Keeyask Generation Project

Aquatic Effects Monitoring Plan

Walleye Movement Monitoring Report

AEMP-2023-04

KEEYASK

Manitoba Environment and Climate Client File 5550.00
Manitoba Environment Act Licence No. 3107

2022 -2023

KEEYASK GENERATION PROJECT

AQUATIC EFFECTS MONITORING PLAN

REPORT #AEMP-2023-04

WALLEYE 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:

Funk, B. and C.L. Hrenchuk. 2023. Walleye 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-2023-04. A report prepared for Manitoba Hydro by North/South Consultants Inc., June 2023. xvi + 232 pp.

SUMMARY

Background

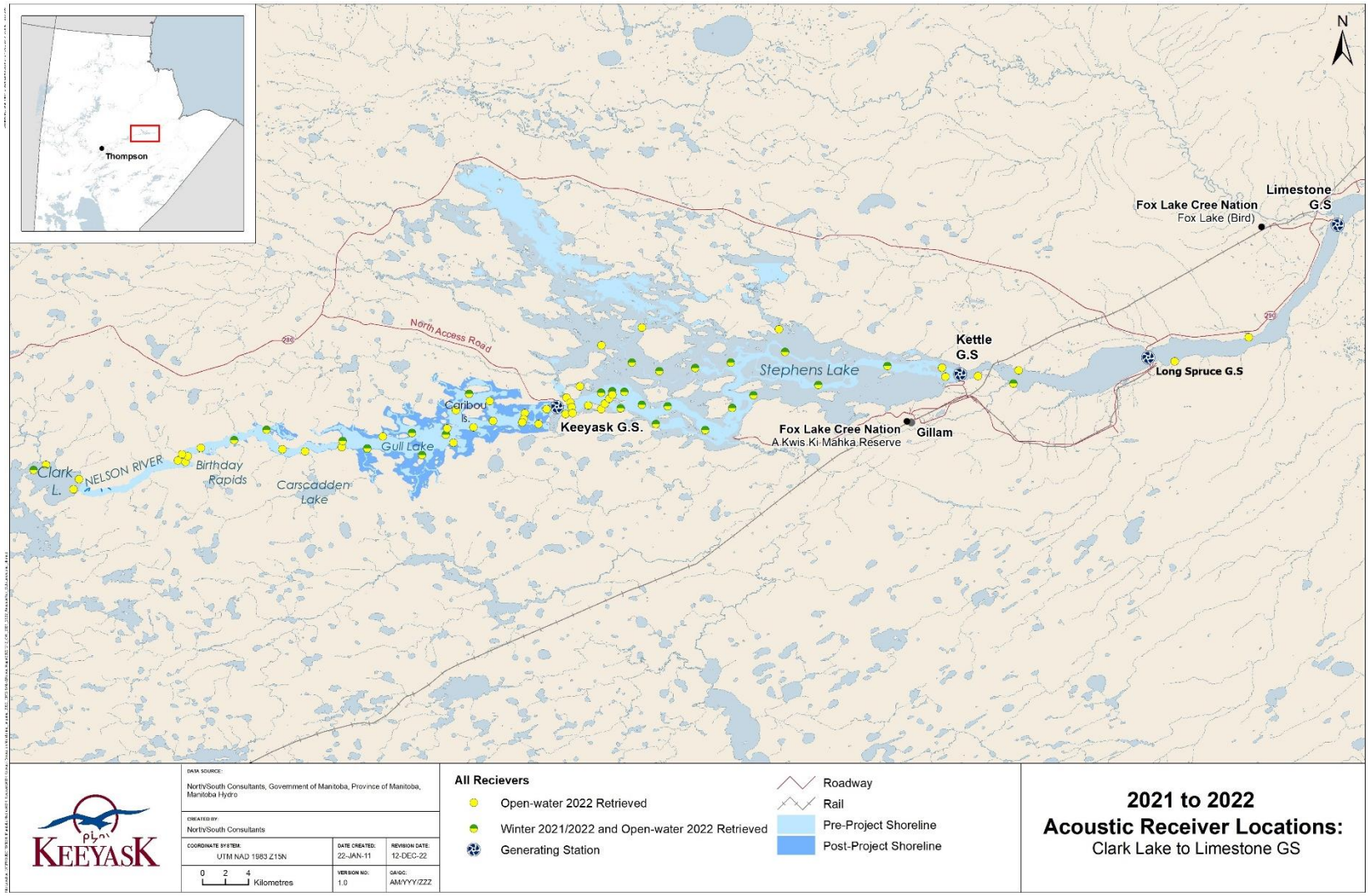
The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the Keeyask Generating Station (GS) on the environment. Besides measuring the accuracy of the predictions made and actual effects of the GS on the environment, monitoring 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.

Movements of pickerel (Walleye) in relation to Birthday Rapids and Gull Rapids were monitored prior to the start of the construction monitoring program in 2013, but because different methods were used to collect data under the Aquatic Effects Monitoring Plan (AEMP), the results are not directly comparable. While earlier studies did not record detailed fish movement patterns between Clark Lake and Stephens Lake, data indicated that the majority of pickerel continued to live in the waterbody where they had been tagged and some moved over Birthday and Gull rapids. A small number of pickerel also moved downstream through the Kettle and Long Spruce generating stations.

This report presents results of pickerel movement monitoring from October 2021 to October 2022. It provides a summary of data collected since the monitoring program was initiated in June 2013. Tags were initially implanted into pickerel in 2013 and these tags expired in 2016. To continue the study, additional transmitters were applied to pickerel in 2014 (expired in 2017), 2016 (expired in 2021), 2018 (expire in 2023), 2019 (expire in 2023), and 2021 (expire in 2025). Monitoring these tags will continue through commissioning and operation of the Keeyask GS.

Monitoring fish movements is an important component of the overall plan to monitor the impacts of construction and operation of the Keeyask GS on fish. Pickerel was identified as one of the key species to monitor because it is: of commercial and domestic importance; abundant in the Keeyask area; known to pass through Gull Rapids in either direction prior to the start of construction; and resilient enough to survive the acoustic tagging procedure.



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.

Why is the study being done?

Monitoring during the end of construction of the GS and the first year after the reservoir was flooded is being done to answer four questions:

Are there pickerel close to the Keeyask GS, particularly during spawning?

This question is important because pickerel used to spawn downstream of Gull Rapids where the Keeyask GS was built. If they no longer use this area now that the dam is finished, we will have to make sure they have other places where they can spawn.

How many pickerel are moving through and/or away from the Keeyask GS and how far are they going?

Movement studies tell us how many pickerel are moving down through the Keeyask GS, how far they travel up or downstream away from the site, whether they are leaving the Keeyask area completely, and when they are making these movements. The distance they travel is monitored as far upstream as the inlet to Clark Lake and downstream as far as the Limestone Reservoir.

If pickerel move through a GS, they cannot move back, and may be injured or killed during passage. This could decrease the number of fish living upstream of the GS.

How many pickerel move upstream past Birthday and/or Long rapids?

Pickerel travelling upstream past these rapids tells us they have left their original habitat in the Keeyask reservoir. Tracking these fish can tell us whether they return to the reservoir, move back and forth, or permanently leave the Keeyask area.

Did pickerel change where they live after the reservoir was flooded and the GS construction was completed?

Flooding of Gull Lake will cause changes to available habitat in the area. Completion of the GS will also change flow patters in Stephens Lake. This may cause pickerel to move away or to use different areas of the river.

What was done?

Movements of pickerel were tracked using acoustic telemetry. This is a technique in which a tag is surgically implanted inside a fish. Each tag sends out a sound signal (called a “ping”) that is picked up by receivers that were placed along the Nelson River between Clark Lake and the Limestone Generating Station (see study area map below). Each fish is given a battery powered transmitter that sends out a unique ping, and pings can be detected up to 1 kilometre (km) away from a receiver. By looking at detections recorded by different receivers, the movement of each fish can be tracked.

Eighty pickerel were originally tagged in 2013, 40 upstream and 40 downstream of Gull Rapids (now called the Keeyask GS) in order to establish pickerel movement pattern(s) before and throughout the project. Since that time, 131 additional fish have been tagged upstream and 110

were tagged downstream to account for expired batteries and fish that moved out of the monitoring area. The additional tagging maintained a sample size of 40 fish up and downstream that could be tracked for the duration of the study.

Measuring a pickerel before surgery (left), surgery (middle), and release (right).

What was found?

Pickerel tagged both upstream and downstream of the Keeyask GS have consistently showed the same movement patterns since monitoring began in 2013. Upstream of the GS, fish either stay in Gull Lake, move between Birthday Rapids and Gull Lake, move between Clark Lake and Gull Lake, or remain in the riverine area downstream of Birthday Rapids. Some fish also move downstream through the Keeyask GS. Pickerel tagged in Stephens Lake either stay in the portion of the lake within 10 km from Keeyask GS, or they move extensively within the lake. Most pickerel monitored in 2022 continued to display these same movement patterns.

Since tagging began in 2013, 40 fish have moved downstream through the Keeyask GS site. Thirteen of these movements likely happened because of tagging stress or mortality, while 27 movements occurred for other reasons. Most of the latter moved downstream in 2017 and 2019. The highest numbers of fish also moved downstream through the Kettle GS in the same years. In 2022, a single, tagged pickerel moved downstream through the Keeyask GS. It made multiple upstream and downstream movements within Stephens Lake, indicating survival.

Before the start of construction in 2014, 14% of the tagged pickerel moved upstream into Clark Lake, most of which (71%) moved back downstream to Gull Lake within one to six months. During construction 18% moved upstream, 50% of which moved back downstream to Gull Lake within one day to nine months. During the first open-water period after impoundment in 2021, 17 tagged pickerel moved upstream (31%), which represents a larger proportion of tagged fish than seen in past years. In 2022, five tagged pickerel (17%) moved upstream into Clark Lake during the open-water period; but similar to past years, more than half of these fish (60%) returned to Gull Lake before the end of the 2022 open-water period. Most fish that moved upstream to Clark Lake were detected here briefly and returned downstream to Gull Lake.

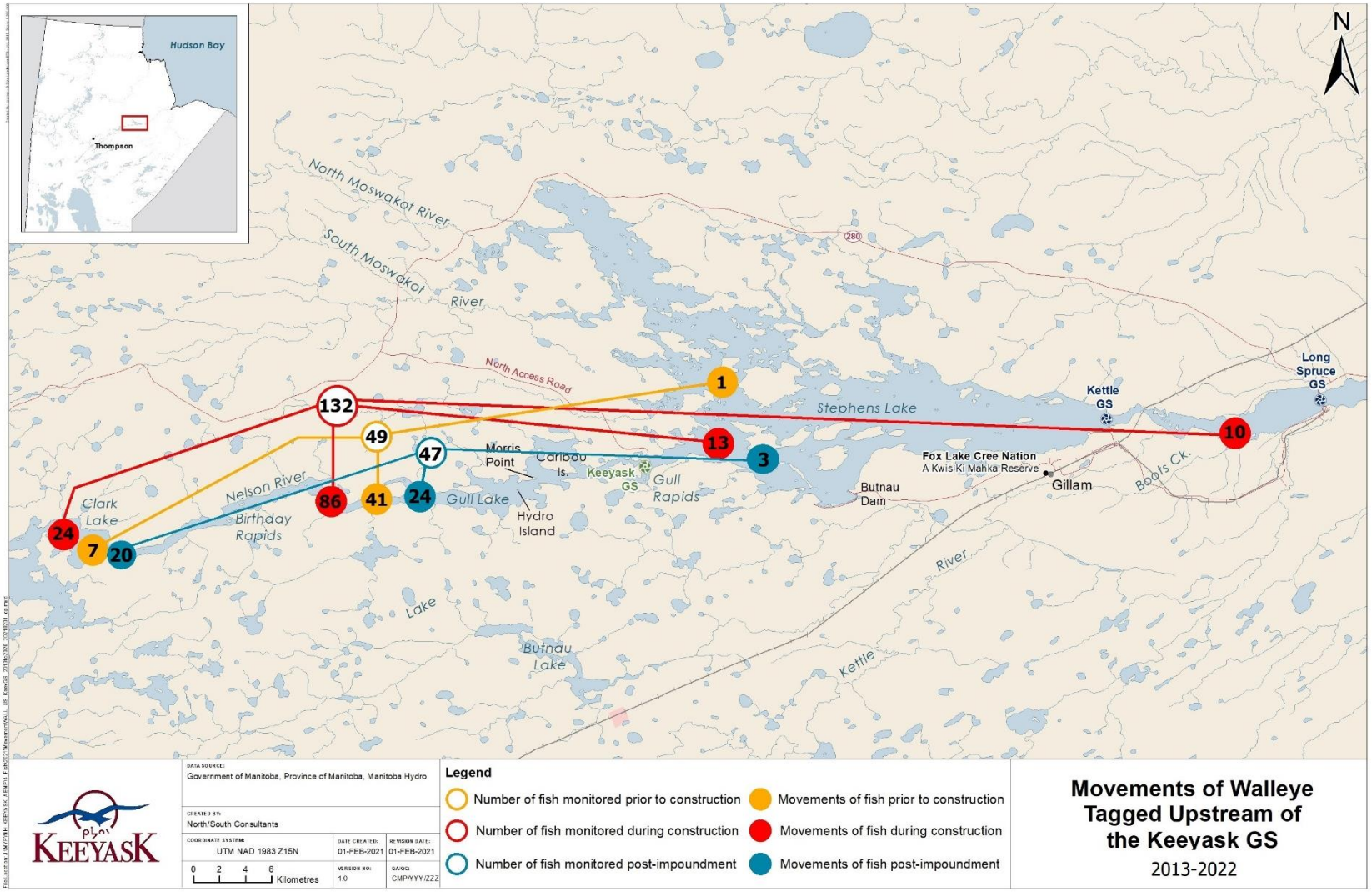
Pickerel in Stephens Lake have consistently used habitat directly downstream of the GS, before and during construction. The Keeyask GS was completed on March 9, 2022, and its operation changed the flow patterns in Stephens Lake. Despite this, most pickerel (66% of detected) were detected near the Keeyask GS (≤ rkm 1.2) during the 2022 spawning period.

What does it mean?

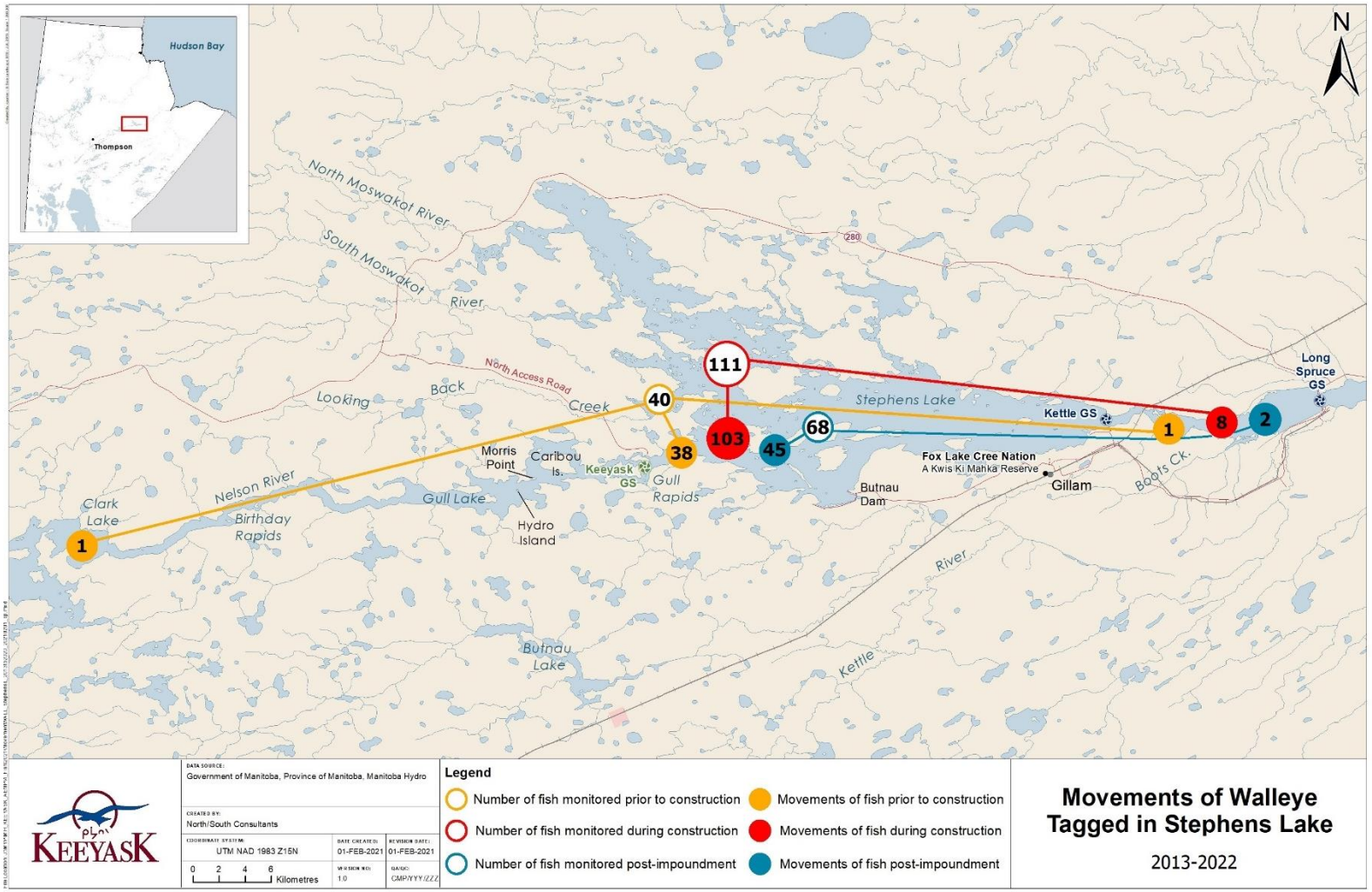
The study continues to show that pickerel use habitat immediately downstream of the construction site, in Stephens Lake, including during the spawning period. After impounding the reservoir, most of the pickerel tagged upstream from the GS showed the same general movement patterns that were seen before impoundment, and more than half of the fish that moved upstream out of the reservoir end up returning downstream within one year. In 2022, there was no indication that the number of pickerel moving downstream into Stephens Lake had increased more than what was seen in the past.

What will be done next?

Fish that were tagged in 2018/2019 and 2021 will continue to be tracked in 2023. Ongoing tracking of fish through operation of the GS, will indicate if the project changed their general movements, which can provide information about what kinds of habitats these fish need to use over several years, when and where they are spawning, where they are feeding, and whether they leave the Keeyask area.



Map showing how many pickerel tagged upstream of the Keeyask GS moved upstream out of Gull Lake, stayed in Gull Lake, 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 pickerel tagged downstream of the Keeyask GS moved upstream through Gull Rapids, 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 Kitchekeesik, and Terry Kitchekeesik 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 licensing process for the Project, an Aquatic Effects Monitoring Plan (AEMP) was developed detailing the monitoring activities of various components of the aquatic environment, including the focus of this report, Walleye (*Sander vitreus*) movement, for the construction and operation phases of the Project.

Pre-construction (baseline) movements of Walleye were monitored using radio telemetry from 2001 to 2005 (Barth *et al.* 2003; Murray *et al.* 2005; Murray and Barth 2007). Radio telemetry studies focused specifically on detecting the upstream and downstream movements of fish over rapids in the study area (Birthday Rapids and Gull Rapids). Pre-construction movement data revealed that the majority of Walleye did not move upstream or downstream over rapids into adjacent study reaches; instead, they remained within the reach where they had been tagged. Those few fish that moved over one or more sets of rapids did so in the summer or fall, suggesting that these movements were not associated with a life history event such as spawning. A small number of Walleye also moved downstream through the generating stations/spillways along the lower Nelson River. Additional information on long distance movements was obtained from mark-recapture studies. These results are not directly comparable to the movement data being collected under the AEMP.

In 2013, 80 Walleye were tagged with acoustic transmitters to assess the frequency of movement through Gull Rapids and to monitor the potential impact that construction of the Keeyask GS may have on movement (Hrenchuk and Barth 2014). Movements of these Walleye from the tagging date until October 2014 are provided in Murray *et al.* (2015); October 2014 to October 2015 are presented in Burnett *et al.* (2016); and October 2015 to October 2016 are presented in Hrenchuk and Lacho (2017).

As the transmitters applied in 2013 reached the end of their battery life in 2016, additional transmitters were applied to Walleye in 2016 to continue the movement study until 2021. Results from June to October 2016 are presented in Hrenchuk and Lacho (2017), October 2016 to October 2017 in Hrenchuk and Lacho (2018), October 2017 to October 2018 in Hrenchuk and Lacho (2019), October 2018 to October 2019 in Hrenchuk (2020), and October 2019 to

September 2020 in Hrenchuk (2021). An additional 60 tags were applied in 2021 to continue to track movements post-impoundment and during early operation.

Impoundment of the Keeyask reservoir was completed on September 5, 2020. Sampling in the Keeyask reservoir in 2021 represented the first year of sampling under operating conditions (water levels and flows). 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. Later in the summer and early fall as additional units became operational, the entire flow of the river was diverted through the powerhouse. Due to Keeyask reservoir impoundment, several key questions identified in the AEMP that have not been previously discussed are addressed.

- What is the frequency of downstream movement through the Keeyask GS and when are the movements occurring?
- Are Walleye utilizing habitat in the vicinity of construction activities (particularly during spawning)?
- What types of habitat are Walleye utilizing in the Keeyask reservoir (*i.e.,* are fish using the upper, middle, or lower end of the reservoir)?
- What proportion of the fish population moves from the Keeyask reservoir upstream past Birthday and/or Long rapids?

This report provides results of Walleye movement monitoring from October 2021 to October 2022, and summarizes what has been observed since the program began in 2013.

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.

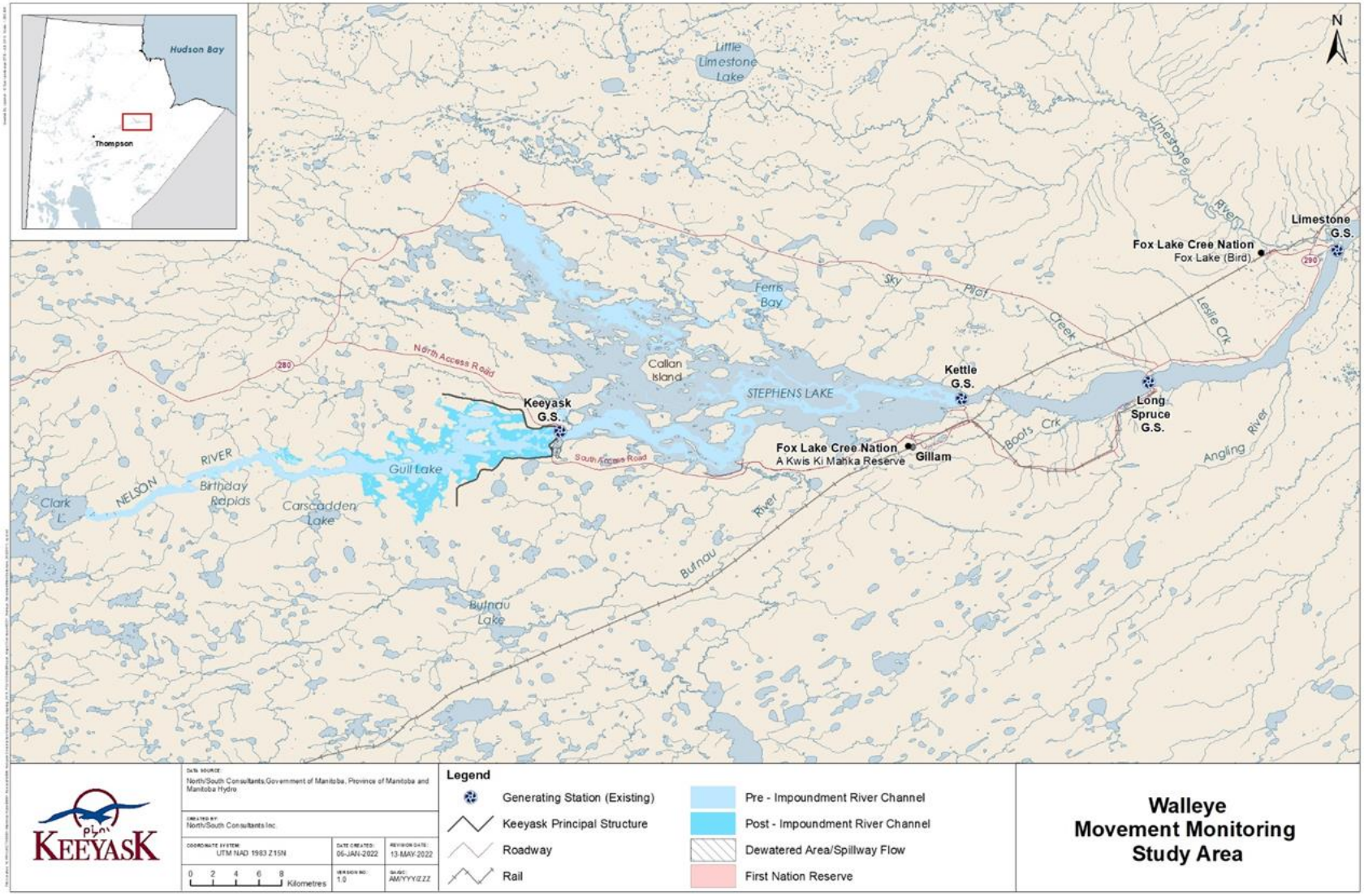
Prior to impoundment, Gull Lake was a widening of the Nelson River, with moderate to low water velocity beginning approximately 20 km upstream the Keeyask GS. Water levels on Gull Lake increased by several metres following impoundment and flooding along the shoreline and small tributaries entering this 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 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 lower Nelson River showing the site of the Keeyask Generating Station and the Walleye 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) were first applied to Walleye in 2013 (40 upstream and 40 downstream of the Keeyask GS site) and 2014 (nine upstream and two downstream) (Murray *et al.* 2015). These transmitters expired during the 2016 open-water period. To continue Walleye movement monitoring with a similar sample size, 80 acoustic transmitters (VEMCO V13-1x[1]) were applied to Walleye between May 27 and June 7, 2016: 40 upstream, and 40 downstream of the Keeyask GS site (Table 1). Shortly after tagging *(i.e*., within 22 days), eight fish moved downstream into Stephens Lake. To return the number of tagged fish upstream to the original sample size, eight additional transmitters were applied on September 24, 2016 (Hrenchuk and Lacho 2017).

In October 2017, monitoring results indicated that several additional fish had either moved downstream out of Gull and Stephens lakes or had gone missing (see Sections 4.1.1 and 4.1.2). Therefore, to maintain a similar sample size of tagged fish, additional transmitters (VEMCO V13-1x) were applied to Walleye upstream of the Keeyask GS and in Stephens Lake in spring 2018. Seventeen fish were tagged upstream of the Keeyask GS between May 27 and June 5, and seven fish were tagged in Stephens Lake between June 6 and 9 (Table 1).

Additional transmitters were applied to Walleye in 2019 (VEMCO V13-1x) to maintain the sample size during GS operation, while obtaining one full year of tracking prior to GS commissioning. Twenty-seven fish were tagged upstream of the Keeyask GS between May 23 and June 7, and 29 were tagged in Stephens Lake between May 30 and June 3. An additional two fish were tagged in Stephens Lake on September 16 (31 total; Table 1). As these tags are nearing the end of their

[1] Battery life for tags implanted in 2013 was estimated at 1,480 days; tags implanted in 2016 and 2018 had an estimated battery life of 1,735 days; tags implanted in 2019 had an estimated battery life of 1,492 days; and tags implanted in 2021 had an estimated battery life of 1,460 days.

expected battery life, an additional 60 tags (VEMCO V13-1x) were applied to Walleye in May and June 2021; 30 upstream and 30 downstream of the Keeyask GS (Appendix 6).

Table 1: Number of acoustic tags applied to Walleye in the Keeyask Study Area (upstream of the Keeyask GS site and in Stephens Lake) between June 2013 and October 2022.

Year	Upstream of Keeyask GS[1]	Stephens Lake	Total
2013*	40	40	80
2014*	9	2	11
2015*	0	0	0
2016*	48	40	88
2017*	0	0	0
2018	17	7	24
2019	27	31	58
2020	0	0	0
2021	30	30	60
2022	0	0	0

1. Referred to as the Keeyask GS after spillway commissioning in 2018.

*Tags no longer active during the current reporting period. Detailed information on movements (2013–2016) can be found in Hrenchuk and Barth (2014), Murray *et al.* (2015), Burnett *et al.* (2016), Hrenchuk and Lacho (2017; 2018; 2019), and Hrenchuk (2020).

3.1.2 ACOUSTIC RECEIVERS

Since 2013, stationary acoustic receivers (VEMCO model VR2W) have been used to continuously monitor tagged Walleye 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 (Figure 1). 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.

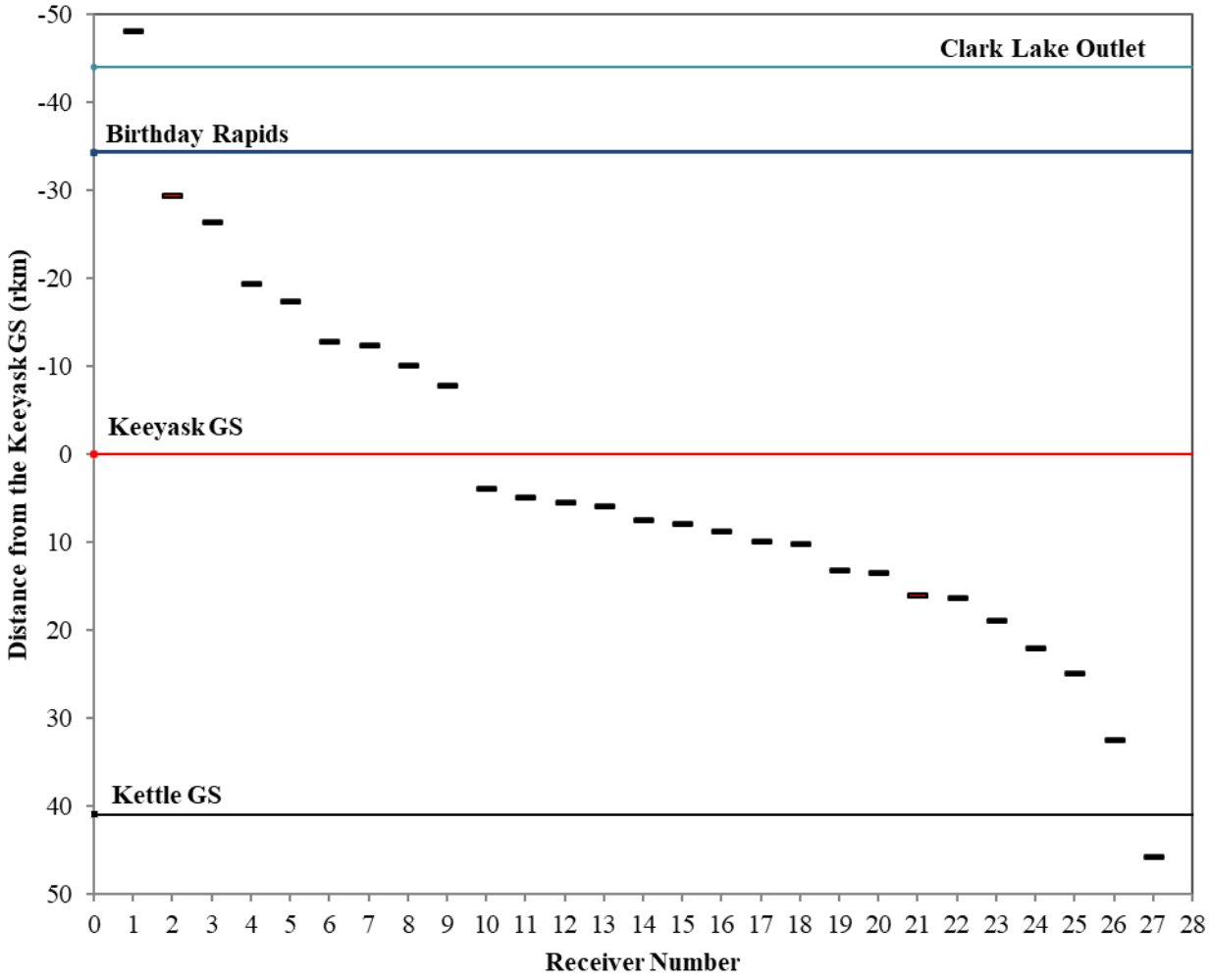
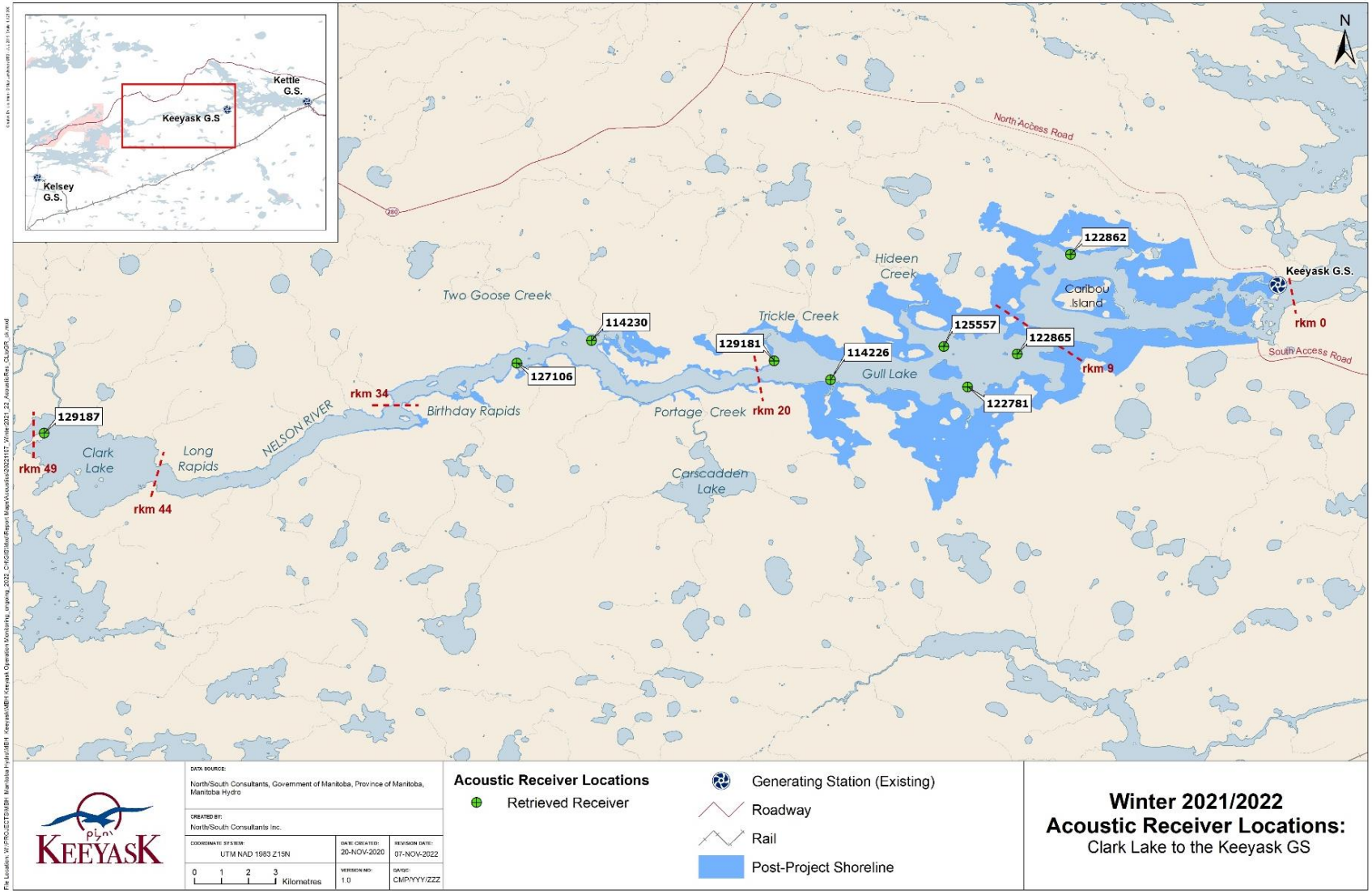
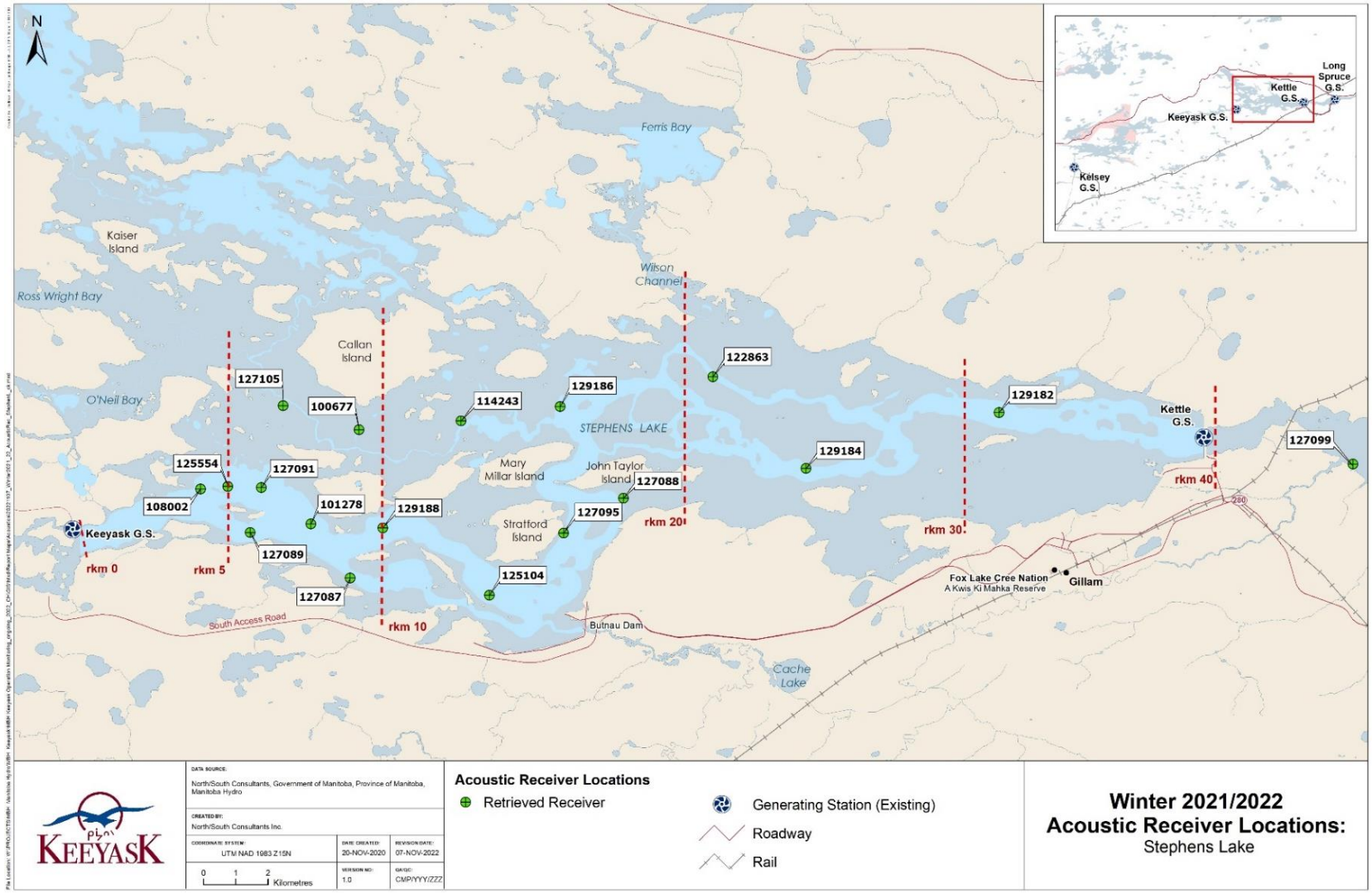


Figure 1: Locations of stationary acoustic receivers (dashes) in relation to the base of the Keeyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Limestone GS between October 2021 and May 2022. A red dash indicates a receiver that was lost.



Map 2: **Locations of stationary receivers set in the Nelson River from Clark Lake to the Keeyask GS between October 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 Keeyask GS to Kettle GS between October 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.**

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 (Map 4). 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 5).

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.

Water temperature within the Nelson River mainstem was recorded with a HOBO Water Temperature Pro data logger from October 10, 2021, to October 11, 2022. Walleye generally spawn in the spring when water temperature ranges from 4–9°C (Scott and Crossman 1998; Stewart and Watkinson 2004). Thus, data collected during this temperature range was considered as the "spawning period".

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

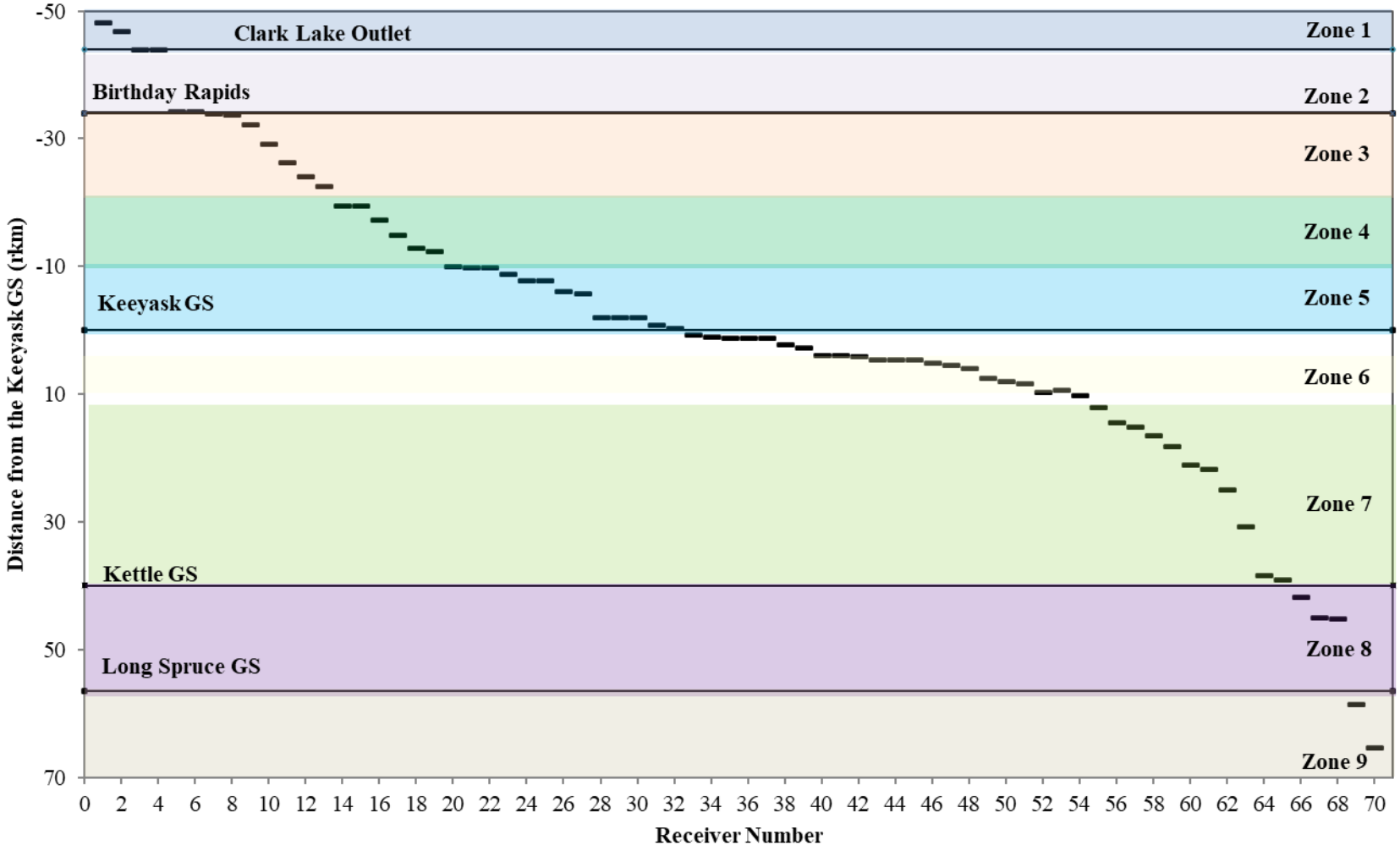
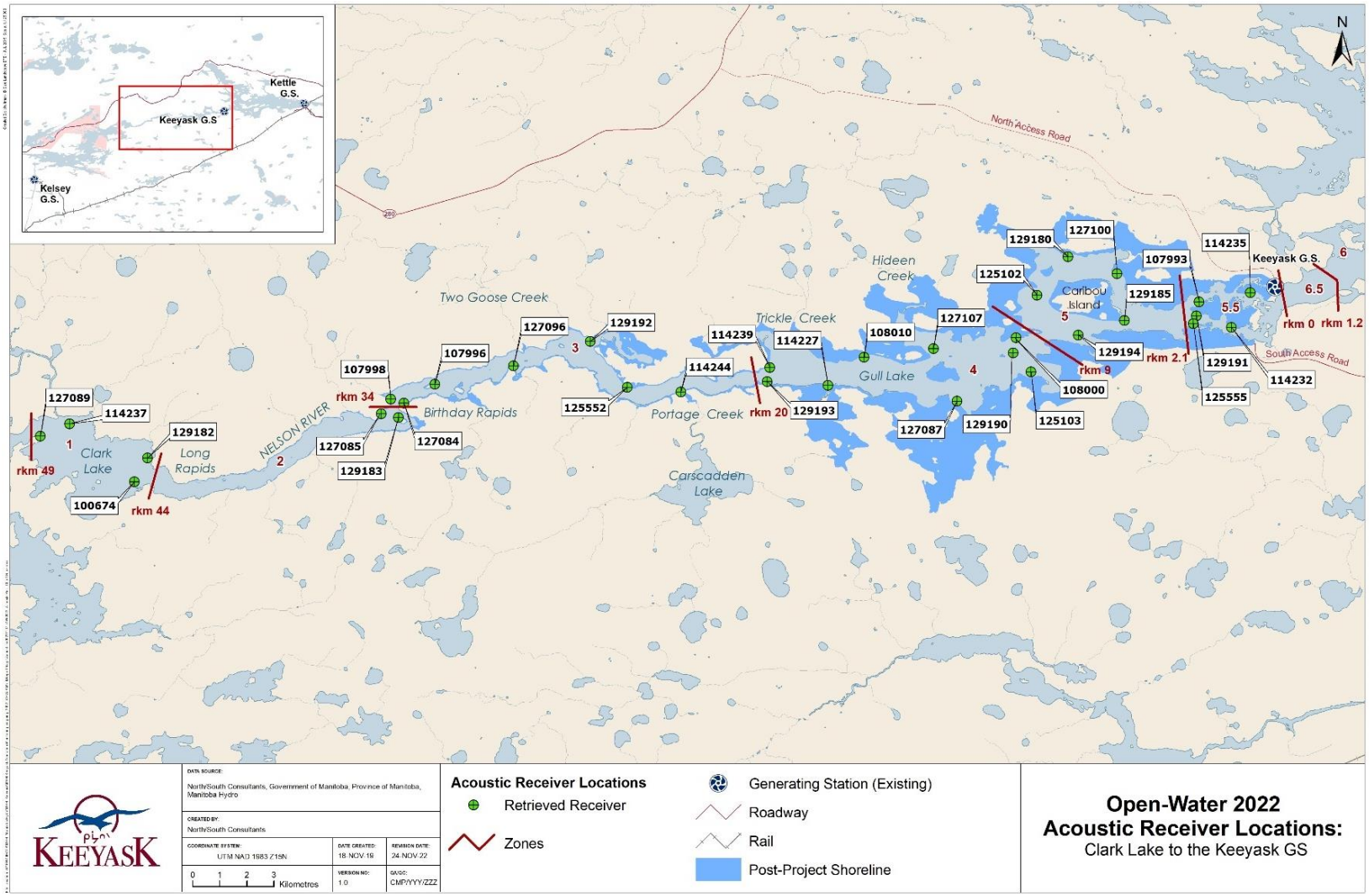
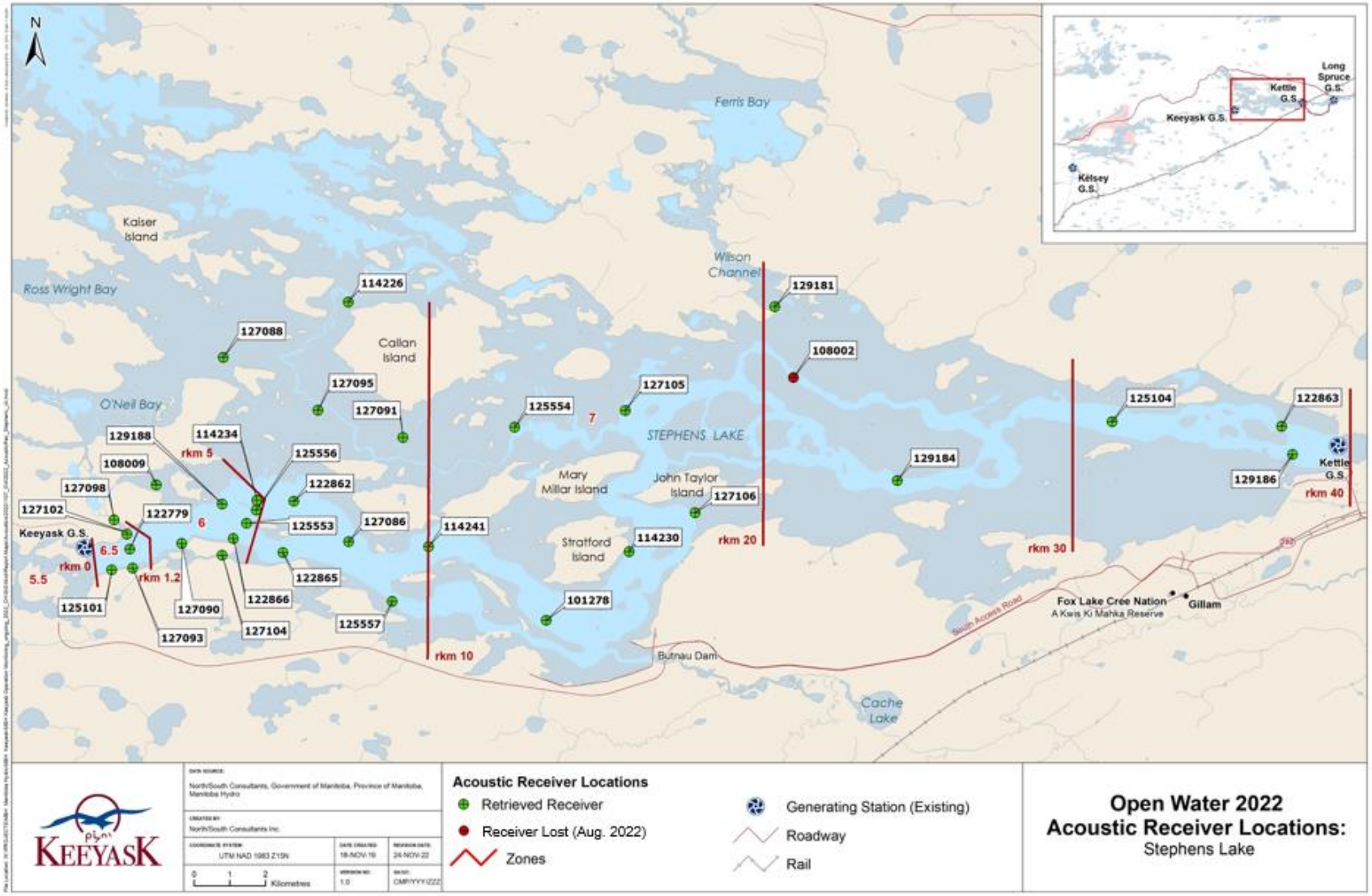


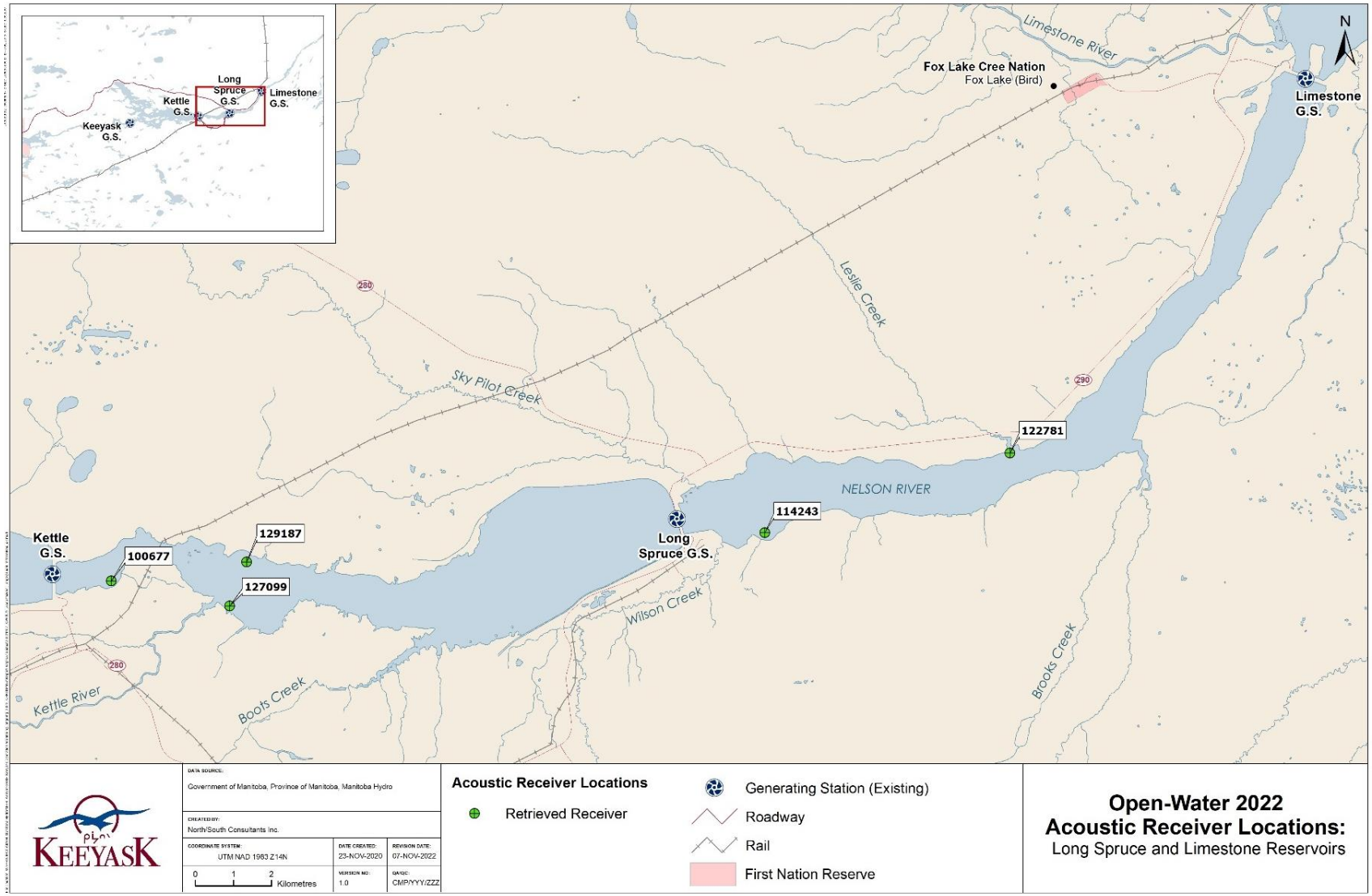
Figure 2: **Locations of stationary acoustic receivers (dashes) in relation to the base of the Keeyask GS (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Limestone GS between May and October, 2022. River zones upstream and downstream of the Keeyask GS are indicated by shading.**



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" based on placement of receiver "gates." River kilometer (rkm) distances at zone divisions are indicated with a red line. The former (pre-impoundment) river channel is shown in light blue.**



Map 5: **Locations of stationary receivers set in Stephens Lake between May and October 2022. The river is divided into three "zones" based on placement of receiver "gates." River kilometer (rkm) distances are indicated with a red line. The pre-impoundment river channel is shown in light blue.**



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) was given a positive (+) distance value from the GS, while the area located upstream (*i.e.*, Gull and Clark lakes) was given negative (-) distance values (Figures 1 and 2). The average rkm distance from the GS was calculated over a 4-hour interval and plotted versus time for each fish. Total detection ranges were calculated by subtracting the farthest downstream detection location from the location of the farthest upstream detection. The proportion of time that all fish spent within each river zone was calculated and plotted.

Rapid downstream movements observed within two weeks of tagging were classified as caused by tagging mortality or stress. It 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.

4.0 RESULTS

Section 4.1 provides a summary of movements observed between tagging in spring 2018 and the end of the 2021 open-water period (October 10, 2021). Appendix A1 provides farthest upstream and downstream detection locations by river kilometer for each tagged fish (2018–2022) while appendices A2 to A5 provide movement summaries, by river kilometre, for each Walleye tagged between 2018 and 2021. Biological information associated with each tagged fish is provided in Appendix A6.

4.1 2017-2021 RESULTS SUMMARY

4.1.1 UPSTREAM OF THE KEEYASK GS

A total of 17 transmitters were applied to Walleye between May 27 and June 5, 2018, an additional 27 tags were applied between May 23 and June 7, 2019, and 30 more tags were applied between May 31 and June 14, 2021, bringing the total number of fish tagged to 74 (Table 1).

Six fish were detected briefly in Gull Lake (between 0 and 18 days) after being tagged, and are considered missing due to tagging stress or mortality:

- #20155 was tagged on June 6, 2019 at the inlet of Gull Lake. It was last located farther downstream in Gull Lake (rkm -9.9) on June 14 (Appendix A2-25).
- #20164 was tagged on June 6, 2019 at the inlet of Gull Lake. It was last located farther downstream in Gull Lake (rkm -15.0) on the same day (Appendix A2-34).
- #20168 was tagged on June 7, 2019 at the inlet of Gull Lake. It was never detected and likely represents a tag malfunction.
- #20169 was tagged on June 7, 2019 at the inlet of Gull Lake. It was last located farther downstream in Gull Lake (rkm -12.9) on June 16 (Appendix A2-35).
- #25743 was tagged on June 5, 2018. It moved downstream immediately and was last detected in lower Gull Lake on June 12, 2018 (Appendix A2-4).
- #25745 was tagged on June 5, 2018 in upper Gull Lake. It was located here until June 6, 2018 (Appendix A2-6).

An additional nine fish are considered missing (*i.e.*, have not been detected for more than a year).

- #25742 was last detected on June 6, 2019 in Gull Lake (rkm -12.9) (Appendix A2-3).
- #25750 was last detected on September 9, 2019 in Clark Lake (rkm -44.5). It is likely that this fish continued to move upstream out of the receiver array (Appendix A2-11).

- #25756 was last detected on July 3, 2019 in Clark Lake (rkm -46.9). It is likely that this fish continued to move upstream out of the receiver array (Appendix A2-17).
- #20153 was last detected on June 26, 2019 in Gull Lake at rkm -10.2 (Appendix A2-23).
- #20175 was last detected on October 5, 2019 in the riverine portion of the Nelson River between Birthday Rapids and Gull Lake (rkm -26.5) (Appendix A2-37).
- #20176 was last detected on October 6, 2019 at the inlet to Gull Lake (rkm -19.5) (Appendix 2-38).
- #25747 was last detected on August 23, 2020 in Gull Lake at rkm -4.8 (Appendix A2-8)
- #25754 was last detected in the riverine portion of the Nelson River between Birthday Rapids and Gull Lake (rkm -29.3) on June 9, 2020 (Appendix A2-15).
- #20157 was last detected on September 19, 2020 in Gull Lake at rkm -12.9 (Appendix A2-27)

The 15 fish described above were not included in data analyses and are not discussed in the remainder of the report.

Prior to winter 2021/2022, 18 tagged Walleye moved downstream from the Keeyask reservoir into Stephens Lake:

- Three moved into Stephens Lake and made multiple upstream and downstream movements. Based on few detections, all three fish are now considered missing.
    - #20182 was tagged on May 25, 2019 at the inlet of Gull Lake. It moved downstream through the Keeyask GS spillway on June 13 (Appendix A2-40).
    - #20186 was tagged on May 29, 2019 in upper Gull Lake. It moved throughout Gull Lake, as far upstream as the inlet and as far downstream as lower Gull Lake until August 10 when it moved downstream through the Keeyask GS spillway (Appendix A2-41).
    - #25739 was tagged on June 5, 2018 in lower Gull Lake and moved downstream through the Keeyask GS spillway between October and November. It was last detected in Stephens Lake (rkm 13.9) on November 20, 2018 and is now considered missing (Appendix A2-1).
- Six moved downstream through the Keeyask GS into Stephens Lake, and then continued to move downstream into the Long Spruce Reservoir.
    - #20147 was tagged on June 5, 2019. It moved within upper Gull Lake until July 24, when it moved downstream through the Keeyask GS spillway. It continued to move downstream in Stephens Lake and was detected within the Long Spruce forebay on August 1, 2019 (Appendix A2-18).
    - #20187 was tagged on May 23, 2019 at the inlet of Gull Lake and moved downstream through the Keeyask GS spillway on June 19. It continued to move

downstream through Stephens Lake and was detected within the Long Spruce Reservoir on July 22, 2019 (Appendix A2-42).

- #25740 was tagged on June 5, 2018. It moved throughout lower Gull Lake until June 14 and was detected in Stephens Lake on June 15. It moved between rkm 3.8 and 7.9 until June 18, after which it continued to move downstream. It was detected within the Long Spruce forebay on July 31, 2018 (Appendix A2-2).
- #25753 was tagged on May 27, 2018 at the inlet of Gull Lake. It then moved as far upstream as Birthday Rapids. It moved downstream through the Keeyask GS on July 25 and through the Kettle GS on August 12, 2018 (Appendix A2-14).
- #25755 was tagged on June 1, 2018, at the inlet of Gull Lake. It moved downstream through the Keeyask GS between June 11 and 12, 2018. It was last detected in Stephens Lake on June 17, 2018 and detected in the Long Spruce forebay on August 6 (Appendix A2-16).
- #48330 was tagged at the inlet of Gull Lake (rkm -17.4) on June 1, 2021. It moved as far upstream as rkm -19.5 before moving downstream through both the Keeyask GS and Kettle GS, being detected in the Long Spruce Reservoir on October 11, 2021 (Appendix A4-29).

- Five moved downstream through the Keeyask GS immediately after tagging and were detected briefly (for one to 15 days) in Stephens Lake with no upstream movements. These fish are considered tagging mortalities or movements induced by stress resulting from the tagging procedure and are not discussed in the remainder of the report.
  - #20158 was tagged on June 6, 2019 at the inlet of Gull Lake. It moved downstream through the Keeyask GS spillway on June 16. It was last detected on June 21, 2019 (Appendix A2-28).
  - #20160 was tagged on June 7, 2019 at the inlet of Gull Lake. It remained at this location until June 13 when it began to move downstream, moving through the Keeyask GS Spillway on June 17. It was located in upper Stephens Lake until the end of the study period (Appendix A2-30).
  - #25748 was tagged on May 28, 2018, in the riverine area upstream of Gull Lake and moved downstream through the Keeyask GS on June 12. It moved through the Kettle GS between June 14 and 18, 2018 (Appendix A2-9).
  - #25752 was tagged on May 27, 2018, at the inlet of Gull Lake and moved downstream through the Keeyask GS on June 8. It moved downstream through the Kettle GS on June 23, 2018 (Appendix A2-13).
  - #48323 was tagged on June 6, 2021 in the middle Keeyask reservoir and moved downstream through the Keeyask GS on July 1, 2021. It was last detected on July 14, 2021 (Appendix A4-23).
- Four were last detected immediately upstream of the Kettle GS and likely moved downstream into the Long Spruce reservoir.

- #20148 was tagged on June 6, 2019 in upper Gull Lake. It moved downstream through the Keeyask GS in winter 2019/2020 and continued to move downstream within Stephens Lake. It was last detected immediately upstream of the Kettle GS on July 5, 2020 (Appendix A2-19).
- #20149 was tagged on June 5, 2019 in upper Gull Lake. It moved downstream through the Keeyask GS spillway on June 21, 2019 and continued to move downstream within Stephens Lake. It was last detected immediately upstream of the Kettle GS on July 2, 2019 (Appendix A2-20).
- #20150 was tagged on June 5, 2019 in upper Gull Lake. It moved downstream within Gull Lake and was last detected at rkm -4.8 on June 21. It moved through the Keeyask GS Spillway on the same day. It was last detected immediately upstream of the Kettle GS on July 2, 2019 (Appendix A2-21).
- #20163 was tagged on June 6, 2019 at the inlet to Gull Lake. It was located here until June 22 when it moved upstream. It was located in the riverine area of the Nelson River between Birthday Rapids and Gull Lake until July 31 when it returned to Gull Lake. It moved downstream through the Keeyask GS spillway on August 9 and was last detected in lower Stephens Lake immediately upstream of the Kettle GS on August 16, 2019 (Appendix A2-33).

To summarize, 74 Walleye were tagged upstream of the Keeyask GS site in from 2018 to 2021. Fifteen are considered missing and 18 moved downstream into Stephens Lake (Table 3). Therefore, 41 fish were available to be detected upstream of the Keeyask GS during winter 2021/2022.

4.1.2 STEPHENS LAKE

Seven transmitters were applied between June 6 and 9, 2018, 31 were applied between May and September, 2019, and another 30 were applied between June 2 and June 6, 2021, bringing the total number of tagged fish to 68 (Table 1).

One fish was only detected briefly after being tagged, and is considered missing due to tagging stress or mortality:

- #25734 was tagged on June 7, 2018. It moved downstream and was last detected at rkm 21.6 on June 13 (Appendix A3-2).

Fifteen tagged Walleye were detected for more than 14 days but have not been located for over two years and are considered missing:

- #20129 was last detected on September 30, 2019 in upper Stephens Lake at rkm 4.2 (Appendix A3-8).
- #20133 was last detected on October 2, 2019 in upper Stephens Lake at rkm 4.2 (Appendix A3-12).

- #20134 was last detected on July 6, 2019 in upper Stephens Lake at rkm 1.2 (Appendix A3-13).
- #20136 was last detected on July 24, 2019 in lower Stephens Lake at rkm 24.7 (Appendix A3-15).
- #20137 was last detected on April 4, 2020 in lower Stephens Lake at rkm 21.6 (Appendix A3-16).
- #20145 was last detected on July 6, 2019 in upper Stephens Lake at rkm 1.2 (Appendix A3-24).
- #20152 was last detected on July 19, 2019 in upper Stephens Lake at rkm 6.5 (Appendix A3-25).
- #20178 was last detected on June 27, 2019 immediately downstream of the Keeyask GS spillway at rkm 0.6 (Appendix A3-34).
- #20180 was last detected on August 3, 2019 in lower Stephens Lake at rkm 24.7 (Appendix A3-36).
- #25736 was tagged on June 7, 2018, immediately downstream of the Keeyask GS. It was detected in upper Stephens Lake (rkm 1.2 to 10.3) until June 26, 2018 (Appendix A3-4).
- #20140 was last detected on August 25, 2020 in upper Stephens Lake at rkm 9.9 (Appendix A3-19)
- #20172 was last detected on July 4, 2020 in upper Stephens Lake at rkm 5.5. It only recorded two days of detections during the 2020 open-water study period (Appendix A3-29).
- #20177 was last detected on June 13, 2020, in upper Stephens Lake at rkm 5.2 (Appendix A3-33).
- #20183 was last detected on June 25, 2020 in upper Stephens Lake at rkm 8.4 (Appendix A3-37).
- #20184 was last detected on June 14, 2020 in lower Stephens Lake at rkm 13.9. This was the only day a detection was logged during the 2020 open-water study period (Appendix A3-38).

These 16 fish are not discussed in the remainder of this report.

Prior to winter 2021/2022, four Walleye moved downstream through the Kettle GS into the Long Spruce reservoir.

- #20141 was tagged on May 31, 2019, immediately downstream of the Keeyask GS. It moved between rkm 0.6 and 9.4 in upper Stephens Lake until June 14 when it moved rapidly downstream. It moved through the Kettle GS on June 15, 2019 (Appendix A3-20).

- #20142 was detected moving between upper and lower Stephens Lake (rkm 5.2 to 18.8 until July 31, 2021. It was first detected downstream of the Kettle GS on August 16, 2020 (Appendix A3-21).
- #25732 was tagged on June 9, 2018, immediately downstream of the Keeyask GS. It remained at this location until June 15, after which it began to move downstream. It moved through the Kettle GS on June 13, 2018 (Appendix A3-1).
- #25738 was tagged on June 7, 2018, immediately downstream of the Keeyask GS. It moved downstream and was last located in lower Stephens Lake at rkm 36.1 on July 6. It was first located in the Long Spruce forebay on June 19, 2018 (Appendix A3-6).

One additional fish likely moved downstream through the Kettle GS, however, its movements could not be confirmed.

- #20167 was tagged on September 16, 2019 at rkm 5.5 in upper Stephens Lake. It moved downstream on September 20 and was last located immediately upstream of the Kettle GS (rkm 40.9) on September 27. Due to the short amount of time between tagging and this downstream movement (four days), it likely represents a movement caused by tagging stress or by mortality (Appendix A3-27).

To summarize, 68 Walleye were tagged in Stephens Lake between 2018 and 2021. Sixteen fish are considered missing and five moved downstream through the Kettle GS (four confirmed and one suspected; Table 3). No fish that moved downstream through the Keeyask GS were available to be detected. Therefore, 47 fish were available to be detected in Stephens Lake during 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-three of the 41 fish (56%) available to be detected were located a total of 241,455 times (range: 3–56,693 detections per individual) (Appendix A1-1). On average, fish were detected for 75 days of the 217-day winter period (35%) (range: 1–202 days). The farthest upstream detections occurred at the inlet to Clark Lake at rkm -48.2 (by two fish; 9%). Two fish (9%) were detected as far downstream as rkm -7.9 (Figure 3; Appendix A1-1).

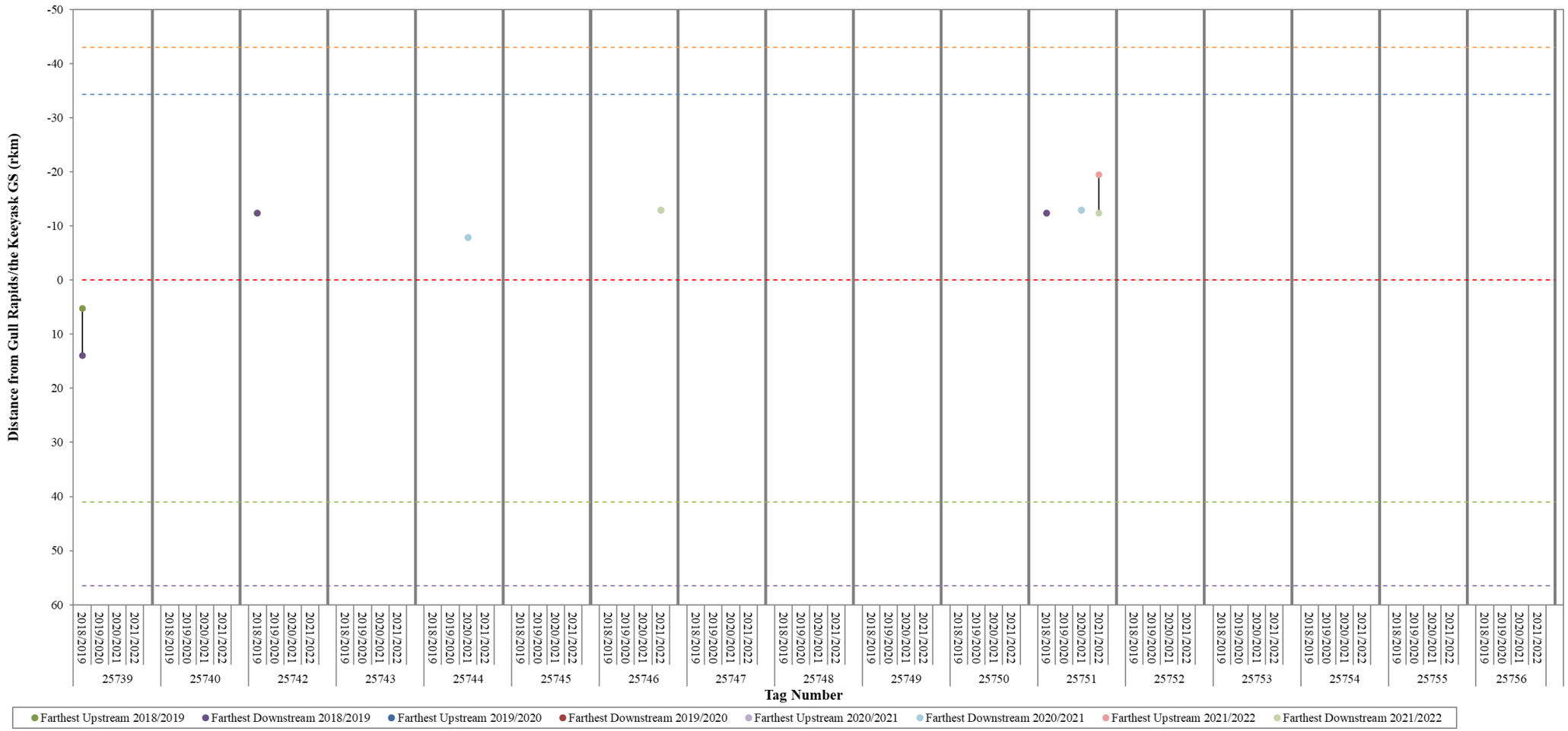


Figure 3: Detection ranges for individual Walleye tagged with acoustic transmitters upstream of the Keeyask GS during the winter period (2018–2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS).

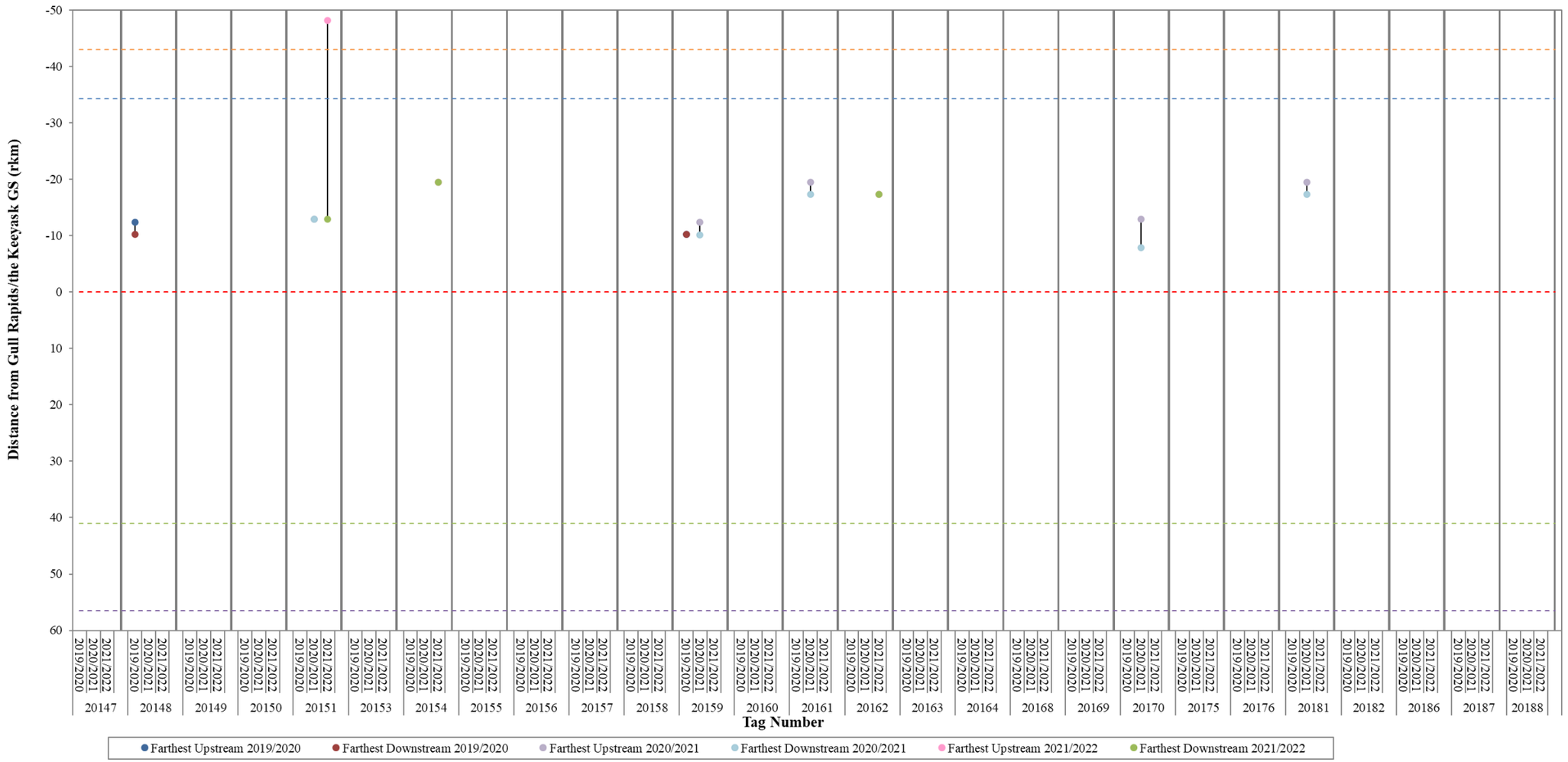


Figure 3: Detection ranges for individual Walleye tagged with acoustic transmitters upstream of the Keeyask GS during the winter period (2018–2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

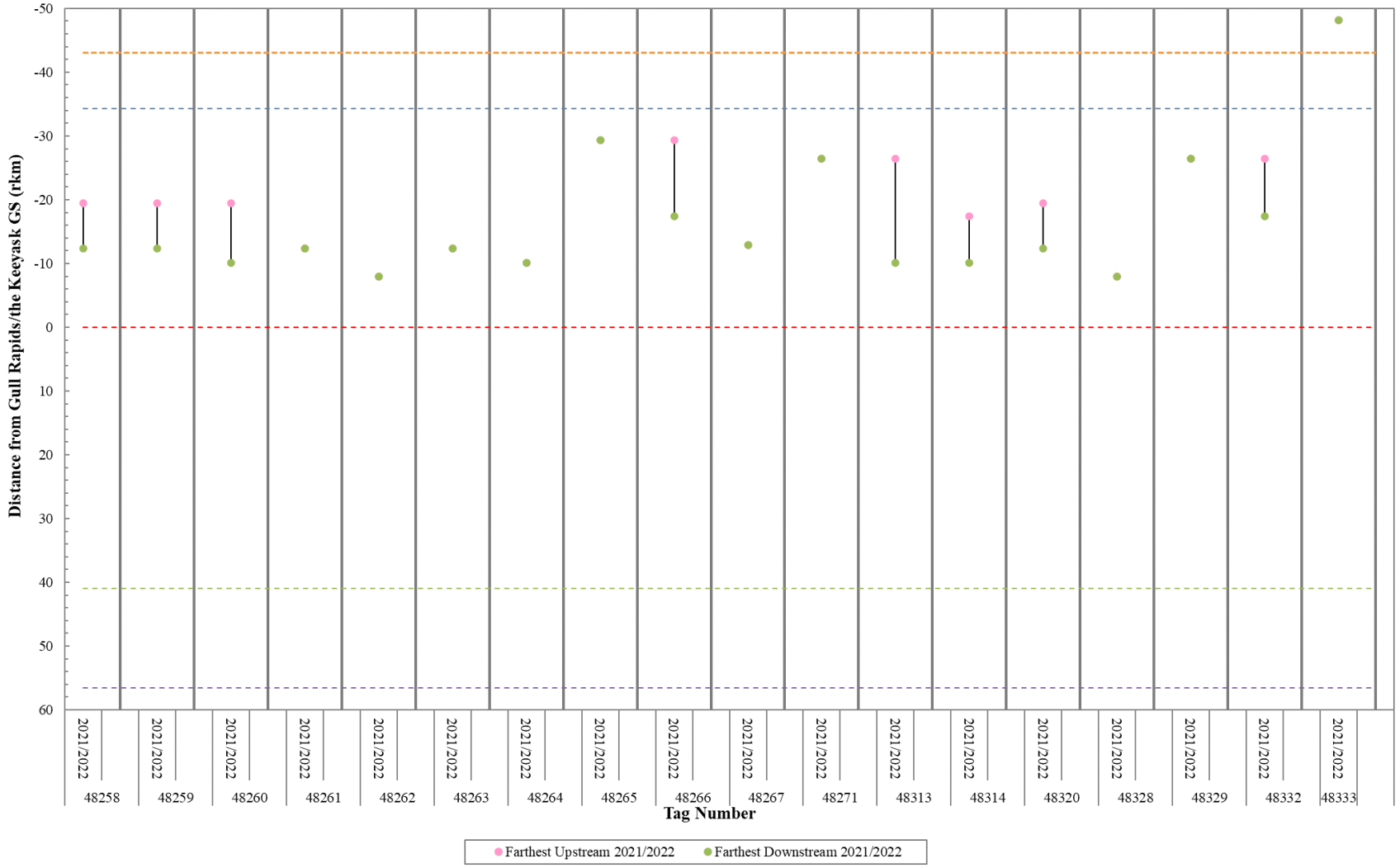


Figure 3: Detection ranges for individual Walleye tagged with acoustic transmitters upstream of the Keeyask GS during the winter period (2021/2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

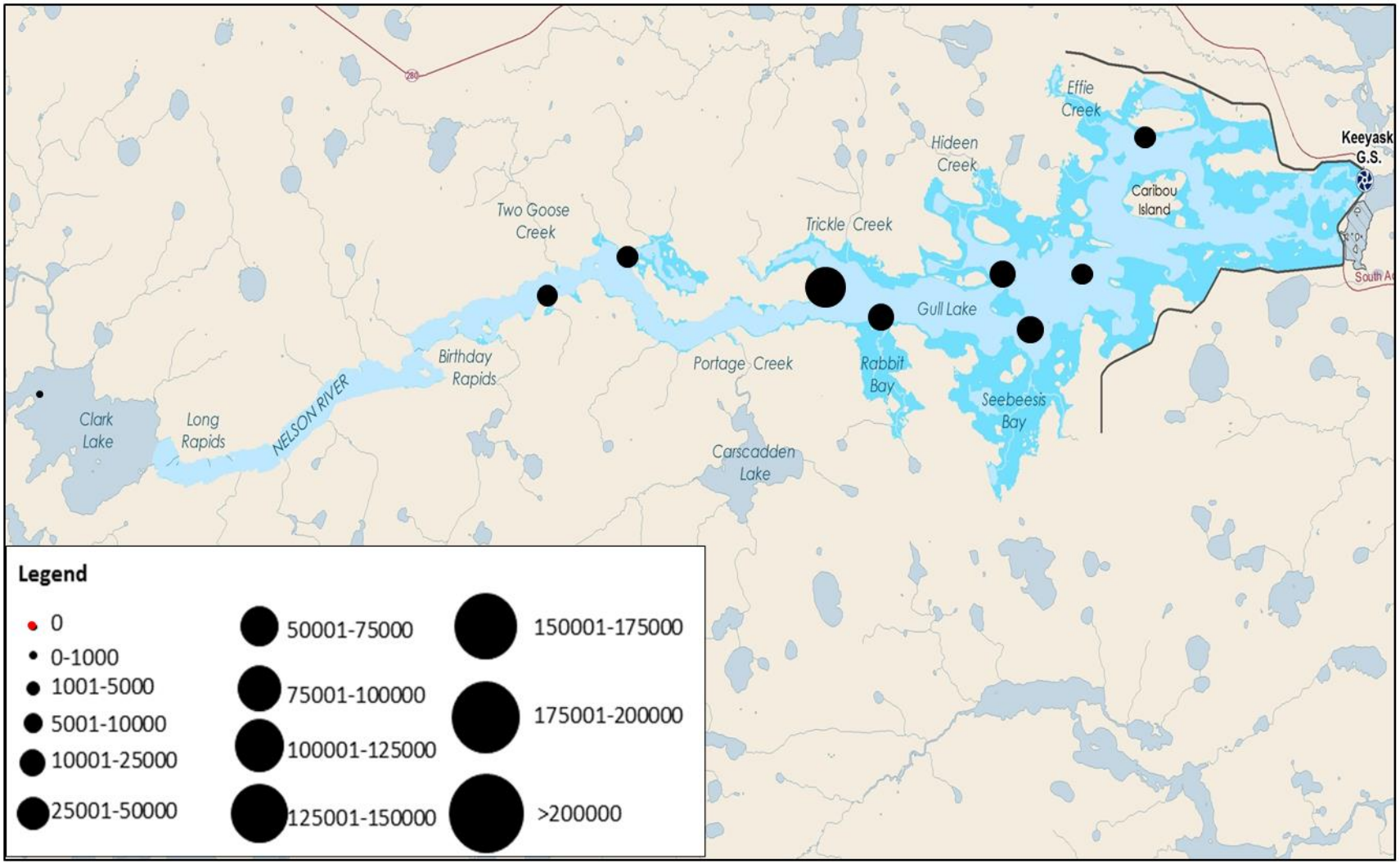


Figure 4: Relative number of detections of Walleye at each acoustic receiver set between Clark Lake and the Keeyask GS during winter 2021/2022 (October 11, to May 15, 2022). Number of detections indicated by size of bubble (defined in legend).

The majority of detections were logged by receivers located at the inlet of Gull Lake at rkm -19.5 (n = 103,478; 39%; Figure 4). The average overall movement range was 5.1 rkm (range 0.0–35.3 rkm) (Figure 3; Table A1-1). Movements were as follows:

- The majority of fish (n = 15; 65%) remained in Gull Lake, moving no farther upstream than rkm -19.5.
- Six (26%) moved between Gull Lake and the middle Keeyask reservoir. These fish were detected as far upstream as rkm - 29.3 (just downstream of Birthday Rapids) and as far downstream as the middle portion of Gull Lake (rkm -10.1).
- Two (9%) moved as far upstream as Clark Lake (rkm -48.2).

Individual movement graphs can be found in Appendix 2 and 4.

4.2.2 STEPHENS LAKE

All of the 17 receivers deployed in Stephens Lake during the 2021/2022 winter period were retrieved. Twenty-four of 47 fish (51%) were located a total of 327,356 times (range: 10–75,839 detections per individual) (Appendix A1-2). On average, fish were detected for 68 days of the 217-day winter period (31%) (range: 1–206 days). Detections were logged at all receivers. Nine fish (38%) were detected at the farthest upstream receiver at rkm 3.9, while one (4%) was detected at the farthest downstream receiver at rkm 32.5.

The majority of detections were logged by receivers located in the southern portion of the reservoir upstream of rkm 8.7 (n = 196,452; 60%; Figure 5). A large number of detections were also logged farther downstream in Stephens Lake at rkm 24.9 (n = 97,730; 30%). The average overall movement range was 5.6 rkm (range 0.0–27.1 rkm) (Figure 6; Table A1-1). Movements were as follows:

- The majority of fish (n = 14; 58%) remained in the upstream portion of Stephens Lake, moving no farther downstream than rkm 13.2.
- Three (13%) moved within both the upstream and downstream portions of Stephens Lake.
- Seven (29%) remained in lower Stephens Lake, moving only as far upstream as rkm 16.1 and as far downstream as rkm 24.9.

Individual movement graphs can be found in Appendix 3 and 5.

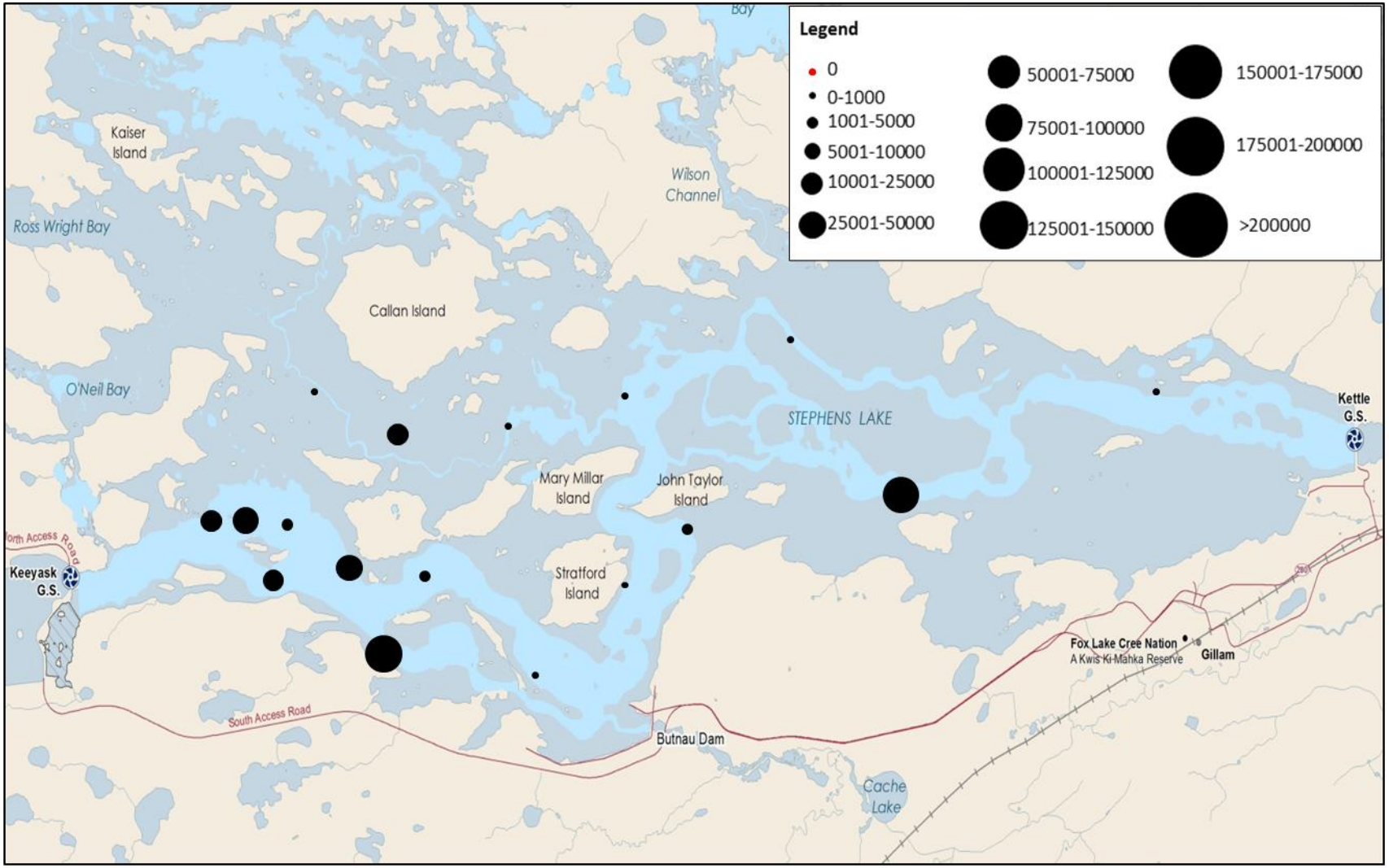


Figure 5: Relative number of detections of Walleye at each acoustic receiver set in Stephens Lake during winter 2021/2022 (October 11, to May 15, 2022). Number of detections indicated by size of bubble (defined in legend).

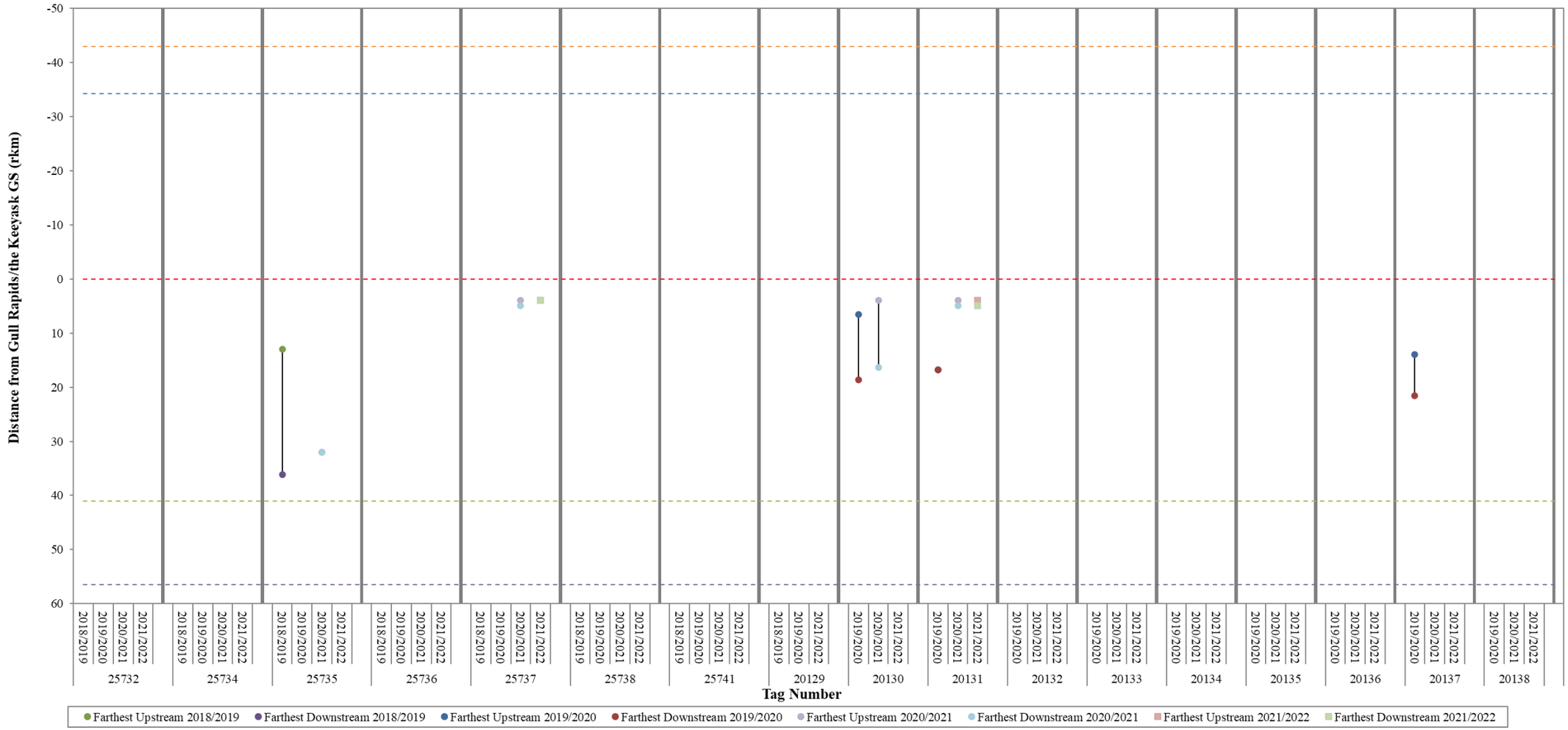


Figure 6: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake during the winter period (2018–2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS).

