



**Teck Coal Limited**  
Water Quality Management  
P.O. Box 1777  
421 Pine Avenue  
Sparwood, B.C. Canada V0B 2G0

+1 250 425 8086 Tel **Technical Report Overview**  
[www.teck.com](http://www.teck.com)

**Report:** Summary of Northern Pikeminnow Studies in Koochanusa Reservoir, 2021

**Overview:** This report summarizes the northern pikeminnow studies conducted in 2021, including spawning telemetry, feasibility of short-term fish penning to facilitate availability of reproductively competent adults, and environmental limitations on reproductive toxicity analyses.

This report was prepared for Teck by Minnow Environmental Inc.

**For More Information**

If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
- Email [feedbackteckcoal@teck.com](mailto:feedbackteckcoal@teck.com)

Future studies will be made available at [teck.com/elkvalley](http://teck.com/elkvalley).



## **Summary of Northern Pikeminnow Studies in Koochanusa Reservoir, 2021**

Prepared for:  
**Teck Coal Limited**  
Sparwood, British Columbia

Prepared by:  
**Minnow Environmental Inc.**  
Georgetown, Ontario

June 2022

# Summary of Northern Pikeminnow Studies in Koochanusa Reservoir, 2021

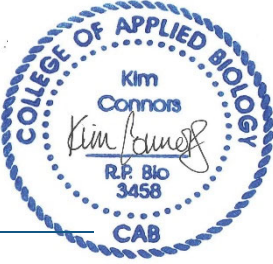
**Noel Soogrim, B.Sc.**  
Project Manager

---



**Kim Connors, M.Sc., R.P.Bio.**  
Senior Project Advisor

---



# TABLE OF CONTENTS

<b>ACRONYMS AND ABBREVIATIONS .....</b>	<b>III</b>
<b>1 INTRODUCTION.....</b>	<b>1</b>
<b>2 METHODS .....</b>	<b>4</b>
2.1 Overview .....	4
2.2 Field Measures.....	4
2.3 Telemetry Study .....	7
2.3.1 Overview.....	7
2.3.2 Fish Tagging.....	7
2.3.3 Passive and Mobile Telemetry and Tracking.....	9
2.3.4 Data Analysis.....	10
2.4 NPM Monitoring .....	11
2.4.1 Overview.....	11
2.4.2 Capture Methods .....	11
2.4.3 NPM Field Processing and Observations .....	13
2.4.4 Laboratory Analysis .....	14
2.4.5 Data Analysis.....	15
2.5 Holding Pen Trials.....	15
<b>3 RESULTS .....</b>	<b>17</b>
3.1 Supporting Field Measures .....	17
3.2 Telemetry Study .....	17
3.3 NPM Monitoring .....	25
3.4 Holding Pen Trials.....	28
<b>4 CONCLUSIONS.....</b>	<b>29</b>
<b>5 REFERENCES.....</b>	<b>30</b>

**APPENDIX A            WATER QUALITY DATA**

**APPENDIX B            TELEMETRY DATA**

**APPENDIX C            FISH COLLECTION DATA**

## LIST OF FIGURES

Figure 1.1:	Location of Teck Coal Mine Operations Relative to Koochanusa Reservoir .....	2
Figure 2.1:	Passive Telemetry Receivers and Surgical Implantation Locations, Koochanusa Reservoir, June to July 2021 .....	5
Figure 2.2:	2021 Northern Pikeminnow Fishing Locations, June to July 2021 .....	6
Figure 3.1:	Daily Mean Surface Water Temperature at Koochanusa Reservoir Study Areas and Maximum and Minimum Air Temperatures Measured at Cranbrook Over the Field Study Duration, June to July 2021 .....	18
Figure 3.2:	Location and Movement Paths for Northern Pikeminnow Tagged and Released at Gold Bay (Top) and the Mouth of the Elk River (Bottom), June and July 2021 .....	21





Figure 3.3: Daily Numbers of Total Individuals Detected and Hours Logged for Northern Pikeminnow Implanted with Tags, June and July 2021 .....22

Figure 3.4: Percentage of Hours Individual Northern Pikeminnow Spent at Each Telemetry Receiver Station During the Telemetry study, June to July 2021 .....23

Figure 3.5: Proportion of Total Hours Logged for Northern Pikeminnow within Each Daily Period, June and July 2021 .....24

**LIST OF TABLES**

Table 3.1: Summary of Measurements Taken from Northern Pikeminnow Used for the Telemetry Study ..... 19

Table 3.2: Summary of Northern Pikeminnow Sampling Effort, Catch, and Catch-Per-Unit-Effort by Sampling Method for Each Koochanusa Reservoir Study Area, June to July 2021 .....26

Table 3.3: Summary of Measurements and Tissue Selenium Concentrations for Female Northern Pikeminnow Monitored in Support of the Toxicity Study .....27



## ACRONYMS AND ABBREVIATIONS

**AAE** – AAE Technical Services Incorporated

**BC** – British Columbia

**BC ENV** – British Columbia Ministry of the Environment and Climate Change Strategy

**Biotactic** – Biotactic Incorporated

**CART** – Combined Acoustic and Radio Tags

**COC** – Chain of Custody

**CPUE** – Catch-per-unit-effort

**CRC ICPMS** – Collision Reaction Cell Inductively Coupled Mass Spectrometry

**DO** – Dissolved Oxygen

**EcoTox** – EcoTox LLC

**FLNRORD** – British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural  
Development

**GLB** – Gold Bay

**GPS** – Global Positioning System

**GSI** – Gonado-somatic Index

**LRL** – Laboratory Reporting Limit

**MER** – The Mouth of the Elk River

**Minnow** – Minnow Environmental Inc.

**NPM** – Northern Pikeminnow

**QA/QC** – Quality Assurance / Quality Control

**SC** – Sand Creek

**Se** – Selenium

**Teck** – Teck Coal Limited

**TENS** – Transdermal Electrical Nerve Stimulation

**USask** – University of Saskatchewan

**US** – United States

**UTM** – Universal Transverse Mercator

**USEPA** – United States Environmental Protection Agency

**VUE** – Vemco User Environment

**WQG** – Water Quality Guideline



# 1 INTRODUCTION

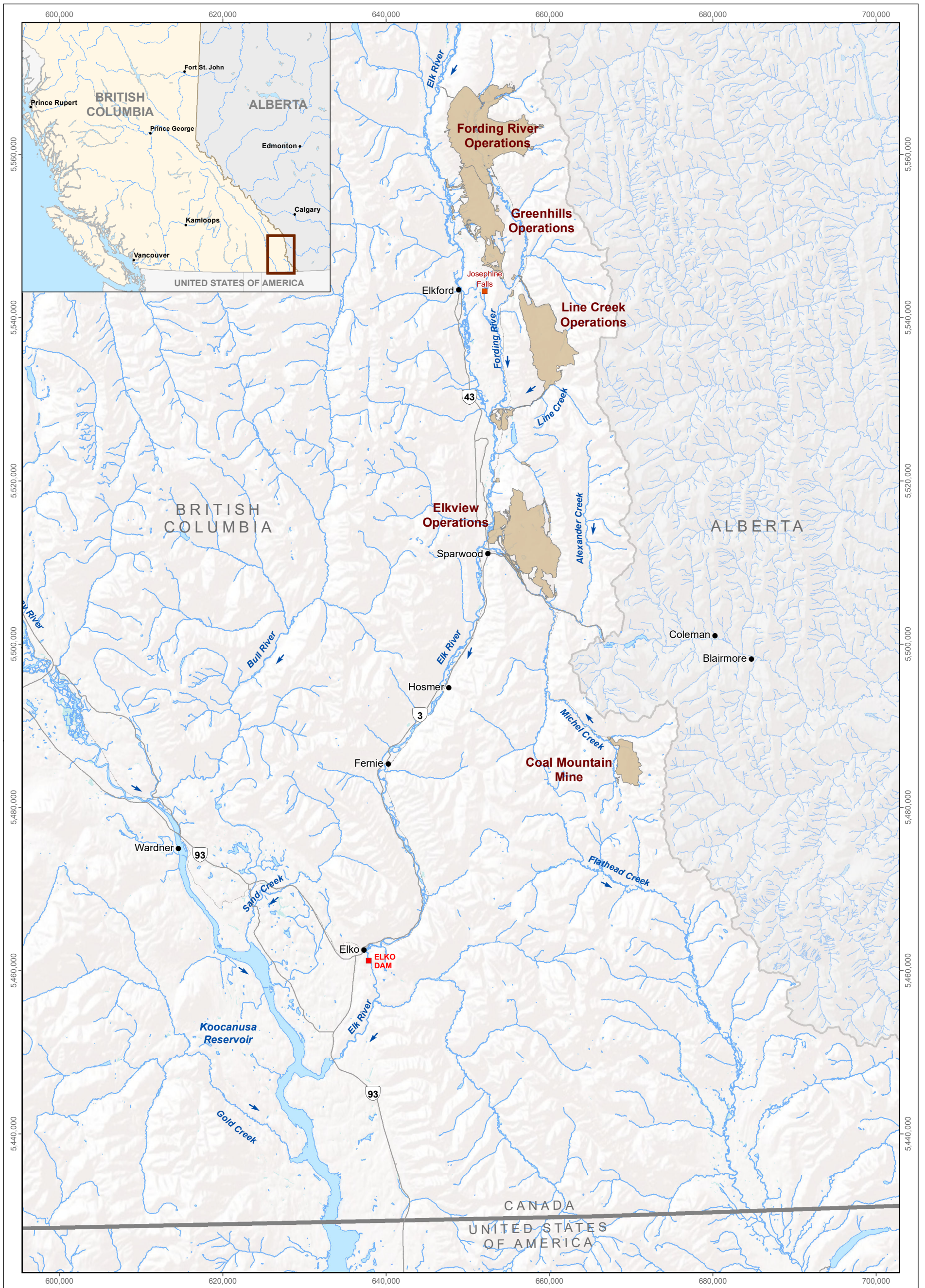
Teck Coal Limited (Teck) owns and operates five steelmaking coal mines within the Elk River watershed of southeastern British Columbia (BC; Figure 1.1). From its headwaters near Elk Lakes, the Elk River flows southwest into Koocanusa Reservoir approximately 20 kilometers (km) upstream from the border between Canada (BC) and the United States (US; Montana; Figure 1.1). Historical monitoring of selenium (Se) concentrations in muscle and ovary tissue of northern pikeminnow (*Ptychocheilus oregonensis*; NPM) from Koocanusa Reservoir has indicated concentrations can exceed the British Columbia Ministry of the Environment and Climate Change Strategy (BC ENV) guideline and/or the United States Environmental Protection Agency (USEPA) criterion (11 mg kg<sup>-1</sup> dry weight [dw] and 15.1 mg kg<sup>-1</sup> dw, respectively; BC ENV 2016, USEPA 2016) for reproductive effects. The monitoring of Se concentration in ovaries of NPM from Koocanusa Reservoir has largely been conducted on samples collected from unripe fish (i.e., not in spawning condition), which precludes evaluation of the potential ecological risks to NPM based on comparison to published Se thresholds. As a result, the potential exposure of early life stage NPM to Se, and the ecological risks posed by Se concentrations in the eggs, are uncertain.

In 2019, a study to evaluate the sensitivity of embryo-larval stages to maternally transferred Se in NPM of Koocanusa Reservoir was commissioned by Teck as a collaborative project involving EcoTox LLC (EcoTox), the University of Saskatchewan (USask), and Minnow Environmental Inc. (Minnow; EcoTox et al. 2019, 2020). For this project, EcoTox was responsible for overall project management, technical oversight, and reporting, USask was responsible for the toxicity evaluation (embryo fertilization, incubation, and toxicity assessment), and Minnow was responsible for field sampling (capture of ripe NPM and tissue chemistry sampling). The assessment of NPM sensitivity to maternally transferred Se was precluded during the 2019 study due to very few females in spawning condition being captured, despite the numerous adult NPM collected during the study (EcoTox et al. 2020). Overall, the 2019 study concluded that Se concentrations in ovary tissue of NPM were inversely related to gonad maturity and fish size (EcoTox et al. 2020). A follow-up study was therefore commissioned in 2021 that included the same study team, study objectives, and study design with the exception that acoustic and radio telemetry was incorporated into the field component of the 2021 study. This Summary of Northern Pikeminnow Studies in Koocanusa Reservoir, 2021 presents the fish sampling methods and telemetry results of the NPM study. The objectives of the field study were to:

1. use acoustic and radio telemetry to aid in the location of potential aggregations of NPM in spawning condition and/or determine movements of NPM within Koocanusa Reservoir;

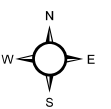
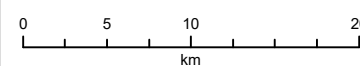






**LEGEND**  
 Teck Coal Mine Operations

**Location of Teck Coal Mine Operations Relative to Koochanusa Reservoir**



Projection: North American Datum 1983 UTM Zone 11  
 Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: April 2022  
 Project 217202.0042



**Figure 1.1**



2. supply USask with ripe NPM for gamete collection and implementation of a Se toxicity investigation; and
3. collect supporting information, including field measures, and NPM tissue for chemistry analyses and age determination.

During implementation of the 2021 field study, surface water temperatures in the reservoir exceeded limits for fish sampling stipulated in a provincial fish collection permit during the predicted NPM spawning window, and therefore some deviations from the sampling locations and methods outlined in the original study design were executed in response. In addition, due to the temperature-related limitations, target numbers of ripe female NPM were not achieved during the 2021 field study precluding completion of the toxicity evaluation by USask. Data collected in 2021 will be used to inform future study designs and data analysis during reporting. This report summarizes information collected during the field component of the 2021 NPM field study, including supporting water quality measures, NPM movement information from the telemetry survey, and general observations regarding placement of NPM in holding pens to attain ripe



## 2 METHODS

### 2.1 Overview

The field component of the work included collection of water quality (field) measures, installation and data collection of water temperature loggers in the lower Elk River, telemetry study implementation, and the monitoring, sampling (e.g., tissue chemistry), and collection of adult NPM for the toxicity component of the study as outlined in the project study design (Minnow 2021, EcoTox et al. 2021), as well as holding pen trials. Similar to the previous studies, the fish sampling locations in Koocanusa Reservoir included Gold Bay (GLB), the Mouth of the Elk River (MER), and Sand Creek (SC; Figure 2.1). Warm weather in southern BC at the time of the field study necessitated sampling at additional study locations in 2021, including the lower Elk River, Gold Creek, and Sand Creek (Figure 2.1), where water temperatures met conditions for fish sampling stipulated in the provincial fish collection permit. The field study was conducted from June 2<sup>nd</sup> to July 29<sup>th</sup>, 2021.

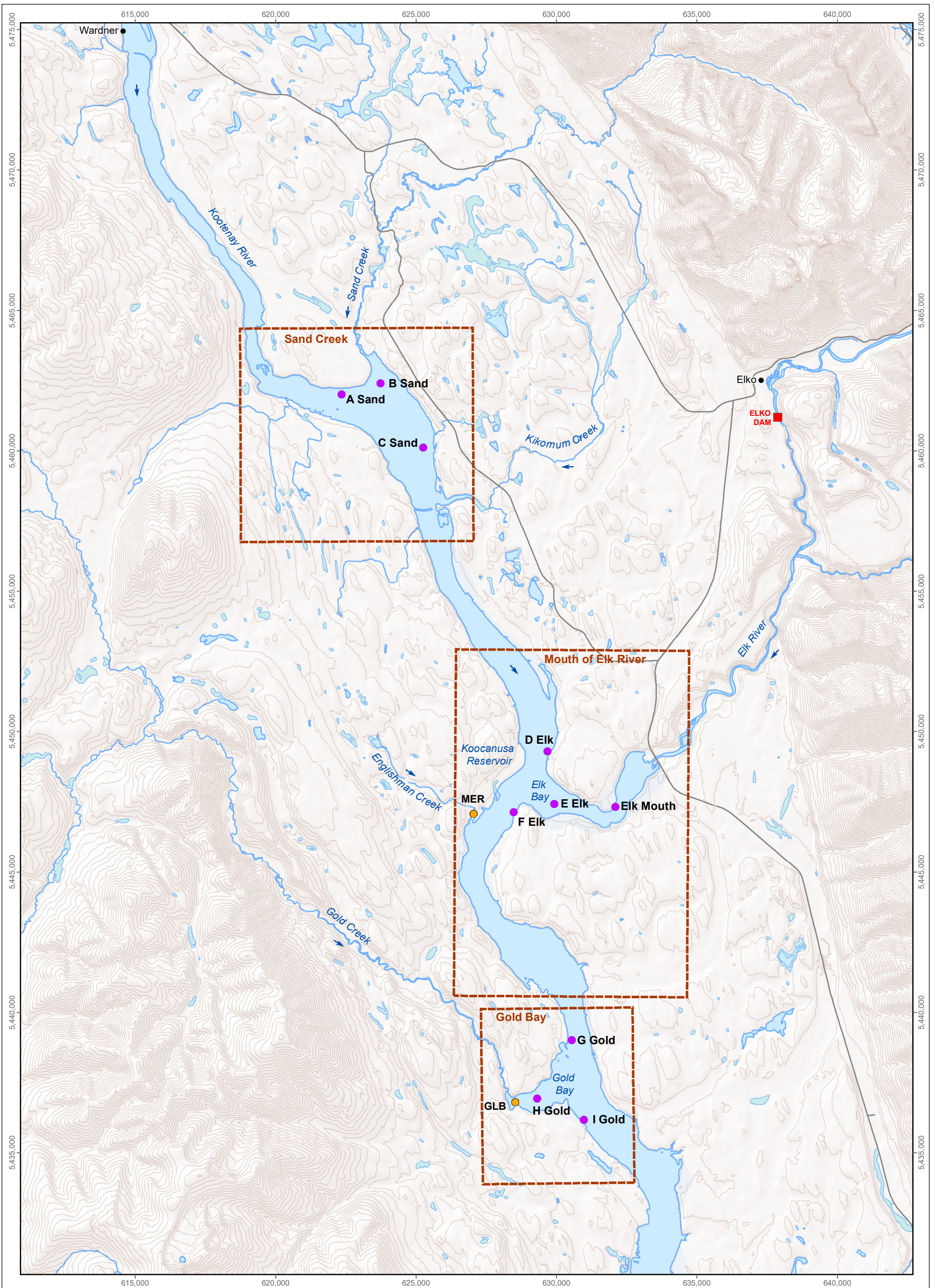
### 2.2 Field Measures

Field measures of water quality were collected to support the analysis of NPM movement (i.e., telemetry study) and spawning timing, and to ensure compliance with provincial fish collection permit conditions. Water temperature prior to entering Koocanusa Reservoir was continuously monitored using two HOBO™ Pendant (MX2201) temperature loggers that were installed upstream and downstream of the Highway 93 bridge crossing the Elk River (Figure 2.2). Temperature (°C) was continuously monitored every 0.5 hours from May 28<sup>th</sup> to August 25<sup>th</sup>, 2021, and data was downloaded twice from the loggers during the study. In addition, *in situ* measurement of water temperature was collected daily at the surface and/or bottom of the water column at all study areas during days in which fish sampling was conducted over the duration of the field study to ensure that water temperatures were below the 20°C limit stipulated in the provincial fish collection permit. Additional measures of dissolved oxygen (DO), pH, conductivity, and specific conductance were periodically recorded at the time of water temperature monitoring. A YSI™ ProDSS meter, which was calibrated according to manufacturer instructions daily prior to conducting the field measurements was used to collect all *in situ* field measures.

Surface water temperature data collected at Koocanusa Reservoir from June 3<sup>rd</sup> to July 27<sup>th</sup>, 2021, were plotted together with daily air temperature minimum and maximum measured at the nearby City of Cranbrook (BC) to illustrate changes in water temperature over the course of the field study. Water temperature data were also compared to the range of 14 to 18°C preferred by NPM for spawning (Gadomski et al. 2001). Dissolved oxygen concentrations were compared to the British Columbia Water Quality Guideline (BC WQG; BC ENV 2021).



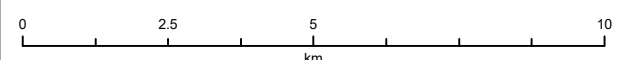




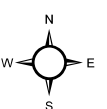
**LEGEND**

- Passive Telemetry Receiver Location
- Surgical Implantation and Tagged Fish Release Location
- Study Location
- Elko Dam

**Passive Telemetry Receivers and Surgical Implantation Locations, Koozanusa Reservoir, June to July 2021**



Projection: North American Datum 1983 UTM Zone 11 U  
 Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

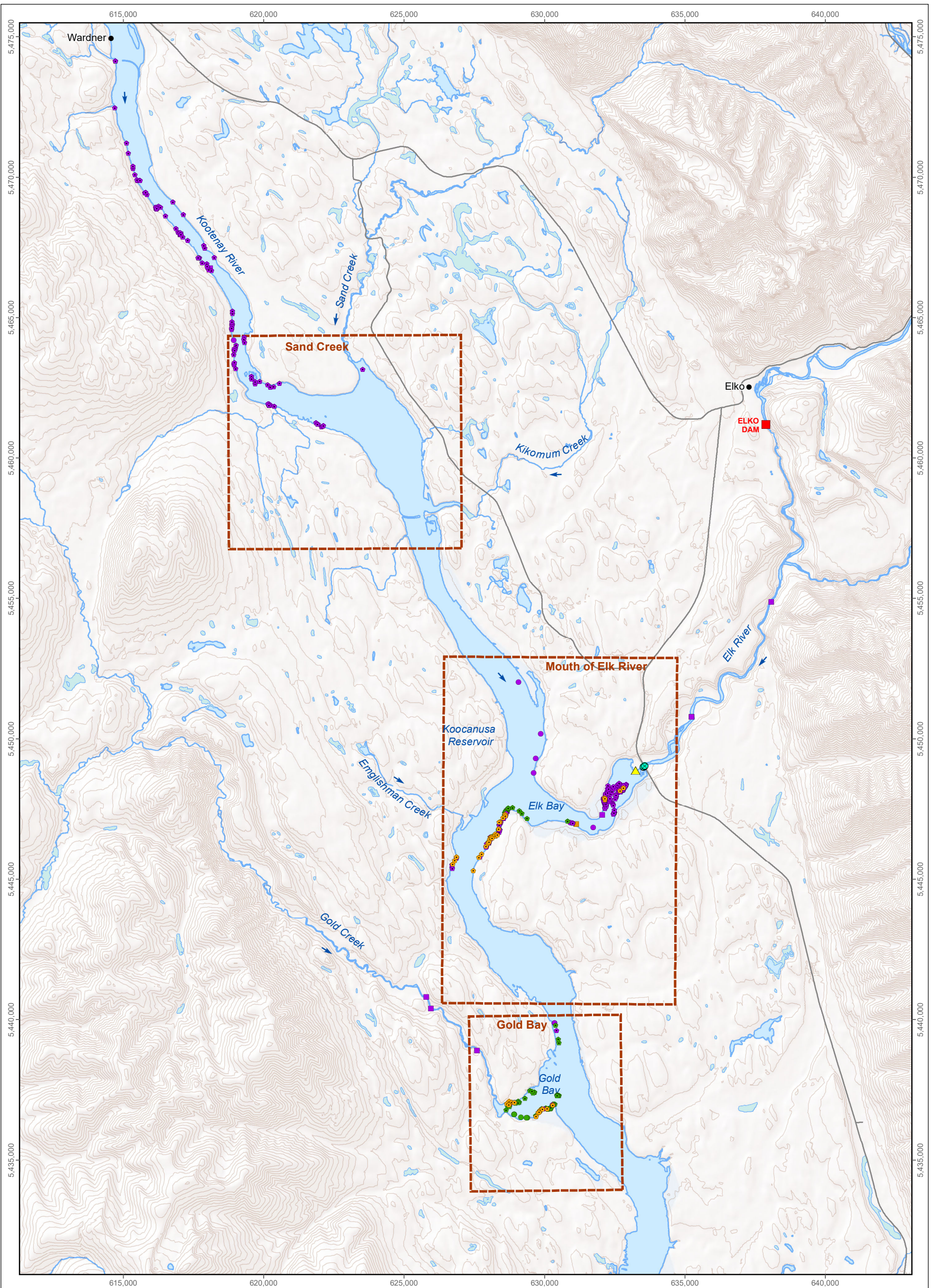


Date: April 2022  
 Project 217202.0042



**Figure 2.1**





**LEGEND**

**Gill Net Location**

- Fishing Location When Surface Water Temperature were Within Permit Stipulations
- Fishing Location When Surface Water Temperature Exceeded Permit Stipulations
- Fishing Location When Temperature Limitation was Lifted by Permit Amendment

**Angling Location**

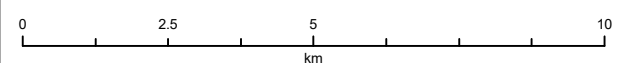
- Fishing Location When Surface Water Temperature Exceeded Permit Stipulations
- Fishing Location When Temperature Limitation was Lifted by Permit Amendment

**Hoop Net Location**

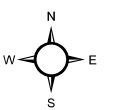
- Fishing Location When Surface Water Temperature were Within Permit Stipulations
- Fishing Location When Surface Water Temperature Exceeded Permit Stipulations

- ▲ Holding Pen
- Temperature Logger Location
- ▭ Study Location
- Elko Dam

**2021 Northern Pikeminnow Fishing Locations, June to July 2021**



Projection: North American Datum 1983 UTM Zone 11 U  
 Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.



Date: April 2022  
 Project 217202.0042



**Figure 2.2**



## 2.3 Telemetry Study

### 2.3.1 Overview

The telemetry study was included as part of the 2021 field study as a means of tracking movements of NPM within Koochanusa Reservoir to potentially identify congregations of NPM, thus supporting efficient capture of NPM in spawning condition for collection of gametes. Minnow worked with Biotactic Incorporated (Biotactic) to complete the telemetry component of the field study. Biotactic was responsible for surgical procedures, passive receiver set-up, training the Minnow team on software/equipment use and download, and daily telemetry data analyses. Minnow was responsible for supplying adult NPM to Biotactic for tag implantation, active fish tracking, and data presentation. High numbers of adult NPM were known to be present at Gold Bay (GLB) and the Mouth of the Elk River (MER) based on previous fish monitoring studies (EcoTox et al. 2021), and therefore these two study locations were used to collect fish for implantation of combined acoustic and radio tags (CART) for the telemetry study. The selection of CART for this study reflected their flexibility in allowing the tracking of individual fish in both lentic and lotic environments (i.e., Koochanusa Reservoir profundal zones and tributaries) thereby increasing the likelihood of locating congregations and/or tracking movement of adult NPM to potential spawning locations. Passive telemetry receivers were placed at three study locations in Koochanusa Reservoir (i.e., GLB, MER, and SC; Figure 2.1), reflecting the same three study locations used in previous studies for monitoring Se concentrations in NPM tissue (EcoTox et al. 2020). Passive and mobile tracking were utilized to provide adequate coverage of each study location within the reservoir at sufficient resolution to be able to direct field staff to specific sampling locations in the event that spawning congregations were identified or suspected.

### 2.3.2 Fish Tagging

Twenty-nine adult NPM were targeted for CART surgical implantation from each of the GLB and MER study locations, resulting in a total sample size of 58 individuals for the telemetry study. Fish sampling was conducted according to conditions stipulated under a BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (FLNRORD) Scientific Fish Collection Permit (No. CB21-620969; Appendix C). Gill nets with 3- to 5-inch (2.5 to 12.7 cm) stretched mesh size and varying in length from 80 to 150 feet (ft; 24 to 45 m) were used for the capture of mature adult NPM (i.e., minimum size of 300 mm). The gill nets were set on the bottom for short durations (less than 30 minutes) to ensure minimal stress on fish. Supporting information including Global Positioning System (GPS) coordinates, time of deployment and retrieval, set depth, and species and numbers of fish captured were recorded for each gill net set. Following removal from the gill nets, adult NPM greater than 300 mm in fork length were immediately placed in a holding bin that was filled with aerated reservoir water. No more than



two adult NPM were retained in a holding bin at once and the duration of retention was maintained at less than five minutes to reduce potential stress on the fish. The retained NPM were transported to an onshore surgical implantation station where Biotactic's team was waiting. Prior to surgery, measurements of length (fork and total length to the nearest millimeter using a standard measuring board) and weight (to the nearest ten to fifty grams using appropriately sized Pesola™ spring scales [500 g, 1,000 g, and/or 5,000 g]) were taken and a determination of sex was made for each fish. In addition, visual observations for the presence of external anomalies including deformities, erosions (fin and gill), lesions, tumours, injuries, infections, and/or parasites were conducted for each fish based on standardized protocols developed by Teck and Minnow that incorporate a severity scale (Appendix Table C.1).

Biotactic established onshore surgical implantation stations at the GLB and MER study locations (Figure 2.1) prior to initiation of field collection of NPM. Each surgical station consisted of one to four holding bins to contain NPM prior to and following surgery, a surgical trough (filled with reservoir water) where fish underwent surgery, and a surgical tool organization/sanitization area (e.g., bleach solution to clean implements). The surgical procedure involved first anesthetizing individual fish taken from the onshore holding bin with electrosedation (i.e., a Transdermal Electrical Nerve Stimulation [TENS] unit and conductive gloves that induce sedation with electrical pulses) in the surgical trough (Biotactic 2021, Kim et al. 2017). Electroседation was implemented for 30 seconds to ensure immobility and minimize stress on the fish prior to surgery. During surgery, the fish was partially submerged in aerated water and continuously held with the conductive gloves within the surgical trough to ensure sedation. The surgery involved making a small incision ventrally on the fish for implantation of the CART transmitter into the body cavity. Following the CART transmitter implant the visible radio antenna was threaded through muscle tissue posterior to the surgical incision site of each fish and the incision was closed with a continuous suture. Lotek Model MM-RC-8-SO CART transmitters were implanted into NPM used for the telemetry study, each having dimensions of 8.5 x 4.3 mm and weighing 6.3 g. The CART transmitters were programmed in the 69 kiloHertz (kHz) range (acoustic) and 149 megaHertz (MHz) range (radio) and set at a pulse rate of 60 and 5 seconds, respectively. An externally visible, individually numbered Floy™ T-bar anchor tag was then attached in musculature near the distal end of the dorsal fin. Post-surgery, the fish was placed in a designated recovery bin, at which point contact with the conductive gloves was broken. Fish were continuously monitored in the recovery bin for a 5-to-15-min period until they were able to swim strongly in an upright position (i.e., recovered from sedation). Once NPM were fully recovered, they were released to Koochanusa Reservoir near the surgical station. The NPM were tagged and released on June 10<sup>th</sup>, 2021, at Gold Bay and on June 11<sup>th</sup>, 2021, at the Mouth of the Elk River study areas (Figure 2.1).



### 2.3.3 Passive and Mobile Telemetry and Tracking

Three sets of stationary acoustic biotelemetry receivers, each composed of three Vemco Group Model VR2T receivers operated at the factory-set frequency of 69 kHz, were deployed within Koochanusa Reservoir at the GLB, MER, and SC study locations (Figure 2.1). Locations for deployment of receivers considered local habitat features, distance from the shoreline, fish detection range (approximately 1 km), distance between each receiver (minimum 1 km), boat traffic, and input from Biotactic and Minnow personnel with experience on telemetry receiver deployments and Koochanusa Reservoir bathymetry, respectively. The receivers were attached to a float anchor system consisting of a 38 cm diameter buoy attached to an approximately 26 kg cinder block using durable braided rope. Each receiver was attached to the line approximately 2 to 4 m below the water surface. The initial installment of receivers occurred from June 2<sup>nd</sup> to 4<sup>th</sup> by Minnow and Biotactic crews. During this time, water levels in Koochanusa Reservoir were rising rapidly in response to spring freshet flow and seasonal management of the reservoir. In addition, spring freshet resulted in considerable amounts of large woody debris entering the reservoir from the Elk and Kootenay rivers. The rapidly increasing water levels and presence of large woody debris presented a risk for losing the deployed receivers through submergence below the surface or dislodgement. In response, all nine receivers were removed from Koochanusa Reservoir on June 8<sup>th</sup> and 9<sup>th</sup> and redeployed on June 22<sup>nd</sup> and 23<sup>rd</sup> once water levels stabilized and the frequency of floating debris reduced. In addition, a receiver set at Gold Bay (I Gold; Figure 2.1) that had shown relatively low NPM detection was re-located to an area of cooler water temperature at the mouth of the Elk River (near the confluence with the reservoir; renamed Elk Mouth; Figure 2.1) on July 6<sup>th</sup> to optimize data collection in response to warm surface water temperatures in Koochanusa Reservoir that limited fish sampling under the fish collection permit.

The receivers were pulled to the surface daily for data downloading to a laptop, which was facilitated in the field using a Bluetooth connection to the Vemco User Environment (VUE) software. These data were provided to and interpreted by Biotactic who then provided field crews with guidance regarding potential locations for deployment of fishing gear on the following day. The frequency of data downloads from the receivers was less than daily later in the season due to surface water temperatures exceeding fish collection permit thresholds for fish sampling and thus preventing crews from sampling within the vicinity of the deployed receivers. In addition to the passive tracking described above, active (mobile) tracking of tagged NPM outside of the detection radius of the stationary receivers (>1 km) was conducted using a Vemco Model VR100 active tracking receiver connected to a hydrophone or a Lotek Model SRX400158-170 wireless radio antenna receiver. Active tracking in profundal areas of the reservoir involved placing a hydrophone approximately 1 to 2 m below the water surface and, once the boat engine and sonar (if present) were shut down, viewing the screen on the VR100



tracking receiver for any tag numbers while listening to the intensity/frequency of accompanying 'beep' signals received. The wireless radio antenna unit was used to actively track tagged NPM closer to tributary inlets and in shallow lentic waters of Kooacanusa Reservoir. The radio antenna was positioned outwards from the field crew member who then rotated 360 degrees while a second crew member viewed the radio tracking receiver screen for any tag numbers while listening for detections. For each active tracking method, GPS coordinates of sampling locations, sampling date and time (24hr), and any NPM identification (tag) numbers identified from the active tracking were recorded. The active tracking data were provided to Biotactic on the day of collection together with data downloaded from the passive receivers. Biotactic then interpreted the information and provided fishing crews with guidance regarding fish sampling locations for the next day of sampling. Passive and mobile tracking began on June 23<sup>rd</sup> and ceased on July 24<sup>th</sup>, 2021.

### 2.3.4 Data Analysis

Receiver locational data were compiled to quantify the activity of individual fish and summarize the data by receiver location: individual Gold Bay, Mouth of the Elk River, Sand Creek, and release locations (i.e., GLB and MER; Figure 2.1). Raw CART transmitter data from receivers were first grouped into continuous time blocks, defined as those detections separated by gaps of less than 10 minutes for each single receiver station, on a single day or period (hereafter referred to as a time block). For diurnal movement summaries, a day was grouped into four periods based on daylight hours at the time of the study, including sunrise (05:00 to 07:00), day (07:00 to 21:00), evening (21:00 to 23:00), and night (23:00 to 05:00). Although an ultrasonic ping rate of 25 seconds was used for the telemetry study, signals can be impeded during periods of fish immobility or due to obstructions (i.e., fish cover structure), therefore an assumption was made that individuals remained in the vicinity of the receiver unless undetected for more than 10 minutes. A new time block would be created if: 1) there was a gap in detections of ten or more minutes; 2) an individual was detected at a new station; or 3) there was a change in day or period. Each time block was summarized by the total number of hours of the time block (maximum time less the minimum time) and the number of locations detected over the time block.

The activity of individual NPM was summarized by totaling the number of detected hours (sum of all time blocks) and locations, as well as the proportion of those hours spent at each individual station and area. The daily activity was plotted as network plots connecting time blocks for each individual. Each location on a given day for the tagged NPM individual was coloured by day (to look for temporal patterns), sized by the total number of hours detected on that day, and spatially "jittered" to avoid multiple overlapping on the generated plots. Plots were created for each individual and grouped by all individuals separately for those NPM released at GLB



and MER. Key individuals were identified based on continuous detection hours and locations to discern daily period patterns. In these plots, locations were differentiated by period and summarized by receiver location by determining the number of individuals detected and the total number of hours logged at each station on each day or by the proportion of hours detected in each daily period. Using the methods described above, an assessment of fish movement among study areas of Kooacanusa Reservoir and/or potential diurnal patterns that could provide insight on timing and location of NPM spawning was completed.

## **2.4 NPM Monitoring**

### **2.4.1 Overview**

The field component of the study included monitoring the spawning condition of NPM with the intent to collect gametes and tissue samples. These activities and sample collections provided supporting information on NPM ripeness, age, and Se concentrations in tissues leading up to and during spawning. The target sample size for the study was a total of 50 female and 100 male NPM in ripe spawning condition collected from Kooacanusa Reservoir among any of the three GLB, MER, and/or SC study locations (Figure 2.2). Fish sampling was conducted June 23<sup>rd</sup> to July 13<sup>th</sup>, 2021 (as conditions permitted), under provincially issued scientific fish collection permit No. CB21-620969 (Appendix C). Under this permit, fishing activities were permitted when surface water temperatures were below 20°C. Since this temperature was exceeded starting late-June (see section 3.1), an application for amendment of the original permit was submitted to the provincial government to alter the temperature clause, and an additional permit application was submitted to allow sampling in tributaries of Kooacanusa Reservoir where water temperatures were below the limit specified in the original provincial permit. On July 13<sup>th</sup>, a new scientific fish collection permit (No. C21-626419; Appendix C) was issued by FLNRORD that expanded the sampling locations to the reservoir tributaries of Gold Creek, Elk River, Sand Creek, and Kikomun Creek, therefore allowing field crews to continue monitoring NPM. On July 26<sup>th</sup>, the original fish collection permit (No. CB21-620969; Appendix C) was amended to lift the 20°C fish sampling limitation, which allowed sampling throughout the Canadian portion of the reservoir despite the high surface water temperature.

### **2.4.2 Capture Methods**

Gill netting was the primary method used to capture NPM for the study (Figure 2.2). Gill nets with 3 to 5 inch (7.6 cm to 12.7 cm) stretch mesh size and measuring 30 to 150 ft (9 to 45 m) in length were deployed from June 23<sup>rd</sup> to July 29<sup>th</sup> for the purposes of NPM monitoring. The gill nets were deployed for a maximum duration of 30 minutes between setting and retrieval, and over a range of times beginning at dawn. Gill nets were set on the bottom of the reservoir perpendicular to



shore at an average depth of 5 m and maximum depth of 27 m. Gill netting was permitted within the primary study areas of the main reservoir only until June 25<sup>th</sup> when netting was ceased in these areas due to surface water exceeding the 20 °C temperature threshold stipulated in the initial provincial fish collection permit. Subsequent to this date, sampling was focussed at the confluences of the Kootenay River and Elk River with Koochanusa Reservoir (Figure 2.2) because water temperatures at these areas were below the threshold indicated in the fish collection permit. Habitat selected for the setting of gill nets was based on those locations identified as high value fish habitat in previous studies and/or sampling, which generally included habitat characterized by gradual to steeply contoured slopes over variable types of substrates, including silt, sand, cobble/boulder, and combinations thereof, as well as locations reflecting variable amounts of submergent vegetation (Vast 2017 a,b). Upon retrieval of each gill net, all captured fish were carefully removed, identified, and enumerated, following which all non-target species were returned to the reservoir and NPM temporarily retained for monitoring as described below (section 2.4.3). For each gill net set, information including date, duration of sampling, sampling depth, GPS Universal Transverse Mercator (UTM) coordinates, and habitat notes were recorded.

