



Keeyask Generation Project  
Aquatic Effects Monitoring Plan

Walleye Movement Monitoring Report  
AEMP-2019-04



# **KEEYASK GENERATION PROJECT**

## **AQUATIC EFFECTS MONITORING PLAN**

REPORT #AEMP-2019-04

### **WALLEYE MOVEMENT MONITORING IN THE NELSON RIVER BETWEEN CLARK LAKE AND THE LIMESTONE GENERATING STATION, OCTOBER 2017 TO OCTOBER 2018: YEAR 5 CONSTRUCTION**

Prepared for

Manitoba Hydro

By

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# SUMMARY

## Background

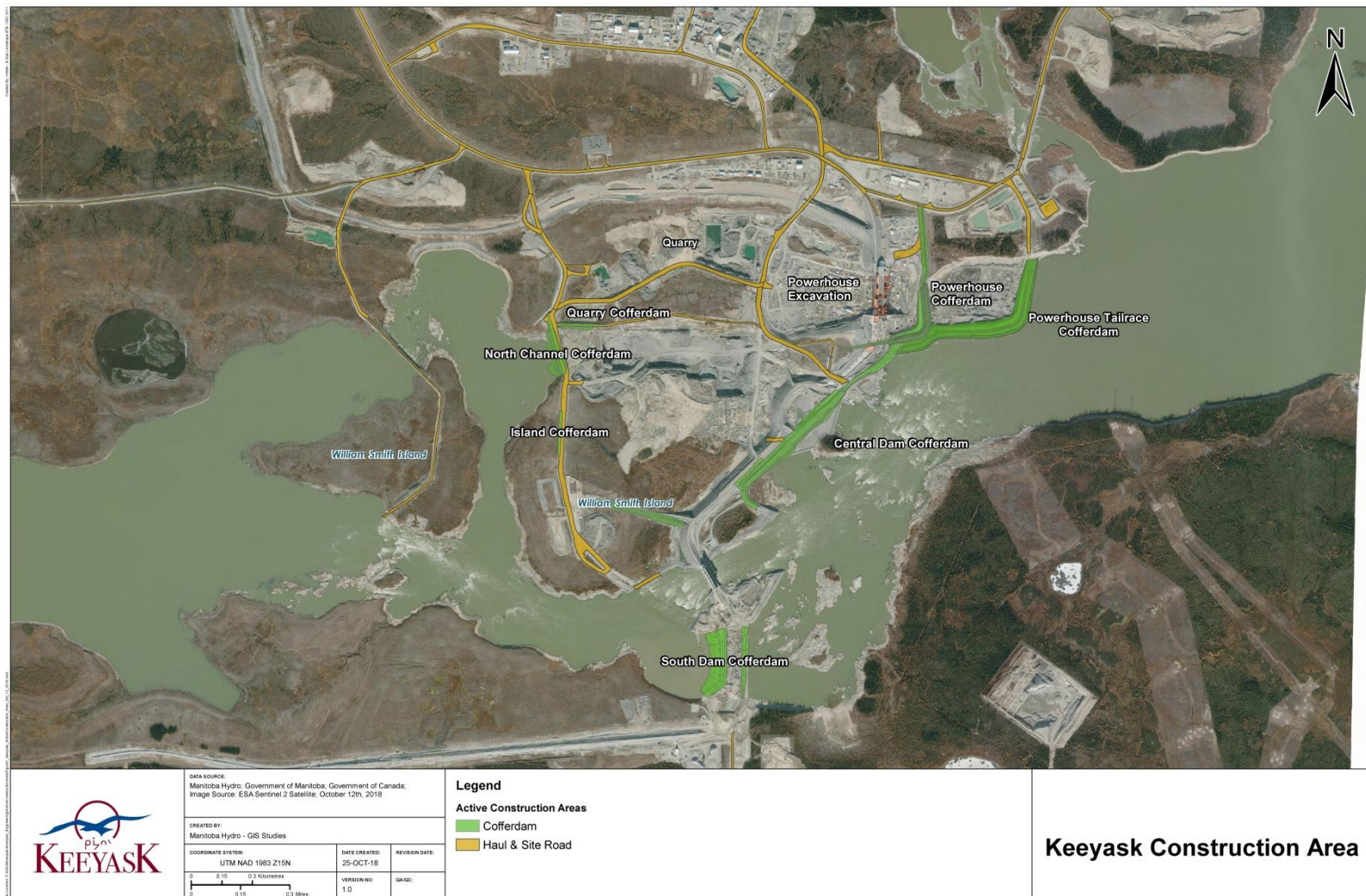
The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the Keeyask Generating Station (GS) on the environment. Besides measuring the accuracy of the predictions made and actual effects of the GS on the environment, monitoring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

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

Movements of 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 Walleye continued to live in the waterbody where they had been tagged. However, Walleye were recorded moving over Birthday and Gull rapids. A small number of Walleye also moved downstream through the generating stations/spillways along the lower Nelson River.

This report presents results of Walleye movement monitoring from October 2017 to October 2018 and provides a summary of data collected since the monitoring program was initiated in June 2013. Although tags originally implanted in 2013/2014 expired in 2016, tags applied to Walleye in 2016 and 2018 will continue to provide movement information until 2021 (2016 tags) and 2023 (2018 tags). 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. Walleye 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 illustrating instream structures at the Keeyask Generating Station site, October 2018.**

## Why is the study being done?

Monitoring during construction is being done to answer two questions:

*Are there Walleye close to the construction site, particularly during spawning?*

If Walleye are in the river close to the construction area, they could be harmed by high amounts of mud in the water or they could be trapped inside an area that will be drained.

*How many Walleye are moving through and/or away from Gull Rapids during construction and how far are they going?*

Movement studies tell us how many Walleye are moving up or down through Gull Rapids, 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.

## What was done?

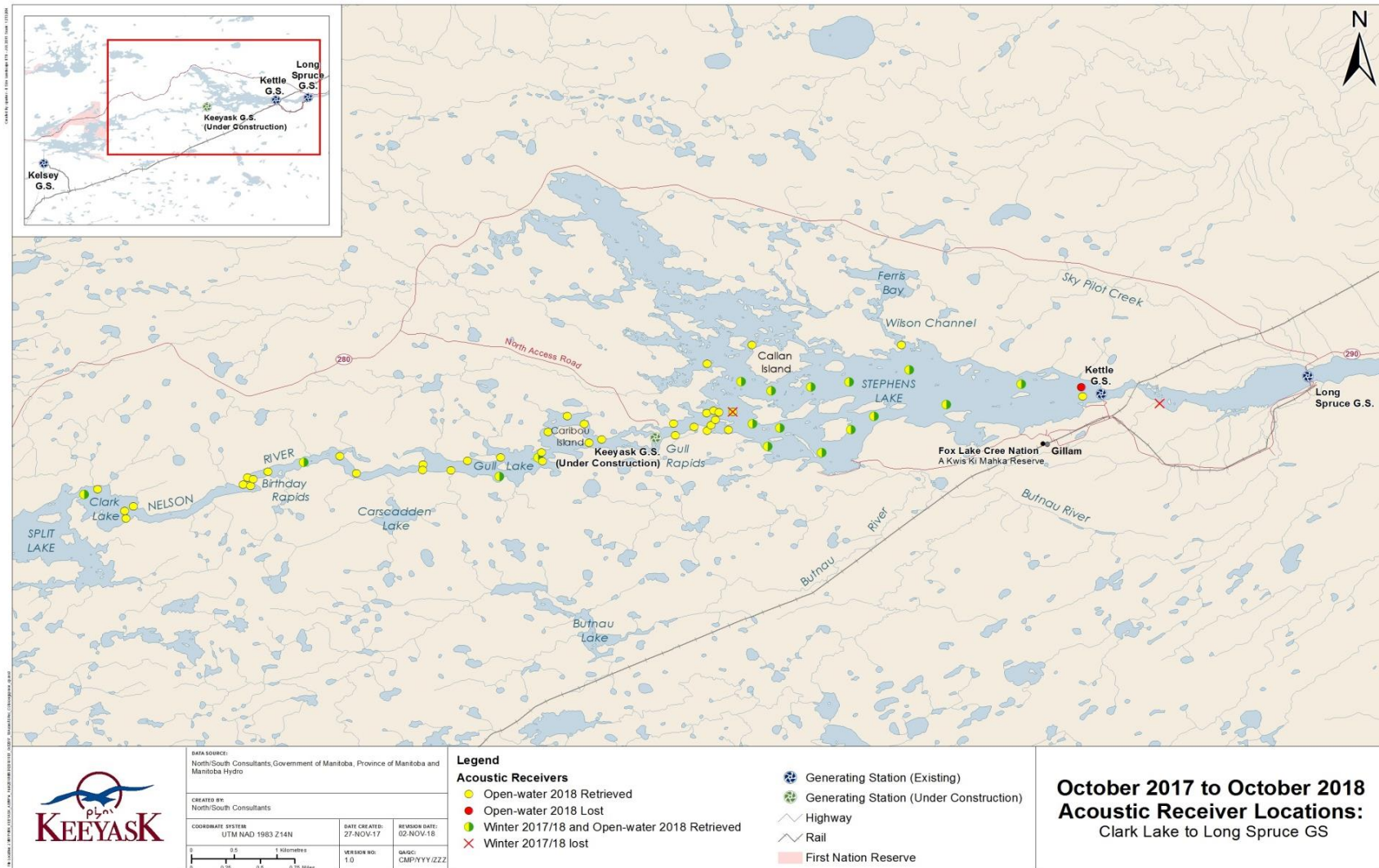
Movements of Walleye were tracked using acoustic telemetry. This is a technique in which a tag is surgically implanted inside a fish. Each tag sends out a sound signal (called a “ping”) that is picked up by receivers that were placed along the Nelson River between Clark Lake and the Limestone Generating 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 Walleye were tagged in 2013, 40 upstream and 40 downstream of Gull Rapids. Because the batteries in these transmitters expired in 2016, an additional 80 transmitters were applied to Walleye in June 2016: 40 upstream and 40 downstream of Gull Rapids. Eight of the fish tagged upstream moved downstream through Gull Rapids post-tagging, so an additional eight tags were applied upstream of Gull Rapids in fall 2016. By October 2017, more fish were considered missing or had moved downstream. To replace these, 24 more tags were applied in spring 2018: 17 upstream of Gull Rapids, and seven in Stephens Lake. The batteries in tags applied to Walleye in 2016 will expire in winter 2021, and those applied in 2018 will expire in winter 2023.



**Measuring a Walleye prior to surgery (left), surgery on a Walleye (middle), and releasing a Walleye after surgery (right).**





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

**What was found?**

A third of the fish tagged upstream of Gull Rapids in 2016 and 2018 have moved downstream, 12 in 2016, four in 2017, and five in 2018. This is different than what was observed for fish tagged in 2013/2014 where only six (15%) of the 40 tagged fish moved downstream through Gull Rapids over four years of monitoring (2013–2016). The reason for this difference is unknown. The majority of downstream movements in 2016 and 2018 occurred soon after tag application and may have been related to stress associated with tagging. Downstream movements in 2017 may have been due to very high river flows. Of the fish that remained upstream of Gull Rapids in 2018, most stayed in the upper and middle portions of Gull Lake. These fish did not use the area of the river close to the Keeyask construction site.

In Stephens Lake, the majority of the fish tagged in 2013/2014 and 2016/2018 remained in the upstream part of the lake, within 10 km of the construction site. No fish tagged in 2016 or 2018 moved upstream through Gull Rapids. Only one fish tagged in 2013/2014 moved upstream through the rapids. This fish moved upstream early in 2014, before construction of the Keeyask GS started. In August 2018, the river channel was completely blocked off and the spillway was opened. Because of this, fish will no longer be able to move upstream through Gull Rapids.

**What does it mean?**

Many Walleye use habitat immediately downstream of the construction site in Stephens Lake, including during the spawning period. The number of tagged Walleye moving downstream through Gull Rapids, the Kettle GS, and the Long Spruce GS in 2016–2018 was greater than during 2013–2016. Increased downstream movements may be related to tagging stress and/or high river flows. No Walleye have been recorded moving upstream over Gull Rapids since construction began.

**What will be done next?**

Fish that were tagged in 2016 can be tracked until 2021, and fish tagged in 2018 can be tracked until 2023, after which the tags will expire. Ongoing tracking of fish during construction will provide additional information about where the fish are moving, and if they continue to use areas near the construction site. Further tracking will also allow for monitoring of potential changes in movements now that the spillway is operational.



## **ACKNOWLEDGEMENTS**

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The collection of biological samples described in this report was authorized by Manitoba Conservation and Water Stewardship, Fisheries Branch, under terms of the Scientific Collection Permit #22-18.

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# 1.0 INTRODUCTION

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

The *Keeyask Generation Project: Response to EIS Guidelines*, completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the aquatic environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement: Aquatic Environment Supporting Volume* (AE SV). As part of the licensing process for the Project, an Aquatic Effects Monitoring Plan (AEMP) was developed detailing the monitoring activities of various components of the aquatic environment, including the focus of this report, 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; for example, Walleye were found to move downstream into Stephens Lake after spawning in Gull Rapids. As pre-Project studies were not designed to record detailed movement patterns in the Clark Lake to Stephens Lake reach as a whole, 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); results from October 2014 to October 2015 are presented in Burnett *et al.* (2016); results from 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 during 2016 to continue the movement study until 2021.

Results from June to October 2016 are presented in Hrenchuk and Lacho (2017) and results from October 2016 to October 2017 are presented in Hrenchuk and Lacho (2018). This report provides results of Walleye movement monitoring from October 2017 to October 2018 and summarizes what has been observed since the program began in 2013.

Walleye movements in the main flow of the Nelson River near the construction site may be affected by the installation of cofferdams (Map 2) that block upstream and downstream movements and alter flow patterns, river diversion (in late summer 2018), and disturbances such as blasting that may increase emigration from the construction area. The broad objective of Walleye movement monitoring is to better understand their movements and habitat use during generating station construction, with particular focus on movements in the vicinity of Gull Rapids.

As presented in the AEMP, the key questions to be answered about Walleye movement monitoring during construction of the Keeyask GS are:

- What is the number (or proportion) of tagged Walleye that move past the construction site?
- Are Walleye utilizing habitat in the vicinity of construction activities (particularly during spawning)?

## 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. Water velocities were classified as low (0.2–0.5 metres per second [m/s]), moderate (0.5–1.5 m/s), or high (greater than 1.5 m/s), as described in the Keeyask AE SV.

Clark Lake is located immediately downstream of Split Lake, and approximately 42 km upstream of Gull Rapids (Map 1). 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.

Birthday Rapids is located approximately 10 km downstream of Clark Lake and 30 km upstream of Gull Rapids (Maps 1 and 3). The drop in elevation from the upstream to downstream side of Birthday Rapids is approximately 2 m. The 14 km reach of the Nelson River between Birthday Rapids and Gull Lake is characterized as a large and somewhat uniform channel with medium to high water velocities. There are a few large bays with reduced water velocity and a number of small tributaries that drain into the Nelson River.

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

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

Just below Gull Rapids, the Nelson River enters Stephens Lake (Map 4). Stephens Lake was formed in 1971 by construction of the Kettle GS. Between Gull Rapids and Stephens Lake, there is an approximately 6 km long reach of the Nelson River that, although affected by water regulation at the Kettle GS, remains riverine habitat with moderate velocity. Construction has



altered the flow distribution immediately downstream of Gull Rapids as all flow now passes via the south channel of Gull Rapids. In August 2018, flow was further constricted when the spillway was commissioned (see Section 2.1).

Construction of the Kettle GS flooded Moose Nose Lake (north arm) and several other small lakes that previously drained into the Nelson River, as well as the old channels of the Nelson River that now lie within the southern portion of the lake (Map 4). Major tributaries of Stephens Lake include the North and South Moswakot rivers that enter the north arm of the lake. Looking Back Creek is a second order stream that drains into the north arm of Stephens Lake (Map 1). Kettle GS is located approximately 40 km downstream of Gull Rapids.

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 (Maps 1 and 5).

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.

## 2.1 CONSTRUCTION SUMMARY

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

## 2.2 FLOWS AND WATER LEVELS

From October 2017 to October 2018, Split Lake outflow ranged from about 2,800-4,000 m<sup>3</sup>/s. Flow typically fell in the range of about 3,000-3,500 m<sup>3</sup>/s, which is near the historical annual median flow of approximately 3,300 m<sup>3</sup>/s. Flow was generally higher during the 2017/2018 winter period, gradually declining from about 3,800 m<sup>3</sup>/s at the end of February 2018 to about 2,800 m<sup>3</sup>/s by the beginning of May. From early May 2018 to the beginning of July, flow gradually increased to about 3,500 m<sup>3</sup>/s and remained at that level to the end of July. The flow subsequently declined to about 2,800 m<sup>3</sup>/s by the end of September. Water levels varied in conjunction with the flows, ranging from about 153.4-155.2 m ASL on Gull Lake.

## 3.0 METHODS

### 3.1 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 range (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. Initially, the receiver array was designed to monitor movements of adult Lake Sturgeon (Hrenchuk and Lacho 2019); however, the same array is also used to monitor juvenile Lake Sturgeon (Lacho and Hrenchuk 2019a), Lake Whitefish (Lacho and Hrenchuk 2019b), and Walleye (the focus of this report).

#### 3.1.1 ACOUSTIC TRANSMITTER APPLICATION

Acoustic transmitters (VEMCO V13-1x) were first applied to Walleye in 2013 (40 upstream and 40 downstream of Gull Rapids) 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<sup>1</sup>) were applied to Walleye between May 27 and June 7, 2016: 40 upstream, and 40 downstream of Gull Rapids (Table 1). Shortly after tagging (*i.e.*, within 22 days), eight fish tagged upstream of Gull Rapids moved downstream into Stephens Lake. In order to return the number of tagged fish upstream of Gull Rapids to the original sample size, eight additional transmitters were applied on September 24, 2016 (described in 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; 1,735 day estimated battery life) were applied to Walleye upstream of Gull Rapids and in Stephens Lake in spring 2018. Seventeen fish were tagged upstream of Gull Rapids between May 27 and June 5, and seven fish were tagged in Stephens Lake between June 6 and 9 (Table 1).

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<sup>1</sup> 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.

### **3.1.2 ACOUSTIC RECEIVERS**

Since 2013, stationary acoustic receivers (VEMCO model VR2W) were used to continuously monitor tagged Walleye 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. As noted below, these receivers could not be set in 2018 due to low water conditions.

During the first four 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 (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 in previous years several were lost, likely due to disruption 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, especially in Gull Lake, is limited.

#### **3.1.2.1 WINTER 2017/2018**

The stationary acoustic receiver array for the winter 2017/2018 (October 17, 2017 to April 30, 2018) period consisted of 20 receivers. Four were set upstream of Gull Rapids, 15 throughout Stephens Lake, and one in the Long Spruce Reservoir (Maps 3, 4, and 5). A single receiver lost during winter 2016/2017 (rkm 23.5) was not reset during winter 2017/2018. Due to low water levels, the receiver in the Long Spruce Reservoir could not be retrieved at the end of the 2017/2018 winter period.

#### **3.1.2.2 OPEN-WATER 2018**

An array of 56 receivers was used during the 2018 open-water period (defined as May 1 to October 10, 2018). Twenty-seven were set upstream of Gull Rapids and 29 were set in Stephens Lake (Maps 6 and 7).

The 2018 open-water array differed slightly from arrays used in previous years. One receiver (#108002) was set in a new location upstream of Gull Rapids, closer to construction, at rkm -4.8

(Map 6). In Stephens Lake, one receiver set during open-water 2017 (rkm 23.5) was not reset due to its proximity to an additional receiver (#114241 at rkm 24.7; Map 7).

Due to low water levels, receivers could not be set in the Long Spruce or Limestone reservoirs during the 2018 open-water period. Several attempts were made to access the sites throughout the open-water period; however, a boat could not be safely launched in either area. Receivers will be set in both locations during open-water 2019 provided conditions are suitable.

Receiver “gates” were established in several key areas selected based on river morphology (channel restrictions) and characteristics of habitat (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.

Four gates were established between Clark Lake and Gull Rapids (44.0, 34.0, 19.0, and 10.0 rkms upstream of Gull Rapids), and two were established in Stephens Lake (4.5 and 40.0 rkms downstream of Gull Rapids) (Maps 6 and 7). The area upstream of Gull Rapids was divided into five zones (Map 6; Zones 1–5), while Stephens Lake was divided into two zones (Map 7; Zones 6 and 7). The Long Spruce Reservoir is referred to as Zone 8 and the Limestone Reservoir as Zone 9. The location of the “gates” has remained consistent since first set in 2013.

On October 10, 2018, the majority of receivers were removed and a subset ( $n = 19$ ) were redeployed to monitor movements during winter 2018/2019.

### 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 Gull Rapids representing a distance of 0 rkm. The area located downstream of Gull Rapids (*i.e.*, Stephens Lake and the Long Spruce Reservoir) were given positive (+) distance values from Gull Rapids, while the area located upstream (*i.e.*, Gull and Clark lakes) were given negative (-) distance values (Figures 1 and 2). The average rkm distance from Gull Rapids was calculated over a 4-hour

interval and plotted versus time for each fish. Total detection ranges were calculated by subtracting the furthest downstream detection location from the location of the furthest upstream detection. The proportion of time that all fish spent within each river zone was calculated and plotted.

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

## 4.0 RESULTS

Section 4.1 provides a movement summary for fish tagged in 2016 prior to winter 2017/2018. Figures 3 to 13 provide movement range, relative detection frequency, and proportional distribution of tagged fish both upstream and downstream of the construction site by season for the period October 2017 to October 2018. Appendix A1 provides furthest upstream and downstream detection summaries, Appendices A2 and A3 provide movement summaries, by river kilometre, for each Walleye tagged in 2016 and 2018. Biological information associated with each tagged fish is provided in Appendix A4.

### 4.1 2016-2017 RESULTS SUMMARY

#### 4.1.1 UPSTREAM OF GULL RAPIDS

Forty tags were applied to Walleye upstream of Gull Rapids between May 28 and June 7, 2016, and an additional eight transmitters were applied on September 24, 2016, bringing the total number of tagged fish to 48 (Table 1). Eight fish were only detected briefly in Gull Lake (between 1 and 18 days) after being tagged, and are considered missing:

- #53763 was tagged at rkm -14.8 on June 5, 2016. It was located in upper Gull Lake (rkm -19.5 to -14.8) until June 18, when it moved downstream. It was last detected at rkm -9.9 on June 19, 2016 (Appendix A2-4).
- #53766 was tagged at rkm -12.5 on September 24, 2016. It remained at this location until October 4, when it moved downstream to lower Gull Lake. It was last detected at rkm -9.5 on October 12, 2016 (Appendix A2-7)
- #53770 was tagged at rkm -14.8 on June 5, 2016. It was located at rkm -17.4 until June 11, 2016 (Appendix A2-11).
- #53774 was tagged at rkm -14.8 on June 5, 2016. It remained at rkm -17.4 until June 10, after which it moved downstream to lower Gull Lake. It was last detected at rkm -9.0 on June 16, 2016 (Appendix A2-15).
- #53778 was tagged at rkm -14.8 on June 3, 2016. It remained at rkm -17.4 until June 16. It then moved downstream and was last detected at rkm -9.5 on June 16, 2016 (Appendix A2-19).
- #53779 was tagged at rkm -14.8 on June 3, 2016. It was located at rkm -12.9 until June 13, 2016 (Appendix A2-20).
- #53790 was tagged at rkm -17.4 on May 29, 2016. It was located here until June 1, 2016 (Appendix A2-31).



- #53802 was tagged at rkm -14.8 on June 7, 2016. It moved downstream immediately and was last detected at rkm -5.8 on June 8, 2016 (Appendix A2-43).

An additional seven fish were detected longer (between 47 and 135 days) after tagging but have not been detected since open-water 2016 or winter 2016/2017 and are presumed missing:

- #53767 was tagged at rkm -12.5 on September 24, 2016. It was located here until October 16 and was last detected at rkm -10.1 on January 8, 2017 (Appendix A2-8).
- #53780 was tagged at rkm -14.8 on May 30, 2016. It was located here until July 13 after which it moved downstream and was last detected at rkm -5.8 on July 16, 2017 (Appendix A2-21).
- #53787 was tagged at rkm -14.8 on May 30, 2016. It moved between rkms -19.5 and -14.8 until August 13 after which it moved downstream and was last detected at rkm -5.8 on September 17, 2016 (Appendix A2-28).
- #53800 was tagged at rkm -14.8 on June 7, 2016. It moved between rkms -19.5 and -14.8 until August 29 after which it moved downstream and was last detected at rkm -5.8 on September 14, 2016 (Appendix A2-41).
- #53803 was tagged at rkm -17.2 on September 24, 2016. It moved between rkms -14.8 and -11.8 until October 16, 2016. It was last detected at rkm -10.1 on January 21, 2017 (Appendix A2-44).
- #53806 was tagged at rkm -14.8 on June 6, 2016. It moved between rkms -14.8 and -34.3 until October 19, 2016, when it was last detected at rkm -17.4 (Appendix A2-47).
- #53807 was tagged at rkm -14.8 on June 6, 2016. It moved upstream and was last located at rkm -48.2 (the inlet of Clark Lake) on August 19, 2016 (Appendix A2-48).

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

Prior to winter 2017/2018, 16 tagged Walleye moved downstream through Gull Rapids into Stephens Lake:

- Seven moved into Stephens Lake and made multiple upstream and downstream movements:
  - #53758 was tagged on September 24, 2016, at rkm -17.5 and moved downstream through Gull Rapids between July 28 and August 11, 2017 (Appendix A2-1).
  - #53759 was tagged on September 24, 2016, at rkm -17.5 and moved downstream through Gull Rapids on September 29, 2016 (Appendix A2-2).
  - #53760 was tagged on September 24, 2016, at rkm -17.5 and moved downstream through Gull Rapids on October 3, 2016 (Appendix A2-3).



- #53775 was tagged on June 5, 2016, at rkm -14.8 and moved downstream through Gull Rapids on June 18, 2016 (Appendix A2-16).
- #53788 was tagged on May 30, 2016, at rkm -14.8 and moved downstream through Gull Rapids on June 21, 2016 (Appendix A2-29).
- #53793 was tagged on June 7, 2016, at rkm -17.4 and moved downstream through Gull Rapids on June 8, 2017 (Appendix A2-34).
- #53799 was tagged on June 7, 2016, at rkm -14.8 and moved downstream through Gull Rapids on October 16, 2016 (Appendix A2-40).
- Six (#53769, #53771, #53773, #53777, #53782, and #53791) moved downstream through Gull Rapids into Stephens Lake, and then continued to move downstream into the Long Spruce Reservoir; two continued downstream and moved into the Limestone Reservoir:
  - #53769 was tagged on June 5, 2016, at rkm -14.8. It moved through Gull Rapids between August 16 and September 1 and through the Kettle GS on September 11, 2016 (Appendix A2-10).
  - #53771 was tagged on May 31, 2016, at rkm -14.8. It moved downstream through Gull Rapids between July 27 and 31. It moved into the Long Spruce Reservoir on August 19 and was detected in the Limestone Reservoir on August 21, 2016 (Appendix A2-12).
  - #53773 was tagged on June 5, 2016, at rkm -14.8. It moved downstream through Gull Rapids between July 13 and 16, 2017, and through the Kettle GS on July 19, 2017 (Appendix A2-14).
  - #53777 was tagged on May 29, 2016, at rkm -17.4. It moved downstream through Gull Rapids between August 14 and 23, 2017. It moved into the Long Spruce Reservoir on August 26 and was detected in the Limestone Reservoir on August 31, 2017 (Appendix A2-18).
  - #53782 was tagged on May 31, 2016, at rkm -19.5. It moved downstream through Gull Rapids between June 10 and 17, and moved through the Kettle GS between July 28 and August 8 (Appendix A2-23).
  - #53791 was tagged on May 29, 2016, at rkm -19.5. It moved downstream immediately after being tagged and was detected in Stephens Lake on June 5. It moved through the Kettle GS on June 27 (Appendix A2-32).
- Three moved downstream through Gull Rapids immediately after tagging and were detected briefly (for one to seven days) in Stephens Lake with no upstream movements. These fish are considered tagging mortalities and are not discussed in the remainder of the report.
  - #53764 was tagged on June 5, 2016, at rkm -14.8 and moved downstream through Gull Rapids on June 12 (Appendix A2-5).

- #53786 was tagged on May 30, 2016, at rkm -14.8 and moved downstream through Gull Rapids on June 2 (Appendix A2-27).
- #53801 was tagged on June 7, 2016, at rkm -14.8 and moved downstream through Gull Rapids on the same day (Appendix A2-42).

In summary, 48 Walleye were tagged upstream of Gull Rapids between May and September, 2016. Fifteen fish are considered missing and 16 fish moved downstream into Stephens Lake. Therefore, 17 fish were available to be detected upstream of Gull Rapids during winter 2017/2018.

Seventeen additional acoustic tags were applied to Walleye upstream of Gull Rapids between May 27 and June 5, 2018. Therefore, 34 fish were available to be detected upstream of Gull Rapids during open-water 2018.

### 4.1.2 STEPHENS LAKE

Forty tags were applied to Walleye in Stephens Lake between May 27 and June 1, 2016. Since that time, ten fish have gone missing:

- One (#53727) has never been detected since being tagged on May 28, 2016, at rkm 1.2.
- Five were detected briefly (between 12 and 29 days) after being tagged and are considered missing:
  - #53726 was tagged on May 27, 2016, at rkm 1.2. It was detected in upper Stephens Lake (rkm 1.2 to 4.4) until June 5. It moved downstream and was last located at rkm 16.8 on June 19, 2017 (Appendix A3-4).
  - #53732 was tagged on May 28, 2016, at rkm 1.2. It was detected moving between rkm 1.2 and 4.5 until June 2, after which it moved downstream. It was last detected in the northern portion of Stephens Lake at rkm 13.0 on June 14, 2016 (Appendix A3-9).
  - #53742 was tagged on May 30, 2016, at rkm 1.2. It was located between rkm 1.2 and 2.7 until June 11, 2016 (Appendix A3-19).
  - #53743 was tagged on May 31, 2016, at rkm 1.2. It immediately moved downstream and was last located on June 13, 2016, at rkm 9.4 (Appendix A3-20).
  - #53754 was tagged on May 31, 2016, at rkm 1.2. It immediately moved downstream and was last located on June 28, 2016, at rkm 18.6 (Appendix A3-31).
- Three were detected longer (between 65 and 136 days) after being tagged but have not been located since open-water 2016 and are considered missing:

- #53733 was tagged on May 30, 2016, at rkm 1.2. It was detected regularly between rkms 1.2 and 13.9 until August 6, 2016, when it was last detected at rkm 13.9 (Appendix A3-10).
- #53739 was tagged on May 31, 2016, at rkm 1.2. It was detected regularly between rkms 1.2 and 5.8 until October 14, 2016, when it was last detected at rkm 2.6 (Appendix A3-16).
- #53812 was tagged on June 1, 2016, at rkm 1.2. It moved downstream on June 20, and was last detected at rkm 20 on August 5, 2016 (Appendix A3-39).
- One (#53735) has been located constantly at a single location. This fish was tagged on May 30, 2016, at rkm 1.2. It moved downstream immediately after tagging and was detected at rkm 18.6 on June 16, 2016. It has been located here on every day since this date with no upstream or downstream movements. It is likely that this fish represents a tagging mortality and the tag has remained within the detection range of this receiver (Appendix A3-12).

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

Prior to winter 2017/2018, five Walleye moved downstream through the Kettle GS into the Long Spruce Reservoir. Three continued downstream and moved into the Limestone reservoir:

- #53728 was tagged on May 28, 2016, at rkm 1.2 and moved downstream through the Kettle GS between August 10 and 12, 2017. It was detected in the Limestone Reservoir on September 16, 2017 (Appendix A3-5).
- #53737 was tagged on May 29, 2016, at rkm 1.2 and moved downstream through the Kettle GS between July 14 and 16, 2017 (Appendix A3-14).
- #53746 was tagged on May 31, 2016, at rkm 1.2 and moved downstream through the Kettle GS between June 13 and August 4, 2017. It was detected in the Limestone Reservoir on August 8, 2017 (Appendix A3-23).
- #53747 was tagged on May 31, 2016, at rkm 1.2 and moved downstream through the Kettle GS between August 21 and 23, 2017 (Appendix A3-24).
- #53751 was tagged on May 31, 2016, at rkm 1.2 and moved downstream through the Kettle GS between August 4 and 6, 2017. It was detected in the Limestone Reservoir on August 8, 2017 (Appendix A3-5).

In summary, 16 fish moved downstream from Gull Lake and seven of these continued to be detected in Stephens Lake. Forty Walleye were tagged in Stephens Lake in 2016, ten of which are considered missing, and five of which moved downstream through the Kettle GS. Therefore, 32 fish were available to be detected in Stephens Lake during winter 2017/2018.

Seven additional acoustic tags were applied to Walleye in Stephens Lake between June 6 and 9, 2018. Therefore, 39 fish were available to be detected in Stephens Lake during open-water 2018.

## **4.2 WINTER 2017/2018**

### **4.2.1 UPSTREAM OF GULL RAPIDS**

The winter receiver array consisted of four receivers deployed at rkms -48.2, -29.4, -12.4, and -10.3 (Figure 1). All four receivers were retrieved (Map 3). Five of the 17 fish (29%) available to be detected were located a total of 5,318 times (range: 2–5,142 detections per individual) (Appendix A1-1). Fish were detected between one and 65 days of the 196 day winter period. On average, fish were detected on 17 days, or for 9% of the study period (standard deviation [StDev] = 27.2 days). The majority of detections (5,309; 99.8%) occurred at rkm -12.4 (Figure 4). Two fish (#53783 and #53789) were located as far upstream as Clark Lake (rkm -48.2). No fish were located by the receiver downstream of Birthday Rapids (rkm -29.4) or at rkm -10.3 (Figure 3).

### **4.2.2 STEPHENS LAKE**

Fifteen receivers were deployed in Stephens Lake during the 2017/2018 winter period, between rkms 5.2 and 36.1 (Figure 1). Fourteen of the 15 acoustic receivers were retrieved; the receiver at rkm 5.8 (#122774) could not be located and was likely moved by ice (Map 4).

Positions were obtained for 19 of the 32 fish (59%) available to be detected, for a total of 298,790 detections (range: 15–64,072 detections per individual) (Appendix A1-2). Fish were detected on 2 to 176 days of the 196 day winter period (1–90% of the time). On average, fish were detected on 79 days, or for 40% of the study period (StDev = 51.4 days). Five (26%) were located as far upstream as rkm 5.2, while one (5%) was located as far downstream as rkm 36.1 (Figure 5). The average overall movement range was 5.4 rkm (StDev = 5.4 rkm; range 0.0–17.5 rkm) (Figure 5; Appendix A1-2).

The majority of detections were logged in the southern portion of Stephens Lake at rkms 18.6 (n = 152,904; 51%), 9.4 (n = 46,468; 16%), 16.8 (n = 40,609; 14%), 7.9 (n = 28,879; 10%), and 5.2 (n = 28,787; 10%). Three fish were detected in the northern portion of Stephens Lake (receiver #114227, #122862, #122866, and #129183) (Figure 6; Map 4).

### **4.2.3 LONG SPRUCE RESERVOIR**

The single receiver set in the Long Spruce Reservoir could not be retrieved due to low water levels which prevented access (Map 5).

## 4.3 OPEN-WATER 2018

### 4.3.1 ACOUSTIC RECEIVER RETRIEVAL

All stationary acoustic receivers deployed upstream of Gull Rapids ( $n = 27$ ) during the 2018 open-water period were successfully retrieved (Map 6). For the first time in 2018, a receiver was successfully deployed and retrieved closer to Keeyask construction at rkm -4.8 (#108002; Map 6). One of the 29 receivers deployed in Stephens Lake (#102966) at rkm 40.8 went missing part way through the study period (Map 7). No data were retrieved from this receiver after July 26, 2018; therefore the “gate” at the downstream end of Stephens Lake was no longer effective after this date. Due to low water levels, no receivers were set or retrieved in the Long Spruce or Limestone reservoirs.

### 4.3.2 ACOUSTIC TRANSMITTER APPLICATION

As previously discussed (Section 3.1.1), 17 tags were applied to Walleye upstream of Gull Rapids between May 27 and June 5, 2018 (Appendix A4-1). These fish had a mean fork length of 406 mm (StDev = 52 mm; range: 320–525 mm) and a mean weight of 775 g (StDev = 381 g; range: 400–1,750 g). Three fish were released on the south shore at the upstream end of Gull Lake (rkm -19.6), six at Rabbit Creek (rkm -17.4), six in a bay on the north shore at rkm -12.8, and two north of Caribou Island (rkm -9.0) (Map 8).

An additional seven tags were applied to Walleye in Stephens Lake between June 6 and 9, 2018 (Appendix A4-2). These fish had a mean fork length of 447 mm (StDev = 65 mm; range: 390–569 mm) and a mean weight of 968g (StDev = 481 g; range: 525–1,725 g). All seven fish were released on the north shore 1.2 rkm downstream of Gull Rapids (Map 8).

### 4.3.3 UPSTREAM OF GULL RAPIDS

Thirty-four Walleye were available to be detected upstream of Gull Rapids during the 2018 open-water period (Section 4.1.1). Twenty-five of these (74%) were detected between 13 and 34,552 times for 1–129 days of the 163 day open-water period (1–79% of the time; Appendix A1-3). The average total movement range was 21.2 rkm (StDev = 20.9 rkm; range: 0.0–68.4 rkm) (Figure 7; Appendix A1-3). The farthest upstream detections occurred at rkm -48.2 (by four fish; 16%) while the farthest downstream occurred at rkm -4.8 (by one fish; 4%) (Figures 7, 8, and 9; Appendix A1-3). Five fish moved downstream through Gull Rapids into Stephens Lake (discussed in Section 4.3.3.3).

Of the nine fish that were not detected:

- Six (#53765, #53768, #53776, #53785, #53795, and #53804) were detected for the majority of the 2017 open-water period moving throughout Gull Lake (Appendices A2-6, A2-9, A2-17, A2-26, A2-36, and A2-45).
- One (#53772) moved between rkm -24.3 and -14.8 during open-water 2016. In 2017, it made a single downstream movement from rkm -29.4 to -7.4 in lower Gull Lake (Appendix A2-13).
- One (#53783) was last detected on March 30, 2018, at the outlet of Clark Lake (rkm -48.2). This fish may have continued to move upstream past the receiver array (Appendix A2-24).
- One (#53798) was detected for a single day (May 29) in 2017 at rkm -10.1 (Appendix A2-39). This fish may spend the majority of its time outside of the receiver array.

#### 4.3.3.1 PROPORTIONAL DISTRIBUTION

As in 2016 and 2017, individual Walleye used Zone 4 (upper and middle basins of Gull Lake) most often, spending an average of 57% (StDev = 45%; range: 0–100%) of the study period in this area (Table 2; Figures 10 and 11). The remaining four zones were used less frequently:

- Zone 1 at 10% (StDev = 22%; range: 0–87%);
- Zone 2 at 1% (StDev = 2%; range: 0–11%);
- Zone 3 at 9% (StDev = 20%; range: 0–68%); and
- Zone 5 at 24% (StDev = 40%; range: 0–100%).

#### 4.3.3.2 MOVEMENTS

Of the eight fish tagged in 2016:

- Five displayed the same pattern of movement during the 2016, 2017, and 2018 open-water study periods:
  - #53781 was detected for ten days or less in all open-water periods and likely remains largely outside of the receiver array.
  - #53789 remained below Birthday Rapids (rkm -32.3) for the majority of each open-water period, moving upstream to Clark Lake in the fall of each year.
  - #53796 moved between Birthday Rapids and Gull Lake.
  - #53797 remained in the upper portion of Gull Lake for the majority of each open-water period, moving upstream to Clark Lake at the end of August, and returning to Gull Lake in June.
  - #53805 moved throughout Gull Lake.



- Two displayed the same general pattern of movement during open-water 2016, 2017, and 2018; however, moved upstream briefly during one of the periods.
  - #53784 remained in Gull Lake in both 2016 and 2018, moving between rkm -19.5 and -12.8 in both years. This fish moved to Birthday Rapids briefly in 2017, after which it returned to rkm -12.8.
  - #53792 moved throughout Gull Lake in all three open-water study periods. In 2018, it moved upstream to rkm -24.7 on June 14-15 and June 21-22.
- One (#53794) displayed a different pattern of movement in 2018. This fish moved between Birthday Rapids and Gull Lake in both 2016 and 2017. In 2018, it continued to move upstream past Birthday Rapids into Clark Lake. It was last detected at the inlet to Clark Lake on June 22, 2018, and may have continued to move upstream past the array.

Of the 17 fish tagged in 2018:

- Six remained exclusively in Gull Lake:
  - One (#25739) remained exclusively in lower Gull Lake (Zone 5), moving between rkm -9.3 and -7.4.
  - Five (#25742, #25744, #25746, #25751, and #25756) moved throughout Gull Lake.
- Three (#25747, #25750, and #25754) moved between the riverine portion of the Nelson River downstream of Birthday Rapids (as far upstream as rkm -26.5) and Gull Lake.
- One (#25749) moved upstream through Birthday Rapids into Clark Lake. It was detected moving throughout Clark Lake from July 8 to September 1, and then returned to the lower end of Gull Lake (rkm 9.3; Zone 5).
- Five (#25740, #25748, #25752, #25753, and #25755) moved downstream through Gull Rapids (described in Section 4.3.3.3).
- Two (#25743 and #25745) were detected only briefly post-tagging (between 2 and 7 days). Fish #25742 displayed rapid downstream movements while #25745 was detected only by a single receiver. Both may represent tagging mortalities.

### 4.3.3.3 MOVEMENTS THROUGH GULL RAPIDS

Five Walleye moved downstream through Gull Rapids into Stephens Lake during the 2018 open-water period. All five Walleye were tagged in the spring of 2018 and moved downstream between 10 and 59 days after being tagged. All movements through Gull Rapids occurred prior to Keeyask spillway commissioning.

Three were detected in Stephens Lake making multiple upstream and downstream movements, and are presumed to be alive:

- #25740 was tagged on June 5, 2018, at rkm -9.3 and moved between rkm -9.0 and -7.4 until June 14 (Appendix A2-50).
  - It was detected in Stephens Lake on June 15 at rkm 4.4. It moved between rkm 3.8 and 7.9 until June 18, after which it continued to move downstream. It was last detected in Stephens Lake at rkm 36.1 on July 27.
- #25753 was tagged on May 27, 2018, at rkm -19.5 (Appendix A2-62). It then moved upstream and was located at Birthday Rapids (rkm -32.3) on July 24. It then displayed rapid downstream movement and was last detected in Gull Lake at rkm -4.8 on July 25.
  - It was detected in Stephens Lake at rkm 1.2 on July 25. It moved between rkm 2.7 and 10.3 until July 26, after which it continued to move downstream. It was last detected at rkm 36.1 on August 11.
- #25755 was tagged on June 1, 2018, at rkm -19.5 (Appendix A2-64). It was last detected in Gull Lake at rkm -4.8 on June 11.
  - It was detected on Stephens Lake on June 12 at rkm 2.7. It immediately moved downstream and was located immediately upstream of Kettle GS (rkm 40.8) on June 15. It then moved upstream and was last located at rkm 18.6 on June 17.

Two were detected briefly in Stephens Lake with few or no upstream movements, and are presumed to be mortalities:

- #25748 was tagged on May 28, 2018, at rkm -20 (Appendix A2-57). It was last detected in Gull Lake at rkm -4.8 on June 12.
  - It was detected in Stephens Lake at rkm 1.2 on June 12. It moved between rkm 7.9 and 10.3 until June 14, but moved quickly downstream and was last detected at rkm 24.7 on the same day.
- #25752 was tagged on May 27, 2018, at rkm -19.5 (Appendix A2-61). It was last detected in Gull Lake at rkm -4.8 on June 8.
  - It was detected in Stephens Lake at rkm 1.2 on June 8. This fish displayed no upstream movements and was last detected immediately upstream of Kettle GS (rkm 40.8) on June 23.

#### 4.3.4 STEPHENS LAKE

Thirty-nine Walleye were available to be detected in Stephens Lake during the 2018 open-water study period (Section 4.1.2). Twenty-seven of these (69%) were detected between 2 and 45,733 times for 1–122 days of the 163 day open-water period (1–75% of the time; Appendix A1-4). The average total movement range was 14.8 rkm (StDev = 11.3 rkm; range: 0.0–39.7 rkm) (Figure 12; Appendix A1-4). The farthest upstream detections occurred at rkm 1.2 (by 21 fish;



78%) while the farthest downstream occurred at rkm 40.9 (by one fish; 4%) (Figures 12 and 13; Appendix A1-4).

Twelve fish located during open-water 2017 were not detected during open-water 2018. Of these:

- Two (#53758 and #53760) moved downstream through Gull Rapids in 2017 (Appendices A2-1 and A2-3). Both fish were detected in upper Stephens Lake (rkm 1.2 to 5.2) for the majority of the 2017 open-water period.
- Two (#53764 and #53788) moved downstream through Gull Rapids in 2016 (Appendices A2-5 and A2-29). Both fish were detected moving between rkm 1.2 and 10.3. Neither fish has been detected since open-water 2016.
- Eight were tagged in Stephens Lake in 2016. Of these:
  - Five were last detected at rkm 9.4 in the southern portion of Stephens Lake (receiver #114239; Map 4).
    - Four (#53730, #53745, #53750, and #53811) were last detected here during the winter 2017/2018 period (Appendices A3-7, A3-22, A3-27, and A3-38).
    - One (#53749) was last detected here on July 29, 2017 (Appendix A3-26).
  - Two (#53738 and #53753) were last detected immediately upstream of the Kettle GS (rkm 40.8 and 40.9) in July and August, 2017, respectively (Appendices A3-15 and A3-30). It is likely that these fish continued to move downstream through the station.
  - One (#53756) was last detected at rkm 13.0 in the northern portion of Stephens Lake (receiver #122866; Map 4) on September 23, 2017 (Appendix A3-33).

#### 4.3.4.1 PROPORTIONAL DISTRIBUTION

As in 2016 and 2017, individual Walleye used Zone 7 (the lower portion of Stephens Lake) most frequently, spending an average of 64% (StDev = 41%, range: 0–100%) of the study period in this area. Zone 6 was used an average of 36% (StDev = 41%, range: 0–100%) of the time (Table 2; Figures 10 and 14). A greater proportion of fish were detected close to Gull Rapids during the beginning of the study period than at the end (Figures 10 and 14). Zone 6 was used an average of:

- 75% (StDev = 7%; range: 59–85%) of the time between June 6 and 13, 2018.
- 42% (StDev = 8%; range: 33–59%) of the time between June 14 and July 14.
- 29% (StDev = 2%; range: 26–33%) of the time between July 15 and October 10.

#### 4.3.4.2 MOVEMENTS

Of the 20 Walleye tagged in 2016:

- Sixteen displayed the same pattern of movement during the 2016, 2017, and 2018 open-water study periods:
  - Four have only been located in the upstream portion of Stephens Lake, at or upstream of rkm 9.4, during all three open-water study periods.
    - Two (#53724 and #53740) are detected most often in the area immediately downstream of Gull Rapids (Zone 6), but make brief downstream movements into the upstream end of Zone 7.
    - Two (#53731 and #53755) make regular movements between Zone 6 and the upstream end of Zone 7.
  - Eleven make more extensive movements throughout Stephens Lake:
    - Five make regular upstream and downstream movements as far downstream as rkm 18.6 (#53729, #53734, and #53741) or rkm 36.1 (#53736 and #53775).
      - Fish #53755 moved downstream through Gull Rapids immediately after tagging in June 2016; however, since that time it has shown the same pattern of movement.
    - Six (#53744, #53752, #53757, #53808, #53809, and #53810) make a single upstream movement to Zone 6 in spring and return downstream (between rkm 18.6 and 24.7) in fall.
  - One (#53748) has remained exclusively in the northern portion of Stephens Lake. In open-water 2018, this fish was located only at two receivers surrounding Callan Island (#122862 and #122866; Map 7).
- Two displayed a different movement than in previous open-water periods.
  - #53723 remained in the area immediately downstream of Gull Rapids (Zone 6) for the entire 2018 open-water period.
    - This fish had moved into Zone 7 during open-water 2016, and was detected as far downstream as rkm 16.8 during open-water 2017.
  - #53725 was detected only as far upstream as rkm 7.9 and as far downstream as rkm 16.8 during open-water 2017. This fish showed more extensive movements during open-water 2018, moving as far upstream as rkm 5.2 and as far downstream as rkm 24.7.
- Two were detected infrequently; no movement pattern could be distinguished.
  - #53759 moved downstream through Gull Rapids during open-water 2016. It was not detected in 2017 and was only detected (two times on one day) at rkm 16.8 during open-water 2018.

- #53793 moved downstream through Gull Rapids during open-water 2017. During open-water 2018, it was located only at rkm 2.7 (290 times on 12 days).

Of the seven fish tagged in 2018:

- Four remained in the upstream portion of Stephens Lake.
  - Two (#25737 and #25741) remained in the area immediately downstream of Gull Rapids (Zone 6) for the entire open-water period.
  - #25735 moved as far downstream as rkm 7.9.
  - #25736 moved as far downstream as rkm 10.3.
- Three moved downstream immediately after tagging (between three and 19 days):
  - #25732 was tagged on June 9, 2018, at rkm 1.2. It remained at this location until June 15, after which it began to move downstream. It was last located immediately upstream of Kettle GS (rkm 40.9) on July 13. It is likely that this fish moved downstream through the station.
  - #25734 was tagged on June 7, 2018 at rkm 1.2. It remained between rkm 1.2 and 6.5, until June 10. It then moved downstream to rkm 21.6 where it was last located on June 13, 2018. This fish may represent a tagging mortality.
  - #25738 was tagged on June 7, 2018, at rkm 1.2. It moved between rkm 1.2 and 2.7 until June 13, and between rkm 6.5 and 9.5 until June 26. It then moved downstream and was last located at rkm 36.1 on July 6.

### 4.3.5 LONG SPRUCE RESERVOIR

Six Walleye were last detected in the Long Spruce Reservoir, two (#53782 and #53791) in 2016 and four (#53737, #53747, #53769, and #53799) in 2017. Due to low water levels, no receivers could be set during open-water 2018. Provided conditions are suitable, receivers will be set in this area in open-water 2019 to monitor potential fish passage.

### 4.3.6 LIMESTONE RESERVOIR

Four Walleye were last detected in the Limestone Reservoir, one (#53771) in 2016 and three (#53728, #53746, and #53751) in 2017. Due to low water levels, no receivers could be set during open-water 2018. Provided conditions are suitable, receivers will be set in this area in open-water 2019 to monitor potential fish passage.

## 5.0 DISCUSSION

Walleye movement monitoring was initiated in 2013 to describe movements during the pre-construction (2013) and construction phases (beginning July 2014) of the Project and to determine if disturbances associated with construction would alter habitat use and coarse-scale movement patterns upstream and downstream of the Project. Acoustic transmitters applied in 2013 and 2014 expired during the open-water period in 2016. Additional tags were applied both upstream and downstream of the construction site during the 2016 open-water period to allow for continued monitoring during construction of the GS. The sample size of tagged Walleye was similar to 2013: 48 transmitters were applied upstream of Gull Rapids, and 40 were applied in Stephens Lake. An additional 24 transmitters were applied in spring 2018 (17 upstream of Gull Rapids and seven in Stephens Lake) to account for fish that had gone missing and return the number of fish monitored to the original sample size. The discussion below highlights movement patterns observed for Walleye tagged in 2016/2018, and compares to those observed in fish tagged in 2013/2014.

### 5.1 EVALUATION OF METHODOLOGY

Fish movement monitoring, via acoustic telemetry, is a significant component of the AEMP, and is being used to assess potential impacts of the Keeyask GS construction on several fish species including Lake Sturgeon (adults and juveniles), Walleye, and Lake Whitefish. Of these fish species/life stages, the methodology is most effective for monitoring movements of adult and juvenile Lake Sturgeon. Lake Sturgeon have a low natural mortality rate, occupy main channel habitats where receivers are located, and in the case of juveniles, rarely move. These are all characteristics that allow for frequent detections of tagged fish. Monitoring movements of Walleye and Lake Whitefish via acoustic telemetry has been less effective relative to Lake Sturgeon. This is because: i) tagged individuals are detected less frequently due to more frequent utilization of shallow water habitats outside the detection range of receivers; ii) potential use of tributaries and off-current embayments where receivers are not located; iii) stress from the tagging procedure may cause an initial downstream movement of some individuals which complicates data interpretation; and iv) a higher natural mortality rate relative to Lake Sturgeon causes a greater proportion of tags to be lost. These characteristics reduce the frequency of detection of tagged fish and the higher proportion of missing fish further complicates data interpretation. Despite this, the data collected to date provide a good understanding of Walleye movements. 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.

One additional receiver was added to the receiver array during the open-water 2018 period. A receiver was deployed at rkm -4.8 (upstream of Gull Rapids) in order to monitor movements

more proximate to the Keeyask GS construction site. During open-water 2018, a single fish (not including those that moved downstream through Gull Rapids) was detected at this receiver (discussed further in Section 5.4). This receiver will continue to be deployed as part of the upstream receiver array.

Despite the robust array of receivers, the proportion of detected Walleye has decreased with each study year, likely reflecting natural mortality rates. Walleye generally live for 15 to 20 years, and, based on size, some tagged fish may be approaching this age (CAMP 2017). The proportion of detection of fish tagged upstream of Gull Rapids in 2013/2014 decreased from 98% in 2013, 81% in 2014, 76% in 2015, and 61% in 2016. The same was true for detection of fish tagged in Stephens Lake in 2013/2014; 100% of tagged fish were detected in 2013, 85% in 2014, 68% in 2015, and 49% in 2016. Fish tagged in 2016 continue to exhibit the same pattern. The proportion of fish detected has decreased from 100% in 2016, 75% in 2017, to 47% in 2018 upstream of Gull Rapids, and from 98% in 2016, 87% in 2017, to 71% in 2018 in Stephens Lake. This trend will likely continue with time due to natural mortality as the fish age.

## 5.2 MOVEMENT PATTERNS

In general, there was little change in the movement patterns of Walleye tagged in 2013/2014 over four years of study. These fish tended to stay in the same general area, exhibiting similar movements each year. Despite the greater proportion of fish that moved downstream through barriers (discussed in Section 5.3), the same is true for Walleye tagged in 2016.

Each year, fish tagged upstream of Gull Rapids 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 remained in the riverine area downstream of Birthday Rapids. Walleye upstream of Gull Rapids have consistently spent little time in the vicinity of the Keeyask GS construction site. Overall mean movement ranges (excluding large-scale downstream movements) have remained similar between tagging periods. Upstream of Gull Rapids, average total yearly movement ranges were between 9.9 and 16.7 rkm for fish tagged in 2013/2014, and 10.8 and 12.3 rkm for fish tagged in 2016 and 2018.

In Stephens Lake, fish tagged in 2016 and 2018 exhibited two patterns of movement: some remained exclusively within the upper 10 rkm during the open water period; while others moved extensively throughout the lake. These movement patterns mirror those observed for fish tagged in 2013/2014, though during 2013–2016 a greater proportion of fish remained within the upper portion of Stephens Lake (Table 2). In contrast to those tagged upstream of Gull Rapids, a high proportion of the Walleye tagged in Stephens Lake used habitat in the vicinity of the Keeyask GS construction site. In 2018, 21 fish (78%) were located at the receiver closest to the construction site (rkm 1.2), two of which remained within 4.4 rkm for the entire study period. In all study years since initial tagging in 2013, Walleye have been detected near Gull Rapids during the spring (likely for spawning) and have moved downstream in the summer and fall. Fish tagged in Stephens Lake in 2013/2014 displayed smaller overall movement ranges than those

tagged in 2016 and 2018. Average total movement ranges were between 7.1 and 10.8 rkm for fish tagged in 2013/2014, and 13.2 and 15.2 rkm for fish tagged in 2016/2018.

### 5.3 MOVEMENTS THROUGH BARRIERS

A substantial proportion of the Walleye tagged in 2016 moved downstream through major barriers (*i.e.*, Gull Rapids, the Kettle GS, and the Long Spruce GS) relative to those tagged in 2013/2014. After tags were applied in 2016 (Hrenchuk and Lacho 2017, 2018), a considerable proportion of fish moved downstream within two months of being tagged. Hrenchuk and Lacho (2017) hypothesized that at least a portion of these movements could be attributed to tagging mortality or stress caused by the tagging procedure. However, a relatively large proportion of Walleye also moved downstream through major barriers in 2017, more than a year after being tagged. Hrenchuk and Lacho (2018) hypothesized that these movements may be attributed to record high flows seen in the area during the 2017 open-water period. Flows in the area normalized to historic averages during the 2018 open-water period (described in Section 2.2) and no additional Walleye tagged in 2016 moved downstream through Gull Rapids.

Similarly, a large portion of the Walleye tagged upstream of Gull Rapids in 2018 also moved downstream through Gull Rapids. Five of 17 (29%) fish moved downstream through Gull Rapids, four of which moved downstream within two weeks of tagging. Based on the frequency of upstream and downstream movements in Stephens Lake, three of these fish appear to be alive. The four downstream movements observed within two weeks of tagging in 2018 are likely related to tagging stress (*i.e.*, the three fish alive in Stephens Lake) or mortality (*i.e.*, the one fish that did not display upstream movements in Stephens Lake). This is similar to 2016, when 25% of fish moved downstream through Gull Rapids shortly after tagging.

No Walleye have moved upstream over Gull Rapids since construction began in mid-2014. Only one Walleye has moved upstream (in 2013) since the study began. Keeyask spillway commissioning began on August 3, 2018, after which upstream movements through Gull Rapids were no longer possible. All downstream movements observed in 2018 also occurred prior to this date.

Because acoustic receivers could not be set in the Long Spruce or Limestone reservoirs in 2018, it is not possible to determine whether any Walleye moved downstream through the Kettle or Long Spruce GS during the 2017/2018 study period. However, to date, all the tagged Walleye that have moved downstream past generating stations on the Nelson River did so when the spillway was operational, so it is unknown whether these fish moved over the spillway or through one of the turbines.



## 5.4 KEY QUESTIONS

The key questions/objectives of Walleye movement monitoring during construction, as described in the AEMP, and presented in the introduction of this report, are addressed below:

*How many (or what proportion of) tagged Walleye move past the construction site?*

Of the 48 Walleye tagged upstream of Gull Rapids in 2016, 16 (33%) moved downstream through Gull Rapids, 12 in 2016, and four in 2017. Eight (50%) of these movements occurred within two weeks of tagging and could be attributed to tagging mortality or stress, while eight (50%) occurred later and could not be attributed to tagging. Of the 17 Walleye tagged upstream of Gull Rapids in 2018, five (29%) moved downstream through Gull Rapids, four (80%) of which likely occurred due to tagging stress. In contrast, only six (15%) of the 41 Walleye initially tagged upstream of Gull Rapids in 2013/2014 moved downstream through Gull Rapids between 2013 and 2016.

No Walleye have moved upstream through Gull Rapids since construction began in 2014. Keeyask spillway commissioning began on August 3, 2018, after which upstream movements through Gull Rapids were no longer possible. All downstream movements in 2018 occurred prior to this date.

*Are Walleye using habitat in the vicinity of construction activities, particularly during spawning?*

Monitoring since 2013 has shown that Walleye tagged upstream of Gull Rapids do not spend much time in the vicinity of the construction site. With the exception of the fish that moved through Gull Rapids, a single Walleye was detected by the closest receiver to Gull Rapids (4.8 rkm upstream) six times on a single day in 2018. Similarly, Walleye tagged in 2013/2014 were rarely detected within 7.5 rkm upstream of the construction site, and none were detected by the closest receiver to Gull Rapids (5.8 rkm), save those that moved downstream through Gull Rapids.

In contrast, Walleye in Stephens Lake regularly use habitat directly downstream of the construction site. In all study years, Walleye (tagged both in 2013/2014 and 2016/2018) have been detected near Gull Rapids during the spring and have likely continued to spawn in this area during the construction period.

## 6.0 SUMMARY AND CONCLUSIONS

- Transmitters applied to Walleye in 2013/2014 expired in 2016 and were not detected during the current study period. In this report, movement patterns of these fish observed between 2013 and 2016 were compared to those of Walleye tagged in 2016 and 2018.
- An additional 24 acoustic transmitters were applied in spring 2018 (17 upstream of Gull Rapids and seven in Stephens Lake) to account for fish that have gone missing or moved out of the study area.
- A larger proportion of fish tagged in 2016 and 2018 moved downstream through barriers (Gull Rapids, Kettle GS, and Long Spruce GS) than those tagged in 2013/2014.
- Walleye tagged upstream of Gull Rapids in 2016 and 2018 continue to display four general movement patterns: remaining in Gull Lake, moving between Birthday Rapids and Gull Lake, moving between Clark Lake and Gull Lake, or remaining in the riverine area downstream of Birthday Rapids.
  - Walleye tagged in 2013/2014 consistently displayed two general movement patterns, either remaining in Gull Lake (largely within the upper basin), or moving between Gull and Clark lakes.
- Walleye tagged in Stephens Lake in 2016 and 2018 were split into two groups based on movement patterns: those that remained exclusively within the upper 10.3 rkm during the open-water period; and those that moved throughout the lake.
  - These patterns were also observed for Walleye tagged in 2013/2014.
- The key questions, as described in the AEMP, for Walleye movement monitoring during construction of the Keeyask GS are as follows:
  - *What is the number (or the proportion) of tagged Walleye that move past the construction site?*

Of the 48 Walleye tagged upstream of Gull Rapids in 2016, 16 (33%) moved downstream through Gull Rapids, 12 in 2016, and four in 2017. Eight (50%) of these movements occurred within two weeks of tagging and could be attributed to tagging mortality or stress, while eight (50%) occurred later and could not be attributed to tagging. Of the 17 Walleye tagged upstream of Gull Rapids in 2018, five (29%) moved downstream through Gull Rapids, four (80%) of which likely occurred due to tagging stress. In contrast, only six (15%) of the 41 Walleye initially tagged upstream of Gull Rapids in 2013/2014 moved downstream through Gull Rapids between 2013 and 2016.

No Walleye have moved upstream through Gull Rapids since construction began in 2014. The Keeyask GS spillway was commissioned in August, 2018, after which upstream movements are no longer possible. All downstream movements occurred prior to this date.

- *Are Walleye utilizing habitat in the vicinity of construction activities (particularly during spawning)?*

Monitoring since 2013 has shown that Walleye tagged upstream of Gull Rapids that remain in Gull Lake do not spend much time in the vicinity of the construction site. In contrast, Walleye tagged in Stephens Lake, or those that have moved downstream from Gull Lake, regularly use habitat directly downstream of the construction site.

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## **TABLES**



**Table 1: Number of acoustic tags applied to Walleye in the Keeyask Study Area (upstream of Gull Rapids and in Stephens Lake) between June 2013 and October 2018.**

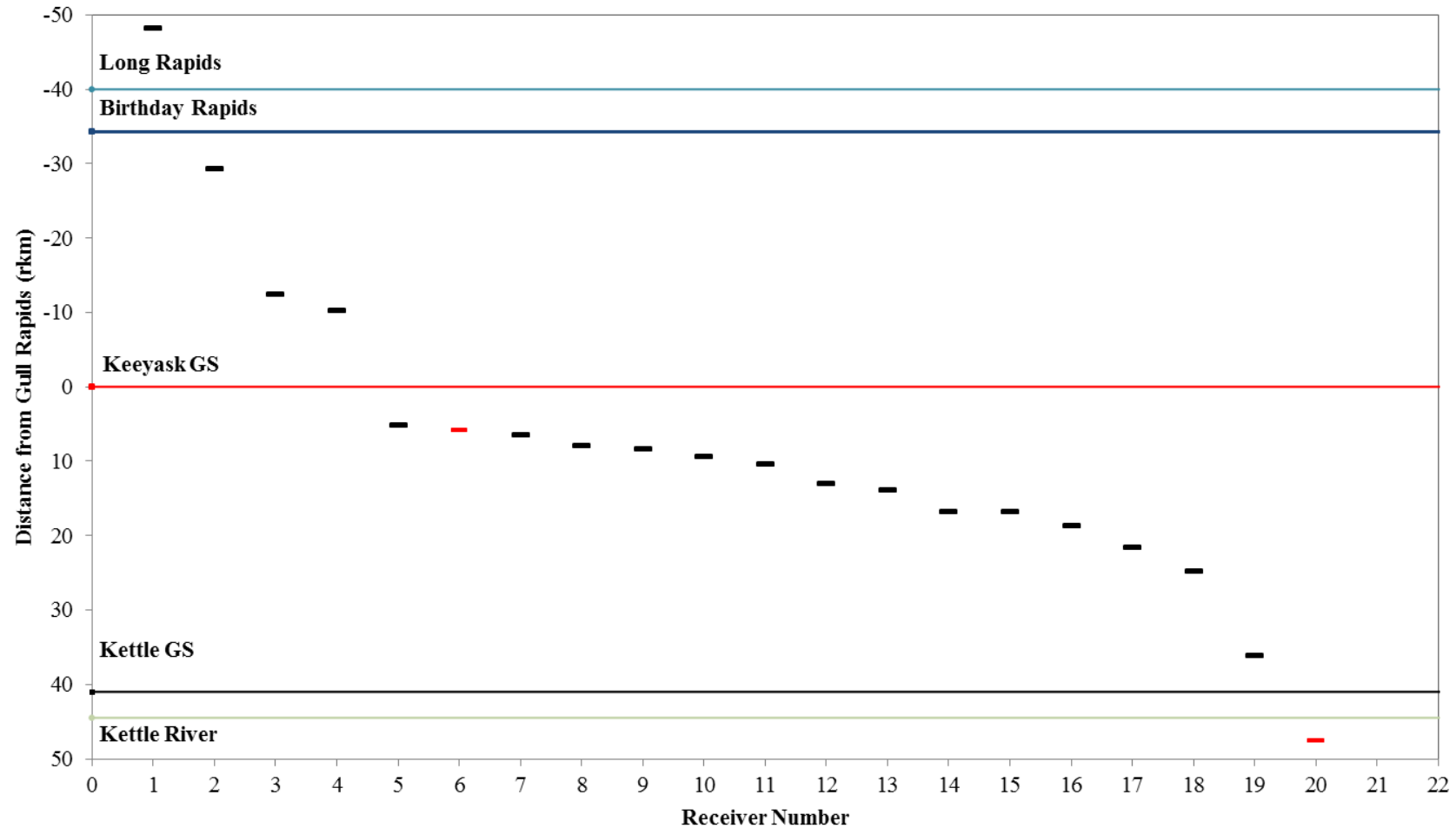
Year	Upstream GR	Stephens Lake	Total
2013*	40	40	80
2014*	9	2	11
2015*	0	0	0
2016	48	40	88
2017	0	0	0
2018	17	7	24

\*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), and Hrenchuk and Lacho (2017).

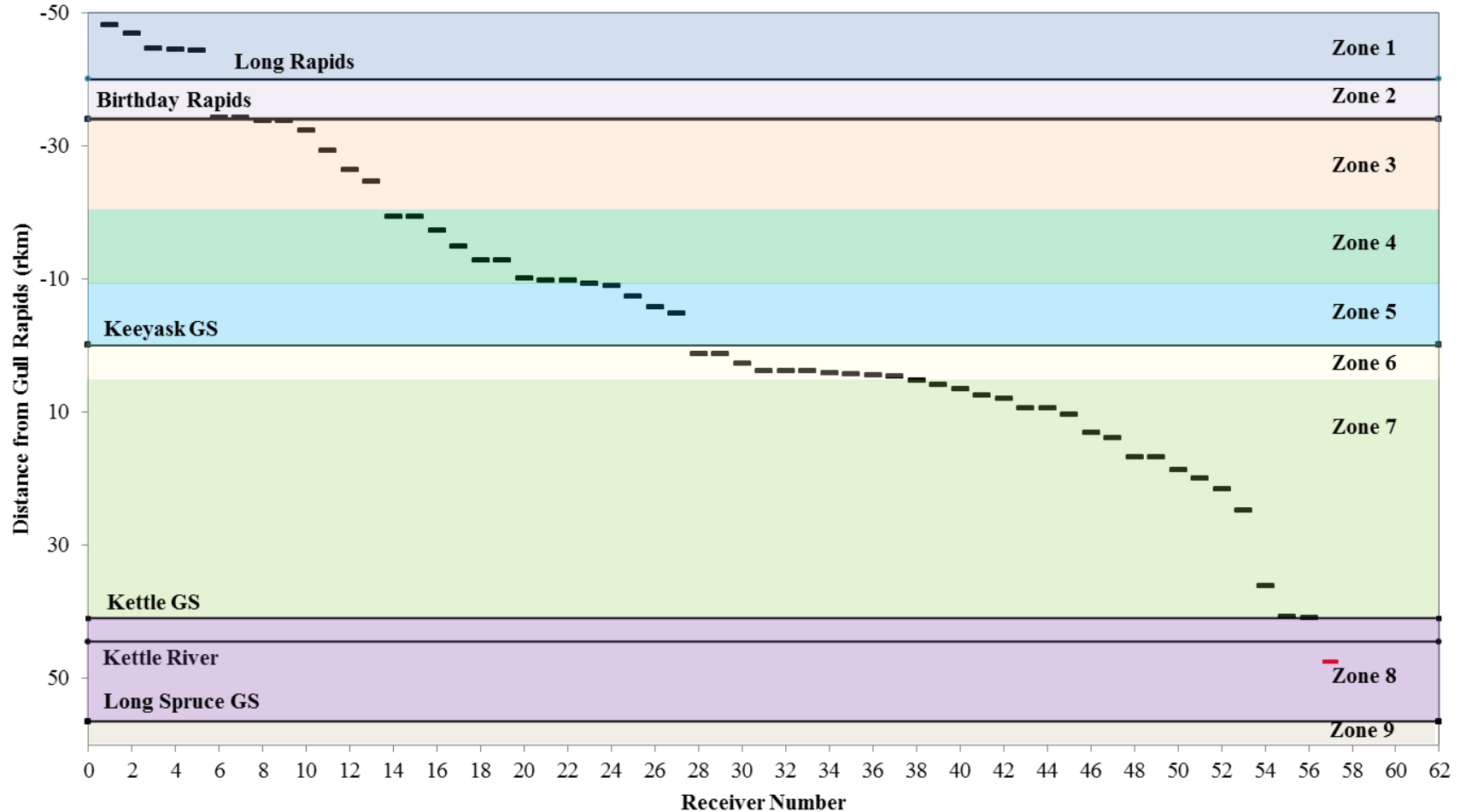
**Table 2: Proportion of time spent in each river zone by Walleye tagged upstream of Gull Rapids and in Stephens Lake in both 2013/2014 and 2016/2018 during a portion of the 2013 (June 4 to October 15), 2014 (June 4 to October 3), 2015 (June 4 to October 11), 2016 (June 4 to October 19), 2017 (June 7 to October 16), and 2018 (June 6 to October 10) open-water periods.**

Tagging Year	Study Year	Upstream of Gull Rapids					Stephens Lake	
		1	2	3	4	5	6	7
<b>2013</b>	2013	4.0	1.3	2.0	84.0	8.7	66.0	34.0
	2014	6.9	1.2	4.8	82.7	4.3	59.0	41.0
	2015	10.4	4.2	6.5	71.8	7.1	76.5	23.5
	2016	8.5	0.1	19.9	61.0	5.9	58.2	41.8
<b>2016/2018</b>	2016	3.7	0.6	6.1	78.6	8.7	30.0	70.0
	2017	5.9	1.8	12.3	63.7	16.3	33.8	66.2
	2018	9.6	0.9	9.2	56.5	23.8	35.5	64.5

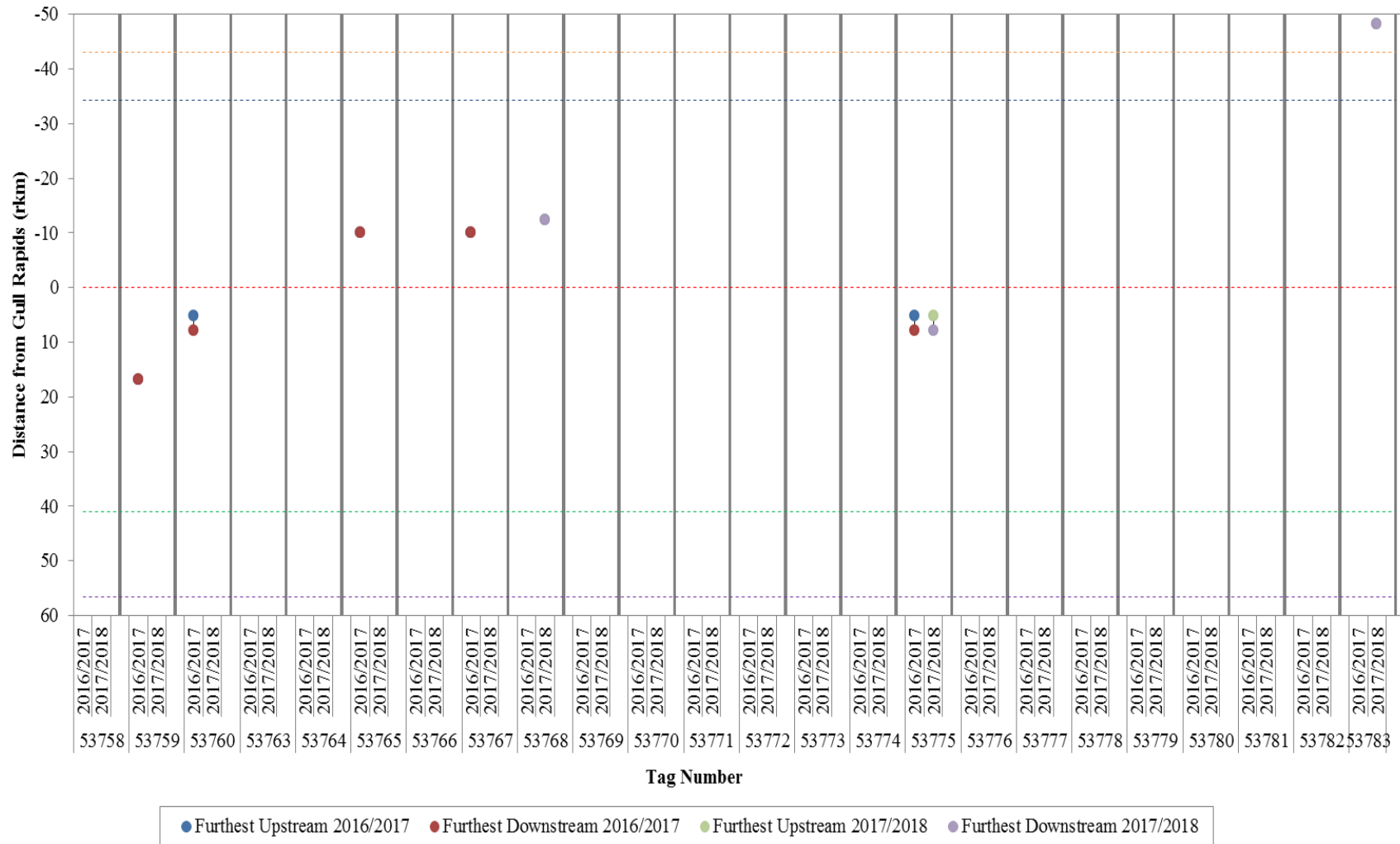
## FIGURES



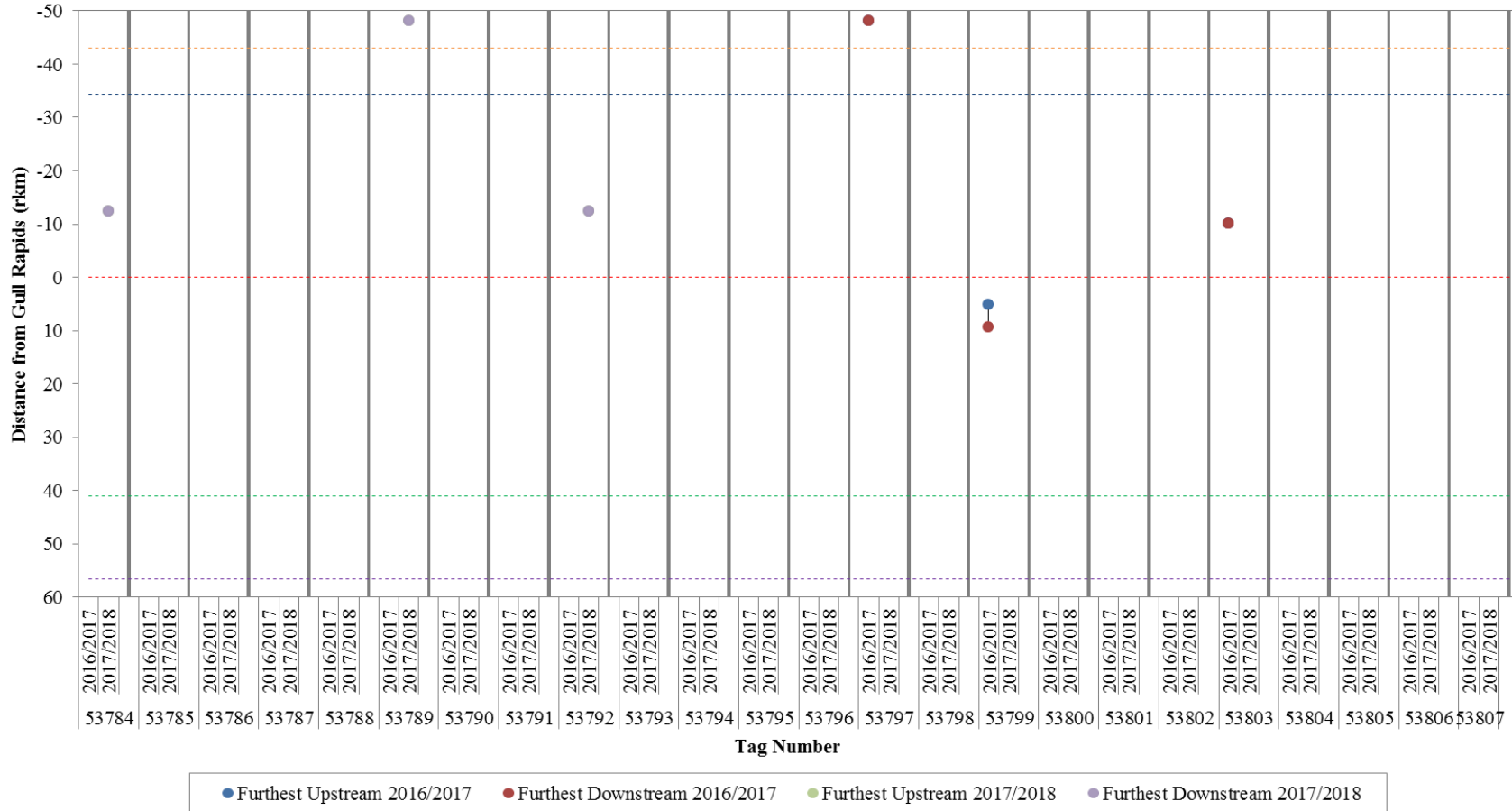
**Figure 1:** Locations of stationary acoustic receivers (dashes) in relation to the base of Gull Rapids (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Limestone GS between October, 2017 and June, 2018. A red dash indicates a receiver that was lost.



