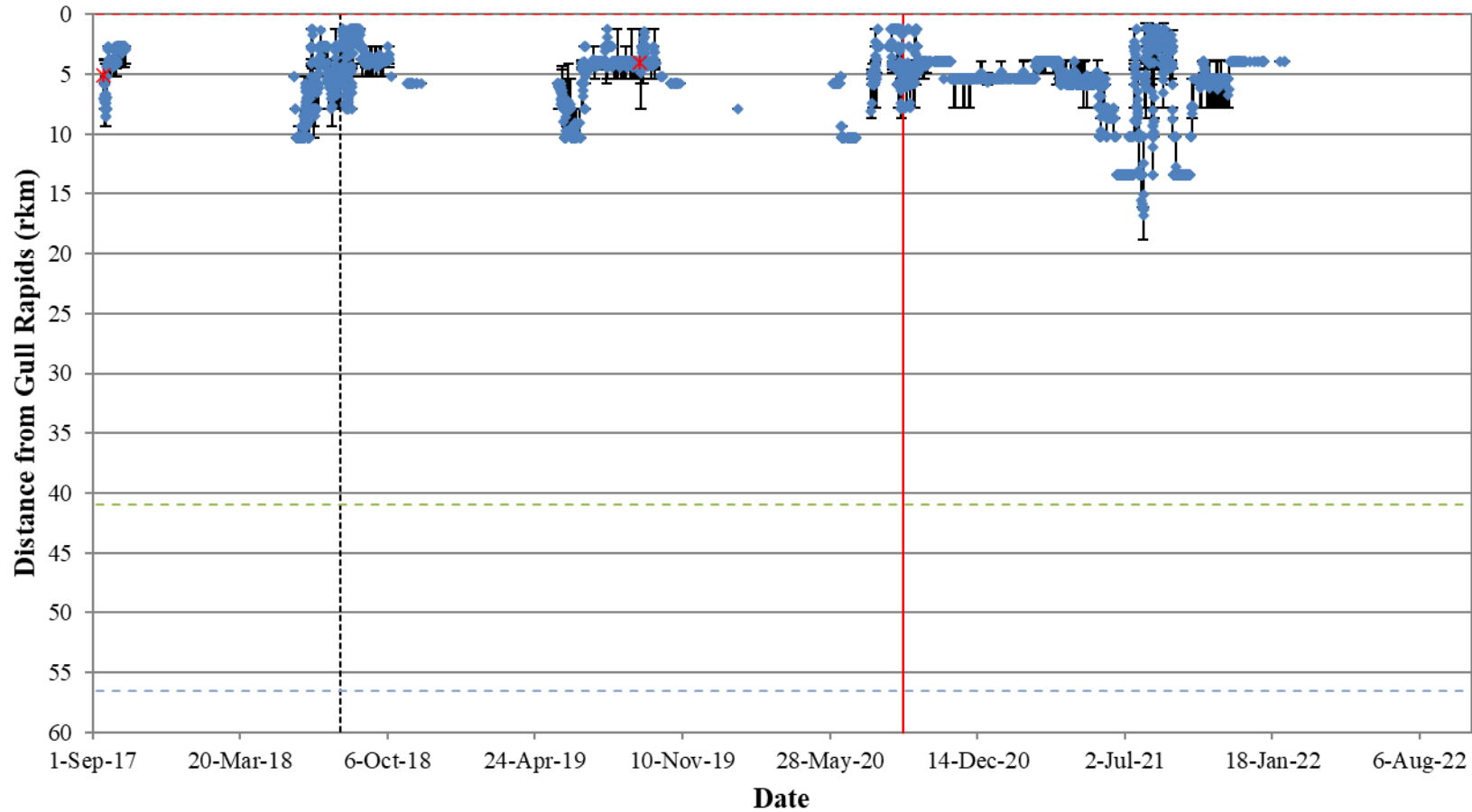


Figure A3-18: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31765) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging and recapture is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

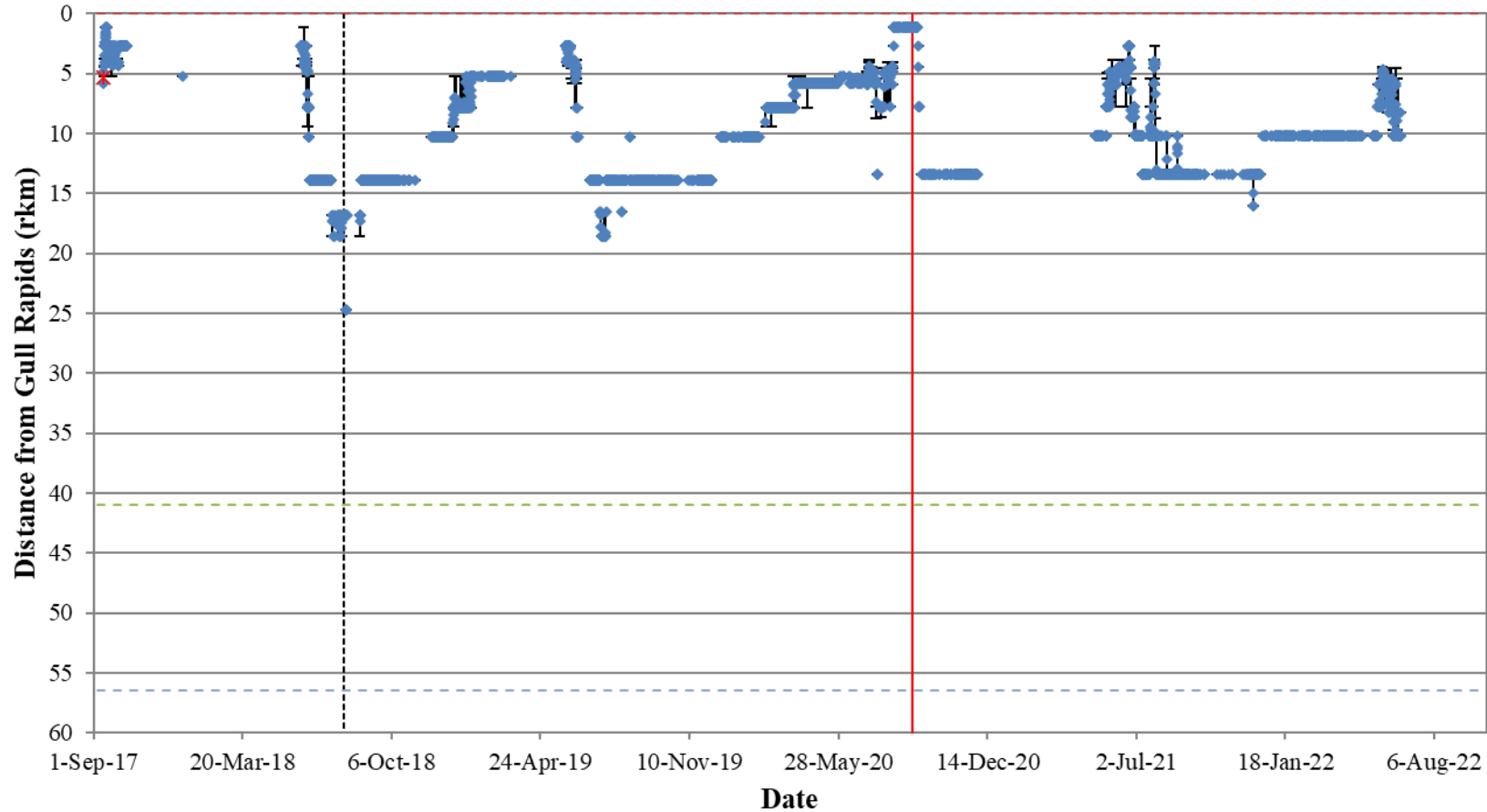


Figure A3-19 Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31766) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

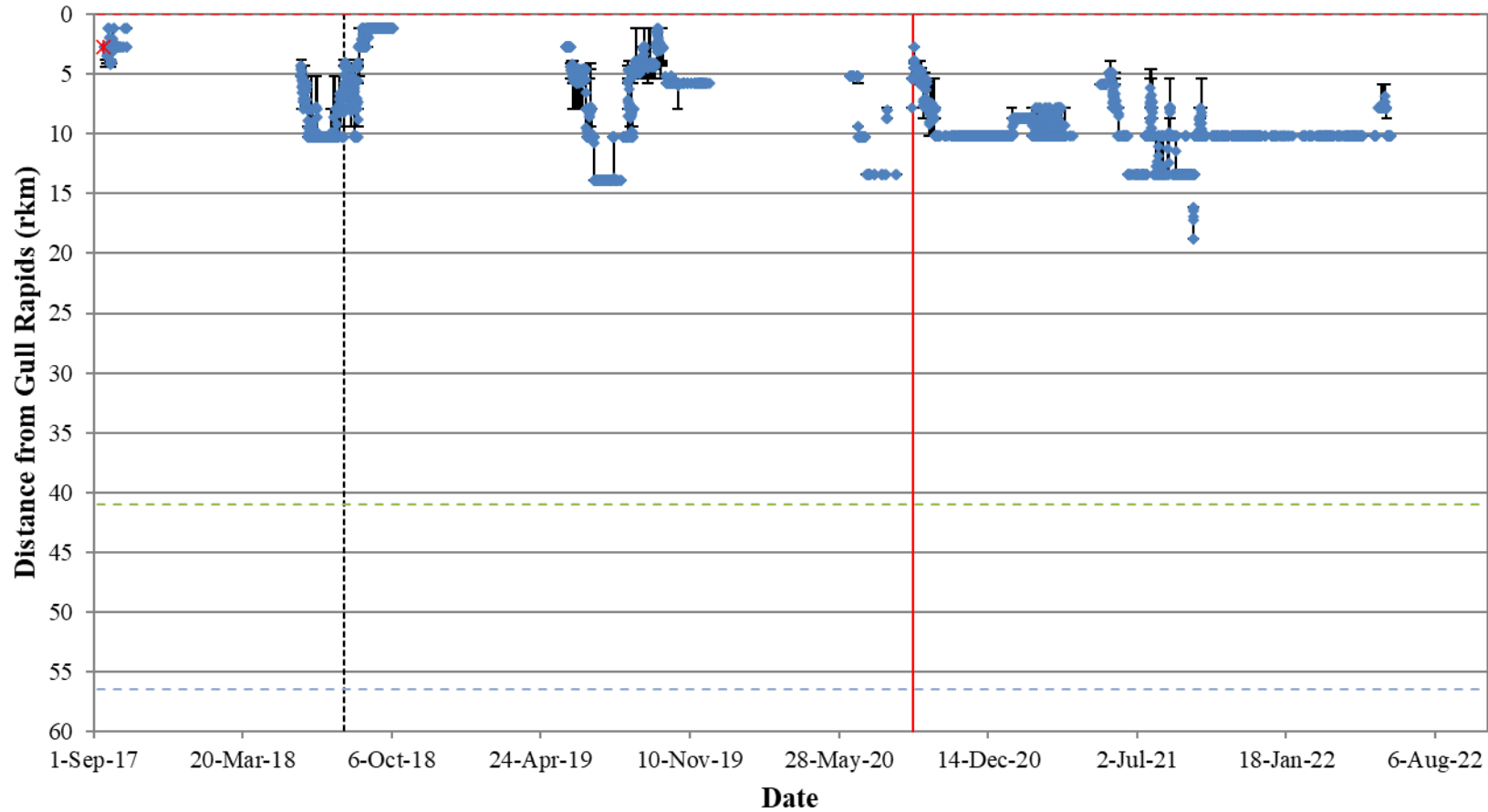


Figure A3-20: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #31767) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 9, 2017 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple). Dashed black vertical line indicates start of spillway operation (Aug 3, 2018). Solid red vertical line indicates completion of reservoir impoundment (September 5, 2020).