Double throat hoop nets designed with 0.9 m diameter hoops and 38 mm bar mesh, attached to 30 m leads, were set from the shore within Koochanusa Reservoir, or parallel to direction of flow (with the net mouth on the downstream side) near tributary confluences to the reservoir, for overnight durations (approximately 24 hrs; Figure 2.2). All hoop nets were set on the bottom of the reservoir at depths ranging from 0.5 to 10 m. Habitat selected for setting hoop nets were those identified as high value fish habitat from previous studies and/or sampling which included habitat defined by gradually contoured slopes characterized by cobble and boulder substrate, as well as flat areas where silt/mud substrate and varying amounts of submergent vegetation were present (Vast 2017 a,b). Upon retrieval of each hoop net, all captured fish were carefully removed, identified, and enumerated, following which all non-target species were returned to the reservoir. Supporting information collected for each hoop net set included date, set and retrieval time, sampling depth, and GPS UTM coordinates. Although hoop nets were indicated as a primary method to capture NPM in the study design (EcoTox et al. 2021; Minnow 2021), large woody debris washed into the reservoir from tributaries severely compromised the effective use of hoop nets (e.g., debris tangled the nets and dislodged them from deployment locations). In addition, fish collection permit limitations related to warm surface water temperatures in shallows targeted for hoop net sampling precluded use of hoop nets for fish collection. As a result, hoop nets were not used extensively over the course of the field study.

Angling was used as a primary method for collection of NPM from July 5<sup>th</sup> to 27<sup>th</sup> in response to warming water temperatures within the reservoir limiting the use of gill nets. Angling was





conducted primarily within the Elk River, and although some angling was conducted at Gold Creek (Figure 2.2), habitat in this creek was considered marginal for NPM spawning (i.e., shallow water depths ranging from 0.1 to 0.3 m with little to no refuge areas for adult NPM) and thus only limited effort was applied. Angling was not conducted at Sand Creek due to the lower creek areas being on private land nor in Kikomun Creek due to low water levels (i.e., less than 30 cm of water). Angling was conducted using standard spinning reel gear and various lures outfitted with single barbless hooks. Habitat targeted for angling primarily included swift flowing waters characterized by substrate of cobble and boulder. Fish captured by angling were identified to species and enumerated and, for non-target species, released at the location of capture. Adult NPM were temporarily retained for monitoring as described below (Section 2.4.3). Supporting information collected for sampling by angling included date, GPS UTM coordinates for the location of sampling, number of active fishing lines, and duration of sampling.

Adult NPM captured by gill net, hoop net, or angling were temporarily retained in holding bins containing aerated reservoir water. These fish were assessed for ripeness by applying gentle pressure to the abdomen and observing whether eggs or milt were readily expressed. If NPM were not ripe, most were returned to the area at which capture occurred. A subset of these fish were sacrificed for collection of body and organ measurements (e.g., length, weight), and tissue chemistry and age determination samples, as described below in subsection 2.4.3.

### **2.4.3 NPM Field Processing and Observations**

Monitoring of NPM included evaluation of reproductive condition of adults to determine ripeness and for potential collection of tissue samples for Se analysis and/or aging. Female NPM were retained for additional sampling in the event that eggs could be expressed manually upon slight pressure applied to the abdomen (i.e., flowing condition). Upon determining that a female NPM was in suitable spawning condition for gamete collection, individuals were placed in a holding bin filled with aerated reservoir water, transported, and transferred to USask field staff for gamete expression and fertilization. In addition to the ripe females that were retained for gamete collections, a subset of females were chosen throughout the study period for ripeness assessment based on the fullness of the body cavity and inspection of the anal pore for “redness” that could be associated with recently expelled eggs. These females were retained to provide additional information on NPM ripeness and Se concentrations in tissue leading up to and at the time of spawning. The subset of females selected for the ripeness assessment were euthanized by a decisive blow to the head and placed on ice to later undergo dissection.

Ripe female NPM supplied to USask for gamete expression and fertilization were subsequently returned to Minnow for processing using the same processing procedures as for those retained as part of the ripeness assessment. Processing of the female NPM included determination of



total and fork lengths measured to the nearest millimetre using a standard measuring board, and assessment of overall body weight measured using appropriately sized spring scales (e.g., 500 g, 1,000 g, and 5,000 g). Clean implements (cutting boards, fillet knives, and tweezers) were used for the dissections. Upon opening of the body cavity, ovaries were removed from each female and weighed to the nearest milligram using an analytical balance with a surrounding draft shield. After weighing, whole ovaries and the carcass were retained for analysis of Se concentration. A skinless, boneless muscle fillet sample was also collected from each fish to provide supplemental data on Se concentrations in muscle. Following these measures and tissue collections, age structures (i.e., otoliths) were removed from each fish, wrapped in waxed paper, and placed inside a labelled envelope. External and internal anomalies such as parasites, infections, tumors, and hemorrhaging were assessed for each processed fish based on a standardized severity scale (Appendix Table C.1). Once all measurements, tissue collections, and observations were complete, the remaining carcass and any other tissue separated from the fish during dissection was weighed using appropriately sized spring scale Pesolas™ (e.g., 500 g, 1,000 g, and 5,000 g), following which this material was placed into a labelled polyethylene bag and frozen. Whole body samples (excluding extracted muscle tissue, ovary tissue, and otoliths) were retained from NPM females in which gametes had been collected and fertilized by USask. In addition, muscle, and ovary tissue, from all processed female NPM (i.e., those that expressed gametes and were fertilized, or the ripeness assessment) were retained for analysis of Se concentration.

#### 2.4.4 Laboratory Analysis

Upon completion of the field study, NPM tissue chemistry samples were shipped frozen (on ice) to ALS Environmental (ALS; Burnaby, BC). The tissue chemistry sample shipment was accompanied by a chain-of-custody (COC) form, a list of expected Laboratory Reporting Limits (LRLs), and laboratory quality assurance/quality control (QA/QC) requirements. At the laboratory, the samples were freeze dried prior to analysis to allow reporting of parameter concentrations on a dry weight basis. The tissue chemistry samples, including ovaries, muscle, and whole-body samples, were analyzed for metal, non-metal, and metalloid parameters typically included in a Collision Reaction Cell Inductively Coupled Plasma Mass Spectrometry (CRC ICPMS) scan, as well as percent moisture.

Aging samples were shipped frozen to AAE Tech Services (AAE; LaSalle, Manitoba) for processing at the completion of the field study. At the laboratory, otoliths were prepared for aging by cleaning, embedding in an epoxy resin and, after the epoxy hardened, sectioning using a diamond-blade saw set at low speed. Each otolith was mounted on a glass slide using a mounting medium and examined under a compound microscope using transmitted light to





determine fish age. For each structure, the age and edge condition were recorded along with a confidence rating for the age determination. A secondary age reading was completed by another individual from the lab for internal QA/QC purposes to ensure accuracy.

#### 2.4.5 Data Analysis

Fish catch data were electronically tabulated and subject to internal QA/QC protocols to ensure accuracy of the data entry. Fish catch data for the study areas were summarized according to total catch and total catch-per-unit-effort (CPUE) of NPM and other fish species individually and combined for each sampling method. Gill netting CPUE was calculated as the number of fish captured per 100 m<sup>2</sup>·hr<sup>-1</sup> of net deployed as follows:

$$\text{CPUE} = \text{No. of fish captured} / ((\text{Fishing Time [hr]} * (\text{Net Length [m]})) / 100)$$

Hoop netting CPUE was calculated as the number of fish captured per trap per day (24 hr) as follows:

$$\text{CPUE} = \text{No. of fish captured} / (\text{Fishing Time [hrs]} / 24)$$

Angling CPUE was calculated as the number of fish captured per fishing line per day as follows:

$$\text{CPUE} = \text{No. of fish captured} / (\text{No. of fishing lines} * (\text{Fishing Time [hrs]} / 24))$$

For NPM, summary statistics including sample size, mean, standard deviation, standard error, minimum, median, and maximum were calculated separated by fish sex for endpoints of age, body size (length and weight), and gonado-somatic index (GSI). The latter was calculated as the proportion of gonad weight relative to total body weight multiplied by 100. Tissue chemistry data received from ALS were evaluated to determine whether lab QA/QC requirements were achieved for the data. Interpretation of the tissue chemistry data was not conducted in this report and will be added to the overall data set to aid in informing future study designs and data analysis during reporting.

#### 2.5 Holding Pen Trials

An impromptu trial assessment of whether NPM placed in holding pens would continue to show gonad maturation to a spawning condition was conducted near the end of the field study, from July 24<sup>th</sup> to 27<sup>th</sup>, for consideration of holding pen usage in future projects. The holding pens were constructed by attaching two cod traps to one another and securing one end of the pen to an anchor and the other to a float line that allowed retrieval of the pen. Two holding pens were constructed in this manner and placed in quiescent water near the Mouth of the Elk River station (Figure 2.2). The holding pens were set at a depth of approximately 3 to 4 m and in water with temperature ranging from 15 to 18°C. The trial involved placing one to three adult NPM believed to be near spawning condition (i.e., females with distended ["full"] abdomen and milting males)



in holding pens for a duration of up to three days, at which time the proximity to spawning condition was re-evaluated in these individuals. Female and male NPM were held in separate pens, and the pen containing females was placed upstream of the pen containing males to prevent inadvertent fertilization of eggs by flowing milt. Monitoring of the NPM held in pens was conducted up to two times daily to ensure fish were not showing any undue signs of stress or injury. Information from the holding pen trial served as the basis for a descriptive evaluation of whether spawning condition in NPM advanced over the duration of time that fish occupied the pens.



## 3 RESULTS

### 3.1 Supporting Field Measures

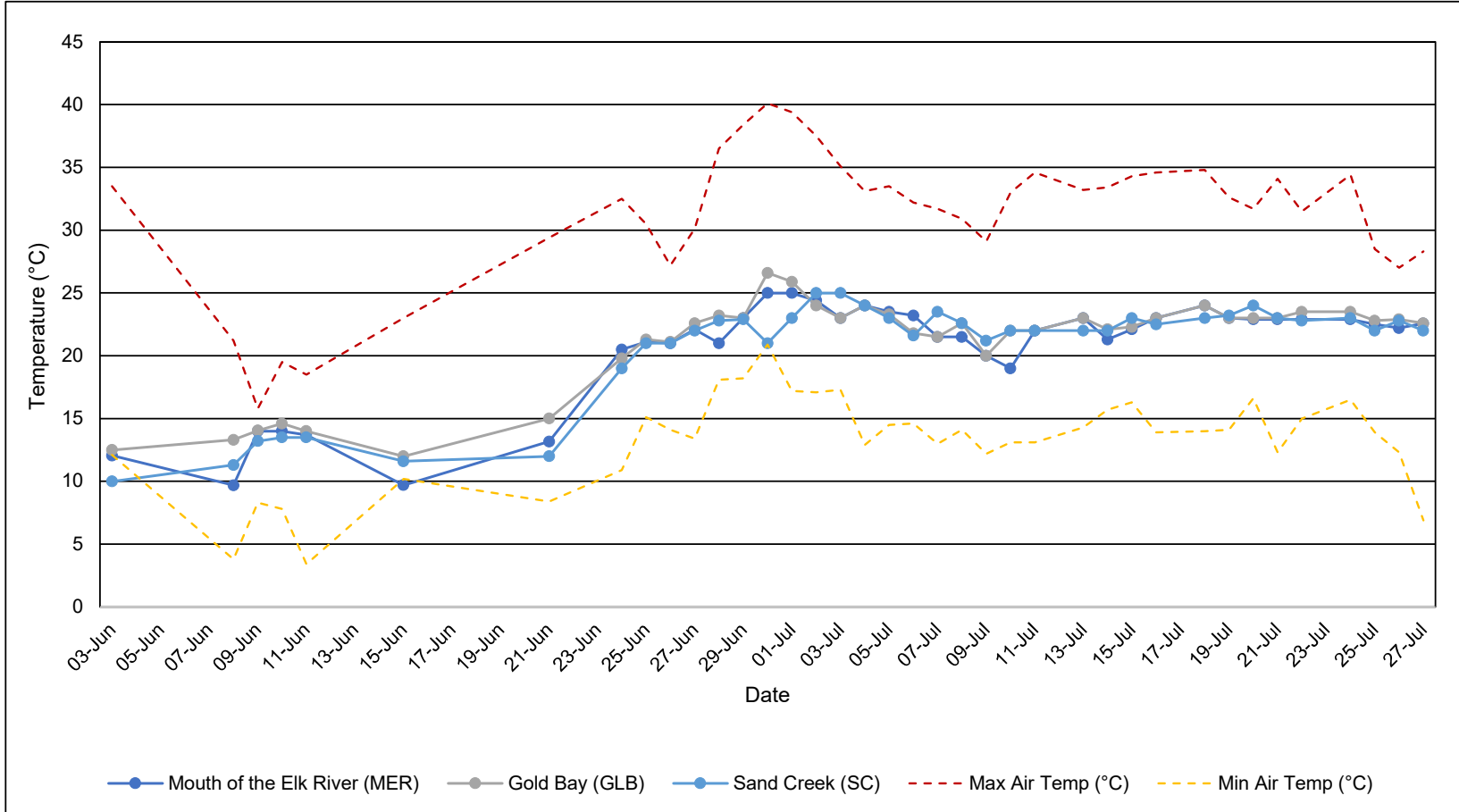
Surface water temperatures of Kooacanusa Reservoir were above the provincial scientific collection permit maximum of 20°C for allowing fish sampling activities starting on June 25<sup>th</sup> at Gold Bay and Sand Creek study locations and on June 28<sup>th</sup> at all remaining study locations and extended until the termination of the field program on July 29<sup>th</sup>, 2021 (Figure 3.1; Appendix Tables A.1 to A.3). High surface water temperatures were a direct result of unusually warm air temperatures in the area over the duration of the field study (Figure 3.1). Notably, water temperatures at mid-column and near the bottom were within the 14 to 18°C temperature range preferred by NPM for spawning (Gadomski et al. 2001) over most of the study duration at all study locations (Appendix Table A.1 to A.3). Water temperature in the Elk River before entering Kooacanusa Reservoir ranged from 5 to 21°C from June 2<sup>nd</sup> to July 29<sup>th</sup>, 2021 (Appendix Figure A.1). Dissolved oxygen concentrations ranged from 7.96 to 13.17 mg/L over the duration of the field study among all study locations and water depths within Kooacanusa Reservoir, and thus were generally above the long-term BC ENV (2021) WQG minimum concentration of 8 mg/L required to support sensitive life stages of warm and/or cold-water biota (Appendix Tables A.1 to A.3). Therefore, DO concentrations within Kooacanusa Reservoir were not expected to limit NPM spawning activity or sexual maturation.

### 3.2 Telemetry Study

A total of 58 adult NPM were tagged for the telemetry study, including 29 from each of the GLB and MER study locations (Appendix Table B.1). At the GLB study location, 7 male, 19 female, and 3 NPM of unknown sex were implanted with CART and released, whereas at the MER study location, 10 male and 19 female NPM were implanted with CART and released (Appendix Table B.1). Between both study locations, NPM implanted with CART had total lengths ranging from 31.1 to 61.7 cm and body weights ranging from 300 to 2,450 g (Table 3.1; Appendix Table B.1). The size of NPM selected for CART implant was consistent with the size range known to reflect adults based on published literature and results from the 2019 study (EcoTox et al. 2020).

Over the telemetry study period (June 23<sup>rd</sup> to July 24<sup>th</sup>), 25 tagged NPM from each study location (GLB and MER; for a total of 50) were detected at least twice (i.e., for intervals greater than 10 minutes) at any given receiver in the reservoir (Appendix Table B.3). For the duration of the study, NPM tagged at GLB and MER were detected an average of approximately 16% and 11% of the time, respectively, among all receivers (Appendix Table B.3). Therefore, caution is warranted in the interpretation of NPM movement and/or location within the reservoir over the





**Figure 3.1: Daily Mean Surface Water Temperature at Koochanusa Reservoir Study Areas and Maximum and Minimum Air Temperatures Measured at Cranbrook Over the Field Study Duration, June to July 2021**

Note: Surface water temperatures are the average of spot measures taken daily within each study area. Daily air temperatures were taken from the Government of Canada Climate Database for Cranbrook, British Columbia (accessed October 2021).

**Table 3.1: Summary of Measurements Taken from Northern Pikeminnow Used for the Telemetry Study**

Sampling Area	Sex	No. Captured	Total Length (cm)			Fork Length (cm)			Body Weight (g)		
			Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Gold Bay (GLB)	Male	7	39.9	56.7	45.8	36.2	52.0	42.0	500	1,700	1,040
	Female	19	31.1	61.7	51.5	28.0	57.2	46.8	300	2,100	1,510
	Unknown	3	35	60	44.3	32.1	54.9	40.6	400	2,000	923
Mouth of the Elk River (MER)	Male	10	35.3	41.5	38.5	31.5	37.6	47.3	400	700	530
	Female	19	35.5	58.4	46.0	31.5	54.0	43.8	350	2,450	1,155

course of the study due to the relatively low percentage of time that individual fish were detected. Bearing the relatively low percentage of time that NPM were detected, the tracking of NPM movement within the reservoir indicated approximately 68% and 76% of individuals tagged at GLB and MER, respectively, had  $\geq 90\%$  of detections near the location of release suggesting reasonable site fidelity for individual fish (Figures 3.2 to 3.4, Appendix Table B.3).<sup>1</sup> On average, 68% of females and 81% of males appeared to largely remain within the respective study location at which tag implantation occurred, suggesting males showed greater site fidelity over the field study duration (Appendix Table B.3). Relatively few NPM travelled from the location at which they were tagged to either of the two other study locations, and for those that did move, low amounts of time appeared to be spent at the location to which emigration occurred as evidenced most clearly at the Sand Creek study location (Figures 3.2 to 3.4, Appendix Figures B.1 to B.3).

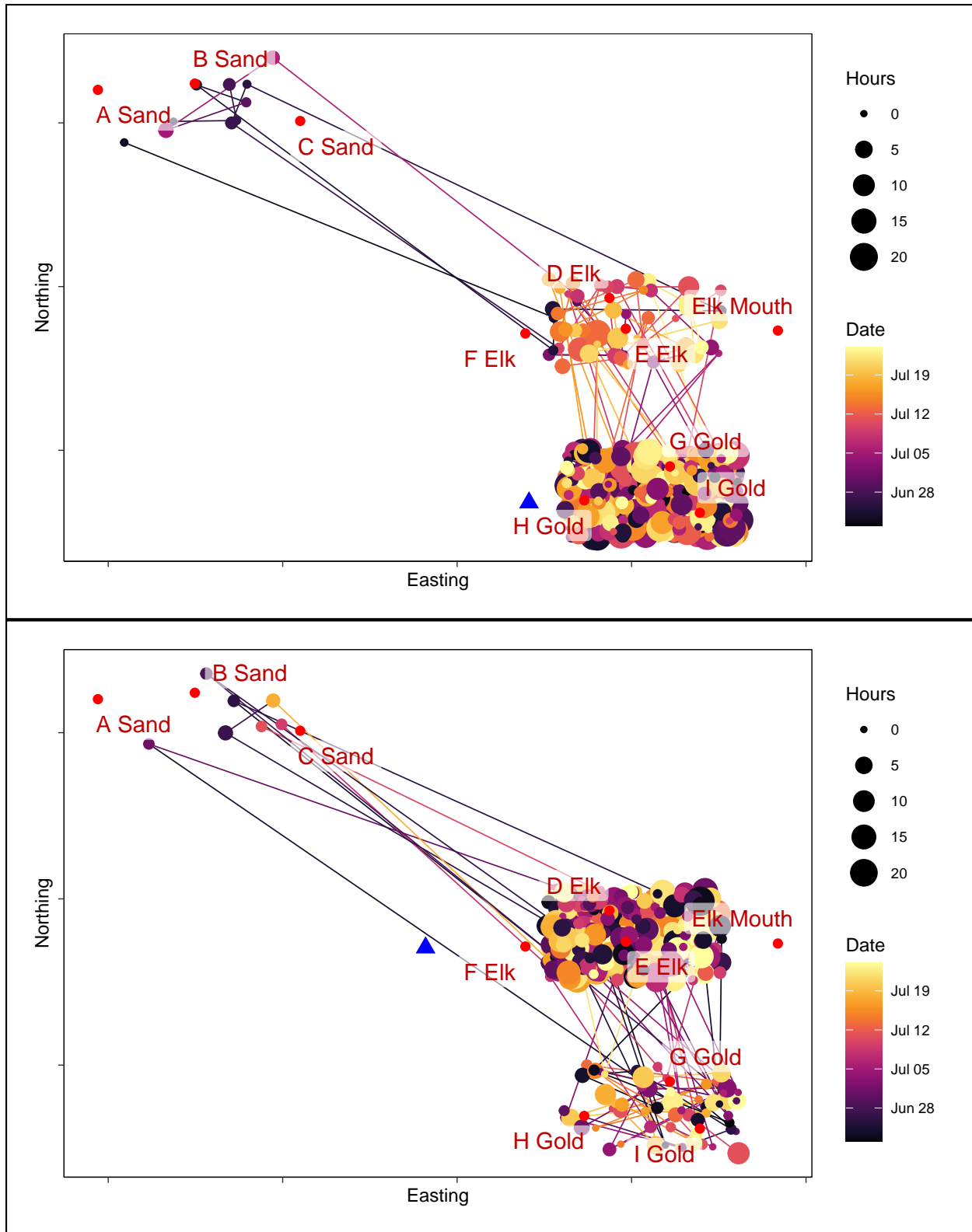
Tracking of daily movement of NPM over the duration of the field study indicated proportionately fewer detections of fish at night, and relatively higher number of detections of fish at sunrise and sunset (Figure 3.5, Appendix Table B.4, Appendix Figures B.4 and B.5). This suggests that NPM were more likely to have travelled to locations outside of the receiver area near sunset, and back into the receiver area near sunrise. Based on the available data, it was unclear whether such diurnal movement for NPM from Kooacanusa Reservoir was related to seasonal spawning activity (to travel somewhere else in the reservoir or up rivers) or to normal foraging activity.

Overall, the telemetry data did not suggest the occurrence of congregations of NPM at any of the Kooacanusa Reservoir study locations over the duration of the field study. The generally limited spatial movement of NPM in Kooacanusa Reservoir from June through July was consistent with incidental tag recovery data from Hildebrand et al. (1995) that suggested NPM have relatively small home range size (i.e., within approximately 3 km). In this study, greater movement of female NPM from one study location to another compared to males during the field study was possibly related to occurrence of spawning migration, but because the reproductive condition of these females was unknown, deductions regarding the rationale for greater spatial movement in females could not be confirmed. Similarly, diurnal movements of NPM at Kooacanusa Reservoir which suggested fish moved outside of locations used during daylight hours in the evening were consistent with the time of day at which NPM would be expected to spawn (i.e., dusk; McPhail 2007), but because there were limitations on when and where fishing could

---

<sup>1</sup> For each of the sets of NPM implanted with CART at GLB and MER study locations, four of 29 fish were not detected following the tagging event. Therefore, summary information provided herein was calculated based on a sample size of 25 for each study location.





**Figure 3.2: Location and Movement Paths for Northern Pikeminnow Tagged and Released at Gold Bay (Top) and the Mouth of the Elk River (Bottom), June and July 2021**

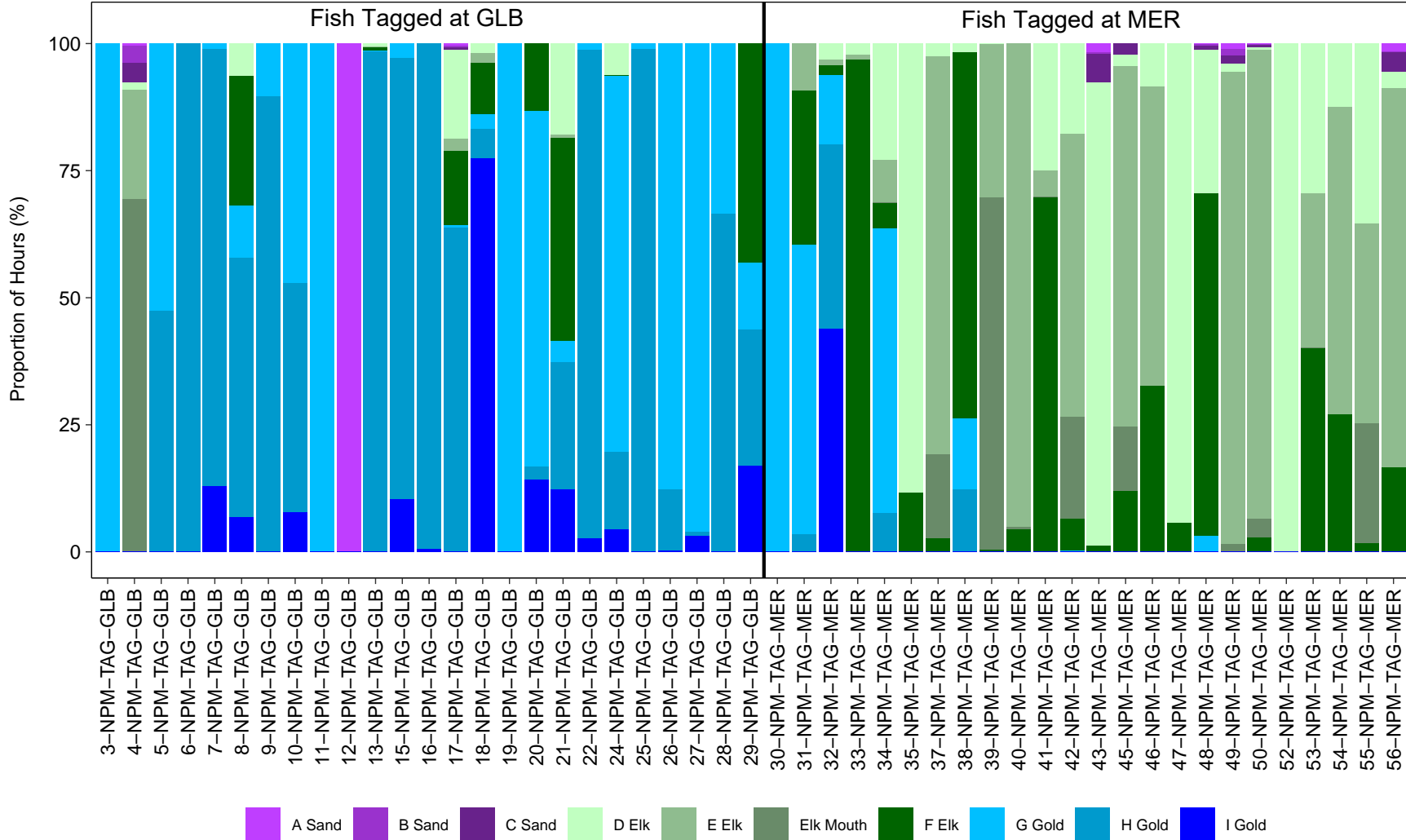
Notes: Locations represent the sum of continuous block of time (gaps <10 min) detected at a station in given area (Gold, Elk, Sand) on a given day. Blue triangles represent the release location of the individuals on June 10th (Gold Bay) or June 11th (the Mouth of the Elk River), 2021.



**Figure 3.3: Daily Numbers of Total Individuals Detected and Hours Logged for Northern Pike minnow Implanted with Tags, June and July 2021**

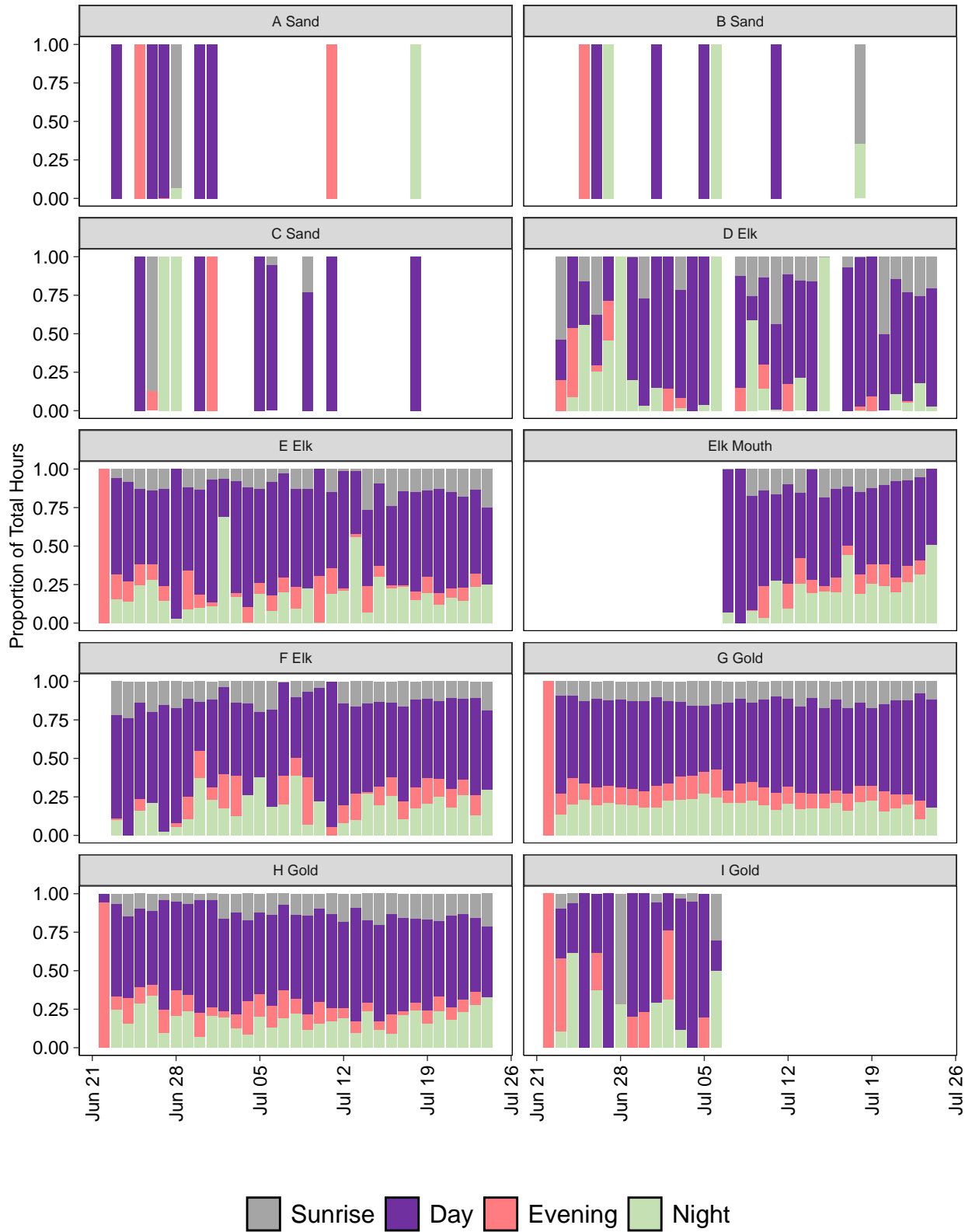
Notes: GLB = fish released at Gold Bay; MER = fish released at the Mouth of the Elk River. Four fish (1–NPM–TAG–GLB; 14–NPM–TAG–GLB; 36–NPM–TAG–MER; 58–NPM–TAG–MER) were excluded due to a lack of data (< 20 detections throughout study period). Receiver I Gold was moved to the Mouth of the Elk River study area on July 6th, 2021 (renamed Elk Mouth), where it remained until the telemetry study termination on July 24th, 2021.





**Figure 3.4: Percentage of Hours Individual Northern Pikeminnow Spent at Each Telemetry Receiver Station During the Telemetry study, June to July 2021**

Notes: GLB = Gold Bay; MER = Mouth of the Elk River. Four fish (1-NPM-TAG-GLB; 14-NPM-TAG-GLB; 36-NPM-TAG-MER; 58-NPM-TAG-MER) were excluded due to a lack of data (< 20 relocations). Individual telemetry receivers from each study location are lettered alphabetically based on their position from north to south within Koochanusa Reservoir and are differentiated by colour in the legend. Purple = telemetry receivers located in Sand Creek; Green = telemetry receivers located in the Mouth of the Elk River; Blue = telemetry receivers located in Gold Bay.



**Figure 3.5: Proportion of Total Hours Logged for Northern Pikeminnow within Each Daily Period, June and July 2021**

occur, spawning condition of the tagged fish was not known precluding determination of the rationale for of daily movement.

### 3.3 NPM Monitoring

Northern pikeminnow and largescale sucker (*Catostomus macrocheilus*) were the dominant fish species collected at GLB and MER study locations over the study duration (Appendix Tables C.2 to C.4). Incidental fish species captured and released during the tagging event in late June included bull trout (*Salvelinus confluentus*), longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersonii*), mountain whitefish (*Prosopium williamsoni*), and rainbow trout (*Oncorhynchus mykiss*; Appendix Table C.2). In addition, peamouth chub (*Mylocheilus caurinus*), westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), golden shiner (*Notemigonus crysoleucas*), yellow perch (*Perca flavescens*), and redbreast shiner (*Richardsonius balteatus*) were captured during fish sampling conducted in late June and through July using gill netting, hoop netting, and/or angling gear (Appendix Tables C.2 to C.4). No burbot, which are a species of concern due to low numbers in the reservoir, were captured during the study. There were no incidental mortalities encountered using gill netting and angling techniques, but low numbers of fish succumbed in hoop nets related to “gilling” of fish in the mesh of the hoop nets (Appendix Tables C.2 to C.4).

Monitoring of NPM beginning in late June (subsequent to tagging) resulted in the capture of a total of 541 NPM among all study locations using all fishing methods (Table 3.2). A high number of adult NPM (n=145) were caught in the lower Elk River suggesting NPM may exhibit potamodromous migratory behavior (Gadmoski et al 2001; Beamesderder 1992), however, the data collected to date cannot confirm this hypothesis. A total of four female NPM in spawning condition were provided to USask for gamete expression and fertilization, and an additional 21 NPM were sacrificed for the ovarian ripeness assessment/tissue sampling (Table 3.3, Appendix Table C.5). Gametes collected from two females were successfully fertilized with milt from two to three males by USask personnel (July 9<sup>th</sup> and 23<sup>rd</sup>). Although two additional female NPM in spawning condition were captured and provided to USask on July 14<sup>th</sup> and July 21<sup>st</sup>, fertilization of the eggs from these fish was unsuccessful. Female NPM sacrificed during monitoring showed fork length ranging from 32.4 to 54.9 cm and age ranging from 9 to 24 years (Table 3.3; Appendix Table C.5), reflective of size and age typical of adult NPM (Scott and Crossman 1998). In addition, these females showed ovary weights ranging from 3 to 257 g, representing a range in GSI from 0.68 to 15.56 (Table 3.3; Appendix Table C.5). Information related to the fertilizations completed during the 2021 field program will be used to inform future study designs and data analysis during reporting.



**Table 3.2: Summary of Northern Pikeminnow Sampling Effort, Catch, and Catch-Per-Unit-Effort by Sampling Method for Each Kooconusa Reservoir Study Area, June to July 2021**

Study Area	Gill Netting			Hoop Netting			Angling		
	Effort (m <sup>2</sup> hr/100m)	No. NPM Caught	CPUE <sup>a</sup> (#fish/effort)	Effort (24 hr)	No. NPM Caught	CPUE <sup>a</sup> (#fish/effort)	Effort (hr * # of fishing lines)	No. NPM Caught	CPUE <sup>a</sup> (#fish/effort)
Gold Bay (GLB)	15.76	85	1.52	198.45	20	0.10	15.42	0	0
Mouth of the Elk River (MER)	27.46	246	8.96	29.75	1	0.03	320.42	145	0.45
Sand Creek (SC)	8.79	24	9.67	128.48	20	0.16	22.12	0	0
<b>Total</b>	<b>52.00</b>	<b>355</b>	<b>6.83</b>	<b>356.68</b>	<b>41</b>	<b>0.11</b>	<b>357.95</b>	<b>145</b>	<b>0.41</b>

Note: Angling was completed in the Gold Creek, Elk River, and Sand Creek tributaries to Kooconusa Reservoir reflected the name of the study area.

<sup>a</sup> Catch-per-unit-effort (CPUE) calculated as the total catch of northern pikeminnow over the total sampling effort applied at the indicated study area.

**Table 3.3: Summary of Measurements and Tissue Selenium Concentrations for Female Northern Pikeminnow Monitored in Support of the Toxicity Study**

Sampling Area	Sex	No. Captured	Total Length (cm)		Fork Length (cm)		Body Weight (g)		Ovary Weight (g)		Gonadal Somatic Index (GSI) <sup>a</sup>		Age	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Gold Bay (GLB)	Female	1	-	51.6	-	47.0	-	1,300	-	19.20	-	1.48	-	13
Mouth of the Elk River (MER)	Female	22	37.1	60	32.4	54.9	458	1,800	3.13	256.74	0.68	15.56	9	24
Sand Creek (SC)	Female	1	-	41.1	-	37.5	-	650	-	35.42	-	5.45	-	14
Standard Deviation			7.19		6.91		452.89		69.51		4.02		3.30	
Standard Error			1.47		1.41		92.45		14.19		0.82		0.67	

Note: Four female NPM from MER were in spawning condition and two had gametes expressed by UofS. These females are indicated in Appendix Table C.5. "-" indicates no available data.

<sup>a</sup> Gonadal Somatic Index = (gonad weight/body weight)\*100.

### 3.4 Holding Pen Trials

Three adult male and two female NPM were placed in separate holding pens established at MER from July 24<sup>th</sup> to 27<sup>th</sup>, 2021 (Figure 2.2) to monitor for potential sexual maturation to a 'ripe' stage. The fish placed in the holding pens appeared healthy (i.e., no discoloration, eroded fins, parasite presence) and did not show signs of stress (i.e., exhibited normal swimming behavior, no indication of attacks to conspecifics) over the one to three day holding duration. None of the female NPM placed in the holding pens advanced to spawning condition (e.g., expression of their eggs upon slight manual pressure applied to the abdomen) during the trials. Therefore, the holding pen trials were inconclusive in determining whether placement of mature NPM in holding pens would result in these fish reaching a ripe spawning condition over a one to three day holding duration. Using cod traps for the holding pens limited available space for NPM movement, which could result in increased presence of parasites, such as *Ichthyophthirius multifiliis* (commonly known as white spot disease on fish) leading to decreased fish health and potential death, as well as cause epithelial abrasion in attempts to escape the pen if fish are retained in the pens for more than three days (Gutowsky et al. 2015). In addition, holding NPM for durations longer than three days could lead to agnostic behavior and reduced feeding interest due to increased stress levels (Gutowsky et al. 2015), both of which may influence advancement of NPM to spawning condition. The location chosen to place holding pens in the 2021 study was ideal for the net pen designs used, however, using different pens in future studies would require installation at a different location due to ephemeral accessibility of the 2021 location, limited space for larger and multiple traps, and greater susceptibility to public tampering.



## 4 CONCLUSIONS

This Summary of Northern Pikeminnow Studies in Koocanusa Reservoir, 2021 was implemented with the objectives of using telemetry to possibly identify aggregations of spawning NPM in Koocanusa Reservoir and to target ripe NPM for gamete collection and implementation of a toxicity study examining effects of Se on NPM embryo/larval development. Challenges related to limits on fish sampling due to unusually warm weather causing surface water temperatures within the reservoir to rise above the limit for fish sampling stipulated under the provincial fish collection permit potentially contributed to a low sample size and subsequent inability to complete a separate Se toxicity investigation. The telemetry study indicated that NPM showed strong site fidelity and suggestion of greater movement during sunset and sunrise periods potentially related to spawning activity (i.e., ascension of rivers for spawning), although the reason for greater movement at these times of the day was not able to be confirmed. Fishing conducted at tributaries of Koocanusa Reservoir, chiefly the Elk River, indicated a high number of adult NPM utilize the lower portion of these systems. Despite the sampling limitations during the 2021 field study, the study was successful in providing information regarding localized NPM movement in Koocanusa Reservoir and providing useful observations regarding NPM ripening while being retained in holding pens, all of which will aid in informing future study designs and data analysis during reporting where capture of ripe NPM in the reservoir is required.