**Figure 2:** Locations of stationary acoustic receivers (dashes) in relation to the base of Gull Rapids (rkm 0) and other major landmarks (lines) in the Nelson River between Clark Lake and the Limestone GS between June and October, 2018. River zones upstream and downstream of Gull Rapids are indicated by shading. A red dash indicates a receiver was lost.

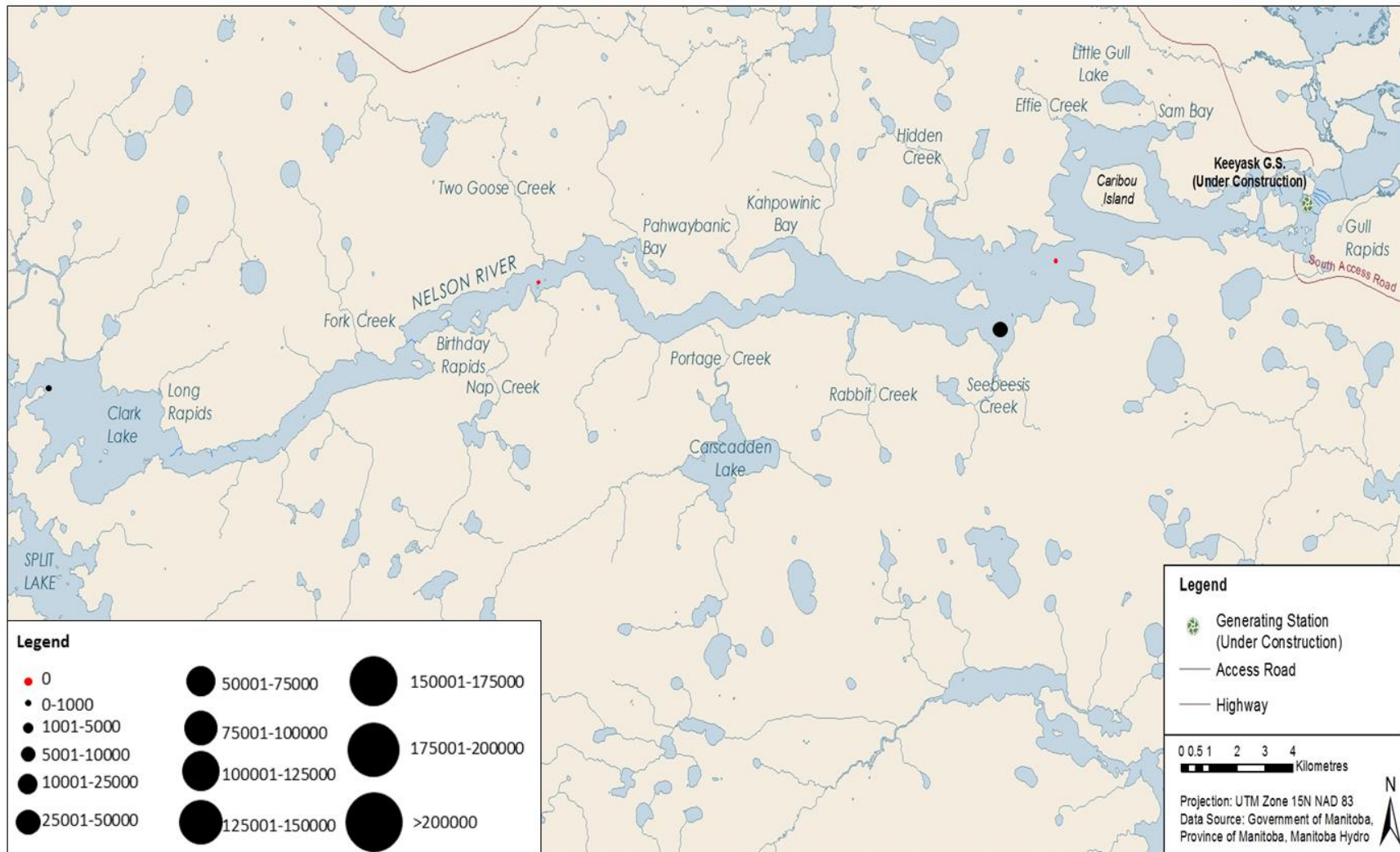


**Figure 3: Detection ranges for individual Walleye tagged with acoustic transmitters upstream of Gull Rapids in 2016 during the winter period (2016–2018). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = Gull Rapids; green = Kettle GS; purple = Long Spruce GS).**

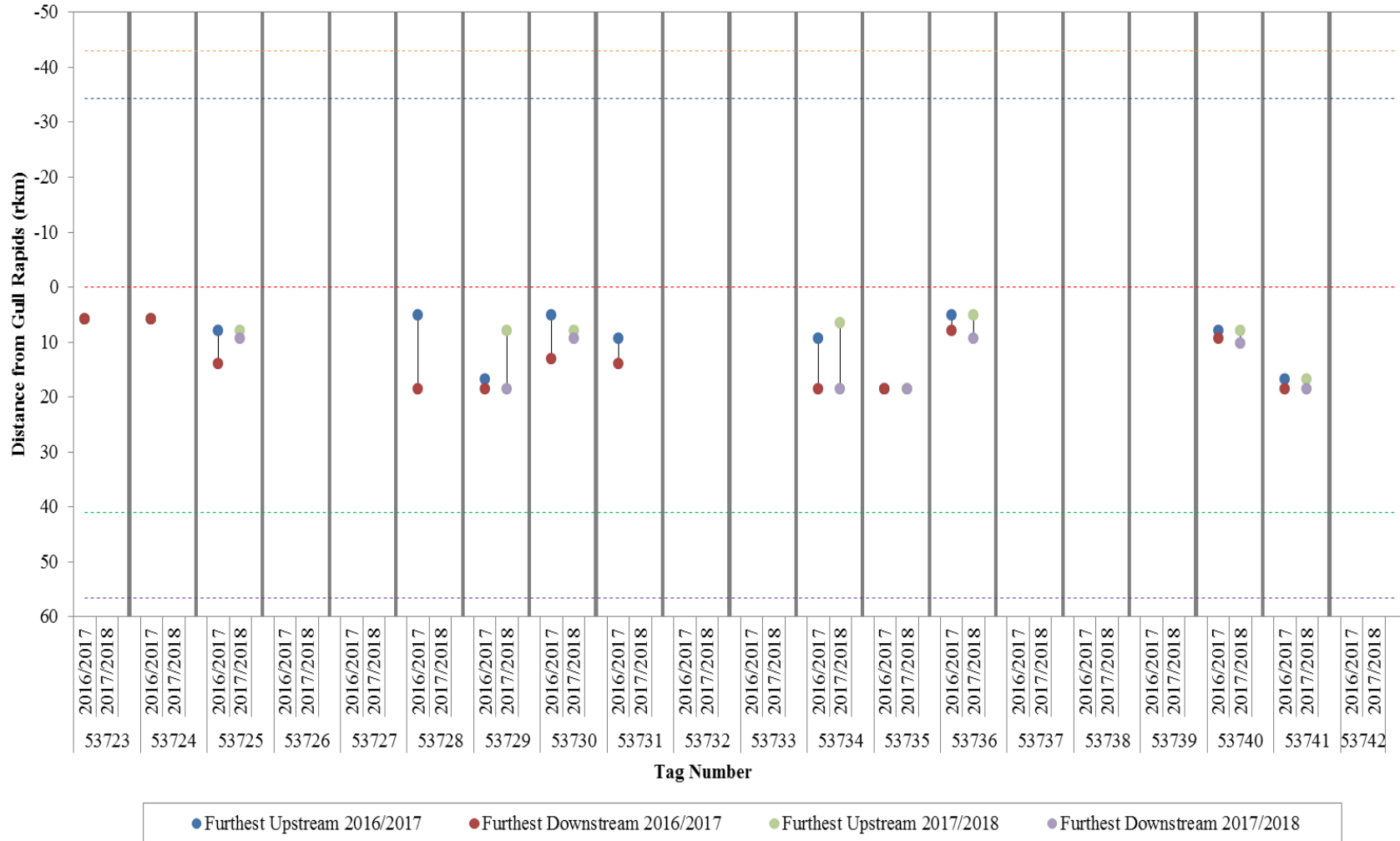


**Figure 3:** Detection ranges for individual Walleye tagged with acoustic transmitters upstream of Gull Rapids in 2016 during the winter period (2016–2018). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = Gull Rapids; green = Kettle GS; purple = Long Spruce GS) (continued).

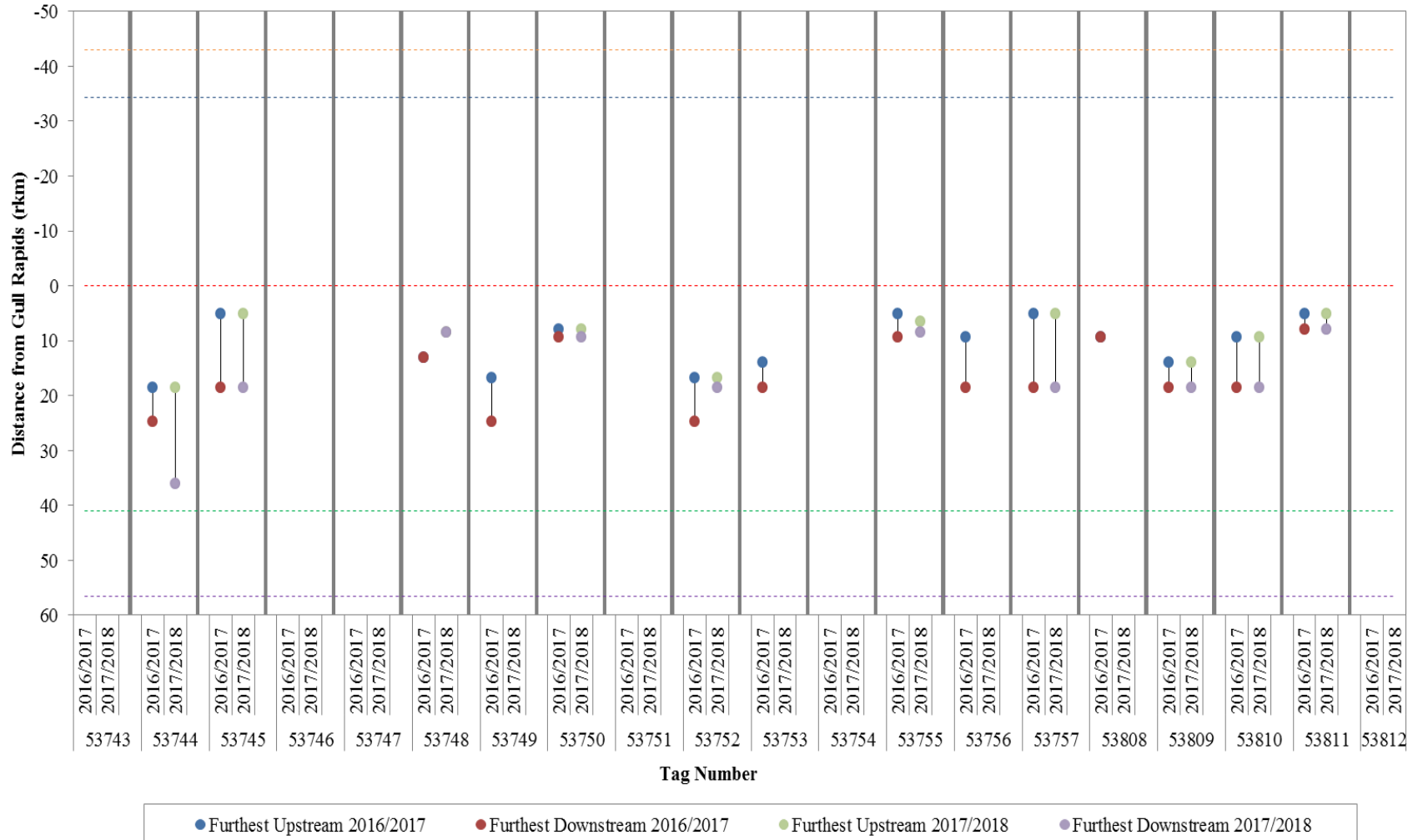




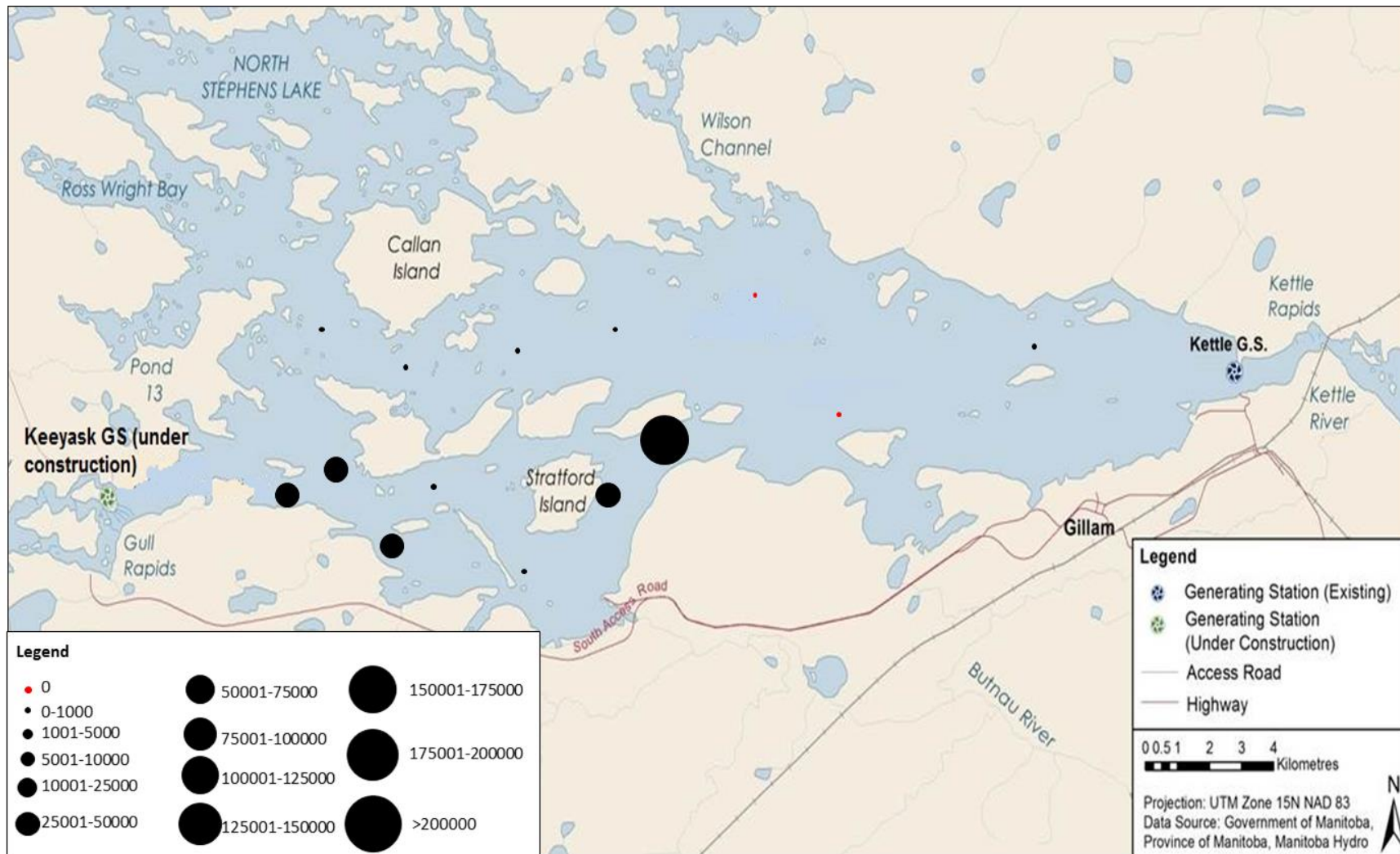
**Figure 4:** Relative number of detections of Walleye at each acoustic receiver set between Clark Lake and Gull Rapids during winter 2017/2018 (October 17, 2017, to April 30, 2018). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.



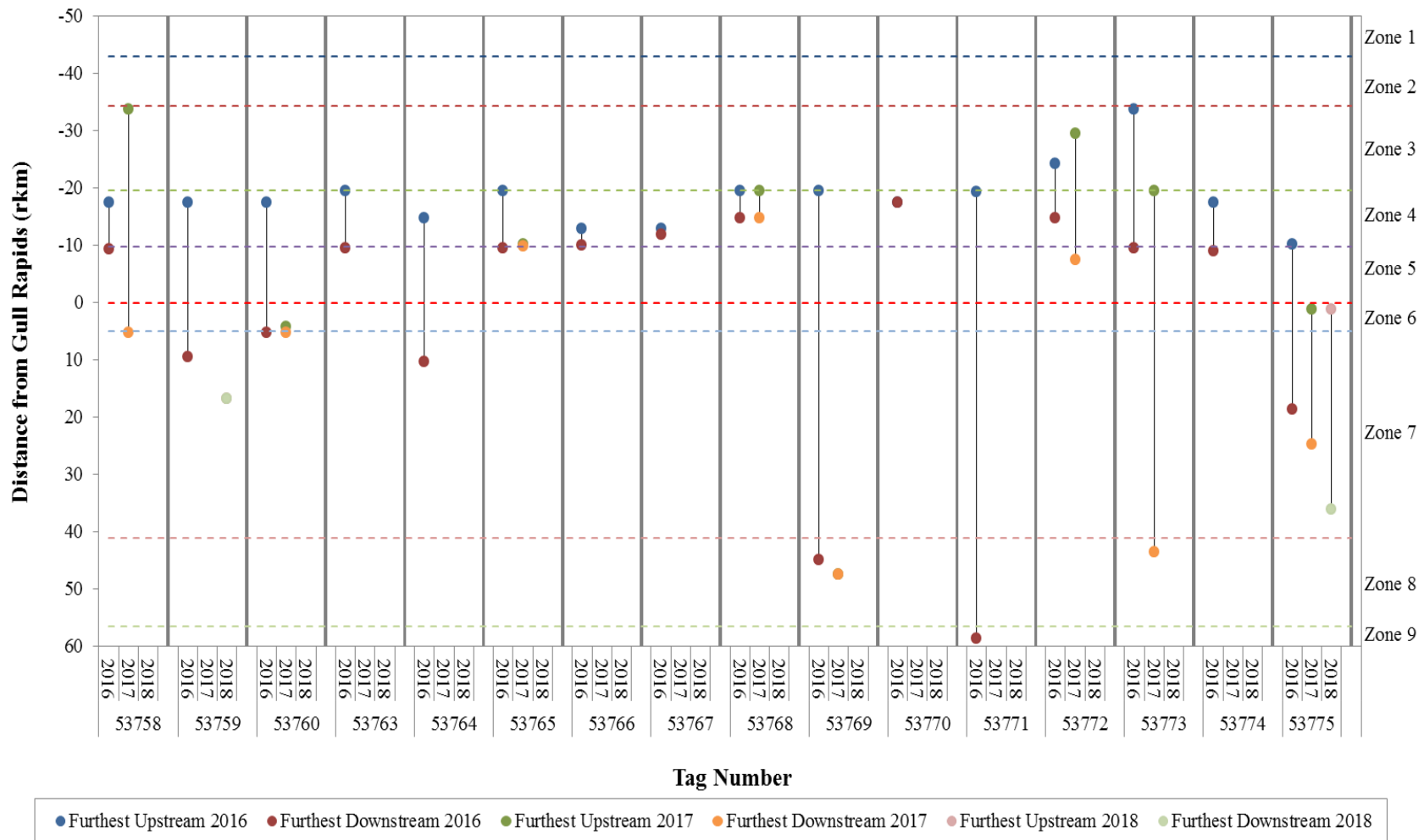
**Figure 5: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 during the winter period (2016–2018). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = Gull Rapids; green = Kettle GS; purple = Long Spruce GS).**



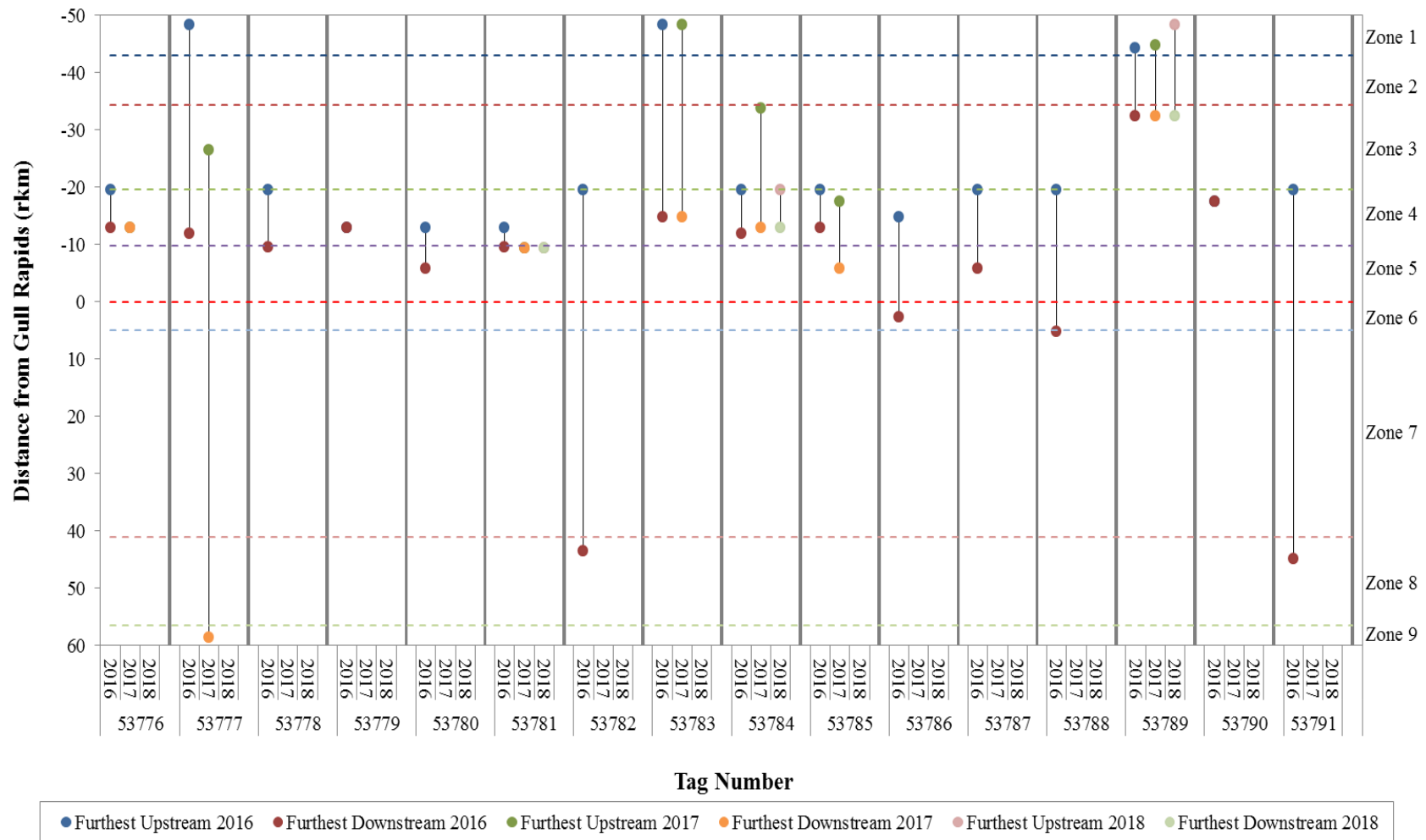
**Figure 5:** Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 during the winter period (2016–2018). Horizontal dotted lines indicate locations of landmarks (orange = Clark Lake outlet; blue = Birthday Rapids, red = Gull Rapids; green = Kettle GS; purple = Long Spruce GS) (continued).



**Figure 6:** Relative number of detections of Walleye at each acoustic receiver set in Stephens Lake during winter 2017/2018 (October 17, 2017, to April 30, 2018). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.

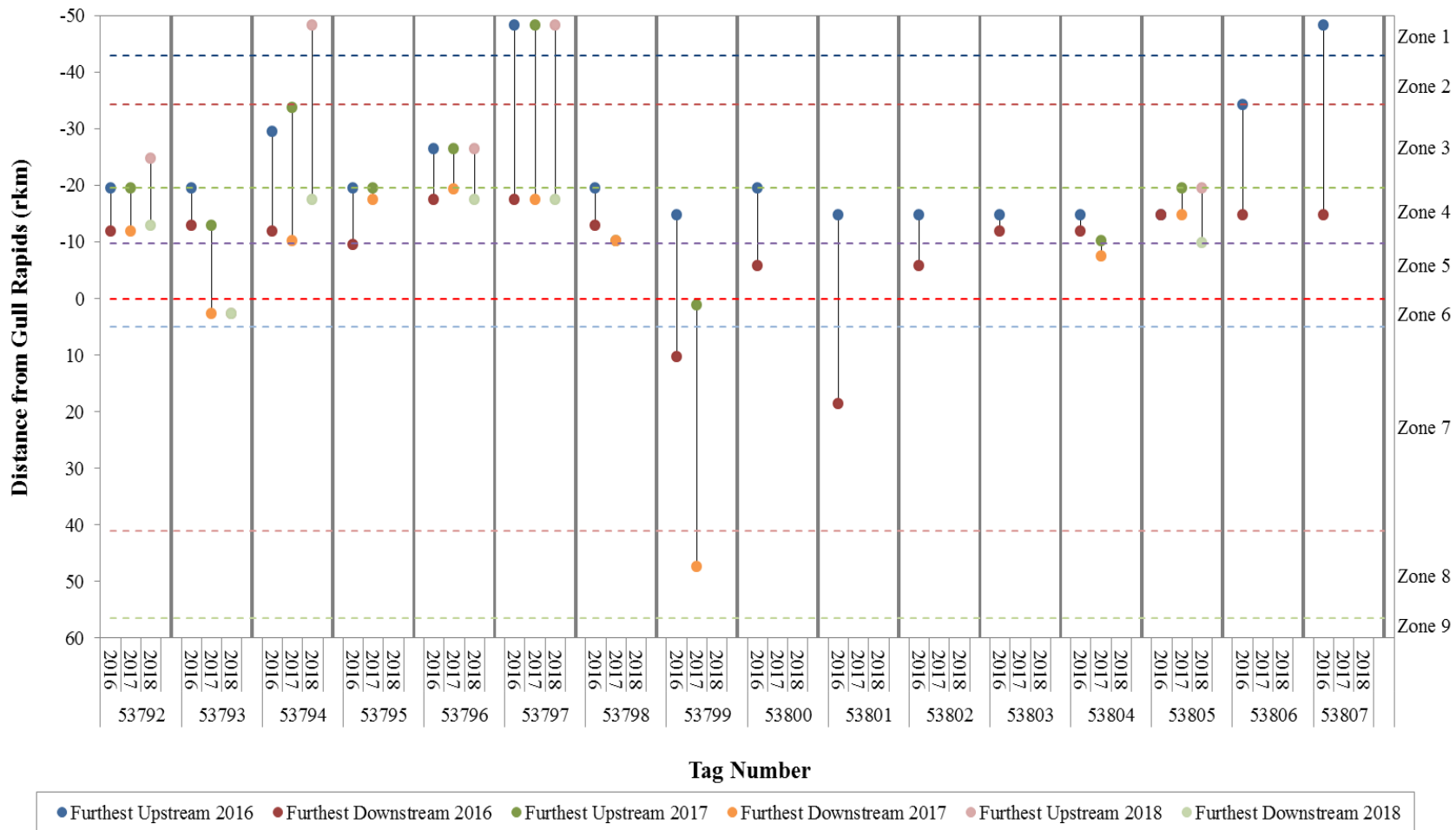


**Figure 7: Detection ranges for individual Walleye tagged with acoustic transmitters upstream of Gull Rapids in 2016 during the open-water period (2016–2018). Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS.**



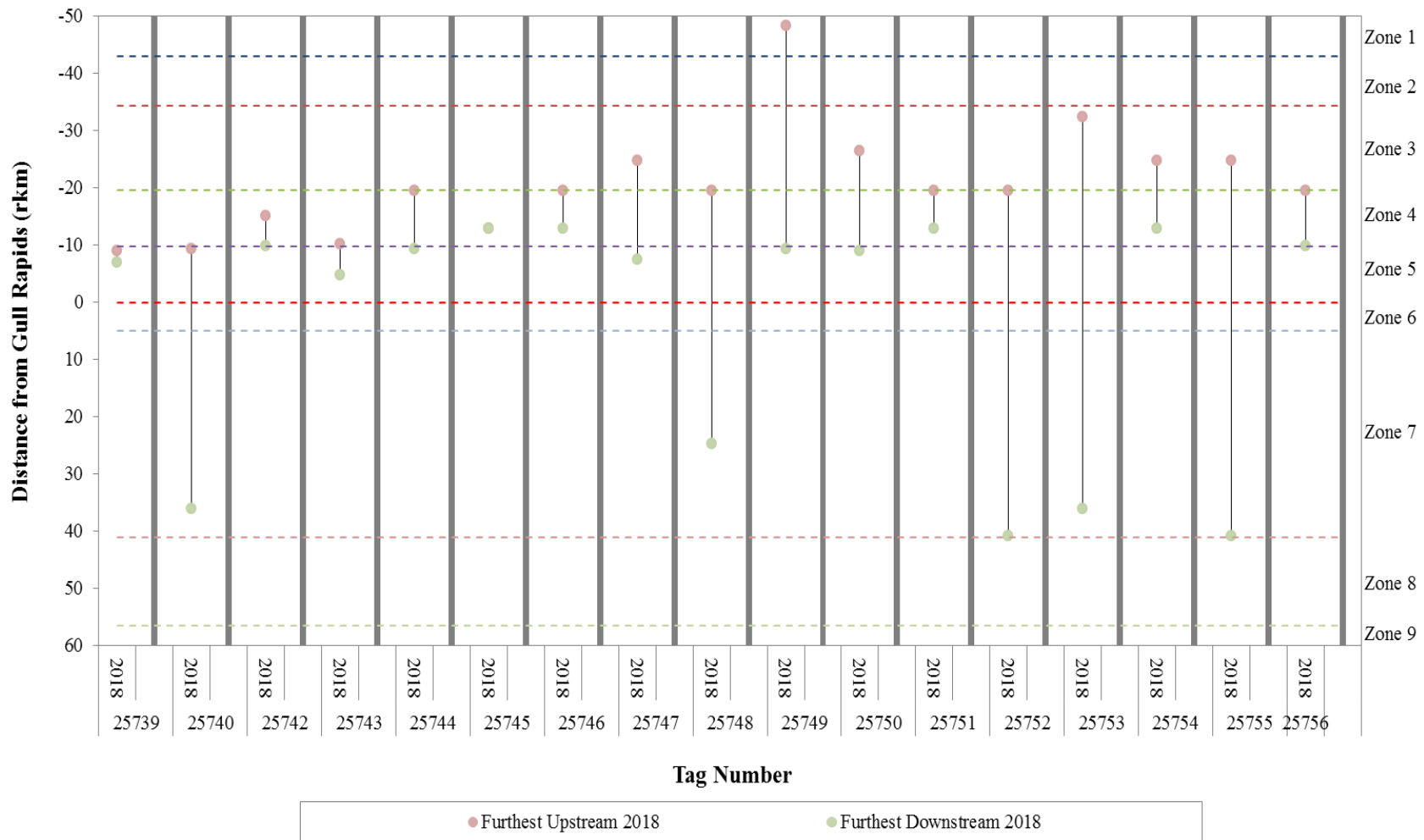
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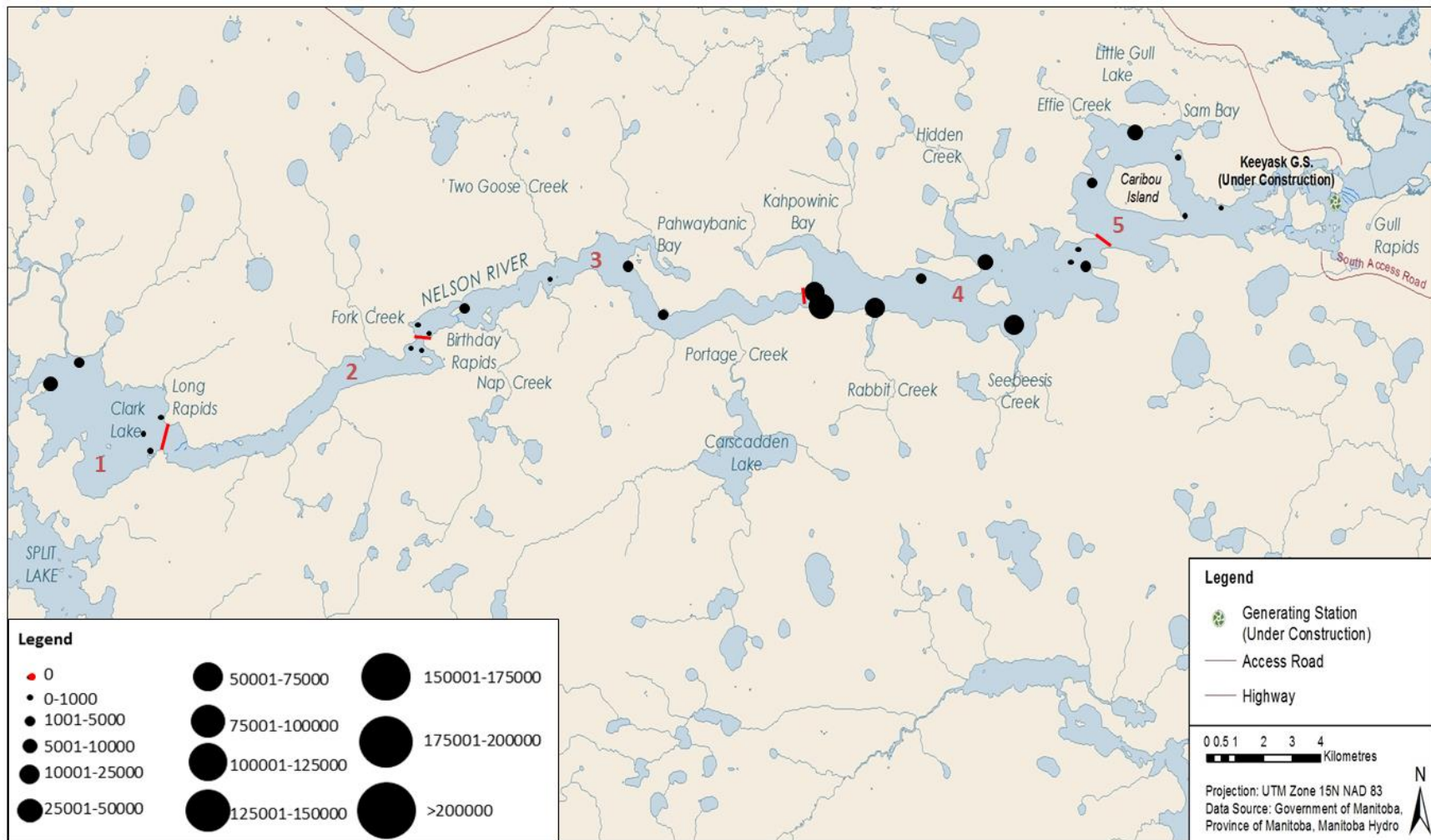


**Figure 7:** Detection ranges for individual Walleye tagged with acoustic transmitters upstream of Gull Rapids in 2016 during the open-water period (2016–2018). Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS (continued).

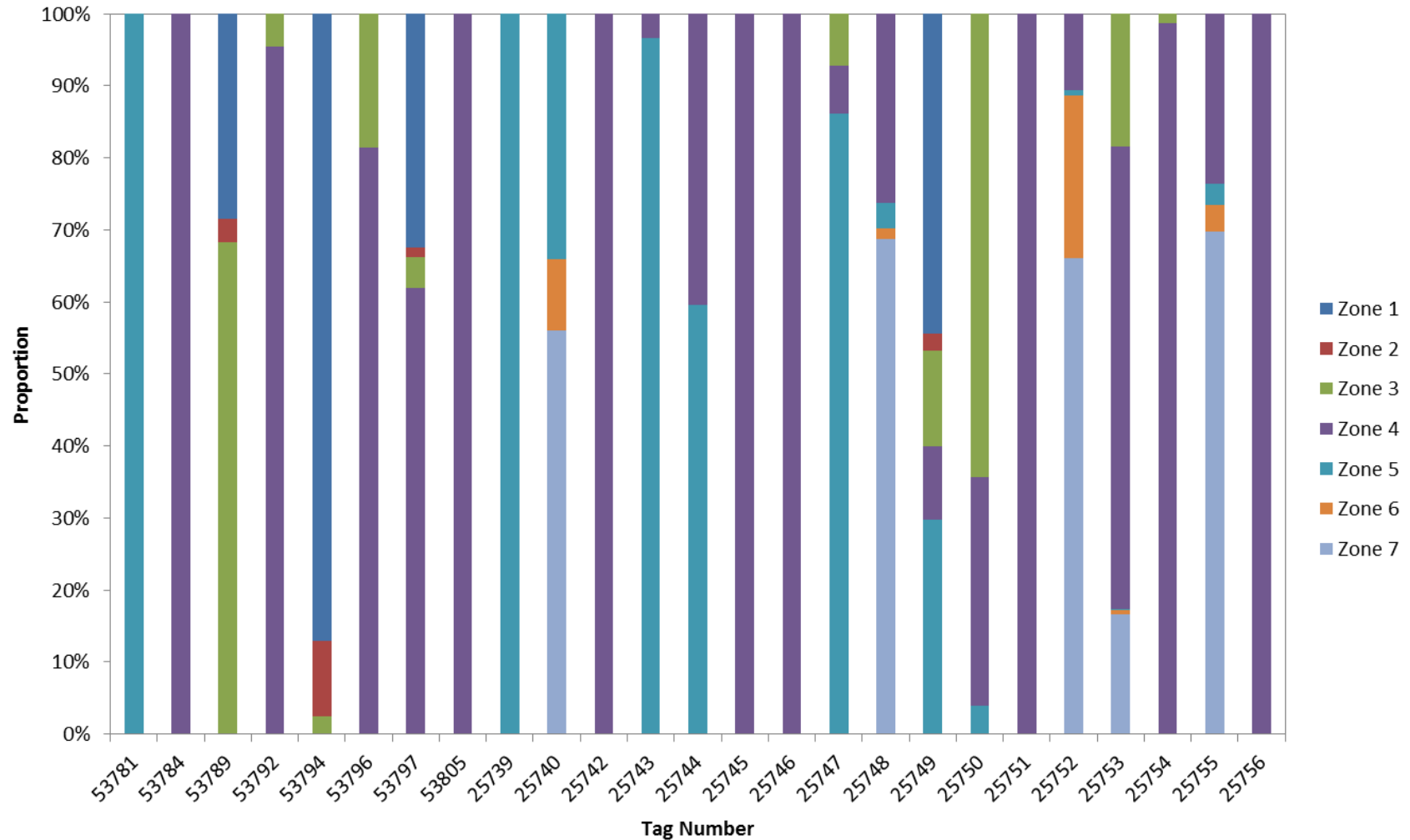




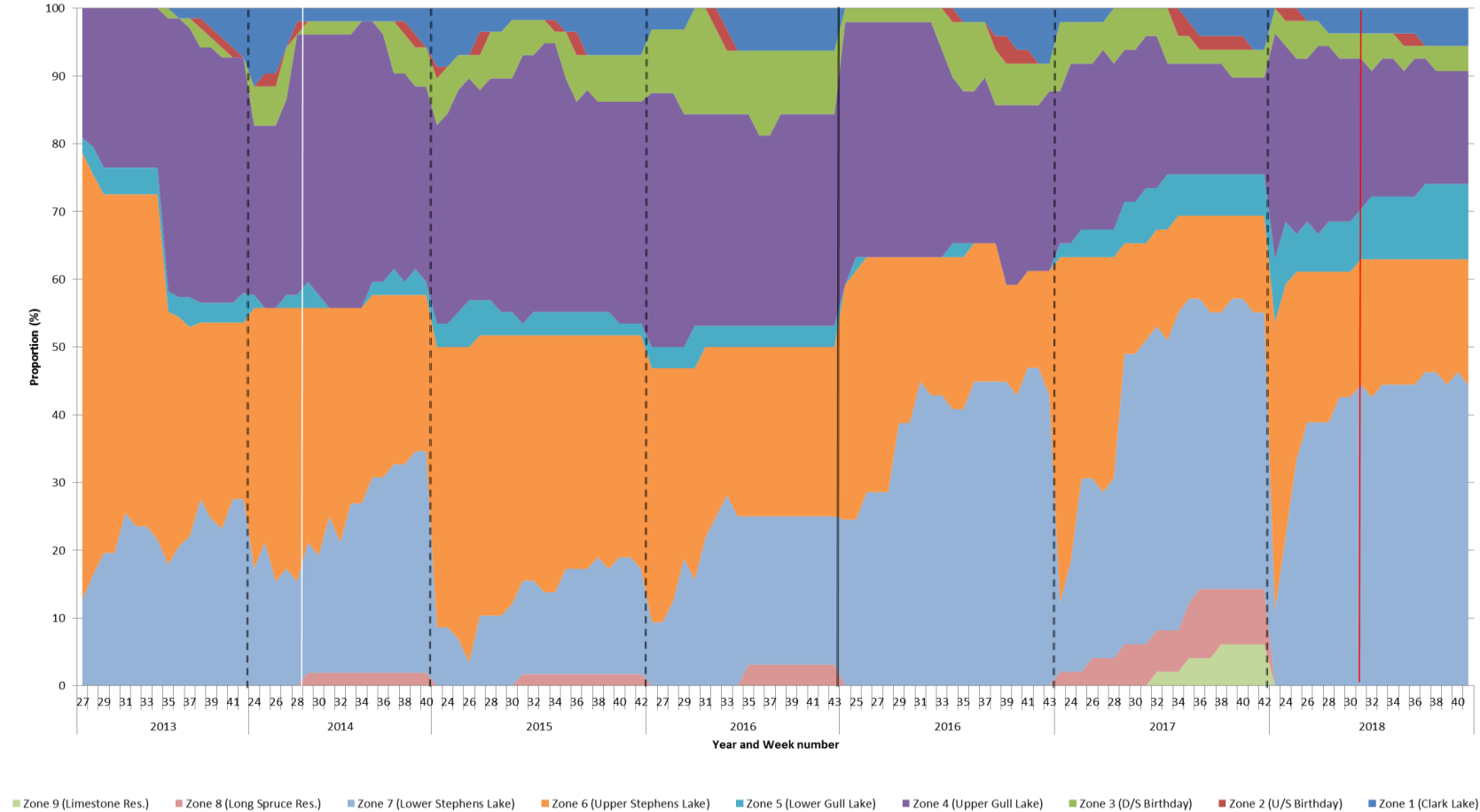
**Figure 8:** Detection ranges for individual Walleye tagged with acoustic transmitters upstream of Gull Rapids in 2018 during the 2018 open-water period. Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS.



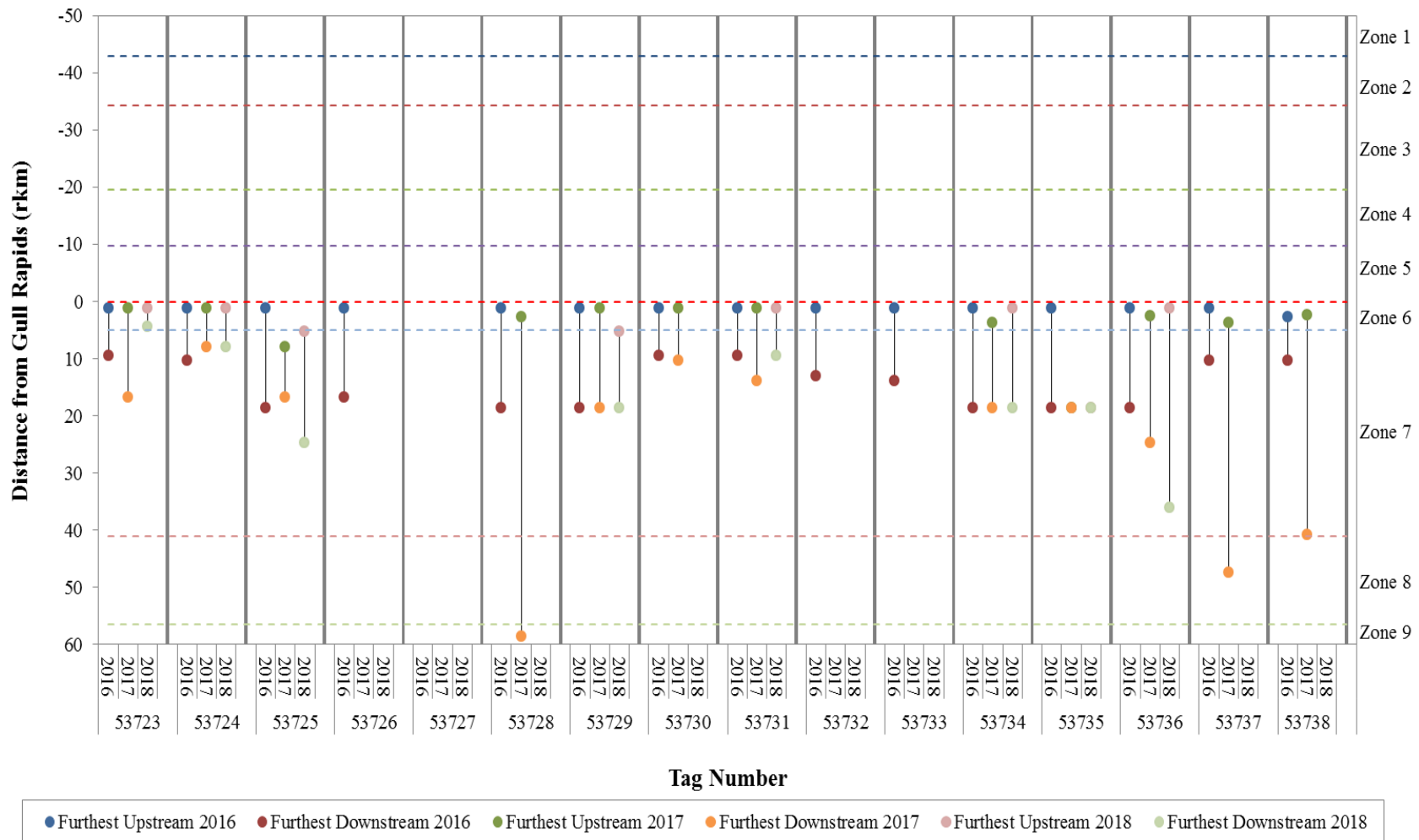
**Figure 9:** Relative number of detections of Walleye at each acoustic receiver set between Clark Lake and Gull Rapids during the 2018 open-water period (May 1 to October 10). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.



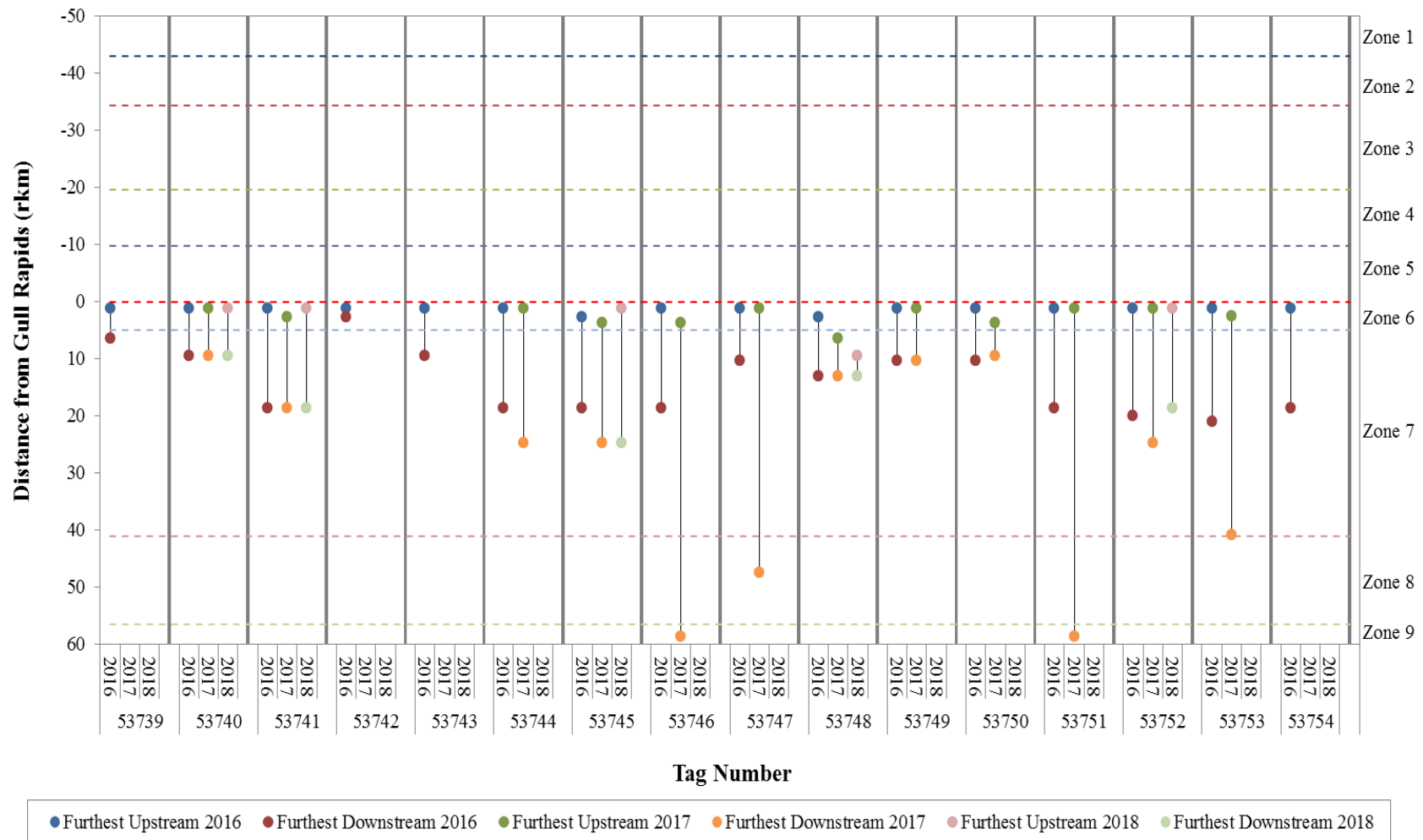
**Figure 10: Proportional distributions by zone for individual Walleye tagged with acoustic transmitters upstream of Keeyask GS in 2016 and 2018 during a portion of the 2018 open-water period (June 6 to October 10).**



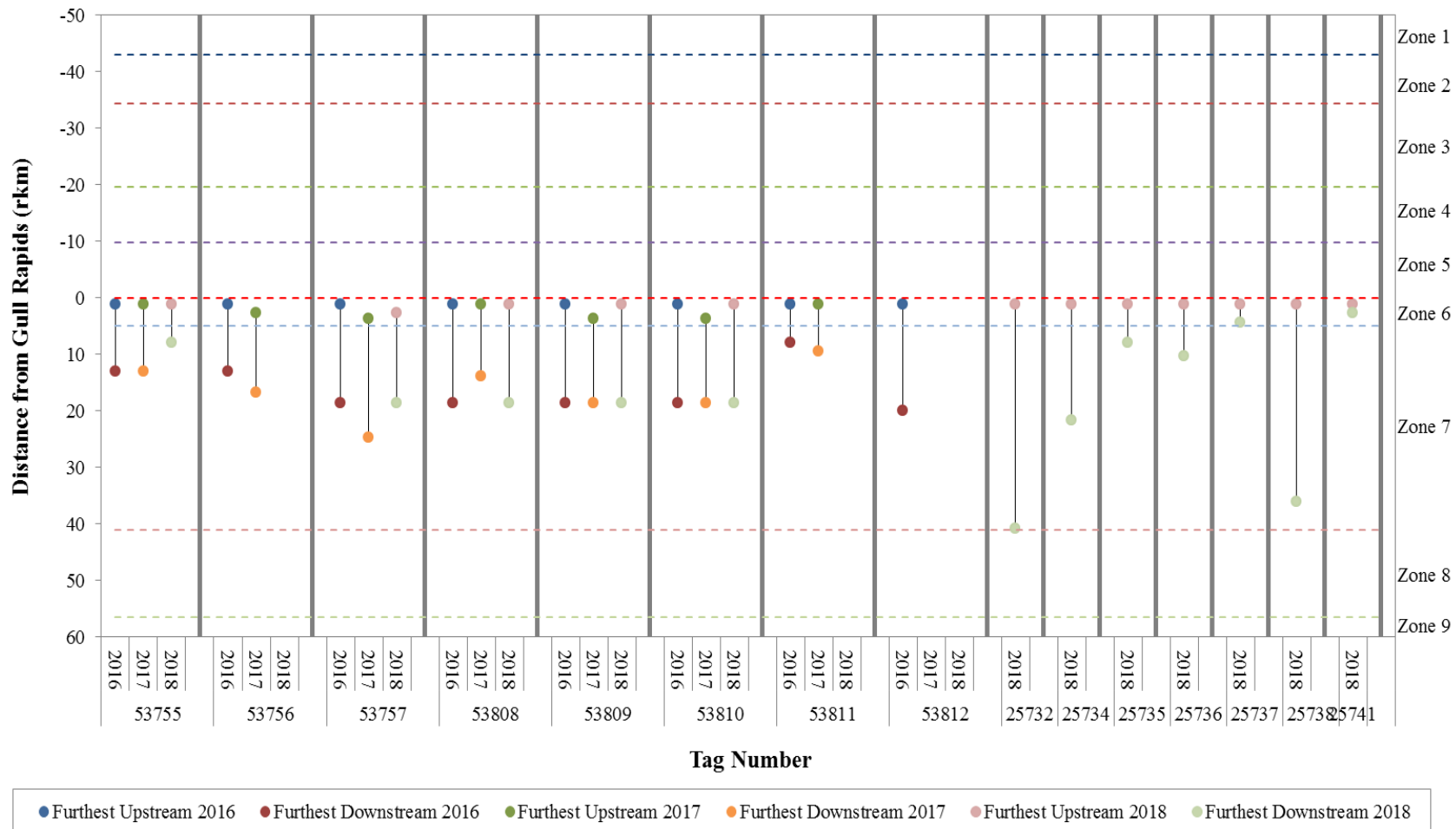
**Figure 11:** Proportional distribution by zone for 52 Walleye tagged with acoustic transmitters in the Keeyask GS Area in 2013/2014 and 2016/2018 (demarcated with solid black line) during a portion of the 2013 (August 25 to October 15), 2014 (June 4 to October 10), 2015 (June 4 to October 11), 2016 (June 25 to October 19), 2017 (June 7 to October 16), and 2018 (June 6 to October 10) open-water periods. Black lines indicate study years. White line indicates start of Keeyask construction. Red line indicates start of Keeyask spillway commissioning.



**Figure 12: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 and 2018 during the open-water period (2016–2018). Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS.**

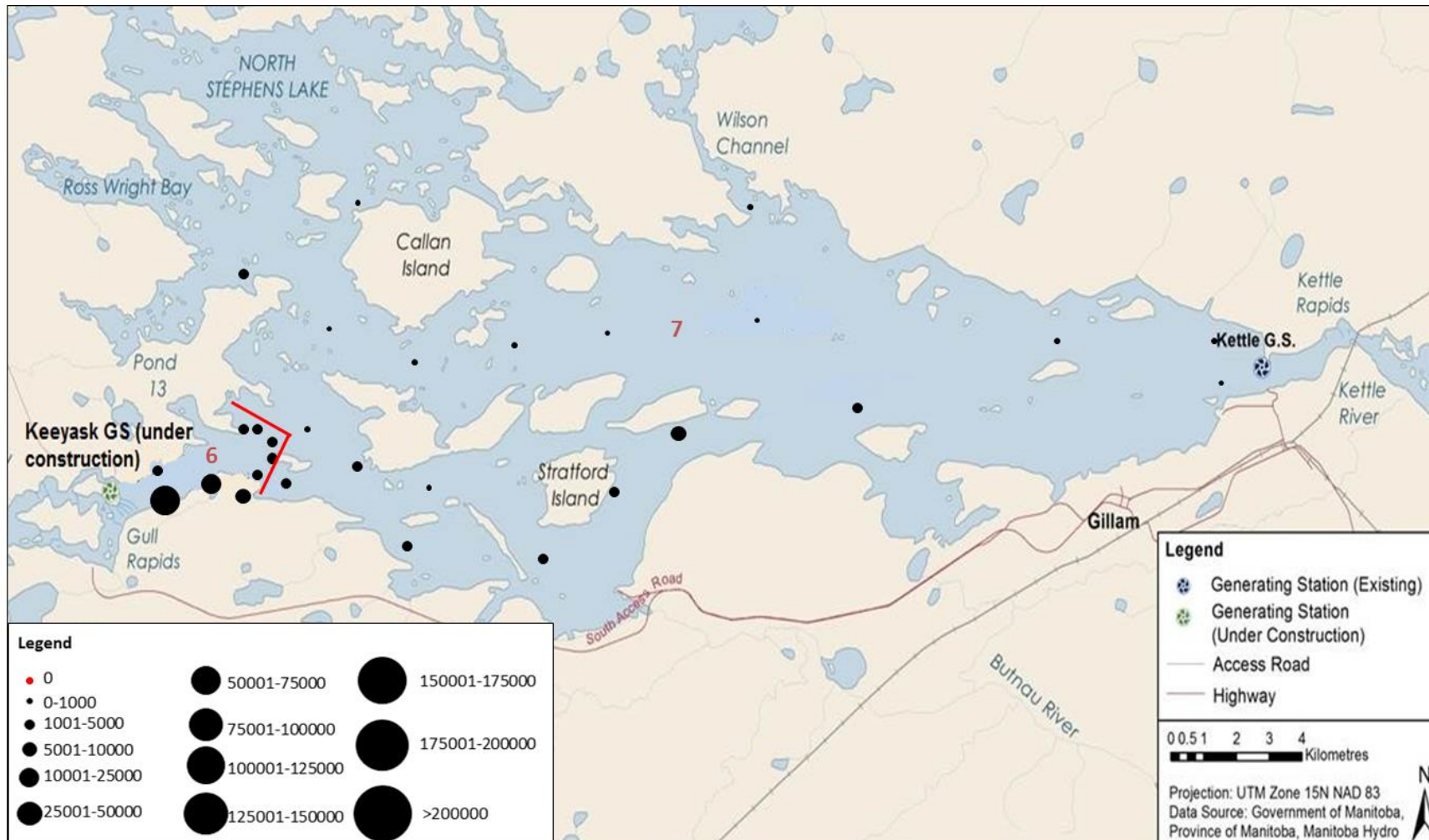


**Figure 12: Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 and 2018 during the open-water period (2016–2018). Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS (continued).**

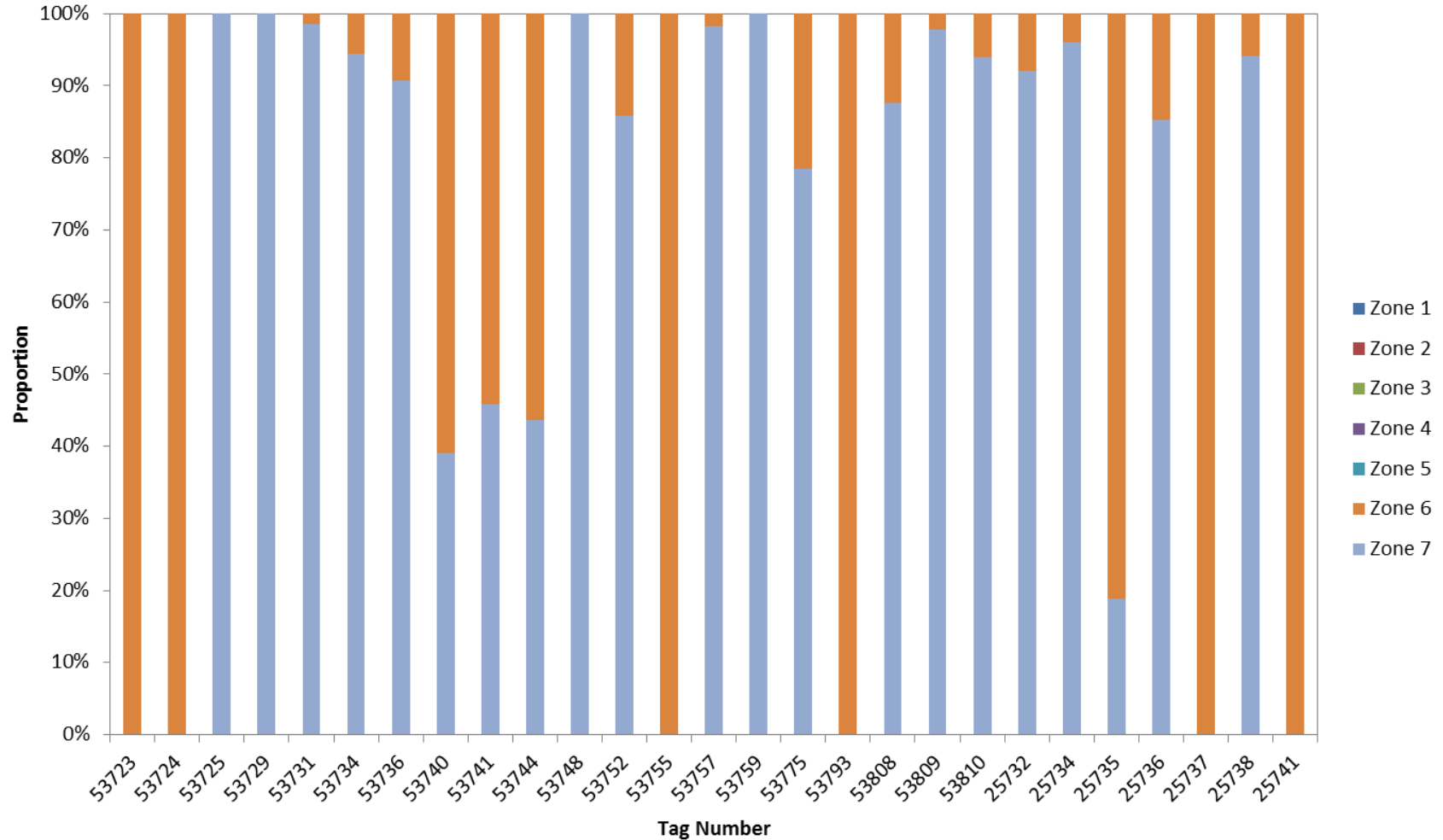


**Figure 12:** Detection ranges for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 and 2018 during the open-water period (2016–2018). Horizontal dotted lines demarcate zones. Blue represents the outlet of Clark Lake, dark pink represents Birthday Rapids, red represents Gull Rapids, light pink represents the Kettle GS, and light green represents the Long Spruce GS (continued).



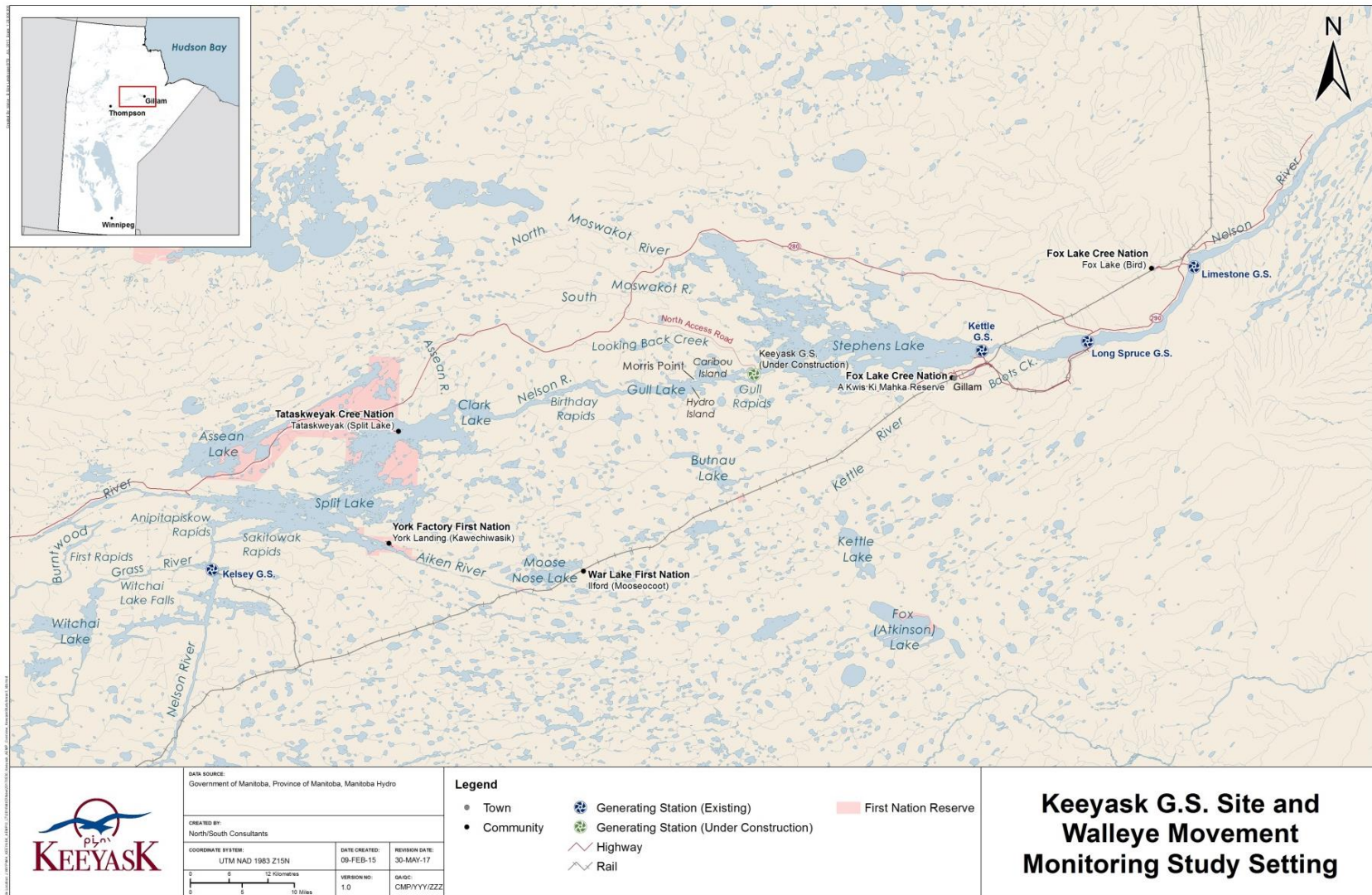


**Figure 13:** Relative number of detections of Walleye at each acoustic receiver set in Stephens Lake during the 2018 open-water period (May 1 to October 10). Number of detections indicated by size of bubble (defined in legend). Receivers with no detections indicated with red dot.