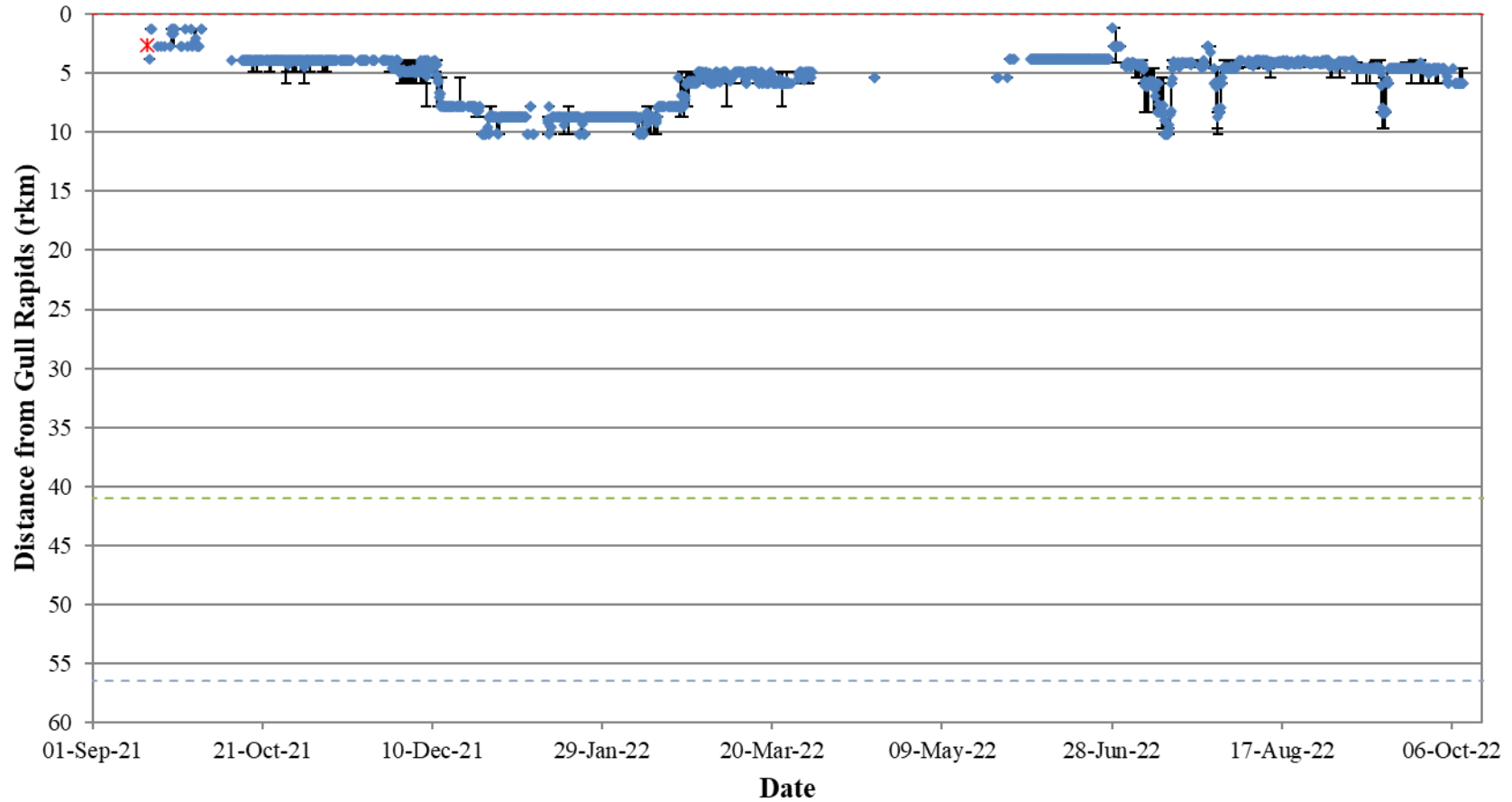


Figure A3-21: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48276) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

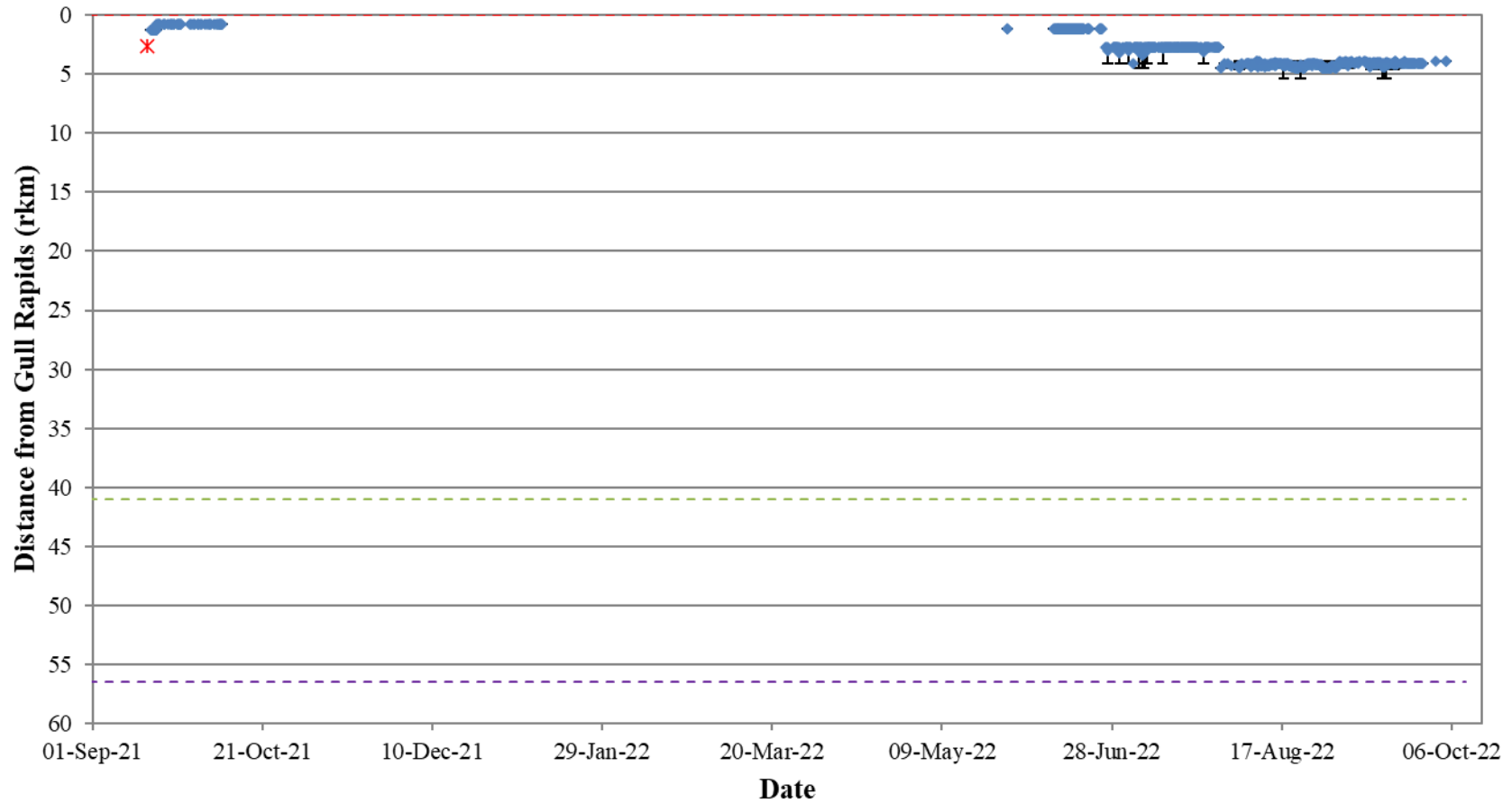


Figure A3-22: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48277) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

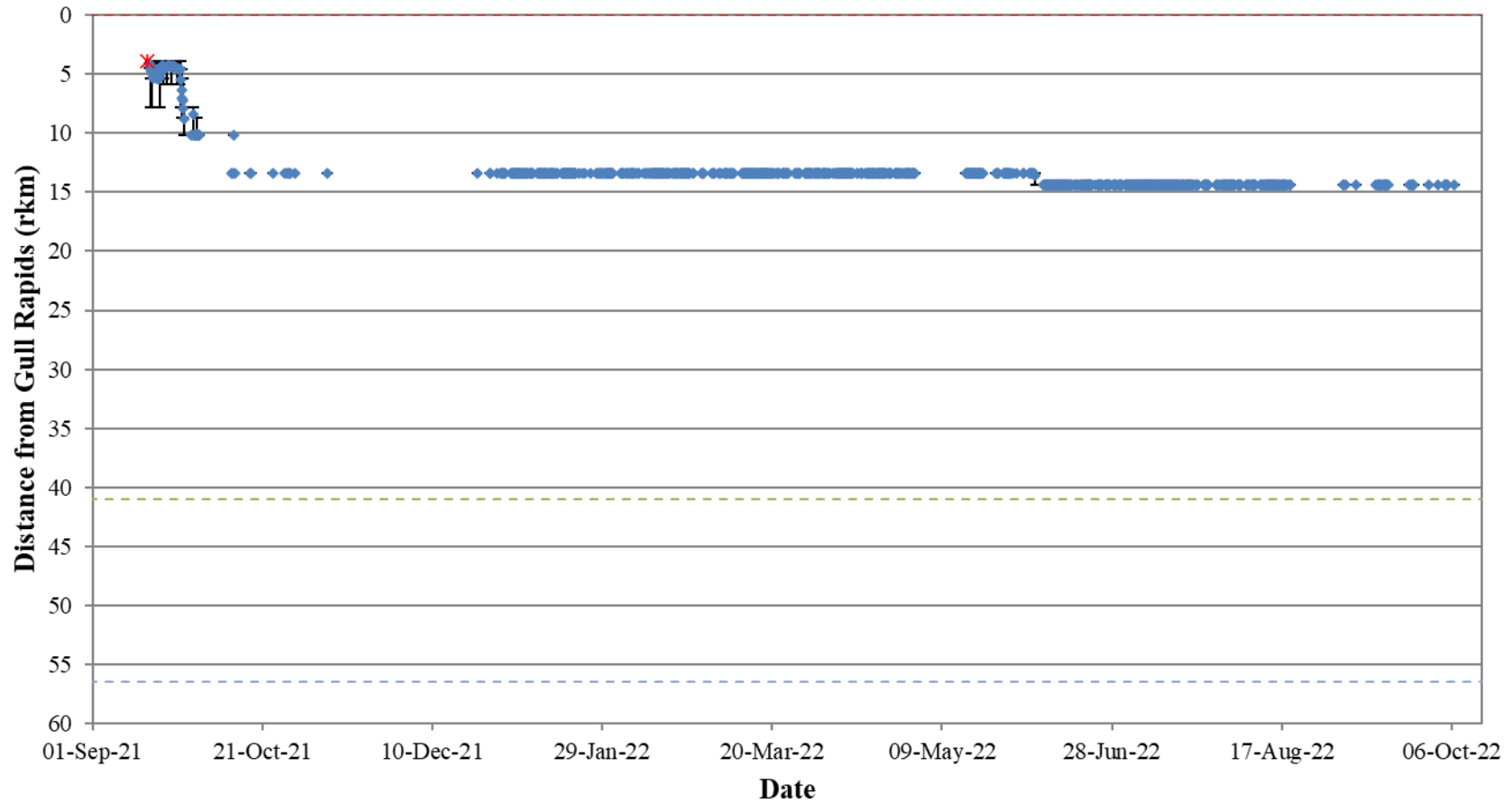


Figure A3-23: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48278) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