## 5 REFERENCES

- British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2016. Water and air baseline monitoring guidance document for mine proponents and operators, Version 2ed. British Columbia Ministry of the Environment, 201 pp.
- BC ENV. 2021. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture – Guideline Summary/ Water Quality Guideline Series, WQG-20. Prov. BC. Victoria, BC.
- Beamesderfer, R.C. 1992. Reproduction and early life history of northern squawfish, *Ptychocheilus oregonensis* in Idaho's St. Joe River. *Environ. Biol. Fish.* 35, 231-241.
- Biotactic Incorporated (Biotactic). 2021. 2021 Northern Pikeminnow Telemetry Study Design, Lake Koochanusa, BC. Prepared for Minnow Environmental Inc., Georgetown, ON. February.
- EcoTox LLC (EcoTox), University of Saskatchewan, and Minnow Environmental Inc. (Minnow). 2019. Draft Study Plan: Evaluation of Selenium Reproductive Effects on Northern Pikeminnow (*Ptychocheilus oregonensis*). Prepared for Teck Coal Limited, Sparwood, BC. May.
- EcoTox, University of Saskatchewan, and Minnow. 2020. Final Report: Evaluation of Selenium Concentrations in Ovary of Northern Pikeminnow (*Ptychocheilus oregonensis*). Prepared for Teck Coal Limited, Sparwood, BC. May.
- EcoTox, University of Saskatchewan, and Minnow. 2021. Draft Study Plan: Evaluation of Maternally Transferred Selenium on Early Life-Stage Development of Northern Pikeminnow (*Ptychochelius oregonensis*). Prepared for Teck Coal Limited, Sparwood, BC. April.
- Gadomski, D.M., C.A. Barfoot, J.M. Bayer, and T.P. Poe. 2001. Early life history of the northern pikeminnow in the lower Columbia River basin. *Trans. Amer. Fish. Soc.* 130, 250-262.
- Gutowsky, L.F.G., W. Aslam, R. Banisaeed, L.R. Bell, K.L. Bove, J.W. Brownscombe, G.J.J. Burrows, E. Chu, J.M.T. Magel, A.M. Rous, and S.J. Cooke. 2015. Considerations for the design and interpretation of fishing release mortality estimates. *Fisheries Research* 167: 64-70.
- Hildebrand, L., T. Clayton, and S. McKenzie. 1995. Lower Columbia River fisheries inventory program: 1990 - 1994. R.L. & L. Environmental Services Ltd., Castlegar, B.C. 156 pp.
- Kim, J., B. Doyle, and N.E. Mandrak. 2017. Electroosmosis of freshwater fishes for the surgical implantation of transmitters. *Can. J. Zool.* 95: 575-580.
- McPhail, J.D. 2007. The Freshwater Fishes of British Columbia. The University of Alberta Press. Edmonton, AB.
- Minnow Environmental Inc. (Minnow). 2021. Study Design for Capture of Northern Pikeminnow (*Ptychochleilus oregonensis*) in Koochanusa Reservoir, 2021. Prepared for Teck Coal Limited, Sparwood, BC. March. Project 217202.0042.
- Scott, W.B. and E.J. Crossman. 1998. Freshwater fishes of Canada. Galt House Publications Ltd. Oakville, ON.





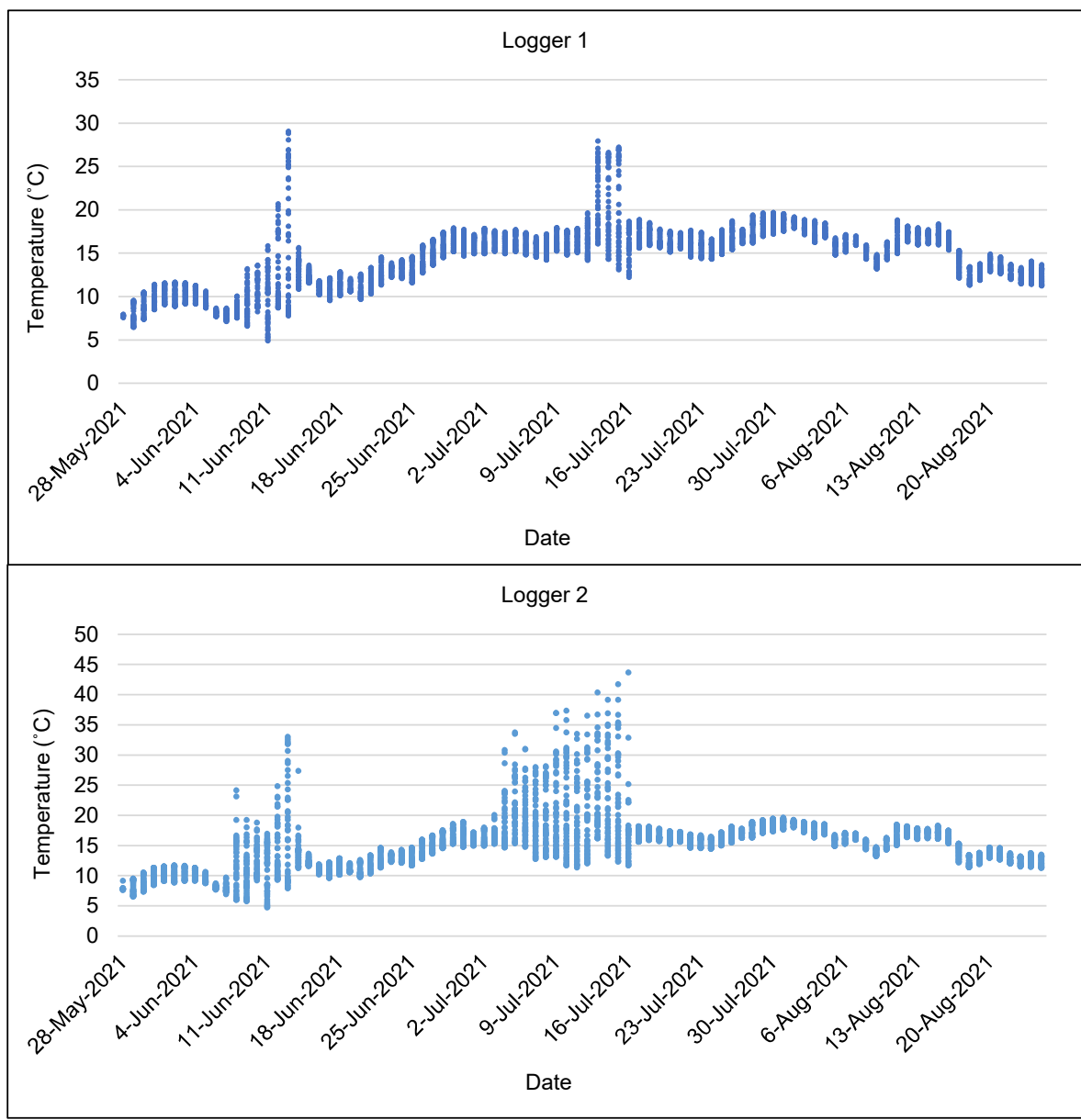
United States Environmental Protection Agency (USEPA). 2016. Aquatic life ambient water quality criterion for selenium – freshwater 2016. U.S. Environmental Protection Agency. Washington, DC, 807 pp.

Vast Resource Solutions Incorporated (VAST). 2017a. Lake Koochanusa Foreshore Inventory and Mapping and Aquatic Habitat Index. Prepared for East Kootenay Integrated Lake Management Partnership. October.

VAST. 2017b. Lake Koochanusa Shoreline Management Guidelines. Prepared for East Kootenay Integrated Lake Management Partnership. October.



## **APPENDIX A**



**Figure A.1: Temperature Logger Data Collected in the Lower Elk River, May to August 2021**

Notes: Logger 1 was located downstream and logger 2 was located upstream of the Highway 93 bridge crossing the Elk River (Figure 2.2). Monitoring data for each day represents a range of temperatures recorded every 0.5 hours in a 24-hour period. Data spikes in mid-June and mid-July indicate periods in which temperature loggers were out of the water due to changing water levels in the river and public tampering.

**Table A.1: In Situ Water Quality Measurements Taken at Gold Bay (GLB), June to July 2021**

Sample Date	Location in Water Column	Depth Below Water Surface (m)	Temperature (°C)	Dissolved Oxygen		Conductivity (µS/cm)	Specific Conductance (µS/cm)
				(mg/L)	(% sat)		
03-Jun-21	Surface	0.5	12.5	-	-	-	-
08-Jun-21	Surface	0.6	13.3	9.83	94.1	105	134
	Bottom	2.5	10.2	10.69	94.4	76	106
09-Jun-21	Surface	0.1	14.2	9.59	93.7	110	139
	Bottom	0.7	14.2	9.63	93.9	111	139
09-Jun-21	Surface	0.2	13.9	9.70	93.9	111	140
	Bottom	1.3	10.5	10.49	93.2	80	110
10-Jun-21	Surface	0.5	14.6	9.87	97.2	118	147
	Bottom	3.8	11.3	9.93	92.5	87	118
11-Jun-21	Surface	0.5	14.0	-	-	-	-
15-Jun-21	Surface	0.5	12.0	-	-	-	-
21-Jun-21	Surface	0.5	15.0	-	-	-	-
24-Jun-21	Surface	1.5	19.8	9.59	101.3	193	220
	Bottom	4.5	17.6	9.55	100.2	193	225
25-Jun-21	Surface	1.8	21.3	9.10	102.7	210	226
	Bottom	6.1	17.3	9.50	98.7	188	221
26-Jun-21	Surface	1.0	21.1	9.05	100.6	205	224
	Bottom	19.0	13.2	9.07	86.3	161	208
27-Jun-21	Surface	1.5	22.6	8.77	101.2	214	226
	Bottom	17.5	13.7	9.26	89.6	164	210
28-Jun-21	Surface	1.7	23.2	8.80	103.2	217	225
	Bottom	18.4	13.7	8.41	82.0	167	213
29-Jun-21	Surface	0.5	23.0	-	-	-	-
30-Jun-21	Surface	0.5	26.6	8.45	104.4	232	227
	Bottom	7.3	16.9	10.07	104.0	186	221
01-Jul-21	Surface	1.6	25.9	8.98	104.5	231	227
	Bottom	22.1	12.1	9.10	84.4	161	214
02-Jul-21	Surface	0.5	24.0	-	-	-	-
03-Jul-21	Surface	0.5	23.0	-	-	-	-
05-Jul-21	Surface	1.0	23.2	8.89	102.2	216	228
	Bottom	7.0	21.6	8.37	95.3	229	215
06-Jul-21	Surface	1.5	21.8	8.69	99.0	246	226
	Bottom	12.9	14.6	9.02	89.4	165	203
07-Jul-21	Surface	0.5	21.5	-	-	-	-
08-Jul-21	Surface	1.5	22.6	8.82	102.1	215	226
	Bottom	13.5	14.6	7.96	78.0	168	210
09-Jul-21	Surface	0.5	20.0	-	-	-	-
10-Jul-21	Surface	0.5	22.0	-	-	-	-
11-Jul-21	Surface	0.5	22.0	-	-	-	-
13-Jul-21	Surface	0.5	23.0	-	-	-	-
14-Jul-21	Surface	0.5	22.1	-	-	-	-
15-Jul-21	Surface	0.5	22.3	-	-	-	-
16-Jul-21	Surface	0.5	23.0	-	-	-	-
18-Jul-21	Surface	0.5	24.0	-	-	-	-
19-Jul-21	Surface	0.5	23.0	-	-	-	-
20-Jul-21	Surface	0.5	23.0	-	-	-	-
21-Jul-21	Surface	0.5	23.0	-	-	-	-
22-Jul-21	Surface	0.5	23.5	-	-	-	-
24-Jul-21	Surface	0.5	23.5	-	-	-	-
25-Jul-21	Surface	0.5	22.8	-	-	-	-
26-Jul-21	Surface	0.5	22.9	-	-	-	-
27-Jul-21	Surface	0.5	22.6	-	-	-	-
Mean	Surface	0.7	20.8	9.15	100.0	187	201
	Bottom	9.8	14.4	9.36	91.6	152	187

Dissolved Oxygen (mg/L) below Long-term Chronic Water Quality Guideline of 8 mg/L (British Columbia Ministry of Environment and Climate Change Strategy 2021).

Note: "-" indicates no data available. Cooler surface temperatures (< 20 °C) beyond June 25th, 2021 were taken at areas in Koochanusa Reservoir influenced by cold tributary waters.

**Table A.2: In Situ Water Quality Measurements Taken at the Mouth of the Elk River (MER), June to July 2021**

Sample Date	Location in Water Column	Depth Below Water Surface (m)	Temperature (°C)	Dissolved Oxygen		Conductivity (µS/cm)	Specific Conductance (µS/cm)
				(mg/L)	(% sat)		
03-Jun	Surface	0.4	12.1	10.14	103.3	184	158
08-Jun	Surface	0.3	9.7	10.36	99.6	195	182
09-Jun	Surface	0.5	14.0	-	-	-	-
10-Jun	Surface	0.5	14.0	-	-	-	-
11-Jun-21	Surface	1.3	13.7	10.08	97.1	125	159
	Bottom	10.2	9.6	10.67	93.6	147	208
15-Jun-21	Surface	1.2	9.7	13.17	108.6	229	219
21-Jun-21	Surface	1.0	13.2	10.04	103.8	211	193
24-Jun-21	Surface	0.5	18.0	-	-	-	-
25-Jun-21	Surface	0.5	18.9	-	-	-	-
26-Jun-21	Surface	0.5	19.6	-	-	-	-
27-Jun-21	Surface	0.5	19.8	-	-	-	-
28-Jun-21	Surface	0.5	21.0	-	-	-	-
29-Jun-21	Mid	4.3	17.2	9.18	103.6	201	187
29-Jun-21	Surface	0.5	23.0	-	-	-	-
30-Jun-21	Surface	0.5	25.0	-	-	-	-
01-Jul-21	Surface	0.5	25.0	-	-	-	-
02-Jul-21	Surface	0.5	24.4	8.31	99.4	230	233
	Bottom	10.8	17.0	8.87	91.9	260	307
03-Jul-21	Surface	0.5	23.0	-	-	-	-
04-Jul-21	Surface	0.5	24.0	-	-	-	-
05-Jul-21	Surface	0.5	23.5	8.32	98.1	244	237
	Bottom	7.3	15.7	9.47	95.4	270	330
06-Jul-21	Surface	1.6	23.2	8.32	57.5	229	237
	Bottom	9.4	16.1	9.13	92.7	270	325
07-Jul-21	Surface	1.0	21.8	8.50	96.8	219	233
	Bottom	20.0	12.4	8.94	83.7	161	212
06-Jul-21	Mid	2.5	16.3	8.87	99.0	206	203
07-Jul-21	Mid	2.5	16.5	8.95	100.0	203	202
07-Jul-21	Mid	2.5	16.5	8.96	100.2	207	205
07-Jul-21	Mid	2.5	15.9	8.72	96.7	208	202
07-Jul-21	Mid	2.5	16.8	8.80	99.5	207	204
07-Jul-21	Mid	2.5	15.9	8.93	98.8	206	200
08-Jul-21	Surface	1.5	21.5	8.57	97.1	215	231
	Bottom	9.3	15.5	9.70	90.9	271	331
09-Jul-21	Surface	1.0	20.0	-	-	-	-
10-Jul-21	Surface	1.0	19.0	-	-	-	-
11-Jul-21	Surface	1.0	17.1	-	-	-	-
11-Jul-21	Surface	0.5	22.0	-	-	-	-
12-Jul-21	Mid	3.3	17.9	8.64	99.6	213	213
13-Jul-21	Surface	0.5	23.0	-	-	-	-
14-Jul-21	Surface	1.5	17.3	9.02	94.6	273	318
	Bottom	3.4	15.5	9.51	95.3	289	353
14-Jul-21	Surface	0.5	22.1	-	-	-	-
15-Jul-21	Surface	0.5	22.1	-	-	-	-
16-Jul-21	Surface	0.0	15.4	9.57	95.8	293	359
	Bottom	3.4	15.4	9.61	96.2	293	359
16-Jul-21	Surface	0.5	23.0	-	-	-	-
18-Jul-21	Surface	0.0	16.7	9.49	96.9	297	355
	Bottom	3.5	15.9	9.60	97.1	299	362
18-Jul-21	Surface	0.5	24.0	-	-	-	-
19-Jul-21	Surface	0.0	15.5	9.50	95.2	298	365
	Bottom	3.4	15.4	9.56	95.8	298	365
19-Jul-21	Surface	0.5	23.0	-	-	-	-
20-Jul-21	Surface	0.5	22.9	-	-	-	-
21-Jul-21	Surface	0.5	22.9	-	-	-	-
22-Jul-21	Surface	0.5	22.9	-	-	-	-
24-Jul-21	Surface	0.5	22.9	-	-	-	-
25-Jul-21	Surface	0.5	22.5	-	-	-	-
26-Jul-21	Surface	0.5	22.2	-	-	-	-
27-Jul-21	Surface	1.0	22.6	-	-	-	-
04-Aug-21	Mid	4.5	18.7	8.00	93.7	232	429
Mean	Surface	0.6	19.9	9.53	96.0	231	248
	Mid	3.0	16.8	8.78	99.0	209	227
	Bottom	8.1	14.9	9.51	93.3	256	315

 Dissolved Oxygen (mg/L) below Long-term Chronic Water Quality Guideline of 8 mg/L (British Columbia Ministry of Environment and Climate Change Strategy 2021).

Note: "-" indicates no data available and "Mid" column readings were supplied by Teck's EQUS Database. Cooler surface temperatures (< 20 °C) beyond June 25th, 2021 were taken at areas in Koochanusa Reservoir influenced by cold tributary waters.

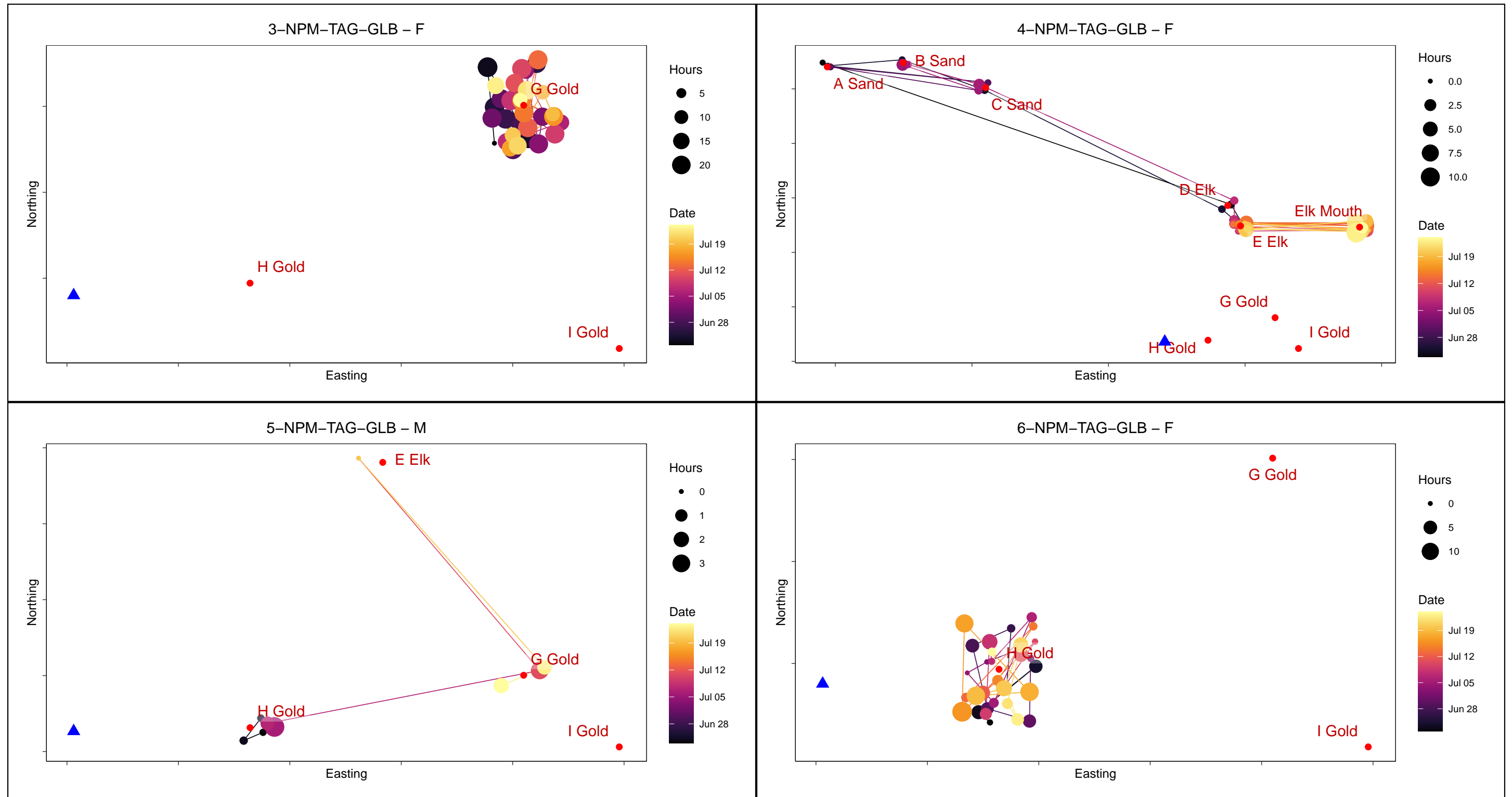
**Table A.3: In Situ Water Quality Measurements Taken at Sand Creek (SC), June to July 2021**

Sample Date	Location in Water Column	Depth Below Water Surface (m)	Temperature (°C)	Dissolved Oxygen		Conductivity (µS/cm)	Specific Conductance (µS/cm)
				(mg/L)	(% sat)		
03-Jun-21	Surface	0.5	10.0	-	-	-	-
08-Jun-21	Surface	0.5	11.3	-	-	-	-
09-Jun-21	Surface	1.5	13.2	-	-	-	-
10-Jun-21	Surface	2.5	13.5	-	-	-	-
11-Jun-21	Surface	3.5	13.5	-	-	-	-
15-Jun-21	Surface	4.5	11.6	-	-	-	-
21-Jun-21	Surface	5.5	12.0	-	-	-	-
24-Jun-21	Surface	6.5	19.0	-	-	-	-
25-Jun-21	Surface	7.5	20.1	-	-	-	-
26-Jun-21	Surface	8.5	19.0	-	-	-	-
27-Jun-21	Surface	9.5	22.0	-	-	-	-
28-Jun-21	Surface	10.5	22.8	-	-	-	-
29-Jun-21	Surface	1.0	17.6	9.12	96.1	158	184
	Bottom	15.0	15.7	9.15	92.9	151	183
29-Jun-21	Surface	0.5	22.9	-	-	-	-
30-Jun-21	Surface	0.5	21.0	-	-	-	-
01-Jul-21	Surface	0.5	23.0	-	-	-	-
02-Jul-21	Surface	0.5	25.0	-	-	-	-
02-Jul-21	Surface	1.0	16.0	-	-	-	-
03-Jul-21	Surface	1.0	18.7	-	-	-	-
03-Jul-21	Surface	0.5	25.0	-	-	-	-
05-Jul-21	Surface	0.5	23.0	-	-	-	-
06-Jul-21	Surface	1.1	22.6	8.58	99.4	185	194
	Bottom	18.5	14.3	8.74	85.3	151	190
07-Jul-21	Surface	1.0	21.2	8.73	98.2	177	191
	Bottom	10.8	16.2	8.48	86.7	164	198
08-Jul-21	Surface	1.5	18.8	8.66	92.9	172	175
	Bottom	12.9	16.2	8.48	86.1	164	197
08-Jul-21	Surface	0.5	22.2	-	-	-	-
09-Jul-21	Surface	0.5	21.2	-	-	-	-
10-Jul-21	Surface	0.5	22.0	-	-	-	-
11-Jul-21	Surface	0.5	22.0	-	-	-	-
13-Jul-21	Surface	0.5	22.0	-	-	-	-
14-Jul-21	Surface	1.0	18.2	-	-	-	-
14-Jul-21	Surface	0.5	22.0	-	-	-	-
15-Jul-21	Surface	0.5	23.0	-	-	-	-
15-Jul-21	Surface	1.0	18.0	-	-	-	-
16-Jul-21	Surface	0.5	22.5	-	-	-	-
18-Jul-21	Surface	0.5	23.0	-	-	-	-
19-Jul-21	Surface	0.5	23.2	-	-	-	-
20-Jul-21	Surface	0.5	24.0	-	-	-	-
21-Jul-21	Surface	0.5	23.0	-	-	-	-
22-Jul-21	Surface	1.0	18.1	-	-	-	-
22-Jul-21	Surface	0.5	22.8	-	-	-	-
24-Jul-21	Surface	0.5	23.0	-	-	-	-
25-Jul-21	Surface	0.5	22.0	-	-	-	-
26-Jul-21	Surface	0.5	22.4	-	-	-	-
27-Jul-21	Surface	0.5	22.0	-	-	-	-
28-Jul-21	Surface	0.5	21.9	-	-	-	-
29-Jul-21	Surface	0.5	22.1	-	-	-	-
Mean	Surface	2.0	20.0	8.71	94.7	171	188
	Bottom	15.5	15.4	8.79	88.1	155	190

 Dissolved Oxygen (mg/L) below Long-term Chronic Water Quality Guideline of 8 mg/L (British Columbia Ministry of Environment and Climate Change Strategy 2021).

Note: "-" indicates no data available. Cooler surface temperatures (< 20 °C) beyond June 25th, 2021 were taken at areas in Kocanusa Reservoir influenced by cold tributary waters.

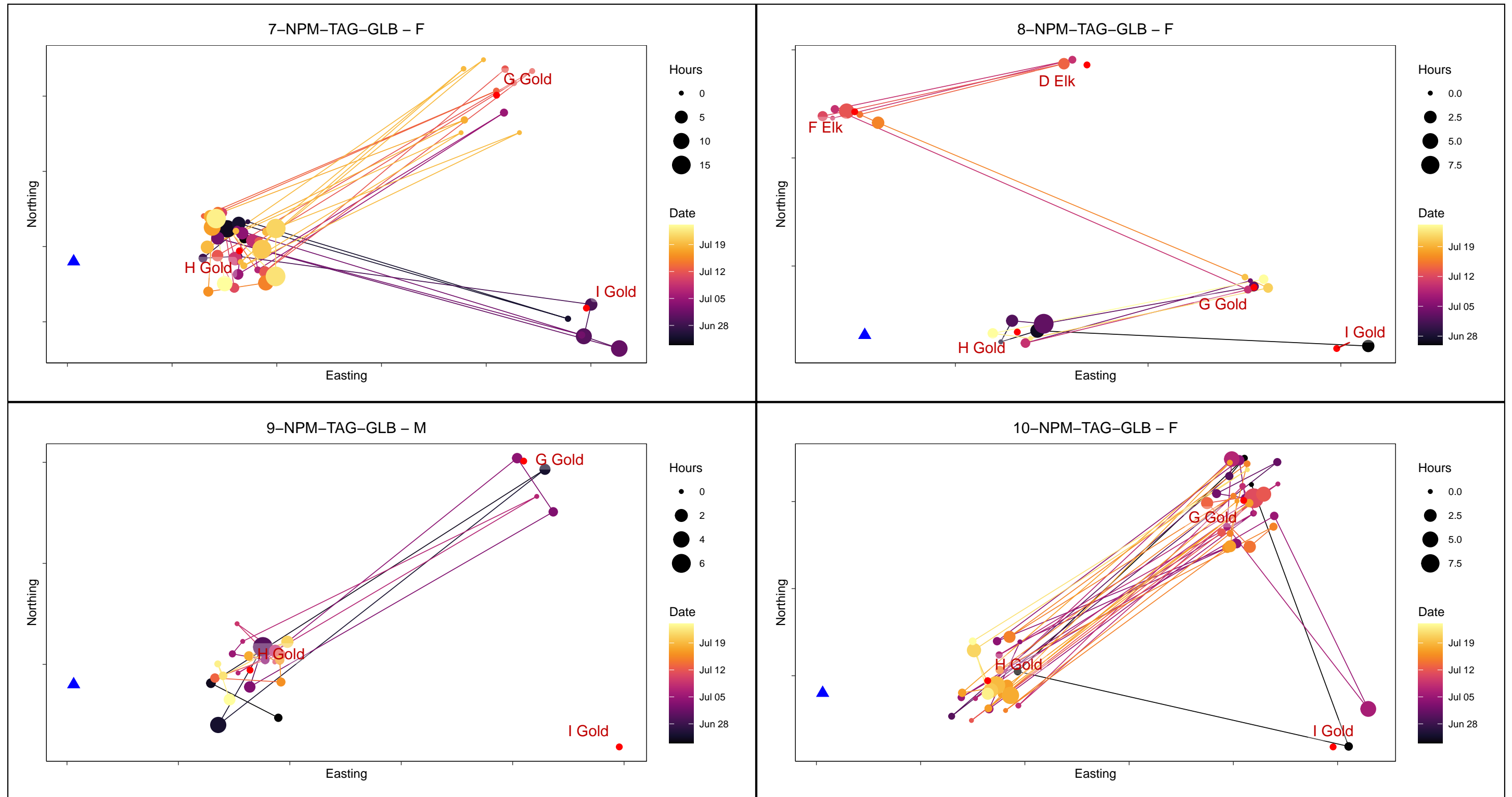
## **APPENDIX B**



**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

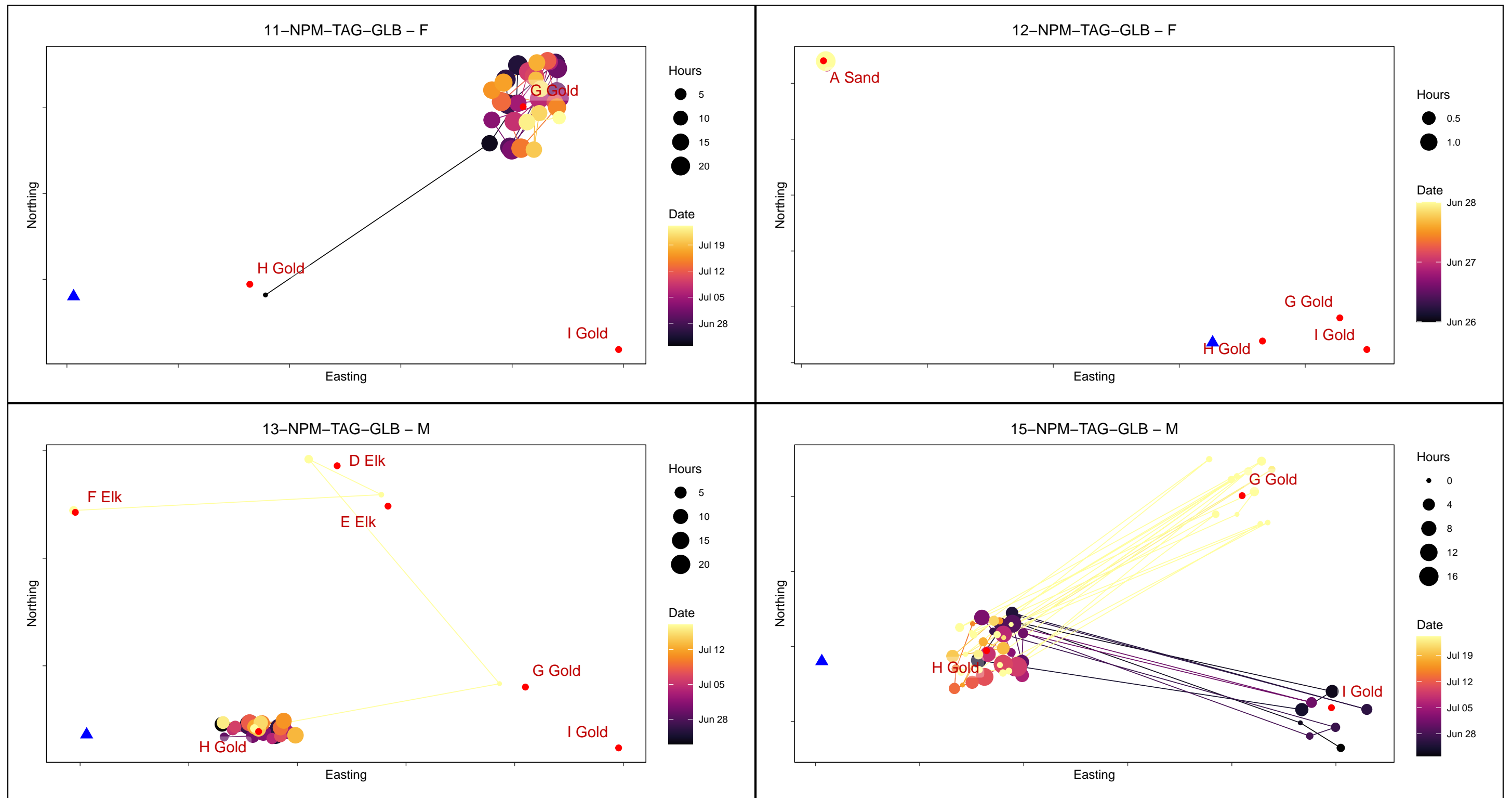
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.





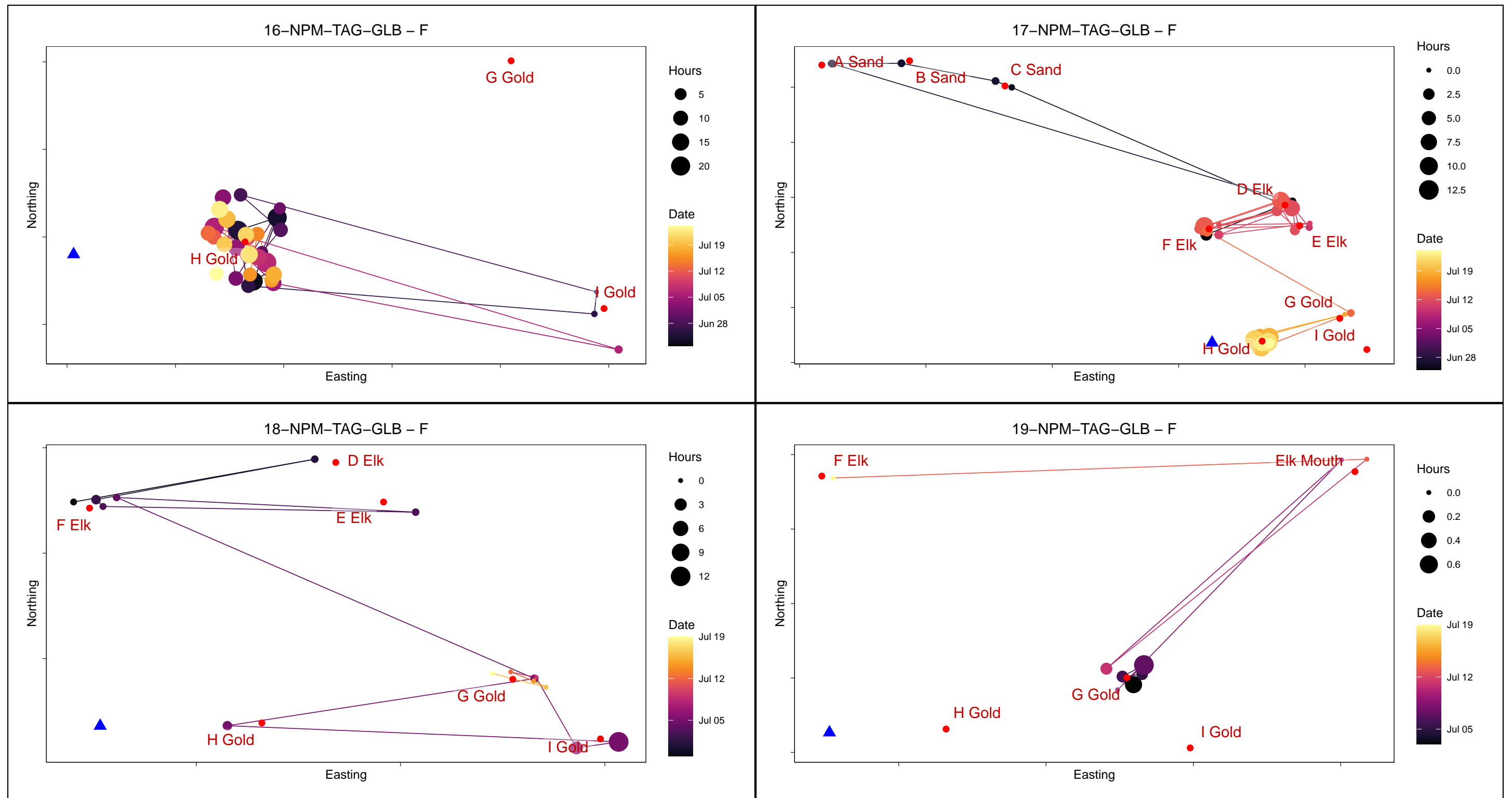
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



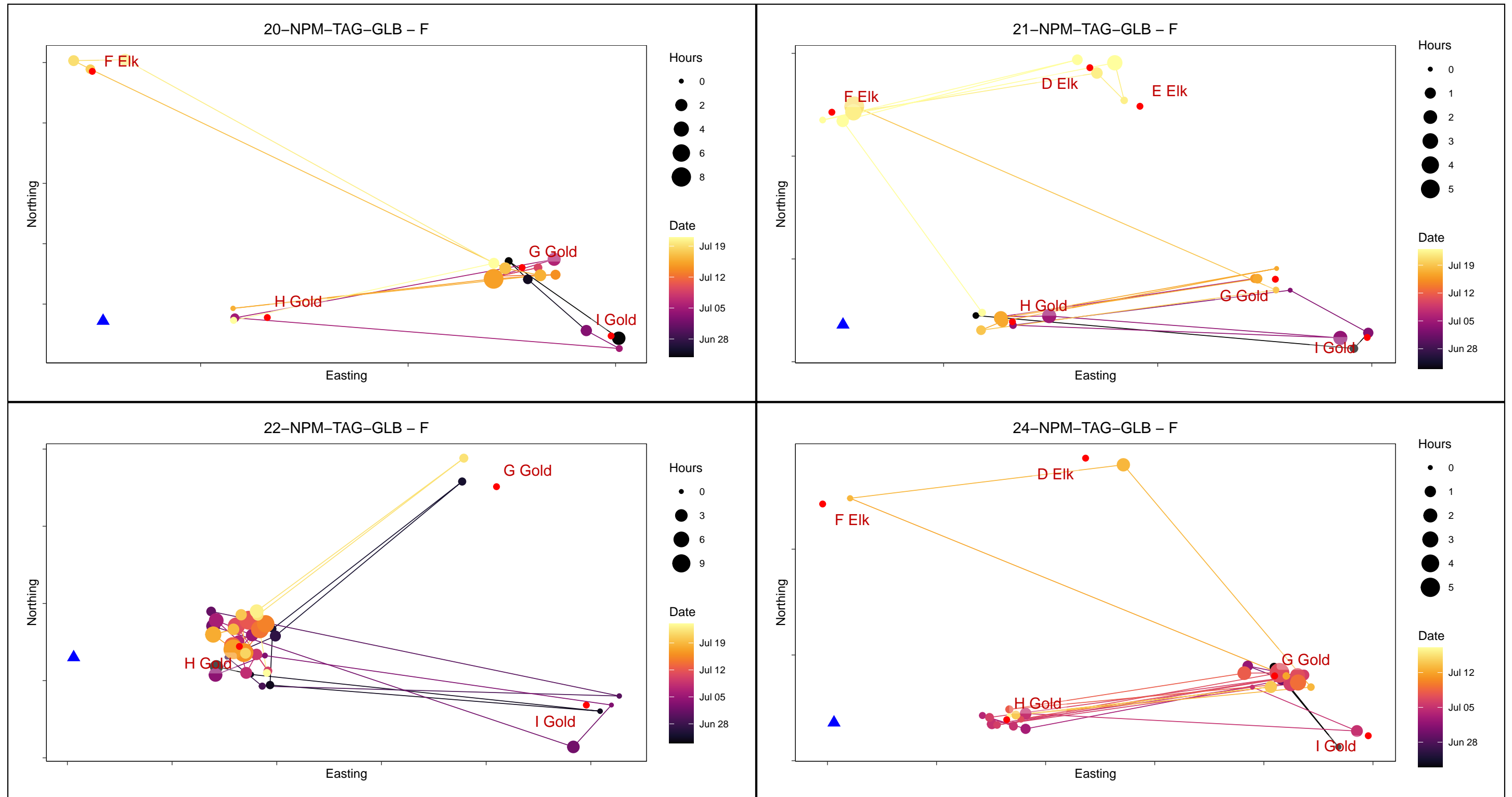
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