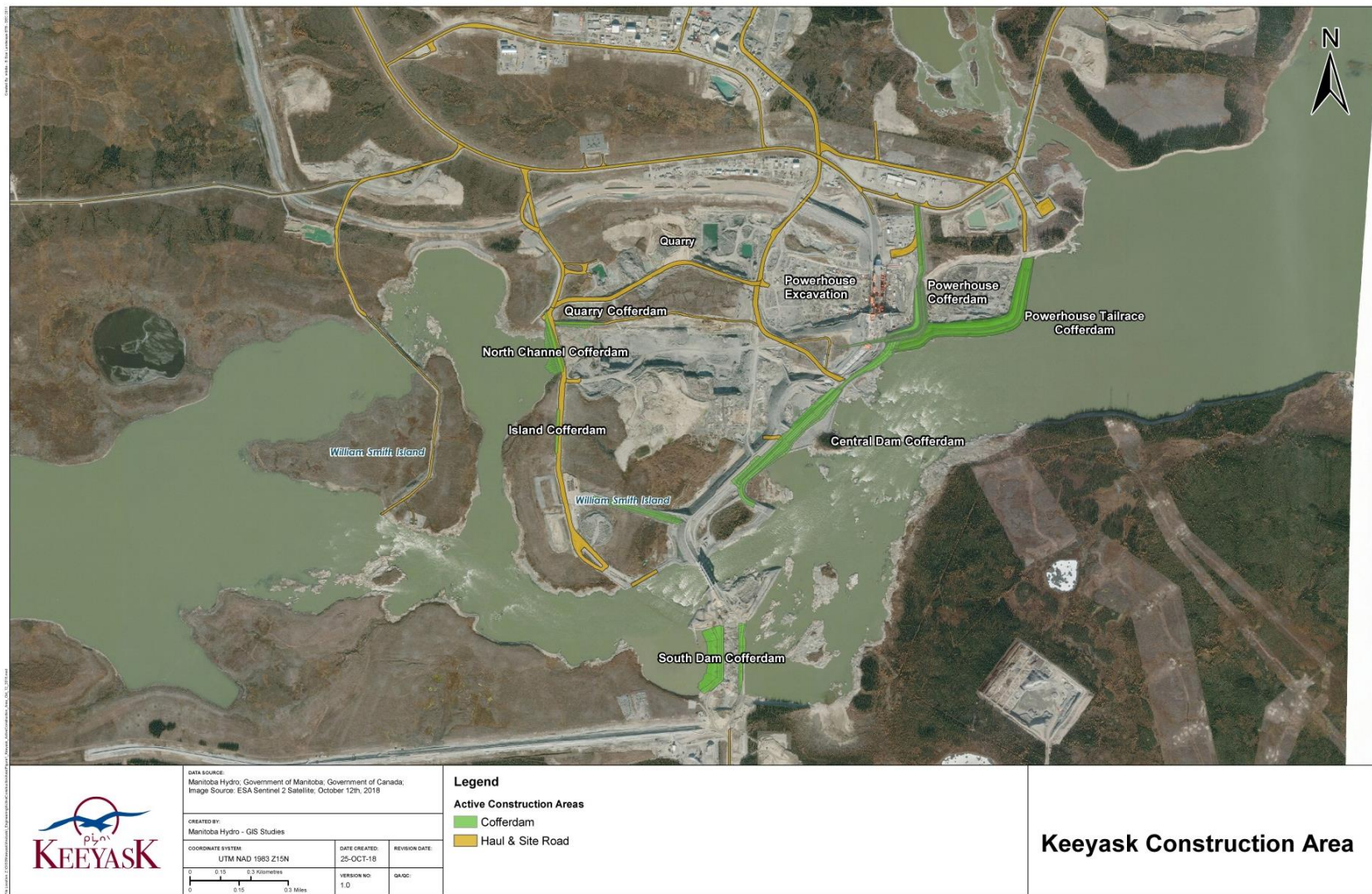
**Figure 14: Proportional distributions by zone for individual Walleye tagged with acoustic transmitters in Stephens Lake in 2016 and 2018 during a portion of the 2018 open-water period (June 6 to October 10).**

## MAPS

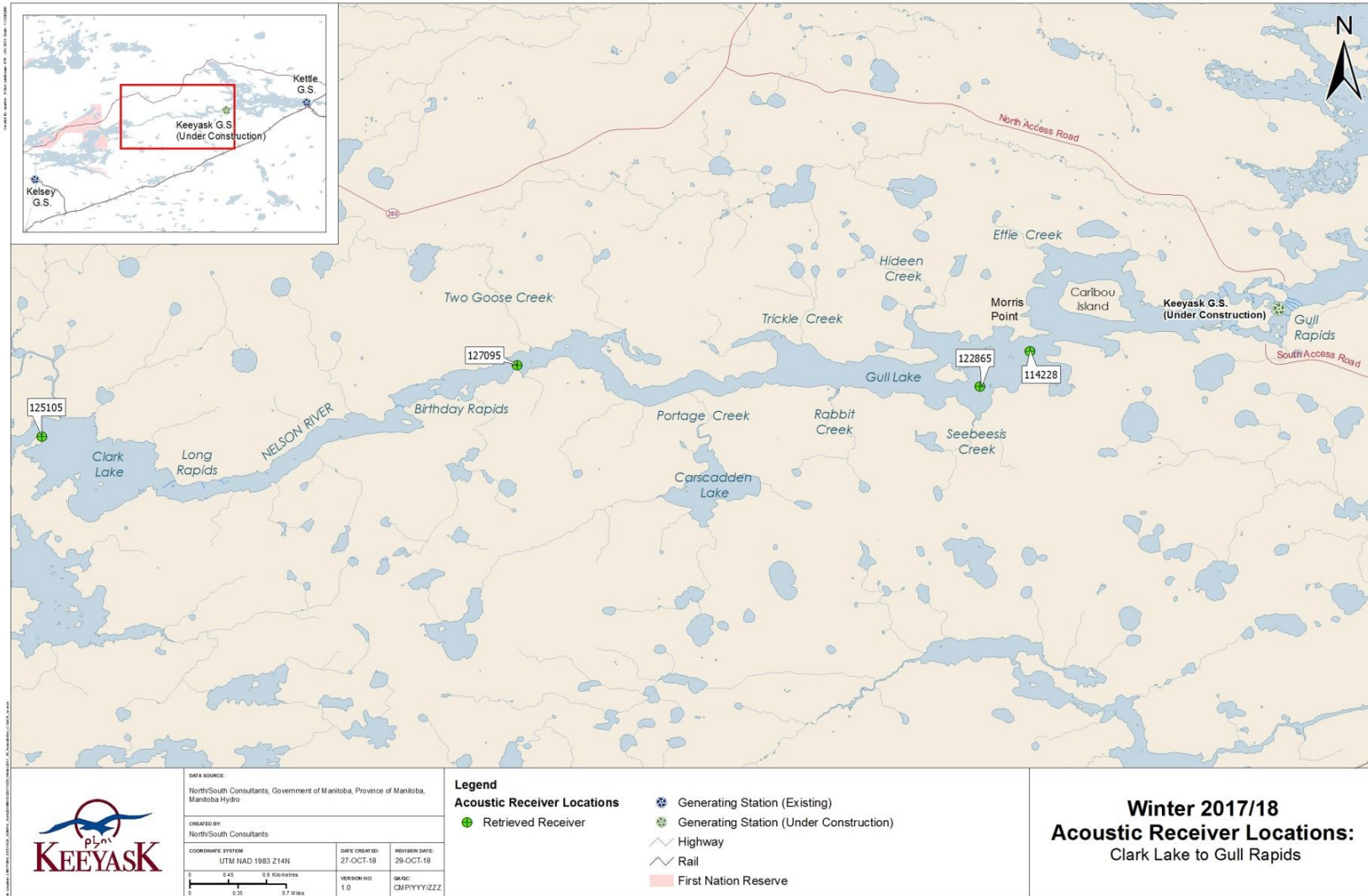


**Map 1: Map of the lower Nelson River showing the site of the Keeyask Generating Station and the Walleye movement monitoring study setting.**



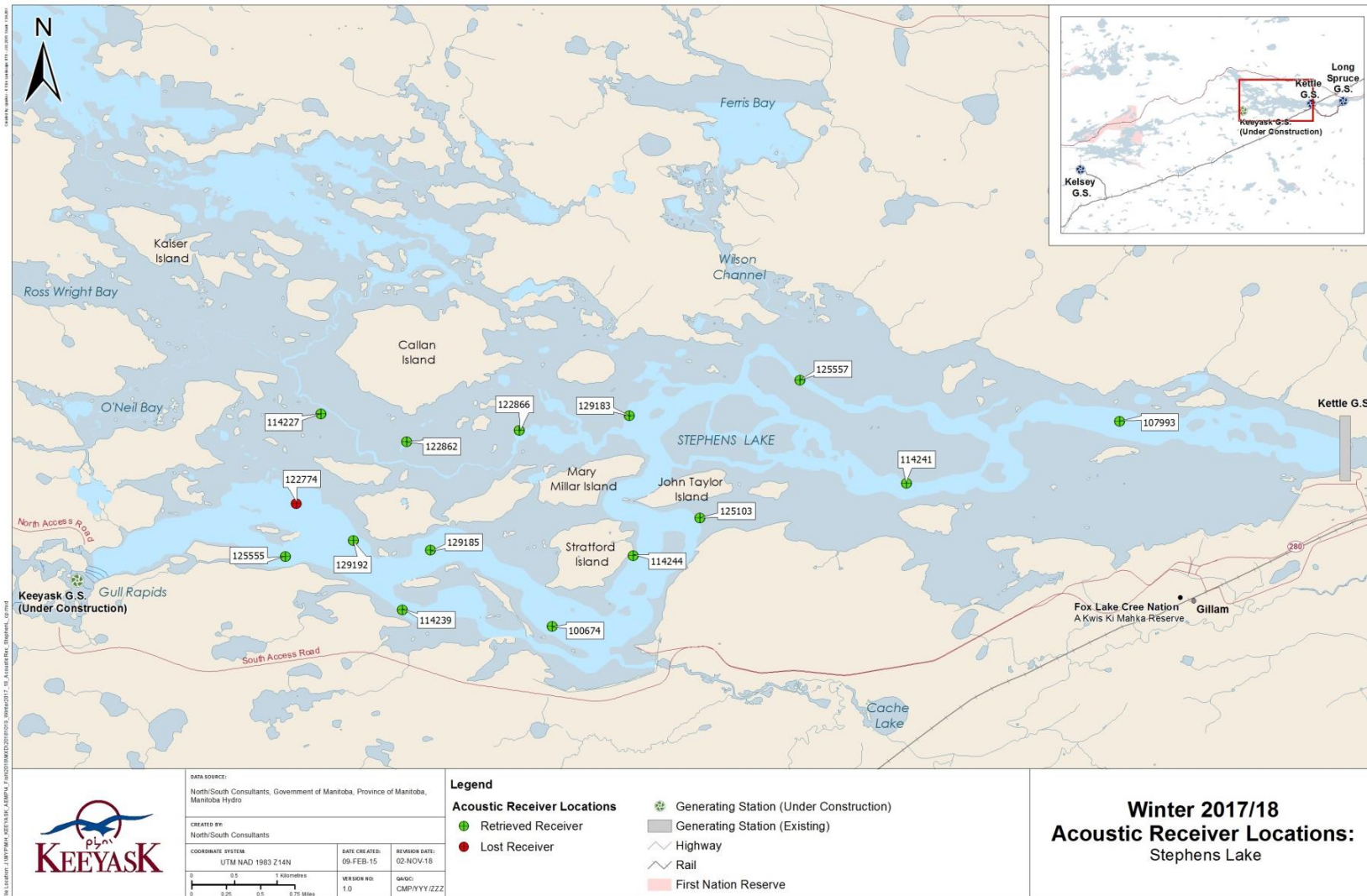


**Map 2: Map of instream structures at the Keeyask Generating Station site, October 2018.**



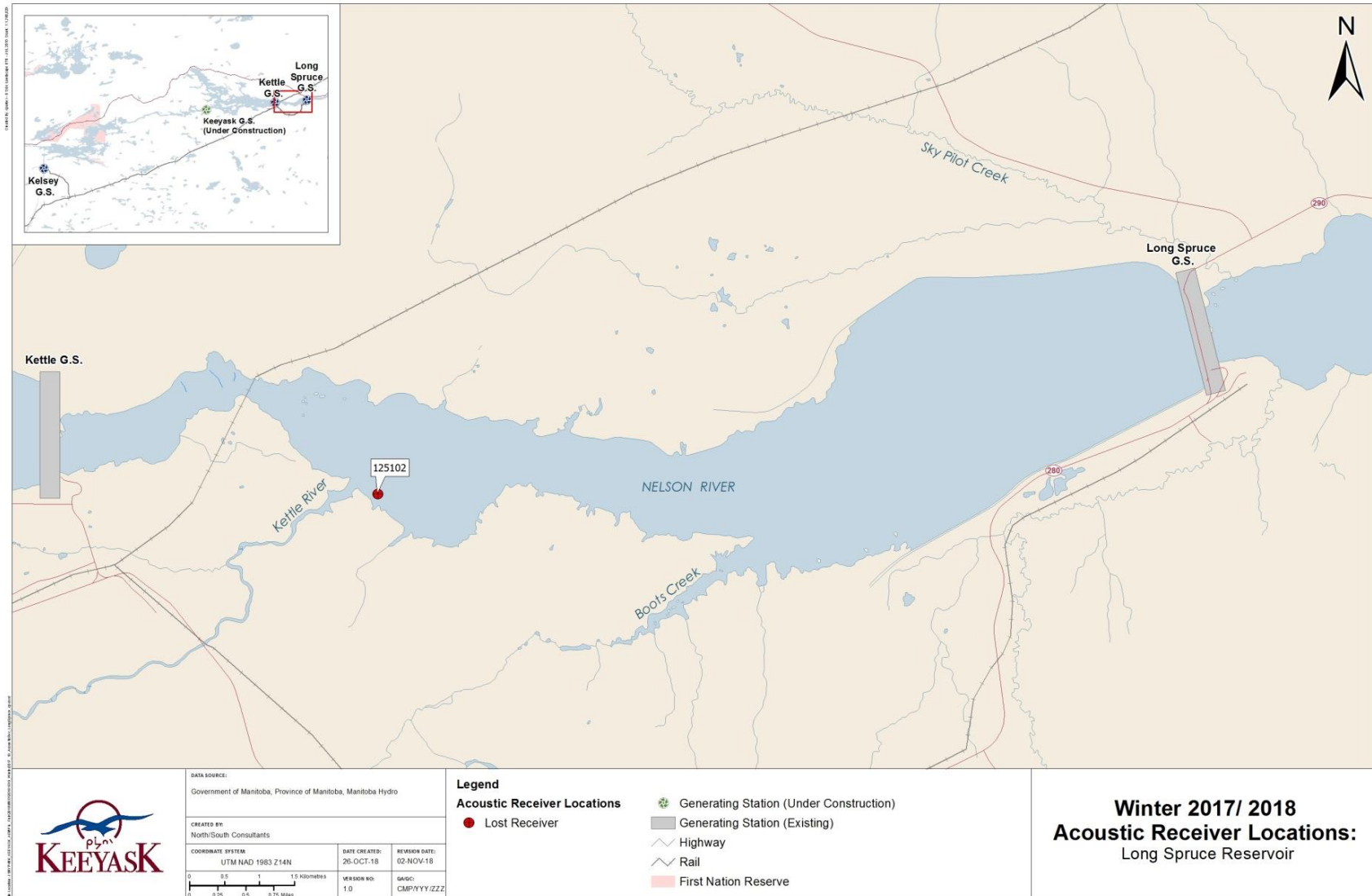
**Map 3: Locations of stationary receivers set in the Nelson River from Clark Lake to Gull Rapids between October 2017 and June 2018.**



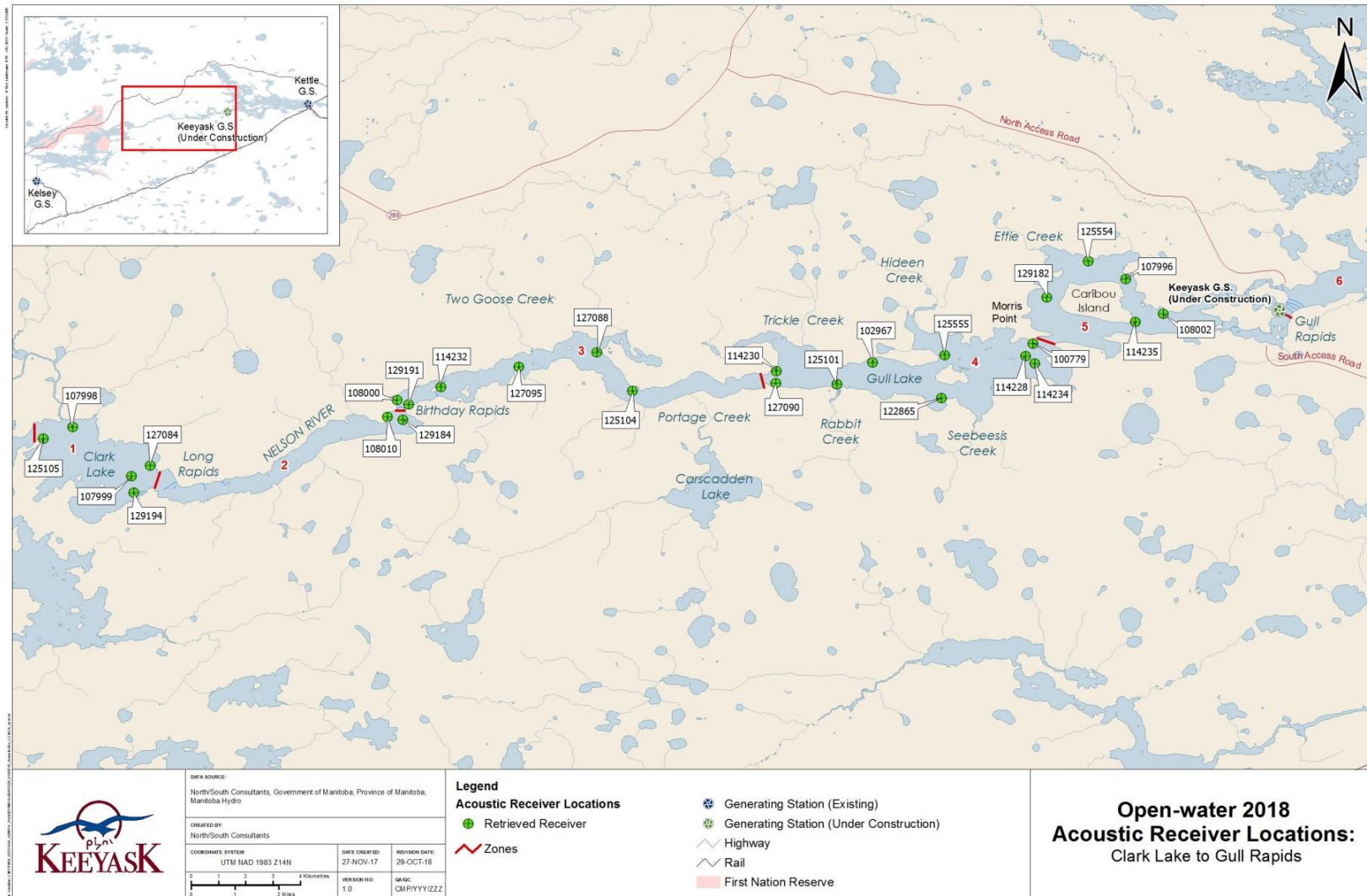


**Map 4: Locations of stationary receivers set in Stephens Lake from Gull Rapids to Kettle GS between October 2017 and June 2018. The former (pre-impoundment) river channel is shown in light blue.**

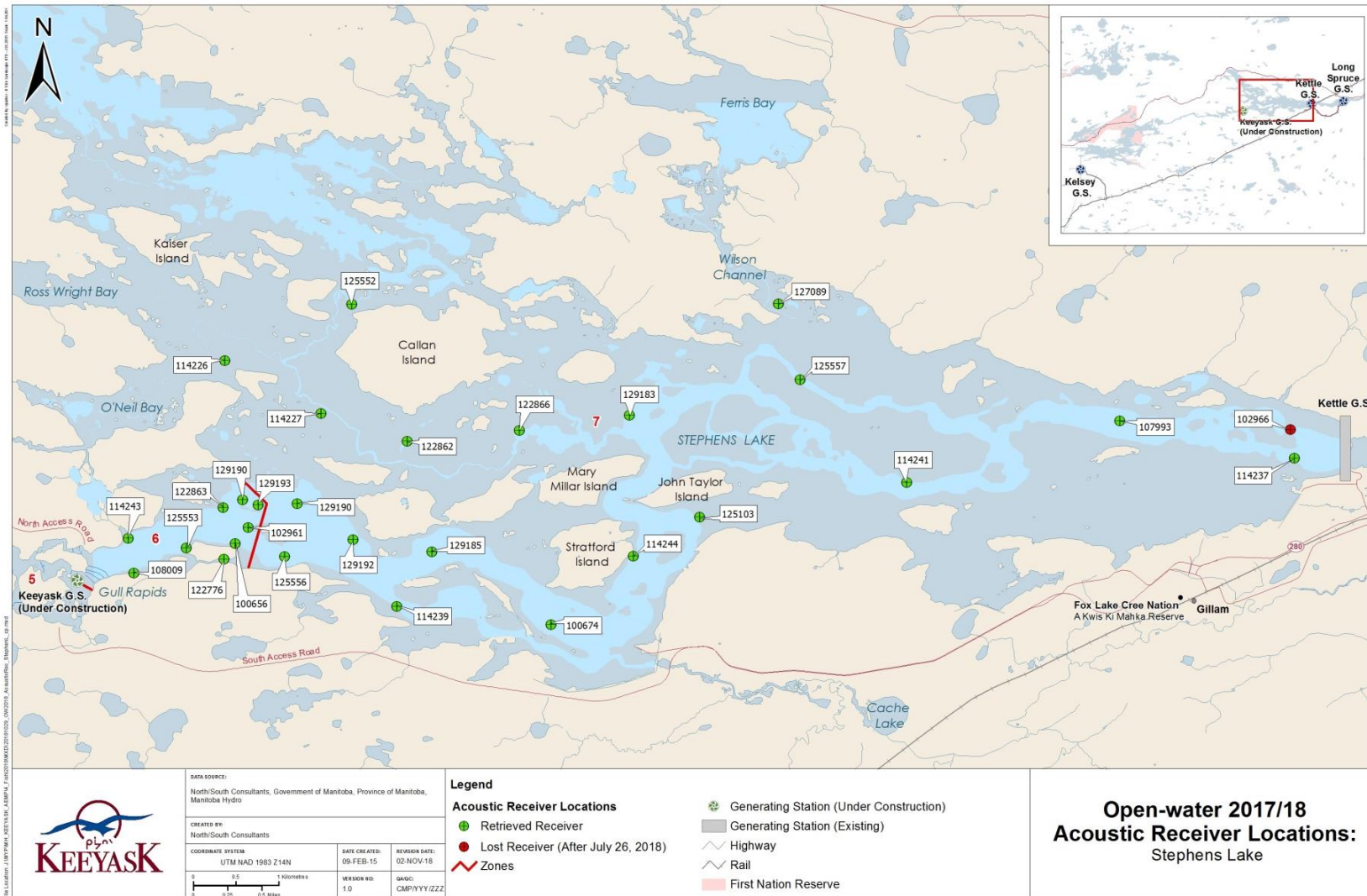




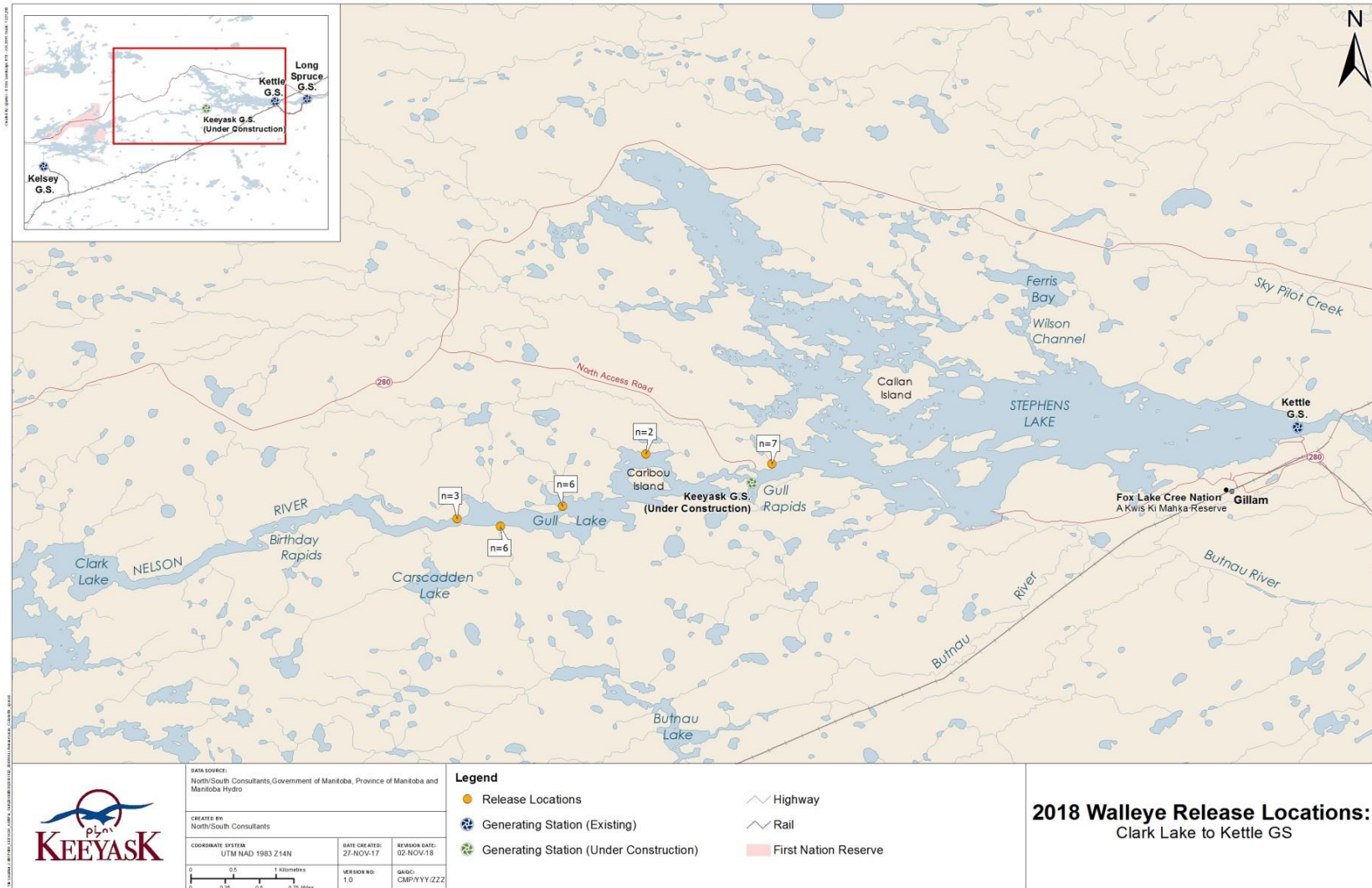
**Map 5: Location of the stationary receiver set in the Long Spruce Reservoir between October 2017 and June 2018.**



**Map 6: Locations of stationary receivers set in the Nelson River from Clark Lake to Gull Rapids between June and October 2018. The river is divided into five "zones" based on placement of receiver "gates."**







**Map 8: Release locations for Walleye tagged with acoustic transmitters upstream of Gull Rapids and in Stephens Lake in spring, 2018.**

# APPENDICES

# APPENDIX 1:

## DETECTION SUMMARIES FOR WALLEYE TAGGED AND MONITORED IN THE KEEYASK STUDY AREA BETWEEN 2016 AND 2018

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Table A1-1:	Detection summary for each of 48 Walleye tagged and monitored upstream of the Keeyask GS during the winter 2017/2018 period (October 17, 2017 to April 30, 2018).....	65
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**Table A1-1: Detection summary for each of 48 Walleye tagged and monitored upstream of the Keeyask GS during the winter 2017/2018 period (October 17, 2017 to April 30, 2018). Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through Gull Rapids. Tag ID highlighted red = moved downstream through Kettle GS.**

Tag ID	Date Tagged	2016/2017					2017/2018				
		n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)	n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)
53758	24-Sep-16	0	-	-	-	-	0	-	-	-	-
53759	24-Sep-16	26	1	16.8	16.8	0.0	0	-	-	-	-
53760	24-Sep-16	238	6	5.2	7.9	2.7	0	-	-	-	-
53763	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53764	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53765	24-Sep-16	1663	46	-10.1	-10.1	0.0	0	-	-	-	-
53766	24-Sep-16	0	-	-	-	-	0	-	-	-	-
53767	24-Sep-16	19	1	-10.1	-10.1	0.0	0	-	-	-	-
53768	5-Jun-16	0	-	-	-	-	126	10	-12.4	-12.4	0.0
53769	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53770	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53771	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53772	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53773	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53774	5-Jun-16	0	-	-	-	-	0	-	-	-	-
53775	5-Jun-16	12123	75	5.2	7.9	2.7	9231	76	5.2	7.9	2.7
53776	30-May-16	0	-	-	-	-	0	-	-	-	-
53777	29-May-16	0	-	-	-	-	0	-	-	-	-
53778	3-Jun-16	0	-	-	-	-	0	-	-	-	-
53779	3-Jun-16	0	-	-	-	-	0	-	-	-	-
53780	3-Jun-16	0	-	-	-	-	0	-	-	-	-
53781	2-Jun-16	0	-	-	-	-	0	-	-	-	-
53782	31-May-16	0	-	-	-	-	0	-	-	-	-
53783	31-May-16	0	-	-	-	-	7	2	-48.2	-48.2	0.0



**Table A1-1: Detection summary for each of 48 Walleye tagged and monitored upstream of the Keeyask GS during the winter 2017/2018 period (October 17, 2017 to April 30, 2018). Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through Gull Rapids. Tag ID highlighted red = moved downstream through Kettle GS (continued).**

Tag ID	Date Tagged	2016/2017					2017/2018				
		n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)	n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)
53784	30-May-16	0	-	-	-	-	41	6	-12.4	-12.4	0.0
53785	30-May-16	0	-	-	-	-	0	-	-	-	-
53786	30-May-16	0	-	-	-	-	0	-	-	-	-
53787	30-May-16	0	-	-	-	-	0	-	-	-	-
53788	30-May-16	0	-	-	-	-	0	-	-	-	-
53789	30-May-16	0	-	-	-	-	2	1	-48.2	-48.2	0.0
53790	29-May-16	0	-	-	-	-	0	-	-	-	-
53791	29-May-16	0	-	-	-	-	0	-	-	-	-
53792	28-May-16	0	-	-	-	-	5142	65	-12.4	-12.4	0.0
53793	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53794	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53795	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53796	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53797	7-Jun-16	15	1	-48.2	-48.2	0.0	0	-	-	-	-
53798	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53799	7-Jun-16	14789	65	5.2	9.4	4.2	0	-	-	-	-
53800	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53801	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53802	7-Jun-16	0	-	-	-	-	0	-	-	-	-
53803	24-Sep-16	2	1	-10.1	-10.1	0.0	0	-	-	-	-
53804	24-Sep-16	0	-	-	-	-	0	-	-	-	-
53805	6-Jun-16	0	-	-	-	-	0	-	-	-	-
53806	6-Jun-16	0	-	-	-	-	0	-	-	-	-
53807	6-Jun-16	0	-	-	-	-	0	-	-	-	-

**Table A1-2: Detection summary for each of 40 Walleye tagged and monitored in Stephens Lake during the winter 2017/2018 period (October 17, 2017 to April 30, 2018). Tag ID highlighted yellow = lost tag. Tag ID highlighted red = moved downstream through Kettle GS.**

Tag ID	Date Tagged	2016/2017					2017/2018				
		n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)	n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)
53723	28-May-16	5	1	5.8	5.8	0	0	-	-	-	-
53724	28-May-16	87	7	5.8	5.8	0	0	-	-	-	-
53725	27-May-16	18620	110	7.9	13.9	6	7577	44	7.9	9.4	1.5
53726	27-May-16	0	-	-	-	-	0	-	-	-	-
53727	28-May-16	0	-	-	-	-	0	-	-	-	-
53728	28-May-16	15806	111	5.2	18.6	13.4	0	-	-	-	-
53729	28-May-16	11525	58	16.8	18.6	1.8	15155	59	7.9	18.6	10.7
53730	28-May-16	569	9	5.2	13	7.8	98	2	7.9	9.4	1.5
53731	28-May-16	128	12	9.4	13.9	4.5	0	-	-	-	-
53732	28-May-16	0	-	-	-	-	0	-	-	-	-
53733	30-May-16	0	-	-	-	-	0	-	-	-	-
53734	30-May-16	23970	90	9.4	18.6	9.2	30201	127	6.5	18.6	12.1
53735	30-May-16	108116	192	18.6	18.6	0	106681	196	18.6	18.6	0
53736	30-May-16	43994	159	5.2	7.9	2.7	20686	96	5.2	9.4	4.2
53737	29-May-16	0	-	-	-	-	0	-	-	-	-
53738	31-May-16	0	-	-	-	-	0	-	-	-	-
53739	31-May-16	0	-	-	-	-	0	-	-	-	-
53740	31-May-16	10630	101	7.9	9.4	1.5	32179	124	7.9	10.3	2.4
53741	30-May-16	32009	171	16.8	18.6	1.8	64072	176	16.8	18.6	1.8
53742	30-May-16	0	-	-	-	-	0	-	-	-	-
53743	31-May-16	0	-	-	-	-	0	-	-	-	-
53744	31-May-16	37297	118	18.6	24.7	6.1	45114	119	18.6	36.1	17.5
53745	31-May-16	13041	108	5.2	18.6	13.4	7093	88	5.2	18.6	13.4
53746	31-May-16	0	-	-	-	-	0	-	-	-	-

**Table A1-2: Detection summary for each of 40 Walleye tagged and monitored in Stephens Lake during the winter 2017/2018 period (October 17, 2017 to April 30, 2018). Tag ID highlighted yellow = lost tag. Tag ID highlighted red = moved downstream through Kettle GS (continued).**

Tag ID	Date Tagged	2016/2017					2017/2018				
		n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)	n	# Days	Furthest U/S (rkm)	Furthest D/S (rkm)	Range (rkm)
53747	31-May-16	0	-	-	-	-	0	-	-	-	-
53748	31-May-16	23	5	13	13	0	15	2	8.4	8.4	0
53749	31-May-16	198	3	16.8	24.7	7.9	0	-	-	-	-
53750	31-May-16	9445	128	7.9	9.4	1.5	3480	55	7.9	9.4	1.5
53751	31-May-16	0	-	-	-	-	0	-	-	-	-
53752	31-May-16	5868	28	16.8	24.7	7.9	1135	18	16.8	18.6	1.8
53753	31-May-16	495	19	13.9	18.6	4.7	0	-	-	-	-
53754	31-May-16	0	-	-	-	-	0	-	-	-	-
53755	31-May-16	2086	8	5.2	9.4	4.2	253	15	6.5	8.4	1.9
53756	01-Jun-16	11795	77	9.4	18.6	9.2	0	-	-	-	-
53757	01-Jun-16	13752	120	5.2	18.6	13.4	16216	156	5.2	18.6	13.4
53808	01-Jun-16	203	2	9.4	9.4	0	0	-	-	-	-
53809	01-Jun-16	15097	148	13.9	18.6	4.7	30603	116	13.9	18.6	4.7
53810	01-Jun-16	6638	54	9.4	18.6	9.2	9560	71	9.4	18.6	9.2
53811	01-Jun-16	20720	126	5.2	7.9	2.7	6122	78	5.2	7.9	2.7
53812	01-Jun-16	0	-	-	-	-	0	-	-	-	-

**Table A1-3: Detection summary for each of 65 Walleye tagged and monitored upstream of the Keeyask GS during the open-water 2016 (May 1 to October 19), 2017 (May 1 to October 16), and 2018 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through Gull Rapids. Tag ID highlighted green = moved downstream through the Kettle GS. Tag ID highlighted orange = moved downstream through the Long Spruce GS.**

Tag ID	Date Tagged	Fork Length (mm)	Weight (g)	2016					2017					2018				
				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)
53758	24-Sep-16	423	750	409	10	-17.4	-9.3	8.1	6376	46	-33.8	5.2	39.0	0	-	-	-	-
53759	24-Sep-16	362	500	2725	18	-17.4	9.4	26.8	0	-	-	-	-	2	1	16.8	16.8	0.0
53760	24-Sep-16	512	1825	360	10	-17.4	5.2	22.6	35	8	4.2	5.2	1.0	0	-	-	-	-
53763	5-Jun-16	510	-	369	11	-19.5	-9.5	10	0	-	-	-	-	0	-	-	-	-
53764	5-Jun-16	560	-	717	6	-14.8	10.3	25.1	0	-	-	-	-	0	-	-	-	-
53765	24-Sep-16	491	1300	5790	20	-19.5	-9.5	10	1122	36	-10.1	-9.9	0.2	0	-	-	-	-
53766	24-Sep-16	484	1250	1164	11	-12.9	-10	3.4	0	-	-	-	-	0	-	-	-	-
53767	24-Sep-16	508	1450	1490	16	-12.9	-11.8	1.1	0	-	-	-	-	0	-	-	-	-
53768	5-Jun-16	520	-	5426	127	-19.5	-14.8	4.7	9240	117	-19.5	-14.8	4.7	0	-	-	-	-
53769	5-Jun-16	393	-	16254	94	-19.5	44.9	64.4	410	4	47.5	47.5	0.0	0	-	-	-	-
53770	5-Jun-16	350	-	299	3	-17.4	-17.4	0	0	-	-	-	-	0	-	-	-	-
53771	5-Jun-16	353	-	1919	26	-19.4	58.6	78	0	-	-	-	-	0	-	-	-	-
53772	5-Jun-16	400	-	2950	19	-24.3	-14.8	9.5	656	8	-29.4	-7.4	22.0	0	-	-	-	-
53773	5-Jun-16	405	-	7239	74	-33.8	-9.5	24.3	2895	36	-19.5	43.5	63.0	0	-	-	-	-
53774	5-Jun-16	522	-	1403	7	-17.4	-9	8.4	0	-	-	-	-	0	-	-	-	-
53775	5-Jun-16	514	-	9686	68	-10.1	18.6	28.7	7764	67	1.2	24.7	23.5	5945	46	1.2	36.1	34.9
53776	30-May-16	535	-	10606	110	-19.5	-12.9	6.6	4044	33	-12.8	-12.8	0.0	0	-	-	-	-
53777	29-May-16	404	1050	8877	99	-48.2	-11.8	36.4	5624	55	-26.5	58.6	85.1	0	-	-	-	-
53778	3-Jun-16	523	-	6979	15	-19.5	-9.5	10	0	-	-	-	-	0	-	-	-	-
53779	3-Jun-16	400	-	389	7	-12.9	-12.9	0	0	-	-	-	-	0	-	-	-	-
53780	3-Jun-16	660	-	3585	28	-12.9	-5.8	7.1	0	-	-	-	-	0	-	-	-	-
53781	2-Jun-16	525	-	344	10	-12.9	-9.5	3.4	21	2	-9.3	-9.3	0.0	13	4	-9.3	-9.3	0.0
53782	31-May-16	509	1550	11144	48	-19.5	43.5	63	0	-	-	-	-	0	-	-	-	-

**Table A1-3: Detection summary for each of 65 Walleye tagged and monitored upstream of the Keeyask GS during the open-water 2016 (May 1 to October 19), 2017 (May 1 to October 16), and 2018 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through Gull Rapids. Tag ID highlighted green = moved downstream through the Kettle GS. Tag ID highlighted orange = moved downstream through the Long Spruce GS (continued).**

Tag ID	Date Tagged	Fork Length (mm)	Weight (g)	2016					2017					2018				
				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)
53783	31-May-16	388	850	18635	92	-48.2	-14.8	33.4	7435	44	-48.2	-14.8	33.4	0	-	-	-	-
53784	30-May-16	510	-	3309	85	-19.5	-11.8	7.7	6111	41	-33.8	-12.8	21.0	1669	38	-19.5	-12.8	6.7
53785	30-May-16	526	-	30891	132	-19.5	-12.9	6.6	4227	42	-17.4	-5.8	11.6	0	-	-	-	-
53786	30-May-16	400	-	266	4	-14.8	2.7	17.5	0	-	-	-	-	0	-	-	-	-
53787	30-May-16	360	-	6972	92	-19.5	-5.8	13.7	0	-	-	-	-	0	-	-	-	-
53788	30-May-16	603	-	2521	24	-19.5	5.2	24.7	0	-	-	-	-	0	-	-	-	-
53789	30-May-16	577	-	17373	84	-44.3	-32.3	12	7018	51	-44.7	-32.3	12.4	4078	47	-48.2	-32.3	15.9
53790	29-May-16	533	2000	1177	4	-17.4	-17.4	0	0	-	-	-	-	0	-	-	-	-
53791	29-May-16	400	725	1265	17	-19.5	44.9	64.4	0	-	-	-	-	0	-	-	-	-
53792	28-May-16	559	-	18568	130	-19.5	-11.8	7.7	19717	122	-19.5	-11.9	7.6	18260	114	-24.7	-12.9	11.8
53793	7-Jun-16	560	2125	40350	133	-19.5	-12.9	6.6	56	3	-12.8	2.7	15.5	290	12	2.7	2.7	0.0
53794	7-Jun-16	440	1200	14606	97	-29.4	-11.8	17.6	4327	63	-33.8	-10.1	23.7	466	7	-48.2	-17.4	30.8
53795	7-Jun-16	410	900	7864	105	-19.5	-9.5	10	24523	122	-19.5	-17.4	2.1	0	-	-	-	-
53796	7-Jun-16	441	1150	4385	62	-26.5	-17.4	9.1	1926	44	-26.5	-19.4	7.1	1529	31	-26.5	-17.4	9.1
53797	7-Jun-16	520	1700	17953	86	-48.2	-17.4	30.8	12338	93	-48.2	-17.4	30.8	34552	129	-48.2	-17.4	30.8
53798	7-Jun-16	495	1500	11017	85	-19.5	-12.9	6.6	3	1	-10.1	-10.1	0.0	0	-	-	-	-
53799	7-Jun-16	511	1650	7477	59	-14.8	10.3	25.1	312	12	1.2	47.5	46.3	0	-	-	-	-
53800	7-Jun-16	530	1750	22181	94	-19.5	-5.8	13.7	0	-	-	-	-	0	-	-	-	-
53801	7-Jun-16	360	600	1488	8	-14.8	18.6	33.4	0	-	-	-	-	0	-	-	-	-
53802	7-Jun-16	468	1300	118	2	-14.8	-5.8	9	0	-	-	-	-	0	-	-	-	-
53803	24-Sep-16	484	1550	1530	21	-14.8	-11.8	3	0	-	-	-	-	0	-	-	-	-
53804	24-Sep-16	410	700	1829	17	-14.8	-11.8	3	160	4	-10.1	-7.4	2.7	0	-	-	-	-
53805	6-Jun-16	532	-	17640	129	-14.8	-14.8	0	8346	100	-19.5	-14.8	4.7	6114	74	-19.5	-9.9	9.6

**Table A1-3: Detection summary for each of 65 Walleye tagged and monitored upstream of the Keeyask GS during the open-water 2016 (May 1 to October 19), 2017 (May 1 to October 16), and 2018 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted purple = moved downstream through Gull Rapids. Tag ID highlighted green = moved downstream through the Kettle GS. Tag ID highlighted orange = moved downstream through the Long Spruce GS (continued).**

Tag ID	Date Tagged	Fork Length (mm)	Weight (g)	2016					2017					2018				
				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)
53806	6-Jun-16	405	-	24853	125	-34.3	-14.8	19.5	0	-	-	-	-	0	-	-	-	-
53807	6-Jun-16	451	-	7475	63	-48.2	-14.8	33.4	0	-	-	-	-	0	-	-	-	-
25739	5-Jun-18	410	800	-	-	-	-	-	-	-	-	-	-	996	30	-9.3	-7.4	1.9
25740	5-Jun-18	388	550	-	-	-	-	-	-	-	-	-	-	3587	29	-9.3	36.1	45.4
25742	5-Jun-18	320	400	-	-	-	-	-	-	-	-	-	-	14026	101	-15.0	-9.9	5.1
25743	5-Jun-18	442	925	-	-	-	-	-	-	-	-	-	-	597	7	-10.2	-4.8	5.4
25744	5-Jun-18	525	1575	-	-	-	-	-	-	-	-	-	-	5128	44	-19.5	-9.3	10.2
25745	5-Jun-18	438	850	-	-	-	-	-	-	-	-	-	-	225	2	-12.8	-12.8	0.0
25746	5-Jun-18	504	1750	-	-	-	-	-	-	-	-	-	-	1946	28	-19.5	-12.8	6.7
25747	28-May-18	374	575	-	-	-	-	-	-	-	-	-	-	12012	100	-24.7	-7.4	17.3
25748	28-May-18	398	525	-	-	-	-	-	-	-	-	-	-	625	6	-19.5	24.7	44.2
25749	28-May-18	393	550	-	-	-	-	-	-	-	-	-	-	9675	75	-48.2	-9.3	38.9
25750	1-Jun-18	403	725	-	-	-	-	-	-	-	-	-	-	3401	49	-26.5	-9.0	17.5
25751	5-Jun-18	343	450	-	-	-	-	-	-	-	-	-	-	3274	72	-19.5	-12.8	6.7
25752	27-May-18	404	700	-	-	-	-	-	-	-	-	-	-	2272	21	-19.5	40.8	60.3
25753	27-May-18	356	425	-	-	-	-	-	-	-	-	-	-	11695	58	-32.3	36.1	68.4
25754	27-May-18	367	550	-	-	-	-	-	-	-	-	-	-	5119	60	-24.7	-12.9	11.8
25755	1-Jun-18	396	775	-	-	-	-	-	-	-	-	-	-	564	11	-24.7	40.9	65.6
25756	1-Jun-18	452	1050	-	-	-	-	-	-	-	-	-	-	5983	54	-19.5	-9.9	9.6

**Table A1-4: Detection summary for each of 47 Walleye tagged and monitored in Stephens Lake during the open-water 2016 (May 1 to October 19), 2017 (May 1 to October 16), and 2018 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted green = moved downstream through the Kettle GS. Tag ID highlighted orange = moved downstream through the Long Spruce GS.**

Tag ID	Date Tagged	Fork Length (mm)	Weight (g)	2016					2017					2018				
				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)
53723	28-May-16	510	1500	6822	52	1.2	9.4	8.2	11415	64	1.2	16.8	15.6	1096	15	1.2	4.4	3.2
53724	28-May-16	433	1050	16473	97	1.2	10.3	9.1	2937	36	1.2	7.9	6.7	492	11	1.2	7.9	6.7
53725	27-May-16	480	1200	1918	22	1.2	18.6	17.4	5934	35	7.9	16.8	8.9	594	13	5.2	24.7	19.5
53726	27-May-16	412	800	1862	17	1.2	16.8	15.6	0	-	-	-	-	0	-	-	-	-
53727	28-May-16	486	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
53728	28-May-16	507	1650	13006	102	1.2	18.6	17.4	4712	42	2.7	58.6	55.9	0	-	-	-	-
53729	28-May-16	375	560	3470	41	1.2	18.6	17.4	2432	46	1.2	18.6	17.4	571	23	5.2	18.6	13.4
53730	28-May-16	491	1700	1907	15	1.2	9.4	8.2	4610	43	1.2	10.3	9.1	0	-	-	-	-
53731	28-May-16	442	950	4702	19	1.2	9.4	8.2	1757	26	1.2	13.9	12.7	924	14	1.2	9.4	8.2
53732	28-May-16	530	1825	380	7	1.2	13.0	11.8	0	-	-	-	-	0	-	-	-	-
53733	30-May-16	322	500	2770	34	1.2	13.9	12.7	0	-	-	-	-	0	-	-	-	-
53734	30-May-16	460	1325	2165	13	1.2	18.6	17.4	2137	28	3.8	18.6	14.8	736	19	1.2	18.6	17.4
53735	30-May-16	374	600	71469	135	1.2	18.6	17.4	98904	168	18.6	18.6	0.0	93804	160	18.6	18.6	0.0
53736	30-May-16	398	900	5122	42	1.2	18.6	17.4	5996	48	2.6	24.7	22.1	713	19	1.2	36.1	34.9
53737	29-May-16	508	1625	2237	64	1.2	10.3	9.1	1772	21	3.8	47.5	43.7	0	-	-	-	-
53738	31-May-16	522	1875	7820	75	2.7	10.3	7.6	692	20	2.6	40.8	38.2	0	-	-	-	-
53739	31-May-16	480	1300	9452	111	1.2	6.5	5.3	0	-	-	-	-	0	-	-	-	-
53740	31-May-16	482	1400	12989	77	1.2	9.4	8.2	6334	60	1.2	9.4	8.2	6514	84	1.2	9.4	8.2
53741	30-May-16	404	975	4836	76	1.2	18.6	17.4	11129	90	2.7	18.6	15.9	15069	122	1.2	18.6	17.4
53742	30-May-16	452	1250	1118	12	1.2	2.7	1.5	0	-	-	-	-	0	-	-	-	-
53743	31-May-16	469	1450	466	9	1.2	9.4	8.2	0	-	-	-	-	0	-	-	-	-
53744	31-May-16	405	750	5132	56	1.2	18.6	17.4	6665	69	1.2	24.7	23.5	3812	48	1.2	24.7	23.5
53745	31-May-16	453	1200	249	4	2.7	18.6	15.9	2884	25	3.8	24.7	20.9	0	-	-	-	-



**Table A1-4: Detection summary for each of 47 Walleye tagged and monitored in Stephens Lake during the open-water 2016 (May 1 to October 19), 2017 (May 1 to October 16), and 2018 (May 1 to October 10) periods. Tag ID highlighted yellow = lost tag. Tag ID highlighted green = moved downstream through the Kettle GS. Tag ID highlighted orange = moved downstream through the Long Spruce GS (continued).**

Tag ID	Date Tagged	Fork Length (mm)	Weight (g)	2016					2017					2018				
				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)
53746	31-May-16	467	1380	310	4	1.2	18.6	17.4	1449	19	3.8	58.6	54.8	0	-	-	-	-
53747	31-May-16	520	1600	19408	65	1.2	10.3	9.1	6715	47	1.2	47.5	46.3	0	-	-	-	-
53748	31-May-16	442	975	4332	57	2.7	13.0	10.3	558	20	6.5	13	6.5	23	2	9.4	13	3.6
53749	31-May-16	411	750	34767	132	1.2	10.3	9.1	2531	12	1.2	10.3	9.1	0	-	-	-	-
53750	31-May-16	531	1800	4459	52	1.2	10.3	9.1	15866	72	3.8	9.4	5.6	0	-	-	-	-
53751	31-May-16	422	825	8287	56	1.2	18.6	17.4	633	25	1.2	58.6	57.4	0	-	-	-	-
53752	31-May-16	468	1400	12710	51	1.2	20.0	18.8	7479	67	1.2	24.7	23.5	2768	26	1.2	18.6	17.4
53753	31-May-16	488	1325	23679	89	1.2	21.0	19.8	3253	39	2.6	40.9	38.3	0	-	-	-	-
53754	31-May-16	475	1375	1653	11	1.2	18.6	17.4	0	-	-	-	-	0	-	-	-	-
53755	31-May-16	506	1475	12782	65	1.2	13.0	11.8	13253	100	1.2	13	11.8	10782	66	1.2	7.9	6.7
53756	01-Jun-16	495	1800	2800	39	1.2	13.0	11.8	7437	91	2.7	16.8	14.1	0	-	-	-	-
53757	01-Jun-16	530	1750	714	5	1.2	18.6	17.4	1466	20	3.8	24.7	20.9	3292	28	2.7	18.6	15.9
53808	01-Jun-16	360	600	5683	43	1.2	18.6	17.4	7513	63	1.2	13.9	12.7	5168	32	1.2	18.6	17.4
53809	01-Jun-16	468	1300	3821	62	1.2	18.6	17.4	4659	58	3.8	18.6	14.8	1654	32	1.2	18.6	17.4
53810	01-Jun-16	532	-	1340	43	1.2	18.6	17.4	2374	68	3.8	18.6	14.8	1625	75	1.2	18.6	17.4
53811	01-Jun-16	405	-	62445	123	1.2	7.9	6.7	61299	156	1.2	9.4	8.2	0	-	-	-	-
53812	01-Jun-16	451	-	5047	27	1.2	20.0	18.8	0	-	-	-	-	0	-	-	-	-
25732	9-Jun-18	415	525	-	-	-	-	-	-	-	-	-	-	2502	19	1.2	40.9	39.7
25734	7-Jun-18	395	600	-	-	-	-	-	-	-	-	-	-	1429	7	1.2	21.6	20.4
25735	6-Jun-18	468	1250	-	-	-	-	-	-	-	-	-	-	1572	34	1.2	7.9	6.7
25736	7-Jun-18	482	1400	-	-	-	-	-	-	-	-	-	-	4814	18	1.2	10.3	9.1
25737	6-Jun-18	390	650	-	-	-	-	-	-	-	-	-	-	13243	78	1.2	4.4	3.2
25738	6-Jun-18	569	1725	-	-	-	-	-	-	-	-	-	-	2300	20	1.2	36.1	34.9
25741	6-Jun-18	409	625	-	-	-	-	-	-	-	-	-	-	45733	120	1.2	2.7	1.5

## APPENDIX 2:

# LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE UPSTREAM OF GULL RAPIDS JUNE 2016 TO OCTOBER 2018

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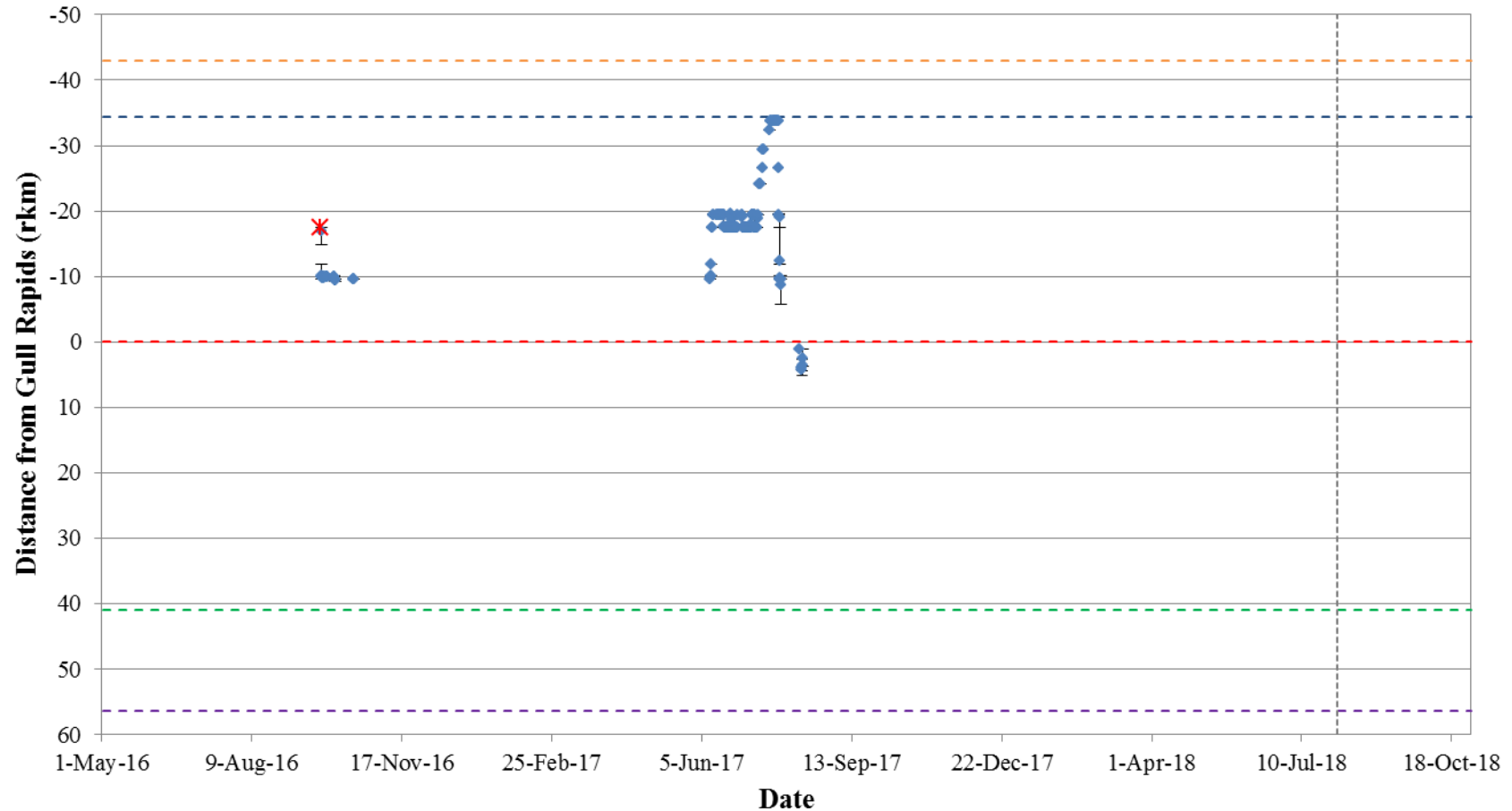
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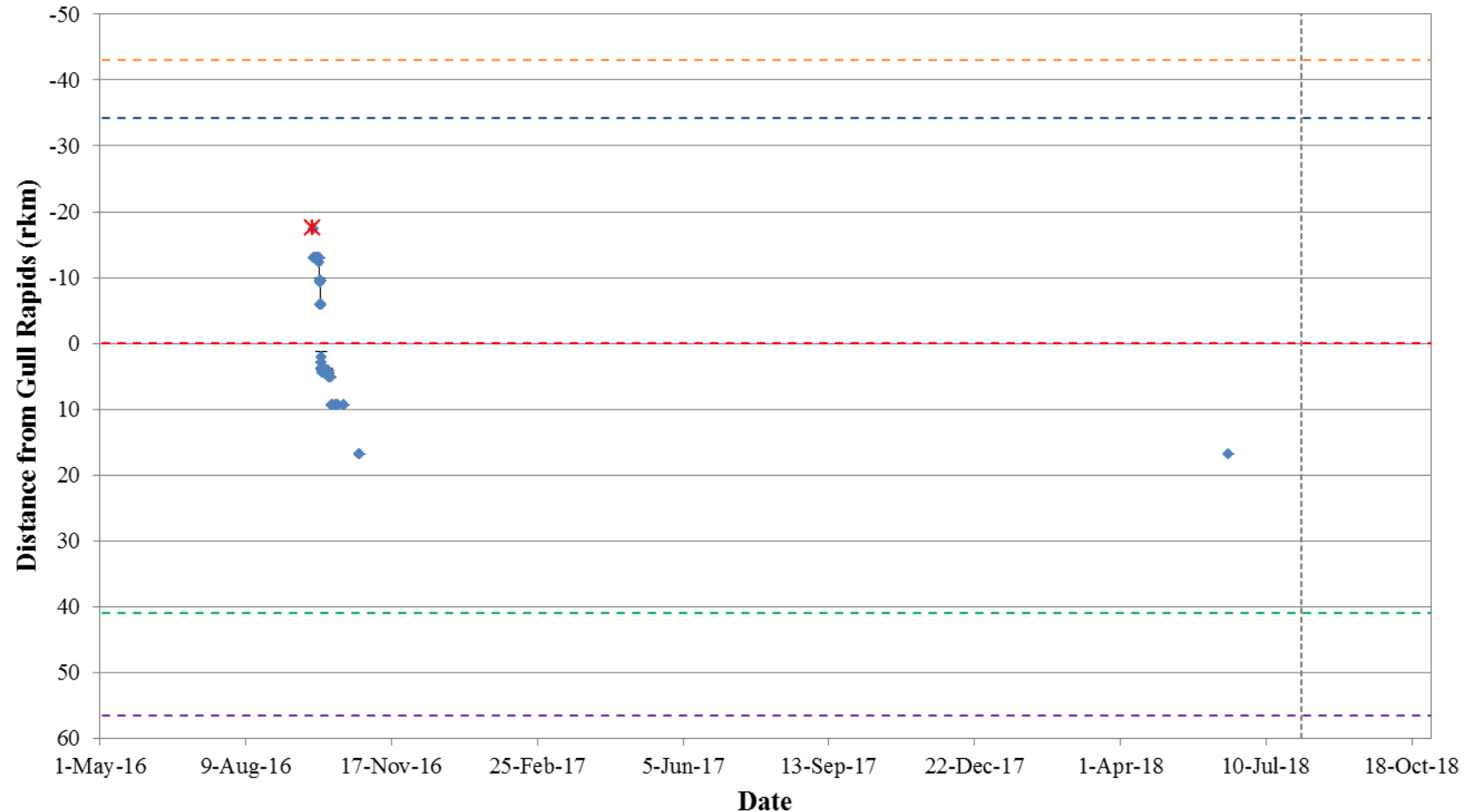
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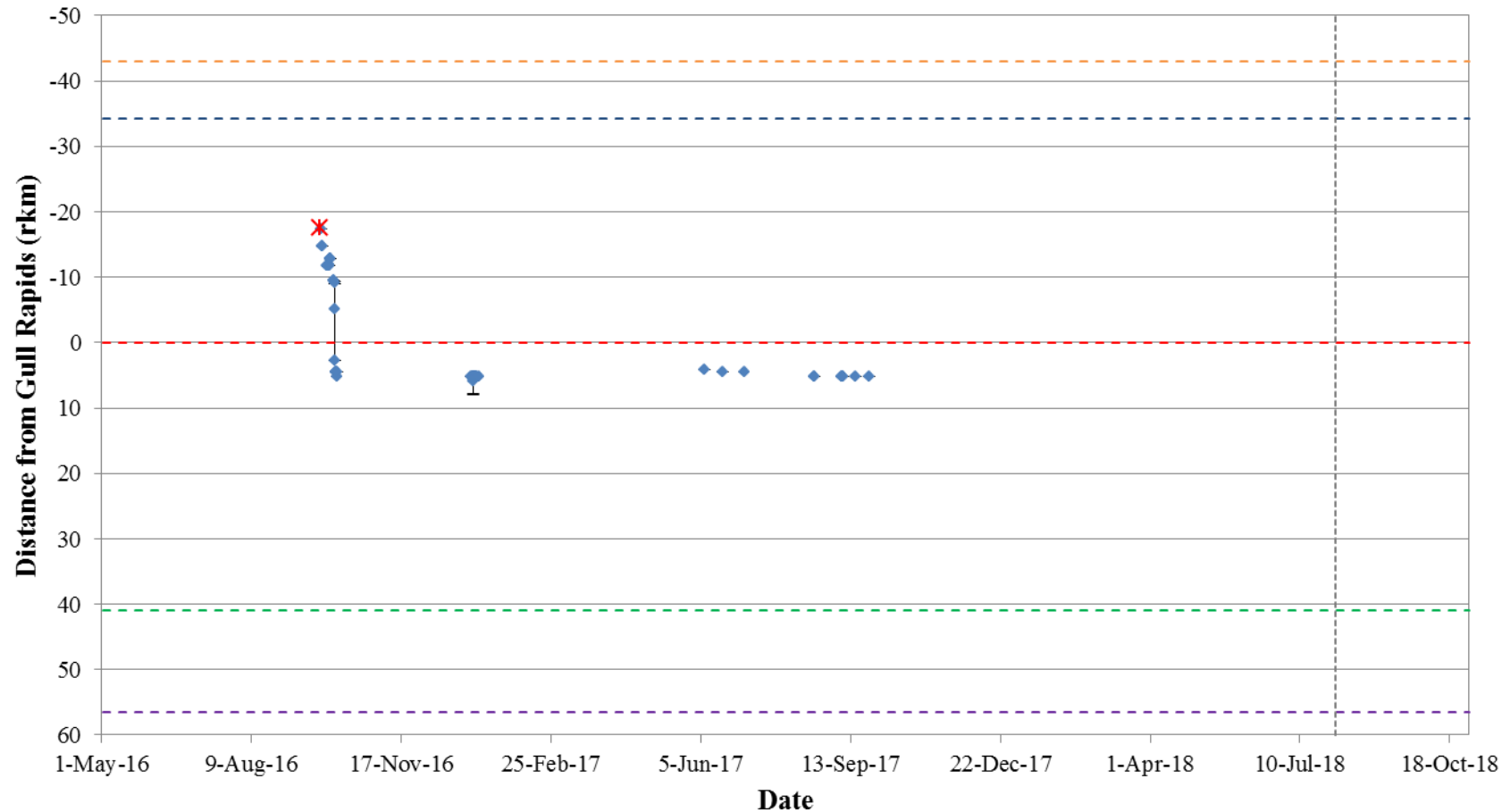
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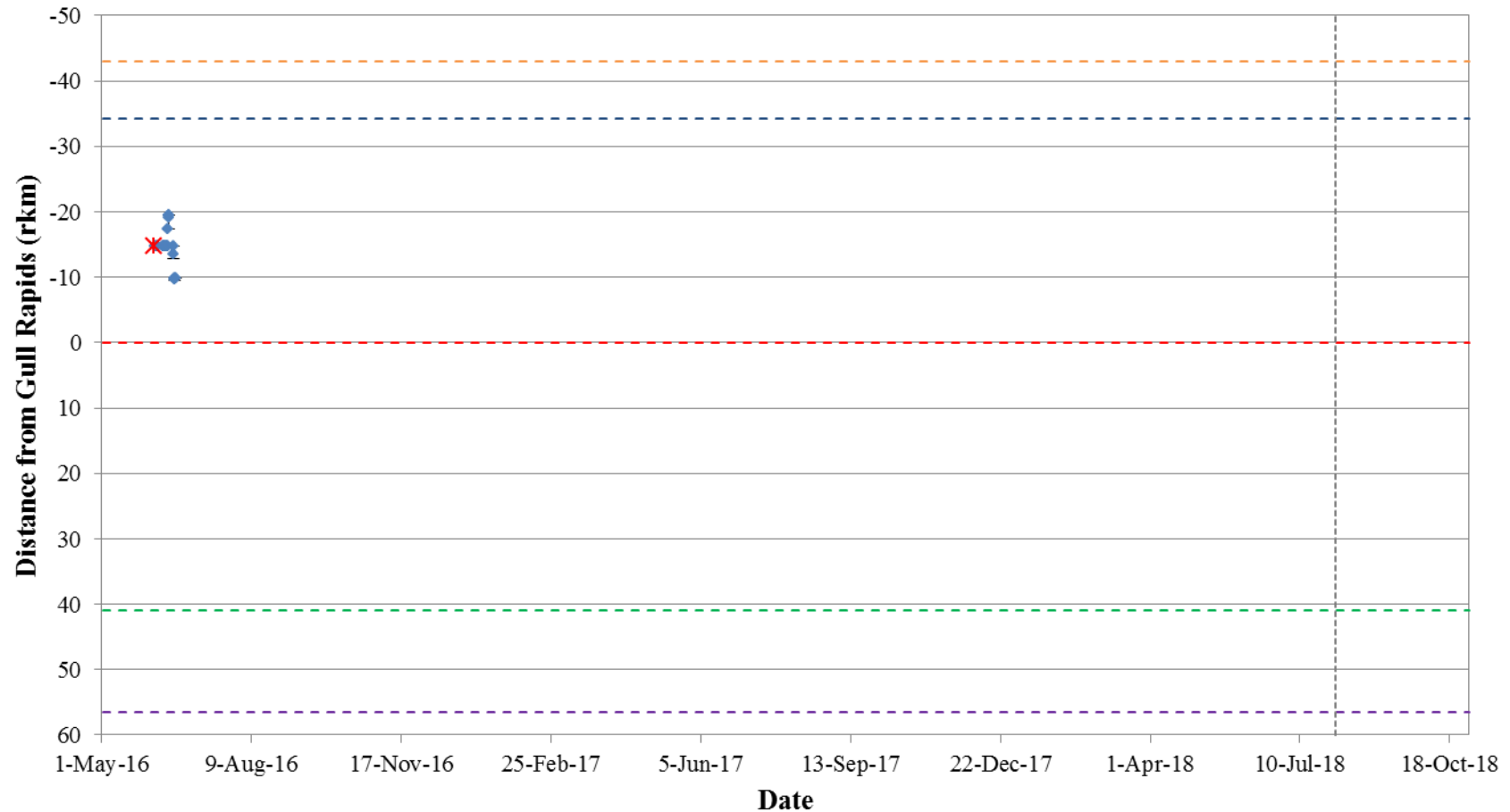
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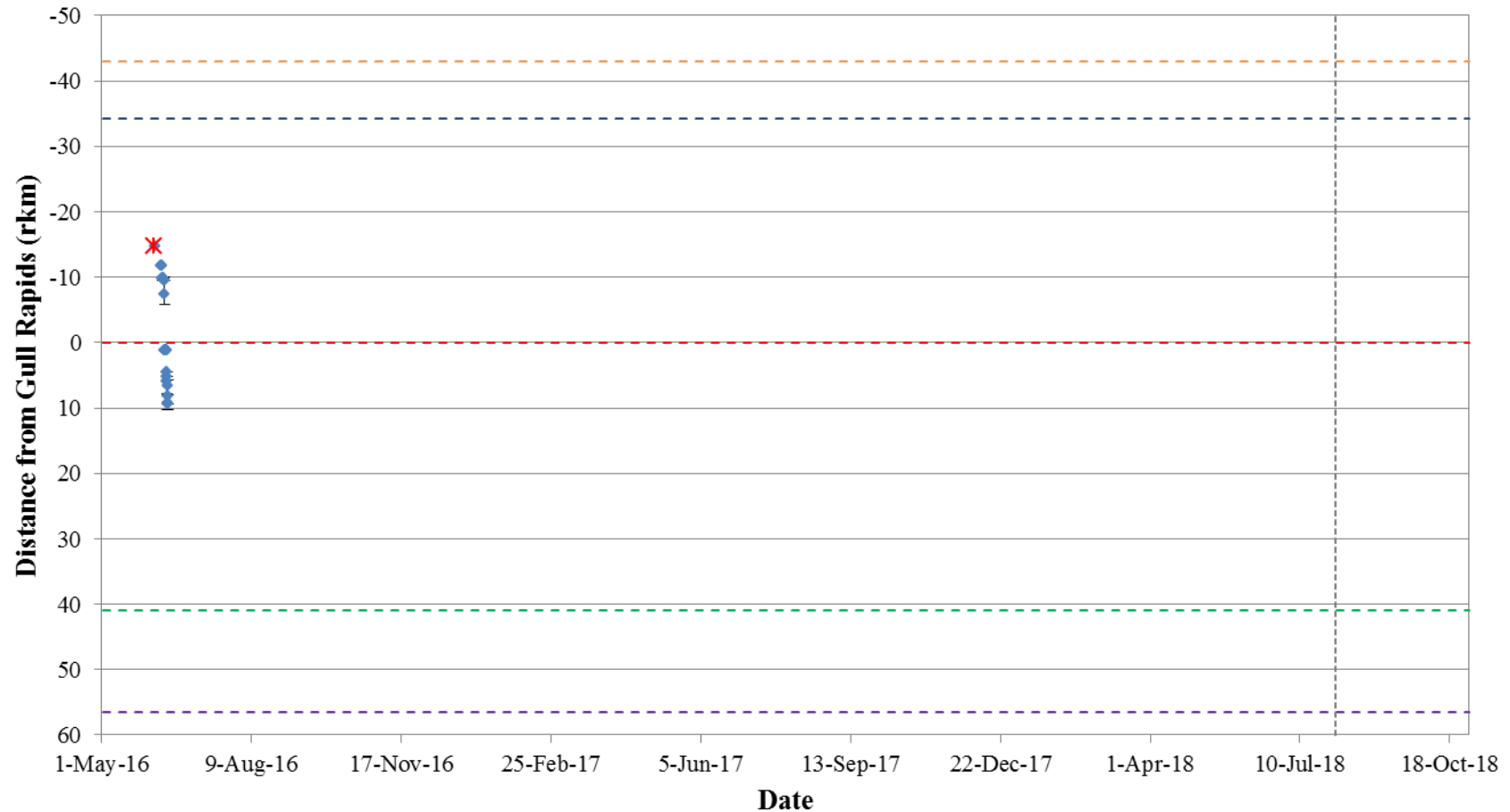
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**Figure A2-3: Position of a Walleye tagged with an acoustic transmitter (code #53760) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

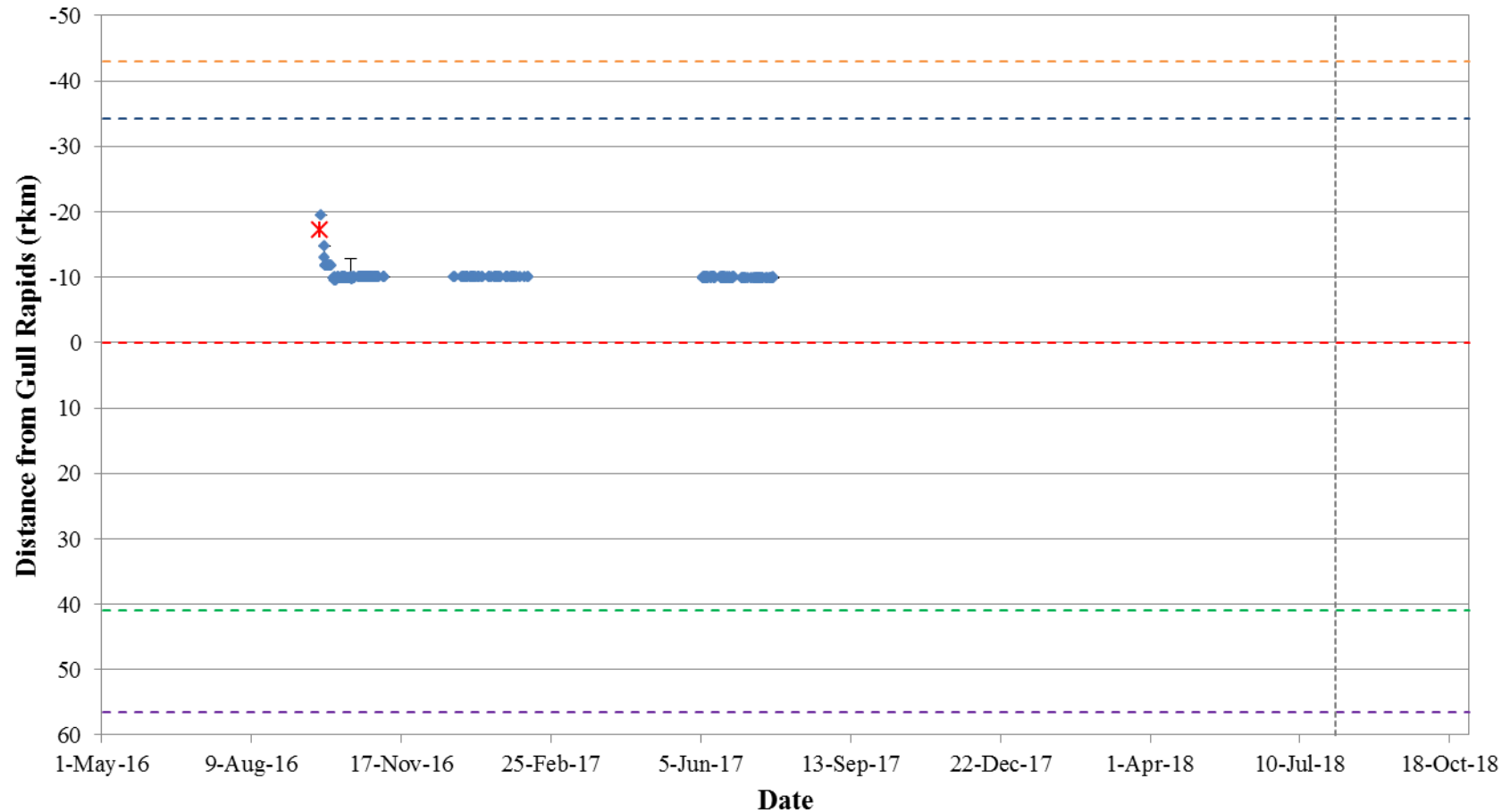


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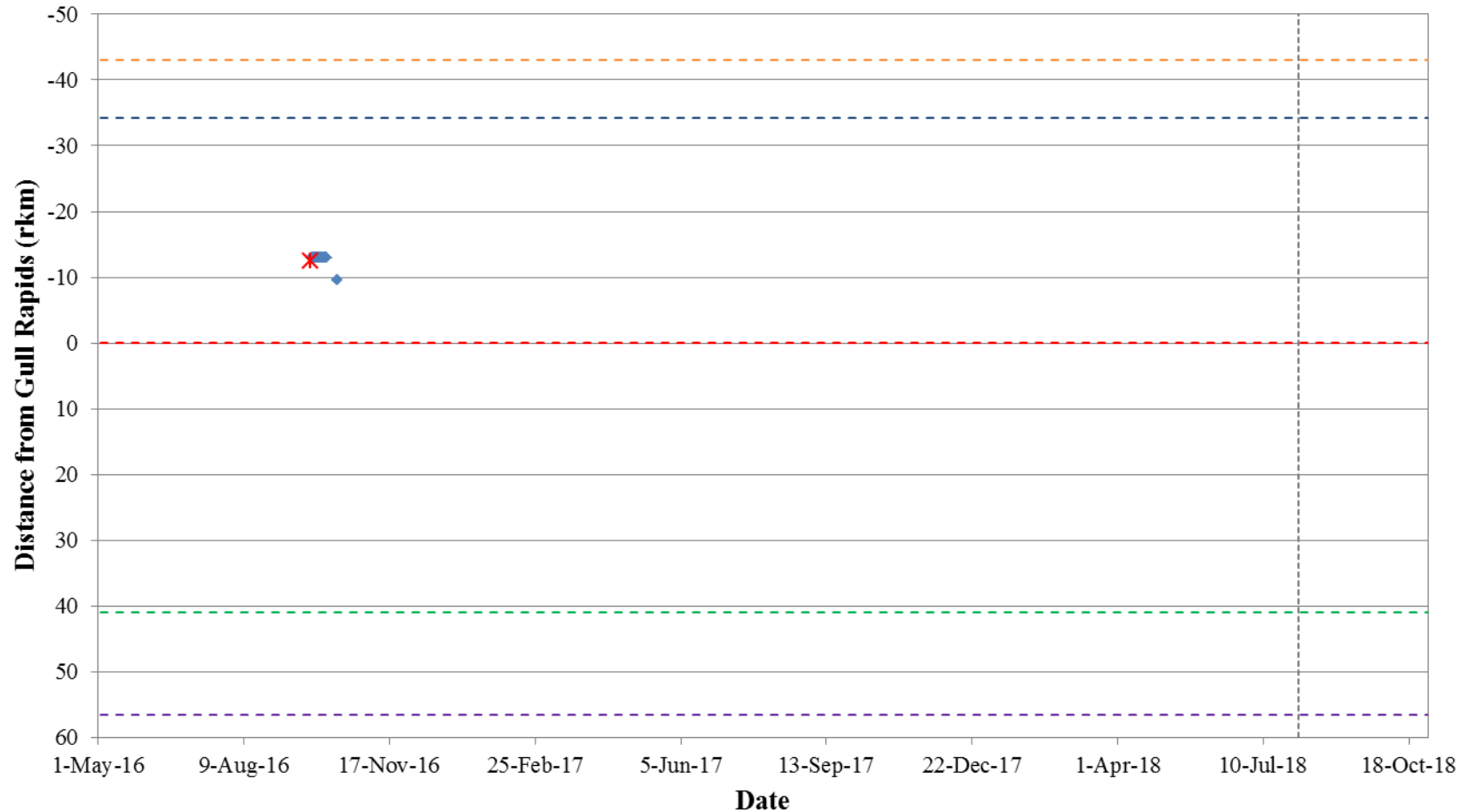


**Figure A2-5: Position of a Walleye tagged with an acoustic transmitter (code #53764) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

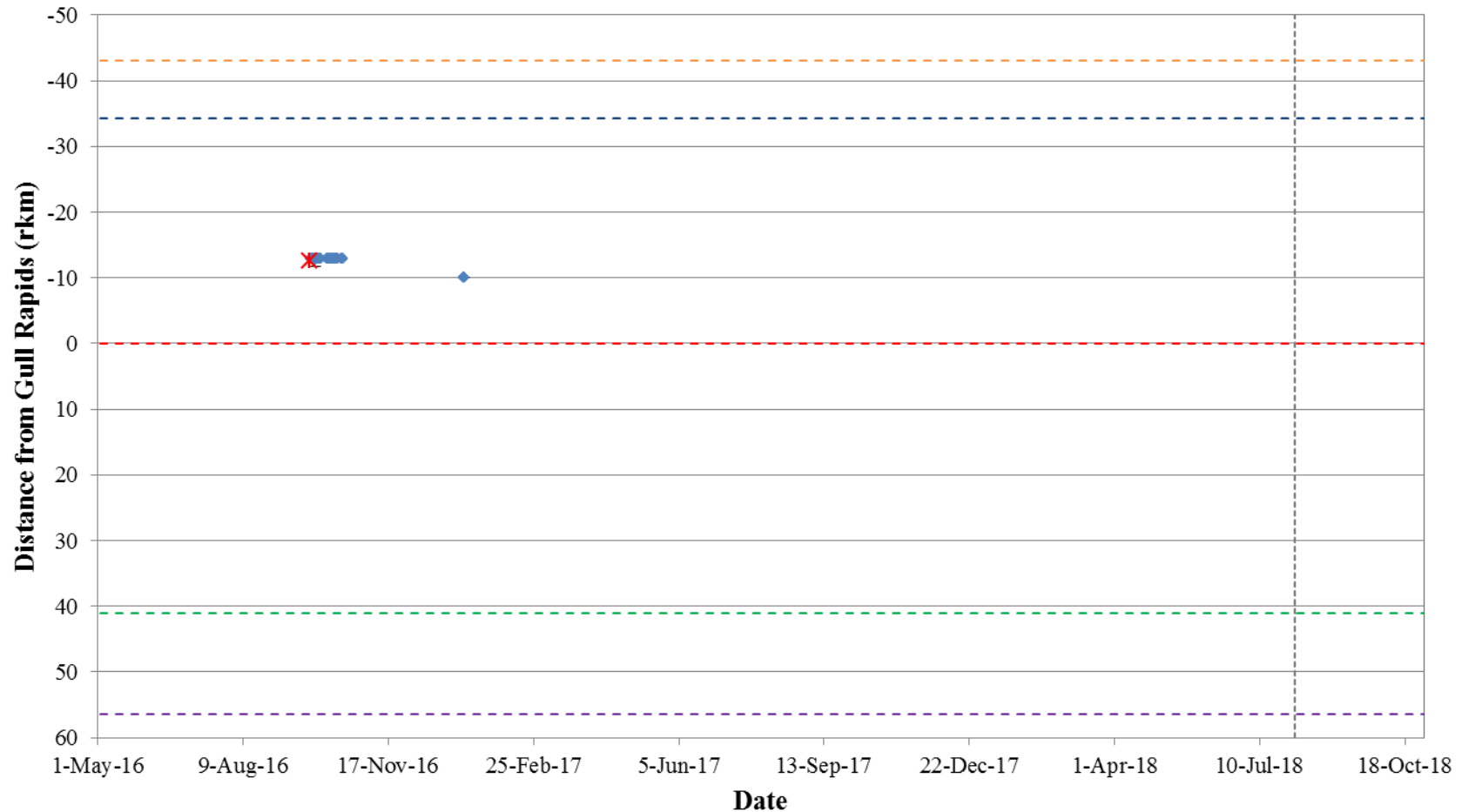




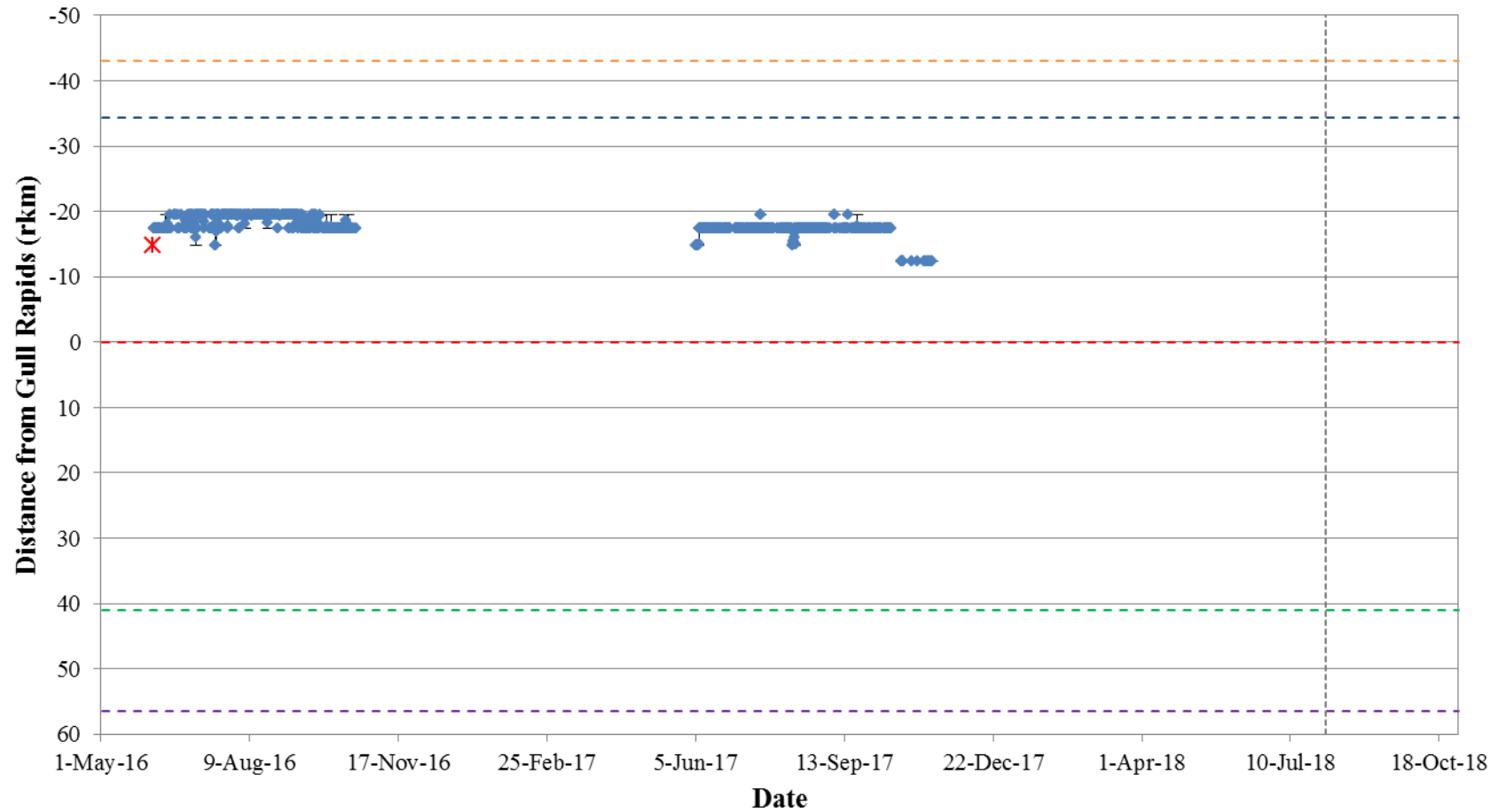
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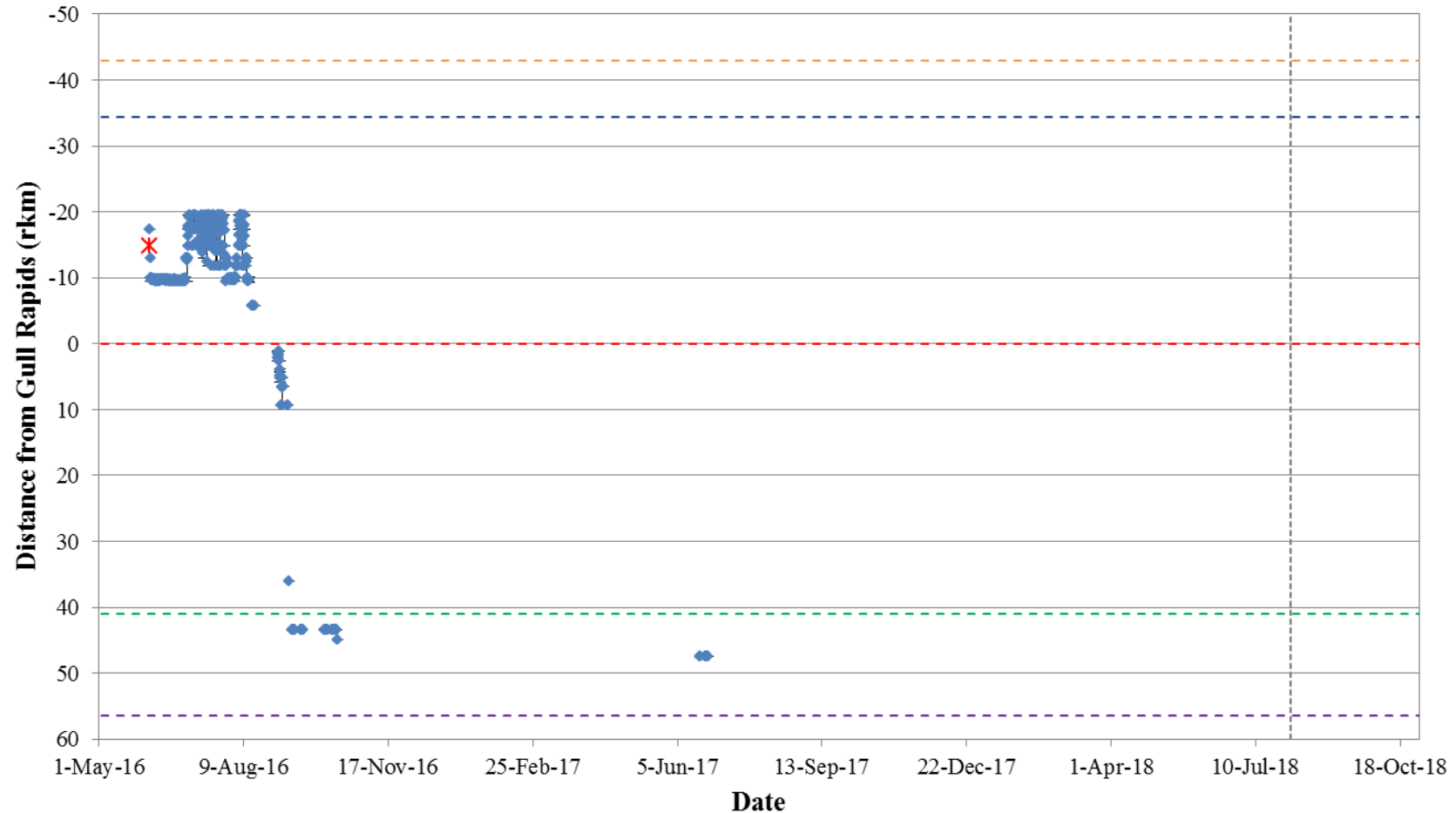
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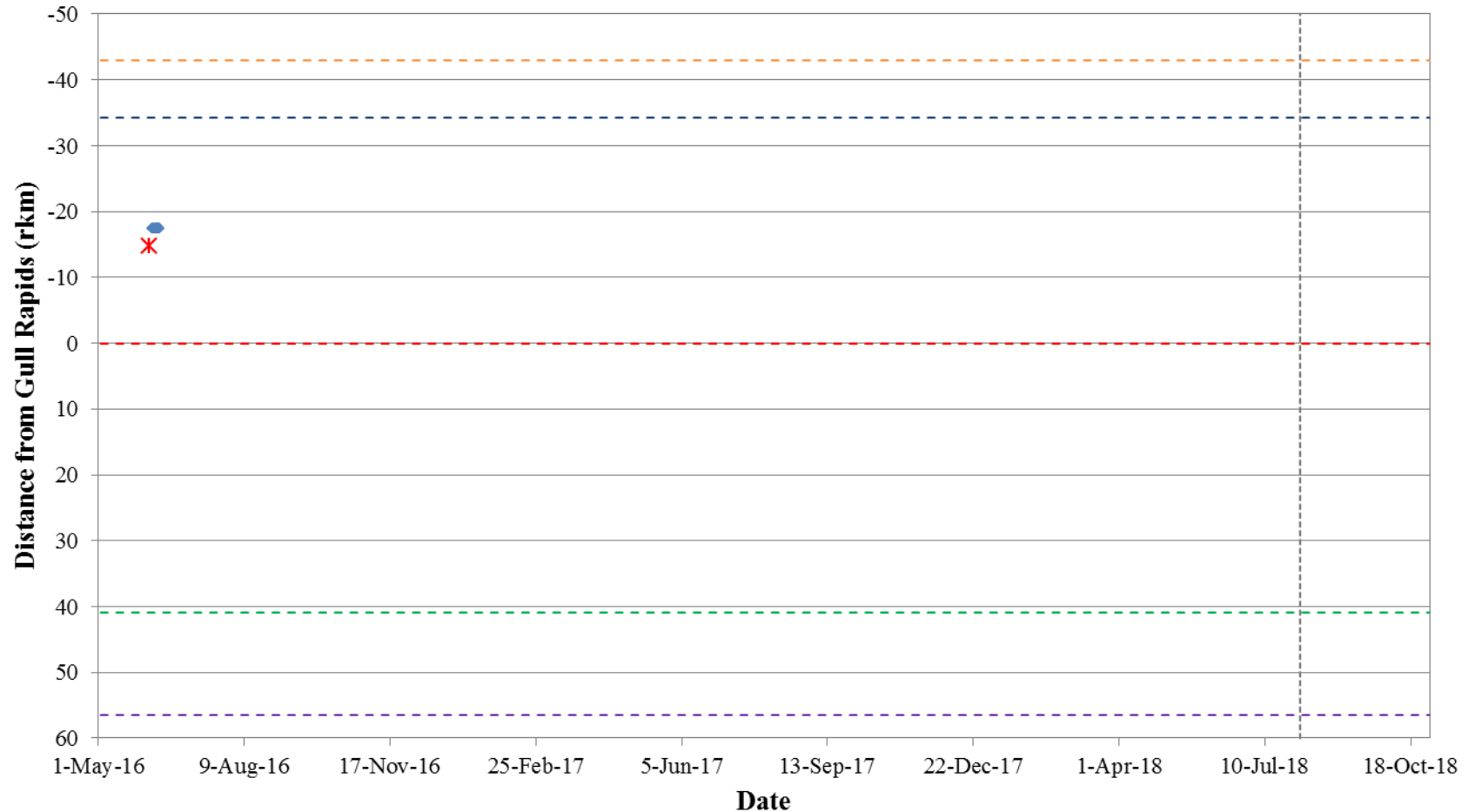
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**Figure A2-9: Position of a Walleye tagged with an acoustic transmitter (code #53768) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