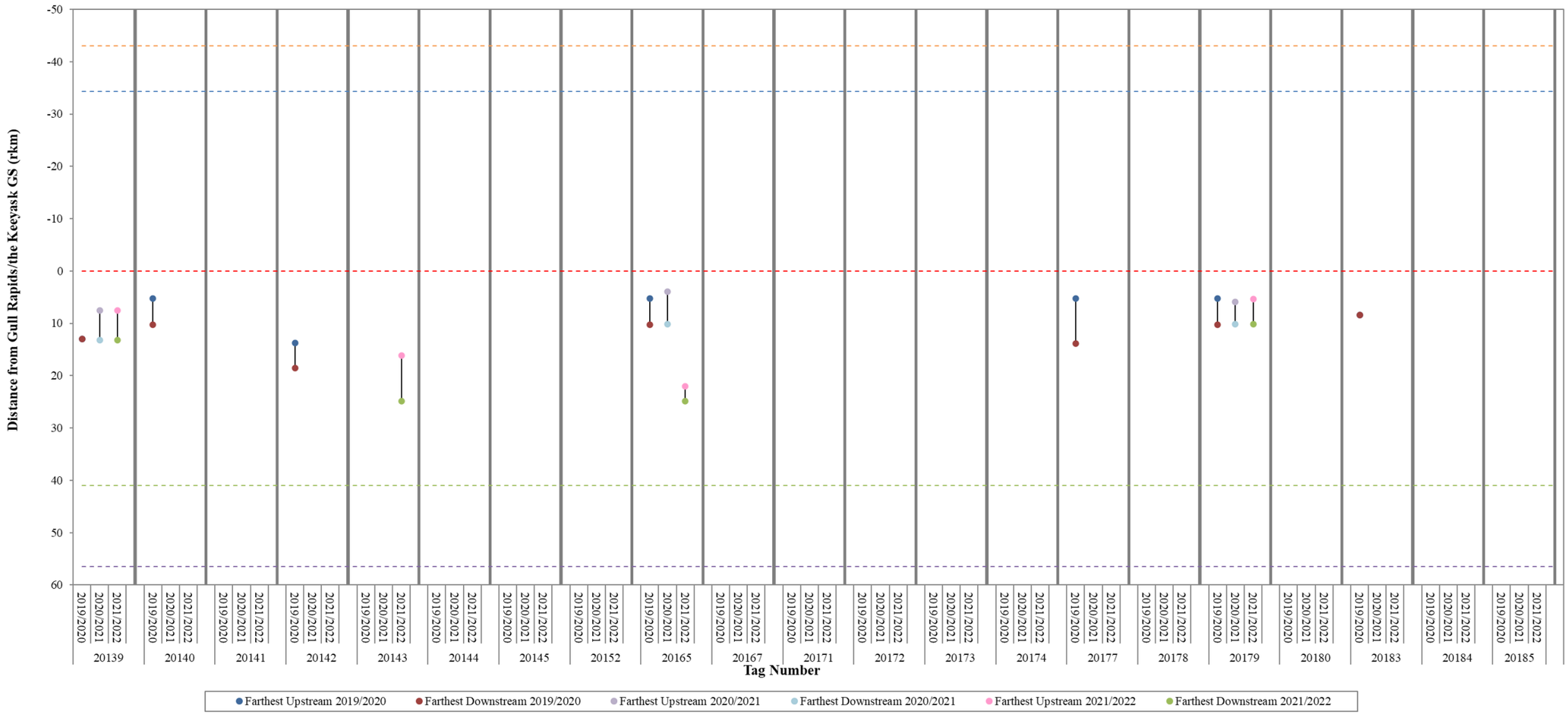


Figure 6: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake during the winter period (2018–2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

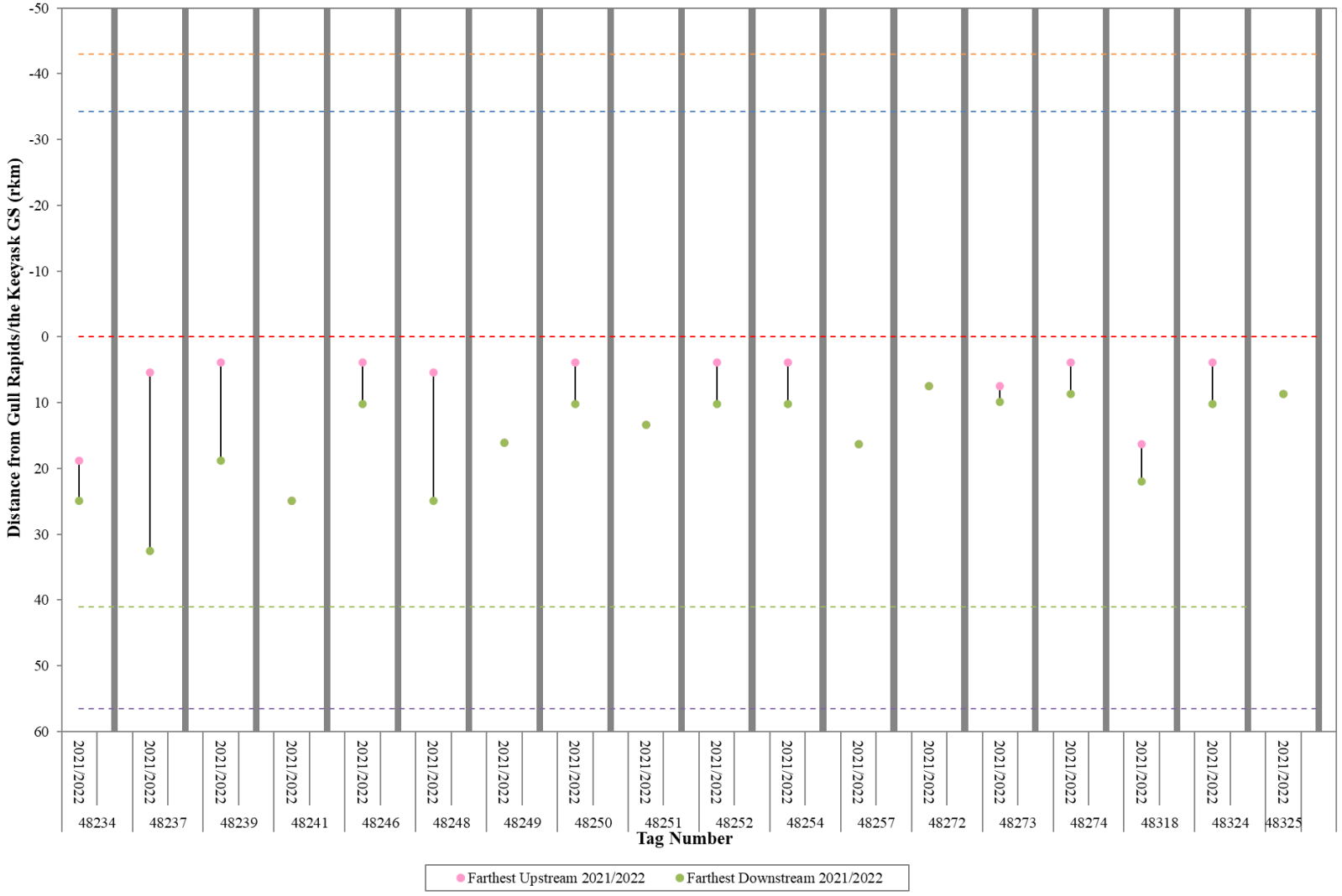


Figure 6: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake during the winter period (2021/2022). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

4.3 OPEN-WATER 2022

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. 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.

Water temperature, as measured in the Nelson River mainstem, reached 4˚C on May 25, 2022, and increased to 9˚C by June 7 (Figure 7). Based on these water temperatures, the time between May 25 and June 7 is referred to as the spawning period.

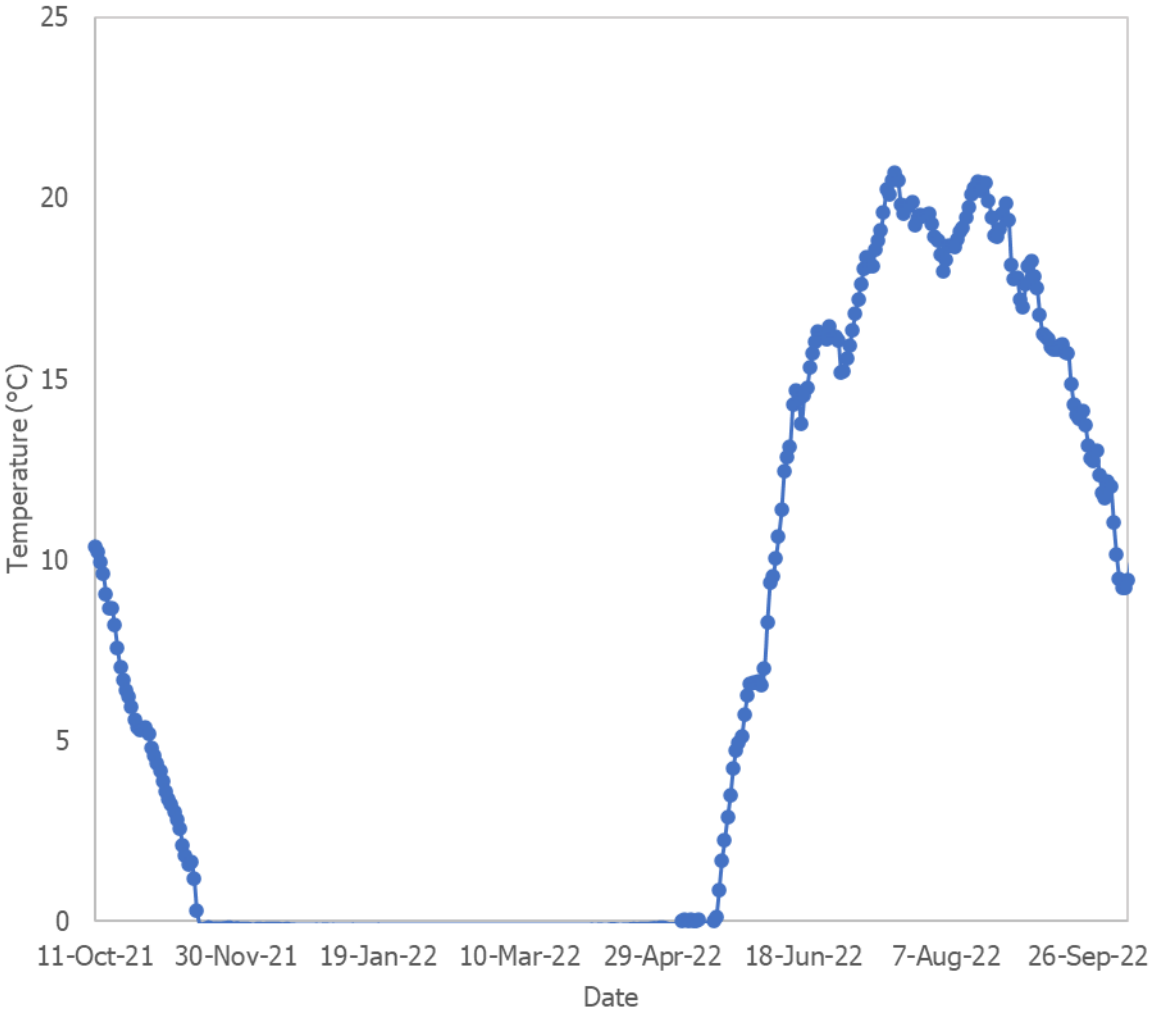


Figure 7: Water temperature in the Nelson River mainstem from October 4, 2021, to October 16, 2022.

4.3.1 UPSTREAM OF THE KEEYASK GS

Forty-one Walleye were available to be detected upstream of the Keeyask GS during the 2022 open-water period (Section 4.1.1). Thirty (73%) were detected 8–74,316 times for 1–130 days of the 149-day open-water period (1–87% of the time; Appendix A1-3). The average total movement range was 14.5 rkm (StDev = 13.8 rkm; range: 0.0–40.4 rkm) (Figure 8; Appendix A1-3). The farthest upstream detections occurred at the inlet to Clark Lake at rkm -48.2 (by three fish; 10%). Four fish (13%) were detected as far downstream as rkm -5.8 (Figures 8 and 9; Appendix A1-3). One fish moved downstream through the Keeyask GS, (discussed further in section 4.3.2.2).

Of the 11 fish that were not detected during open-water 2022:

- Three (#25746, #20170 and #48327) were detected for less than 20 days of the 2021 open-water period and likely remain largely in areas outside of the receiver array.
- Eight were regularly detected within Keeyask reservoir in the 2021 open-water period.

4.3.1.1 PROPORTIONAL DISTRIBUTION

Walleye tagged in 2021 spent a greater amount of time in the portion of the reservoir between Birthday Rapids and Gull Lake (Zone 3) than those tagged from 2016-2019. This is likely a reflection of tagging location as most fish tagged in 2021 were captured in Zone 3. Because of this, proportional distributions were calculated separately for these two groups.

Walleye tagged in 2016–2019 spent the majority of time in the Gull Lake portion of the reservoir (Zones 4 and 5), rarely moving upstream. (Table 2; Figure 10). Walleye tagged in 2021 spent the majority of the open-water period in the area between Birthday Rapids and Gull Lake (Zone 3) and in the upper portion of Gull Lake (Zone 4) (Table 2; Figure 10).

No fish tagged in either time period spent time in the area immediately upstream of the Keeyask GS (Zone 5.5).

Table 2: Proportion of time spent in each river zone by Walleye tagged upstream of the Keeyask GS site during a portion of the 2013 (June 4 to October 15), 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 (June 13 to October 10), and 2022 (May 16 to October 10) open-water periods.

Tagging Year	Study Year	1	2	3	4	5	5.5
2013	2013	4.0	1.3	2.0	84.0	8.7	
	2014	6.9	1.2	4.8	82.7	4.3	
	2015	10.4	4.2	6.5	71.8	7.1	
	2016	8.5	0.1	19.9	61.0	5.9	
2016/2018	2016	3.7	0.6	6.1	78.6	8.7	
	2017	5.9	1.8	12.3	63.7	16.3	
	2018	9.6	0.9	9.2	56.5	23.8	
	2019	18.7	1.3	6.9	53.4	19.8	
	2020	0.0	0.1	1.1	43.3	55.6	
2019	2019	0.1	0.1	5.3	83.7	10.8	
	2020	2.7	0.3	15.8	74.3	7.0	
2016-2019	2019	5.3	0.5	5.7	75.2	13.4	
	2020	1.5	0.2	9.2	60.3	28.8	
	2021	8.6	2.5	8.8	55.1	25.0	
	2022	0.4	0.0	0.6	61.3	37.7	0.0
2021	2021	8.5	1.9	35.5	40.3	13.8	
	2022	1.7	3.7	32.3	48.4	13.9	0.0

4.3.1.2 MOVEMENT PATTERNS

During the 2022 open-water period, the majority of detections were logged in the area slightly upstream of the Gull Lake inlet between rkm -22.6 to -19.5 (n = 151,844 detections; 54%) (Figure 9).

Twenty-four fish remained in the Keeyask reservoir:

- Eight (#20154, #20156, #25744, #25749, #20159, #48261, #48262, and #48328) remained within the Gull Lake portion of the reservoir.
- Ten (#48258, #48265, #48266, #48268, #48314, #48319, #48320, #48326, #48329, and #48331) remained in the middle Keeyask reservoir.
- Six (#20151, #48259, #48260, #48328, #48321, and #48332) moved between Birthday Rapids and Gull Lake.

Five fish moved upstream out of the Keeyask reservoir into Clark Lake. This is fewer than in 2021 when 17 fish moved upstream.

- Three (#25751, #48263, and #48313) were detected in Clark Lake briefly and returned to the Keeyask reservoir by the end of the open-water period.
- #20161 was last detected at the inlet to Clark Lake in September 2021. It likely moved upstream past the receiver array and was next detected here in May 2022. It moved downstream and was detected in the Keeyask reservoir for the remainder of the open-water period.
- #48270 was last detected at the inlet to Clark Lake in fall 2021. It was detected here again in May 2022. It briefly moved downstream into Gull Lake but returned to Clark Lake in July and was detected here until the end of September.

One fish (#48264) moved downstream through the Keeyask GS into Stephens Lake. It was detected in the lower portion of the Keeyask reservoir until July 19 when it was detected immediately upstream of the powerhouse (receiver 114235). It continued to move downstream and was last detected in lower Stephens Lake (rkm 21.7) on August 11. It made multiple upstream and downstream movements in Stephens Lake indicating it survived passage.

All movements out of Stephens Lake since 2013 are outlined in Table 3 and Figure 11.

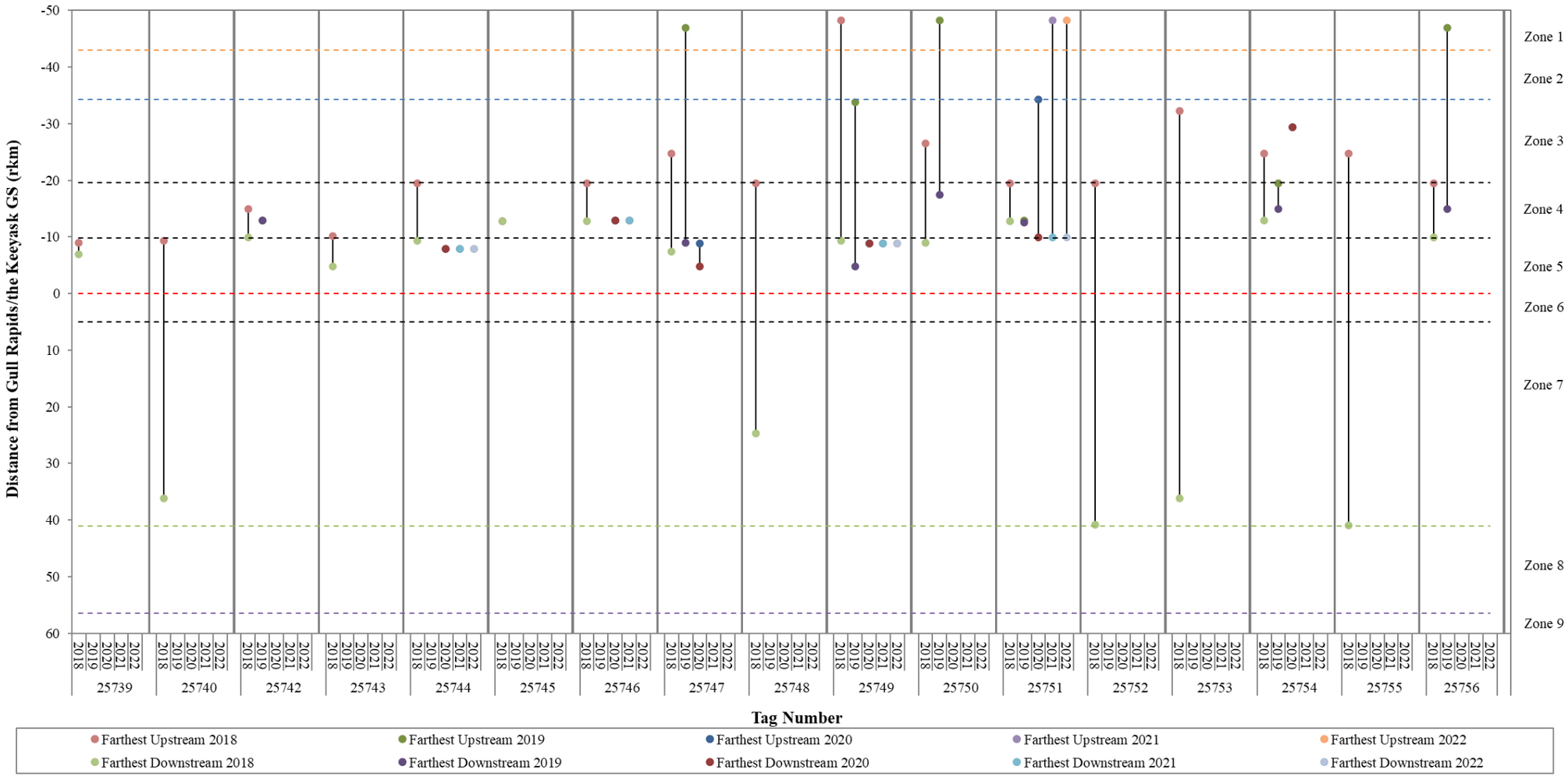


Figure 8: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 upstream of the Keeyask during the open-water period (2018–2022). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS).

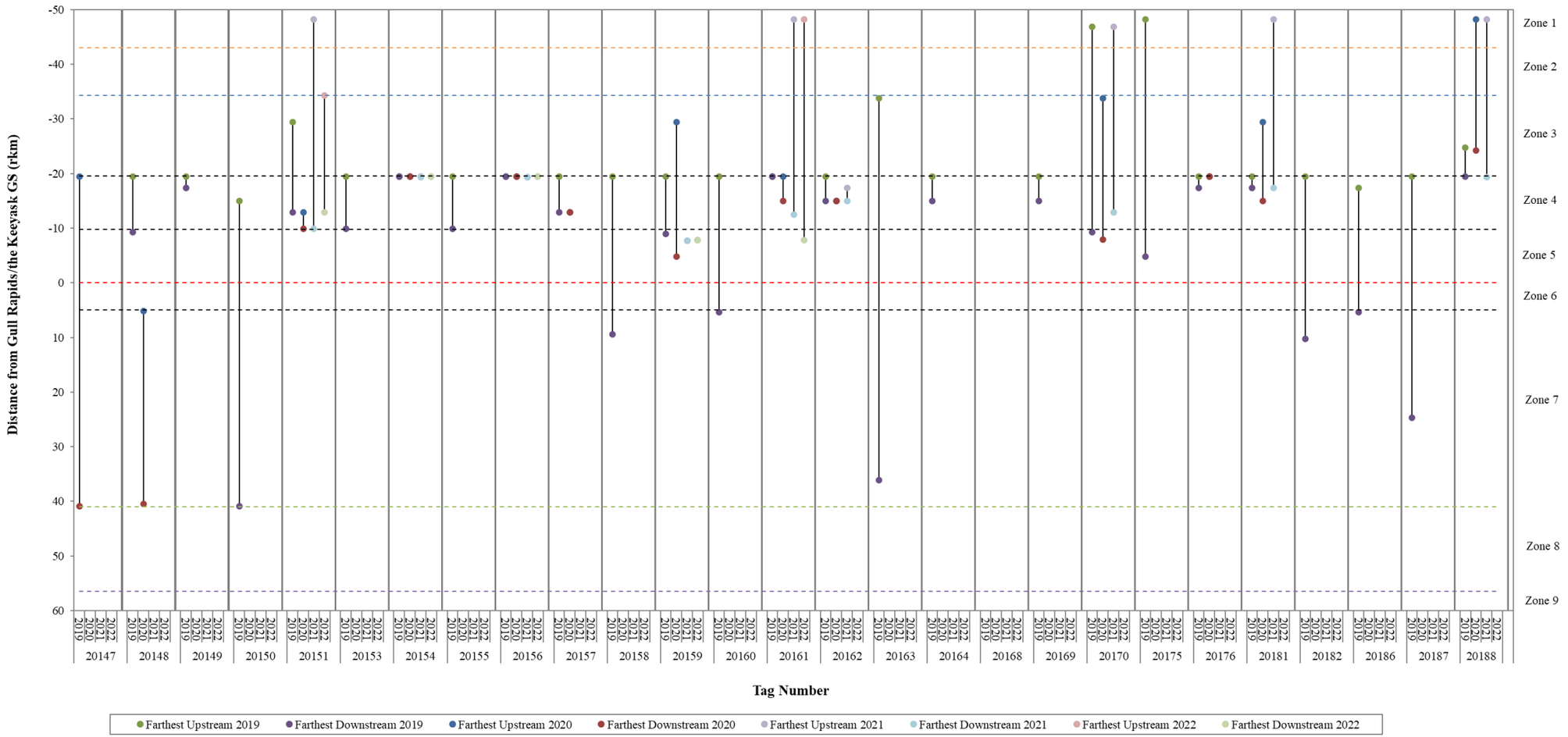


Figure 8: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 upstream of the Keeyask GS during the open-water period (2018–2021). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

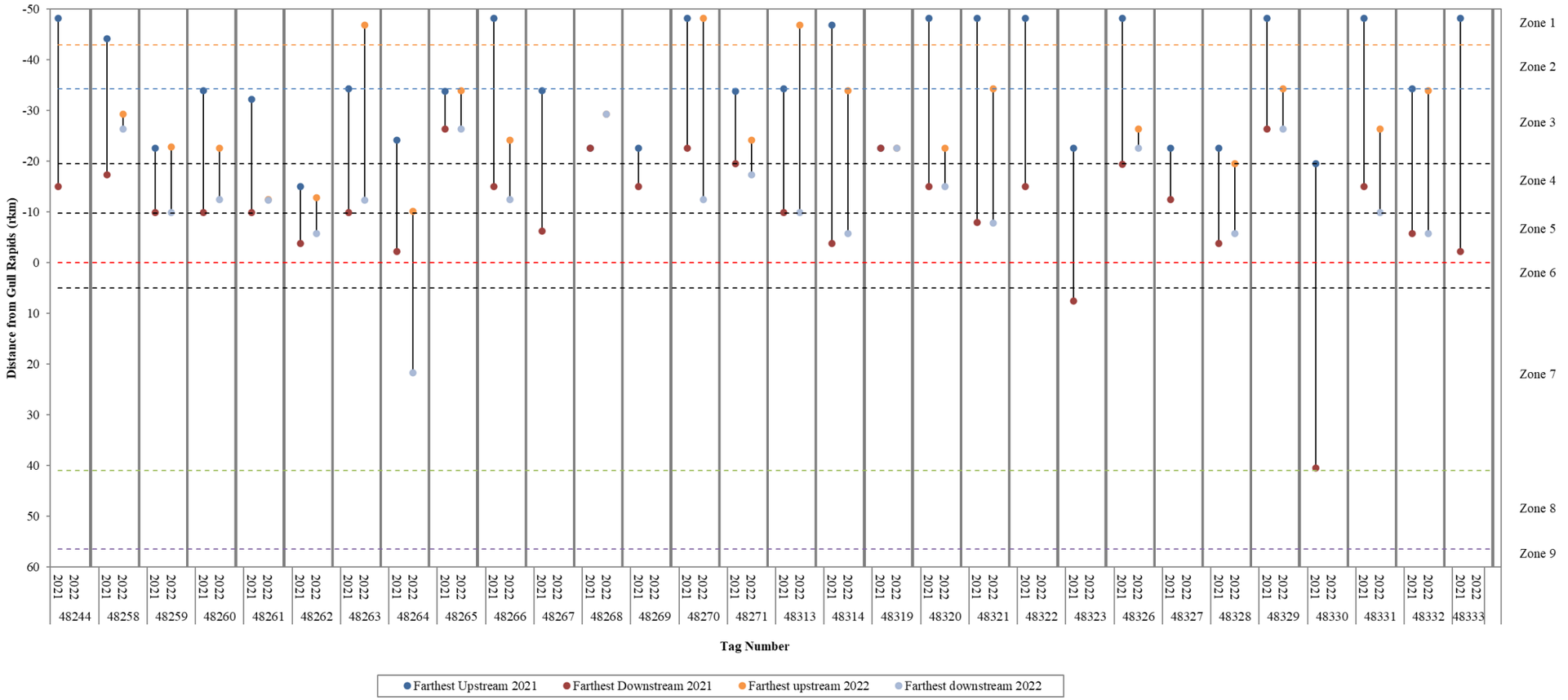


Figure 8: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 upstream of the Keeyask GS during the open-water period (2021-2022). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids; red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS) (continued).

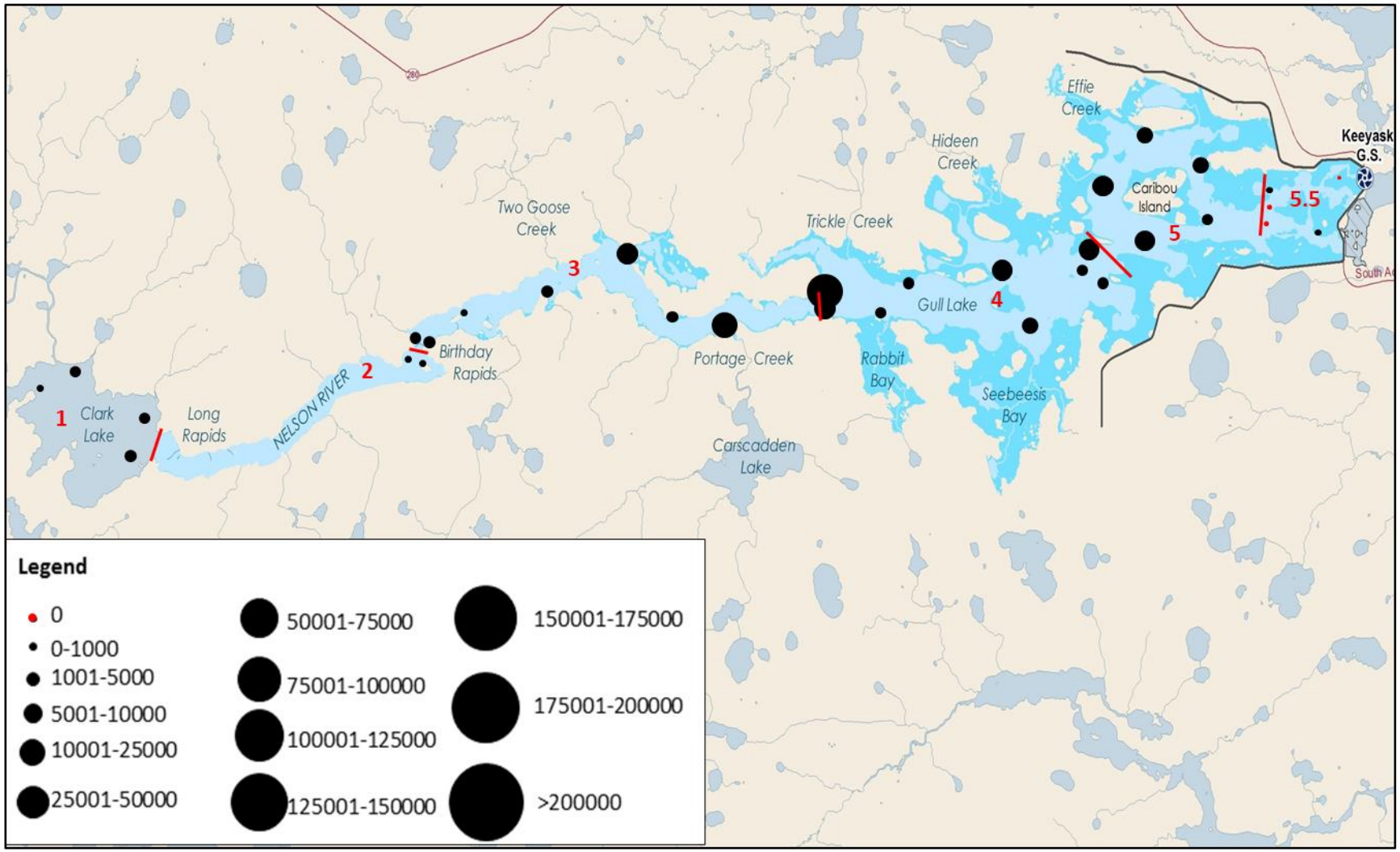


Figure 9: Relative number of detections at each acoustic receiver set in the Nelson River between Clark Lake and the Keeyask GS during the 2022 open-water period (May 16 to October 10). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into six "zones" based on placement of receiver "gates."

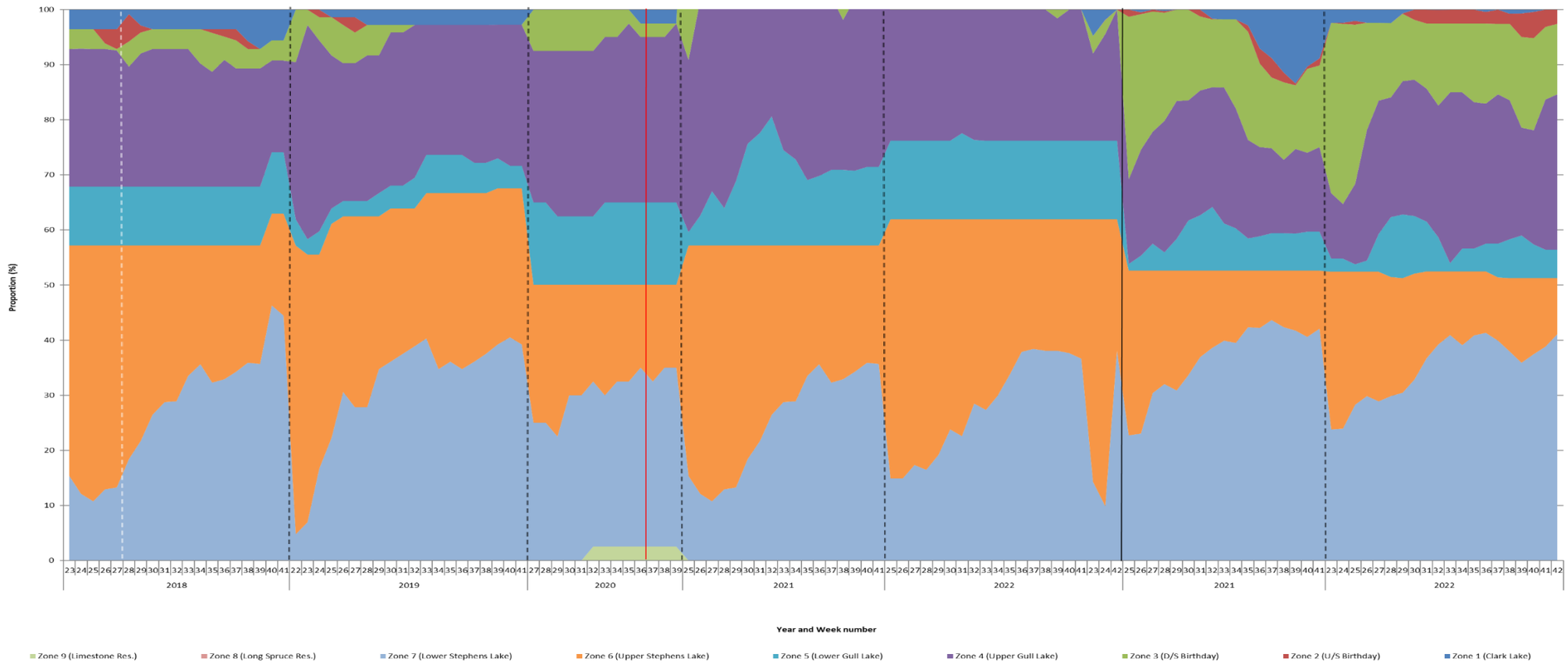


Figure 10: Proportional distribution by zone, for Walleye tagged with acoustic transmitters in the Keeyask GS Area during a portion of the 2013 (June 4 to October 15), 2014 (June 4 to October 3), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16), 2018 (June 6 to October 10), 2019 (June 2 to October 7), 2020 (July 3 to September 23), 2021 (June 13 to October 10), and 2022 (May 16 to October 10) open-water periods. In 2022, Zone 5.5 was combined with 5 and Zone 6.5 was combined with 6 to provide consistency between years. Black dashed lines indicate study years. Solid black line indicates new fish tagged. Solid white line indicates start of Keeyask construction. Red line indicates completion of Keeyask GS reservoir impoundment.

Table 3: Proportion of tagged Walleye that moved downstream through the Keeyask GS site and the Kettle GS each year since studies began in 2013.

Year	Keeyask GS Site									Kettle GS[1]								
	Total Movements[2]			Tagging Stress/Mortality[3]			Adjusted Movements[4]			Total Movements[2]			Tagging Stress/mortality[3]			Adjusted Movements[4]		
	Total Fish	Total Move	%	# Fish Tagged	Total Move	%[5]	Total Fish	Total Move	%[6]	Total Fish	n	%	# Fish Tagged	n	%[5]	Total Fish	n	%[6]
2013	40	2	5	40	2	5	40	0	0	40	-	-	40	-	-	40	-	-
2014	42	1	2	9	0	0	42	1	2	40	1	3	2	-	-	40	1	3
2015	40	4	10	0	-	-	40	4	10	43	1	2	0	-	-	43	1	2
2016	79	11	14	48	5	10	79	6	8	88	4	5	40	3	8	88	1	1
2017	28	5	18	0	-	-	28	5	18	42	8	19	0	-	-	42	8	19
2018	34	5	15	17	4	24	34	1	3	42	8	19	7	5	71	42	3	7
2019	46	8	17	27	2	7	46	6	13	55	5	9	31	1	3	55	4	7
2020	31	1	3	0	-	-	31	1	3	45	1	2	0	-	-	45	1	2
2021	47	2	4	30	-	-	47	2	4	51	-	-	30	-	-	51	-	-
2022	41	1	2	0	-	-	41	1	2	47	2	4	0	-	-	47	2	4

1. Includes all fish tagged in Stephens Lake as well as those that moved downstream from Gull Lake.
2. Includes all downstream movements, including those that occurred due to tagging stress and mortality and those that occurred independently.
3. Includes only Walleye that moved downstream within two weeks of tagging. These movements are likely caused by tagging stress or mortality
4. Includes only Walleye that displayed downstream movements independently of tagging.
5. Proportion is calculated as a percentage of those tagged in the current year.
6. Proportion is calculated as a percentage of the total number of fish available for detection in the current year.
7. Referred to as Gull Rapids prior to 2018 when the Keeyask GS spillway was commissioned and the Keeyask GS after.

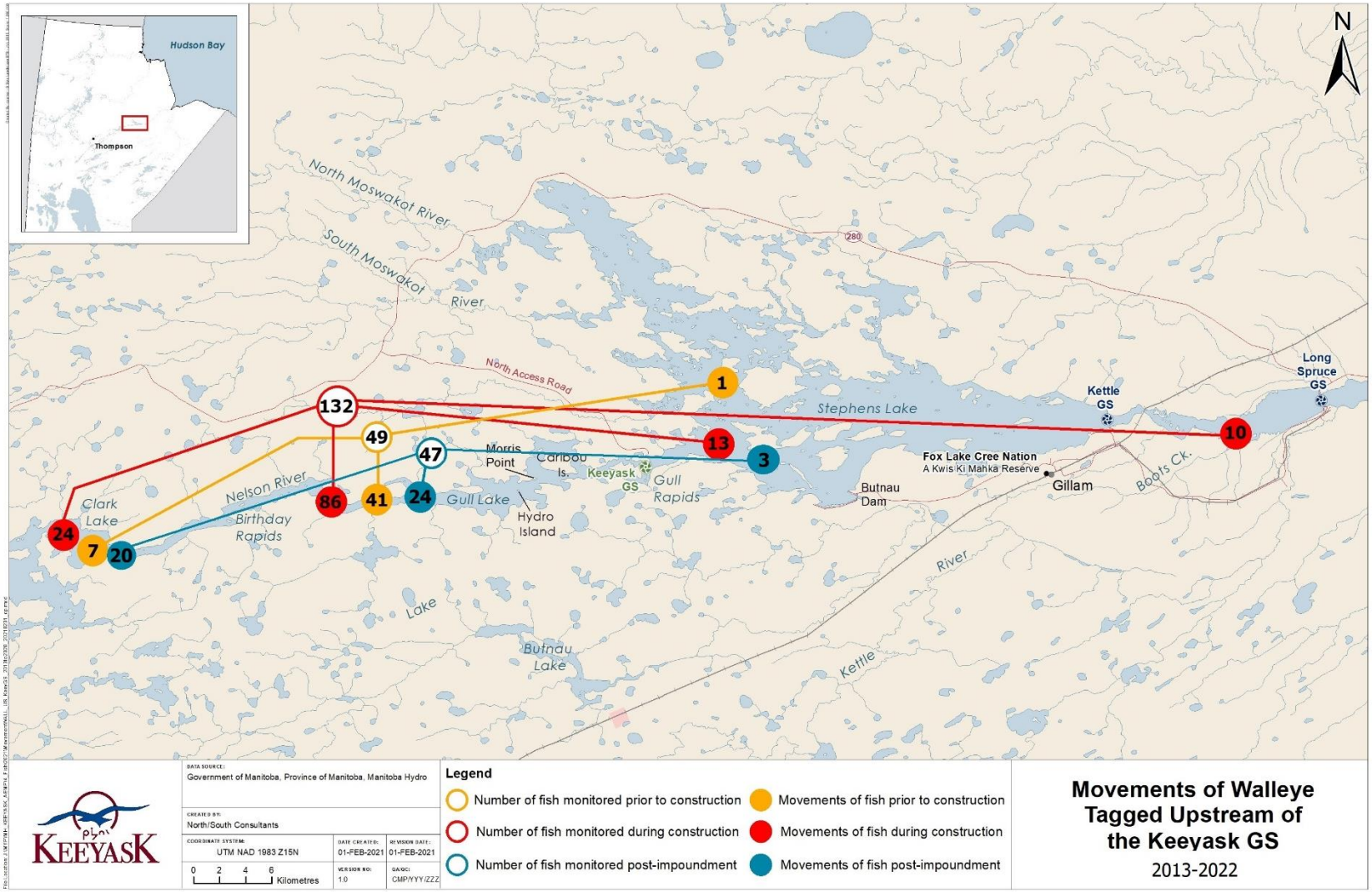


Figure 11: Map showing how many Walleye moved upstream out of Gull Lake, stayed in Gull Lake, and moved into Stephens Lake before construction (yellow), during construction (red) and after reservoir impoundment (blue). Movements of fish due to tagging stress or mortality were not included. Numbers of fish monitored (hollow circles) represent the number of fish tagged while the number of fish movements (solid circles) represent the number of fish detected.

4.3.2 STEPHENS LAKE

Forty-seven Walleye were available to be detected in Stephens Lake during the 2022 open-water period (Section 4.1.2). Thirty-five (74%) were detected between 191 and 67,999 times for 3–133 days of the 149-day open-water period (2–89% of the time; Appendix A1-4). The average total movement range was 12.0 rkm (StDev = 12.6 rkm; range: 0.0–64.6 rkm) (Figure 12; Appendix A1-4). The farthest upstream detections occurred near the Keeyask GS spillway at rkm 0.7 (by 11 fish; 31%). Two fish moved downstream through the Kettle GS (described further in Section 4.3.3.2). Not including these fish, the farthest downstream detections occurred in lower Stephens Lake at rkm 30.7 (by one fish; 3%) (Figure 13; Appendix A1-4).

Twelve fish were not detected during open-water 2022:

- Five (#20144, #48243, #48245, #48253, and #48255) were detected for less than 12 days of the 2021 open-water study period and likely remain largely in areas outside of the receiver array.
- Seven (#25741, #20130, #20165, #48238, #48247, #48256, #48275) were detected within Stephens Lake for the majority of the open-water 2021 study period.

One fish that was previously considered missing (#20171; last detected at rkm 7.4 on June 15, 2019) was located during the 2022 open-water period moving between rkm 1.2 and 8.0.

4.3.2.1 PROPORTIONAL DISTRIBUTION

Walleye tagged in both 2016–2019 and 2021 were captured and released in similar locations, and their proportional distributions were calculated together. Walleye spent the majority of the 2022 open-water period in Zone 7 (farther from the Keeyask GS), spending an average of 59% (StDev = 40%; range: 0–100%) of the study period in this area. The area immediately downstream of the Keeyask GS (Zone 6.5) was used for 25% of the study period (StDev = 33.9%; range:0-100%), and Zone 6 was used for 16% (StDev = 25.4%; range: 0-100%) (Table 4; Figure 10).

Table 4: Proportion of time spent in each river zone by Walleye tagged in Stephens Lake during a portion of the 2013 (June 4 to October 15), 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 (June 13 to October 10), and 2022 (May 16 to October 10) open-water periods.

Tagging Year	Study Year	6	6.5	7
2013	2013	66.0		34.0
	2014	59.0		41.0
	2015	76.5		23.5
	2016	58.2		41.8
2016/2018	2016	30.0		70.0
	2017	33.8		66.2
	2018	35.5		64.5
	2019	56.1		43.9
	2020	24.8		75.2
2019	2019	50.0		50.0
	2020	45.7		50.3
2016-2019	2019	51.7		48.3
	2020	41.5		55.3
	2021	55.9		44.1
2021	2021	30.4		69.6
2018-2021	2022	16.0	25.0	59.0

4.3.2.2 MOVEMENTS

As observed in previous years, most detections (n = 323,209; 87%) were logged by receivers located in the southern portion of Stephens Lake between rkms 0.7 and 10.2 during the 2022 open-water period. A large number of detections (n = 106,595; 29%; Figure 13) were logged along the north shore at rkm 1.2.

General movement patterns were similar to previous years:

- Eighteen fish remained in upper Stephens Lake, travelling as far downstream as rkm 10.2.
- Eleven fish moved between upper and lower Stephens Lake, moving as far upstream as rkm 0.7 and as far downstream as rkm 24.9.
- Four fish (#25735, #48241, #48242, and #48257) remained in lower Stephens Lake between rkms 15.0 and 30.7.
- Two fish moved downstream through the Kettle GS.

- #48236 moved between rkm 0.7 and 21.7 during the first part of the 2022 open-water period. It then moved downstream and was last detected upstream of the Kettle GS on July 3. It was detected within the Long Spruce Reservoir until July 5. It continued to move downstream and was detected in the Limestone reservoir on July 7–8. Based on the lack of upstream movements, it is unclear if this fish survived passage.
- #48318 was detected within lower Stephens Lake (rkm 14.4–22.0) until September 3. It was then detected within the Long Spruce reservoir at rkm 44.9 until October 4. Based on the lack of upstream movements, it is unclear if this fish survived passage.

All movements out of Stephens Lake since 2013 are outlined in Figure 14.

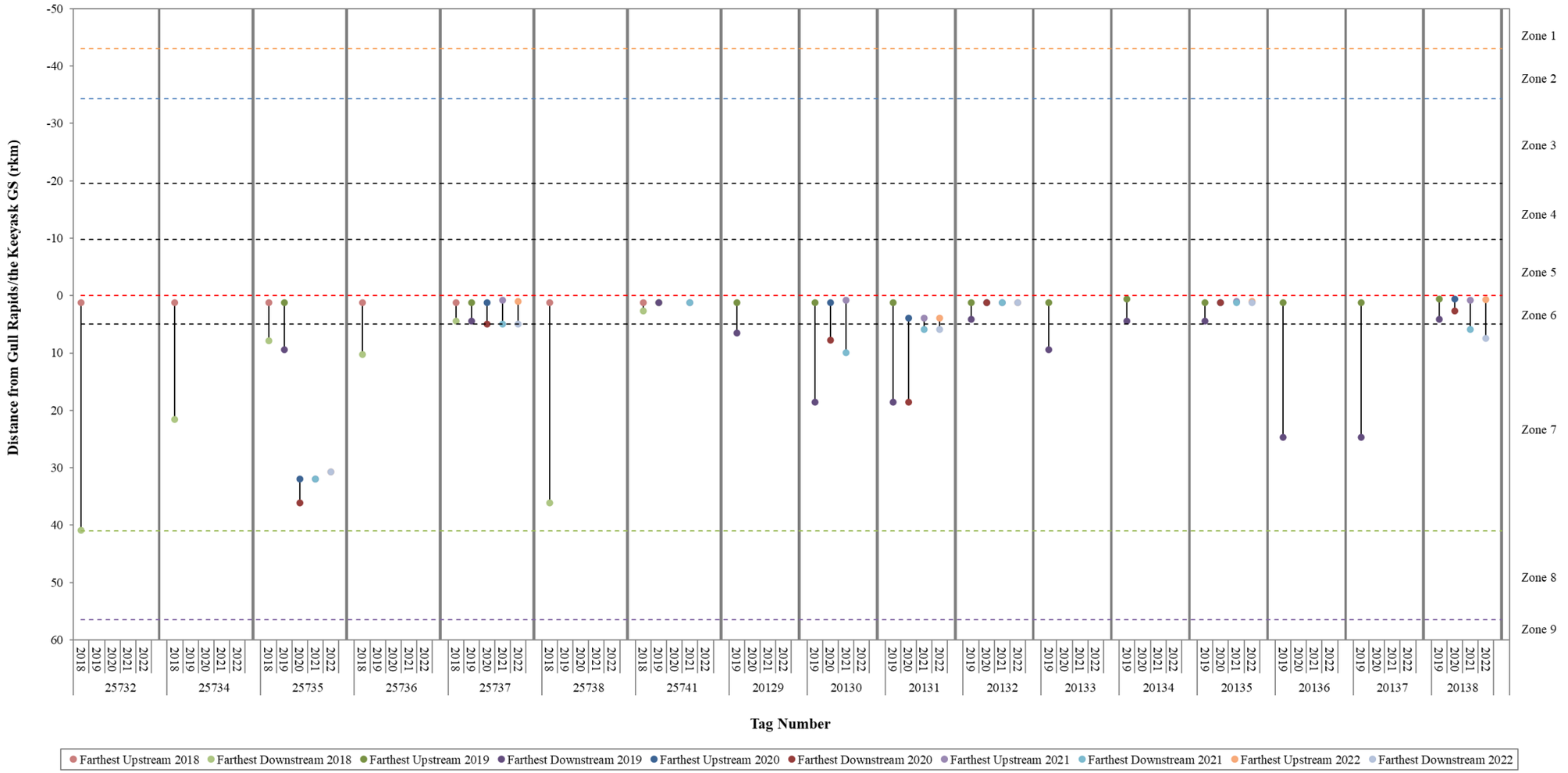


Figure 12: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 in Stephens Lake during the open-water period (2018–2022). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS).

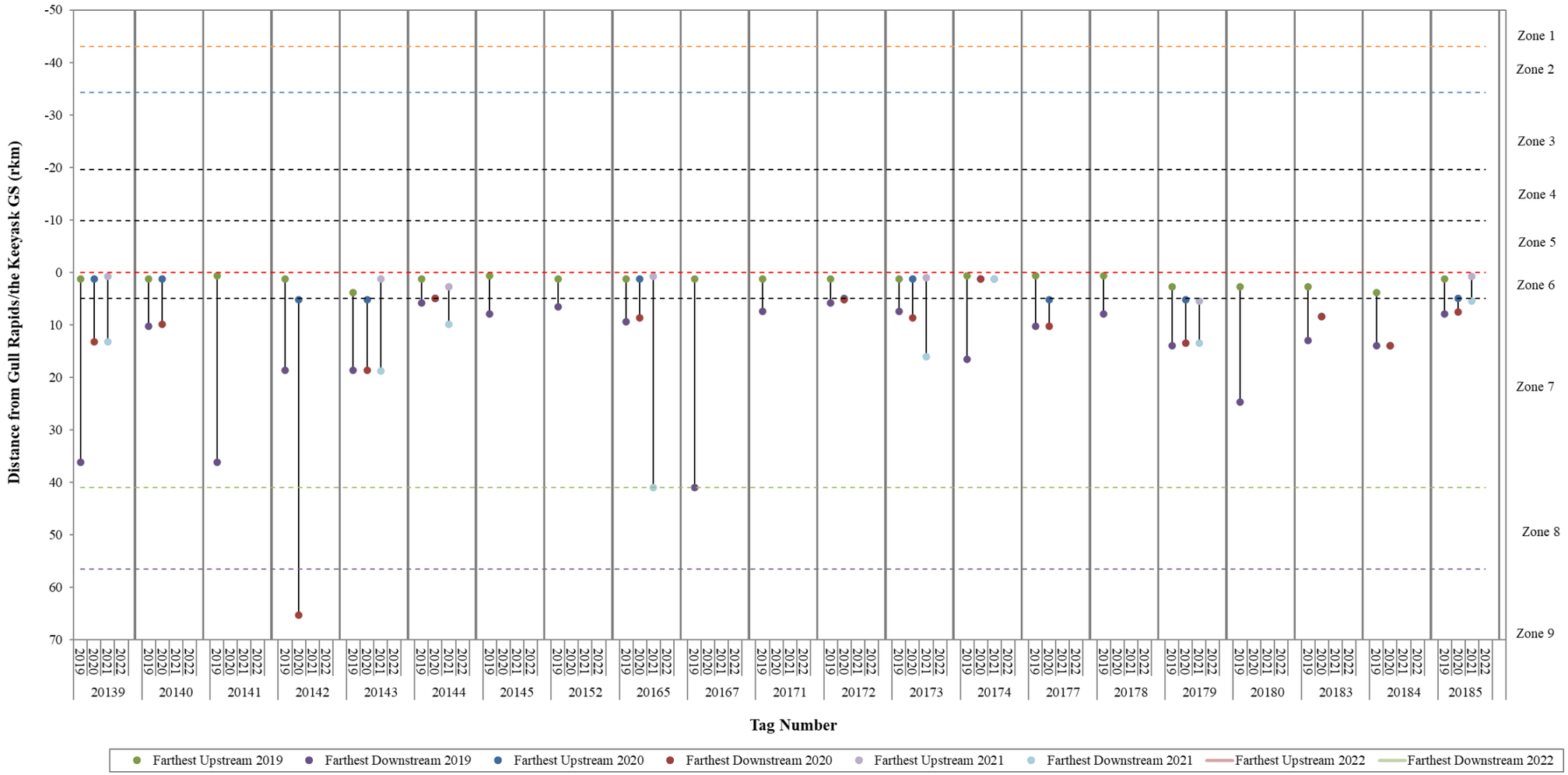


Figure 12: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 in Stephens Lake during the open-water period (2018–2022). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS). (continued).

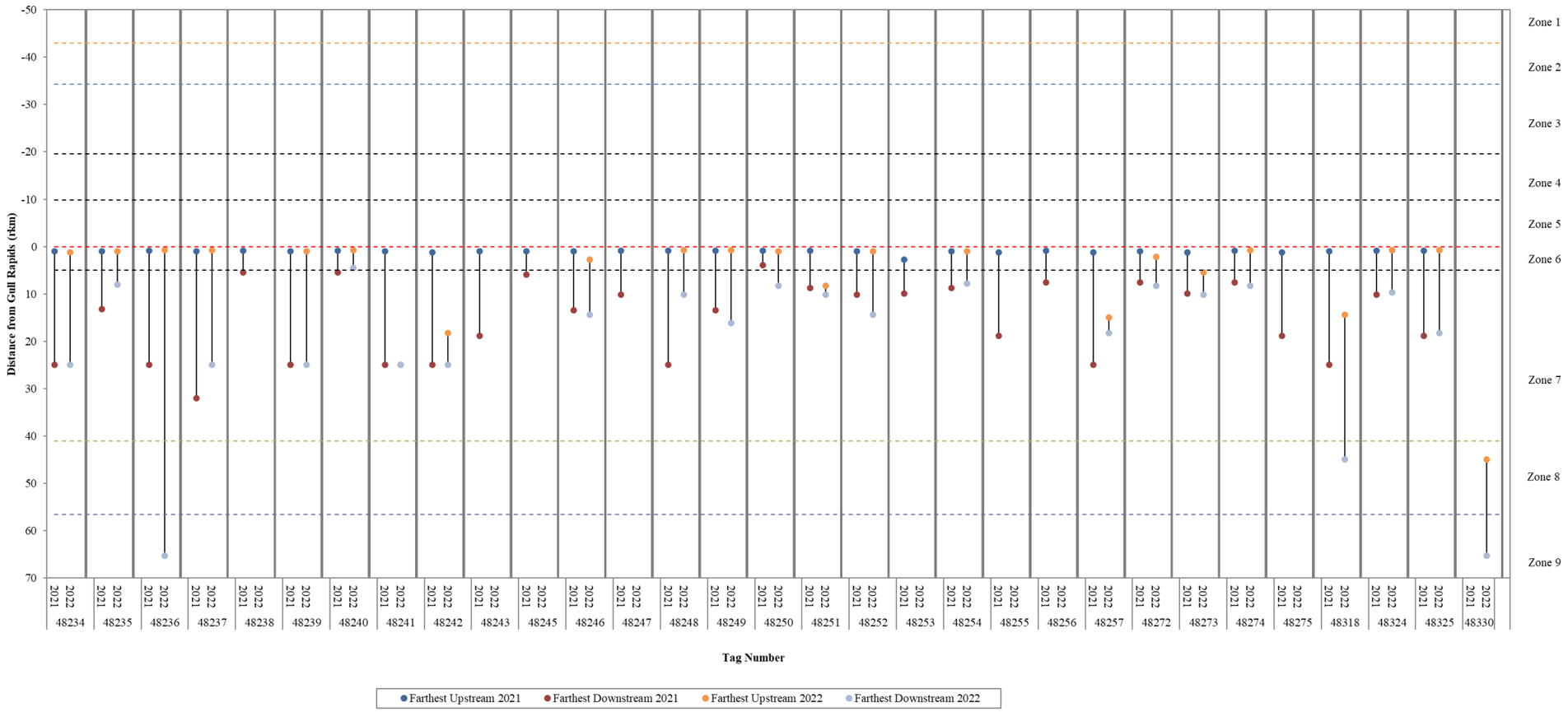


Figure 12: Detection ranges for individual Walleye tagged with acoustic transmitters in 2018-2021 in Stephens Lake during the open-water period (2021–2022). Horizontal dotted lines demarcate zones (orange = Clark Lake outlet; blue = Birthday Rapids, red = the Keeyask GS; green = Kettle GS; purple = Long Spruce GS). (continued).

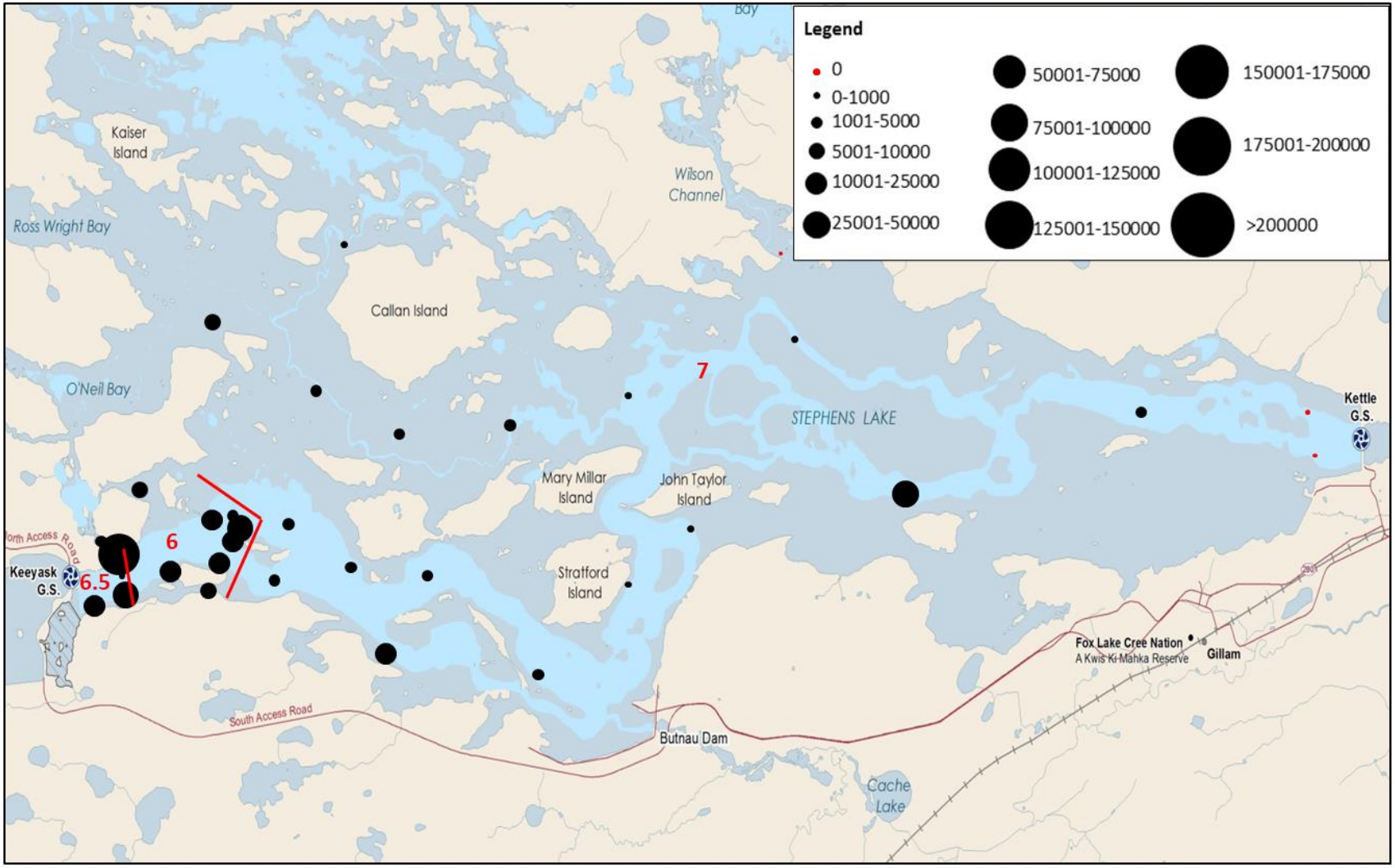


Figure 13: Relative number of detections at each acoustic receiver set in Stephens Lake during the 2022 open-water period (May 16 to October 10). Number of detections indicated by size of circle (defined in legend). Receivers with no detections indicated with red dot. The river is divided into three "zones" based on placement of receiver "gates."

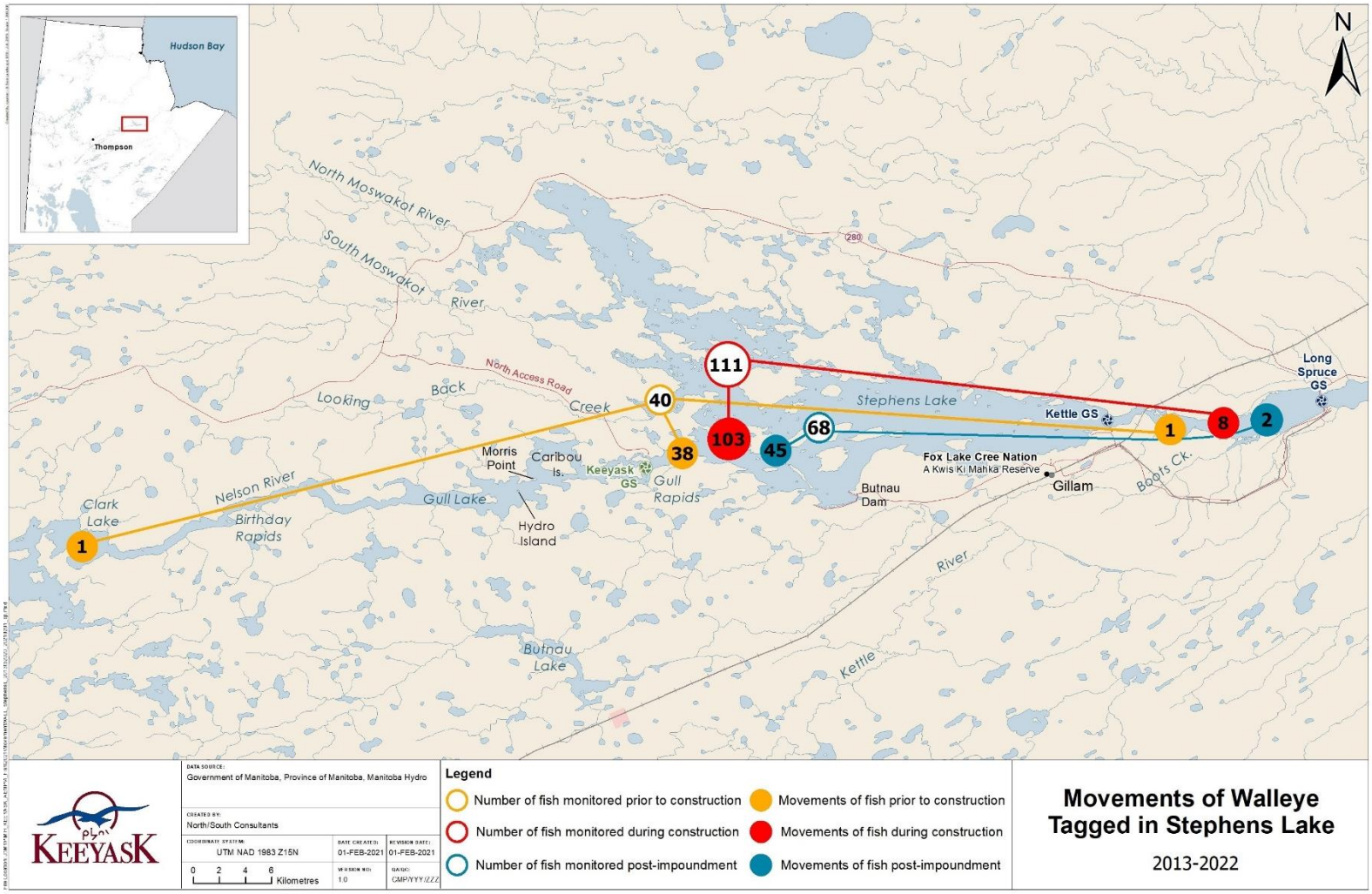


Figure 14: Map showing how many Walleye moved upstream through Gull Rapids, stayed in Stephens Lake, and moved downstream through the Kettle GS before construction (yellow), during construction (red) and after reservoir impoundment (blue). Movements due to tagging stress and mortality were not included. 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.

5.0 DISCUSSION

Walleye movement monitoring was initiated in 2013 to describe movements during the pre-construction (2013), construction/commissioning (2014–2021), and operation (2022-present) phases of the Keeyask Project. The intent of the study was 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 impoundment and operation of the Keeyask GS on Walleye and their movements.

Acoustic transmitters have been applied to Walleye upstream and downstream of the Keeyask GS (formerly Gull Rapids) in six different years since the study began (2013, 2014, 2016, 2018, 2019, and 2021). Transmitters applied in earlier years have since expired (2013–2016) and regular tagging is required to maintain a sample size of 80 fish and provide overlap to record movements associated with different phases of the Project (construction, reservoir impoundment, and operation). Walleye tagged in 2018, 2019, and 2021 are discussed herein and compared to movement patterns of those tagged in 2013–2016.

5.1 EVALUATION OF METHODOLOGY

Acoustic telemetry continues to be an effective method for monitoring movements and habitat use patterns of Walleye in the study area. During the 2022 open-water period, the majority of tagged fish remaining in the study area were located. In 2022, 73% of fish were detected upstream of the Keeyask GS (compared to 47–100% in previous years) and 74% were detected in Stephens Lake (compared to 50–98% in previous years). The data collected to date provides a good understanding of Walleye movement on a coarse-scale. This has been facilitated by the extensive array of stationary acoustic receivers spread over a ~100 km length of the Nelson River between Clark Lake and the Limestone GS, and the inclusion of receiver gates which provide confidence that movements of Walleye past key points are being detected.

5.2 MOVEMENT PATTERNS

Although different Walleye have been tagged and monitored over time, similar coarse-scale movement patterns have been observed both upstream and downstream of the Keeyask GS site since the study began in 2013. Each year, fish tagged upstream of the Keeyask GS have been split into four groups: those that remained in Gull Lake; those that moved between Birthday Rapids and Gull Lake; those that moved between Clark Lake and Gull Lake; and those that remain in the riverine area downstream of Birthday Rapids. These movement patters have not changed following reservoir impoundment in September 2020. Walleye in 2022 continued to inhabit Gull Lake and the riverine portion of the reservoir, spending little time near the GS. No fish moved

farther downstream than within 5.9 km of the GS. Walleye tagged in 2018/2019 showed similar movement patterns as previous years, remaining almost exclusively (99% of the open-water period) in the Gull Lake portion of the reservoir. Walleye tagged in the Keeyask reservoir in 2021 also spent a majority of their time in Gull Lake (62% of the open-water period), but also spent 32% of the open-water period in the middle Keeyask reservoir, where they had originally been tagged. Fewer fish moved out of the Keeyask reservoir in 2022 compared to 2021. In 2021, 17 fish (36% of all detected) moved upstream into Clark Lake, while only five (17% of all detected) moved upstream in 2022.

Walleye tagged in Stephens Lake have been consistently split into two groups: those that remain exclusively within the upper portion of the lake (*i.e.*, within 10.2 rkm of the Keeyask GS), and those that move extensively within the lake. These patterns persisted in 2022. Walleye also continued to spend time in the vicinity of the GS, recording detections for 25% of the open-water period within 2.1 km downstream of the GS.

5.3 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 this period are addressed below.

What is the frequency of downstream movement through the Keeyask GS, and when are the movements occurring?

The EIS predicted an increase in the number of Walleye leaving the Keeyask reservoir due to changes in water level and velocities following impoundment. Since tagging began in 2013, 40 fish have moved downstream through the Keeyask GS site. Thirteen of these movements likely occurred due to tagging stress or mortality, while 27 movements occurred independent of tagging (Figure 13). By year, the highest proportion of tagged Walleye moved downstream through the Keeyask GS construction site (independent of tagging stress) in 2017 (18%) and the Keeyask GS spillway in 2019 (13%). In all other years, the rate of downstream movement has ranged from 0% (in 2013) to 10% (in 2015). In 2022, only one fish (#48264; 2%) moved downstream through the Keeyask GS. It was detected in Stephens Lake on July 19, 2022, after which it made multiple upstream and downstream movements, indicating it survived passage. Overall, there does not appear to be a clear increasing or decreasing trend in the proportion of Walleye that move downstream past the Keeyask GS.

Are Walleye using habitat in the vicinity of the Keeyask GS, particularly during spawning?

Monitoring since 2013 has shown that Walleye tagged upstream of the Keeyask GS do not spend much time in the vicinity of the construction site or the completed GS. Since studies began, Walleye have rarely been detected at the receiver set closest to the Keeyask GS site (rkm -5.8 from 2013–2017, -4.8 from 2018–2019, -2.2 in 2020–2021, and -0.3 in 2022). In 2022, no fish moved farther downstream than rkm -5.8.

In contrast, Walleye in Stephens Lake regularly used habitat directly downstream of the construction site and continue to use this area after GS completion. The Keeyask GS was completed on March 9, 2022, when all powerhouse units were commissioned, causing flow alterations downstream in Stephens Lake. Walleye have been detected near the Keeyask GS site (≤1.2 rkm) during spring in all study years and have likely continued to spawn in this area during the construction and initial operation periods. In 2022, 23 Walleye (66% of detected fish) were detected within 1.2 km of the GS during the spawning period (May 25–June 7).

What types of habitat are Walleye utilizing in the Keeyask reservoir (i.e., are fish using the upper, middle, or lower end of the reservoir)?

Walleye have continued to spend the majority of the open-water period in the upper basin of Gull Lake (Zone 4) since the study began in 2013. This has not changed following reservoir impoundment. However, as observed in the 2021, the proportion of time spent in Gull Lake differed based on tagging year. Walleye tagged in 2018/2019 spent nearly the entire open-water period in Gull Lake, with 61% in upper Gull Lake (Zone 4) and 37% in lower Gull Lake (Zone 5). Walleye tagged in 2021 also used upper Gull Lake most frequently (48%), but also spent time in the middle Keeyask reservoir (Zone 3; 32%). This most likely reflects tagging location, as the majority of fish tagged in 2021 were captured and tagged in Zone 3.

What proportion of the fish population moves from the Keeyask reservoir upstream past Birthday and/or Long rapids?

Before the start of construction in 2014, seven of 49 tagged Walleye (14%) moved upstream into Clark Lake. During the construction period, 24 of 132 tagged Walleye (18%) moved upstream. During the first open-water period post-impoundment (2021), 17 tagged Walleye (36%; five tagged in 2018/2019 and 12 tagged in 2021) moved upstream. Only five fish (17%) moved upstream into Clark Lake in 2022, three of which returned to Gull Lake before the end of the 2022 open-water period.

6.0 SUMMARY AND CONCLUSIONS

- Acoustic transmitters were applied to Walleye upstream and downstream of the Keeyask GS construction site in 2013, 2014, 2016, 2018, 2019, and 2021. The transmitters applied in 2013, 2014, and 2016 have expired. Sixty new transmitters were applied in spring 2021 (30 upstream and 30 downstream of the Keeyask GS) and will last until open-water 2025.
- Walleye tagged upstream of the Keeyask GS have consistently displayed four general movement patterns since monitoring began in 2013. These fish either: remain in Gull Lake, move between Birthday Rapids and Gull Lake, move between Clark Lake and Gull Lake, or remain in the riverine area downstream of Birthday Rapids. These patterns have not changed following reservoir impoundment in September 2020.
- Walleye tagged in Stephens Lake have been consistently split into two groups: those that remain exclusively within the upper portion (within 10.2 rkm of the Keeyask GS) of the lake; and those that move extensively throughout the lake.
- The key questions, as described in the AEMP, for Walleye movement monitoring during construction and impoundment of the Keeyask GS are as follows:
    - *What is the frequency of downstream movement through the Keeyask GS, and when are the movements occurring?*

      Since tagging began in 2013, 40 fish have moved downstream through the Keeyask GS site. Thirteen of these movements likely occurred due to tagging stress or mortality, while 27 movements occurred independently of tagging. By year, the highest proportion of tagged Walleye moved downstream through the Keeyask GS construction site (independent of tagging stress) in 2017 (18%) and the Keeyask GS spillway in 2019 (13%). In all other years, the rate of downstream movement has ranged from 0% (in 2013) to 10% (in 2015). Only one fish (#48264; 2%) moved downstream through the Keeyask GS in 2022. It was detected in Stephens Lake on July 19, 2022, after which it made multiple upstream and downstream movements after, indicating it survived passage. Overall, there does not appear to be a clear increasing or decreasing trend in the proportion of Walleye that move downstream past the Keeyask GS.
    - *Are Walleye utilizing habitat in the vicinity of the Keeyask GS (particularly during spawning)?*

      Monitoring since 2013 has shown that Walleye tagged upstream of the Keeyask GS do not spend much time in the vicinity of the construction site or the completed GS. Since studies began, Walleye have rarely been detected at the receiver set closest to the Keeyask GS site (rkm -5.8 from 2013–2017, -4.8 from 2018–2019, -2.2 in 2020–2021, and -0.3 in 2022). In 2022, no fish moved farther downstream than rkm -5.8.

In contrast, Walleye in Stephens Lake regularly used habitat directly downstream of the construction site and continue to use this area after GS completion. Walleye have been detected near the Keeyask GS site (≤ rkm 1.2) during the spring in all study years and have likely continued to spawn in this area during the construction and initial operation periods. In 2022, 23 Walleye (66% of detected fish) were detected within 1.2 km of the GS during the spawning period (May 25–June 7).

- *What types of habitat are Walleye utilizing in the Keeyask reservoir (i.e., are fish using the upper, middle, or lower end of the reservoir)?*

  Walleye have continued to spend the majority of the open-water period in the upper basin of Gull Lake (Zone 4) since the study began in 2013. As observed in the 2021, the proportion of time spent in Gull Lake differed based on tagging year. Walleye tagged in 2018/2019 spent nearly the entire open-water period in Gull Lake, with 61% in upper Gull Lake (Zone 4) and 37% in lower Gull Lake (Zone 5). Walleye tagged in 2021 also used upper Gull Lake most frequently (48%), but also spent time in the middle Keeyask reservoir (Zone 3; 32%). This most likely reflects tagging location, as most fish tagged in 2021 were captured and tagged in Zone 3.

- *What proportion of the fish population move from the Keeyask reservoir upstream past Birthday and/or Long rapids?*

  Before the start of construction in 2014, seven of 49 tagged Walleye (14%) moved upstream into Clark Lake. During the construction period, 24 of 132 tagged Walleye (18%) moved upstream. During the first open-water period post-impoundment, 17 tagged Walleye (36%) moved upstream. Only five Walleye (17%) moved upstream into Clark Lake in 2022, and three returned to Gull Lake before the end of the study period.

- The EIS predicted an increase in the number of Walleye leaving the Keeyask reservoir due to changes in water level and velocities following impoundment. Overall, there does not appear to be a clear increasing or decreasing trend in the proportion of Walleye that move downstream past the Keeyask GS. Since tagging began in 2013, 27 fish have moved downstream through the Keeyask GS site independent of tagging stress or mortality. By year, the highest proportion of tagged Walleye moved downstream through the Keeyask GS site in 2017 (18%) and 2019 (13%). In all other years, the rate of downstream movement has ranged from 0% (in 2013) to 10% (in 2015). Only one fish (3%) moved downstream through the Keeyask GS in 2022. The number of movements upstream out of the Keeyask reservoir increased in 2021 but has returned to pre-impoundment rates in 2022. Prior to impoundment, 24 of 132 tagged Walleye (18%) moved upstream into Clark Lake while 17 tagged Walleye moved upstream (31%) in 2021. However, this decreased in 2022 and five tagged Walleye (17%) moved upstream into Clark Lake during the open-water period. In all sampling years, most fish that moved upstream to Clark Lake were detected here briefly and returned downstream to Gull Lake.

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APPENDICES

APPENDIX 1: DETECTION SUMMARIES FOR WALLEYE TAGGED AND MONITORED IN THE KEEYASK STUDY AREA BETWEEN 2018 AND 2022

Table A1-1: Detection summary for Walleye monitored upstream of the Keeyask GS during the winter 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS.

Tag ID	Date tagged	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)
25739	5-Jun-18	919	9	5.2	13.9		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25740	5-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25742	5-Jun-18	771	10	-12.4	-12.4	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25743	5-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25744	5-Jun-18	0	-	-	-	-	0	-	-	-	-	26	4	-7.9	-7.9	0.0	-	-	-	-	-
25745	5-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25746	5-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	10543	119	-12.9	-12.9	0.0
25747	28-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25748	28-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25749	28-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25750	1-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25751	5-Jun-18	37	8	-12.4	-12.4	0	0	-	-	-	-	49906	189	-12.9	-12.9	0.0	13	1	-19.5	-12.4	7.1
25752	27-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25753	27-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25754	27-May-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25755	1-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25756	1-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20147	05-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20148	05-Jun-19	-	-	-	-	-	2209	46	-12.4	-10.3	2.1	-	-	-	-	-	-	-	-	-	-
20149	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-		-	-	-	-	
20150	05-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-		-	-	-	-	
20151	05-Jun-19	-	-	-	-	-	0	-	-	-	-	4269	37	-12.9	-12.9	0.0	14550	139	-48.2	-12.9	35.3
20153	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20154	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	56693	137	-19.5	-19.5	0.0
20155	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A1-1: Detection summary for Walleye monitored upstream of the Keeyask GS during the winter 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	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)
20156	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20157	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20158	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20159	07-Jun-19	-	-	-	-	-	3466	83	-10.3	-10.3	0.0	3148	53	-12.4	-10.1	2.3	-	-	-	-	-
20160	07-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20161	07-Jun-19	-	-	-	-	-	0	-	-	-	-	3954	35	-19.5	-17.4	2.1	-	-	-	-	-
20162	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	1136	21	-17.4	-17.4	0.0
20163	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20164	06-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20168	07-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20169	07-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20170	06-Jun-19	-	-	-	-	-	0	-	-	-	-	469	5	-12.9	-7.9	5.0	-	-	-	-	-
20175	29-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20176	29-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20181	29-May-19	-	-	-	-	-	0	-	-	-	-	6356	49	-19.5	-17.4	2.1	-	-	-	-	-
20182	25-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20186	29-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20187	23-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20188	23-May-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A1-1: Detection summary for Walleye monitored upstream of the Keeyask GS during the winter 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	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)
48244	03-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48258	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7316	78	-19.5	-12.4	7.1
48259	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10116	102	-19.5	-12.4	7.1
48260	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20600	87	-19.5	-10.1	9.4
48261	07-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24168	202	-12.4	-12.4	0.0
48262	10-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	3	-7.9	-7.9	0.0
48263	14-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16750	144	-12.4	-12.4	0.0
48264	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-10.1	-10.1	0.0
48265	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10899	68	-29.3	-29.3	0.0
48266	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6901	85	-29.3	-17.4	11.9
48267	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	359	7	-12.9	-12.9	0.0
48268	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48269	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48270	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48271	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3139	46	-26.4	-26.4	0.0
48313	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1396	53	-26.4	-10.1	16.3
48314	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16558	152	-17.4	-10.1	7.3
48319	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48320	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10662	72	-19.5	-12.4	7.1
48321	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48322	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48323	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48326	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48327	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48328	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14883	128	-7.9	-7.9	0.0
48329	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1635	19	-26.4	-26.4	0.0
48330	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48331	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48332	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12989	53	-26.4	-17.4	9.0
48333	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	136	2	-48.2	-48.2	0.0

Table A1-2: Detection summary for Walleye monitored in Stephens Lake during the winter 2016/2017 (October 20, 2015 to April 30, 2017), 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS.

Tag ID	Date tagged	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)
25732	9-Jun-18	0	-	-	-	-															
25734	7-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25735	6-Jun-18	0	-	-	-	-	600	13	13	36.1	23.1	391	15	32	32	0.0	-	-	-	-	-
25736	7-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25737	6-Jun-18	0	-	-	-	-	0	-	-	-	-	26	3	3.9	4.9	1.0	13	4	3.9	3.9	0.0
25738	6-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25741	6-Jun-18	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20129	03-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20130	01-Jun-19	-	-	-	-	-	1057	5	6.5	16.8	10.3	1946	16	3.9	16.3	12.4	-	-	-	-	-
20131	31-May-19	-	-	-	-	-	66	5	16.8	16.8	0.0	77327	206	3.9	4.9	1.0	36553	189	3.9	4.9	1.0
20132	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20133	31-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20134	31-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20135	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20136	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20137	31-May-19	-	-	-	-	-	8548	48	13.9	21.6	7.7	-	-	-	-	-	-	-	-	-	-
20138	31-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20139	31-May-19	-	-	-	-	-	20139	4	13	13	0.0	126	6	7.5	13.2	5.7	6582	67	7.5	13.2	5.7
20140	31-May-19	-	-	-	-	-	20140	14	5.2	10.3	5.1	-	-	-	-	-	-	-	-	-	-
20141	31-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20142	31-May-19	-	-	-	-	-	7989	75	13.9	18.6	4.7	-	-	-	-	-	-	-	-	-	-
20143	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	136	3	16.1	24.9	8.8

Table A1-2: Detection summary for Walleye monitored in Stephens Lake during the winter 2016/2017 (October 20, 2015 to April 30, 2017), 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	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)
20144	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20145	01-Jun-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20152	31-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20165	16-Sep-19	-	-	-	-	-	39683	174	5.2	10.3	5.1	52505	200	3.9	10.2	6.3	28	1	22	24.9	2.9
20167	16-Sep-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20171	27-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20172	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20173	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20174	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20177	30-May-19	-	-	-	-	-	10513	89	5.2	13.9	8.7	-	-	-	-	-	-	-	-	-	-
20178	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20179	30-May-19	-	-	-	-	-	45009	183	5.2	10.3	5.1	56962	5	5.9	10.2	4.3	52110	196	5.4	10.2	4.8
20180	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20183	30-May-19	-	-	-	-	-	177	6	8.4	8.4	0.0	-	-	-	-	-	-	-	-	-	-
20184	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20185	30-May-19	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A1-2: Detection summary for Walleye monitored in Stephens Lake during the winter 2016/2017 (October 20, 2015 to April 30, 2017), 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) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	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)
48234	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21720	71	18.8	24.9	6.1
48235	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48236	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48237	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20791	108	5.4	32.5	27.1
48238	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48239	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8935	82	3.9	18.8	14.9
48240	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
48241	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75839	206	24.9	24.9	0.0
48242	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48243	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48245	04-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48246	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10543	119	3.9	10.2	6.3
48247	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48248	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14942	95	5.4	24.9	19.5
48249	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	16.1	16.1	0.0
48250	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14911	78	3.9	10.2	6.3
48251	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1	13.4	13.4	0.0
48252	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28241	149	3.9	10.2	6.3
48253	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48254	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8042	38	3.9	10.2	6.3
48255	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48256	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48257	06-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	278	10	16.3	16.3	0.0
48272	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	8	7.5	7.5	0.0
48273	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18117	59	7.5	9.9	2.4
48274	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5801	50	3.9	8.7	4.8
48275	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48318	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1003	36	16.3	22.0	5.7
48324	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2377	45	3.9	10.2	6.3
48325	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	329	11	8.7	8.7	0.0

Table A1-3: Detection summary for Walleye and monitored upstream of the Keeyask GS during the open-water 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 tag. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS.

Tag ID	Date tagged	2018					2019					2020					2021					2022				
		n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)
25739	5-Jun-18	996	30	-9.3	-7.4	1.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25740	5-Jun-18	3587	29	-9.3	36.1	45.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25742	5-Jun-18	14026	101	-15.0	-9.9	5.1	586	8	-12.9	-12.9	0.0	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25743	5-Jun-18	597	7	-10.2	-4.8	5.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25744	5-Jun-18	5128	44	-19.5	-9.3	10.2	0	-	-	-	-	2	1	-8	-7.9	0.0	38	12	-7.9	-7.9	0.0	1574	52	-7.9	-7.9	0.0
25745	5-Jun-18	225	2	-12.8	-12.8	0.0	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25746	5-Jun-18	1946	28	-19.5	-12.8	6.7	0	-	-	-	-	423	21	-13	-12.9	0.0	2	1	-12.9	-12.9	0.0	0	-	-	-	-
25747	28-May-18	12012	100	-24.7	-7.4	17.3	4724	53	-46.9	-9	37.9	963	34	-8.9	-4.8	4.1	0	-	-	-	-	0	-	-	-	-
25748	28-May-18	625	6	-19.5	24.7	44.2						0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25749	28-May-18	9675	75	-48.2	-9.3	38.9	2504	64	-33.8	-4.8	29.0	8435	39	-8.9	-8.9	0.0	3139	46	-8.9	-8.9	0.0	11965	115	-8.9	-8.9	0.0
25750	1-Jun-18	3401	49	-26.5	-9.0	17.5	6437	35	-48.2	-17.4	30.8	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25751	5-Jun-18	3274	72	-19.5	-12.8	6.7	3532	83	-12.9	-12.5	0.4	6091	60	-34.3	-9.9	24.4	7861	53	-48.2	-9.9	38.3	636	19	-48.2	-9.9	38.3
25752	27-May-18	2272	21	-19.5	40.8	60.3	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25753	27-May-18	11695	58	-32.3	36.1	68.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25754	27-May-18	5119	60	-24.7	-12.9	11.8	4147	58	-19.5	-15	4.5	10	1	-29.4	-29.4	0.0	0	-	-	-	-	0	-	-	-	-
25755	1-Jun-18	564	11	-24.7	40.9	65.6	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25756	1-Jun-18	5983	54	-19.5	-9.9	9.6	3332	22	-46.9	-15	31.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20147	05-Jun-19	-	-	-	-	-	11721	46	-19.5	40.9	60.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20148	05-Jun-19	-	-	-	-	-	25306	116	-19.5	-9.3	10.2	998	8	5.2	40.5	35.3	0	-	-	-	-	0	-	-	-	-
20149	06-Jun-19	-	-	-	-	-	7	1	-19.5	-17.4	2.1	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20150	05-Jun-19	-	-	-	-	-	1783	8	-15.0	40.9	55.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20151	05-Jun-19	-	-	-	-	-	7125	97	-29.4	-12.9	16.5	7166	72	-12.9	-9.9	3.0	6885	89	-48.2	-9.9	38.3	2708	48	-34.3	-12.9	21.4
20153	06-Jun-19	-	-	-	-	-	1607	9	-19.5	-9.9	9.6	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20154	06-Jun-19	-	-	-	-	-	66867	115	-19.5	-19.5	0.0	31732	78	-19.5	-19.5	0.0	107836	144	-19.5	-19.4	0.1	21568	85	-19.5	-19.5	0.0
20155	06-Jun-19	-	-	-	-	-	621	5	-19.5	-9.9	9.6	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20156	06-Jun-19	-	-	-	-	-	62130	121	-19.5	-19.5	0.0	22726	56	-19.5	-19.5	0.0	951	27	-19.4	-19.4	0.0	74316	130	-19.5	-19.5	0.0
20157	06-Jun-19	-	-	-	-	-	1174	9	-19.5	-12.9	6.6	131	12	-12.9	-12.9	0.0	0	-	-	-	-	0	-	-	-	-
20158	06-Jun-19	-	-	-	-	-	1697	6	-19.5	9.4	28.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20159	07-Jun-19	-	-	-	-	-	10988	82	-19.5	-9.0	10.5	6662	71	-29.4	-4.8	24.6	126	9	-7.7	-7.7	0.0	154	28	-7.8	-7.8	0.0
20160	07-Jun-19	-	-	-	-	-	9846	10	-19.5	5.4	24.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20161	07-Jun-19	-	-	-	-	-	4014	81	-19.5	-19.5	0.0	1817	37	-19.5	-15.0	4.5	8590	88	-48.2	-12.5	35.7	6319	67	-48.2	-7.8	40.4
20162	06-Jun-19	-	-	-	-	-	537	13	-19.5	-15.0	4.5	76	8	-15.0	-15.0	0.0	5694	75	-17.4	-15.0	2.4	0	-	-	-	-
20163	06-Jun-19	-	-	-	-	-	6084	53	-33.8	36.1	69.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20164	06-Jun-19	-	-	-	-	-	106	1	-19.5	-15.0	4.5	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20168	07-Jun-19	-	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20169	07-Jun-19	-	-	-	-	-	27	4	-19.5	-15.0	4.5	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20170	06-Jun-19	-	-	-	-	-	6259	89	-46.9	-9.3	37.6	2464	42	-33.8	-7.9	25.9	384	7	-46.9	-12.9	34.0	0	-	-	-	-
20175	29-May-19	-	-	-	-	-	6127	65	-48.2	-4.8	43.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20176	29-May-19	-	-	-	-	-	42406	118	-19.5	-17.4	2.1	1390	17	-19.5	-19.5	0.0	0	-	-	-	-	0	-	-	-	-
20181	29-May-19	-	-	-	-	-	6572	93	-19.5	-17.4	2.1	1604	24	-29.4	-15.0	14.4	18752	52	-48.2	-17.4	30.8	0	-	-	-	-

Table A1-3: Detection summary for Walleye and monitored upstream of the Keeyask GS during the open-water 2018 (May 1 to October 10), 2019 (May 1 to October 7), 2020 (May 1 to September 23), and 2021 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through the Keeyask GS. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	2018					2019					2020					2021					2022				
		n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)
20182	25-May-19	-	-	-	-	-	10080	22	-19.5	10.3	29.8	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20186	29-May-19	-	-	-	-	-	10480	74	-17.4	5.4	22.8	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20187	23-May-19	-	-	-	-	-	4991	35	-19.5	24.7	44.2	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20188	23-May-19	-	-	-	-	-	31081	102	-24.7	-19.5	5.2	2715	27	-48.2	-24.2	24.0	3561	36	-48.2	-19.4	28.8	0	-	-	-	-
48244	03-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4065	55	-48.2	-15	33.2	0	-	-	-	-
48258	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7034	72	-44.2	-17.4	26.8	60	1	-29.3	-26.4	2.9
48259	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11740	103	-22.6	-9.9	12.7	20728	124	-22.6	-9.9	12.7
48260	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1771	12	-33.9	-9.9	24.0	1025	22	-22.6	-12.5	10.1
48261	07-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14837	109	-32.2	-9.9	22.3	5327	117	-12.5	-12.4	0.1
48262	10-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6686	71	-15	-3.8	11.2	1844	51	-12.9	-5.8	7.1
48263	14-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7971	78	-34.3	-9.9	24.4	6876	58	-46.9	-12.4	34.5
48264	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31981	122	-24.2	-2.2	22.0	14965	62	-10.1	21.7	31.8
48265	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10385	70	-33.8	-26.4	7.4	6505	29	-33.9	-26.4	7.5
48266	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19958	101	-48.2	-15	33.2	7011	39	-24.2	-12.5	11.7
48267	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8532	81	-33.9	-6.2	27.7	0	-	-	-	-
48268	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9172	22	-22.6	-22.6	0.0	28	1	-29.3	-29.3	0.0
48269	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23174	99	-22.6	-15	7.6	0	-	-	-	-
48270	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4093	38	-48.2	-22.6	25.6	5882	97	-48.2	-12.5	35.7
48271	05-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16646	104	-33.8	-19.5	14.3	6315	46	-24.2	-17.4	6.8
48313	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6469	69	-34.3	-9.9	24.4	2753	22	-46.9	-9.9	37.0
48314	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21586	117	-46.9	-3.8	43.1	16846	25	-33.9	-5.8	28.1
48319	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1777	13	-22.6	-22.6	0.0	8	3	-22.6	-22.6	0.0
48320	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13062	113	-48.2	-15	33.2	10477	91	-22.6	-15.0	7.6
48321	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4198	49	-48.2	-7.9	40.3	3368	60	-34.3	-7.8	26.5
48322	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7284	55	-48.2	-15	33.2	0	-	-	-	-
48323	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4033	32	-22.6	7.5	30.1	0	-	-	-	-
48326	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20171	121	-48.2	-19.4	28.8	15348	63	-26.4	-22.6	3.8
48327	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4121	17	-22.6	-12.5	10.1	0	-	-	-	-
48328	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28131	124	-22.6	-3.8	18.8	25110	127	-19.5	-5.8	13.7
48329	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2232	34	-48.2	-26.4	21.8	9421	62	-34.3	-26.4	7.9
48330	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2502	23	-19.5	40.5	60.0	543	19	44.9	65.3	20.4
48331	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10686	89	-48.2	-15	33.2	9135	96	-26.4	-9.9	16.5
48332	01-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12924	103	-34.3	-5.8	28.5	8536	87	-33.9	-5.8	28.1
48333	31-May-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7130	67	-48.2	-2.2	46.0	0	-	-	-	-

Table A1-4: Detection summary for Walleye monitored in Stephens Lake during the open-water 2016 (May 1 to October 19), 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 tag. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS.