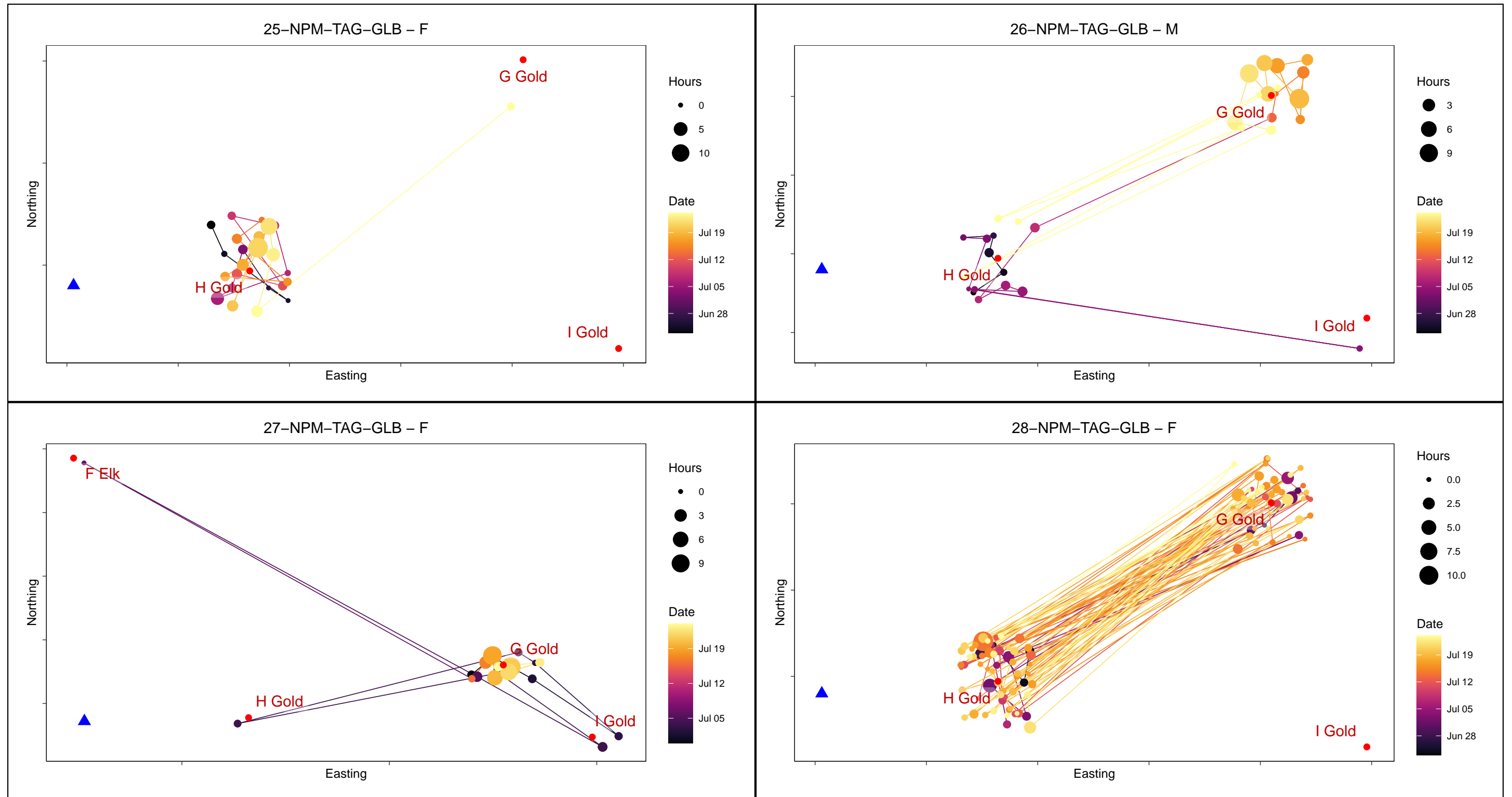
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



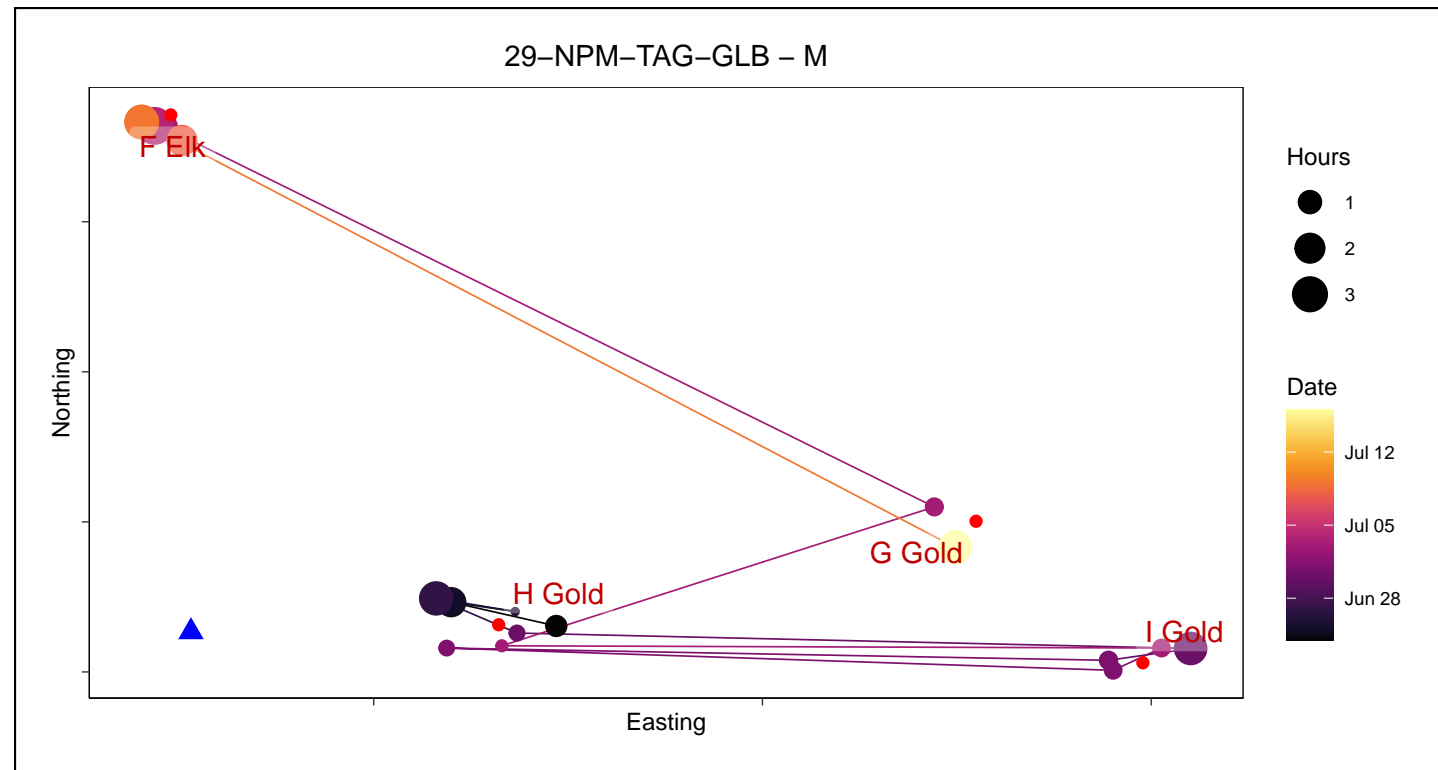
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



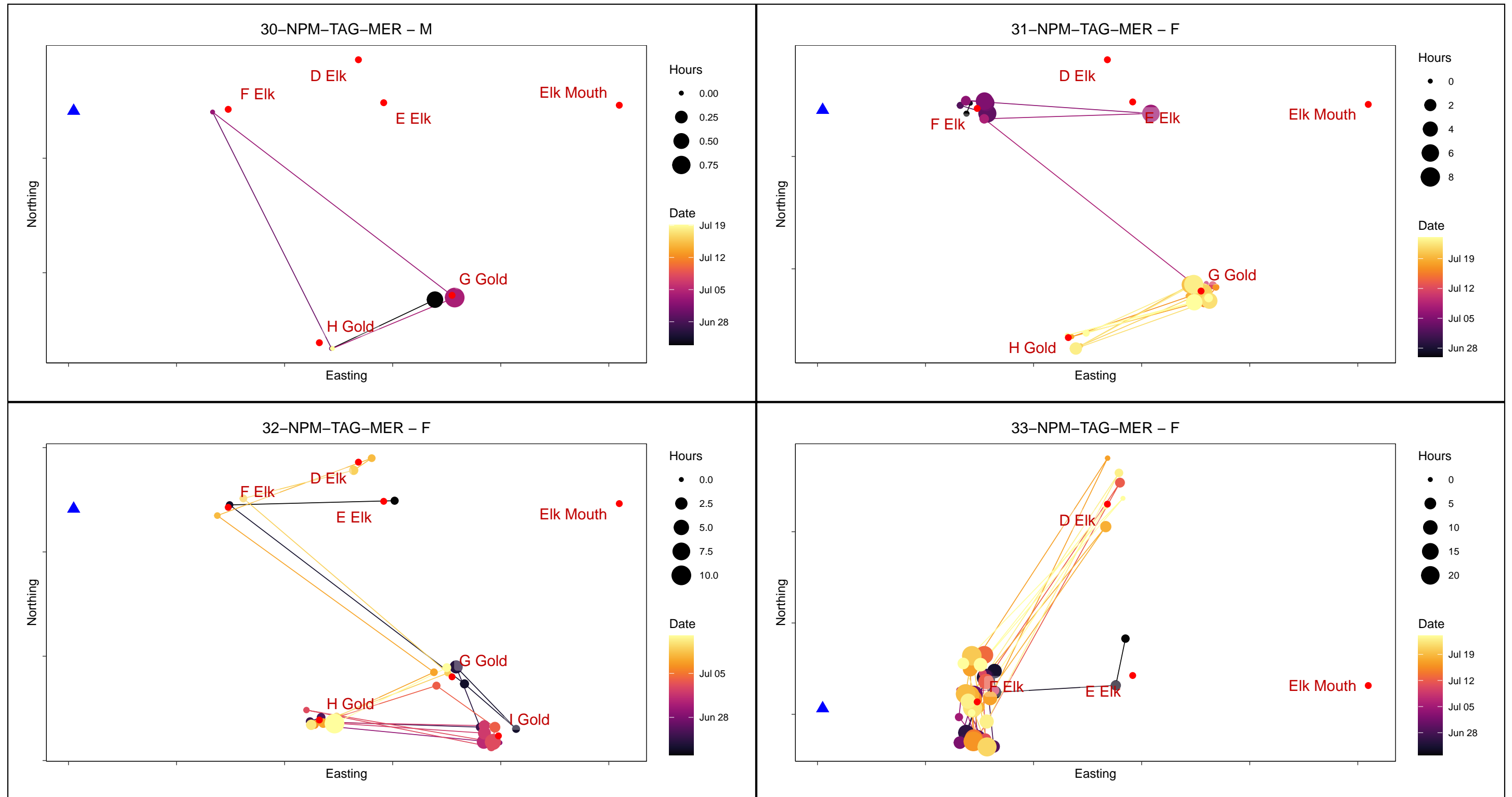
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



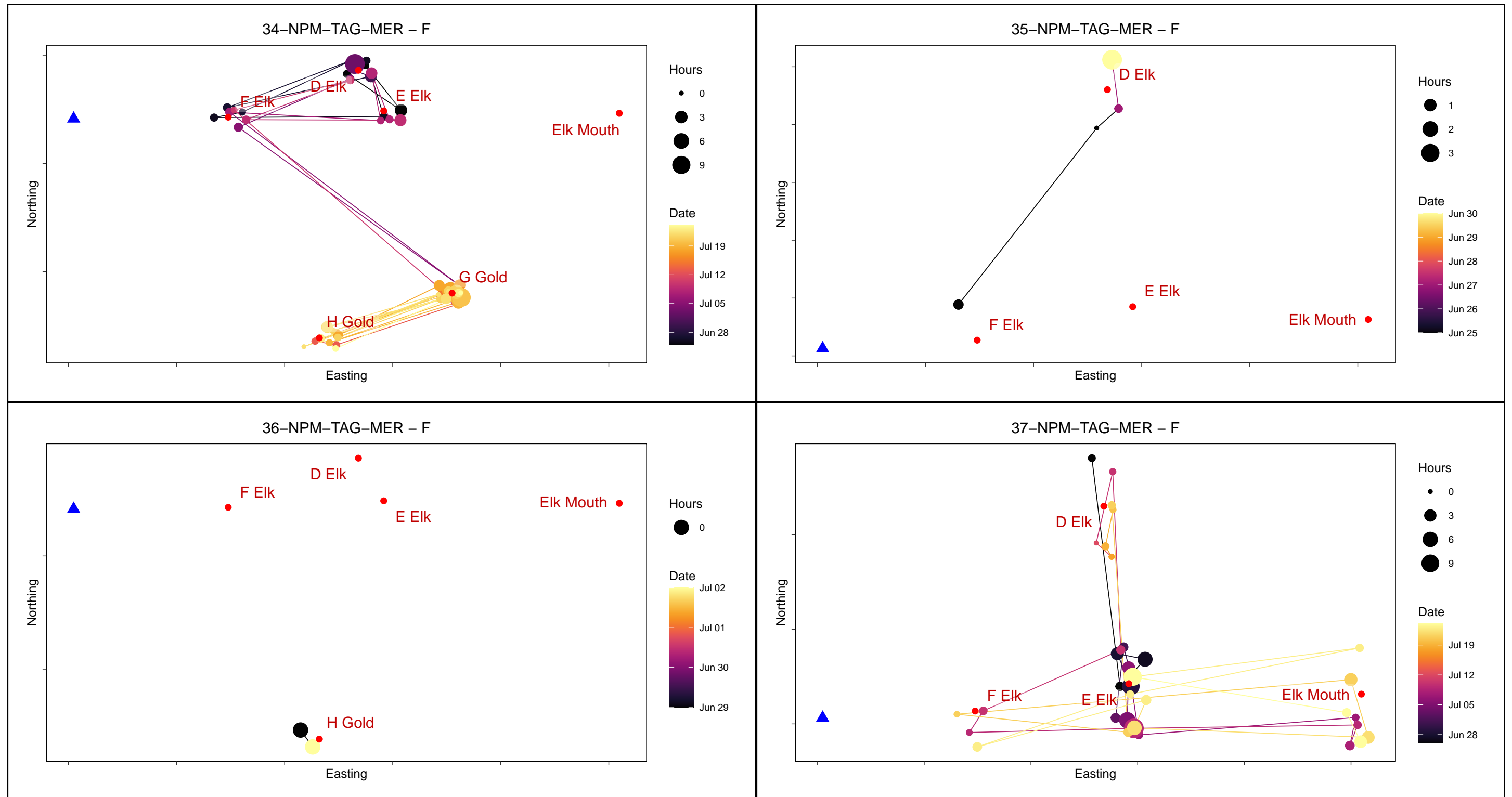
**Figure B.1: Location and Movement Paths for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

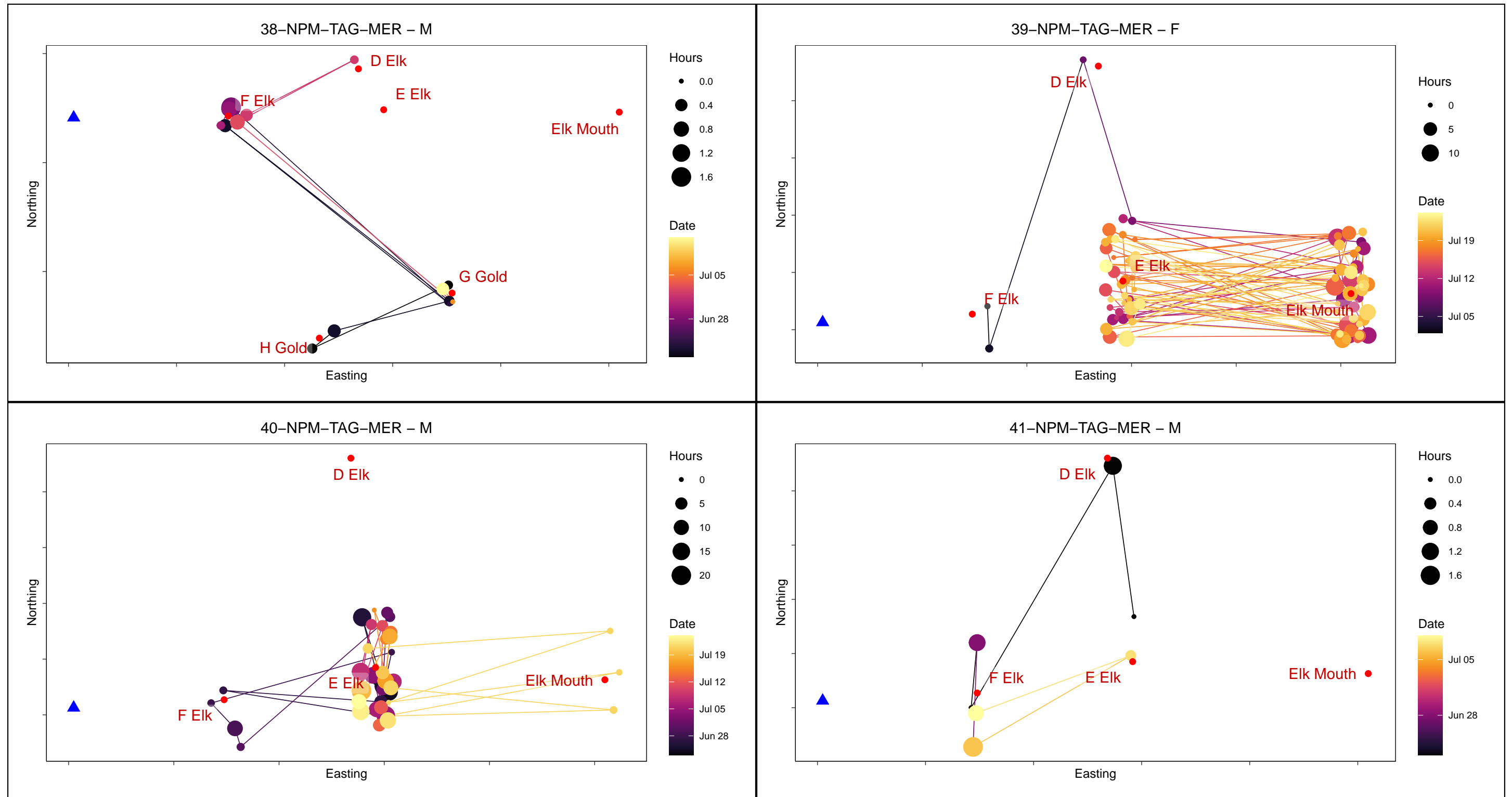
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

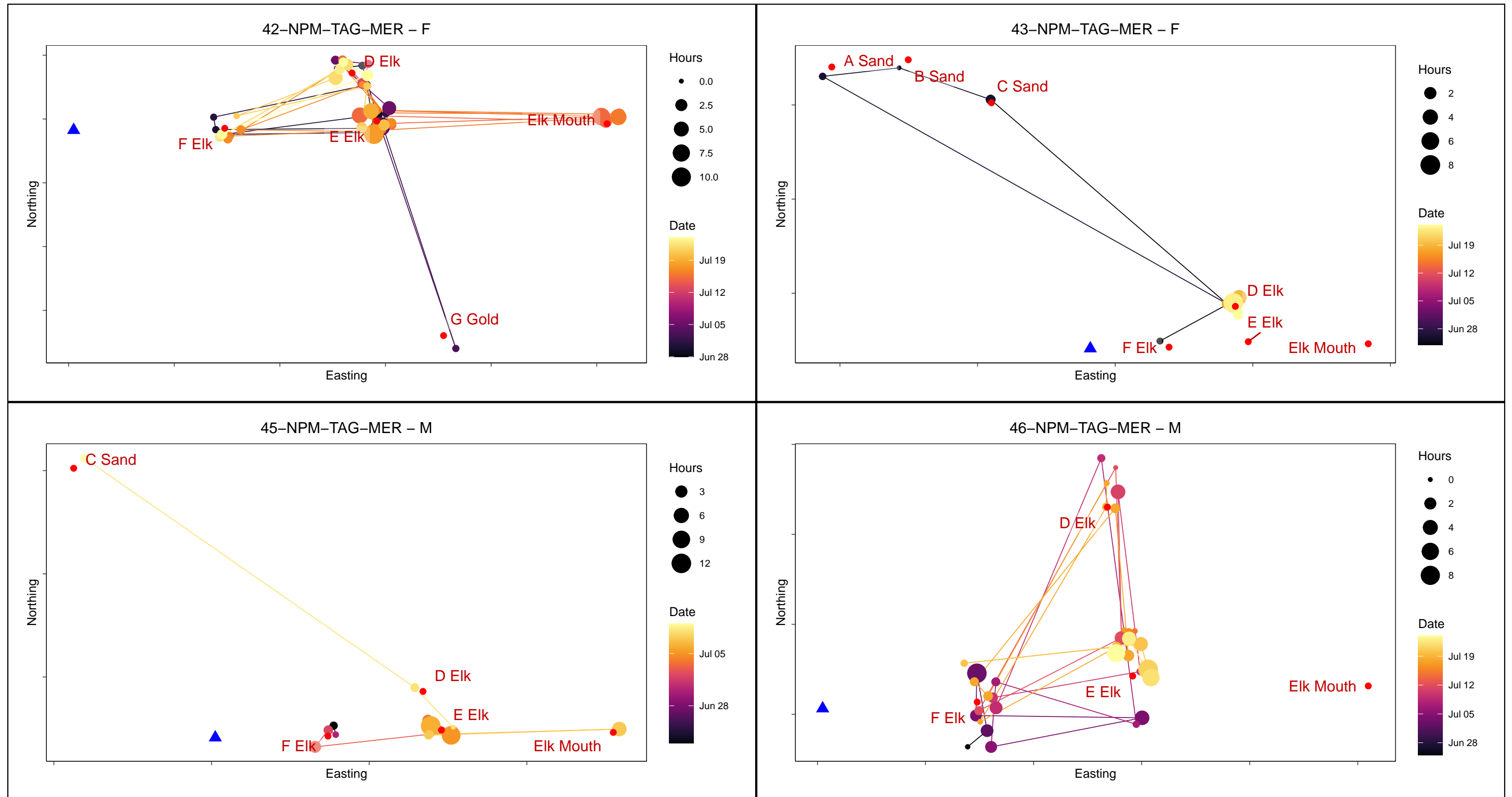
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.





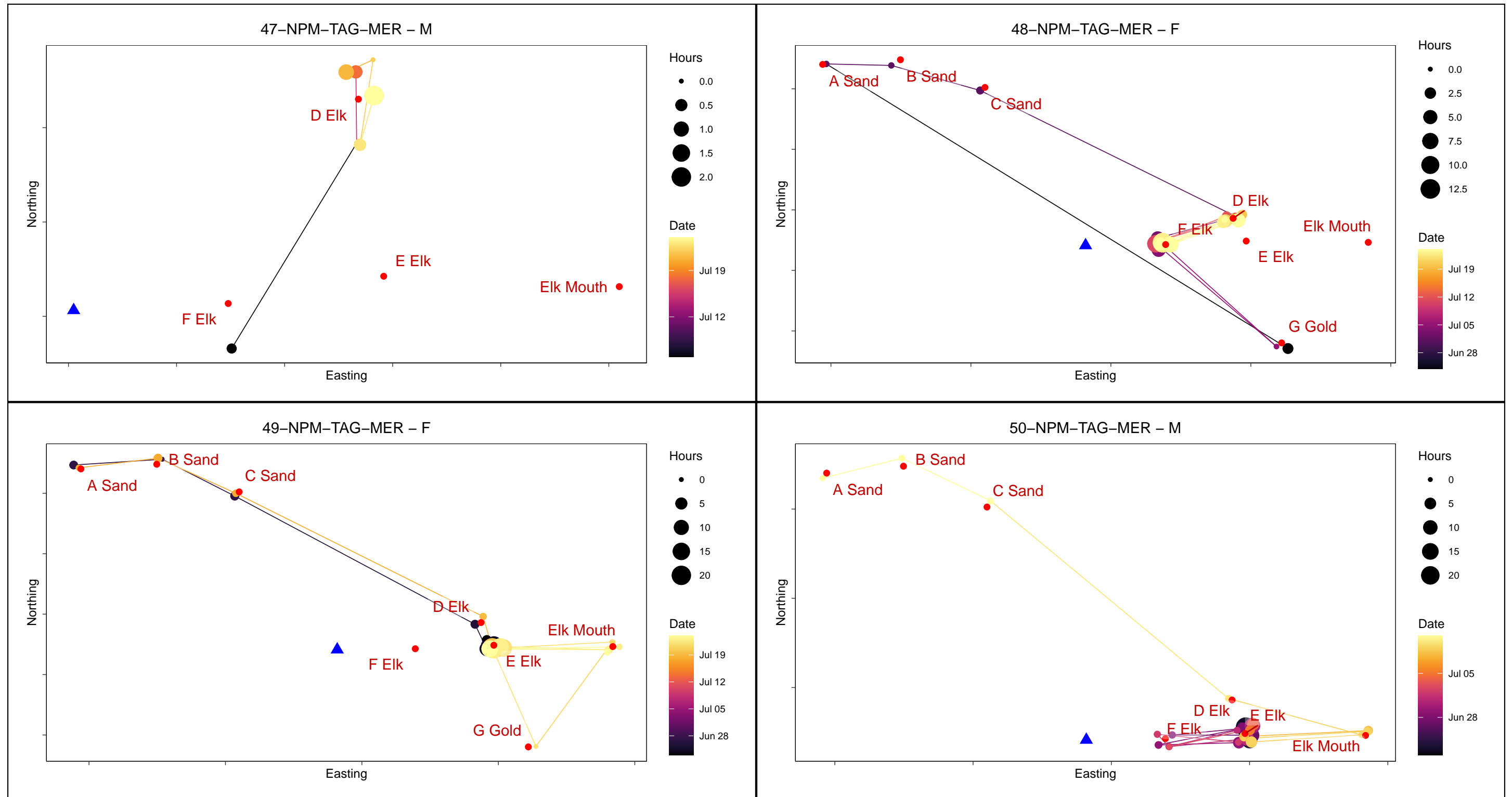
**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



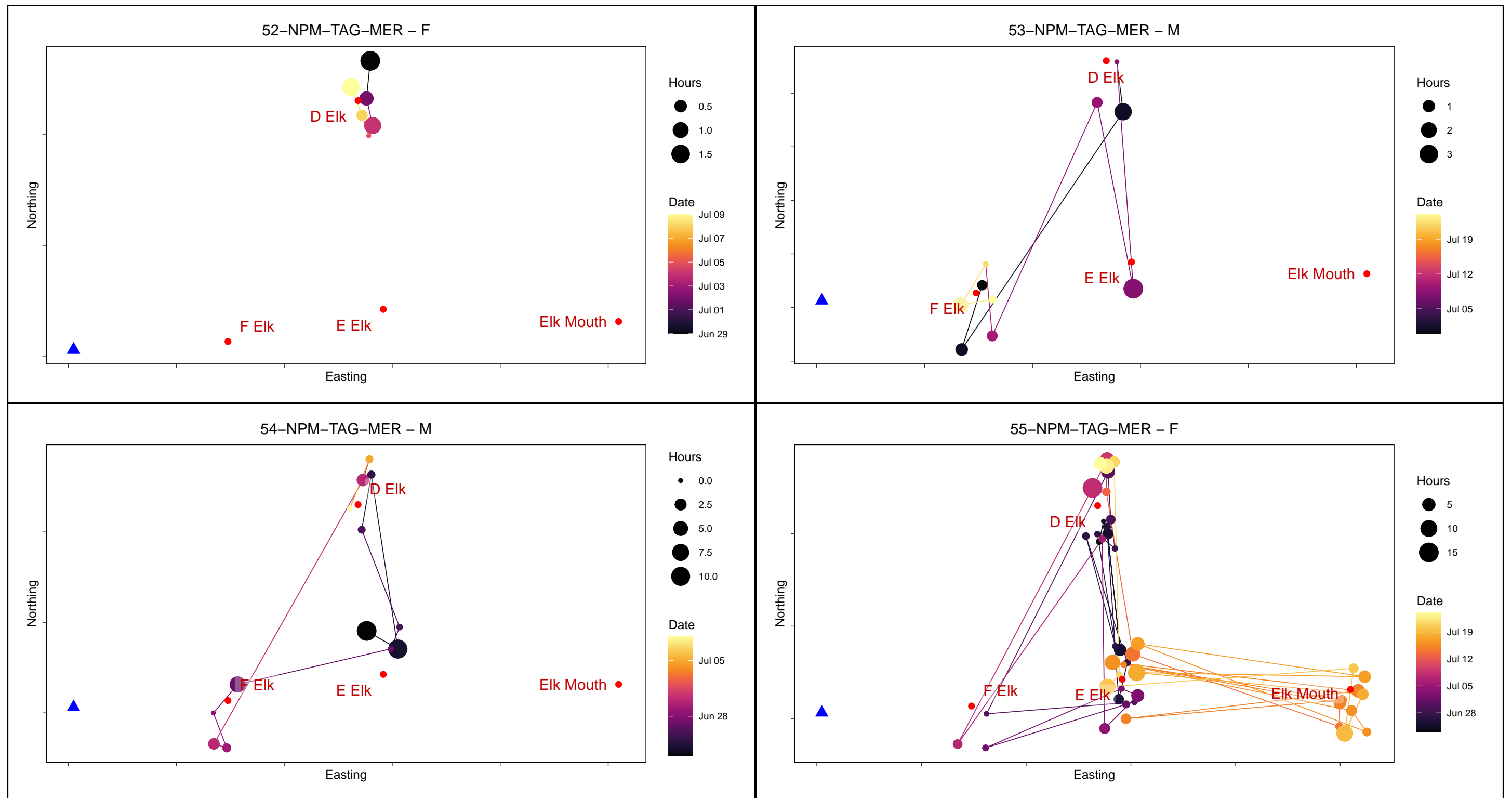
**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

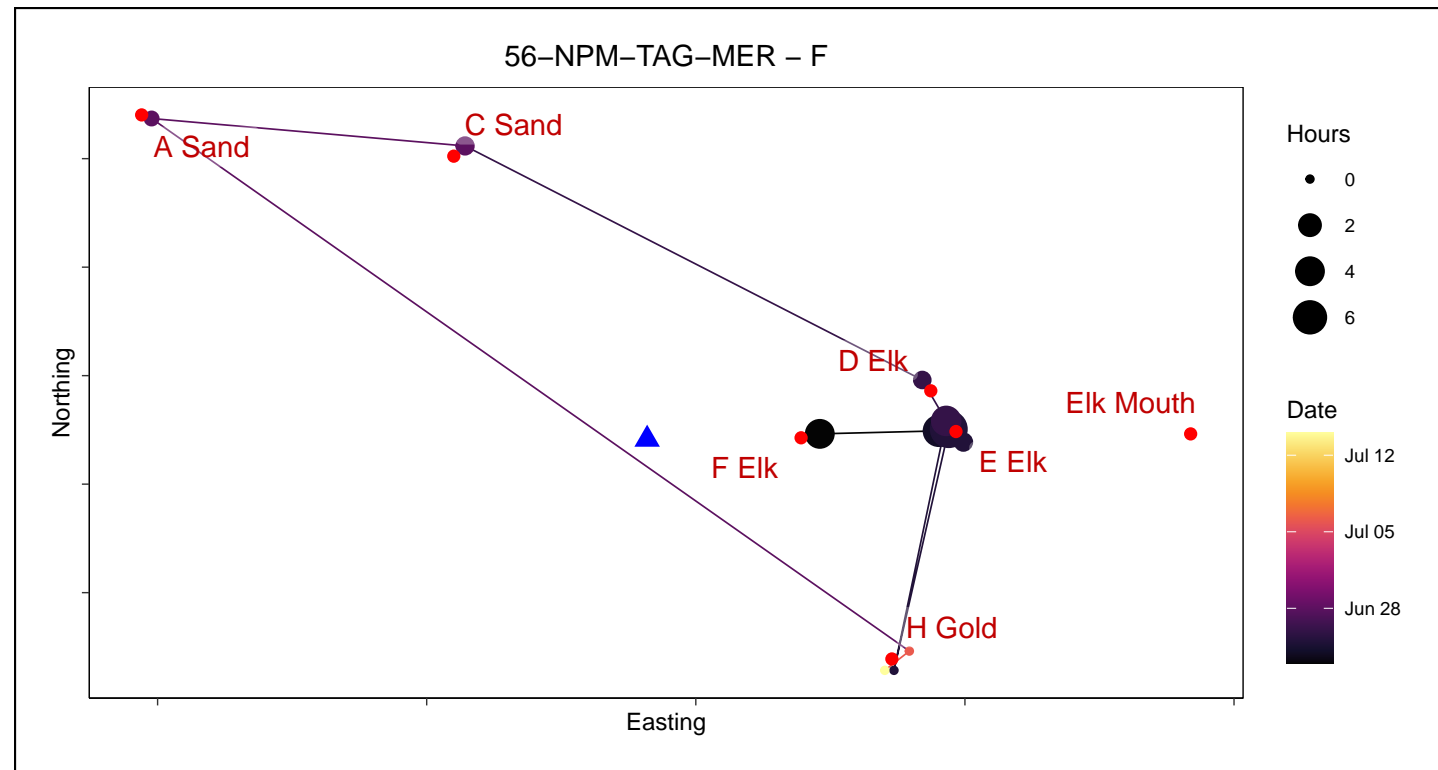
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

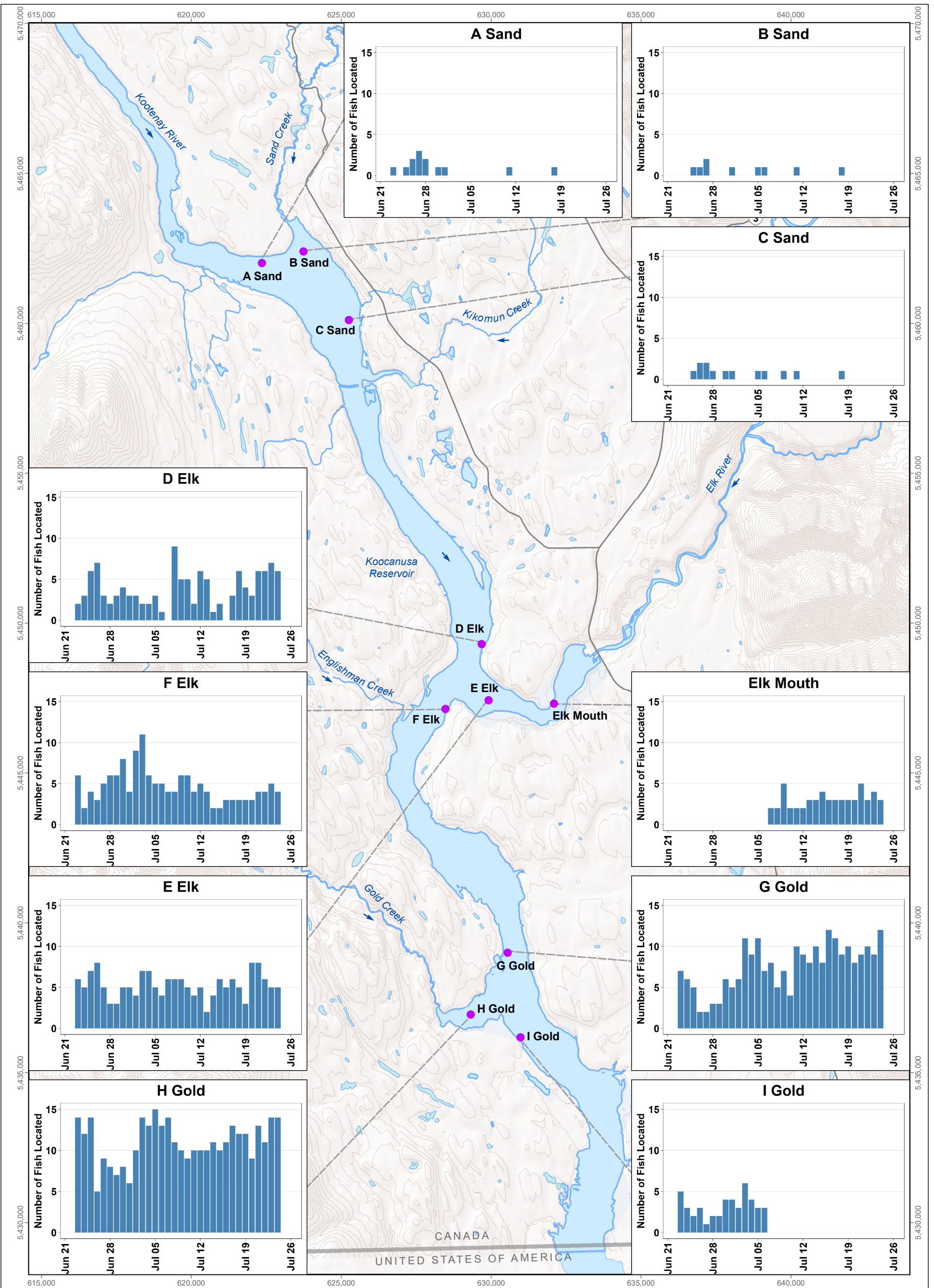
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.