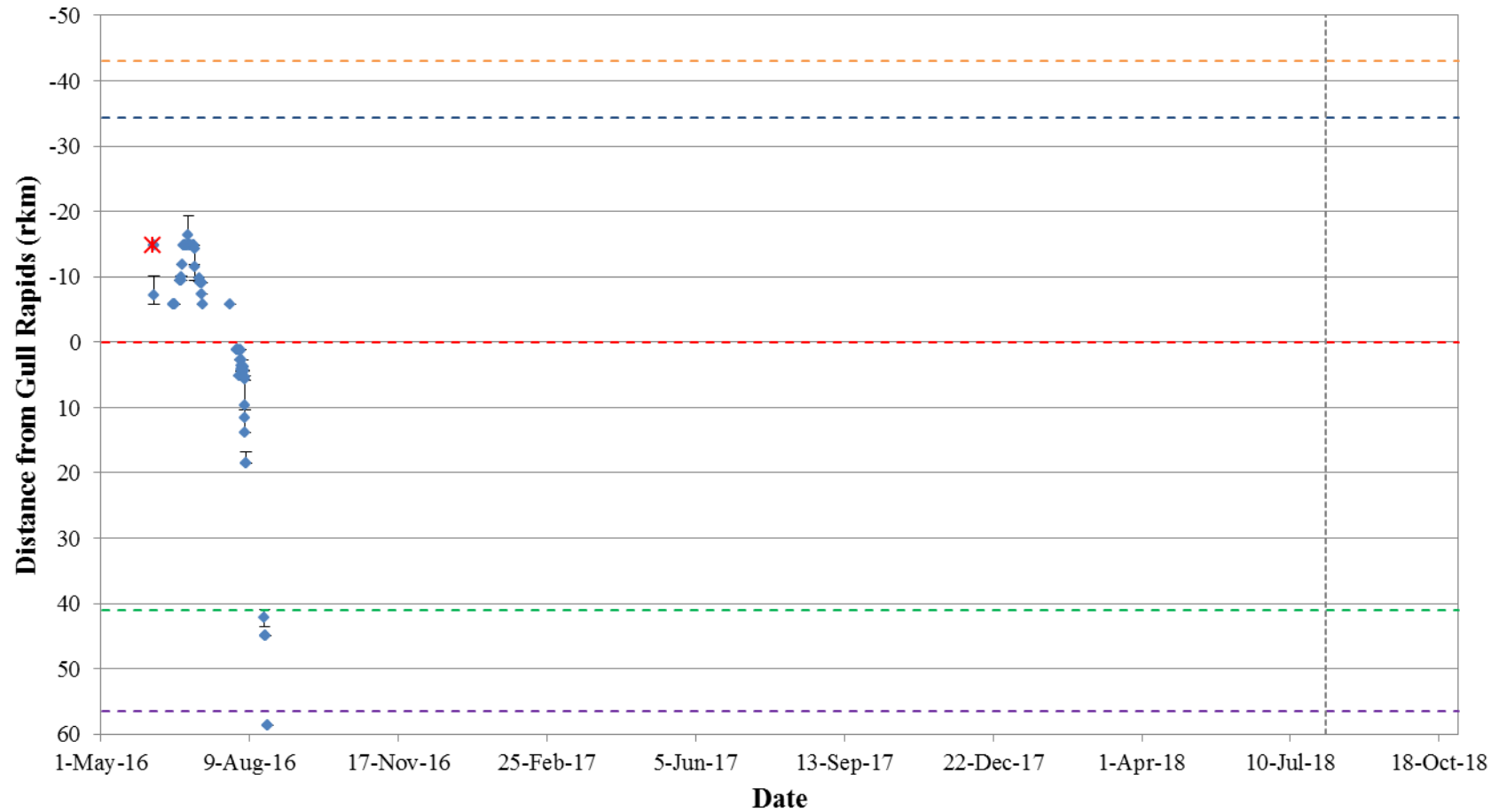


**Figure A2-10: Position of a Walleye tagged with an acoustic transmitter (code #53769) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

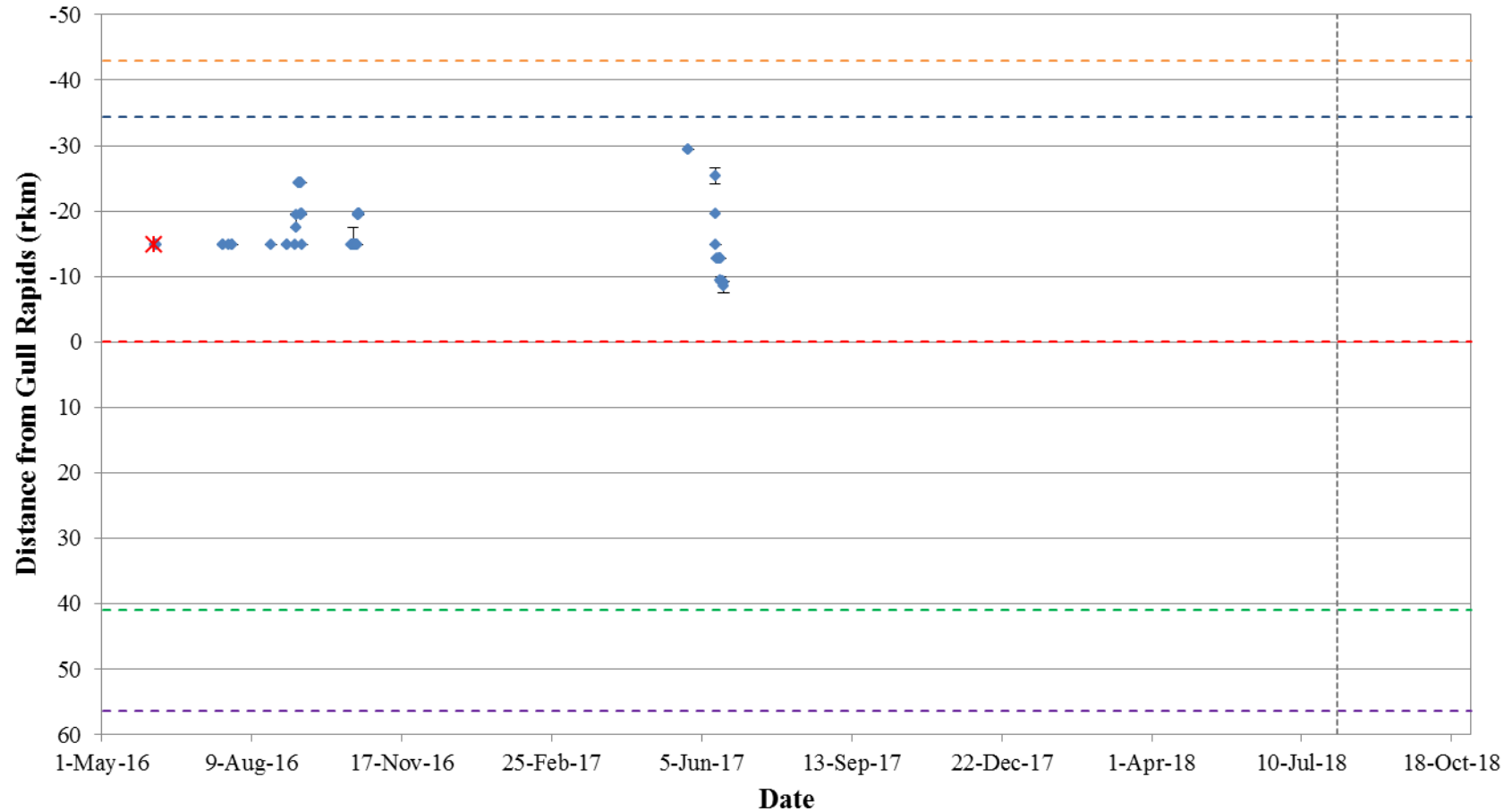


**Figure A2-11: Position of a Walleye tagged with an acoustic transmitter (code #53770) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

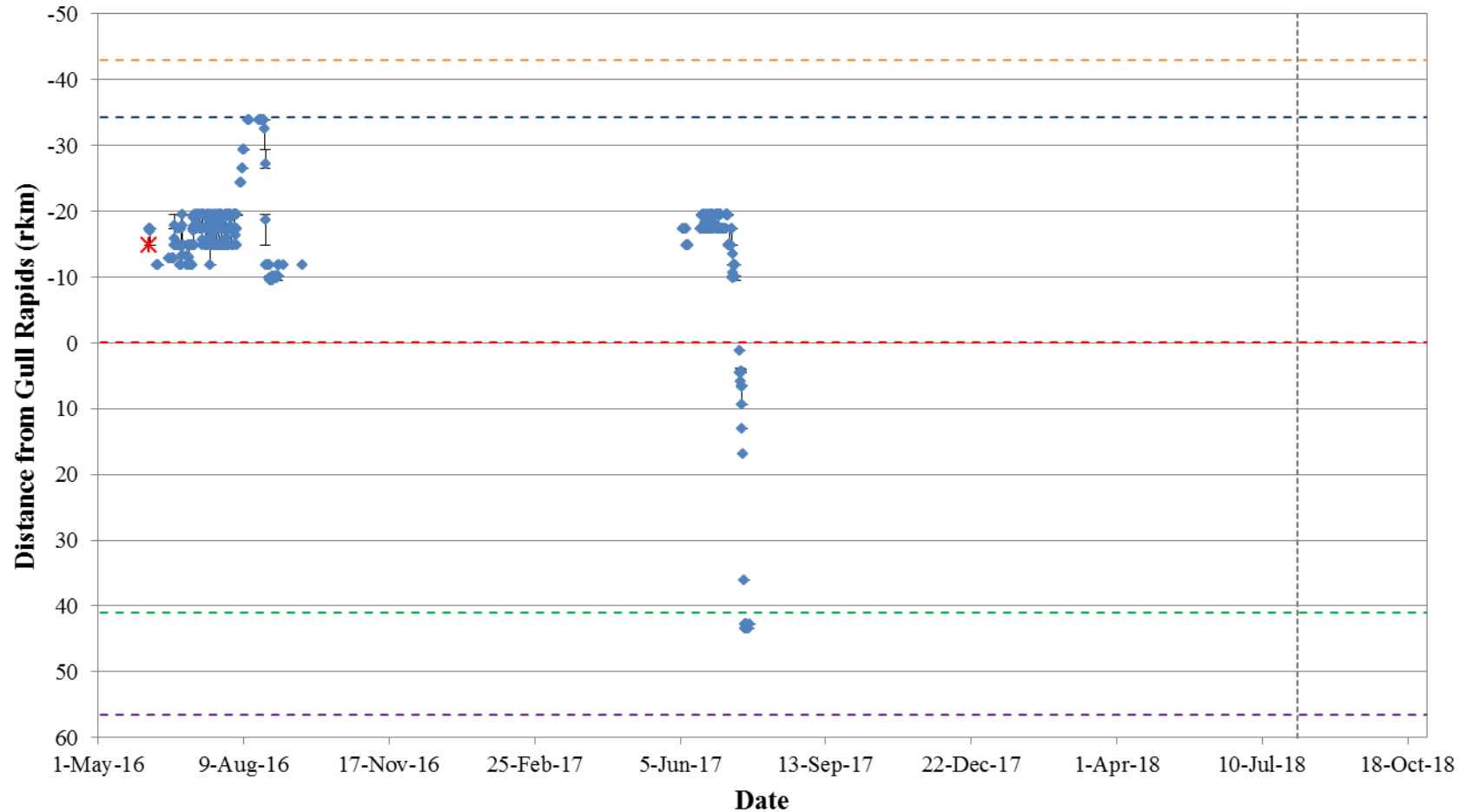




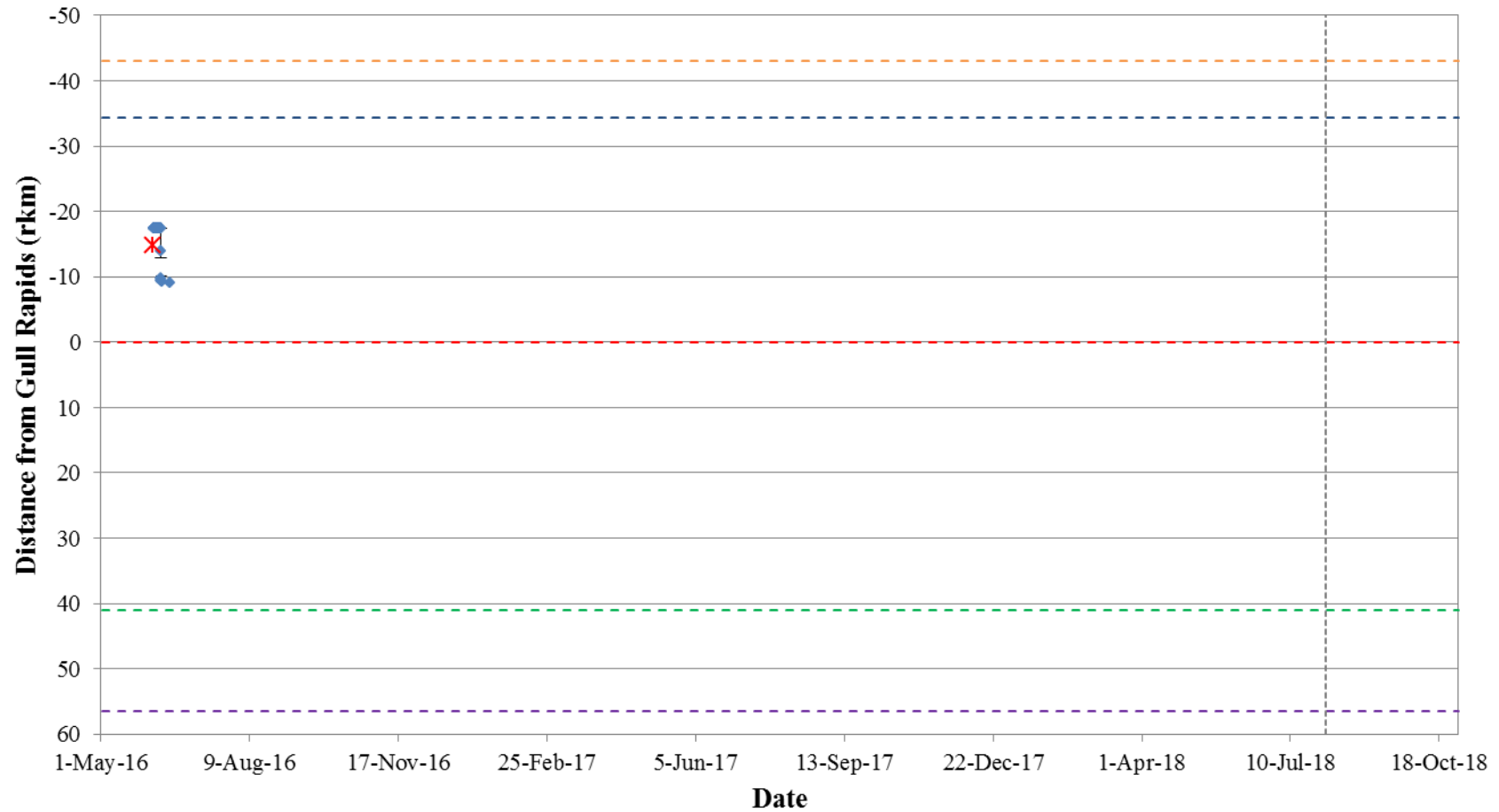
**Figure A2-12: Position of a Walleye tagged with an acoustic transmitter (code #53771) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



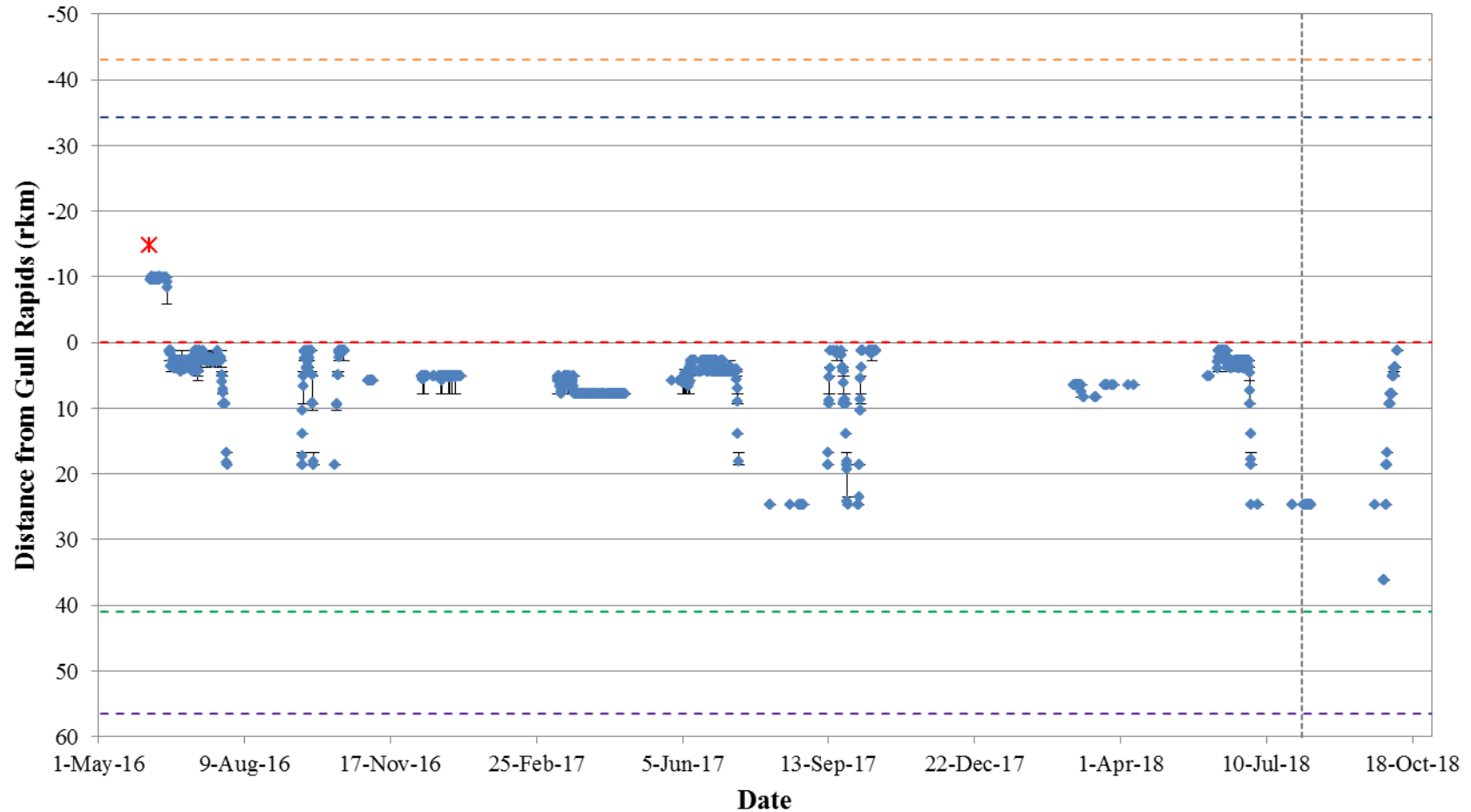
**Figure A2-13: Position of a Walleye tagged with an acoustic transmitter (code #53772) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



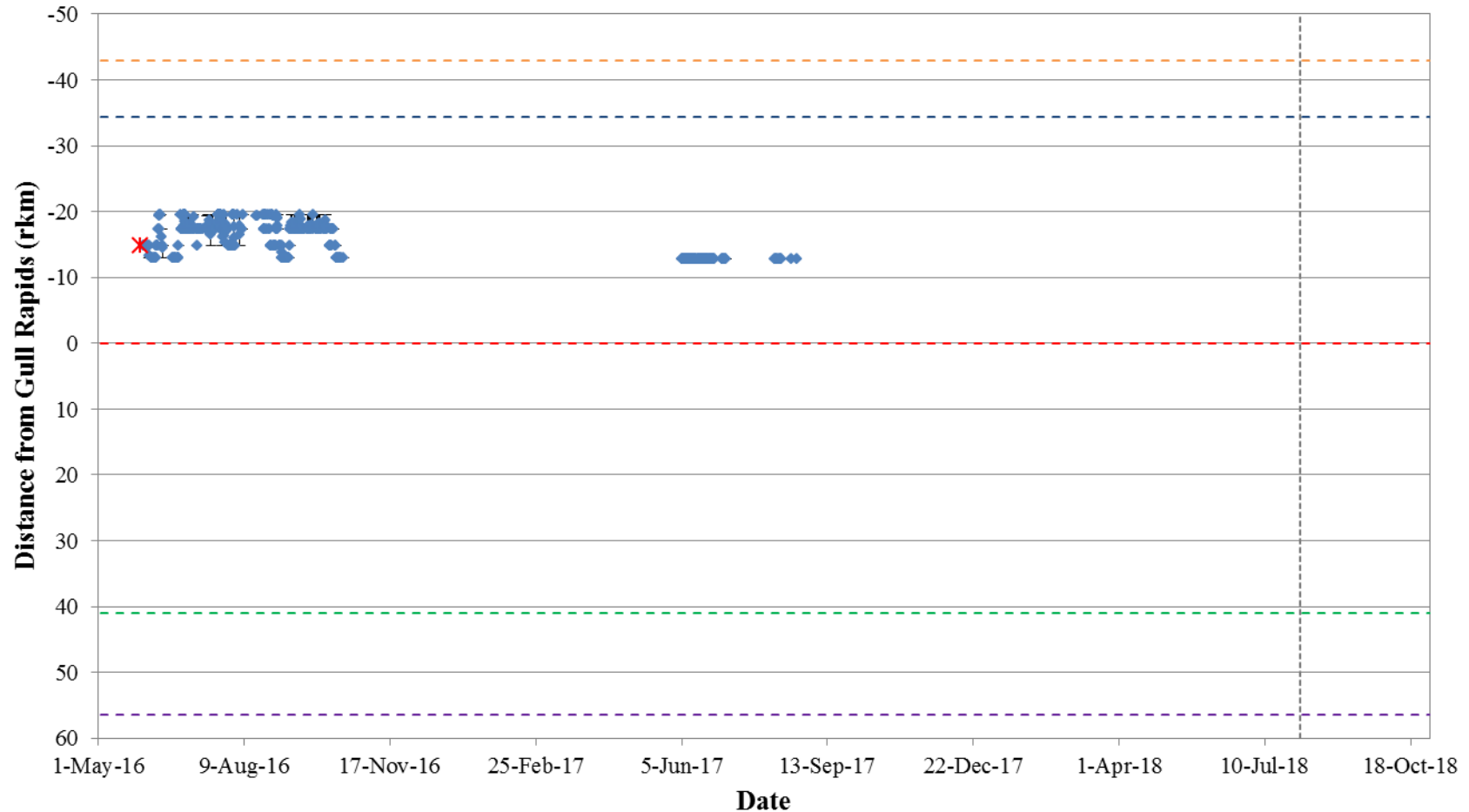
**Figure A2-14: Position of a Walleye tagged with an acoustic transmitter (code #53773) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



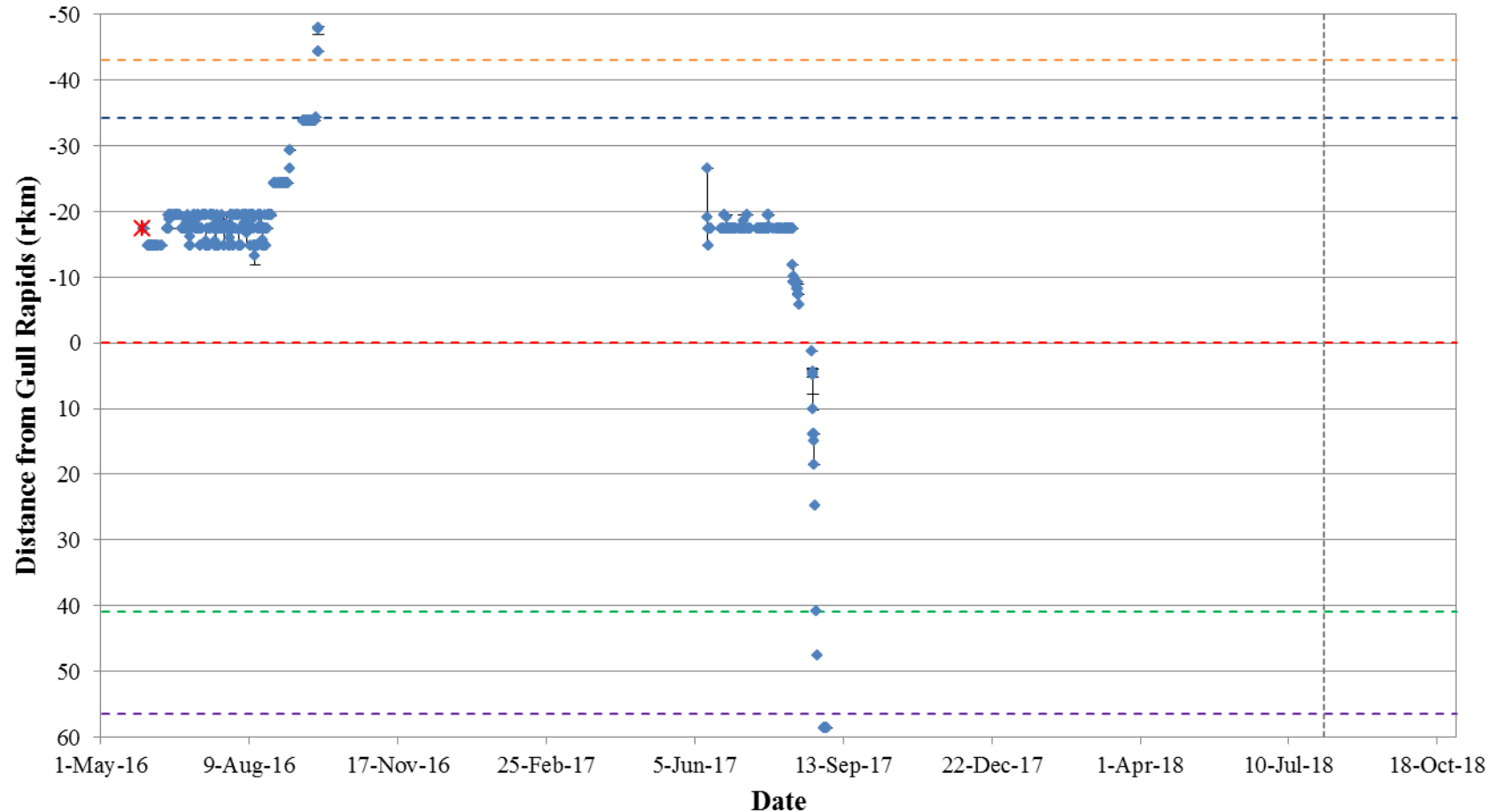
**Figure A2-15: Position of a Walleye tagged with an acoustic transmitter (code #53774) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-16: Position of a Walleye tagged with an acoustic transmitter (code #53775) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

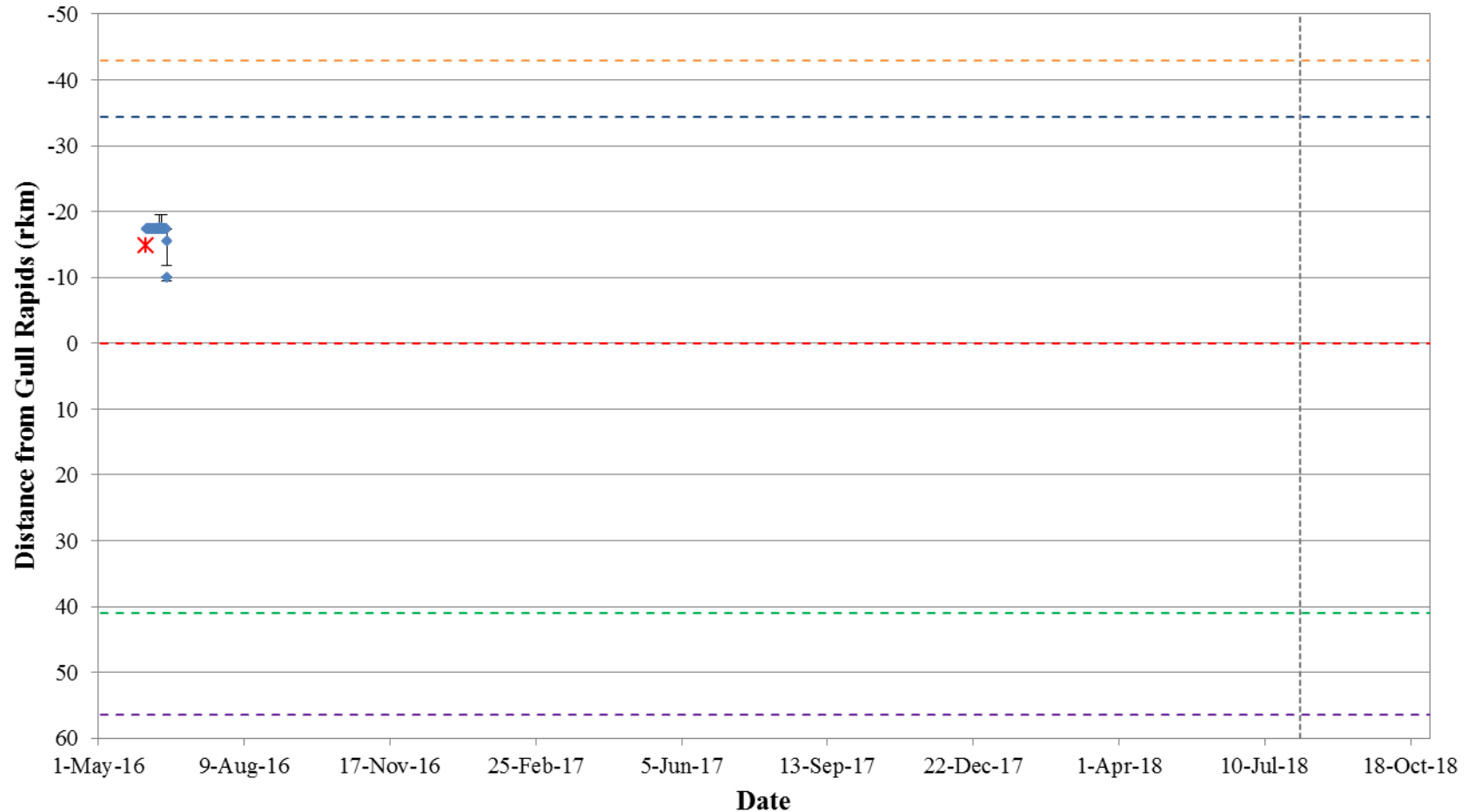


**Figure A2-17: Position of a Walleye tagged with an acoustic transmitter (code #53776) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

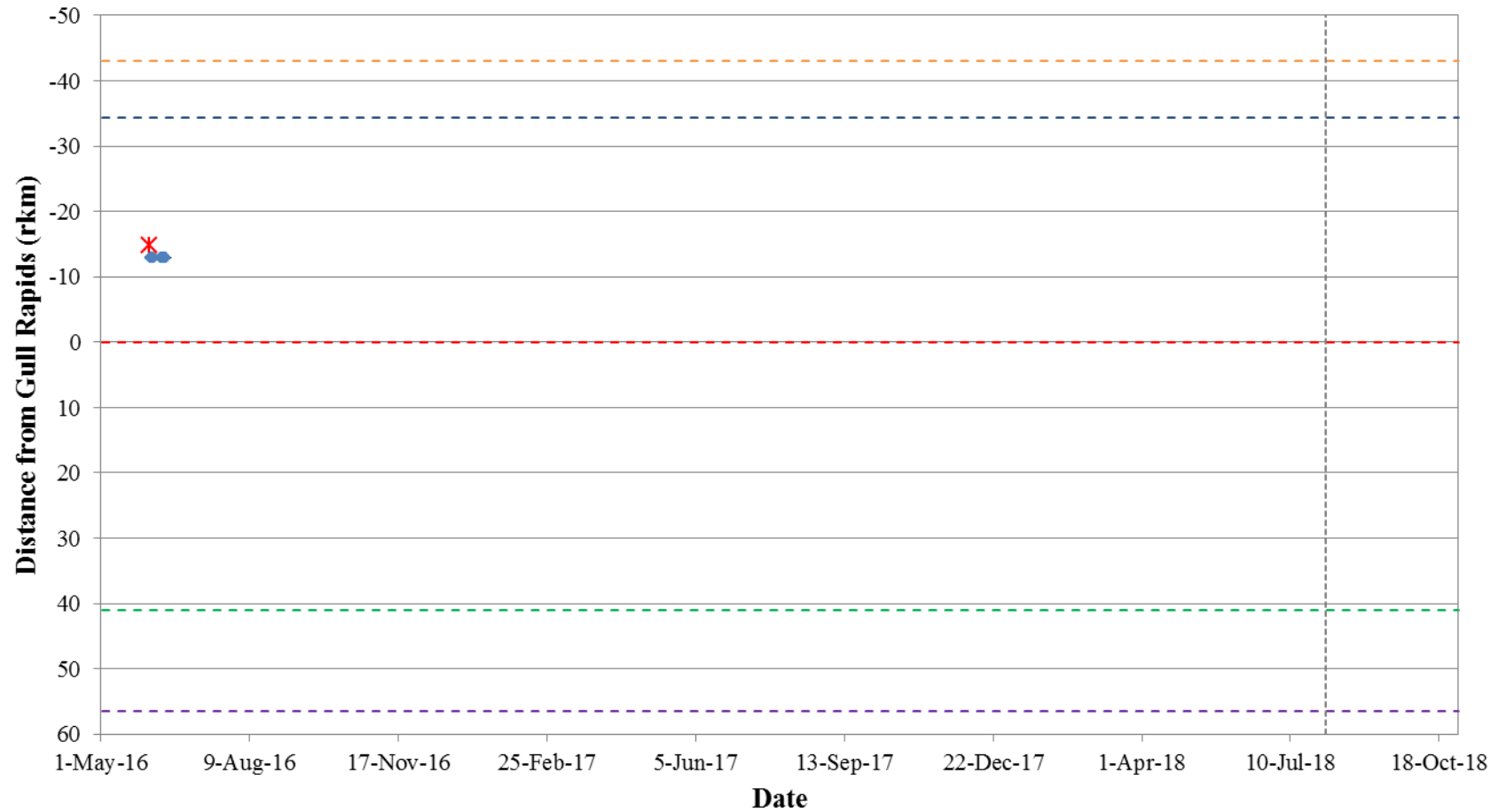


**Figure A2-18: Position of a Walleye tagged with an acoustic transmitter (code #53777) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

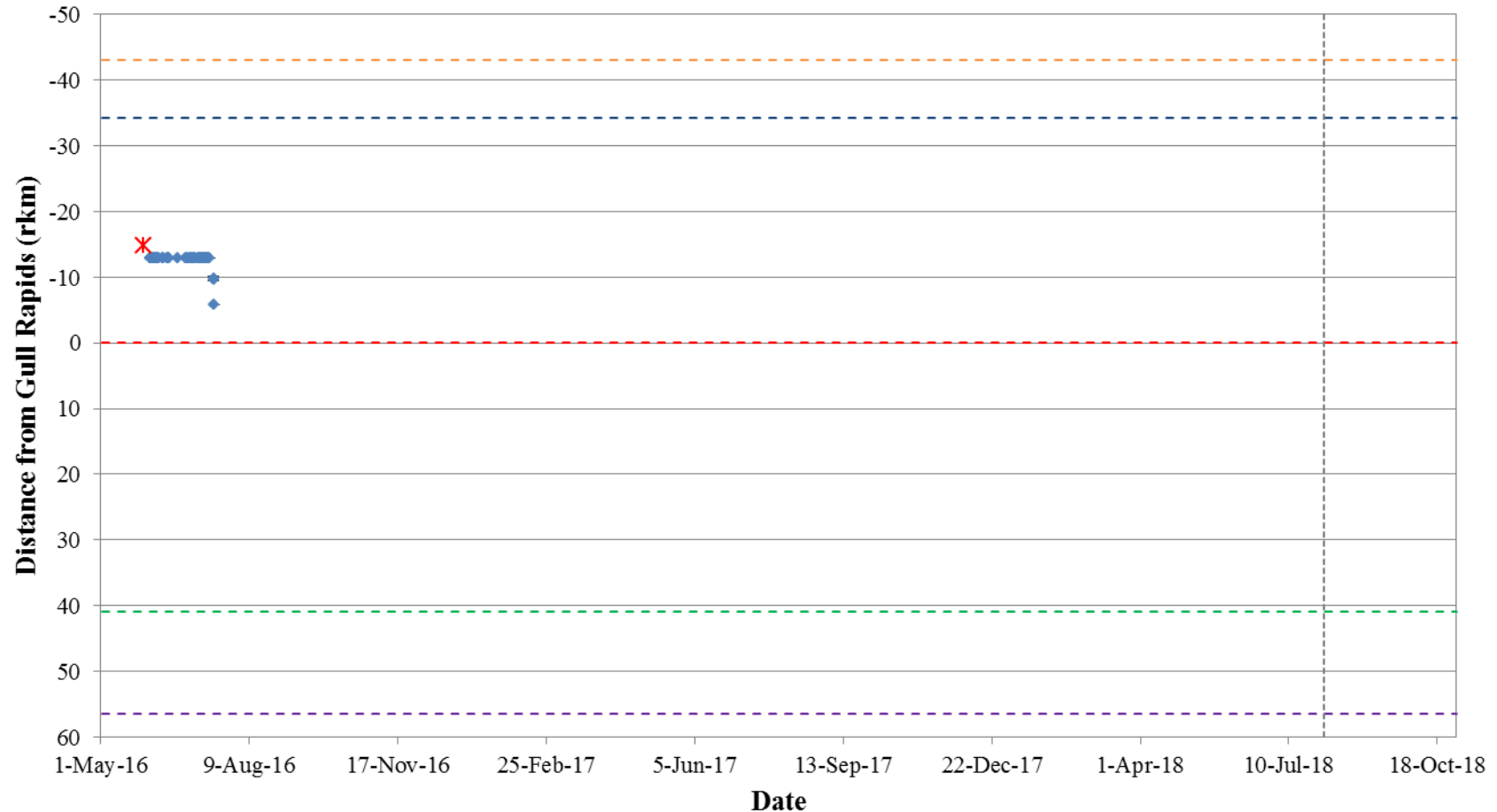




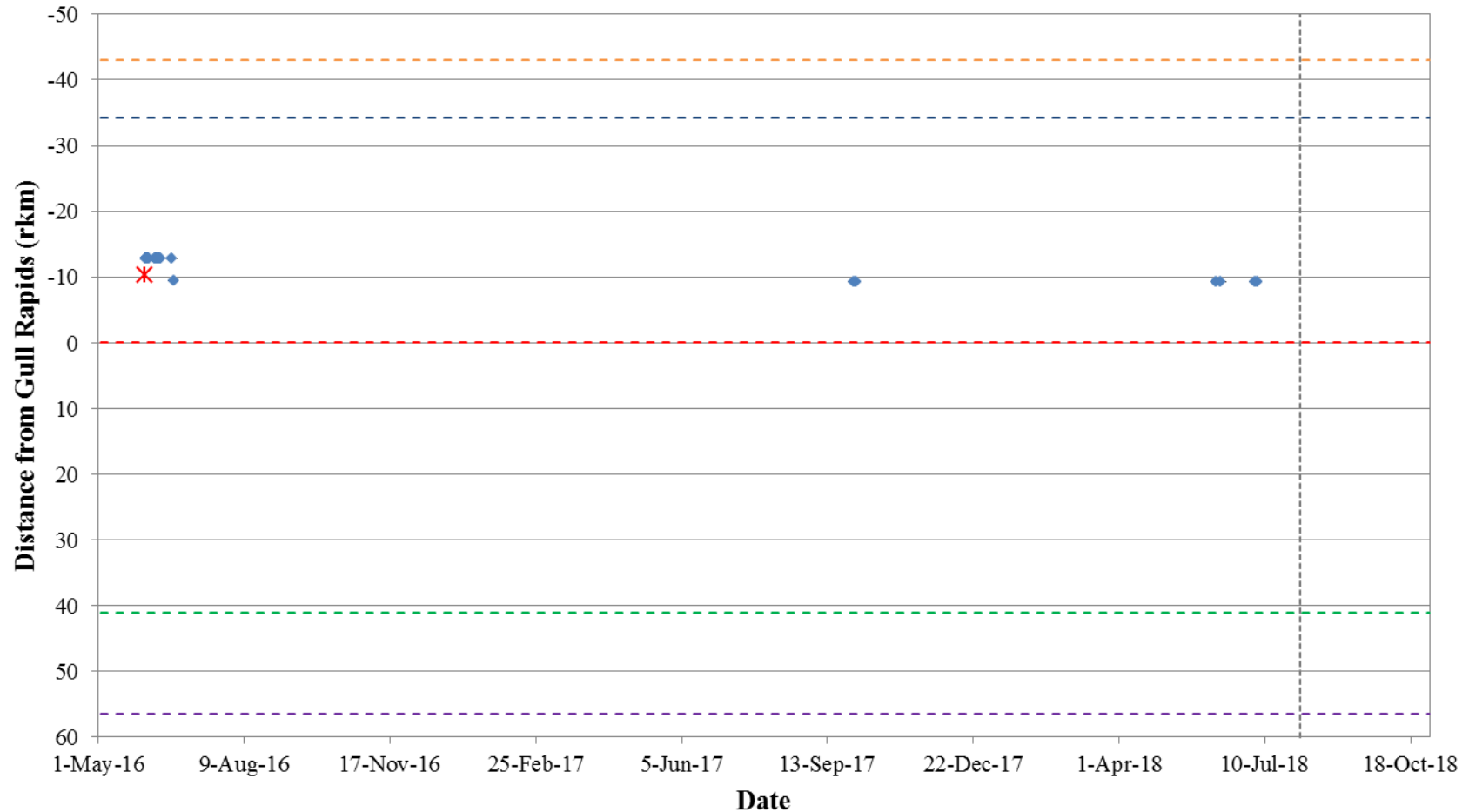
**Figure A2-19: Position of a Walleye tagged with an acoustic transmitter (code #53778) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

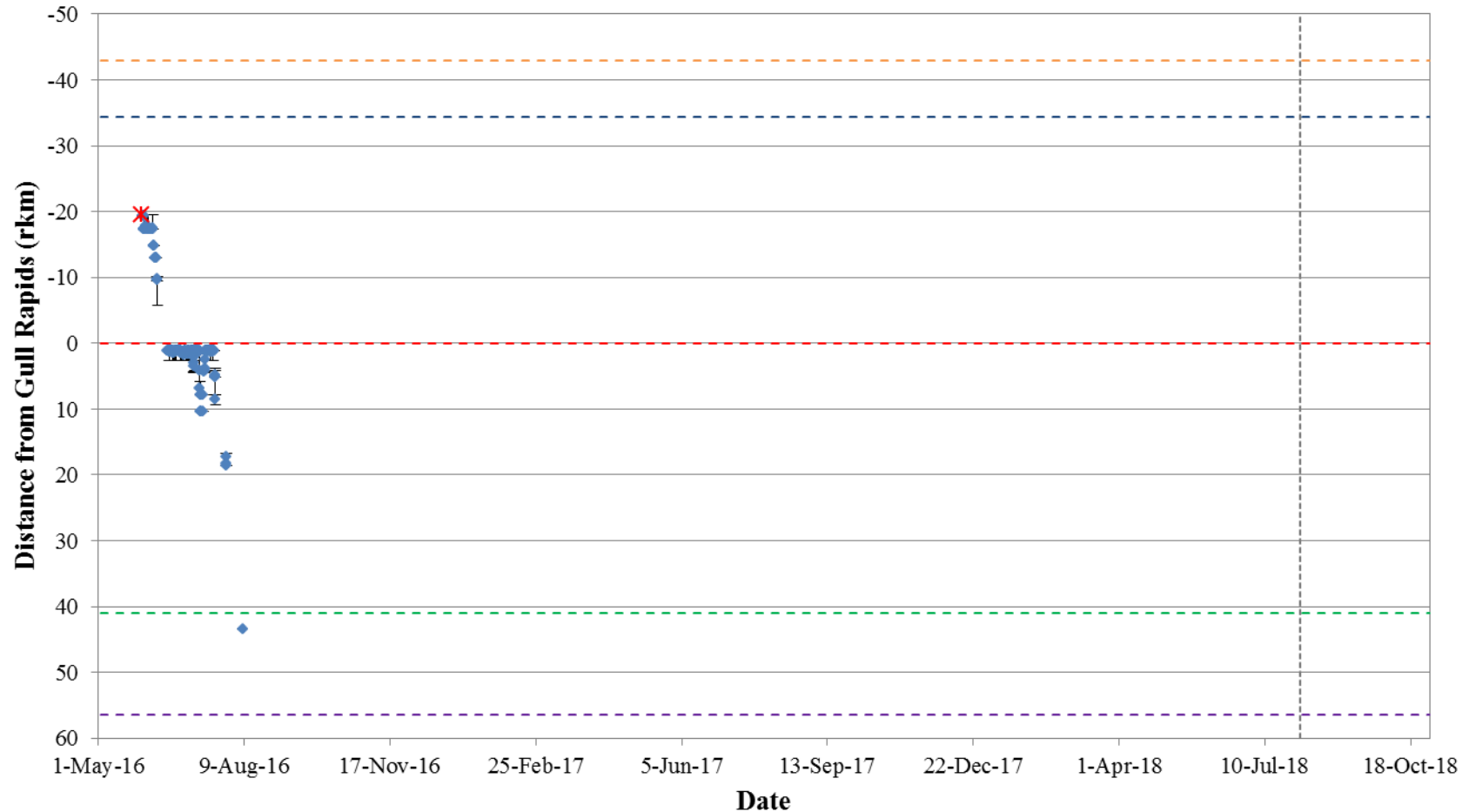


**Figure A2-20: Position of a Walleye tagged with an acoustic transmitter (code #53779) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

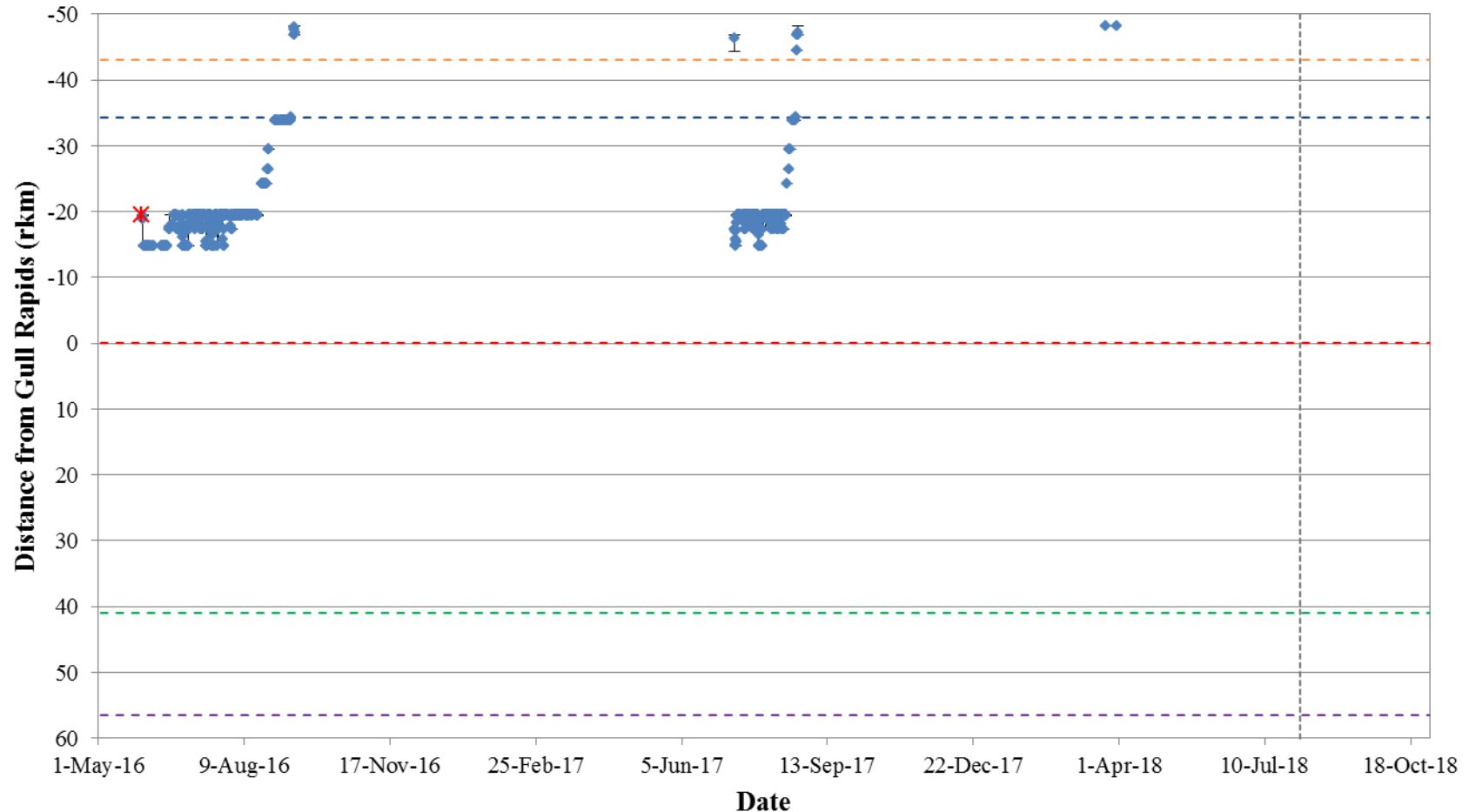


**Figure A2-21: Position of a Walleye tagged with an acoustic transmitter (code #53780) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

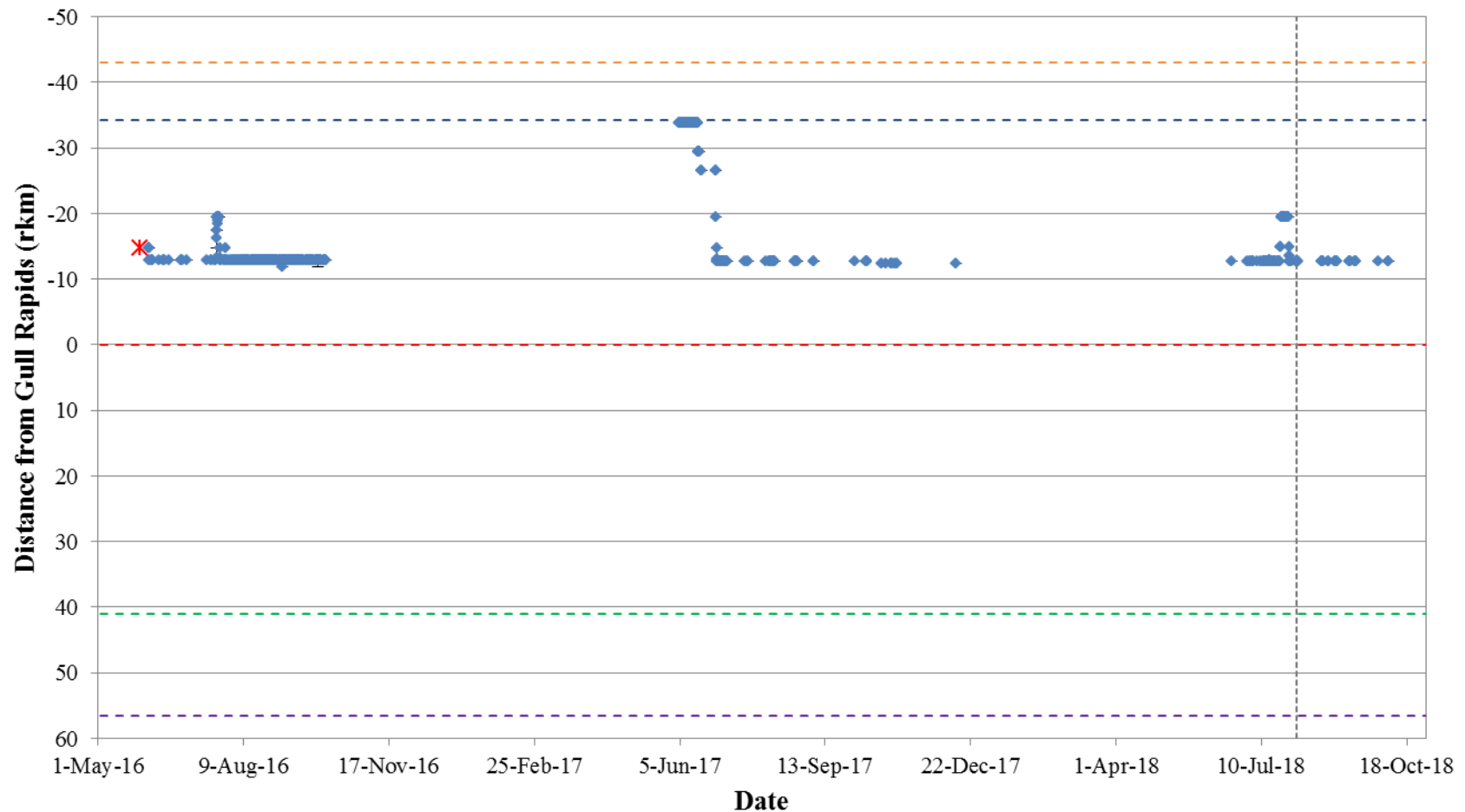




**Figure A2-23: Position of a Walleye tagged with an acoustic transmitter (code #53782) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

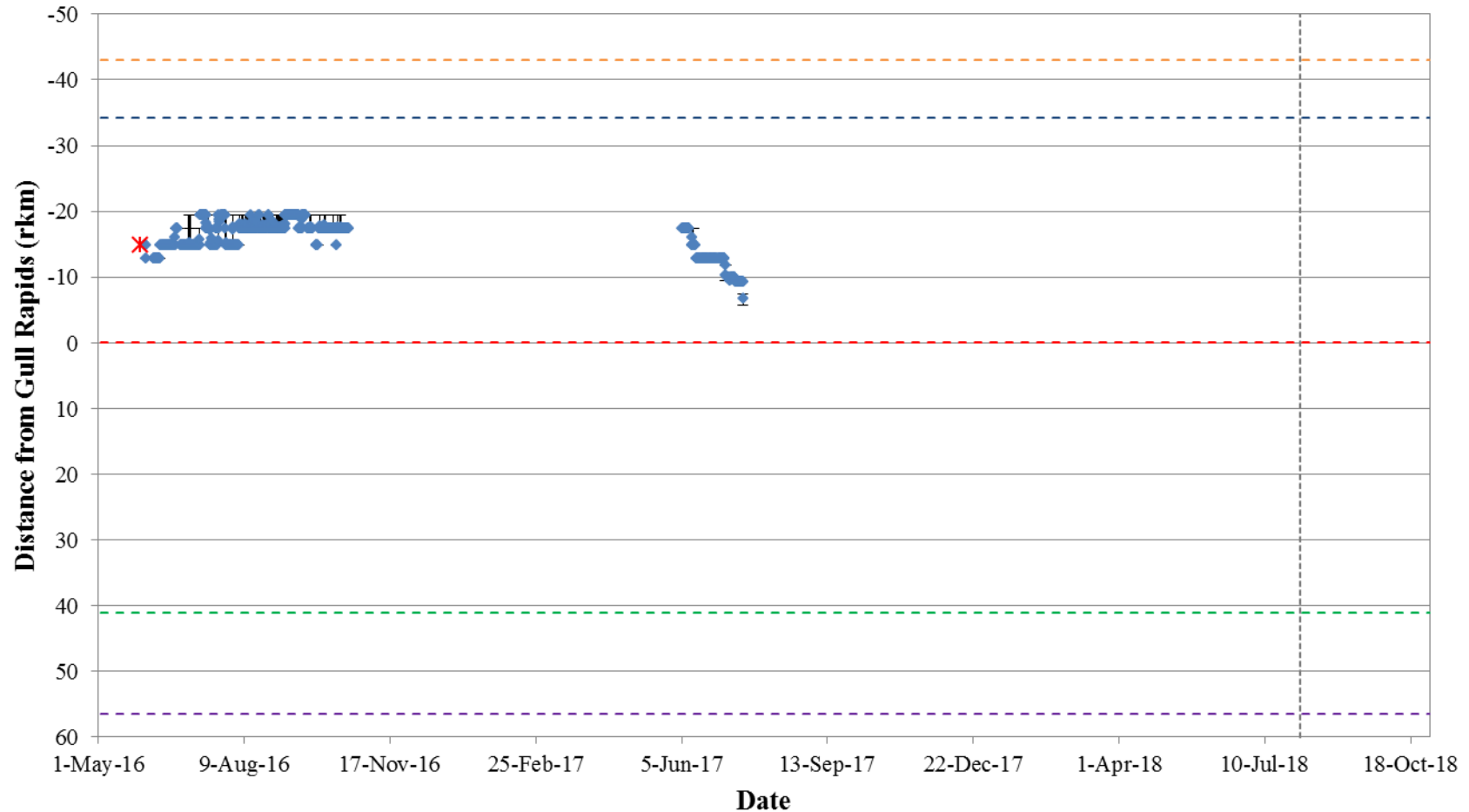


**Figure A2-24: Position of a Walleye tagged with an acoustic transmitter (code #53783) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

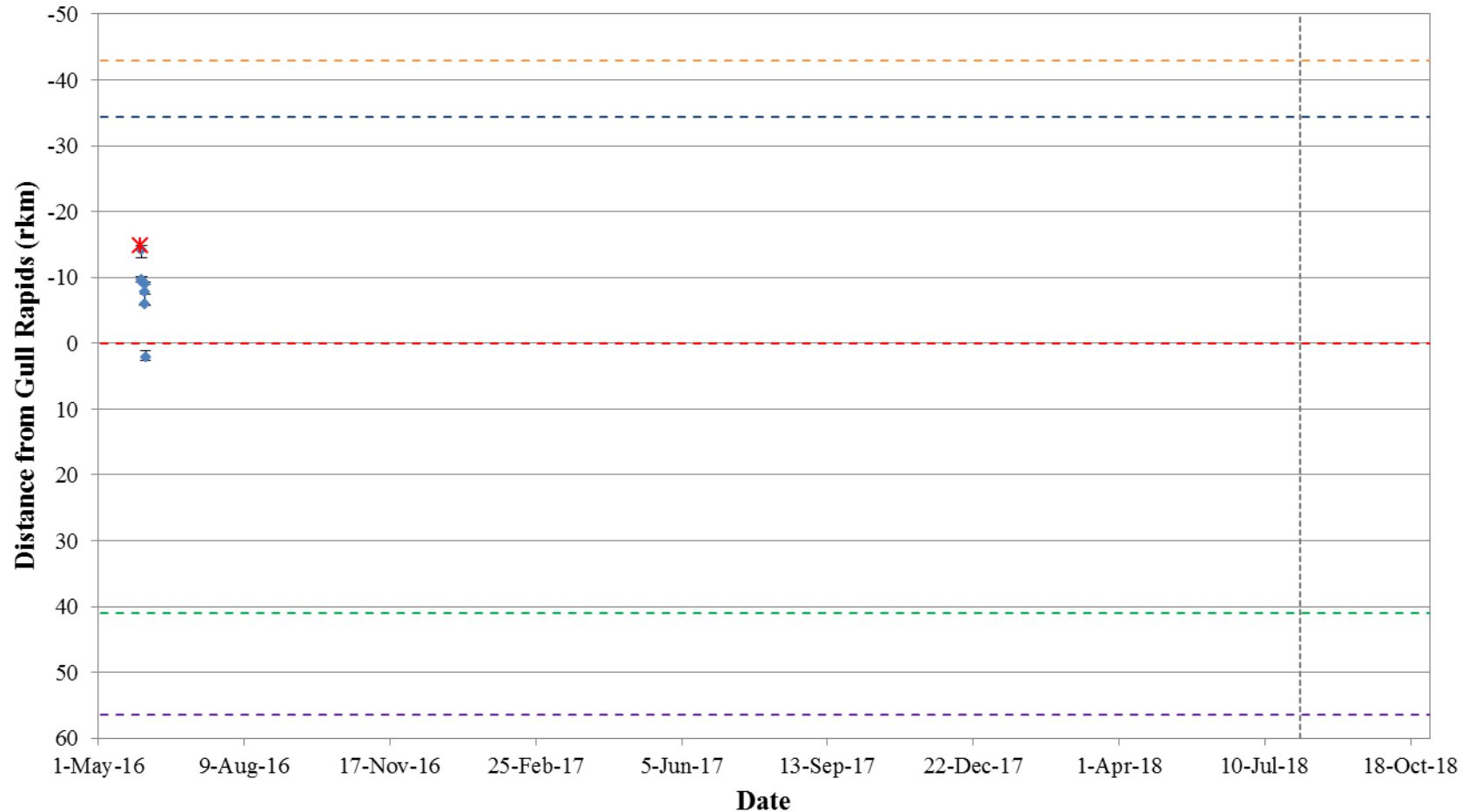


**Figure A2-25: Position of a Walleye tagged with an acoustic transmitter (code #53784) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

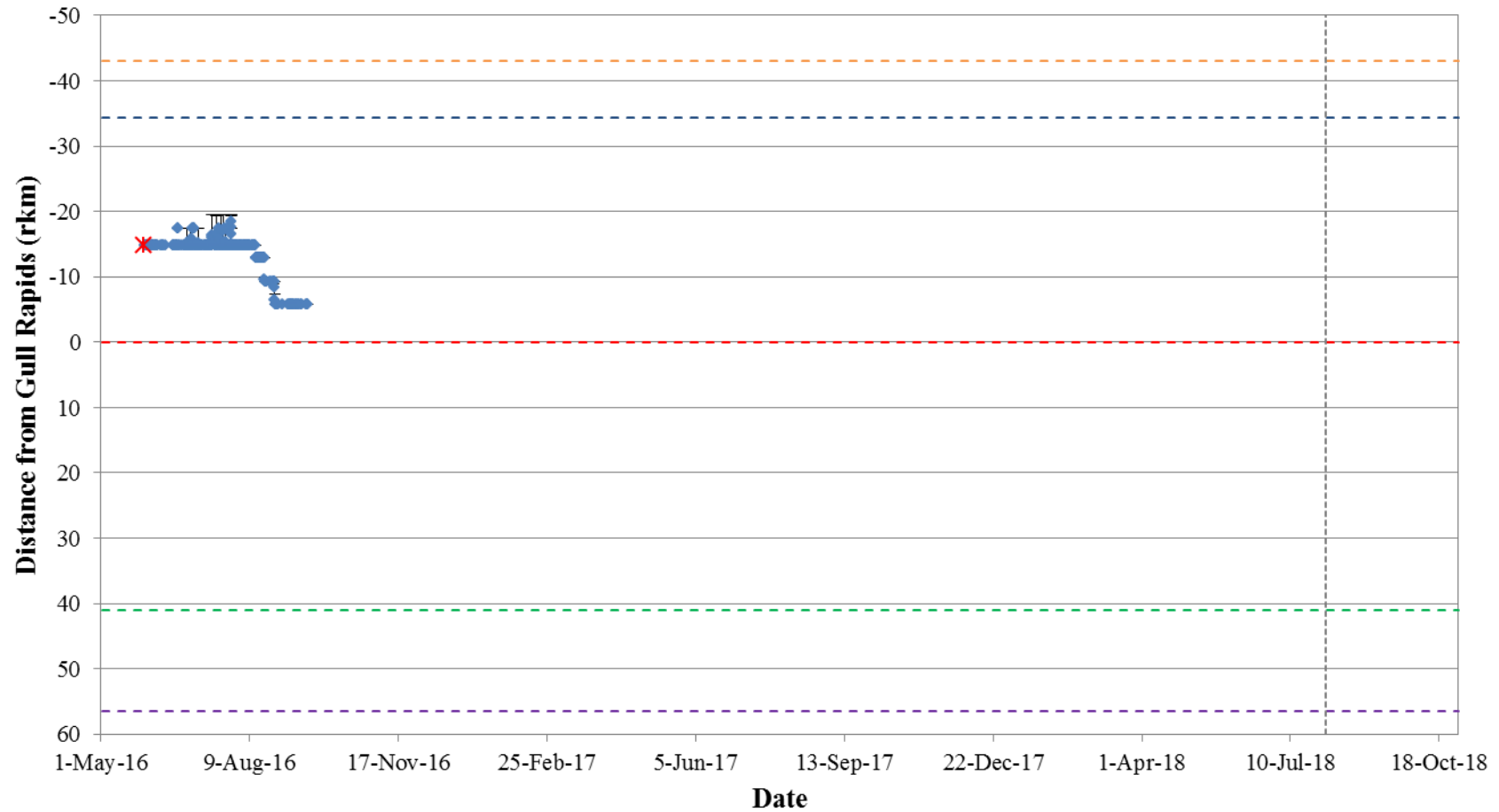




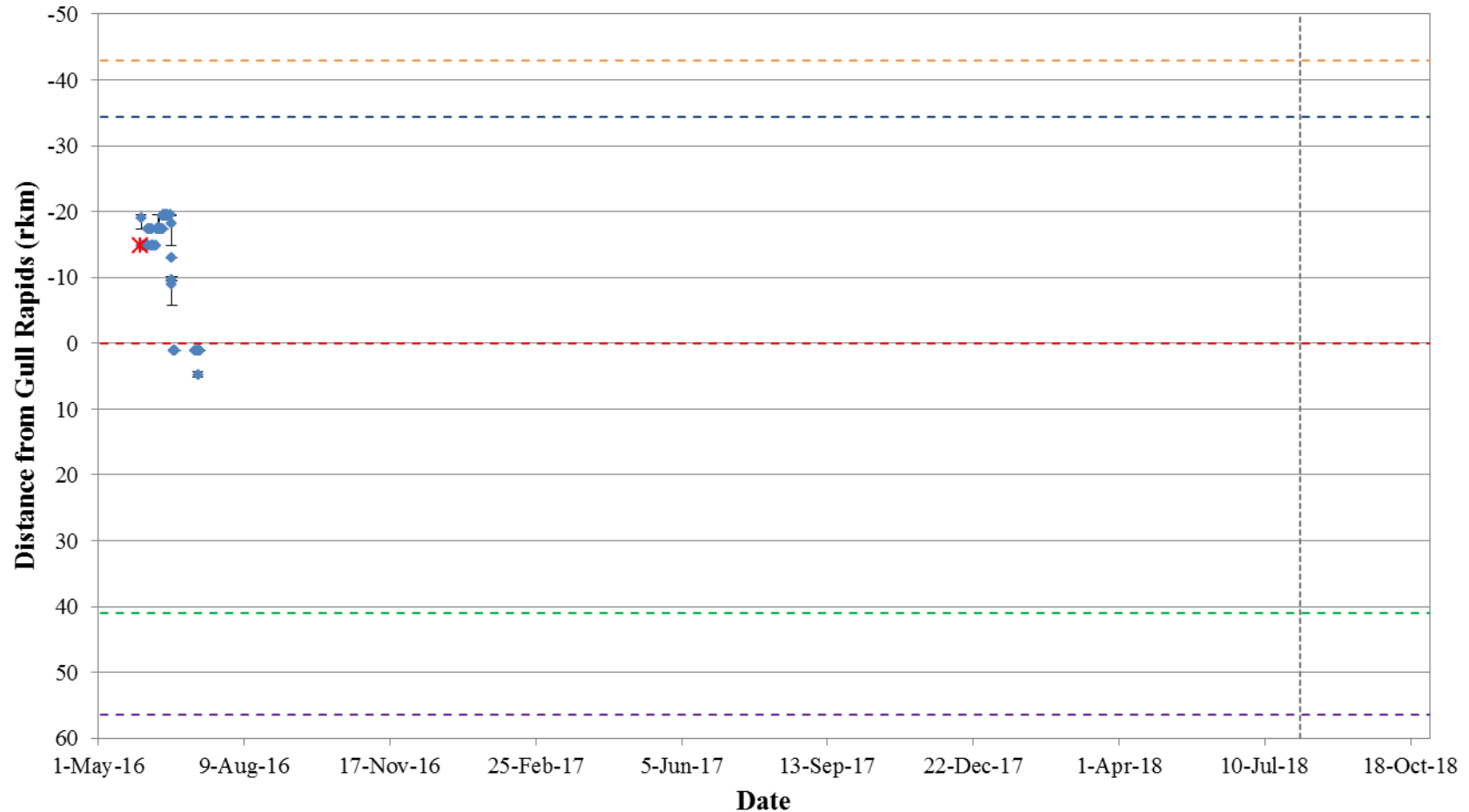
**Figure A2-26: Position of a Walleye tagged with an acoustic transmitter (code #53785) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



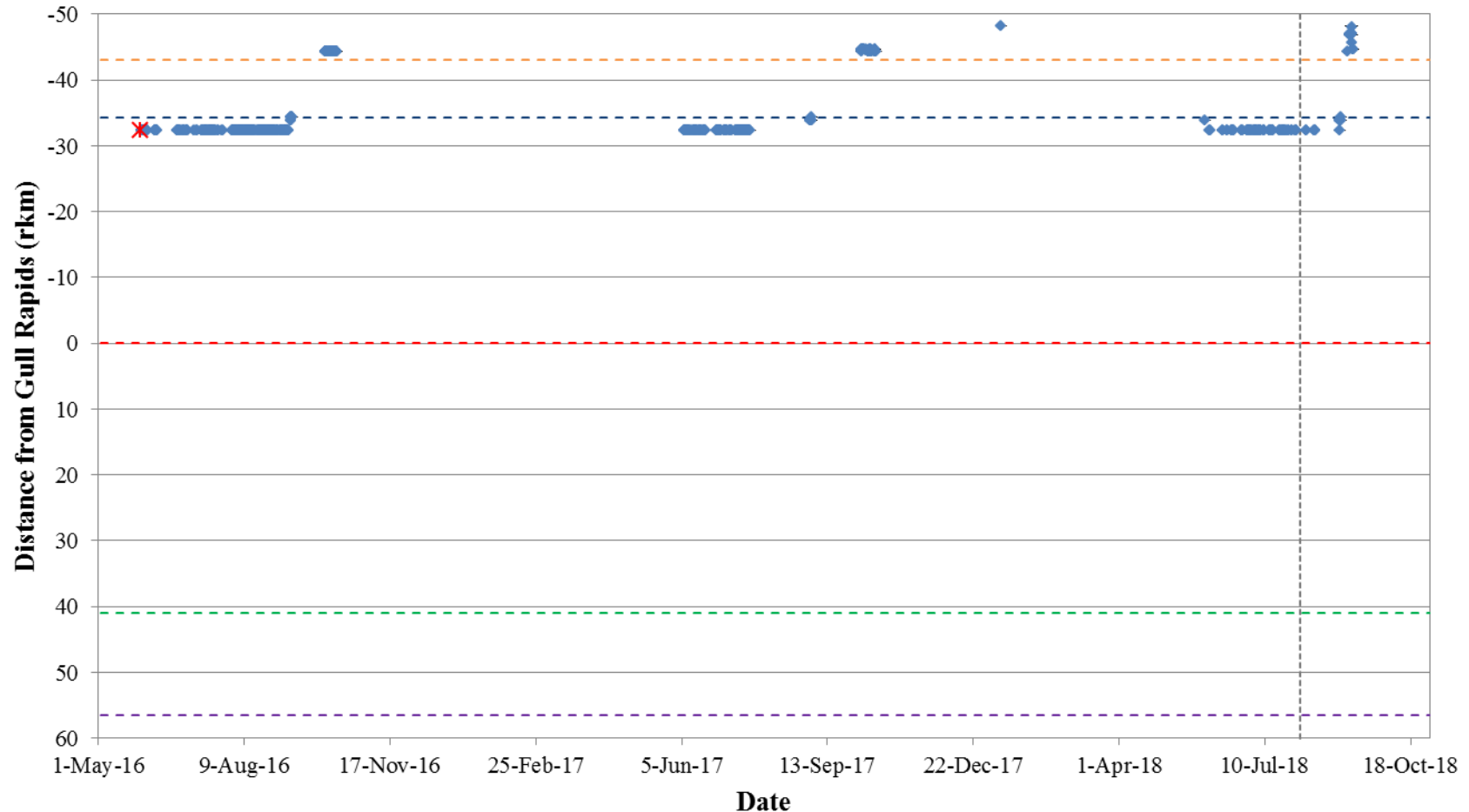
**Figure A2-27: Position of a Walleye tagged with an acoustic transmitter (code #53786) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