Tag ID	Date tagged	2018					2019					2020					2021					2022				
		n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)
25732	9-Jun-18	2502	19	1.2	40.9	39.7	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25734	7-Jun-18	1429	7	1.2	21.6	20.4	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25735	6-Jun-18	1572	34	1.2	7.9	6.7	2081	33	1.2	9.4	8.2	4117	75	32.0	36.1	4.1	321	10	32.0	32.0	0.0	2327	72	30.7	30.7	0.0
25736	7-Jun-18	4814	18	1.2	10.3	9.1	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25737	6-Jun-18	13243	78	1.2	4.4	3.2	11124	78	1.2	4.4	3.2	15411	64	1.2	5.0	3.8	9863	70	0.8	5.0	4.2	9687	84	1.0	5.0	4.0
25738	6-Jun-18	2300	20	1.2	36.1	34.9	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
25741	6-Jun-18	45733	120	1.2	2.7	1.5	156	21	1.2	1.2	0.0	0	-	-	-	-	383	20	1.2	1.2	0.0	0	-	-	-	-
20129	03-Jun-19	-	-	-	-	-	2257	23	1.2	6.5	5.3	0	-	-	-	-	0	-	-	-	-		-	-	-	-
20130	01-Jun-19	-	-	-	-	-	3708	25	1.2	18.6	17.4	1753	15	1.2	7.8	6.6	4460	29	0.8	9.9	9.1	0	-	-	-	-
20131	31-May-19	-	-	-	-	-	11481	79	1.2	18.6	17.4	4020	63	3.9	18.6	14.7	12054	114	3.9	5.9	2.0	29195	107	3.9	5.9	2.0
20132	01-Jun-19	-	-	-	-	-	20473	103	1.2	4.1	2.9	23801	82	1.2	1.2	0.0	20	7	1.2	1.2	0.0	18344	120	1.2	1.2	0.0
20133	31-May-19	-	-	-	-	-	6795	44	1.2	9.4	8.2	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20134	31-May-19	-	-	-	-	-	771	11	0.6	4.4	3.8	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20135	01-Jun-19	-	-	-	-	-	55200	124	1.2	4.4	3.2	36772	82	1.2	1.2	0.0	67306	130	1.0	1.2	0.2	67999	124	1.0	1.2	0.2
20136	01-Jun-19	-	-	-	-	-	673	18	1.2	24.7	23.5	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20137	31-May-19	-	-	-	-	-	2094	29	1.2	24.7	23.5	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20138	31-May-19	-	-	-	-	-	22235	95	0.6	4.1	3.5	20138	37	0.6	2.7	2.1	5014	53	0.8	5.9	5.1	15821	102	0.7	7.5	6.8
20139	31-May-19	-	-	-	-	-	2457	39	1.2	36.1	34.9	20139	22	1.2	13.2	12.0	1755	28	0.8	13.2	12.4	720	11	1.0	24.9	23.9
20140	31-May-19	-	-	-	-	-	1190	50	1.2	10.3	9.1	20140	37	1.2	9.9	8.7	0	-	-	-	-	0	-	-	-	-
20141	31-May-19	-	-	-	-	-	2202	15	0.6	36.1	35.5	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20142	31-May-19	-	-	-	-	-	9295	91	1.2	18.6	17.4	20142	30	5.2	65.3	60.1	0	-	-	-	-	0	-	-	-	-
20143	01-Jun-19	-	-	-	-	-	181	6	3.8	18.6	14.8	20143	7	5.2	18.6	13.4	4327	38	1.2	18.8	17.6	3350	33	1.0	24.9	23.9
20144	01-Jun-19	-	-	-	-	-	5023	31	1.2	5.8	4.6	20144	3	5.0	5.0	0.0	554	9	2.7	9.9	7.2	0	-	-	-	-
20145	01-Jun-19	-	-	-	-	-	883	20	0.6	7.9	7.3	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20152	31-May-19	-	-	-	-	-	11491	41	1.2	6.5	5.3	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20165	16-Sep-19	-	-	-	-	-	5391	11	1.2	9.4	8.2	23771	89	1.2	8.7	7.5	22233	89	0.8	40.9	40.1	0	-	-	-	-
20167	16-Sep-19	-	-	-	-	-	1661	9	1.2	40.9	39.7	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20171	27-May-19	-	-	-	-	-	1870	14	1.2	7.4	6.2	0	-	-	-	-	0	-	-	-	-	1172	8	0.7	9.3	8.6
20172	30-May-19	-	-	-	-	-	5131	43	1.2	5.8	4.6	11	2	5.0	5.2	0.2	0	-	-	-	-	0	-	-	-	-
20173	30-May-19	-	-	-	-	-	2377	45	1.2	7.4	6.2	2394	27	1.2	8.7	7.5	8824	57	1.0	16.1	15.1	17348	86	1.0	24.9	23.9
20174	30-May-19	-	-	-	-	-	20228	60	1.0	16.5	15.5	36791	82	1.2	1.2	0.0	32278	115	1.3	1.3	0.0	45444	124	1.2	1.2	0.0
20177	30-May-19	-	-	-	-	-	11339	100	0.6	10.3	9.7	670	19	5.2	10.3	5.1	0	-	-	-	-	0	-	-	-	-
20178	30-May-19	-	-	-	-	-	4293	26	0.6	7.9	7.3	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20179	30-May-19	-	-	-	-	-	2746	35	2.7	13.9	11.2	394	25	5.2	13.4	8.2	7947	44	5.4	13.4	8.0	4434	25	1.2	18.2	17.0

Table A1-4: Detection summary for Walleye monitored in Stephens Lake during the open-water 2016 (May 1 to October 19), 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 tag. Tag ID highlighted green = moved downstream through Kettle GS. Tag ID highlighted orange = suspected to have moved downstream through Kettle GS. Tag ID highlighted red = moved downstream through Long Spruce GS (continued).

Tag ID	Date tagged	2018					2019					2020					2021					2022				
		n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)	n	# Days	U/S (rkm)	D/S (rkm)	Range (rkm)
20180	30-May-19	-	-	-	-	-	1874	37	2.7	24.7	22.0	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
20183	30-May-19	-	-	-	-	-	1338	12	2.7	13.0	10.3	11	3	8.4	8.4	0.0	0	-	-	-	-	0	-	-	-	-
20184	30-May-19	-	-	-	-	-	2823	16	3.8	13.9	10.1	3	2	13.9	13.9	0.0	0	-	-	-	-	0	-	-	-	-
20185	30-May-19	-	-	-	-	-	5527	63	1.2	7.9	6.7	177	8	5.0	7.5	2.5	1469	31	0.8	5.4	4.6	13895	115	0.7	10.2	9.5
48234	02-Jun-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1964	15	1	24.9	23.9	4422	33	1.2	24.9	23.7
48235	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	736	19	1	13.2	12.2	2318	49	1	8	7.0
48236	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	2214	35	0.8	24.9	24.1	1354	18	0.7	65.3	64.6
48237	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3101	29	1	32	31.0	1604	22	0.7	24.9	24.2
48238	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	6601	33	0.8	5.4	4.6	0	-	-	-	-
48239	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	2048	25	1	24.9	23.9	1384	23	1	24.9	23.9
48240	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3124	45	0.8	5.4	4.6	7819	81	0.7	4.5	3.8
48241	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	18349	94	1	24.9	23.9	28019	133	24.9	24.9	0.0
48242	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3141	29	1.2	24.9	23.7	415	7	18.2	24.9	6.7
48243	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	1389	10	1	18.8	17.8	0	-	-	-	-
48245	04-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	358	9	1	5.9	4.9	0	-	-	-	-
48246	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	18039	76	1	13.4	12.4	31425	94	2.7	14.4	11.7
48247	05-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3726	27	0.8	10.2	9.4	0	-	-	-	-
48248	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3452	19	0.8	24.9	24.1	5531	34	0.7	10.2	9.5
48249	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	7771	52	0.8	13.4	12.6	5325	58	0.7	16.1	15.4
48250	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	16010	116	0.8	3.9	3.1	9912	113	1	8.3	7.3
48251	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	855	9	0.8	8.7	7.9	191	3	8.3	10.2	1.9
48252	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	11239	92	1	10.2	9.2	15865	109	1	14.4	13.4
48253	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	451	4	2.7	9.9	7.2	0	-	-	-	-
48254	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	2482	46	1	8.7	7.7	1643	38	1	7.8	6.8
48255	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	2216	11	1.2	18.8	17.6	0	-	-	-	-
48256	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	19665	105	0.8	7.5	6.7	0	-	-	-	-
48257	06-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3894	43	1.2	24.9	23.7	215	7	15	18.2	3.2
48272	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	2204	43	1	7.5	6.5	631	30	2.2	8.3	6.1
48273	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3757	60	1.2	9.9	8.7	2685	27	5.4	10.2	4.8
48274	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	3823	60	0.8	7.5	6.7	7772	92	0.7	8.3	7.6
48275	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	8714	31	1.2	18.8	17.6	0	-	-	-	-
48318	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	9581	77	1	24.9	23.9	3783	118	14.4	44.9	30.5
48324	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	15250	91	0.8	10.2	9.4	7556	71	0.7	9.7	9.0
48325	02-Jun-21	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	6355	48	0.8	18.8	18.0	7181	63	0.7	18.2	17.5

APPENDIX 2:
LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE UPSTREAM OF THE KEEYASK GS IN 2018/2019: MAY 2018 TO OCTOBER 2022

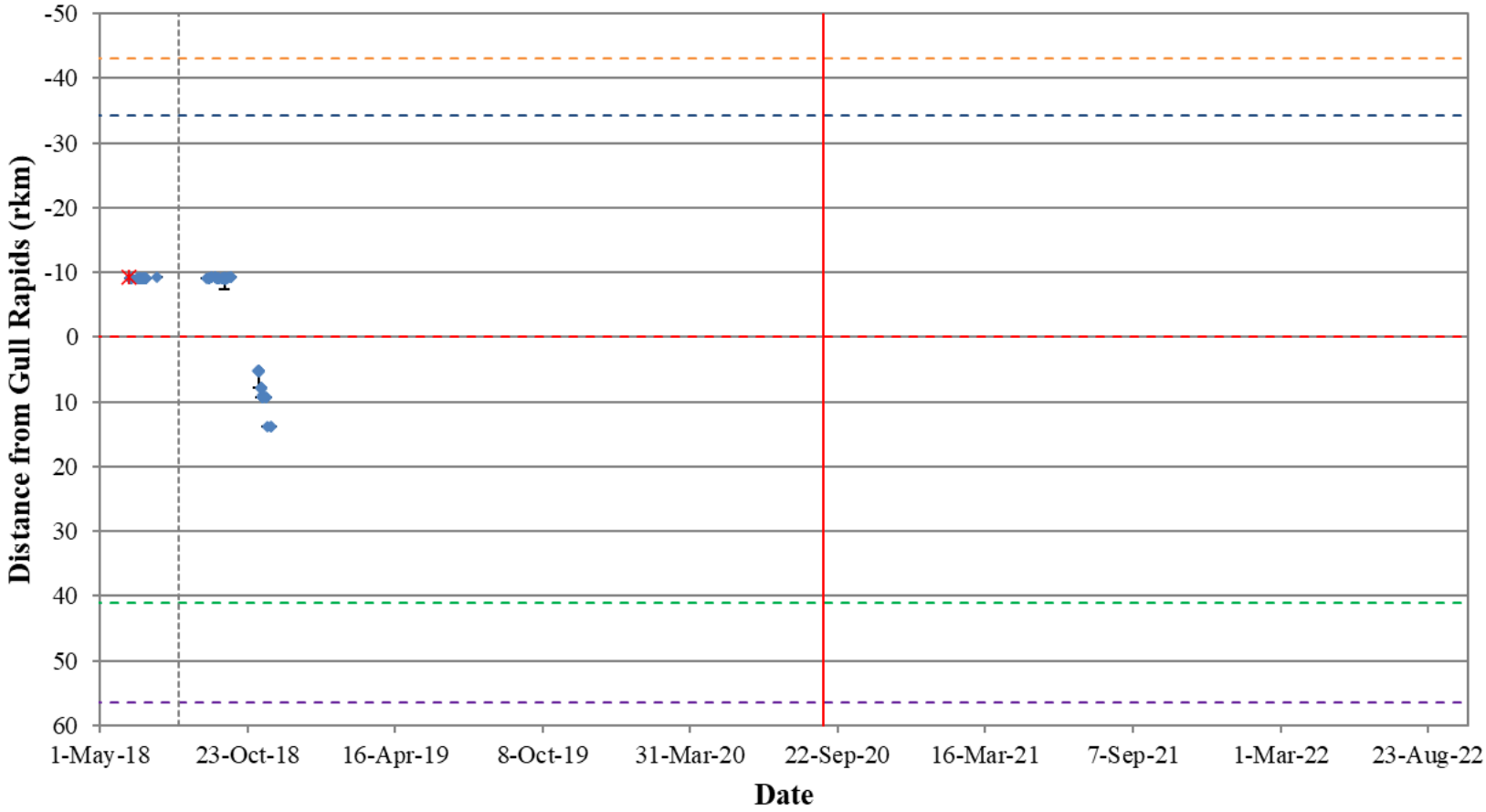

Figure A2-1: Position of a Walleye tagged with an acoustic transmitter (code #25739) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

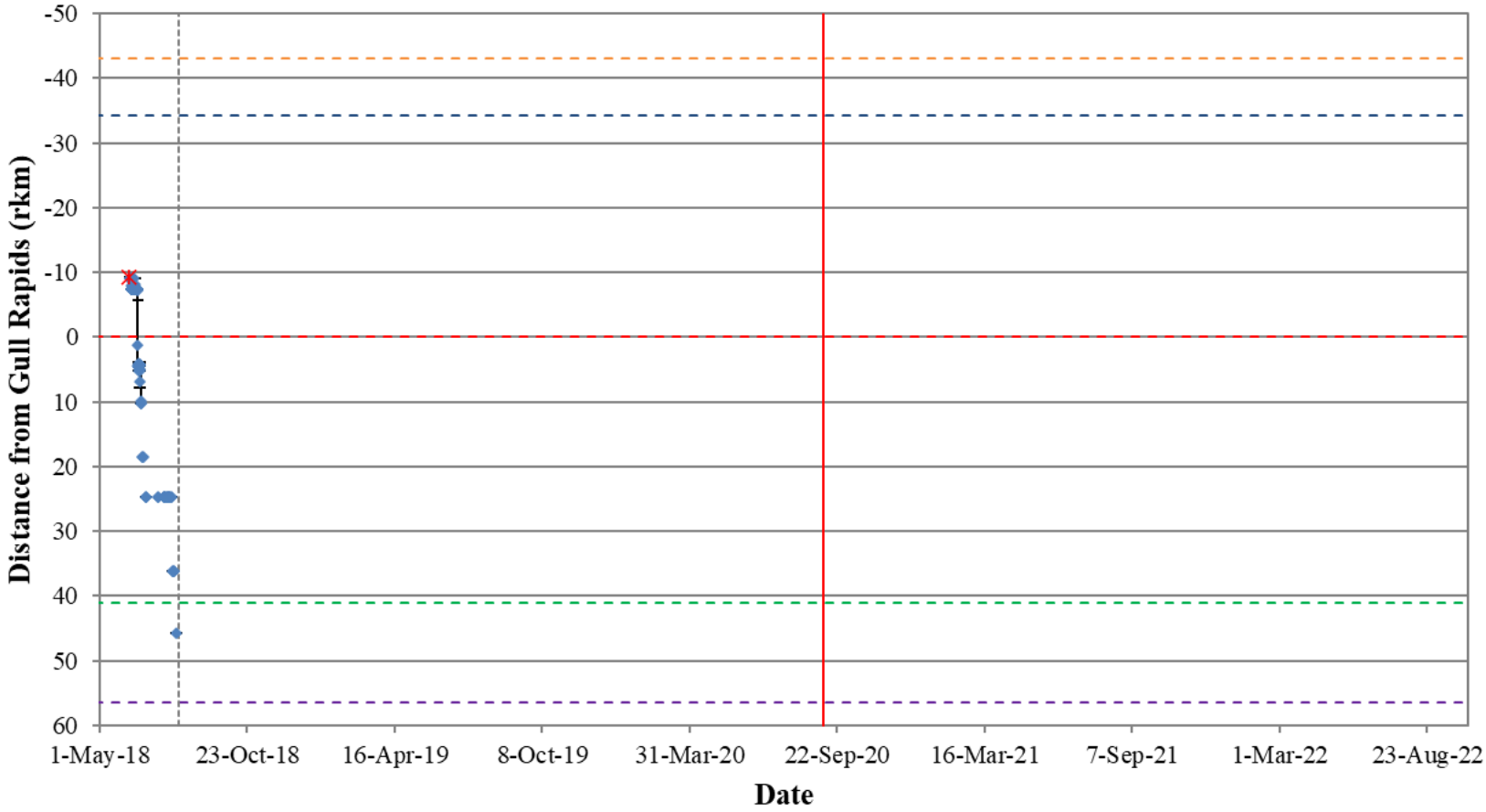

Figure A2-2: Position of a Walleye tagged with an acoustic transmitter (code #25740) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

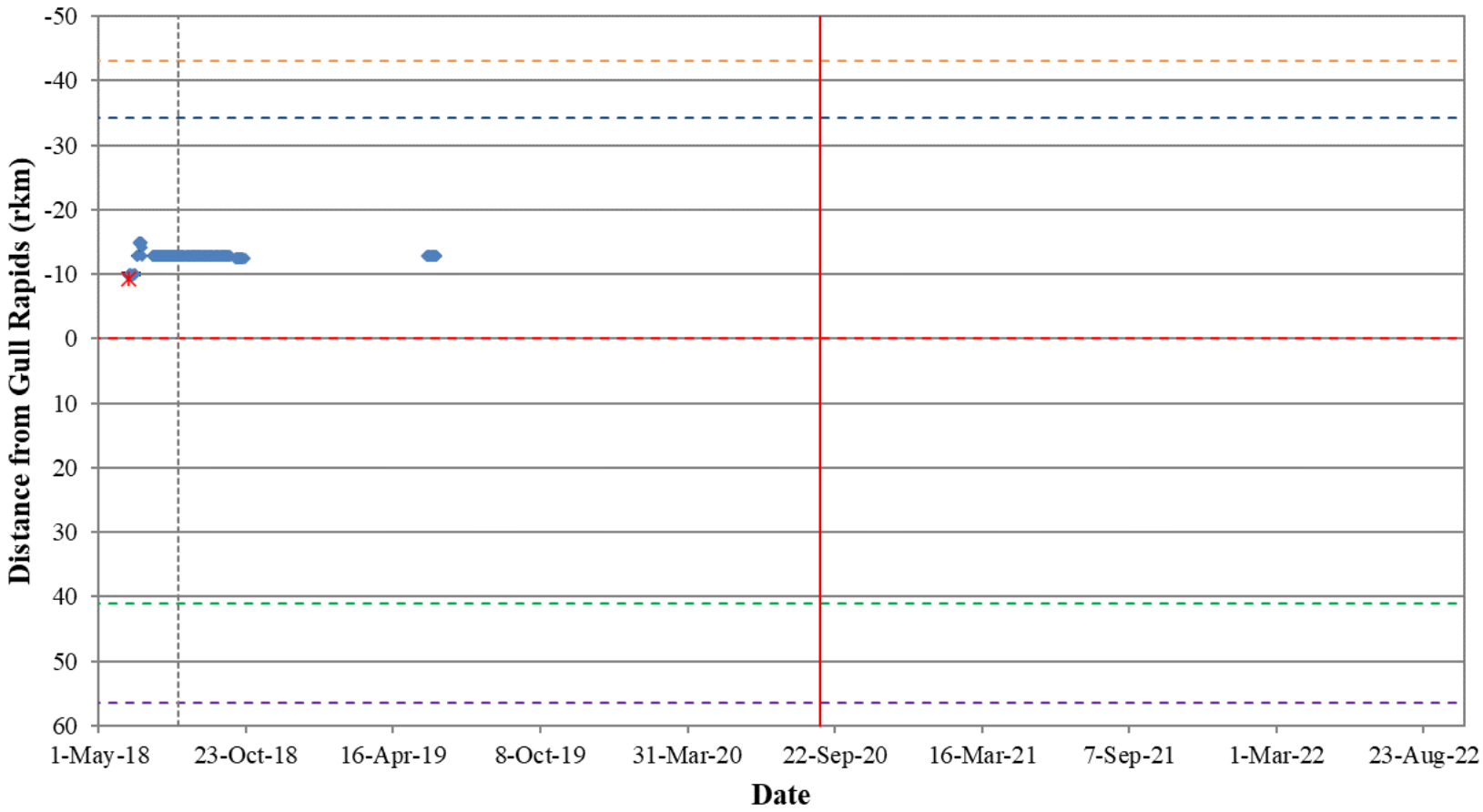

Figure A2-3: Position of a Walleye tagged with an acoustic transmitter (code #25742) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

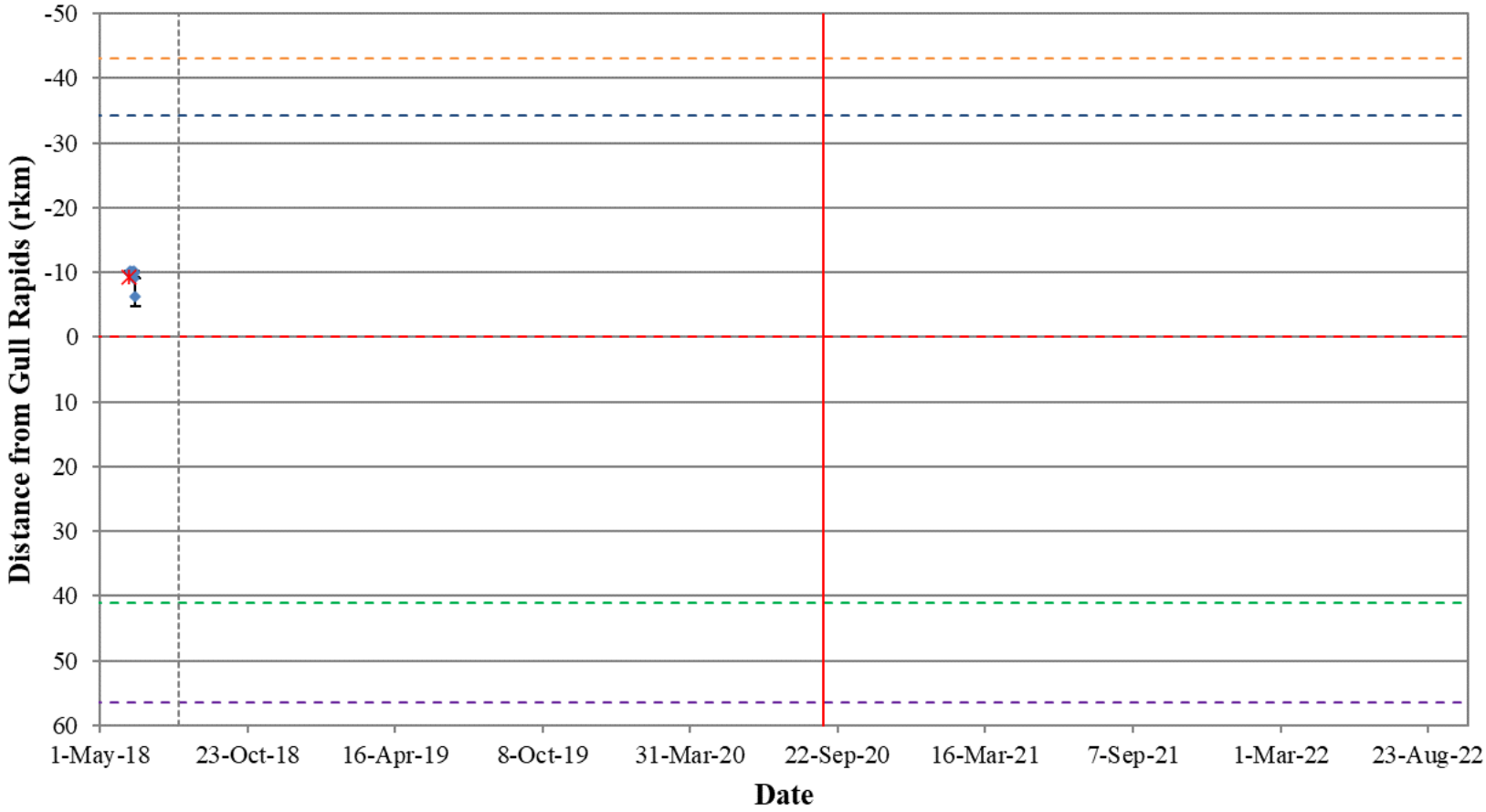

Figure A2-4: Position of a Walleye tagged with an acoustic transmitter (code #25743) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

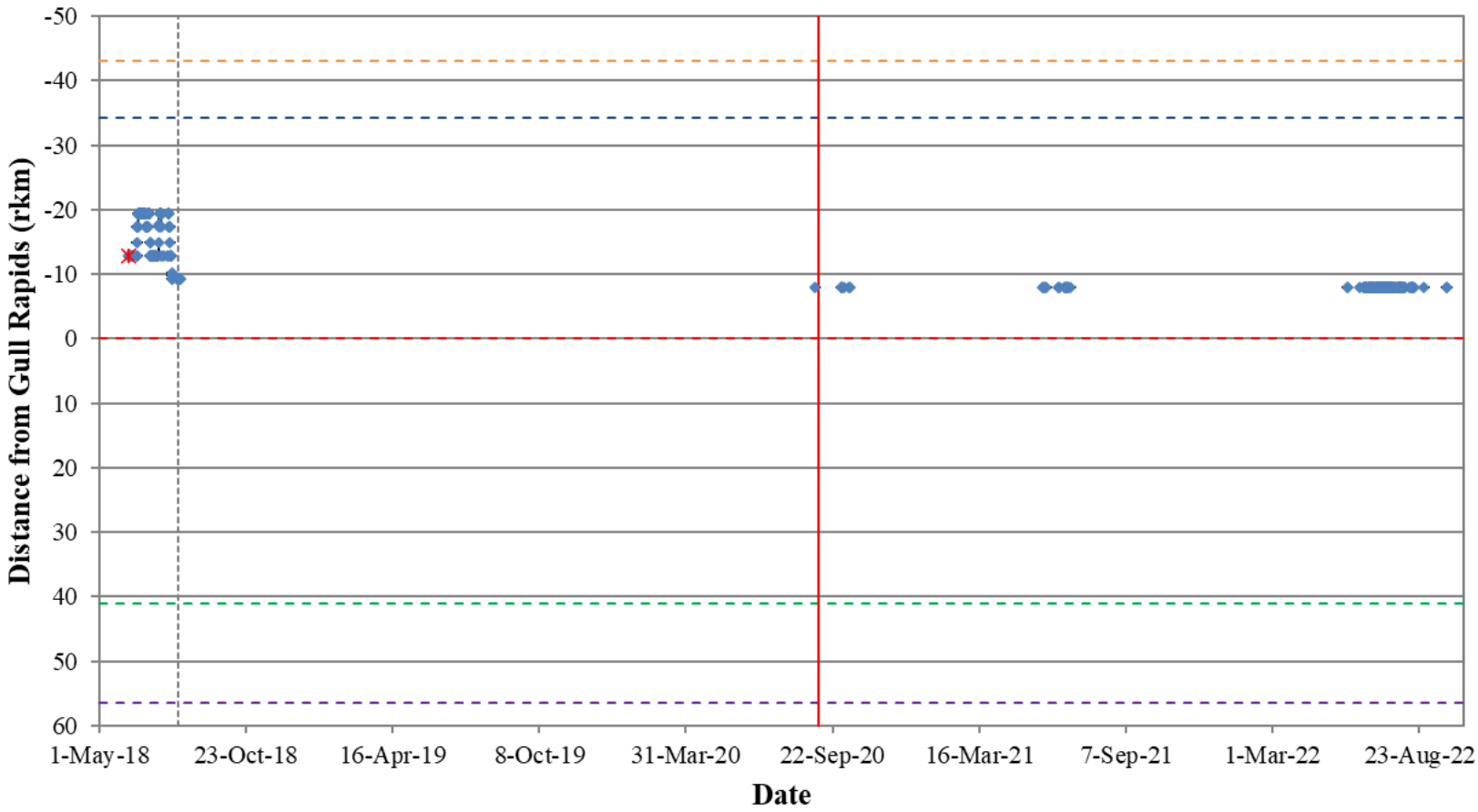

Figure A2-5: Position of a Walleye tagged with an acoustic transmitter (code #25744) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

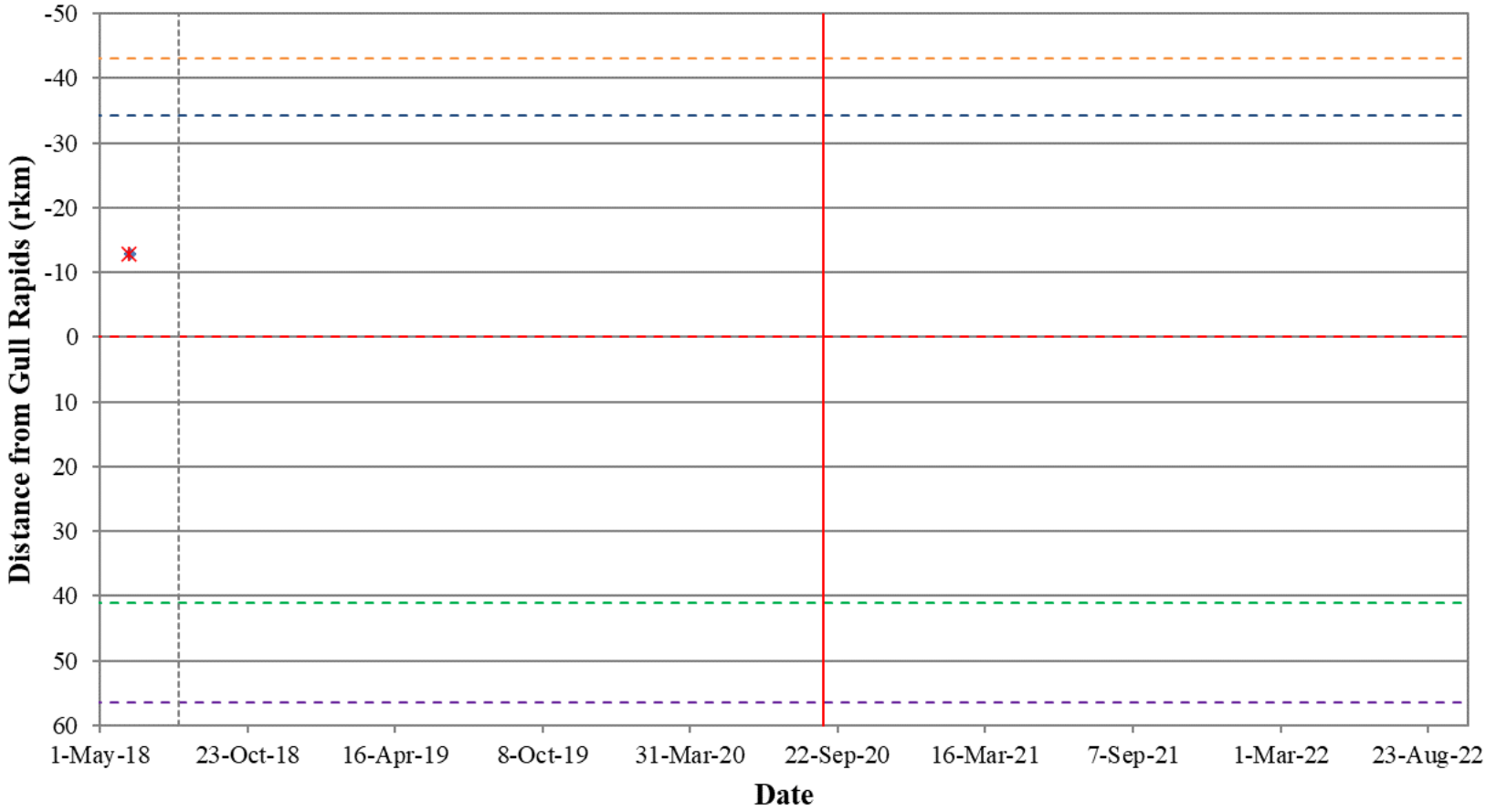

Figure A2-6: Position of a Walleye tagged with an acoustic transmitter (code #25745) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

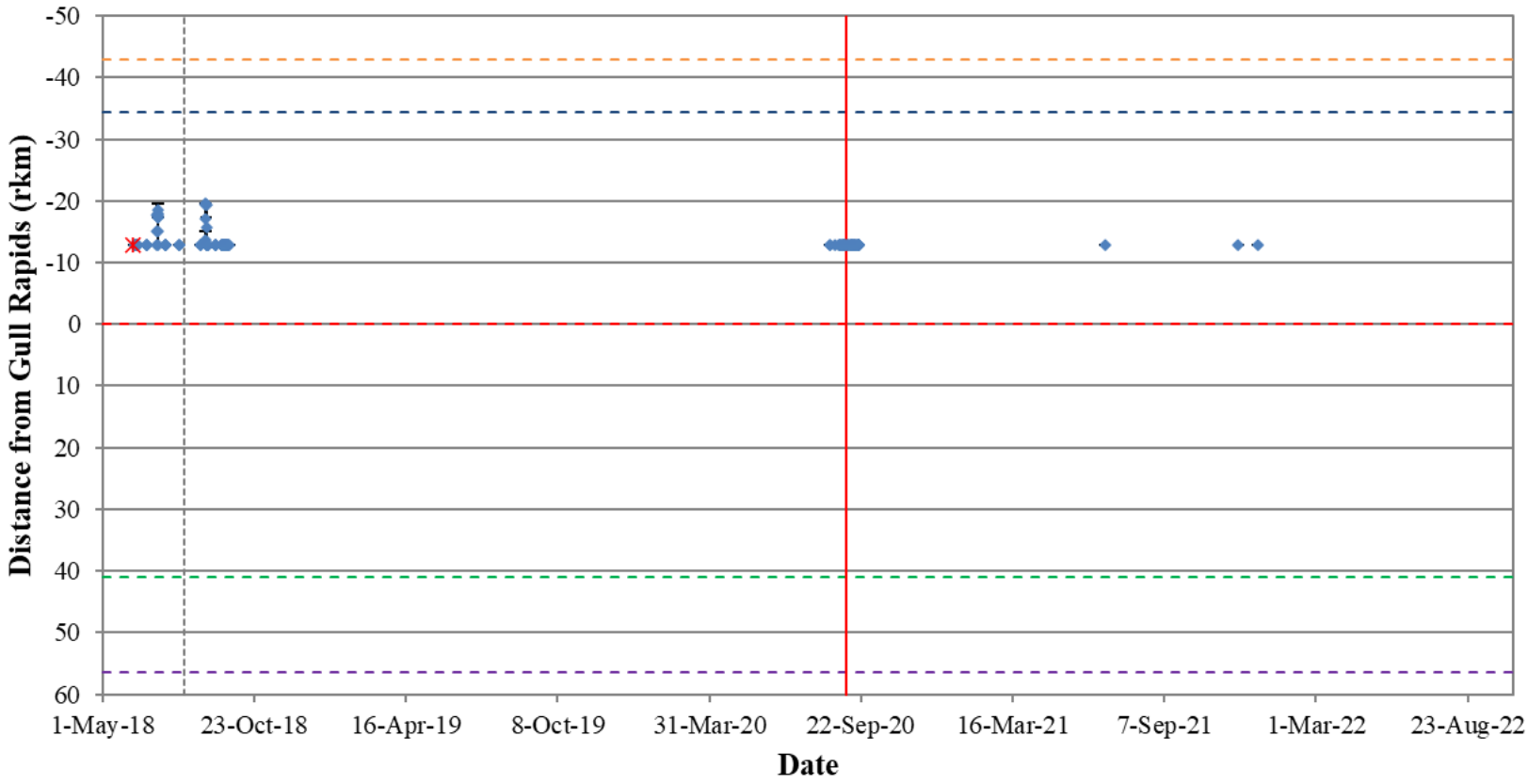

Figure A2-7: Position of a Walleye tagged with an acoustic transmitter (code #25746) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

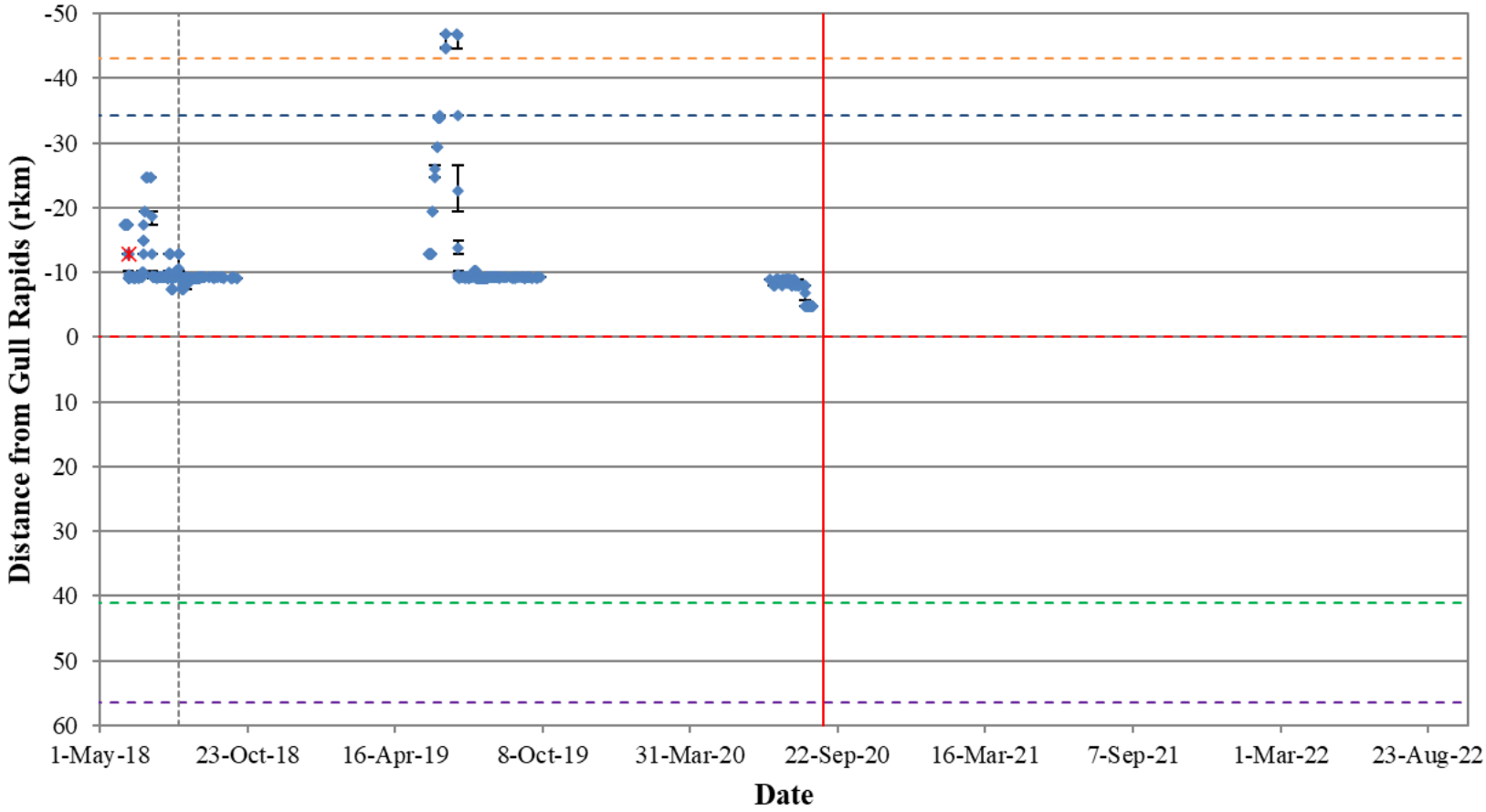

Figure A2-8: Position of a Walleye tagged with an acoustic transmitter (code #25747) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

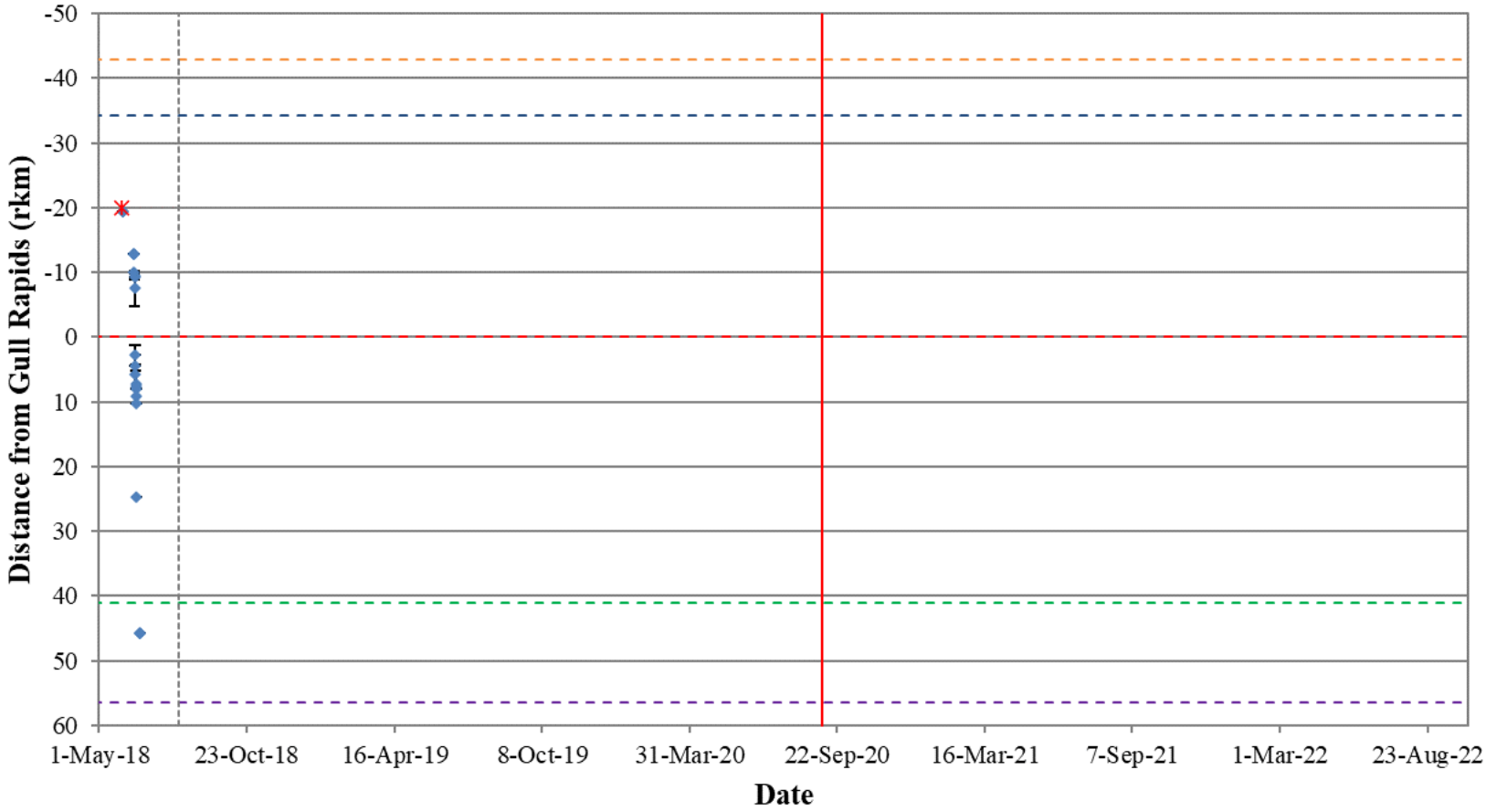

Figure A2-9: Position of a Walleye tagged with an acoustic transmitter (code #25748) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

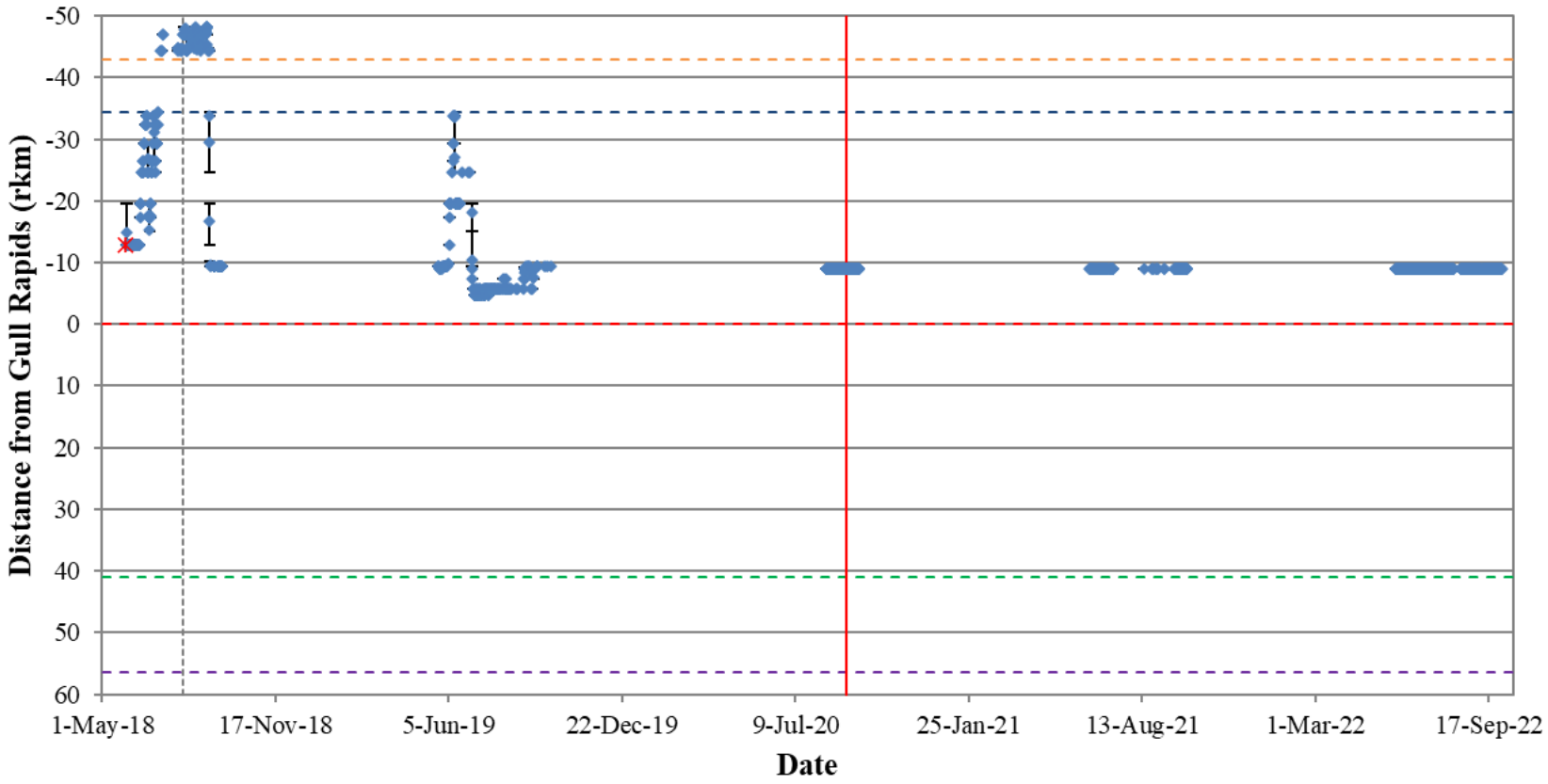

Figure A2-10: Position of a Walleye tagged with an acoustic transmitter (code #25749) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

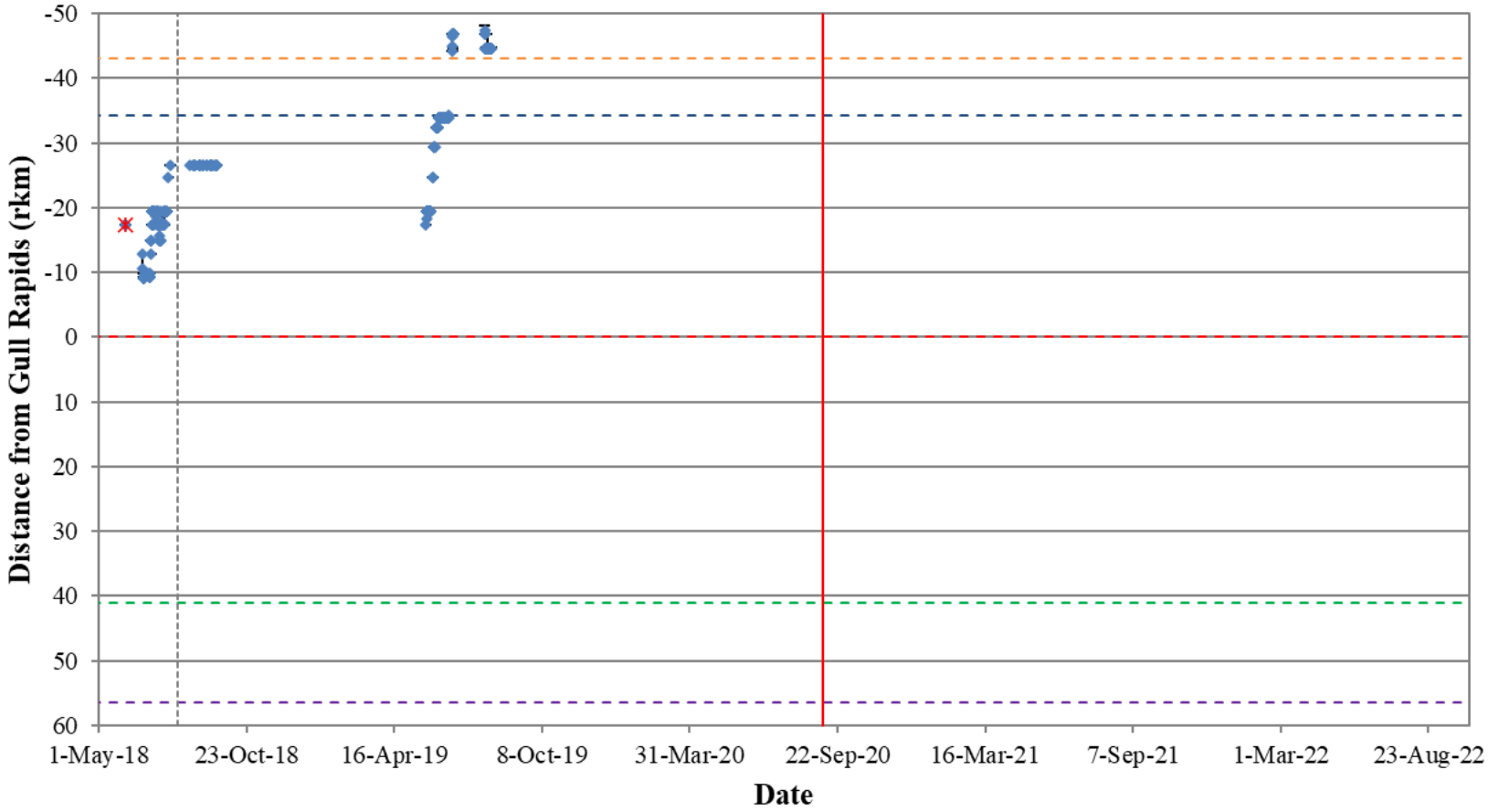

Figure A2-11: Position of a Walleye tagged with an acoustic transmitter (code #25750) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

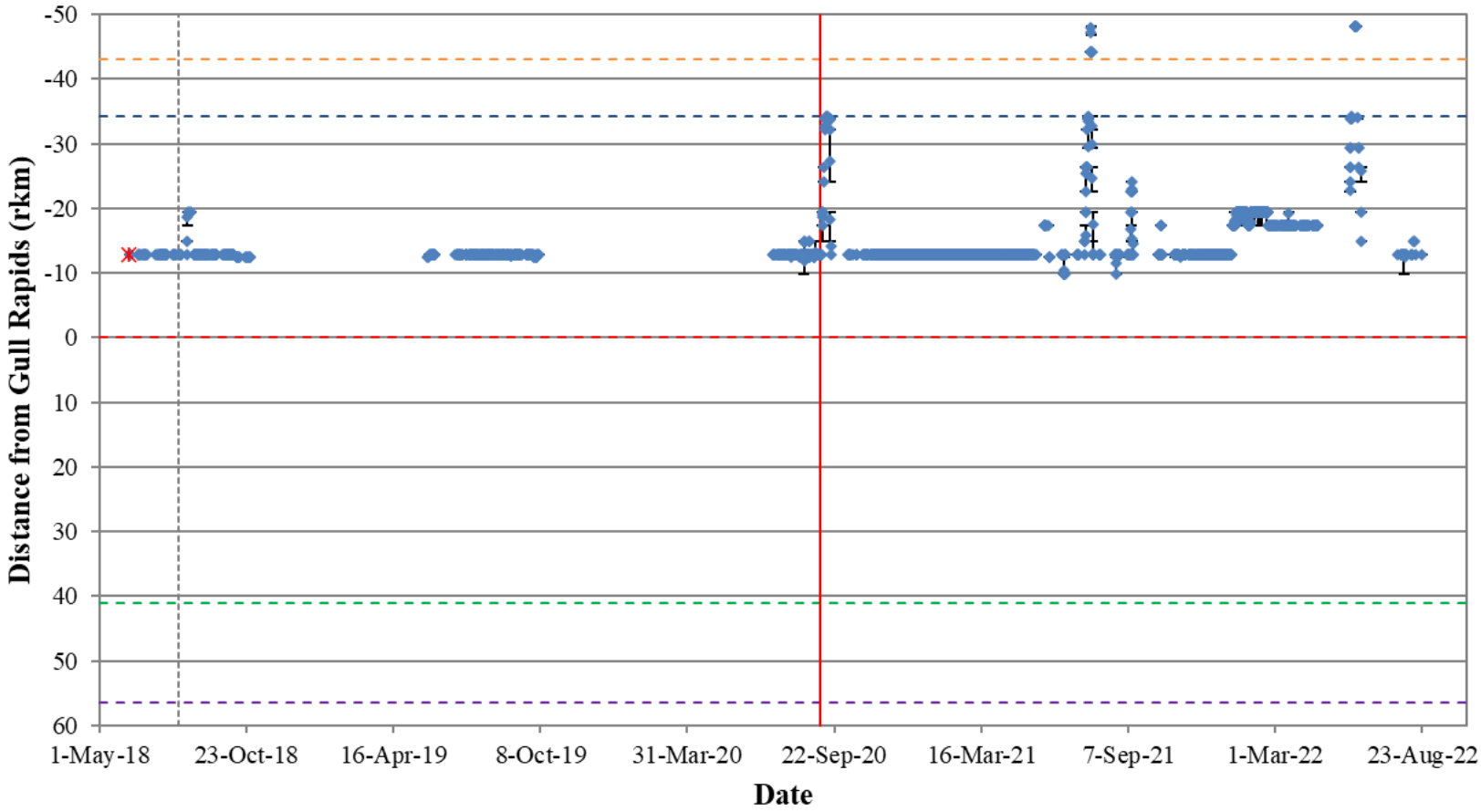

Figure A2-12: Position of a Walleye tagged with an acoustic transmitter (code #25751) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

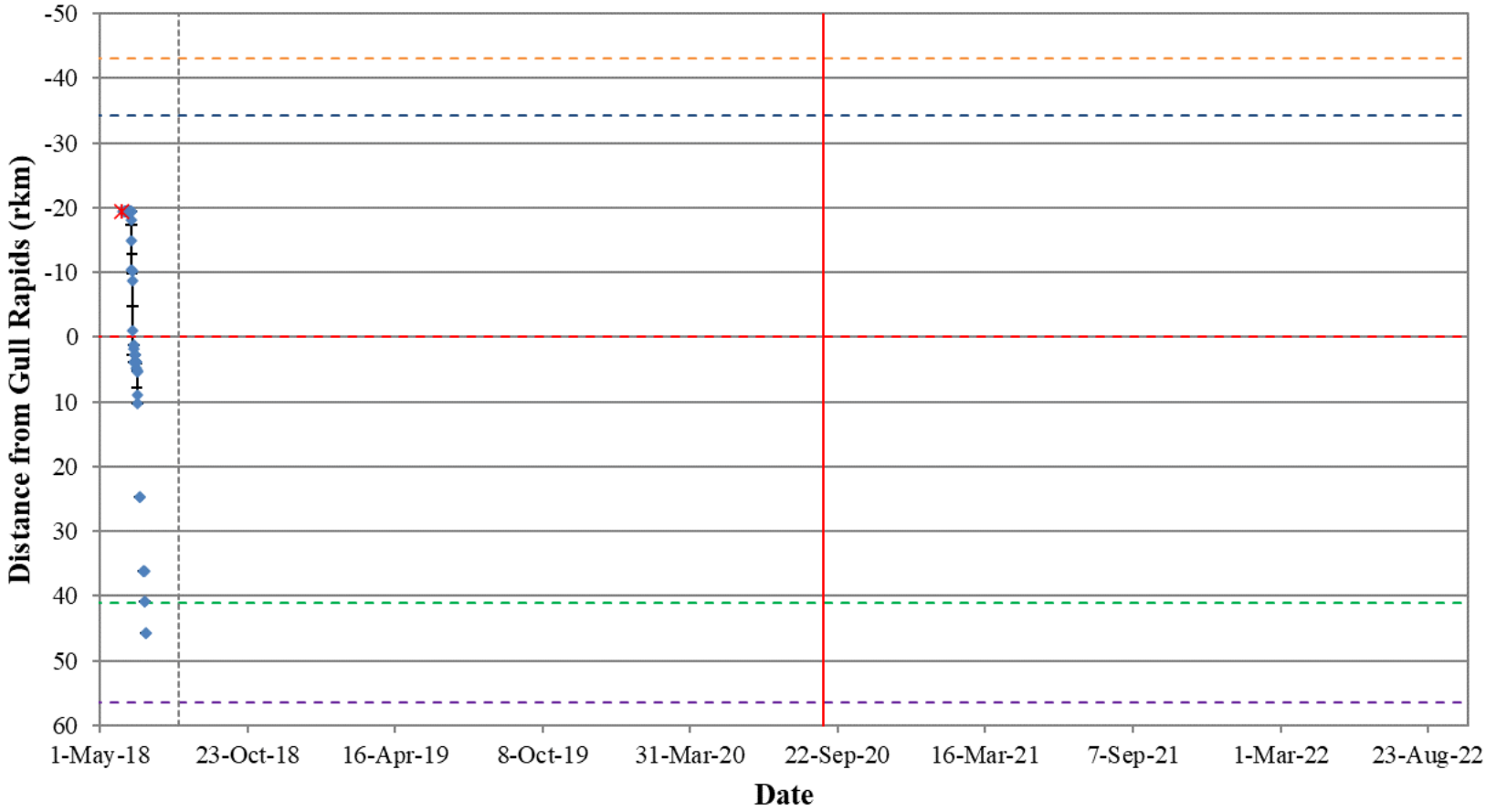

Figure A2-13: Position of a Walleye tagged with an acoustic transmitter (code #25752) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

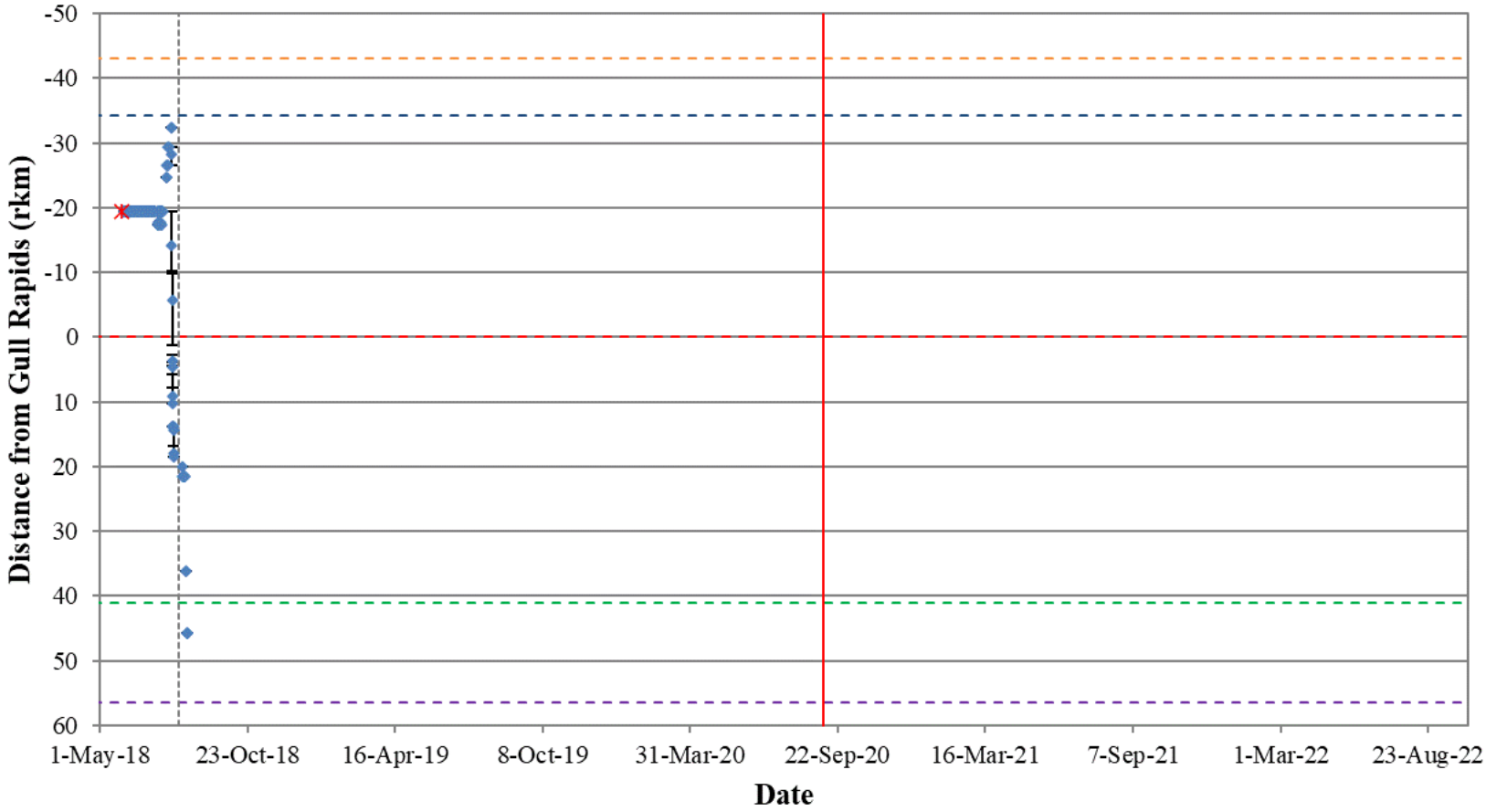

Figure A2-14: Position of a Walleye tagged with an acoustic transmitter (code #25753) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

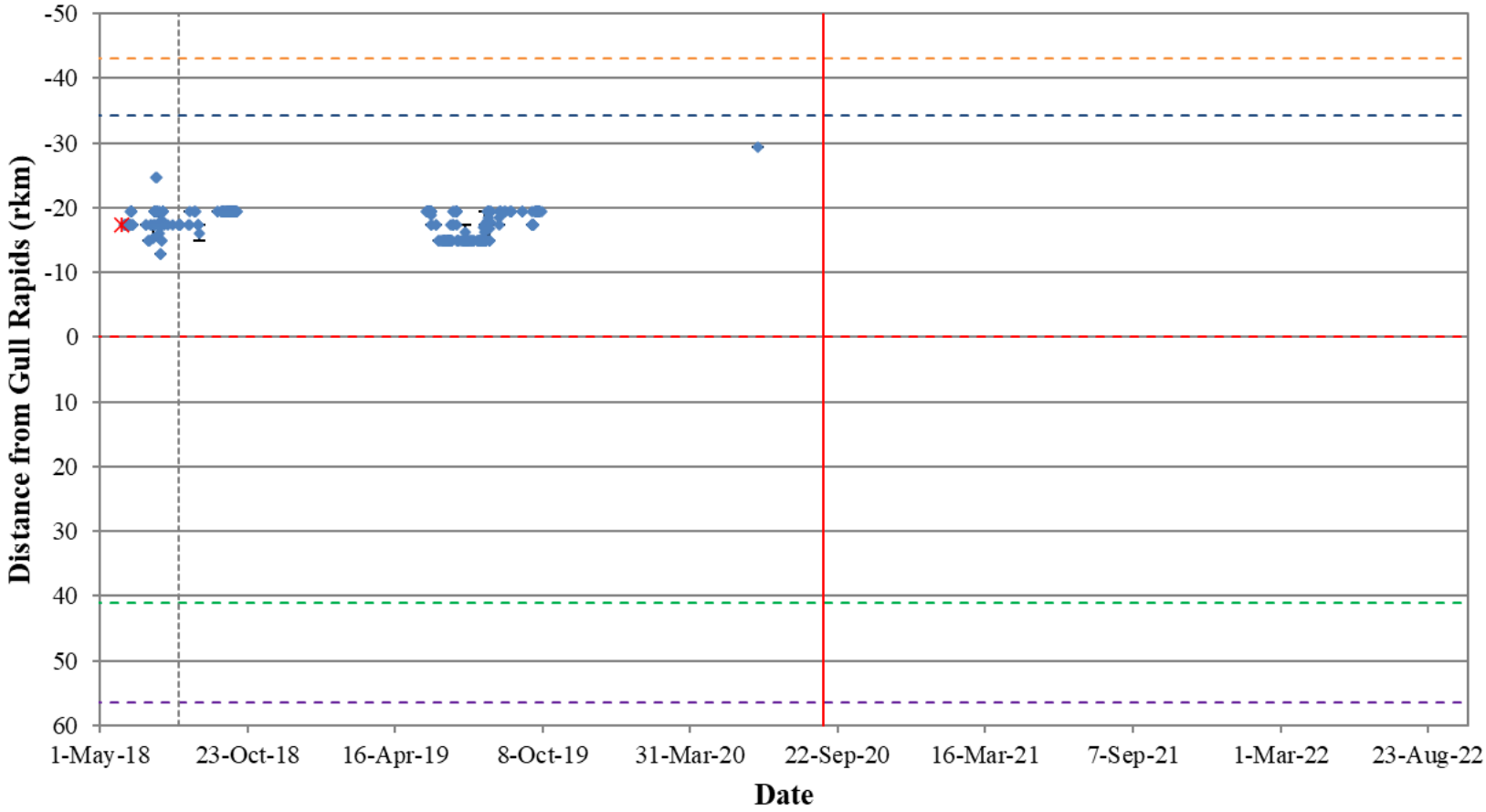

Figure A2-15: Position of a Walleye tagged with an acoustic transmitter (code #25754) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

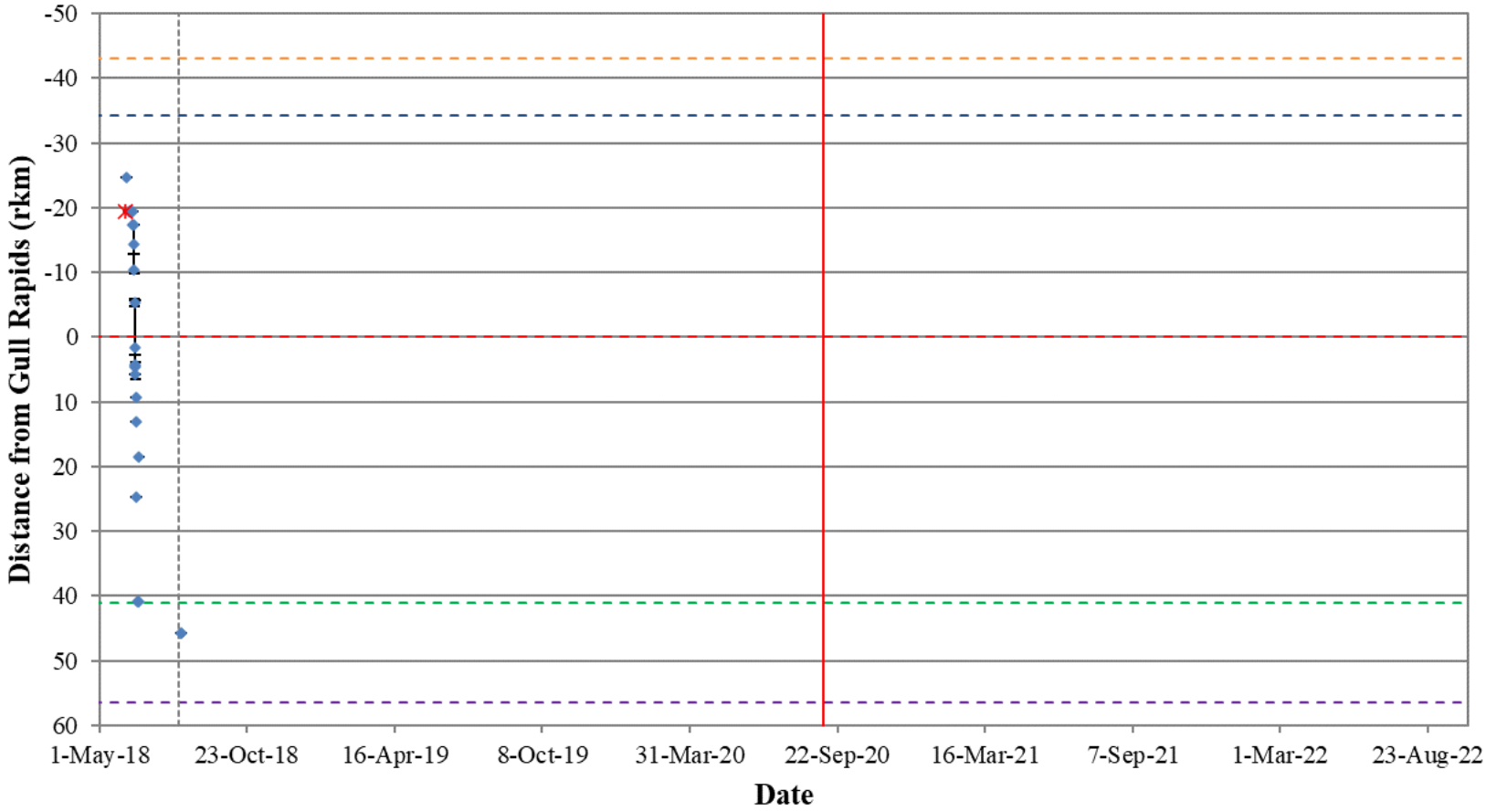

Figure A2-16: Position of a Walleye tagged with an acoustic transmitter (code #25755) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

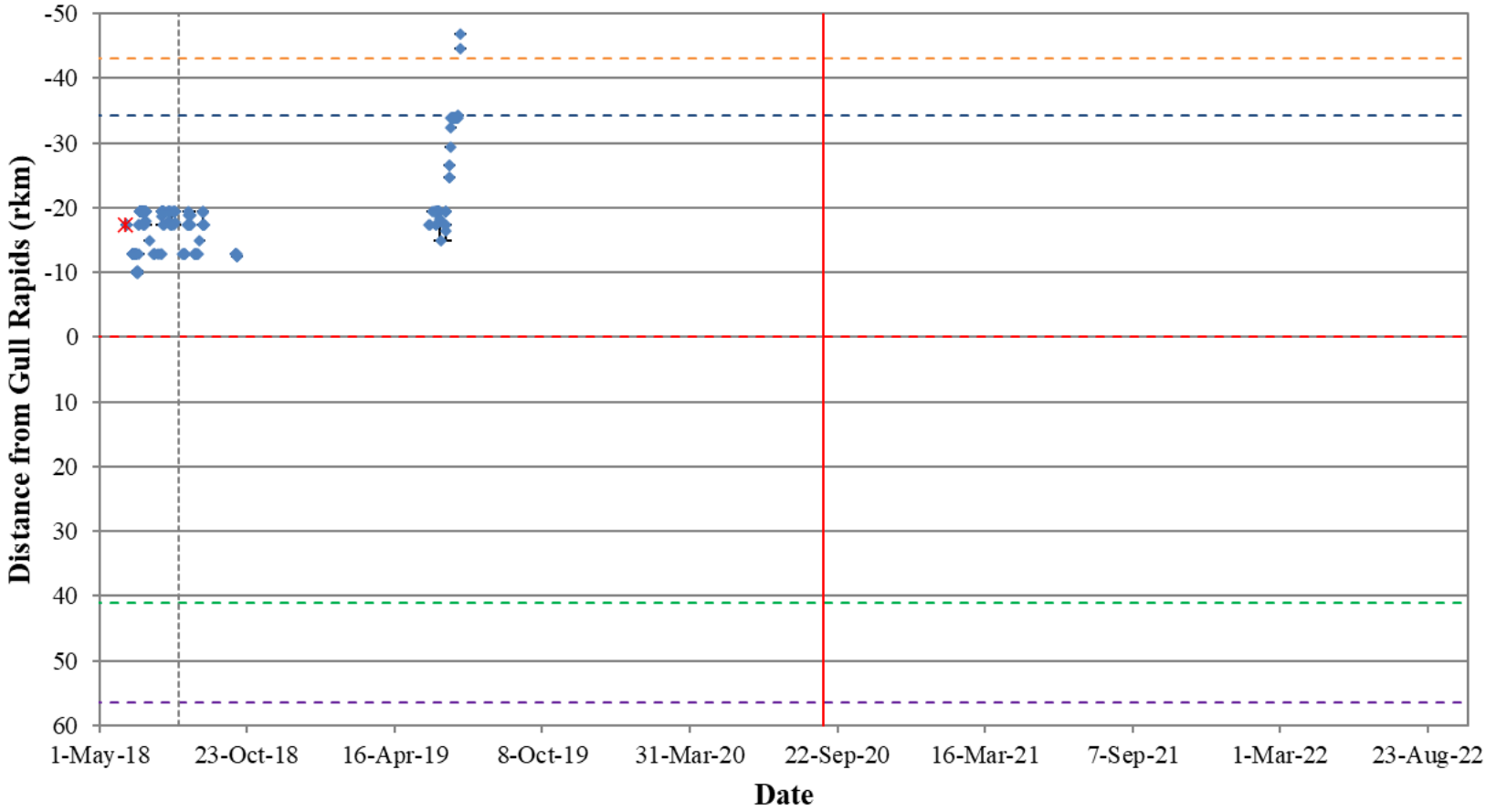

Figure A2-17: Position of a Walleye tagged with an acoustic transmitter (code #25756) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

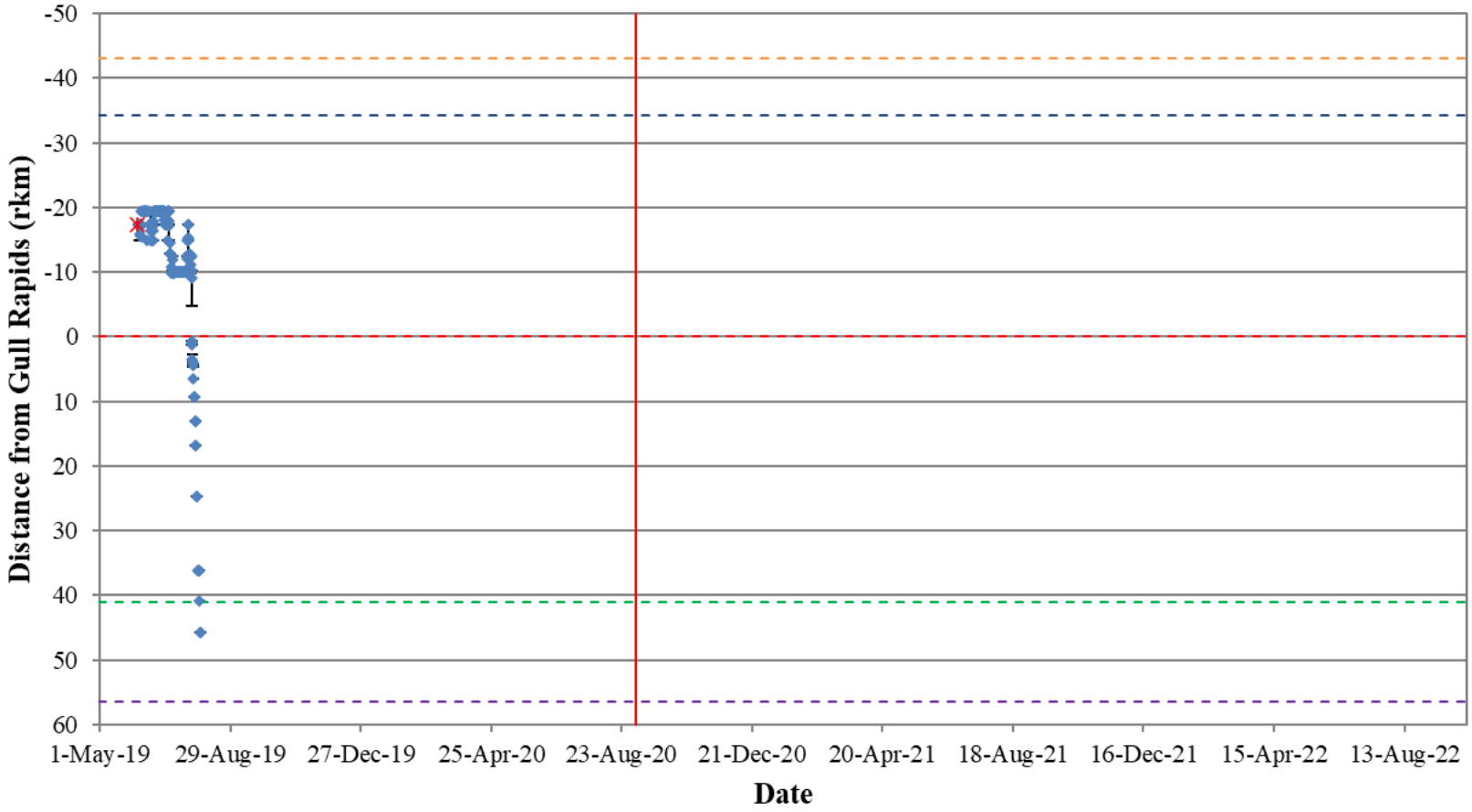

Figure A2-18: Position of a Walleye tagged with an acoustic transmitter (code #20147) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

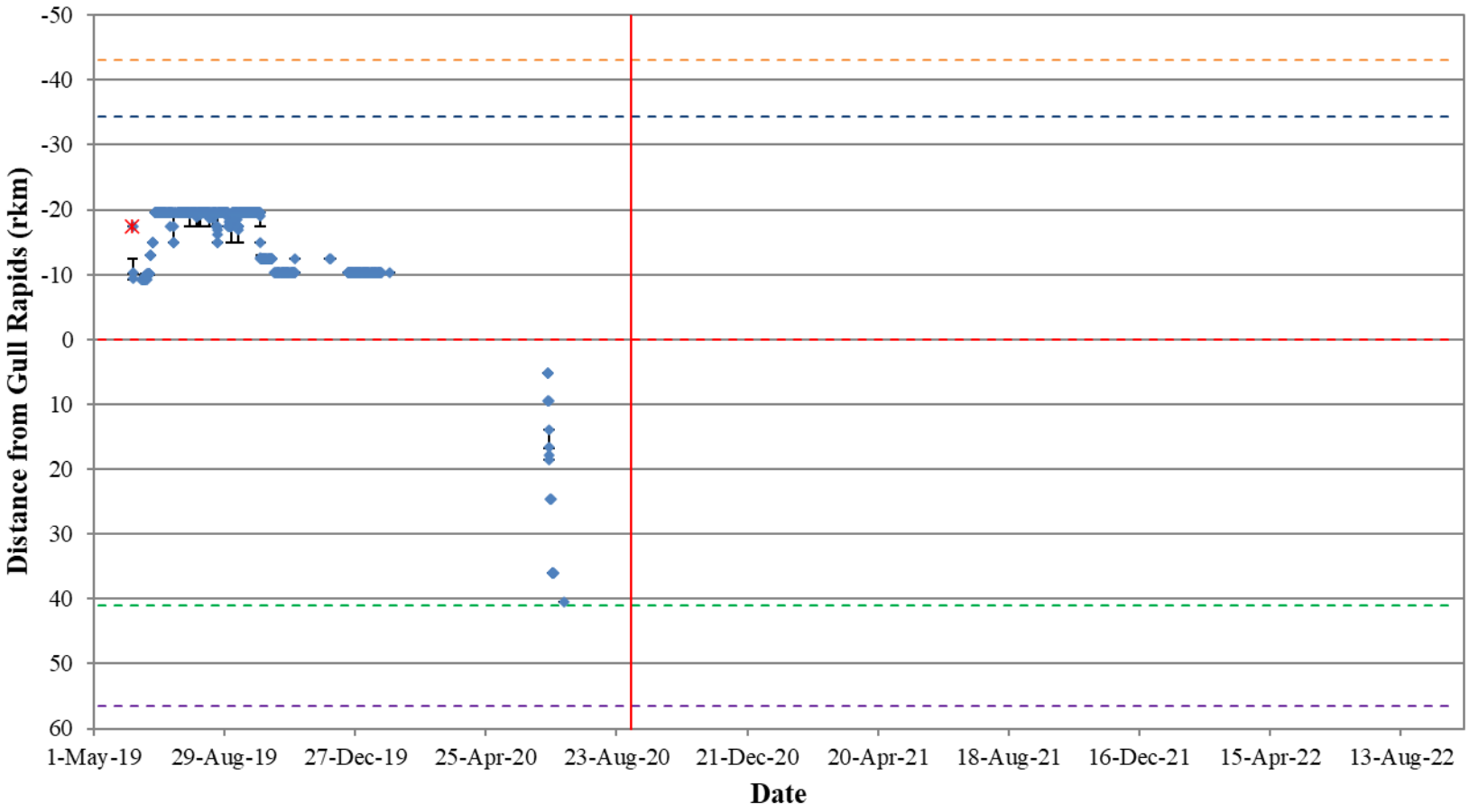

Figure A2-19: Position of a Walleye tagged with an acoustic transmitter (code #20148) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

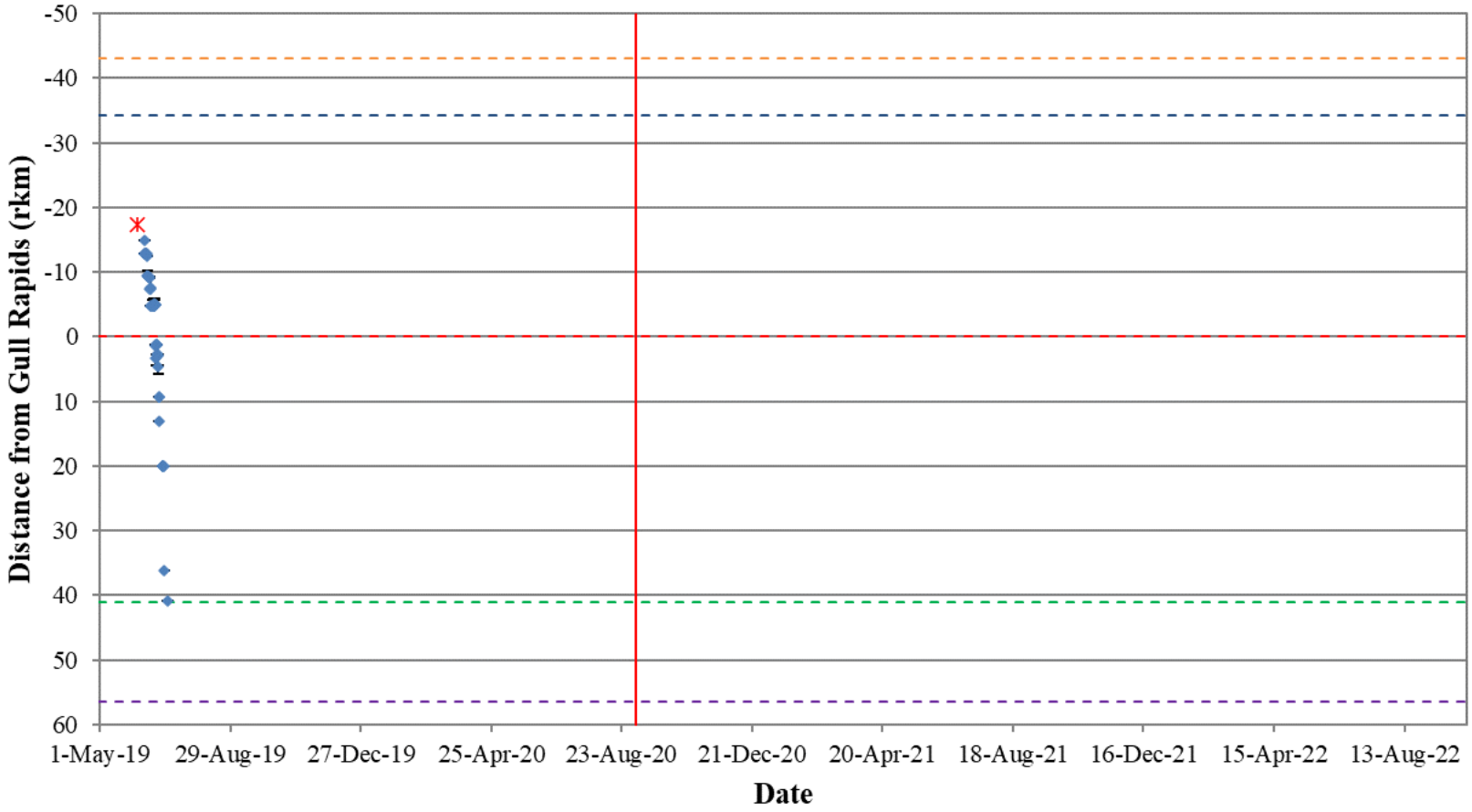

Figure A2-20: Position of a Walleye tagged with an acoustic transmitter (code #20149) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

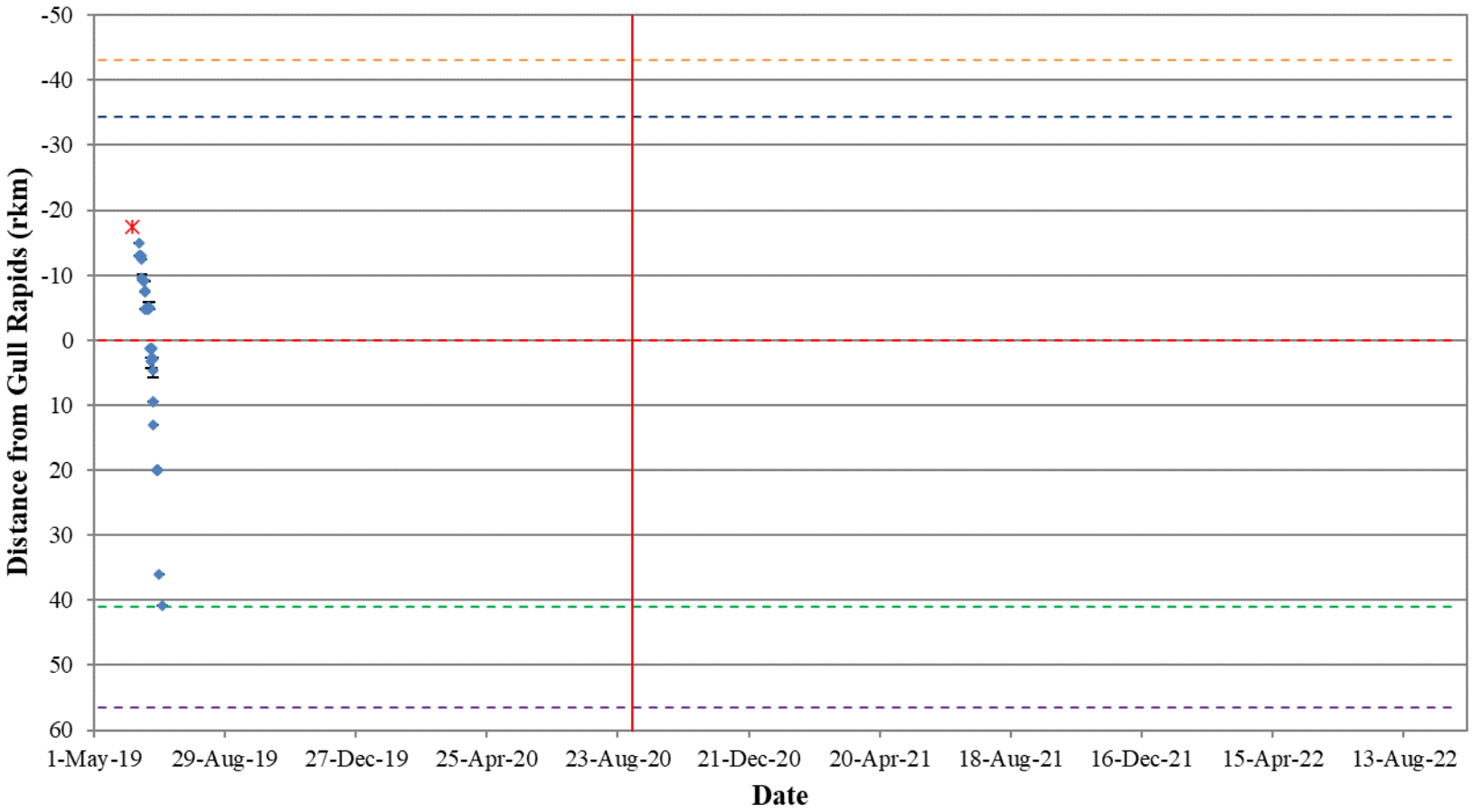

Figure A2-21: Position of a Walleye tagged with an acoustic transmitter (code #20150) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

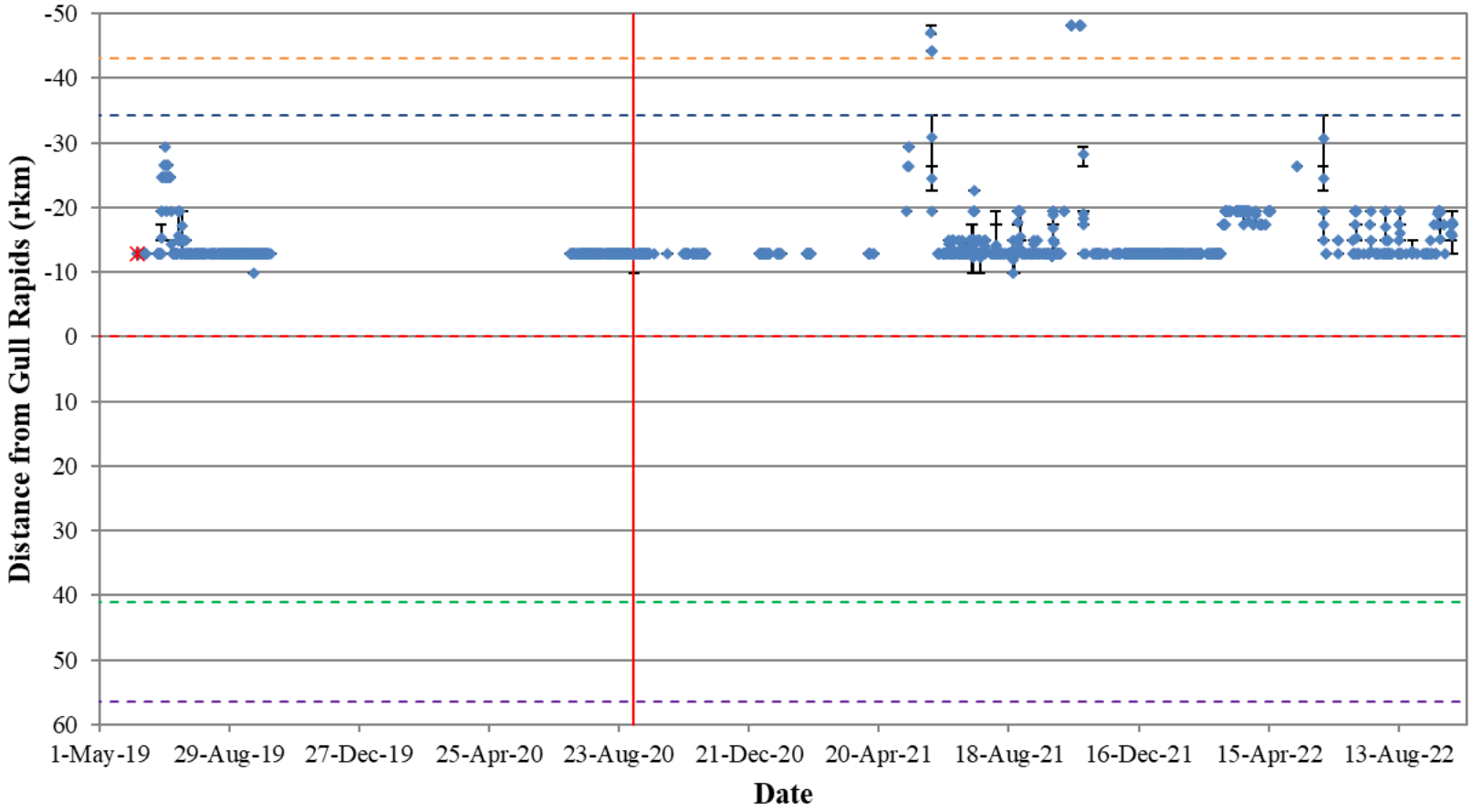

Figure A2-22: Position of a Walleye tagged with an acoustic transmitter (code #20151) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

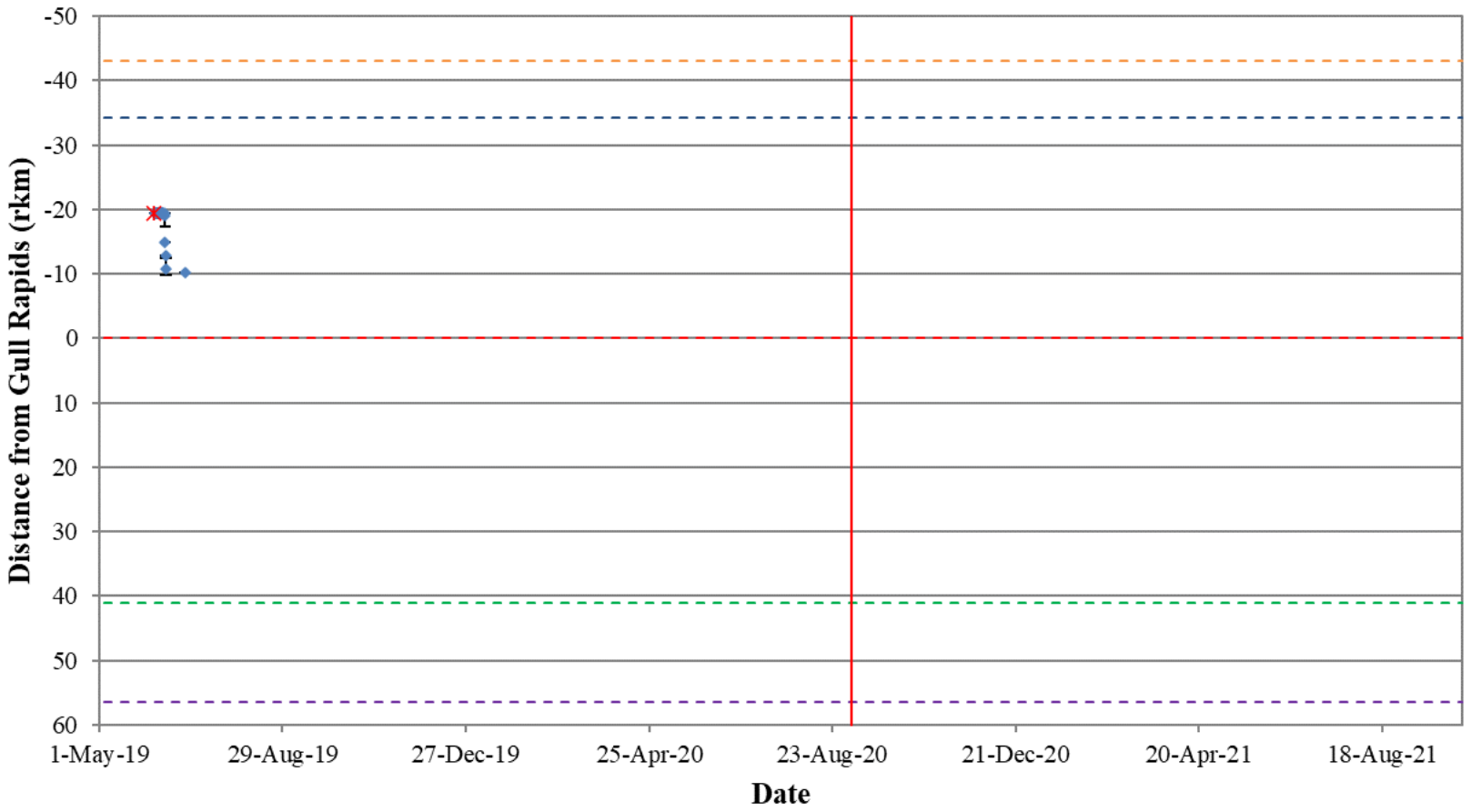

Figure A2-23: Position of a Walleye tagged with an acoustic transmitter (code #20153) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

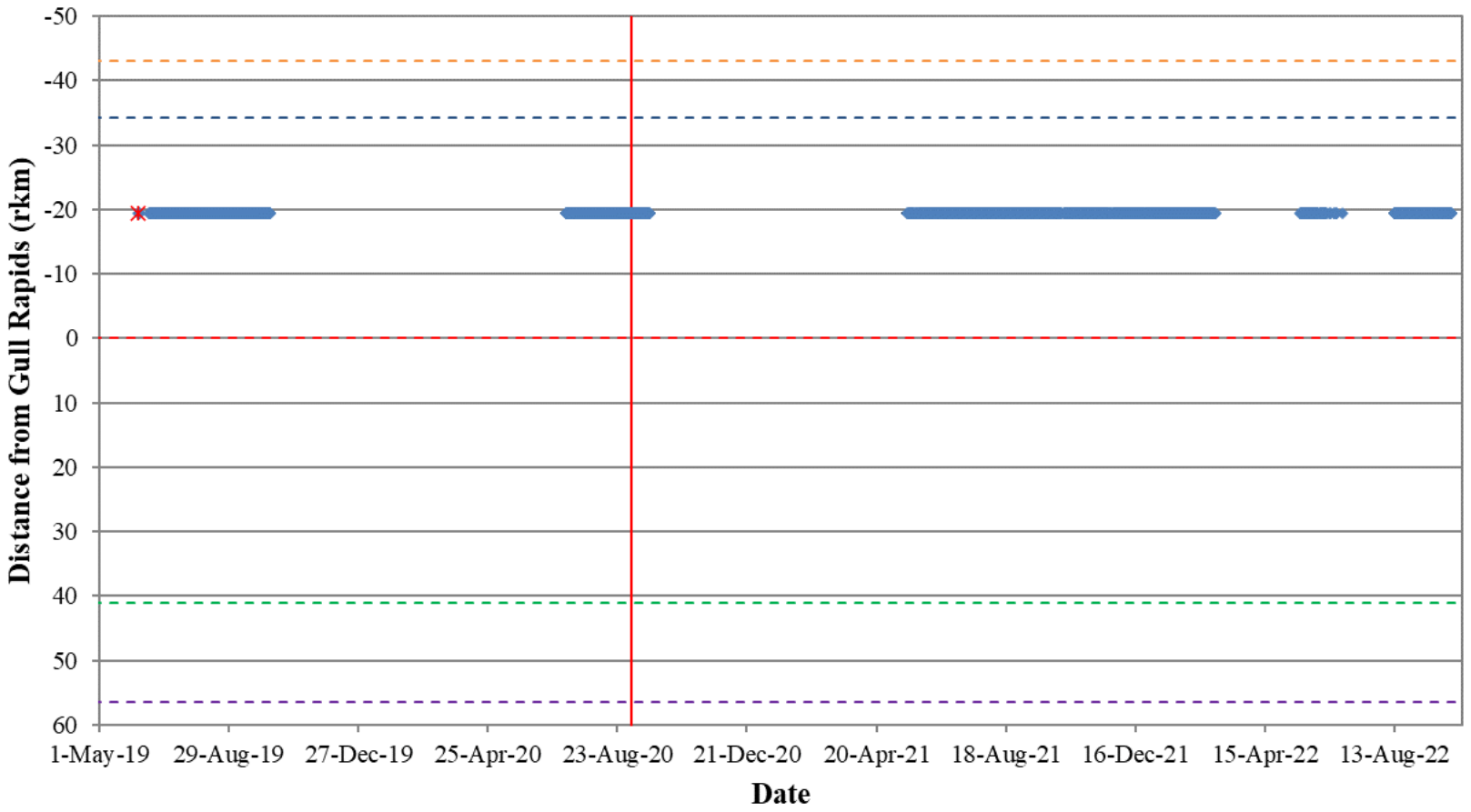

Figure A2-24: Position of a Walleye tagged with an acoustic transmitter (code #20154) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce (purple).

