2023-2024

Year 5

Columbia Basin Invasive Northern Pike (*Esox lucius*) Suppression and Monitoring, British Columbia

Prepared for:
The Ministry of Water, Land, and Resource Stewardship

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Cover Photos

Top: Adult northern pike captured in the Robson Reach on May 30 2023. Photo by Okanagan Nation Alliance.

Bottom: Young-of-year northern pike captured in Zuckerberg Pond on Jul 13 2023. Photo by Okanagan Nation Alliance.

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Executive Summary

Northern pike have been introduced (legally and illegally) to systems outside of their native distribution for the purposes of sport fishing. When introduced, northern pike are known to have detrimental effects on native fish populations, including salmonids. In 2004, northern pike were first observed in the Pend d'Oreille River Box Canyon Reservoir in Pend Oreille County, Washington. This population is suspected to have seeded the population now established in the Lower Columbia River. As of January 2024, over 40,708 northern pike have been removed from the Columbia River Basin in Canada (1,021) and the United States (39,687) through active suppression, angler incentives, and other suppression initiatives.

In 2023, active suppression was conducted from May 23 – Sep 14 in the Columbia and Pend d'Oreille Rivers using gillnetting and backpack electrofishing. In total, 74 northern pike were captured (73 removed; all from the Columbia River) over 30 crew days. Most northern pike captured in 2023 were adults from the Robson Reach (36 northern pike). The remainder of individuals were captured in Zuckerberg Pond (6 adults, 31 young-of-year). Gillnetting was the primary method of suppression in 2023 (282 sets and 879 hours of soak time or active fishing time) and was the only method to capture northern pike. Northern Pike were not encountered during backpack electrofishing in Zuckerberg Pond (< 10 minutes). An additional northern pike was submitted for the email-in angler incentive program. Northern pike were not encountered in 2023 during BC Hydro's Large River Indexing Program (CLBMON-45); previously, northern pike have been encountered in every year of this program since 2010.

Spring catch-per-unit-effort in the Columbia River has been comparable over the last six years (2018 – 2023) however is markedly lower than when suppression began in 2014 (82% lower in 2023 compared to 2014).

Columbia River northern pike capture locations were consistent with previous years, with the majority of captures occurring in the Robson Reach and by Zuckerberg Island. Adult northern pike have predominantly been encountered along the right (and secondarily the left) downstream bank of the Robson Reach section of the Columbia River between Celgar Mill and the Robson Bridge, near Zuckerberg Island, and the Kootenay Oxbow. Northern pike were not captured in the Pend d'Oreille River (Seven Mile Reservoir) in 2023. The Waneta Reservoir was not sampled in 2023 due to lack of captures in 2022.

Northern pike habitat (shallow water with low flow and aquatic vegetation) is available in the Columbia and Pend d'Oreille Rivers. More northern pike have been captured in the Columbia River than the Pend d'Oreille River between 2018 – 2023, though Pend d'Oreille northern pike have been found to be larger and older. Water temperatures in the Pend d'Oreille River are generally warmer and more suitable for northern pike growth compared to the Columbia River Mainstem. However, off-channel habitat present in the Columbia River do reach optimal northern pike growing temperatures (Zuckerberg Pond). In 2023, adult northern pike tended to use habitats similar to previous years, primarily in water depths of 2 – 7 m with aquatic vegetation. This habitat appears abundant in the Robson Reach of the Columbia River Mainstem, where the majority of adult northern pike captures have occurred. Optimal rearing habitat has been identified at Zuckerberg Pond, and potential rearing habitat has been identified at Kootenay Oxbow, Waldie Island, and the Robson Reach.

In 2023, mountain whitefish and sculpin appear to be the preferred prey of adult northern pike in the Columbia River; kokanee and sculpin appear to be the preferred prey of young-of-year northern pike. Young-of-year have typically consumed more invertebrates in Zuckerberg Pond (thought to be due to availability); however, were not identified in stomach contents in 2023. Historically, dace, northern pikeminnow, peamouth chub, rainbow trout, redside shiners, suckers, brook trout, lake whitefish, and yellow perch have also been identified as northern pike prey species and non-fish prey items included grasshoppers, aquatic sow bugs, wasps, flying ants, leeches, and other unidentified invertebrates.

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1.0 Introduction

Northern pike (*Exos lucius*) are a carnivorous fish with a circumpolar distribution. In Canada and the United States, they are native to the east of the Rocky Mountain Range; excluding Canadian Maritime Provinces and the Atlantic Coastal Plain (east of the Appalachian Mountain Range) in the United States (Figure 1; McPhail 2007; Hatfield and Pollard 2009). Northern pike have been introduced (a species living outside its native distributional range due to human activity, either intentional or accidental), legally and illegally, to systems outside of their native distribution in Canada and the United States for the purposes of sport fishing (Hatfield and Pollard 2009; Runciman and Leaf 2009). Because northern pike are a prolific predatory fish species, they are known to have detrimental effects on native fish populations, including salmonids (Baxter and Neufeld 2015; Muhlfield et *al.* 2008).