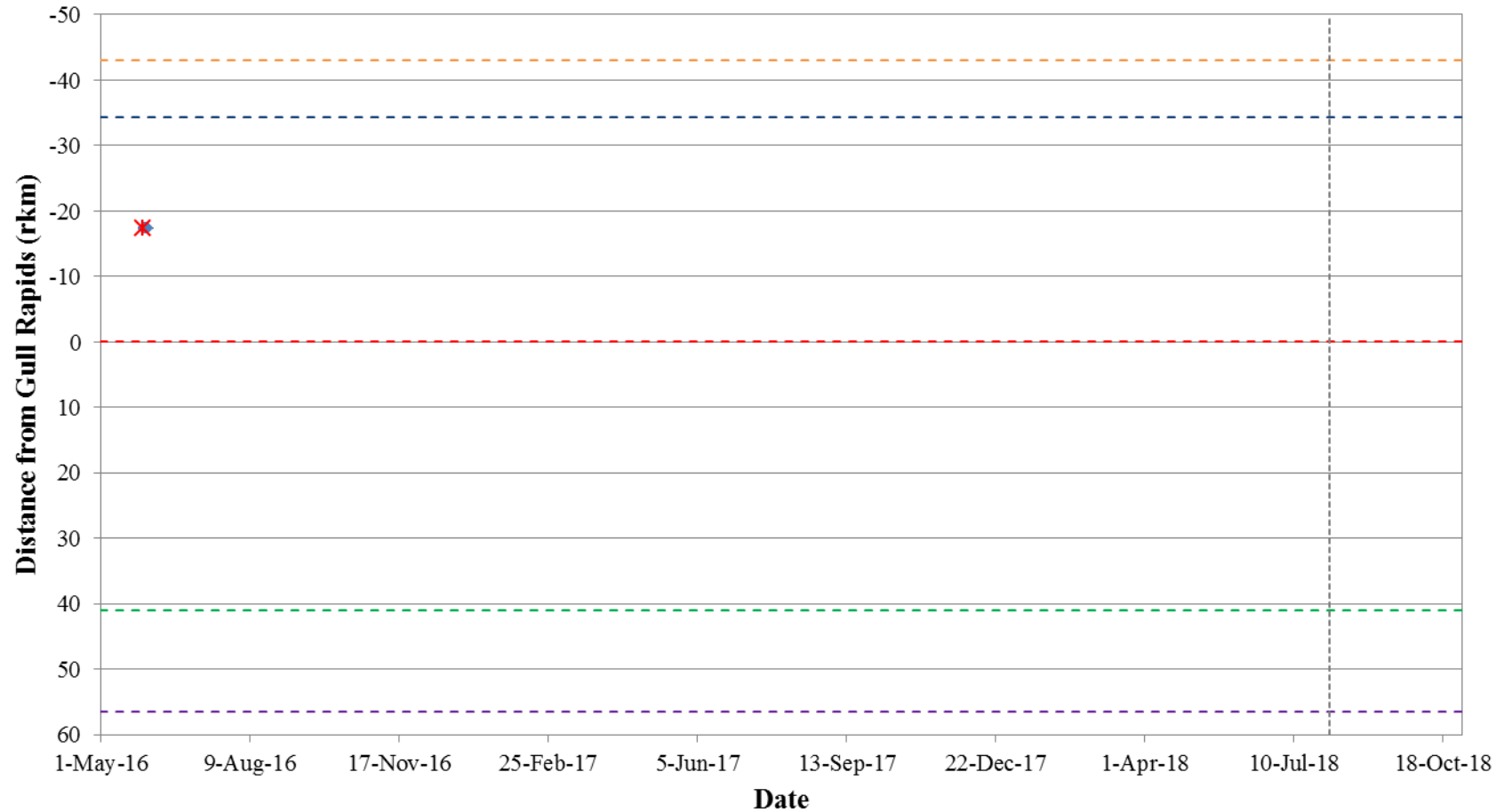
**Figure A2-28: Position of a Walleye tagged with an acoustic transmitter (code #53787) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



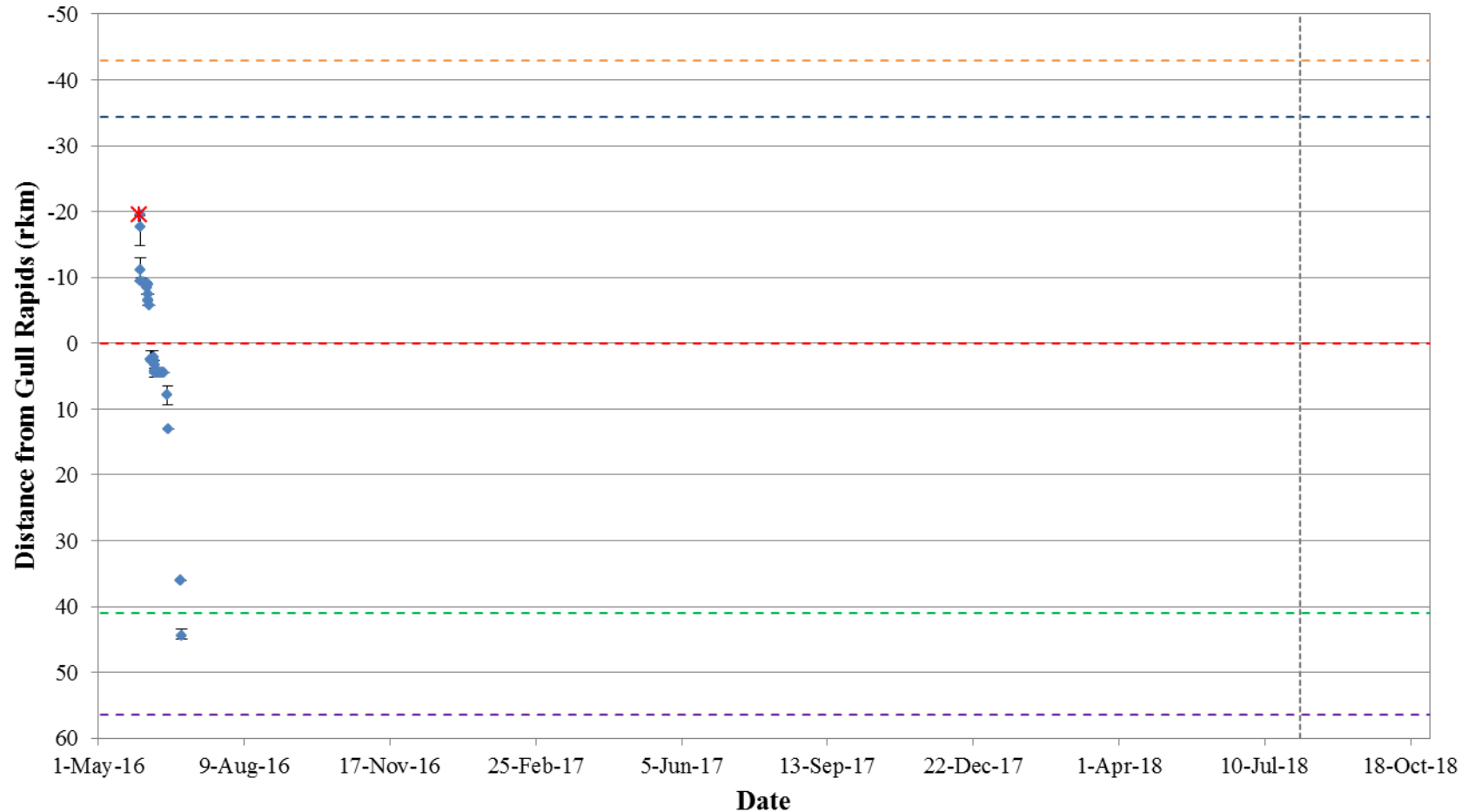
**Figure A2-29: Position of a Walleye tagged with an acoustic transmitter (code #53788) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-30: Position of a Walleye tagged with an acoustic transmitter (code #53789) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

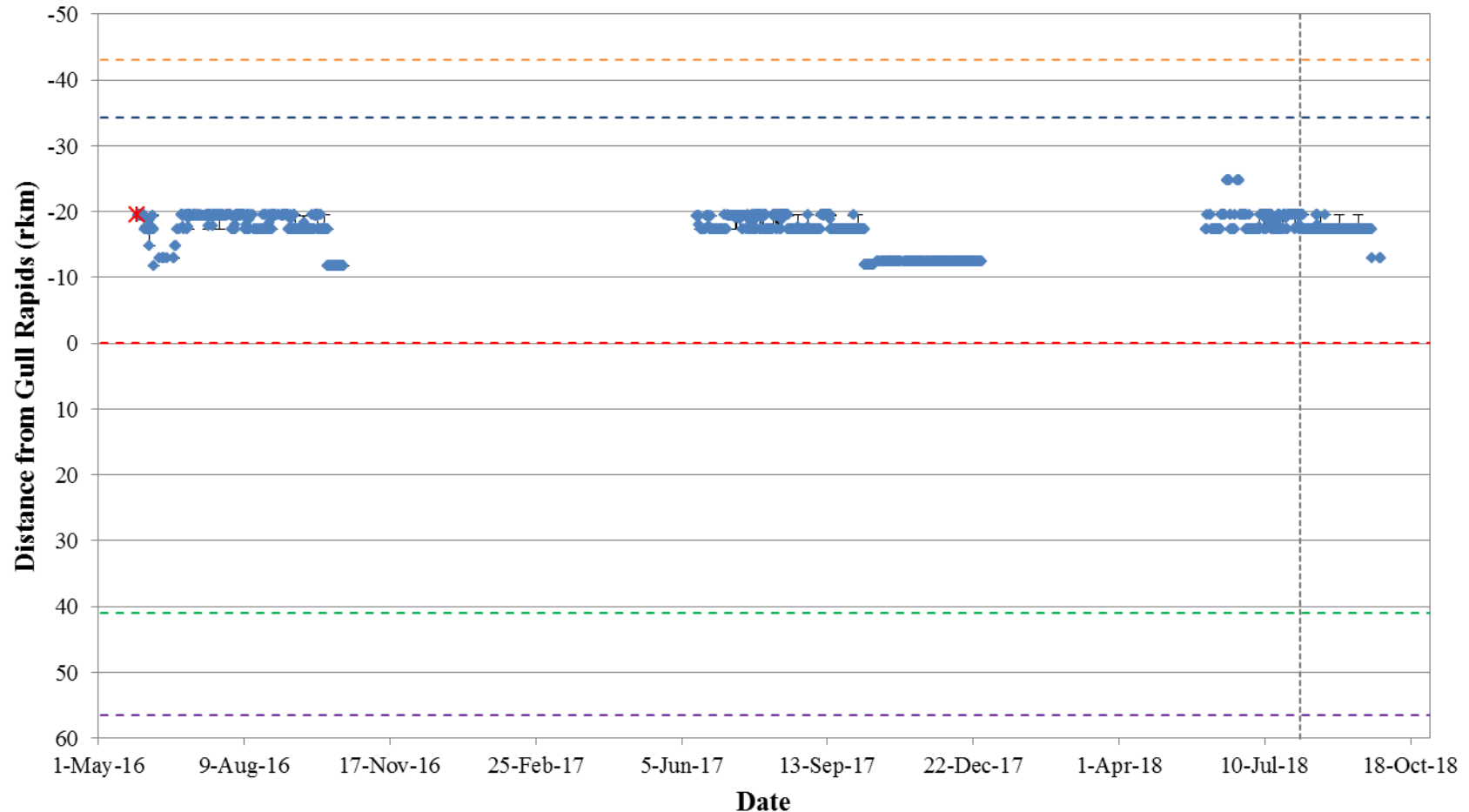


**Figure A2-31: Position of a Walleye tagged with an acoustic transmitter (code #53790) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

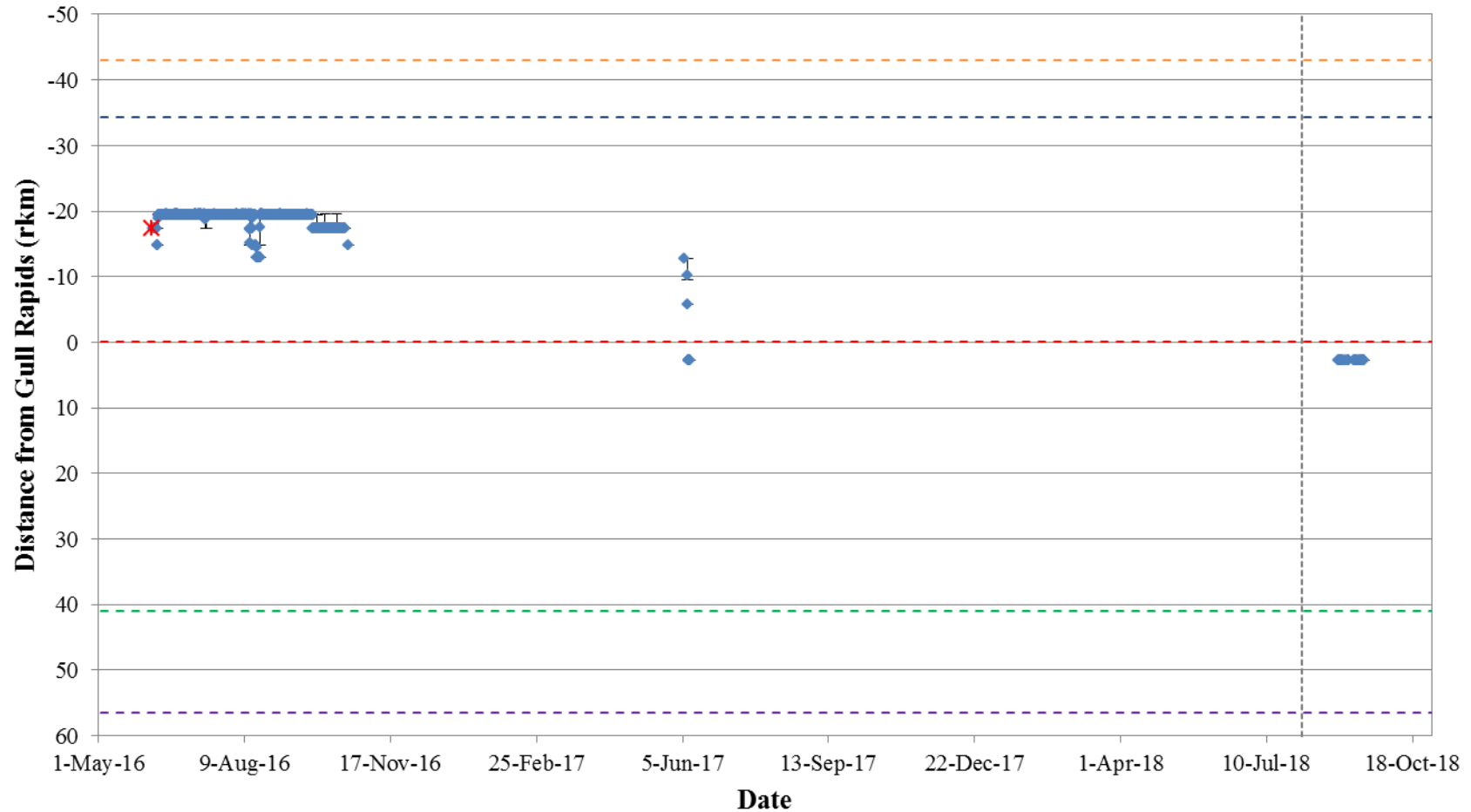


**Figure A2-32: Position of a Walleye tagged with an acoustic transmitter (code #53791) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

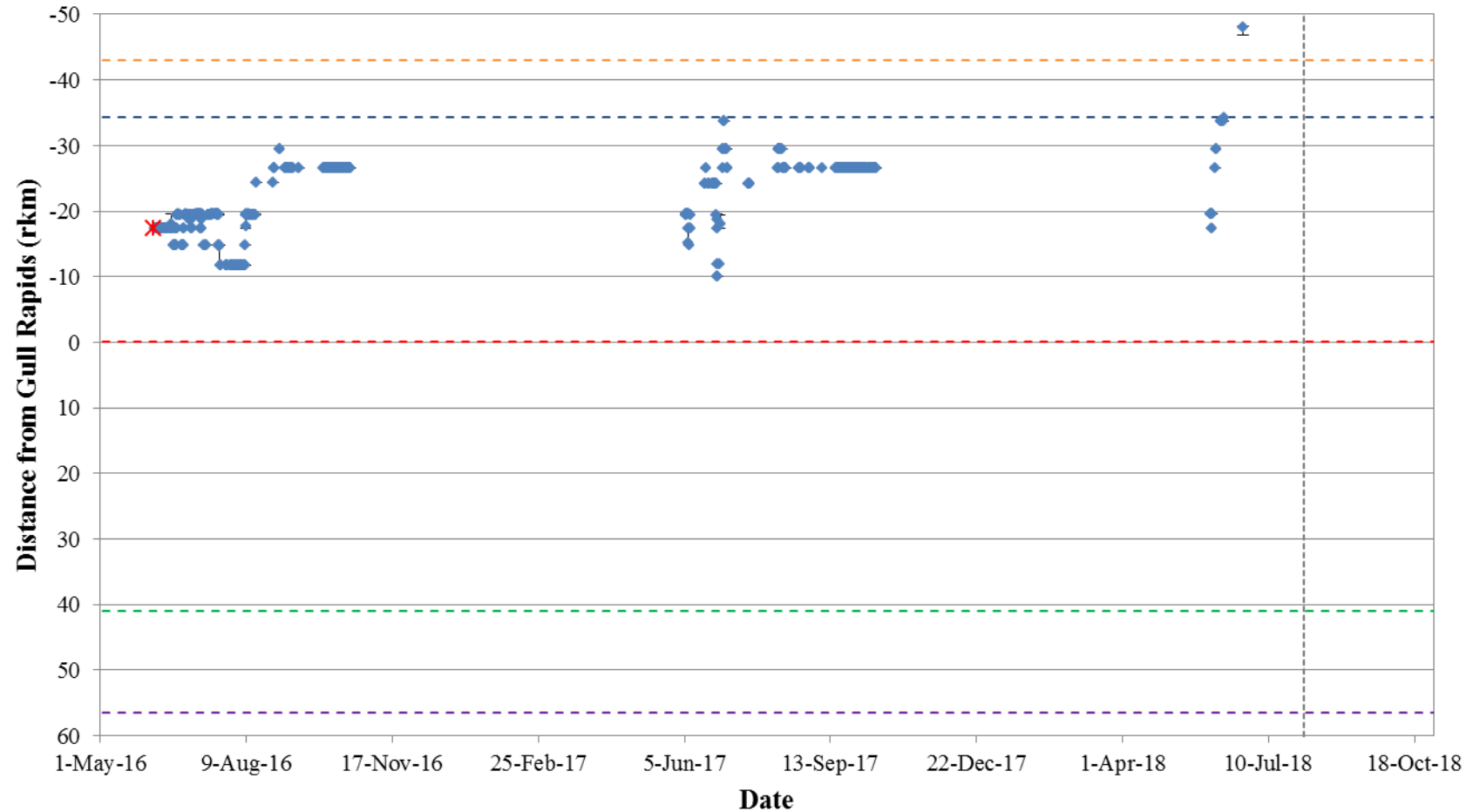




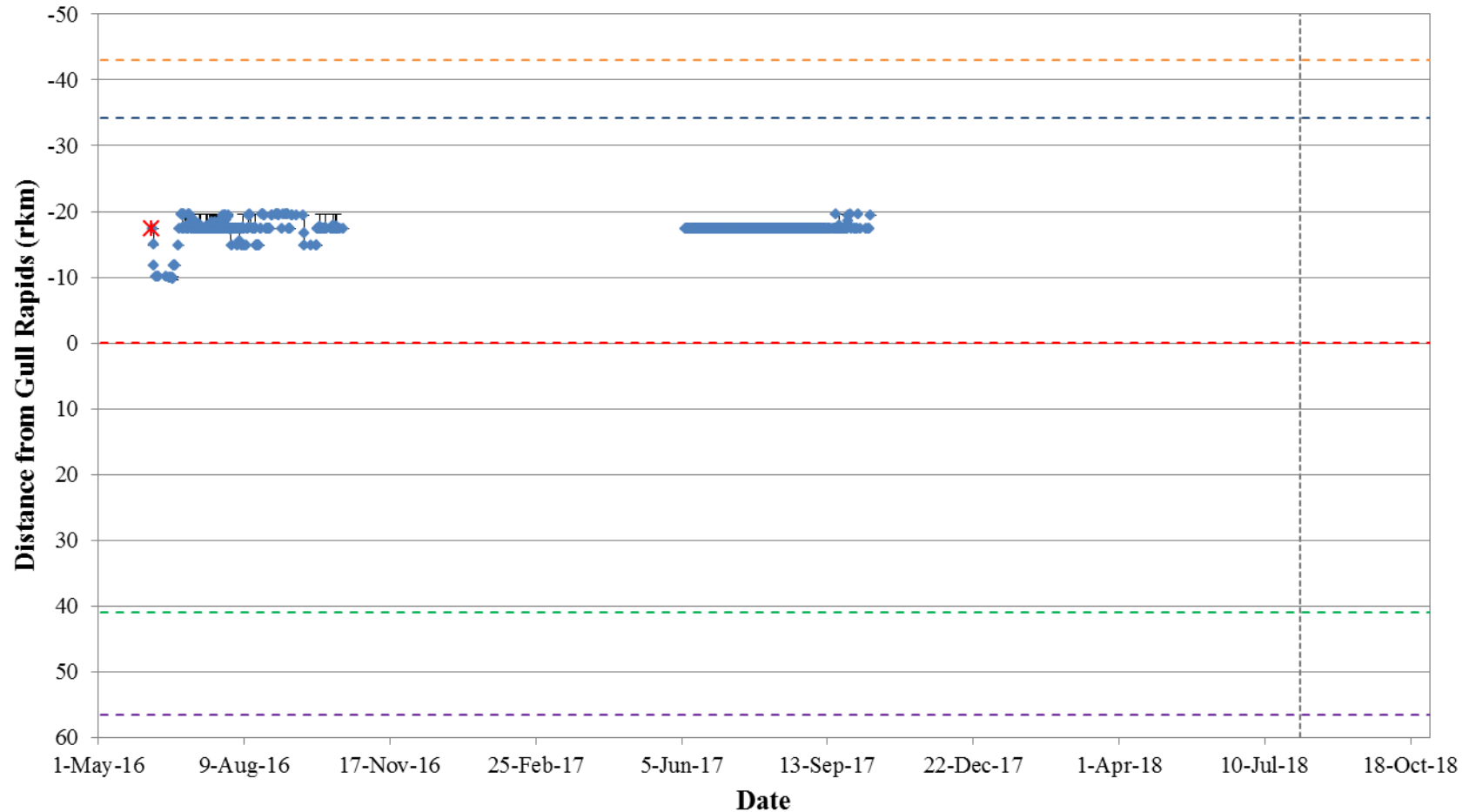
**Figure A2-33: Position of a Walleye tagged with an acoustic transmitter (code #53792) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



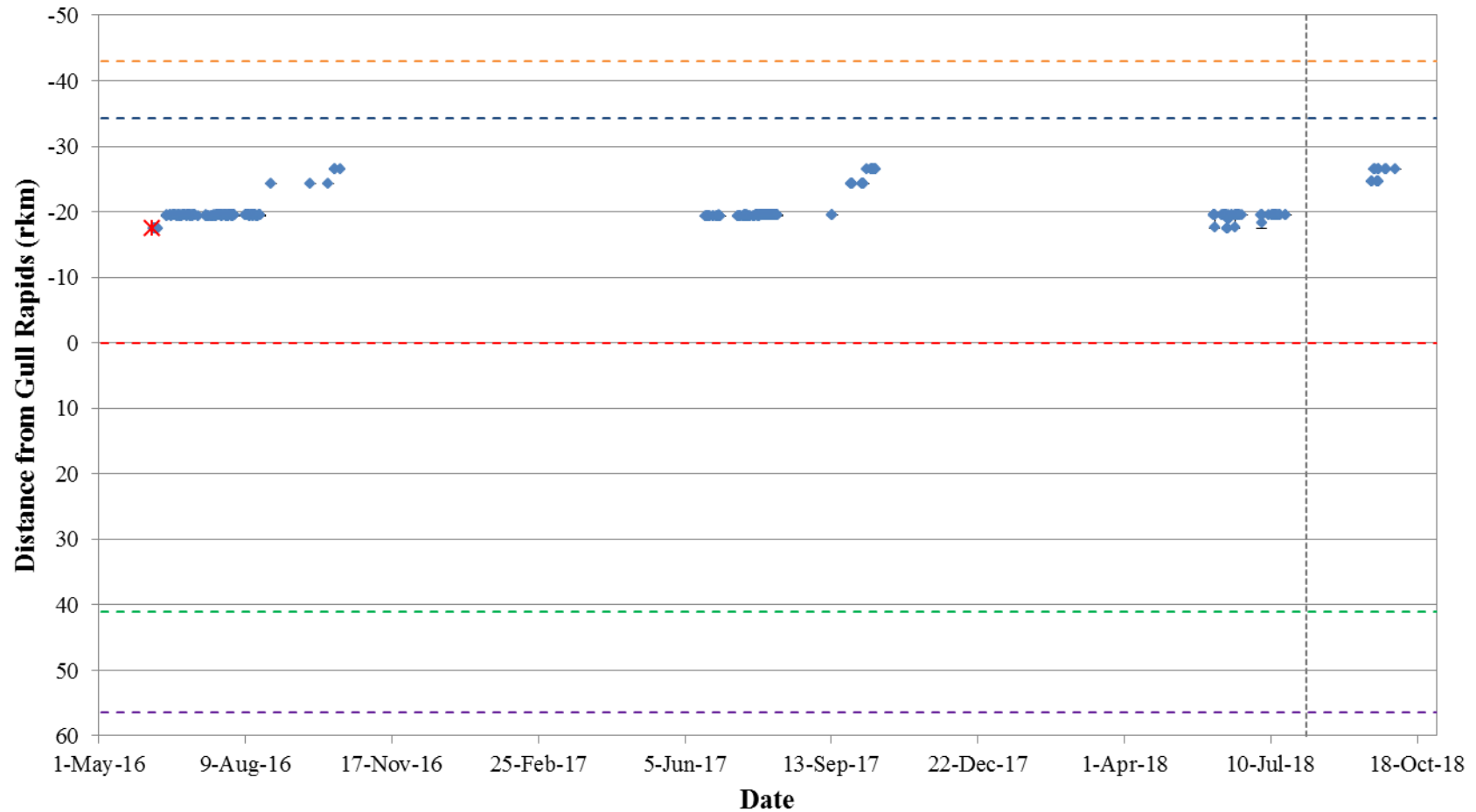
**Figure A2-34: Position of a Walleye tagged with an acoustic transmitter (code #53793) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



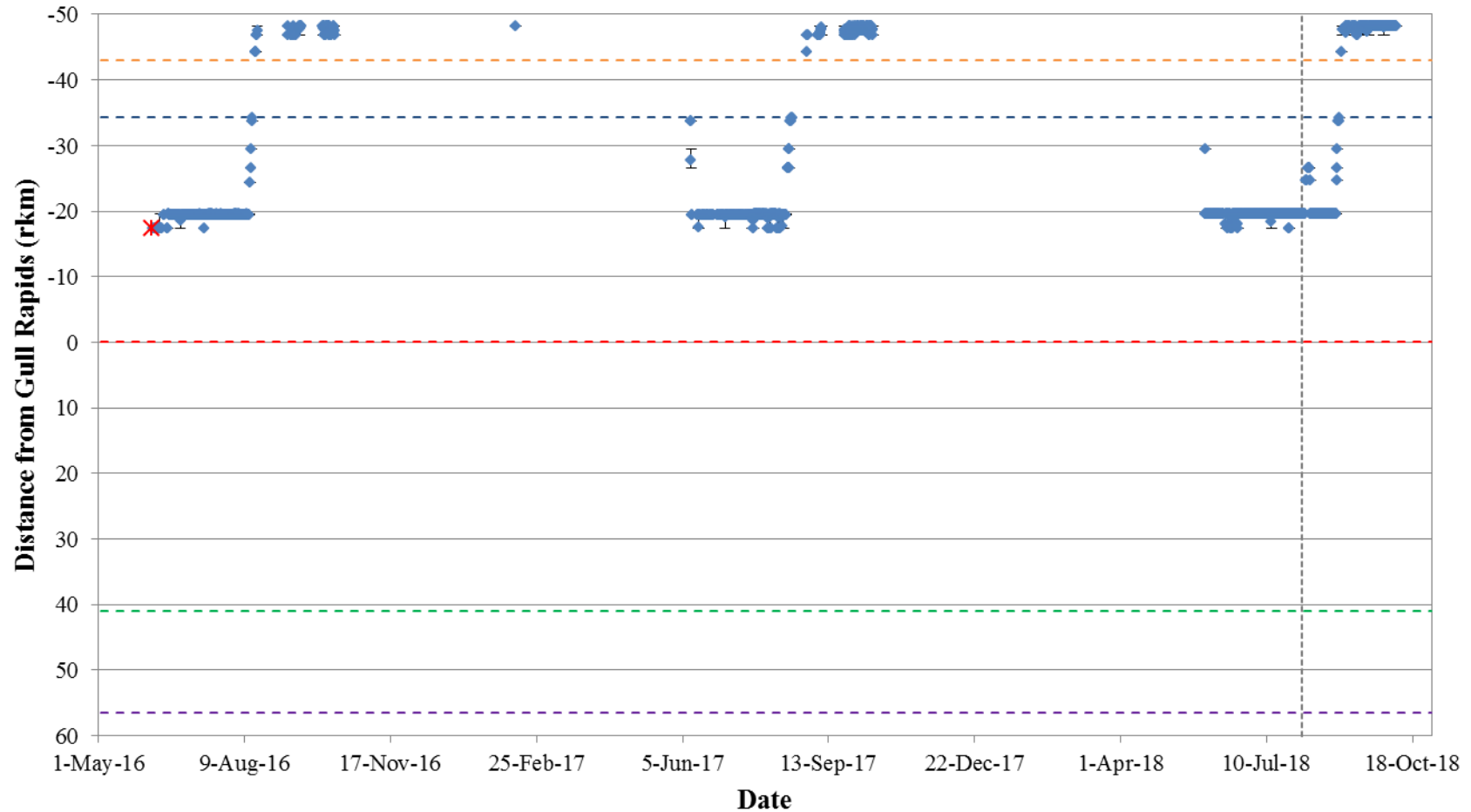
**Figure A2-35: Position of a Walleye tagged with an acoustic transmitter (code #53794) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



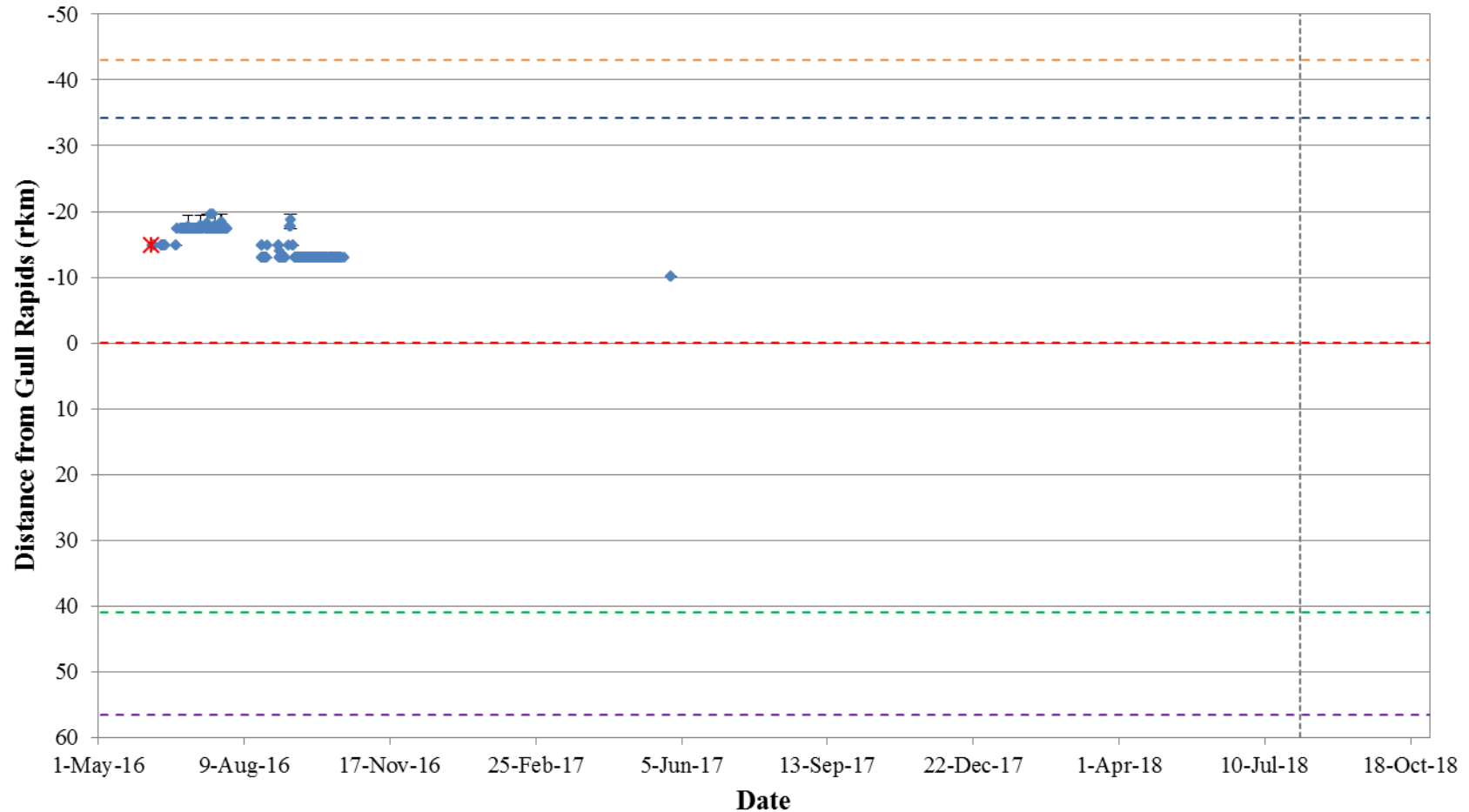
**Figure A2-36: Position of a Walleye tagged with an acoustic transmitter (code #53795) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-37: Position of a Walleye tagged with an acoustic transmitter (code #53796) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

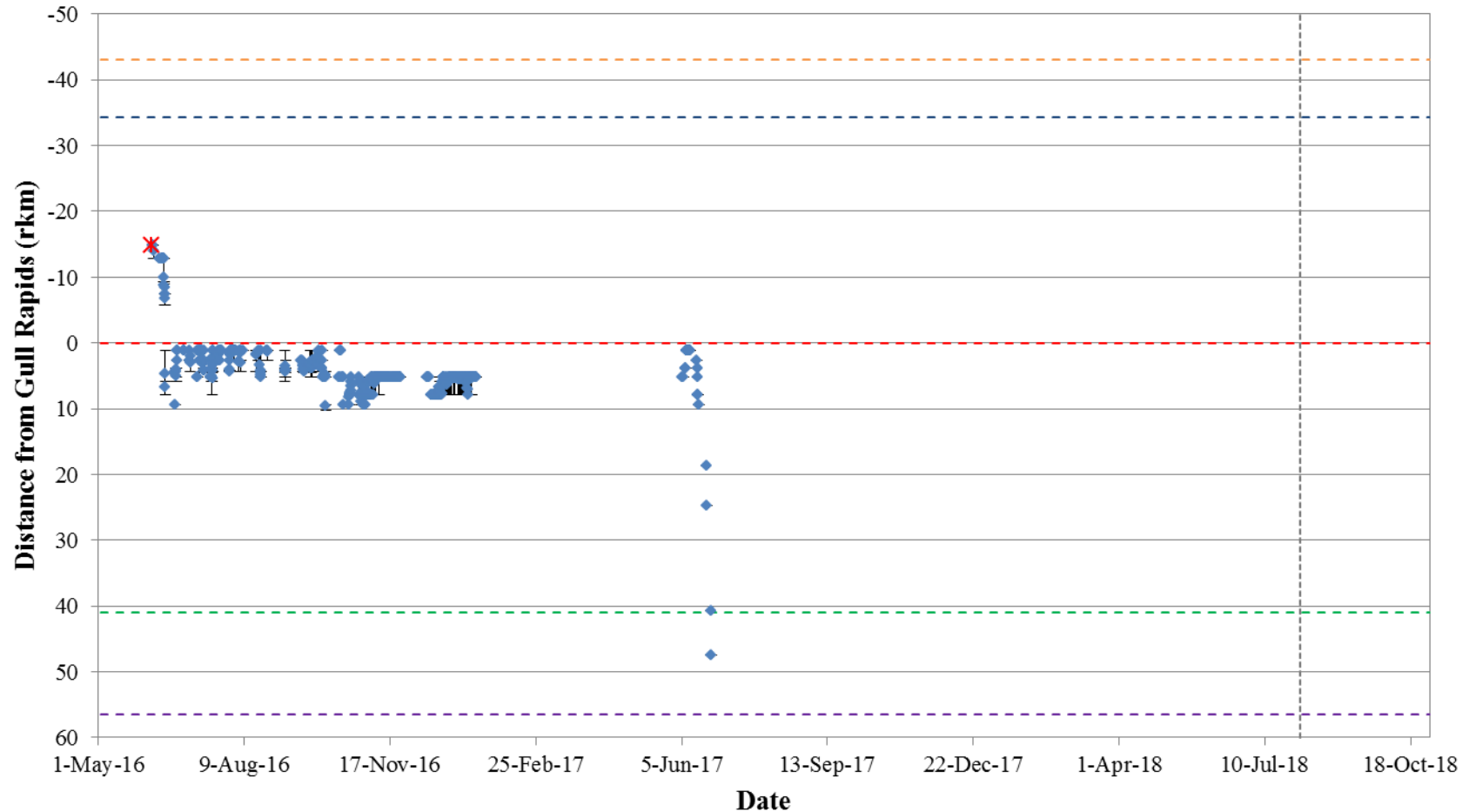


**Figure A2-38: Position of a Walleye tagged with an acoustic transmitter (code #53797) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

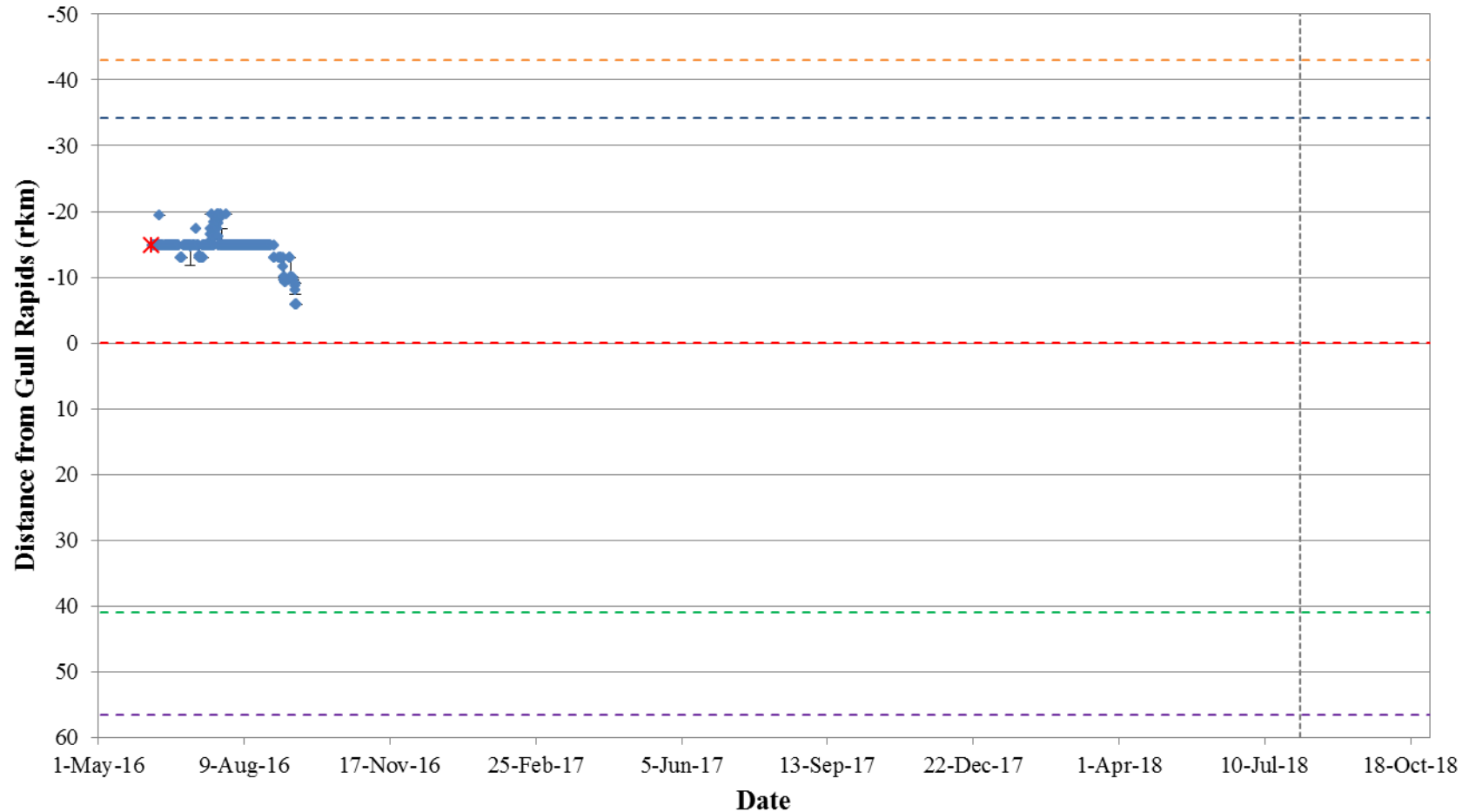


**Figure A2-39: Position of a Walleye tagged with an acoustic transmitter (code #53798) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

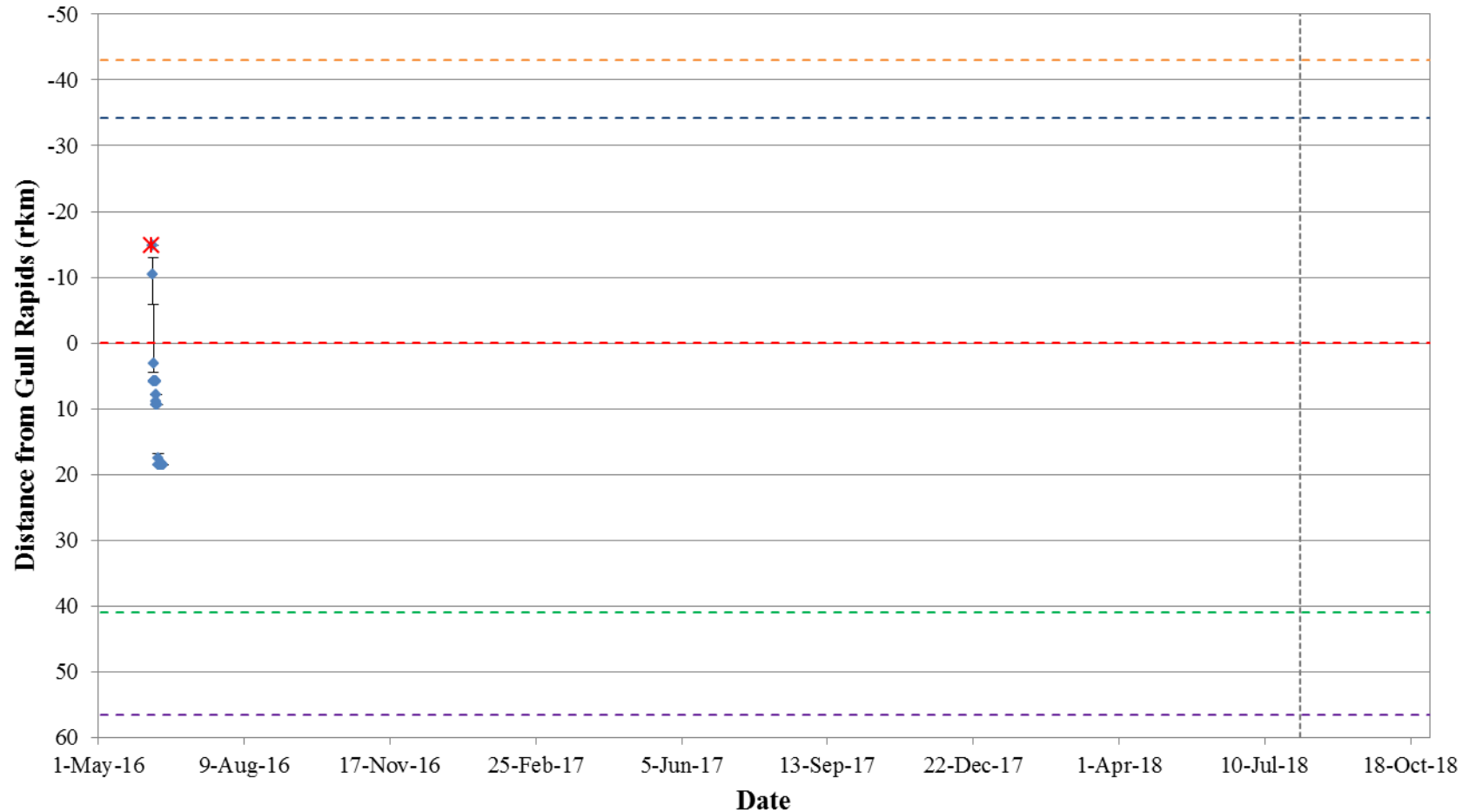




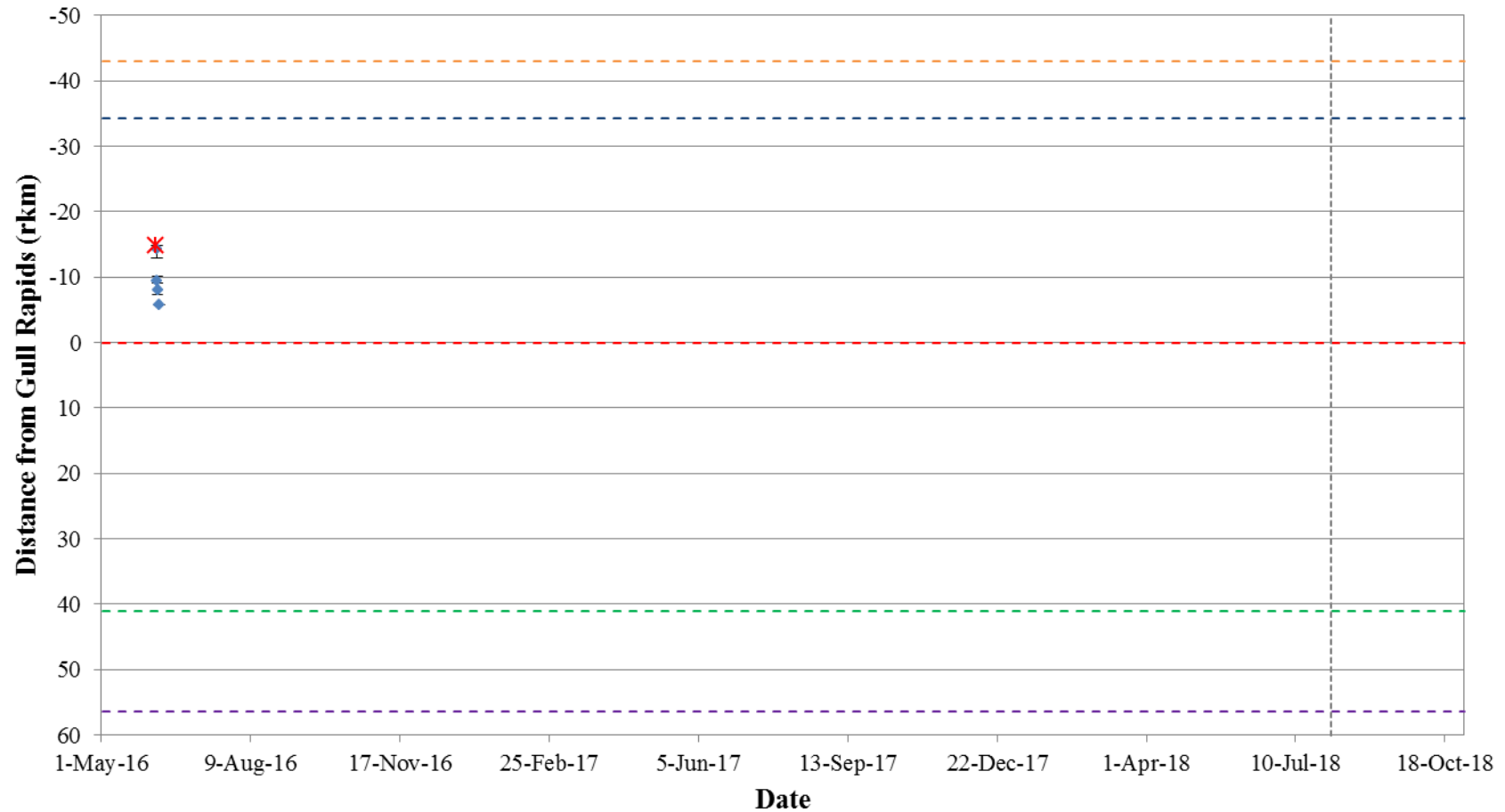
**Figure A2-40: Position of a Walleye tagged with an acoustic transmitter (code #53799) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



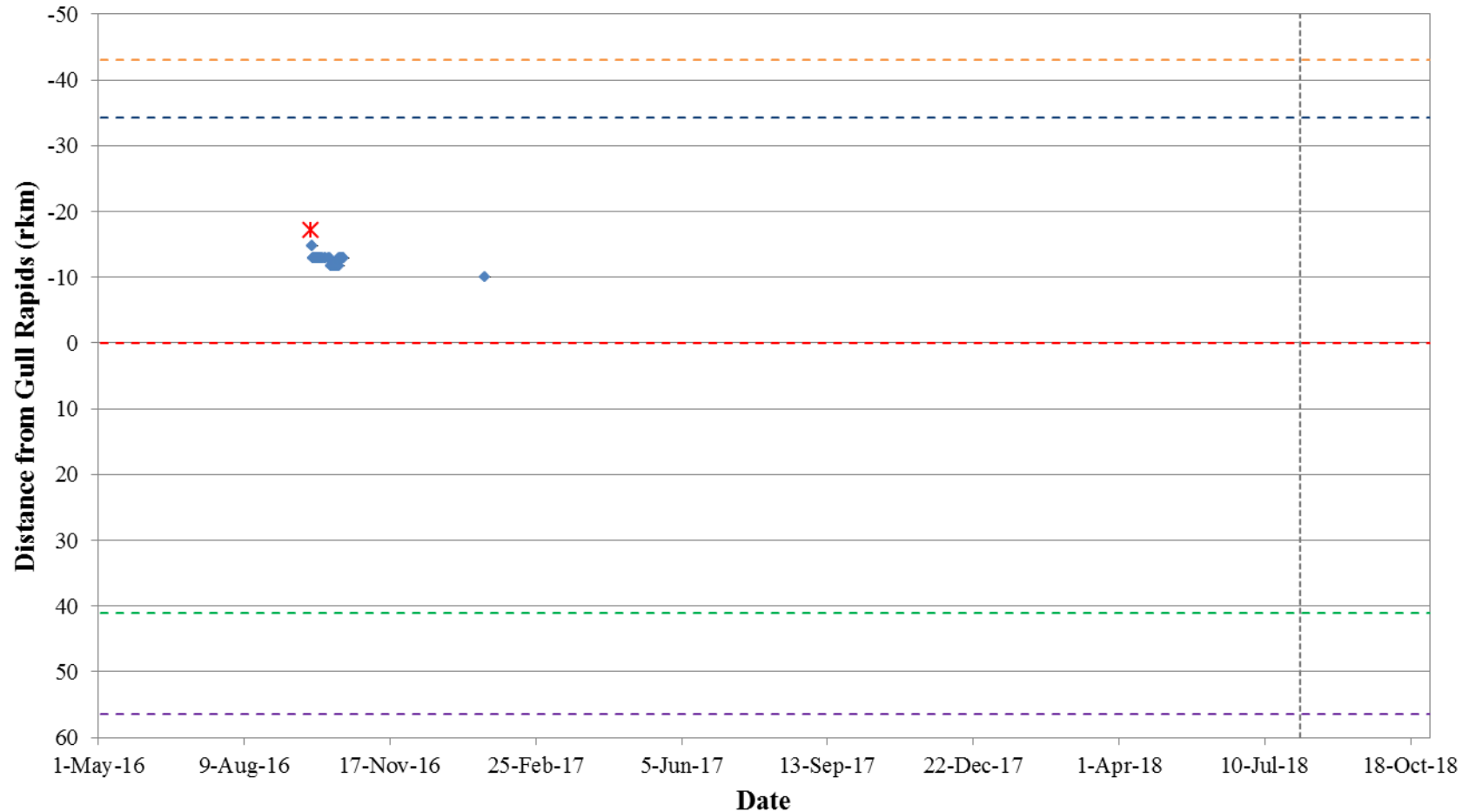
**Figure A2-41: Position of a Walleye tagged with an acoustic transmitter (code #53800) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



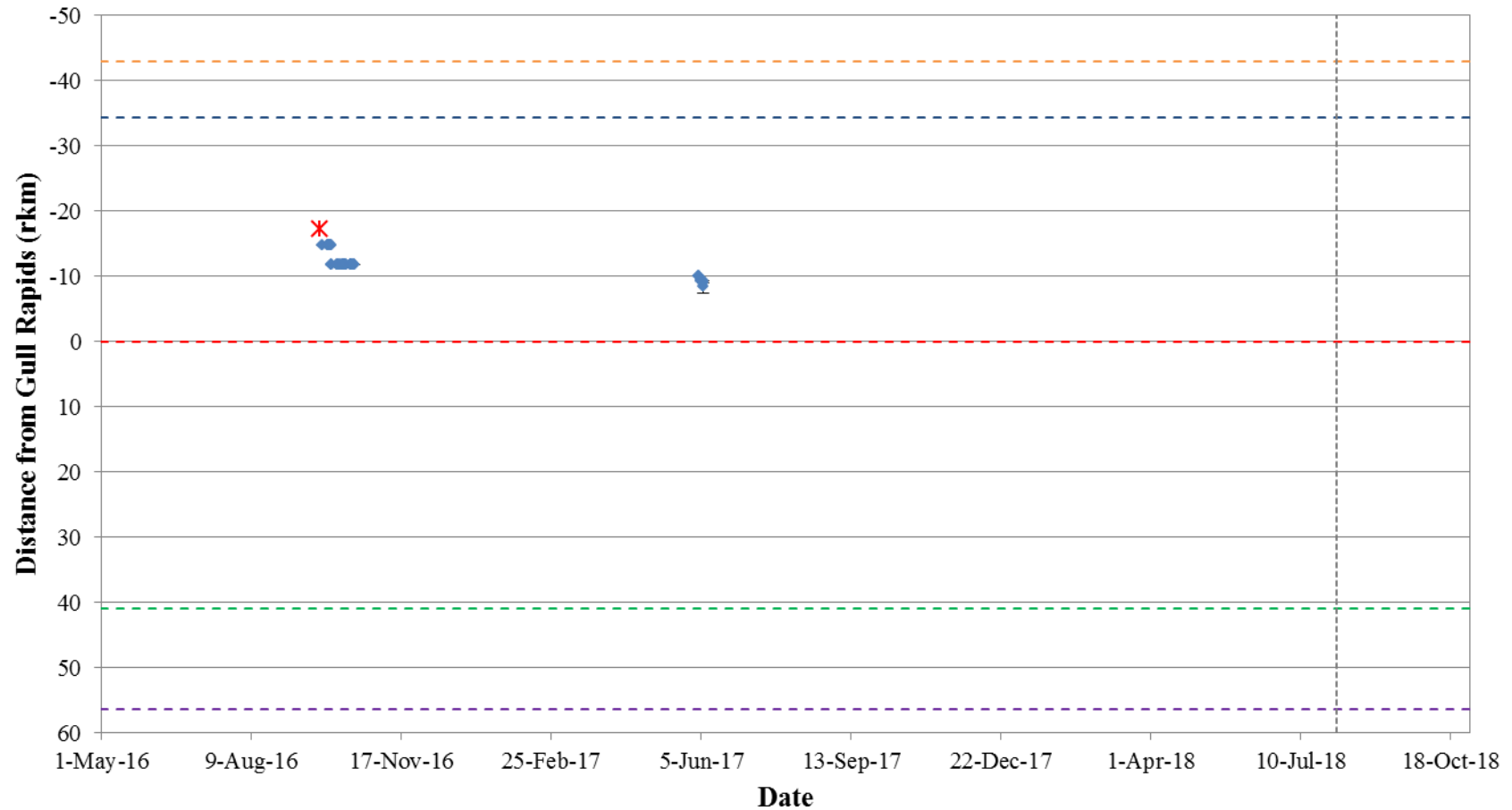
**Figure A2-42: Position of a Walleye tagged with an acoustic transmitter (code #53801) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



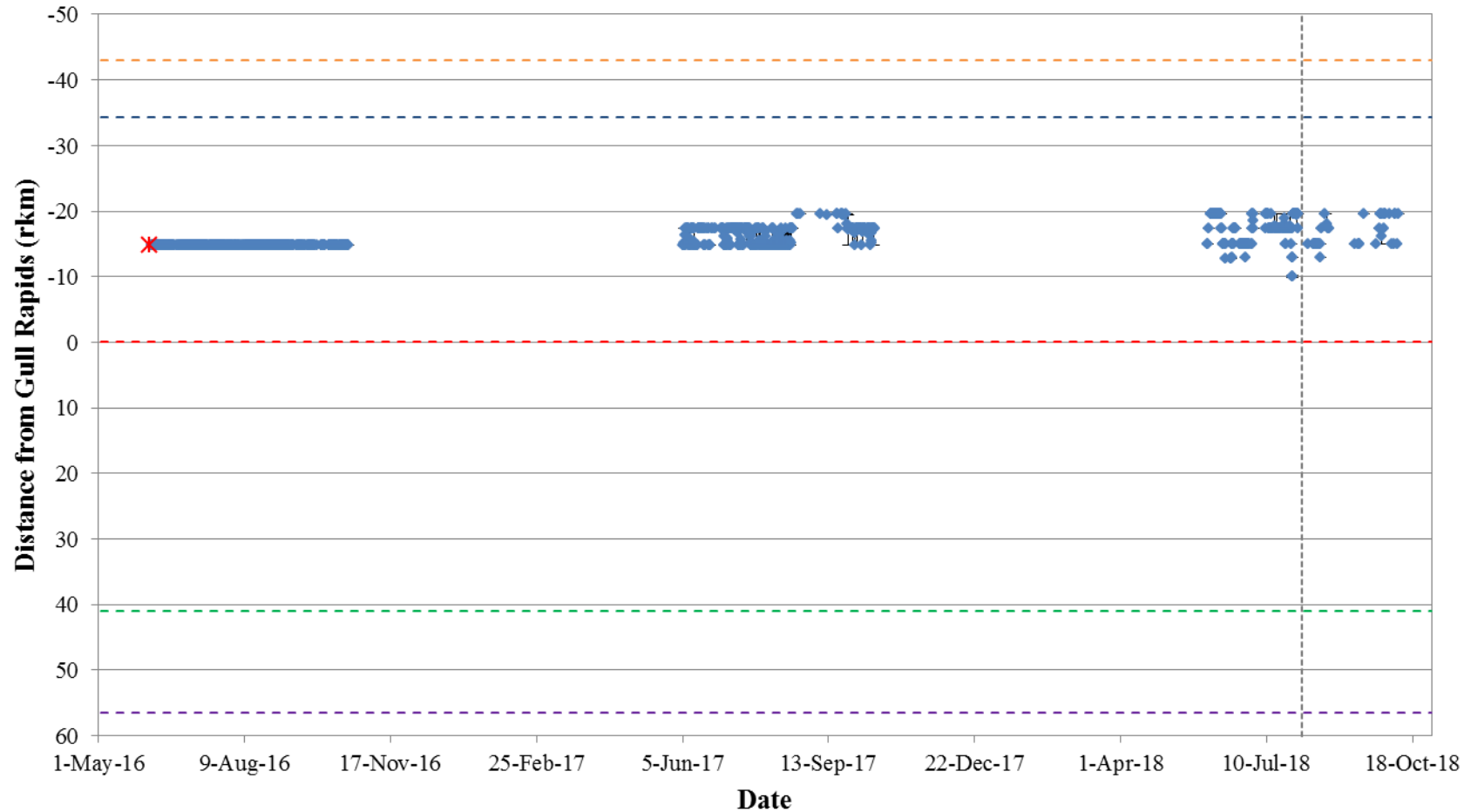
**Figure A2-43: Position of a Walleye tagged with an acoustic transmitter (code #53802) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



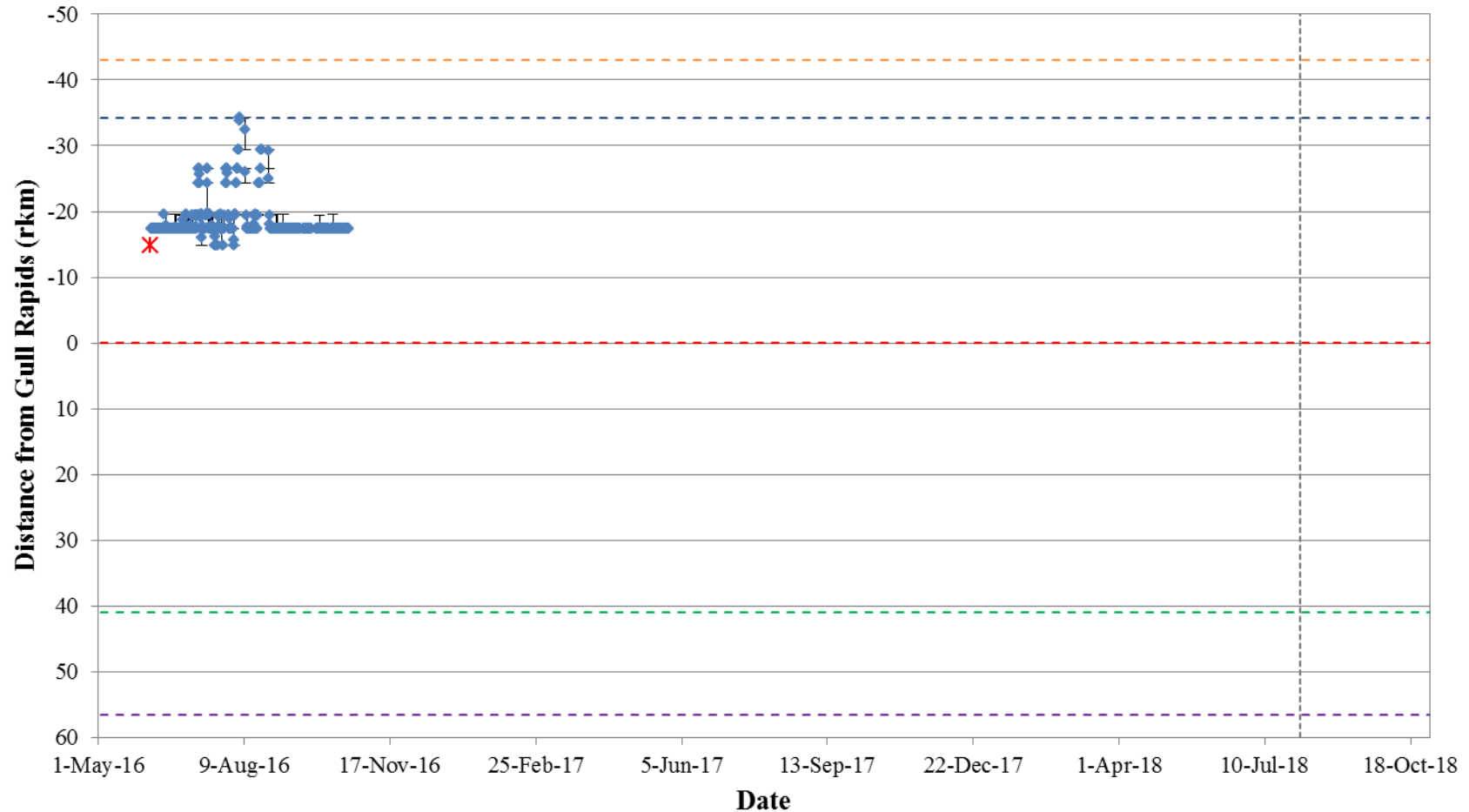
**Figure A2-44: Position of a Walleye tagged with an acoustic transmitter (code #53803) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-45: Position of a Walleye tagged with an acoustic transmitter (code #53804) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

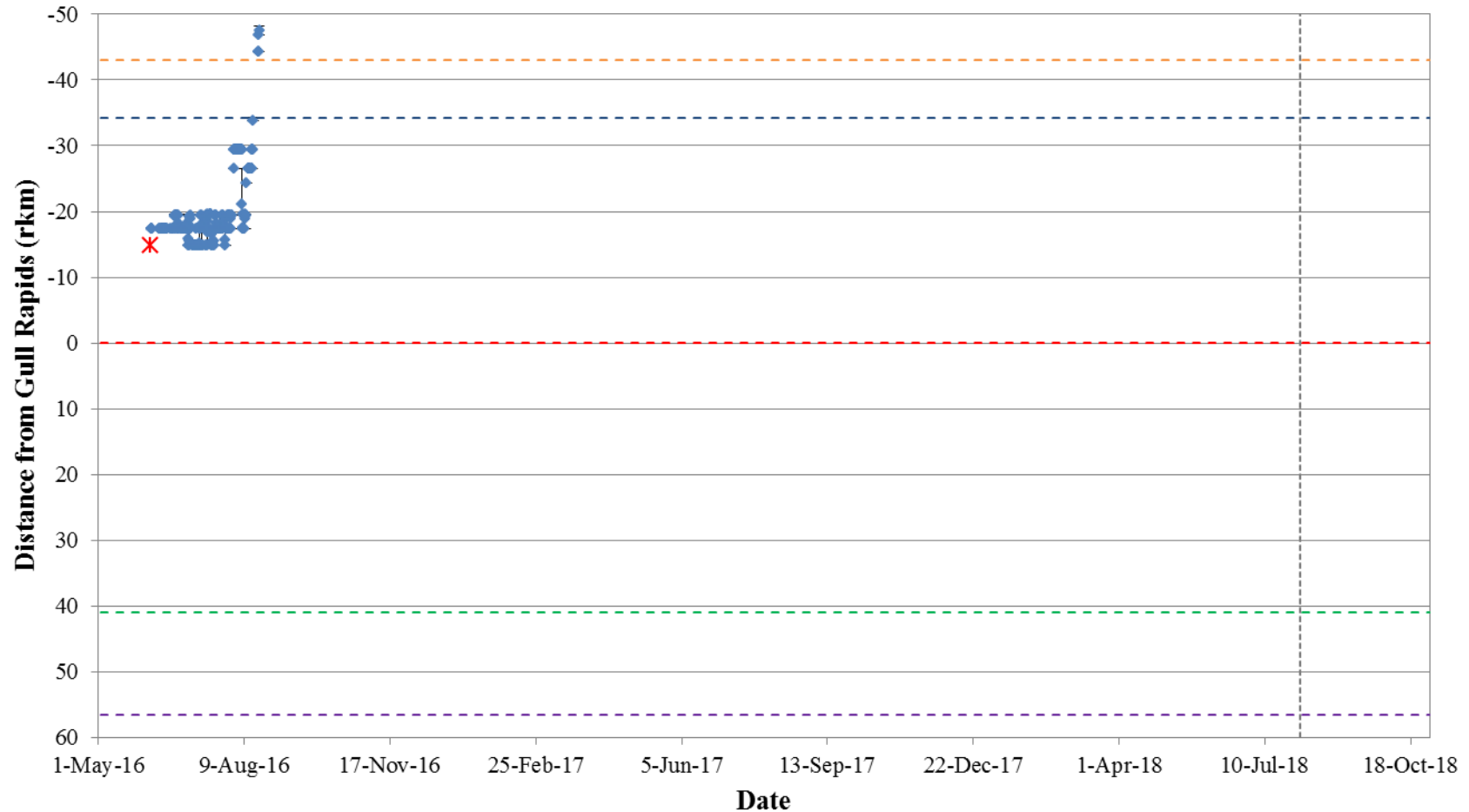


**Figure A2-46: Position of a Walleye tagged with an acoustic transmitter (code #53805) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

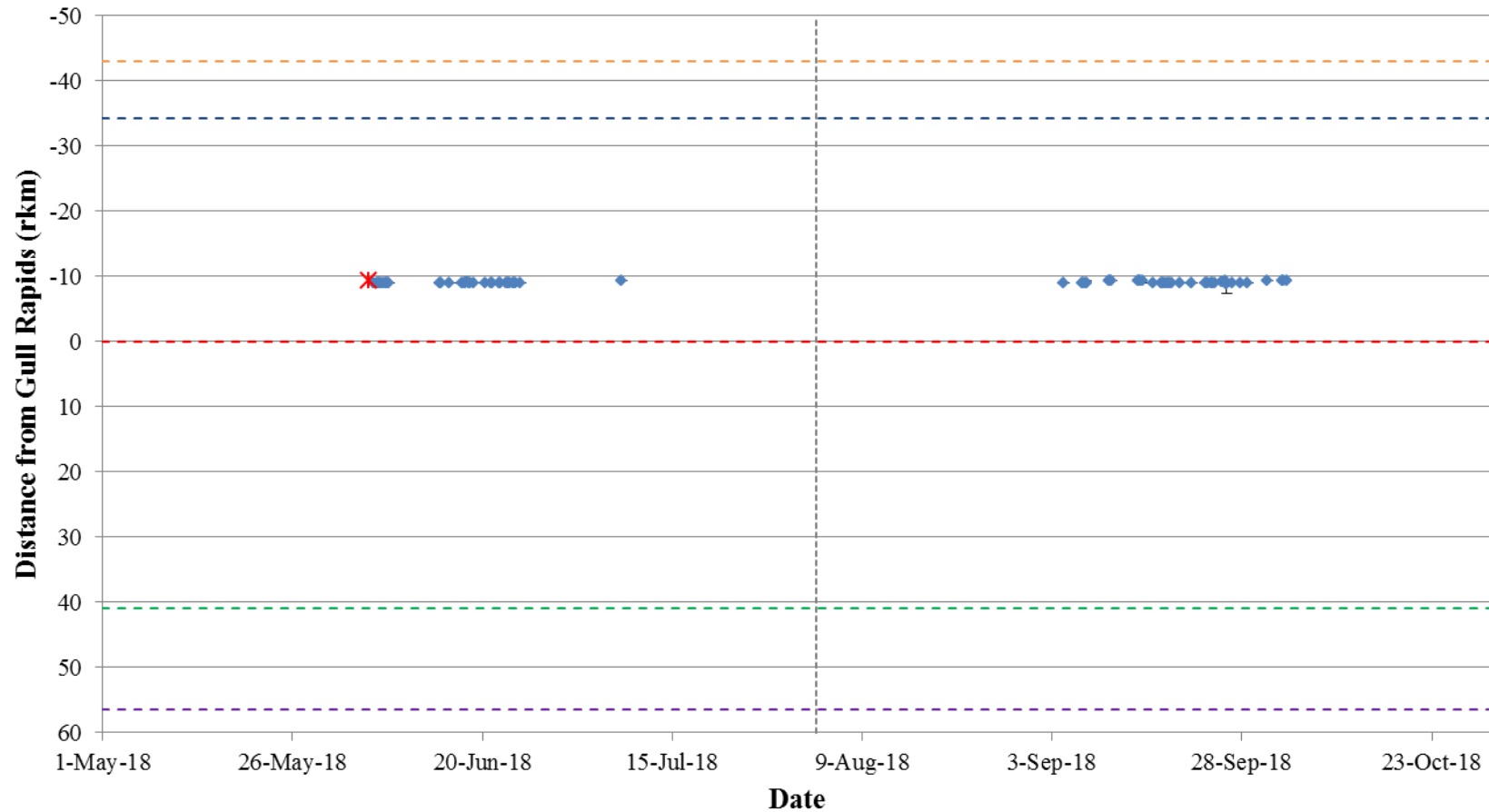


**Figure A2-47: Position of a Walleye tagged with an acoustic transmitter (code #53806) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

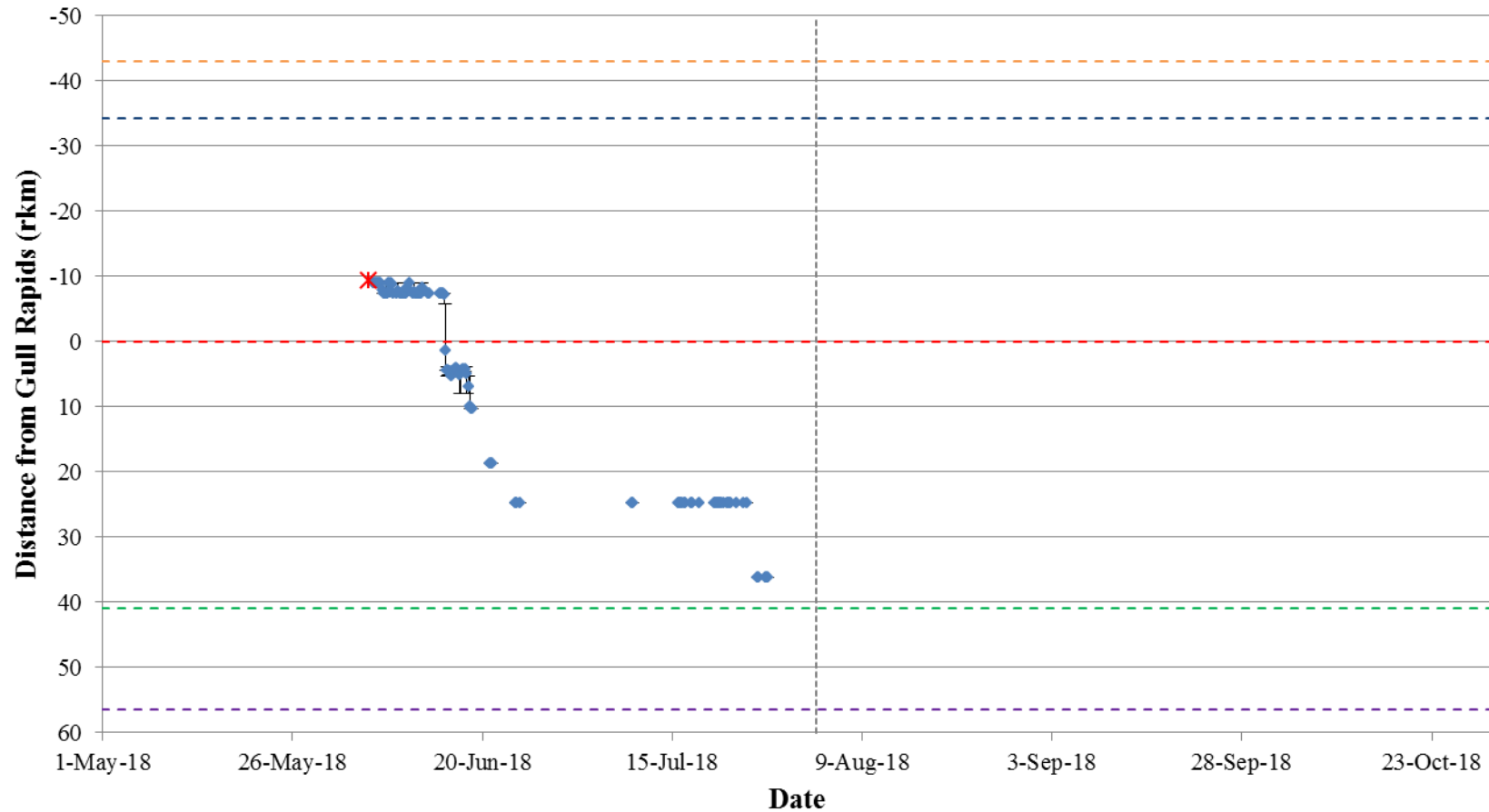




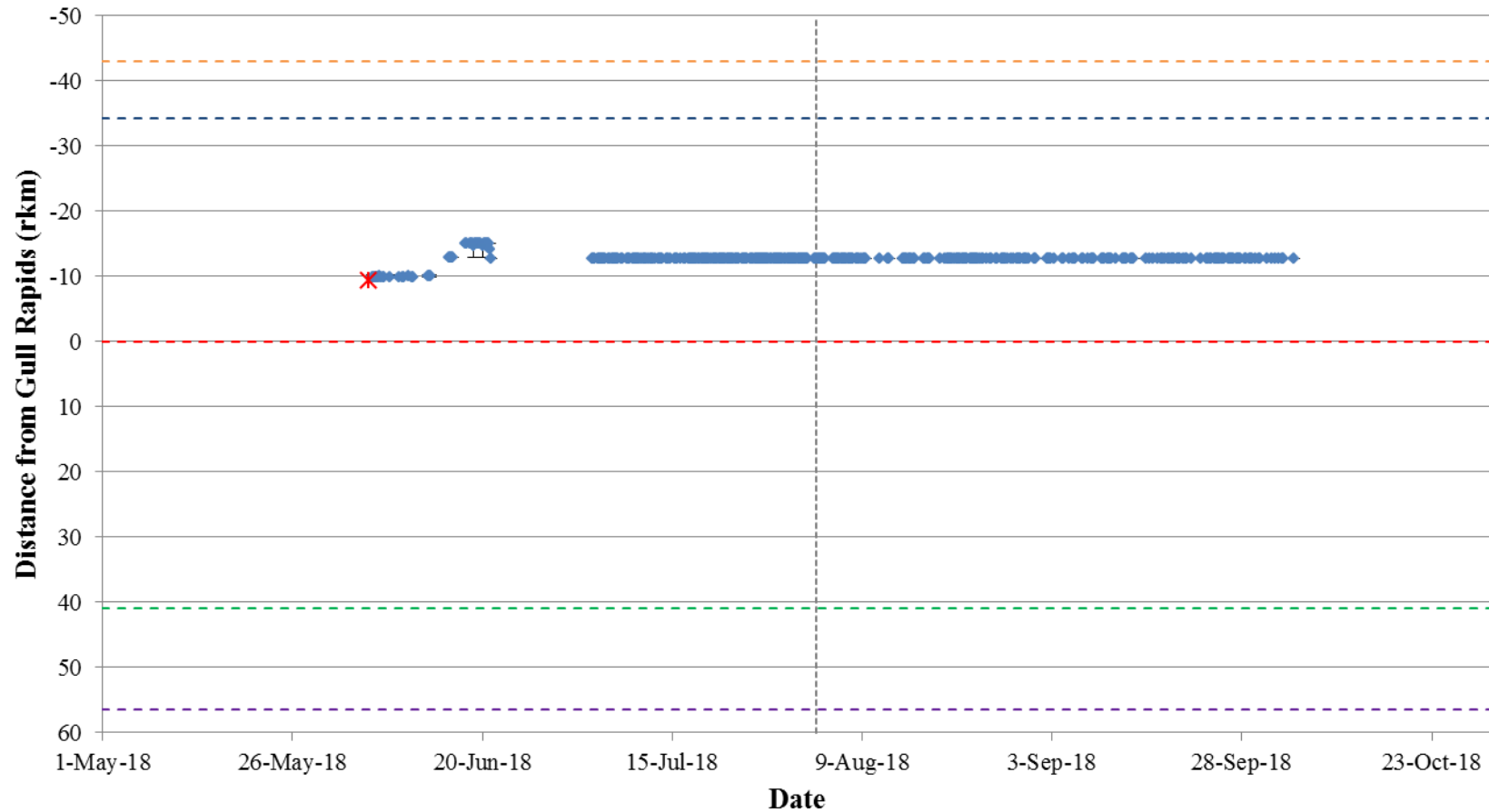
**Figure A2-48: Position of a Walleye tagged with an acoustic transmitter (code #53807) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-49: Position of a Walleye tagged with an acoustic transmitter (code #25739) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