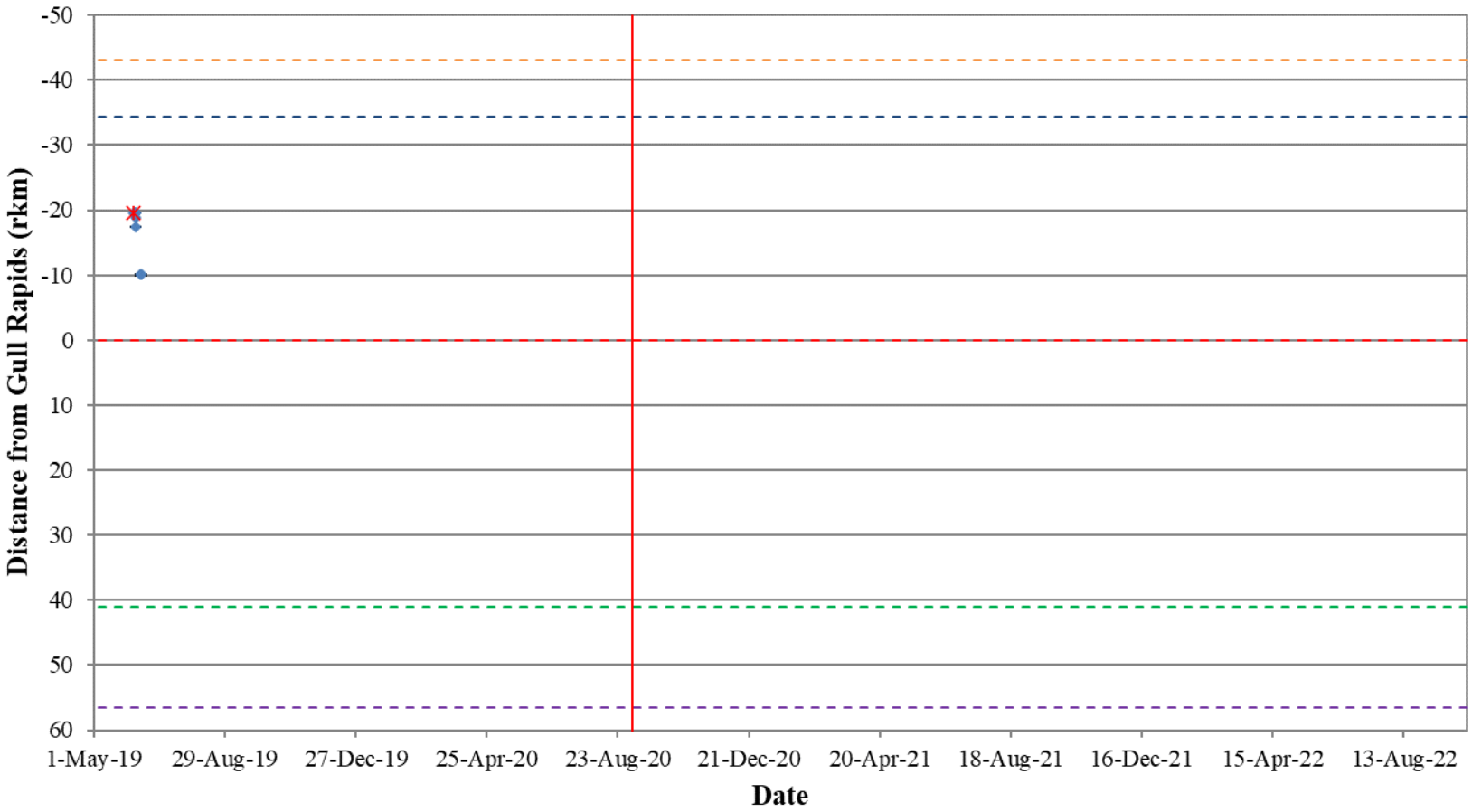

Figure A2-25: Position of a Walleye tagged with an acoustic transmitter (code #20155) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

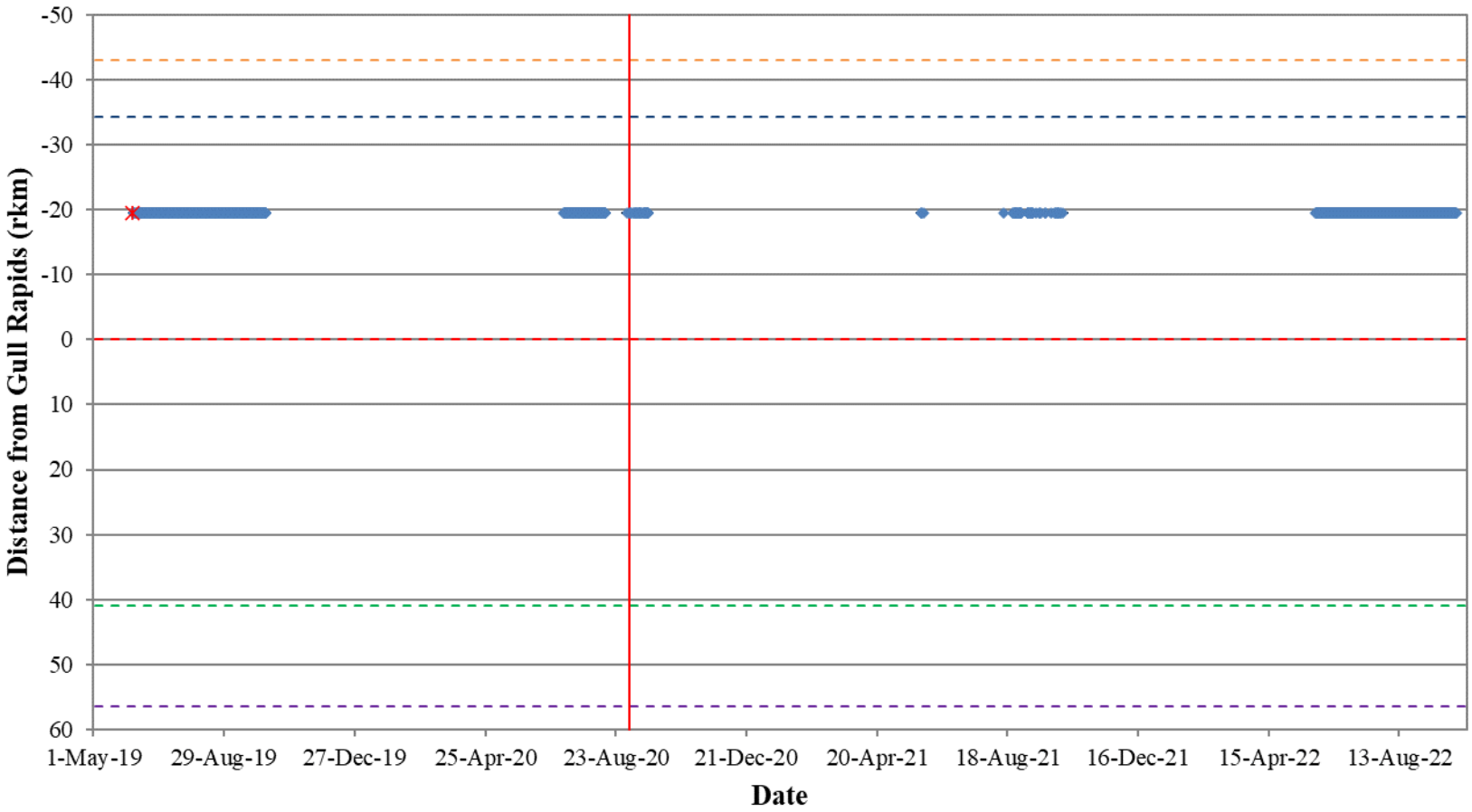

Figure A2-26: Position of a Walleye tagged with an acoustic transmitter (code #20156) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

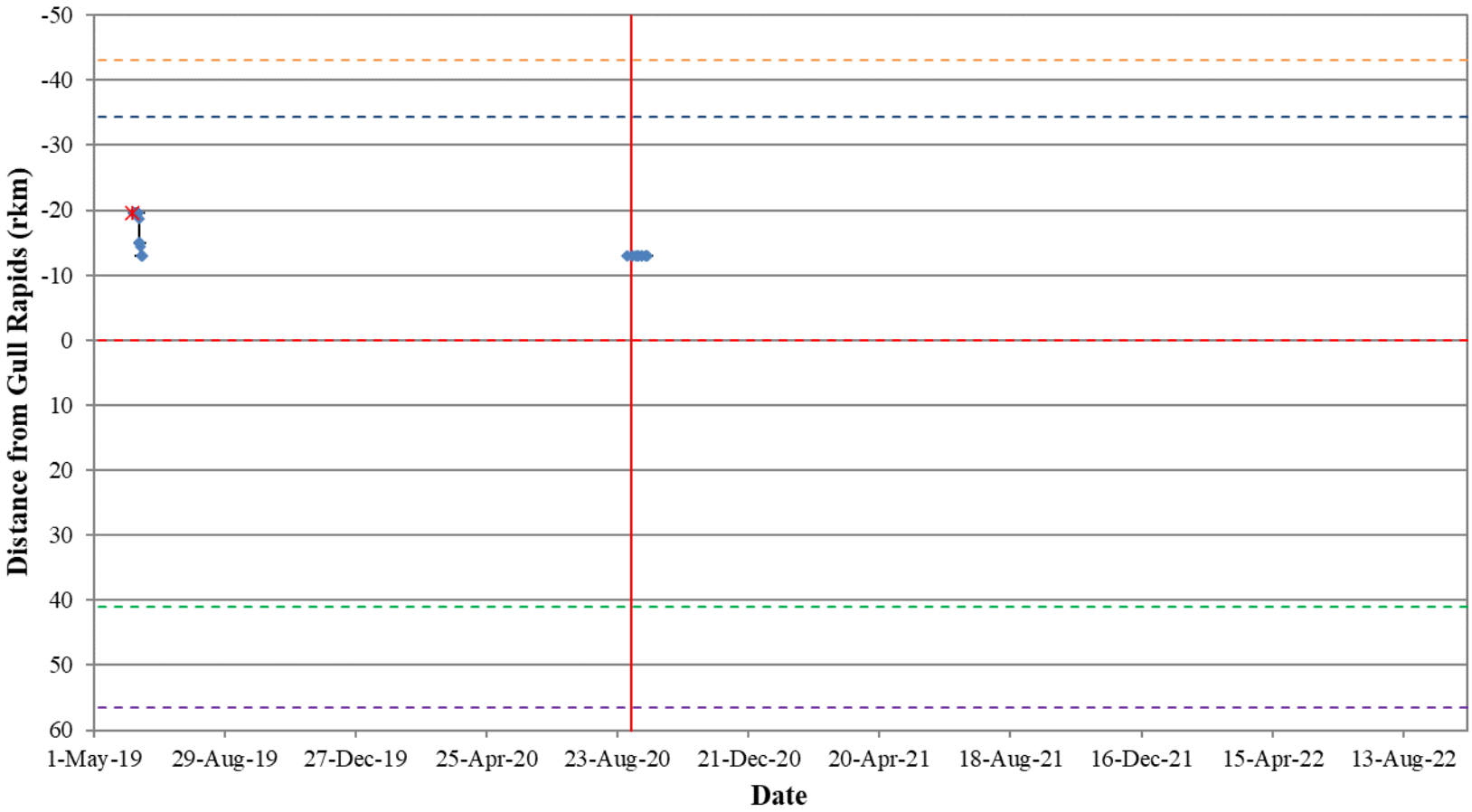

Figure A2-27: Position of a Walleye tagged with an acoustic transmitter (code #20157) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

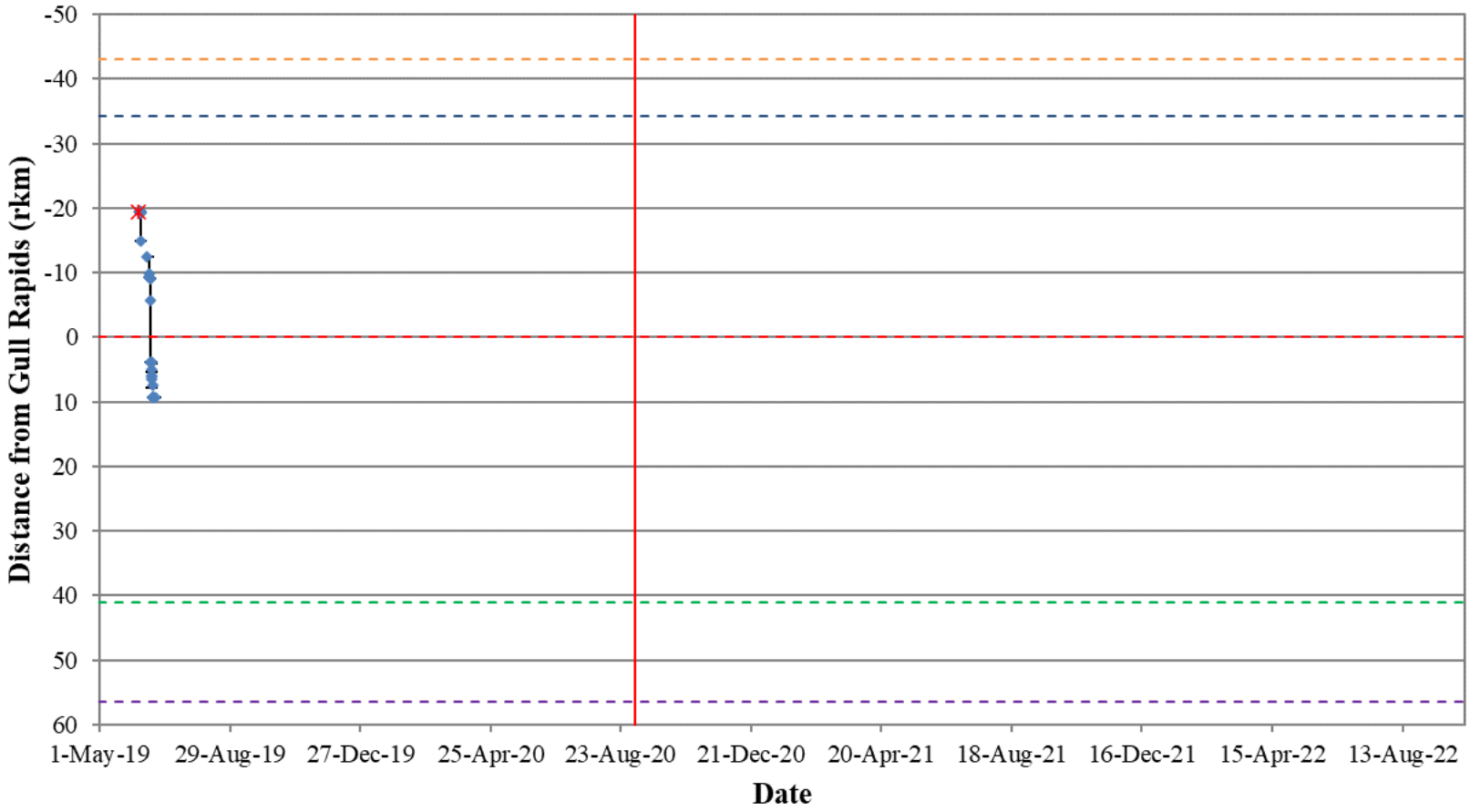

Figure A2-28: Position of a Walleye tagged with an acoustic transmitter (code #20158) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

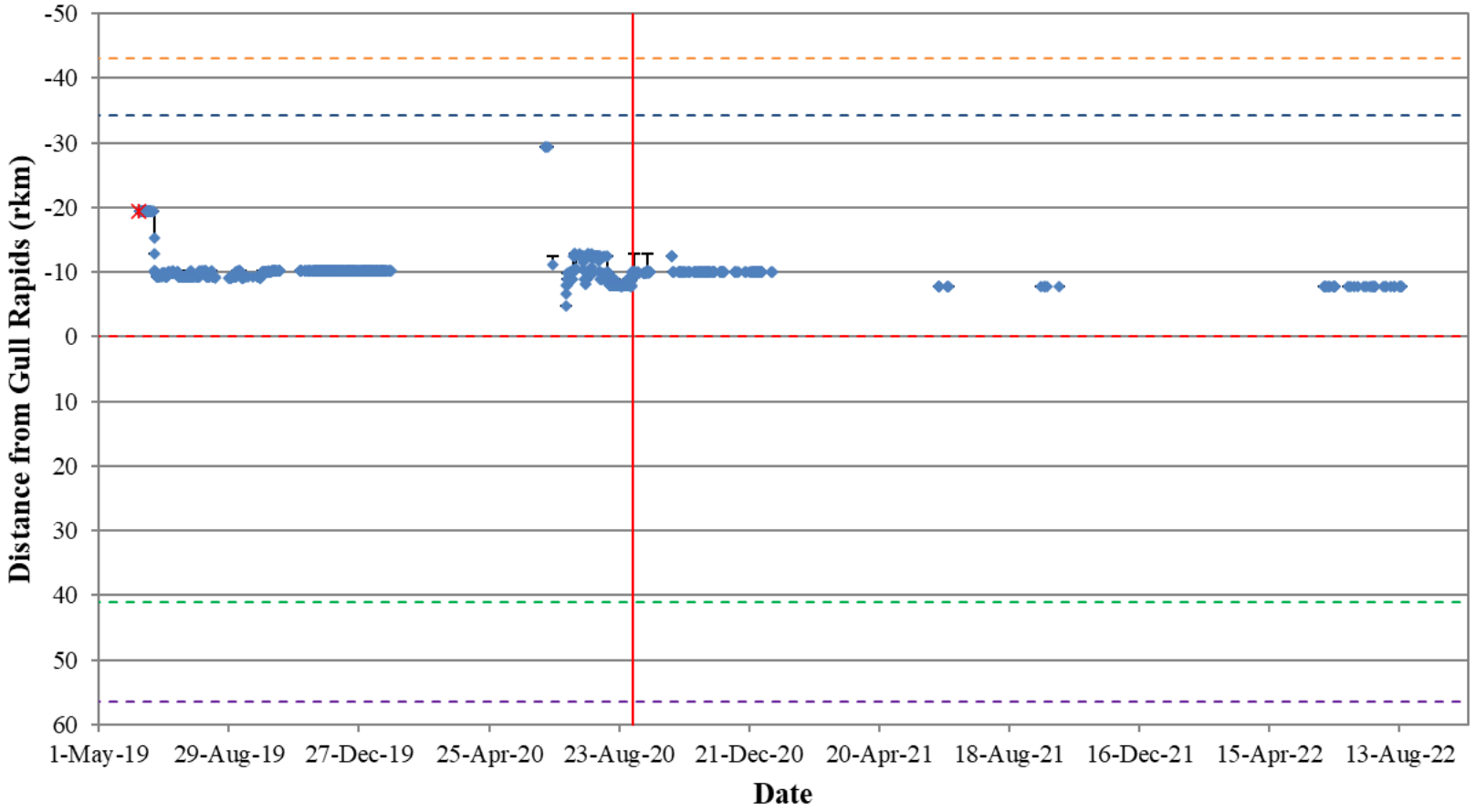

Figure A2-29: Position of a Walleye tagged with an acoustic transmitter (code #20159) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

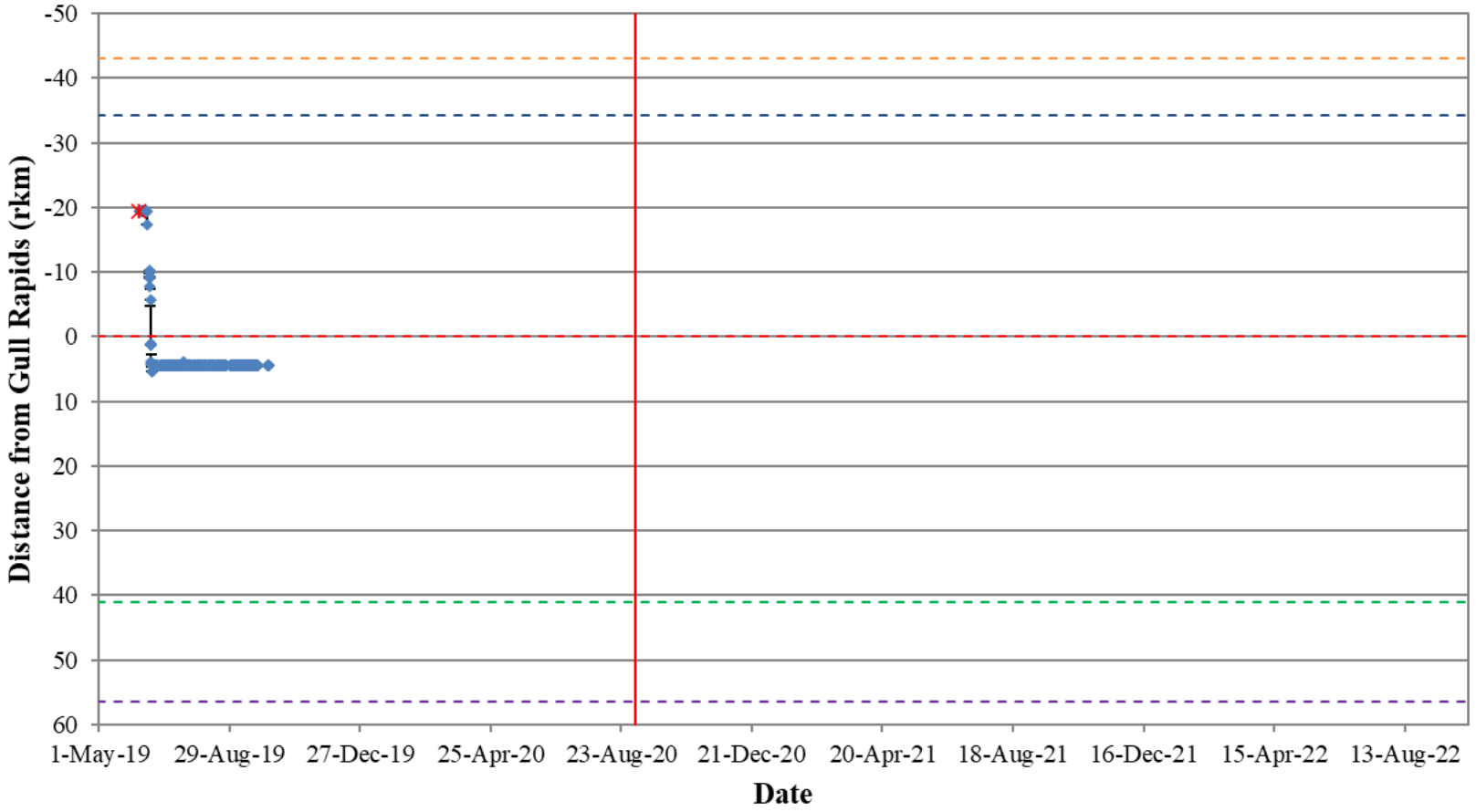

Figure A2-30: Position of a Walleye tagged with an acoustic transmitter (code #20160) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

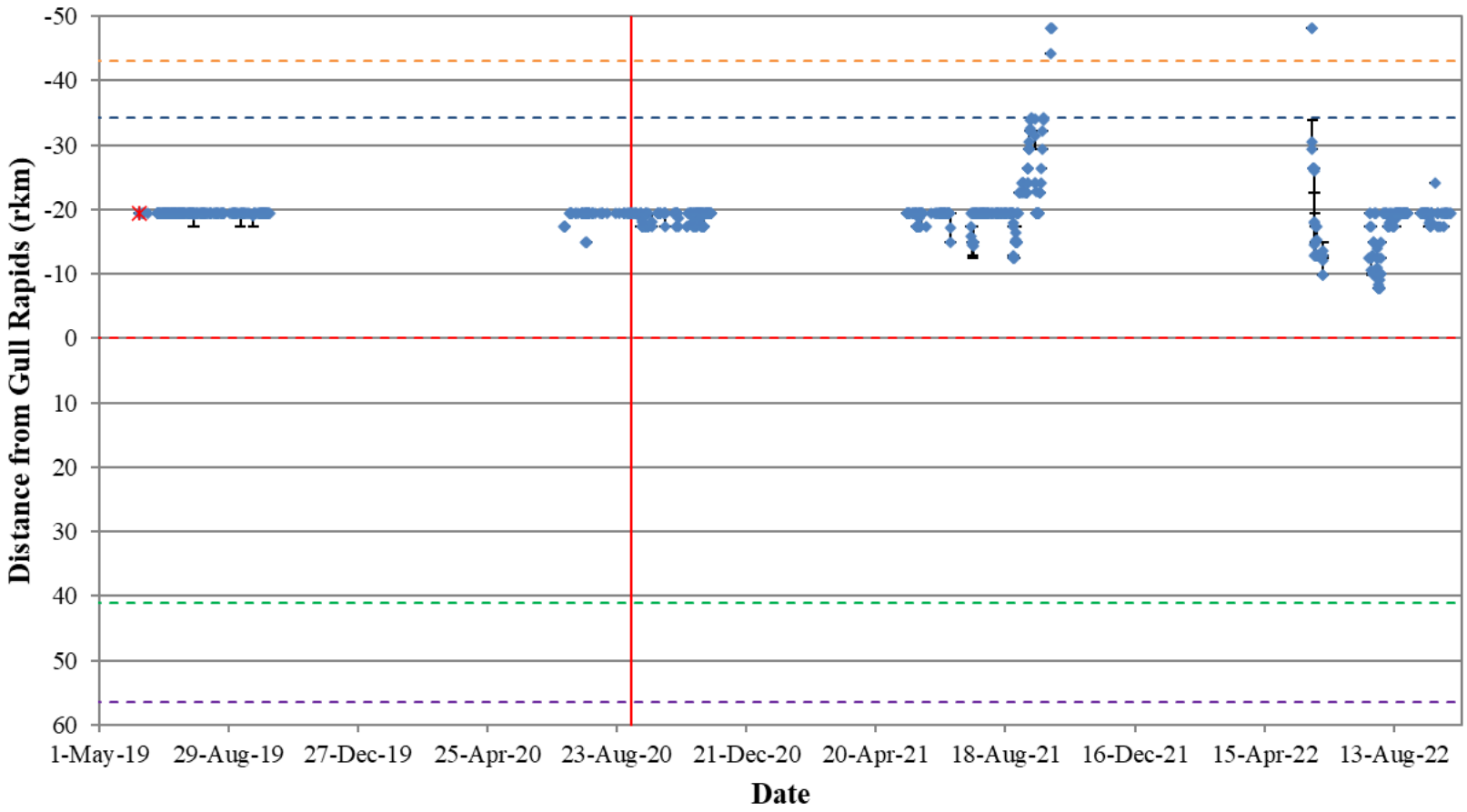

Figure A2-31: Position of a Walleye tagged with an acoustic transmitter (code #20161) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

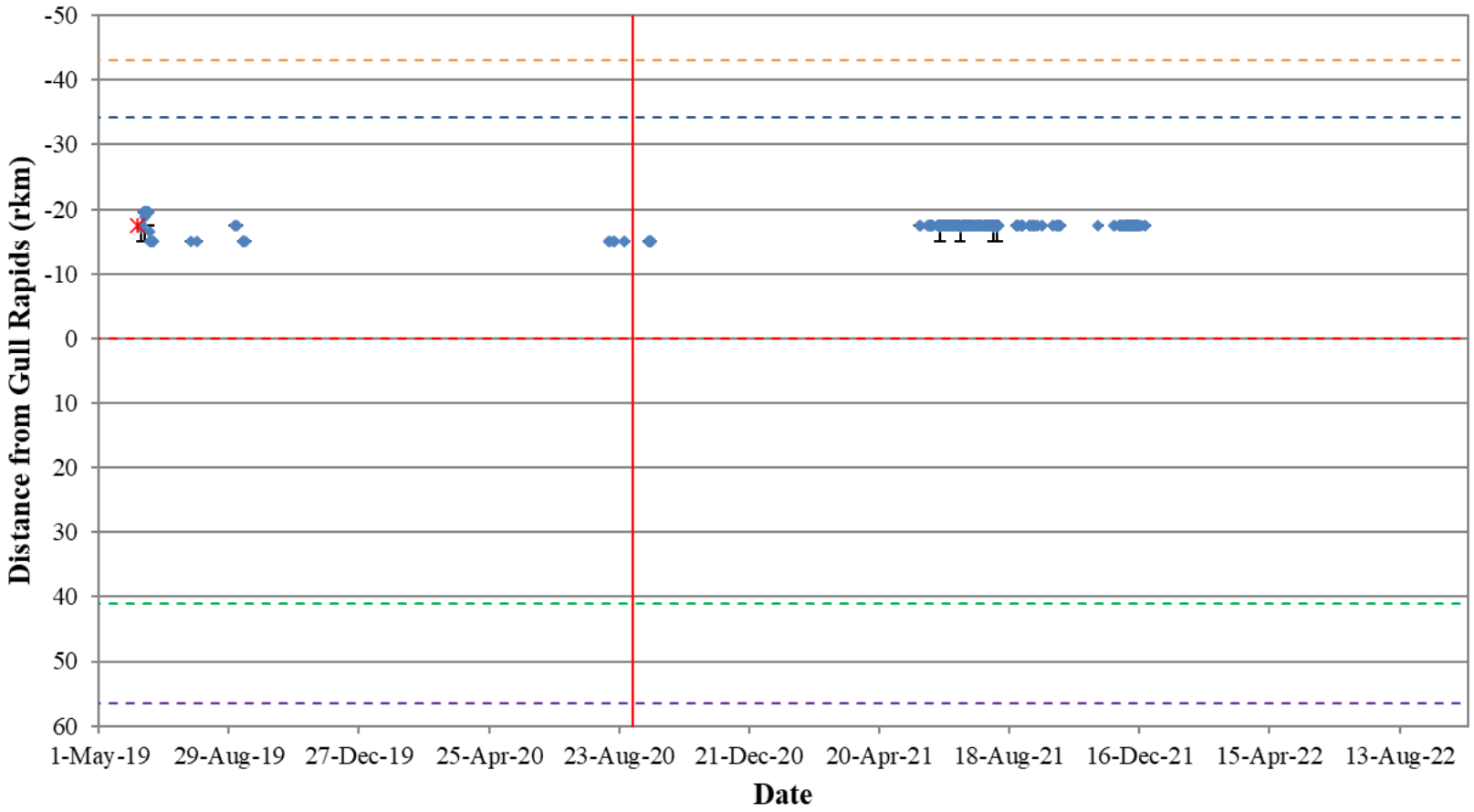

Figure A2-32: Position of a Walleye tagged with an acoustic transmitter (code #20162) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

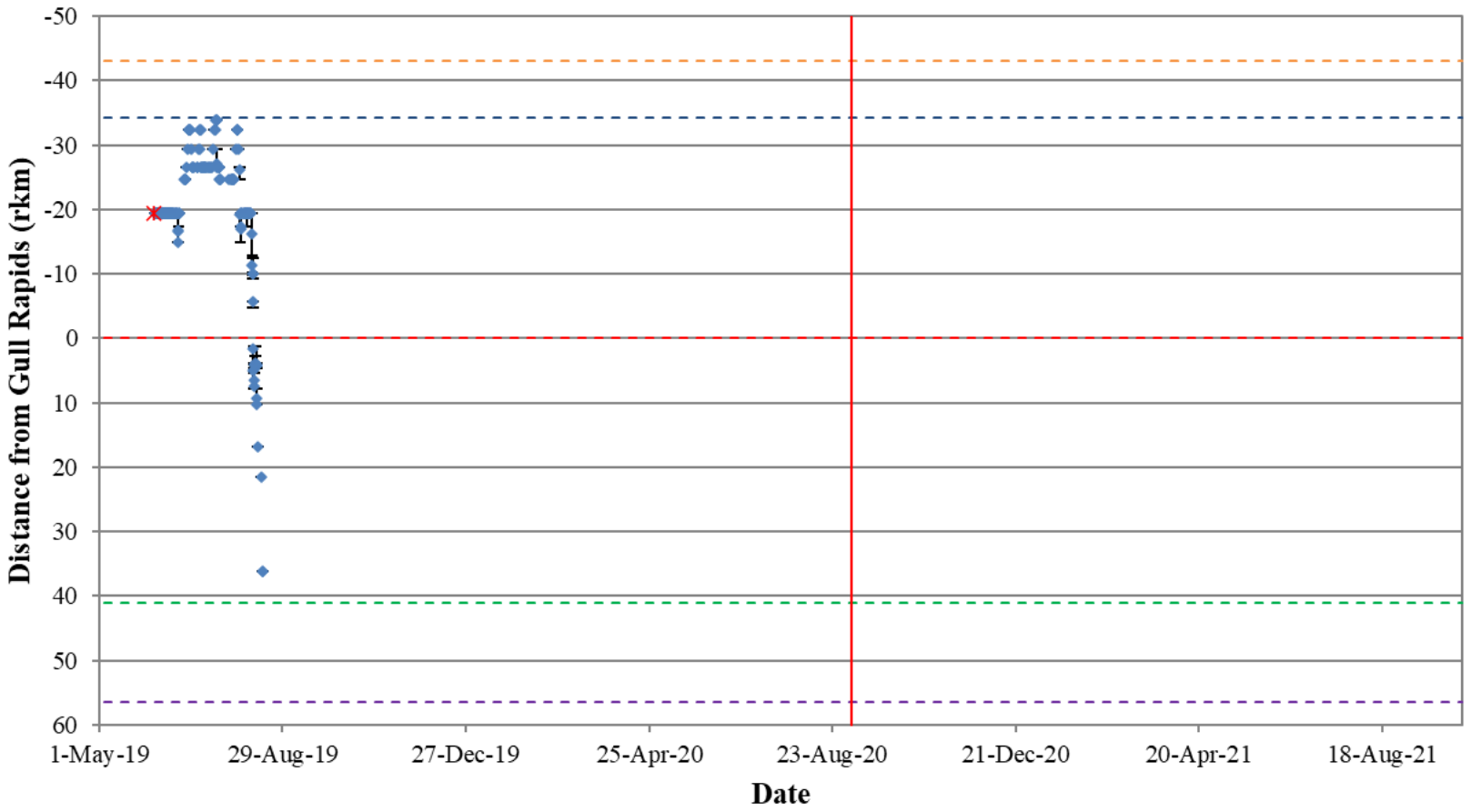

Figure A2-33: Position of a Walleye tagged with an acoustic transmitter (code #20163) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

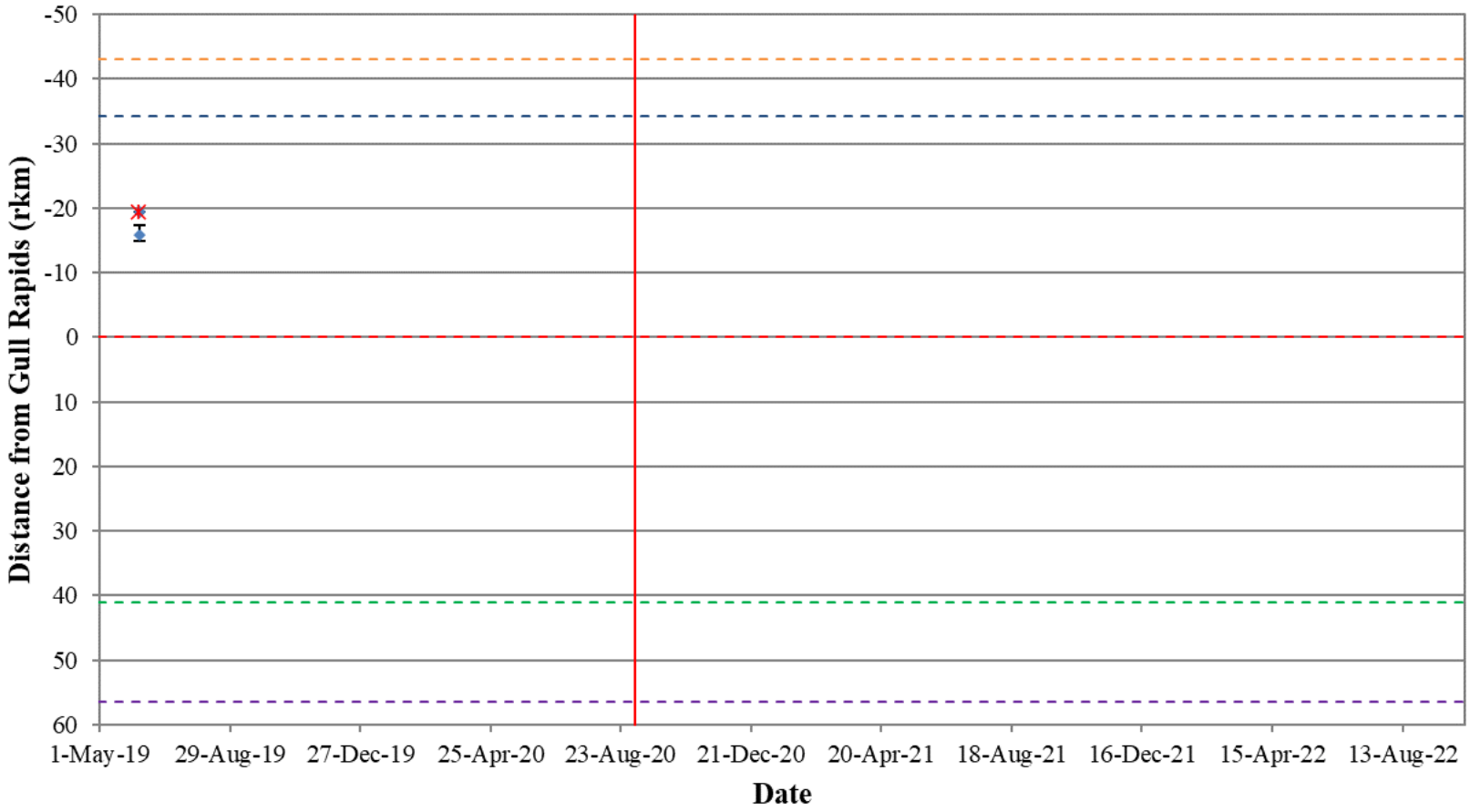

Figure A2-34: Position of a Walleye tagged with an acoustic transmitter (code #20164) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

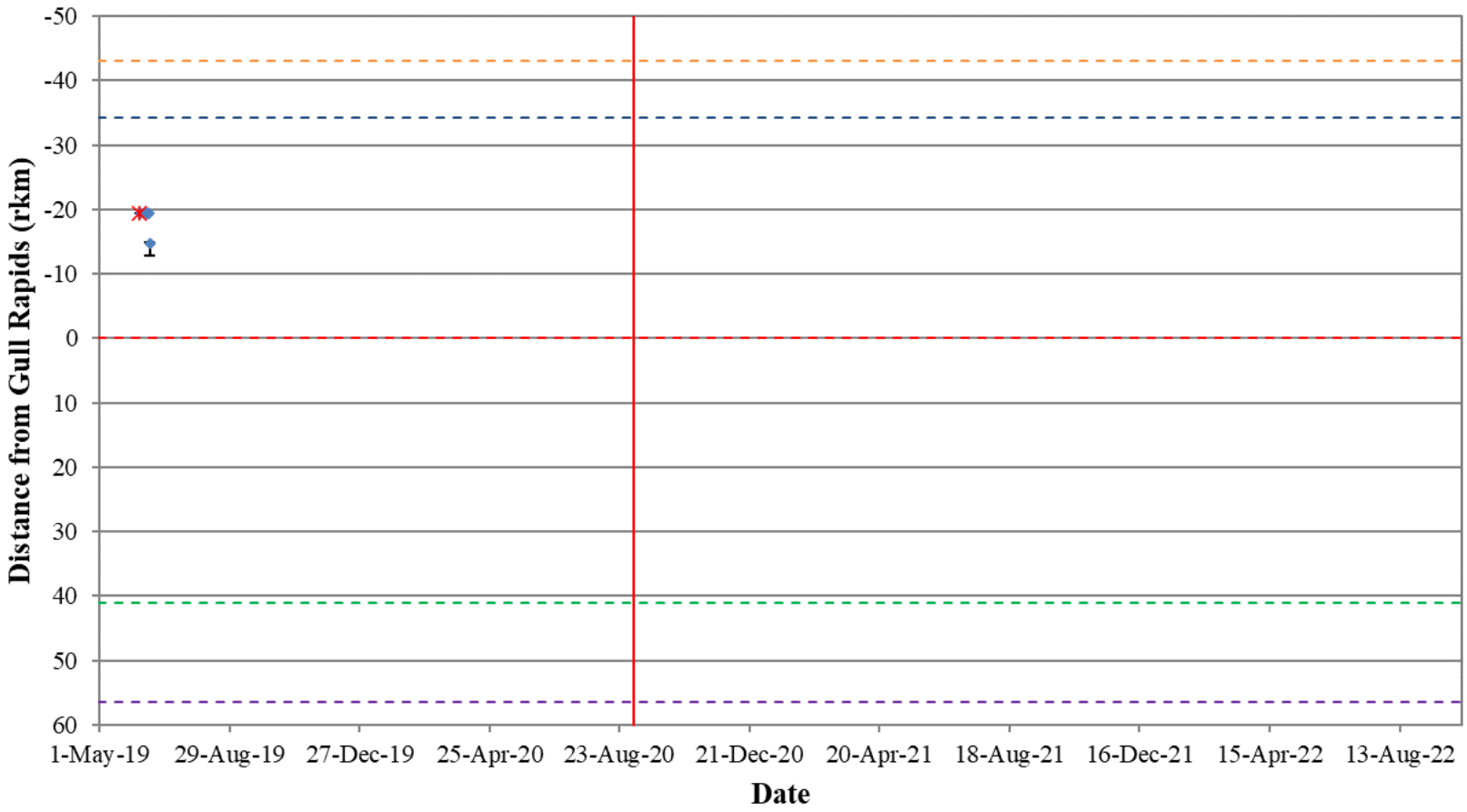

Figure A2-35: Position of a Walleye tagged with an acoustic transmitter (code #20169) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

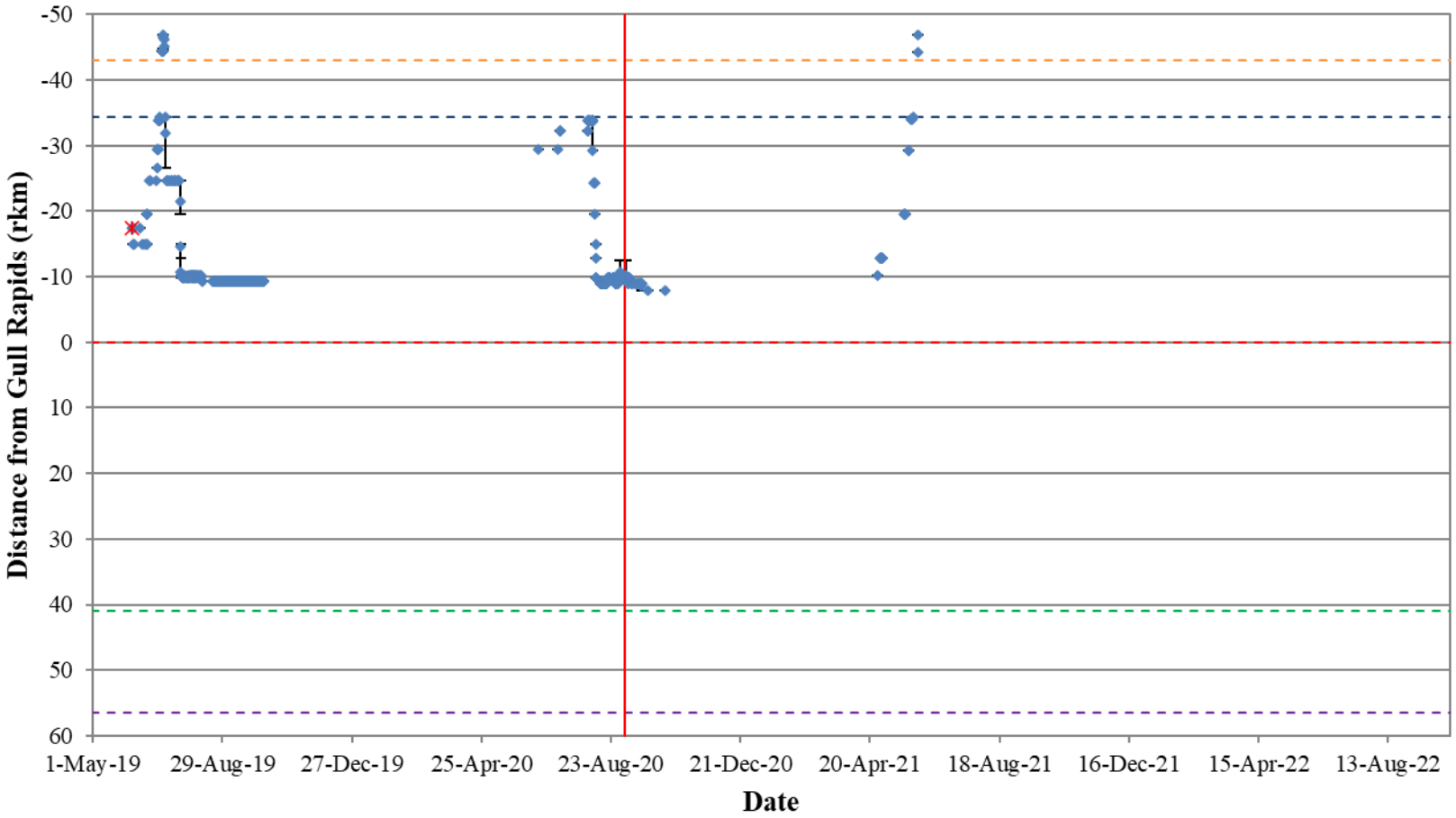

Figure A2-36: Position of a Walleye tagged with an acoustic transmitter (code #20170) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

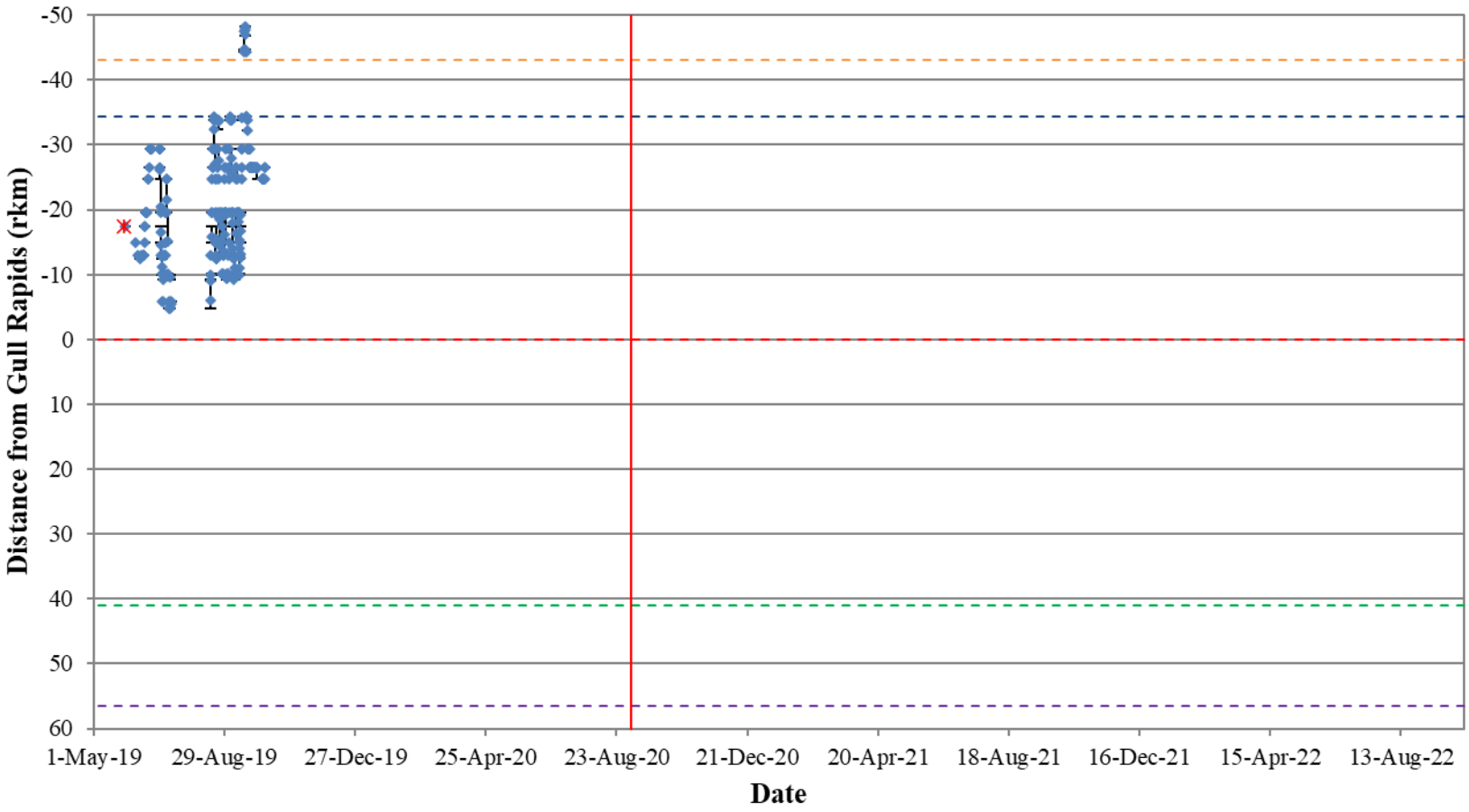

Figure A2-37: Position of a Walleye tagged with an acoustic transmitter (code #20175) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

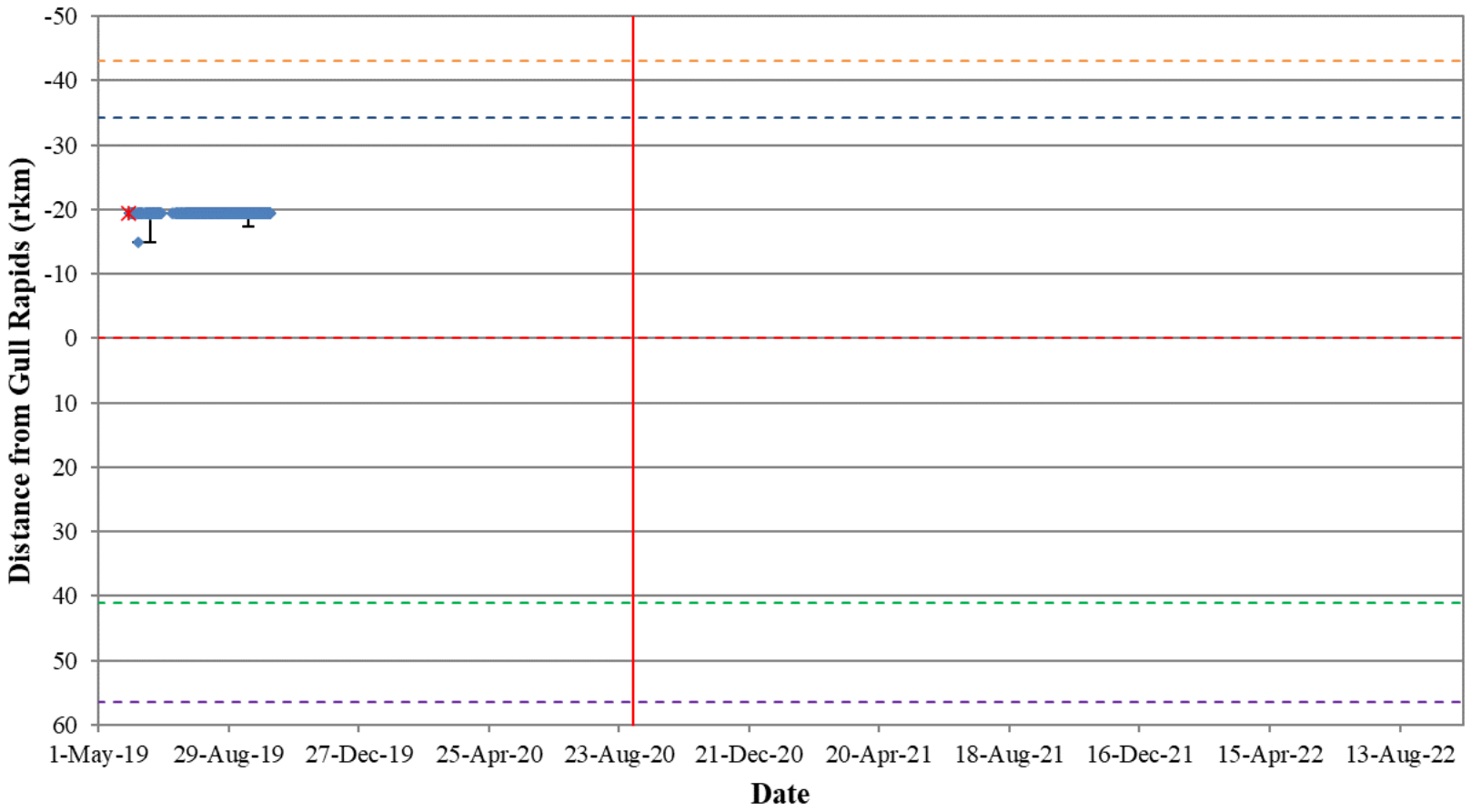

Figure A2-38: Position of a Walleye tagged with an acoustic transmitter (code #20176) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

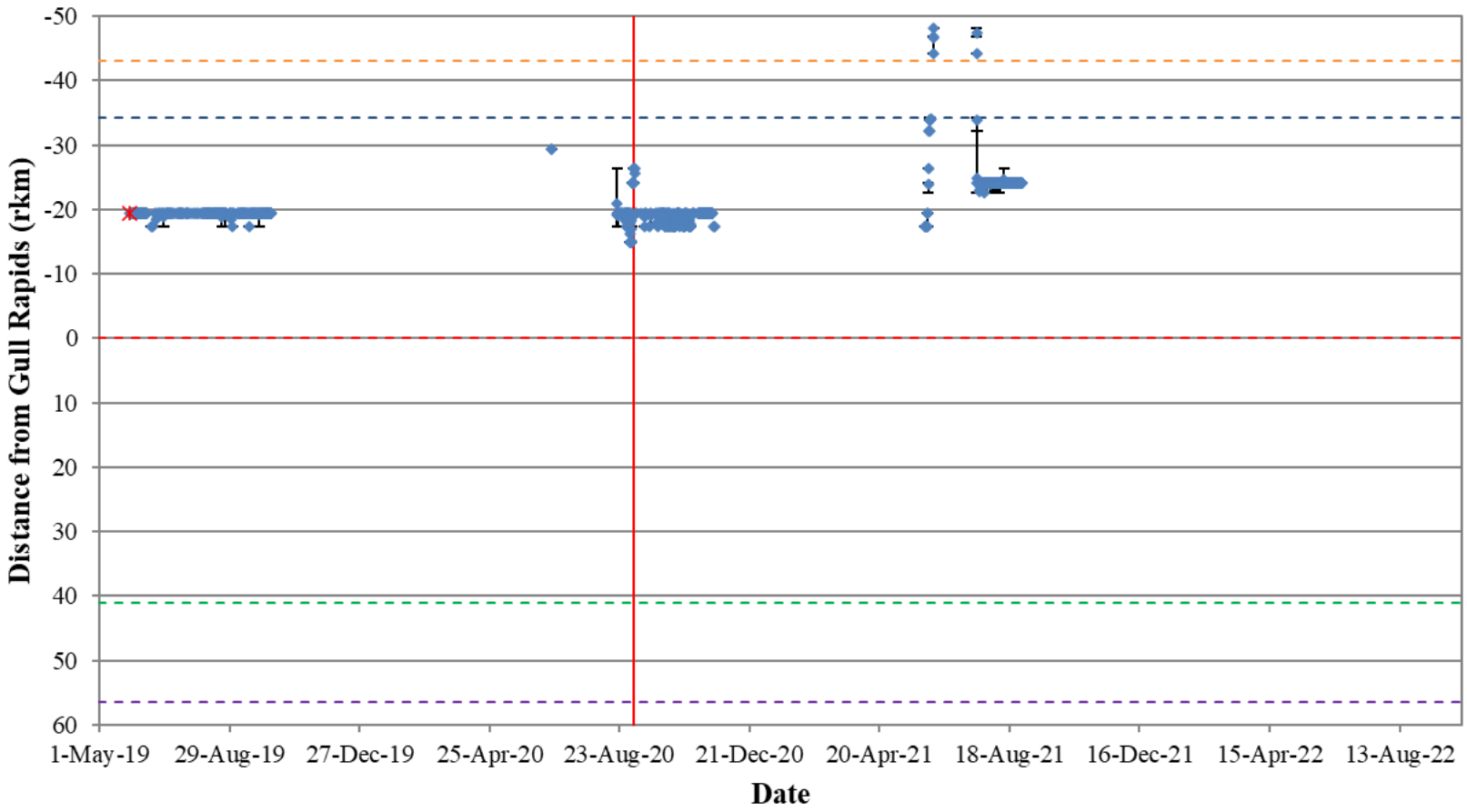

Figure A2-39: Position of a Walleye tagged with an acoustic transmitter (code #20181) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

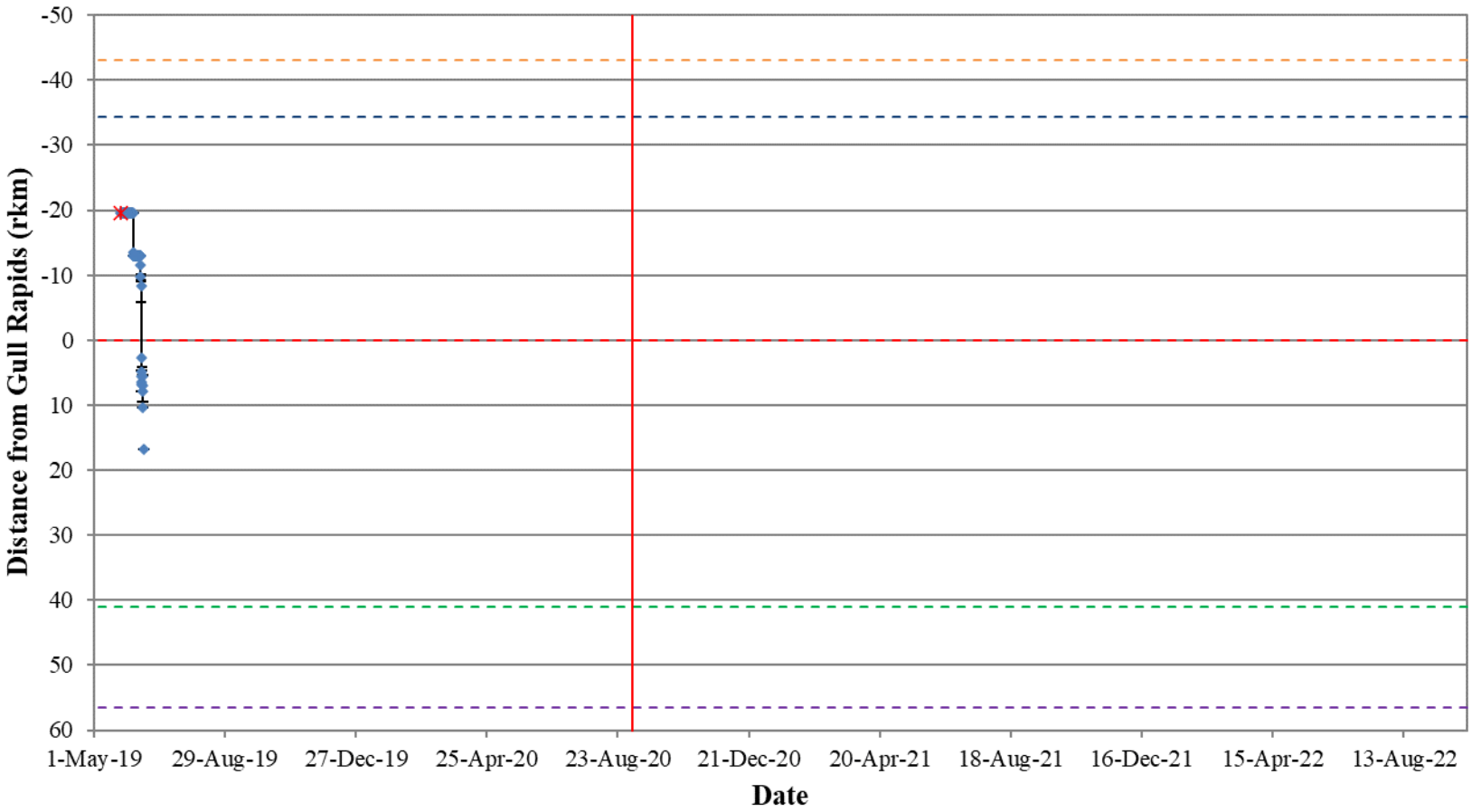

Figure A2-40: Position of a Walleye tagged with an acoustic transmitter (code #20182) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

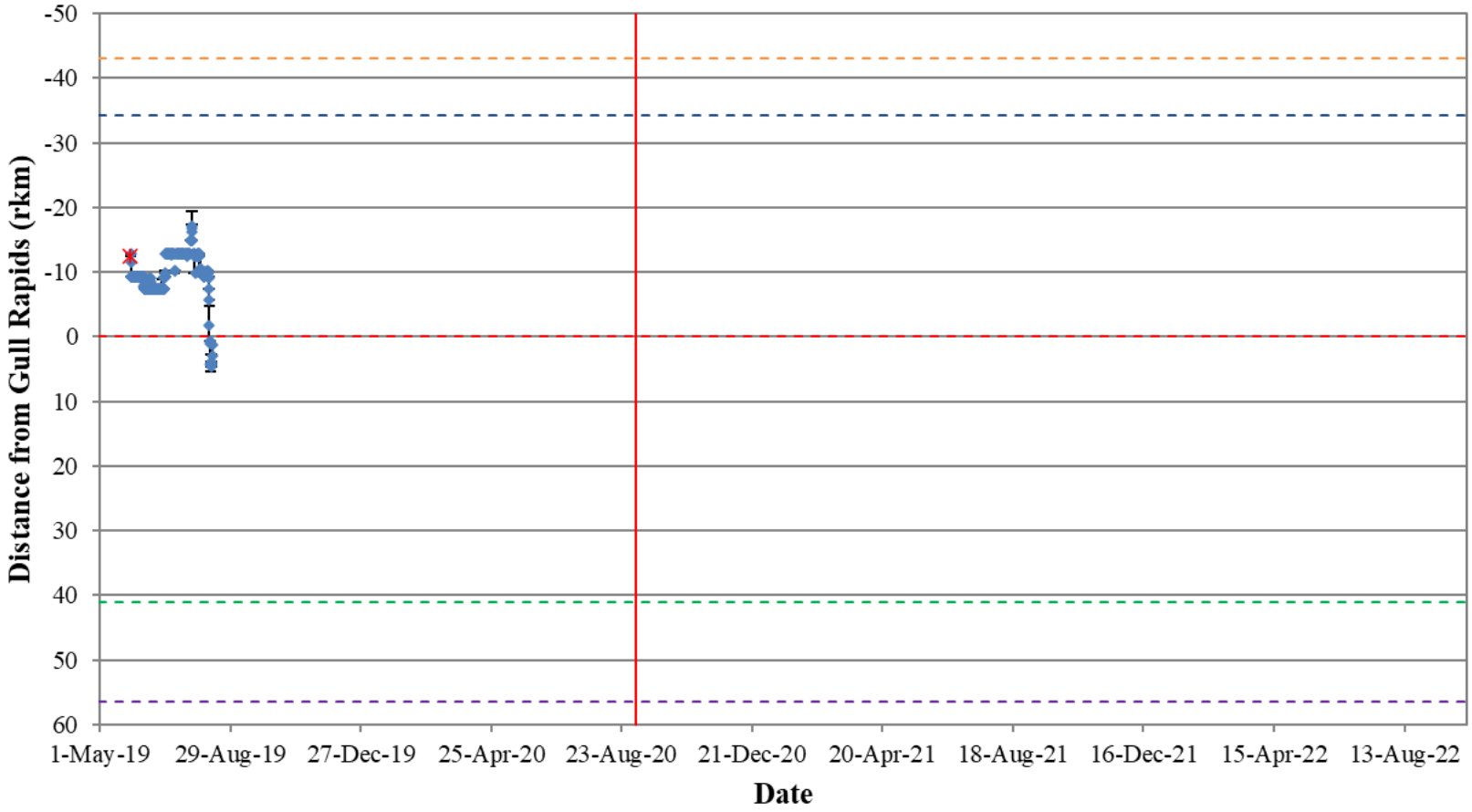

Figure A2-41: Position of a Walleye tagged with an acoustic transmitter (code #20186) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

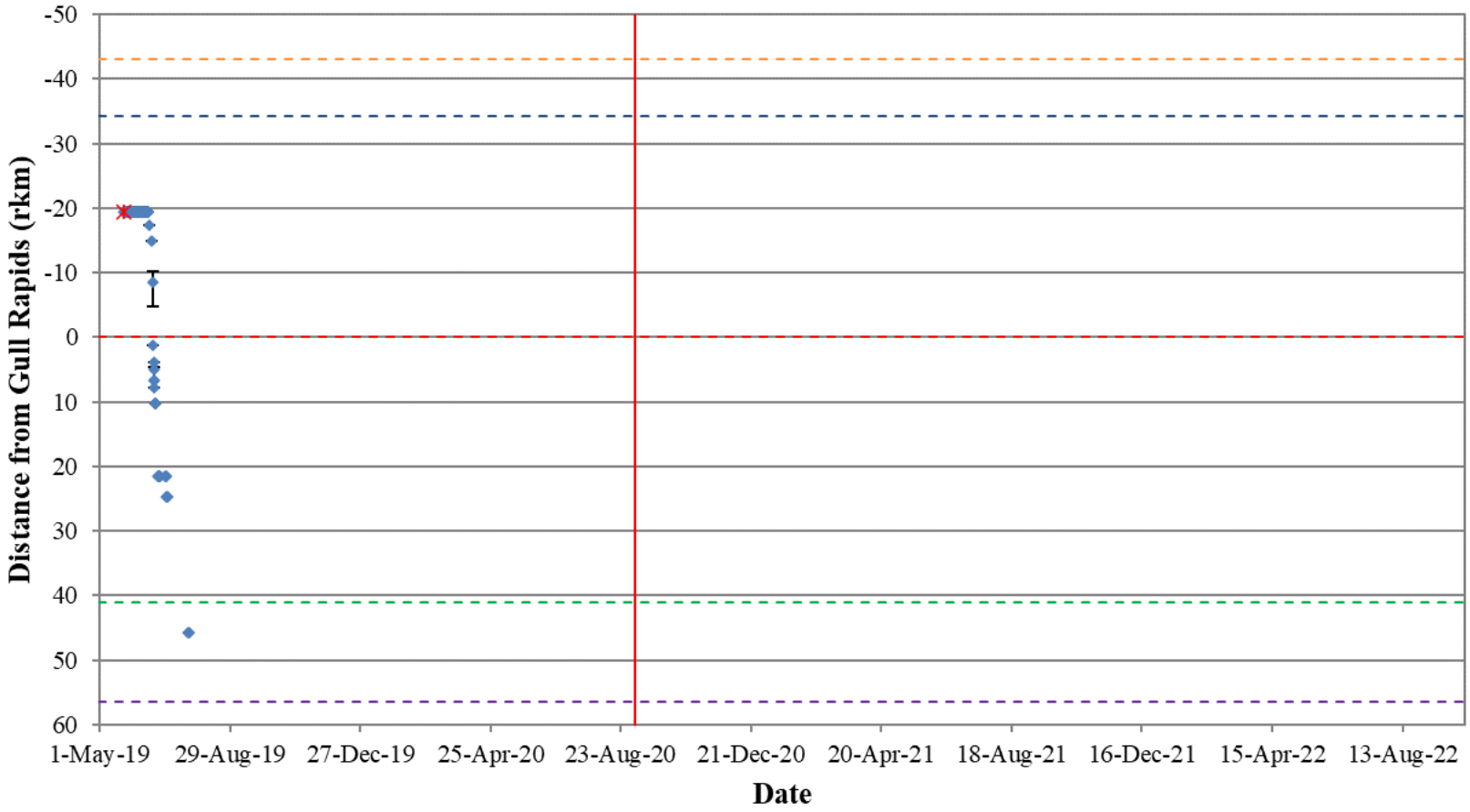

Figure A2-42: Position of a Walleye tagged with an acoustic transmitter (code #20187) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

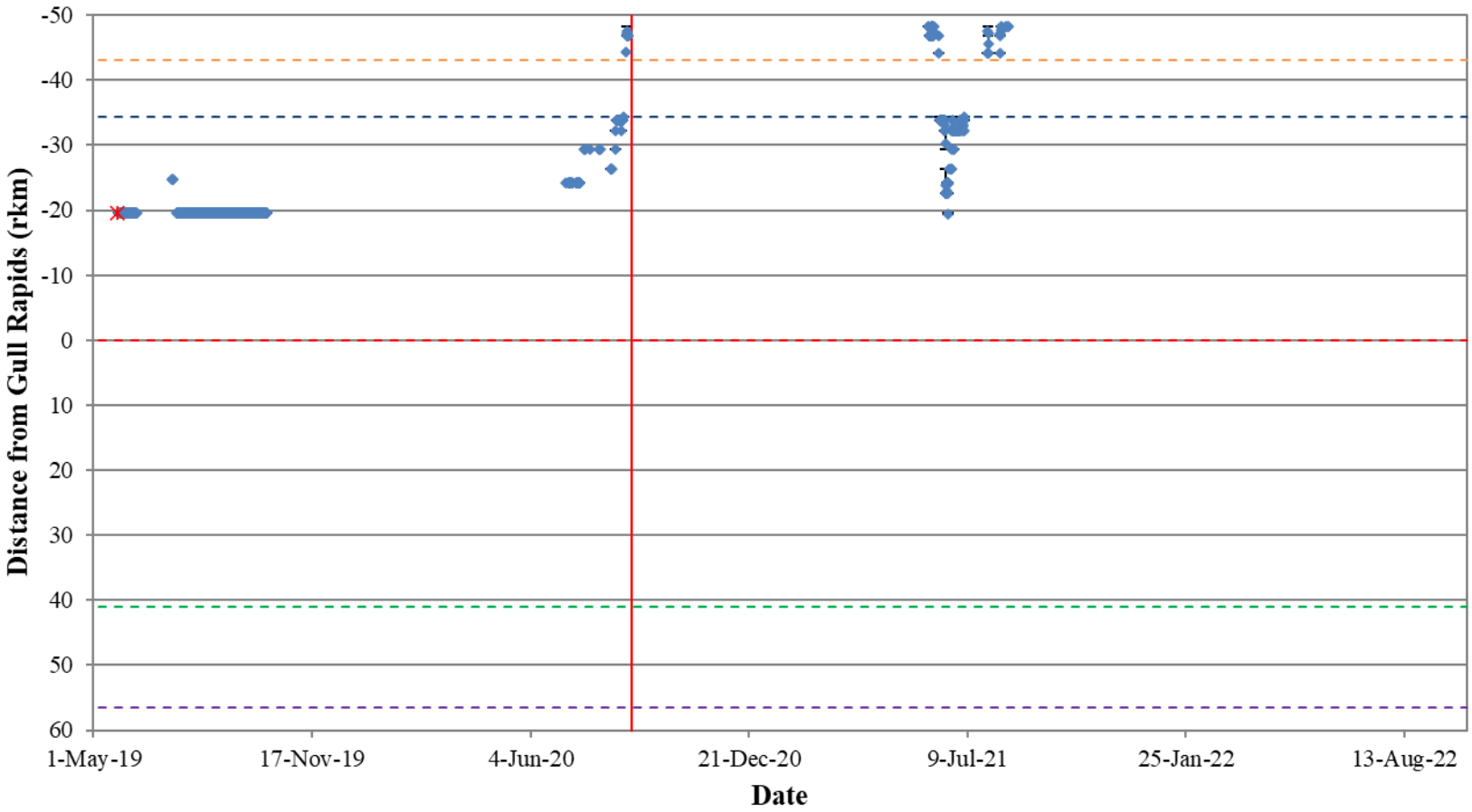

Figure A2-43: Position of a Walleye tagged with an acoustic transmitter (code #20188) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

APPENDIX 3: LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE IN STEPHENS LAKE IN 2018/2019: MAY 2018 TO OCTOBER 2022

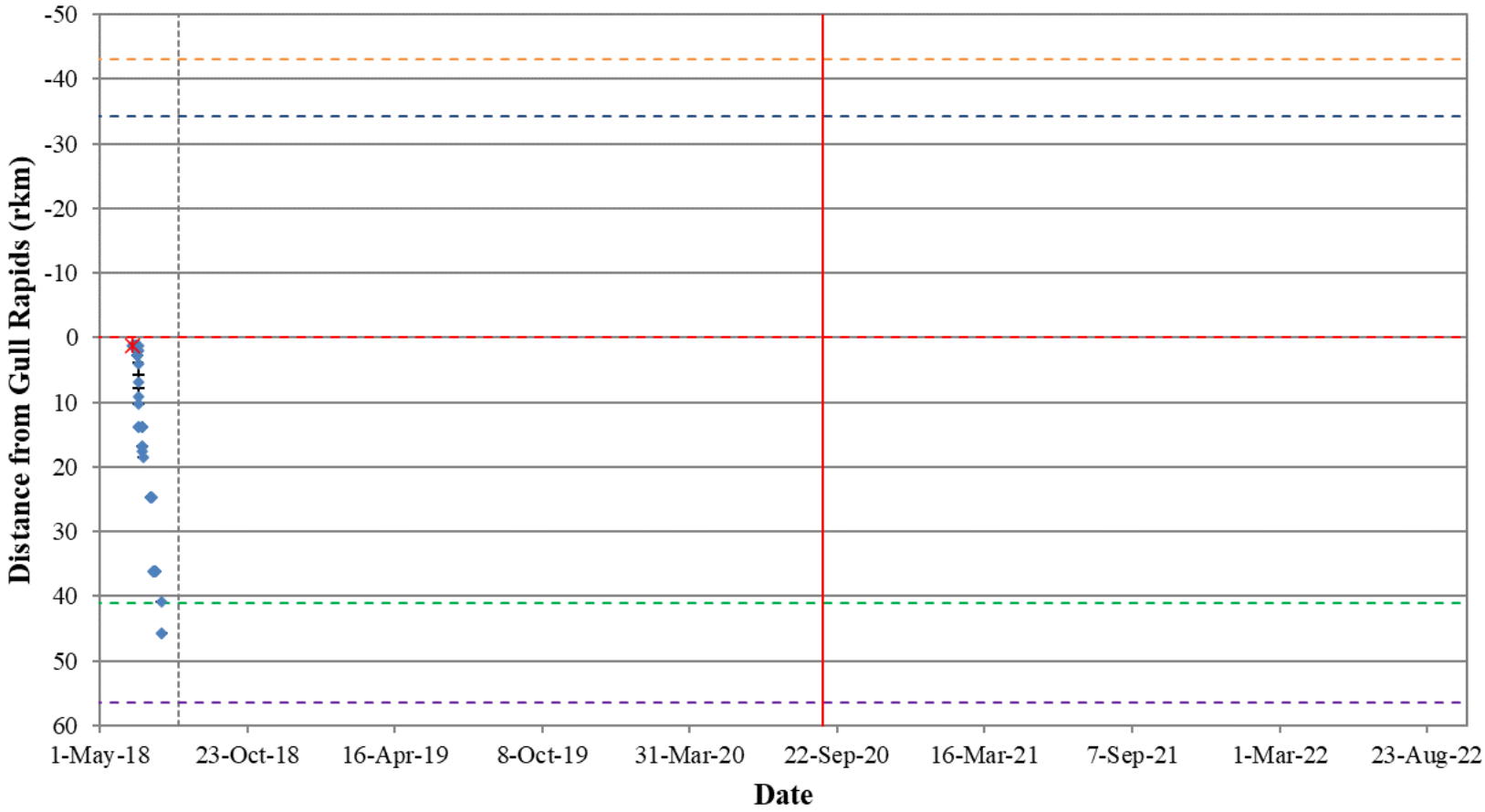

Figure A3-1: Position of a Walleye tagged with an acoustic transmitter (code #25732) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

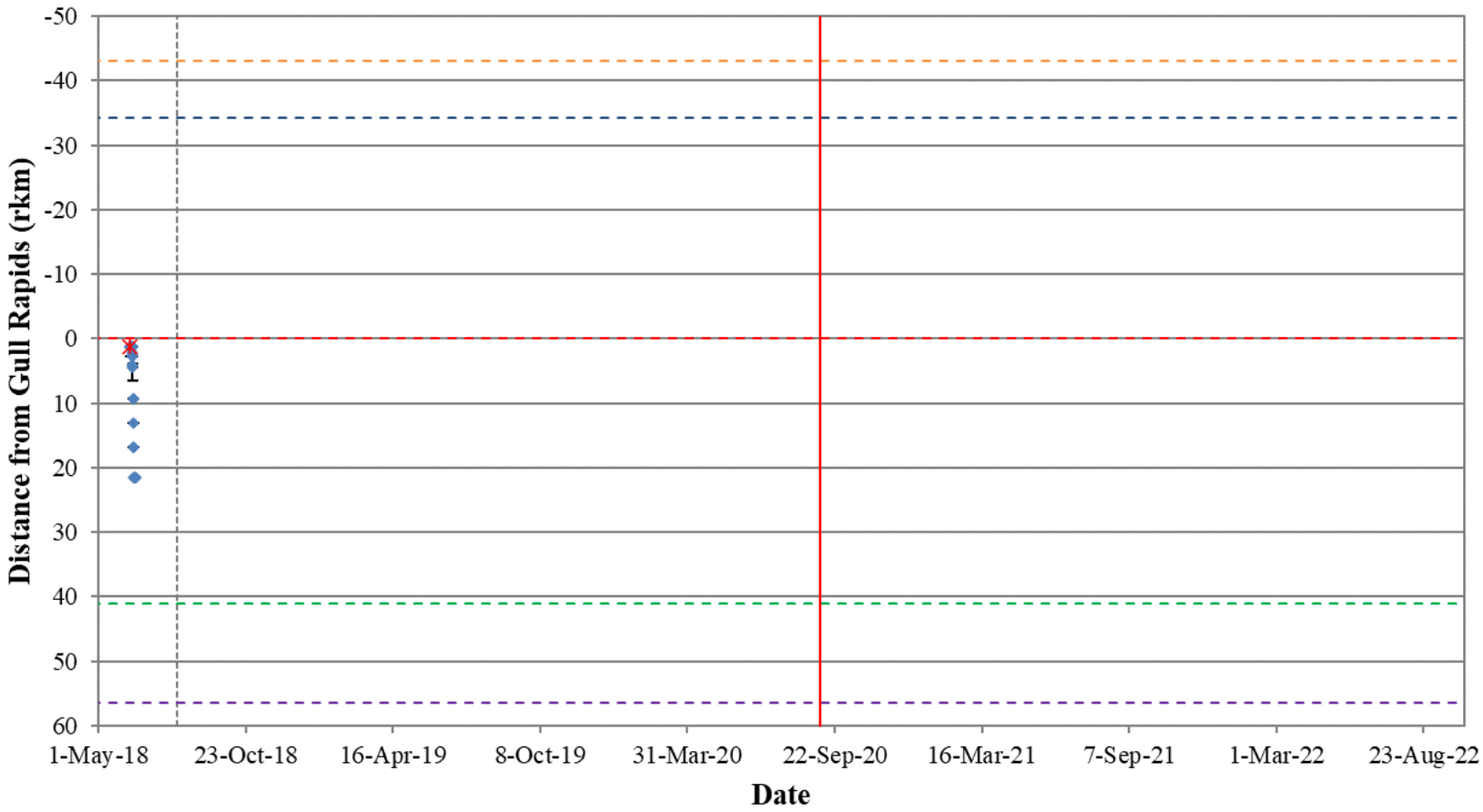

Figure A3-2: Position of a Walleye tagged with an acoustic transmitter (code #25734) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

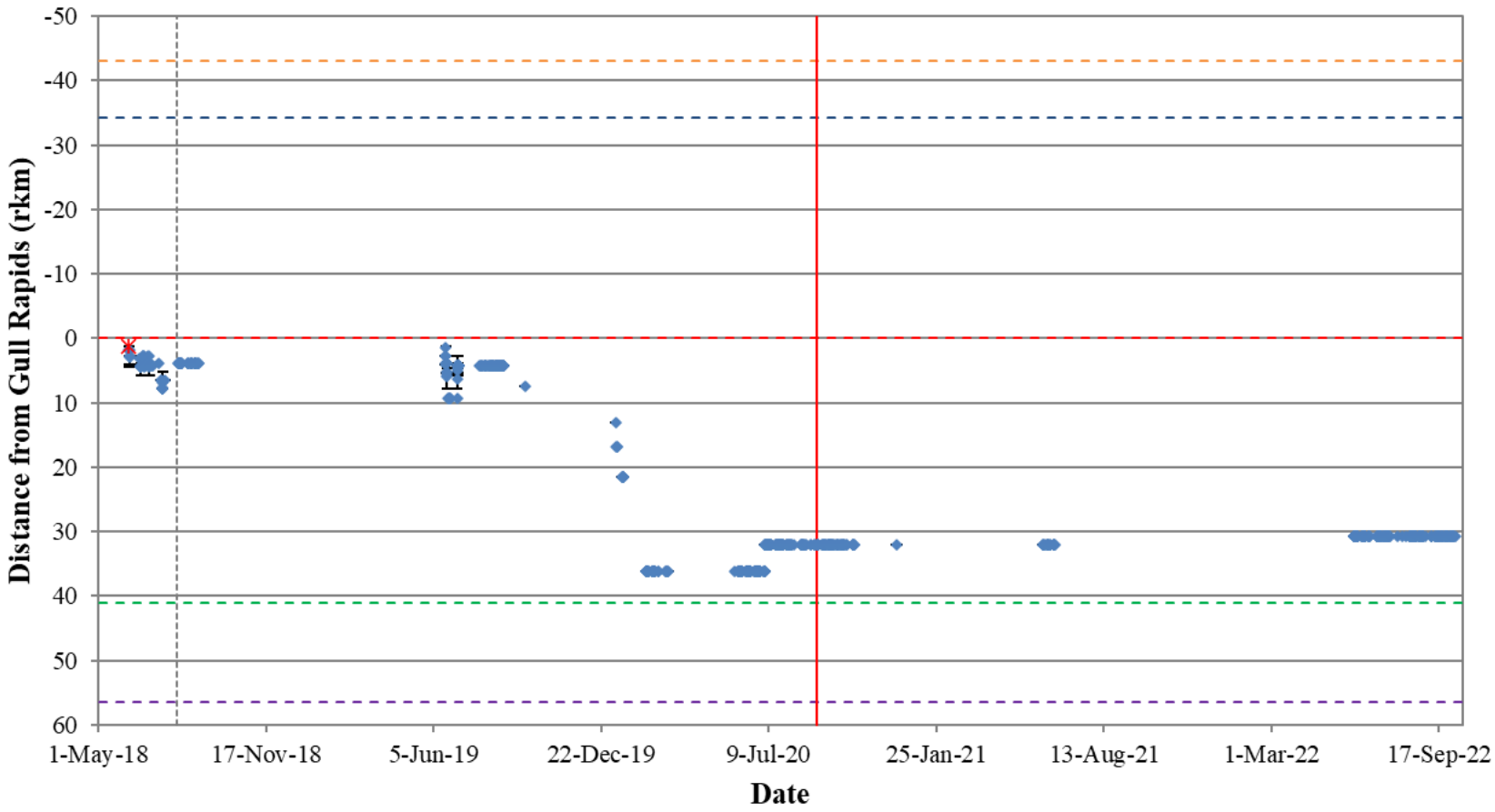

Figure A3-3: Position of a Walleye tagged with an acoustic transmitter (code #25735) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

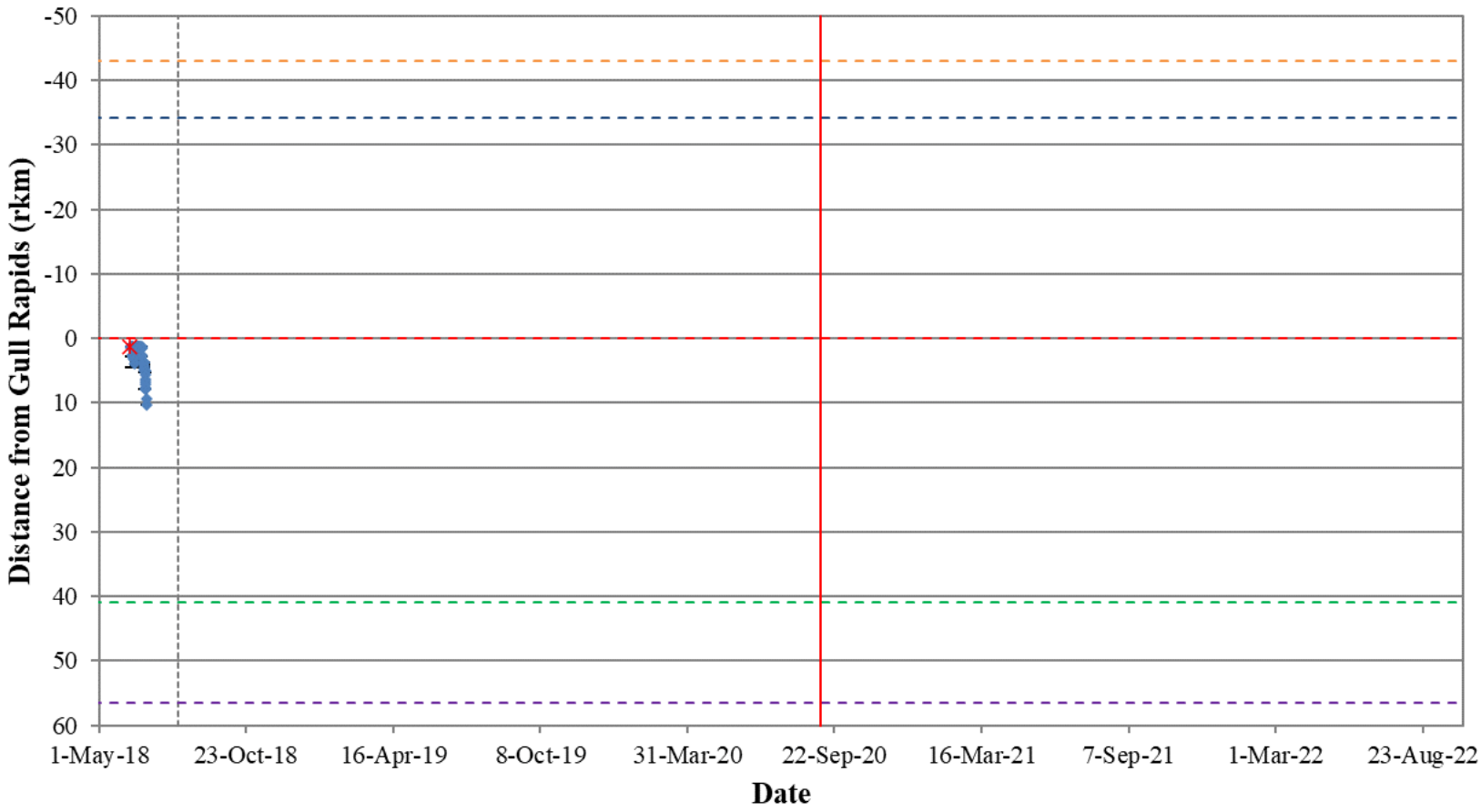

Figure A3-4: Position of a Walleye tagged with an acoustic transmitter (code #25736) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