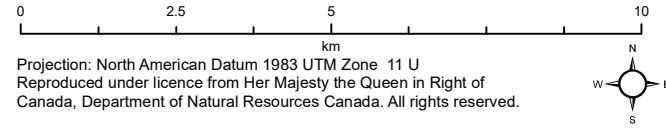
**Figure B.2: Location and Movement Paths for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**LEGEND**  
 ● Passive Telemetry Receiver Location

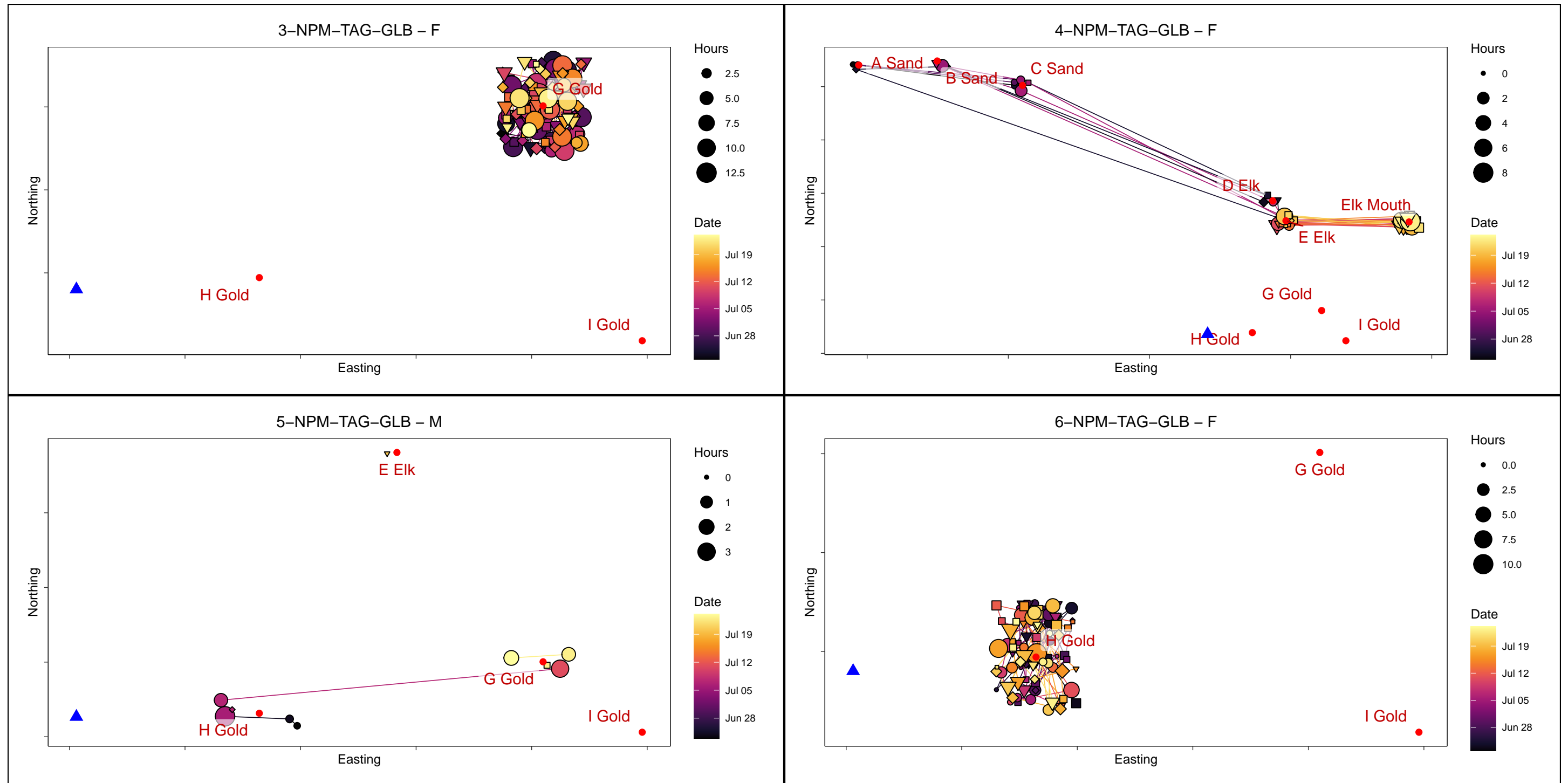
**Proportion of Tagged Northern Pikeminnow Detected at Passive Telemetry Receivers in Koochanusa Reservoir for the 2021 Northern Pikeminnow Selenium Toxicity Study, June to July 2021**



Date October 2021  
 Project 217202.0042



**Figure B.3**

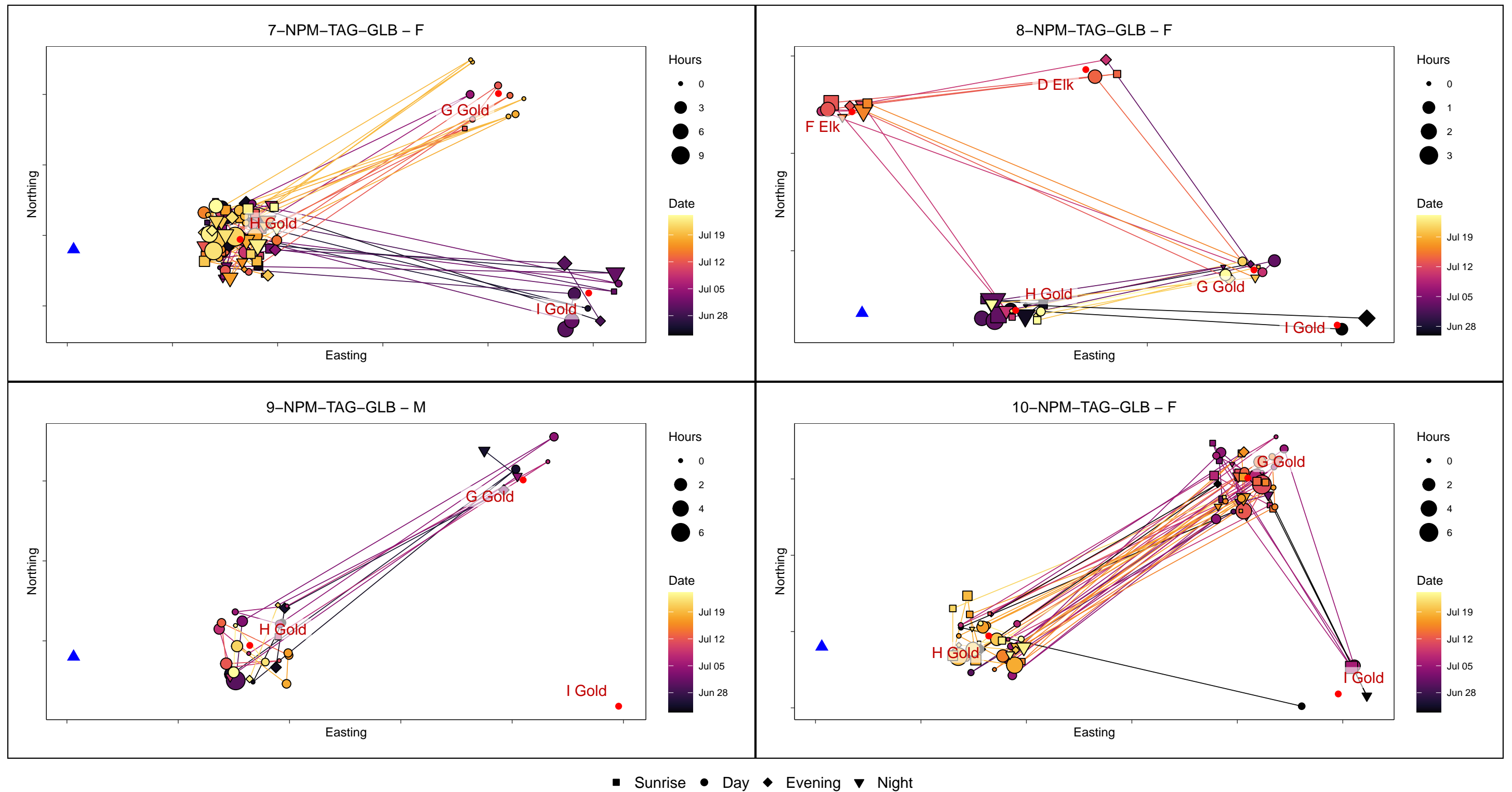


■ Sunrise ● Day ◆ Evening ▼ Night

**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

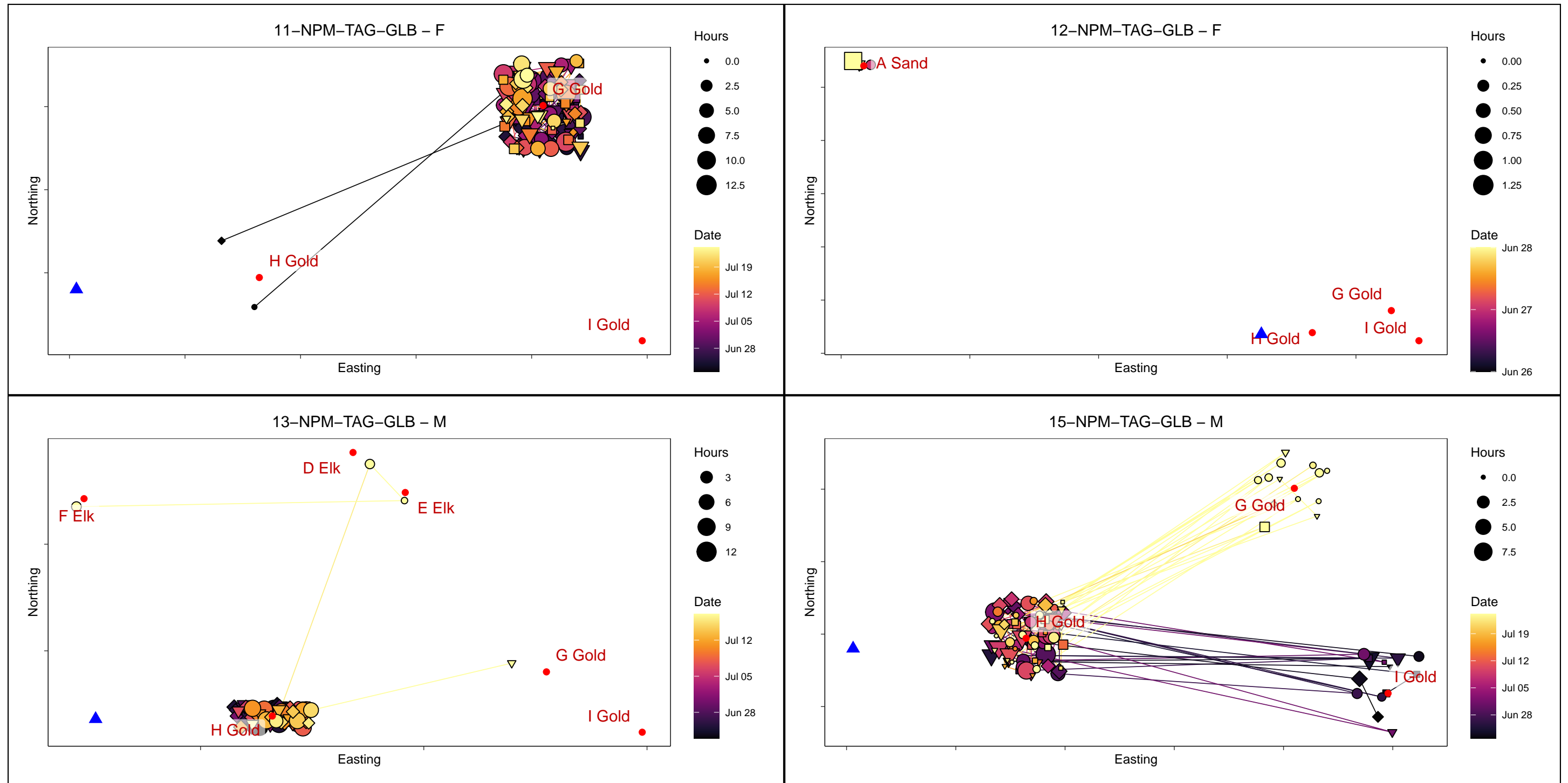
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.





**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.

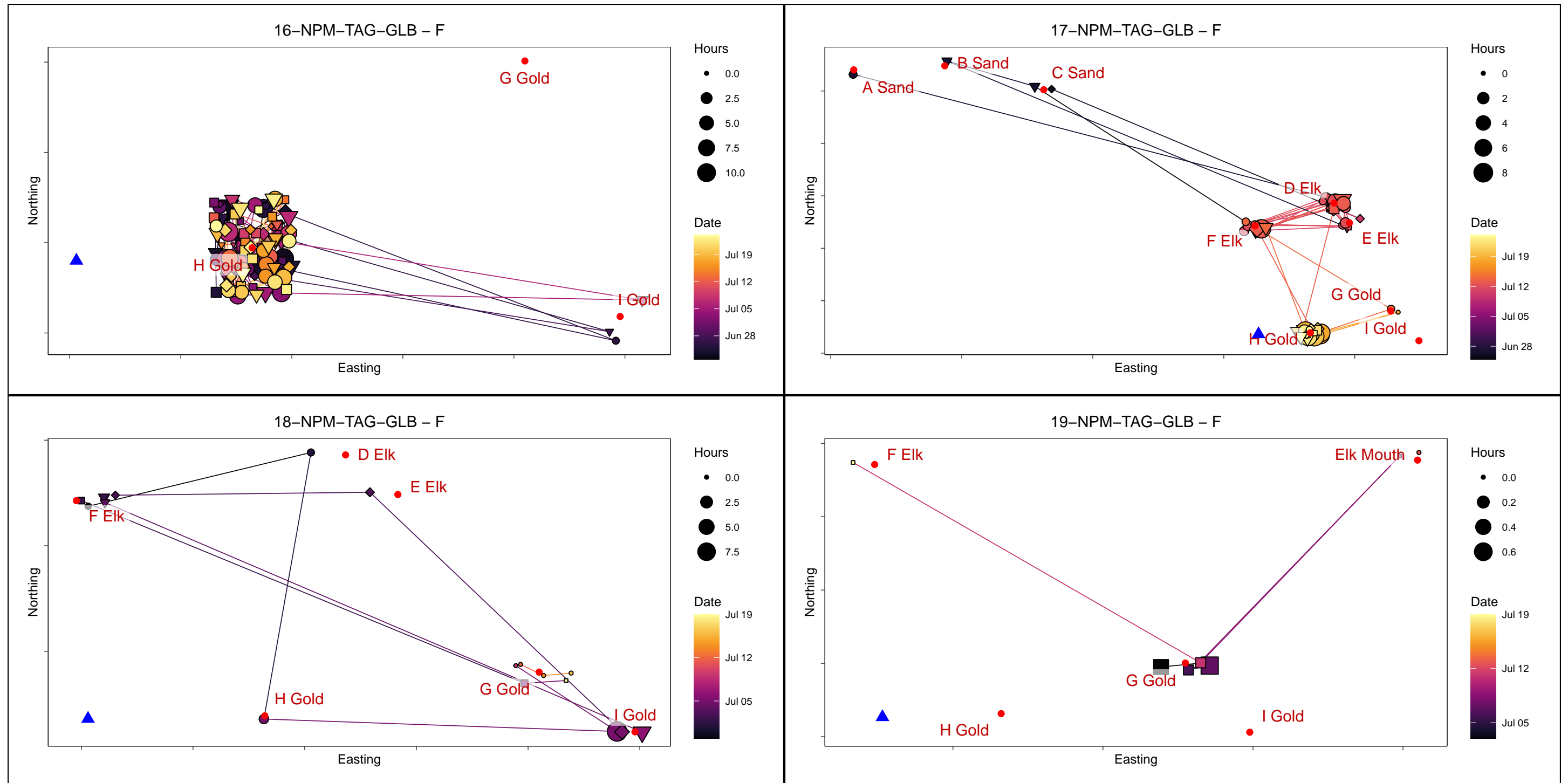


■ Sunrise ● Day ◆ Evening ▼ Night

**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.

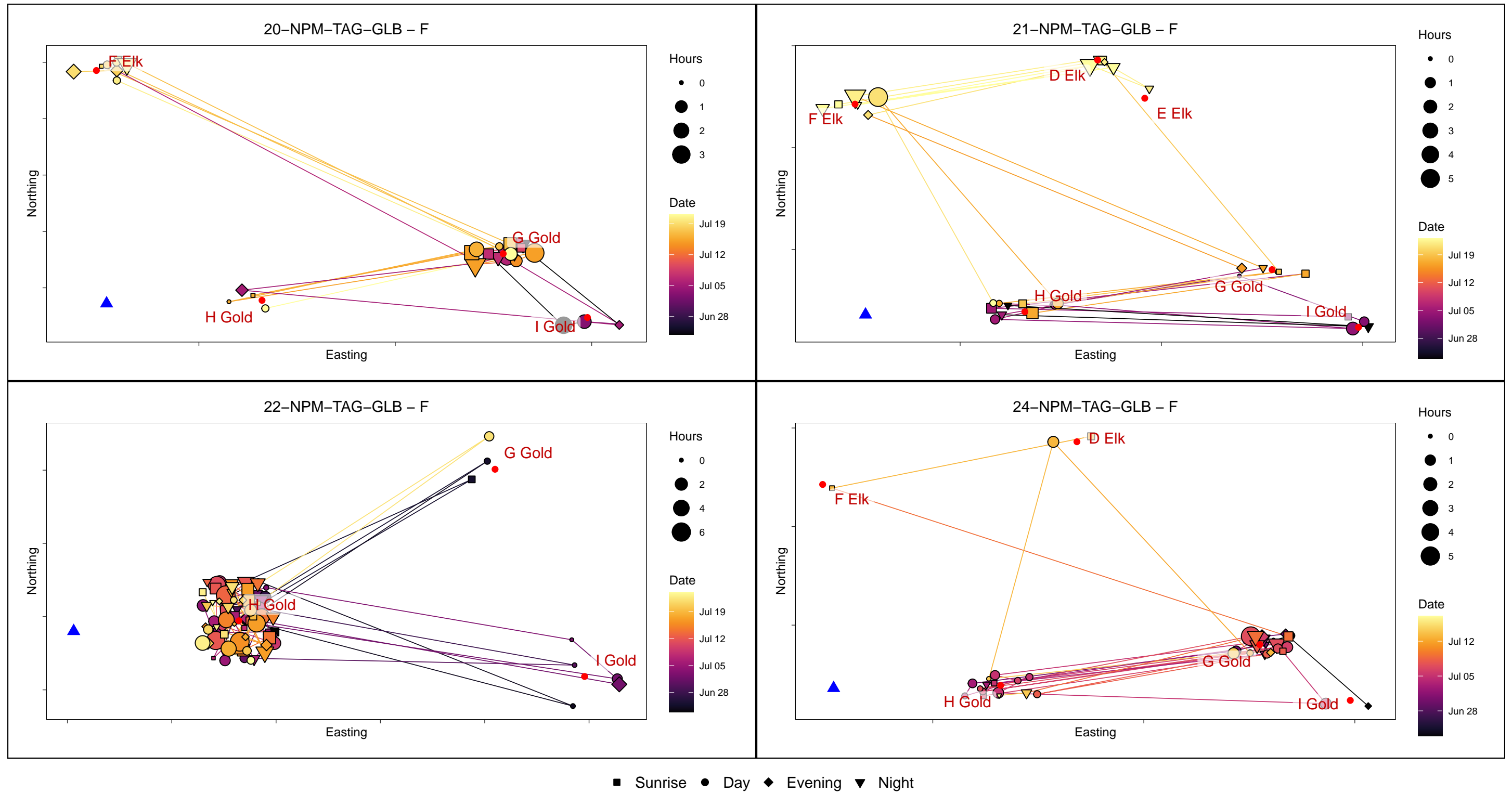




■ Sunrise ● Day ◆ Evening ▼ Night

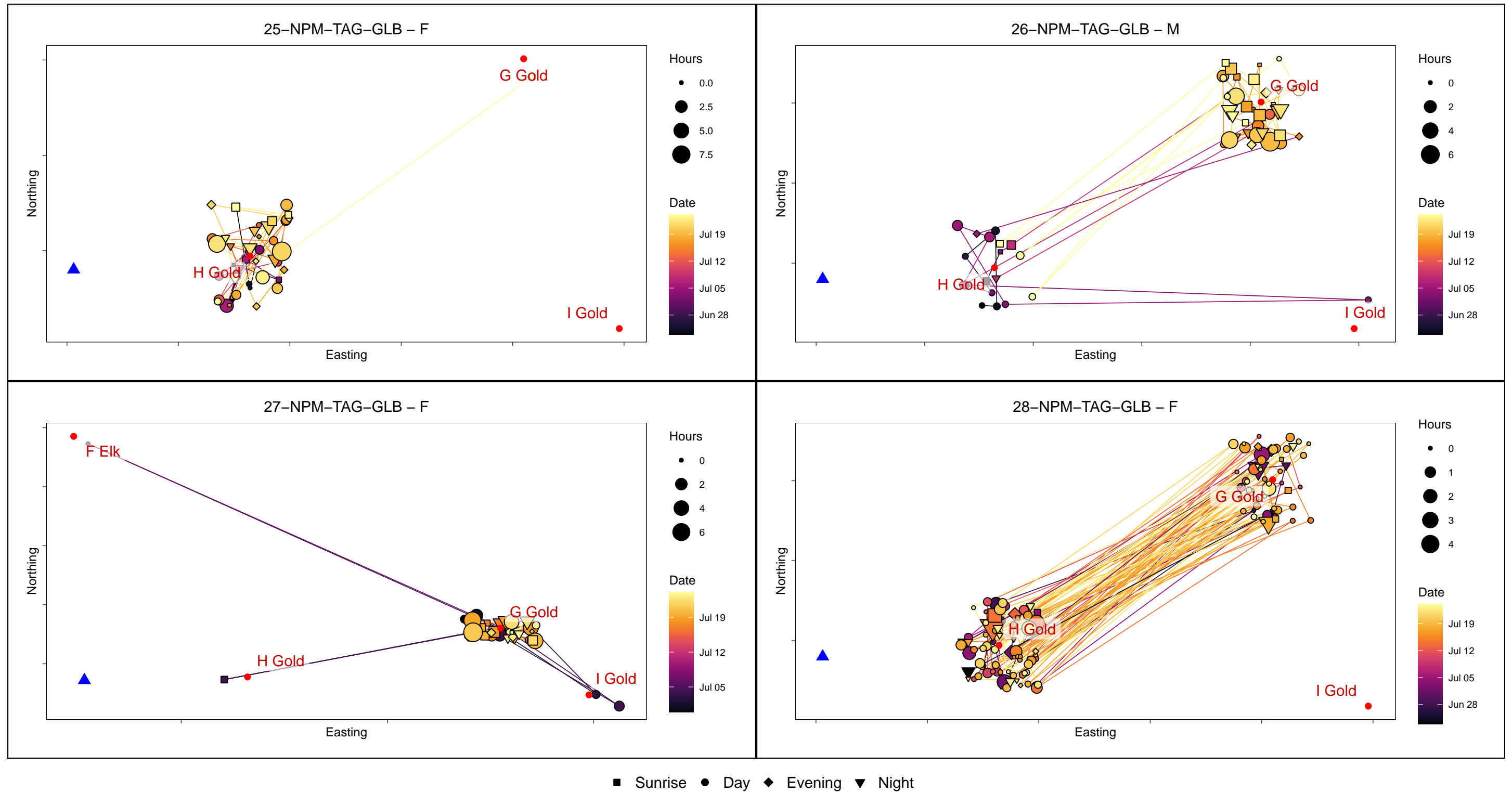
**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



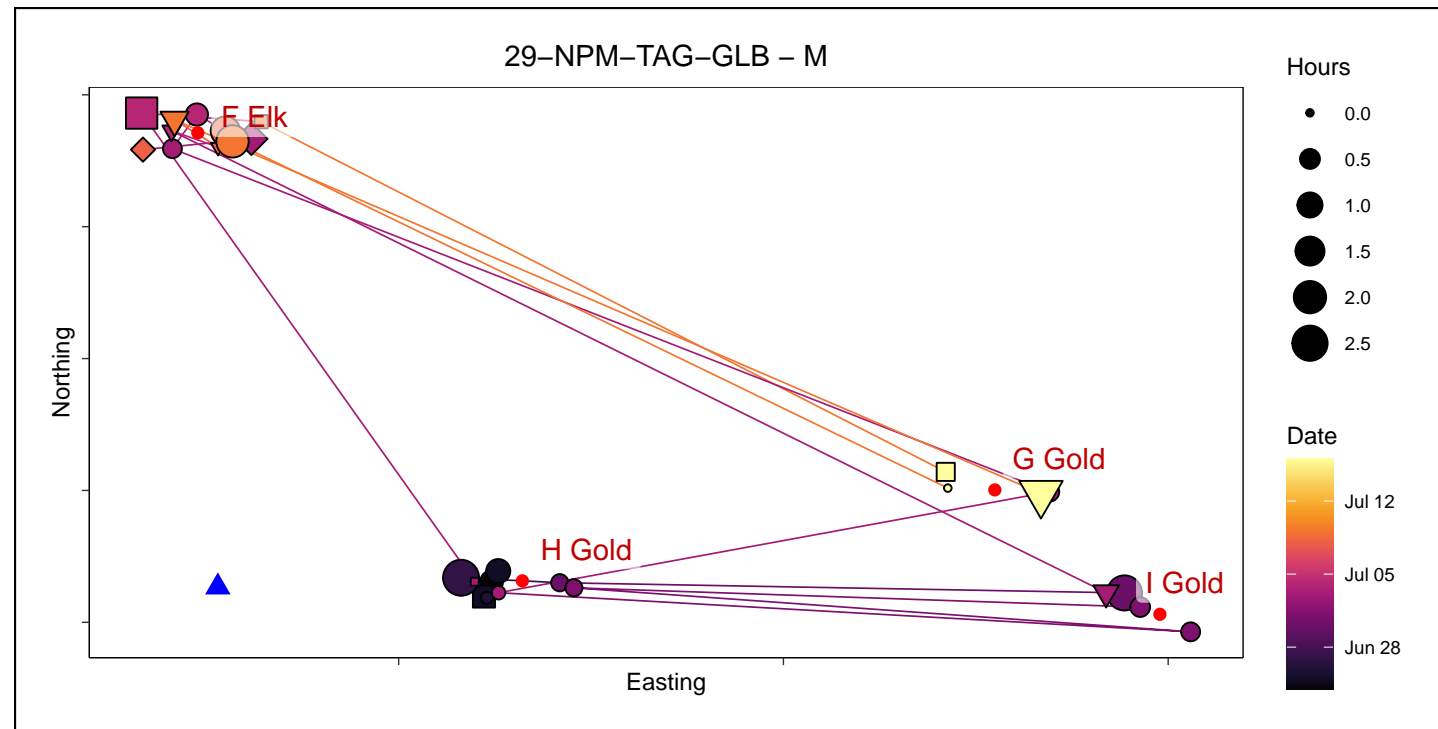
**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

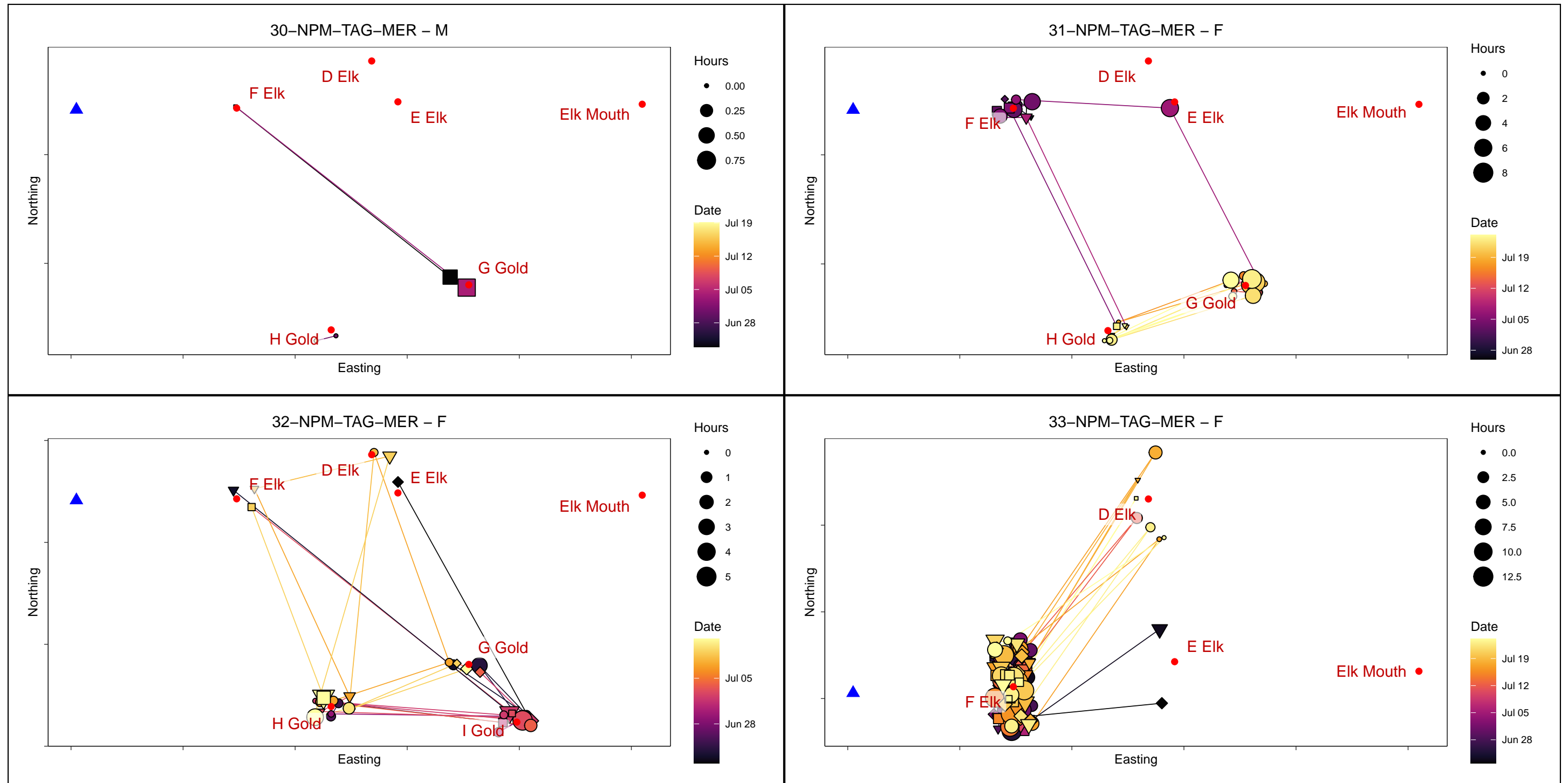
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



■ Sunrise ● Day ◆ Evening ▼ Night

**Figure B.4: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at Gold Bay (GLB), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at Gold Bay on June 10, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.

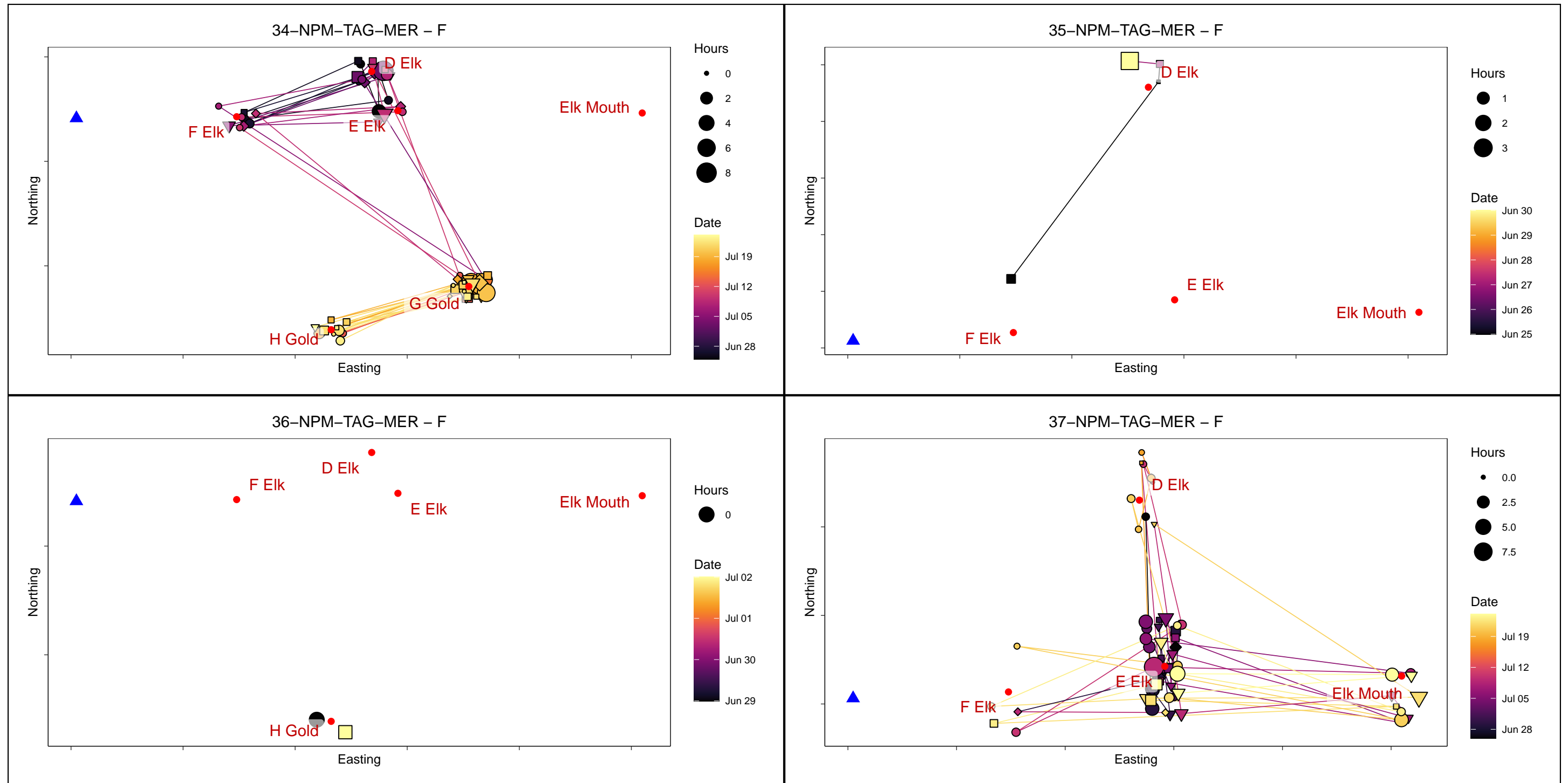


■ Sunrise ● Day ◆ Evening ▼ Night

**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.

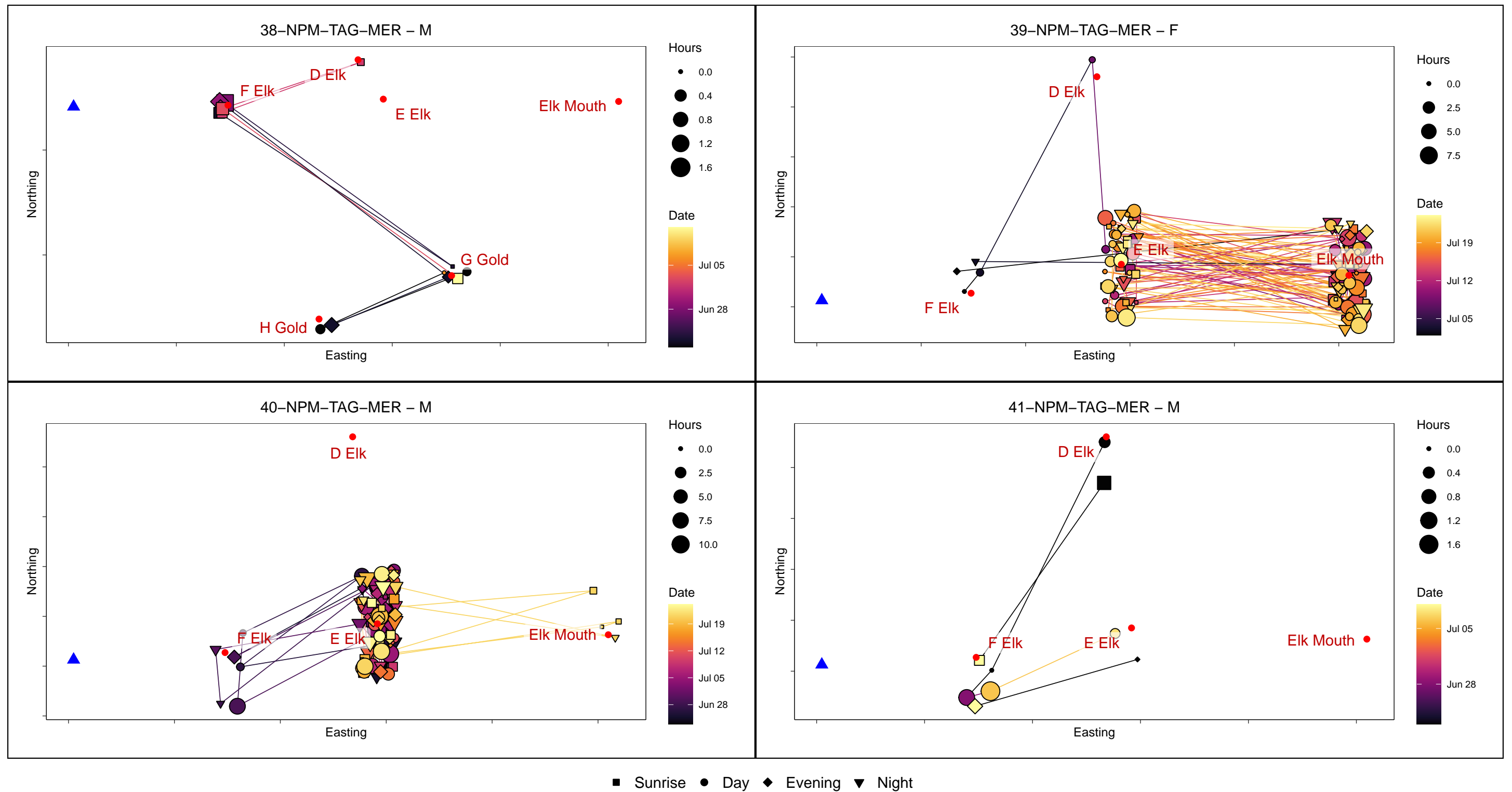




■ Sunrise ● Day ◆ Evening ▼ Night

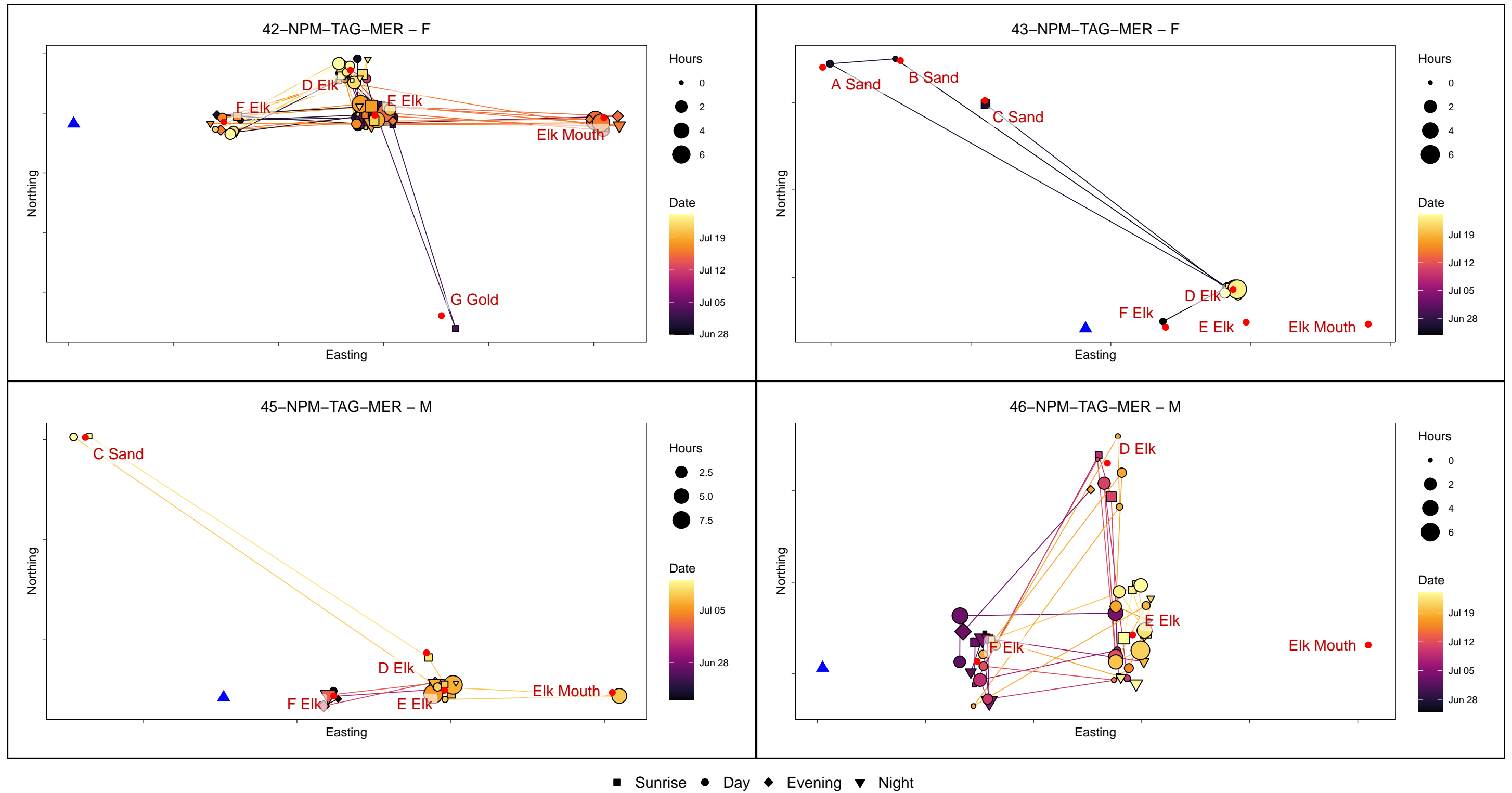
**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