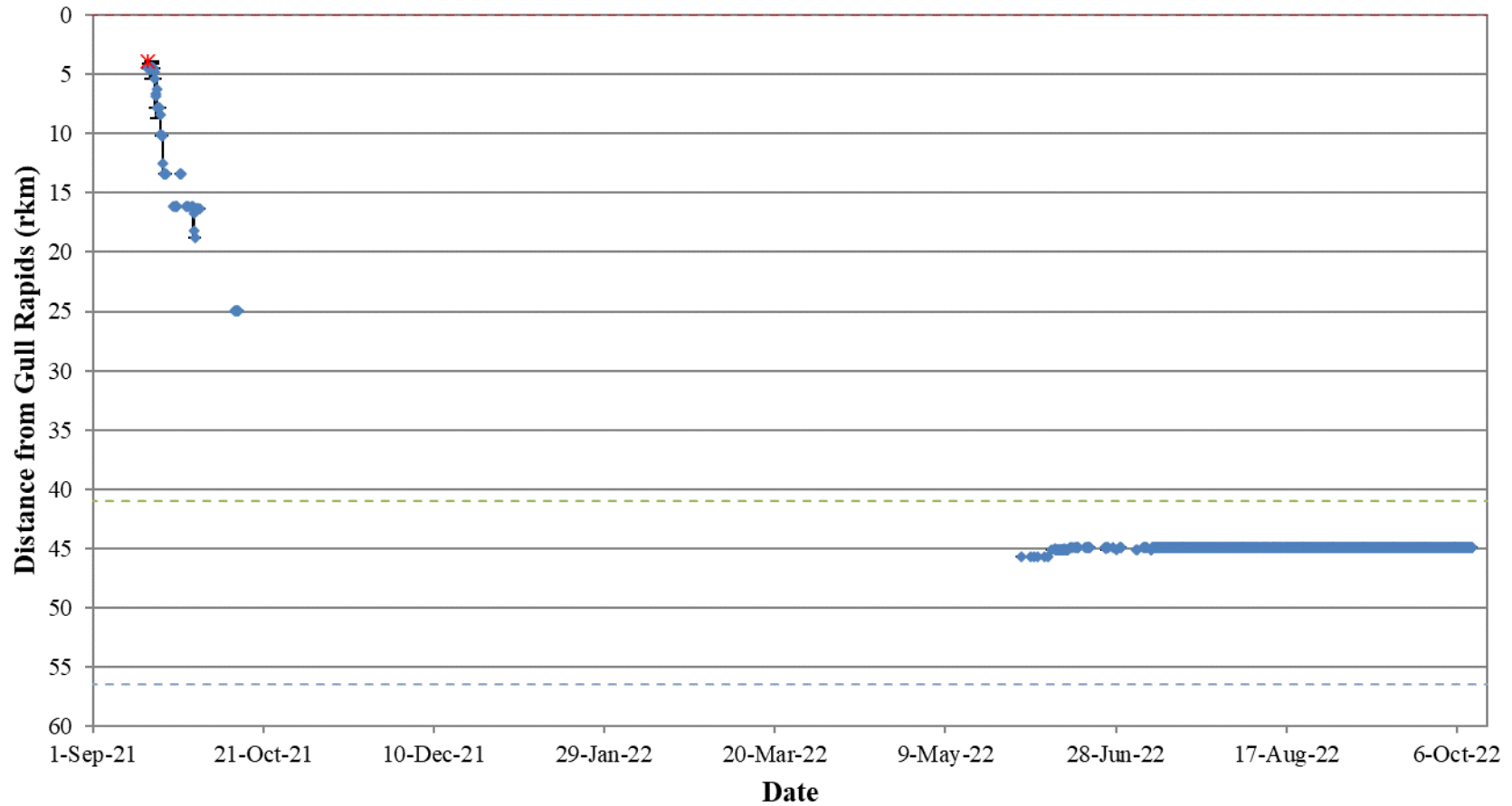


Figure A3-24: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48279) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

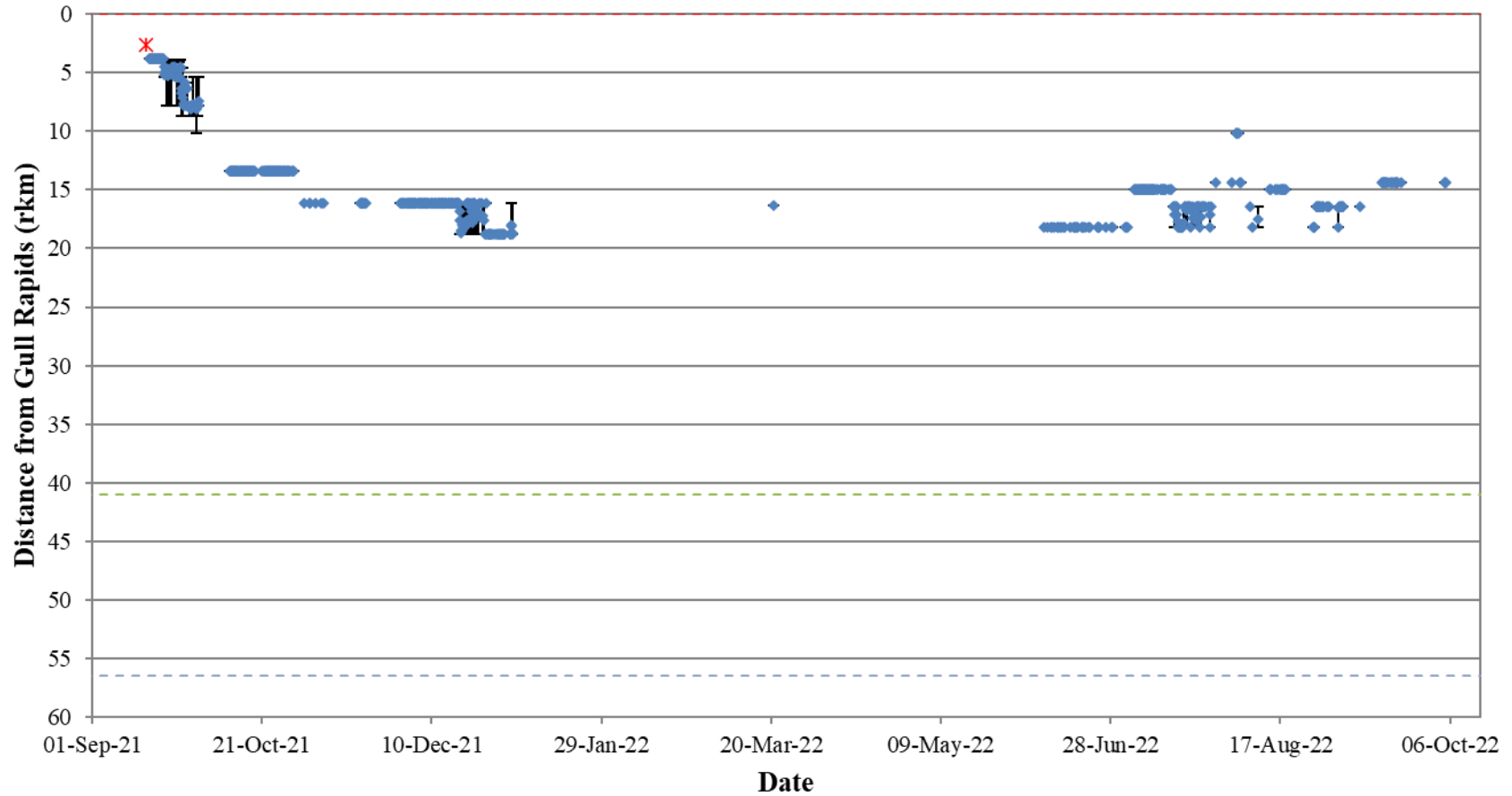


Figure A3-25: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48282) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

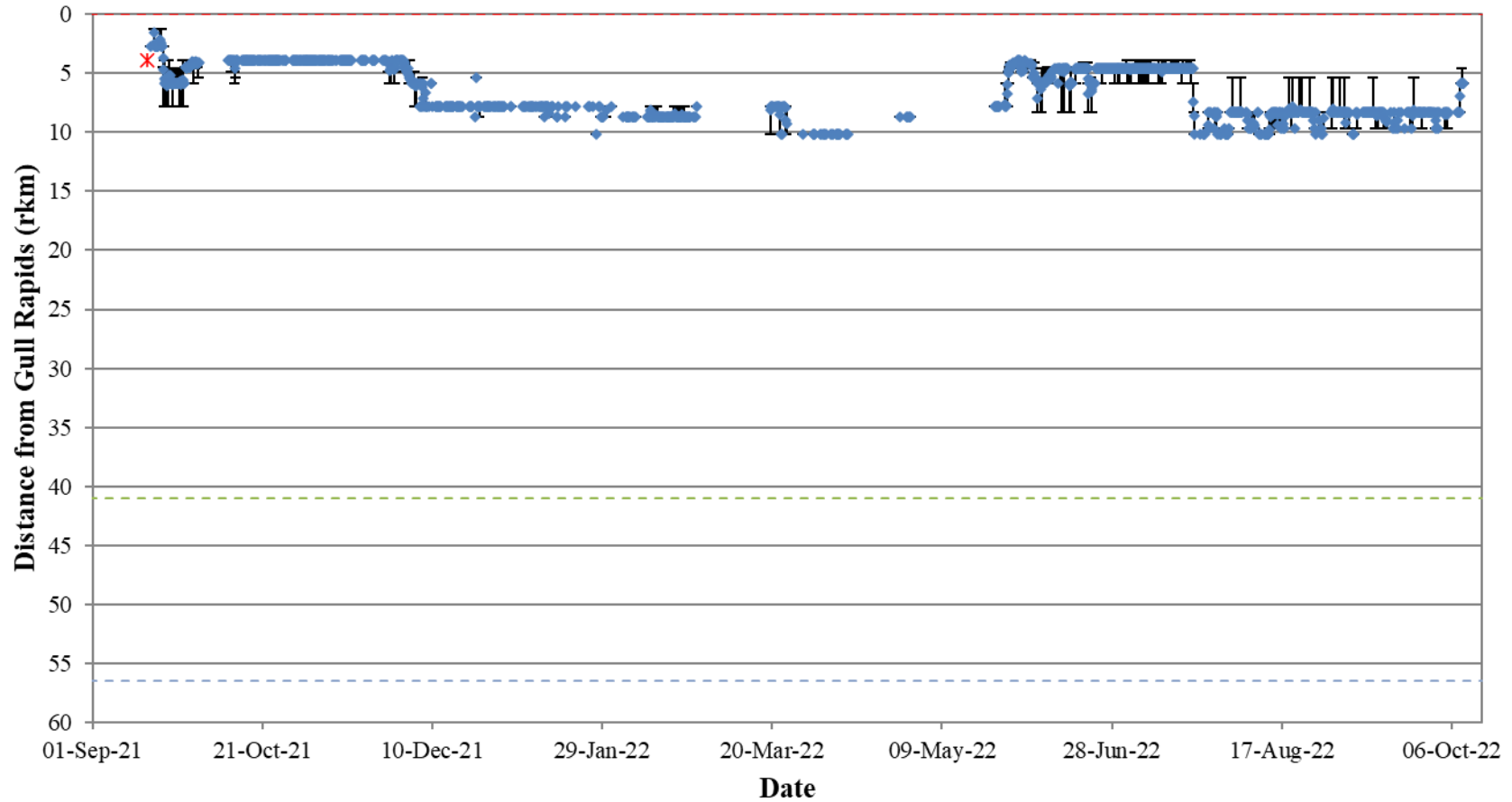


Figure A3-26: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48283) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