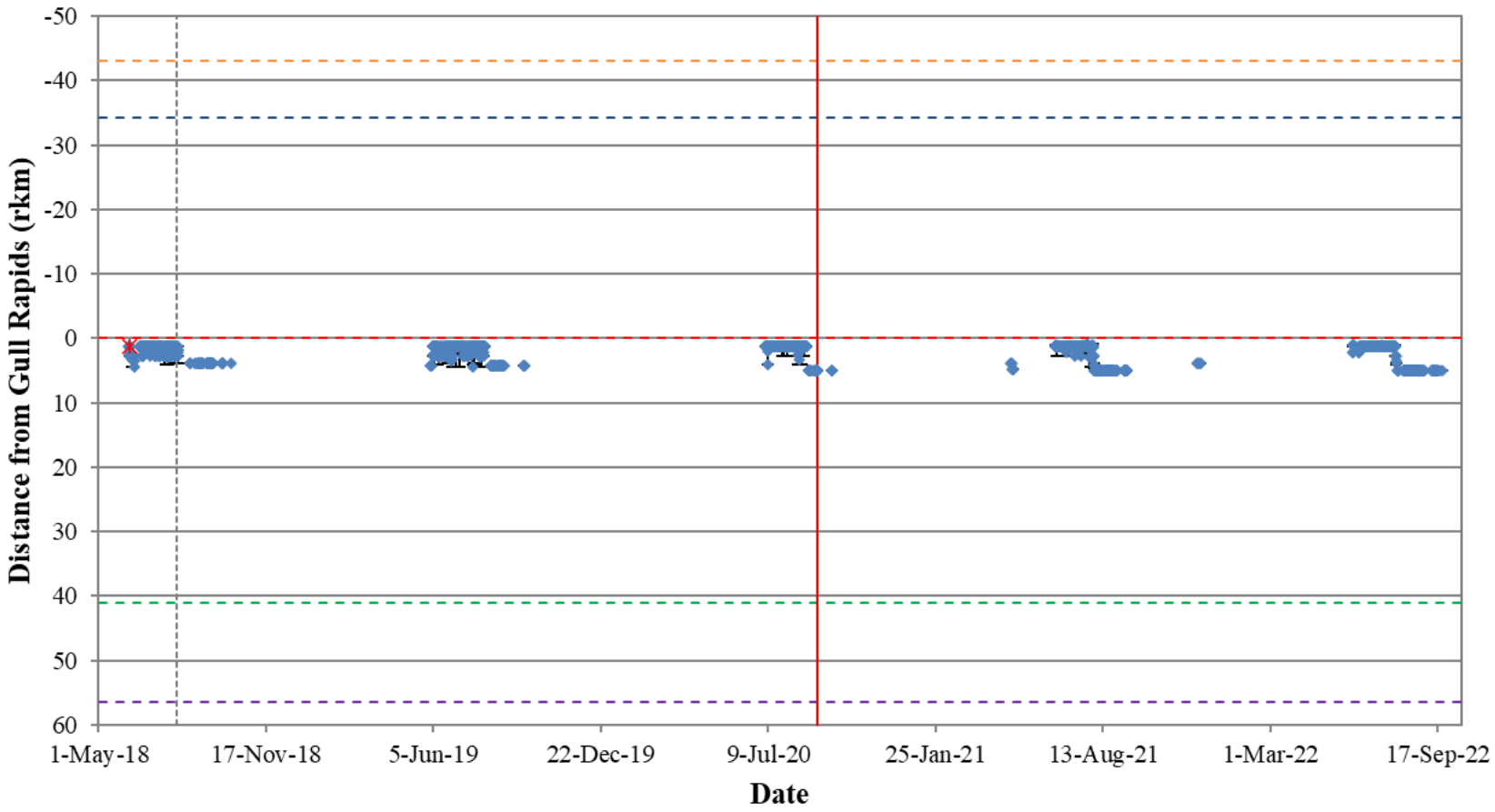

Figure A3-5: Position of a Walleye tagged with an acoustic transmitter (code #25737) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

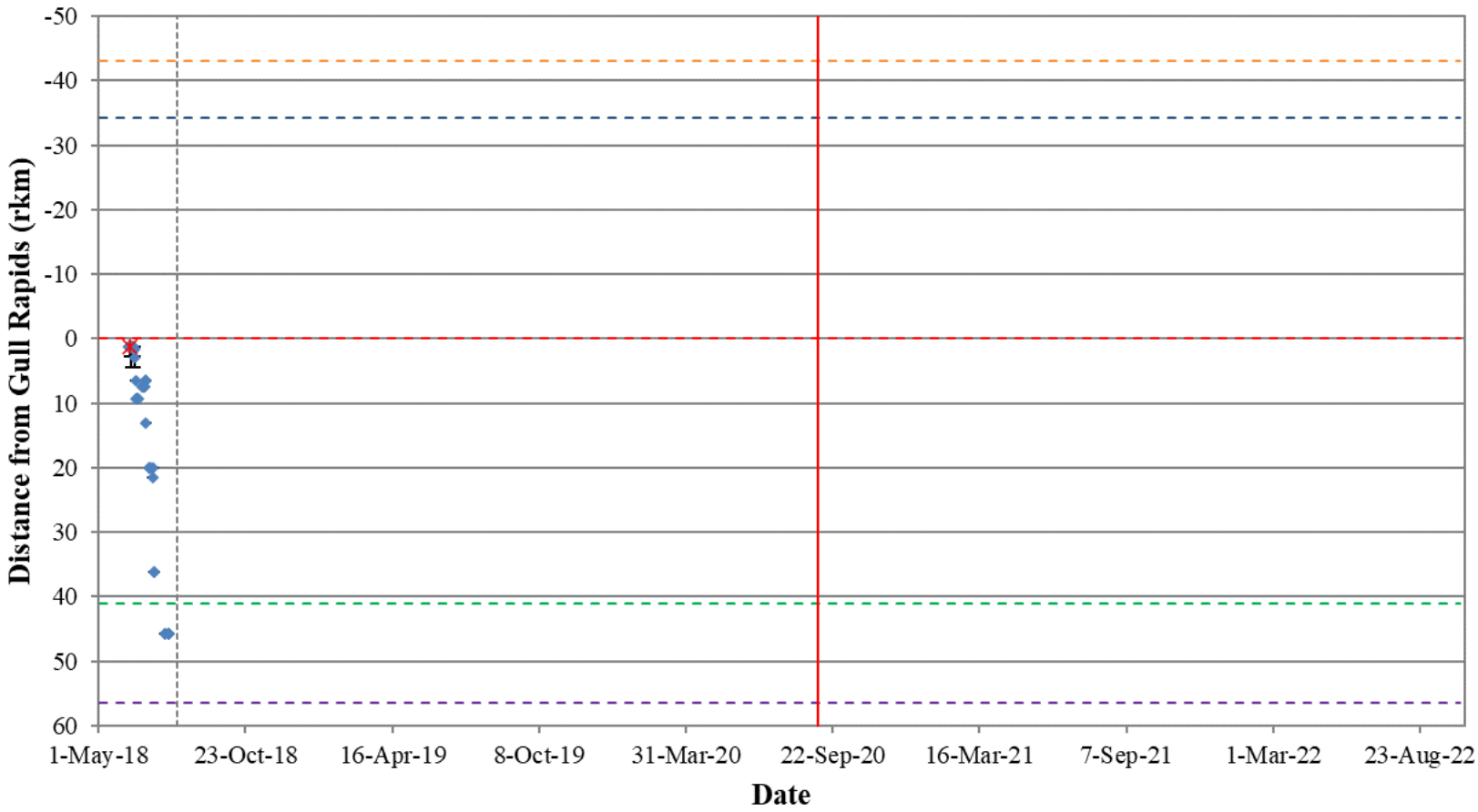

Figure A3-6: Position of a Walleye tagged with an acoustic transmitter (code #25738) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

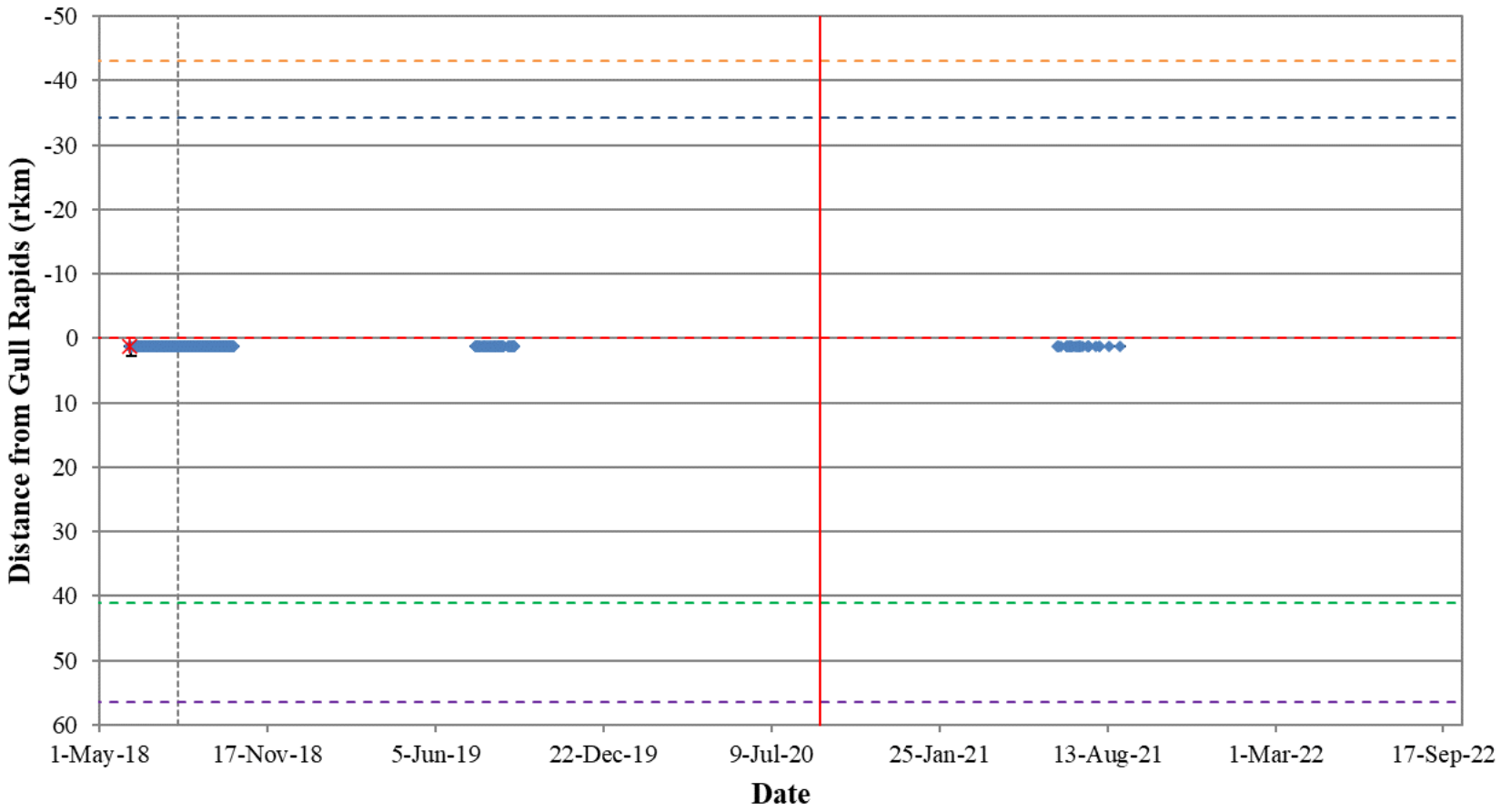

Figure A3-7: Position of a Walleye tagged with an acoustic transmitter (code #25741) in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2018, to October 10, 2022. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with a vertical dotted line and end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

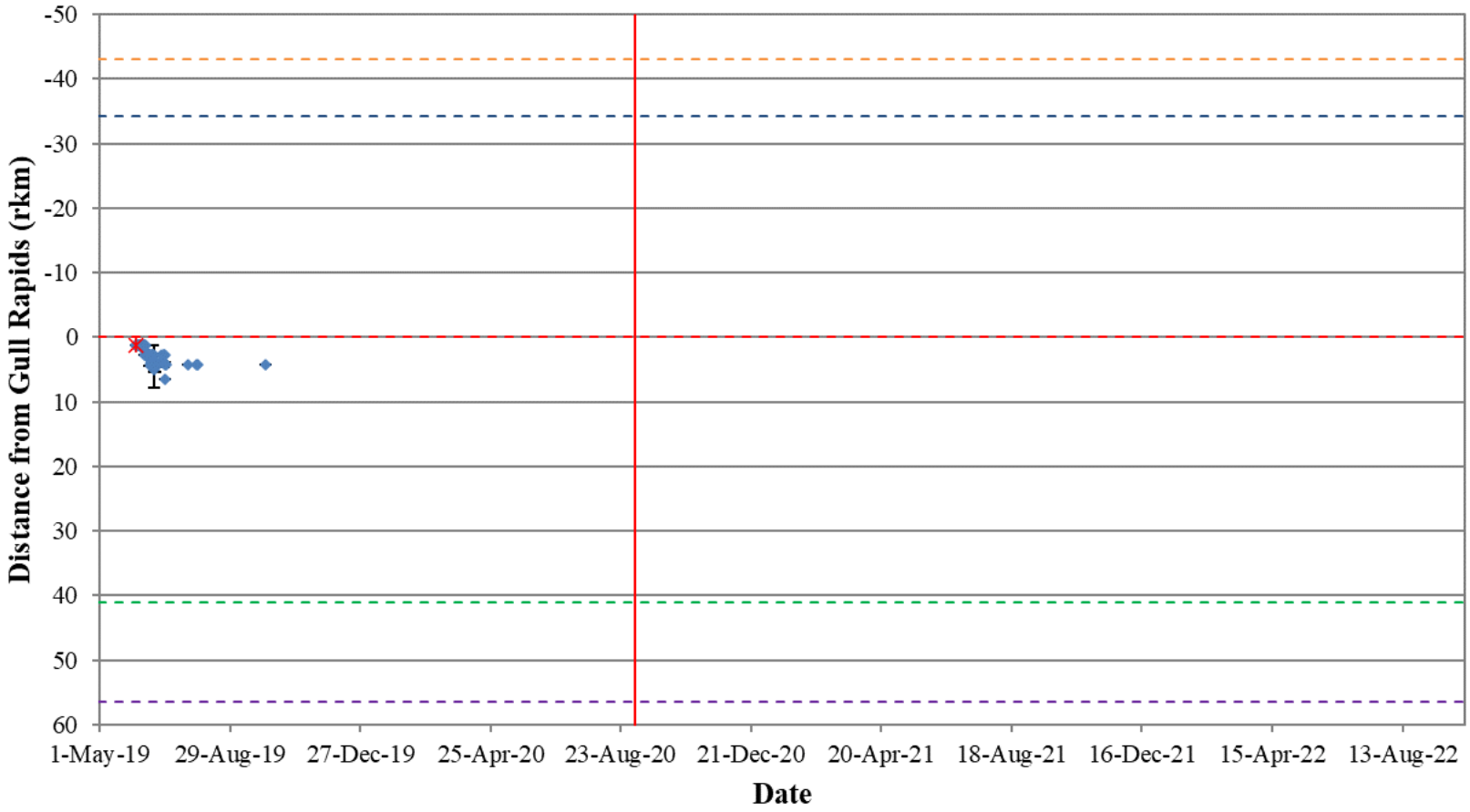

Figure A3-8: Position of a Walleye tagged with an acoustic transmitter (code #20129) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

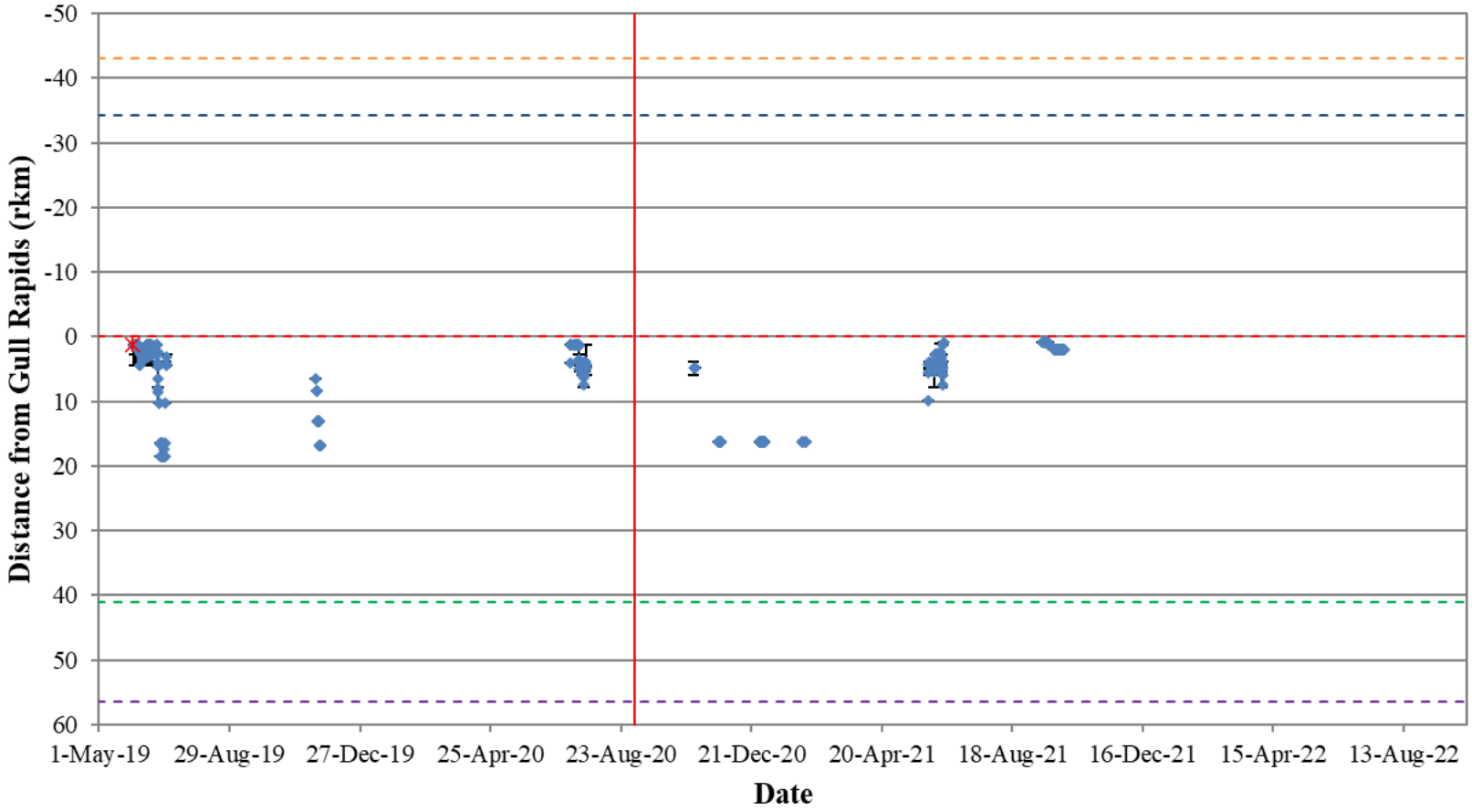

Figure A3-9: Position of a Walleye tagged with an acoustic transmitter (code #20130) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

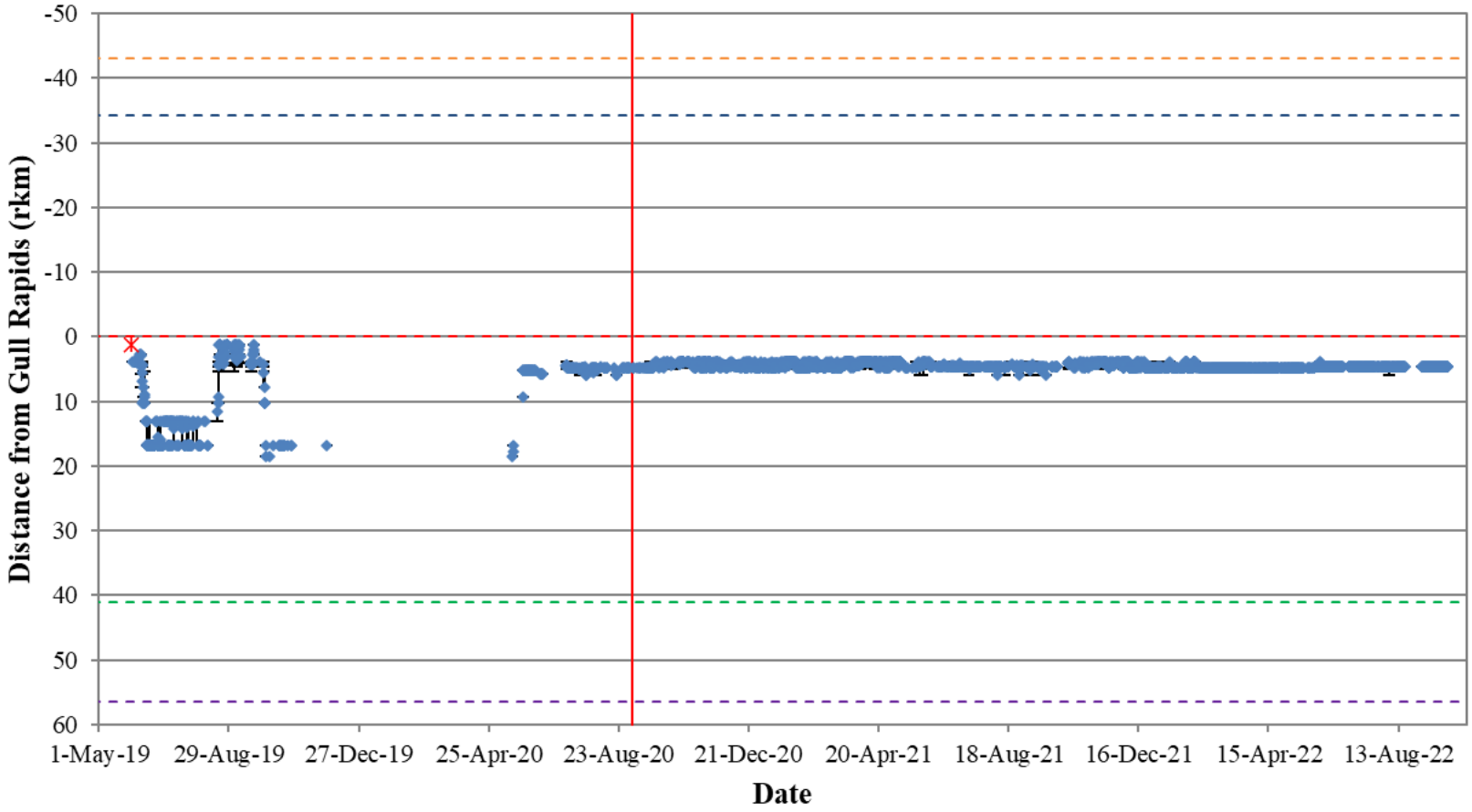

Figure A3-10: Position of a Walleye tagged with an acoustic transmitter (code #20131) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

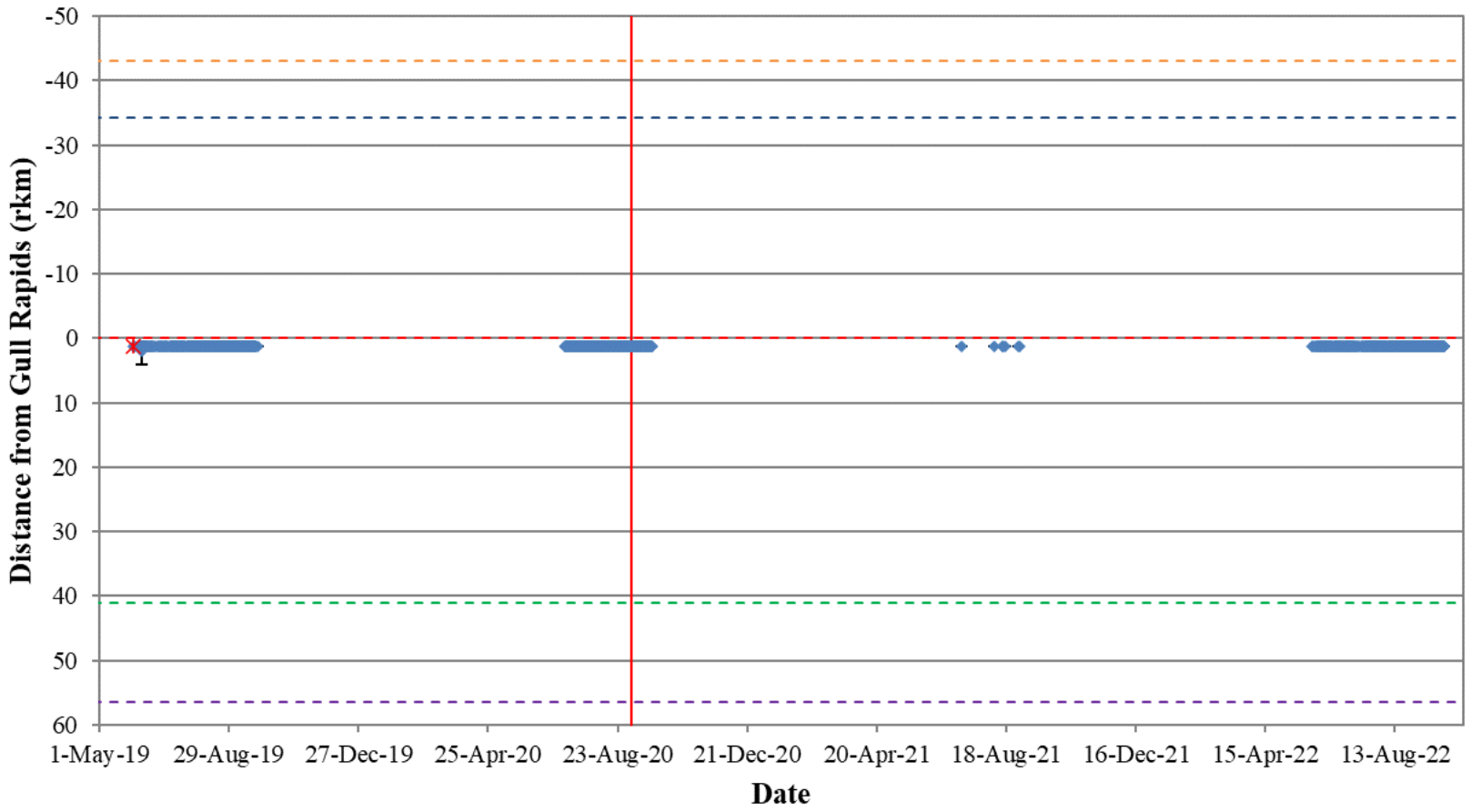

Figure A3-11: Position of a Walleye tagged with an acoustic transmitter (code #20132) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

Figure A3-12: Position of a Walleye tagged with an acoustic transmitter (code #20133) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

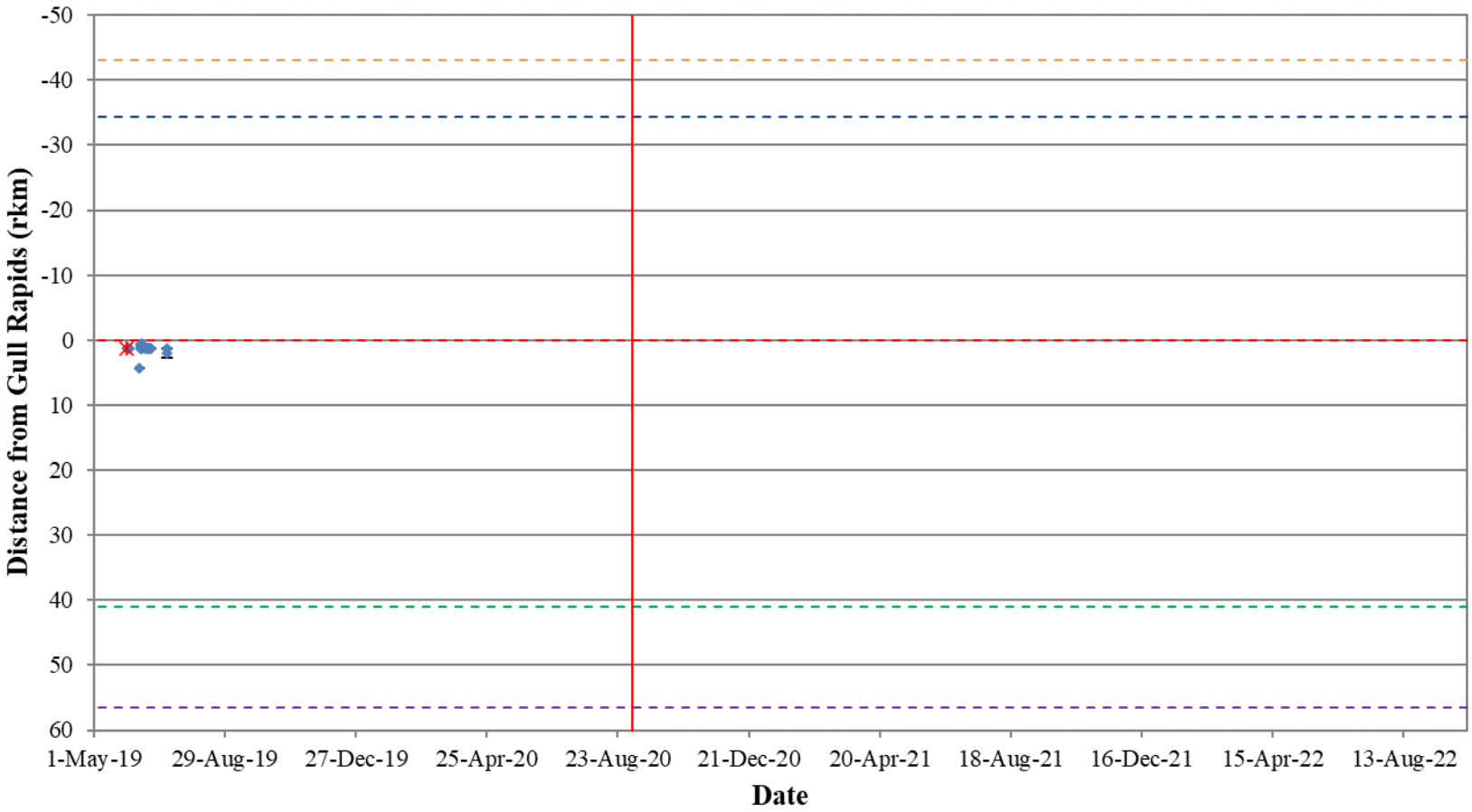

Figure A3-13: Position of a Walleye tagged with an acoustic transmitter (code #20134) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

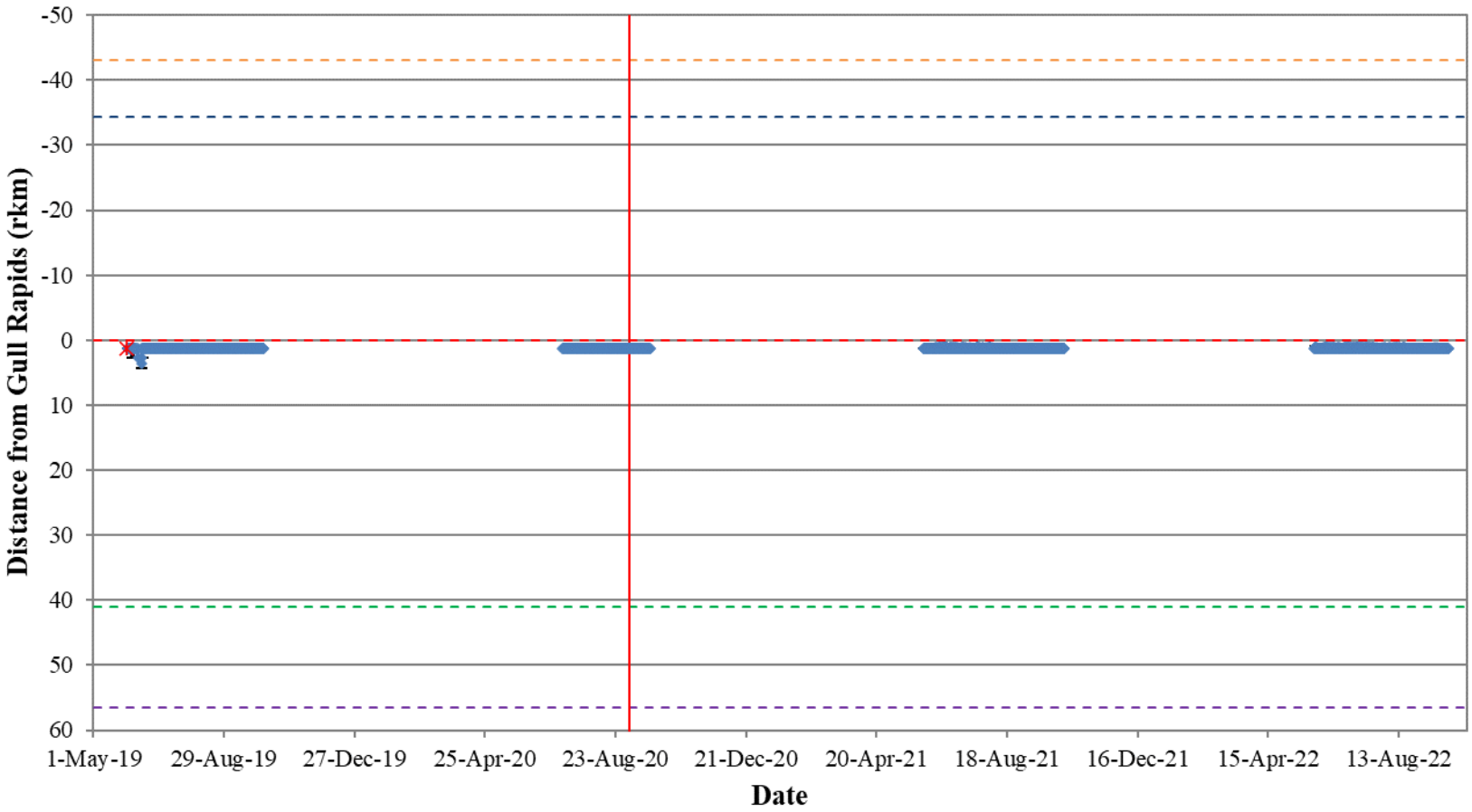

Figure A3-14: Position of a Walleye tagged with an acoustic transmitter (code #20135) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

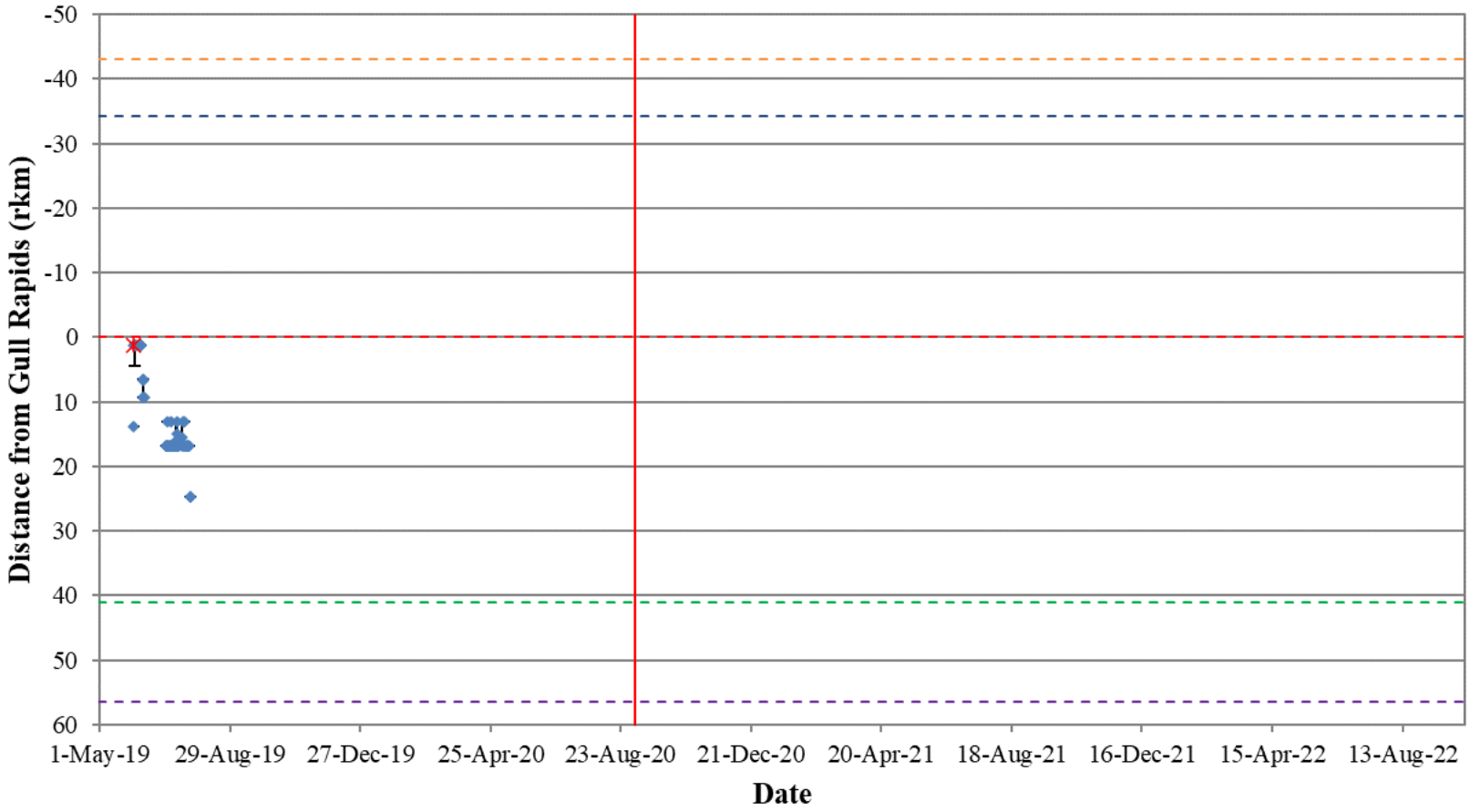

Figure A3-15: Position of a Walleye tagged with an acoustic transmitter (code #20136) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

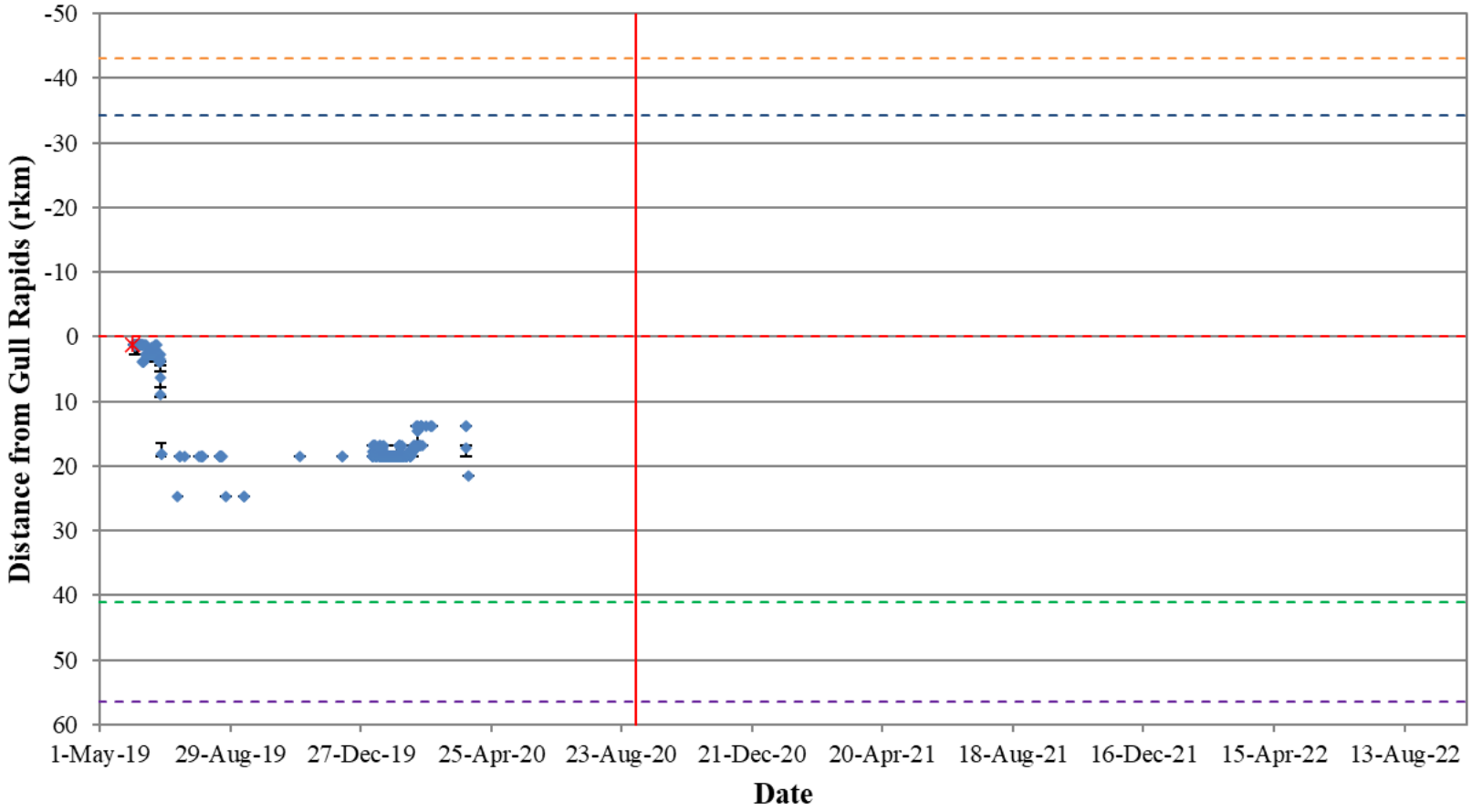

Figure A3-16: Position of a Walleye tagged with an acoustic transmitter (code #20137) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

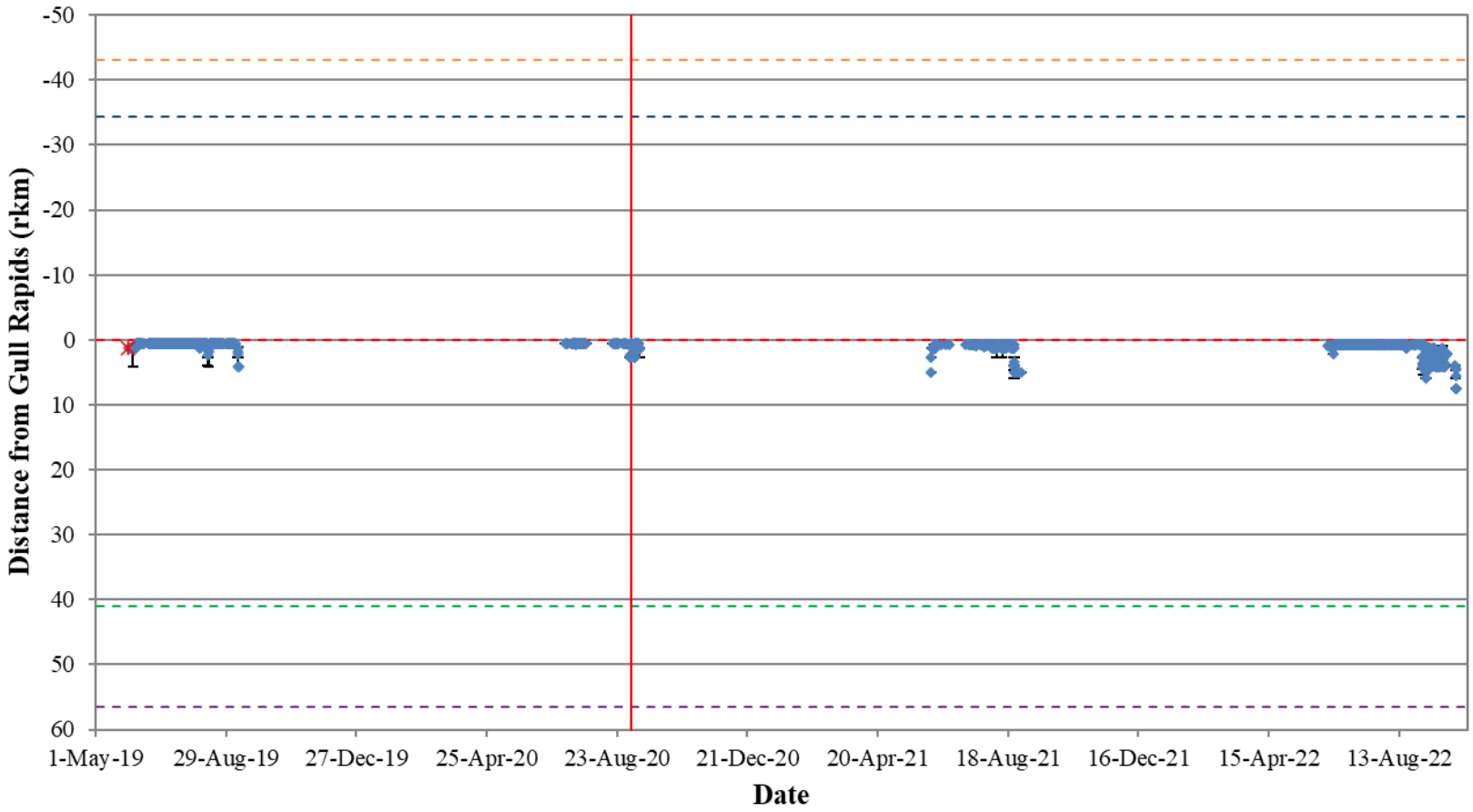

Figure A3-17: Position of a Walleye tagged with an acoustic transmitter (code #20138) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

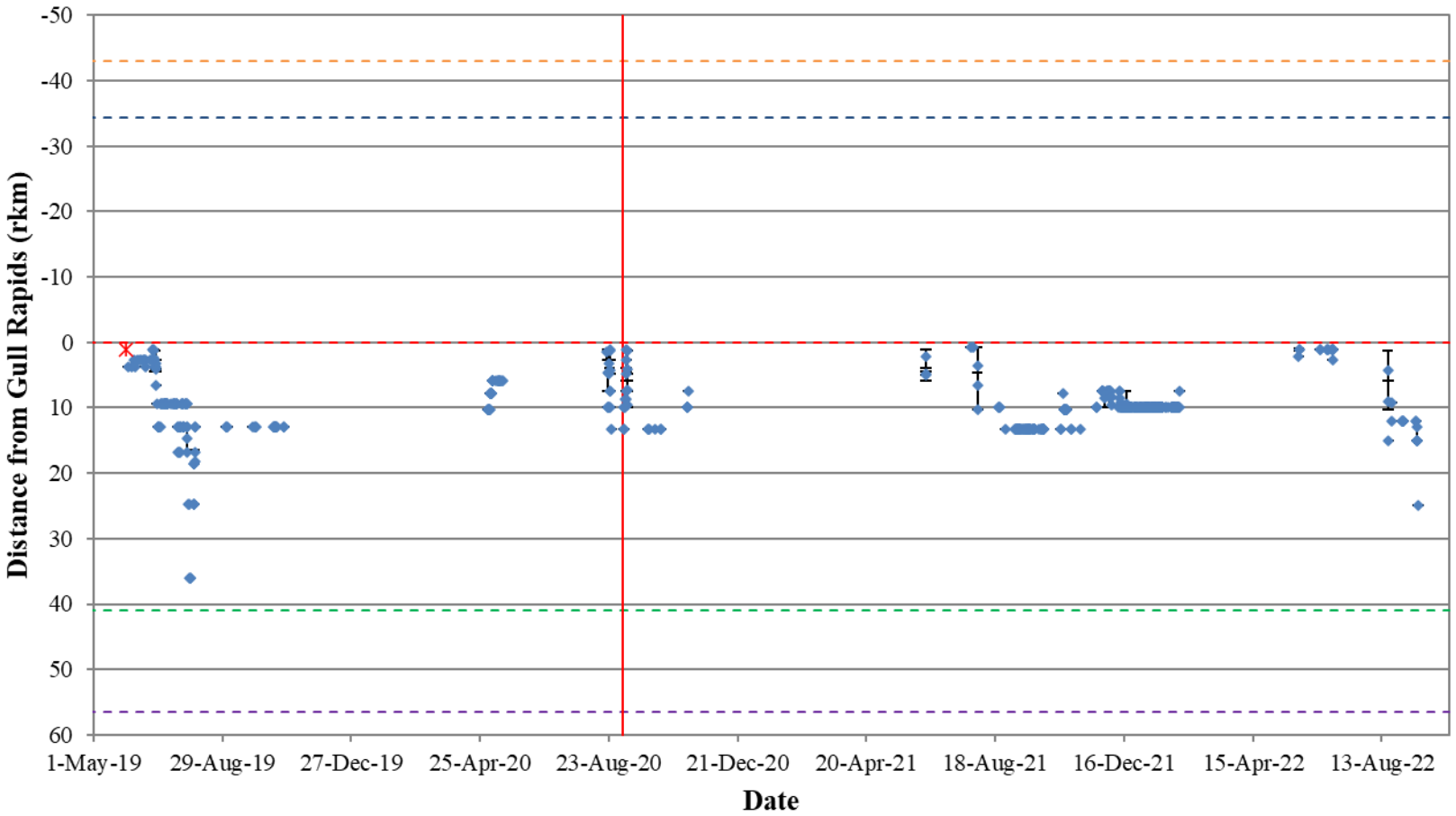

Figure A3-18: Position of a Walleye tagged with an acoustic transmitter (code #20139) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

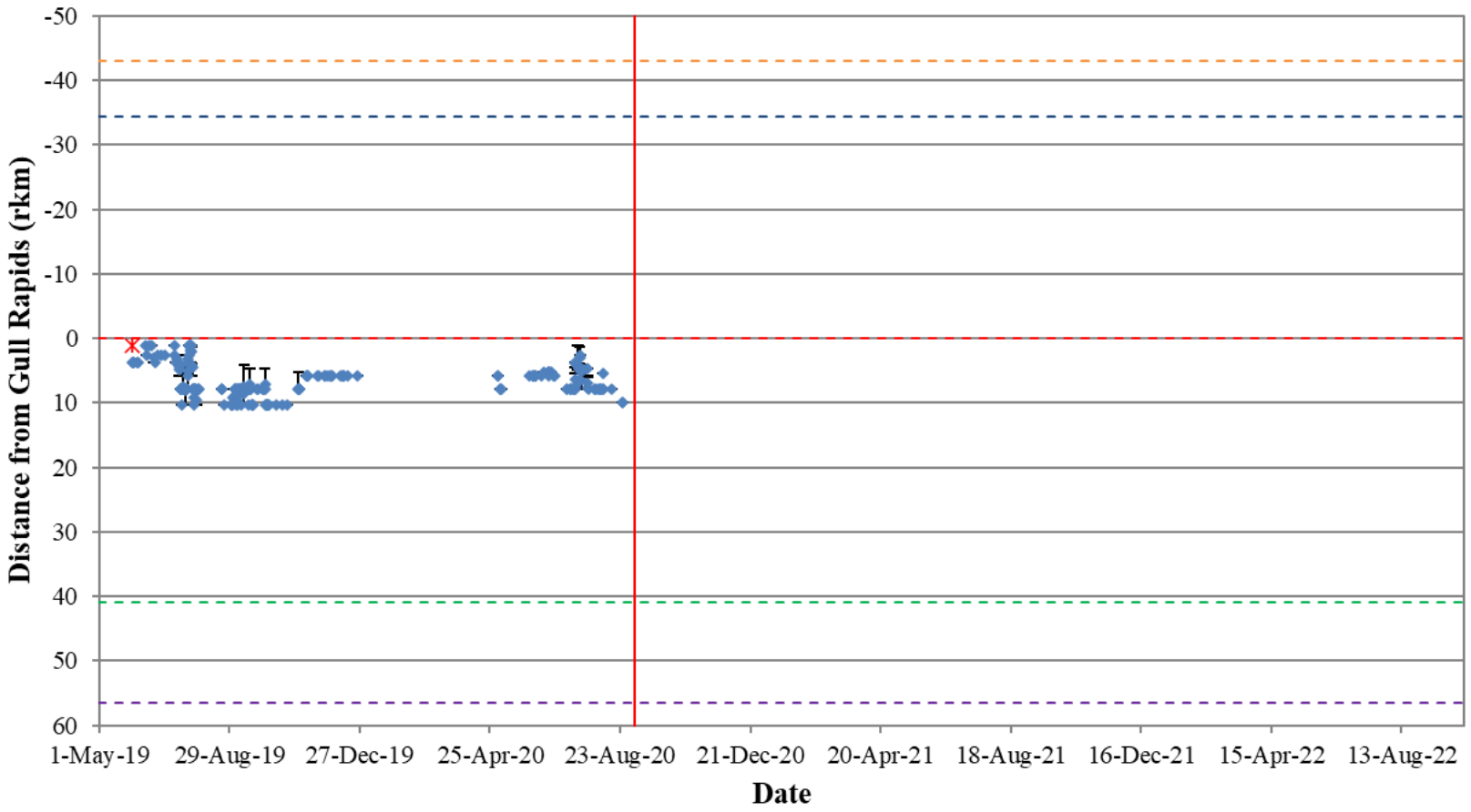

Figure A3-19: Position of a Walleye tagged with an acoustic transmitter (code #20140) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

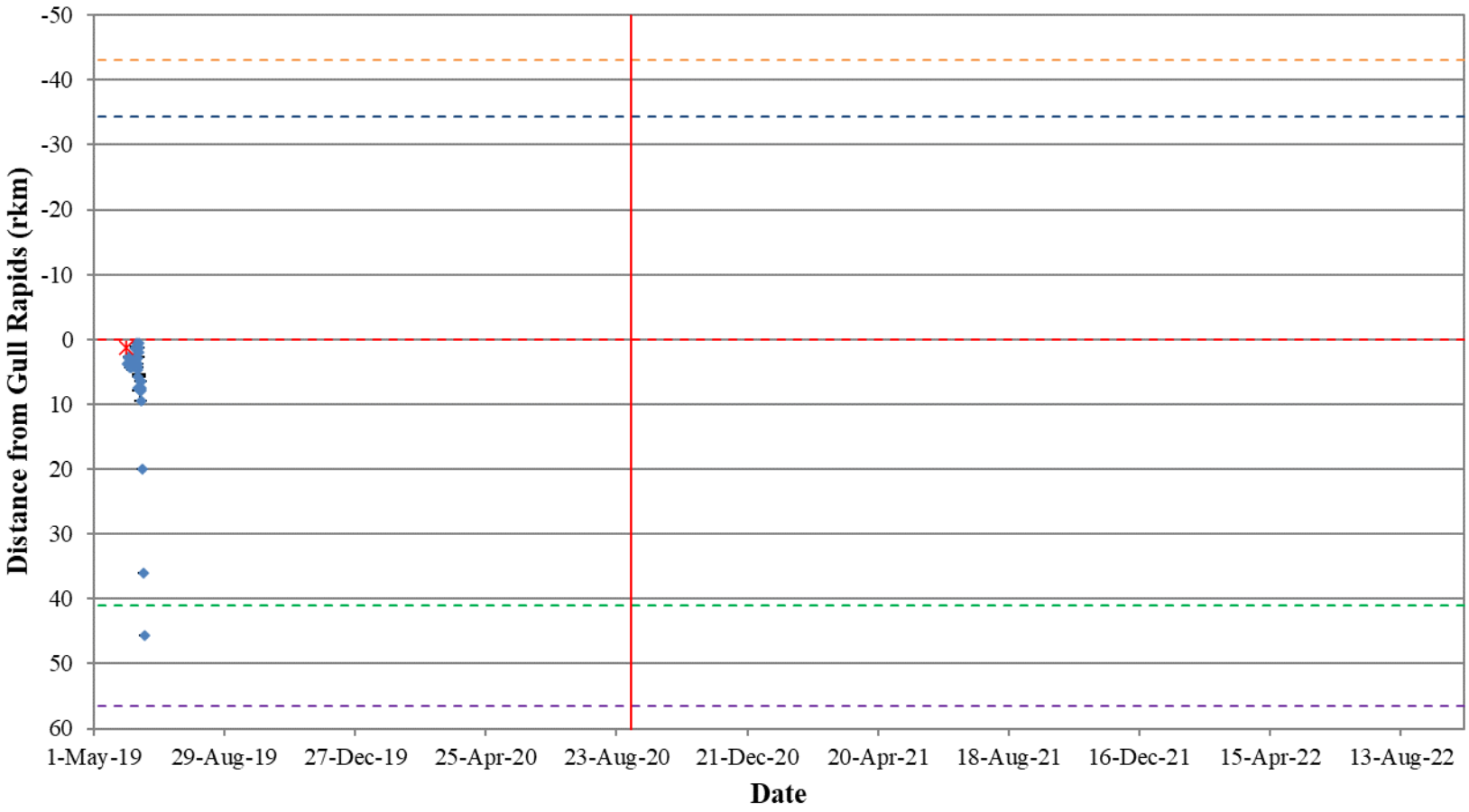

Figure A3-20: Position of a Walleye tagged with an acoustic transmitter (code #20141) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

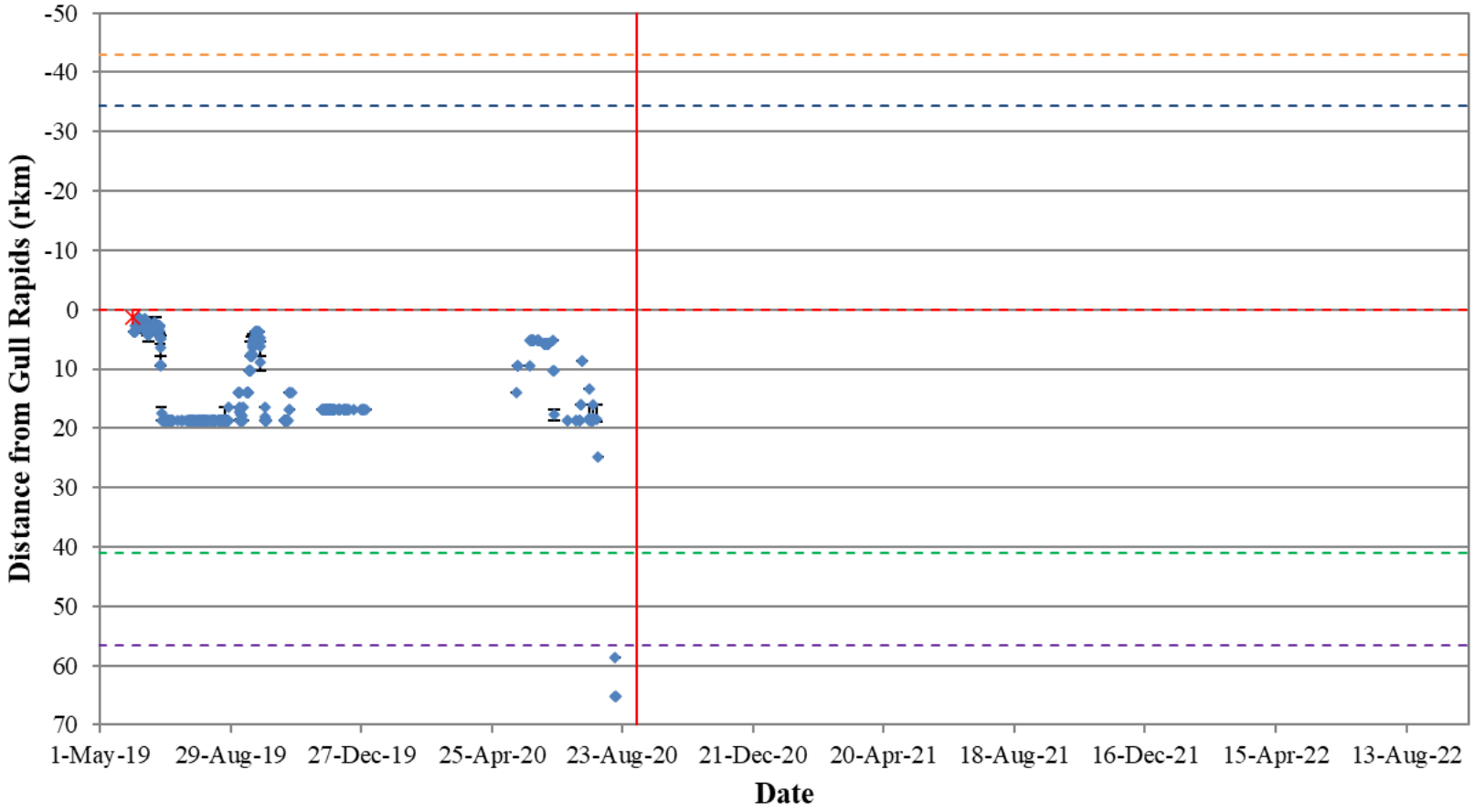

Figure A3-21: Position of a Walleye tagged with an acoustic transmitter (code #20142) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

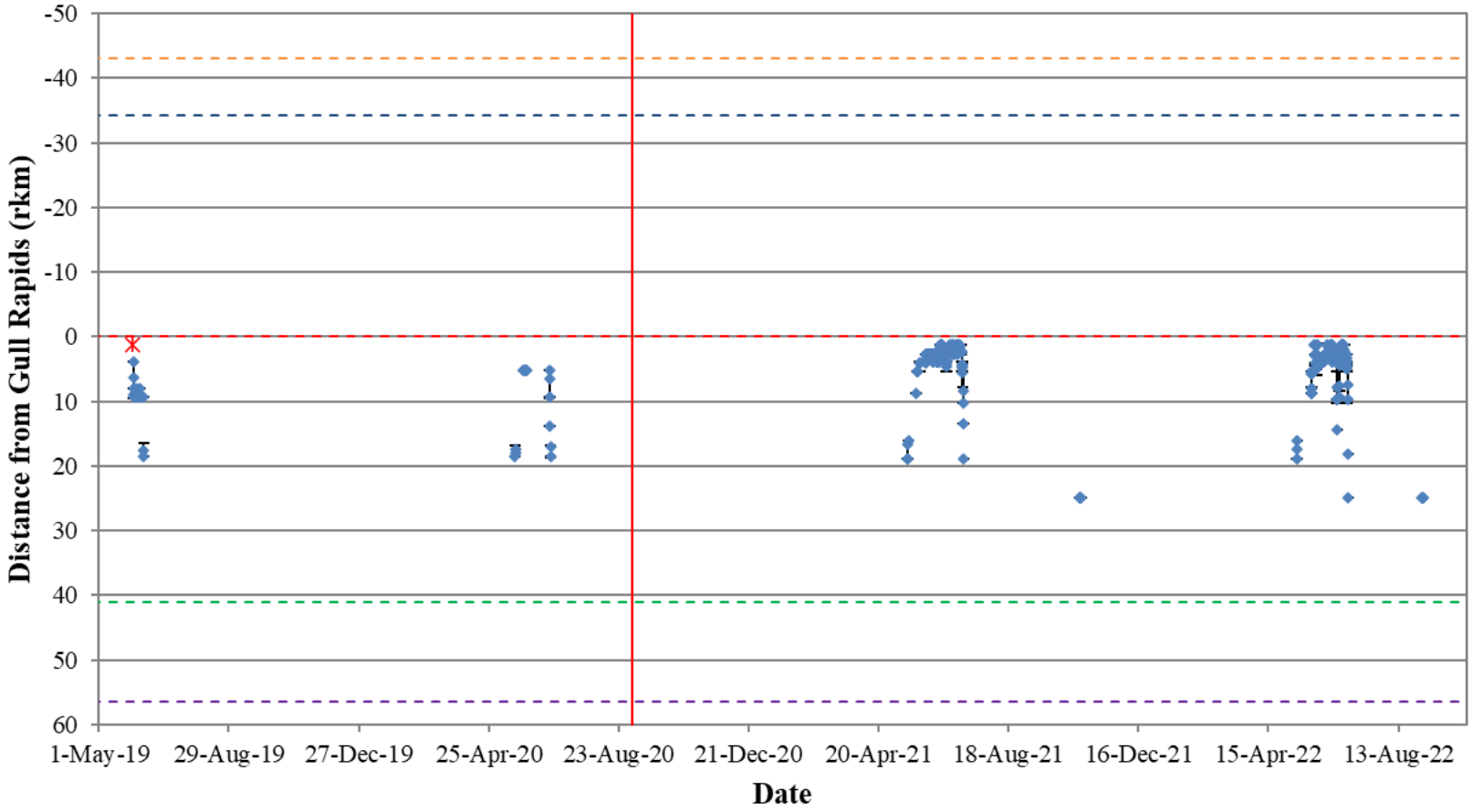

Figure A3-22: Position of a Walleye tagged with an acoustic transmitter (code #20143) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

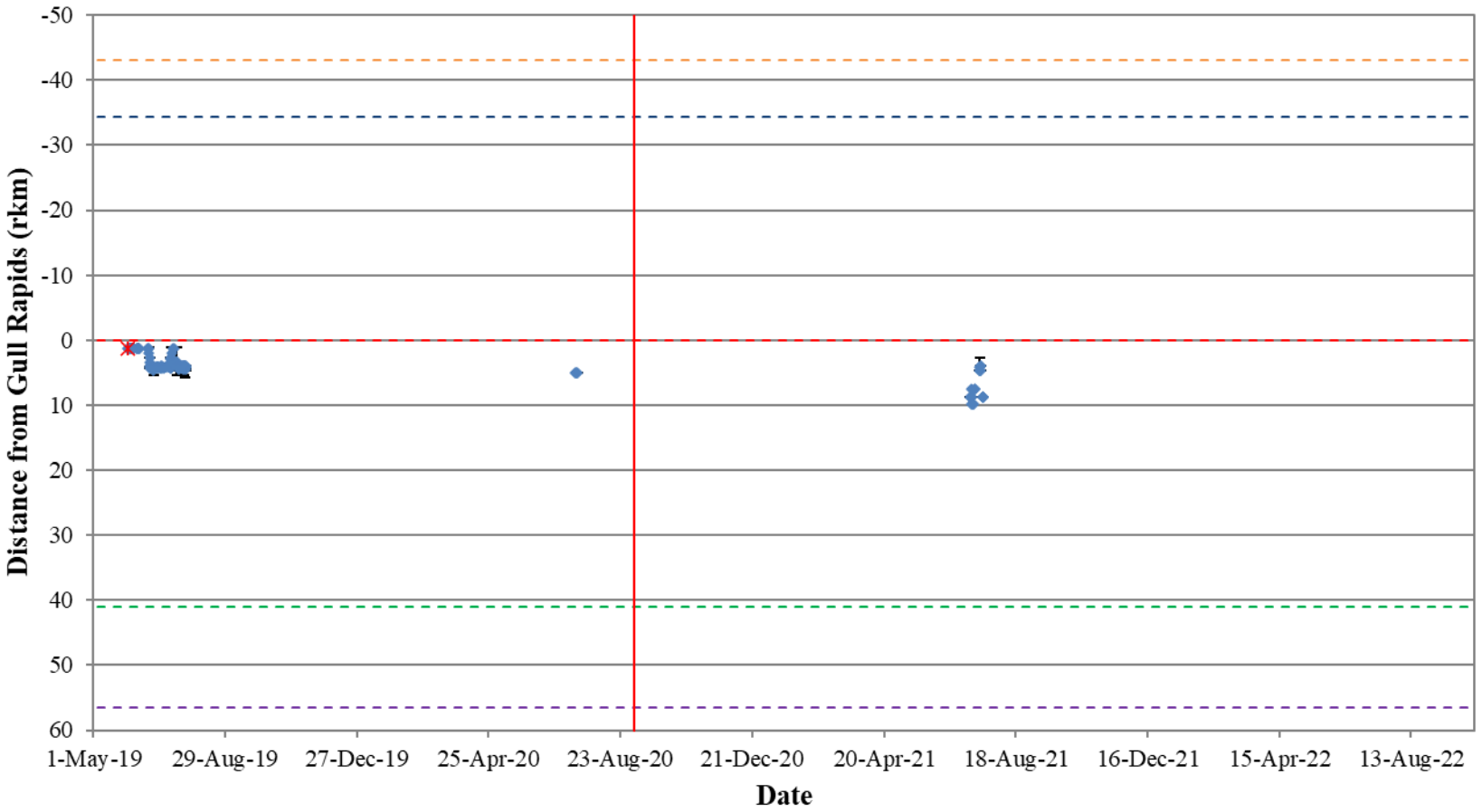

Figure A3-23: Position of a Walleye tagged with an acoustic transmitter (code #20144) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

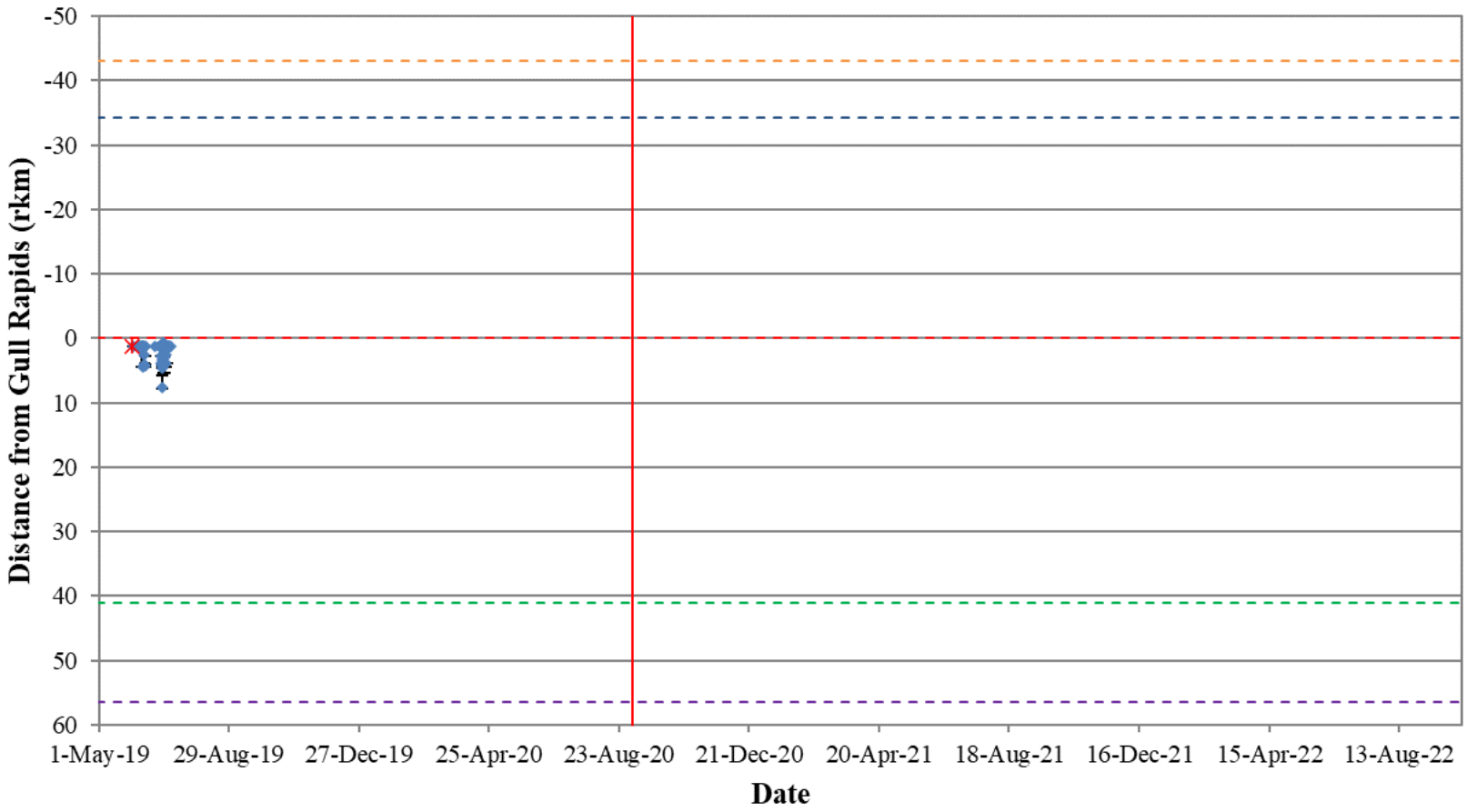

Figure A3-24: Position of a Walleye tagged with an acoustic transmitter (code #20145) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

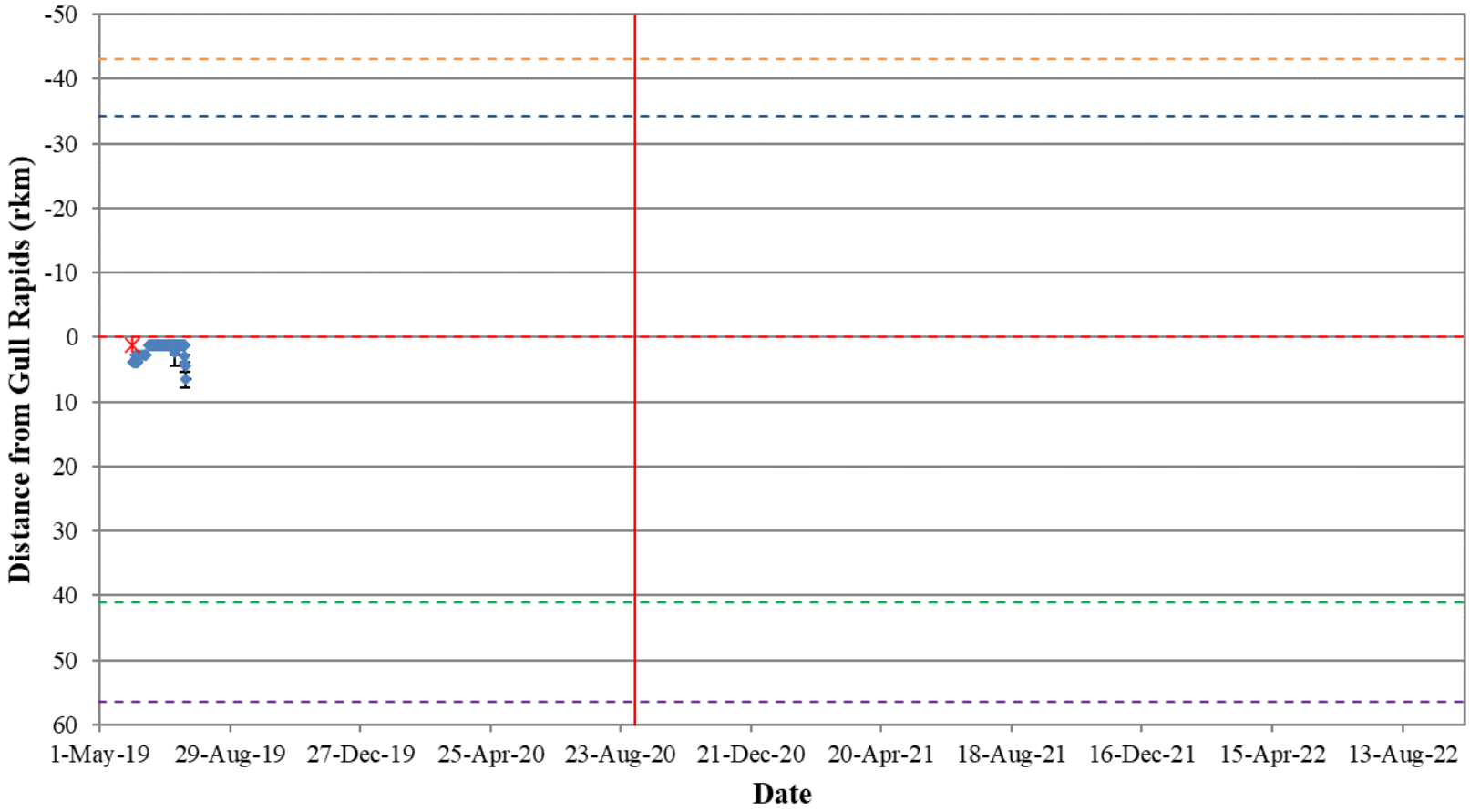

Figure A3-25: Position of a Walleye tagged with an acoustic transmitter (code #20152) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

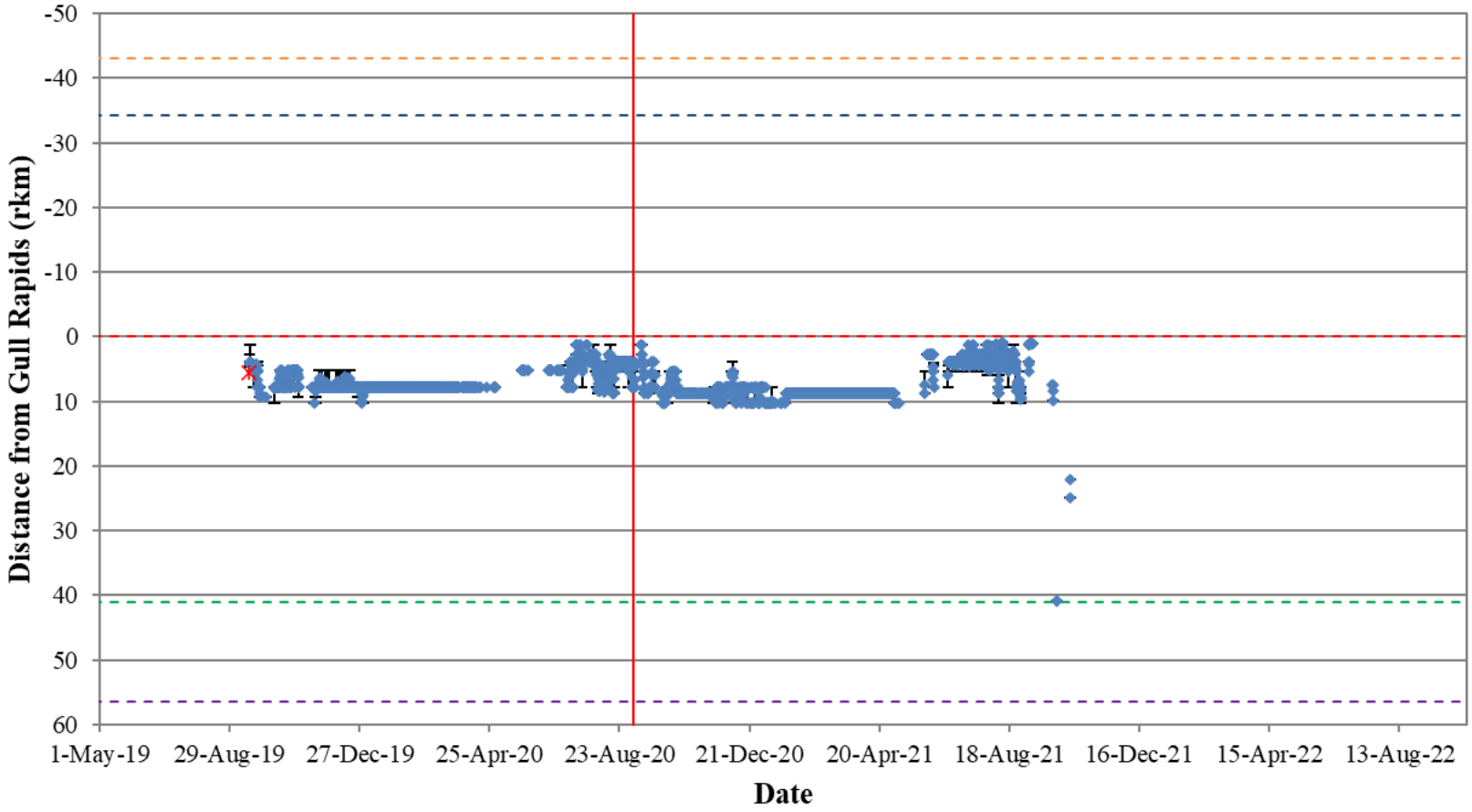

Figure A3-26: Position of a Walleye tagged with an acoustic transmitter (code #20165) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

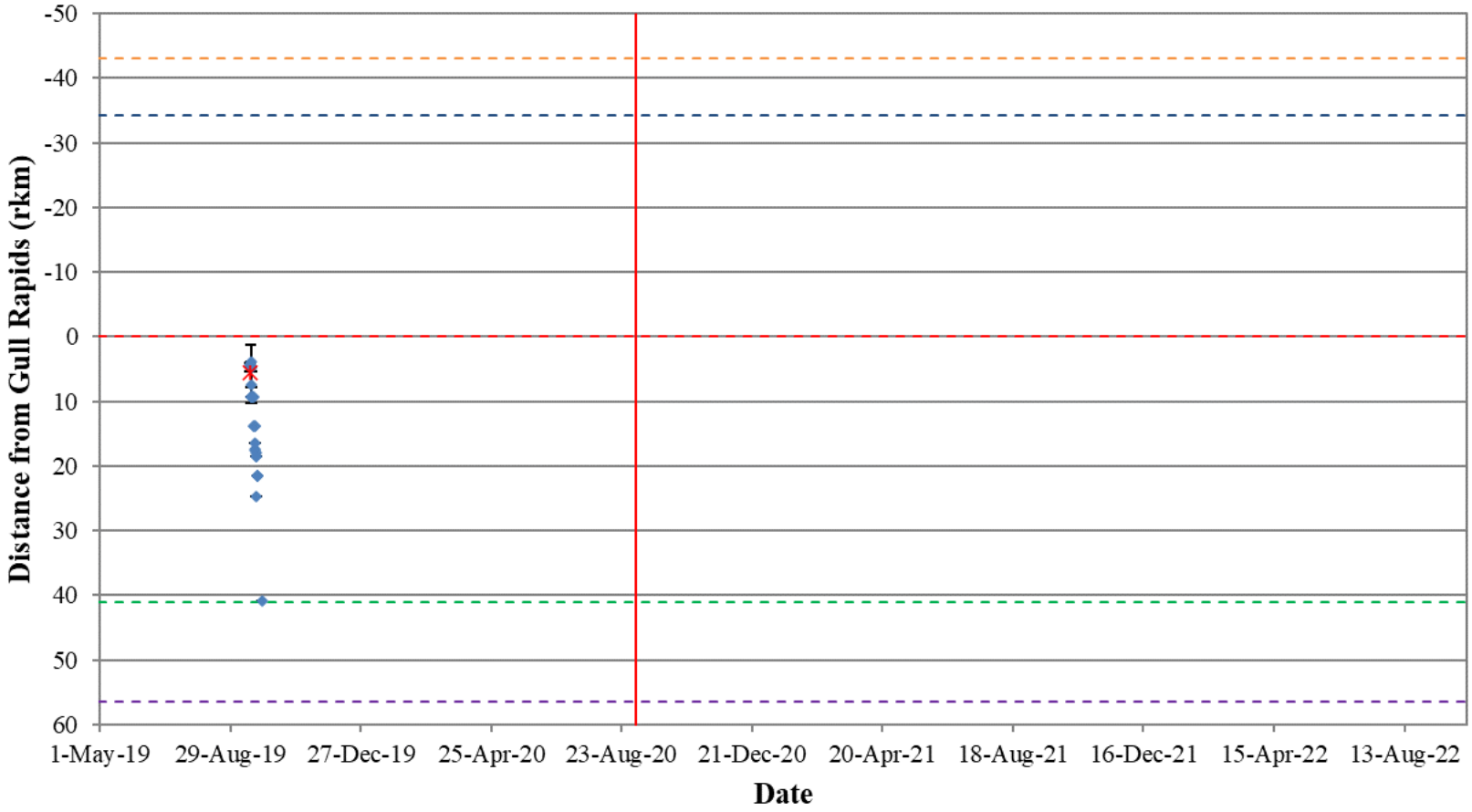

Figure A3-27: Position of a Walleye tagged with an acoustic transmitter (code #20167) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

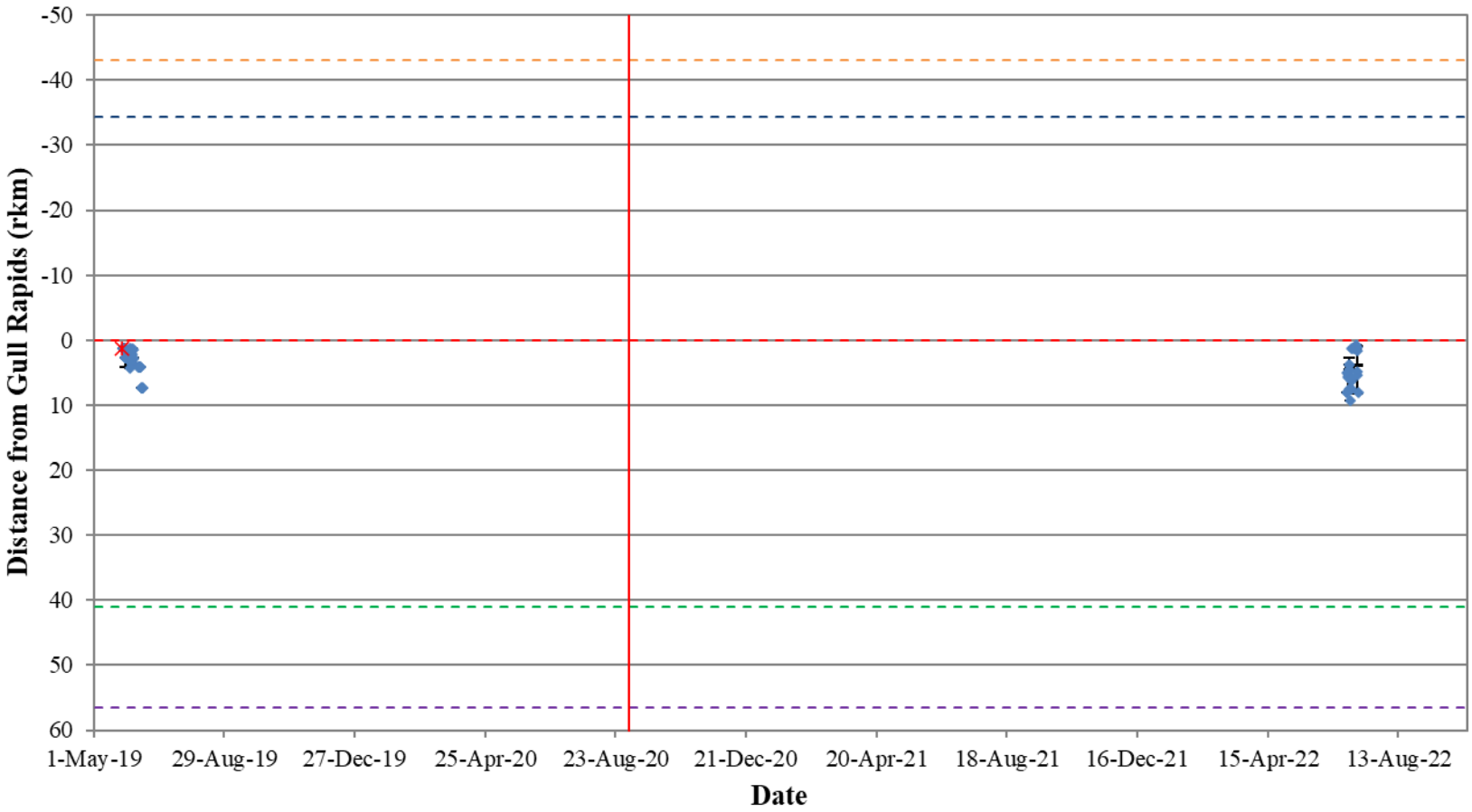

Figure A3-28: Position of a Walleye tagged with an acoustic transmitter (code #20171) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

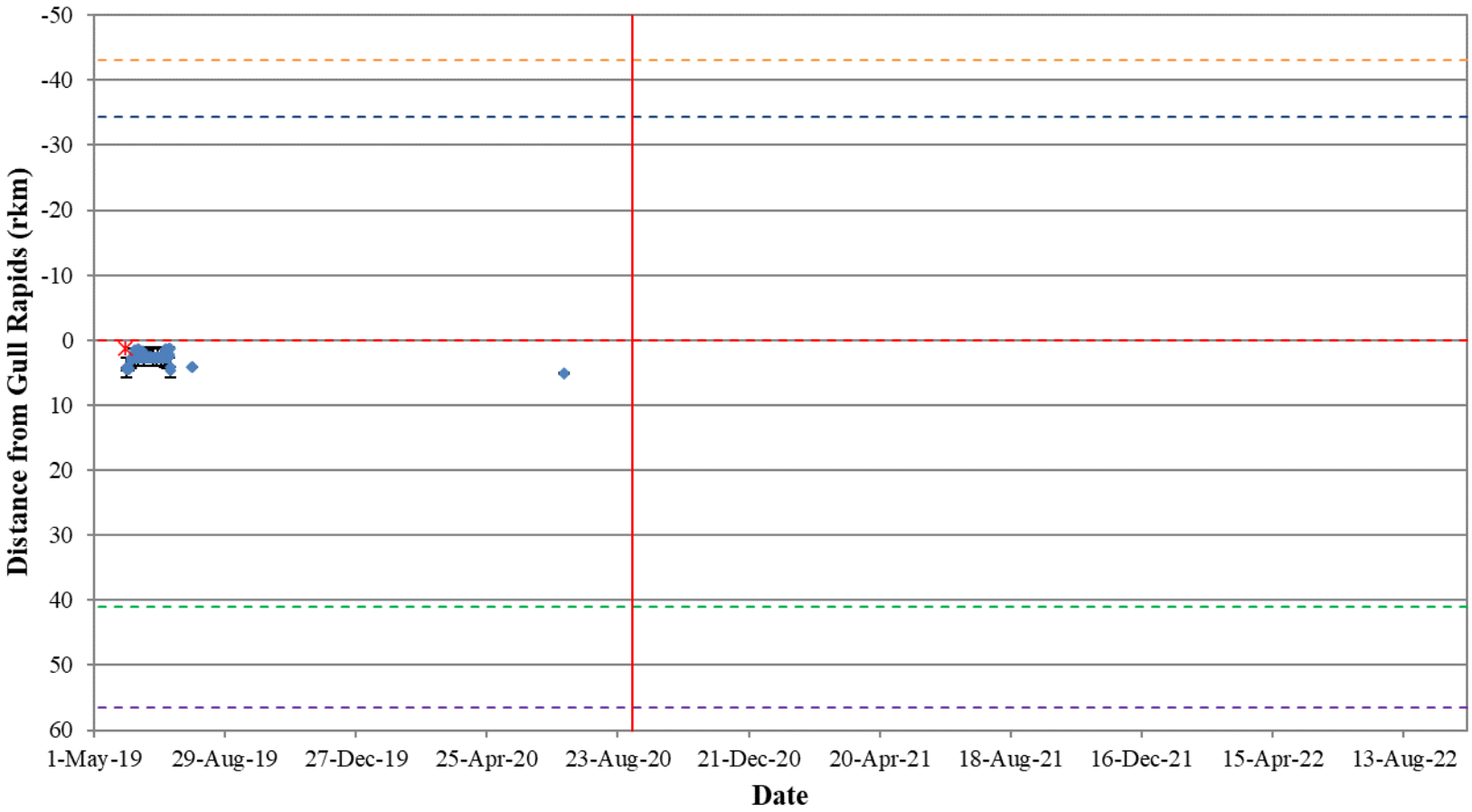

Figure A3-29: Position of a Walleye tagged with an acoustic transmitter (code #20172) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