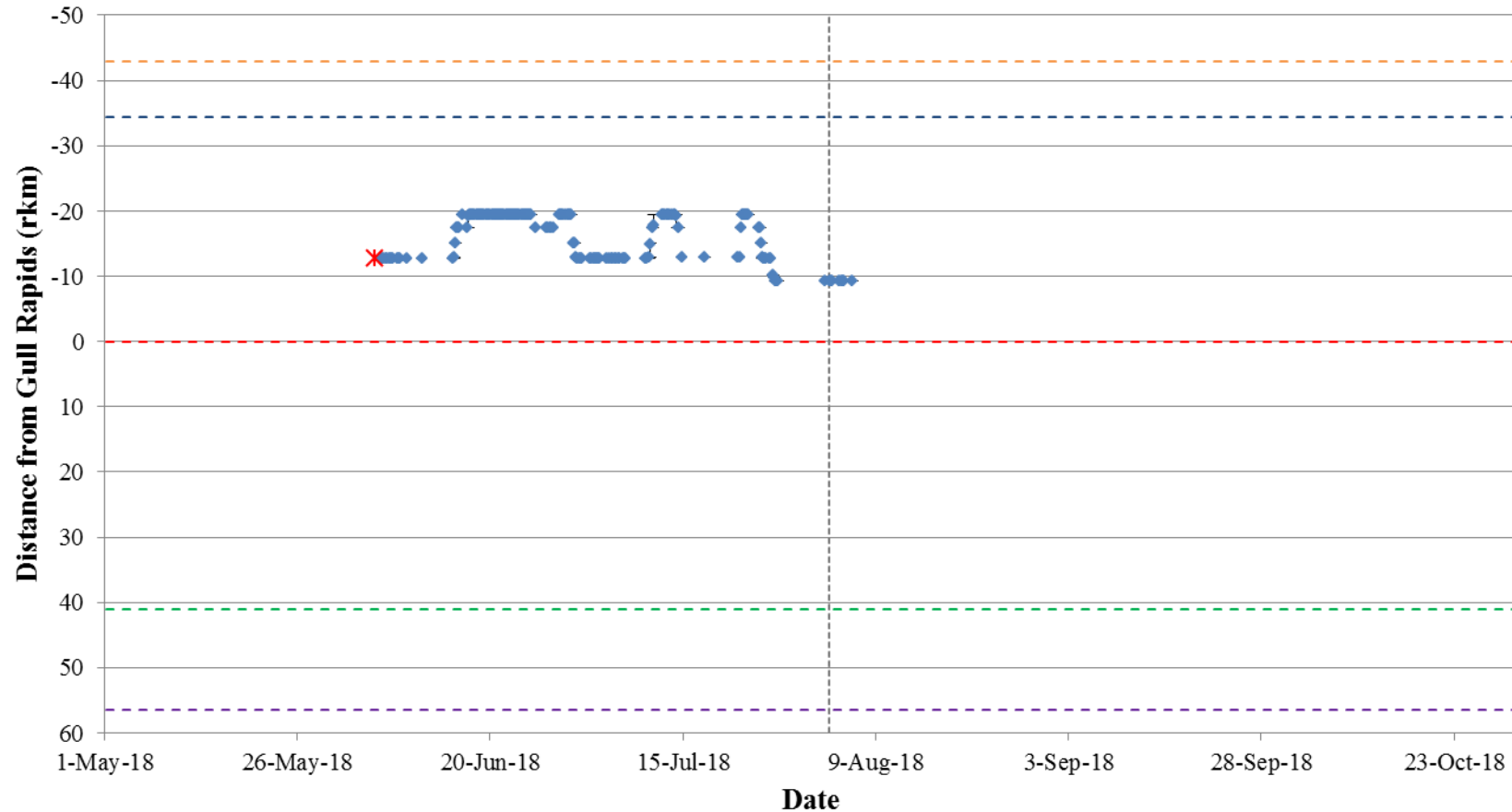
**Figure A2-50: Position of a Walleye tagged with an acoustic transmitter (code #25740) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



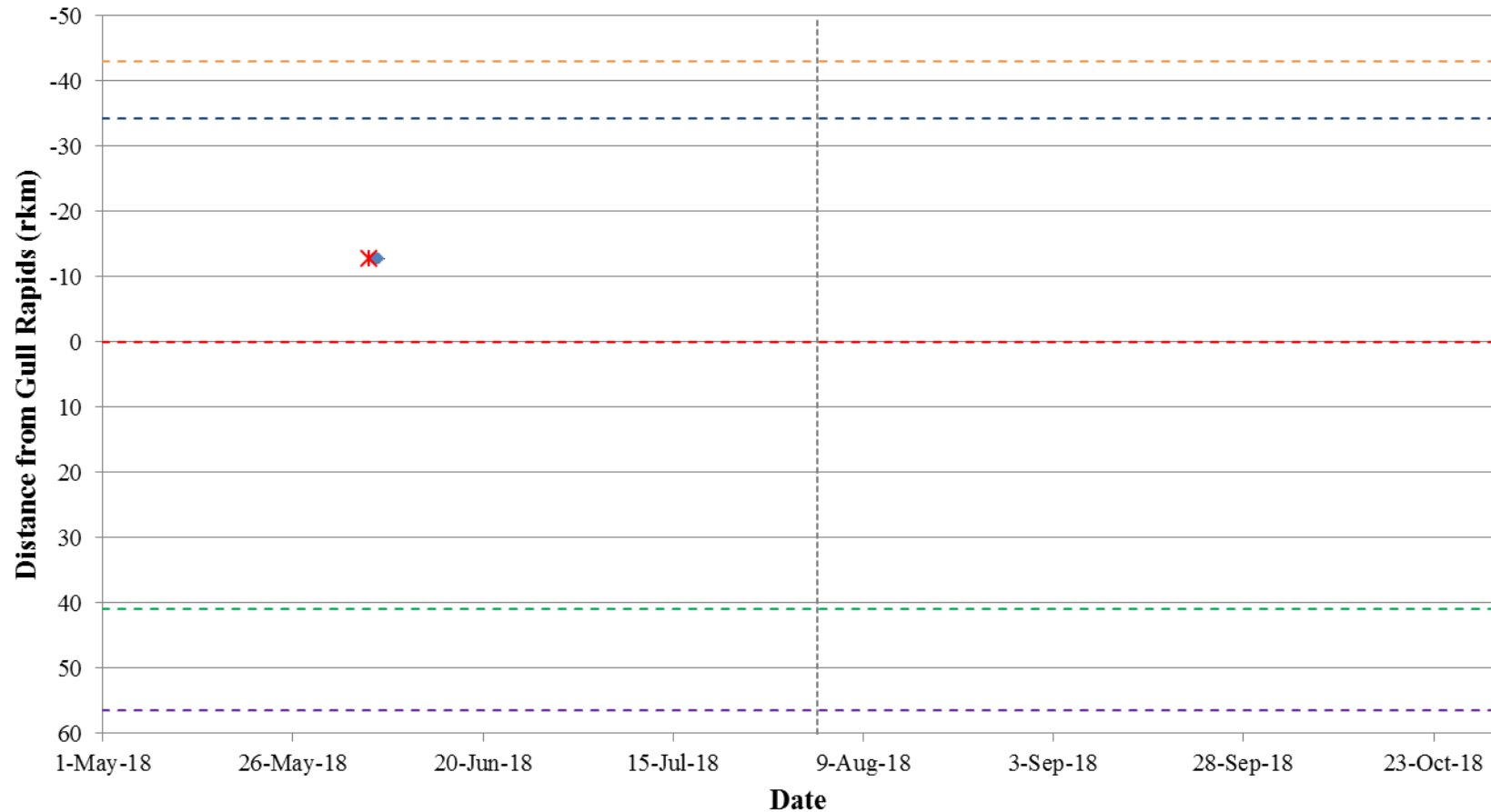
**Figure A2-51: Position of a Walleye tagged with an acoustic transmitter (code #25742) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



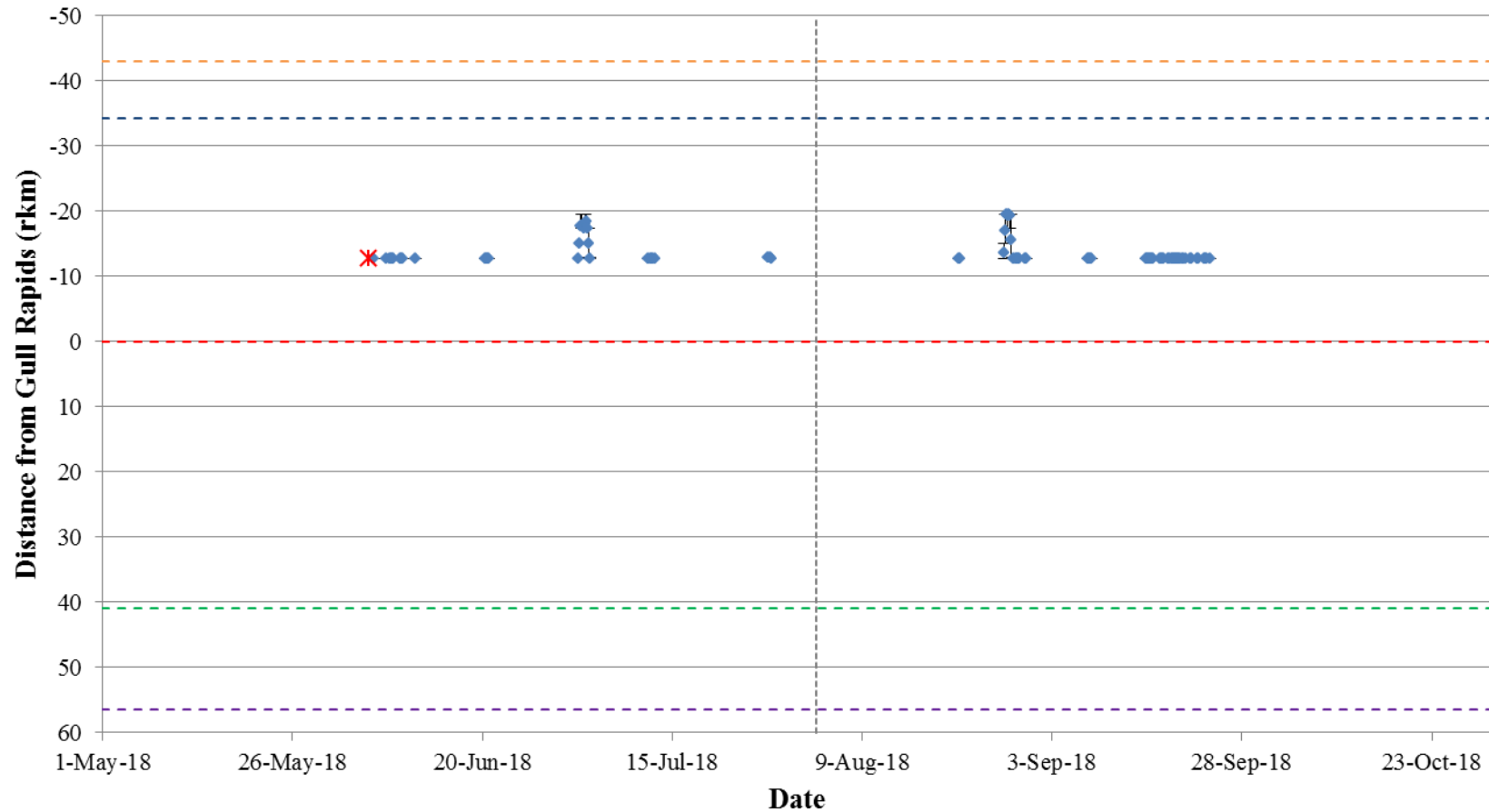
**Figure A2-52: Position of a Walleye tagged with an acoustic transmitter (code #25743) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-53: Position of a Walleye tagged with an acoustic transmitter (code #25744) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

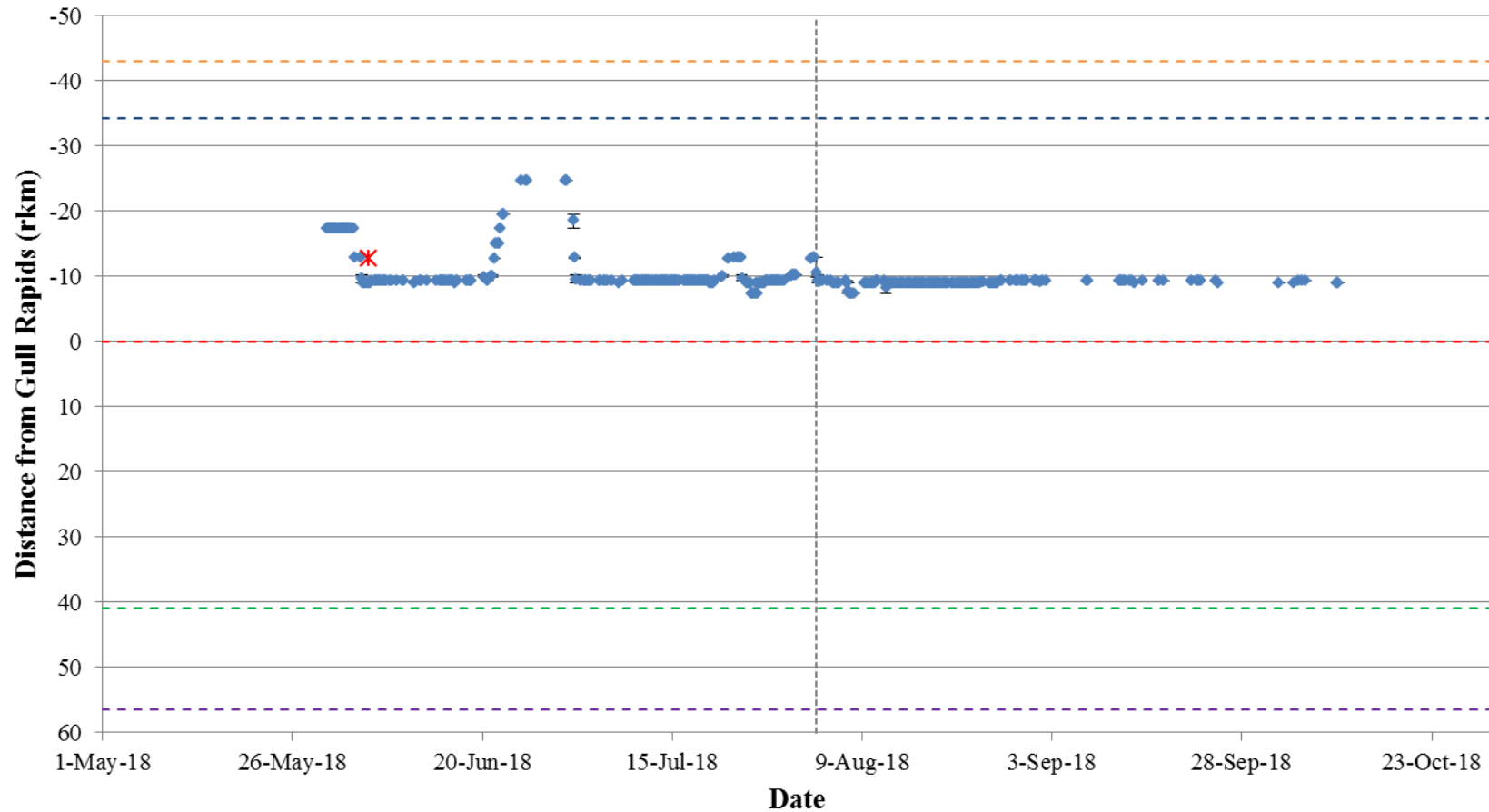


**Figure A2-54: Position of a Walleye tagged with an acoustic transmitter (code #25745) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

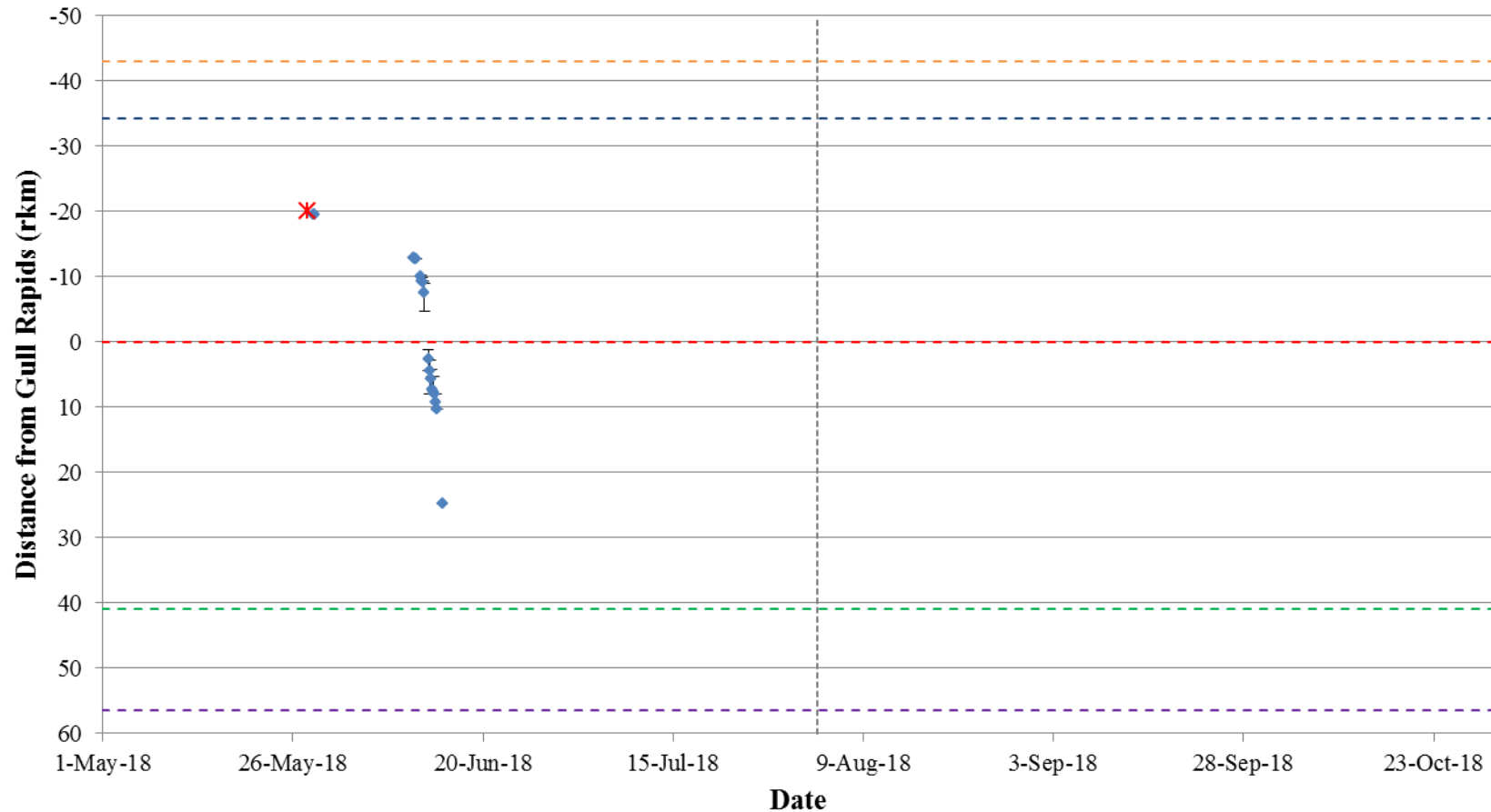


**Figure A2-55: Position of a Walleye tagged with an acoustic transmitter (code #25746) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

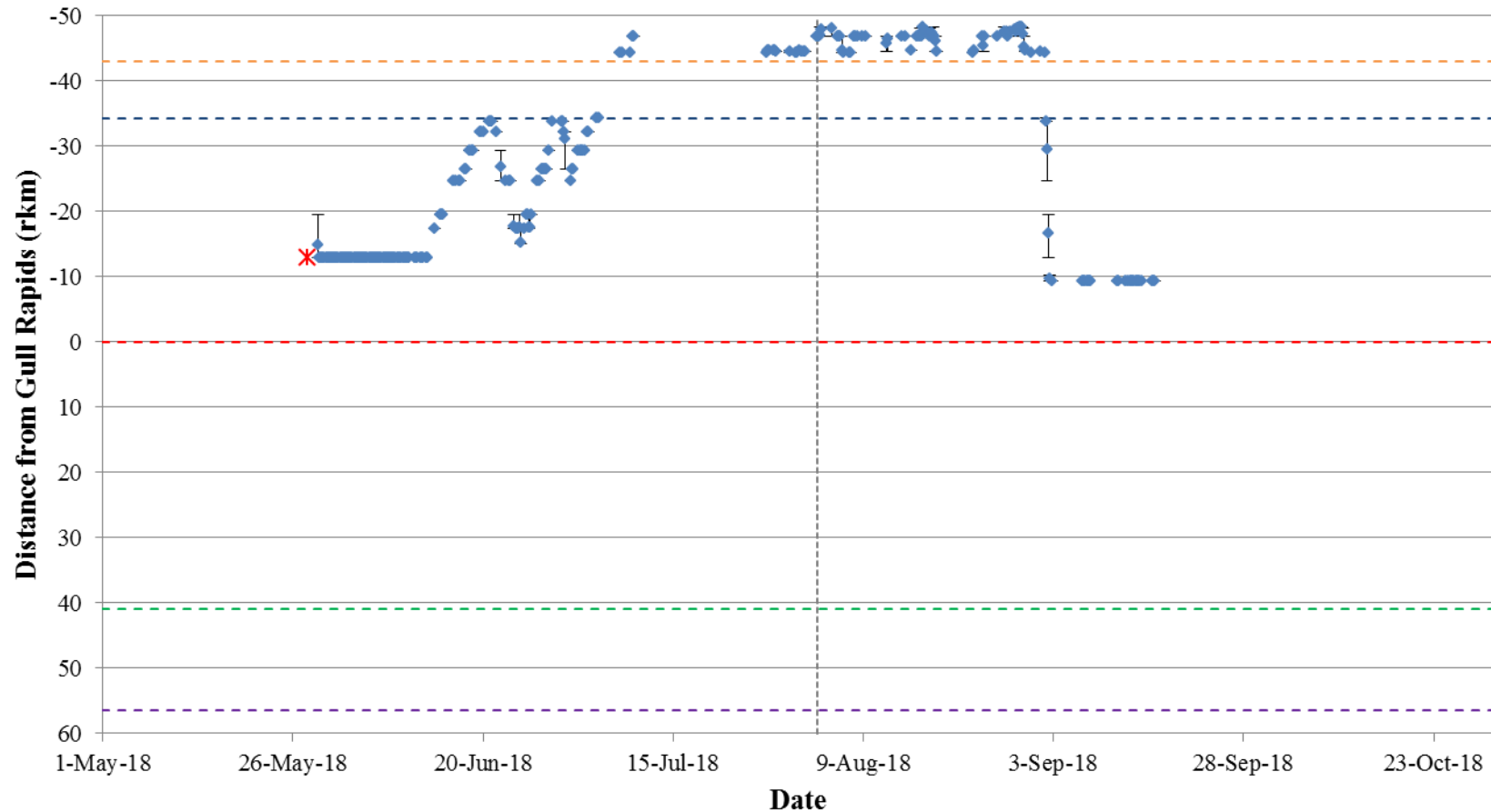




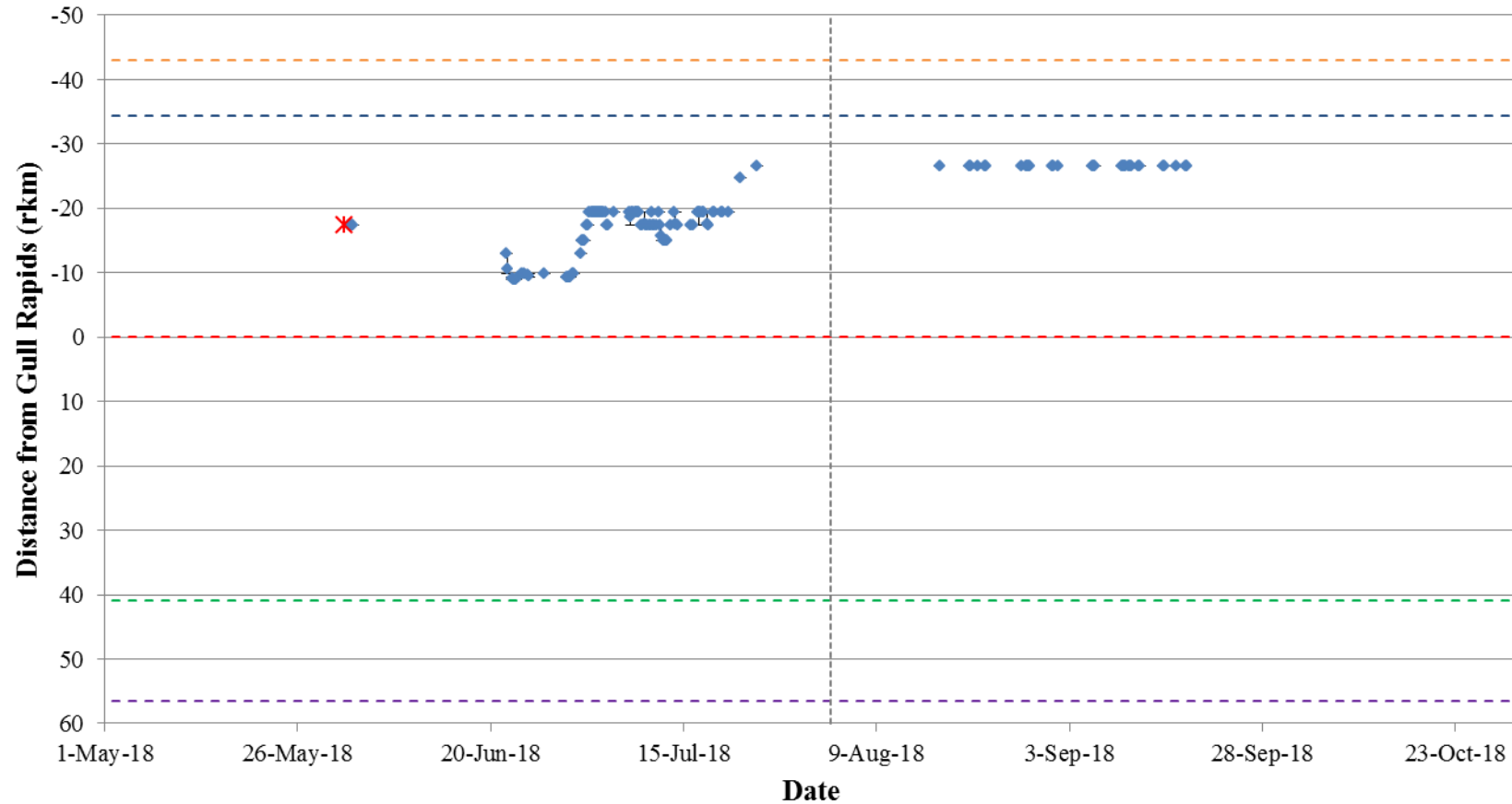
**Figure A2-56: Position of a Walleye tagged with an acoustic transmitter (code #25747) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



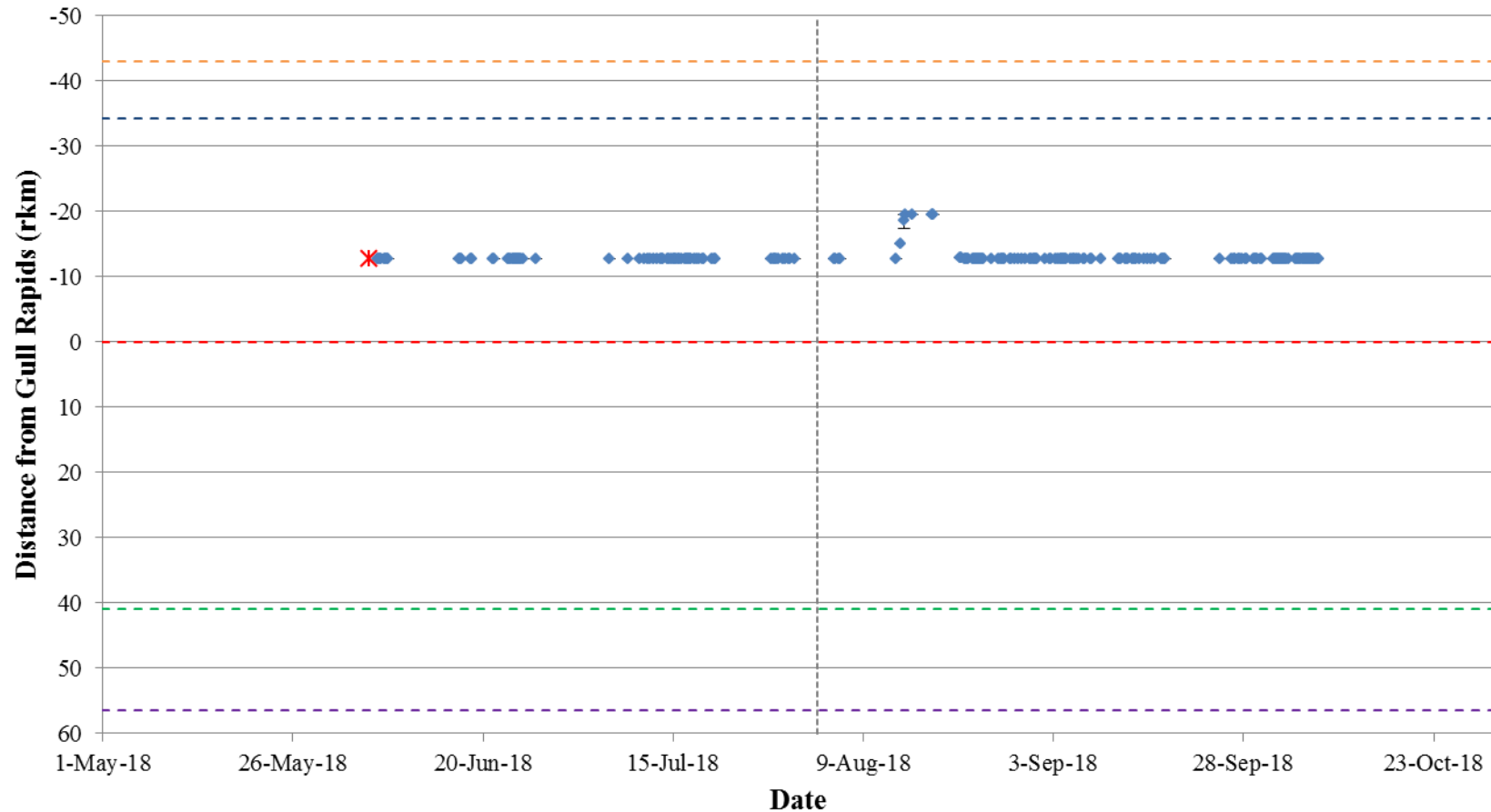
**Figure A2-57: Position of a Walleye tagged with an acoustic transmitter (code #25748) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



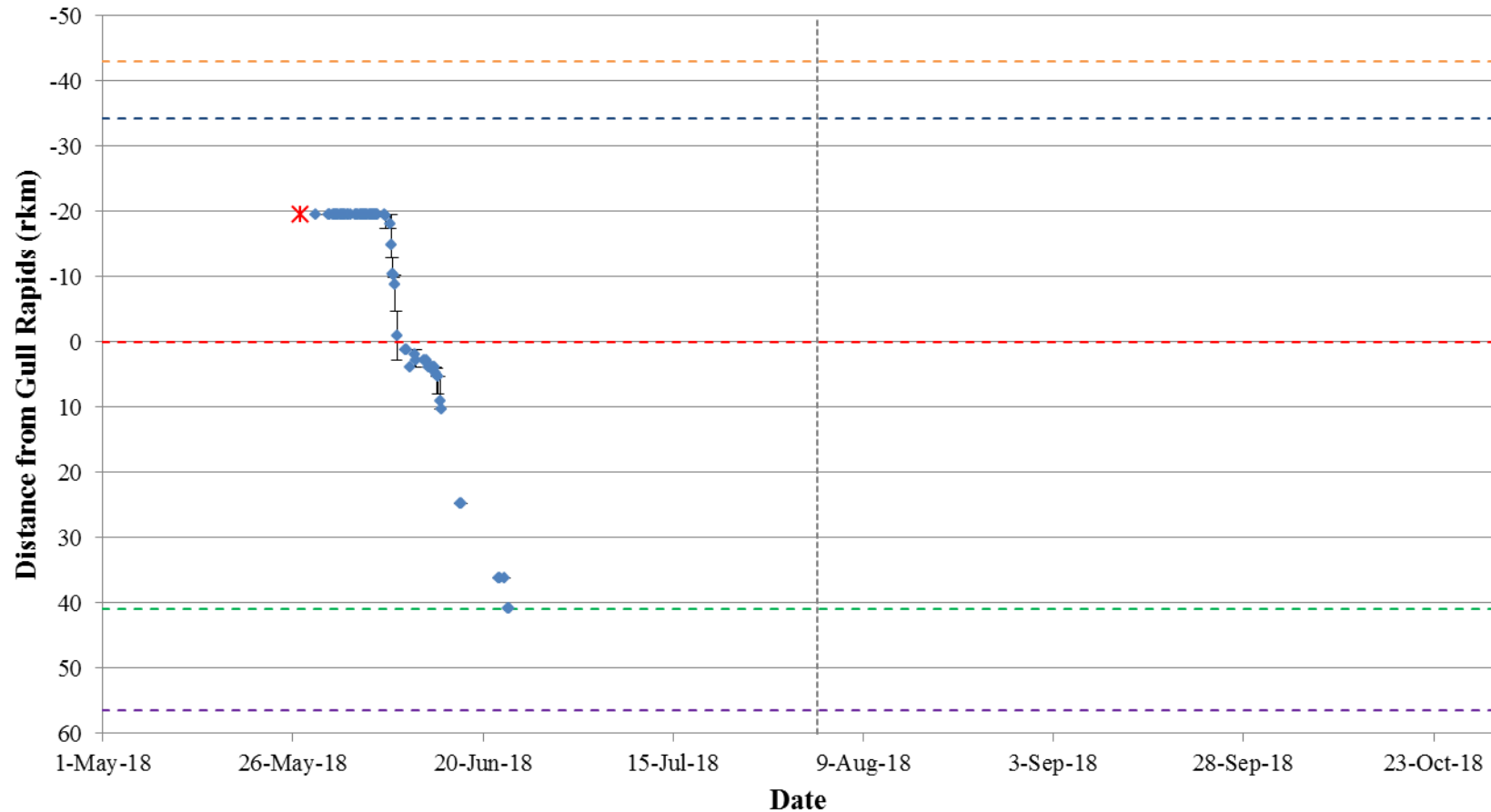
**Figure A2-58: Position of a Walleye tagged with an acoustic transmitter (code #25749) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



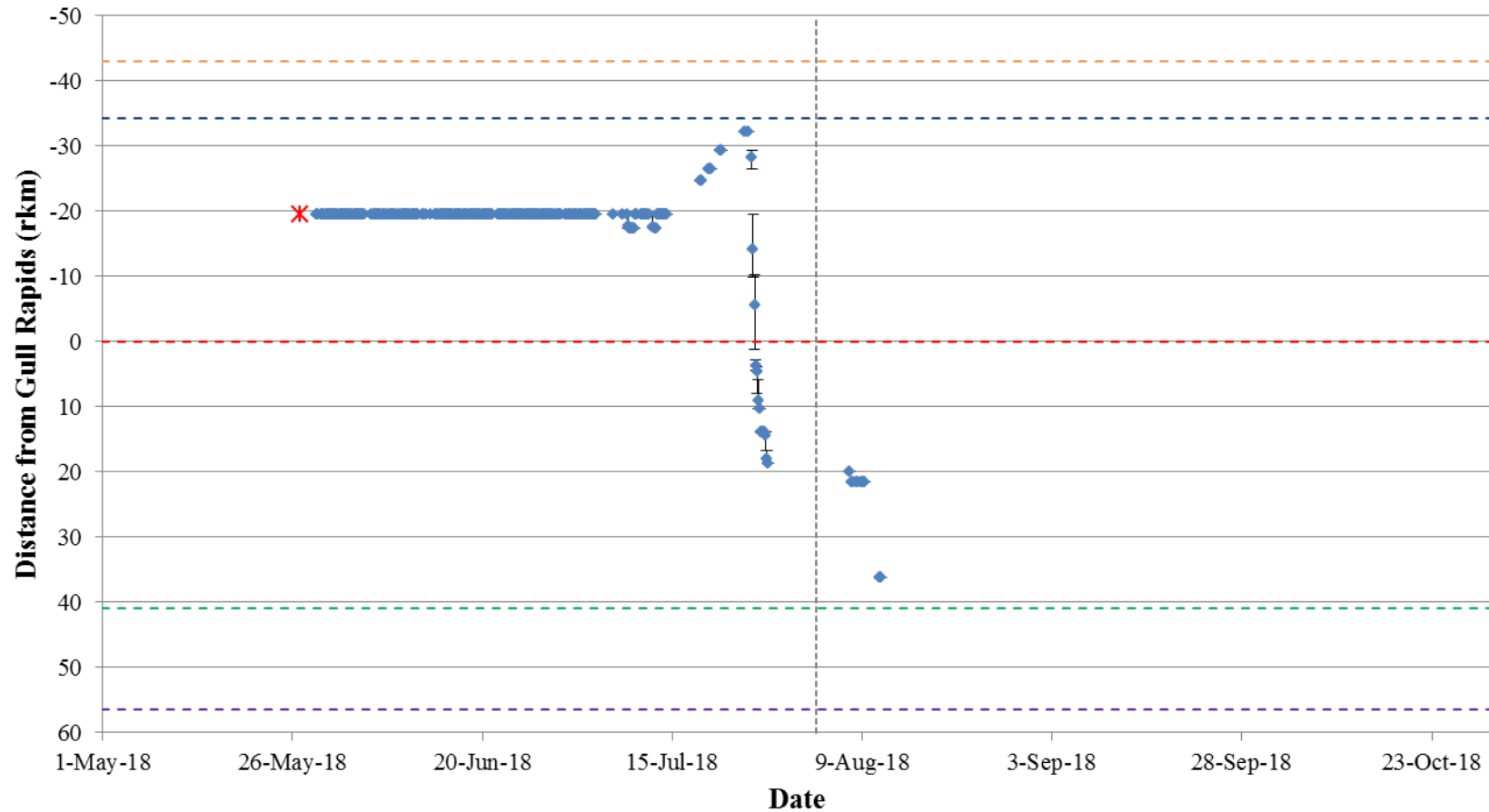
**Figure A2-59: Position of a Walleye tagged with an acoustic transmitter (code #25750) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



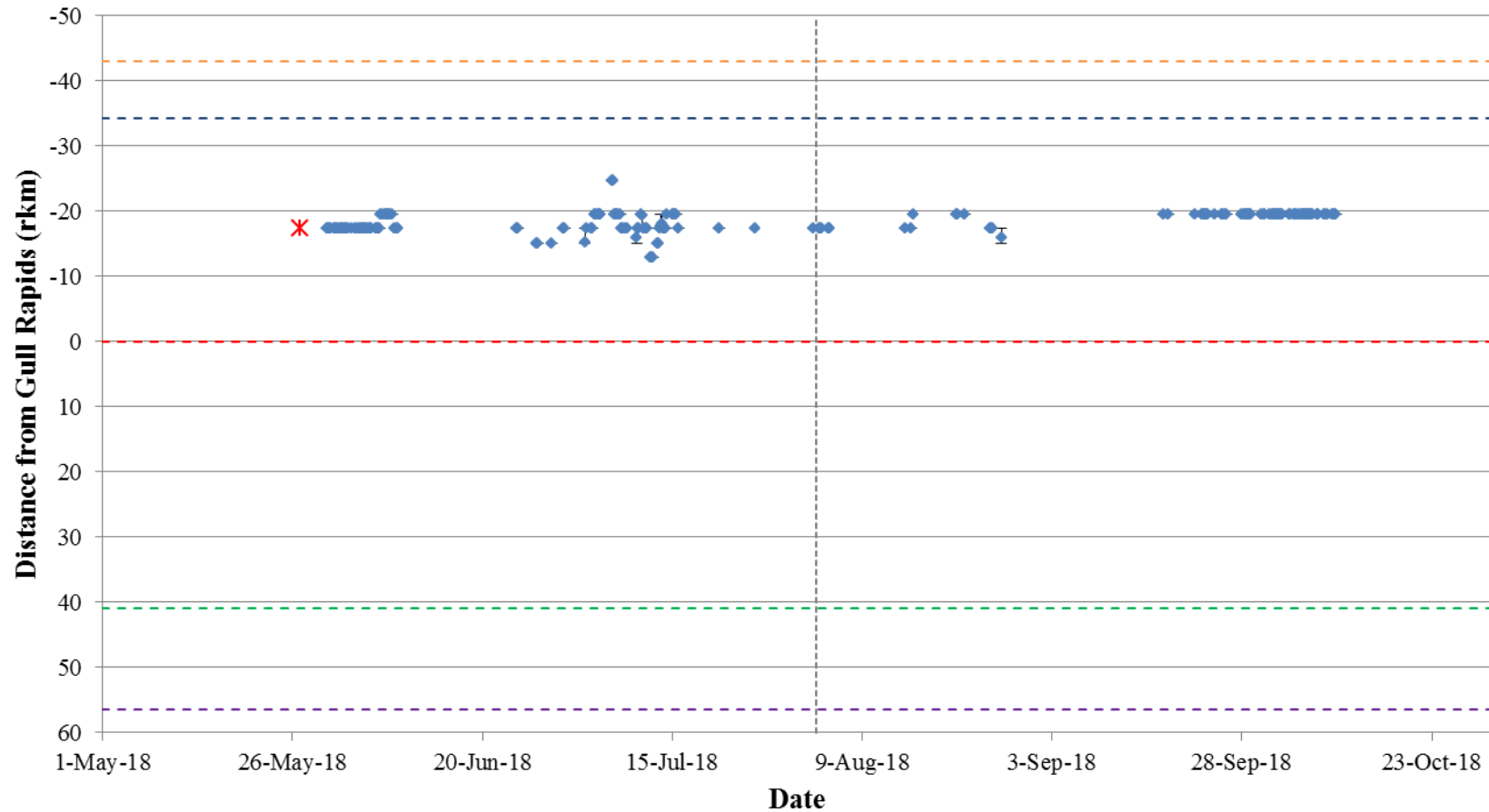
**Figure A2-60: Position of a Walleye tagged with an acoustic transmitter (code #25751) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-61: Position of a Walleye tagged with an acoustic transmitter (code #25752) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

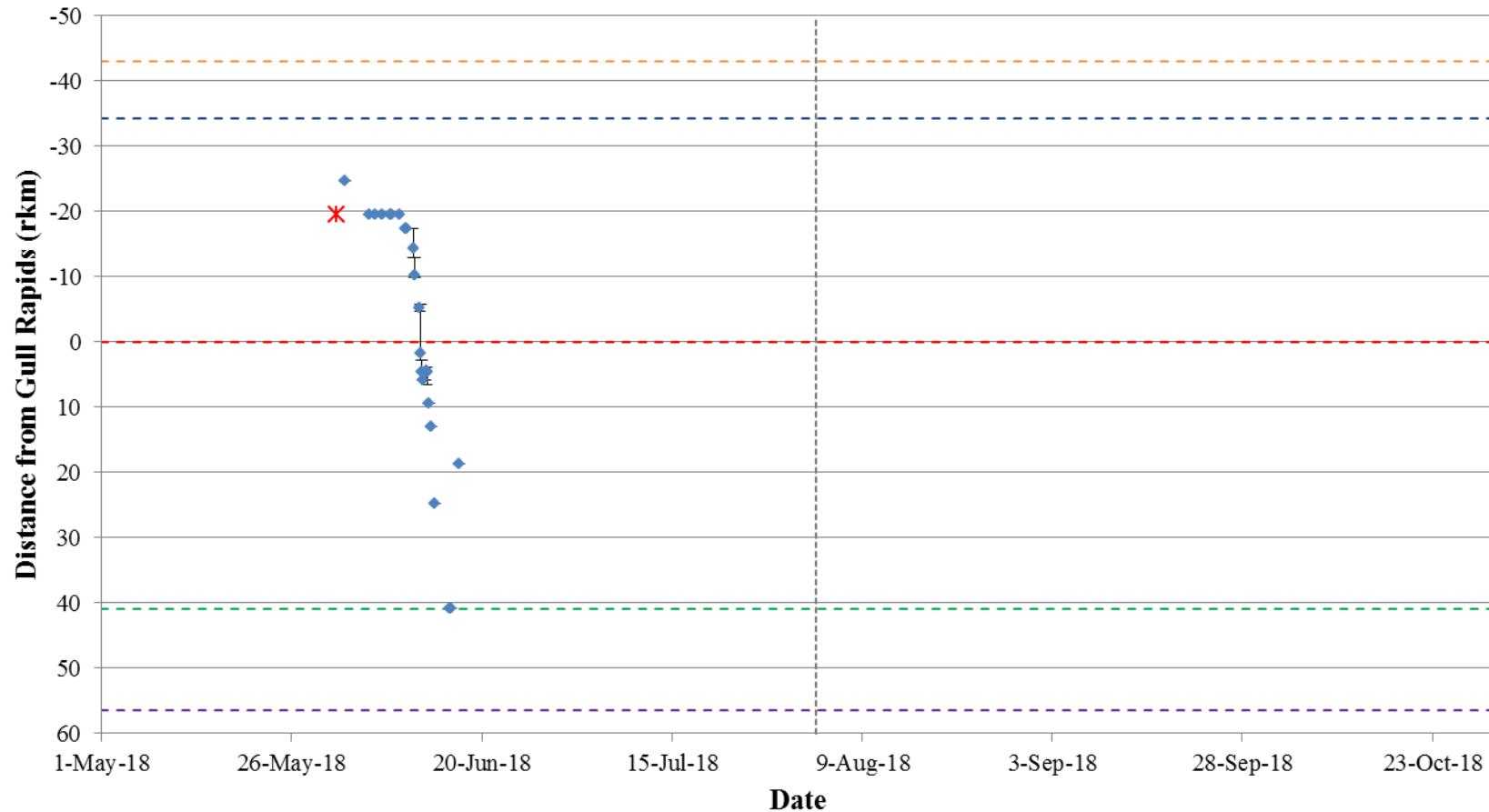


**Figure A2-62: Position of a Walleye tagged with an acoustic transmitter (code #25753) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

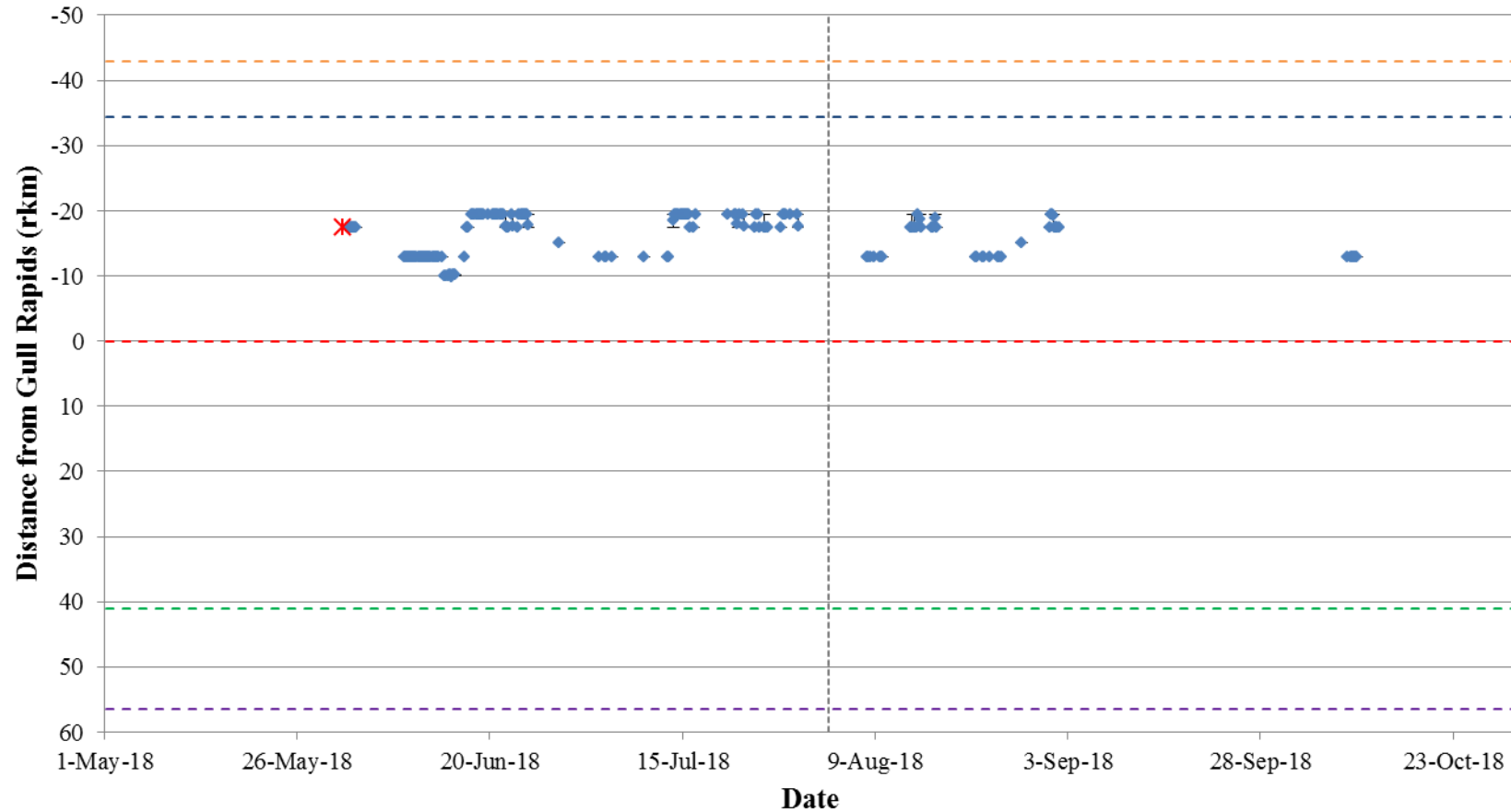


**Figure A2-63: Position of a Walleye tagged with an acoustic transmitter (code #25754) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**





**Figure A2-64: Position of a Walleye tagged with an acoustic transmitter (code #25755) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A2-65: Position of a Walleye tagged with an acoustic transmitter (code #25756) in the Nelson River between Clark Lake and Gull Rapids in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

## **APPENDIX 3:**

# **LOCATION SUMMARY FOR INDIVIDUAL ACOUSTIC TAGGED WALLEYE IN STEPHENS LAKE JUNE 2016 TO OCTOBER 2018**

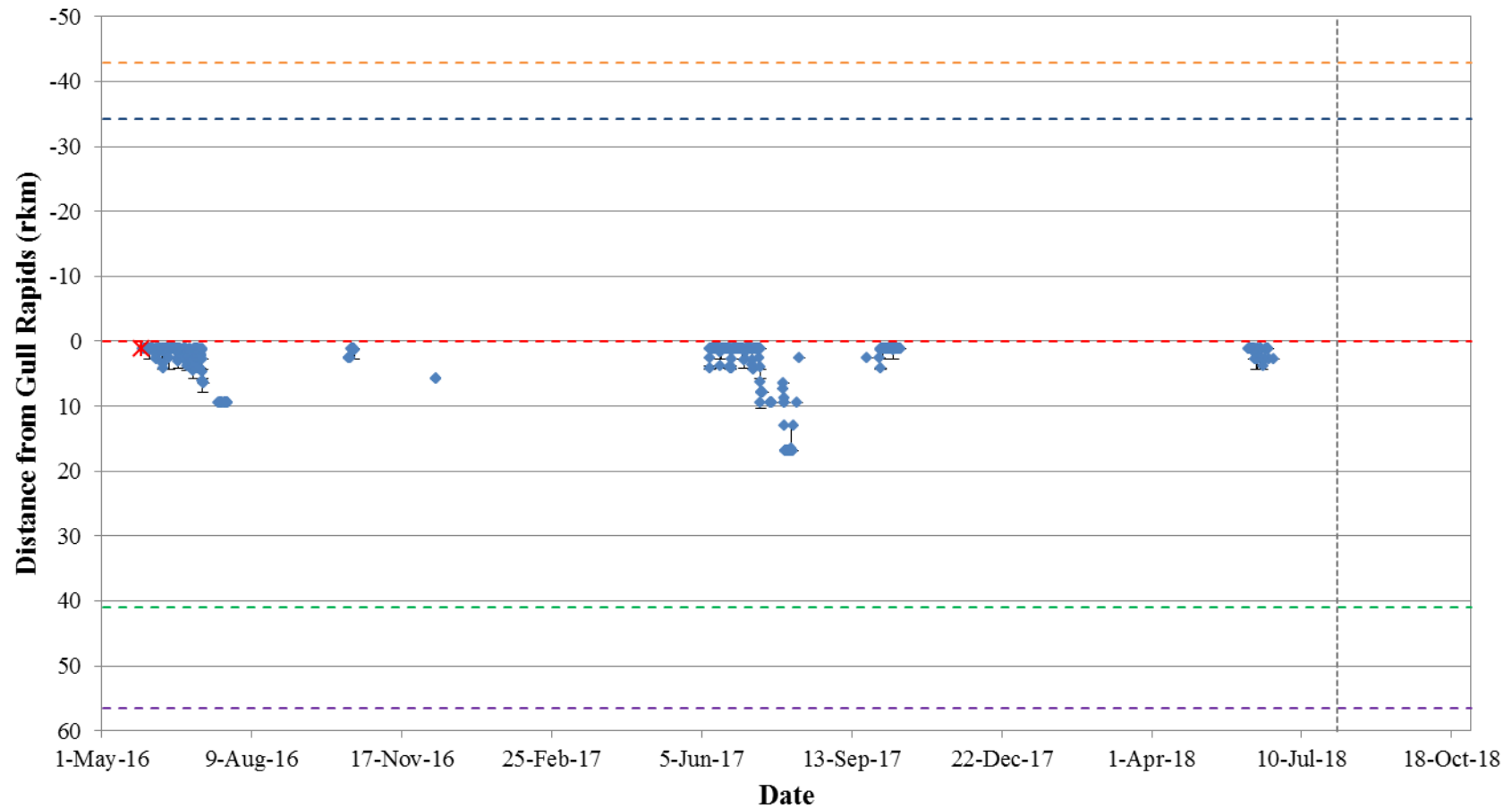
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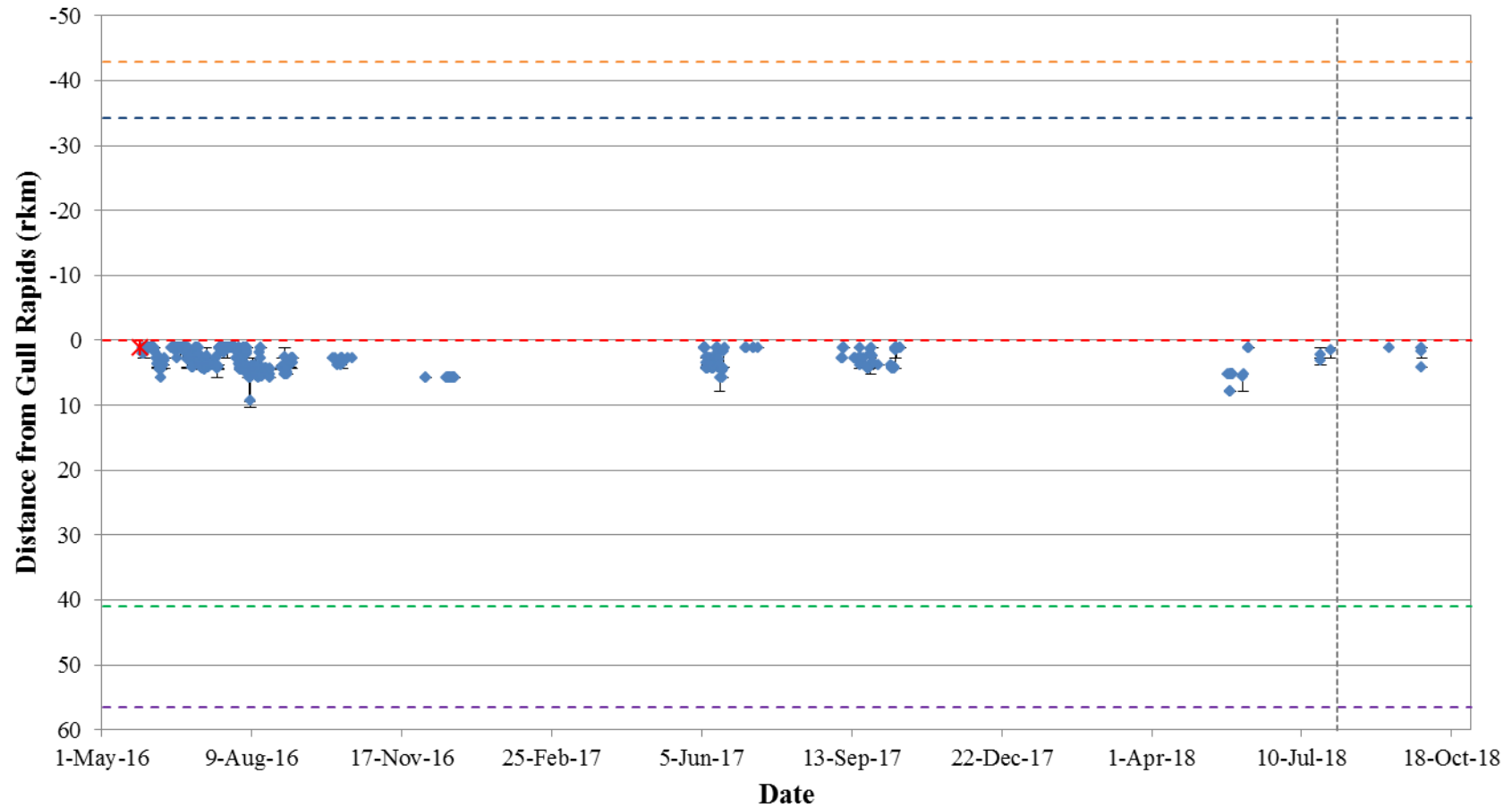
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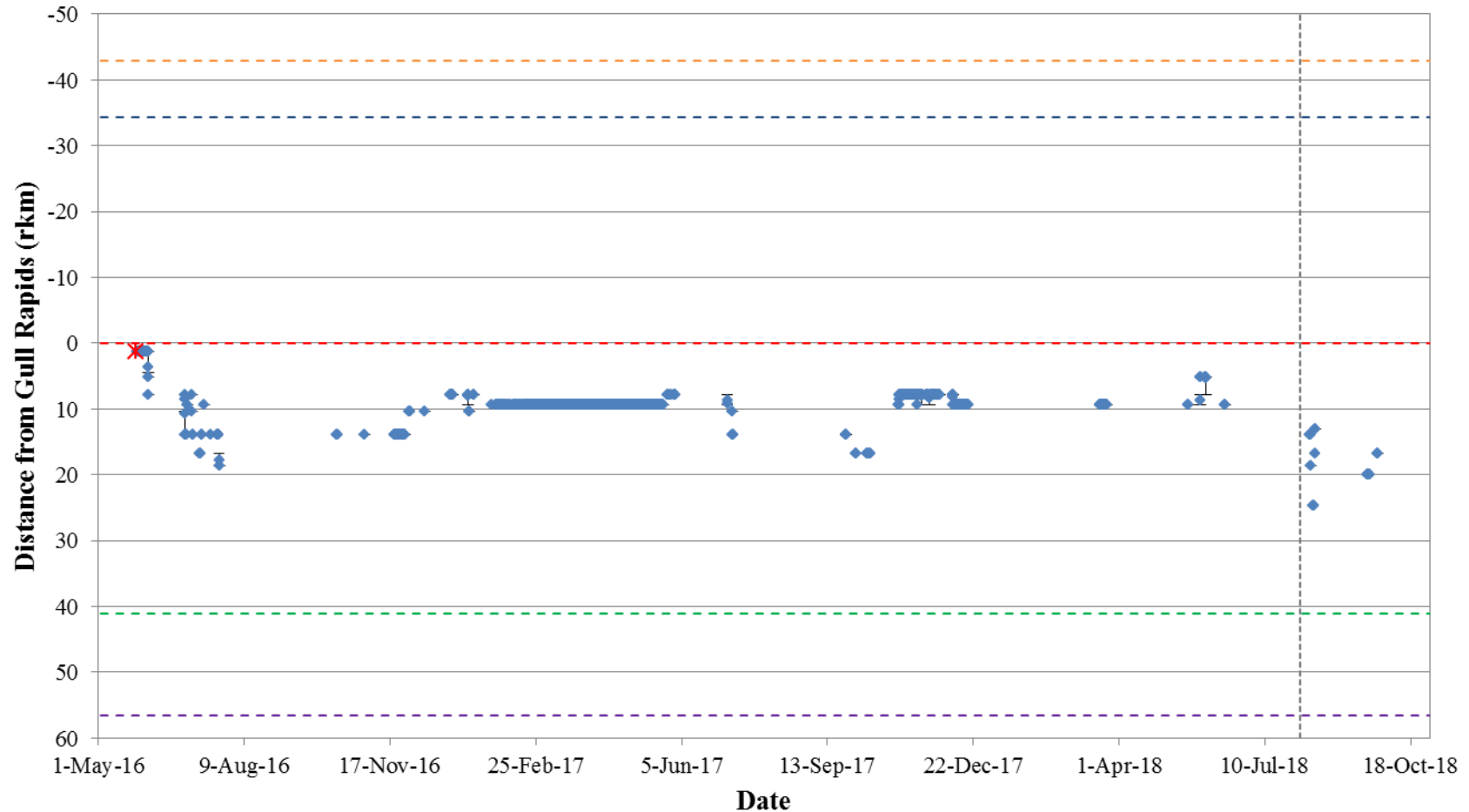


**Figure A3-1: Position of a Walleye tagged with an acoustic transmitter (code #53723) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

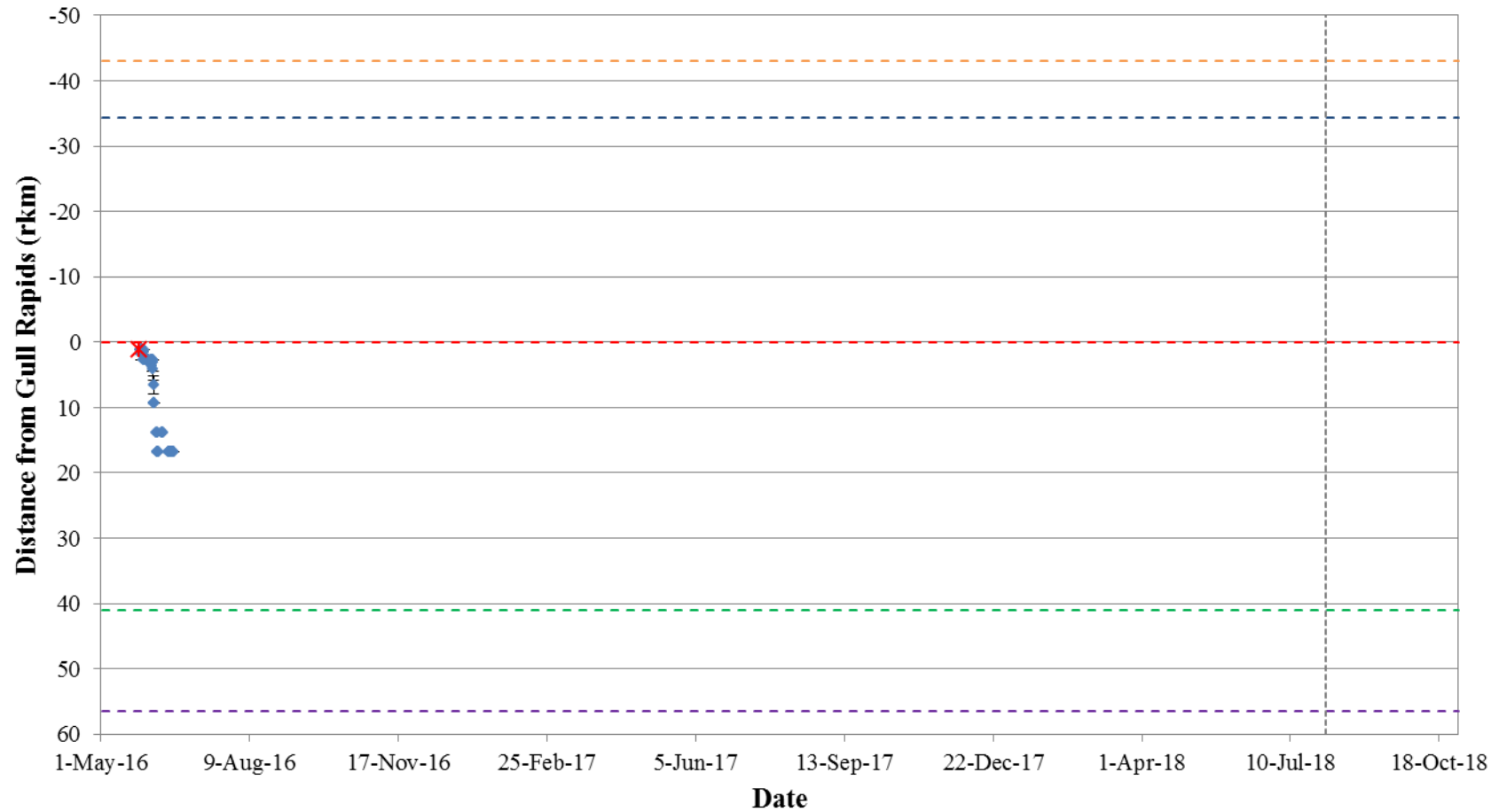


**Figure A3-2: Position of a Walleye tagged with an acoustic transmitter (code #53724) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

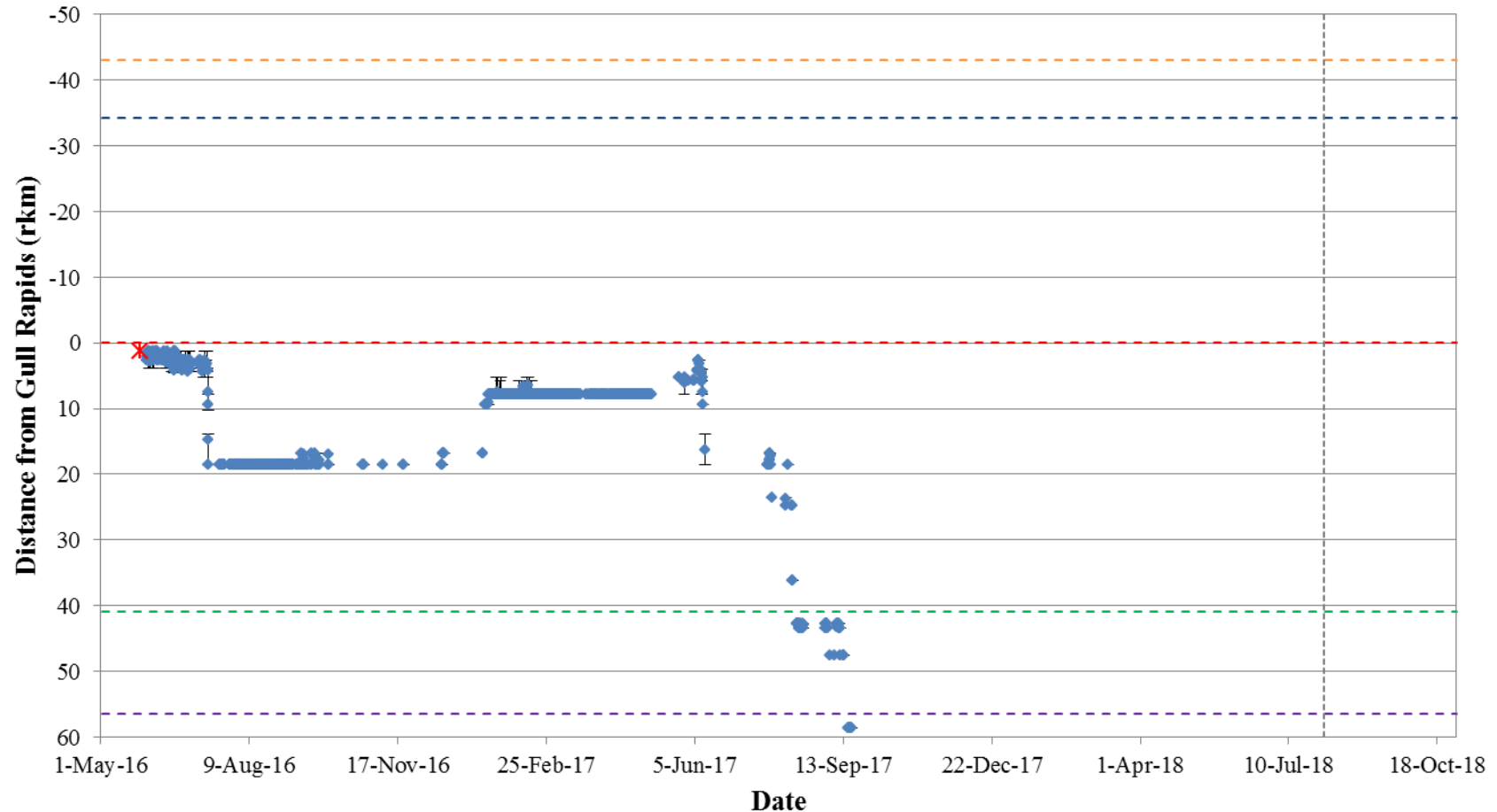




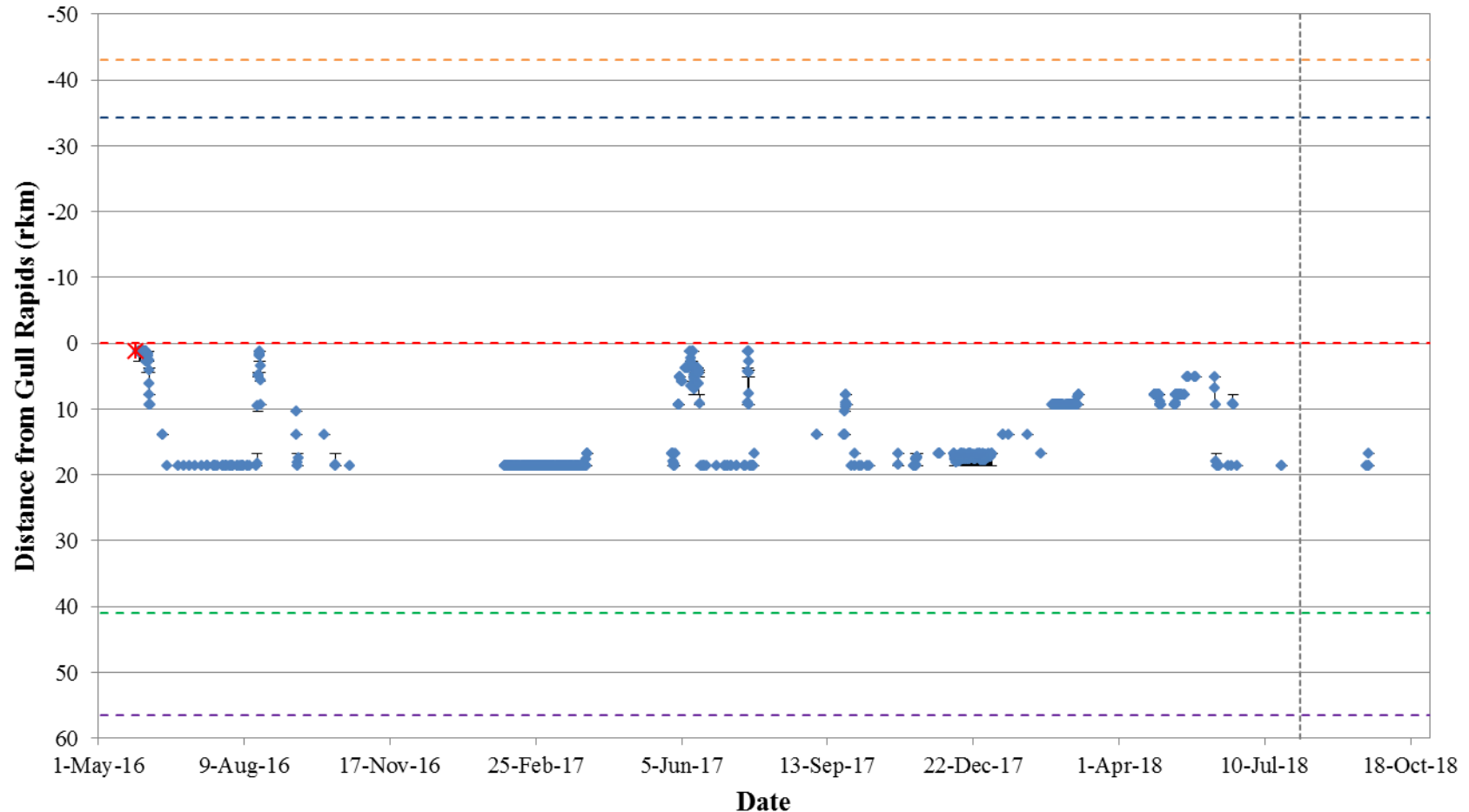
**Figure A3-3: Position of a Walleye tagged with an acoustic transmitter (code #53725) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