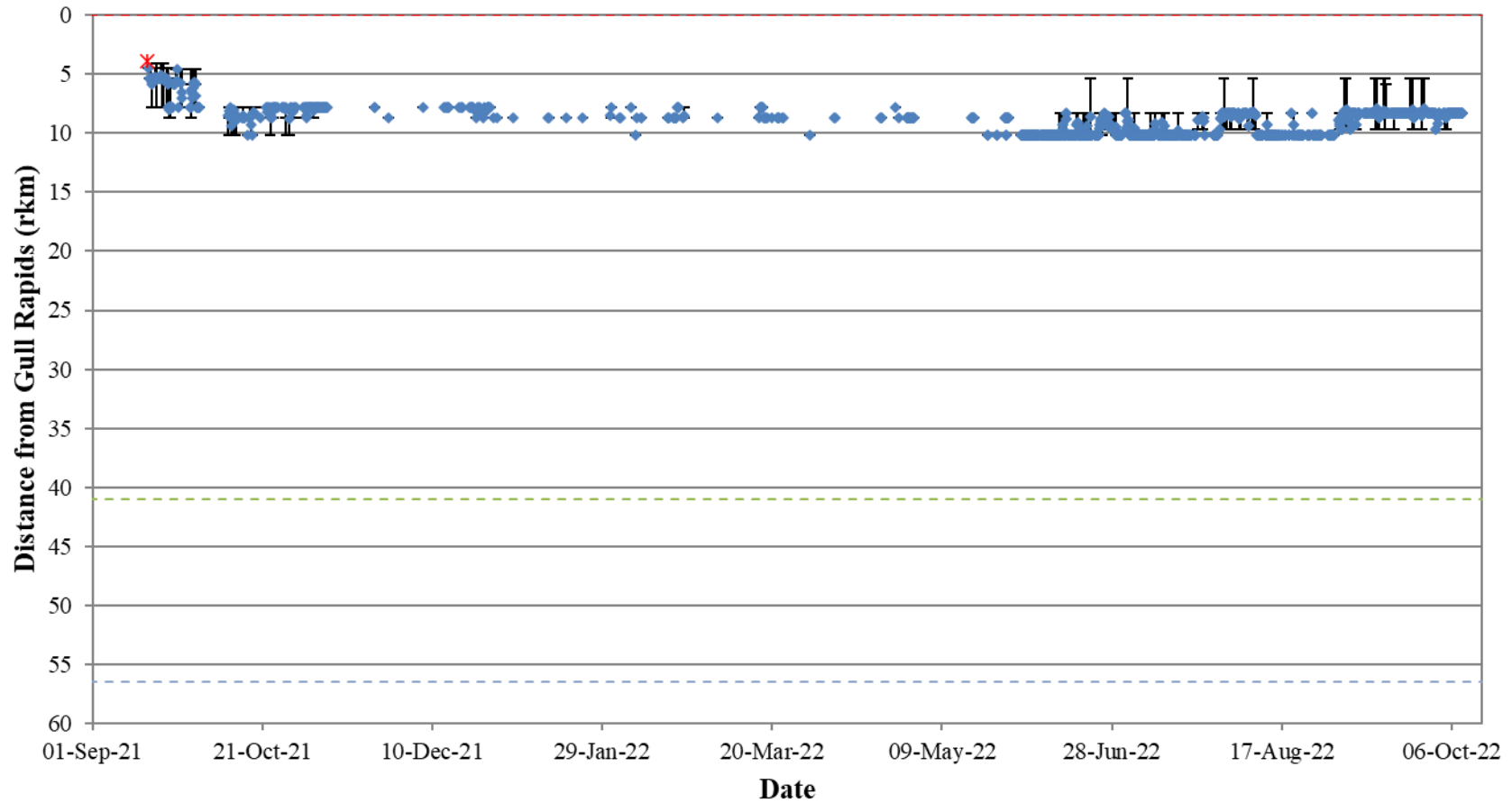


Figure A3-27: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48284) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

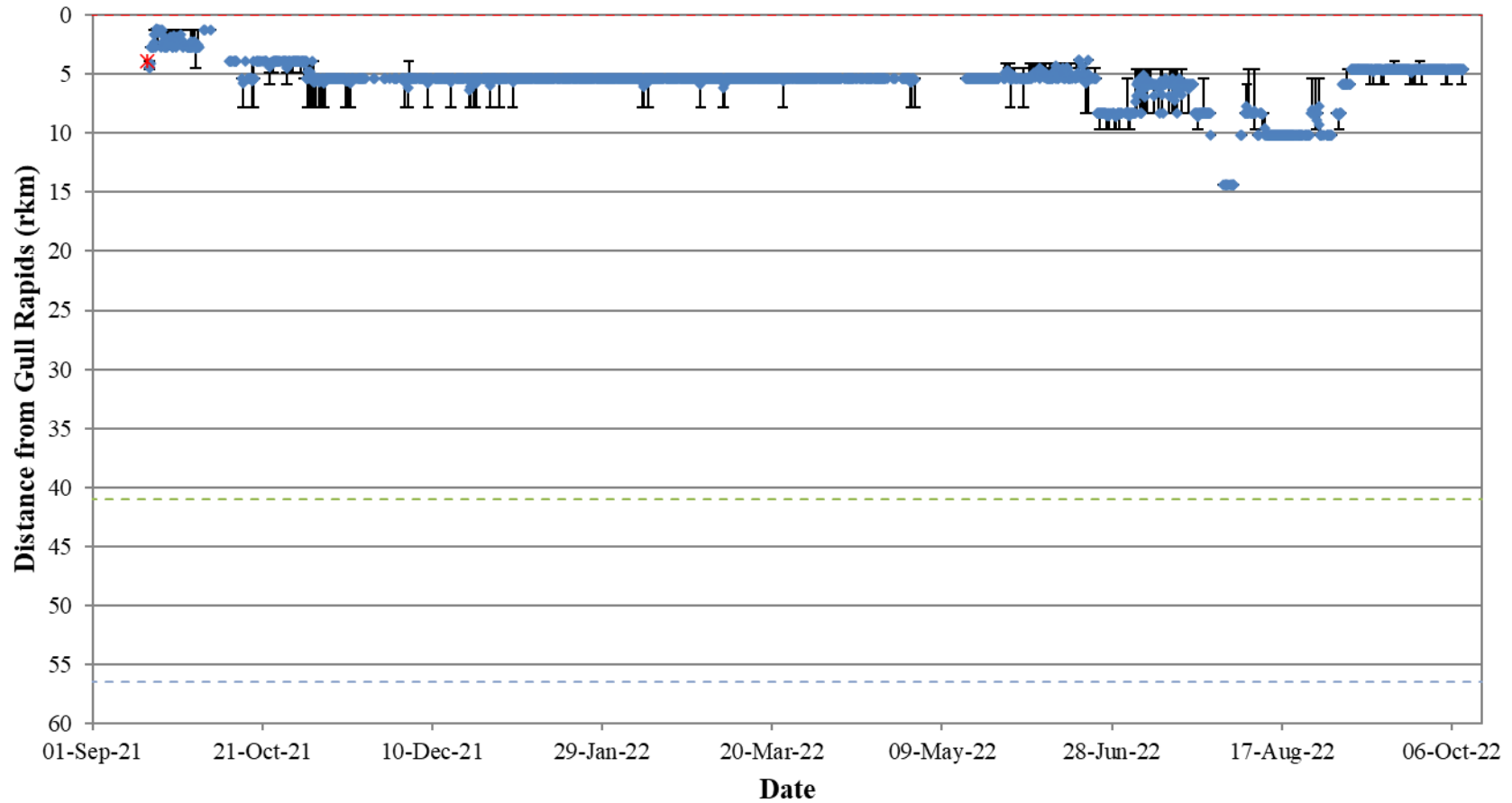


Figure A3-28: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48285) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