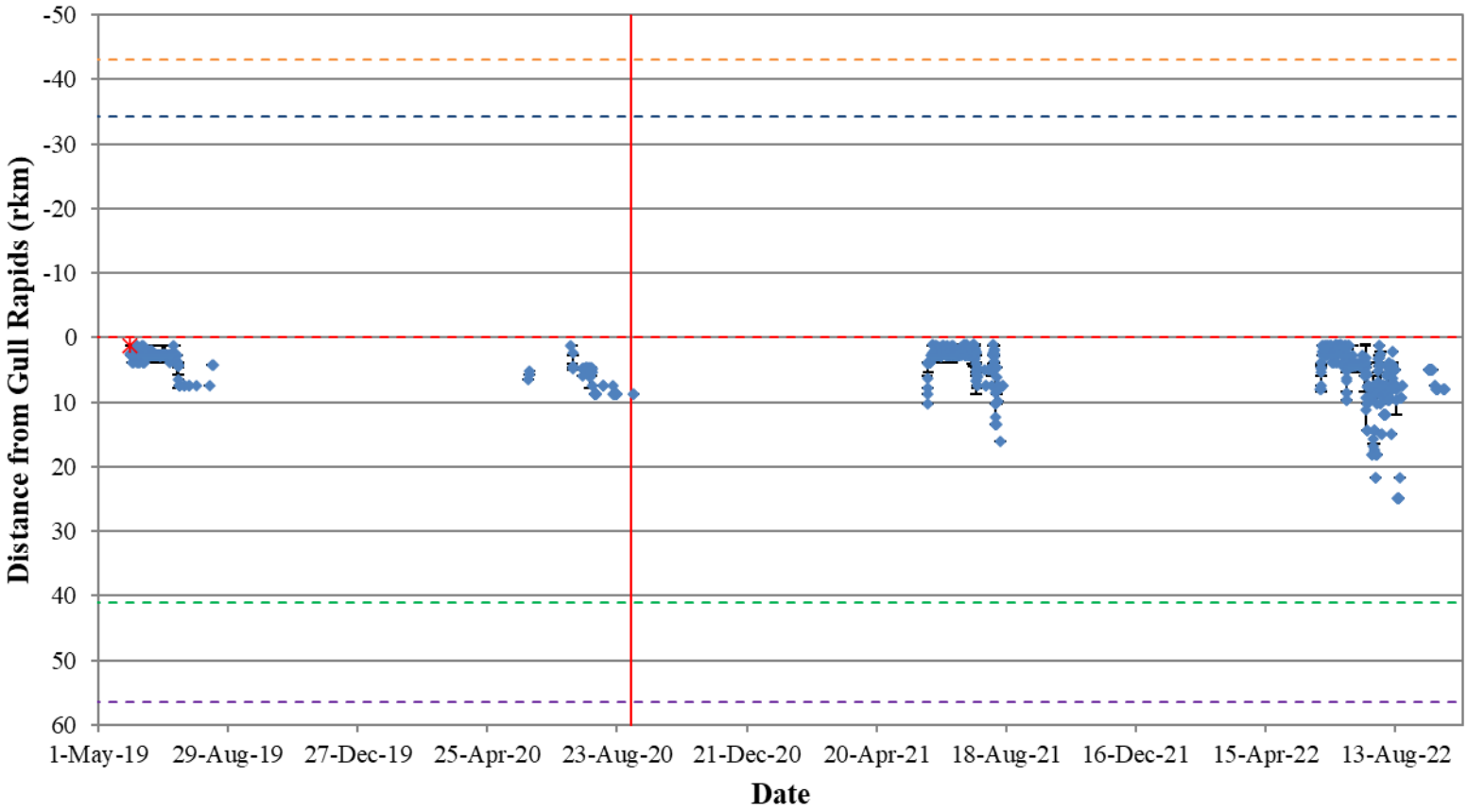

Figure A3-30: Position of a Walleye tagged with an acoustic transmitter (code #20173) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

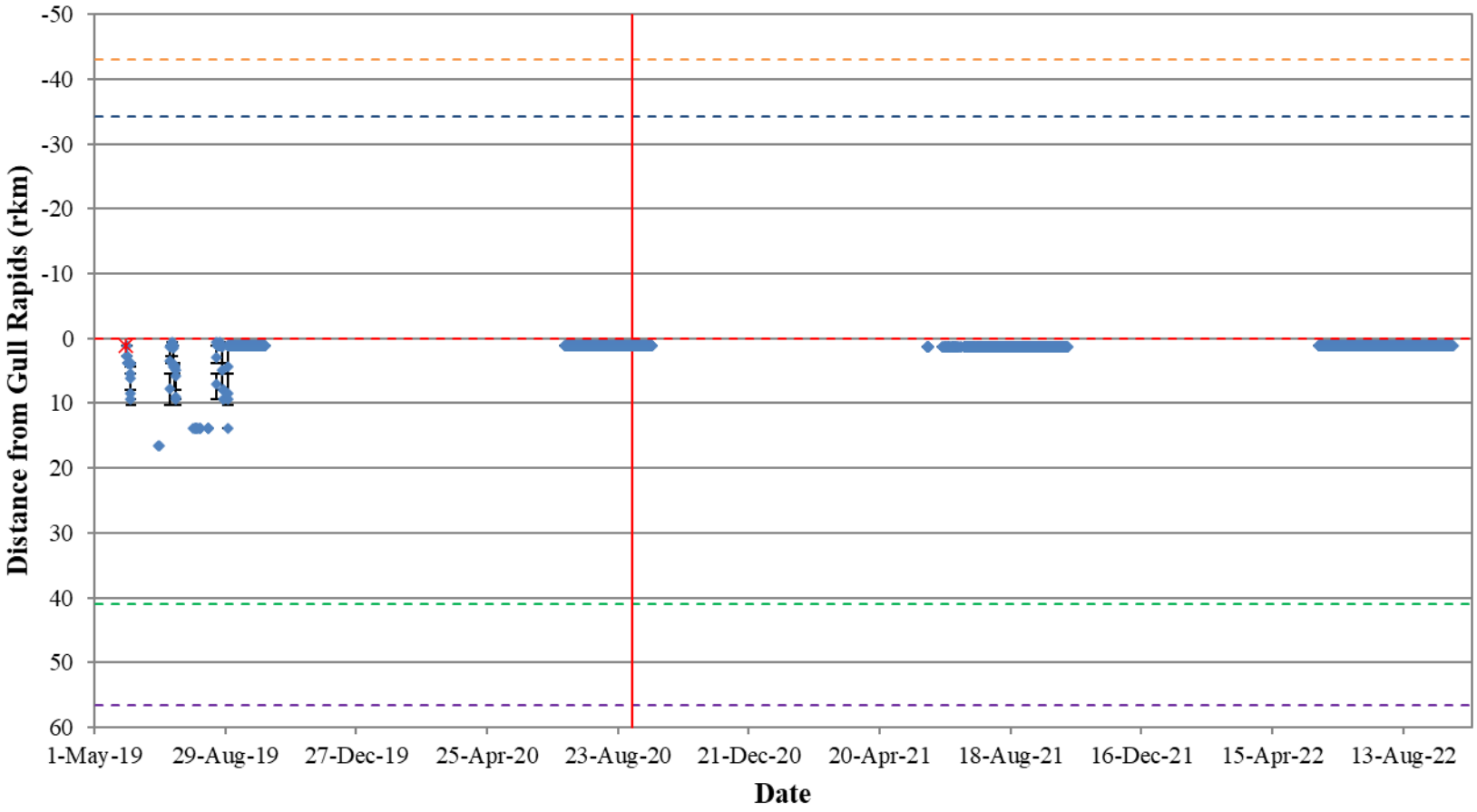

Figure A3-31: Position of a Walleye tagged with an acoustic transmitter (code #20174) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

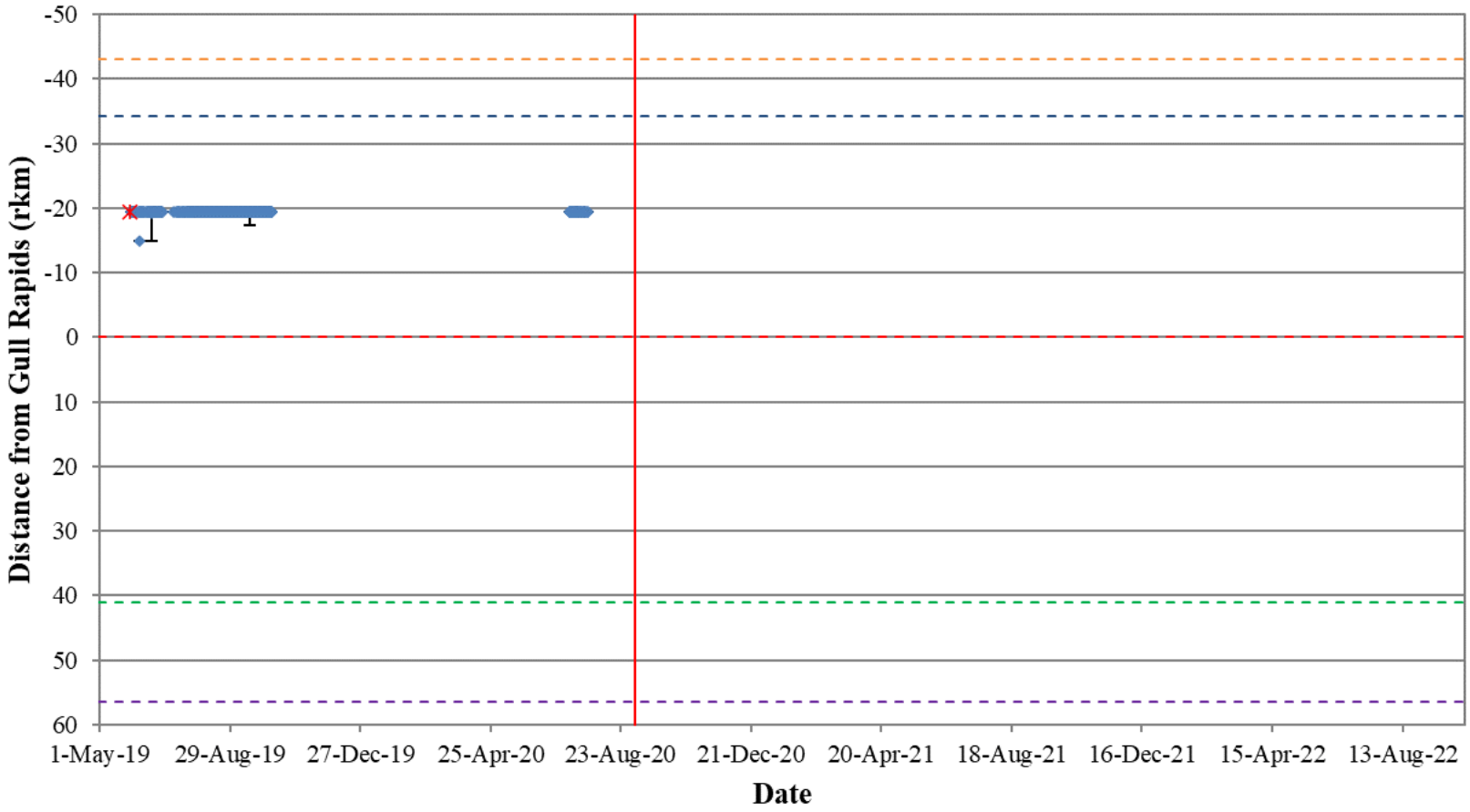

Figure A3-32: Position of a Walleye tagged with an acoustic transmitter (code #20176) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

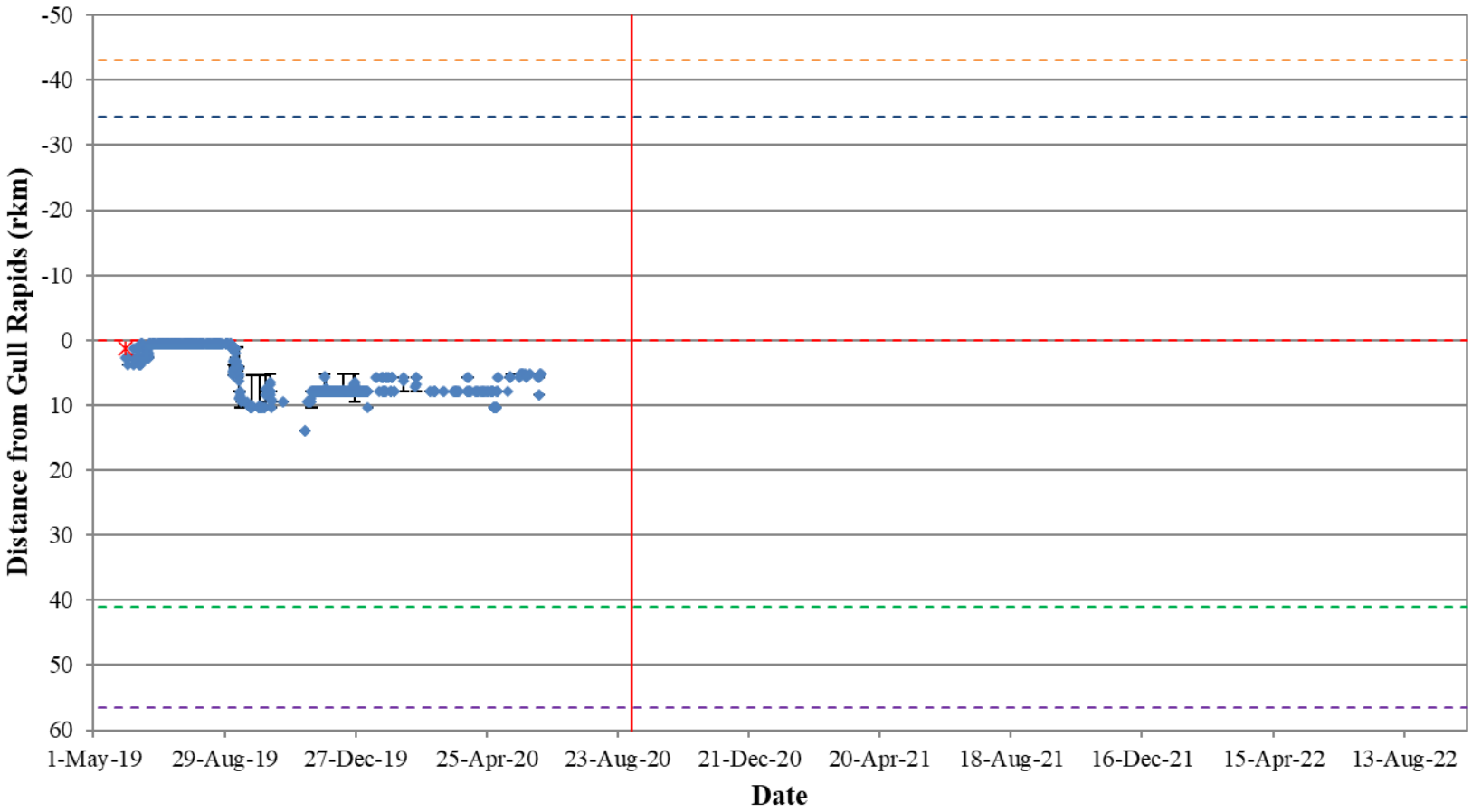

Figure A3-33: Position of a Walleye tagged with an acoustic transmitter (code #20177) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

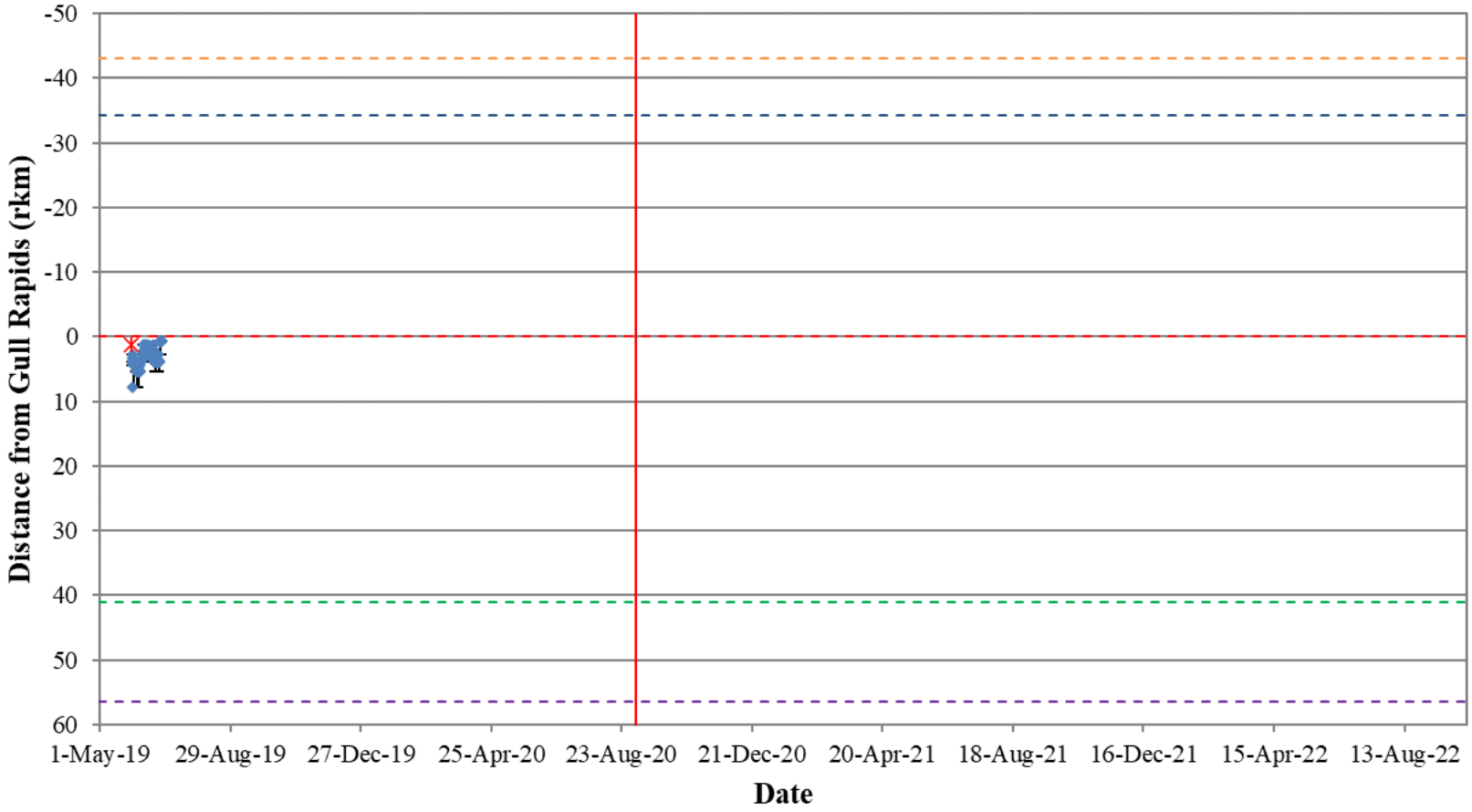

Figure A3-34: Position of a Walleye tagged with an acoustic transmitter (code #20178) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

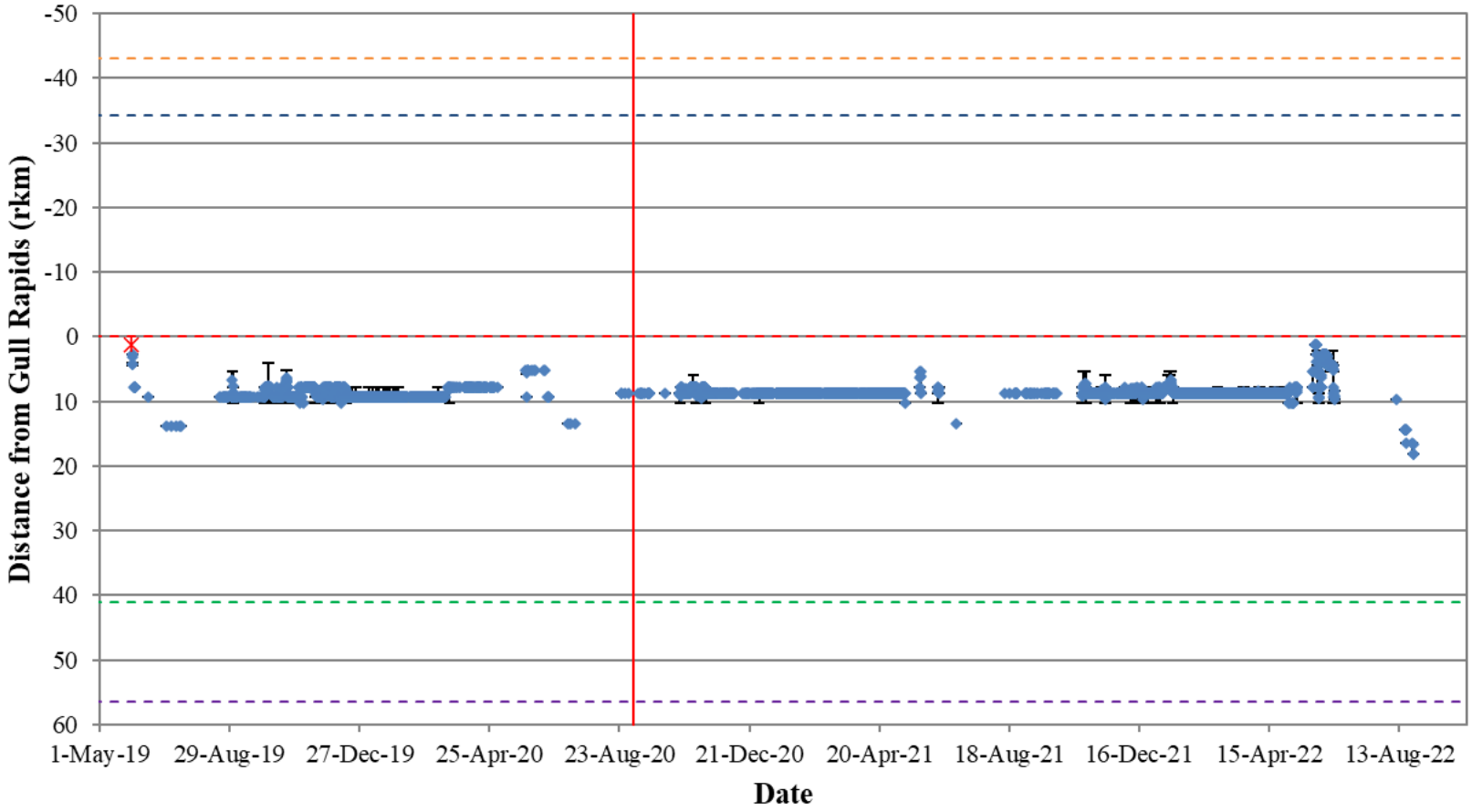

Figure A3-35: Position of a Walleye tagged with an acoustic transmitter (code #20179) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

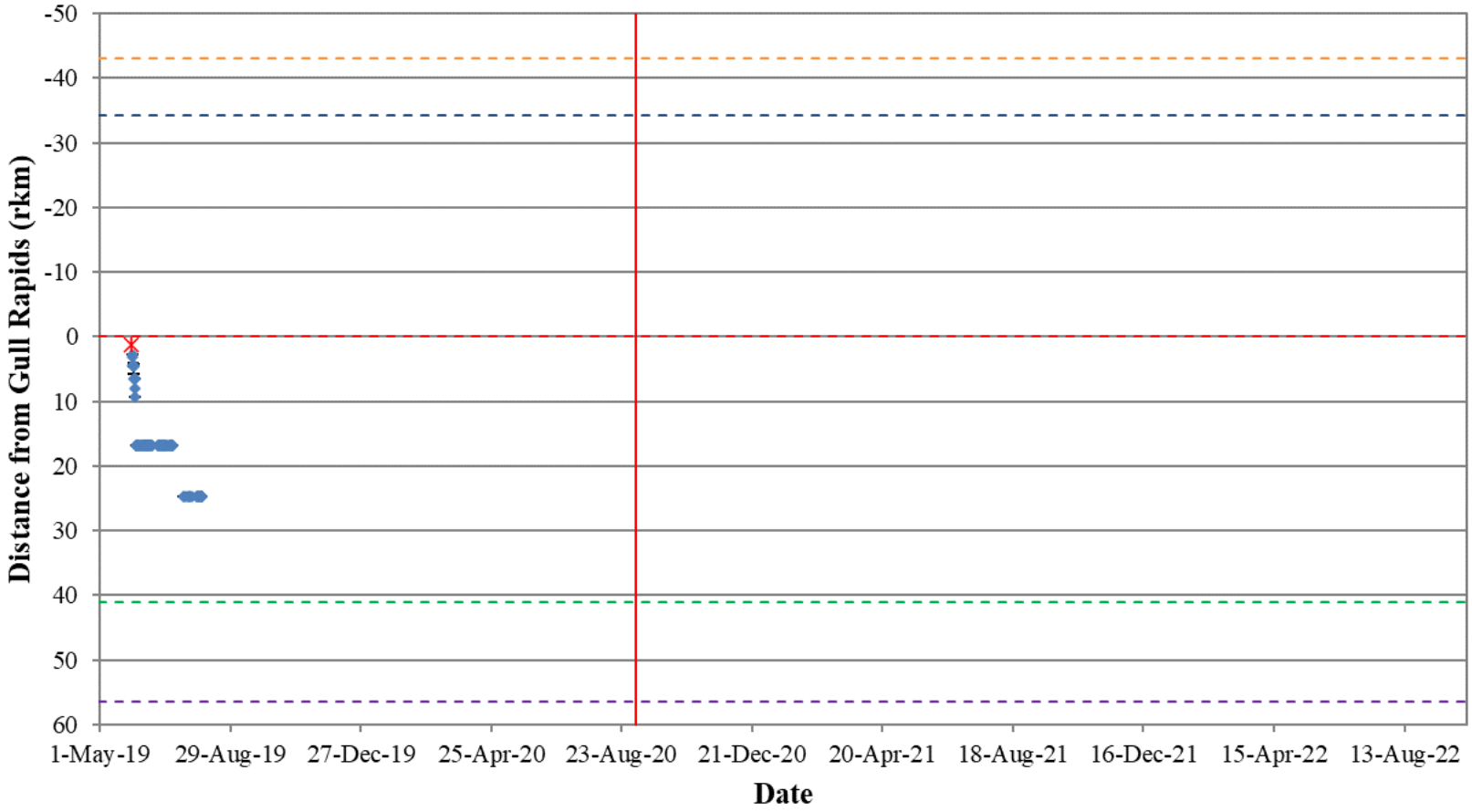

Figure A3-36: Position of a Walleye tagged with an acoustic transmitter (code #20180) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

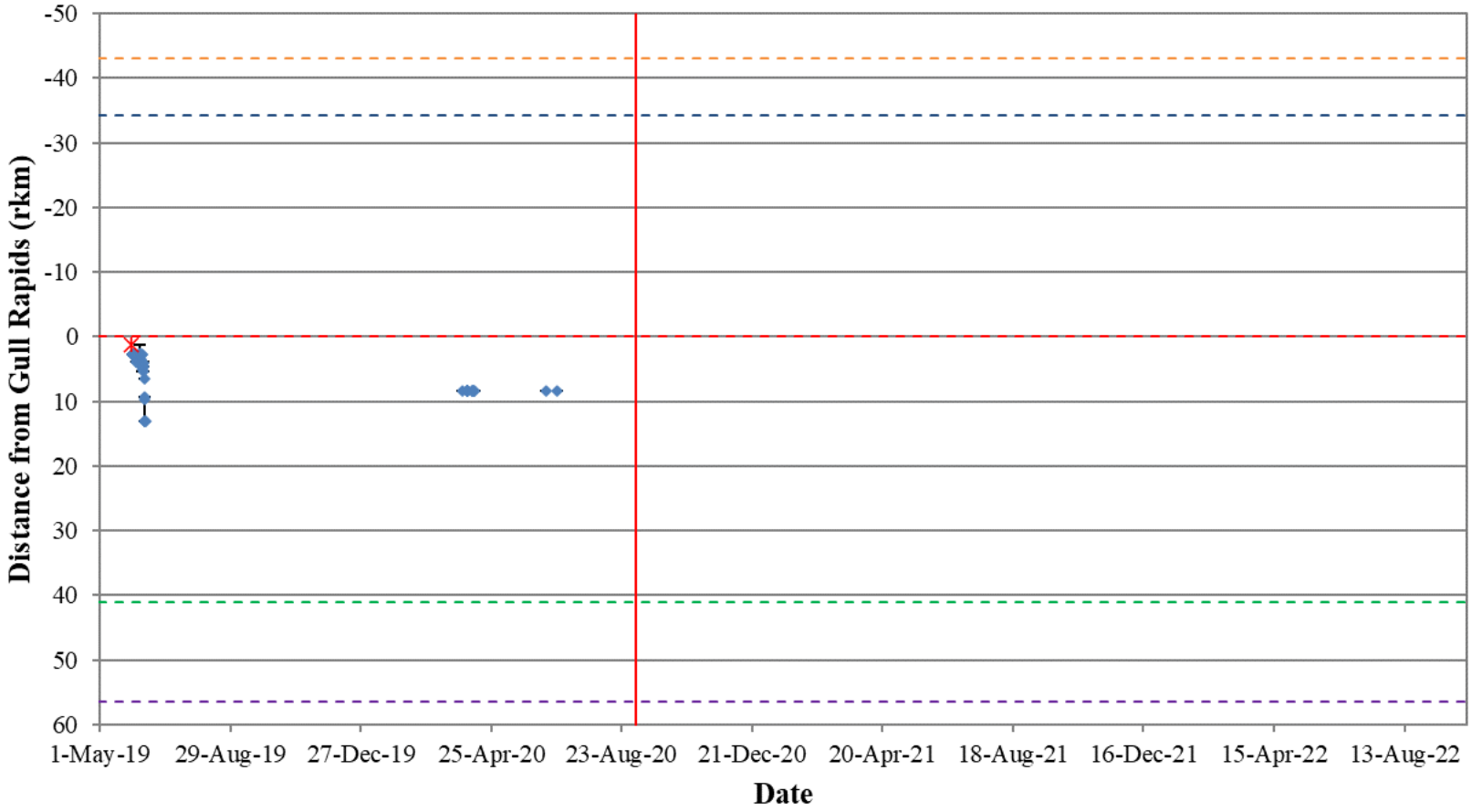

Figure A3-37: Position of a Walleye tagged with an acoustic transmitter (code #20183) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

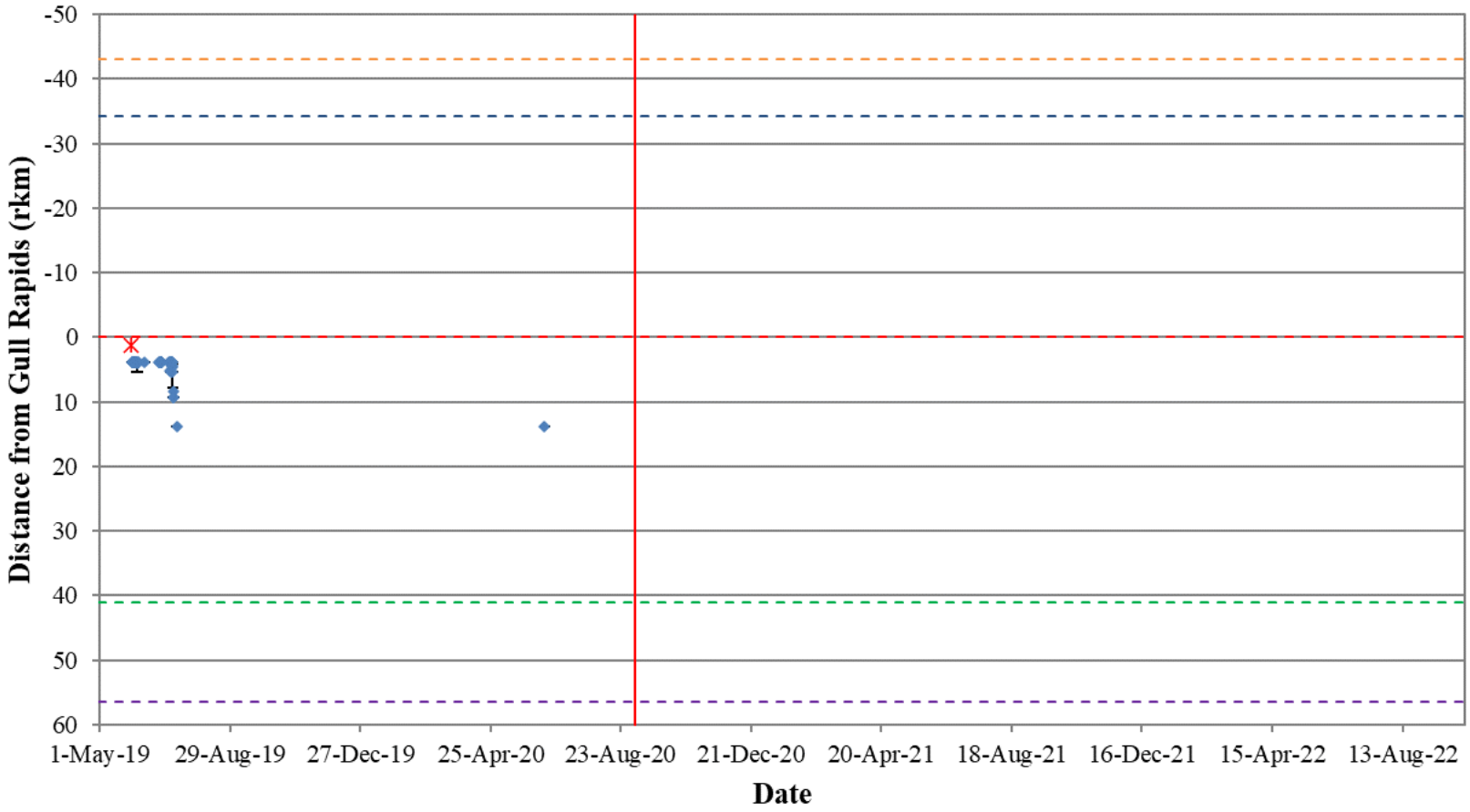

Figure A3-38: Position of a Walleye tagged with an acoustic transmitter (code #20184) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

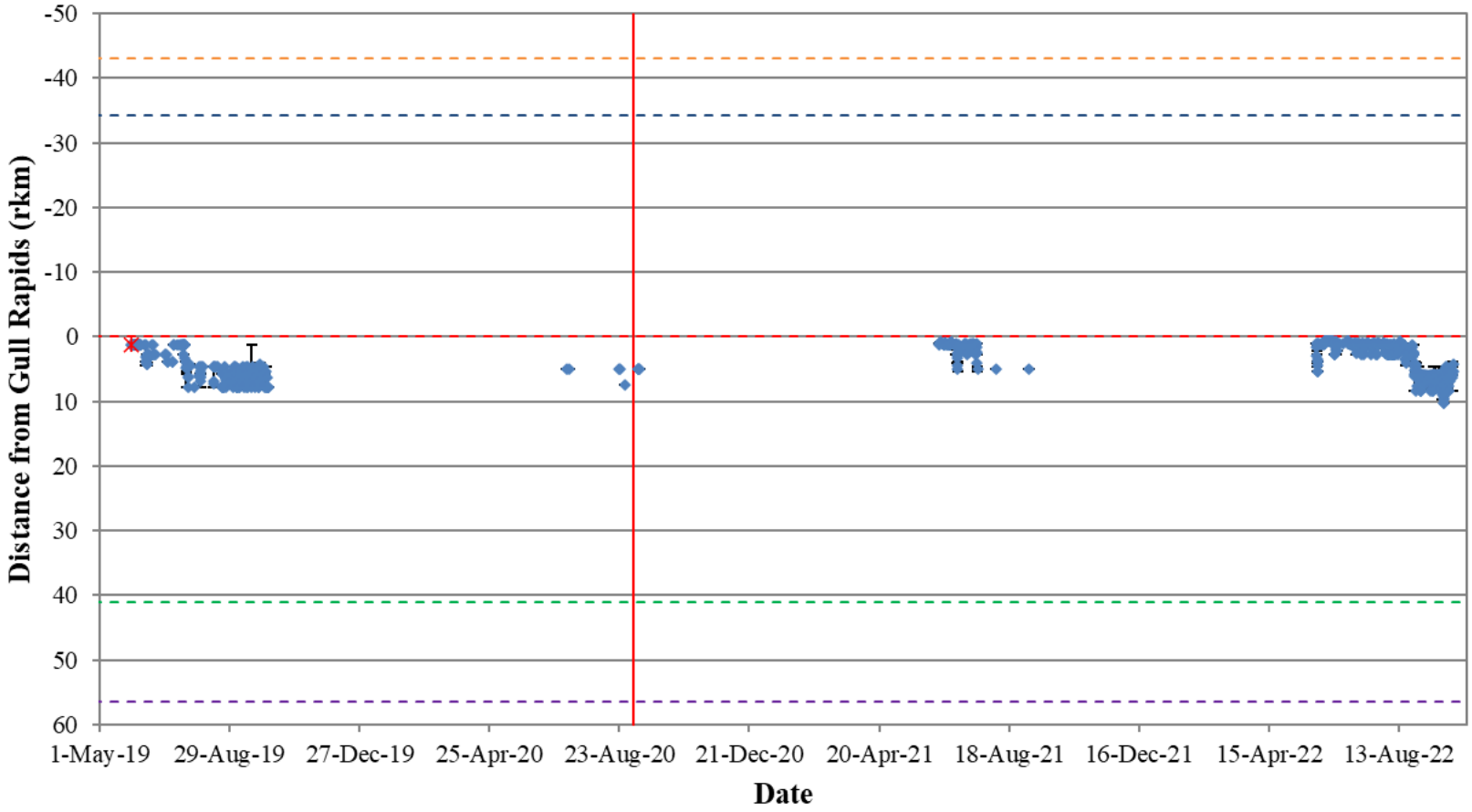

Figure A3-39: Position of a Walleye tagged with an acoustic transmitter (code #20185) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2019 to October 10, 2022. Date and location of tagging is indicated by a star. The end of reservoir impoundment is indicated with a solid vertical red line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

APPENDIX 4:
LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE UPSTREAM OF THE KEEYASK GS IN 2021: MAY 2021 TO OCTOBER 2022

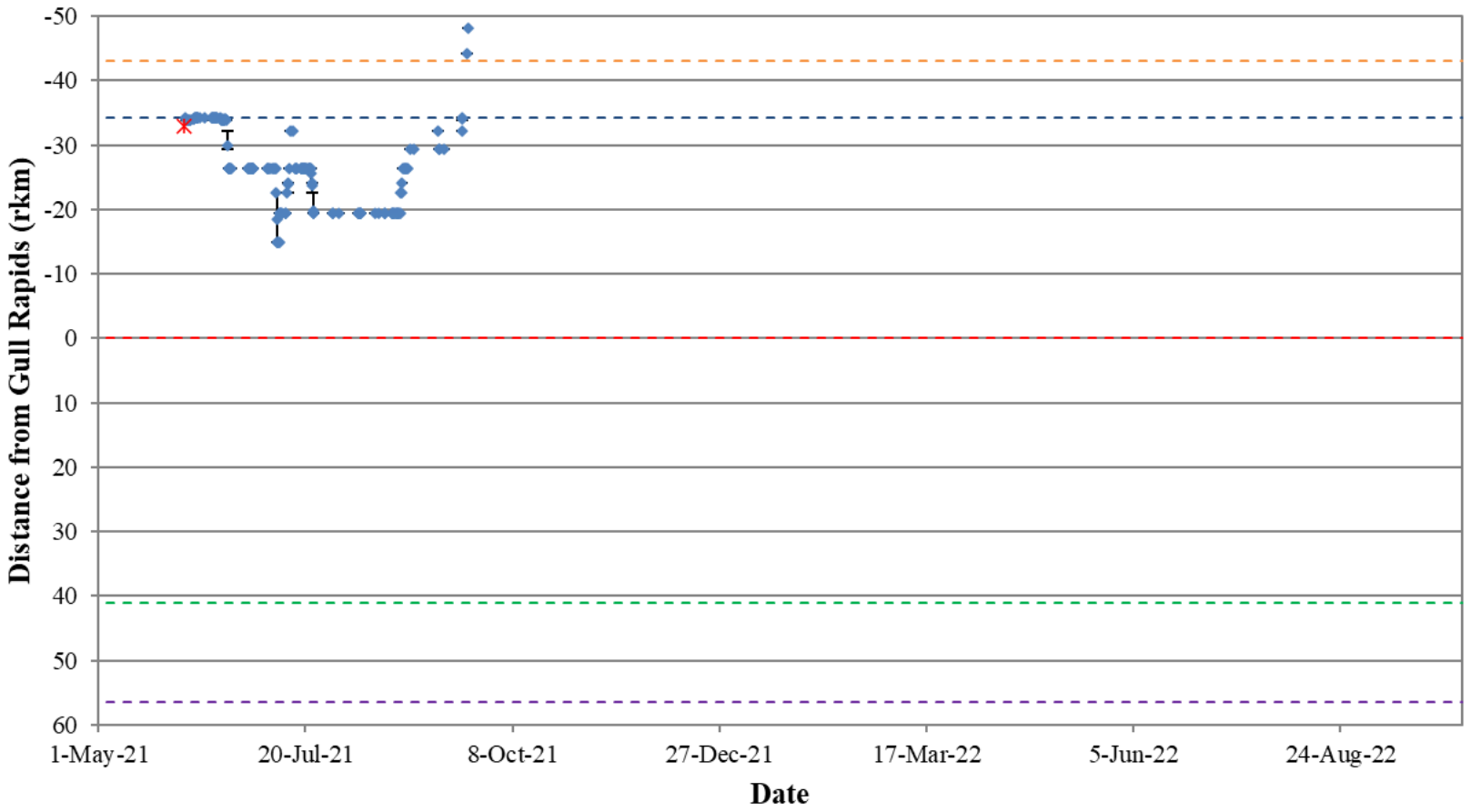

Figure A4-1: Position of a Walleye tagged with an acoustic transmitter (code #48244) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

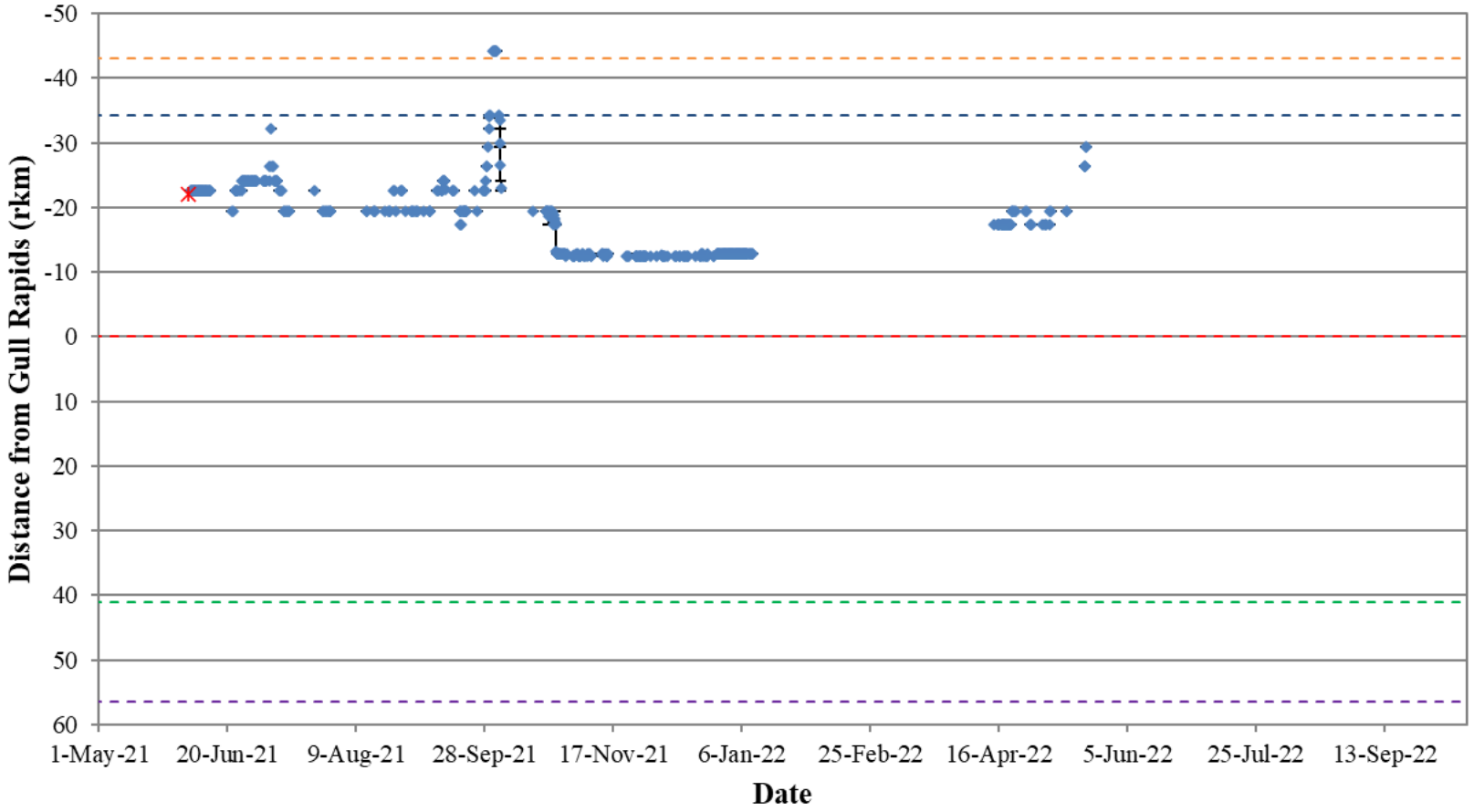

Figure A4-2: Position of a Walleye tagged with an acoustic transmitter (code #48258) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

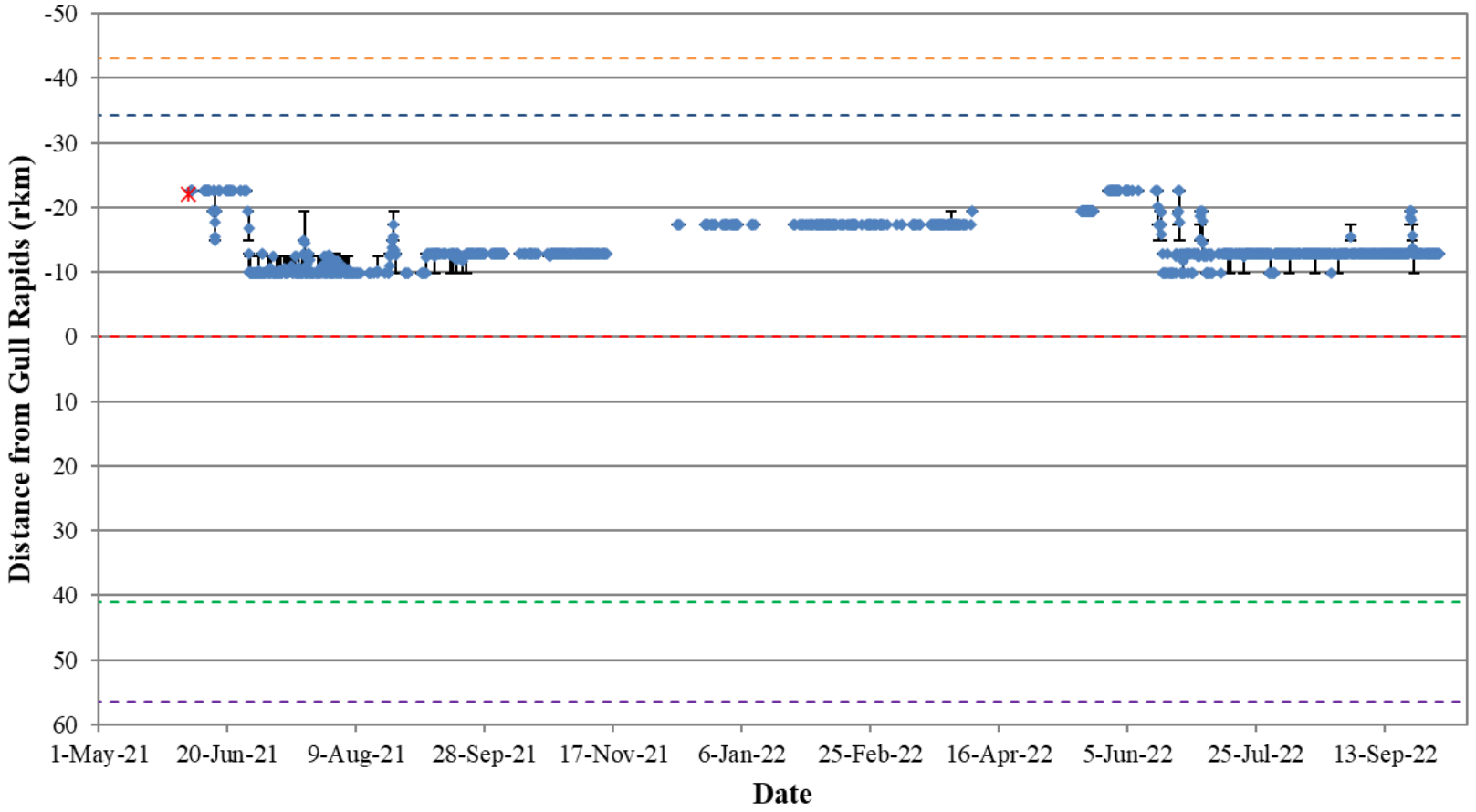

Figure A4-3: Position of a Walleye tagged with an acoustic transmitter (code #48259) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

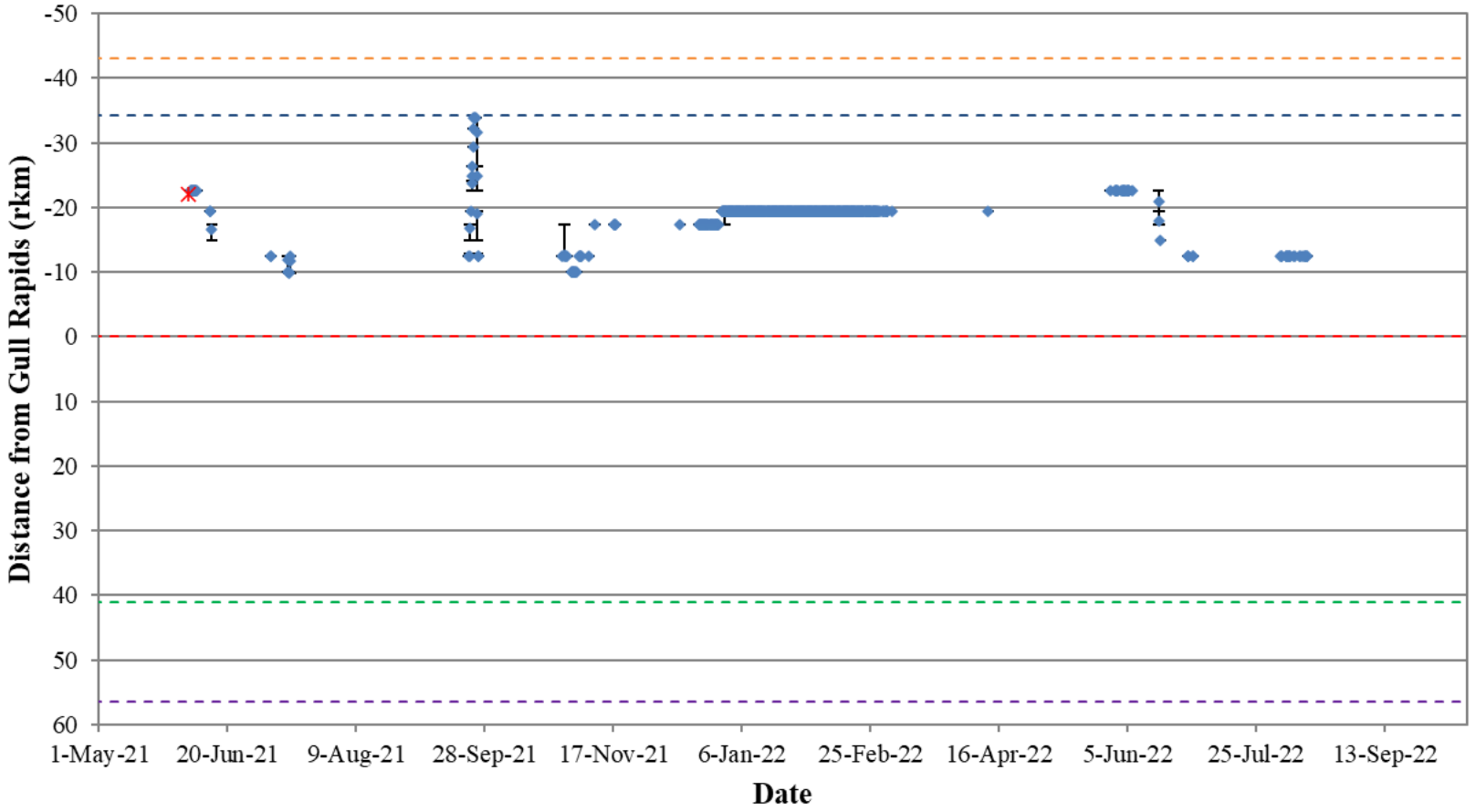

Figure A4-4: Position of a Walleye tagged with an acoustic transmitter (code #48260) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

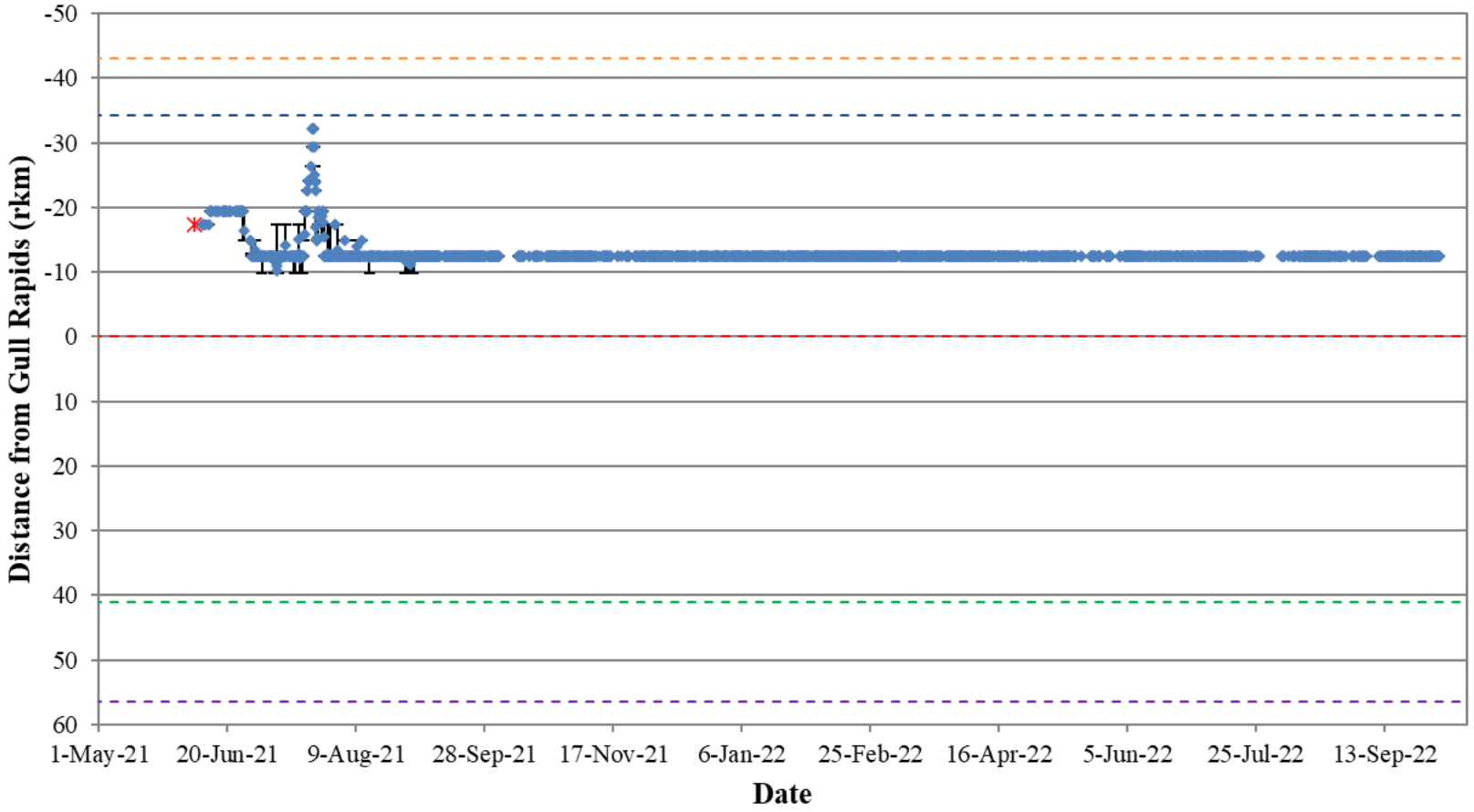

Figure A4-5: Position of a Walleye tagged with an acoustic transmitter (code #48261) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

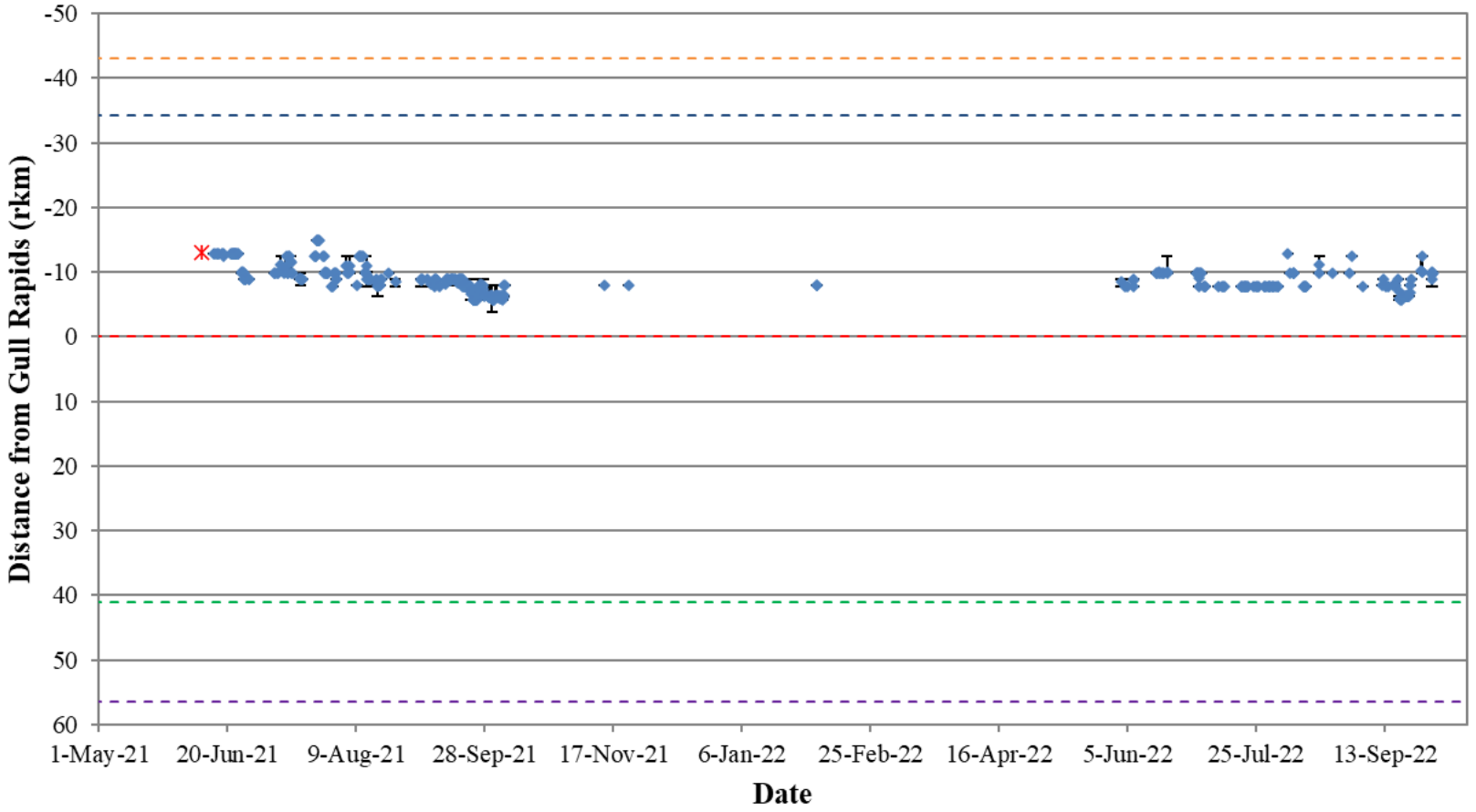

Figure A4-6: Position of a Walleye tagged with an acoustic transmitter (code #48262) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

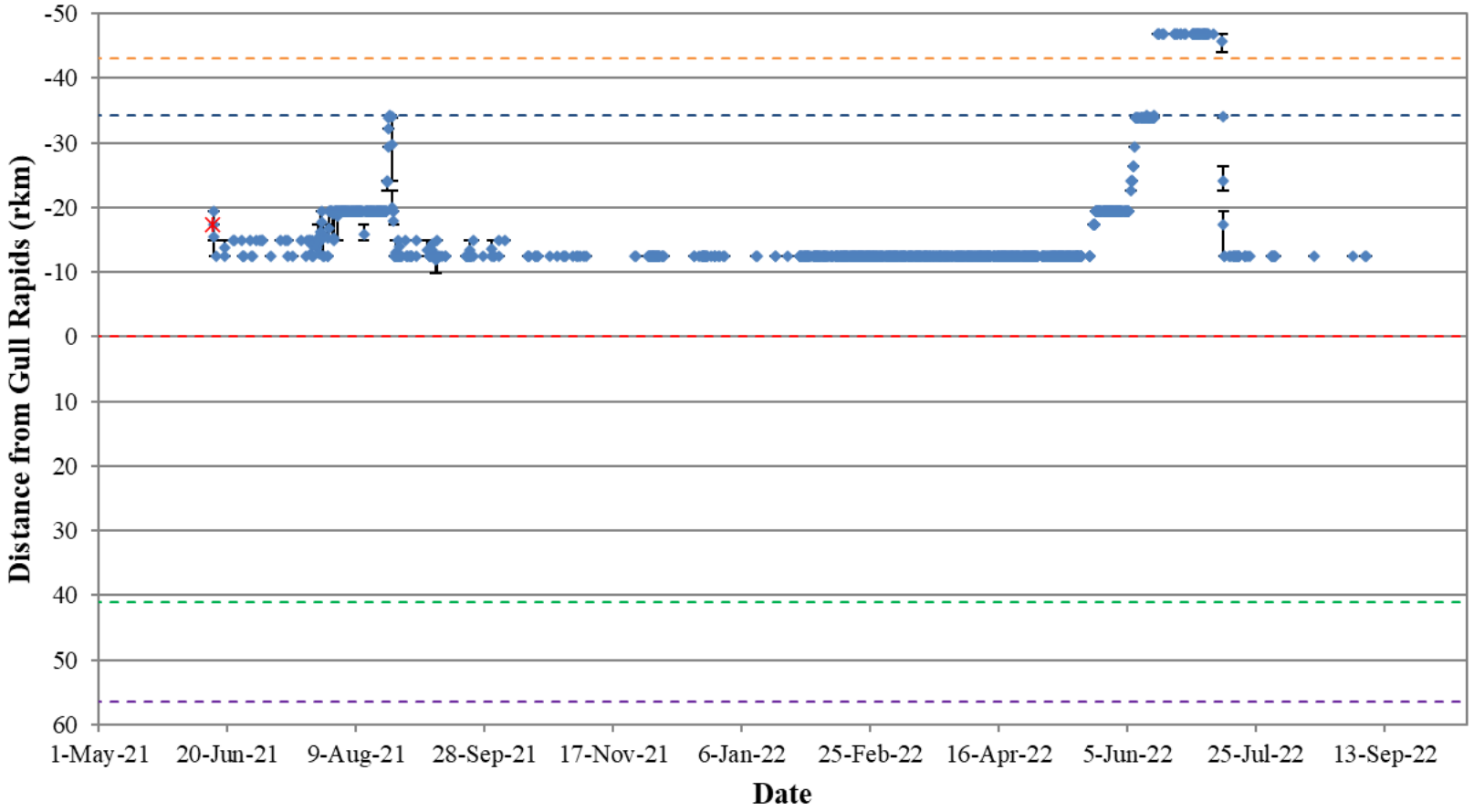

Figure A4-7: Position of a Walleye tagged with an acoustic transmitter (code #48263) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

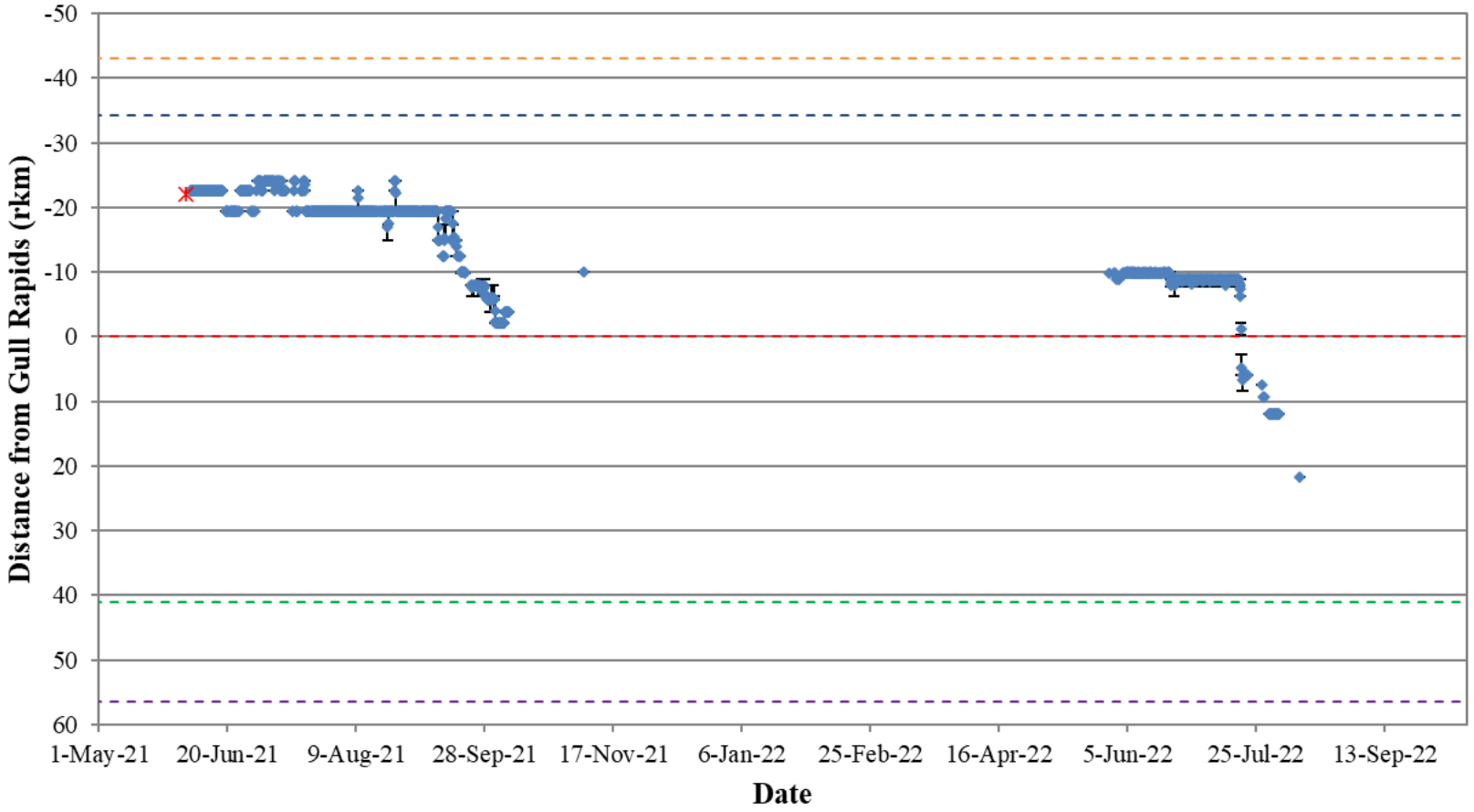

Figure A4-8: Position of a Walleye tagged with an acoustic transmitter (code #48264) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

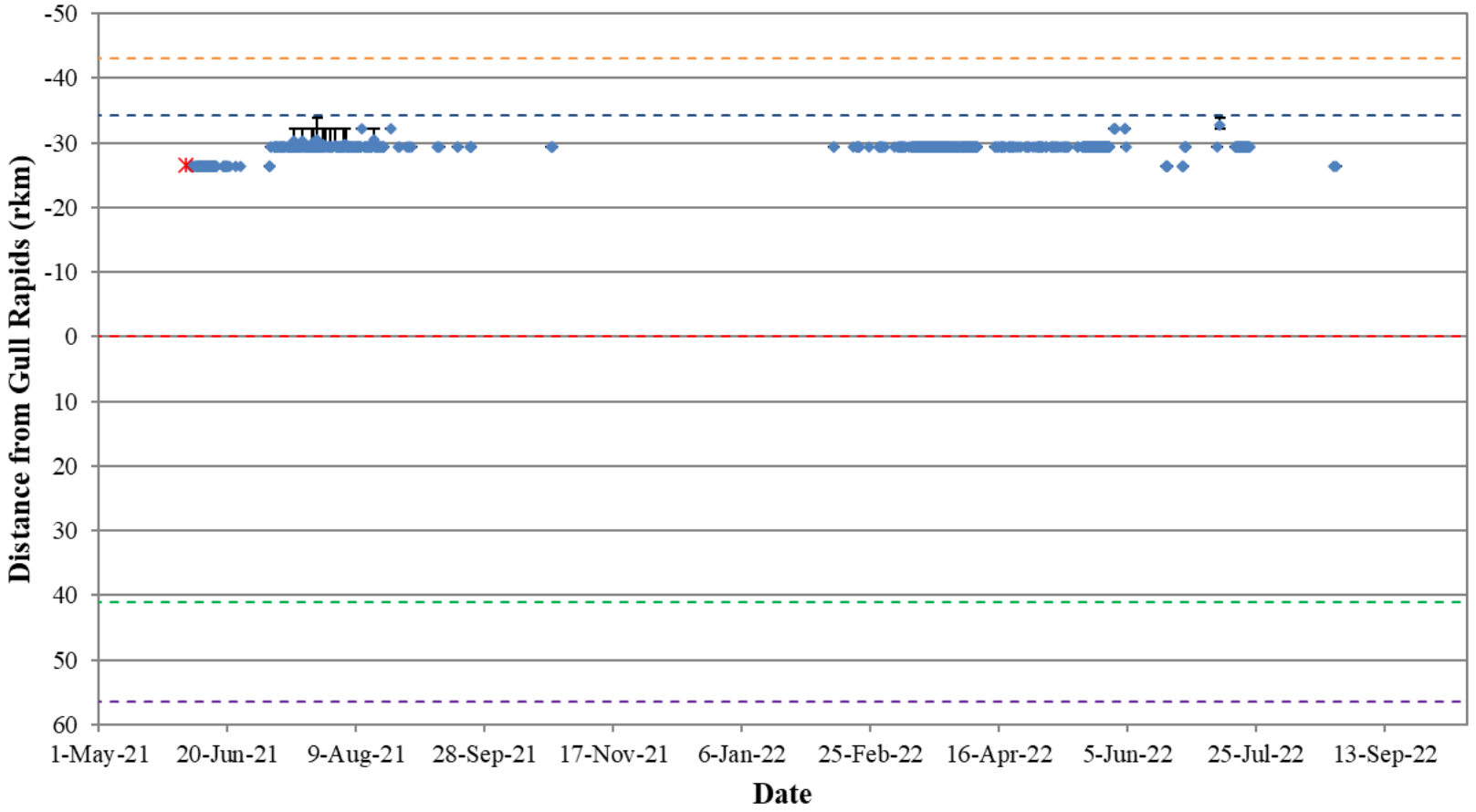

Figure A4-9: Position of a Walleye tagged with an acoustic transmitter (code #48265) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

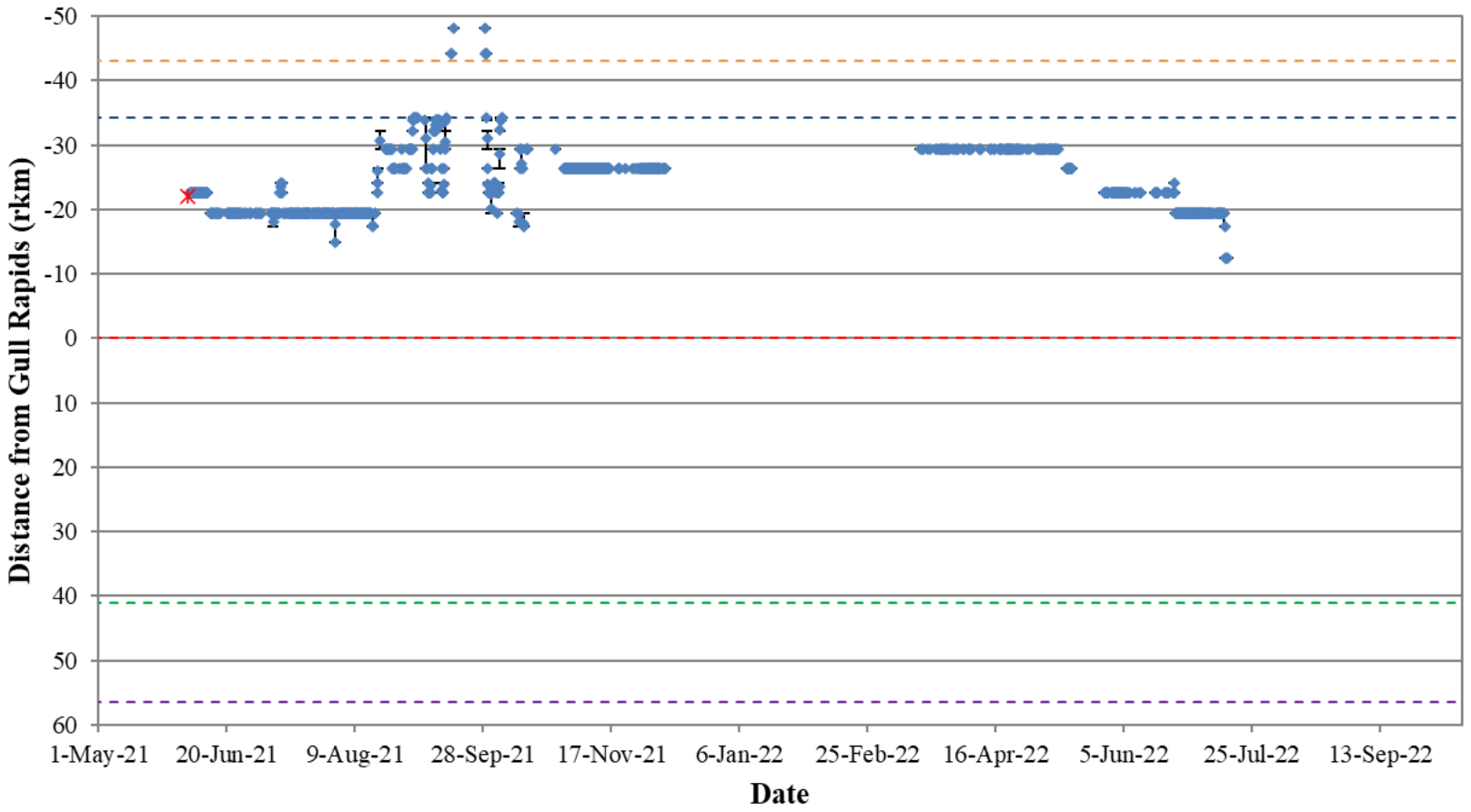

Figure A4-10: Position of a Walleye tagged with an acoustic transmitter (code #48266) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

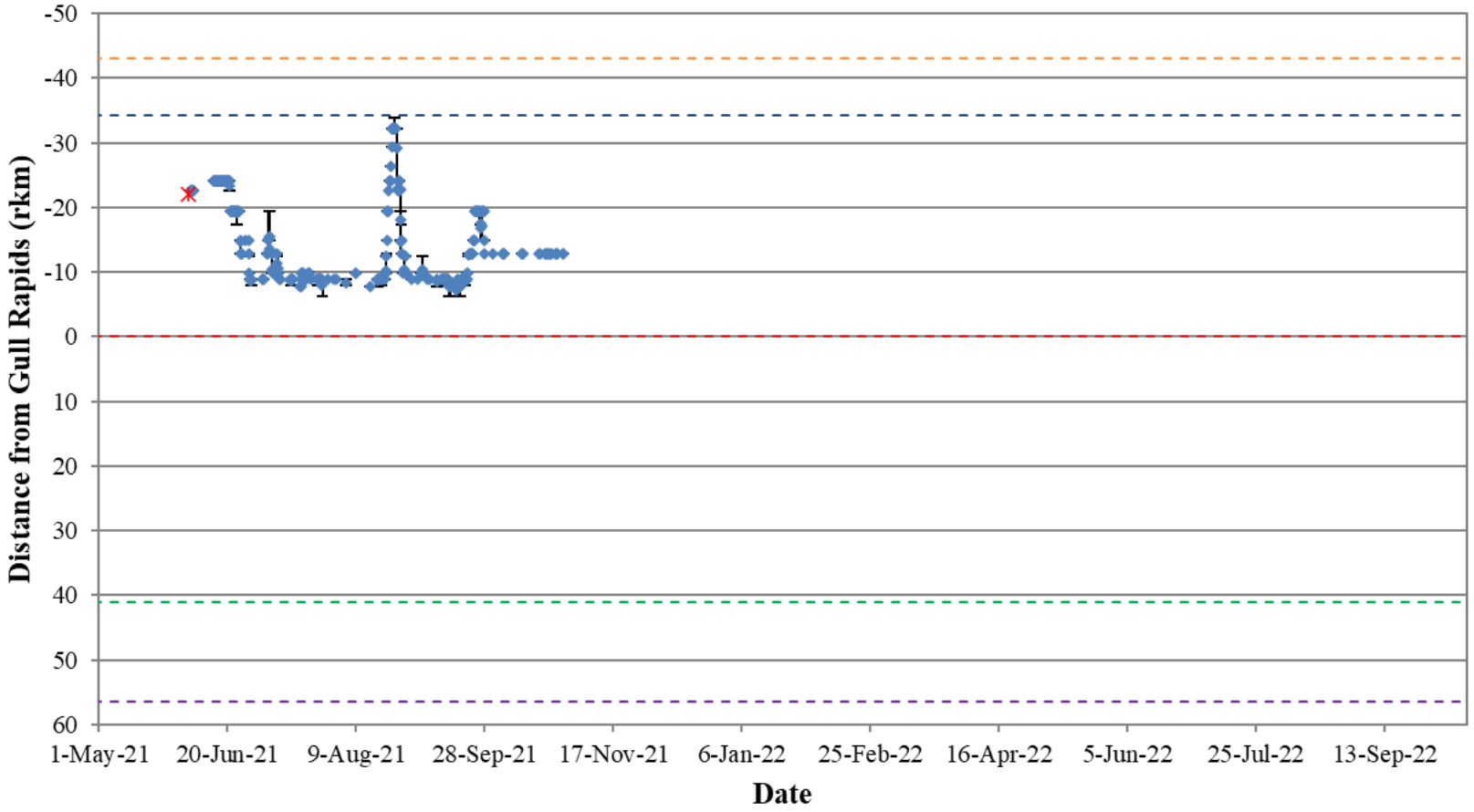

Figure A4-11: Position of a Walleye tagged with an acoustic transmitter (code #48267) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

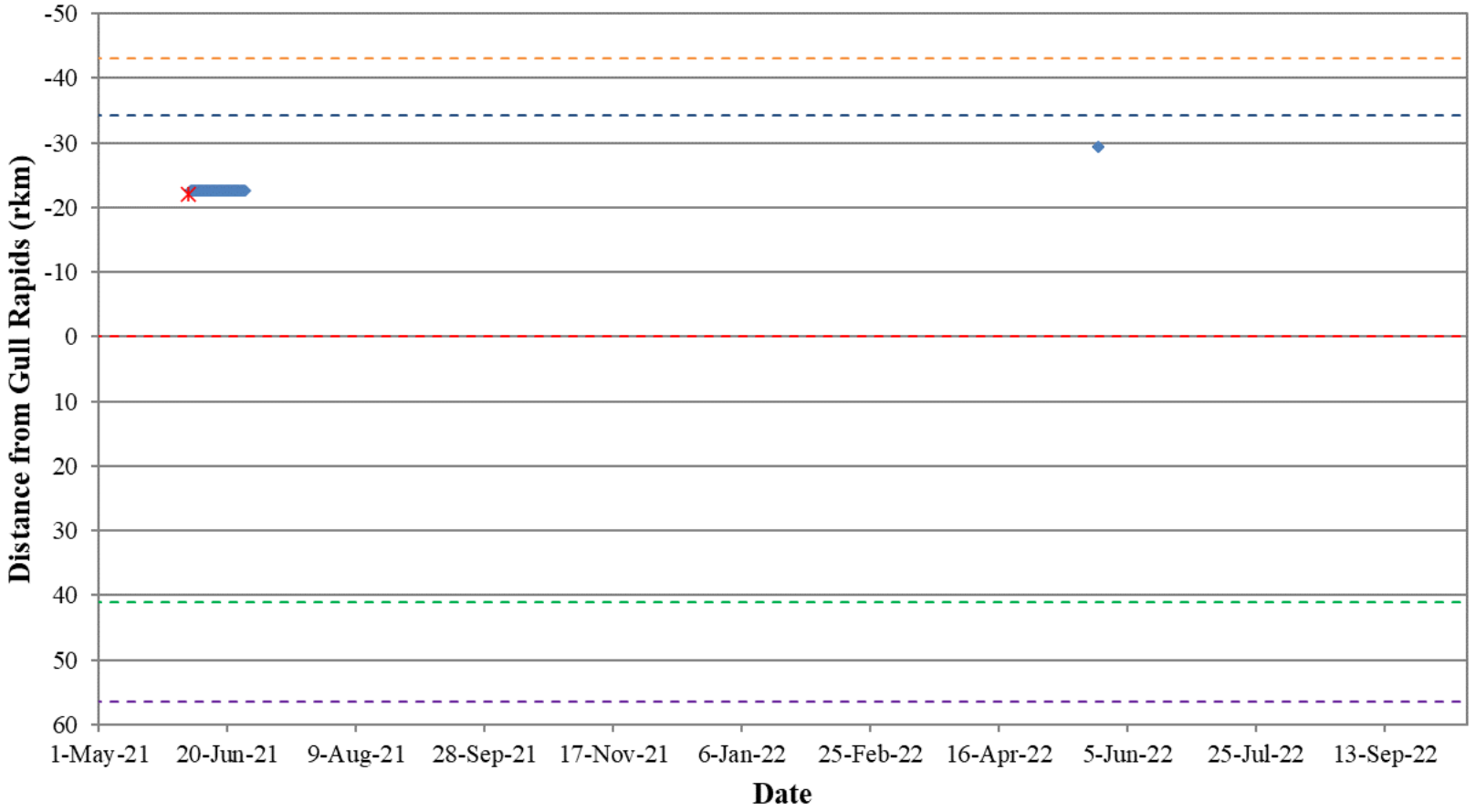

Figure A4-12: Position of a Walleye tagged with an acoustic transmitter (code #48268) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

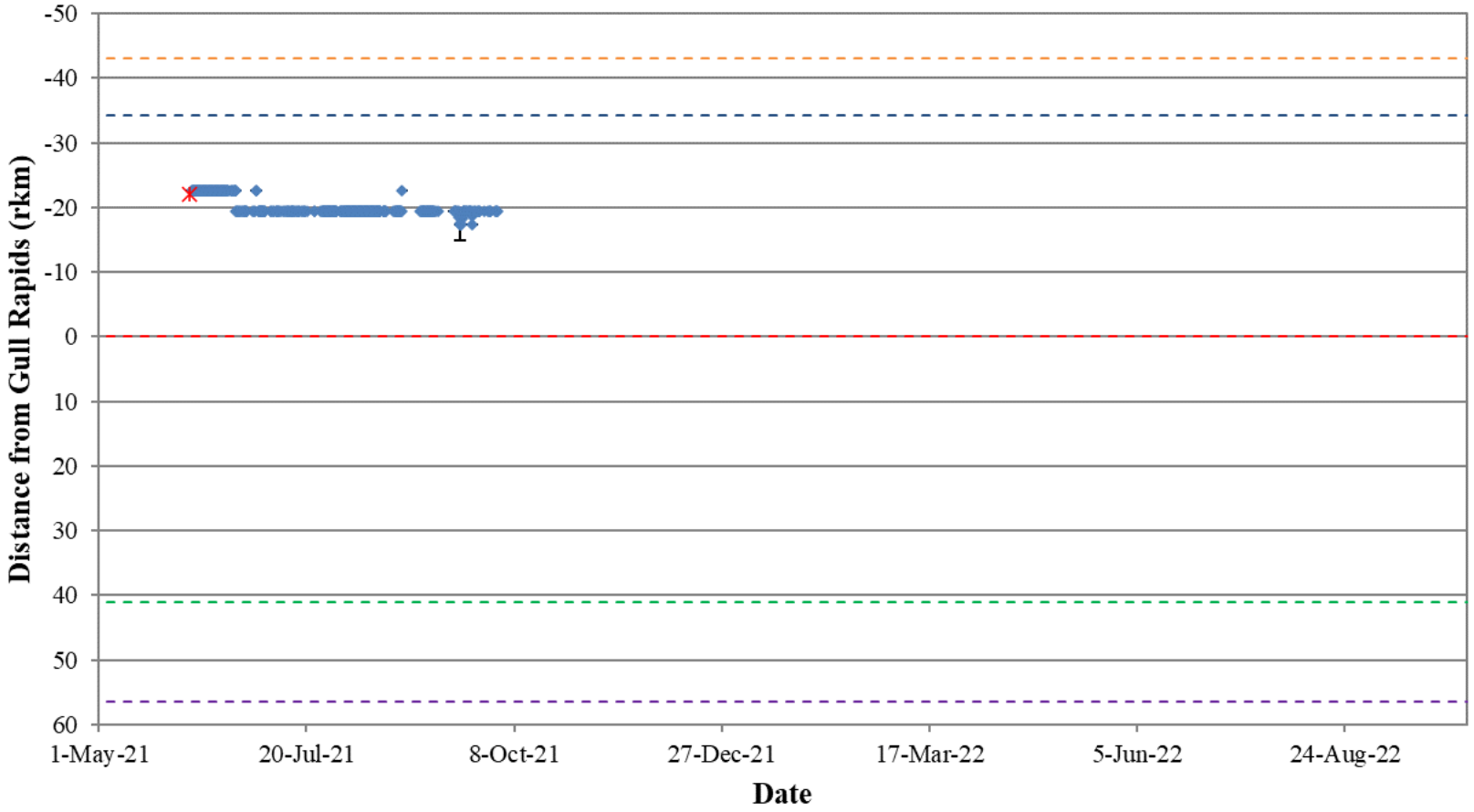

Figure A4-13: Position of a Walleye tagged with an acoustic transmitter (code #48269) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

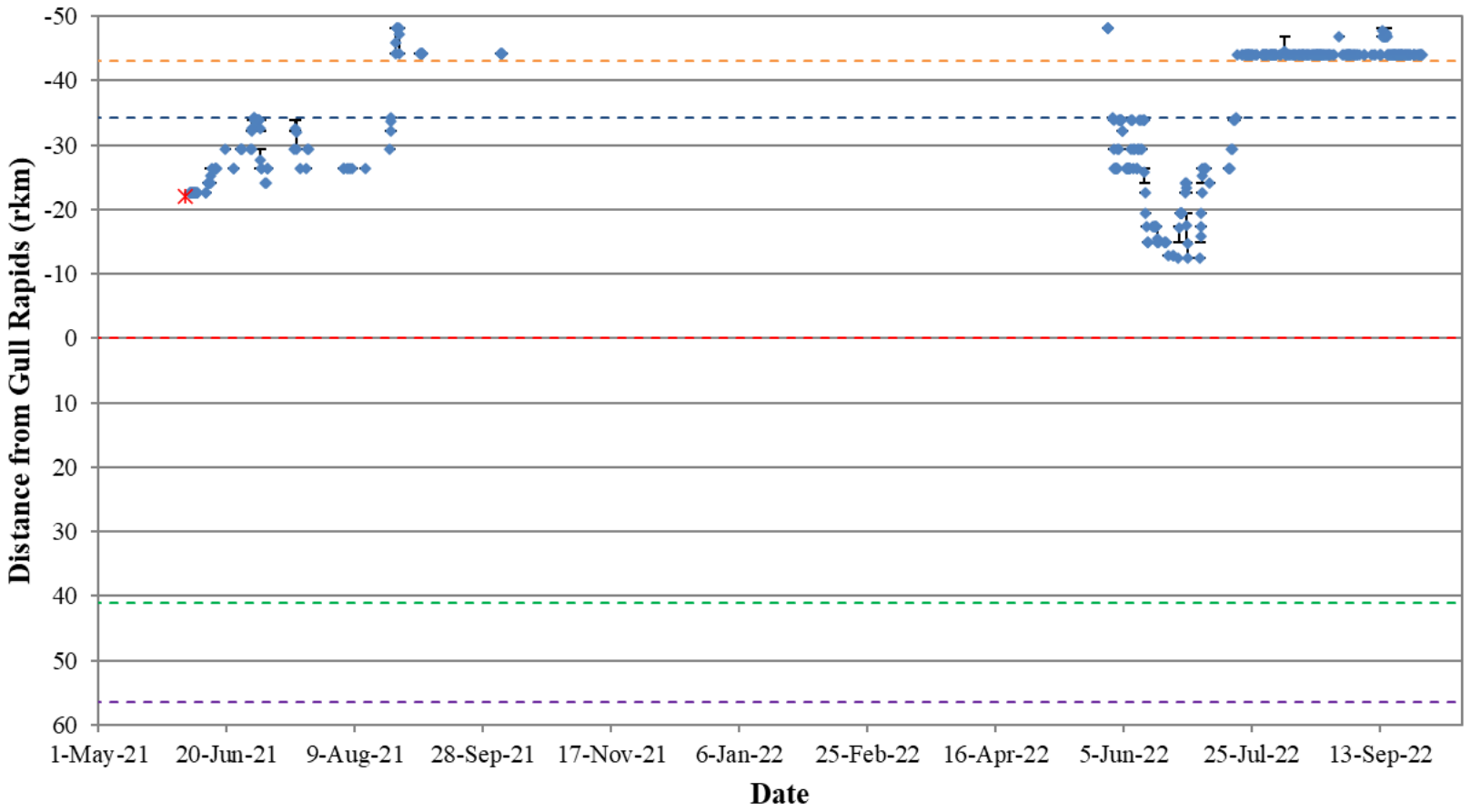

Figure A4-14: Position of a Walleye tagged with an acoustic transmitter (code #48270) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

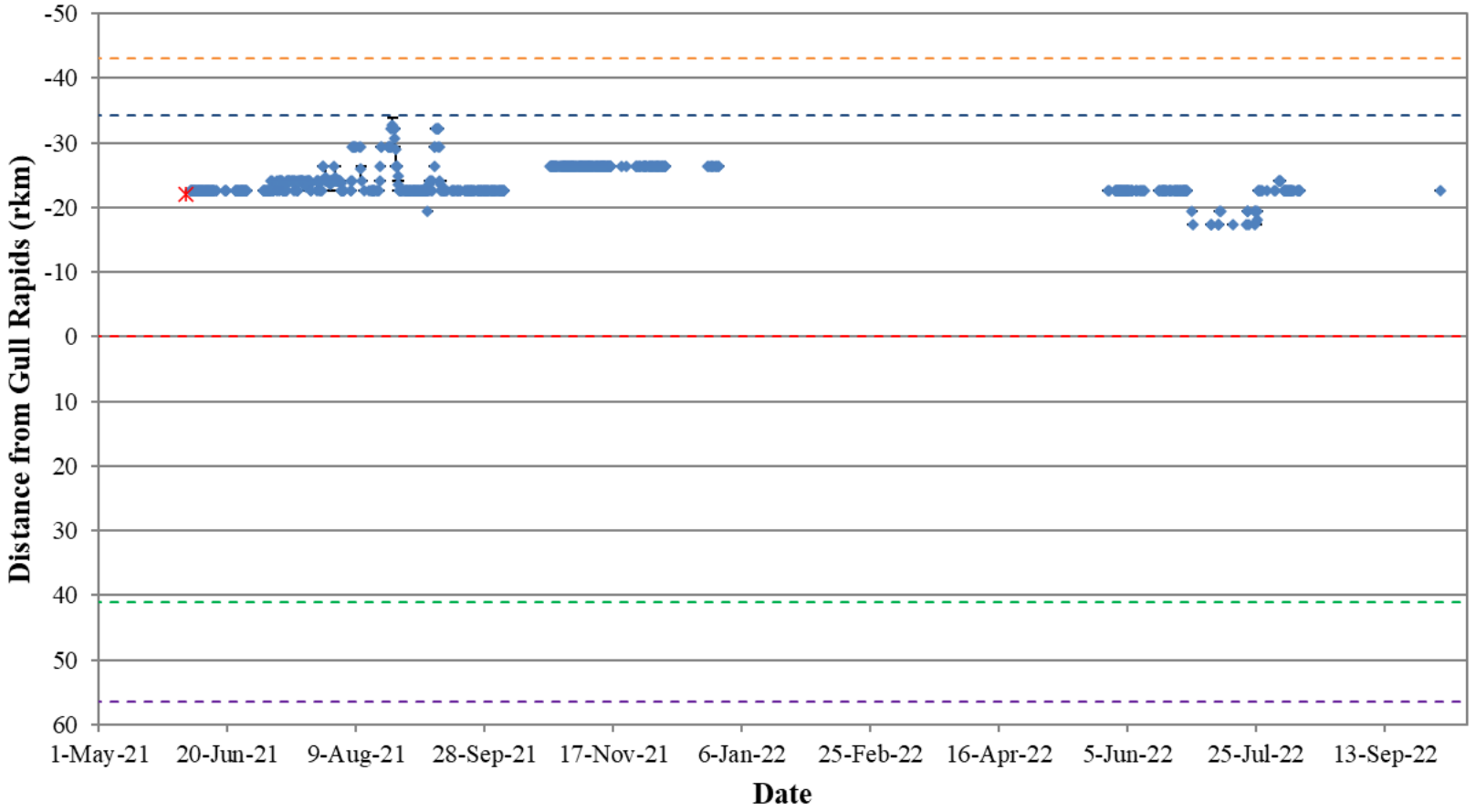

Figure A4-15: Position of a Walleye tagged with an acoustic transmitter (code #48271) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