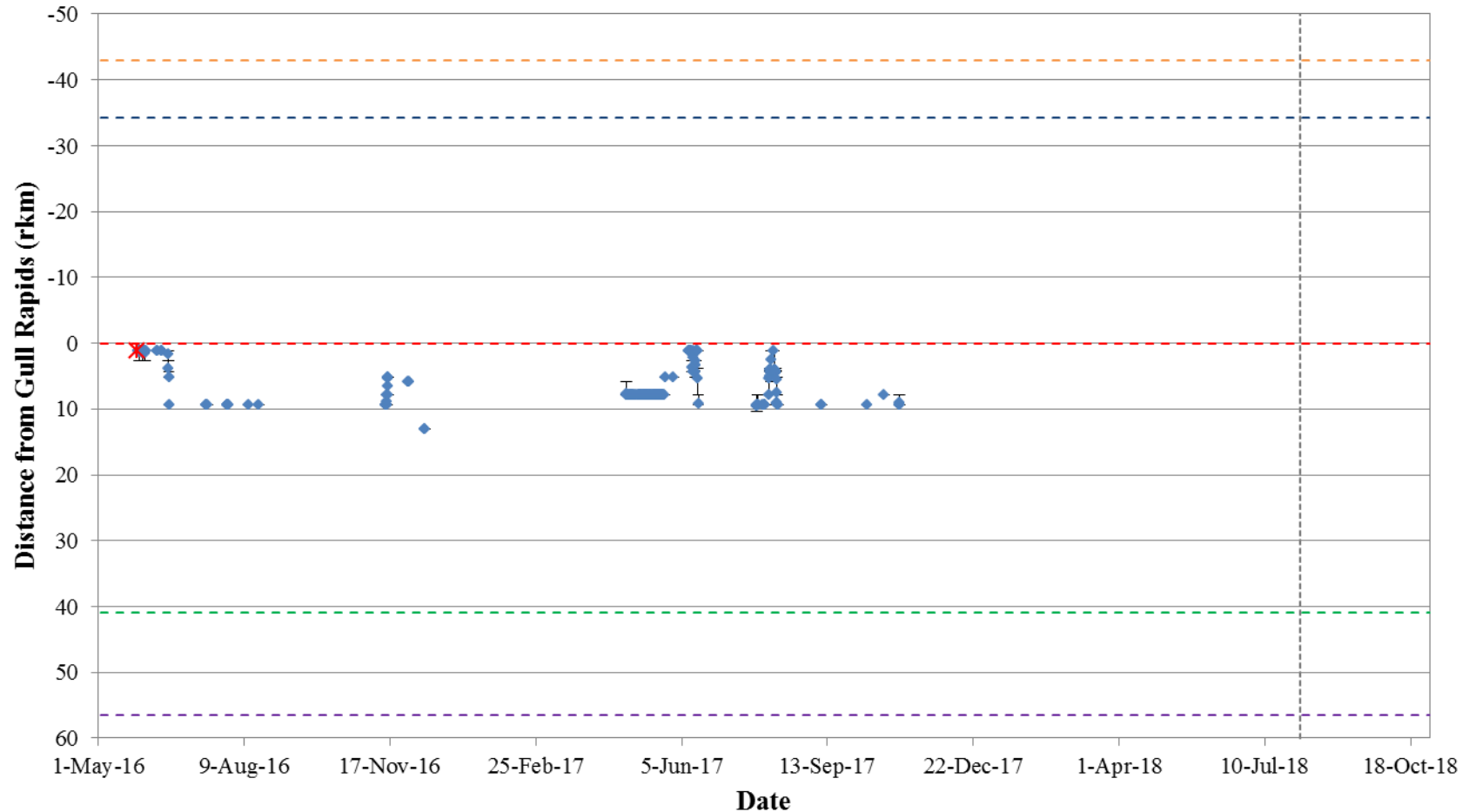
**Figure A3-4: Position of a Walleye tagged with an acoustic transmitter (code #53726) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



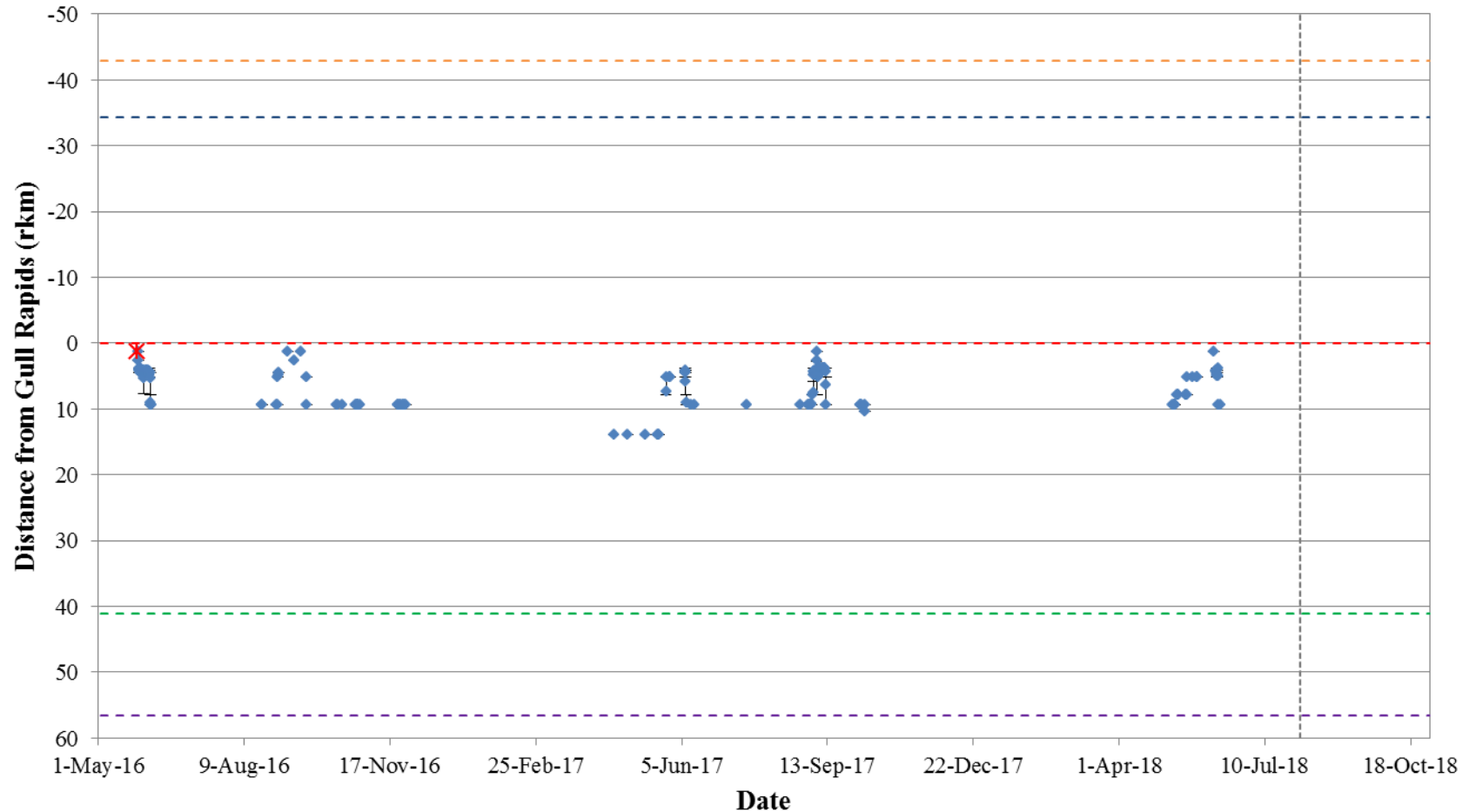
**Figure A3-5: Position of a Walleye tagged with an acoustic transmitter (code #53728) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



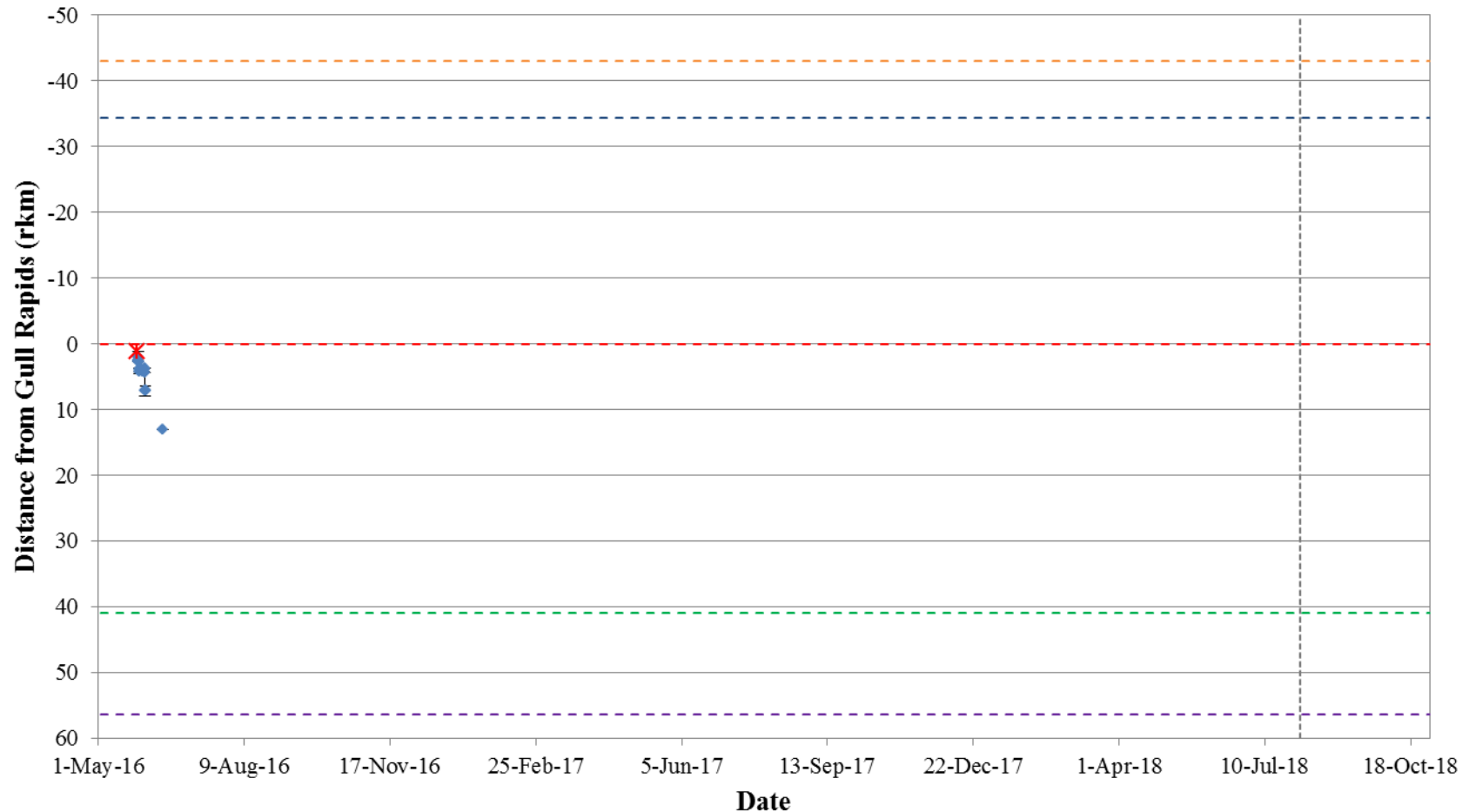
**Figure A3-6: Position of a Walleye tagged with an acoustic transmitter (code #53729) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

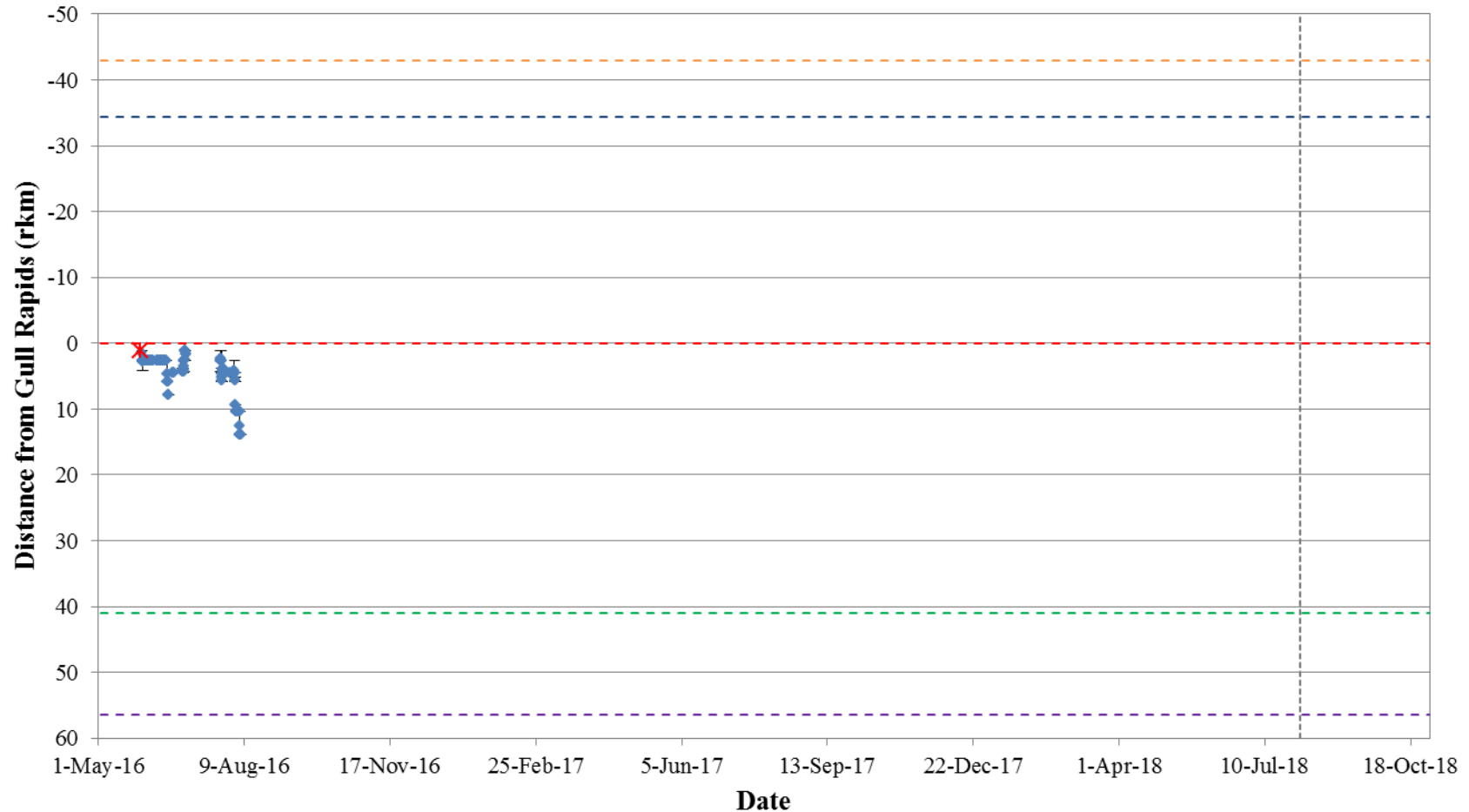


**Figure A3-7: Position of a Walleye tagged with an acoustic transmitter (code #53730) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



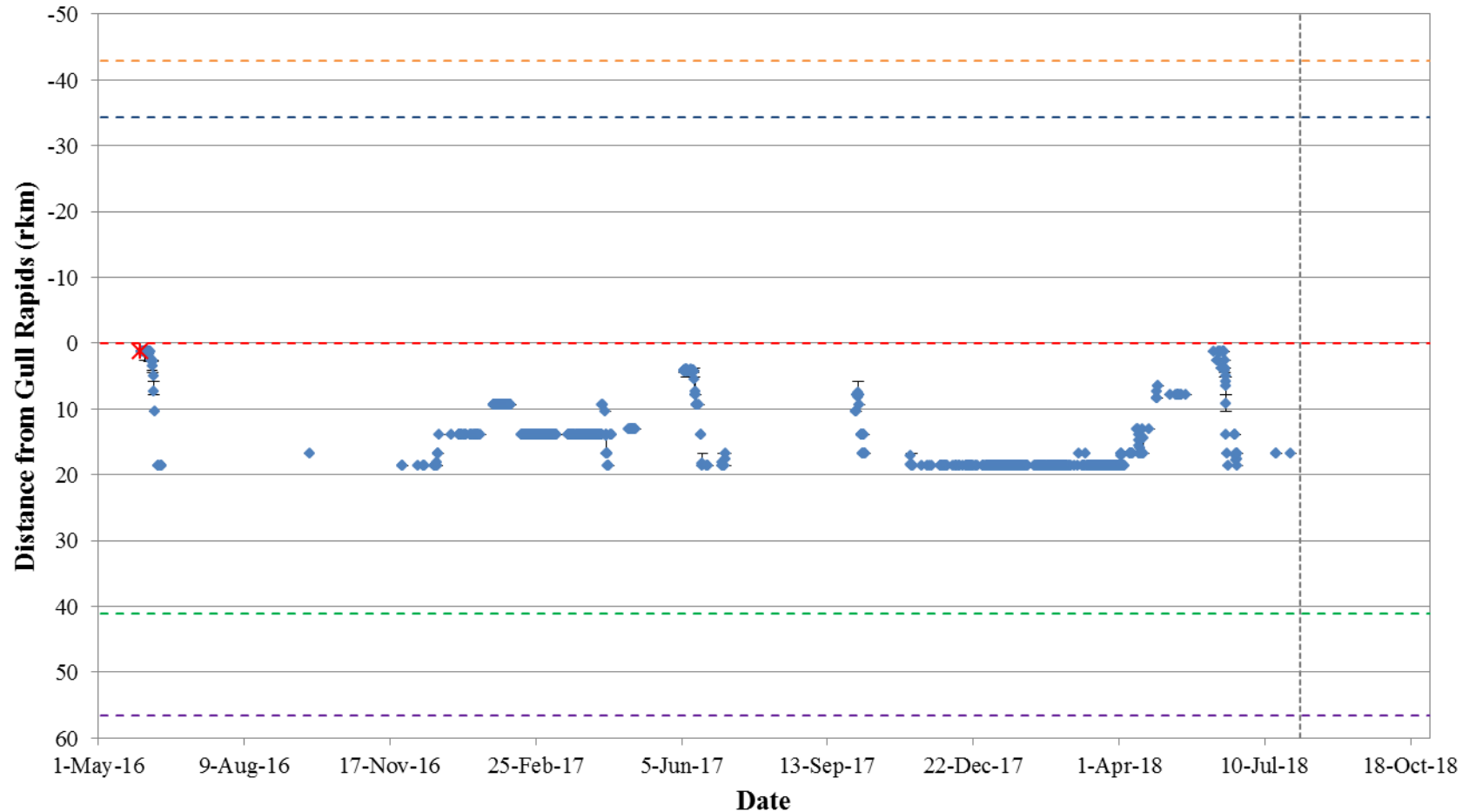
**Figure A3-8: Position of a Walleye tagged with an acoustic transmitter (code #53731) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



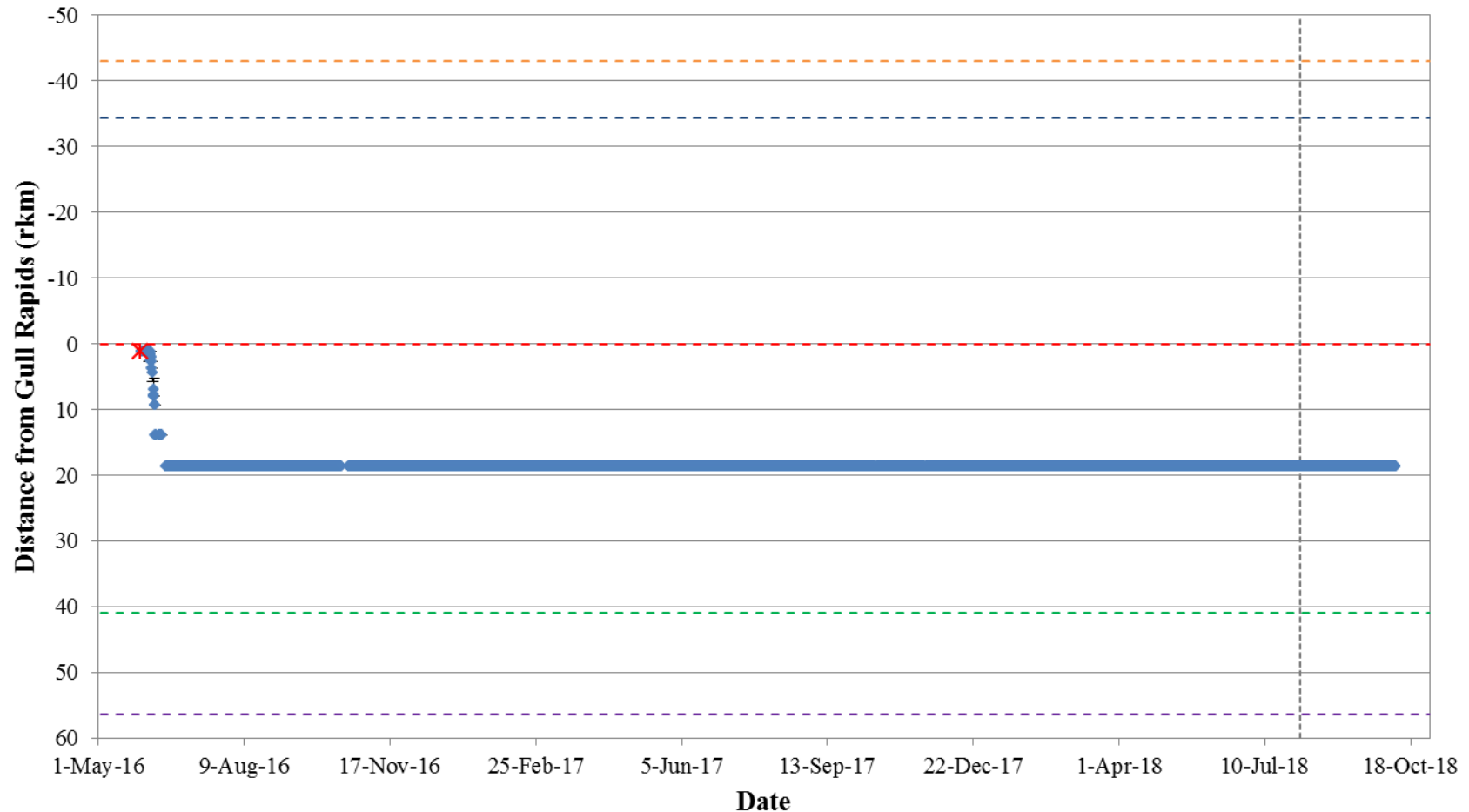


**Figure A3-10: Position of a Walleye tagged with an acoustic transmitter (code #53733) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

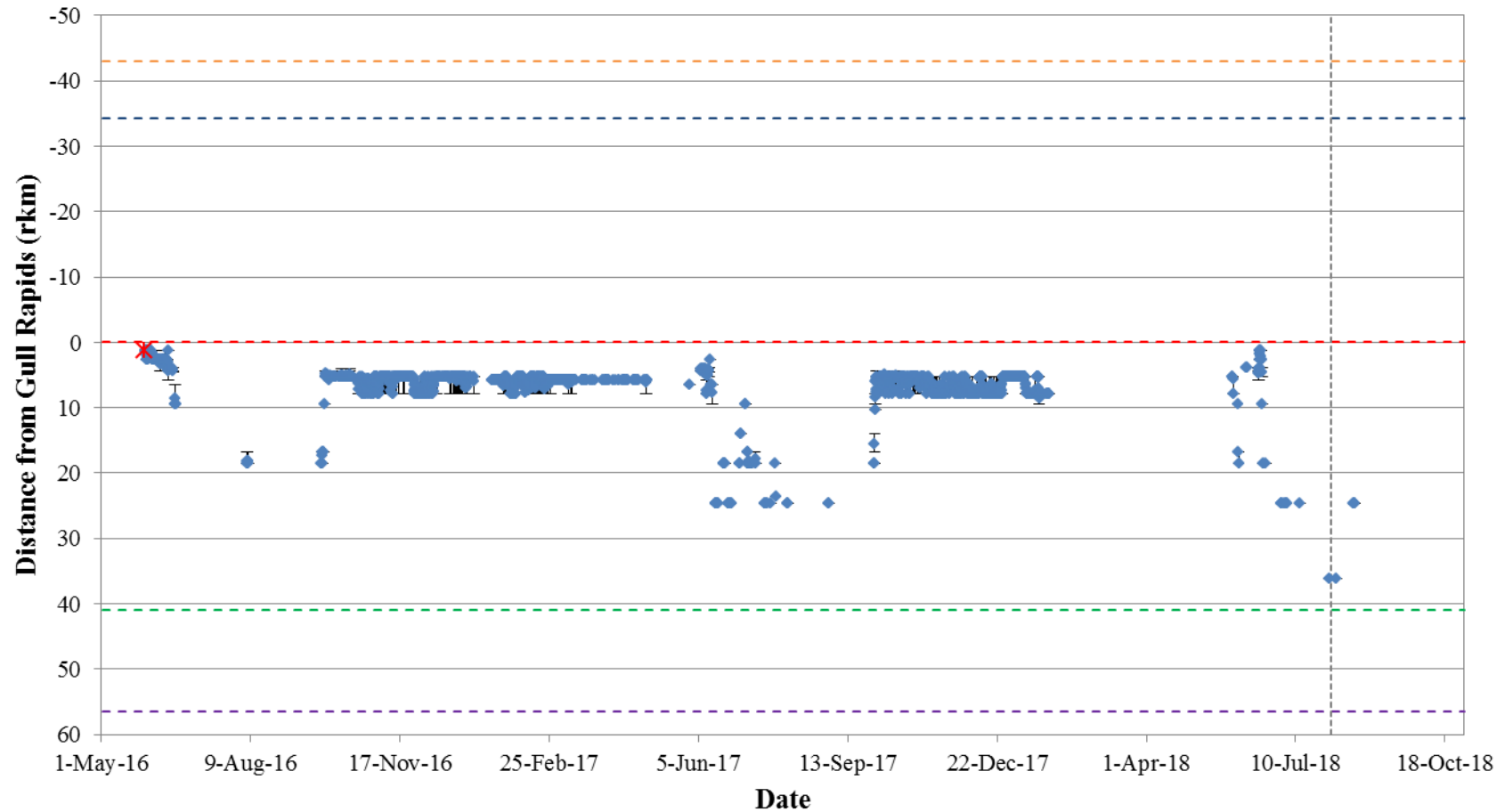




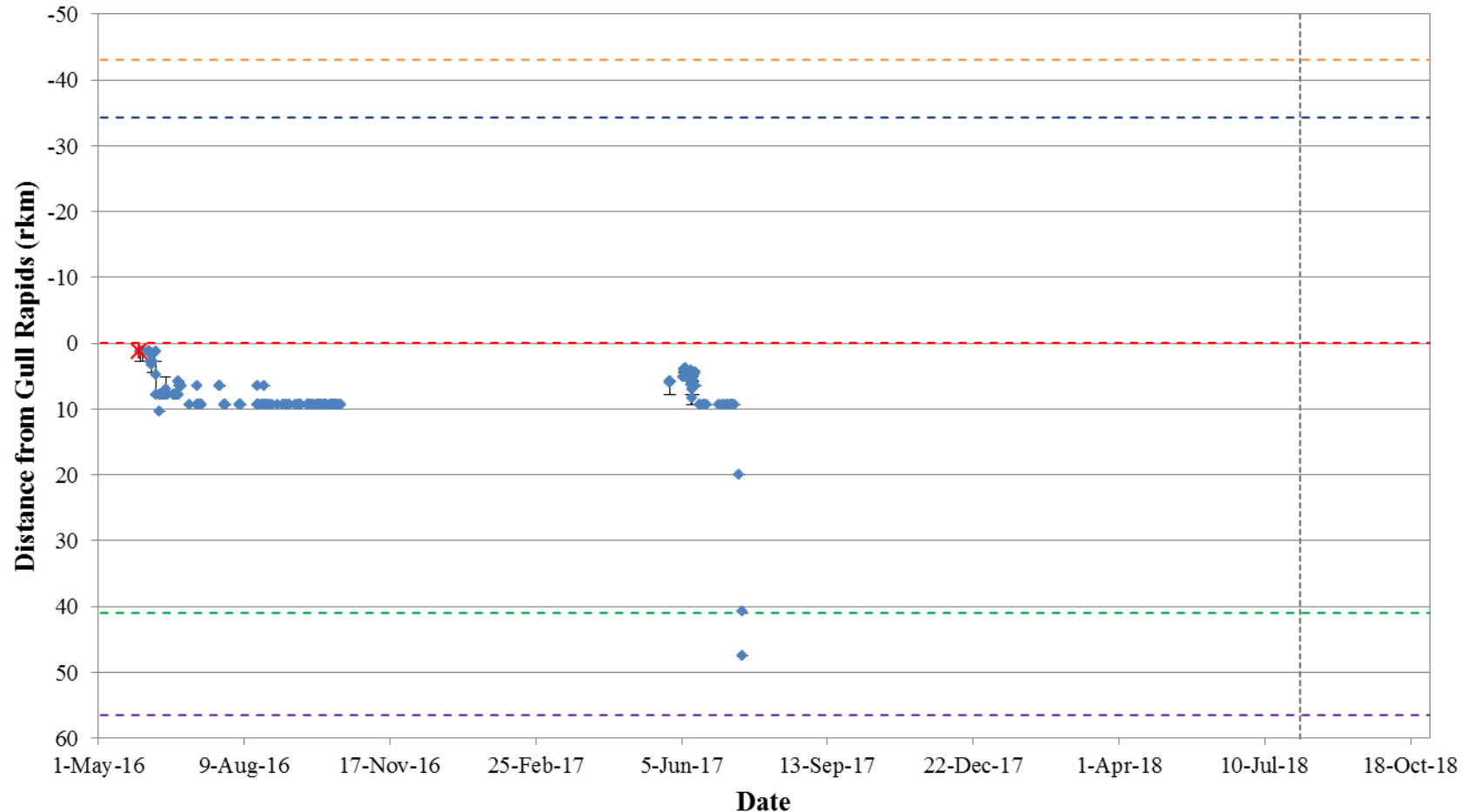
**Figure A3-11: Position of a Walleye tagged with an acoustic transmitter (code #53734) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



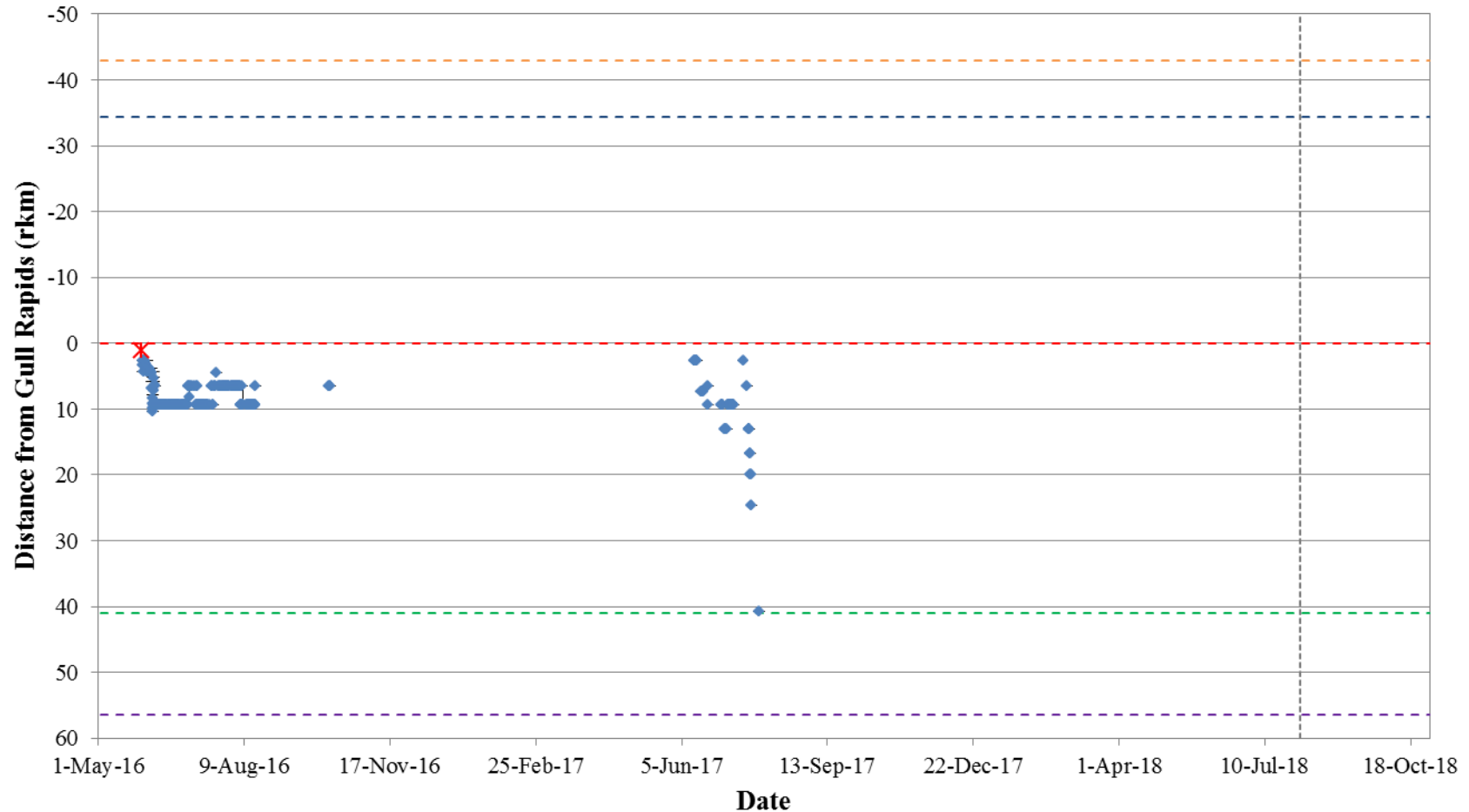
**Figure A3-12: Position of a Walleye tagged with an acoustic transmitter (code #53735) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



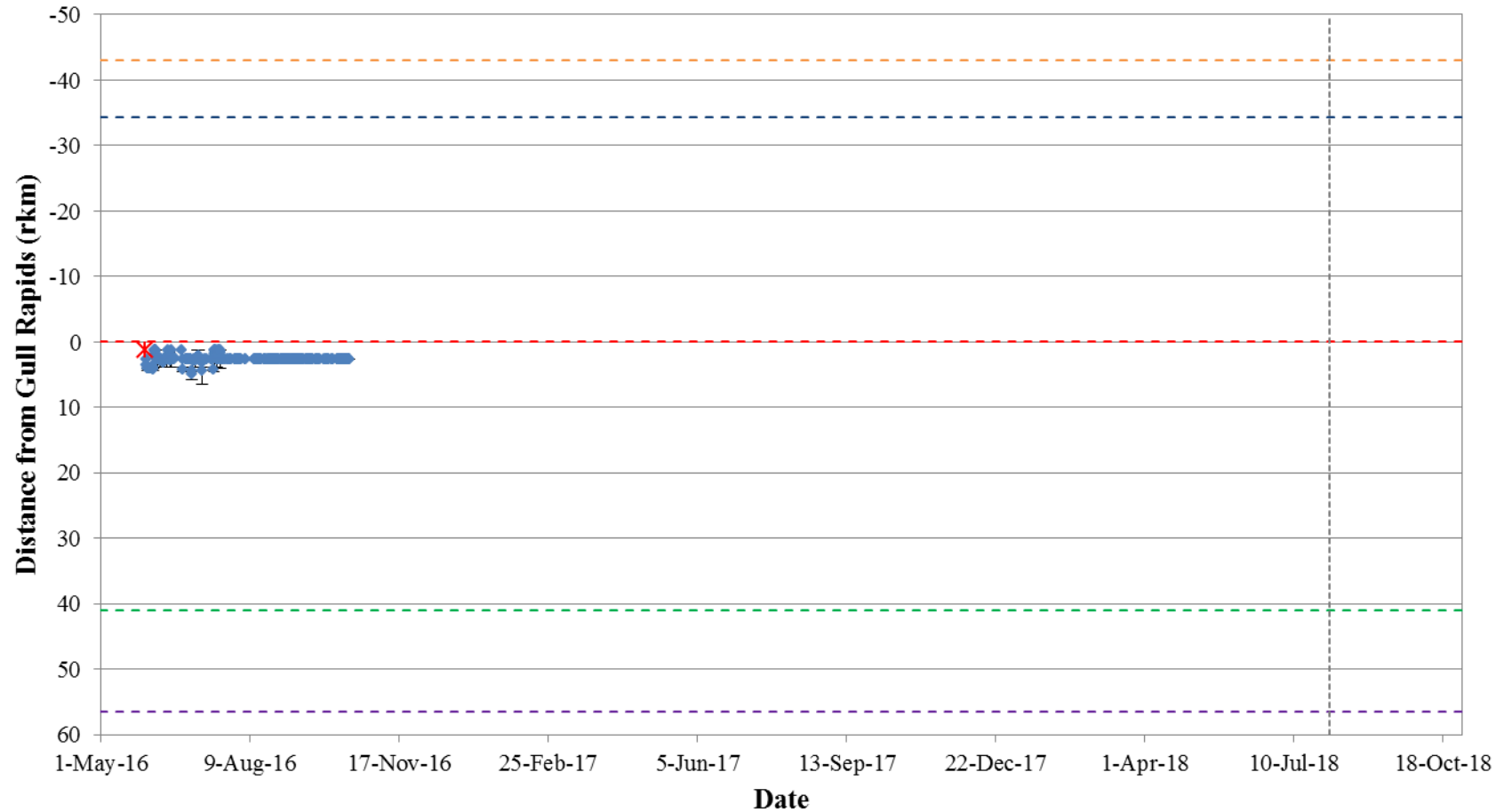
**Figure A3-13: Position of a Walleye tagged with an acoustic transmitter (code #53736) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



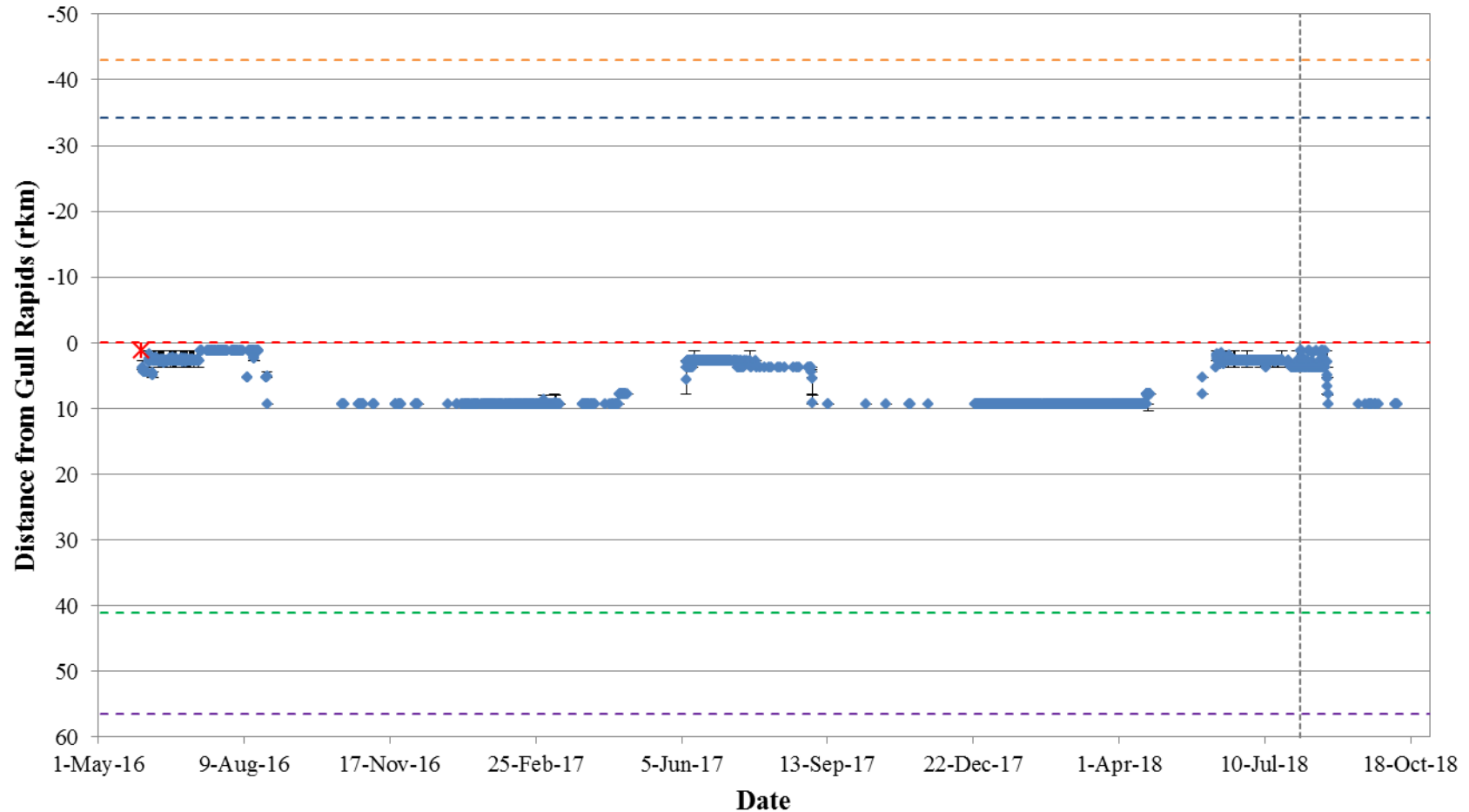
**Figure A3-14: Position of a Walleye tagged with an acoustic transmitter (code #53737) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



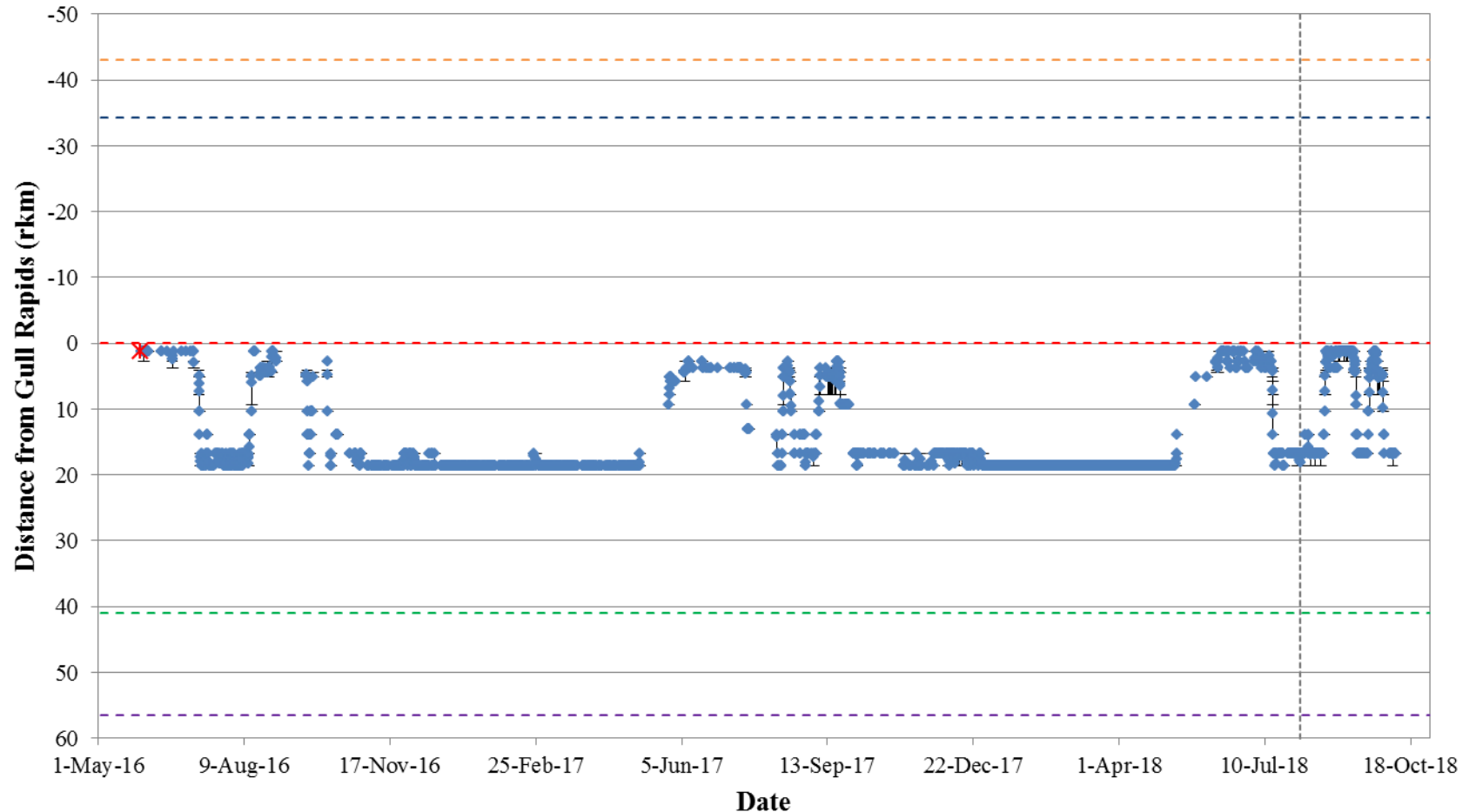
**Figure A3-15: Position of a Walleye tagged with an acoustic transmitter (code #53738) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-16: Position of a Walleye tagged with an acoustic transmitter (code #53739) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

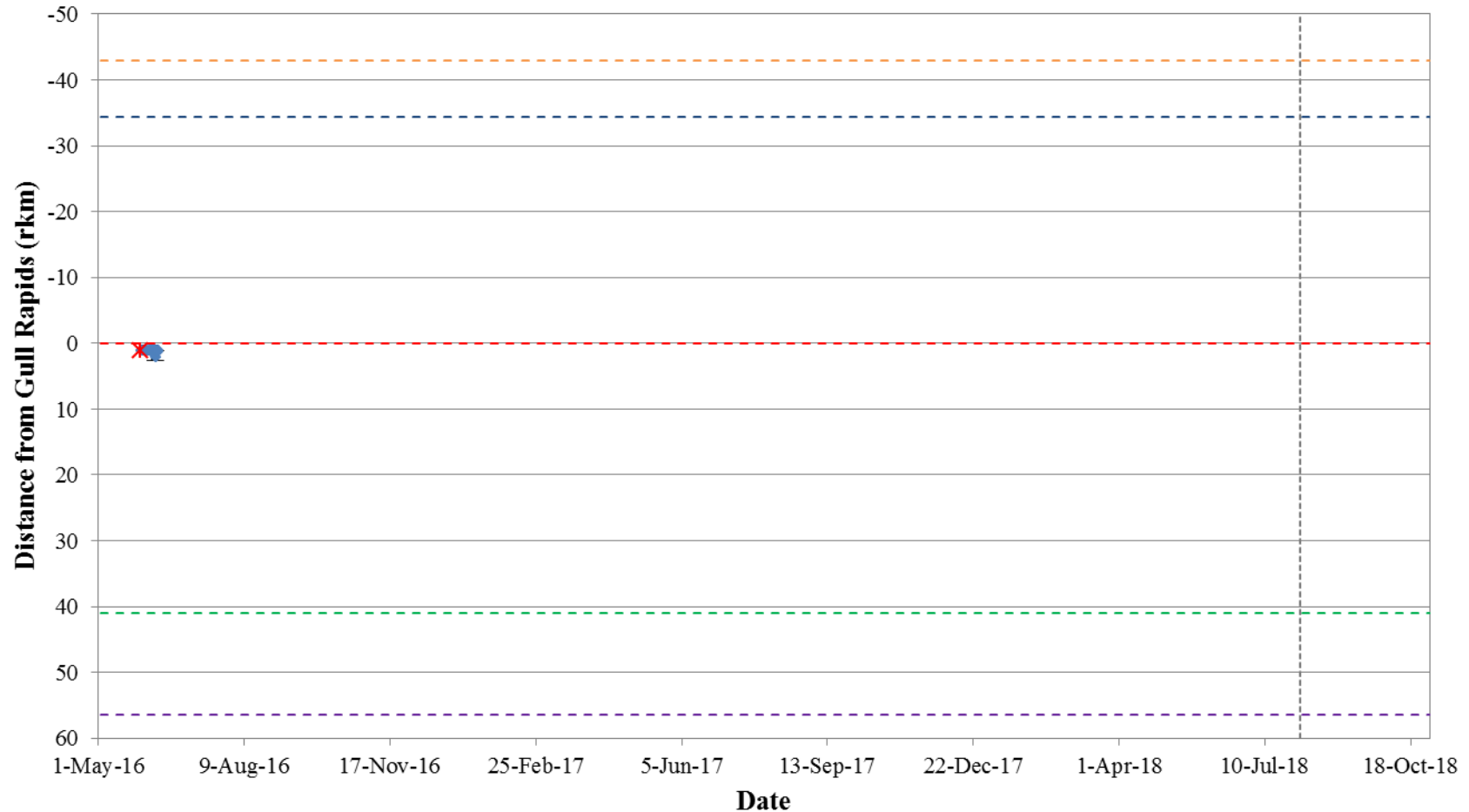


**Figure A3-17: Position of a Walleye tagged with an acoustic transmitter (code #53740) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

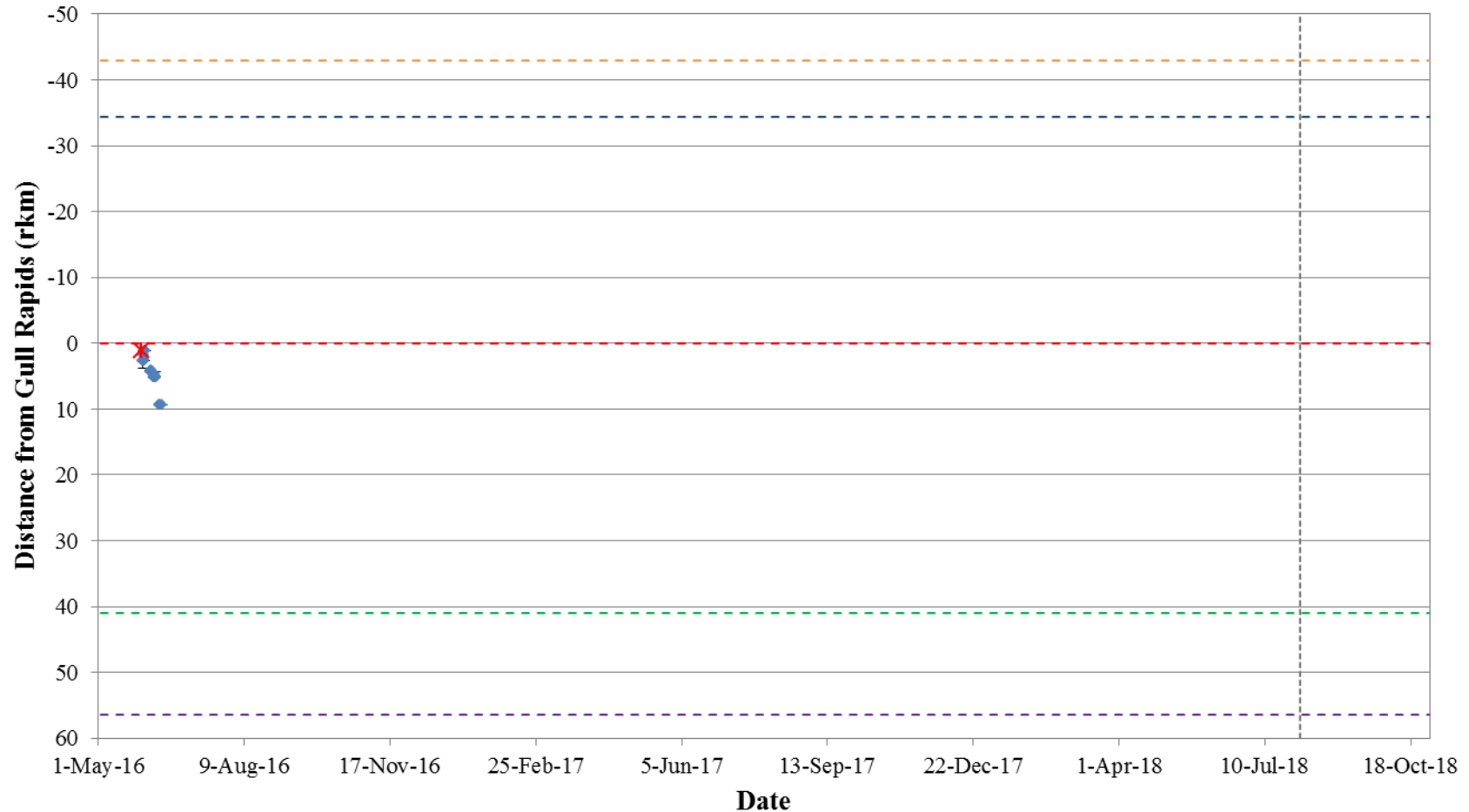


**Figure A3-18: Position of a Walleye tagged with an acoustic transmitter (code #53741) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

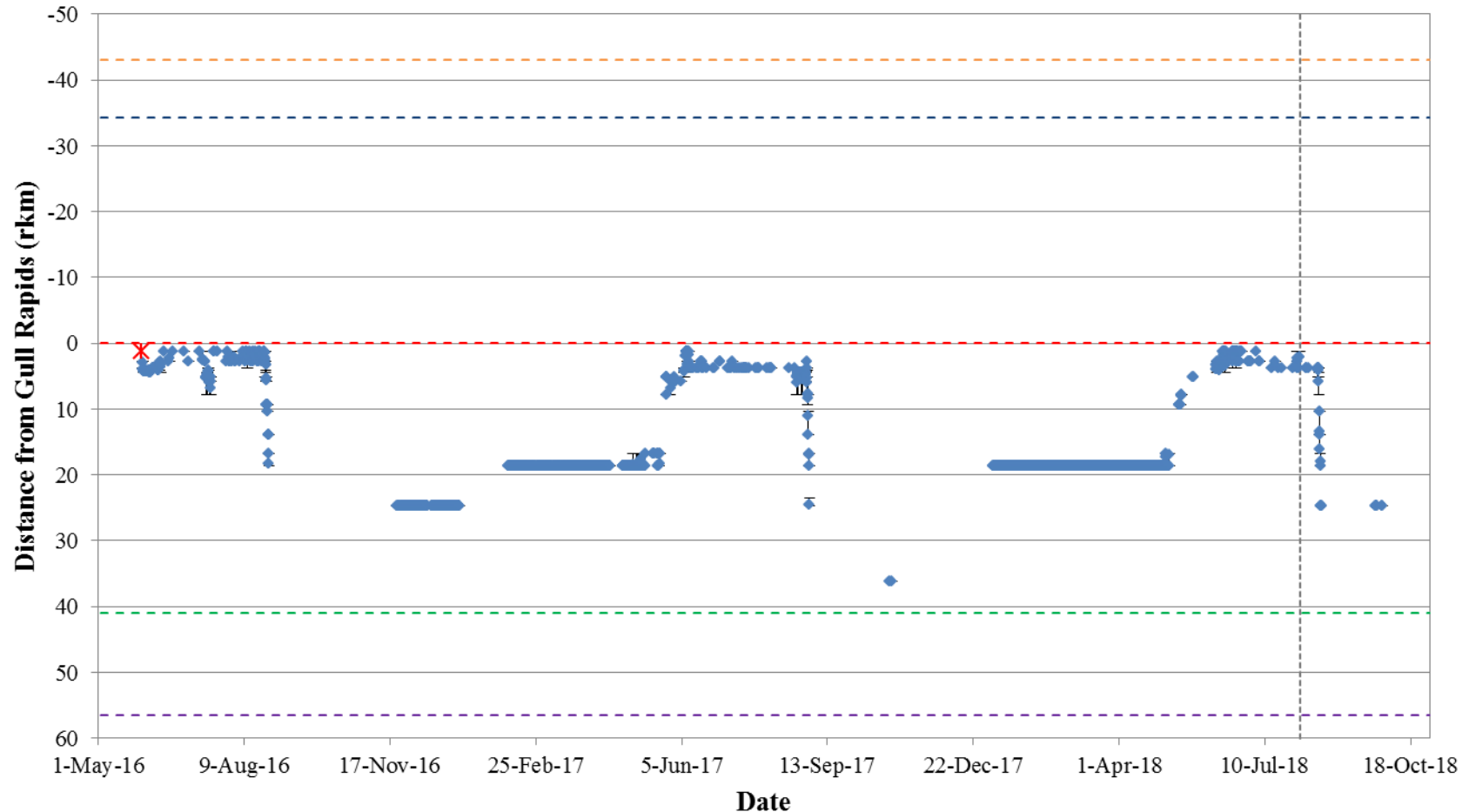




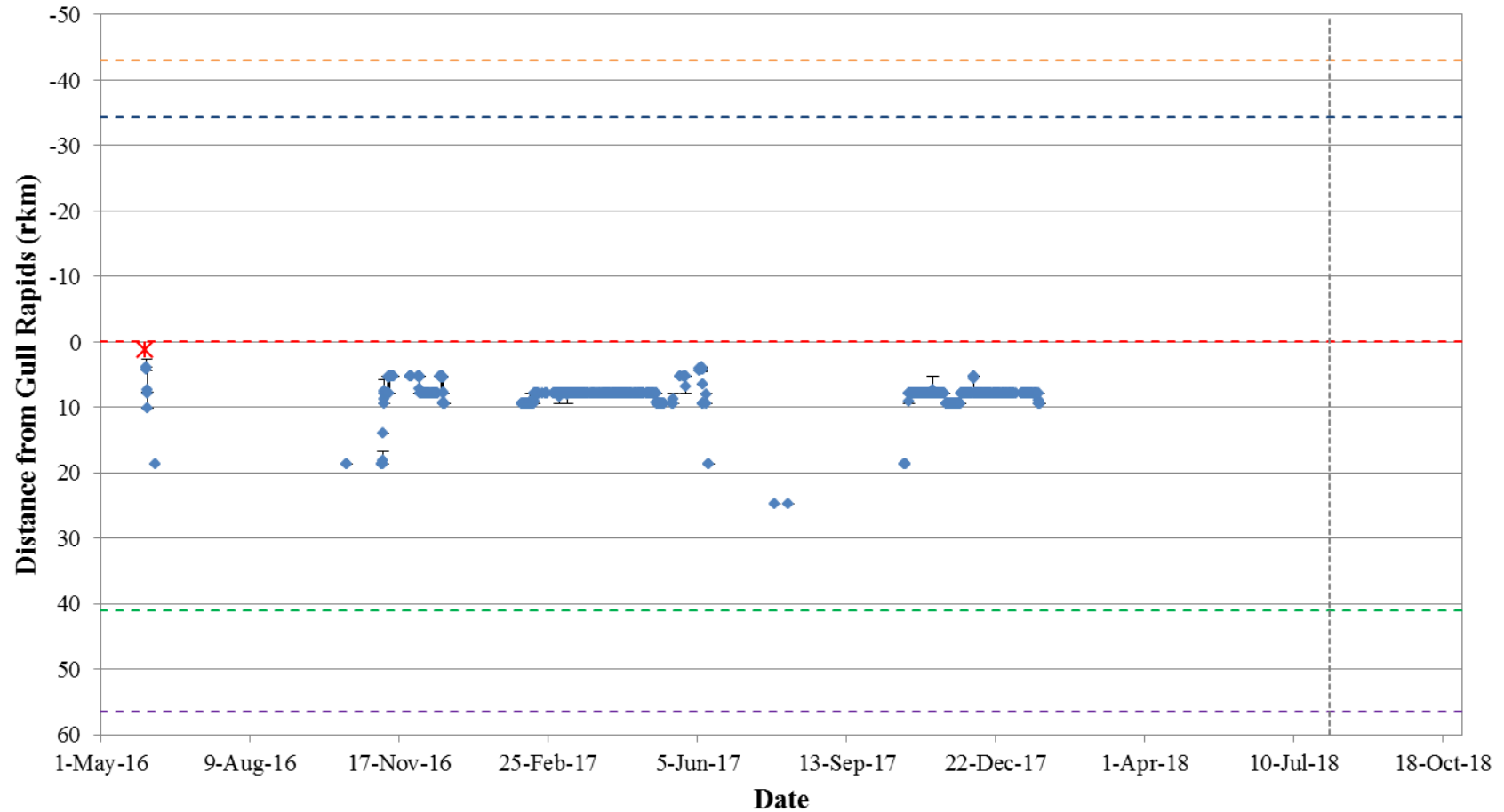
**Figure A3-19: Position of a Walleye tagged with an acoustic transmitter (code #53742) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



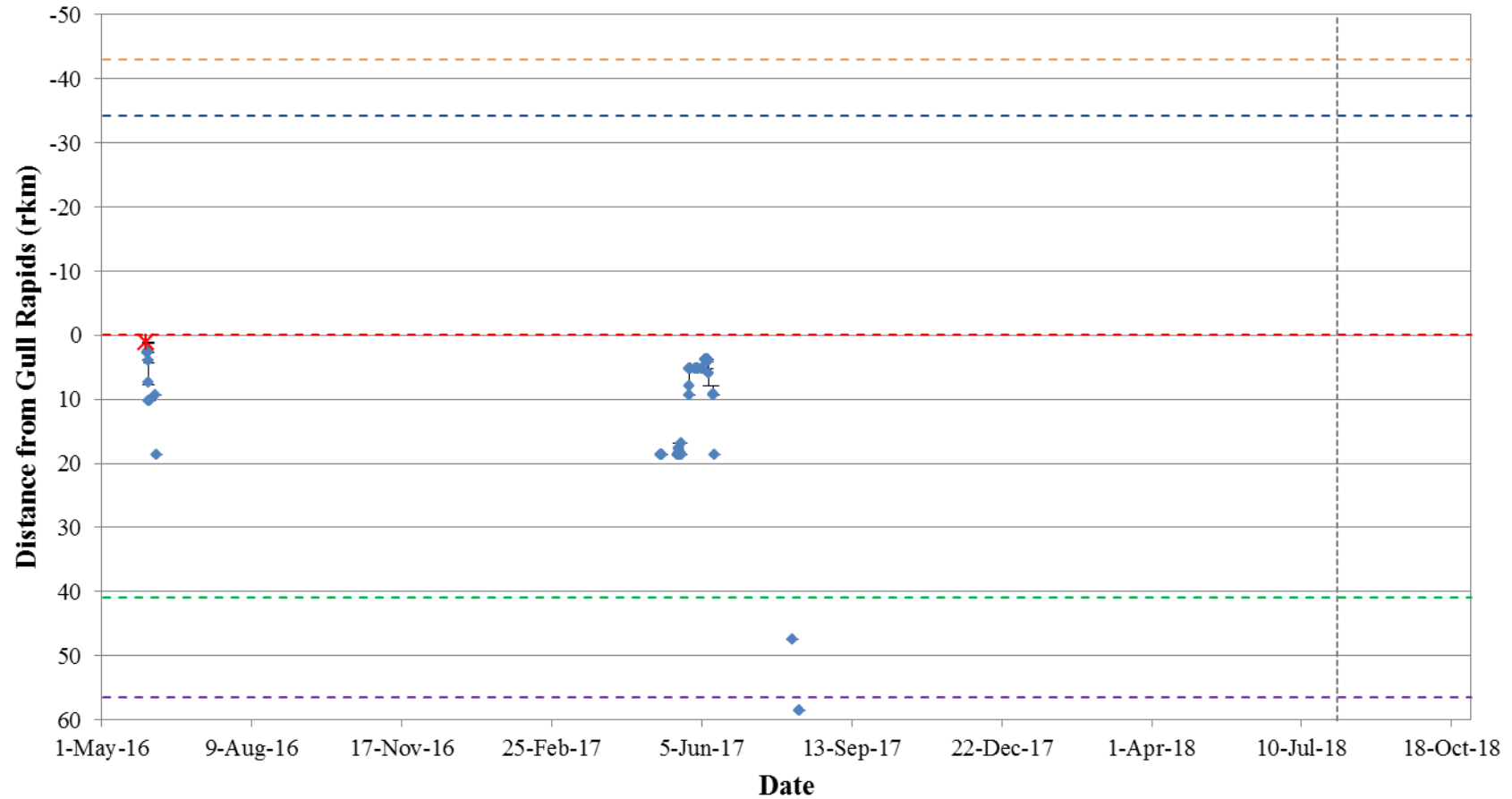
**Figure A3-20: Position of a Walleye tagged with an acoustic transmitter (code #53743) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



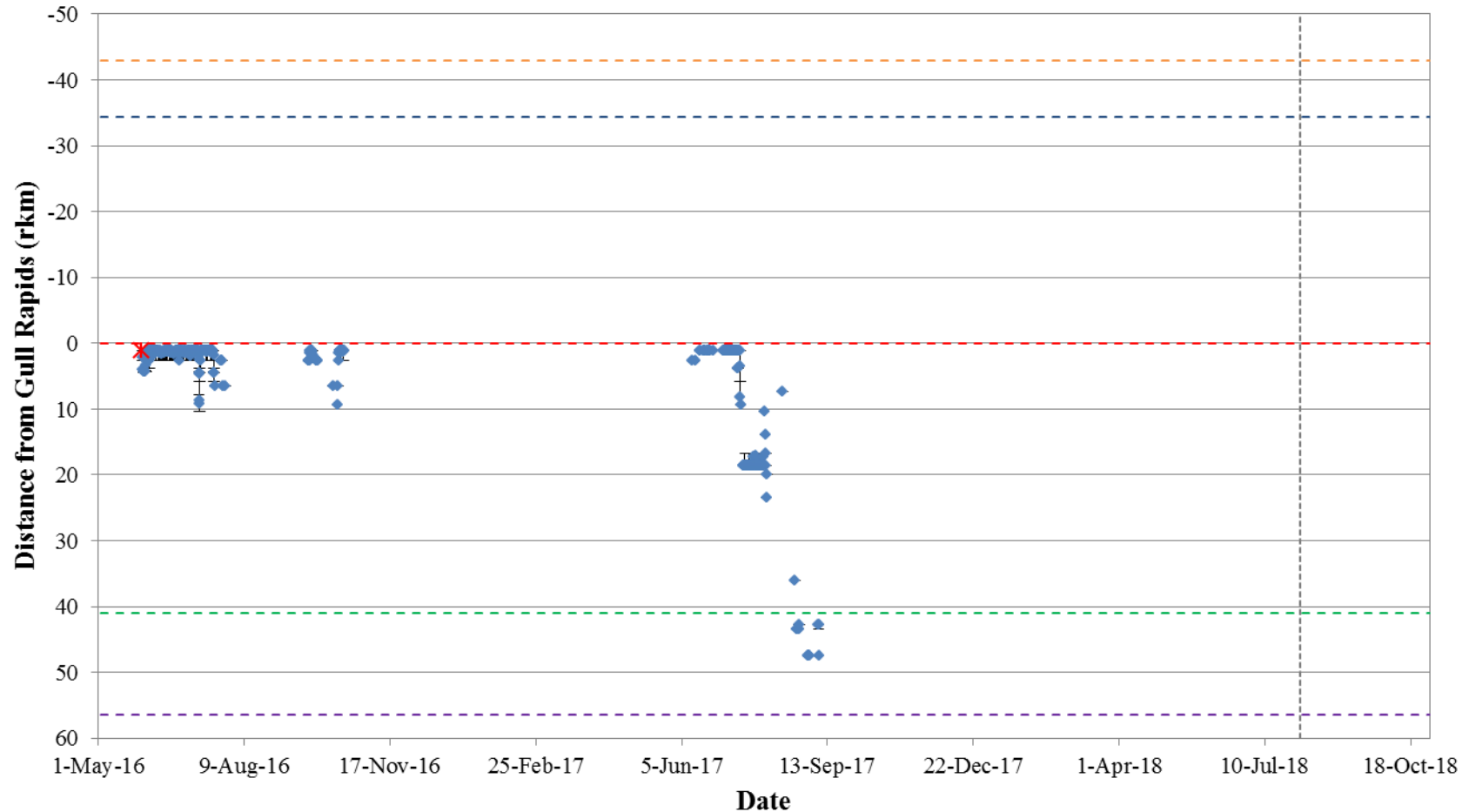
**Figure A3-21: Position of a Walleye tagged with an acoustic transmitter (code #53744) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



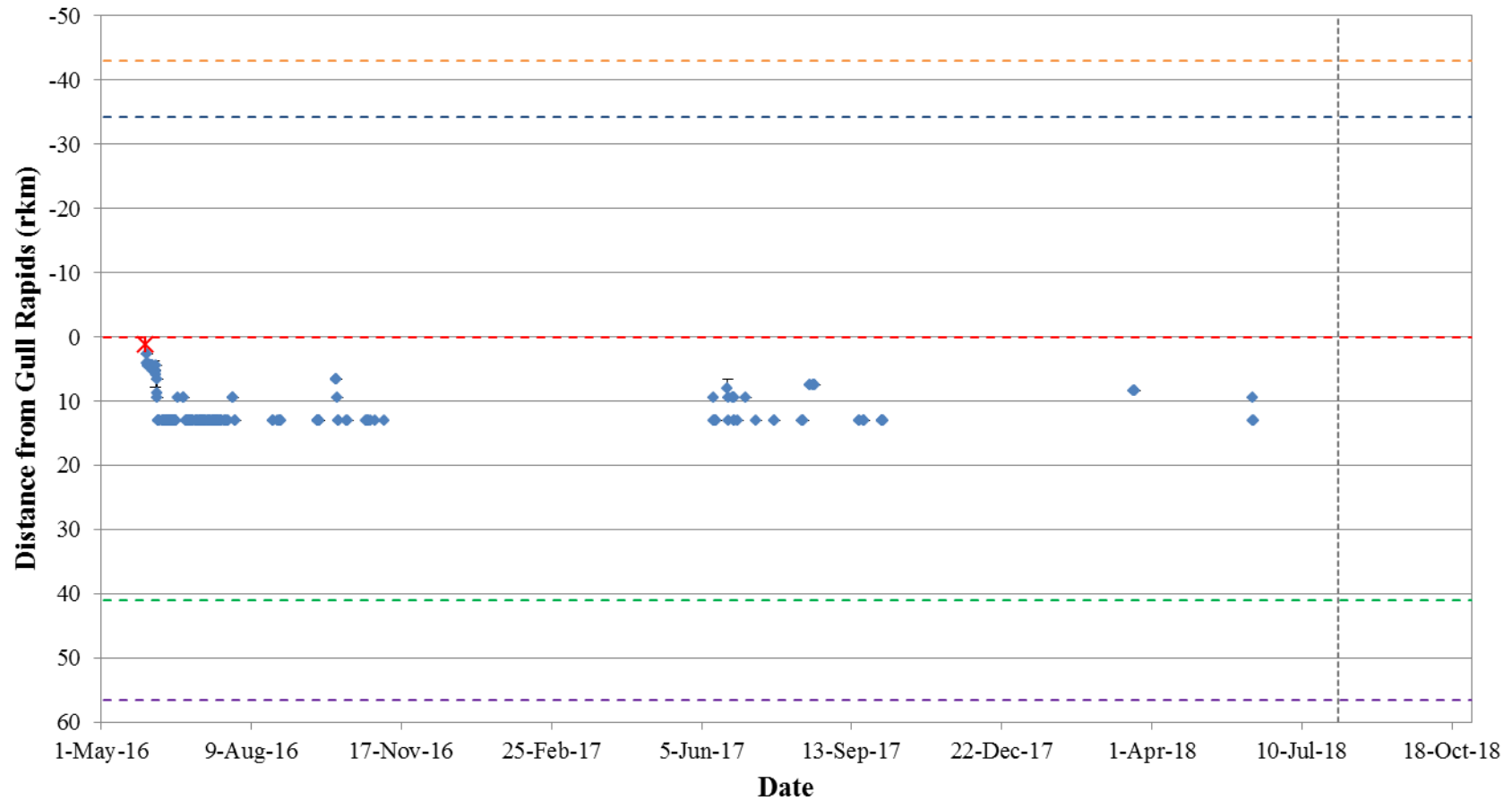
**Figure A3-22: Position of a Walleye tagged with an acoustic transmitter (code #53745) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



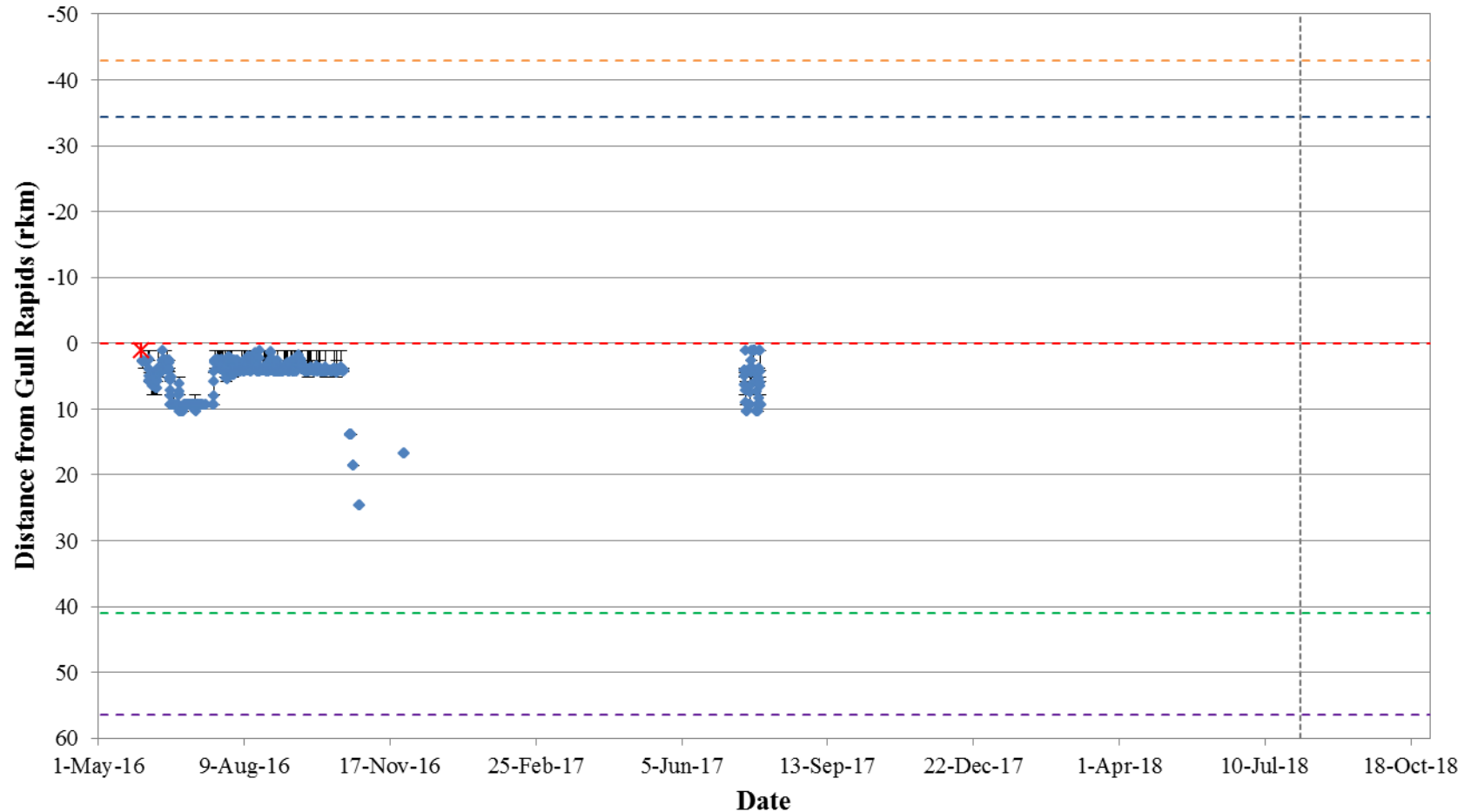
**Figure A3-23: Position of a Walleye tagged with an acoustic transmitter (code #53746) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-24: Position of a Walleye tagged with an acoustic transmitter (code #53747) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

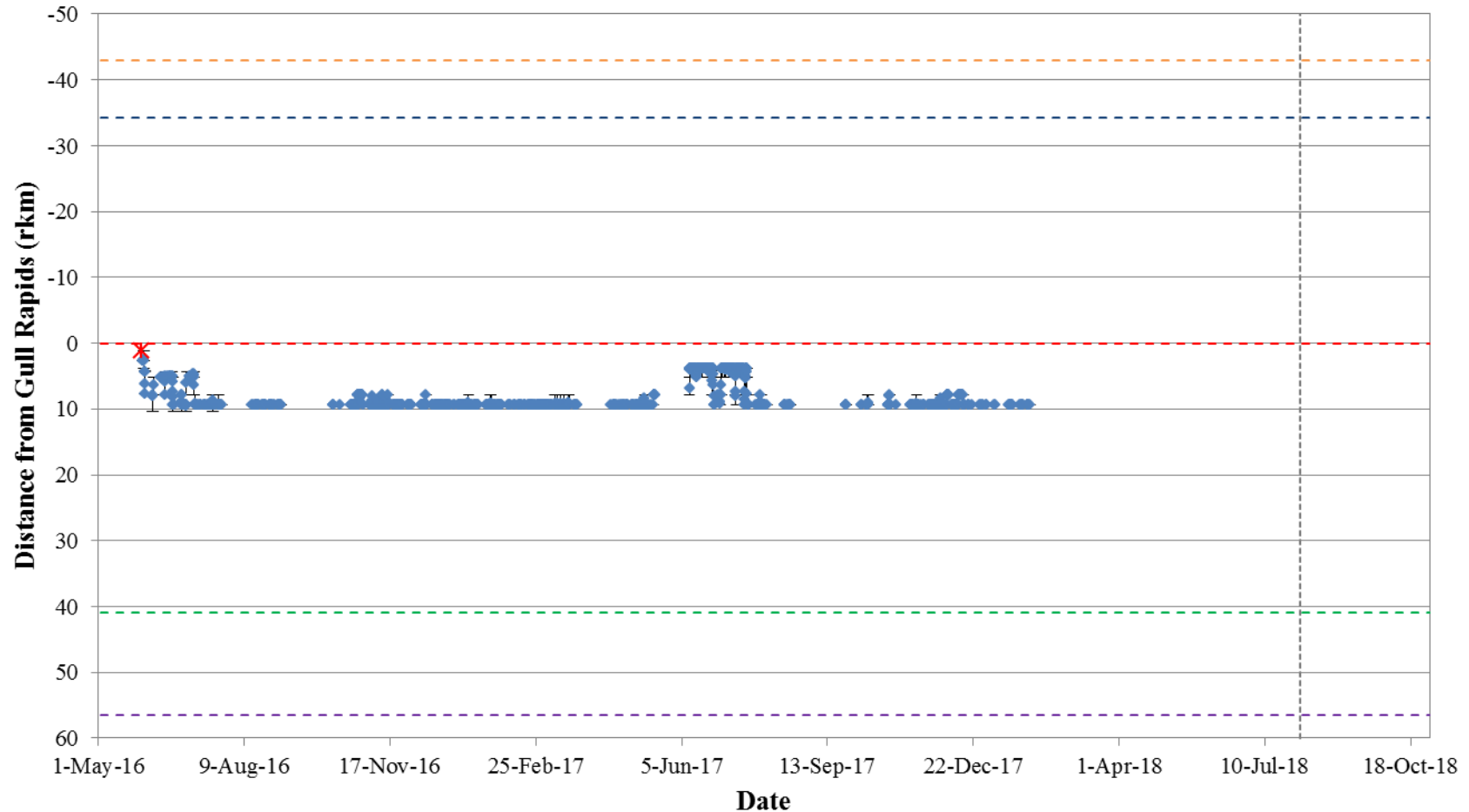


**Figure A3-25: Position of a Walleye tagged with an acoustic transmitter (code #53748) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