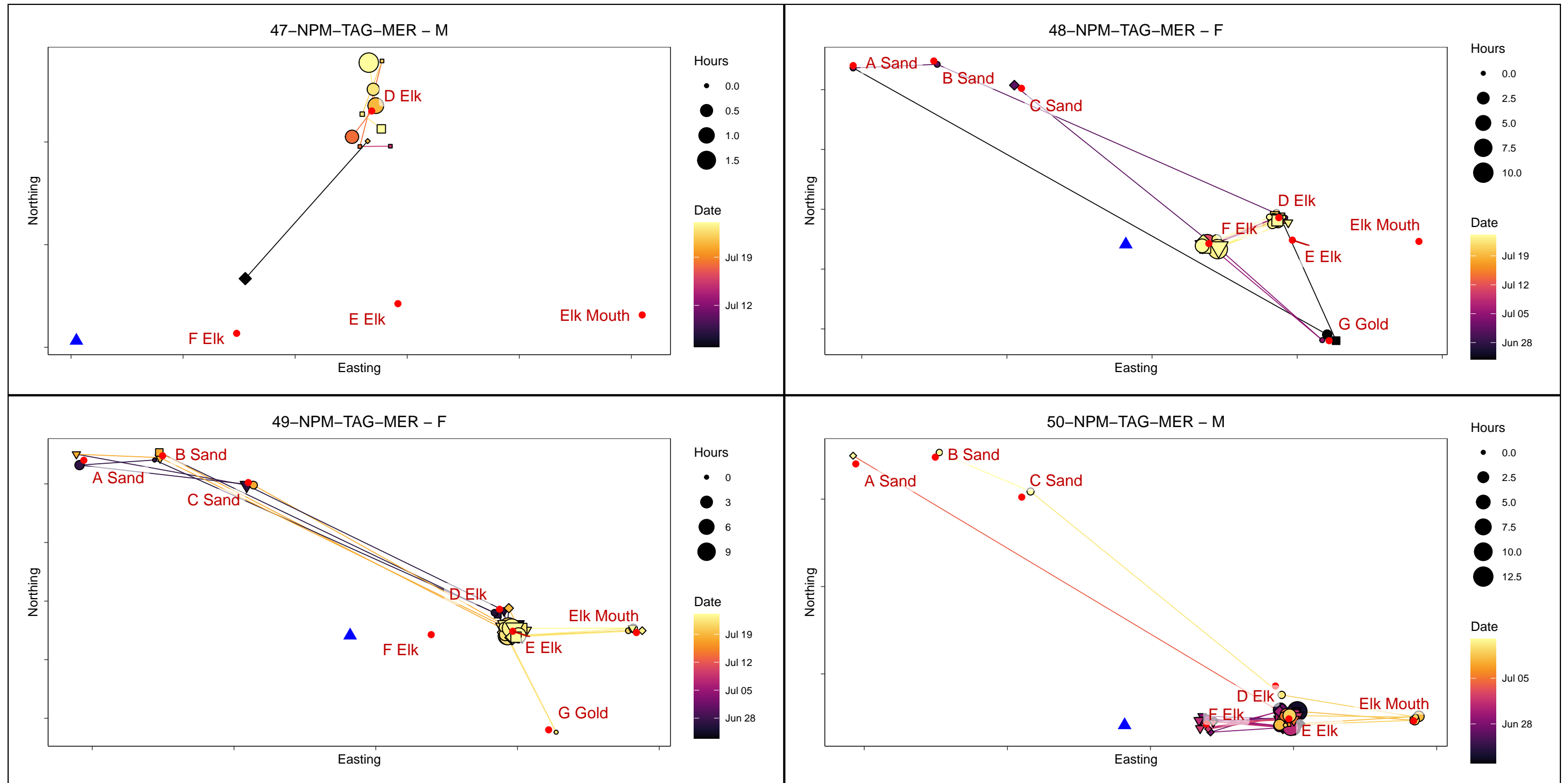
**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



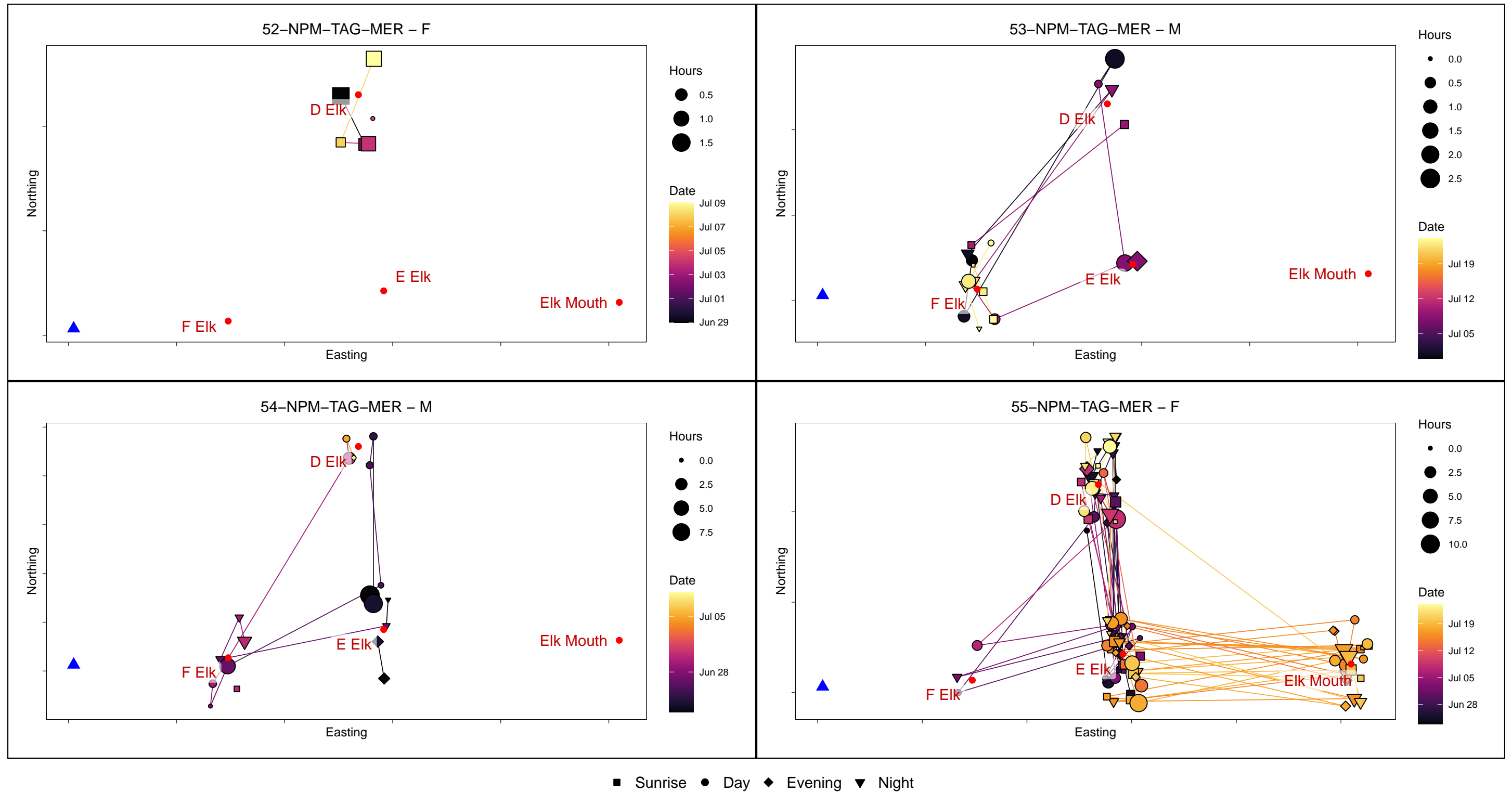
**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

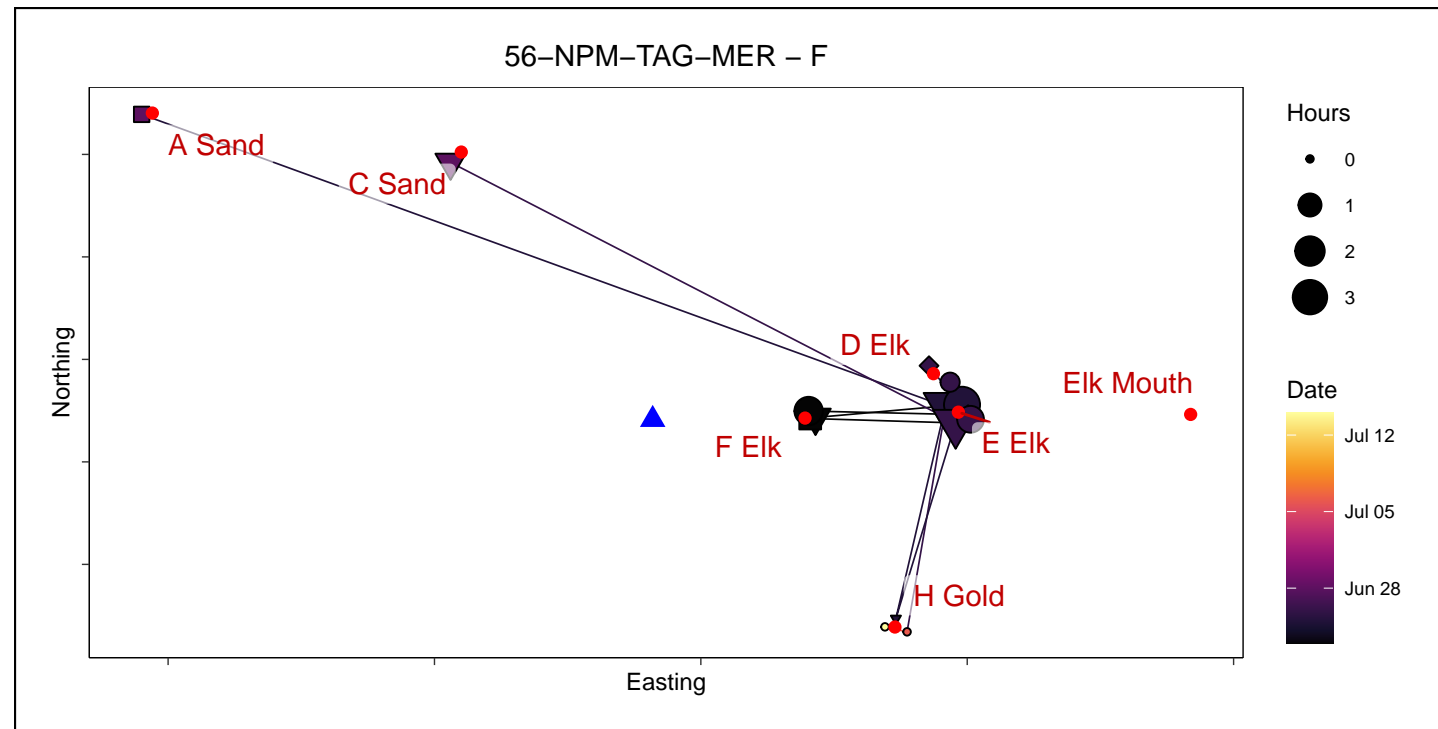
Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.



**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.





■ Sunrise ● Day ◆ Evening ▼ Night

**Figure B.5: Location and Movement Paths During Daily Periods (Sunrise, Day, Evening, Night) for Northern Pikeminnow at the Mouth of the Elk River (MER), June and July 2021**

Notes: Locations represent the sum of continuous block of time (gaps <10 mins) detected at a single receiver location on a given day. Blue triangles represent the tagged and released location at the mouth of the Elk River on June 11, 2021. Individuals located only once or not at all were not plotted. "-F" = female and "-M" = male.

**Table B.1: Northern Pike Information Collected During the CART Implantations, June 10 and 11, 2021**

Sampling Area	Date	Fish Identification Number	Radio Tag Code	Acoustic Tag Code	Floy Tag Code	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Sex	Time of Surgery	Time of Release	External Fish Anomaly Classification	Assessment of External Fish Anomaly Severity
Gold Bay (GLB)	10-Jun-21	01-NPM-TAG-GLB	41	12709	2308	40.5	36.6	600	F	12:20	12:30	-	
	10-Jun-21	02-NPM-TAG-GLB	42	12710	2309	56.7	52.0	1,700	M	12:25	12:35	-	
	10-Jun-21	03-NPM-TAG-GLB	43	12711	2310	31.1	28.0	300	F	13:53	14:05	-	
	10-Jun-21	04-NPM-TAG-GLB	44	12712	2311	53.0	46.7	1,300	F	13:57	14:06	-	
	10-Jun-21	05-NPM-TAG-GLB	45	12713	2312	49.2	45.9	1,300	M	14:01	14:12	-	
	10-Jun-21	06-NPM-TAG-GLB	46	12714	2313	51.3	47.6	1,650	F	14:12	14:18	C2	Lesions: wounds on side of body; possibly from net
	10-Jun-21	07-NPM-TAG-GLB	47	12715	2314	46.1	42.0	1,050	F	14:21	14:35	-	
	10-Jun-21	08-NPM-TAG-GLB	48	12716	2315	59.5	55.0	2,050	F	14:27	14:35	-	
	10-Jun-21	09-NPM-TAG-GLB	49	12717	2316	45.0	40.6	1,050	M	15:15	15:26	G2	Eyes: hemorrhaging eye(s) or blind in one or both eyes
	10-Jun-21	10-NPM-TAG-GLB	50	12718	2317	53.0	47.9	1,750	F	15:19	15:26	-	
	10-Jun-21	11-NPM-TAG-GLB	51	12719	2318	54.9	49.6	1,750	F	15:26	15:43	C2	Lesions: wounds on side of body; possibly from net
	10-Jun-21	12-NPM-TAG-GLB	52	12720	2319	61.7	57.2	2,100	F	15:34	15:43	-	
	10-Jun-21	13-NPM-TAG-GLB	53	12721	2320	40.7	37.1	680	M	15:42	15:57	-	
	10-Jun-21	14-NPM-TAG-GLB	54	12722	2321	38.0	34.7	400	U	16:19	16:27	-	
	10-Jun-21	15-NPM-TAG-GLB	55	12723	2322	39.9	36.2	500	M	16:22	16:40	-	
	10-Jun-21	16-NPM-TAG-GLB	56	12724	2323	46.6	42.0	850	F	16:27	16:40	-	
	10-Jun-21	17-NPM-TAG-GLB	57	12725	2324	55.1	49.9	1,950	F	16:45	16:57	-	
	10-Jun-21	18-NPM-TAG-GLB	58	12726	2325	54.4	49.9	1,870	F	16:50	16:57	-	
	10-Jun-21	19-NPM-TAG-GLB	59	12727	2326	35.0	32.1	370	U	16:57	17:07	G2	Eyes: hemorrhaging eye(s) or blind in one or both eyes
	10-Jun-21	20-NPM-TAG-GLB	60	12728	2327	60.0	54.9	2,000	-	17:23	17:34	-	
	10-Jun-21	21-NPM-TAG-GLB	61	12729	2328	55.6	51.0	1,850	F	18:31	18:41	-	
	10-Jun-21	22-NPM-TAG-GLB	62	12730	2329	53.0	48.1	1,750	F	18:35	18:41	-	
	10-Jun-21	23-NPM-TAG-GLB	63	12731	2330	53.4	48.9	1,600	F	18:40	18:51	-	
	10-Jun-21	24-NPM-TAG-GLB	64	12732	2331	52.0	47.4	1,550	F	18:45	18:52	-	
	10-Jun-21	25-NPM-TAG-GLB	65	12733	2332	53.8	48.9	1,500	F	18:51	19:01	-	
	10-Jun-21	26-NPM-TAG-GLB	66	12734	2333	43.0	39.8	900	M	19:12	19:25	-	
	10-Jun-21	27-NPM-TAG-GLB	67	12735	2334	50.0	45.0	1,400	F	19:17	19:25	-	
	10-Jun-21	28-NPM-TAG-GLB	68	12736	2335	53.0	48.4	1,820	F	19:21	19:32	-	
	10-Jun-21	29-NPM-TAG-GLB	69	12737	2336	46.2	42.2	1,150	M	19:25	19:32	-	

Note: external fish anomaly assessment was completed using Appendix Table C.1.

**Table B.1: Northern Pikeminnow Information Collected During the CART Implantations, June 10 and 11, 2021**

Sampling Area	Date	Fish Identification Number	Radio Tag Code	Acoustic Tag Code	Floy Tag Code	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Sex	Time of Surgery	Time of Release	External Fish Anomaly Classification	Assessment of External Fish Anomaly Severity
Mouth of the Elk River (MER)	11-Jun-21	30-NPM-TAG-MER	70	12738	2337	38.1	34.6	500	M	13:13	13:27	-	
	11-Jun-21	31-NPM-TAG-MER	71	12739	2338	36.6	33.0	350	F	13:18	13:27	-	
	11-Jun-21	32-NPM-TAG-MER	72	12740	2339	39.3	35.8	600	F	13:22	13:36	-	
	11-Jun-21	33-NPM-TAG-MER	74	12742	2340	37.0	32.8	350	F	13:26	13:36	-	
	11-Jun-21	34-NPM-TAG-MER	75	12743	2341	47.0	42.6	1,300	F	13:32	13:46	-	
	11-Jun-21	35-NPM-TAG-MER	76	12744	2343	51.0	46.4	1,400	F	13:36	13:46	-	
	11-Jun-21	36-NPM-TAG-MER	77	12745	2344	58.4	54.0	2,450	F	14:03	14:15	-	
	11-Jun-21	37-NPM-TAG-MER	78	12746	2345	53.9	48.8	1,700	F	14:06	14:15	-	
	11-Jun-21	38-NPM-TAG-MER	79	12747	2346	38.4	34.6	550	M	14:10	14:25	-	
	11-Jun-21	39-NPM-TAG-MER	80	12748	2347	37.6	33.7	450	F	14:15	14:25	-	
	11-Jun-21	40-NPM-TAG-MER	81	12749	2348	35.3	31.5	400	M	14:20	14:30	-	Miit
	11-Jun-21	41-NPM-TAG-MER	82	12750	2349	38.3	34.8	550	M	14:25	14:30	-	
	11-Jun-21	42-NPM-TAG-MER	83	12751	284	54.6	49.5	1,800	F	15:02	15:15	-	
	11-Jun-21	43-NPM-TAG-MER	84	12752	287	56.2	50.8	2,070	F	15:07	15:15	-	
	11-Jun-21	44-NPM-TAG-MER	85	12753	288	38.5	34.6	600	F	15:26	15:45	-	
	11-Jun-21	45-NPM-TAG-MER	86	12694	289	41.0	37.5	620	M	15:29	15:45	-	
	11-Jun-21	46-NPM-TAG-MER	87	12695	290	40.0	35.8	600	M	15:33	15:45	-	
	11-Jun-21	47-NPM-TAG-MER	88	12696	291	38.0	34.0	480	M	15:37	15:45	-	
	11-Jun-21	48-NPM-TAG-MER	89	12697	292	47.0	42.8	1,150	F	16:04	16:17	-	
	11-Jun-21	49-NPM-TAG-MER	90	12698	293	37.3	33.6	500	F	16:08	16:17	-	
	11-Jun-21	50-NPM-TAG-MER	91	12699	294	38.1	34.7	500	M	16:31	16:52	-	Miit
	11-Jun-21	51-NPM-TAG-MER	92	12700	295	45.2	40.9	920	F	16:34	16:52	-	
	11-Jun-21	52-NPM-TAG-MER	93	12701	296	37.3	33.8	450	F	16:38	16:52	-	
	11-Jun-21	53-NPM-TAG-MER	94	12702	297	41.5	37.6	700	M	16:47	16:52	G2	Eyes: hemorrhaging eye(s) or blind in one or both eyes
	11-Jun-21	54-NPM-TAG-MER	95	12703	298	35.9	32.5	400	M	16:52	17:05	-	
	11-Jun-21	55-NPM-TAG-MER	97	12705	299	53.4	49.8	1,650	F	17:18	17:27	-	
	11-Jun-21	56-NPM-TAG-MER	98	12706	2350	52.6	48.5	1,650	F	17:23	17:27	-	
	11-Jun-21	57-NPM-TAG-MER	99	12707	2351	55.6	51.3	2,100	F	17:25	17:35	-	
11-Jun-21	58-NPM-TAG-MER	100	12708	2352	35.5	31.5	450	F	17:35	17:45	-		

Note: external fish anomaly assessment was completed using Appendix Table C.1.

**Table B.2: Active Telemetry Tracking Records for the 2021 Northern Pikeminnow Selenium Toxicity Study, June to July 2021**

Area	Date	Time	UTM (NAD 83, 11U)		Tag ID	Notes
			Easting	Northing		
Gold Bay (GLB)	15-Jun-21	-	-	-	12705	~1.36 km us to vast ds Elk Site
	15-Jun-21	-	-	-	12696	~1.36km us to vast ds elk site
	24-Jun-21	12:36	628750	5436886	12713	-
	24-Jun-21	12:41	628725	5436882	12734	-
	24-Jun-21	12:45	628750	5436886	12713	-
	24-Jun-21	13:18	628946	5436995	12723	-
	24-Jun-21	13:18	628946	5436995	12721	-
	24-Jun-21	13:35	928760	6436874	12734	-
	24-Jun-21	13:42	628883	5436917	12723	-
	24-Jun-21	13:42	628883	5436917	12721	-
	24-Jun-21	13:42	628883	5436917	63563	-
	25-Jun-21	13:44	630500	5439138	12711	-
	25-Jun-21	13:54	630497	5439137	12719	-
	25-Jun-21	14:30	630557	5439023	63564	-
	25-Jun-21	14:37	630532	5438919	12719	-
	25-Jun-21	14:37	630532	5438919	12711	-
	25-Jun-21	15:23	630434	5439732	12711	-
	25-Jun-21	15:23	630434	5439732	12719	-
	26-Jun-21	11:49	628915	5436921	12721	-
	26-Jun-21	11:49	628915	5436921	63563	-
	26-Jun-21	11:57	629951	5436952	12740	-
	26-Jun-21	11:59	629951	5436952	12714	-
	26-Jun-21	12:05	629883	5436967	12723	-
	28-Jun-21	13:03	628507	5436835	12716	-
	28-Jun-21	13:49	627039	5446442	12738	-
	28-Jun-21	14:05	628257	5446685	17747	-
	01-Jul-21	9:02	632127	549093	12746	-
	02-Jul-21	12:51	632837	5449488	-	Elkmouth look out
	02-Jul-21	13:06	636171	5452395	-	Elk canyon
	02-Jul-21	14:06	638461	5458493	-	Elk Dam
	05-Jul-21	9:40	-	-	12718	-
	08-Jul-21	14:12	630549	5439073	12711	-
	08-Jul-21	14:12	630549	5439073	12719	-
	08-Jul-21	14:29	629236	5436957	12721	-
	13-Jul-21	7:07	629252	5436947	12724	-
	13-Jul-21	7:07	629252	5436947	12717	-
	13-Jul-21	7:07	629252	5436947	12714	-
	13-Jul-21	7:10	629252	5436947	12649	-
	13-Jul-21	7:13	629252	5436947	12730	-
	14-Jul-21	8:30	630549	5439073	12711	-
	14-Jul-21	8:31	630549	5439073	12743	-
	14-Jul-21	8:31	630549	5439073	12719	-
	14-Jul-21	8:41	629236	5436957	12714	-
	14-Jul-21	8:43	629236	5436957	12724	-
	14-Jul-21	8:43	629236	5436957	12721	-
28-Jun-21	8:48	619307	5463287	12706	-	
Mouth of the Elk River (MER)	25-Jun-21	11:25	630969	5446997	12743	-
	25-Jun-21	11:33	631059	5447001	12749	-
	25-Jun-21	11:35	631082	5447004	12699	-
	25-Jun-21	11:35	631082	5447004	12698	-
	25-Jun-21	11:38	631152	5446998	63556	Code not a fish ID
	26-Jun-21	9:43	630917	5447031	12749	-
	26-Jun-21	9:43	630917	5447031	12699	-
	26-Jun-21	10:07	631090	5447005	12703	-
	27-Jun-21	8:22	622370	5462016	12725	North of Sand
	27-Jun-21	8:42	626624	5454523	12706	North of Elk Bay
	27-Jun-21	9:19	630892	5447075	12749	Elk Receiver
	27-Jun-21	10:20	631731	5446834	12699	New Elk Receiver
	27-Jun-21	11:38	628391	5447126	12703	South of Elk
	27-Jun-21	11:52	627589	5443695	12696	-
	27-Jun-21	11:52	627589	5443695	12702	-
	27-Jun-21	12:34	632499	5435005	12723	-
	27-Jun-21	12:39	633865	5434491	-	No fish
	28-Jun-21	8:48	699307	5413267	12706	~312m upstream of Sand
	28-Jun-21	9:02	618960	5465447	-	~412m North of Sand
	28-Jun-21	9:14	619563	5462585	-	~212m upstream of Sand

Note: "-" indicates no available data.

**Table B.2: Active Telemetry Tracking Records for the 2021 Northern Pikeminnow Selenium Toxicity Study, June to July 2021**

Area	Date	Time	UTM (NAD 83, 11U)		Tag ID	Notes
			Easting	Northing		
Mouth of the Elk River (MER)	28-Jun-21	9:40	623841	5460453	-	Opposite bank at Sand
	28-Jun-21	9:57	625617	5457658	-	Downstream of bridges of Gold - Sand
	28-Jun-21	10:03	625624	5457312	-	Further downstream of bridge
	28-Jun-21	13:03	628507	5436835	12716	Gold near creek
	28-Jun-21	13:49	627039.5	5446442.3	12738	Englishman Bay
	28-Jun-21	13:54	626992.9	5446818.1	12738	In Englishman's Bay
	28-Jun-21	14:01	628257.7	5446685.3	17747	-
	15-Jun-21	-	-	-	12722	~9.49km DS to vast border site
	15-Jun-21	-	-	-	12715	~3.76 km upstream to Vast US Gold Site
	29-Jun-21	7:55	631483	5435508	-	South of Gold Receiver
	29-Jun-21	11:20	619368	5463224	-	North of SC
	29-Jun-21	12:50	623208	5461690	-	Adjacent to SC
	30-Jun-21	6:45	622263	5454252	-	Kikkomun
	30-Jun-21	7:29	622106	5461225	-	South shore at Sand
	30-Jun-21	9:02	618944	5463399	-	North of Islands Kootenay
	30-Jun-21	9:58	618943	5463792	-	North of Island, Kootenay
	01-Jul-21	8:35	632450	5447319	-	In Elk Bay
	01-Jul-21	9:32	632127	5447093	12746	Elk Bay
	01-Jul-21	12:40	632050	5447288	-	Elk on bay
	06-Jul-21	12:52	632116	5447332	-	Elk
	07-Jul-21	12:55	625123	5461202	-	Sand
	08-Jul-21	11:00	629701	5449321	12705	-
	08-Jul-21	11:00	629701	5449321	12743	Moved from Gold
	08-Jul-21	11:21	631399	5446841	12749	Elk River
	08-Jul-21	11:32	632095	5447332	12746	-
	08-Jul-21	11:32	632095	5447332	12699	-
	08-Jul-21	11:50	628503	5447185	12737	-
	09-Jul-21	8:01	631961	5447230	12748	-
	09-Jul-21	8:15	631578	5446728	12746	-
	09-Jul-21	8:15	631578	5446728	12699	-
	09-Jul-21	8:20	631578	5446728	12749	-
	09-Jul-21	10:55	628428	5436820	12717	Gold Bay
	09-Jul-21	10:55	628428	5436820	12736	-
	10-Jul-21	8:45	630099	5437110	12730	Gold Bay
	10-Jul-21	9:05	-	-	12733	Gold Bay
	10-Jul-21	9:55	627265	5444835	12753	By Dorr road South of DSELK
	10-Jul-21	10:45	630667	5447528	12749	Elk River
	13-Jul-21	7:53	628545	5447325	12716	-
	13-Jul-21	7:53	628545	5447325	12725	-
	13-Jul-21	7:53	628545	5447325	12742	-
13-Jul-21	7:53	628545	5447325	12745	-	
13-Jul-21	9:10	632791	5448236	12712	-	
14-Jul-21	9:07	628503	5447185	12742	-	
14-Jul-21	9:27	630878	5447073	12749	-	
Sand Creek (SC)	21-Jul-21	8:45	623684	5467686	-	Sand creek
Gold Creek	20-Jul-21	9:00	627555	5438908	-	-
	20-Jul-21	9:30	627519	5439006	-	-
	20-Jul-21	9:45	627310	5438992	-	-
	20-Jul-21	10:15	625962	5440410	-	-
	20-Jul-21	10:51	622315	5442834	-	Farthest upstream
	20-Jul-21	11:15	623028	5442094	-	At road washout
	20-Jul-21	11:30	623960	5441504	-	-
	20-Jul-21	11:46	625727	5440787	-	-
Kootenay River	21-Jul-21	10:27	614110	5477278	-	Kootenay River
	21-Jul-21	10:45	615264	5472254	-	Kootenay River
	21-Jul-21	10:55	614887	5474087	-	Kootenay River
RG_GC	21-Jun	-	626668	5454059	12730	-
RG_USGOLD	21-Jun	-	630811	5439055	12711	-
RG_GRASMERE	21-Jun	-	629326	5441735	12732	-
	21-Jun	-	629326	5441735	12719	-
RG_DSELK	21-Jun	-	627146	5445481	12739	-
	21-Jun	-	627146	5445481	12753	-
RG_SC	21-Jun	-	625623	5457297	12712	-
	21-Jun	-	625623	5457297	12697	-
At Elk Bridge	14-Jul	-	-	-	94	radio tag

Note: "-" indicates no available data.



**Table B.3: Summary of Northern Pike Minnow Tag Detection Information for the Telemetry Study, June to July 2021**

Fish ID	Release Location	Sex	Location Summary				Percentage of Time At Each Station											Percentage of Time in Each Area		
			Total Number of Locations	Total Continuous Hours	Number of Stations	Number of Areas	A Sand	B Sand	C Sand	D Elk	E Elk	Elk Mouth	F Elk	G Gold	H Gold	I Gold	Sand	Elk	Gold	
12-NPM-TAG-GLB	GLB	F	68	2	1	1	100	0	0	0	0	0	0	0	0	0	0	100	0	0
4-NPM-TAG-GLB	GLB	F	6,331	91	6	2	0.42	3.4	3.7	1.6	21	69	0	0	0	0	0	7.6	92	0
21-NPM-TAG-GLB	GLB	F	1,766	27	6	2	0	0	0	18	0.63	0	40	4.1	25	12	0	59	41	
17-NPM-TAG-GLB	GLB	F	8,254	126	8	3	0.43	0.39	0.51	17	2.4	0	15	0.34	64	0	1.3	34	64	
8-NPM-TAG-GLB	GLB	F	2,169	34	5	2	0	0	0	6.4	0	0	25	10	51	6.8	0	32	68	
18-NPM-TAG-GLB	GLB	F	1,767	20	6	2	0	0	0	1.9	2	0	10	2.8	5.8	77	0	14	86	
20-NPM-TAG-GLB	GLB	F	2,462	32	4	2	0	0	0	0	0	0	13	70	2.5	14	0	13	87	
24-NPM-TAG-GLB	GLB	F	2,148	27	5	2	0	0	0	6.2	0	0	0.15	74	15	4.4	0	6.4	94	
3-NPM-TAG-GLB	GLB	F	67,108	601	1	1	0	0	0	0	0	0	0	100	0	0	0	0	100	
6-NPM-TAG-GLB	GLB	F	6,967	131	1	1	0	0	0	0	0	0	0	0	100	0	0	0	100	
7-NPM-TAG-GLB	GLB	F	14,096	200	3	1	0	0	0	0	0	0	0	1.1	86	13	0	0	100	
10-NPM-TAG-GLB	GLB	F	4,984	70	3	1	0	0	0	0	0	0	0	47	45	7.8	0	0	100	
11-NPM-TAG-GLB	GLB	F	59,792	551	2	1	0	0	0	0	0	0	0	100	0.045	0	0	0	100	
16-NPM-TAG-GLB	GLB	F	22,619	375	2	1	0	0	0	0	0	0	0	0	99	0.53	0	0	100	
19-NPM-TAG-GLB	GLB	F	123	2	3	2	0	0	0	0	0	0	0	100	0	0	0	0	100	
22-NPM-TAG-GLB	GLB	F	7,314	118	3	1	0	0	0	0	0	0	0	1.2	96	2.6	0	0	100	
25-NPM-TAG-GLB	GLB	F	2,920	56	2	1	0	0	0	0	0	0	0	1.2	99	0	0	0	100	
27-NPM-TAG-GLB	GLB	F	3,946	59	4	2	0	0	0	0	0	0	0	96	0.77	3.2	0	0	100	
28-NPM-TAG-GLB	GLB	F	3,872	62	2	1	0	0	0	0	0	0	0	34	66	0	0	0	100	
1-NPM-TAG-GLB	GLB	F	1	0	1	1	0	0	0	0	0	0	0	-	0	0	0	0	-	
14-NPM-TAG-GLB	GLB	F	1	0	1	1	0	0	0	0	0	0	0	-	0	0	0	0	-	
5-NPM-TAG-GLB	GLB	M	633	12	3	2	0	0	0	0	0	0	0	53	47	0	0	0	100	
9-NPM-TAG-GLB	GLB	M	1,779	26	2	1	0	0	0	0	0	0	0	10	90	0	0	0	100	
13-NPM-TAG-GLB	GLB	M	22,014	239	5	2	0	0	0	0.63	0.13	0	0.72	0.11	98	0	0	1.5	99	
15-NPM-TAG-GLB	GLB	M	14,318	183	3	1	0	0	0	0	0	0	0	2.8	87	10	0	0	100	
26-NPM-TAG-GLB	GLB	M	3,843	62	3	1	0	0	0	0	0	0	0	88	12	0.23	0	0	100	
29-NPM-TAG-GLB	GLB	M	1,600	23	4	2	0	0	0	0	0	0	43	13	27	17	0	43	57	
36-NPM-TAG-MER	MER	F	2	77	1	1	0	0	0	0	0	0	0	0	100	0	0	0	100	
58-NPM-TAG-MER	MER	F	1	0	1	1	0	0	0	0	0	0	0	-	0	0	0	0	-	
32-NPM-TAG-MER	MER	F	3,279	41	6	2	0	0	0	3.1	1.1	0	2	14	36	44	0	6.3	94	
34-NPM-TAG-MER	MER	F	6,679	82	5	2	0	0	0	23	8.4	0	5	56	7.6	0	0	36	64	
31-NPM-TAG-MER	MER	F	4,919	66	4	2	0	0	0	0	9.3	0	30	57	3.5	0	0	40	60	
43-NPM-TAG-MER	MER	F	927	18	5	2	1.7	0.36	5.6	91	0	0	1.2	0	0	0	7.6	92	0	
56-NPM-TAG-MER	MER	F	2,209	24	6	3	1.7	0	3.8	3.3	75	0	17	0	0	0	5.5	94	0	
48-NPM-TAG-MER	MER	F	5,138	69	6	3	0.21	0.19	0.84	28	0	0	67	3.1	0	0	1.2	96	3.1	
49-NPM-TAG-MER	MER	F	12,892	134	7	3	1.2	1.1	1.7	1.6	93	1.6	0	0	0	0	4	96	0	
33-NPM-TAG-MER	MER	F	31,562	404	3	1	0	0	0	2.1	1.1	0	97	0	0	0	0	100	0	
35-NPM-TAG-MER	MER	F	344	5	2	1	0	0	0	88	0	0	12	0	0	0	0	100	0	
37-NPM-TAG-MER	MER	F	7,643	87	4	1	0	0	0	2.6	78	17	2.7	0	0	0	0	100	0	
39-NPM-TAG-MER	MER	F	14,784	237	4	1	0	0	0	0.097	30	69	0.33	0	0	0	0	100	0	
42-NPM-TAG-MER	MER	F	7,250	96	5	2	0	0	0	18	56	20	6.1	0.29	0	0	0	100	0.29	
52-NPM-TAG-MER	MER	F	467	6	1	1	0	0	0	100	0	0	0	0	0	0	0	100	0	
55-NPM-TAG-MER	MER	F	11,942	152	4	1	0	0	0	36	39	24	1.7	0	0	0	0	100	0	
30-NPM-TAG-MER	MER	M	85	1	3	2	0	0	0	0	0	0	0	100	0	0	0	0	100	
38-NPM-TAG-MER	MER	M	496	6	4	2	0	0	0	1.8	0	0	72	14	12	0	0	74	26	
40-NPM-TAG-MER	MER	M	25,947	305	3	1	0	0	0	0	95	0.41	4.4	0	0	0	0	100	0	
41-NPM-TAG-MER	MER	M	547	5	3	1	0	0	0	25	5.1	0	70	0	0	0	0	100	0	
45-NPM-TAG-MER	MER	M	3,850	42	5	2	0	0	2.3	2.1	71	13	12	0	0	0	2.3	98	0	
46-NPM-TAG-MER	MER	M	4,536	66	3	1	0	0	0	8.4	59	0	33	0	0	0	0	100	0	
47-NPM-TAG-MER	MER	M	253	5	2	1	0	0	0	94	0	0	5.7	0	0	0	0	100	0	
50-NPM-TAG-MER	MER	M	11,062	113	7	2	0.11	0.25	0.43	0.5	92	3.8	2.8	0	0	0	0.78	99	0	
53-NPM-TAG-MER	MER	M	898	12	3	1	0	0	0	30	30	0	40	0	0	0	0	100	0	
54-NPM-TAG-MER	MER	M	3,910	35	3	1	0	0	0	12	61	0	27	0	0	0	0	100	0	

Notes: Continuous blocks of time were defined as a time series of locations at a given location and day with less than a 10 minute gap. "-" = individual located at station once, but not again resulting in ) continuous hours. Five individuals (1-NPM-TAG-GLB; 23-NPM-TAG-GLB; 44-NPM-TAG-MER; 51-NPM-TAG-MER; 57-NPM-TAG-MER) were never relocated after their release and are not included in the summary. GLB = Gold Bay and MER = Mouth of the Elk River.

**Table B.4: Average Proportion of Hours Spent by Tagged Northern Pikeminnow at Each Study Area by Daily Period, June to July 2021**

<b>Station</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>	<b>Sunrise</b>
G Gold	55%	14%	19%	12%
H Gold	57%	13%	18%	12%
I Gold	55%	19%	17%	9%
D Elk	59%	6%	20%	14%
E Elk	59%	11%	18%	11%
F Elk	60%	10%	18%	13%
Elk Mouth	61%	8%	21%	10%
A Sand	56%	22%	12%	10%
B Sand	50%	13%	29%	8%
C Sand	61%	10%	18%	10%

Notes: day = 07:00 to 21:00 (58%), evening = 21:00 to 00:00 (8%), night = 00:00 to 05:00 (25%), and sunrise = 05:00 to 07:00 (8%). Percent of each time period (indicated in the brackets for each daily period designation above) was calculated by taking the duration of each daily period and dividing it by 24 hours. Daily period time frames were chosen based on daylight hours at the study location during the time of project implementation.

## **APPENDIX C**

**Table C.1: Severity Scale to Assess External and Internal Fish Anomalies**

Scale	Body Surface (A)	Body Form (B)	Lesions (C)	Tumours (D)	Fins (E)	Lips/Jaws/Snout (F)	Eyes (G)	Gills (H)	Opercula (I)	Infection (fungus, bacteria, virus) (J)	Parasites (K)
0	Normal; no aberrations	Normal	None	None	No active erosion	Normal, no lesions, swelling, tears etc.	No aberrations; good "clear" eye	Normal; No apparent aberrations	Normal; both opercula intact and complete	No observed infections	No observed parasites
1	Slight inflammation or reddening	Slight spinal curvature	Tears or wounds on caudal fins, pectoral or dorsal fins.	Tumour present, but localized and with no signs of sloughing/ulceration	Light active erosion	Swelling on or around lips, mouth or snout	Swollen or protruding eyes	Gills with light, discolored margin along tips of the lamellae	Slight shortening of one or both opercula, gills covered	Minor, spatially isolated infection Note % of body covered:_____	Few observed parasites (#:_____)
2	Moderate inflammation or reddening	One of lordosis, kyphosis or scoliosis	Lesions or wounds on side of body	More than one tumour or one large tumour with no/minor sloughing/ulceration	Moderate active erosion with some hemorrhaging	Small punctures or lesions	Hemorrhaging eye(s) or blind in one or both eyes	Frayed; erosion of tips of gill lamellae resulting in "ragged" gills	Moderate shortening of one or both opercula, gills exposed	Moderate infection or more than one body surface affected Note % of body covered:_____	Moderate parasite infestation (#:_____)
3	Severe inflammation or reddening	Signs of lordosis and kyphosis and scoliosis	Many lesions, rips or tears on body and on fins. Possibly on face as well.	One or more large tumour that may impair breathing/feeding/swimming performance; signs of ulceration and/or sloughing	Severe active erosion with hemorrhaging	Tears, hanging maxilla, missing lips	Missing eye(s)	Clubbed; swelling of the tips of the gill lamellae	One or both opercula substantially shortened or missing, gills completely exposed	Infection covering large spatial area (>25% of surface) Note % of body covered:_____	Numerous parasites (#:_____)
Flag for Follow-up	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N

Notes: Lordosis refers to the inward curvature of the spine, kyphosis refers to the outward curvature of the spine, and scoliosis refers to the sideways curvautre of the spine. All fish will be photodocumented and flagged for follow-up with a qualified professional (e.g., fish pathologist) if ucertainities are present.