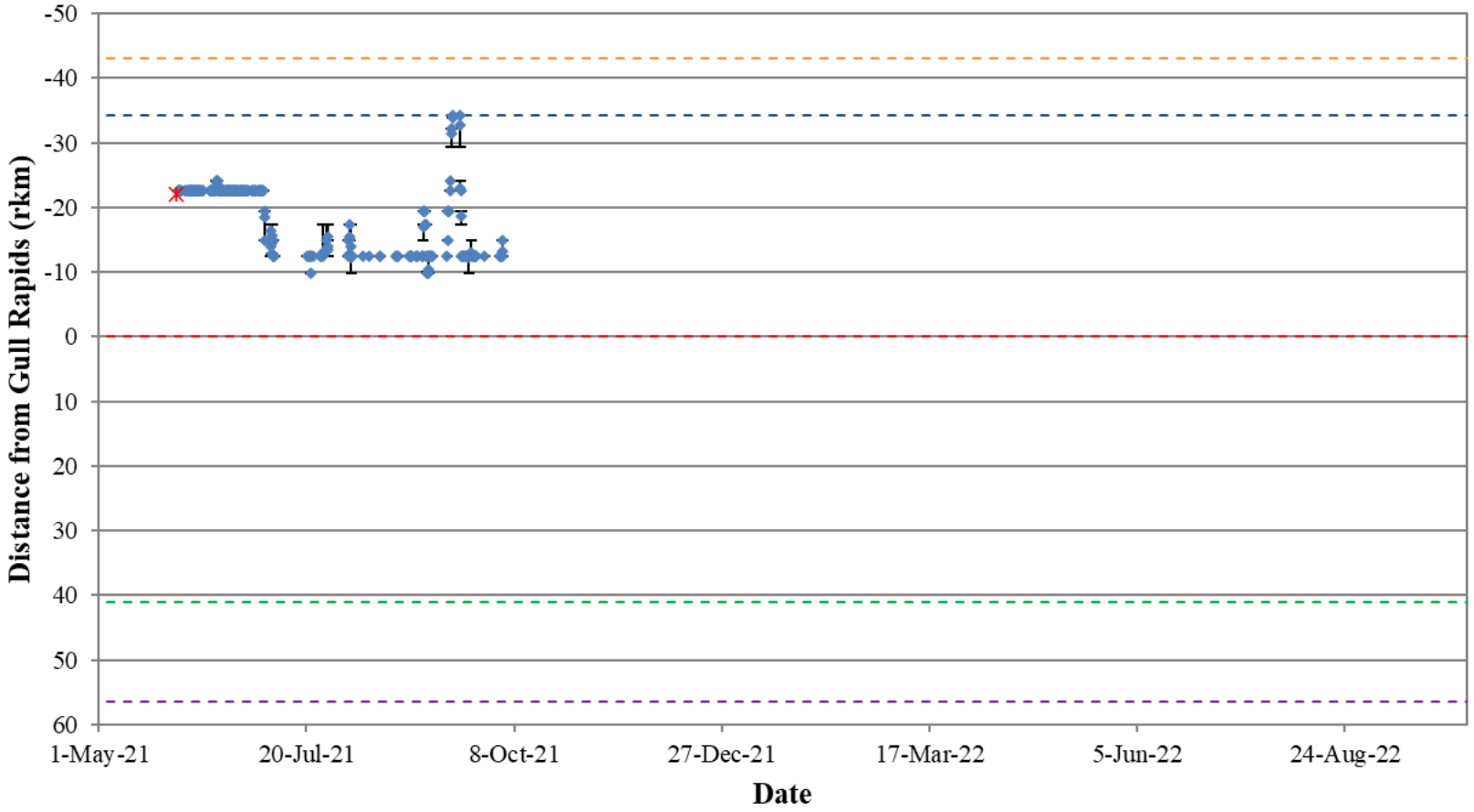

Figure A4-16: Position of a Walleye tagged with an acoustic transmitter (code #48276) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

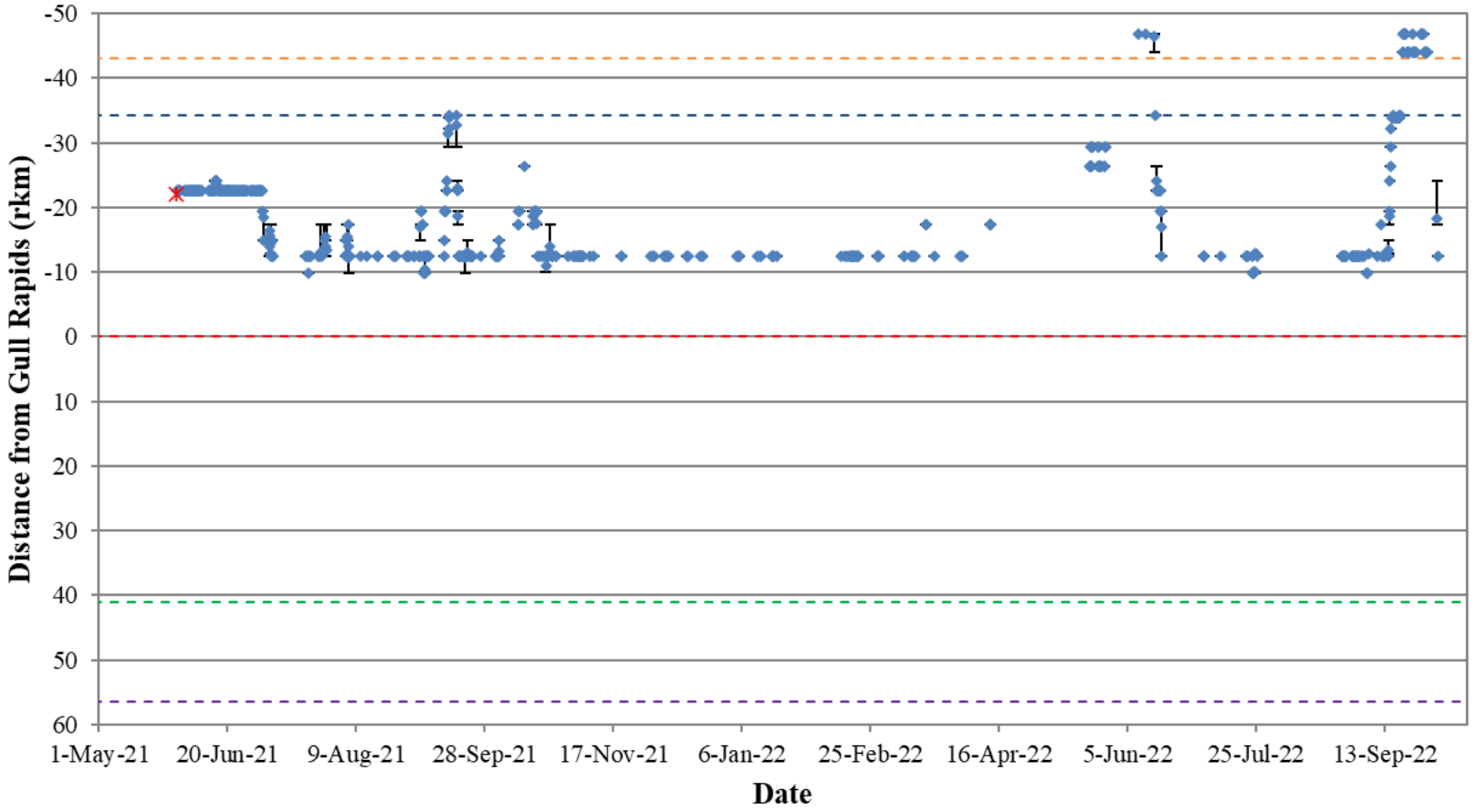

Figure A4-17: Position of a Walleye tagged with an acoustic transmitter (code #48313) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

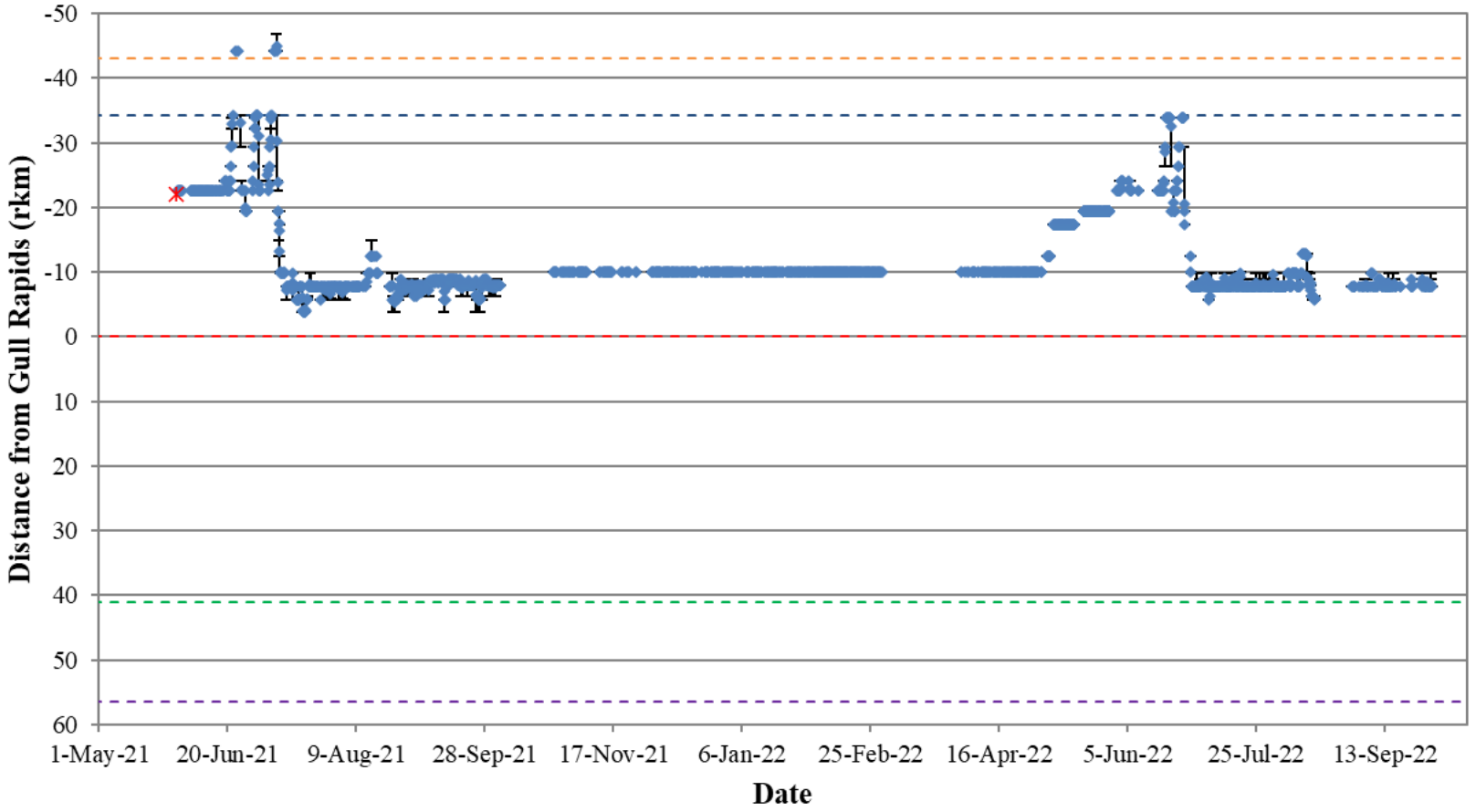

Figure A4-18: Position of a Walleye tagged with an acoustic transmitter (code #48314) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

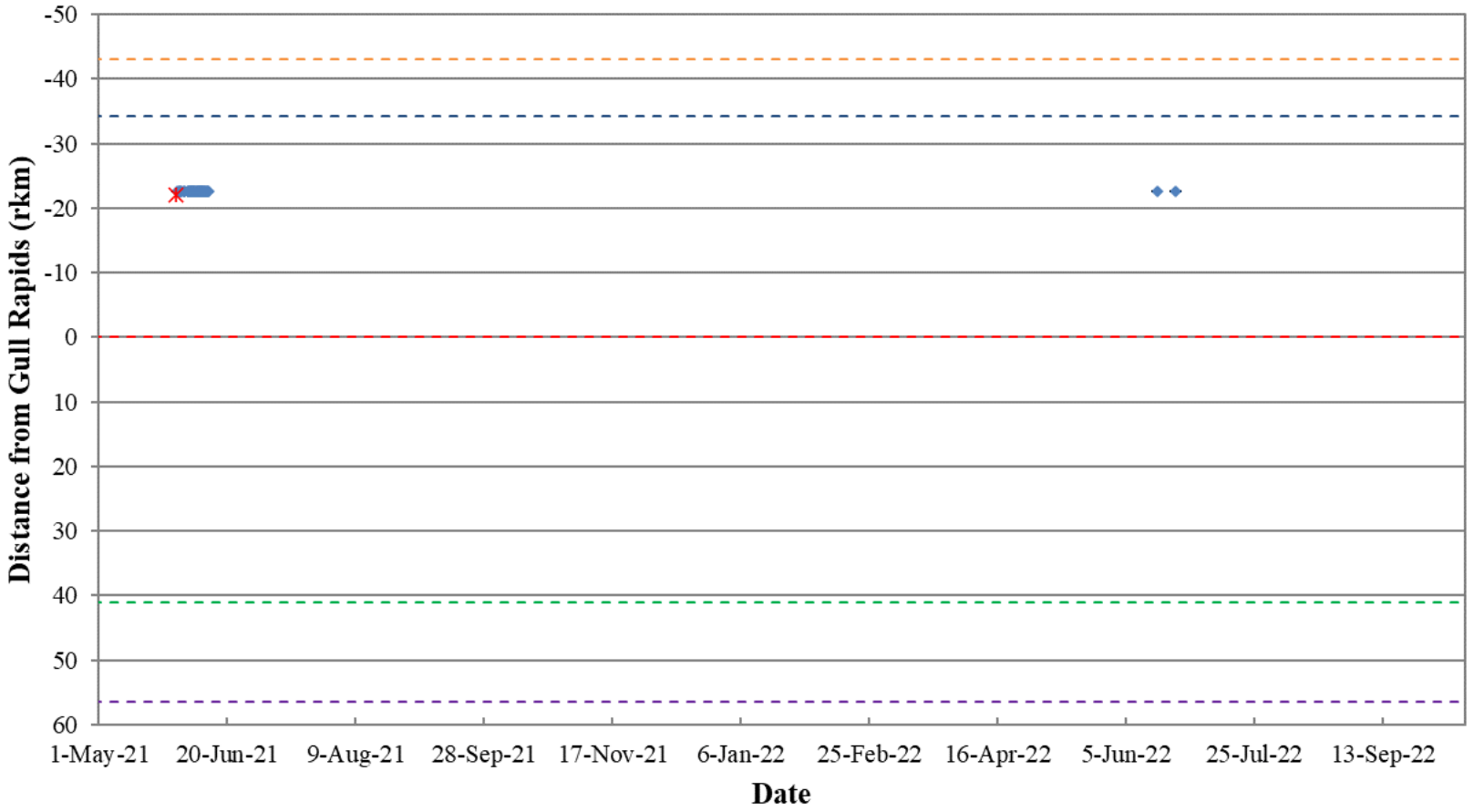

Figure A4-19: Position of a Walleye tagged with an acoustic transmitter (code #48319) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

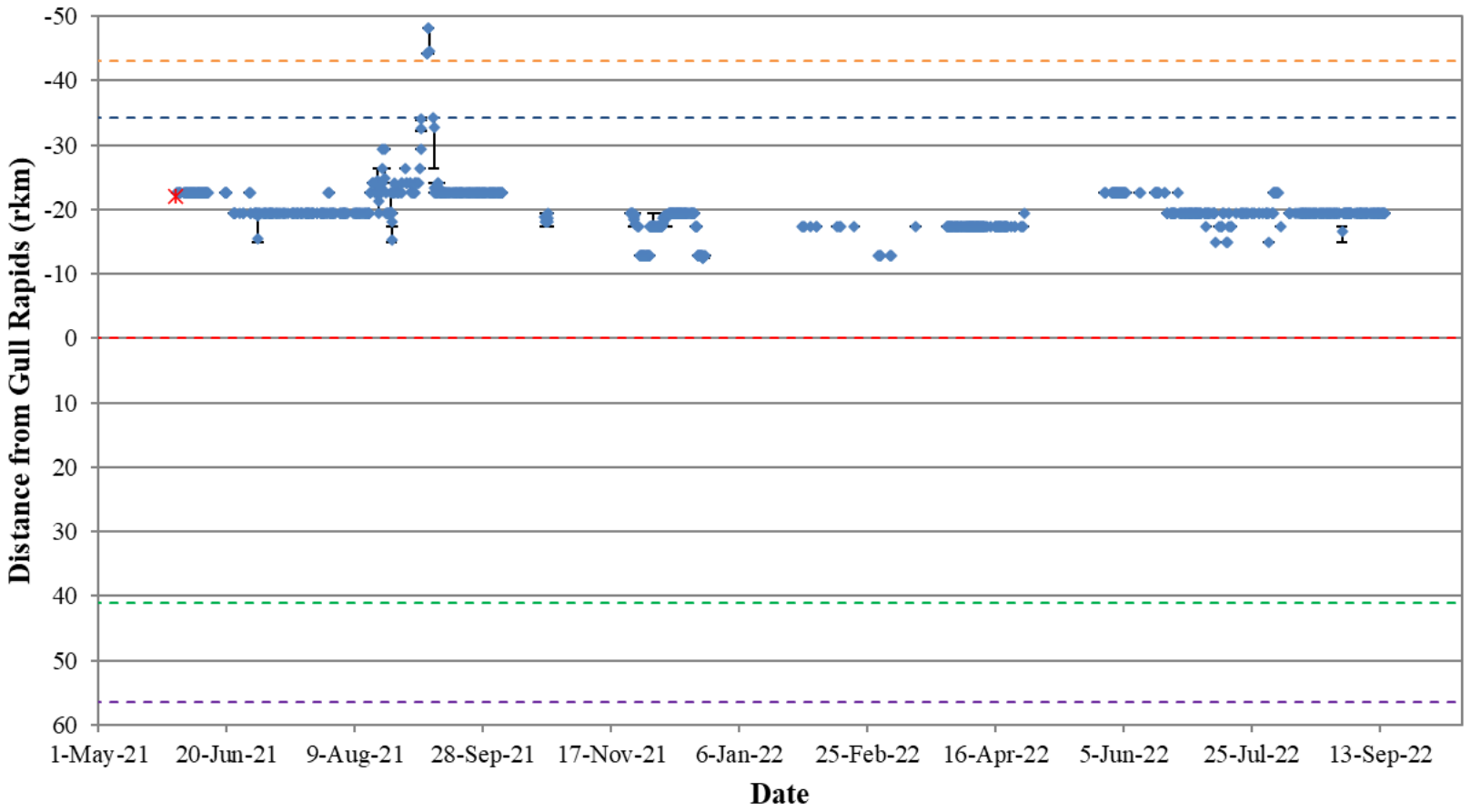

Figure A4-20: Position of a Walleye tagged with an acoustic transmitter (code #48320) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

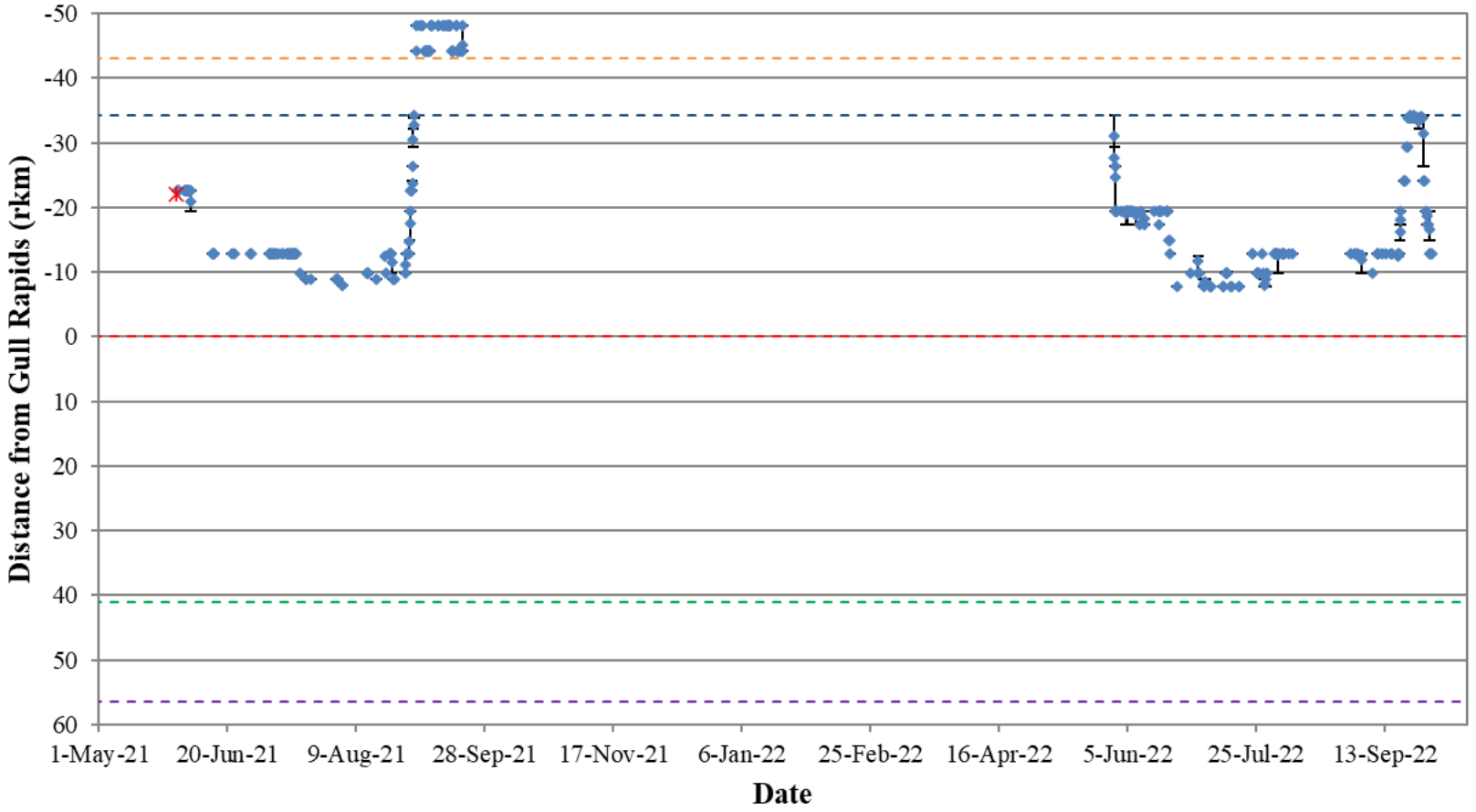

Figure A4-21: Position of a Walleye tagged with an acoustic transmitter (code #48321) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

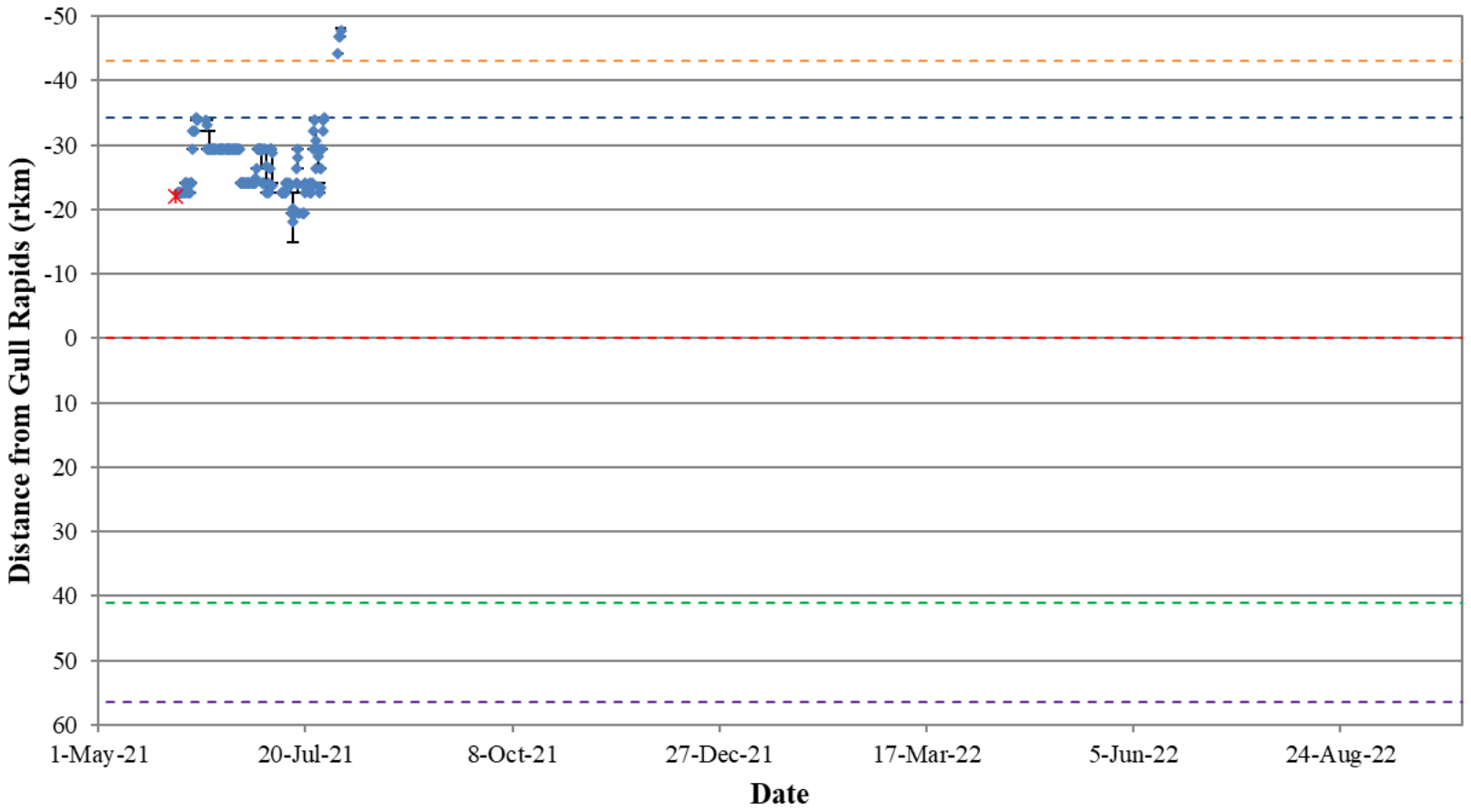

Figure A4-22: Position of a Walleye tagged with an acoustic transmitter (code #48322) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

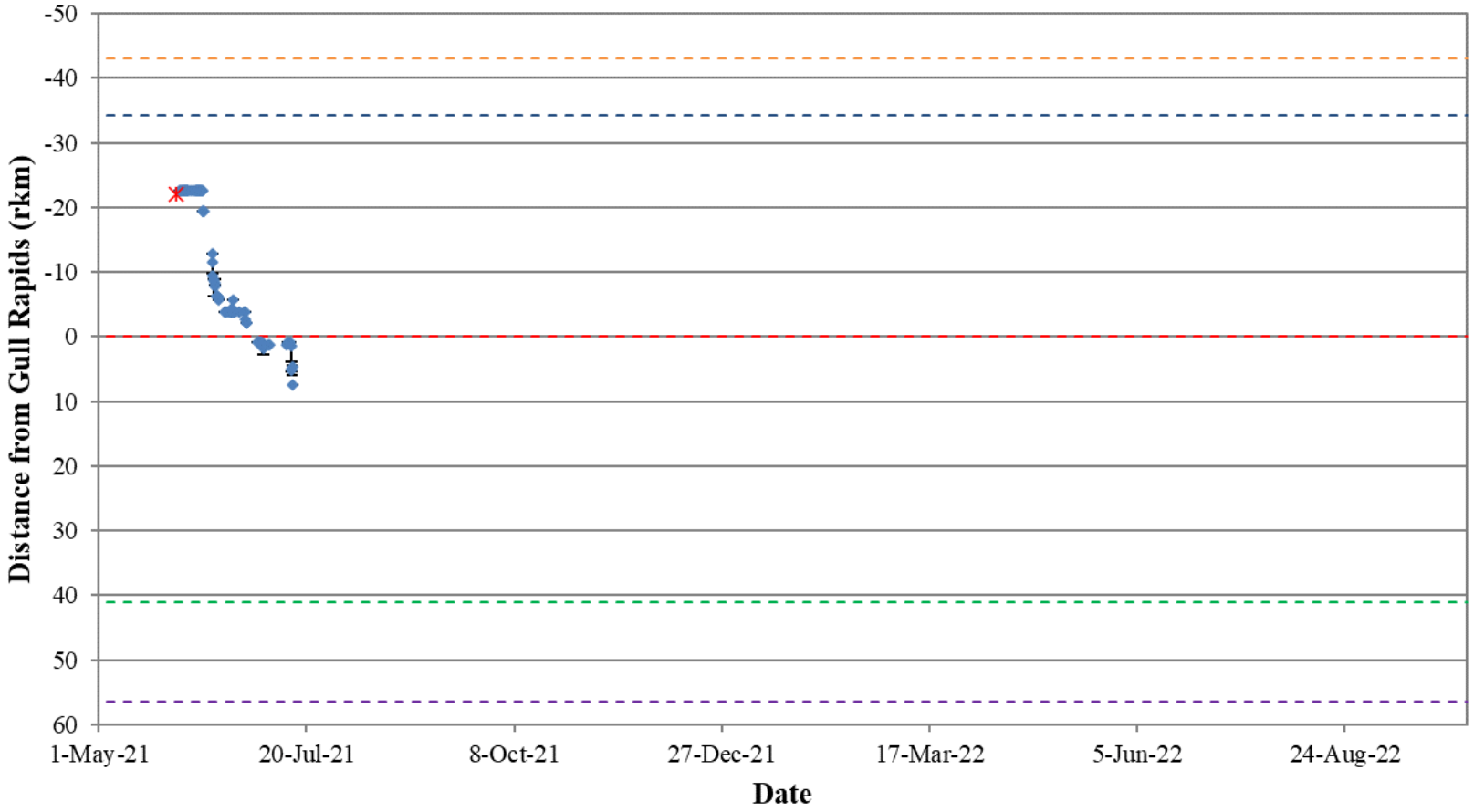

Figure A4-23: Position of a Walleye tagged with an acoustic transmitter (code #48323) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

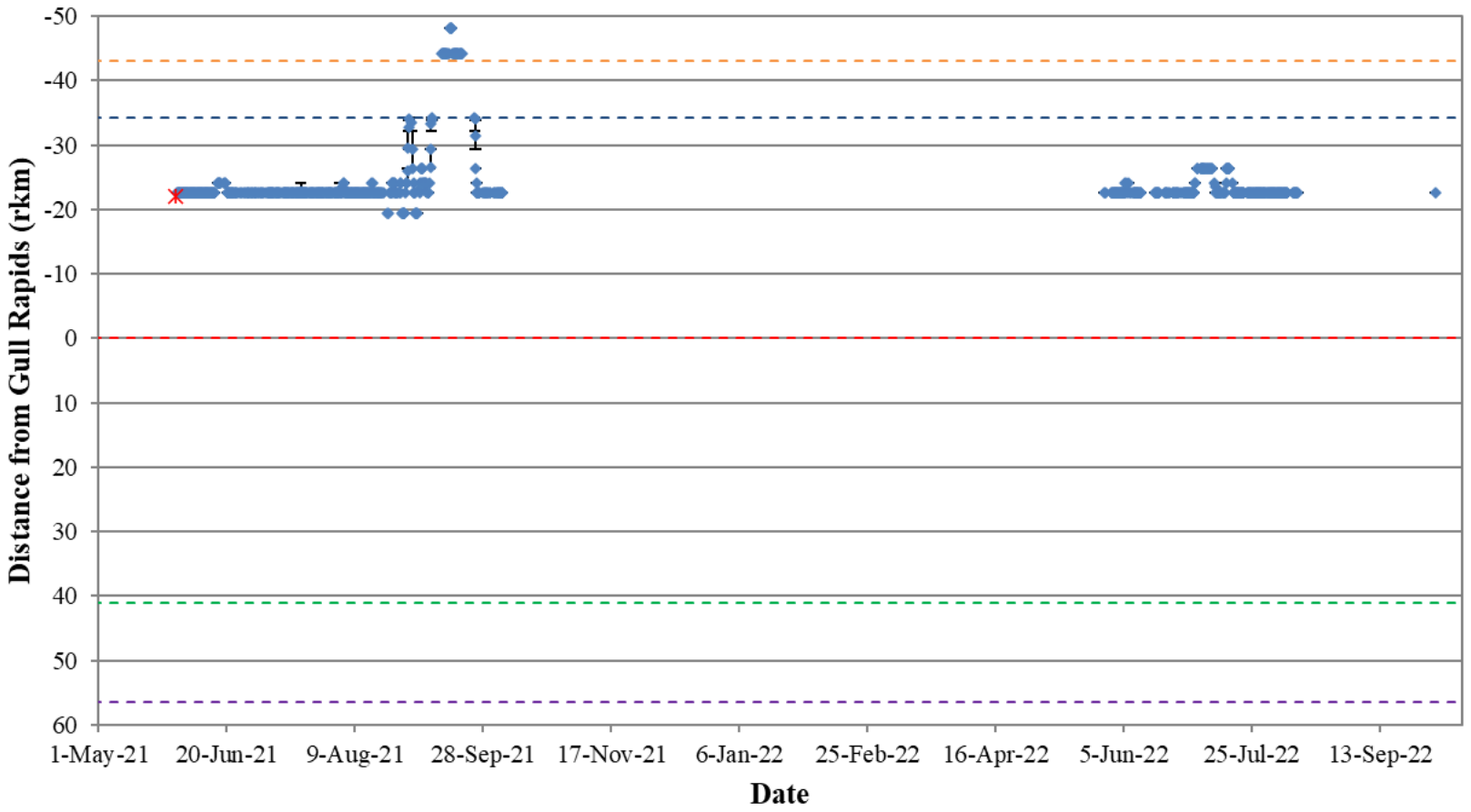

Figure A4-24: Position of a Walleye tagged with an acoustic transmitter (code #48326) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

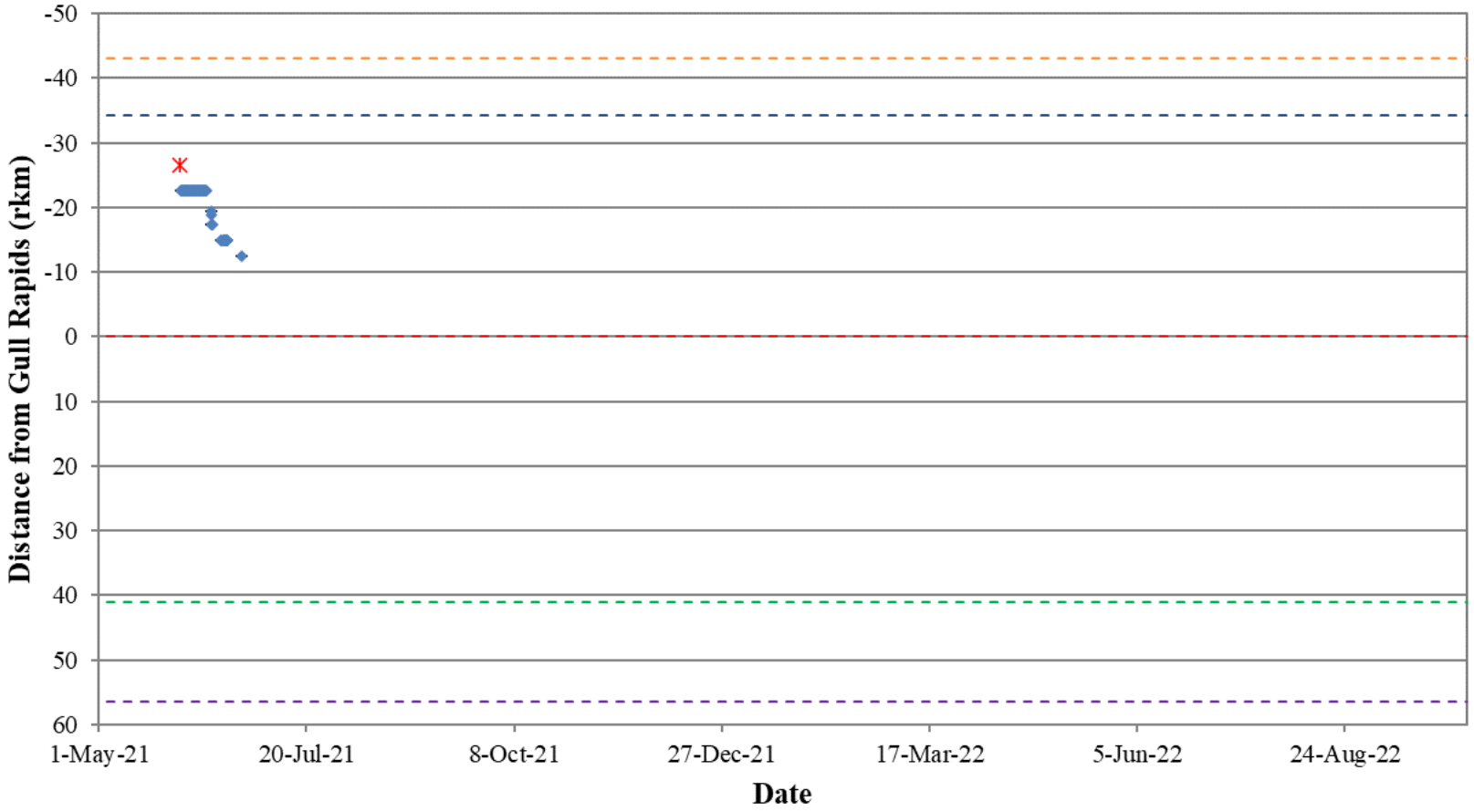

Figure A4-25: Position of a Walleye tagged with an acoustic transmitter (code #48327) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

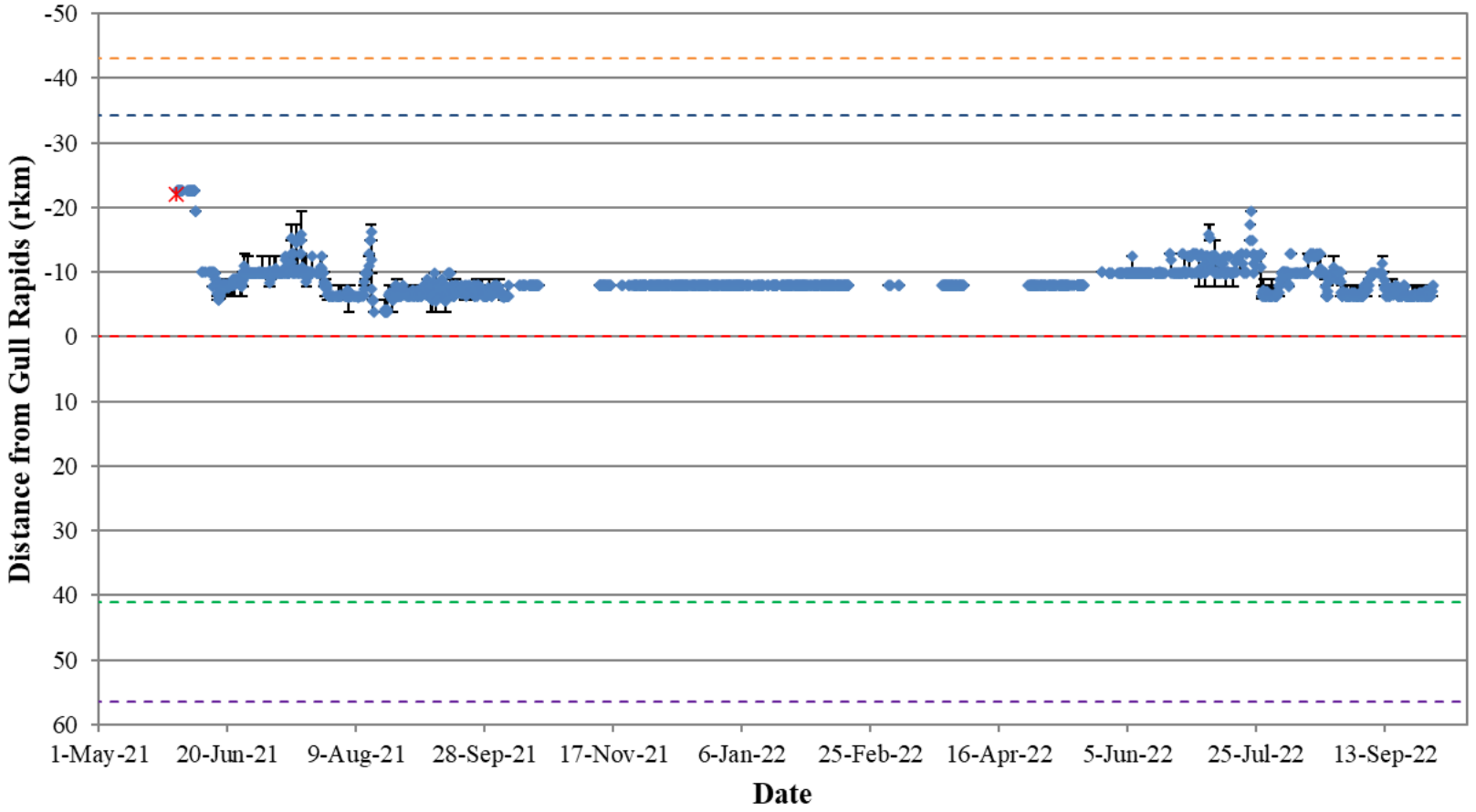

Figure A4-26: Position of a Walleye tagged with an acoustic transmitter (code #48328) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

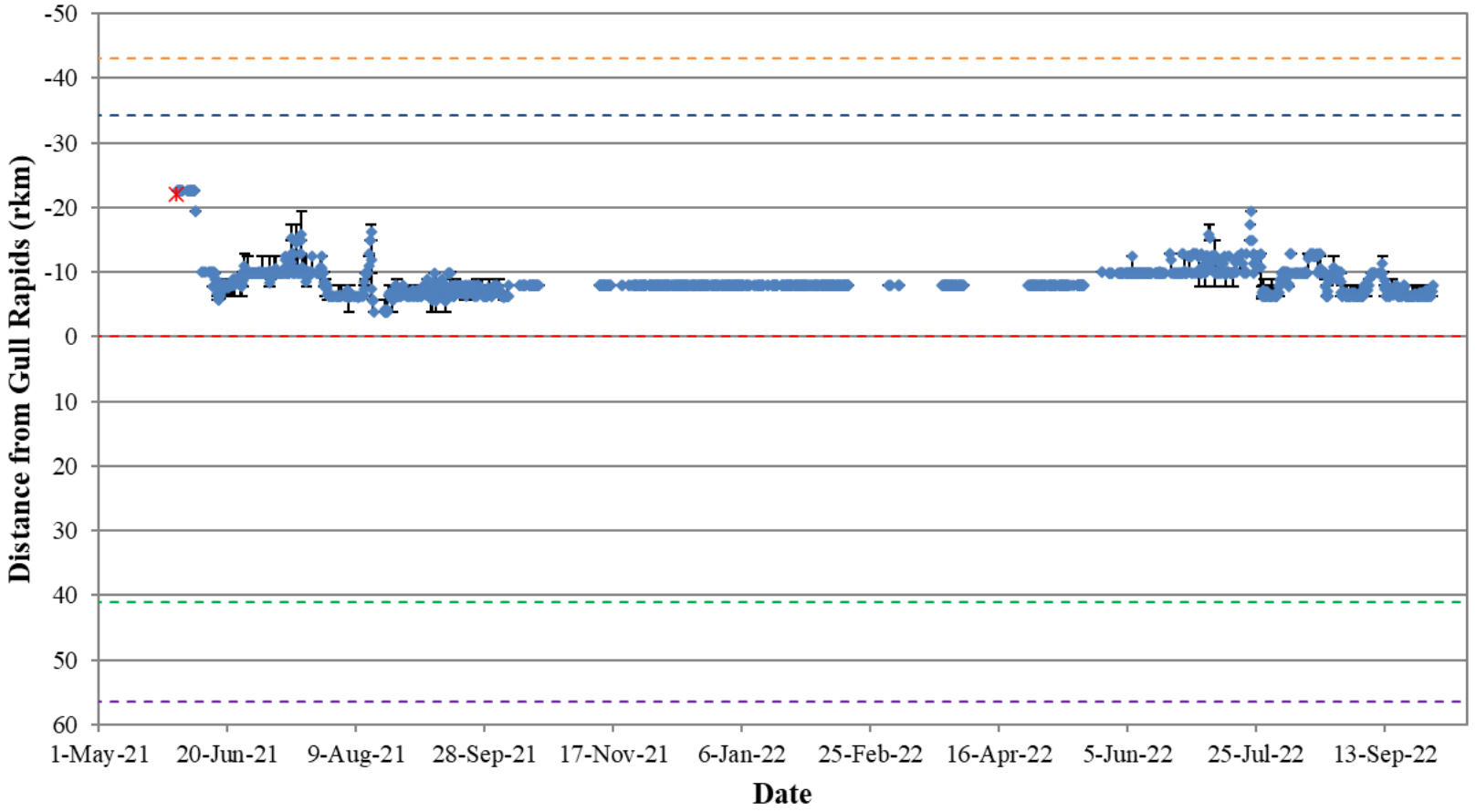

Figure A4-27: Position of a Walleye tagged with an acoustic transmitter (code #48329) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

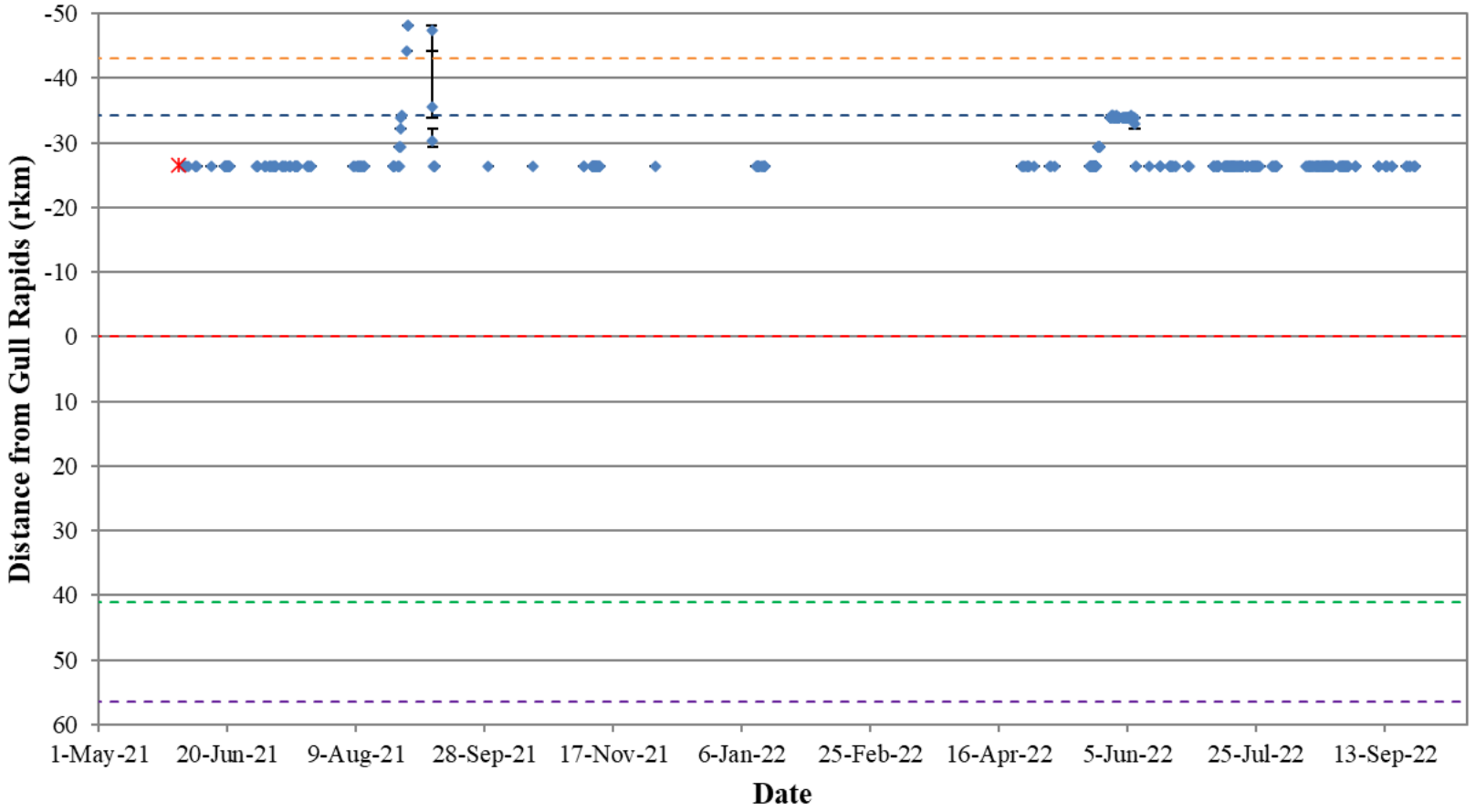

Figure A4-28: Position of a Walleye tagged with an acoustic transmitter (code #48329) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

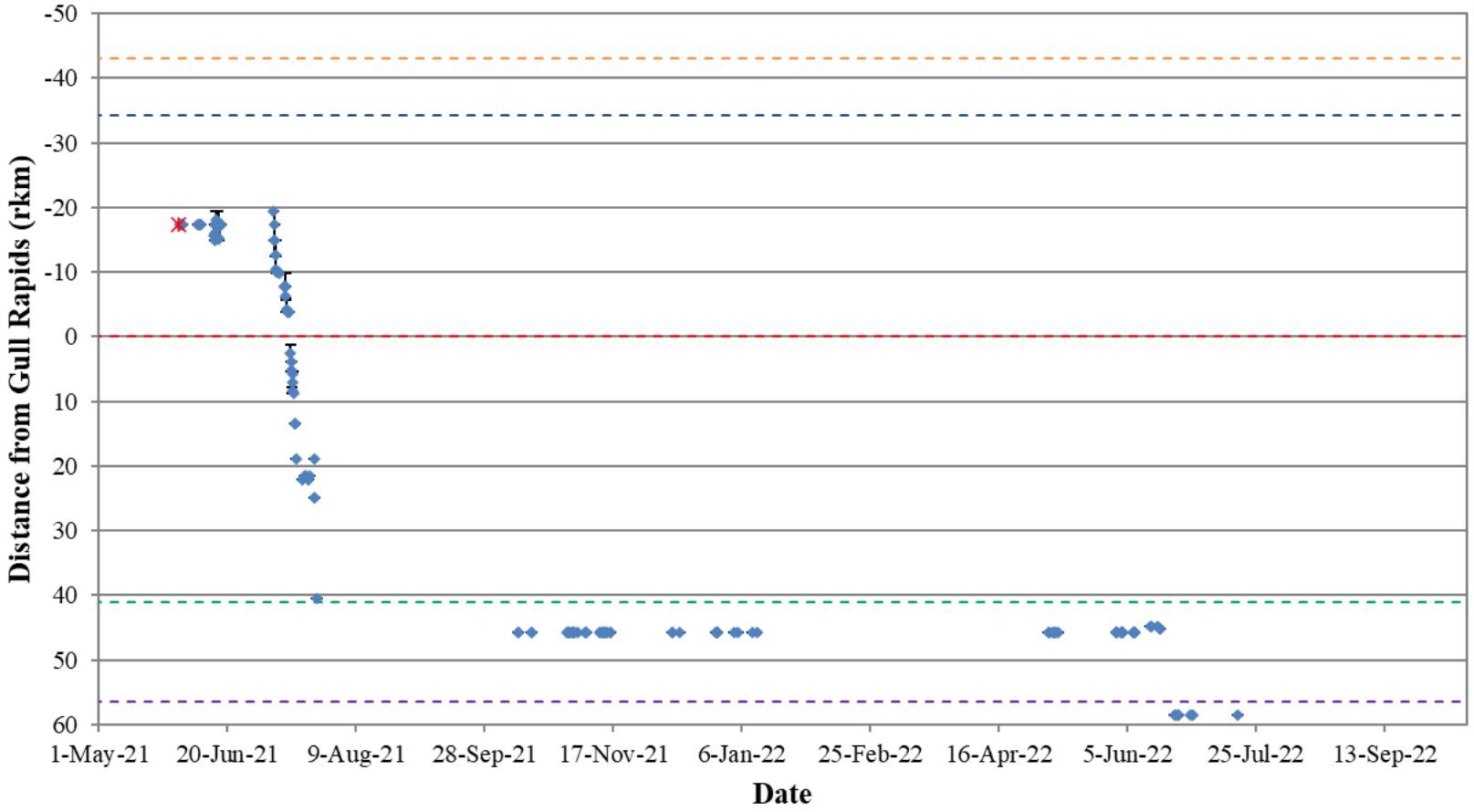

Figure A4-29: Position of a Walleye tagged with an acoustic transmitter (code #48330) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

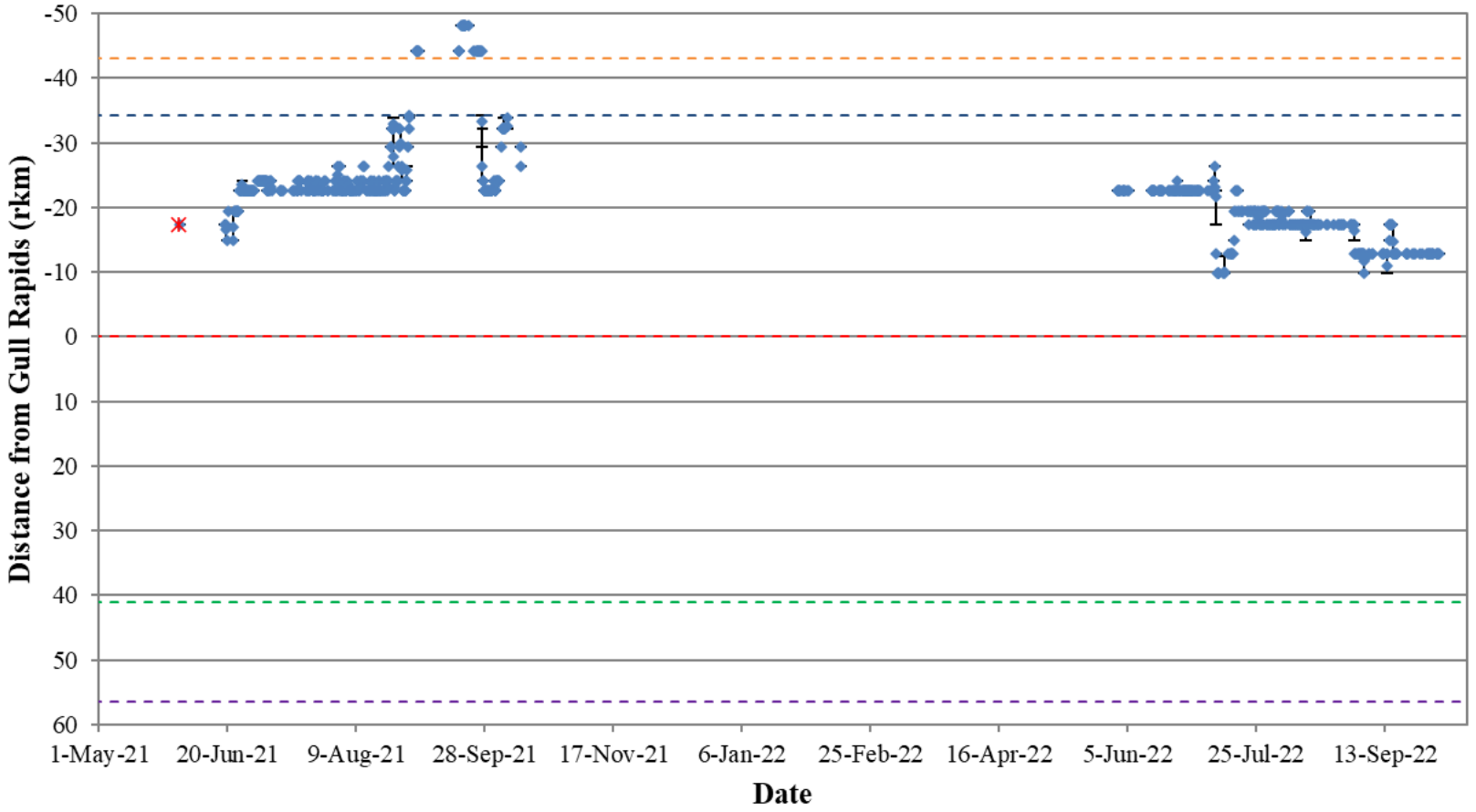

Figure A4-30: Position of a Walleye tagged with an acoustic transmitter (code #48331) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

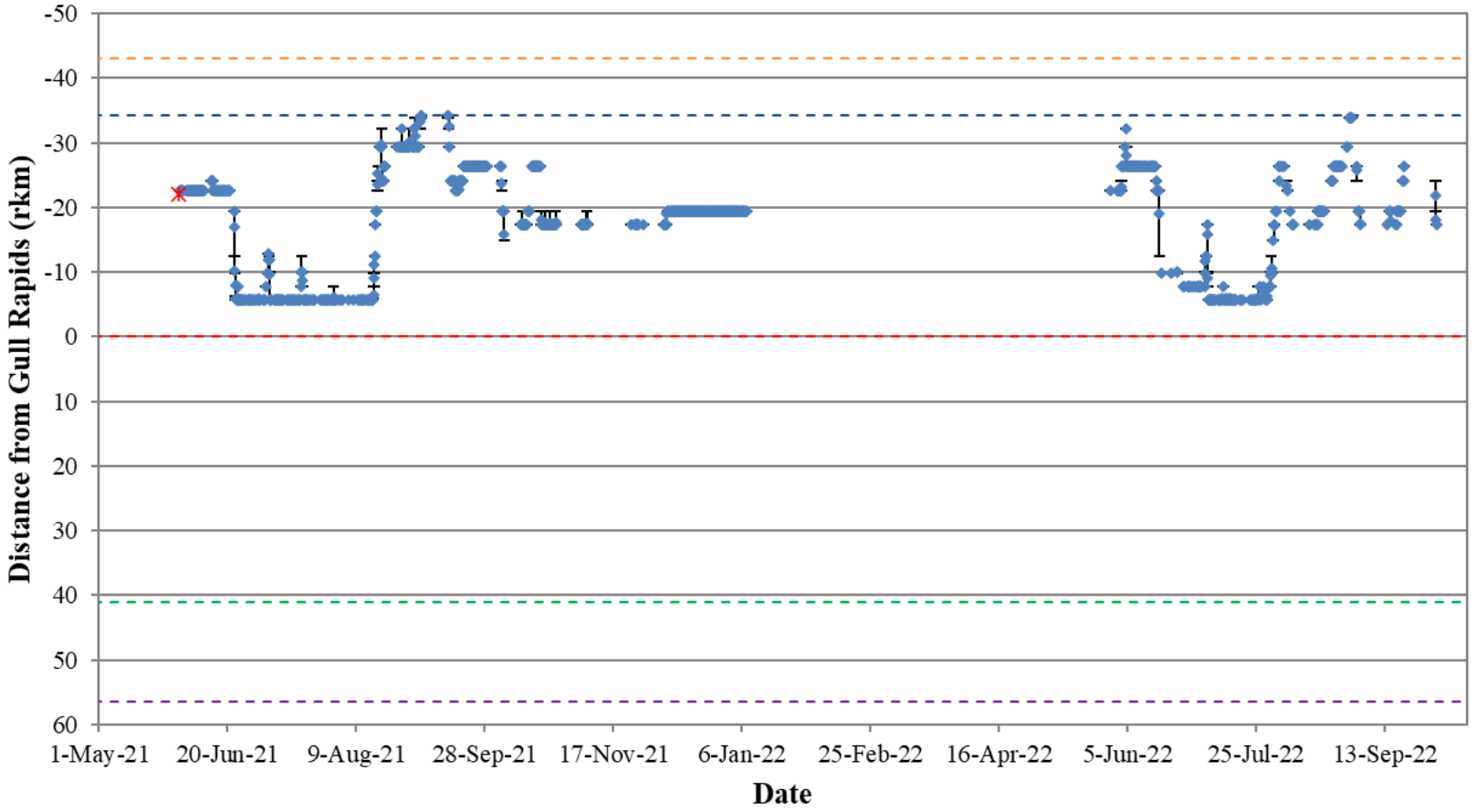

Figure A4-31: Position of a Walleye tagged with an acoustic transmitter (code #48332) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

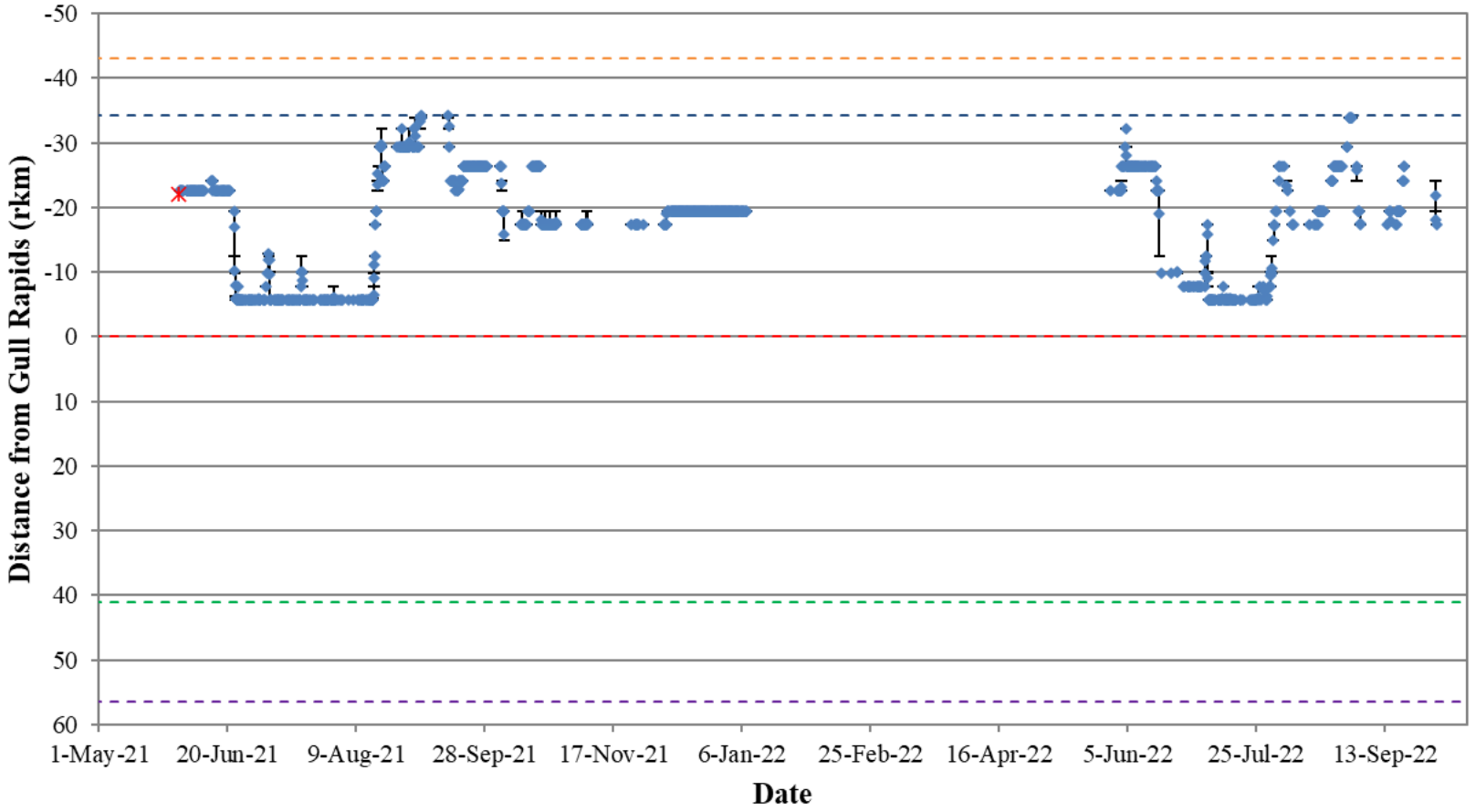

Figure A4-32: Position of a Walleye tagged with an acoustic transmitter (code #48333) in the Nelson River between Clark Lake and the Keeyask GS in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

APPENDIX 5:
LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE IN STEPHENS LAKE IN 2021: MAY 2021 TO OCTOBER 2022

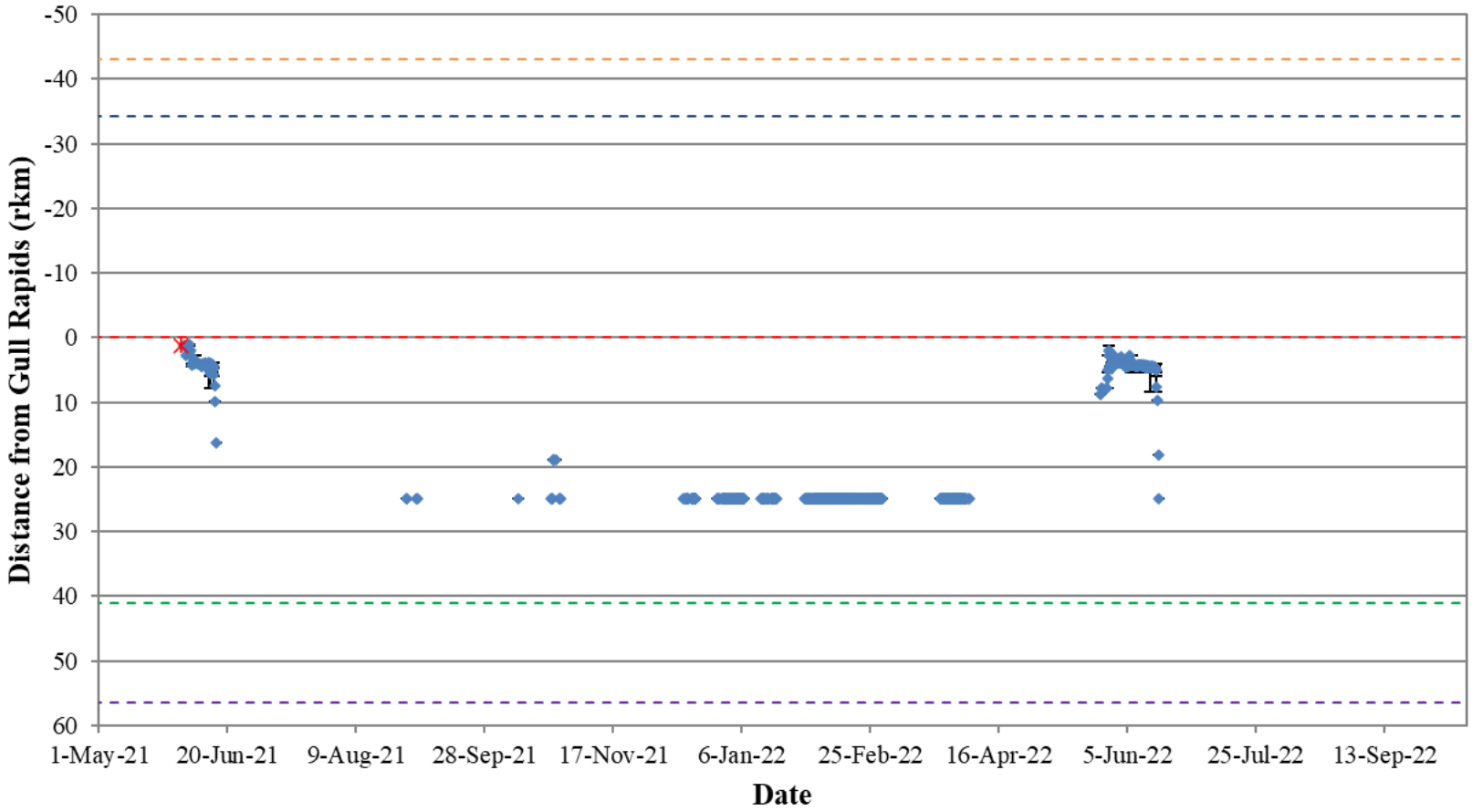

Figure A5-1: Position of a Walleye tagged with an acoustic transmitter (code #48234) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

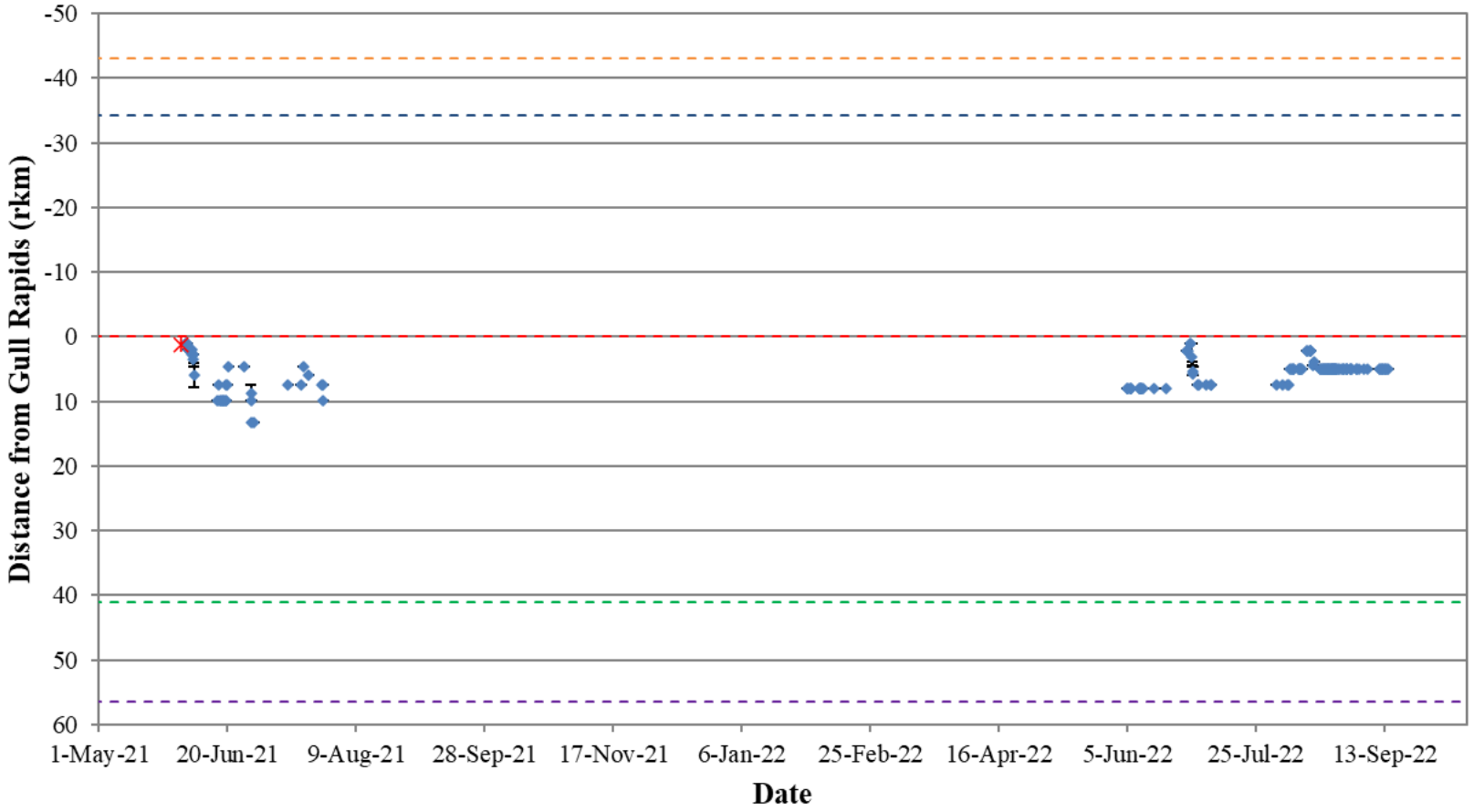

Figure A5-2: Position of a Walleye tagged with an acoustic transmitter (code #48235) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

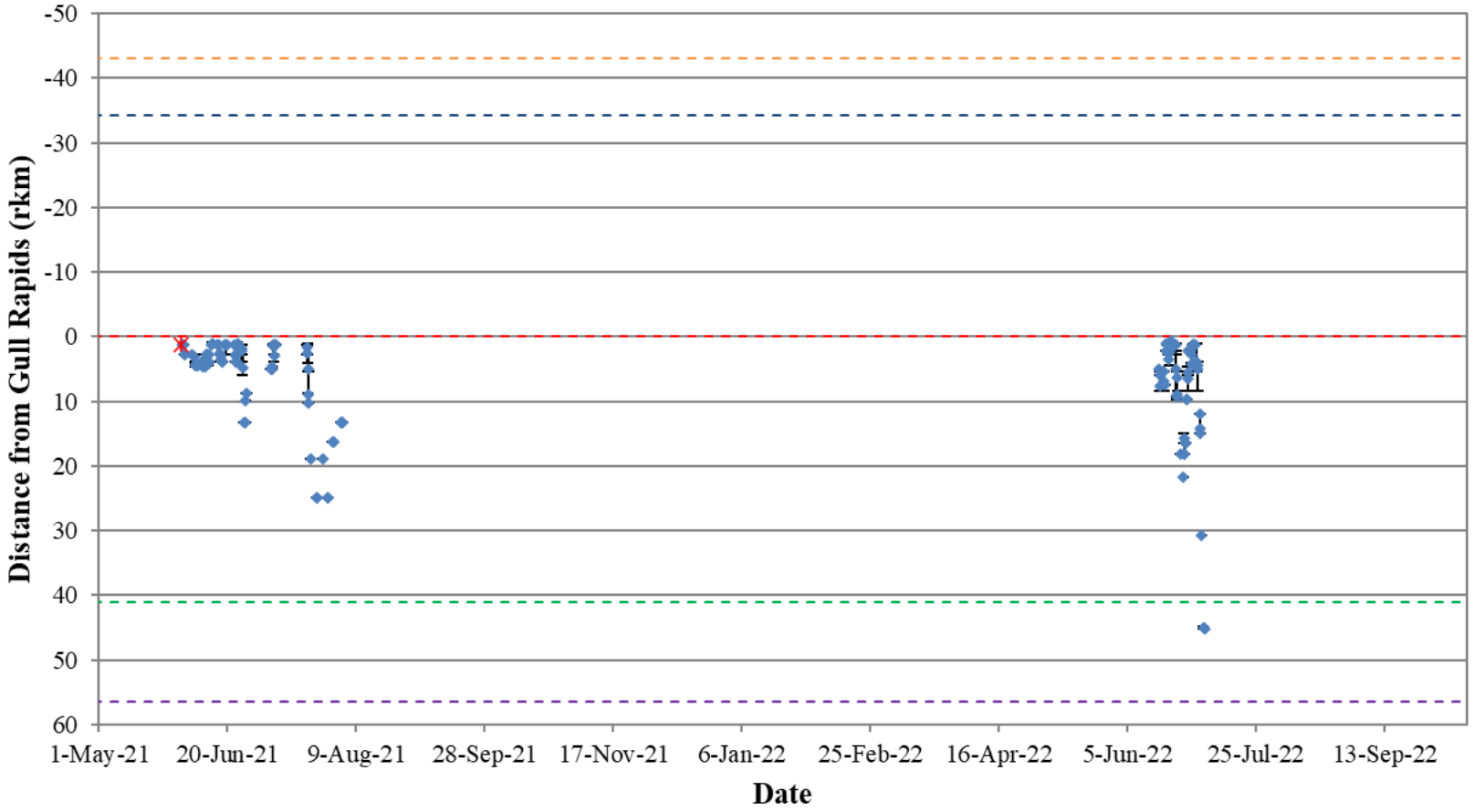

Figure A5-3: Position of a Walleye tagged with an acoustic transmitter (code #48236) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

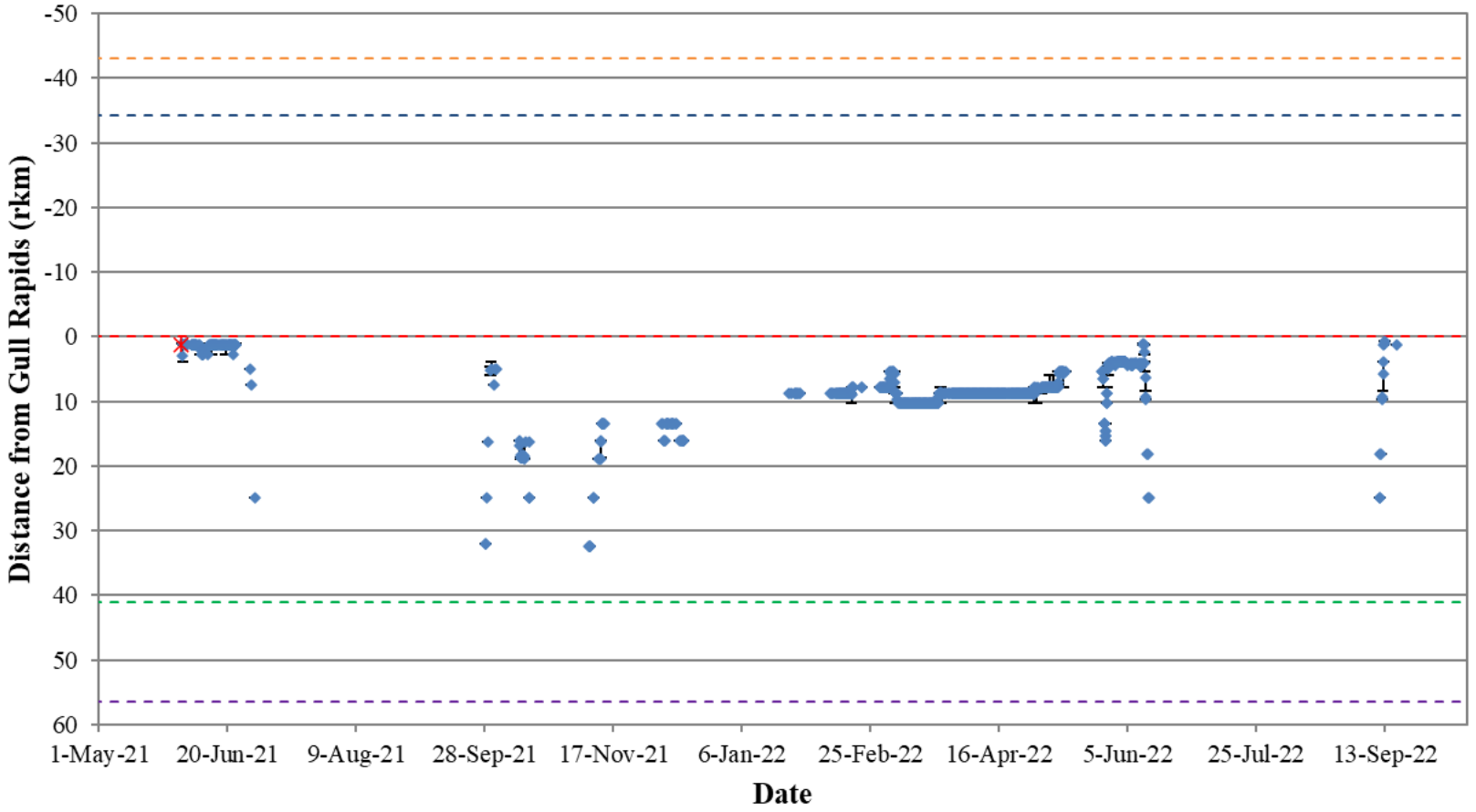

Figure A5-4: Position of a Walleye tagged with an acoustic transmitter (code #48237) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

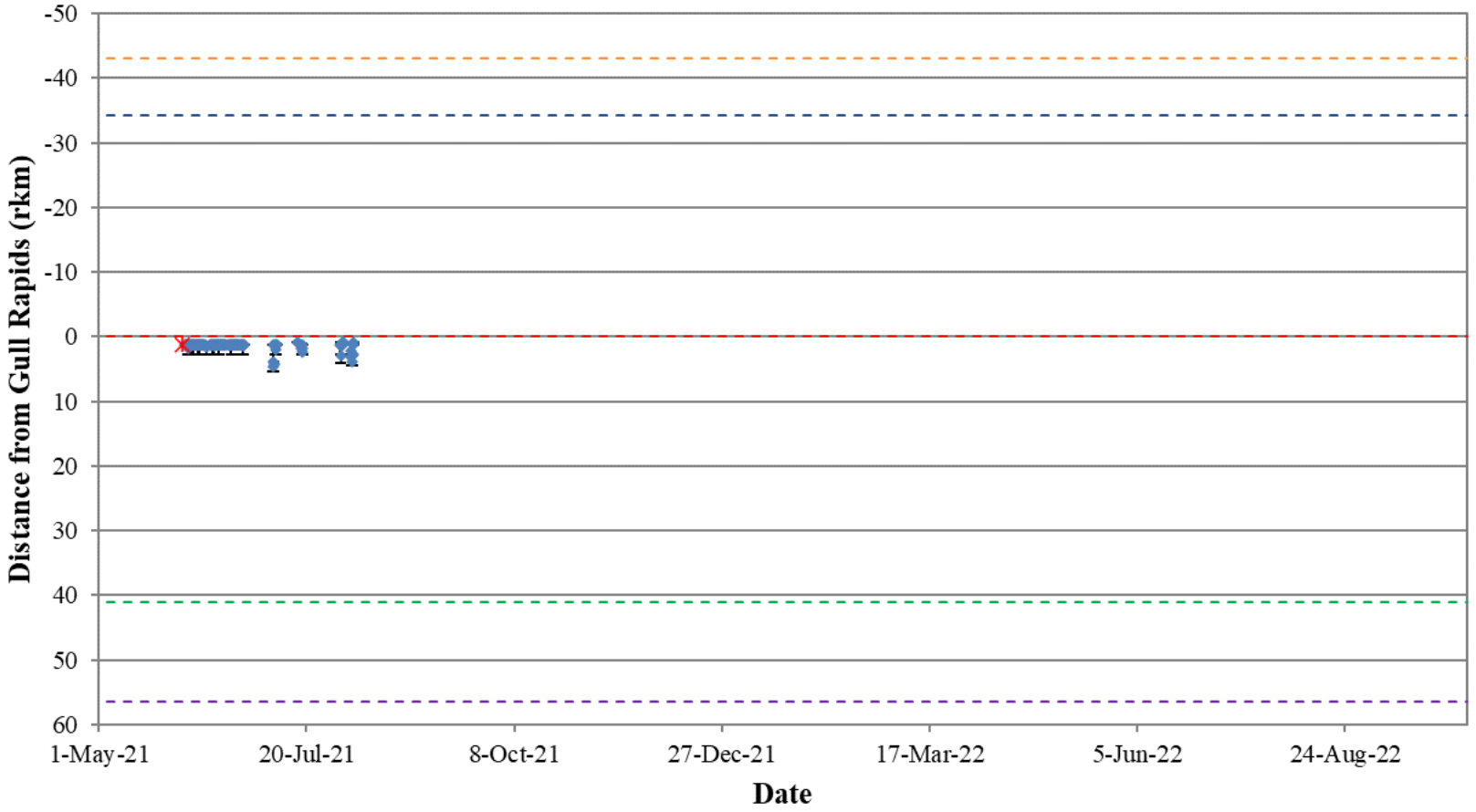

Figure A5-5: Position of a Walleye tagged with an acoustic transmitter (code #48238) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

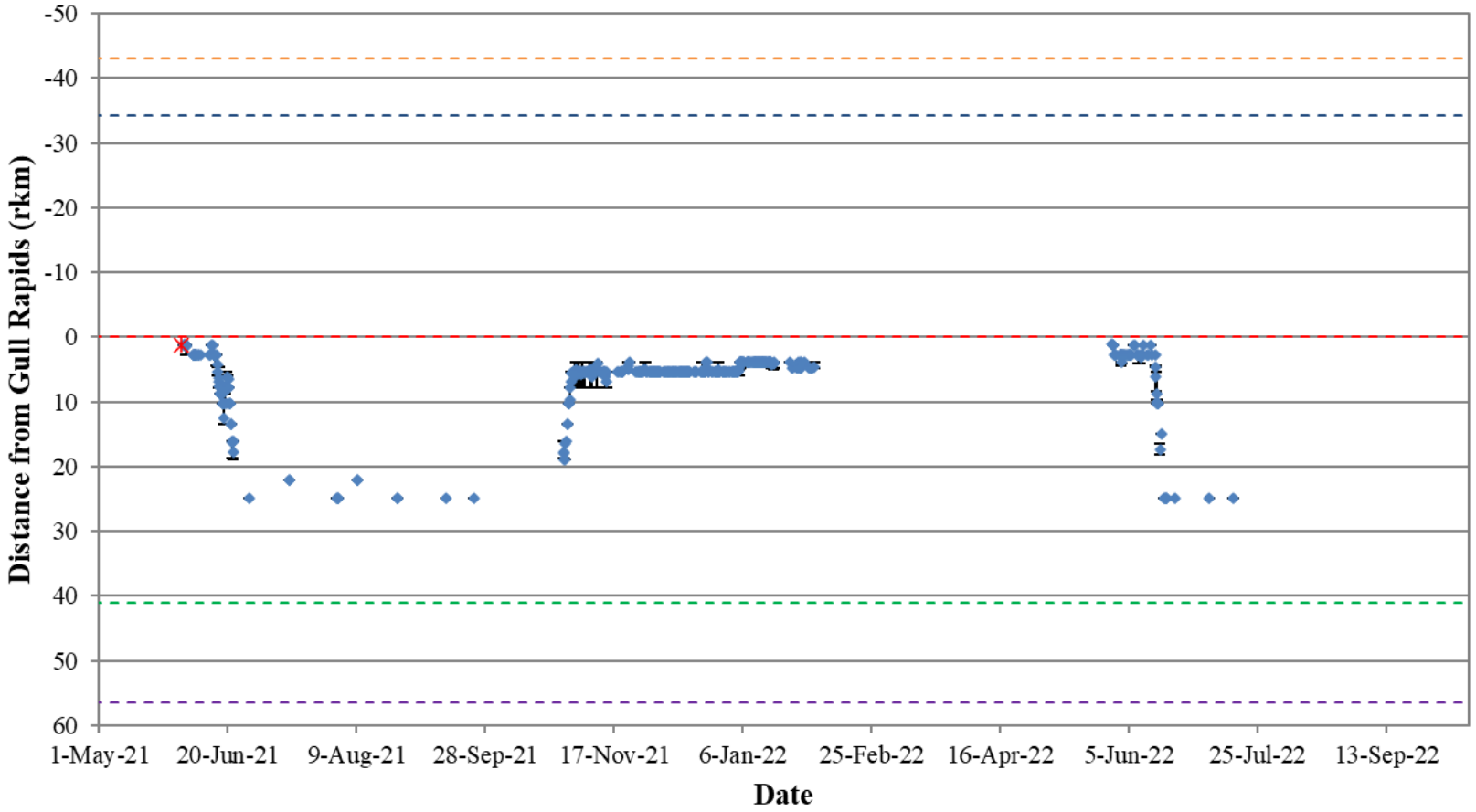

Figure A5-6: Position of a Walleye tagged with an acoustic transmitter (code #48239) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

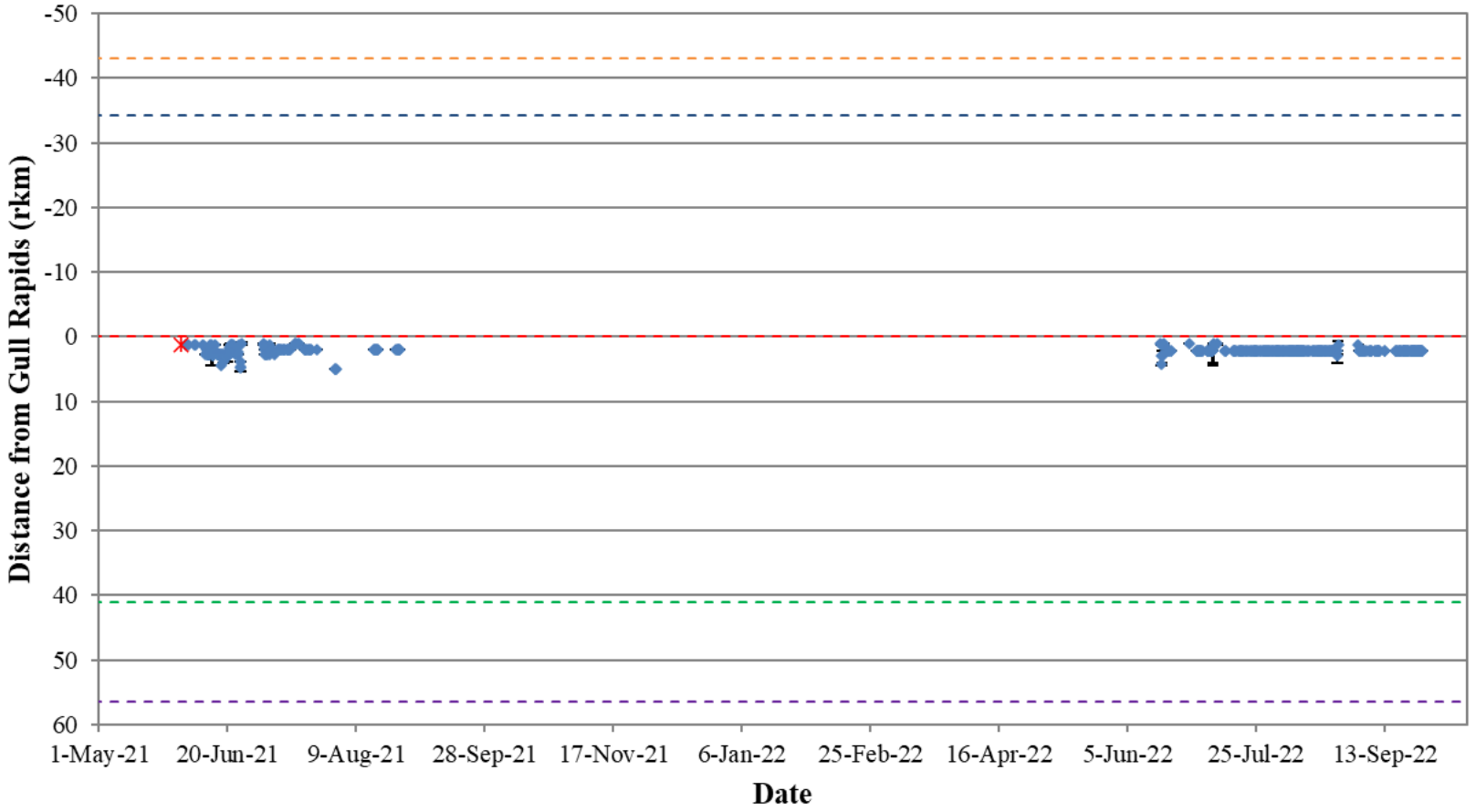

Figure A5-7: Position of a Walleye tagged with an acoustic transmitter (code #48240) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

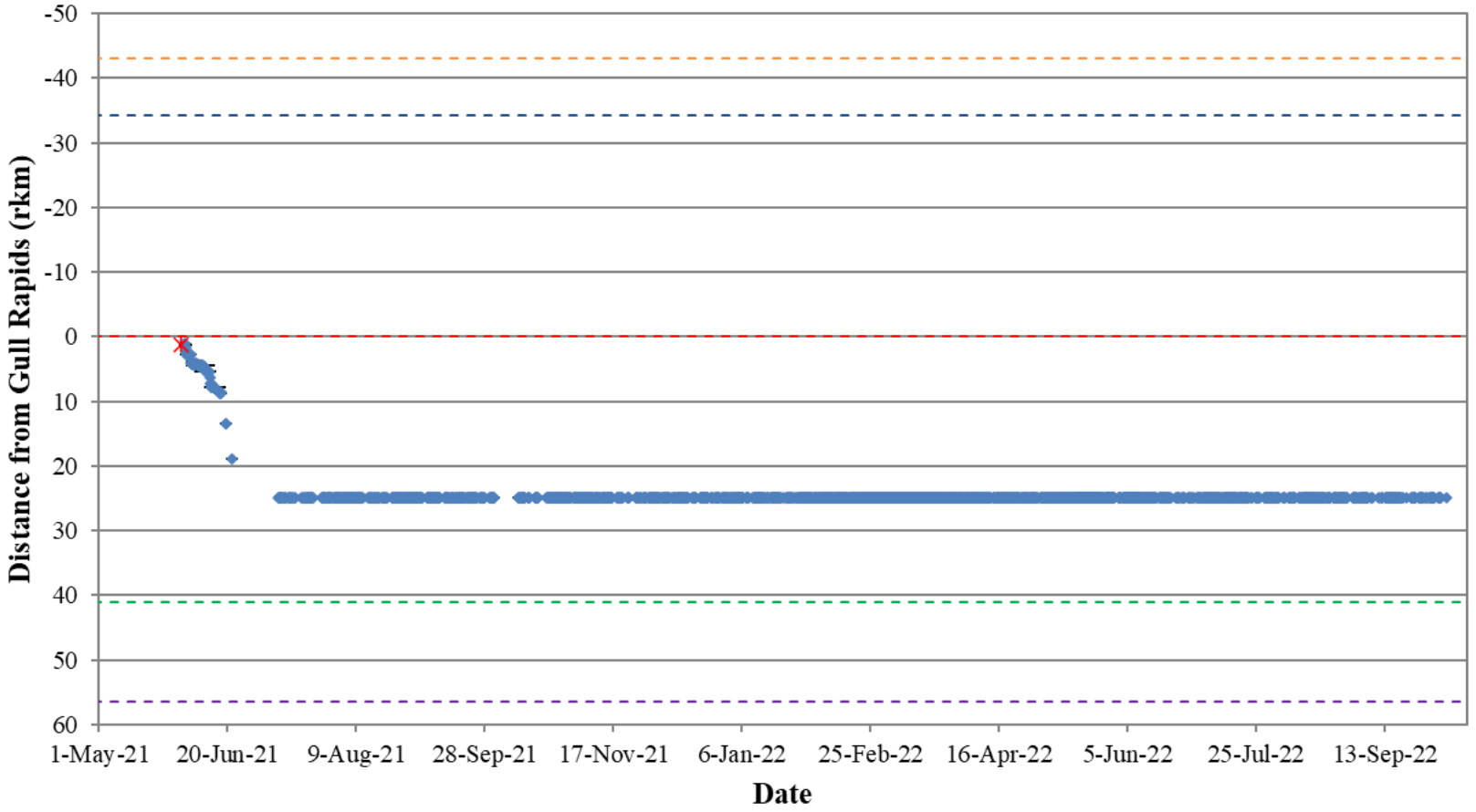

Figure A5-8: Position of a Walleye tagged with an acoustic transmitter (code #48241) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