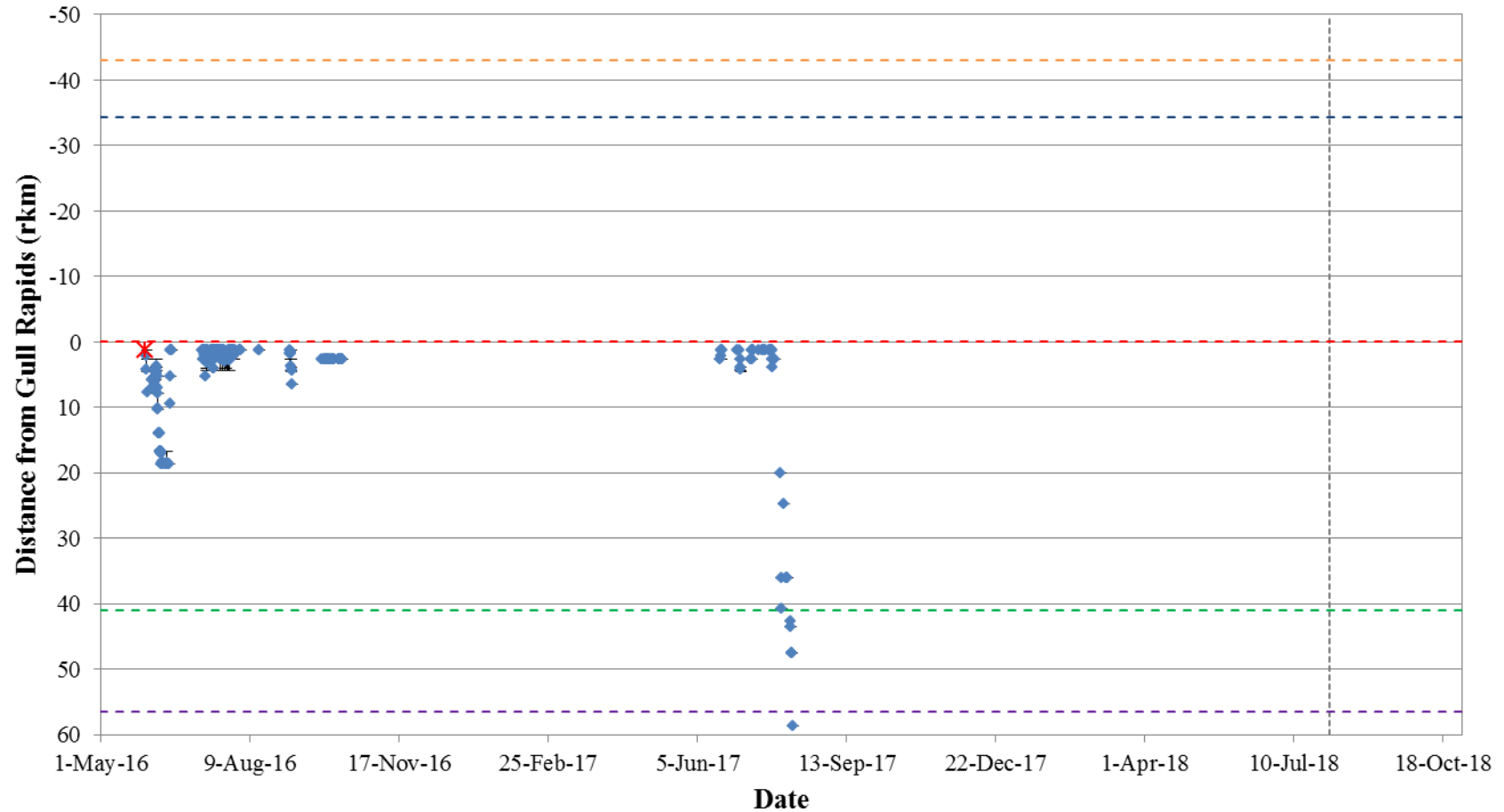


**Figure A3-26: Position of a Walleye tagged with an acoustic transmitter (code #53749) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

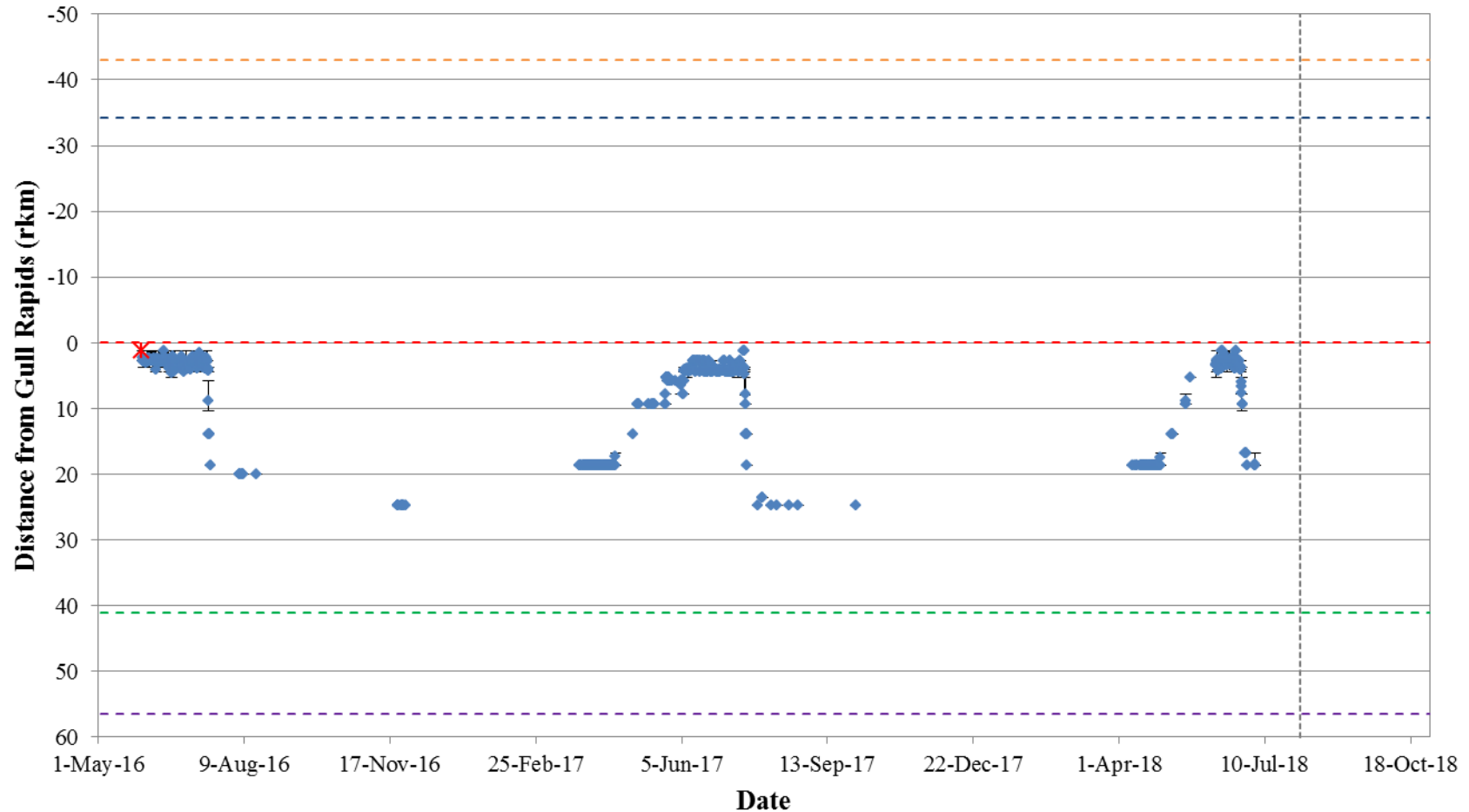




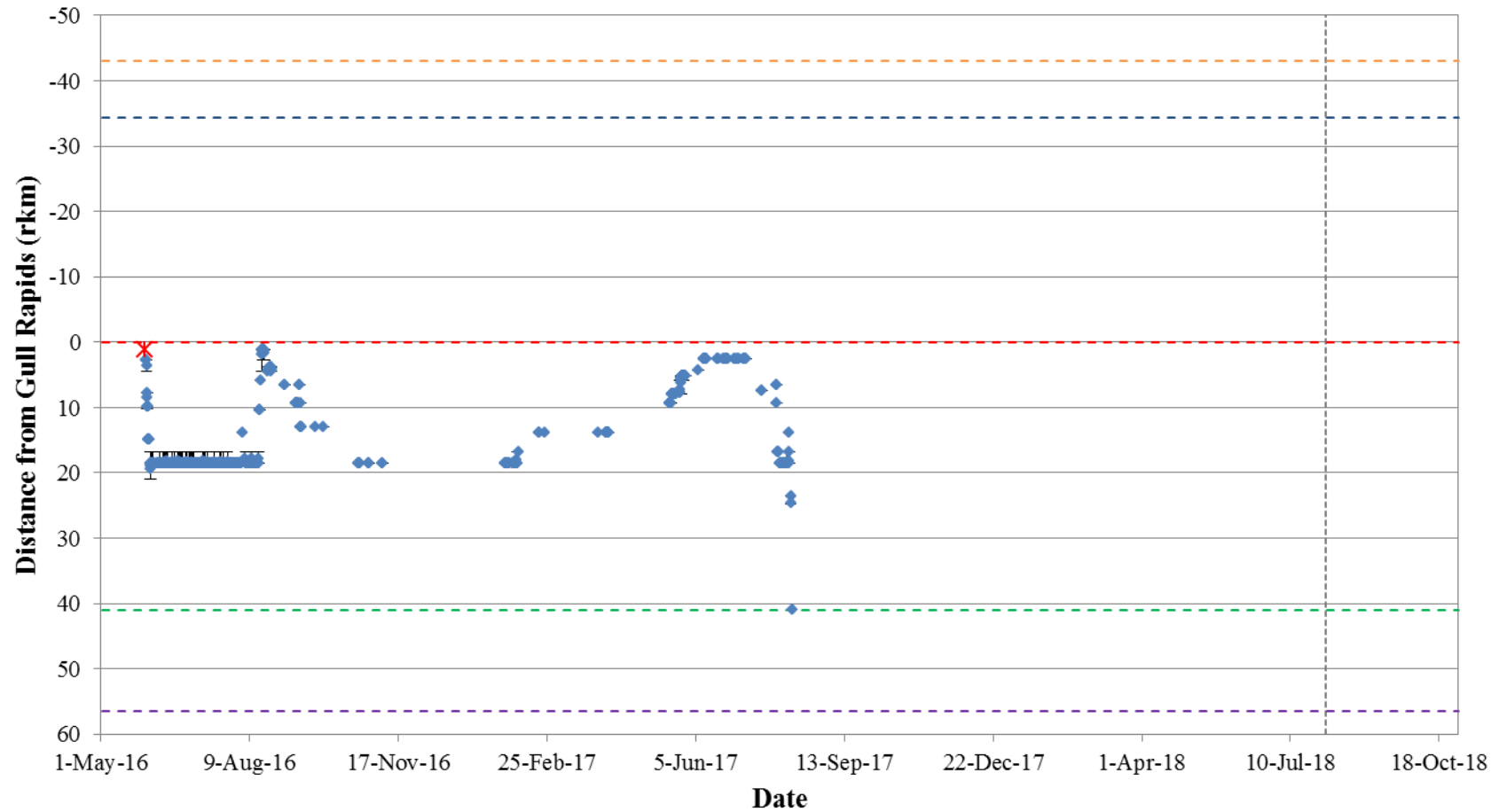
**Figure A3-27: Position of a Walleye tagged with an acoustic transmitter (code #53750) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



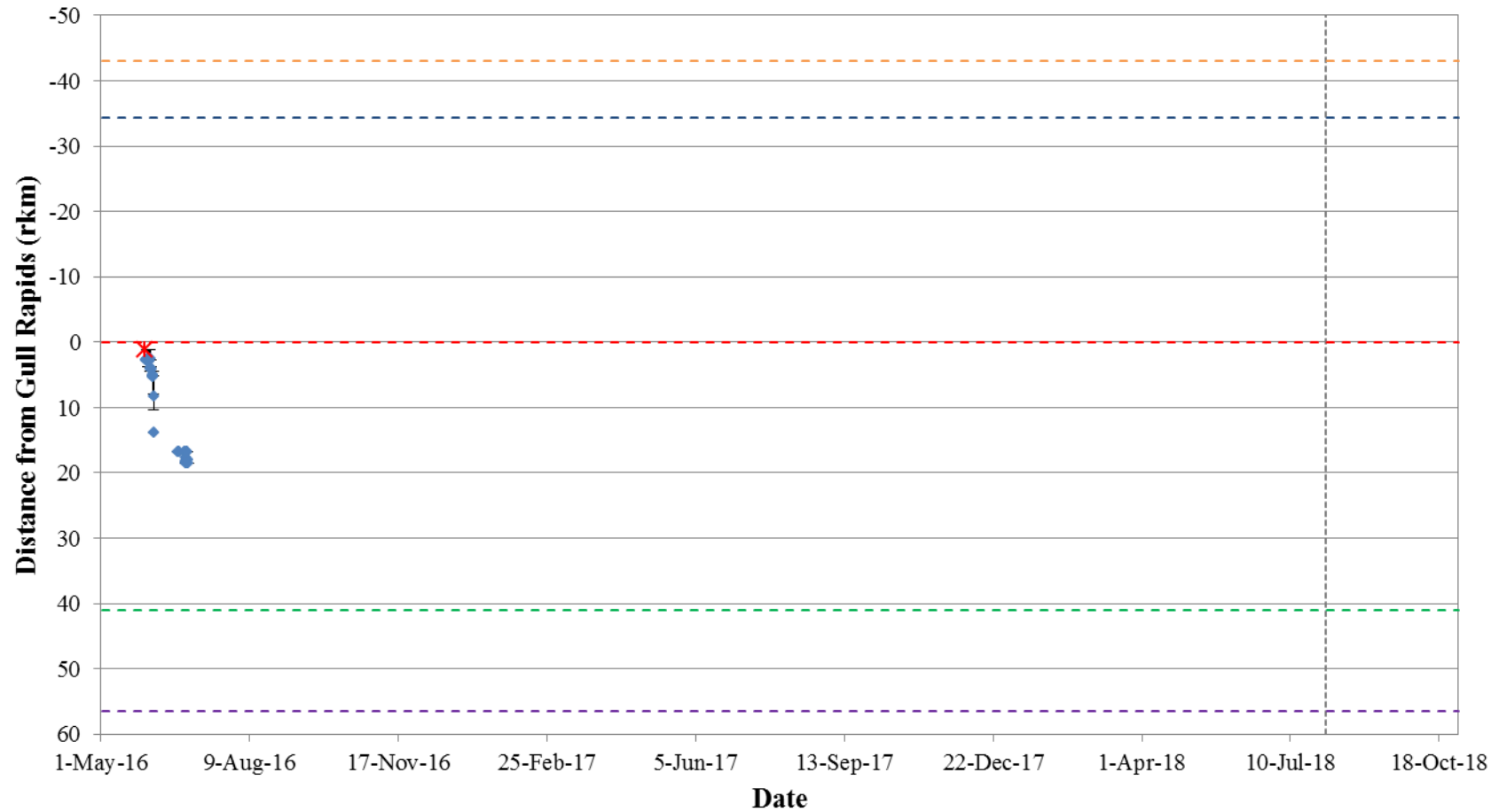
**Figure A3-28: Position of a Walleye tagged with an acoustic transmitter (code #53751) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



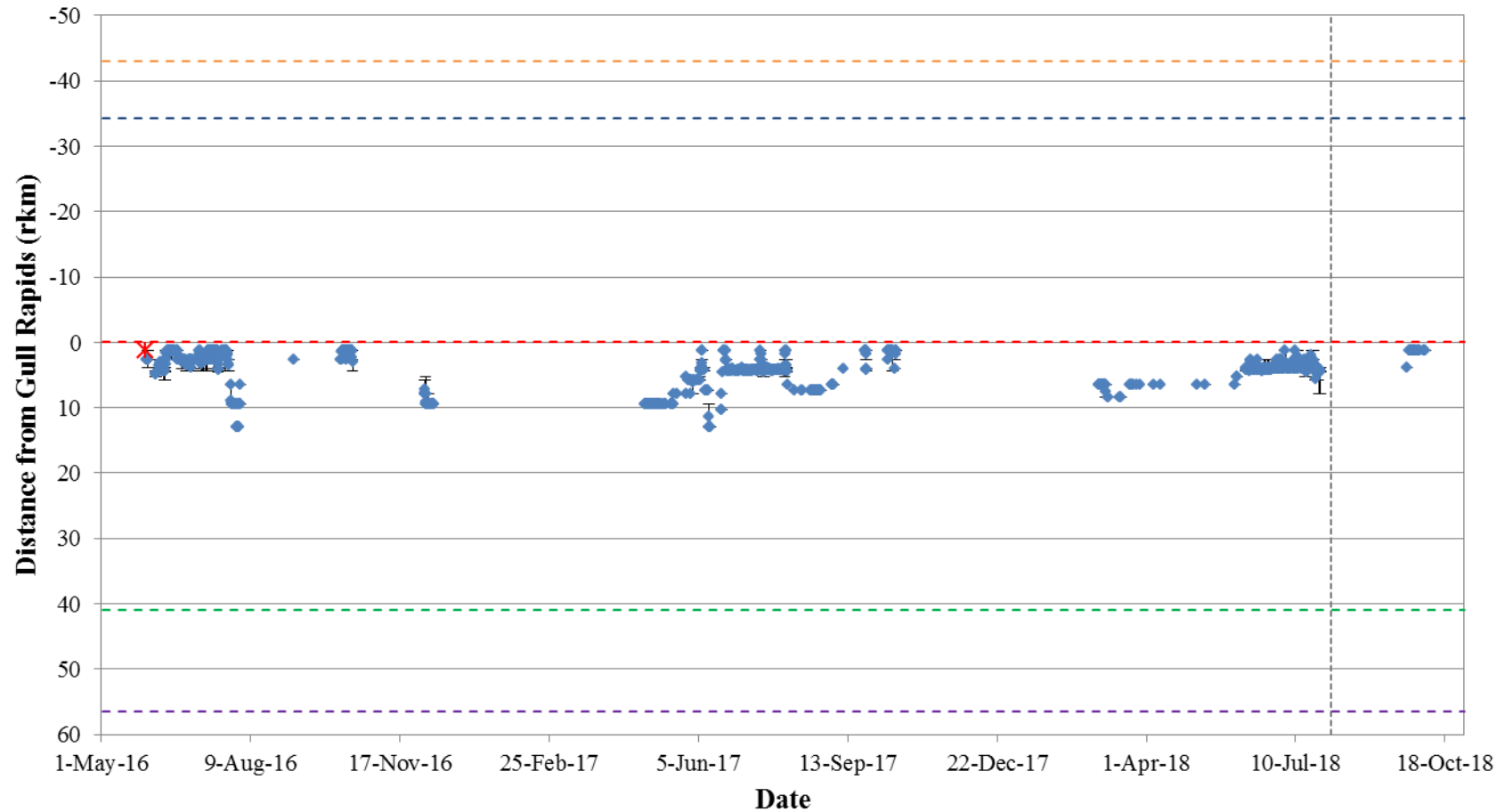
**Figure A3-29: Position of a Walleye tagged with an acoustic transmitter (code #53752) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



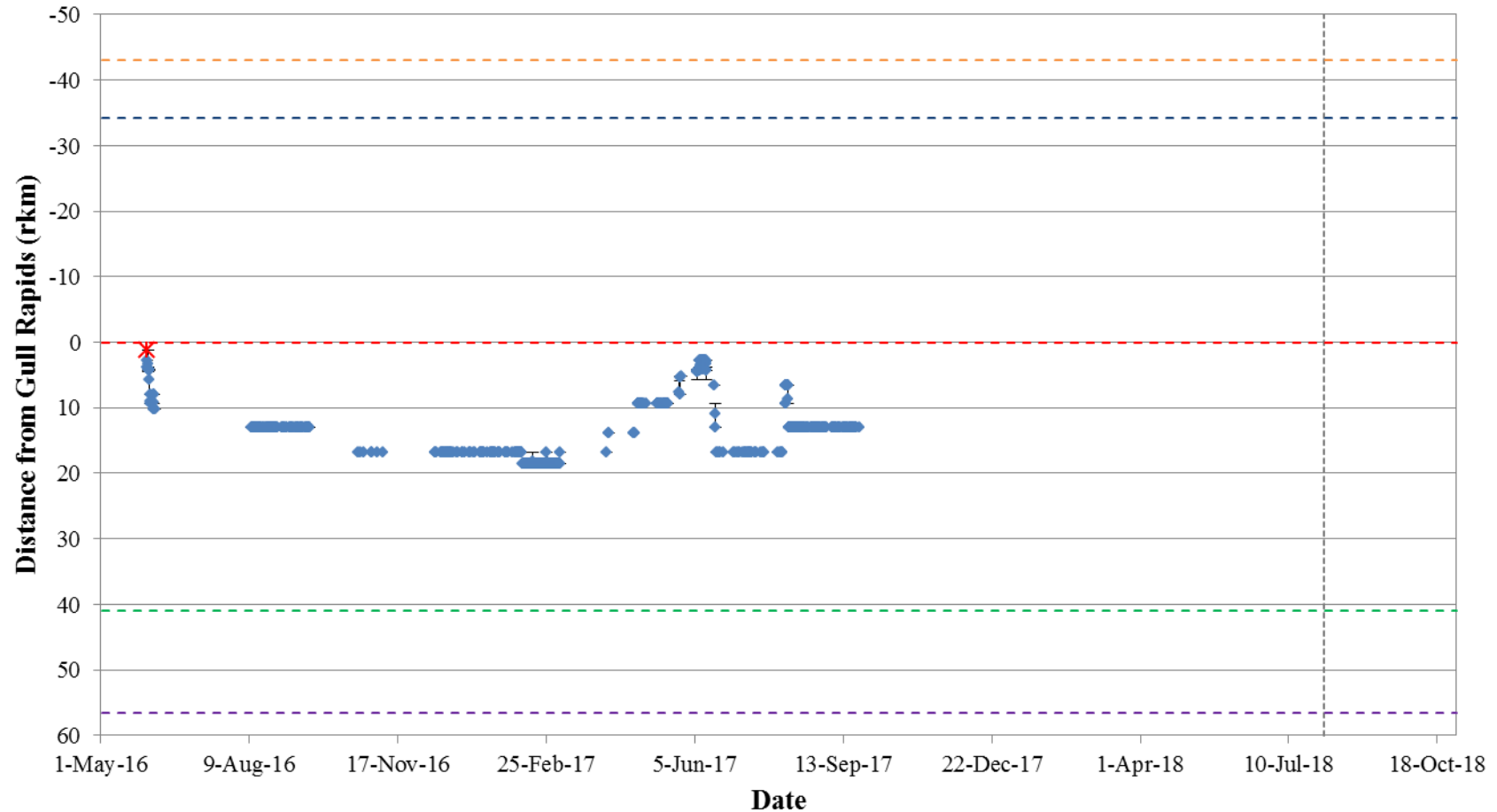
**Figure A3-30: Position of a Walleye tagged with an acoustic transmitter (code #53753) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



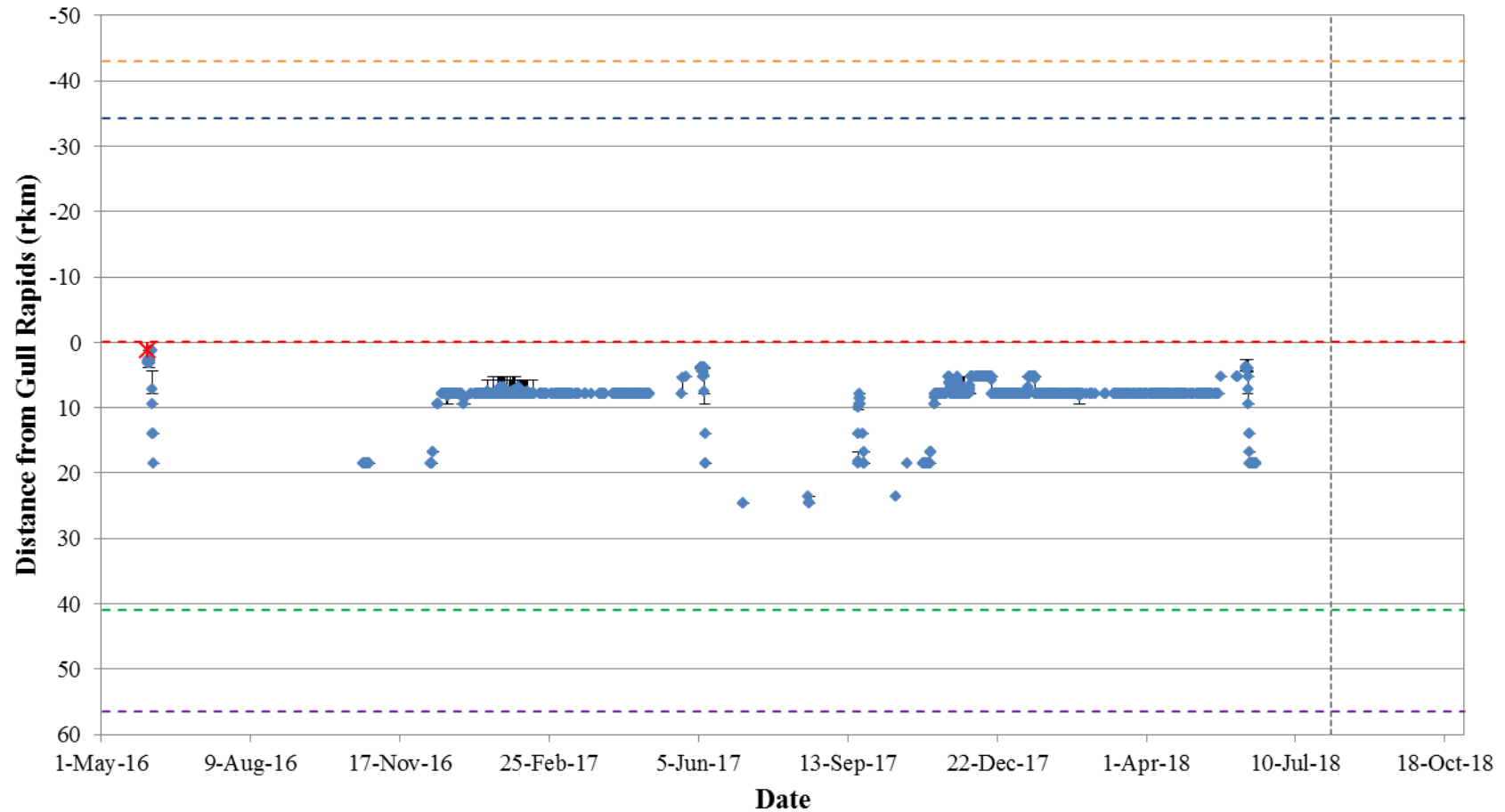
**Figure A3-31: Position of a Walleye tagged with an acoustic transmitter (code #53754) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-32: Position of a Walleye tagged with an acoustic transmitter (code #53755) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

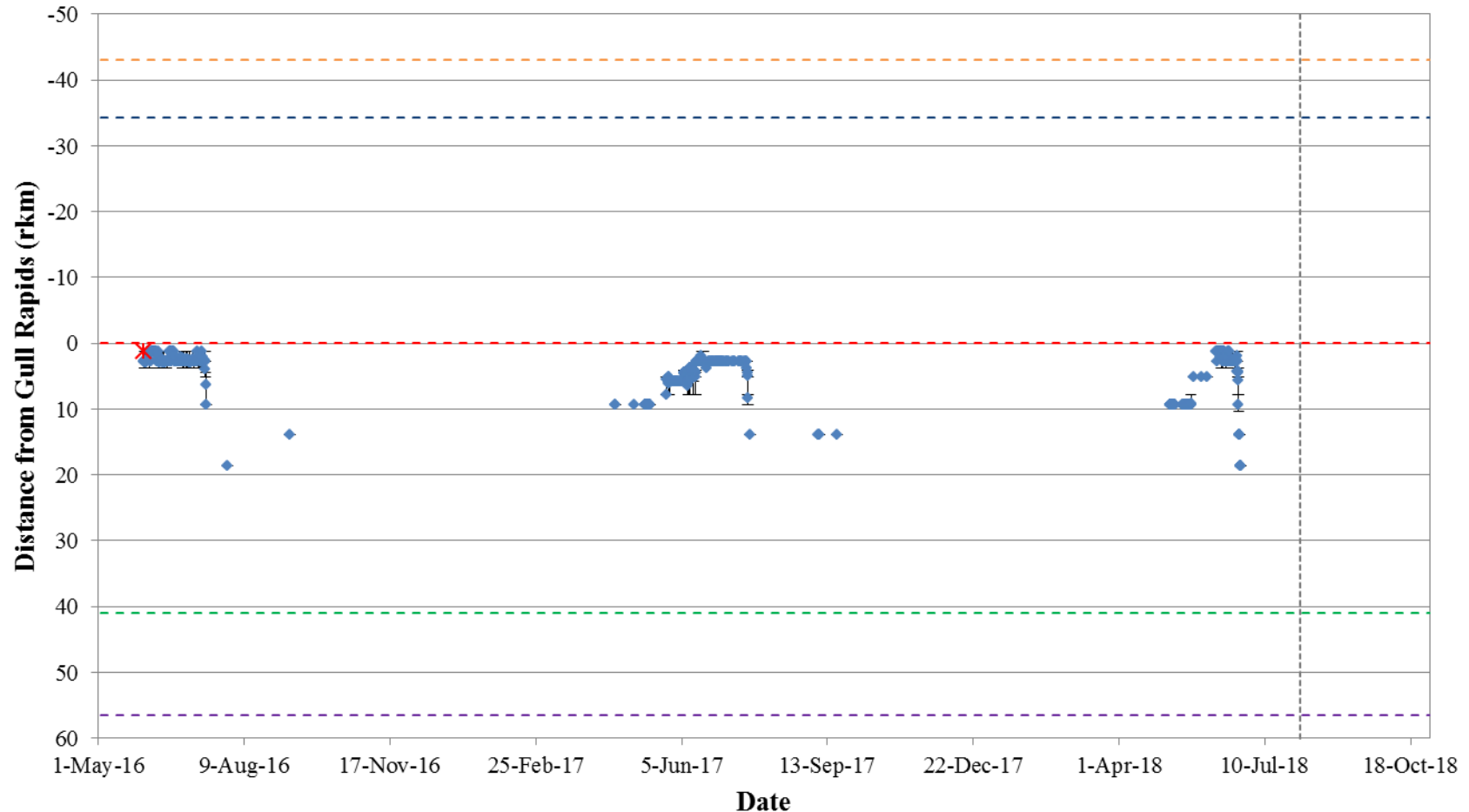


**Figure A3-33: Position of a Walleye tagged with an acoustic transmitter (code #53756) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

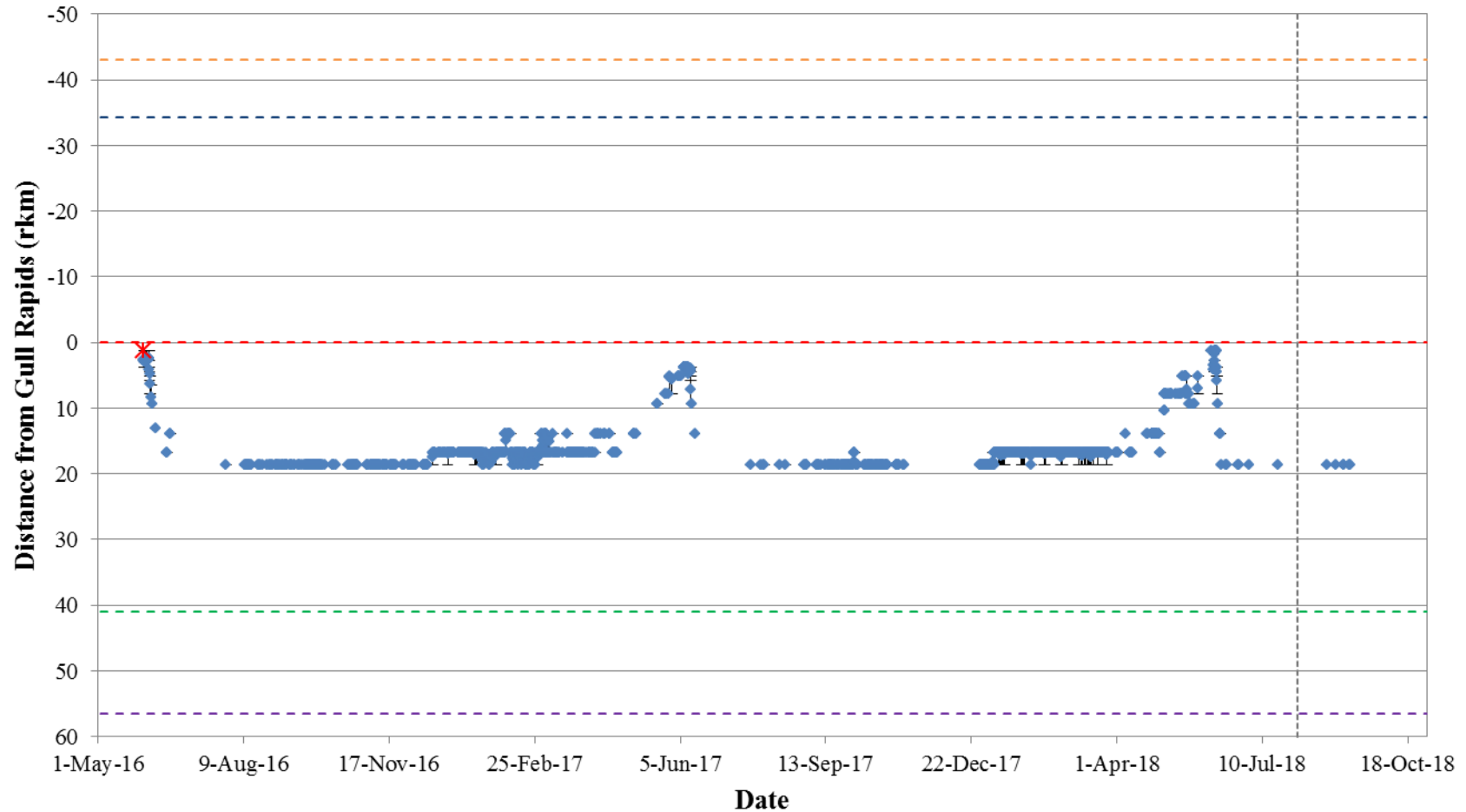


**Figure A3-34: Position of a Walleye tagged with an acoustic transmitter (code #53757) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

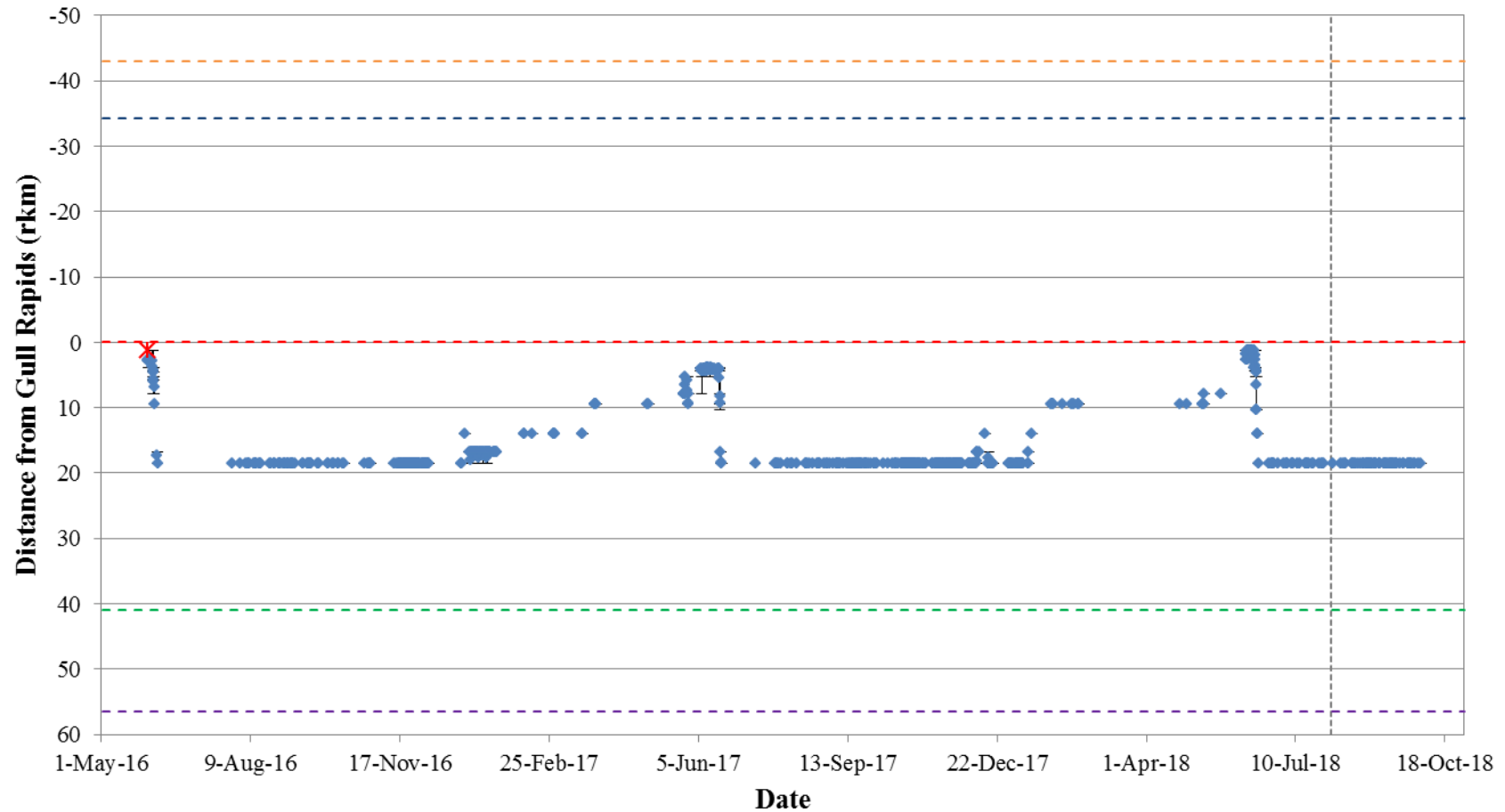




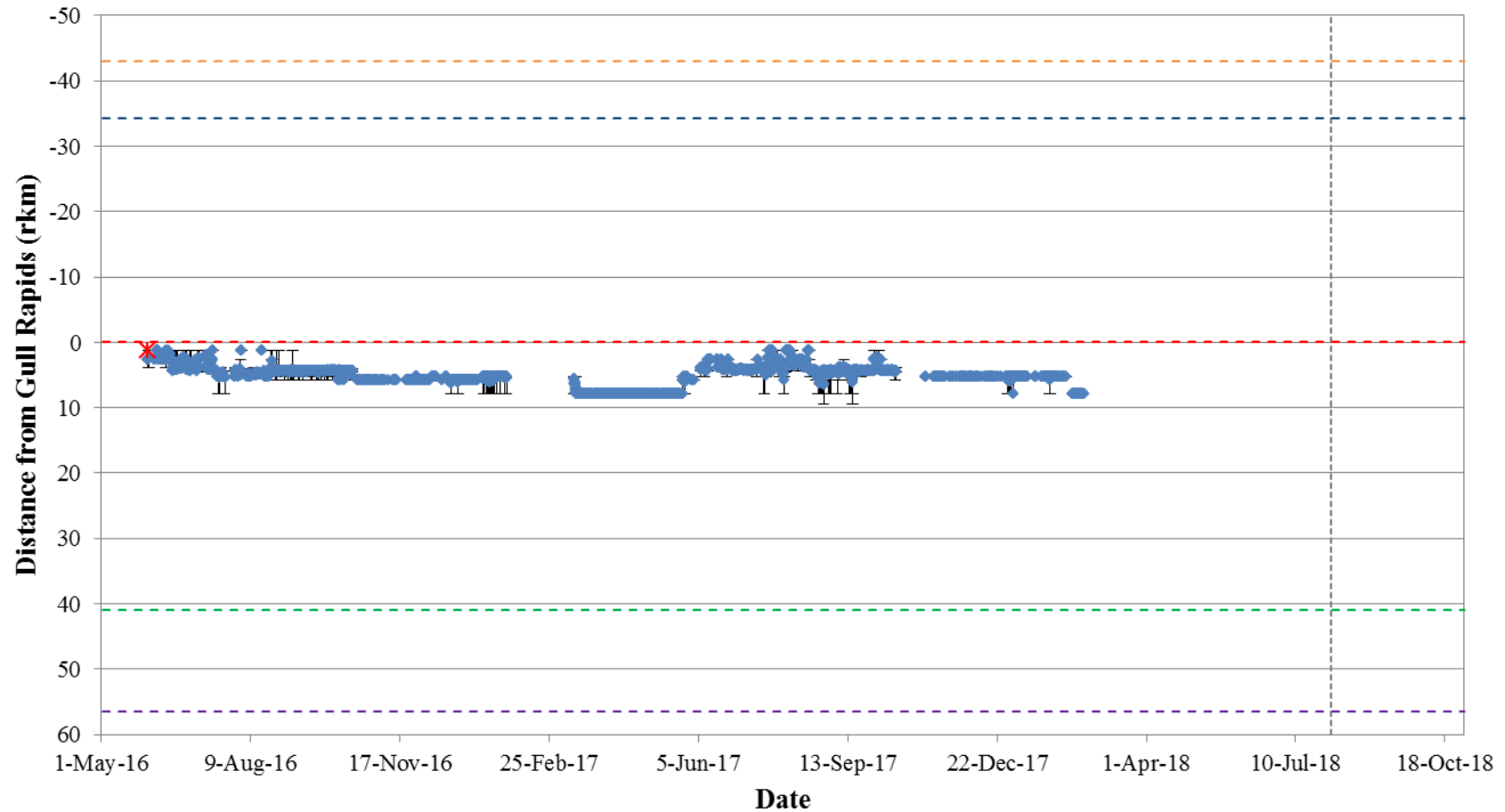
**Figure A3-35: Position of a Walleye tagged with an acoustic transmitter (code #53808) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



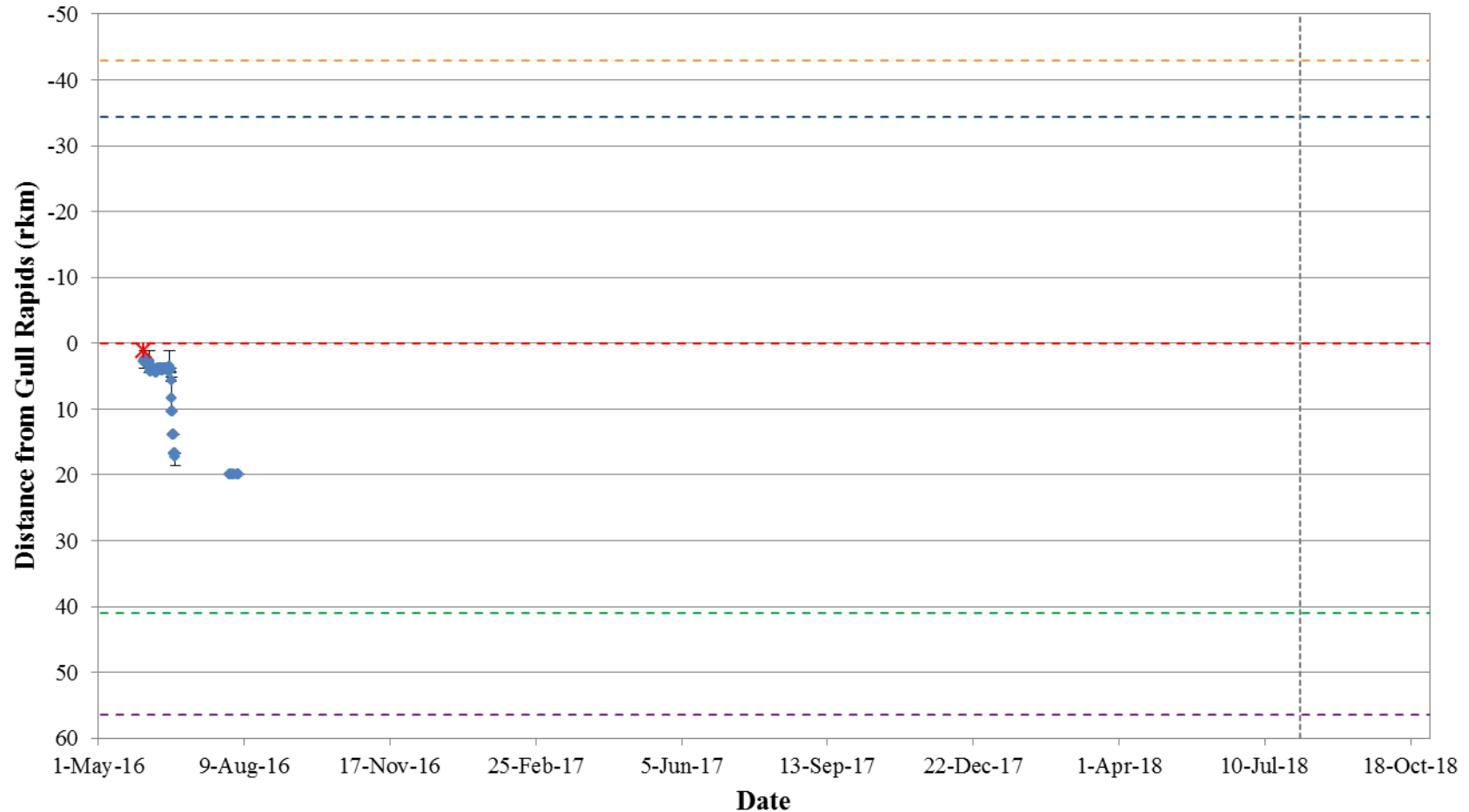
**Figure A3-36: Position of a Walleye tagged with an acoustic transmitter (code #53809) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



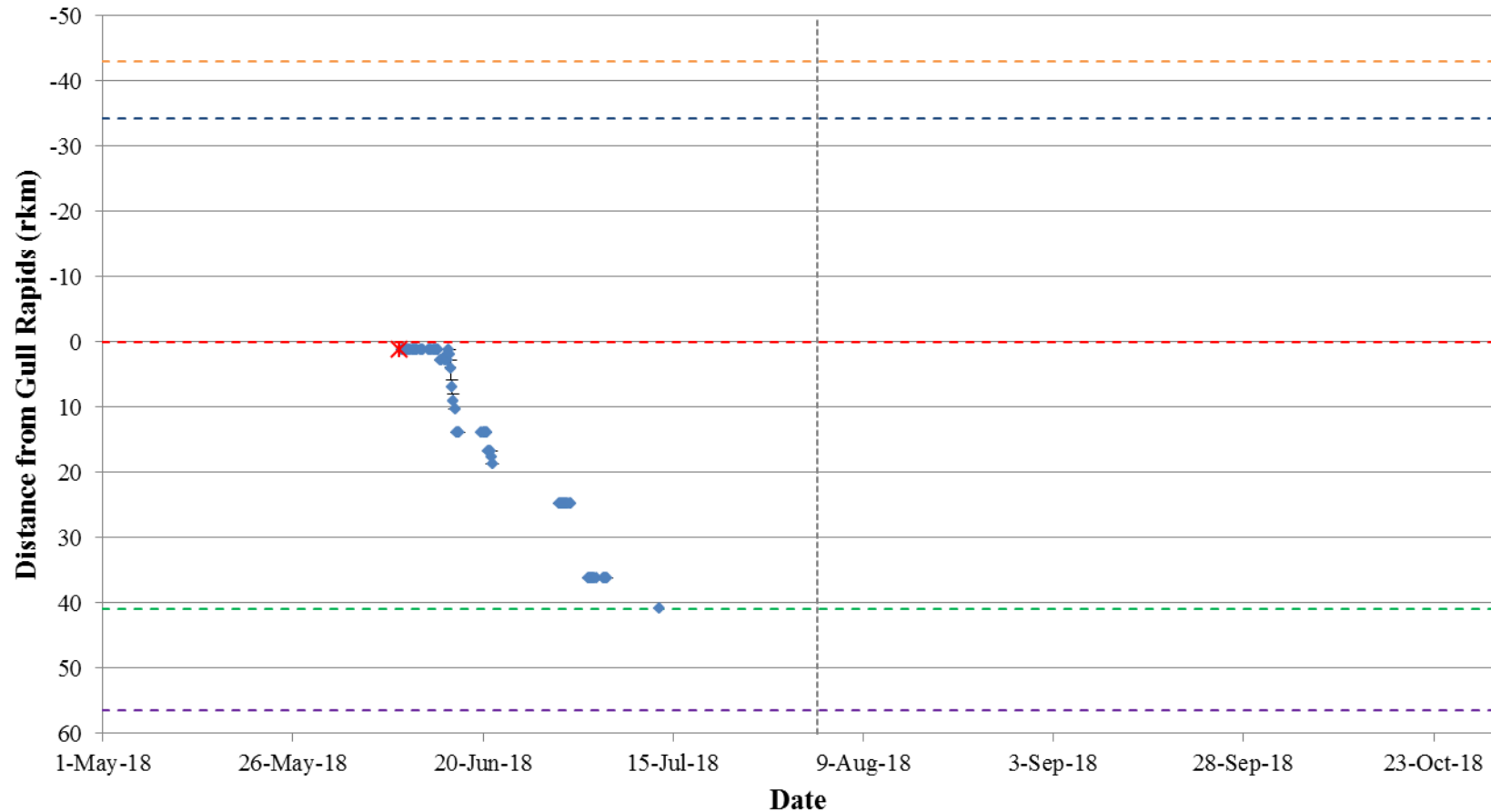
**Figure A3-37: Position of a Walleye tagged with an acoustic transmitter (code #53810) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



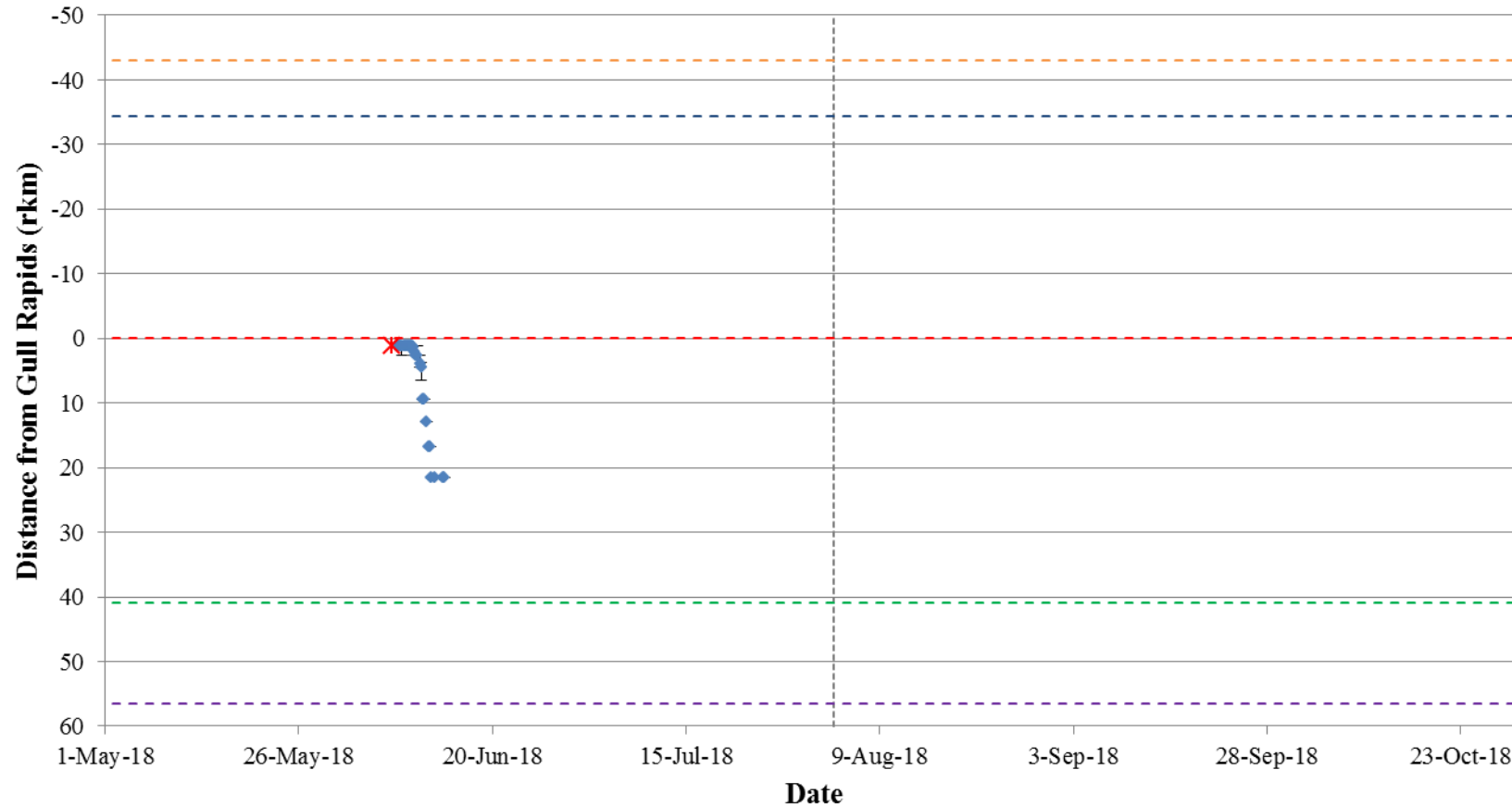
**Figure A3-38: Position of a Walleye tagged with an acoustic transmitter (code #53811) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



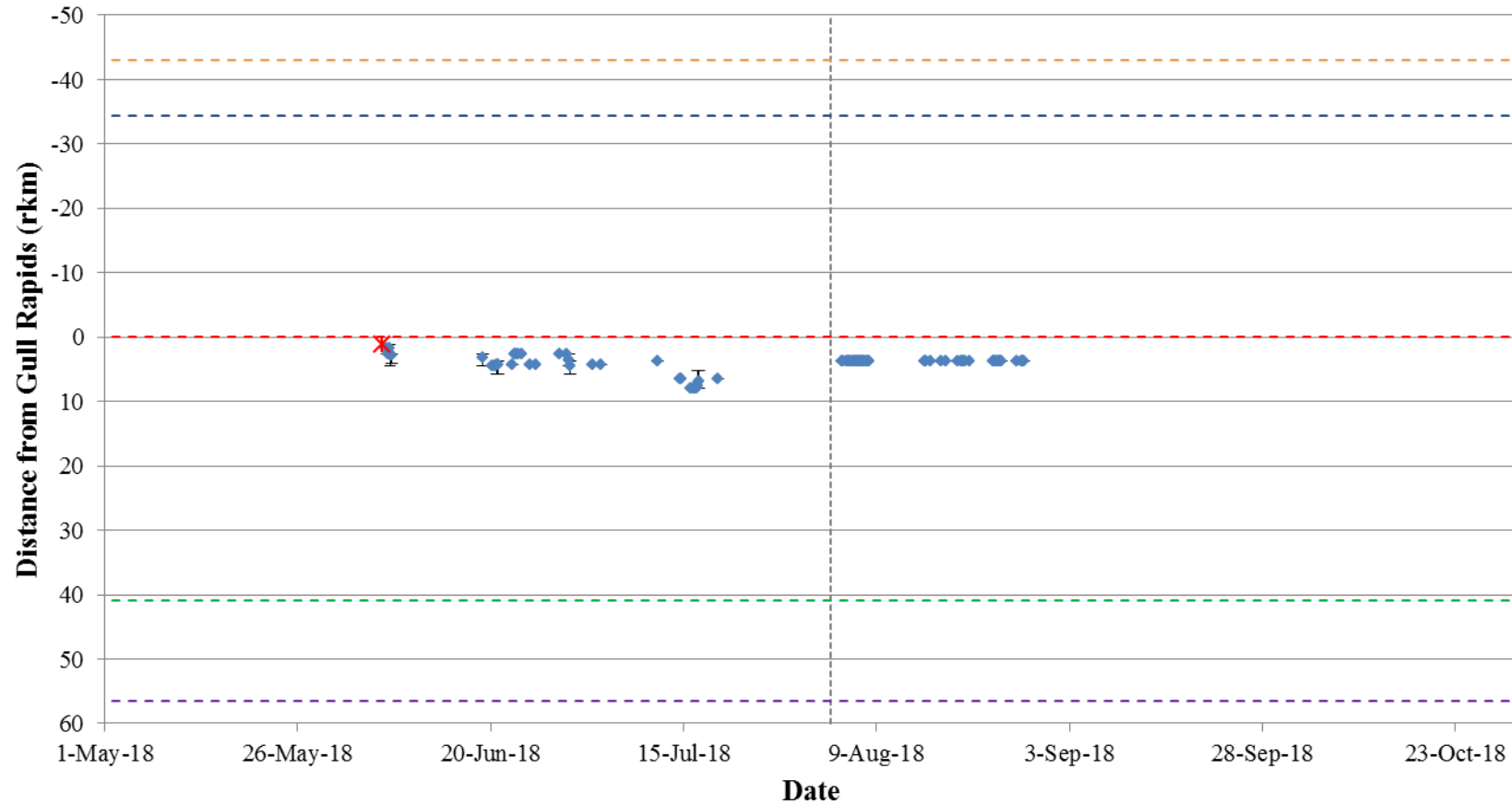
**Figure A3-39: Position of a Walleye tagged with an acoustic transmitter (code #53812) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2016, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-40: Position of a Walleye tagged with an acoustic transmitter (code #25732) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-41: Position of a Walleye tagged with an acoustic transmitter (code #25734) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

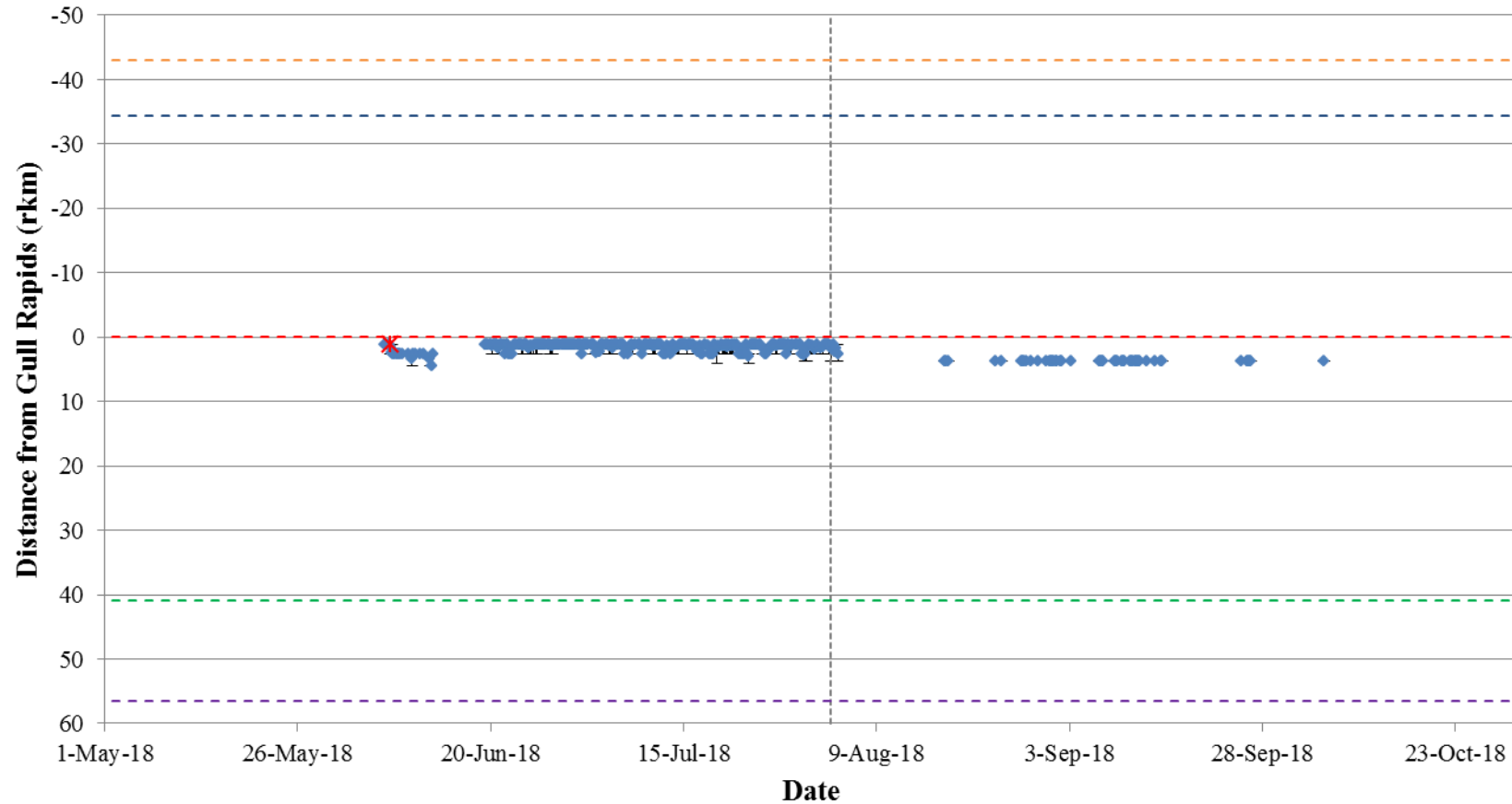


**Figure A3-42: Position of a Walleye tagged with an acoustic transmitter (code #25735) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

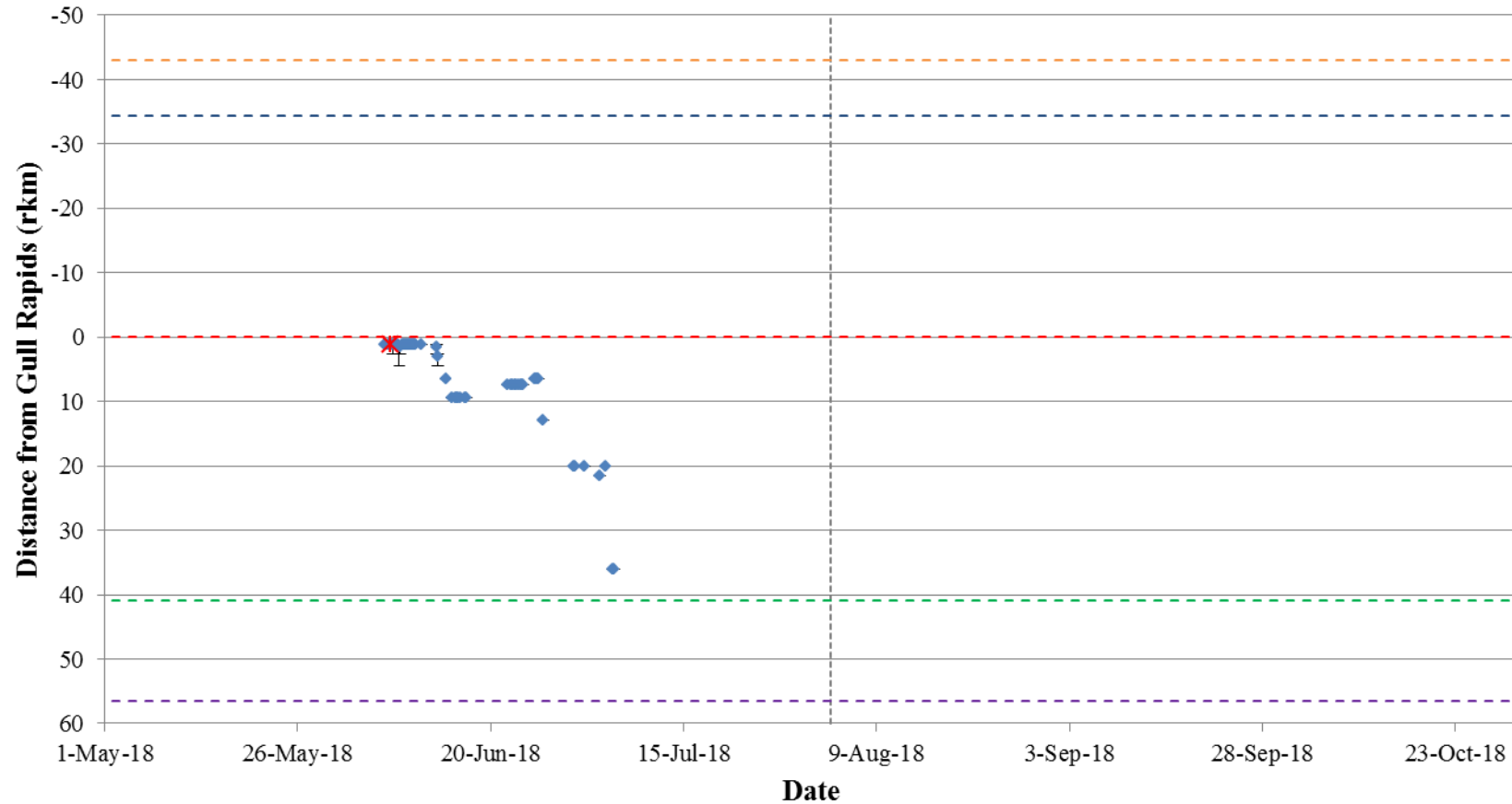




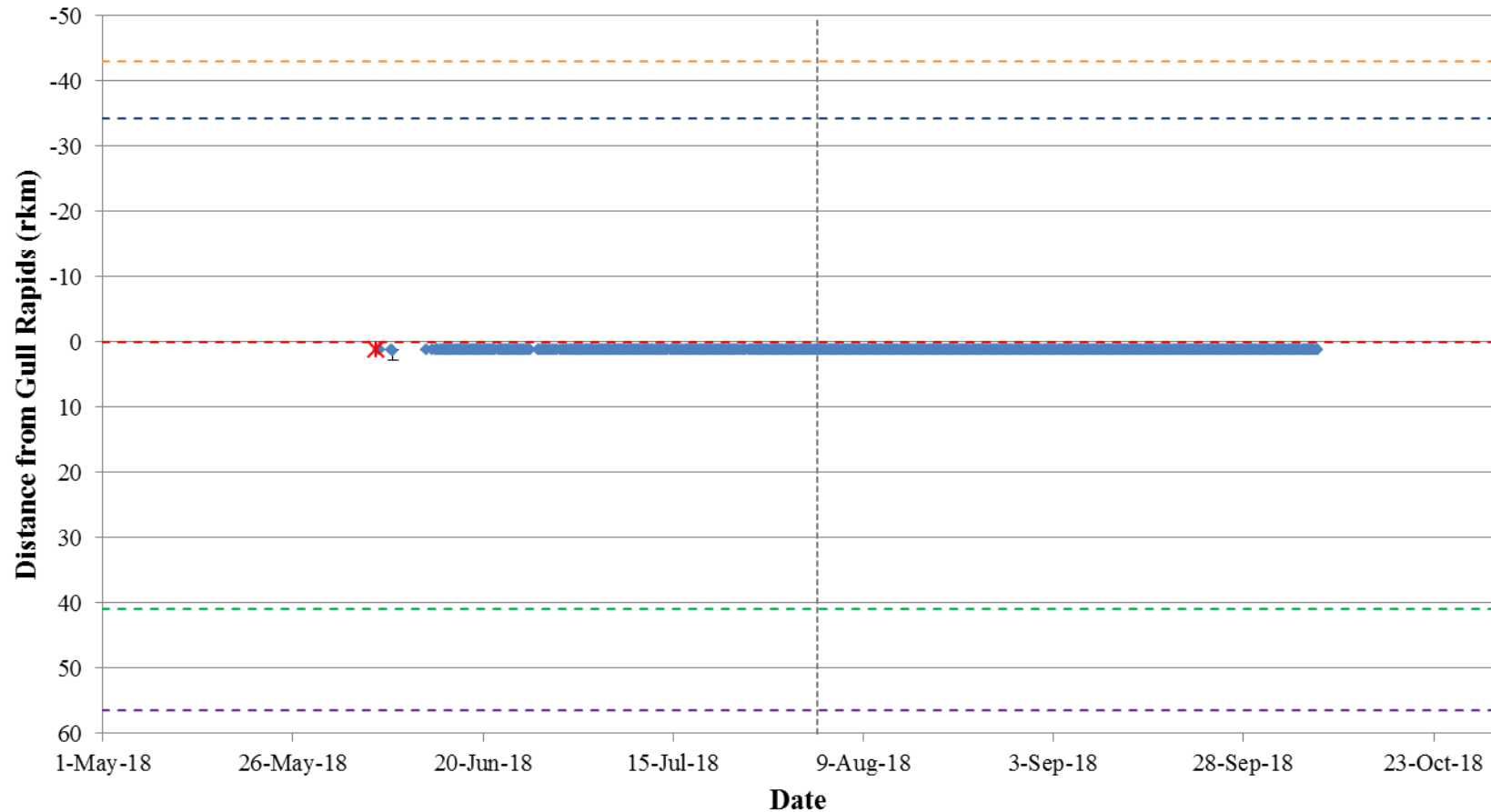
**Figure A3-43: Position of a Walleye tagged with an acoustic transmitter (code #25736) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-44: Position of a Walleye tagged with an acoustic transmitter (code #25737) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-45: Position of a Walleye tagged with an acoustic transmitter (code #25738) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**



**Figure A3-46: Position of a Walleye tagged with an acoustic transmitter (code #25741) in the Nelson River in Stephens Lake in relation to Gull Rapids (rkm 0) from May 1, 2018, to October 10, 2018. Date and location of tagging is indicated by a star. Beginning of Keeeyask spillway commissioning is indicated with vertical dotted line. Dotted horizontal lines indicate landmarks in the study area: entrance to Clark Lake (orange), Birthday Rapids (blue), Gull Rapids (red), Kettle GS (green), and Limestone GS (purple).**

## **APPENDIX 4: BIOLOGICAL AND TAG INFORMATION FOR WALLEYE TAGGED UPSTREAM AND DOWNSTREAM OF GULL RAPIDS**

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Table A4-1:	Tag and biological information for each Walleye acoustically tagged upstream of Gull Rapids in 2016 and 2018. ....	196
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**Table A4-1: Tag and biological information for each Walleye acoustically tagged upstream of Gull Rapids in 2016 and 2018.**

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
53763	107147	5-Jun-16	1735	6-Mar-21	510	-
53764	107146	5-Jun-16	1735	6-Mar-21	560	-
53768	110340	5-Jun-16	1735	6-Mar-21	520	-
53769	110341	5-Jun-16	1735	6-Mar-21	393	-
53770	107150	5-Jun-16	1735	6-Mar-21	350	-
53771	107149	5-Jun-16	1735	6-Mar-21	353	-
53772	107145	5-Jun-16	1735	6-Mar-21	400	-
53773	110339	5-Jun-16	1735	6-Mar-21	405	-
53774	110338	5-Jun-16	1735	6-Mar-21	522	-
53775	110337	5-Jun-16	1735	6-Mar-21	514	-
53776	107205	30-May-16	1735	28-Feb-21	535	-
53777	107241	29-May-16	1735	27-Feb-21	404	1050
53778	100336	3-Jun-16	1735	4-Mar-21	523	-
53779	110335	3-Jun-16	1735	4-Mar-21	400	-
53780	110334	3-Jun-16	1735	4-Mar-21	660	-
53781	110333	2-Jun-16	1735	3-Mar-21	525	-
53782	110332	31-May-16	1735	1-Mar-21	509	1550
53783	110331	31-May-16	1735	1-Mar-21	388	850
53784	107208	30-May-16	1735	28-Feb-21	510	-
53785	107207	30-May-16	1735	28-Feb-21	526	-
53786	107203	30-May-16	1735	28-Feb-21	400	-
53787	107202	30-May-16	1735	28-Feb-21	360	-
53788	107201	30-May-16	1735	28-Feb-21	603	-
53789	107235	30-May-16	1735	28-Feb-21	577	-
53790	107240	29-May-16	1735	27-Feb-21	533	2000
53791	107242	29-May-16	1735	27-Feb-21	400	725
53792	-9999	28-May-16	1735	26-Feb-21	559	-
53793	110520	7-Jun-16	1735	8-Mar-21	560	2125
53794	110519	7-Jun-16	1735	8-Mar-21	440	1200
53795	110518	7-Jun-16	1735	8-Mar-21	410	900
53796	110517	7-Jun-16	1735	8-Mar-21	441	1150
53797	110516	7-Jun-16	1735	8-Mar-21	520	1700
53798	110525	7-Jun-16	1735	8-Mar-21	495	1500
53799	110524	7-Jun-16	1735	8-Mar-21	511	1650
53800	110523	7-Jun-16	1735	8-Mar-21	530	1750
53801	110522	7-Jun-16	1735	8-Mar-21	360	600
53802	110521	7-Jun-16	1735	8-Mar-21	468	1300

**Table A4-1: Tag and biological information for each Walleye acoustically tagged upstream of Gull Rapids in 2016 and 2018 (continued).**

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
53805	107225	6-Jun-16	1735	7-Mar-21	532	-
53806	107142	6-Jun-16	1735	7-Mar-21	405	-
53807	107126	6-Jun-16	1735	7-Mar-21	451	-
53767	111527	24-Sep-16	1735	25-Jun-21	508	1450
53766	111528	24-Sep-16	1735	25-Jun-21	484	1250
53765	111530	24-Sep-16	1735	25-Jun-21	491	1300
53804	111531	24-Sep-16	1735	25-Jun-21	410	700
53803	111532	24-Sep-16	1735	25-Jun-21	484	1550
53758	111533	24-Sep-16	1735	25-Jun-21	423	750
53759	111535	24-Sep-16	1735	25-Jun-21	362	500
53760	111536	24-Sep-16	1735	25-Jun-21	412	1825
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

**Table A4-2: Tag and biological information for each Walleye acoustically tagged upstream of Gull Rapids in 2016 and 2018.**

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
53723	110348	28-May-16	1735	26-Feb-21	510	1500
53724	110538	28-May-16	1735	26-Feb-21	433	1050
53725	110532	27-May-16	1735	25-Feb-21	480	1200
53726	110544	27-May-16	1735	25-Feb-21	412	800
53727	110537	28-May-16	1735	26-Feb-21	486	-
53728	110347	28-May-16	1735	26-Feb-21	507	1650
53729	110350	28-May-16	1735	26-Feb-21	375	560
53730	110349	28-May-16	1735	26-Feb-21	491	1700
53731	110534	28-May-16	1735	26-Feb-21	442	950
53732	110536	28-May-16	1735	26-Feb-21	530	1825
53733	110326	30-May-16	1735	28-Feb-21	322	500
53734	110343	30-May-16	1735	28-Feb-21	460	1325
53735	110344	30-May-16	1735	28-Feb-21	374	600
53736	110345	30-May-16	1735	28-Feb-21	398	900
53737	110346	29-May-16	1735	27-Feb-21	508	1625
53738	110542	31-May-16	1735	1-Mar-21	522	1875
53739	110540	31-May-16	1735	1-Mar-21	480	1300
53740	110543	31-May-16	1735	1-Mar-21	482	1400
53741	110330	30-May-16	1735	28-Feb-21	404	975
53742	110327	30-May-16	1735	28-Feb-21	452	1250
53743	110422	31-May-16	1735	1-Mar-21	469	1450
53744	110421	31-May-16	1735	1-Mar-21	405	750
53745	110417	31-May-16	1735	1-Mar-21	453	1200
53746	110541	31-May-16	1735	1-Mar-21	467	1380
53747	110418	31-May-16	1735	1-Mar-21	520	1600
53748	110951	31-May-16	1735	1-Mar-21	442	975
53749	110425	31-May-16	1735	1-Mar-21	411	750
53750	110424	31-May-16	1735	1-Mar-21	531	1800
53751	110423	31-May-16	1735	1-Mar-21	422	825
53752	110419	31-May-16	1735	1-Mar-21	468	1400
53753	110952	31-May-16	1735	1-Mar-21	488	1325
53754	110953	31-May-16	1735	1-Mar-21	475	1375
53755	110954	31-May-16	1735	1-Mar-21	506	1475
53756	110957	1-Jun-16	1735	2-Mar-21	495	1800
53757	110958	1-Jun-16	1735	2-Mar-21	534	2200
53808	110963	1-Jun-16	1735	2-Mar-21	503	1725
53809	110961	1-Jun-16	1735	2-Mar-21	440	1225



**Table A4-2: Tag and biological information for each Walleye acoustically tagged upstream of Gull Rapids in 2016 and 2018 (continued).**

Acoustic Tag #	Floy Tag #	Tagging Date	Tag Life (days)	Expiry Date	Fork Length (mm)	Weight (g)
53810	110962	1-Jun-16	1735	2-Mar-21	466	1250
53811	110964	1-Jun-16	1735	2-Mar-21	456	1175
53812	110959	1-Jun-16	1735	2-Mar-21	427	975
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