**Table C.1: Severity Scale to Assess External and Internal Fish Anomalies**

Scale	Infections (L)	Tumors (M)	Parasites (N)	Internal Cavity Wall (O)	Non-Reproductive Organs (P)	Reproductive Organs (Q)
0	No observed infections	None	No observed parasites	Normal; no hemorrhaging	Normal, no lesions, discoloration, or tears; organ size proportionate to body size	Normal
1	Minor, spatially isolated infection Note % of organs covered: _____	Tumour present, but localized and with no signs of sloughing/ulceration	Few observed parasites (#: _____)	Light hemorrhaging	Light discoloration, no lesions or tears; organ size proportionate to body size	Light discoloration in organ wall, eggs or milt
2	Moderate infection or more than one organ surface affected Note % of organs covered: _____	More than one tumour or one large tumour with no/minor sloughing/ulceration	Moderate parasite infestation (#: _____)	Moderate hemorrhaging	Moderate discoloration, some lesions and/or tears; organ size proportionally smaller than body size	Moderate discoloration in organ wall, eggs and milt
3	Infection covering large spatial area (>25% of surface) Note % of organs covered: _____	One or more large tumour that may impair breathing/feeding/swimming performance; signs of ulceration and/or sloughing	Numerous parasites (#: _____)	Significant hemorrhaging	Complete discoloration, multiple lesions and tears; organ size significantly smaller than body size	Complete discoloration of organ wall, calcification of eggs
Flag for Follow-up	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N

Notes: Lordosis refers to the inward curvature of the spine, kyphosis refers to the outward curvature of the spine, and scoliosis refers to the sideways curvautre of the spine. All fish will be photodocumented and flagged for follow-up with a qualified professional (e.g., fish pathologist) if ucertainities are present.



Table C.2: Gill Net Records for Fish Caught During the 2021 Northern PikeMinnow Selenium Toxicity Study, June to July 2021

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Time (hours)	Effort (m <sup>2</sup> hrs/100m)	Depth Range (m)		Set		Northern PikeMinnow					Bulltrout		Largescale Sucker		Longnose Sucker		Mountain Whitefish		Peamouth		Rainbow Trout		White Sucker							
		Eastings	Northings							Length (ft)	Mesh (inches)	Catch	Mesh Size Caught In			mortalities/sacrificed	tagged and released	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>		
													3	4	5																							
Gold Bay (GB)	GB-GN-03	630141	5436847	08-Jun-21	08-Jun-21	14:47	15:15	0.47	0.21	1.5	3.0	150	3-5	1	0	0	1	0	0	4.687	0	0.000	3	14.0607	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000
	GB-GN-04	629906	5436838	08-Jun-21	08-Jun-21	14:50	15:20	0.50	0.08	1.5	3.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000		
	GB-GN-01	629478	5437471	08-Jun-21	08-Jun-21	14:00	14:30	0.50	0.15	1	4.0	100	3-5	2	2	0	0	0	0	13.123	0	0.000	1	6.5617	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-02	629640	5437422	08-Jun-21	08-Jun-21	14:20	14:41	0.35	0.05	1.5	2.5	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	1	18.7477		
	GB-GN-A	630294	5437003	10-Jun-21	10-Jun-21	12:45	13:15	0.50	0.23	2	6.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-B	630228	5436880	10-Jun-21	10-Jun-21	12:55	13:29	0.57	0.17	2	8.0	100	3	3	3	-	-	0	3	17.369	0	0.000	4	23.1589	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-C	630342	5436997	10-Jun-21	10-Jun-21	13:18	13:48	0.50	0.23	0	8.0	150	3-5	2	1	1	0	0	2	8.749	0	0.000	9	39.3701	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	1	4.3745		
	GB-GN-D	630228	5436856	10-Jun-21	10-Jun-21	13:42	14:20	0.63	0.19	2	7.0	100	3	0	0	-	-	0	0	0.000	0	0.000	4	20.7211	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	1	5.1803		
	GB-GN-E	630212	5436838	10-Jun-21	10-Jun-21	14:25	14:55	0.50	0.15	2	7.0	100	3	1	1	-	-	0	1	6.562	0	0.000	3	19.6850	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-F	630053	5436854	10-Jun-21	10-Jun-21	14:35	15:05	0.50	0.23	2	8.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	2	8.7489	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	8	34.9956		
	GB-GN-G	630272	5436930	10-Jun-21	10-Jun-21	15:00	15:40	0.67	0.20	2	7.0	100	3	2	2	-	-	0	2	9.843	0	0.000	3	14.7638	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	7	34.4488		
	GB-GN-H	630369	5437002	10-Jun-21	10-Jun-21	15:15	15:50	0.58	0.27	2	8.0	150	3-5	1	1	0	0	0	1	3.750	0	0.000	7	26.2467	1	3.7495	0	0.000	0	0.0000	0	0.000	0	0.0000	2	7.4991		
	GB-GN-I	630239	5436879	10-Jun-21	10-Jun-21	15:50	16:20	0.50	0.15	2	7.0	100	3	1	1	-	-	0	1	6.562	0	0.000	5	32.8084	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-J	630313	5436989	10-Jun-21	10-Jun-21	16:00	16:30	0.50	0.23	2	8.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	4	17.4978	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-K	630116	5436812	10-Jun-21	10-Jun-21	16:30	17:00	0.50	0.15	2	7.0	100	3	0	0	-	-	0	0	0.000	0	0.000	1	6.5617	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-L	629898	5436832	10-Jun-21	10-Jun-21	16:40	17:15	0.58	0.27	1	8.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	4	14.9981	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	1	3.7495		
	GB-GN-M	630225	5436868	10-Jun-21	10-Jun-21	17:05	17:35	0.50	0.15	2	7.0	100	3	0	0	-	-	0	0	0.000	0	0.000	4	26.2467	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-N	629690	5436583	10-Jun-21	10-Jun-21	17:25	17:55	0.50	0.23	2	7.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	6	26.2467	1	4.3745	0	0.000	0	0.0000	0	0.000	1	4.3745	0	0.0000		
	GB-GN-O	629825	5436745	10-Jun-21	10-Jun-21	17:40	18:10	0.50	0.15	2	7.0	100	3	0	0	-	-	0	0	0.000	0	0.000	3	19.6850	0	0.0000	1	6.562	0	0.0000	0	0.000	1	6.5617	0	0.0000		
	GB-GN-P	630314	5436996	10-Jun-21	10-Jun-21	18:00	18:30	0.50	0.23	2	8.0	150	3-5	1	1	0	0	0	1	4.374	0	0.000	3	13.1234	1	4.3745	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-Q	629062	5437092	10-Jun-21	10-Jun-21	18:20	18:40	0.33	0.10	2	7.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-01	635896	5433727	10-Jun-21	10-Jun-21	12:51	13:15	0.40	0.10	2	5.0	80	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-02	629636	5437433	10-Jun-21	10-Jun-21	13:05	13:55	0.83	0.25	2	5.0	100	4	0	-	0	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-03	630505	5437304	10-Jun-21	10-Jun-21	14:01	14:35	0.57	0.14	3	8.0	80	4-5	5	-	1	4	0	0	36.186	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-04	630448	5437328	10-Jun-21	10-Jun-21	14:09	14:40	0.52	0.16	2	5.0	100	4	0	-	0	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-05	630476	5437293	10-Jun-21	10-Jun-21	15:26	16:00	0.57	0.14	5	8.0	80	5	0	-	-	0	0	0	0.000	0	0.000	1	7.2371	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-06	630447	5437293	10-Jun-21	10-Jun-21	15:33	16:15	0.70	0.21	2	4.0	100	4	2	-	2	-	0	0	9.374	0	0.000	1	4.6889	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-07	630505	5437304	10-Jun-21	10-Jun-21	16:13	16:45	0.53	0.13	5	8.0	80	5	1	-	-	1	1	0	7.689	1	7.689	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-08	630447	5437297	10-Jun-21	10-Jun-21	16:33	16:55	0.37	0.09	3	8.0	80	4	0	-	0	-	0	0	0.000	0	0.000	12	134.2162	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-09	630476	5437293	10-Jun-21	10-Jun-21	16:55	17:27	0.53	0.13	2	5.0	80	5	0	-	-	0	0	0	0.000	0	0.000	2	15.3789	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-10	630447	5437293	10-Jun-21	10-Jun-21	17:10	17:43	0.55	0.17	3	10.0	100	4	0	-	0	-	0	0	0.000	0	0.000	4	23.8607	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-11	629099	5437063	10-Jun-21	10-Jun-21	17:40	18:10	0.50	0.12	2	6.0	80	5	5	-	-	5	0	0	41.010	0	0.000	2	16.4042	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-12	629591	5437394	10-Jun-21	10-Jun-21	18:04	18:31	0.45	0.14	2	6.0	100	4-5	0	-	0	0	0	0	0.000	1	7.291	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-13	629056	5437046	10-Jun-21	10-Jun-21	18:29	18:55	0.43	0.11	1	4.0	80	4-5	2	-	1	1	0	0	18.928	0	0.000	2	18.9279	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GC-GN-14	629302	5437194	10-Jun-21	10-Jun-21	18:37	19:04	0.45	0.14	2	5.0	100	4	1	-	1	-	0	0	7.291	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-01	628678	5436923	24-Jun-21	24-Jun-21	12:33	13:00	0.45	0.14	1	3.0	100	3-5	1	0	1	0	0	0	7.291	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-02	628753	5436914	24-Jun-21	24-Jun-21	13:10	13:30	0.33	0.10	3	5.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	9.8425	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		
	GB-GN-03	628960	5437033	24-Jun-21	24-Jun-21	13:25	13:50	0.42	0.06	5	5.5	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000		

Table C.2: Gill Net Records for Fish Caught During the 2021 Northern PikeMinnow Selenium Toxicity Study, June to July 2021

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Time (hours)	Effort (m <sup>2</sup> hrs/100m)	Depth Range (m)		Set		Northern PikeMinnow					Bulltrout		Largescale Sucker		Longnose Sucker		Mountain Whitefish		Peamouth		Rainbow Trout		White Sucker							
		Easting	Northing							Length (ft)	Mesh (inches)	Catch	Mesh Size Caught In			mortalities/sacrificed	tagged and released	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>		
													3	4	5																							
Gold Bay	GB-GN-05	630087	5436832	29-Jul-21	29-Jul-21	9:21	9:58	0.62	0.14	2.2	14.7	75	3-5	0	0	0	0	0	0.000	0	0.000	1	7.0937	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	
	GB-GN-06	630295	5436959	29-Jul-21	29-Jul-21	9:53	10:16	0.38	0.09	2.8	24.1	75	3-5	1	1	0	0	0	11.412	0	0.000	3	34.2349	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	
Mouth of the Elk River (MER)	ER-GN-01	628649	5447420	11-Jun-21	11-Jun-21	11:50	12:20	0.50	0.12	1	10.0	80	4-5	3	-	1	2	0	3	24.606	0	0.000	4	32.8084	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000
	ER-GN-02	629103	5447449	11-Jun-21	11-Jun-21	12:06	12:35	0.48	0.15	2	8.0	100	3	0	0	-	-	0	0	0.000	0	0.000	3	20.3638	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	1	6.7879		
	ER-GN-03	628649	5447420	11-Jun-21	11-Jun-21	12:34	13:04	0.50	0.12	1	10.0	80	4-5	0	-	0	0	0	0.000	1	8.202	3	24.6063	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.0000	
	ER-GN-04	629375	5447172	11-Jun-21	11-Jun-21	12:46	13:20	0.57	0.17	2	6.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	9	52.1075	0	0.000	0	0.0000	0	0.000	4	23.1589				
	ER-GN-05	628696	5447486	11-Jun-21	11-Jun-21	13:15	13:54	0.65	0.16	1	8.0	80	4-5	0	-	0	0	0	0	0.000	1	6.309	0	0.0000	4	25.2372	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-06	629190	5447343	11-Jun-21	11-Jun-21	13:16	14:05	0.82	0.25	2	8.0	100	3	0	0	-	-	0	0	0.000	0	0.000	12	48.2083	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-07	628581	5447368	11-Jun-21	11-Jun-21	14:09	14:40	0.52	0.13	1	6.0	80	4-5	2	-	1	1	0	2	15.875	0	0.000	4	31.7501	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-08	630814	5447074	11-Jun-21	11-Jun-21	14:27	15:15	0.80	0.24	1	4.0	100	4	1	-	0	-	0	1	4.101	0	0.000	4	16.4042	1	4.1010	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000		
	ER-GN-09	628581	5447368	11-Jun-21	11-Jun-21	14:47	15:35	0.80	0.20	1	4.0	80	4-5	1	-	1	0	0	1	5.126	0	0.000	6	30.7579	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-10	628858	5447551	11-Jun-21	11-Jun-21	15:30	16:04	0.57	0.17	1	4.0	100	4	0	-	0	-	0	0	0.000	0	0.000	4	23.1589	1	5.7897	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-11	628632	5447455	11-Jun-21	11-Jun-21	15:46	16:26	0.67	0.16	2	6.0	80	4-5	4	-	3	1	0	4	24.606	2	12.303	6	36.9094	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-12	628571	5447275	11-Jun-21	11-Jun-21	16:26	16:37	0.18	0.06	2	8.0	100	4	2	-	2	-	0	2	35.791	1	17.895	4	71.5820	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-A	628156	5446526	11-Jun-21	11-Jun-21	11:30	12:15	0.75	0.23	1	8.0	100	3	0	0	-	-	0	0	0.000	0	0.000	12	52.4934	0	0.0000	0	0.000	0	0.0000	1	4.374	0	0.0000				
	ER-GN-B	628375	5446793	11-Jun-21	11-Jun-21	11:35	12:40	1.08	0.50	1	8.0	150	3-5	3	3	0	0	0	3	6.057	0	0.000	21	42.3985	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-C	628104	5446506	11-Jun-21	11-Jun-21	12:25	13:10	0.75	0.23	1	8.0	100	3	2	2	-	-	0	2	8.749	0	0.000	4	17.4978	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-D	628368	5446789	11-Jun-21	11-Jun-21	12:45	13:15	0.50	0.23	1	8.0	150	3-5	4	2	1	1	0	4	17.498	0	0.000	9	39.3701	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-E	628113	5446511	11-Jun-21	11-Jun-21	13:15	13:55	0.67	0.20	1	8.0	100	3	1	1	-	-	0	1	4.921	0	0.000	8	39.3701	1	4.9213	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-F	628377	5446790	11-Jun-21	11-Jun-21	13:50	14:20	0.50	0.23	1	8.0	150	3-5	1	0	1	0	0	1	4.374	0	0.000	19	83.1146	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-G	627997	5446334	11-Jun-21	11-Jun-21	14:10	15:00	0.83	0.25	1	8.0	100	3	2	2	-	-	0	2	7.874	0	0.000	16	62.9921	1	3.9370	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-H	628351	5446748	11-Jun-21	11-Jun-21	14:40	15:35	0.92	0.42	1	8.0	150	3-5	0	0	-	-	0	0	0.000	0	0.000	9	21.4746	1	2.3861	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-I	628092	5446490	11-Jun-21	11-Jun-21	15:05	16:00	0.92	0.28	1	8.0	100	3	6	6	-	-	0	3	21.475	0	0.000	8	28.6328	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-J	628415	5447043	11-Jun-21	11-Jun-21	15:40	16:50	1.17	0.53	1	7.0	150	3-5	4	4	0	0	0	0	7.499	0	0.000	19	35.6205	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-K	628120	5446515	11-Jun-21	11-Jun-21	16:05	16:20	0.25	0.08	1	8.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-01	628710	5447530	23-Jun-21	23-Jun-21	14:55	15:15	0.33	0.10	1	15.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	1	9.8425	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-02	628611	5447423	23-Jun-21	23-Jun-21	15:03	15:20	0.28	0.04	5	13.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	1	23.1589	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-03	628710	5447530	23-Jun-21	23-Jun-21	15:30	15:50	0.33	0.10	2	12.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	5	49.2126	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-04	628387	5446938	23-Jun-21	23-Jun-21	15:25	15:45	0.33	0.05	2	-	50	3-5	26	15	1	0	0	0	511.811	2	39.370	0	0.0000	6	118.1102	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-05	628405	5446764	24-Jun-21	24-Jun-21	15:07	15:25	0.30	0.09	7	15.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	6	65.6168	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-06	628071	5446507	24-Jun-21	24-Jun-21	15:12	15:39	0.45	0.07	9	12.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-07	628313	5446600	24-Jun-21	24-Jun-21	15:30	16:00	0.50	0.15	3.5	17.0	100	3-5	5	5	0	0	0	0	32.808	1	6.562	12	78.7402	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-08	631003	5447003	25-Jun-21	25-Jun-21	11:32	12:00	0.47	0.14	2	10.0	100	3-5	12	1	0	2	0	0	84.364	0	0.000	16	112.4859	1	7.0304	0	0.000	0	0.0000	0	0.000	0	0.000	0	0.0000		
	ER-GN-09	631010	5447013	26-Jun-21	26-Jun-21	9:50	10:20	0.50	0.15	1	7.0	100	3-5	1	1	0	0	0	0	6.562	0	0.000	9	59.0														



Table C.2: Gill Net Records for Fish Caught During the 2021 Northern PikeMinnow Selenium Toxicity Study, June to July 2021

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Time (hours)	Effort (m <sup>2</sup> hrs/100m)	Depth Range (m)		Set		Northern PikeMinnow					Bulltrout		Largescale Sucker		Longnose Sucker		Mountain Whitefish		Peamouth		Rainbow Trout		White Sucker																
		Easting	Northing							Length (ft)	Mesh (inches)	Catch	Mesh Size Caught In			mortalities/sacrificed	tagged and released	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>											
													3	4	5																																
Mouth of the Elk River (MER)	ER-GN-04	632169	5448050	11-Jul-21	11-Jul-21	7:59	8:28	0.48	0.07	3	3.0	50	3-5	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000
	ER-GN-04	632256	5448332	11-Jul-21	11-Jul-21	8:10	8:40	0.50	0.15	1	8.0	100	3-5	0	0	0	0	0	0.000	0	0.000	1	6.5617	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000
	ER-GN-05	632690	5448398	11-Jul-21	11-Jul-21	8:30	9:00	0.50	0.08	1	5.0	50	3	0	0	-	-	0	0	0.000	0	0.000	1	13.1234	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	
	ER-GN-05	632709	5448131	11-Jul-21	11-Jul-21	8:37	9:03	0.43	0.07	4.1	3.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	
	ER-GN-06	632761	5448178	11-Jul-21	11-Jul-21	8:40	9:06	0.43	0.07	2	3.5	50	3-5	1	0	0	0	0	0	15.142	1	15.142	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-06	632447	5448304	11-Jul-21	11-Jul-21	9:00	9:35	0.58	0.18	1	7.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	5.6243	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-08	632885	5448359	13-Jul-21	13-Jul-21	9:00	9:30	0.50	0.15	1	2.4	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	6.5617	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-09	632806	5448212	13-Jul-21	13-Jul-21	9:08	9:38	0.50	0.08	1	3.0	50	3	3	3	-	-	0	0	39.370	0	0.000	1	13.1234	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-07	632652	5448419	11-Jul-21	11-Jul-21	9:10	9:45	0.58	0.09	1	7.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-07	632757	5448172	11-Jul-21	11-Jul-21	9:12	9:40	0.47	0.07	2	3.7	50	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-08	632800	5448185	11-Jul-21	11-Jul-21	9:15	9:42	0.45	0.07	1	4.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-10	632734	5448171	13-Jul-21	13-Jul-21	9:45	10:13	0.47	0.14	3.5	1.7	100	3-5	1	0	0	0	0	0	7.030	0	0.000	1	7.0304	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-11	632648	5448141	13-Jul-21	13-Jul-21	9:50	10:21	0.52	0.08	2.1	3.1	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-12	632697	5448114	13-Jul-21	13-Jul-21	10:22	10:52	0.50	0.15	3.5	-	100	3-5	0	0	0	0	0	0	0.000	0	0.000	3	19.6850	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-13	632239	5448230	13-Jul-21	13-Jul-21	10:40	11:02	0.37	0.06	1.8	3.0	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-14	632770	5448237	14-Jul-21	14-Jul-21	9:42	10:11	0.48	0.15	1.2	2.1	100	3-5	1	0	1	0	0	0	6.788	0	0.000	1	6.7879	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-15	632847	5448287	14-Jul-21	14-Jul-21	9:52	10:25	0.55	0.08	1	2.2	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-16	632760	5448204	14-Jul-21	14-Jul-21	10:22	10:52	0.50	0.15	0.8	3.0	100	3-5	1	0	1	0	0	0	6.562	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-17	632882	5448347	14-Jul-21	14-Jul-21	10:30	10:58	0.47	0.07	0.5	2.2	50	3	0	-	-	-	0	0	0.000	0	0.000	1	14.0607	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-18	632258	5448140	14-Jul-21	14-Jul-21	11:10	11:35	0.42	0.13	2	2.5	100	3-5	1	0	0	0	0	0	7.874	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-19	632246	5448082	14-Jul-21	14-Jul-21	11:15	11:40	0.42	0.06	2	3.5	50	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-20	632773	5448249	15-Jul-21	15-Jul-21	10:45	11:15	0.50	0.23	2	3.5	150	3-5	5	0	0	0	0	0	21.872	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-21	632773	5448175	15-Jul-21	15-Jul-21	11:25	11:50	0.42	0.19	1	4.0	150	3-5	2	2	-	-	0	0	10.499	0	0.000	1	5.2493	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-22	632739	5448339	16-Jul-21	16-Jul-21	10:20	10:50	0.50	0.23	1	3.0	150	3-5	2	0	0	2	0	0	8.749	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-23	632728	5448199	16-Jul-21	16-Jul-21	10:30	11:02	0.53	0.16	1	3.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	6.1516	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-24	632794	5448236	16-Jul-21	16-Jul-21	11:00	11:36	0.60	0.27	1	3.0	150	3-5	2	0	0	2	0	0	7.291	0	0.000	0	0.0000	0	0.0000	1	3.645	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-25	632905	5448383	16-Jul-21	16-Jul-21	11:11	11:32	0.35	0.11	1	2.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	9.3738	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-26	632781	5448228	16-Jul-21	16-Jul-21	11:50	12:19	0.48	0.22	1	3.0	150	3-5	1	0	1	0	0	0	4.525	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-28	632762	5448227	17-Jul-21	17-Jul-21	10:30	11:00	0.50	0.15	1	3.5	100	3-5	1	0	0	0	0	0	6.562	0	0.000	0	0.0000	0	0.0000	1	6.562	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000			
	ER-GN-29	632785	5448192	17-Jul-21	17-Jul-21	11:15	11:45	0.50	0.15	1	3.5	100	3-5	0	0	0	0	0	0	0.000	0	0.000	1	6.5617	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	1	6.562	0	0.0000	0	0.000	0	0.0000			
	ER-GN-27	632819	5448339	17-Jul-21	17-Jul-21	12:00	12:27	0.45	0.14	1	2.0	100	3-5	0	0	0	0	0	0	0.000	0	0.000	3	21.8723	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.000	0	0.0000							





Table C.2: Gill Net Records for Fish Caught During the 2021 Northern Pike minnow Selenium Toxicity Study, June to July 2021

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Time (hours)	Effort (m <sup>2</sup> hrs/100m)	Depth Range (m)		Set		Northern Pike minnow					Bulltrout		Largescale Sucker		Longnose Sucker		Mountain Whitefish		Peamouth		Rainbow Trout		White Sucker													
		Easting	Northing							Length (ft)	Mesh (inches)	Catch	Mesh Size Caught In			mortalities/ sacrificed	tagged and released	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>								
													3	4	5																													
Sand Creek (SC)	SC-GN-03	620251	5461888	06-Jul	06-Jul	9:26	10:04	0.63	0.19	0.5	8.5	100	3	0	0	-	-	0	0	0.000	0	0.000	2	10.3605	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000
	SC-GN-04	620182	5461887	07-Jul	07-Jul	8:44	9:08	0.40	0.18	1	18	150	3-5	0	0	0	0	0	0	0.000	0	0.000	1	5.4681	0	0.0000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000
	SC-GN-05	620182	5461887	07-Jul	07-Jul	8:45	9:15	0.50	0.23	1	15	150	3-5	0	0	0	0	0	0	0.000	0	0.000	3	13.1234	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-06	617674	5467130	07-Jul	07-Jul	9:45	10:11	0.43	0.20	1	11	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	1	5.047	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000				
	SC-GN-07	617673	5467128	07-Jul	07-Jul	10:00	10:23	0.38	0.18	1.8	11.3	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-01	623519	5463166	09-Jul-21	09-Jul-21	12:53	13:08	0.25	0.08	1	2.0	100	3	3	3	-	-	0	0	39.370	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-01	618136	5466685	14-Jul-21	14-Jul-21	8:12	8:38	0.43	0.13	2	13.0	100	3	0	0	-	-	0	0	0.000	0	0.000	1	7.5712	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-02	618041	5466702	14-Jul-21	14-Jul-21	8:14	8:42	0.47	0.21	3	11.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-03	617991	5466803	14-Jul-21	14-Jul-21	8:46	9:15	0.48	0.22	2	6.5	150	3-5	1	1	0	0	0	0	4.525	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-04	617803	5466960	14-Jul-21	14-Jul-21	8:50	9:19	0.48	0.15	2.5	12.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-05	617971	5466912	14-Jul-21	14-Jul-21	9:19	9:44	0.42	0.19	2	13.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-06	617666	5467140	14-Jul-21	14-Jul-21	9:26	9:52	0.43	0.13	2	6.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-07	617982	5466831	14-Jul-21	14-Jul-21	9:49	10:14	0.42	0.19	1.5	9.0	150	3-5	1	1	0	0	0	0	5.249	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-08	618240	5467143	14-Jul-21	14-Jul-21	9:59	10:26	0.45	0.14	2	8.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-09	617899	5467481	14-Jul-21	14-Jul-21	10:32	10:57	0.42	0.13	1.5	7.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-10	617859	5467580	14-Jul-21	14-Jul-21	10:34	11:00	0.43	0.20	1.5	1.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-11	617293	5467749	14-Jul-21	14-Jul-21	11:07	11:32	0.42	0.19	3	5.0	150	3-5	1	1	0	0	0	0	5.249	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-12	617117	5467871	14-Jul-21	14-Jul-21	11:10	11:40	0.50	0.15	0.5	2.3	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-13	617031	5467966	14-Jul-21	14-Jul-21	11:45	12:13	0.47	0.14	1.5	4.5	100	3	0	0	-	-	0	0	0.000	0	0.000	1	7.0304	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-13	616949	5468047	14-Jul-21	14-Jul-21	11:47	12:15	0.47	0.21	2	3.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-14	616996	5468018	14-Jul-21	14-Jul-21	12:22	12:49	0.45	0.21	1.5	7.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	1	4.8605	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-15	616871	5468179	14-Jul-21	14-Jul-21	12:25	12:53	0.47	0.14	7	7.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-16	617134	5468672	14-Jul-21	14-Jul-21	13:01	13:28	0.45	0.14	0.5	5.0	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-17	616759	5469126	14-Jul-21	14-Jul-21	13:06	13:33	0.45	0.21	4	4.0	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-18	616156	5468916	14-Jul-21	14-Jul-21	13:42	14:01	0.32	0.10	1.5	6.5	100	3	1	1	-	-	0	0	10.361	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-19	616253	5468970	14-Jul-21	14-Jul-21	13:45	14:09	0.40	0.18	1.5	6.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-01	616181	5468869	15-Jul-21	15-Jul-21	6:56	7:24	0.47	0.21	0.5	6.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-02	616181	5468869	15-Jul-21	15-Jul-21	6:58	7:32	0.57	0.17	1.5	4.5	100	3	0	0	-	-	0	0	0.000	0	0.000	1	5.7897	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-03	616187	5468929	15-Jul-21	15-Jul-21	7:30	7:53	0.38	0.18	1	6.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	1	5.7058	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-04	616326	5468928	15-Jul-21	15-Jul-21	7:38	8:05	0.45	0.14	1	5.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-05	616497	5468620	15-Jul-21	15-Jul-21	8:01	8:28	0.45	0.21	2	6.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-06	617026	5468031	15-Jul-21	15-Jul-21	8:18	8:42	0.40	0.12	2	4.5	100	3	0	0	-	-	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000	0	0.000	0	0.0000		
	SC-GN-07	617045	5467963	15-Jul-21	15-Jul-21	8:37	9:00	0.38	0.18	2.5	6.5	150	3-5	0	0	0	0	0	0	0.000	0	0.000	0	0.0000	0	0.0000	0	0.000	0	0.0000	0	0												



**Table C.3: Hoop Net Records for Fish Caught During the 2021 Northern Pikeminnow Selenium Toxicity Study, June to July 2021**

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Removal Time	Fishing Hours (hrs)	Effort (Fishing days)	Depth Range (m)		Net Size	Northern Pikeminnow			Bull Trout		Golden Shiner		Largescale Sucker		Longnose Sucker		Peamouth		Redside Shiner		White Sucker		Yellow Perch	
		Eastings	Northing							Catch	Mortalities/ Sacrificed		CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>
Gold Bay (GLB)	GB-HN-01	628917	5436640	08-Jun-21	09-Jun-21	12:10	10:35	22.42	0.934	1	1.5	2.5'	2	0	2.141	0	0.000	4	4.283	2	2.141	0	0.000	1	1.071	1	1.071	0	0.000	11	11.777
	GB-HN-02	635367	5433948	08-Jun-21	09-Jun-21	12:52	11:15	22.38	0.933	1	2	2.5'	0	0	0.000	0	0.000	0	0.000	1	1.072	0	0.000	1	1.072	3	3.217	0	0.000	0	0.000
	GB-HN-03	628917	5436640	09-Jun-21	10-Jun-21	10:50	11:20	24.50	1.021	1	1.5	2.5'	4	0	3.918	1	0.980	0	0.000	2	1.959	0	0.000	1	0.980	0	0.000	0	0.000	1	0.980
	GB-HN-04	636210	5434219	09-Jun-21	10-Jun-21	11:40	12:07	24.45	1.019	2	5	2.5'	3	0	2.945	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	7	6.871
	GB-HN-05	628917	5436640	10-Jun-21	11-Jun-21	12:00	18:00	30.00	1.250	1	1.5	2.5'	0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
	GB-HN-06	636210	5434219	10-Jun-21	11-Jun-21	12:15	18:00	29.75	1.240	2	5	2.5'	0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
	GB-HN-07	630352	5439883	26-Jun-21	27-Jun-21	14:15	12:12	21.95	0.915	0	8	2.5'	2	1	2.187	0	0.000	0	0.000	0	0.000	0	0.000	1	1.093	0	0.000	0	0.000	0	0.000
	GB-HN-08	630352	5439883	27-Jun-21	28-Jun-21	12:30	11:30	23.00	0.958	0	8	2.5'	9	0	9.391	0	0.000	0	0.000	1	1.043	0	0.000	1	1.043	2	2.087	0	0.000	4	4.174
Mouth of the Elk River (MER)	ER-HN-01	630918	5447015	26-Jun-21	27-Jun-21	9:40	10:55	25.25	1.052	1	8	2.5'	1	0	0.950	0	0.000	0	0.000	4	3.802	0	0.000	3	2.851	0	0.000	0	0.000	0	0.000
	ER-HN-02	631731	5446834	27-Jun-21	27-Jun-21	10:30	15:00	4.50	0.188	1	7	2.5'	0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
Sand Creek (SC)	SC-HN-01	618935	5464212	02-Jul-21	03-Jul-21	7:10	7:45	24.58	1.024	1	8	3'	5	1	4.881	0	0.000	0	0.000	21	20.502	4	3.905	10	9.763	0	0.000	2	1.953	1	0.976
	SC-HN-02	618881	5464769	02-Jul-21	03-Jul-21	8:40	8:30	23.83	0.993	1	10	3'	3	0	3.021	0	0.000	0	0.000	4	4.028	0	0.000	4	4.028	0	0.000	0	0.000	0	0.000
	SC-HN-03	629859	5450182	05-Jul-21	06-Jul-21	15:43	8:50	17.12	0.713	0.5	10	3'	11	0	15.424	0	0.000	0	0.000	11	15.424	0	0.000	1	1.402	0	0.000	0	0.000	0	0.000
	SC-HN-04	631830	5453261	05-Jul-21	06-Jul-21	16:00	9:30	17.50	0.729	1	14	3'	0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
	SC-HN-05	630572	5448917	06-Jul-21	07-Jul-21	10:30	8:43	22.22	0.926	0.5	10	3'	0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	1.080	1	1.080	0	0.000	0	0.000
	SC-HN-06	629072	5452025	06-Jul-21	07-Jul-21	10:46	10:00	23.23	0.968	1	10.0	3'	1	0	1.033	0	0.000	0	0.000	1	1.033	0	0.000	0	0.000	1	1.033	0	0.000	0	0.000
<b>Total</b>									<b>14.862</b>	<b>-</b>			<b>41</b>	<b>2</b>	<b>2.759</b>	<b>1</b>	<b>0.067</b>	<b>4</b>	<b>0.269</b>	<b>47</b>	<b>3.162</b>	<b>4</b>	<b>0.269</b>	<b>24</b>	<b>1.615</b>	<b>8</b>	<b>0.538</b>	<b>2</b>	<b>0.135</b>	<b>24</b>	<b>1.615</b>

Note: "-" indicates no available data.

<sup>a</sup> Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the hoop net sets in one area.

**Table C.4: Angling Records for Fish Caught During the 2021 Northern Pikeminnow Selenium Toxicity Study, June to July 2021**

Area	Station ID	UTM (NAD83, 11 U)		Set Date	Removal Date	Start Time	End Time	Angling Hours (hrs)	# of Lines	Effort (hours)	Effort (angling lines*days)	Northern Pikeminnow			Bull Trout		Largescale Sucker		Mountain White Fish		Peamouth Chub		Rainbow Trout		Westslope Cutthroat Trout		White Sucker					
		Start Easting	Start Northing									Catch	Mortalities/Sacrificed	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>a</sup>		
Gold Bay (GLB)	GC-AG-01	627598	5438891	22-Jul-21	22-Jul-21	7:00	8:20	1.33	2	3	0.11	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	GC-AG-02	625957	5440399	22-Jul-21	22-Jul-21	8:30	9:45	1.25	3	4	0.16	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	GC-AG-03	625783	5440810	22-Jul-21	22-Jul-21	10:00	14:30	4.50	2	9	0.38	0	0	0.00	0	0.00	1	2.67	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
Mouth of the Elk River (MER)	ER-AG-01	632048	5447297	5-Jul-21	5-Jul-21	12:36	13:30	0.90	4	4	0.15	1	0	6.67	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-02	628665	5447431	7-Jul-21	7-Jul-21	10:29	15:30	5.02	4	20	0.84	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-03	632671	5448240	11-Jul-21	11-Jul-21	9:05	9:35	0.50	3	2	0.06	1	0	16.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-04	633522	5448993	15-Jul-21	15-Jul-21	7:45	15:00	7.25	2	15	0.60	14	0	23.17	0	0.00	0	0.00	1	1.66	0	0.00	0	0.00	4	6.62	0	0.00	0	0.00		
	ER-AG-05	633522	5448993	16-Jul-21	16-Jul-21	7:15	13:00	5.75	4	23	0.96	13	0	13.57	0	0.00	0	0.00	2	2.09	0	0.00	0	0.00	6	6.26	1	1.04	0	0.00		
	ER-AG-06	638074	5454879	17-Jul-21	17-Jul-21	8:00	17:45	9.75	5	49	2.03	34	0	16.74	6	2.95	0	0.00	4	1.97	1	0.49	0	0.00	21	10.34	0	0.00	0	0.00		
	ER-AG-07	635232	5450784	18-Jul-21	18-Jul-21	8:30	13:30	5.00	3	15	0.63	11	1	17.60	0	0.00	0	0.00	0	0.00	1	1.60	3	4.80	8	12.80	0	0.00	0	0.00		
	ER-AG-08	635232	5450784	19-Jul-21	19-Jul-21	6:20	13:00	6.67	6	40	1.67	26	0	15.60	2	1.20	0	0.00	1	0.60	0	0.00	2	1.20	6	3.60	0	0.00	0	0.00		
	ER-AG-09	633612	544903	20-Jul-21	20-Jul-21	5:30	12:00	6.50	5	33	1.35	12	2	8.86	0	0.00	1	0.74	0	0.00	0	0.00	0	0.00	5	3.69	0	0.00	0	0.00		
	ER-AG-10	633612	544903	21-Jul-21	21-Jul-21	5:30	12:00	6.50	5	33	1.35	13	1	9.60	0	0.00	2	1.48	0	0.00	0	0.00	1	0.74	2	1.48	0	0.00	0	0.00		
	ER-AG-11	633612	544903	23-Jul-21	23-Jul-21	6:30	10:45	4.25	4	17	0.71	13	2	18.35	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-12	633612	544903	24-Jul-21	24-Jul-21	11:00	16:30	5.50	2	11	0.46	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-13	631131	5446970	26-Jul-21	26-Jul-21	10:00	16:00	6.00	1	6	0.25	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-14	633612	544903	26-Jul-21	26-Jul-21	5:30	11:00	5.50	5	28	1.15	5	1	4.36	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	ER-AG-15	633612	544903	27-Jul-21	27-Jul-21	5:30	11:00	5.50	5	28	1.15	2	0	1.75	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.87	0	0.00		
Sand Creek (SC)	SC-AG-01	618096	5466762	14-Jul-21	14-Jul-21	8:15	11:00	2.75	3	8	0.34	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	SC-AG-02	617041	5467975	14-Jul-21	14-Jul-21	11:18	14:01	2.72	4	11	0.45	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
	SC-AG-03	616180	5468908	15-Jul-21	15-Jul-21	7:01	8:01	1.00	3	3	0.12	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
<b>Total</b>												<b>94.13</b>	<b>75</b>	<b>358</b>	<b>14.91</b>	<b>145</b>	<b>7</b>	<b>9.7</b>	<b>8</b>	<b>0.5</b>	<b>4</b>	<b>0.3</b>	<b>8</b>	<b>0.5</b>	<b>2</b>	<b>0.1</b>	<b>6</b>	<b>0.4</b>	<b>53</b>	<b>3.6</b>	<b>1</b>	<b>0.1</b>

<sup>a</sup> Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total angling effort in one area.