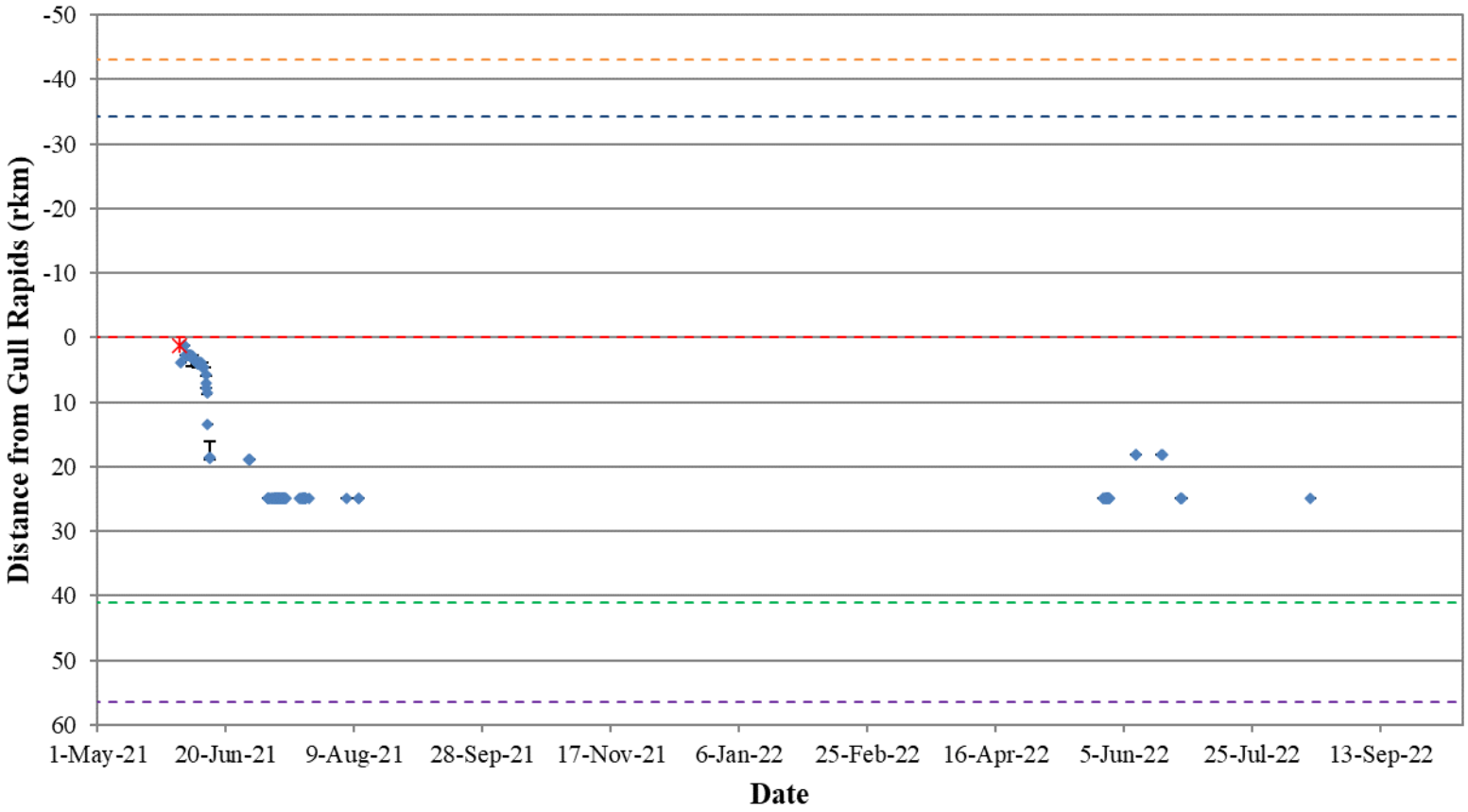

Figure A5-9: Position of a Walleye tagged with an acoustic transmitter (code #48242) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

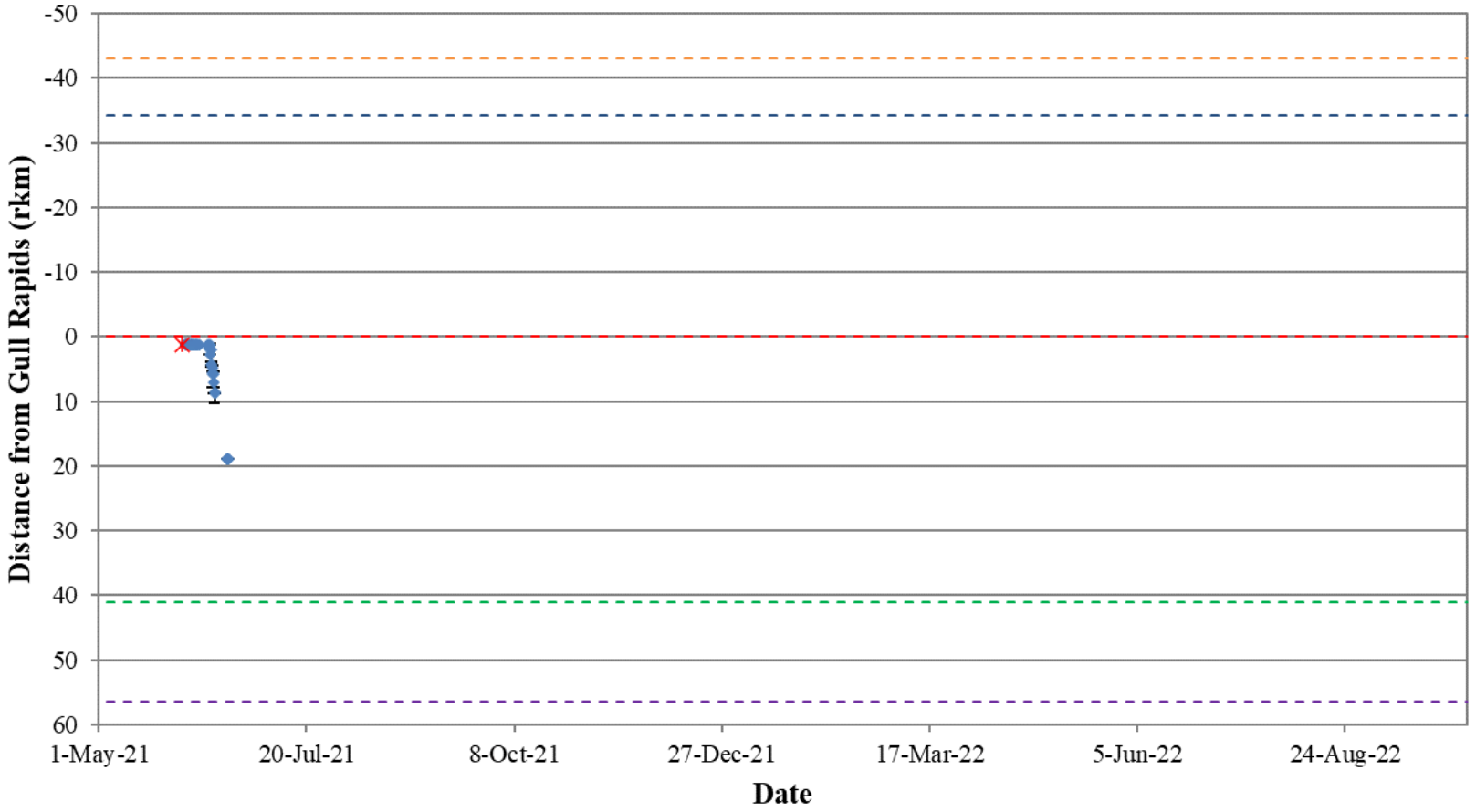

Figure A5-10: Position of a Walleye tagged with an acoustic transmitter (code #48243) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

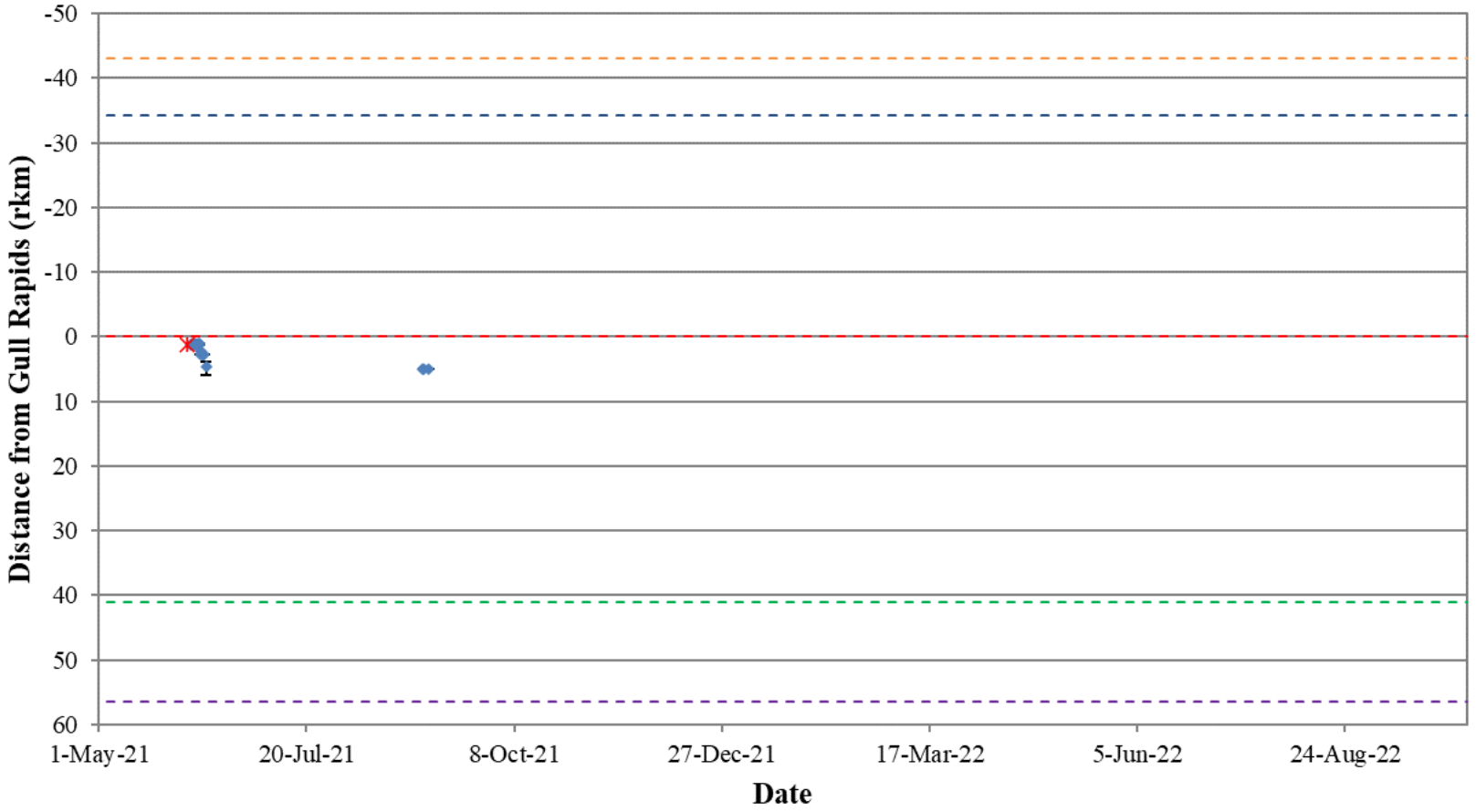

Figure A5-11: Position of a Walleye tagged with an acoustic transmitter (code #48245) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

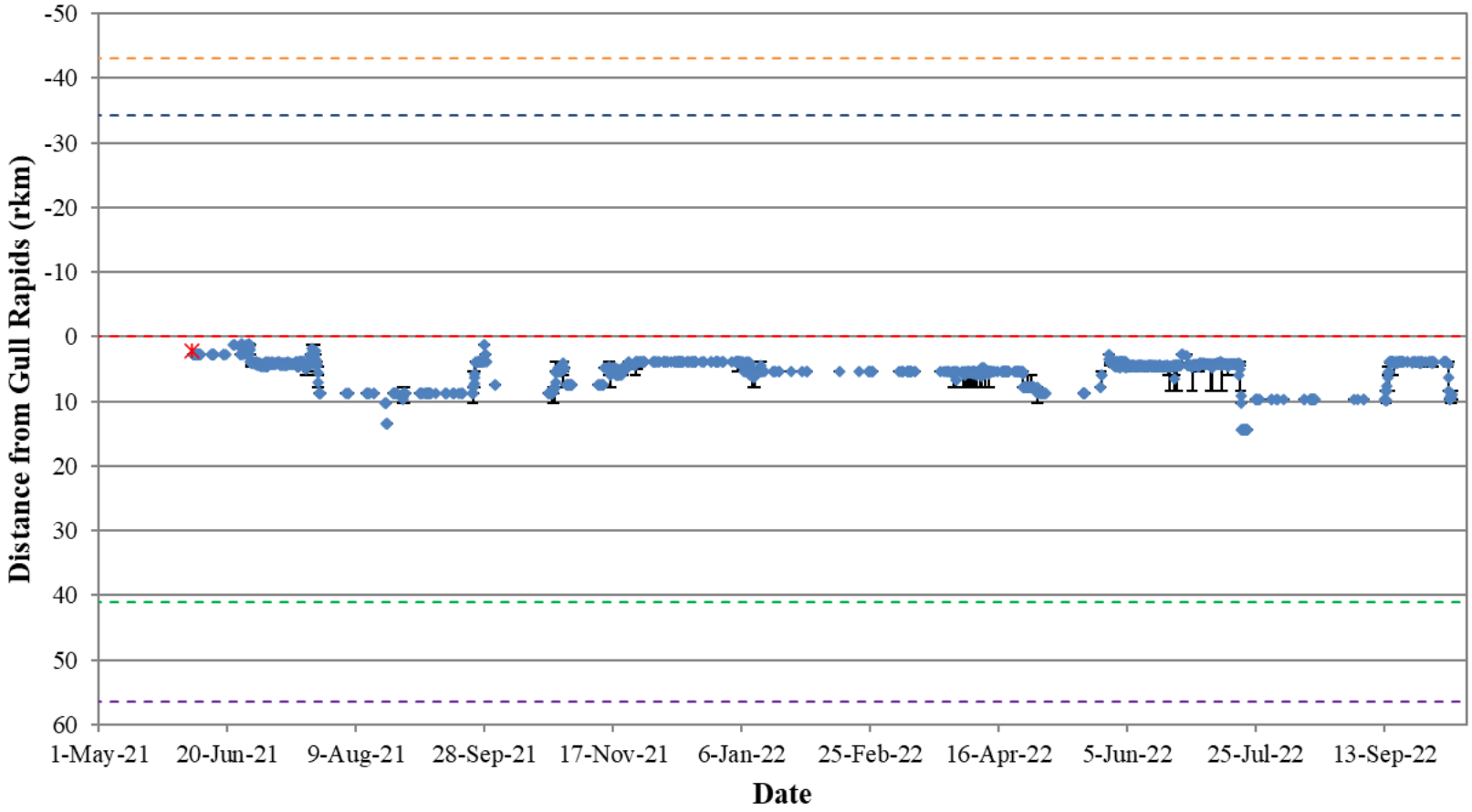

Figure A5-12: Position of a Walleye tagged with an acoustic transmitter (code #48246) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

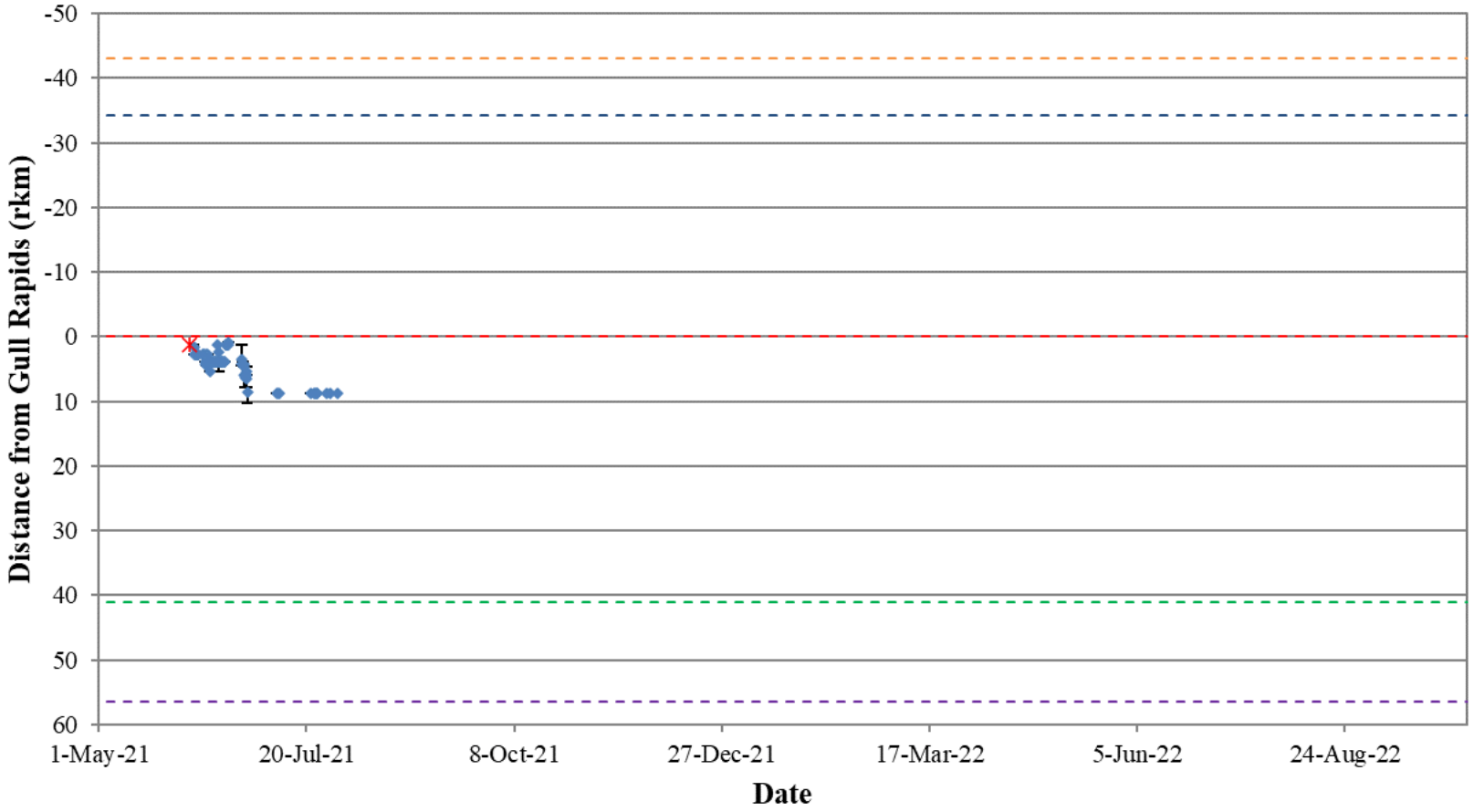

Figure A5-13: Position of a Walleye tagged with an acoustic transmitter (code #48247) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

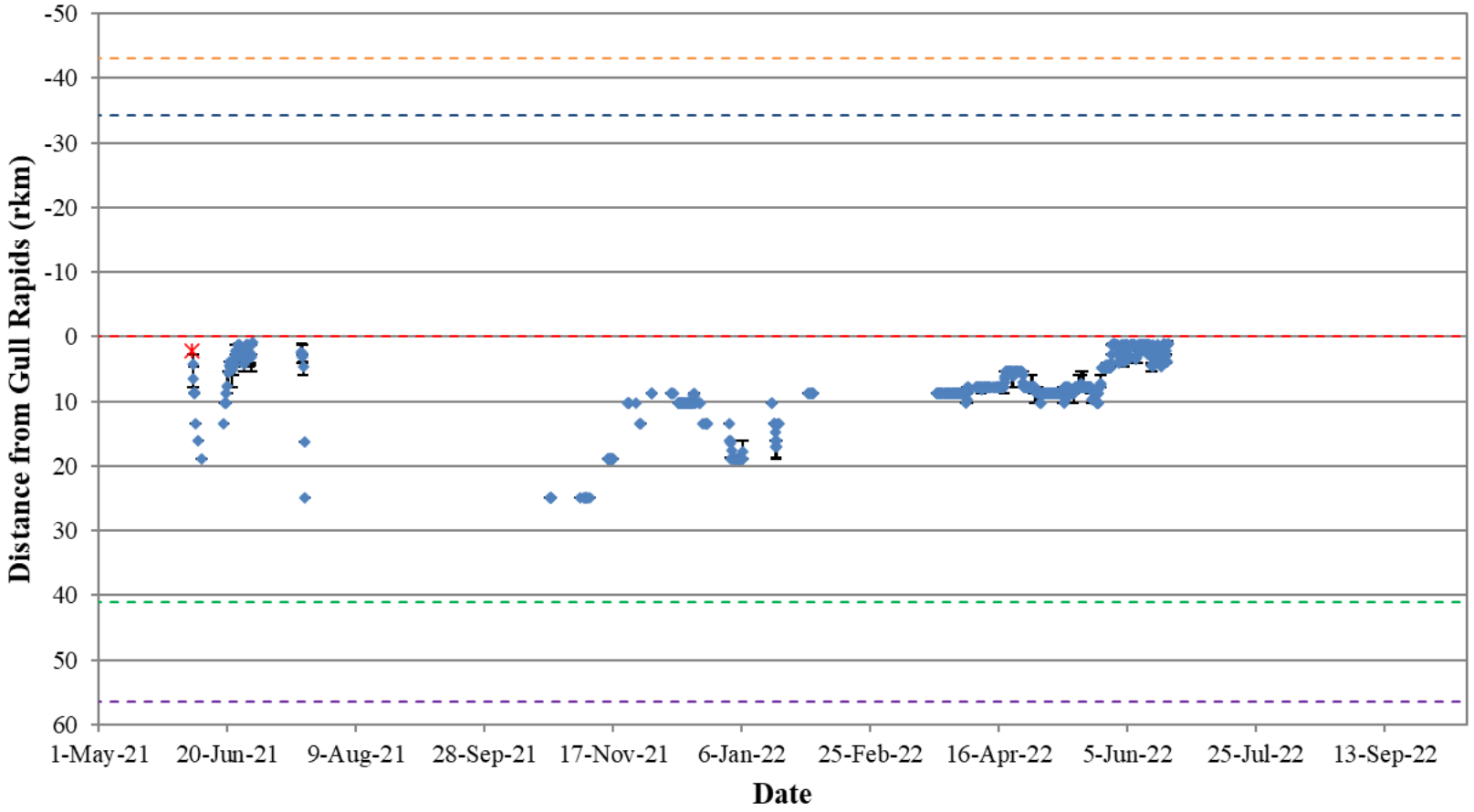

Figure A5-14: Position of a Walleye tagged with an acoustic transmitter (code #48248) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

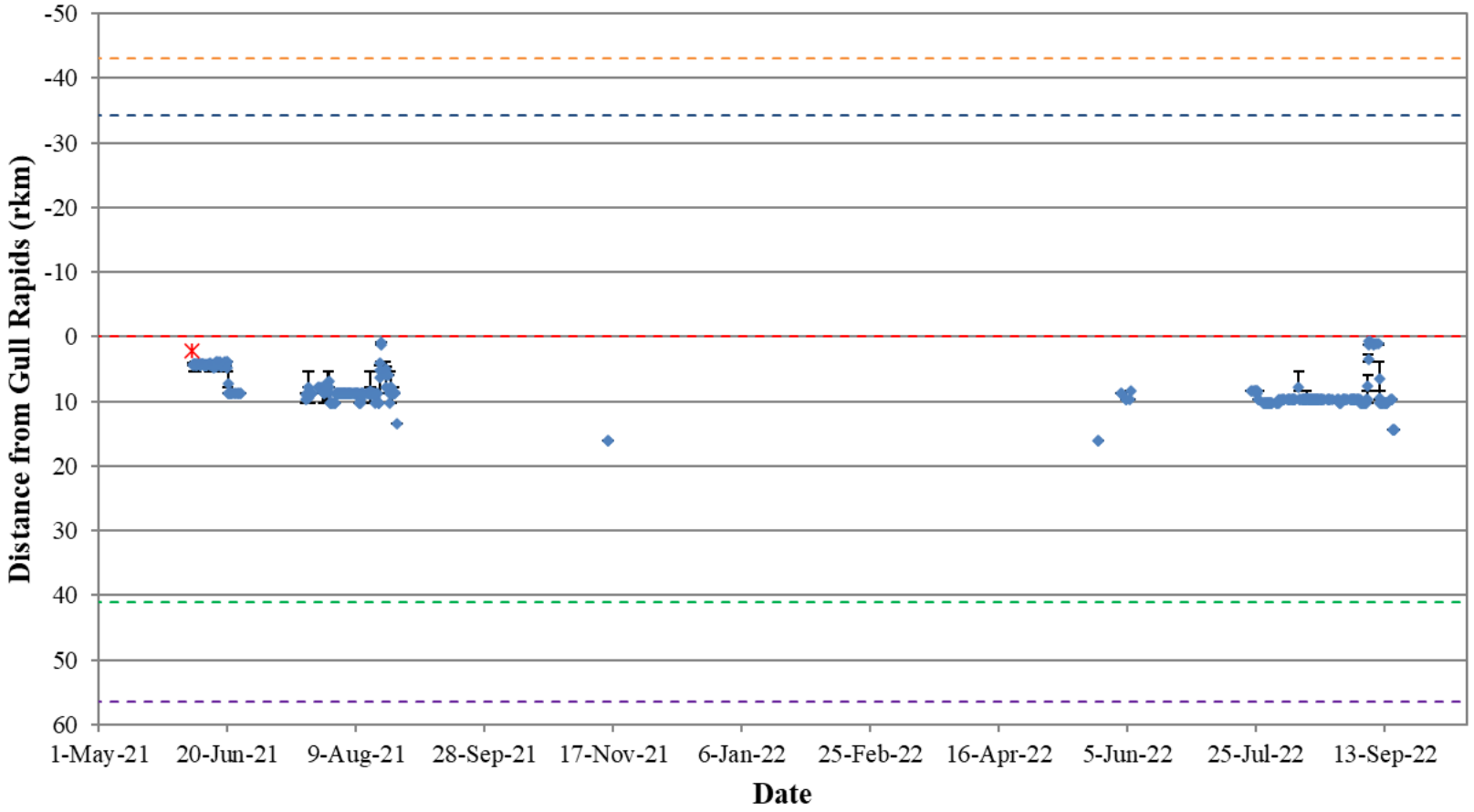

Figure A5-15: Position of a Walleye tagged with an acoustic transmitter (code #48249) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

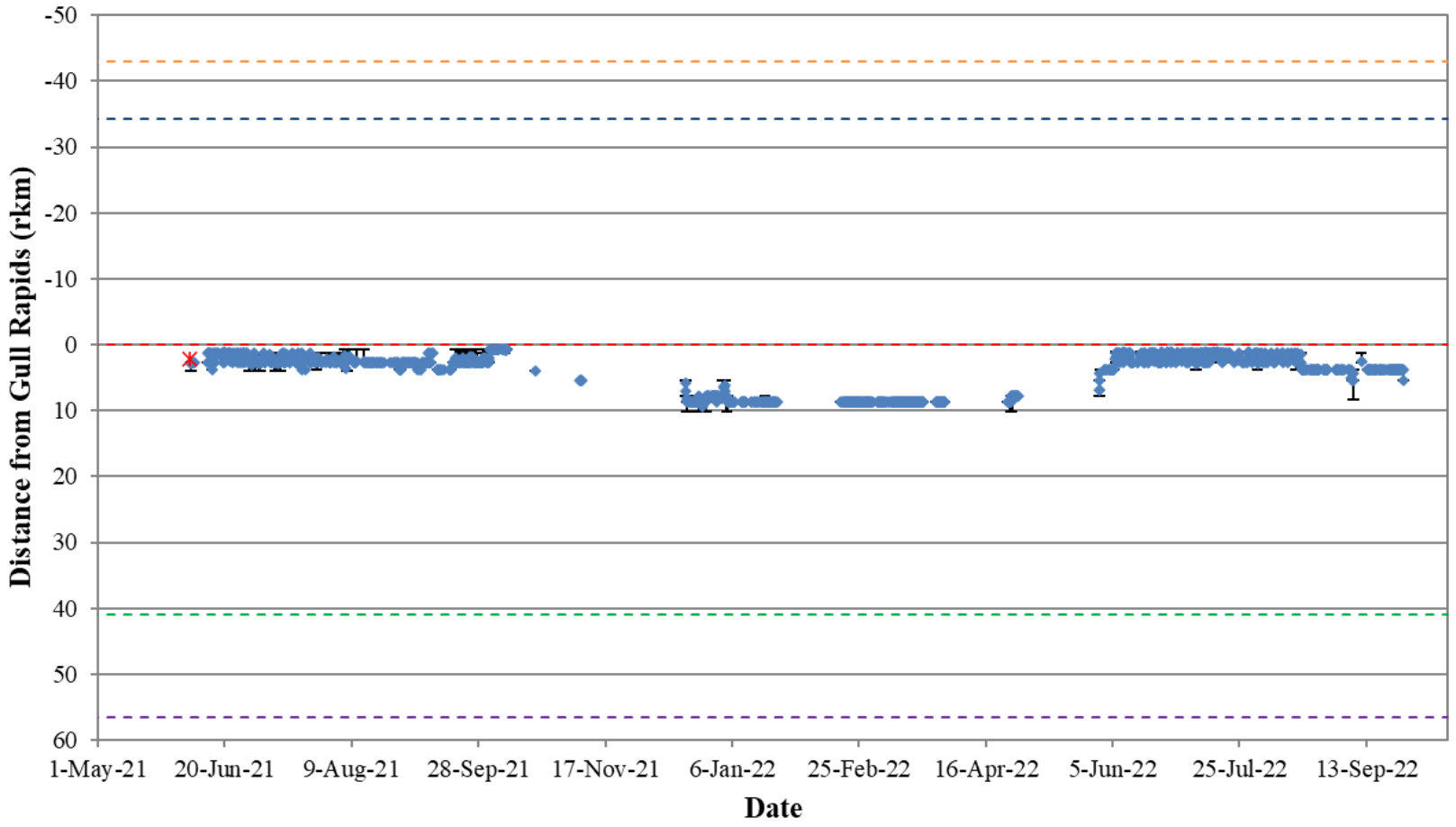

Figure A5-16: Position of a Walleye tagged with an acoustic transmitter (code #48250) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

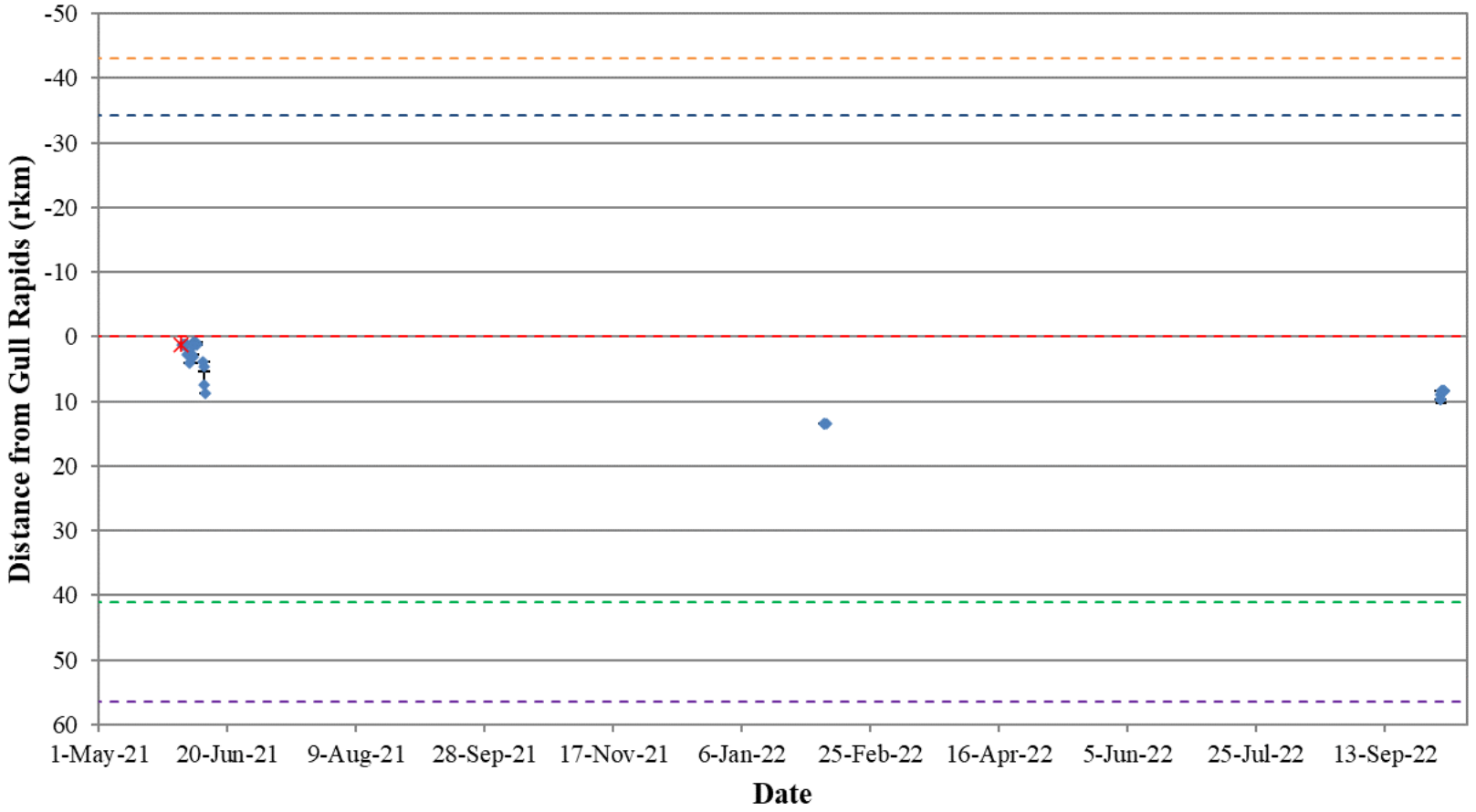

Figure A5-17: Position of a Walleye tagged with an acoustic transmitter (code #48251) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

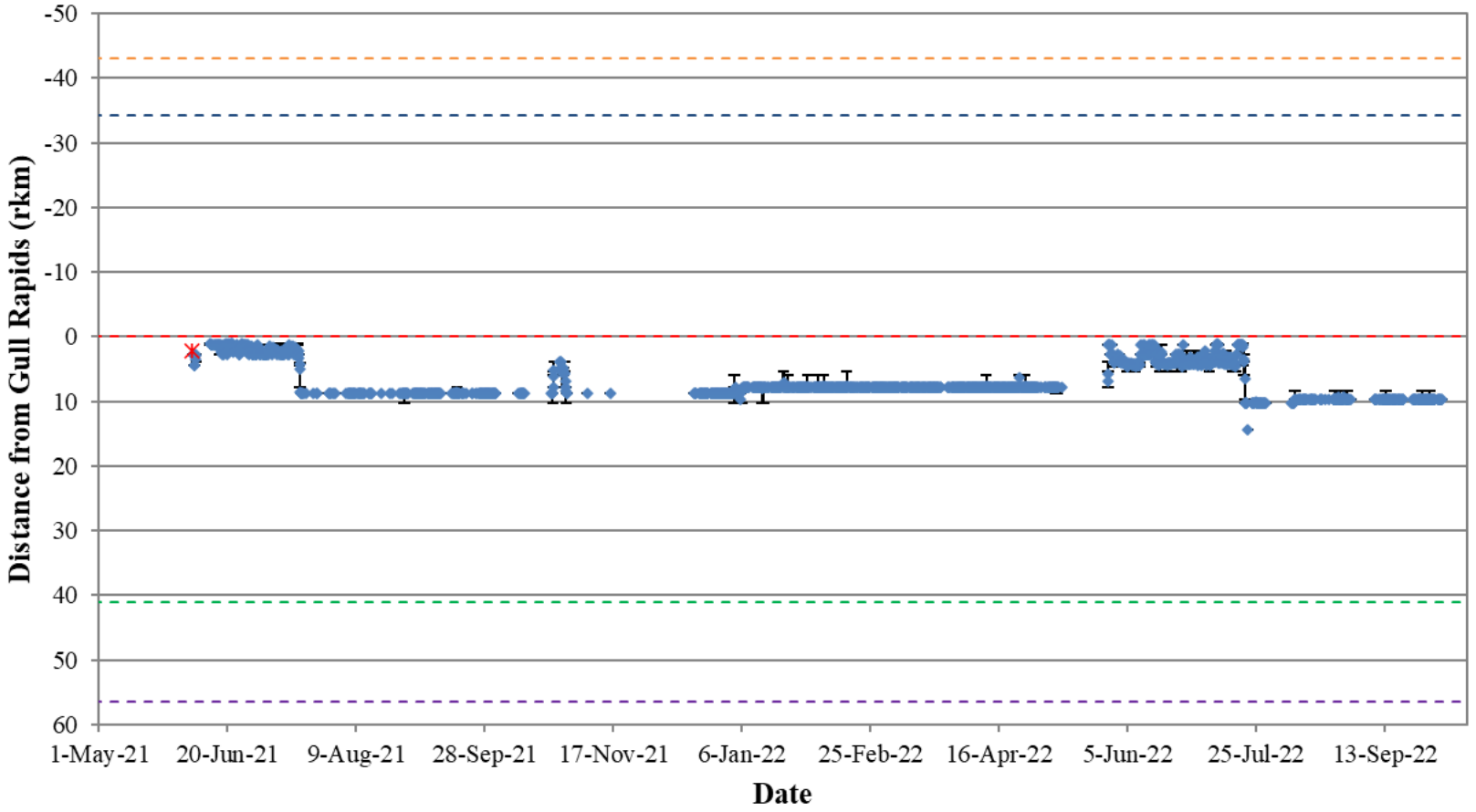

Figure A5-18: Position of a Walleye tagged with an acoustic transmitter (code #48252) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

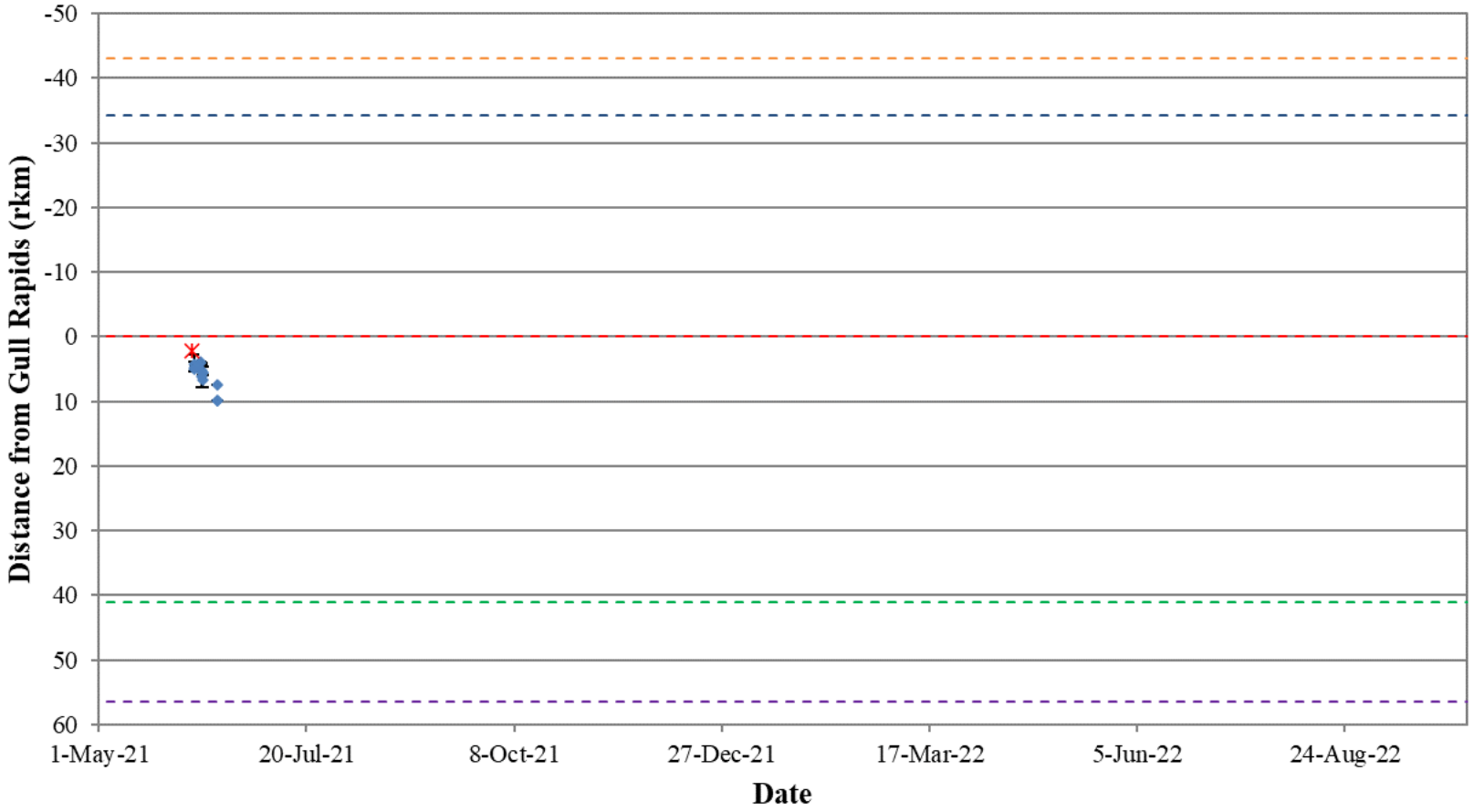

Figure A5-19: Position of a Walleye tagged with an acoustic transmitter (code #48253) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

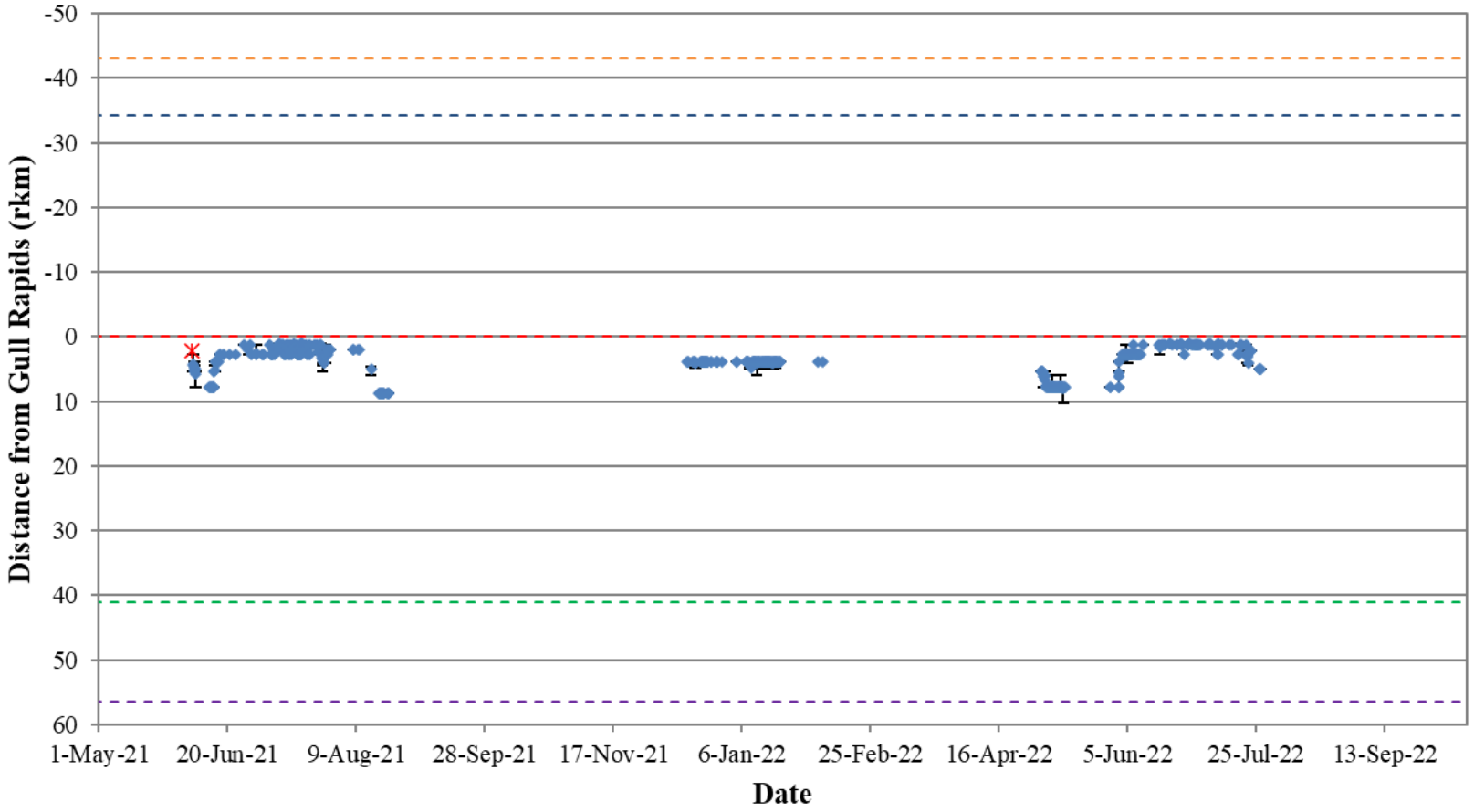

Figure A5-20: Position of a Walleye tagged with an acoustic transmitter (code #48254) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

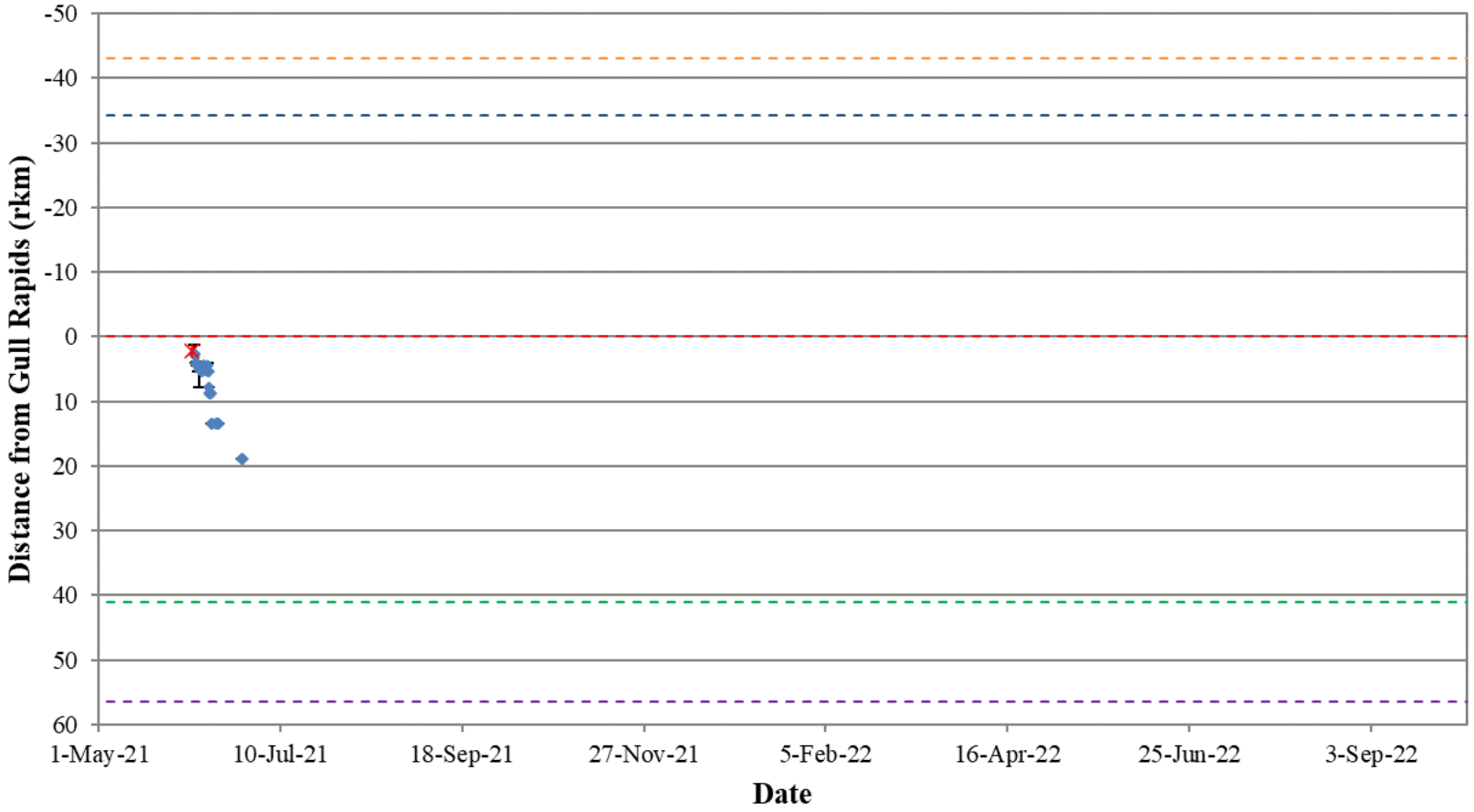

Figure A5-21: Position of a Walleye tagged with an acoustic transmitter (code #48255) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

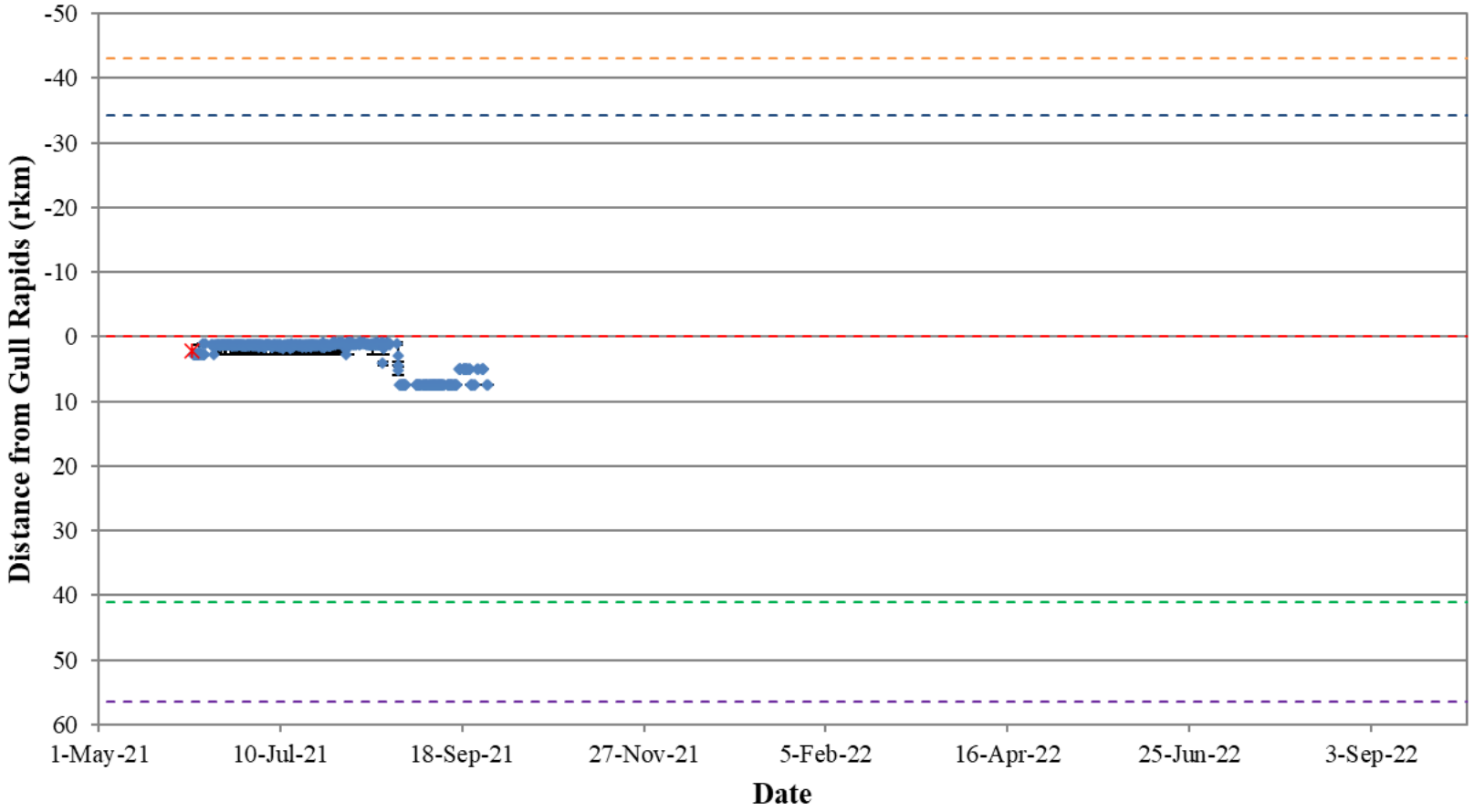

Figure A5-22: Position of a Walleye tagged with an acoustic transmitter (code #48256) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

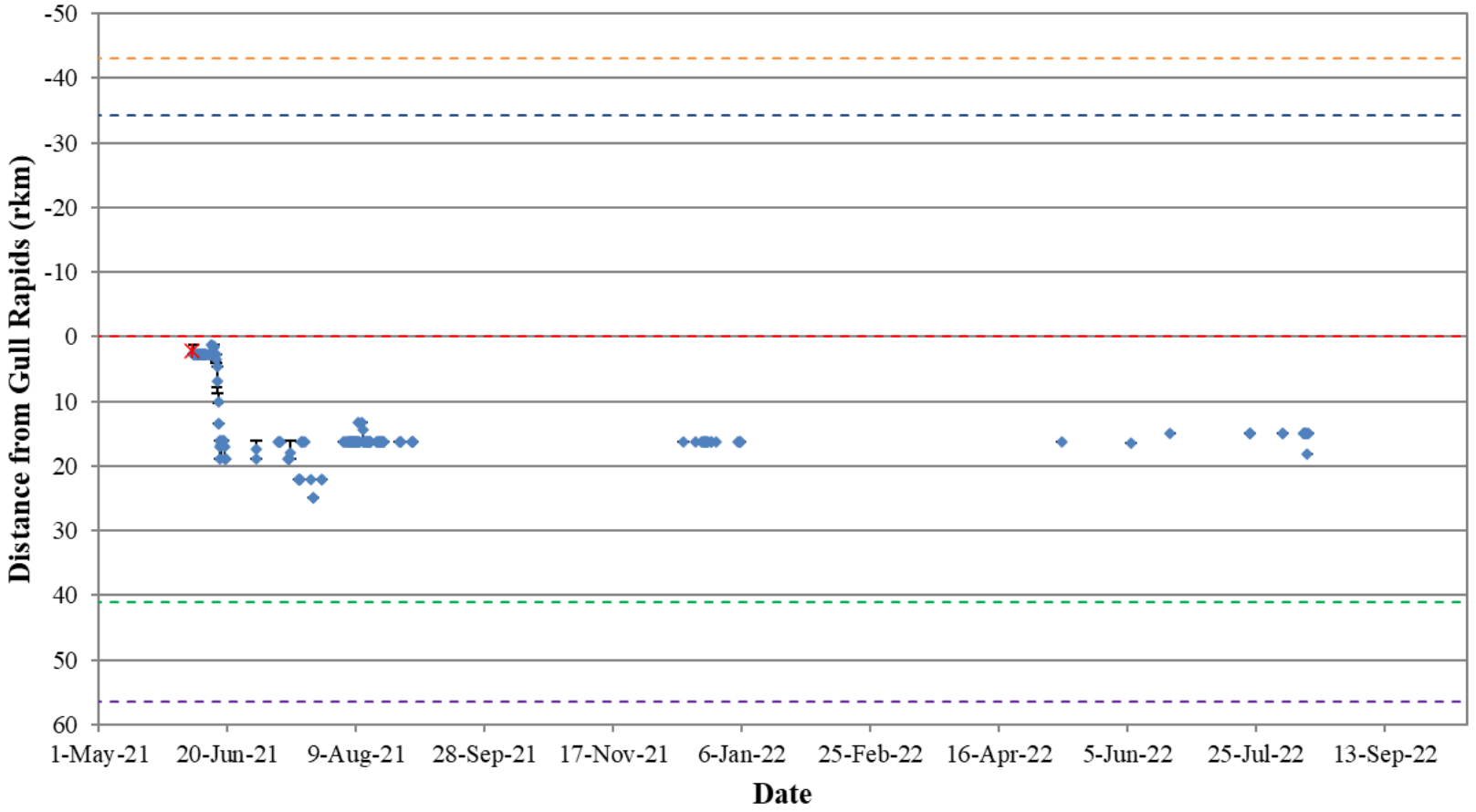

Figure A5-23: Position of a Walleye tagged with an acoustic transmitter (code #48257) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

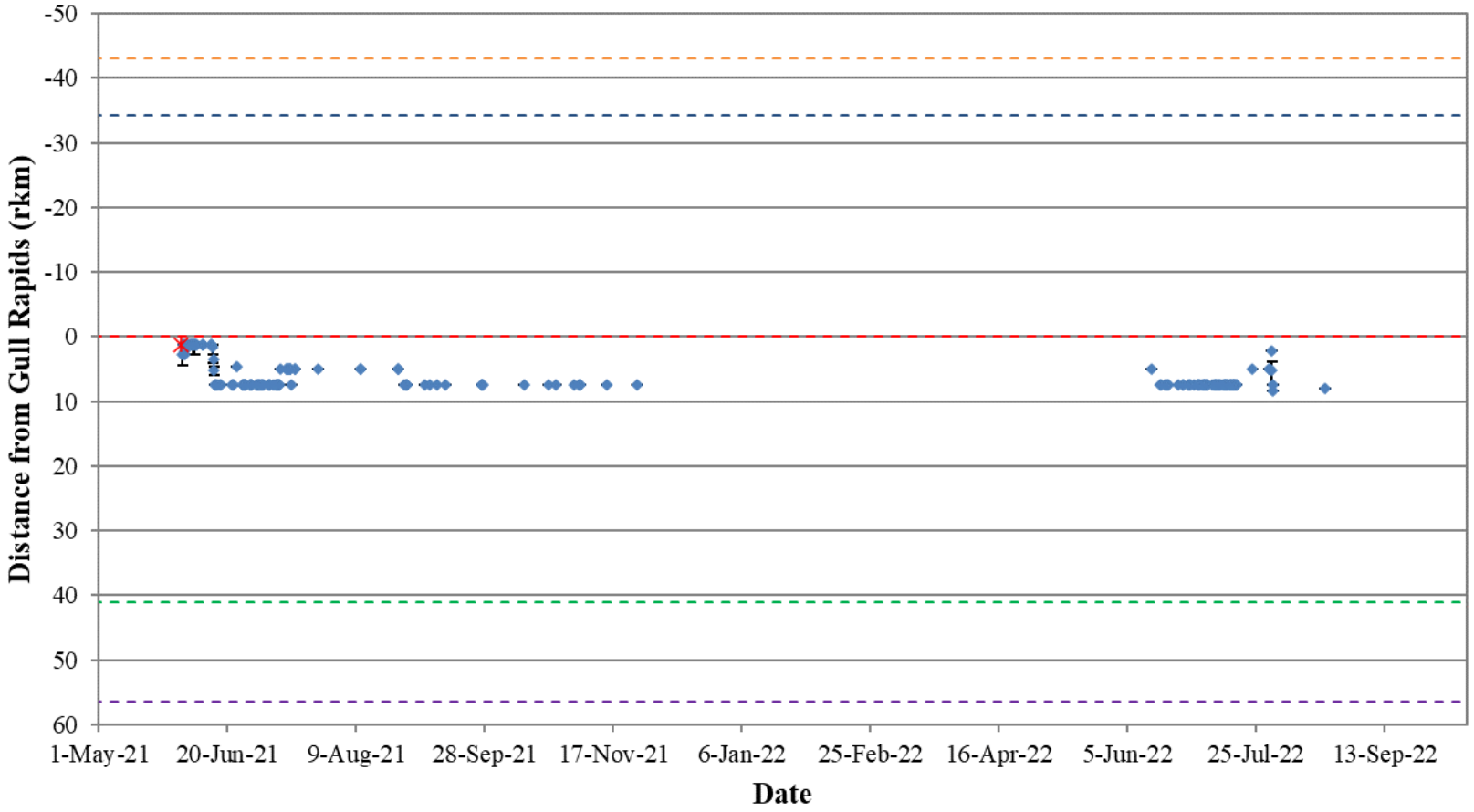

Figure A5-24: Position of a Walleye tagged with an acoustic transmitter (code #48272) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

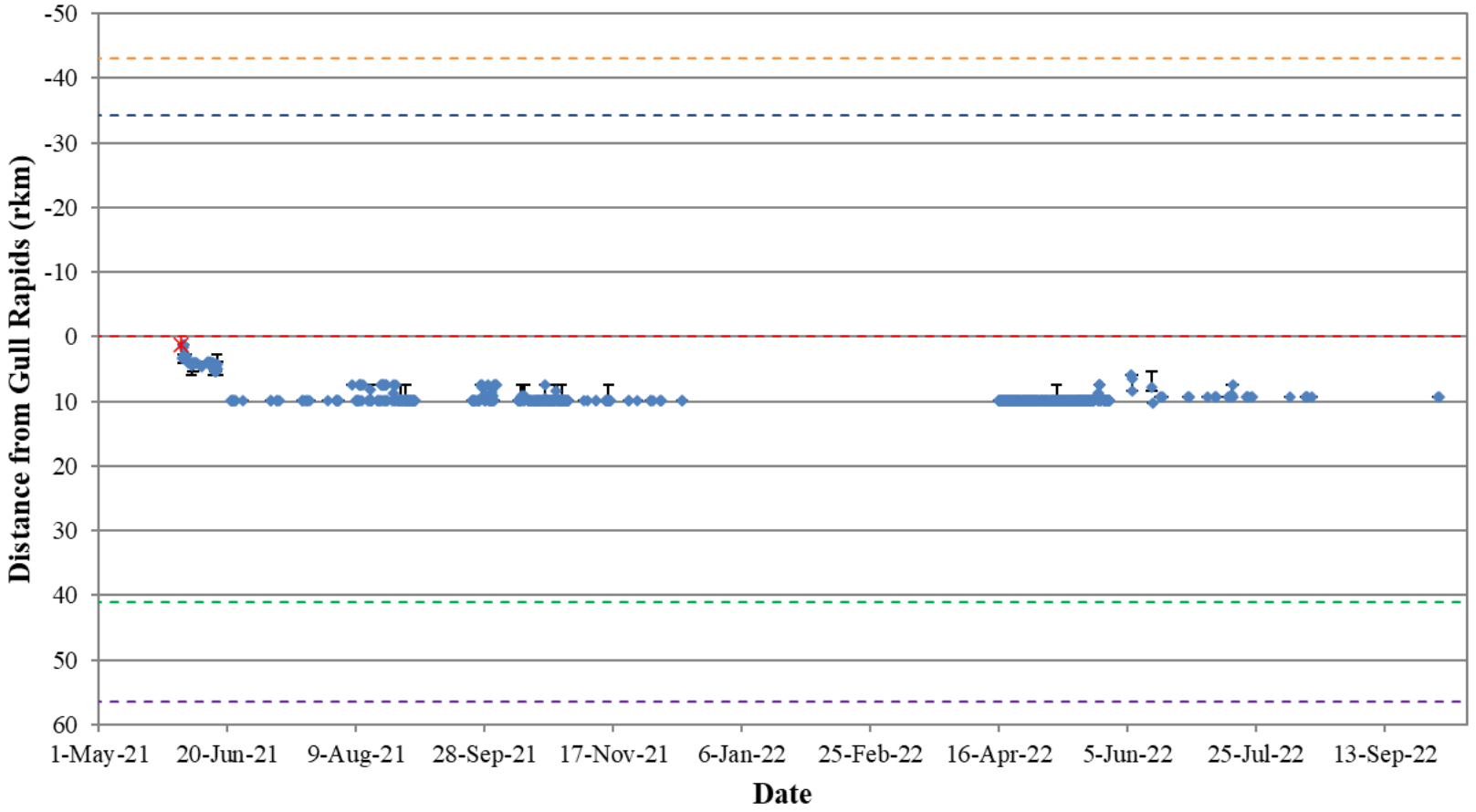

Figure A5-25: Position of a Walleye tagged with an acoustic transmitter (code #48273) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

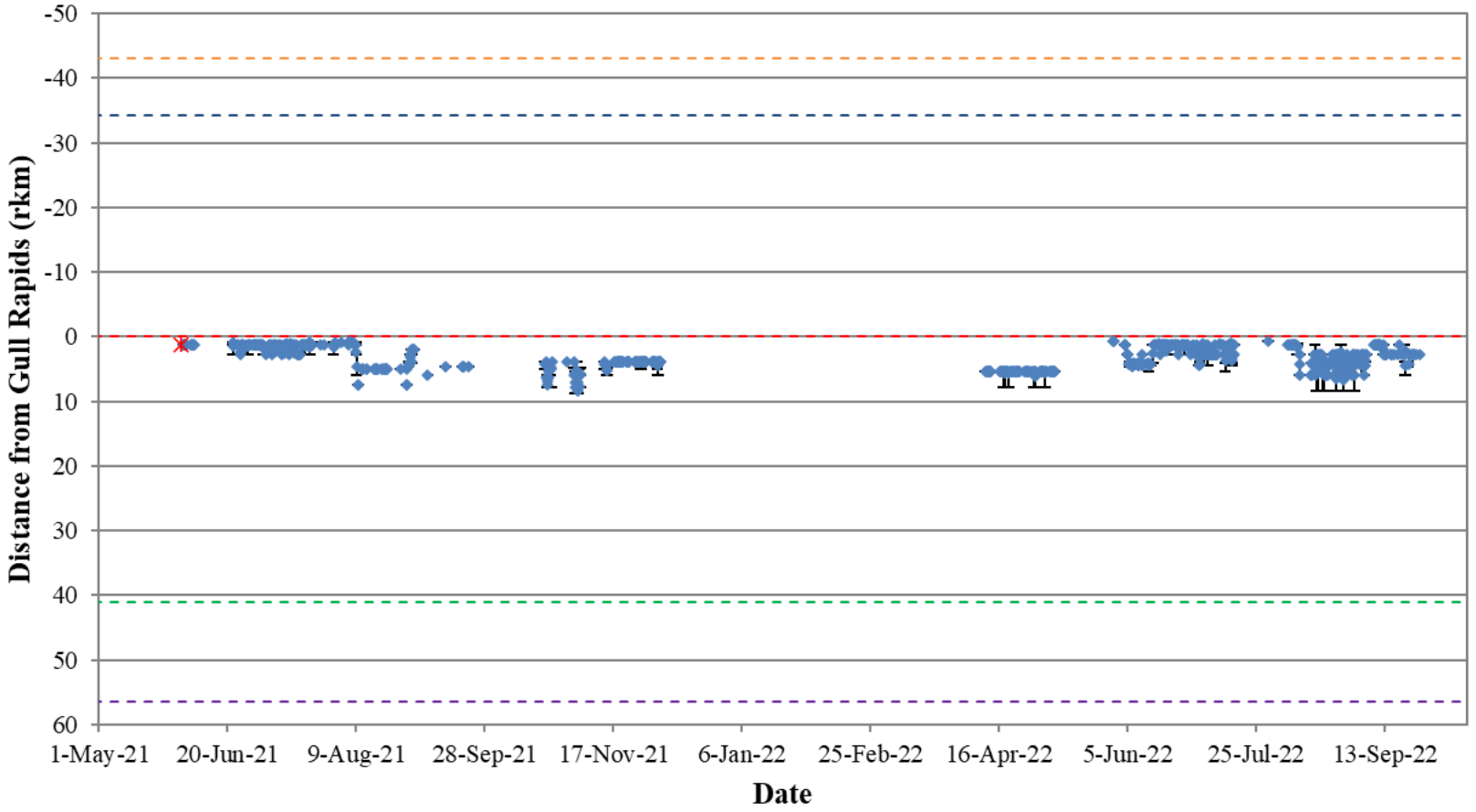

Figure A5-26: Position of a Walleye tagged with an acoustic transmitter (code #48274) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

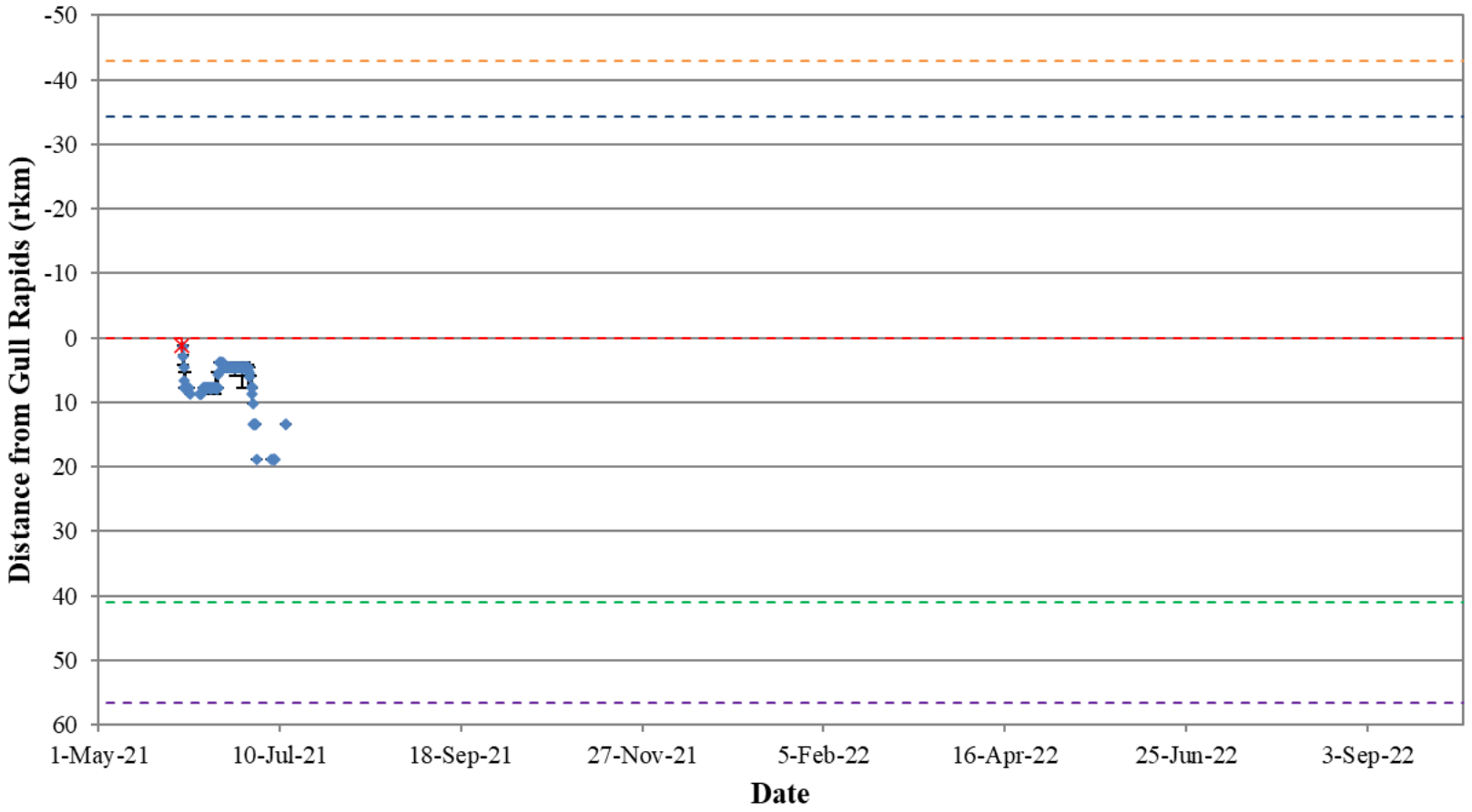

Figure A5-27: Position of a Walleye tagged with an acoustic transmitter (code #48275) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

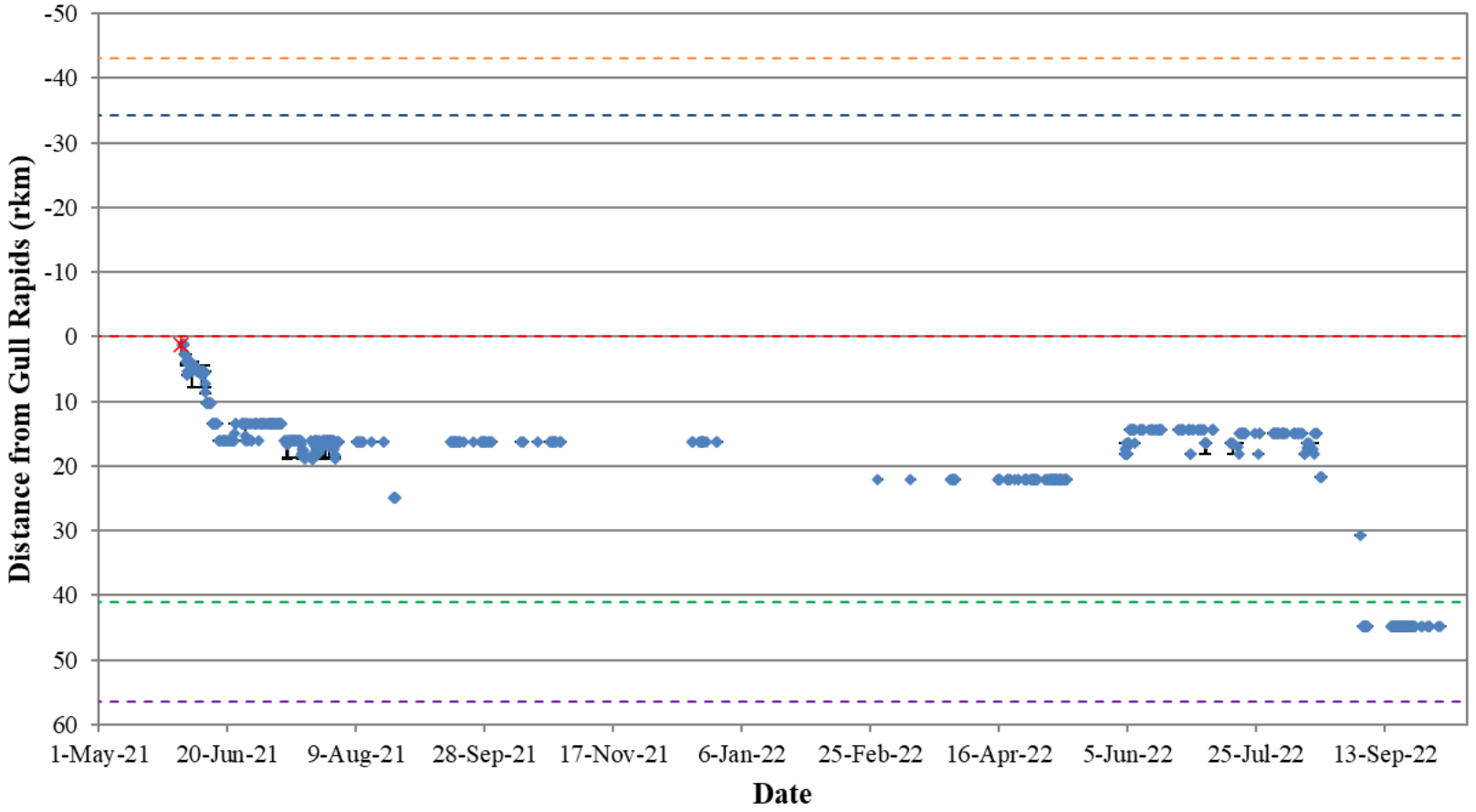

Figure A5-28: Position of a Walleye tagged with an acoustic transmitter (code #48318) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

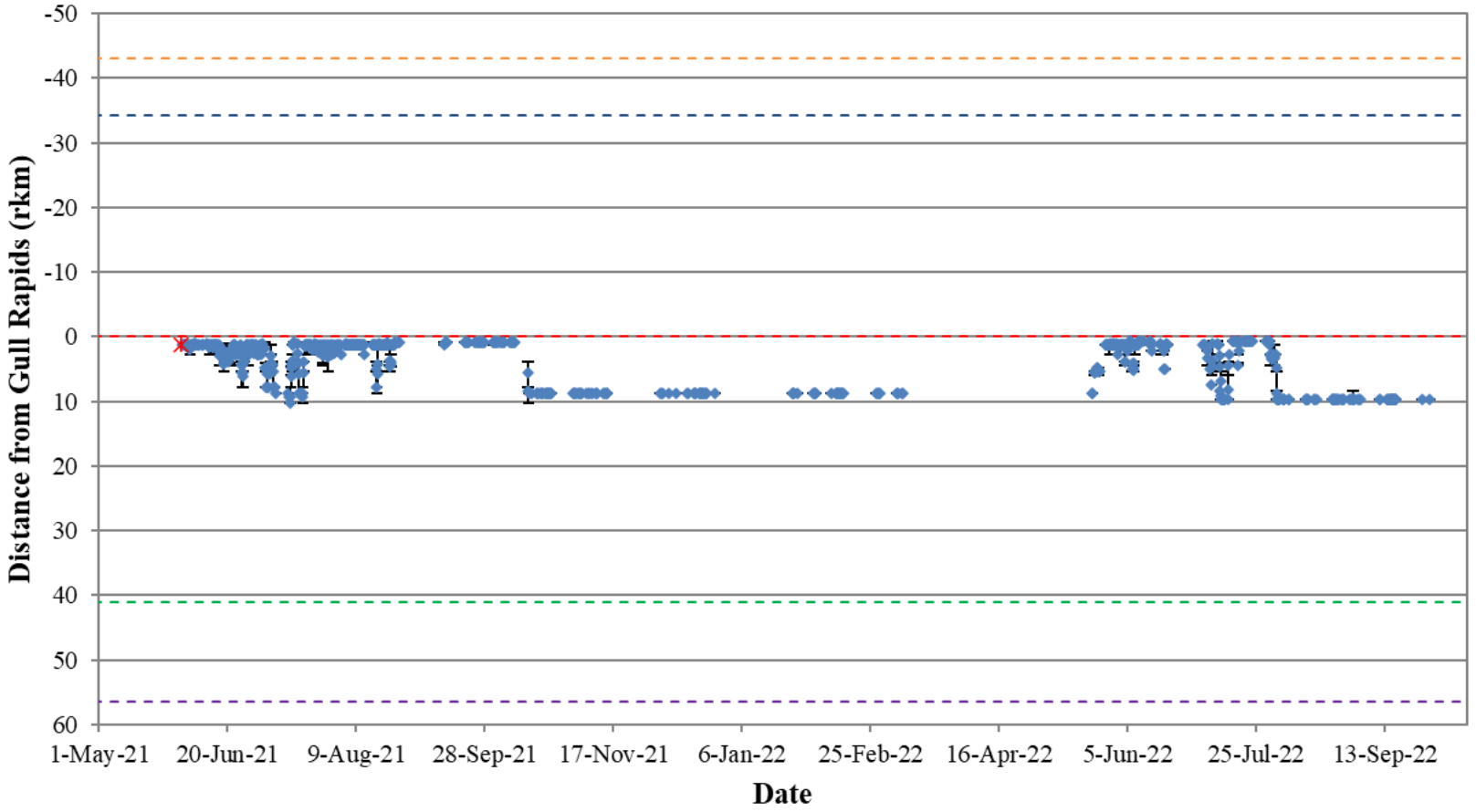

Figure A5-29: Position of a Walleye tagged with an acoustic transmitter (code #48324) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

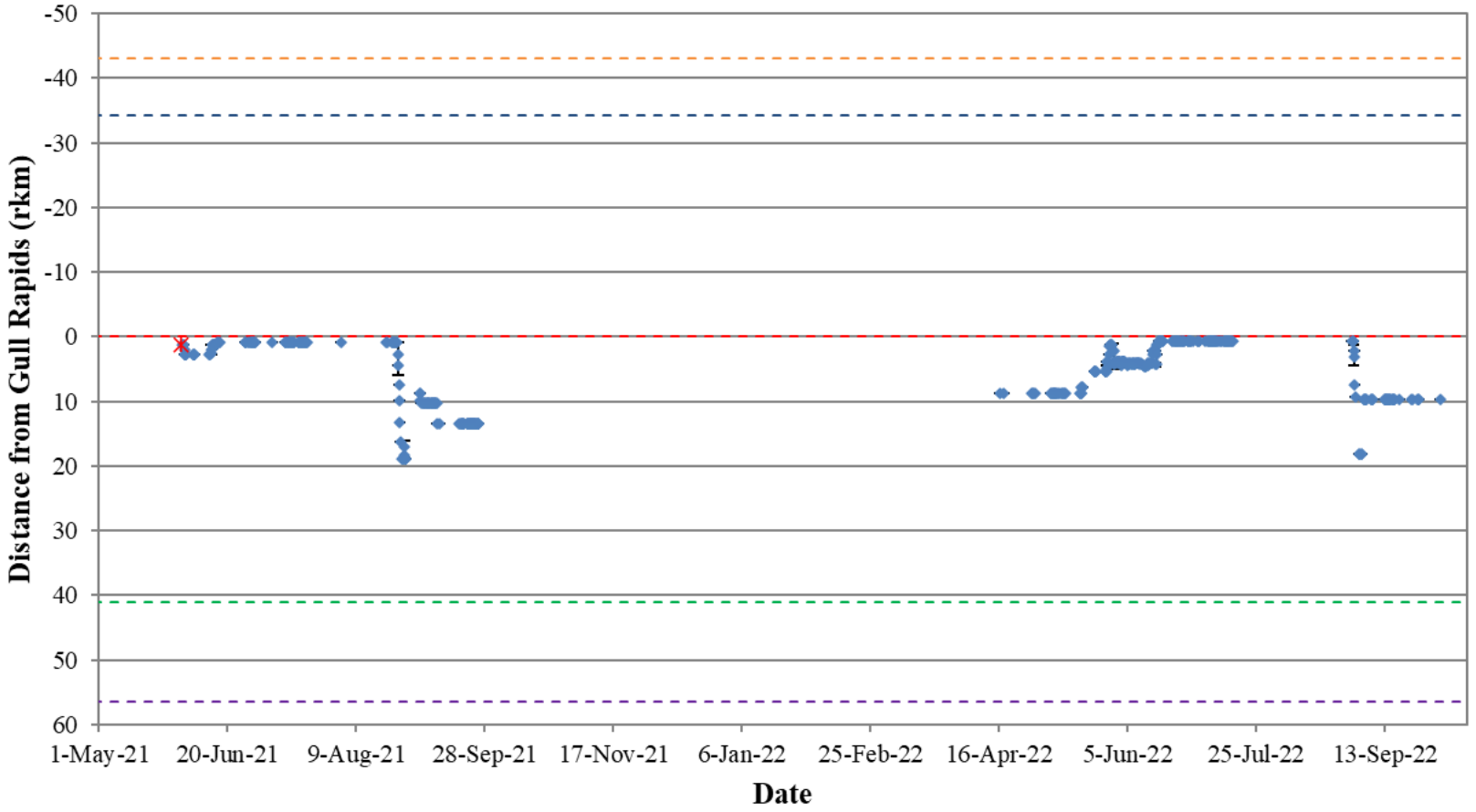

Figure A5-30: Position of a Walleye tagged with an acoustic transmitter (code #48325) in the Nelson River in Stephens Lake in relation to the Keeyask GS (rkm 0) from May 1, 2021 to October 10, 2022. Date and location of tagging is indicated by a star. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Keeyask GS (red), Kettle GS (green), and Long Spruce GS (purple).

APPENDIX 6:
BIOLOGICAL AND TAG INFORMATION FOR WALLEYE TAGGED UPSTREAM AND DOWNSTREAM OF THE KEEYASK GS

Table A6-1: Tag and biological information for each Walleye acoustically tagged upstream of the Keeyask GS between 2018 and 2022.

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
25739	109719	5-Jun-18	1735	6-Mar-23	410	800
25740	109718	5-Jun-18	1735	6-Mar-23	388	550
25742	109712	5-Jun-18	1735	6-Mar-23	320	400
25743	109713	5-Jun-18	1735	6-Mar-23	442	925
25744	109715	5-Jun-18	1735	6-Mar-23	525	1575
25745	109716	5-Jun-18	1735	6-Mar-23	438	850
25746	109717	5-Jun-18	1735	6-Mar-23	504	1750
25747	109704	28-May-18	1735	26-Feb-23	374	575
25748	109706	28-May-18	1735	26-Feb-23	398	525
25749	109705	28-May-18	1735	26-Feb-23	393	550
25750	109710	1-Jun-18	1735	2-Mar-23	403	725
25751	109711	5-Jun-18	1735	6-Mar-23	343	450
25752	109701	27-May-18	1735	25-Feb-23	404	700
25753	109702	27-May-18	1735	25-Feb-23	356	425
25754	109703	27-May-18	1735	25-Feb-23	367	550
25755	109708	1-Jun-18	1735	2-Mar-23	396	775
25756	109709	1-Jun-18	1735	2-Mar-23	452	1050
20147	114247	5-Jun-19	1492	6-Jul-23	523	1769
20148	114246	5-Jun-19	1492	6-Jul-23	383	590
20149	114245	6-Jun-19	1492	7-Jul-23	335	450
20150	114249	5-Jun-19	1492	6-Jul-23	500	1300
20151	114250	5-Jun-19	1492	6-Jul-23	485	1400
20153	114239	6-Jun-19	1492	7-Jul-23	498	1450
20154	114240	6-Jun-19	1492	7-Jul-23	415	800
20155	114241	6-Jun-19	1492	7-Jul-23	417	800
20156	114242	6-Jun-19	1492	7-Jul-23	299	300
20157	114243	6-Jun-19	1492	7-Jul-23	447	1000
20158	114244	6-Jun-19	1492	7-Jul-23	288	300
20159	114231	7-Jun-19	1492	8-Jul-23	500	1500
20160	114232	7-Jun-19	1492	8-Jul-23	415	800
20161	114226	7-Jun-19	1492	8-Jul-23	446	950
20162	114236	6-Jun-19	1492	7-Jul-23	300	300
20163	114237	6-Jun-19	1492	7-Jul-23	363	600
20164	114238	6-Jun-19	1492	7-Jul-23	343	500
20168	114775	7-Jun-19	1492	8-Jul-23	429	850
20169	114233	7-Jun-19	1492	8-Jul-23	391	550
20170	114235	6-Jun-19	1492	7-Jul-23	365	400
20171	114647	27-May-19	1492	27-Jun-23	386	600
20175	114642	29-May-19	1492	29-Jun-23	374	580
20176	114645	29-May-19	1492	29-Jun-23	419	900
20181	114644	29-May-19	1492	29-Jun-23	345	500
20182	-	25-May-19	1492	25-Jun-23	311	350
20186	114641	29-May-19	1492	29-Jun-23	350	450

Table A6-1: Tag and biological information for each Walleye acoustically tagged upstream of the Keeyask GS between 2018 and 2022 (continued)

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
20187	114649	23-May-19	1492	23-Jun-23	320	-
20188	114650	23-May-19	1492	23-Jun-23	380	-
48244	121601	3-Jun-21	1460	2-Jun-25	385	720
48258	121628	5-Jun-21	1460	4-Jun-25	438	920
48259	121627	5-Jun-21	1460	4-Jun-25	431	1000
48260	121626	5-Jun-21	1460	4-Jun-25	474	1220
48261	121520	7-Jun-21	1460	6-Jun-25	422	1050
48262	121513	10-Jun-21	1460	9-Jun-25	320	475
48263	121536	14-Jun-21	1460	13-Jun-25	392	710
48264	121614	5-Jun-21	1460	4-Jun-25	516	1870
48265	121619	5-Jun-21	1460	4-Jun-25	460	1270
48266	121624	5-Jun-21	1460	4-Jun-25	538	1700
48267	121625	5-Jun-21	1460	4-Jun-25	488	1440
48268	121623	5-Jun-21	1460	4-Jun-25	452	1160
48269	121622	5-Jun-21	1460	4-Jun-25	475	1280
48270	121612	5-Jun-21	1460	4-Jun-25	505	1700
48271	121613	5-Jun-21	1460	4-Jun-25	497	1500
48313	116422	31-May-21	1460	30-May-25	541	2100
48314	116425	31-May-21	1460	30-May-25	435	1000
48319	116419	31-May-21	1460	30-May-25	363	580
48320	116420	31-May-21	1460	30-May-25	386	740
48321	116423	31-May-21	1460	30-May-25	474	1350
48322	116424	31-May-21	1460	30-May-25	393	640
48323	116418	31-May-21	1460	30-May-25	327	490
48326	116417	31-May-21	1460	30-May-25	319	500
48327	122261	1-Jun-21	1460	31-May-25	350	500
48328	116421	31-May-21	1460	30-May-25	440	1250
48329	122266	1-Jun-21	1460	31-May-25	420	850
48330	122255	1-Jun-21	1460	31-May-25	360	570
48331	122254	1-Jun-21	1460	31-May-25	355	520
48332	122270	1-Jun-21	1460	31-May-25	398	770
48333	116416	31-May-21	1460	30-May-25	349	500

Table A6-2: Tag and biological information for each Walleye acoustically tagged upstream of the Keeyask GS between 2018 and 2022.

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
25732	90279	9-Jun-18	1735	10-Mar-23	415	525
25734	90277	7-Jun-18	1735	8-Mar-23	395	600
25735	109725	6-Jun-18	1735	7-Mar-23	468	1250
25736	90276	7-Jun-18	1735	8-Mar-23	482	1400
25737	109722	6-Jun-18	1735	7-Mar-23	390	650
25738	109721	6-Jun-18	1735	7-Mar-23	569	1725
25741	109720	6-Jun-18	1735	7-Mar-23	409	625
20129	114779	3-Jun-19	1492	4-Jul-23	363	500
20130	114785	1-Jun-19	1493	3-Jul-23	340	450
20131	114646	31-May-19	1494	3-Jul-23	530	1500
20132	114786	1-Jun-19	1495	5-Jul-23	320	400
20133	114796	31-May-19	1496	5-Jul-23	477	1200
20134	114795	31-May-19	1497	6-Jul-23	500	1450
20135	114783	1-Jun-19	1498	8-Jul-23	330	400
20136	114787	1-Jun-19	1499	9-Jul-23	472	1100
20137	114797	31-May-19	1500	9-Jul-23	482	1450
20138	114794	31-May-19	1501	10-Jul-23	451	1350
20139	114800	31-May-19	1502	11-Jul-23	439	900
20140	114799	31-May-19	1503	12-Jul-23	367	600
20141	114639	31-May-19	1504	13-Jul-23	433	850
20142	114798	31-May-19	1505	14-Jul-23	471	1300
20143	114792	1-Jun-19	1506	16-Jul-23	415	900
20144	114784	1-Jun-19	1507	17-Jul-23	367	550
20145	114782	1-Jun-19	1508	18-Jul-23	426	850
20152	114636	31-May-19	1509	18-Jul-23	479	1150
20165	117592	16-Sep-19	1510	4-Nov-23	465	1200
20167	117590	16-Sep-19	1511	5-Nov-23	420	800
20171	114647	27-May-19	1492	27-Jun-23	386	600
20172	114632	30-May-19	1512	20-Jul-23	470	1200
20173	114633	30-May-19	1513	21-Jul-23	470	1350
20174	114634	30-May-19	1514	22-Jul-23	502	1350
20177	114630	30-May-19	1515	23-Jul-23	460	1300
20178	114631	30-May-19	1516	24-Jul-23	499	1600
20179	114637	30-May-19	1517	25-Jul-23	453	1000
20180	114638	30-May-19	1518	26-Jul-23	520	1500
20183	114635	30-May-19	1519	27-Jul-23	455	850
20184	114628	30-May-19	1520	28-Jul-23	392	700
20185	114629	30-May-19	1521	29-Jul-23	390	650
48234	116450	2-Jun-21	1460	1-Jun-25	761	2550
48235	116449	2-Jun-21	1460	1-Jun-25	454	1070
48236	116448	2-Jun-21	1460	1-Jun-25	462	1320
48237	116447	2-Jun-21	1460	1-Jun-25	402	720
48238	116446	2-Jun-21	1460	1-Jun-25	348	490

Table A6-2: Tag and biological information for each Walleye acoustically tagged upstream of the Keeyask GS between 2018 and 2022 (continued).

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
48239	116445	2-Jun-21	1460	1-Jun-25	337	400
48240	116444	2-Jun-21	1460	1-Jun-25	428	1000
48241	116443	2-Jun-21	1460	1-Jun-25	370	600
48242	117975	2-Jun-21	1460	1-Jun-25	422	950
48243	117974	2-Jun-21	1460	1-Jun-25	397	840
48245	117971	4-Jun-21	1460	3-Jun-25	440	825
48246	122126	6-Jun-21	1460	5-Jun-25	422	750
48247	117970	5-Jun-21	1460	4-Jun-25	412	650
48248	122127	6-Jun-21	1460	5-Jun-25	340	450
48249	122046	6-Jun-21	1460	5-Jun-25	350	450
48250	122047	6-Jun-21	1460	5-Jun-25	481	1250
48251	116433	2-Jun-21	1460	1-Jun-25	365	600
48252	122147	6-Jun-21	1460	5-Jun-25	484	1350
48253	122150	6-Jun-21	1460	5-Jun-25	391	675
48254	122149	6-Jun-21	1460	5-Jun-25	430	1000
48255	122148	6-Jun-21	1460	5-Jun-25	460	950
48256	122045	6-Jun-21	1460	5-Jun-25	472	1100
48257	122128	6-Jun-21	1460	5-Jun-25	485	1300
48272	116435	2-Jun-21	1460	1-Jun-25	345	550
48273	116437	2-Jun-21	1460	1-Jun-25	380	580
48274	116434	2-Jun-21	1460	1-Jun-25	362	600
48275	116436	2-Jun-21	1460	1-Jun-25	433	810
48318	116431	2-Jun-21	1460	1-Jun-25	415	875
48324	116429	2-Jun-21	1460	1-Jun-25	353	500
48325	116432	2-Jun-21	1460	1-Jun-25	350	600