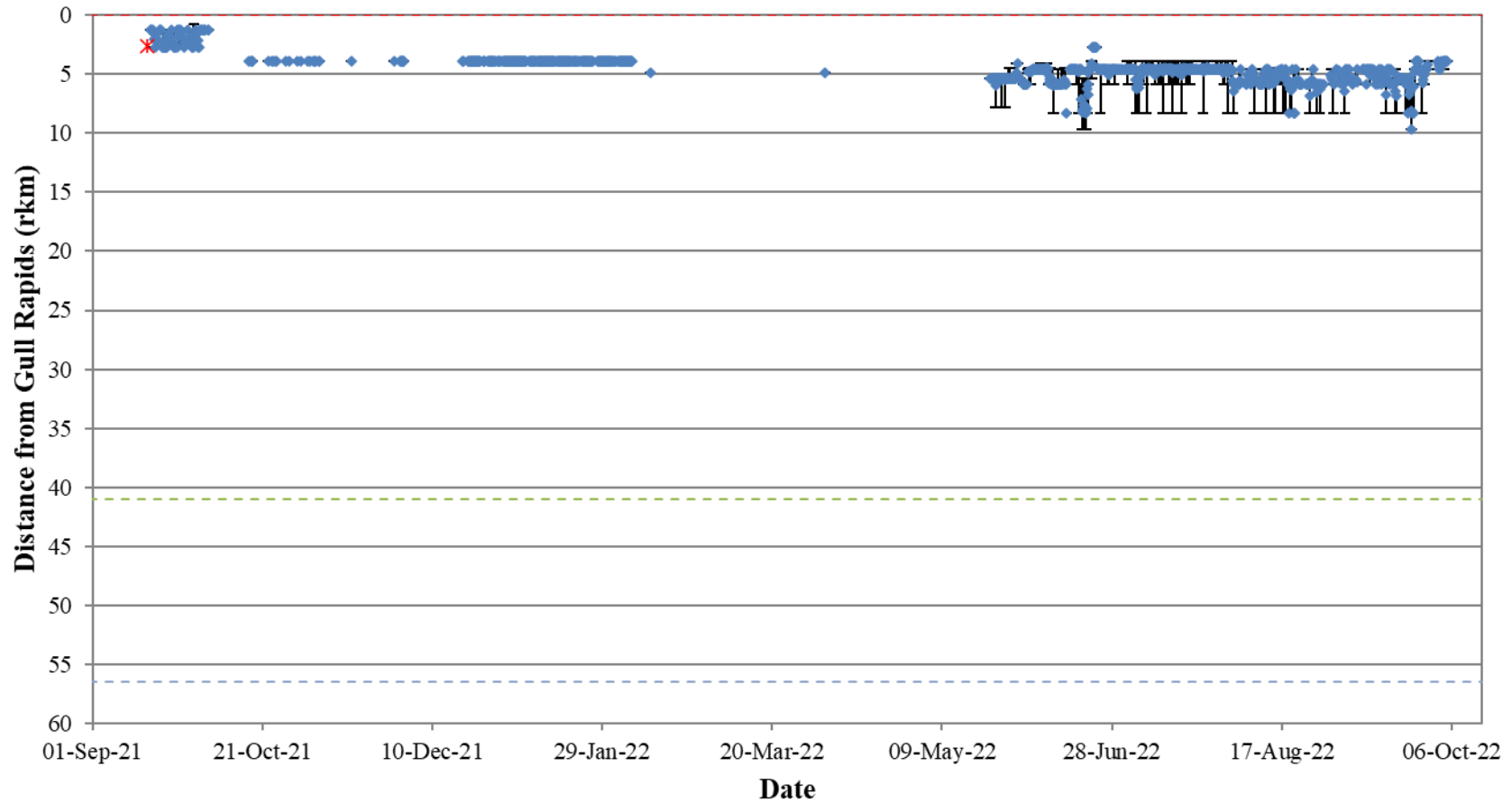


Figure A3-29: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48288) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

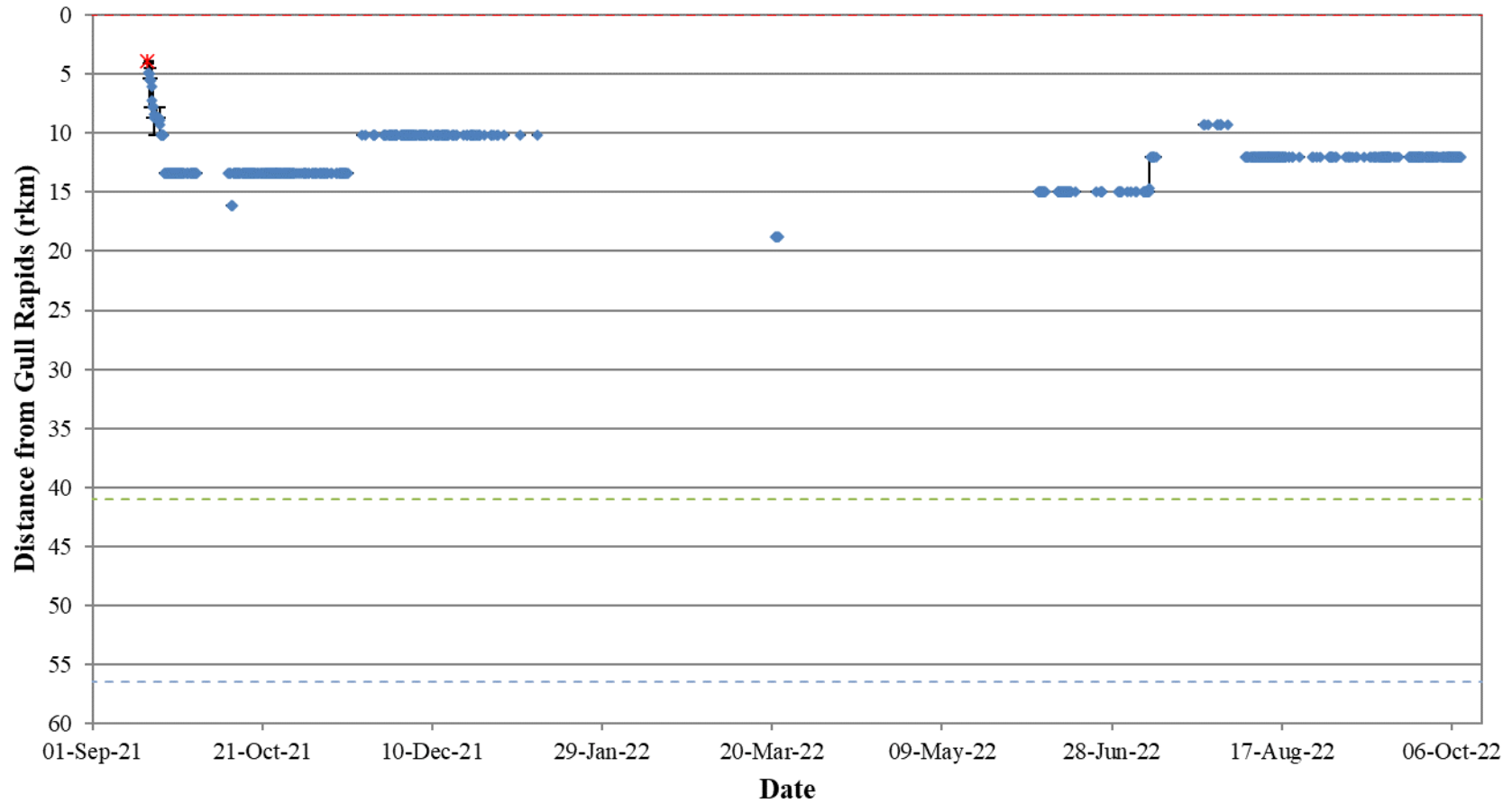


Figure A3-30: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48289) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

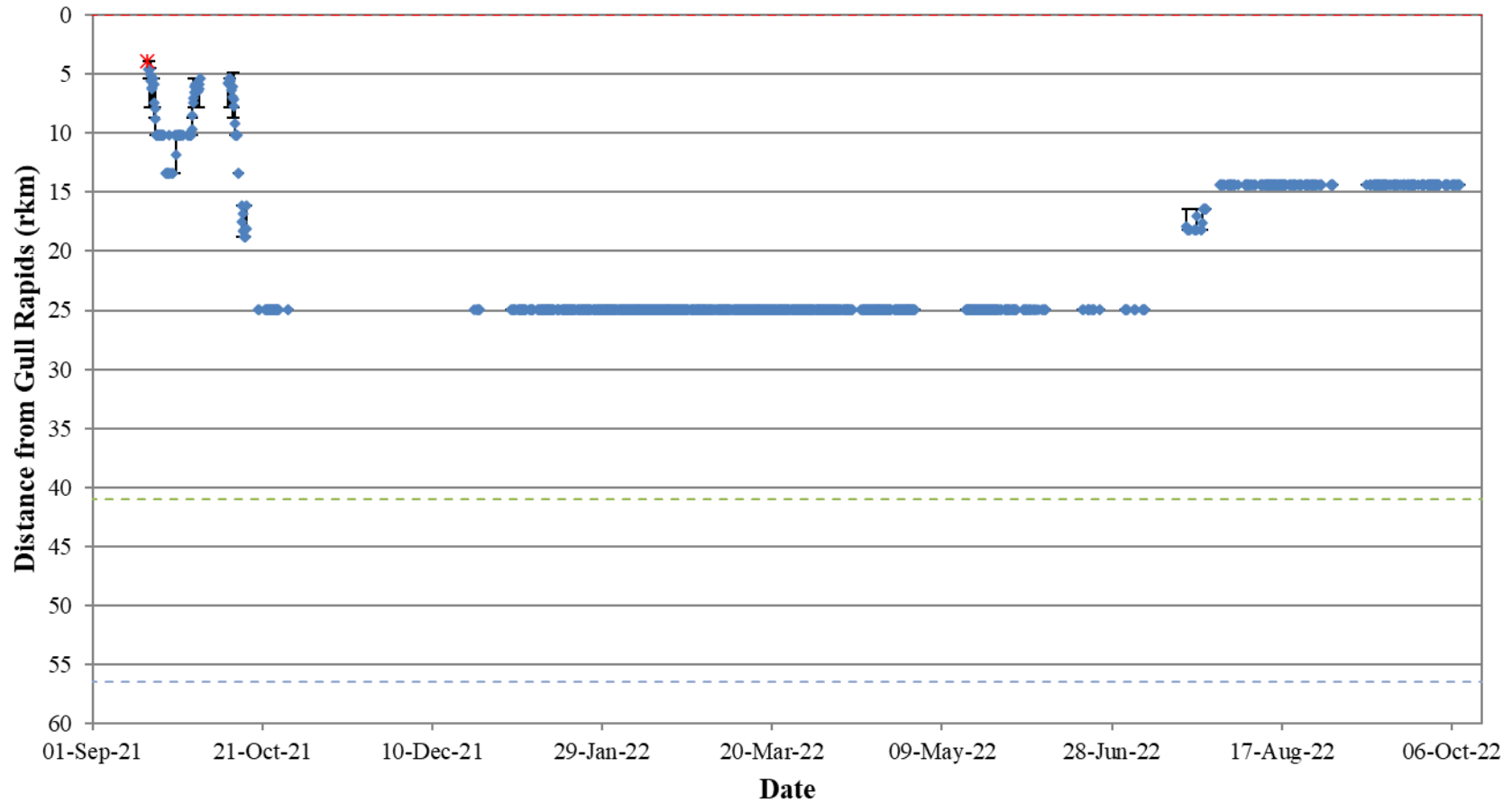


Figure A3-31: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48290) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