**Table C.5: Data Collected on Fish Sacrificed for NPM Monitoring, July 2021**

Sampling Area	Date	Fish Identification Number	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Ovary Weight (g)	Liver Weight (g)	Carcass Weight <sup>a</sup> (g)	Gonadal Somatic Index (GSI) <sup>b</sup>	Age	External Fish Anomaly Classification	Assessment of External Fish Anomaly Severity
Gold Bay (GLB)	28-Jul-21	RG_GC_NSC-01	51.6	47.0	1,300	19.20	30.839	1,100	1.48	13	-	-
Mouth of the Elk River (MER)	03-Jul-21	RG_ER_NSC-01	55.2	50.0	1,650	256.74	29.259	1,100	15.56	16	H3	Gills: Frayed; Erosion of tips of gill lamellae resulting in "ragged" gills
	03-Jul-21	RG_ER_NSC-02	55.6	50.8	1,800	242.19	42.653	1,400	13.45	16	A1, O2	Body Surface: slight inflammation or reddening / Internal Cavity Wall: Moderate hemorrhaging
	05-Jul-21	RG_ER_NSC-03	37.1	33.5	458	29.77	7.092	385	6.51	9	-	-
	05-Jul-21	RG_ER_NSC-04	56.0	50.9	1,700	130.11	35.995	1,400	7.65	17	-	-
	05-Jul-21	RG_ER_NSC-05	56.1	50.9	1,550	94.15	32.225	1,200	6.07	15	C2	Lesions: Lesions or wounds on side of body
	09-Jul-21	RG_ER_NSC-06 <sup>c</sup>	60.0	54.9	1,650	28.76	24.001	-	1.74	16	-	-
	09-Jul-21	RG_ER_NSC-07	50.6	47.5	1,100	31.07	20.736	800	2.82	13	C2	Lesions: Lesions or wounds on side of body
	09-Jul-21	RG_ER_NSC-08	50.6	46.4	1,400	44.67	27.216	1,200	3.19	17	-	-
	09-Jul-21	RG_ER_NSC-09	41.4	37.7	630	32.82	13.863	530	5.21	14	-	-
	09-Jul-21	RG_ER_NSC-10	41.5	37.4	710	26.03	12.867	550	3.67	14	-	-
	09-Jul-21	RG_ER_NSC-11	57.0	52.2	1,730	110.47	34.445	1,440	6.39	22	E1	Ripped Caudal Fin
	18-Jul-21	RG_ER_NSC-12	50.5	46.0	1,200	72.66	17.662	1,000	6.05	18	-	-
	18-Jul-21	RG_ER_NSC-13	49.9	45.5	1,100	76.24	12.935	900	6.93	11	-	-
	20-Jul-21	RG_ER_NSC-14	55.3	51.2	1,550	80.26	26.094	1,350	5.18	14	-	-
	20-Jul-21	RG_ER_NSC-15	57.5	52.1	1,600	19.33	24.113	1,400	1.21	17	-	-
	21-Jul-21	RG_ER_NSC-16 <sup>c</sup>	49.5	44.9	1,100	143.62	8.806	850	13.06	12	-	-
	23-Jul-21	RG_ER_NSC-17	59.0	54.4	1,750	152.46	38.512	1,550	8.71	24	-	-
	23-Jul-21	RG_ER_NSC-18 <sup>c</sup>	44.5	40.2	800	5.72	9.638	750	0.72	14	-	-
	26-Jul-21	RG_ER_NSC-19	54.0	50.5	1,500	79.46	22.606	1,240	5.30	16	C2	Lesions: Lesions or wounds on side of body, lesion behind head
	28-Jul-21	RG_ER_NSC-20	58.1	53.3	1,200	13.53	11.812	1,150	1.13	16	C1	Lesions: Tears or wounds on caudal fins, pectoral or dorsal fins
29-Jul-21	RG_ER_NSC-21	39.8	36.5	550	29.43	11.728	470	5.35	13	-	-	
29-Jul-21	RG_ER_NSC-22	37.8	32.4	460	3.13	4.951	395	0.68	11	-	-	
Sand Creek (SC)	03-Jul-21	RG_SC_NSC-01	41.8	37.5	650	35.42	5.524	535	5.45	14	K1	-

Notes: muscle and ovary tissue, and otolith samples were taken from each sacrificed fish. "-" indicates no available data. External fish anomaly classification based on Appendix Table C.1.

<sup>a</sup> Carcass weight indicates the weight of the carcass with all organs removed.

<sup>b</sup> Gonadal Somatic Index = (gonad weight/body weight)\*100.

<sup>c</sup> Northern pikeminnow was in spawning condition and whole body sample (carcass and organs) were kept for analyses.



**FISH COLLECTION PERMIT**  
**Environmental Impact Assessment**

File: 34770-20

Permit No.: CB21-620969

Permit Holder: Minnow Environmental Inc – Lisa Bowron  
204-1006 Fort Street  
Victoria, BC V8V 3K4

Authorized Persons: Madelaine Stokes, Noel Soogrim, Marc Giorgini, Andy Wight, Aden Stewart, Jeremy Benson, Emily Hulley, Clare Nelligan, Alex McClymont, Justin Vanslingerland, Chad Apol, Michael Wilson, Derek Donald

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

**Permitted Sampling Period: May 1, 2021 to September 1, 2021**

**Permitted Waterbodies: Kootenay-Boundary Region –Kooconusa Reservoir (349)**

**Permitted Sampling Techniques: TN, GN, AG, Pot Trapping (subject to permit terms)**

**Potential Species: NSC, RSC, PCC, YP, BT, WCT, RB, MW, BB, CCG**

**Targeted Species: NSC (subject to permit terms)**

**Permitted Sampling: Up to 100 Northern Pikeminnow NSC from Kooconusa Reservoir (349) (subject to permit terms)**

**Provincial Terms: (Permit holder and authorized persons must be aware of all terms):**

See Appendix A.

**Region Specific Terms:**

See Appendix A.

Authorized by:

Albert Chirico, Regional Information Specialist/Fisheries  
As authorized by the Regional Manager  
Recreational Fisheries & Wildlife Programs  
**Kootenay-Boundary Region**

Date: April 14, 2021

Permit Fee \$25

## Appendix A: Fish Collection Permit Terms

*Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.*

### Provincial Terms

1. This collecting permit is **only** valid for species listed as threatened, endangered or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon, eulachon or SARA listed species (see Appendix B).

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.
3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.
4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.
5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: <https://www2.gov.bc.ca/fish-data-submission-process>.

Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: [fishdatasub@gov.bc.ca](mailto:fishdatasub@gov.bc.ca)

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g. electroshocking).
7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.
8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g. whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.
9. No electrofishing is to take place in waters having a temperature less than five degrees C.
10. No sampling of fish in waters having a temperature greater than twenty degrees C.
11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

## Provincial Terms continued

When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: <http://www.frontcounterbc.gov.bc.ca/>

Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an R.P.Bio.). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling and release:

### STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works. <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>
- A QP must ensure that the worksite has been substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines <https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html>.

### FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf>.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (<https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/>).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

### DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data>

### FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).



**Minimum Standards During Salvage for Fish Collection Sampling Effort\***

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
Sport other (bass, perch, sunfish, walleye, northern pike)		all	up to 30 after 30 count	J, K, L	
Sculpin sp.		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
Burbot, Lamprey		0-150 mm (total length)	All	J, K, L, N	
Listed Species (salish sucker, sturgeon, etc.)		All	All		Refer to SAR permit for conditions
All fishes not listed above		All	minimum 10 of each then count only	J, K, L	

**Abbreviations for salmonids**

- RB-Rainbow
- CT(CCT)-Cutthroat
- DV-Dolly Varden
- BT- Bull Trout
- GR- Arctic Grayling
- LT- Lake Trout
- KO- Kokanee

## Region Specific Terms

### West Coast Region

- Within the boundaries of Management Units 1-1 through 1-13, there is no electrofishing in: (1) streams above 630 meters elevation, (2) in anadromous rivers from January 1 to June 30, (3) or any lake tributaries from January 1 to June 30.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see:  
<http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- The permit holder must advise the West Coast Region of sampling activities 24 hrs. prior to field operations. Please complete the following notification form:  
[http://www.env.gov.bc.ca/pasb/reports/fish/permit\\_notify1.html](http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify1.html)

### South Coast Region

- The permit holder must notify Fish and Aquatic Habitat Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca) with the following information at least 24 hours prior to undertaking work:
  - approved SFC permit number
  - company
  - contact
  - address
  - phone
  - water body
  - purpose of collection
  - start date
  - end date
- All streams sampled, for which a watershed code does not presently exist, will require a map showing the location of the stream and sampling location with the map scale identified at time of reporting.
- Electrofishing and minnow trapping can harm or kill non-target species of management concern such as the endangered Coastal Giant Salamander (within the Chilliwack River drainage system), Oregon Spotted Frog, and Pacific Water Shrew (within the lower Fraser River Valley). Any incidental captures (alive or dead) of any red-listed or blue-listed wildlife species must be reported to the Ministry of Forest, Lands, Natural Resources and Rural Development, South Coast Region. For further information on these species or to report incidental captures, please contact the Fish and Aquatic Habitat Branch by e-mail at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca).
- All non-native fish species captured under this permit are to be humanely euthanized and disposed of appropriately. Within 48 hours of capture, a record of the species, capture location, date, waterbody, number, size range (mm) and digital imagery must be submitted to the Fish and Aquatic Habitat Branch by email at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca). Non-native fish species include but are not limited to: American Shad; Black Catfish; Black Crappie; Brown Catfish; Carp; Goldfish; Largemouth or Smallmouth Bass; Pumpkinseed Sunfish; and Weather-fish.
- Please refer to the following website for the least risk in-stream work windows:  
<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows>. Where possible, collection should be conducted during the least risk work windows identified. The exception is seasonal or ephemeral streams where sampling may not be possible during the prescribed window due to flow conditions.
- The permit holder must refer to the following when sampling Salish Sucker, Nooksack Dace and Stickleback species.  
Salish sucker sampling guidelines -  
<http://www.frontcounterbc.gov.bc.ca/pdf/SalishSuckerCollectionGuidelines2015.pdf>

Nooksack dace sampling guidelines –

<http://www.frontcounterbc.gov.bc.ca/pdf/NooksackDaceCollectionGuidelines2015.pdf>

Stickleback species pairs sampling guidelines - <http://www.dfo-mpo.gc.ca/species-especies/publications/sara-lep/stickleback-epinoches/index-eng.html>

### **Thompson/Okanagan Region**

- Please refer to information at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows> for the appropriate in stream work windows.

### **Kootenay/Boundary Region**

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- The permit holder must contact the local zone Conservation Officer Service prior to initiating the field collections.
- All burbot traps must have a section in the top or sidewall that has been secured by a length of untreated, 100% cotton twine no greater than No. 30 (e.g. 30 thread count) or 3 mm diameter. When twine deteriorates, this must produce a square opening with a minimum size of 20 cm x 20 cm. This is intended to ensure that if the trap is lost, the section secured by the twine will rot, allowing captive fish to escape, and preventing the trap from continuing to fish.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.

### **Cariboo Region**

- Cariboo Region requires seven days (7) written notice, complete with waterbody and watershed codes for the proposed areas prior to sampling in the Cariboo Region. Please submit written email notice to: [Lee.Williston@gov.bc.ca](mailto:Lee.Williston@gov.bc.ca) or fax to 250 398 4214.
- Until such time as the permit holder has discussed specific activities with the Regional Manager and obtains written permission, fish collection, fish sampling or fish salvage may not be undertaken within the boundaries of Management Units 5-04 or 5-05.

### **Skeena Region**

- For information related to Fish Collection Permit Activities in the Skeena Region, please contact Kristin Charleton at 250-876-7131 or [Kristin.Charleton@gov.bc.ca](mailto:Kristin.Charleton@gov.bc.ca).
- Accidental fish mortalities and or injuries that occur during salvage activities, related to this permit, must be reported to the Skeena Regional office within 48 hrs. Contact Troy Larden at [Troy.Larden@gov.bc.ca](mailto:Troy.Larden@gov.bc.ca) or Kristin Charleton at [Kristin.Charleton@gov.bc.ca](mailto:Kristin.Charleton@gov.bc.ca) to report.

### **Omineca Region**

- The permit holder must advise Region 7A (Omineca) of sampling activities 48 hrs. prior to field operations by completion of the following form: [http://www.env.gov.bc.ca/pasb/reports/fish/permit\\_notify7a.html](http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify7a.html)
- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- Voucher specimens for all regionally significant red and blue-listed species (3 per species), with exception to SARA-listed white sturgeon (*Acipenser transmontanus*), must be submitted to the Regional Fish Information Specialist as per RISC standards.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>. When lethal sampling has occurred for the purposes of environmental effects monitoring or impact

assessment, the permit holder must, within 90 days of the expiry of this permit, submit a report that summarizes all raw data related to the lethal program. This would typically include location of catch, species, fish tissue metals analysis, fish tissue moisture content, fish length and fish weight, at minimum. Interim reports may also be required and must be submitted as required by the permit issuer. All fish tissue analysis data related to the lethal program must be submitted ALONG with the standard sampling effort data submission template to <https://www2.gov.bc.ca/fish-data-submission-process>. Questions regarding submission requirements for lethal sampling may be directed to [Susanne.Weber@gov.bc.ca](mailto:Susanne.Weber@gov.bc.ca).

### **Peace Region**

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.



## Appendix B: Table 1 - Species at Risk

The following are species at risk that have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either endangered, threatened or a species of special concern. Species also listed under the Species at Risk Act (SARA) are identified with an asterisk and are subject to additional permitting requirements through the Federal Department of Fisheries and Oceans (DFO).

Common Name	Scientific Name
Benthic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Benthic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Nooksack Dace	* <i>Rhinichthys sp.</i>
Morrison Creek Lamprey	* <i>Lampetra richardsoni</i>
Vancouver Lamprey (Cowichan Lake Lamprey)	* <i>Lampetra macrostoma</i>
Cultus Pygmy Sculpin	* <i>Cottus sp.</i>
Shorthead Sculpin	* <i>Cottus confusus</i>
Hotwater Physa	* <i>Physella wrighti</i>
Limnetic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Benthic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Salish Sucker	<i>Catostomus sp.</i>
Speckled Dace	<i>Rhinichthys osculus</i>
Charlotte Unarmoured Stickleback	<i>Gasterosteus aculeatus</i>
Columbia Mottled Sculpin	<i>Cottus bairdi hubbsi</i>
Giant Stickleback	<i>Gasterosteus sp.</i>
Green Sturgeon	<i>Acipenser medirostris</i>
Umatilla Dace	<i>Rhinichthys umatilla</i>
West Slope Cutthroat Trout	* <i>Oncorhynchus clarki lewisi</i>
White Sturgeon	<i>Acipenser transmontanus</i>

Applications for permits to specifically collect and retain listed species must be reviewed by the appropriate provincial expert, who will screen permits to ensure that any impacts on listed species are acceptable. For white sturgeon the contact is Steve McAdam ([steve.mcadam@gov.bc.ca](mailto:steve.mcadam@gov.bc.ca)). For listed non-game freshwater fish the contact is Jordan Rosenfeld ([jordan.rosenfeld@gov.bc.ca](mailto:jordan.rosenfeld@gov.bc.ca)).

## Appendix C: Advisory

### GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit.

For example,

- This permit **does not** authorize the collection of fish in national or provincial parks.
- This permit does not authorize the collection of fish in tidal waters.
- This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
- This permit is NOT authority to angle for fish without a valid angling licence.

It is the responsibility of the permit holder to obtain proper authorization.

- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing his or her own permit. The issuer is not obliged to send a reminder notice.

### LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the Act or regulations that may apply to this permit.

#### Wildlife Act

##### **Suspension and cancellation of permits**

- 25 (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.
- (2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

##### **Documents not transferable**

- 81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person
- (a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or
  - (b) uses another person's licence, permit or limited entry hunting authorization.

##### **Failure to pay fine**

- 85 (1) This section applies if a person
- (a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and
  - (b) has been served with notice of this section.
- (2) In the circumstances referred to in subsection (1),
- (a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,
  - (b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,
  - (b.1) the person must not apply for employment as an assistant guide,
  - (b.2) the person must not guide as an assistant guide, and
  - (c) the person commits an offence if, before that fine is paid, the person
    - (i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,
    - (ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,
    - (iii) applies for employment as an assistant guide, or
    - (iv) guides as an assistant guide.



### **Proof of identity and authorization**

- 97 (1) In this section, “**authorization**” means a licence, permit or limited entry hunting authorization issued under this Act.
- (2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,
- (a) state the person’s name and address,
  - (b) produce prescribed photo identification, and
  - (c) demonstrate in accordance with subsection (3) that the person holds the authorization.
- (3) A person may demonstrate that the person holds an authorization by
- (a) producing the authorization, or
  - (b) unless the regulations require that the original authorization be produced,
    - (i) producing a legible copy of the authorization, or
    - (ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.
- (4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,
- (a) state the person’s name and address, and
  - (b) produce prescribed photo identification.
- (5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.
- (6) A person who contravenes subsection (2) or (4) commits an offence.

### **Wildlife Act General Regulation**

#### **Proof of identity**

- 21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:
- (a) valid photo identification issued to a person by any of the following:
    - (i) the government of Canada;
    - (ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;
    - (iii) the Nisga’a Nation, if the person is a Nisga’a citizen;
    - (iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;
  - (b) in the case of a person who is a non-resident alien,
    - (i) valid photo identification in the form of
      - (A) a passport, or
      - (B) a driver’s licence issued to the person by a foreign jurisdiction in which the person has a current address, or
    - (ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by
      - (A) a lawyer, or
      - (B) a notary who is a member in good standing under the *Notaries Act*
  - (c) in any case, a valid NEXUS card.
- (2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

---

### **Freshwater Fish Regulation**

#### **Offences**

- 2 A person commits an offence where the person
- (a) has in possession,
  - (b) transports, or
  - (c) traffics in
- live fish unless authorized by a permit or a licence.



**FISH COLLECTION PERMIT**  
**Environmental Impact Assessment**

File: 34770-20

Permit No.: CB21-620969 AMENDED\_2

Permit Holder: Minnow Environmental Inc – Lisa Bowron  
204-1006 Fort Street  
Victoria, BC V8V 3K4

Authorized Persons: Madelaine Stokes, Noel Soogrim, Marc Giorgini, Andy Wight, Aden Stewart, Jeremy Benson, Emily Hulley, Clare Nelligan, Alex McClymont, Justin Vanslingerland, Chad Apol, Michael Wilson, Derek Donald

- **Amended June 29, 2021 to include these additional authorized persons: Andre Baril, Markus Hecker, Katherine Raes**
- **Amended July 26, 2021 to include variance.**

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

**Permitted Sampling Period: May 1, 2021 to September 1, 2021**

**Permitted Waterbodies: Kootenay-Boundary Region –Kooconusa Reservoir (349)**

**Permitted Sampling Techniques: TN, GN, AG, Pot Trapping (subject to permit terms)**

**Potential Species: NSC, RSC, PCC, YP, BT, WCT, RB, MW, BB, CCG**

**Targeted Species: NSC (subject to permit terms)**

**Permitted Sampling: Up to 100 Northern Pikeminnow NSC from Kooconusa Reservoir (349) (subject to permit terms)**

**Provincial Terms: (Permit holder and authorized persons must be aware of all terms):**

See Appendix A.

**Region Specific Terms:**

Variance: Authorized persons may sample in waters above 20 degrees for the purposes of this permit. See Appendix A.

**Authorized by:**

Albert Chirico, Regional Information Specialist/Fisheries  
As authorized by the Regional Manager  
Recreational Fisheries & Wildlife Programs  
**Kootenay-Boundary Region**

*This amended permit supercedes amended permit CB21-620969 dated April 14, 2021*

Date: July 26, 2021

Permit Fee \$25

## Appendix A: Fish Collection Permit Terms

*Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.*

### Provincial Terms

1. This collecting permit is **only** valid for species listed as threatened, endangered or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon, eulachon or SARA listed species (see Appendix B).

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.
3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.
4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.
5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: <https://www2.gov.bc.ca/fish-data-submission-process>.

Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: [fishdatasub@gov.bc.ca](mailto:fishdatasub@gov.bc.ca)

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g. electroshocking).
7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.
8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g. whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.
9. No electrofishing is to take place in waters having a temperature less than five degrees C.
10. No sampling of fish in waters having a temperature greater than twenty degrees C.
11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

## Provincial Terms continued

When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: <http://www.frontcounterbc.gov.bc.ca/>

Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an R.P.Bio.). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling and release:

### STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works. <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>
- A QP must ensure that the worksite has been substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines <https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html>.

### FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf>.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (<https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/>).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

### DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data>

### FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).

**Minimum Standards During Salvage for Fish Collection Sampling Effort\***

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
<b>Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO</b>	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
<b>Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)</b>		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
<b>Sport other (bass, perch, sunfish, walleye, northern pike)</b>		all	up to 30 after 30 count	J, K, L	
<b>Sculpin sp.</b>		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
<b>Burbot, Lamprey</b>		0-150 mm (total length)	All	J, K, L, N	
<b>Listed Species (salish sucker, sturgeon, etc.)</b>		All	All		Refer to SAR permit for conditions
<b>All fishes not listed above</b>		All	minimum 10 of each then count only	J, K, L	

**Abbreviations for salmonids**

- RB-Rainbow
- CT(CCT)-Cutthroat
- DV-Dolly Varden
- BT- Bull Trout
- GR- Arctic Grayling
- LT- Lake Trout
- KO- Kokanee



## Region Specific Terms

### West Coast Region

- Within the boundaries of Management Units 1-1 through 1-13, there is no electrofishing in: (1) streams above 630 meters elevation, (2) in anadromous rivers from January 1 to June 30, (3) or any lake tributaries from January 1 to June 30.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see:  
<http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- The permit holder must advise the West Coast Region of sampling activities 24 hrs. prior to field operations. Please complete the following notification form:  
[http://www.env.gov.bc.ca/pasb/reports/fish/permit\\_notify1.html](http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify1.html)

### South Coast Region

- The permit holder must notify Fish and Aquatic Habitat Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca) with the following information at least 24 hours prior to undertaking work:
  - approved SFC permit number
  - company
  - contact
  - address
  - phone
  - water body
  - purpose of collection
  - start date
  - end date
- All streams sampled, for which a watershed code does not presently exist, will require a map showing the location of the stream and sampling location with the map scale identified at time of reporting.
- Electrofishing and minnow trapping can harm or kill non-target species of management concern such as the endangered Coastal Giant Salamander (within the Chilliwack River drainage system), Oregon Spotted Frog, and Pacific Water Shrew (within the lower Fraser River Valley). Any incidental captures (alive or dead) of any red-listed or blue-listed wildlife species must be reported to the Ministry of Forest, Lands, Natural Resources and Rural Development, South Coast Region. For further information on these species or to report incidental captures, please contact the Fish and Aquatic Habitat Branch by e-mail at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca).
- All non-native fish species captured under this permit are to be humanely euthanized and disposed of appropriately. Within 48 hours of capture, a record of the species, capture location, date, waterbody, number, size range (mm) and digital imagery must be submitted to the Fish and Aquatic Habitat Branch by email at [SCFishandAquaticWildlife@gov.bc.ca](mailto:SCFishandAquaticWildlife@gov.bc.ca). Non-native fish species include but are not limited to: American Shad; Black Catfish; Black Crappie; Brown Catfish; Carp; Goldfish; Largemouth or Smallmouth Bass; Pumpkinseed Sunfish; and Weather-fish.
- Please refer to the following website for the least risk in-stream work windows:  
<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows>. Where possible, collection should be conducted during the least risk work windows identified. The exception is seasonal or ephemeral streams where sampling may not be possible during the prescribed window due to flow conditions.
- The permit holder must refer to the following when sampling Salish Sucker, Nooksack Dace and Stickleback species.  
Salish sucker sampling guidelines -  
<http://www.frontcounterbc.gov.bc.ca/pdf/SalishSuckerCollectionGuidelines2015.pdf>

Nooksack dace sampling guidelines –

<http://www.frontcounterbc.gov.bc.ca/pdf/NooksackDaceCollectionGuidelines2015.pdf>

Stickleback species pairs sampling guidelines - <http://www.dfo-mpo.gc.ca/species-especies/publications/sara-lep/stickleback-epinoches/index-eng.html>



### **Thompson/Okanagan Region**

- Please refer to information at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows> for the appropriate in stream work windows.

### **Kootenay/Boundary Region**

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- The permit holder must contact the local zone Conservation Officer Service prior to initiating the field collections.
- All burbot traps must have a section in the top or sidewall that has been secured by a length of untreated, 100% cotton twine no greater than No. 30 (e.g. 30 thread count) or 3 mm diameter. When twine deteriorates, this must produce a square opening with a minimum size of 20 cm x 20 cm. This is intended to ensure that if the trap is lost, the section secured by the twine will rot, allowing captive fish to escape, and preventing the trap from continuing to fish.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.

### **Cariboo Region**

- Cariboo Region requires seven days (7) written notice, complete with waterbody and watershed codes for the proposed areas prior to sampling in the Cariboo Region. Please submit written email notice to: [Lee.Williston@gov.bc.ca](mailto:Lee.Williston@gov.bc.ca) or fax to 250 398 4214.
- Until such time as the permit holder has discussed specific activities with the Regional Manager and obtains written permission, fish collection, fish sampling or fish salvage may not be undertaken within the boundaries of Management Units 5-04 or 5-05.

### **Skeena Region**

- For information related to Fish Collection Permit Activities in the Skeena Region, please contact Kristin Charleton at 250-876-7131 or [Kristin.Charleton@gov.bc.ca](mailto:Kristin.Charleton@gov.bc.ca).
- Accidental fish mortalities and or injuries that occur during salvage activities, related to this permit, must be reported to the Skeena Regional office within 48 hrs. Contact Troy Larden at [Troy.Larden@gov.bc.ca](mailto:Troy.Larden@gov.bc.ca) or Kristin Charleton at [Kristin.Charleton@gov.bc.ca](mailto:Kristin.Charleton@gov.bc.ca) to report.

### **Omineca Region**

- The permit holder must advise Region 7A (Omineca) of sampling activities 48 hrs. prior to field operations by completion of the following form: [http://www.env.gov.bc.ca/pasb/reports/fish/permit\\_notify7a.html](http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify7a.html)
- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- Voucher specimens for all regionally significant red and blue-listed species (3 per species), with exception to SARA-listed white sturgeon (*Acipenser transmontanus*), must be submitted to the Regional Fish Information Specialist as per RISC standards.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>. When lethal sampling has occurred for the purposes of environmental effects monitoring or impact

assessment, the permit holder must, within 90 days of the expiry of this permit, submit a report that summarizes all raw data related to the lethal program. This would typically include location of catch, species, fish tissue metals analysis, fish tissue moisture content, fish length and fish weight, at minimum. Interim reports may also be required and must be submitted as required by the permit issuer. All fish tissue analysis data related to the lethal program must be submitted ALONG with the standard sampling effort data submission template to <https://www2.gov.bc.ca/fish-data-submission-process>. Questions regarding submission requirements for lethal sampling may be directed to [Susanne.Weber@gov.bc.ca](mailto:Susanne.Weber@gov.bc.ca).

### Peace Region

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see: <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.



### Appendix B: Table 1 - Species at Risk

The following are species at risk that have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either endangered, threatened or a species of special concern. Species also listed under the Species at Risk Act (SARA) are identified with an asterisk and are subject to additional permitting requirements through the Federal Department of Fisheries and Oceans (DFO).

Common Name	Scientific Name
Benthic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Benthic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Nooksack Dace	* <i>Rhinichthys sp.</i>
Morrison Creek Lamprey	* <i>Lampetra richardsoni</i>
Vancouver Lamprey (Cowichan Lake Lamprey)	* <i>Lampetra macrostoma</i>
Cultus Pygmy Sculpin	* <i>Cottus sp.</i>
Shorthead Sculpin	* <i>Cottus confusus</i>
Hotwater Physa	* <i>Physella wrighti</i>
Limnetic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Benthic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Salish Sucker	<i>Catostomus sp.</i>
Speckled Dace	<i>Rhinichthys osculus</i>
Charlotte Unarmoured Stickleback	<i>Gasterosteus aculeatus</i>
Columbia Mottled Sculpin	<i>Cottus bairdi hubbsi</i>
Giant Stickleback	<i>Gasterosteus sp.</i>
Green Sturgeon	<i>Acipenser medirostris</i>
Umatilla Dace	<i>Rhinichthys umatilla</i>
West Slope Cutthroat Trout	* <i>Oncorhynchus clarki lewisi</i>
White Sturgeon	<i>Acipenser transmontanus</i>

Applications for permits to specifically collect and retain listed species must be reviewed by the appropriate provincial expert, who will screen permits to ensure that any impacts on listed species are acceptable. For white sturgeon the contact is Steve McAdam ([steve.mcadam@gov.bc.ca](mailto:steve.mcadam@gov.bc.ca)). For listed non-game freshwater fish the contact is Jordan Rosenfeld ([jordan.rosenfeld@gov.bc.ca](mailto:jordan.rosenfeld@gov.bc.ca)).

## Appendix C: Advisory

### GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit. For example,
  - This permit **does not** authorize the collection of fish in national or provincial parks.
  - This permit does not authorize the collection of fish in tidal waters.
  - This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
  - This permit is NOT authority to angle for fish without a valid angling licence.
- It is the responsibility of the permit holder to obtain proper authorization.
- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing his or her own permit. The issuer is not obliged to send a reminder notice.

### LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the Act or regulations that may apply to this permit.

#### Wildlife Act

##### **Suspension and cancellation of permits**

- 25 (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.
- (2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

##### **Documents not transferable**

- 81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person
- (a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or
  - (b) uses another person's licence, permit or limited entry hunting authorization.

##### **Failure to pay fine**

- 85 (1) This section applies if a person
- (a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and
  - (b) has been served with notice of this section.
- (2) In the circumstances referred to in subsection (1),
- (a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,
  - (b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,
  - (b.1) the person must not apply for employment as an assistant guide,
  - (b.2) the person must not guide as an assistant guide, and
  - (c) the person commits an offence if, before that fine is paid, the person
    - (i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,
    - (ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,
    - (iii) applies for employment as an assistant guide, or
    - (iv) guides as an assistant guide.

### **Proof of identity and authorization**

- 97 (1) In this section, “**authorization**” means a licence, permit or limited entry hunting authorization issued under this Act.
- (2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,
- (a) state the person’s name and address,
  - (b) produce prescribed photo identification, and
  - (c) demonstrate in accordance with subsection (3) that the person holds the authorization.
- (3) A person may demonstrate that the person holds an authorization by
- (a) producing the authorization, or
  - (b) unless the regulations require that the original authorization be produced,
    - (i) producing a legible copy of the authorization, or
    - (ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.
- (4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,
- (a) state the person’s name and address, and
  - (b) produce prescribed photo identification.
- (5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.
- (6) A person who contravenes subsection (2) or (4) commits an offence.

### **Wildlife Act General Regulation**

#### **Proof of identity**

- 21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:
- (a) valid photo identification issued to a person by any of the following:
    - (i) the government of Canada;
    - (ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;
    - (iii) the Nisga’a Nation, if the person is a Nisga’a citizen;
    - (iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;
  - (b) in the case of a person who is a non-resident alien,
    - (i) valid photo identification in the form of
      - (A) a passport, or
      - (B) a driver’s licence issued to the person by a foreign jurisdiction in which the person has a current address, or
    - (ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by
      - (A) a lawyer, or
      - (B) a notary who is a member in good standing under the *Notaries Act*
  - (c) in any case, a valid NEXUS card.
- (2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

---

### **Freshwater Fish Regulation**

#### **Offences**

- 2 A person commits an offence where the person
- (a) has in possession,
  - (b) transports, or
  - (c) traffics in
- live fish unless authorized by a permit or a licence.



**FISH COLLECTION PERMIT**  
**Environmental Impact Assessment**

File: 34770-20

Permit No.: CB21-626419

Permit Holder: Minnow Environmental Inc – Noel Soogrim  
204-1006 Fort Street  
Victoria, BC V8V 3K4

Authorized Persons: Lisa Bowron, Madelaine Stokes, Noel Soogrim, Marc Giorgini, Andy Wight, Aden Stewart, Jeremy Benson, Emily Hulley, Clare Nelligan, Alex McClymont, Justin Vanslingerland, Chad Apol, Michael Wilson, Derek Donald

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

**Permitted Sampling Period: July 13, 2021 to September 30, 2021**

**Permitted Waterbodies: Kootenay-Boundary Region – Gold Creek (340-115000-56800), Kootenay-Boundary Region – Gold Creek (349-218500), Kootenay-Boundary Region – Elk River (349-248100), Kootenay-Boundary Region – Sand Creek (349-284500), Kootenay-Boundary Region – Kikomun Creek (349-275000).**

**Permitted Sampling Techniques: AG (subject to permit terms)**

**Potential Species: BT, BB, WCT, MW, PCC, YP, CCG, RB, RSC, NSC.**

**Targeted Species: NSC (subject to permit terms)**

**Permitted Sampling: Up to 100 Northern Pikeminnow (NSC) collectively from Gold Creek (340-115000-56800), Gold Creek (349-218500), Elk River (349-248100), Sand Creek (349-284500), and Kikomun Creek (349-275000).**

**(subject to permit terms)**

**Provincial Terms: (Permit holder and authorized persons must be aware of all terms):**

See Appendix A.

**Region Specific Terms:**

See Appendix A.

**Authorized by:**

Albert Chirico, Regional Information Specialist/Fisheries  
As authorized by the Regional Manager  
Recreational Fisheries & Wildlife Programs  
**Kootenay-Boundary Region**

Date: July 13, 2021

Permit Fee \$25



## Appendix A: Fish Collection Permit Terms

*Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.*

### Provincial Terms

1. This collecting permit is **only** valid for species listed as threatened, endangered or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon, eulachon or SARA listed species (see Appendix B).

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.
3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.
4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.
5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: <https://www2.gov.bc.ca/fish-data-submission-process>.

Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: [fishdatasub@gov.bc.ca](mailto:fishdatasub@gov.bc.ca)

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g. electroshocking).
7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.
8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g. whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.
9. No electrofishing is to take place in waters having a temperature less than five degrees C.
10. No sampling of fish in waters having a temperature greater than twenty degrees C.
11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

## Provincial Terms continued

When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: <http://www.frontcounterbc.gov.bc.ca/>

Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an R.P.Bio.). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling and release:

### STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works. <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>
- A QP must ensure that the worksite has been substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines <https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html>.

### FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf>.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (<https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/>).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

### DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data>

### FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).

**Minimum Standards During Salvage for Fish Collection Sampling Effort\***

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
<b>Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO</b>	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
<b>Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)</b>		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
<b>Sport other (bass, perch, sunfish, walleye, northern pike)</b>		all	up to 30 after 30 count	J, K, L	
<b>Sculpin sp.</b>		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
<b>Burbot, Lamprey</b>		0-150 mm (total length)	All	J, K, L, N	
<b>Listed Species (salish sucker, sturgeon, etc.)</b>		All	All		Refer to SAR permit for conditions
<b>All fishes not listed above</b>		All	minimum 10 of each then count only	J, K, L	

**Abbreviations for salmonids**

RB-Rainbow  
 CT(CCT)-Cutthroat  
 DV-Dolly Varden  
 BT- Bull Trout  
 GR- Arctic Grayling  
 LT- Lake Trout  
 KO- Kokanee

## Region Specific Terms

### Kootenay/Boundary Region

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- The permit holder must contact the local zone Conservation Officer Service prior to initiating the field collections.
- All burbot traps must have a section in the top or sidewall that has been secured by a length of untreated, 100% cotton twine no greater than No. 30 (e.g. 30 thread count) or 3 mm diameter. When twine deteriorates, this must produce a square opening with a minimum size of 20 cm x 20 cm. This is intended to ensure that if the trap is lost, the section secured by the twine will rot, allowing captive fish to escape, and preventing the trap from continuing to fish.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimio, see:  
<http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.



BRITISH  
COLUMBIA

---

## Appendix B: Table 1 - Species at Risk

The following are species at risk that have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either endangered, threatened or a species of special concern. Species also listed under the Species at Risk Act (SARA) are identified with an asterisk and are subject to additional permitting requirements through the Federal Department of Fisheries and Oceans (DFO).

Common Name	Scientific Name
Benthic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Benthic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Paxton Lake Stickleback	* <i>Gasterosteus sp.</i>
Limnetic Vananda Creek Stickleback	* <i>Gasterosteus sp.</i>
Nooksack Dace	* <i>Rhinichthys sp.</i>
Morrison Creek Lamprey	* <i>Lampetra richardsoni</i>
Vancouver Lamprey (Cowichan Lake Lamprey)	* <i>Lampetra macrostoma</i>
Cultus Pygmy Sculpin	* <i>Cottus sp.</i>
Shorthead Sculpin	* <i>Cottus confusus</i>
Hotwater Physa	* <i>Physella wrighti</i>
Limnetic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Benthic Enos Lake Stickleback	<i>Gasterosteus sp.</i>
Salish Sucker	<i>Catostomus sp.</i>
Speckled Dace	<i>Rhinichthys osculus</i>
Charlotte Unarmoured Stickleback	<i>Gasterosteus aculeatus</i>
Columbia Mottled Sculpin	<i>Cottus bairdi hubbsi</i>
Giant Stickleback	<i>Gasterosteus sp.</i>
Green Sturgeon	<i>Acipenser medirostris</i>
Umatilla Dace	<i>Rhinichthys umatilla</i>
West Slope Cutthroat Trout	* <i>Oncorhynchus clarki lewisi</i>
White Sturgeon	<i>Acipenser transmontanus</i>

Applications for permits to specifically collect and retain listed species must be reviewed by the appropriate provincial expert, who will screen permits to ensure that any impacts on listed species are acceptable. For white sturgeon the contact is Steve McAdam ([steve.mcadam@gov.bc.ca](mailto:steve.mcadam@gov.bc.ca)). For listed non-game freshwater fish the contact is Jordan Rosenfeld ([jordan.rosenfeld@gov.bc.ca](mailto:jordan.rosenfeld@gov.bc.ca)).

## Appendix C: Advisory

### GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit. For example,
  - This permit **does not** authorize the collection of fish in national or provincial parks.
  - This permit does not authorize the collection of fish in tidal waters.
  - This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
  - This permit is NOT authority to angle for fish without a valid angling licence.
- It is the responsibility of the permit holder to obtain proper authorization.
- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing his or her own permit. The issuer is not obliged to send a reminder notice.

### LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the Act or regulations that may apply to this permit.

#### Wildlife Act

##### **Suspension and cancellation of permits**

- 25 (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.
- (2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

##### **Documents not transferable**

- 81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person
- (a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or
  - (b) uses another person's licence, permit or limited entry hunting authorization.

##### **Failure to pay fine**

- 85 (1) This section applies if a person
- (a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and
  - (b) has been served with notice of this section.
- (2) In the circumstances referred to in subsection (1),
- (a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,
  - (b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,
  - (b.1) the person must not apply for employment as an assistant guide,
  - (b.2) the person must not guide as an assistant guide, and
  - (c) the person commits an offence if, before that fine is paid, the person
    - (i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,
    - (ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,
    - (iii) applies for employment as an assistant guide, or
    - (iv) guides as an assistant guide.



### **Proof of identity and authorization**

- 97 (1) In this section, “**authorization**” means a licence, permit or limited entry hunting authorization issued under this Act.
- (2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,
- (a) state the person’s name and address,
  - (b) produce prescribed photo identification, and
  - (c) demonstrate in accordance with subsection (3) that the person holds the authorization.
- (3) A person may demonstrate that the person holds an authorization by
- (a) producing the authorization, or
  - (b) unless the regulations require that the original authorization be produced,
    - (i) producing a legible copy of the authorization, or
    - (ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.
- (4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,
- (a) state the person’s name and address, and
  - (b) produce prescribed photo identification.
- (5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.
- (6) A person who contravenes subsection (2) or (4) commits an offence.

### **Wildlife Act General Regulation**

#### **Proof of identity**

- 21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:
- (a) valid photo identification issued to a person by any of the following:
    - (i) the government of Canada;
    - (ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;
    - (iii) the Nisga’a Nation, if the person is a Nisga’a citizen;
    - (iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;
  - (b) in the case of a person who is a non-resident alien,
    - (i) valid photo identification in the form of
      - (A) a passport, or
      - (B) a driver’s licence issued to the person by a foreign jurisdiction in which the person has a current address, or
    - (ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by
      - (A) a lawyer, or
      - (B) a notary who is a member in good standing under the *Notaries Act*
  - (c) in any case, a valid NEXUS card.
- (2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

---

### **Freshwater Fish Regulation**

#### **Offences**

- 2 A person commits an offence where the person
- (a) has in possession,
  - (b) transports, or
  - (c) traffics in
- live fish unless authorized by a permit or a licence.