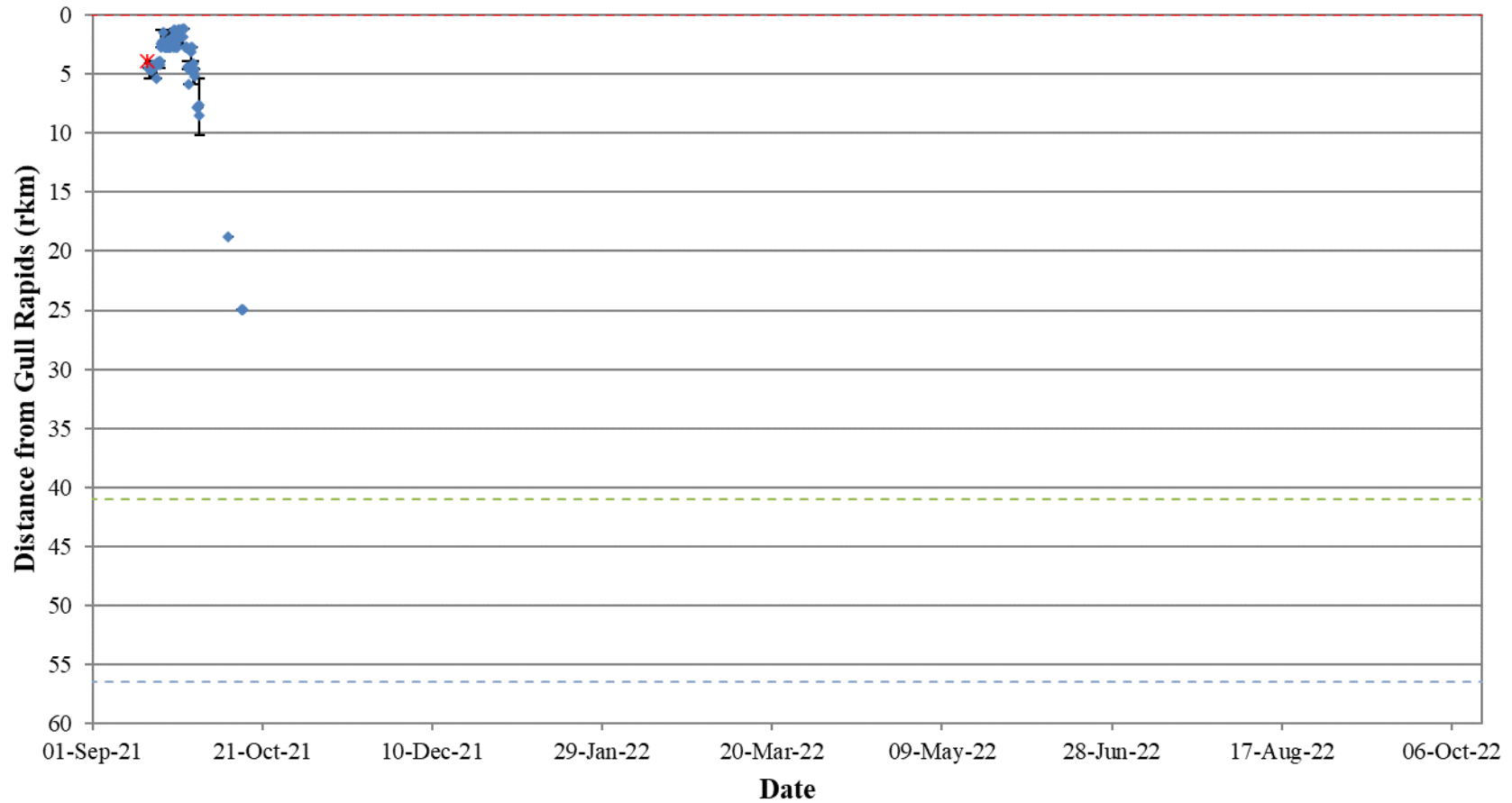


Figure A3-32: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48291) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 17, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

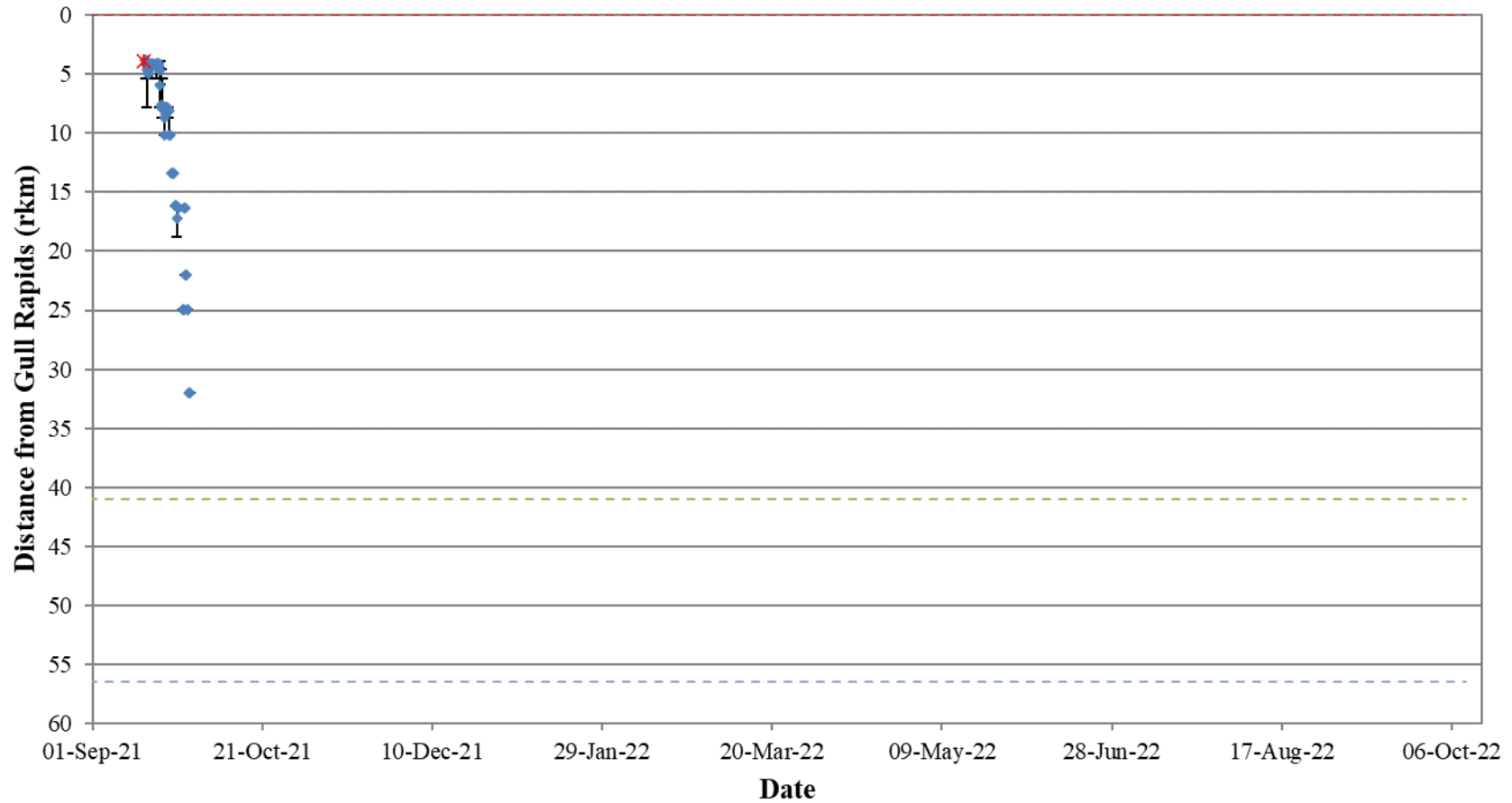


Figure A3-33: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48294) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

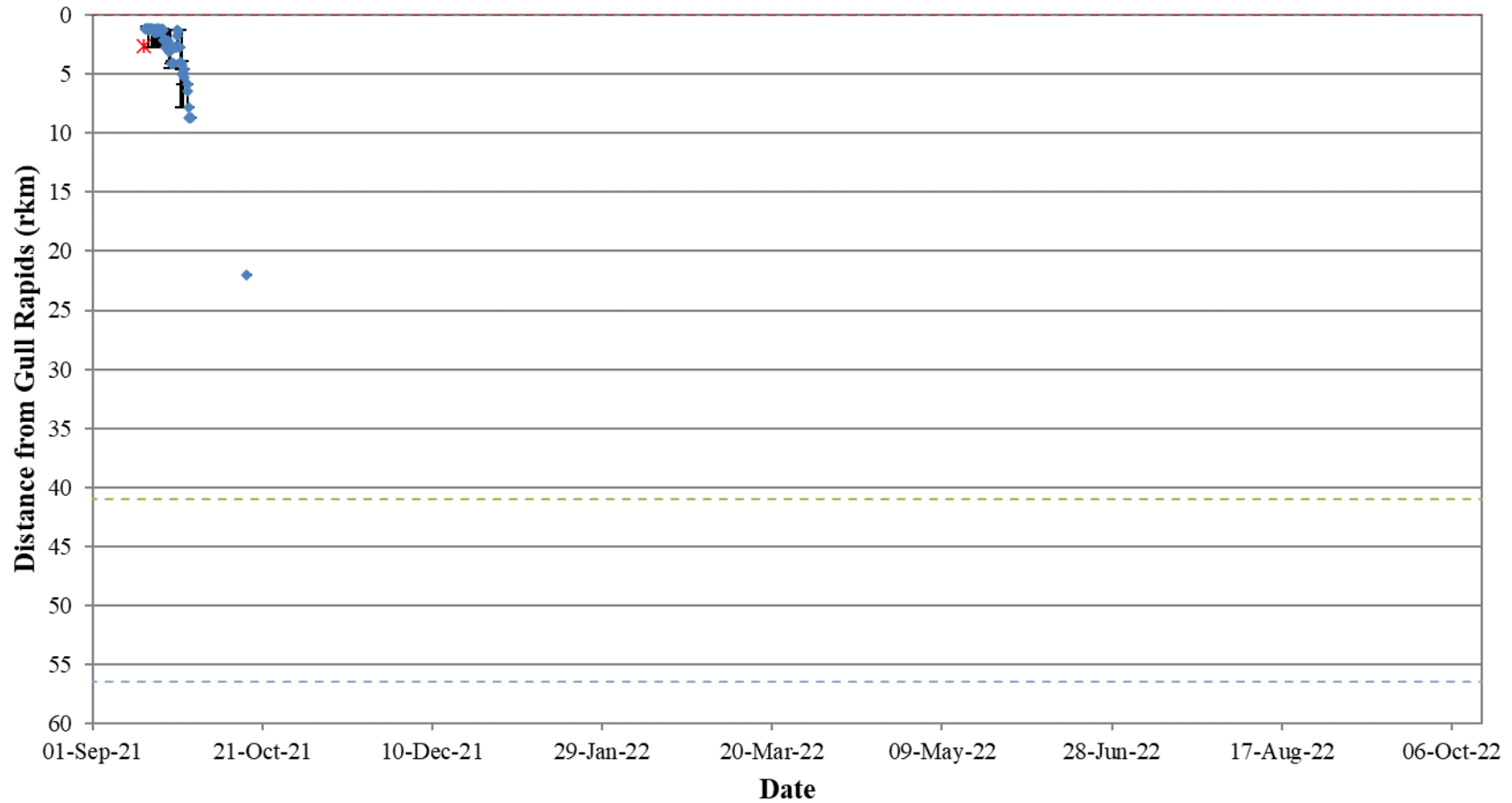


Figure A3-34: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48295) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

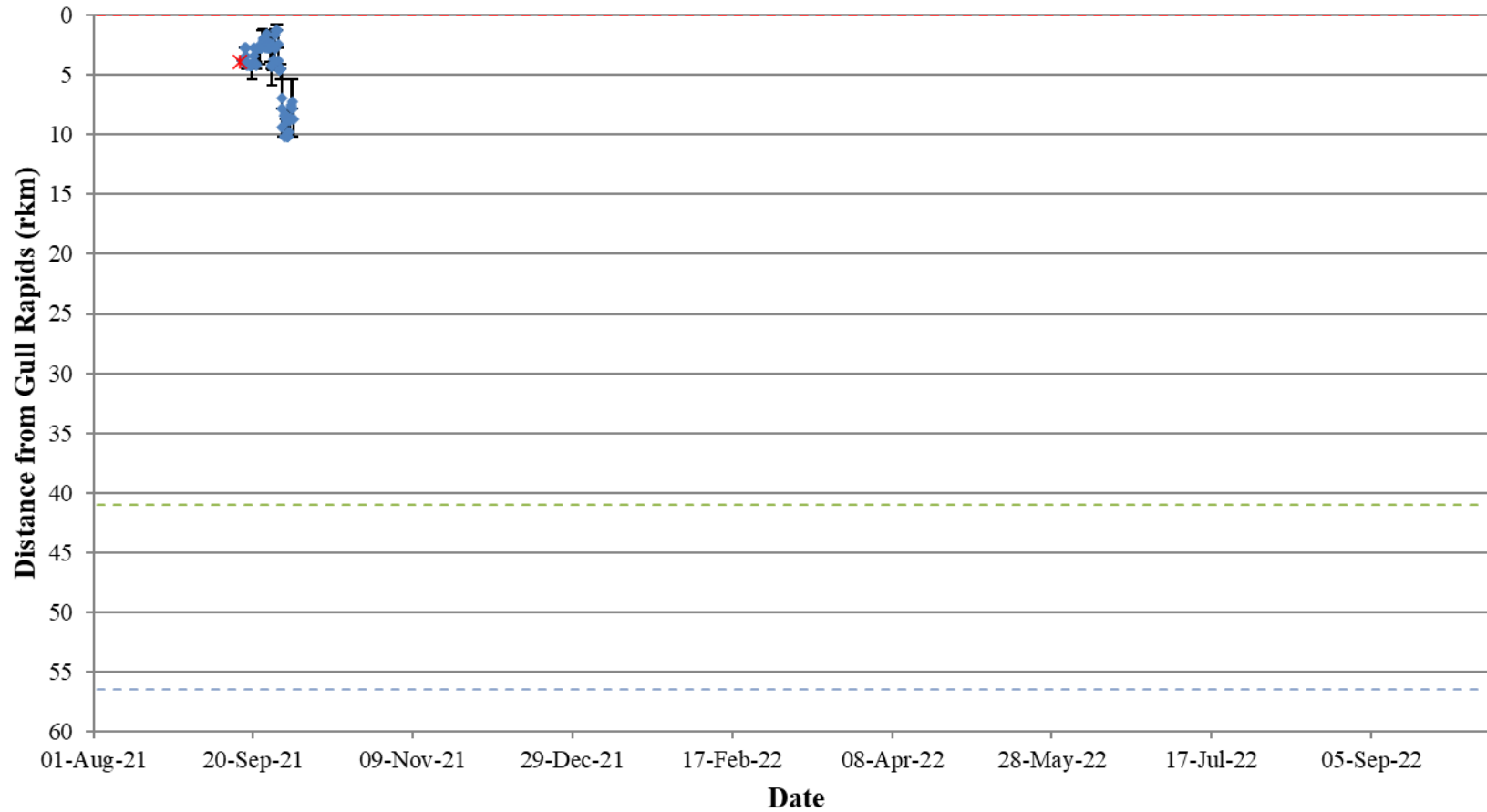


Figure A3-35: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48296) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

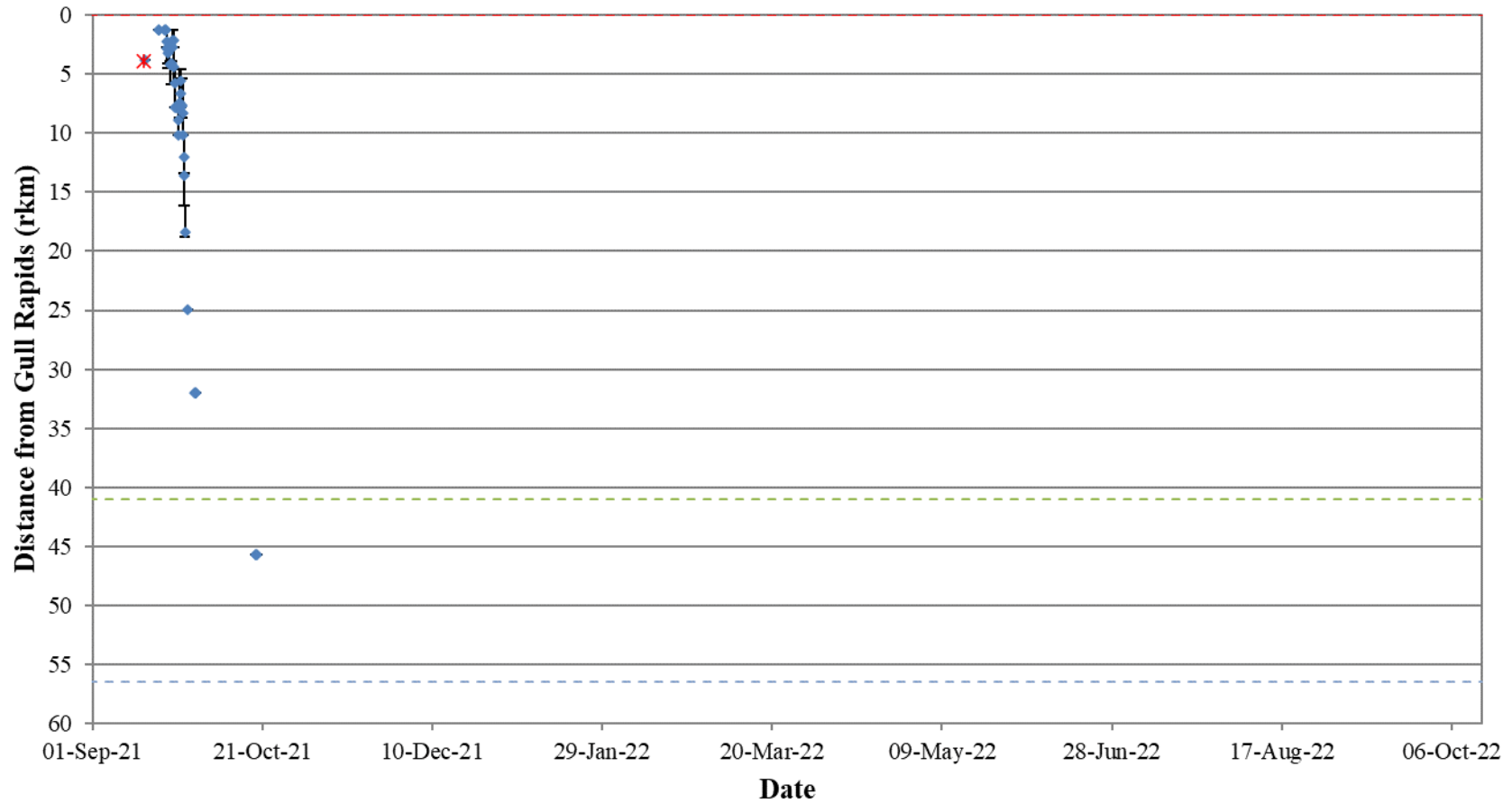


Figure A3-36: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48300) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

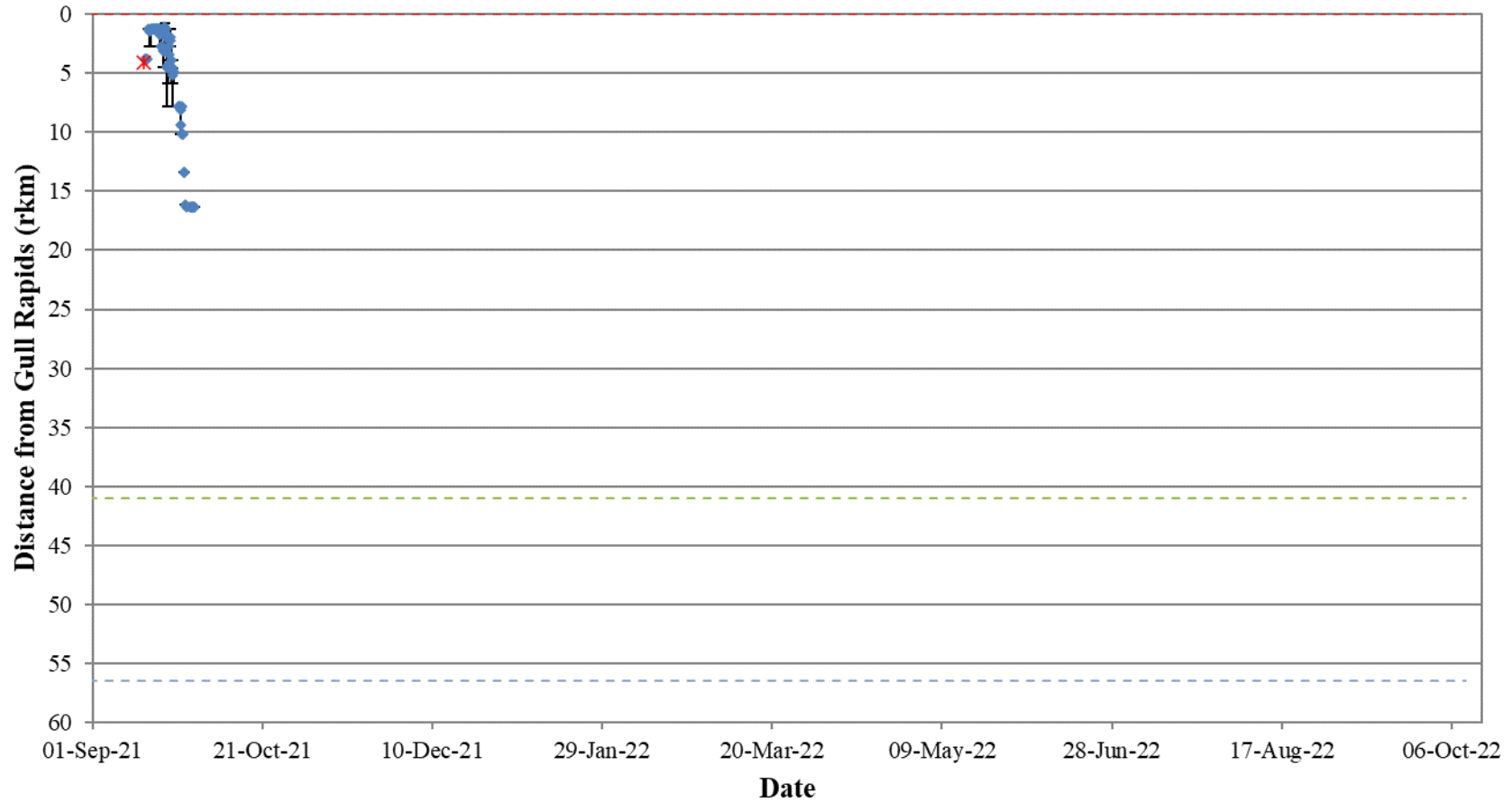


Figure A3-37: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48301) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

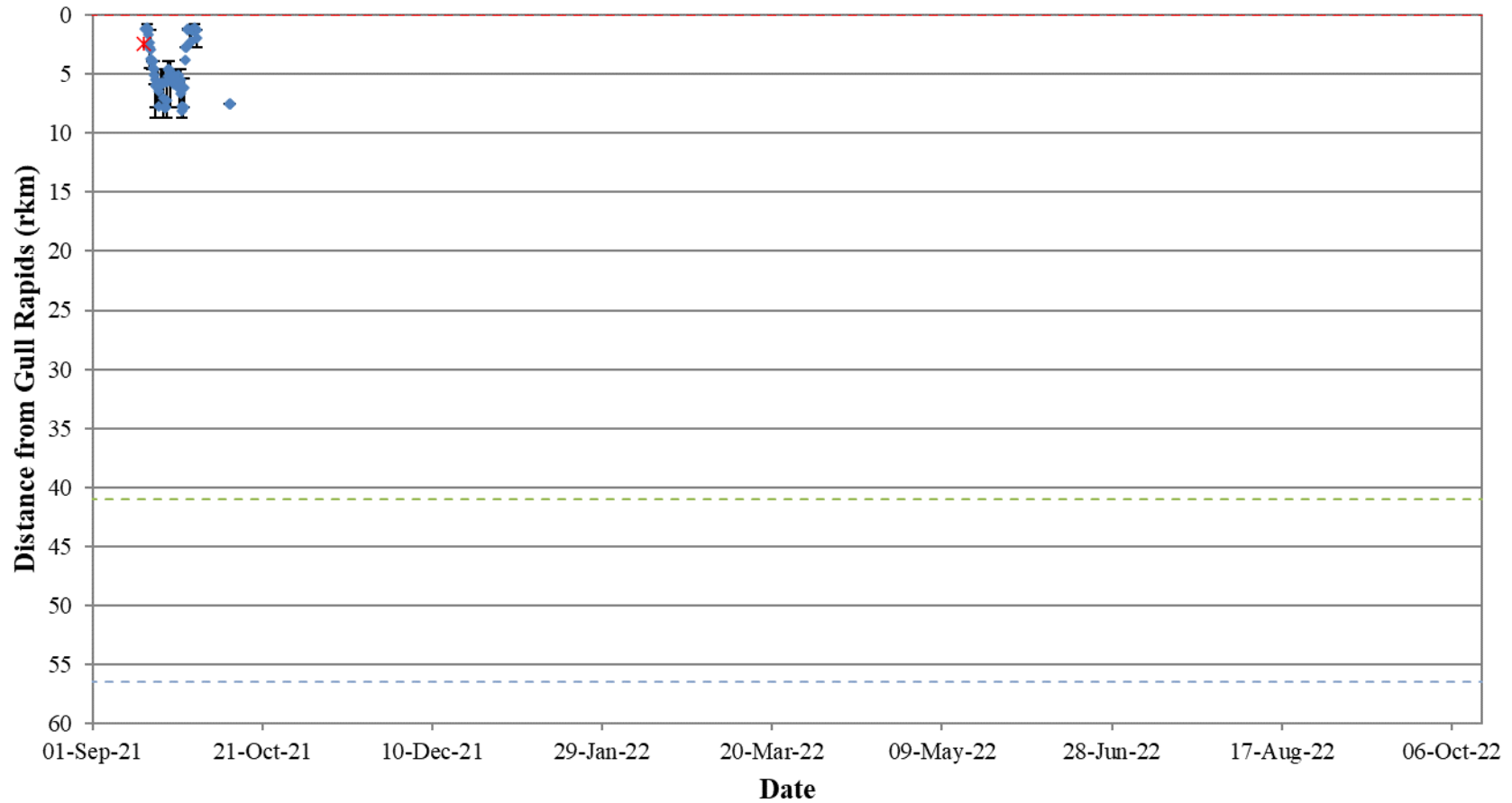


Figure A3-38: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48306) in Stephens Lake in relation to the Keeyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

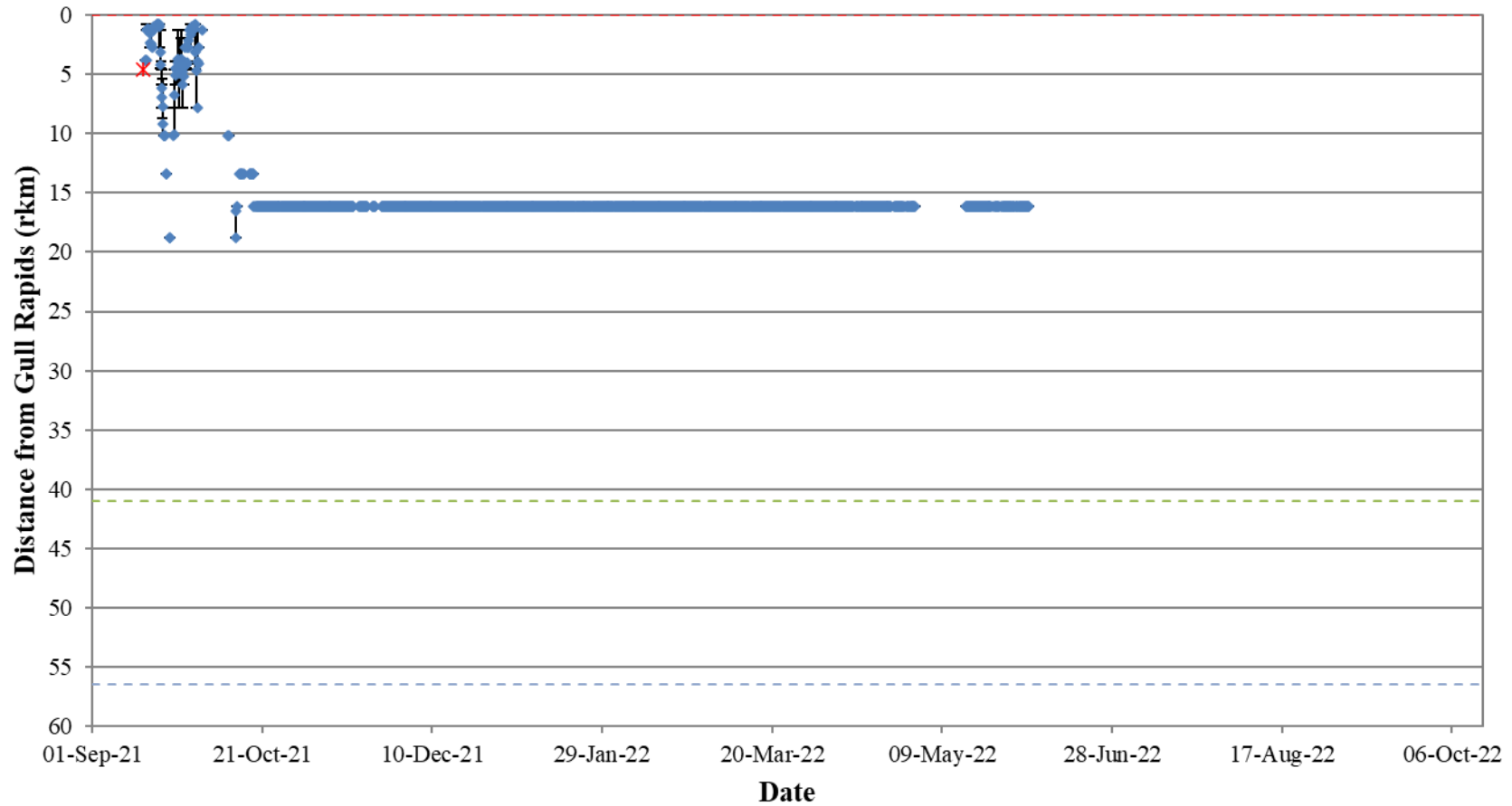


Figure A3-39: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48307) in Stephens Lake in relation to the Keyeyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

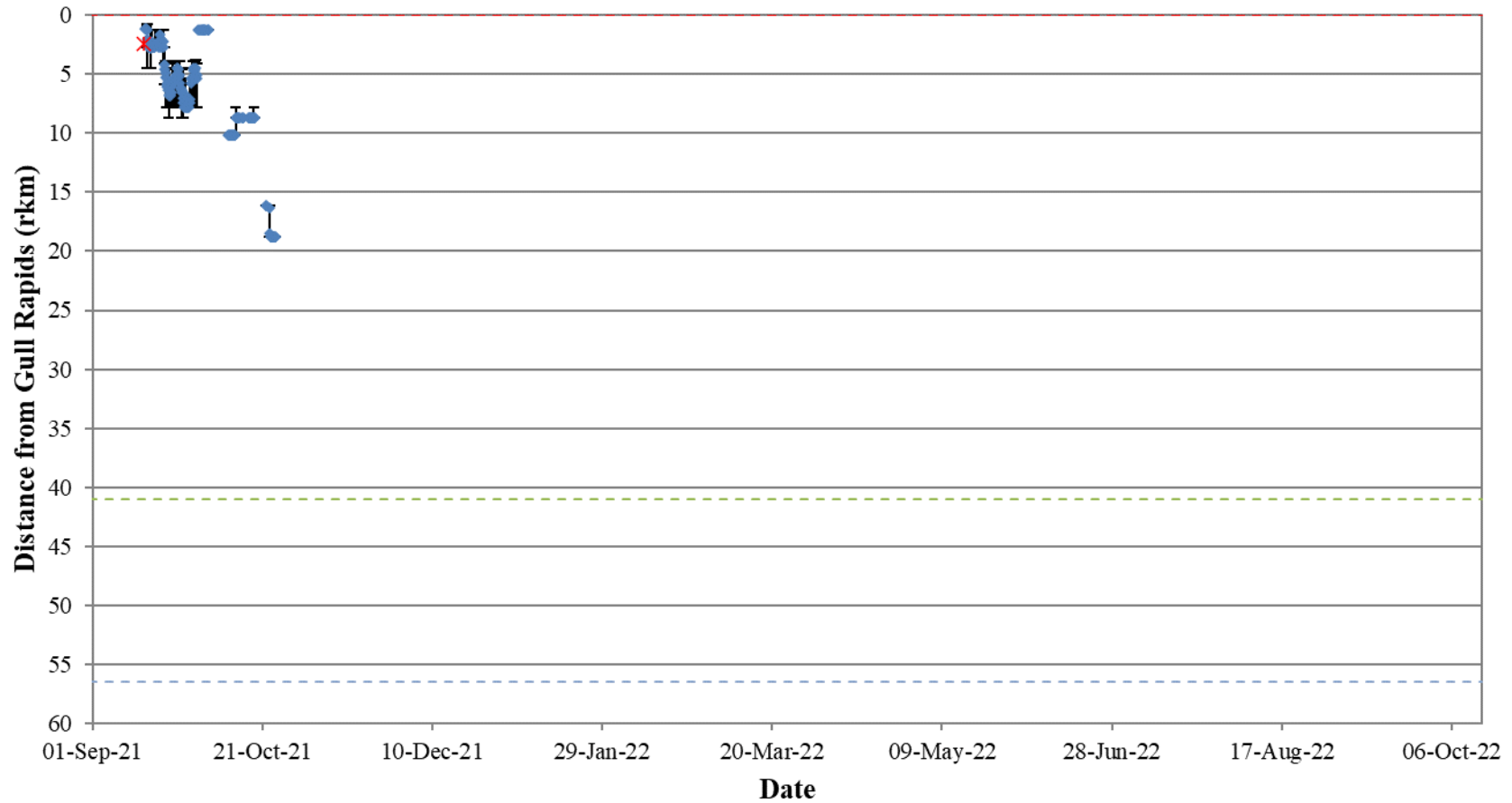


Figure A3-40: Position of a Lake Sturgeon tagged with an acoustic transmitter (code #48312) in Stephens Lake in relation to the Keyyask GS (rkm 0), from September 16, 2021 to October 10, 2022. Date and location of tagging is indicated in red. Error bars are shown in solid black. Horizontal dashed lines indicate the positions of Keyyask GS (red), Kettle GS (green), and Long Spruce GS (purple).