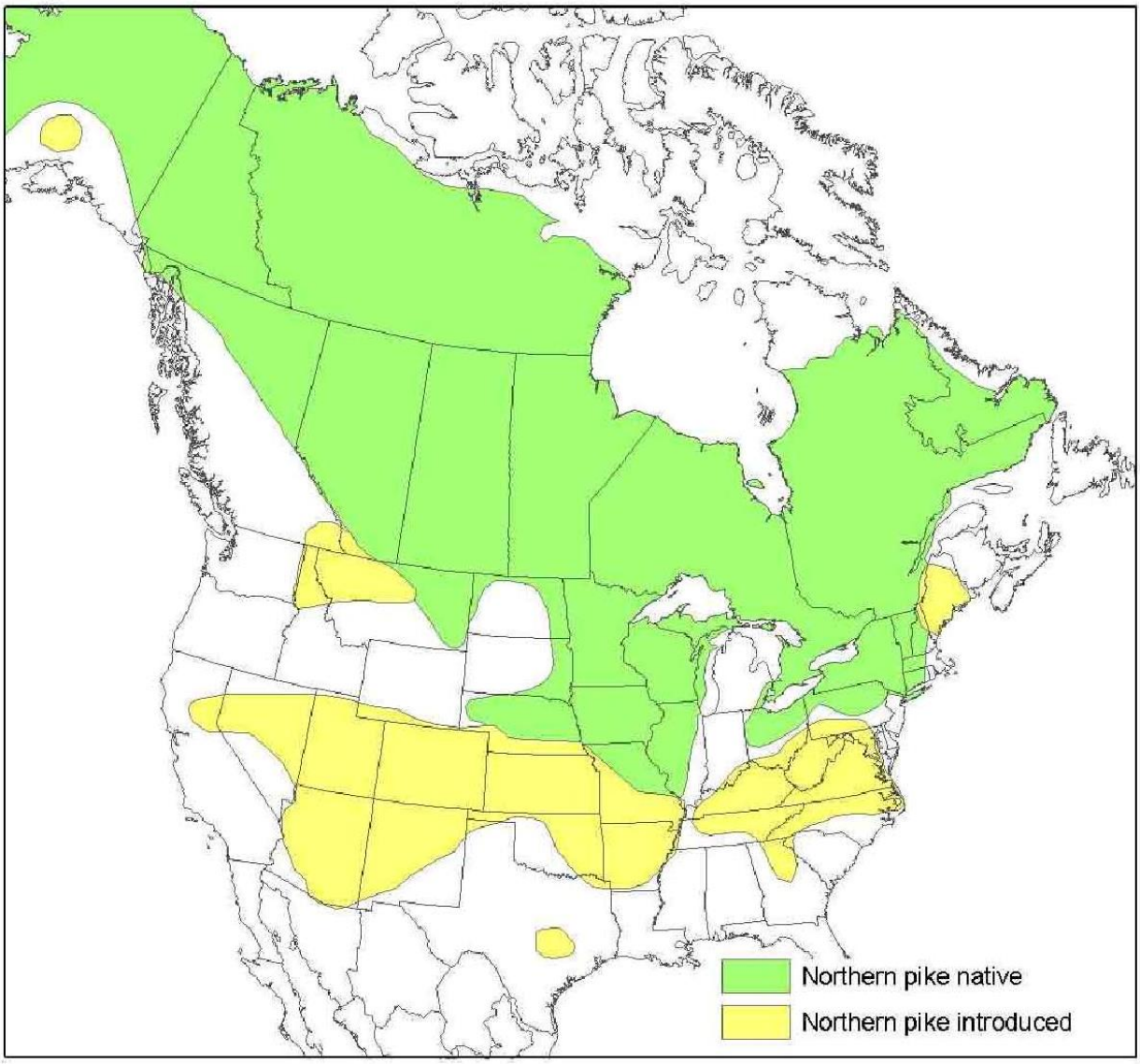

Figure 1. North American distribution of northern pike identifying their native and non-native (introduced) range (figure from Harvey 2009).

Northern pike are monomorphic (males and females look the same, though females tend to be larger at age) and are easily identified by their duckbill-shaped head, elongated body and posteriorly-placed dorsal and anal fins, which allow rapid acceleration; one feature making them a successful predator (Doyon et *al*. 1988; Hubbs and Lagler 2004; McPhail 2007).

Introduced northern pike were observed in the Koocanusa Reservoir in 1995 by the Montana Department of Fish, Wildlife, and Parks (Parnell 1996; Runciman and Leaf 2009). This population is suspected to have seeded British Columbia's (BC) first northern pike introduction at Ha Ha Lake near Wardner, BC; documented in 2005 (Harvey 2009; Runciman and Leaf 2009; Davis 2011). In 2004, northern pike were observed in the Pend d'Oreille River Box Canyon Reservoir in Pend Oreille County, Washington (WDFW and KTI 2012; Bartholdt 2018). This population is expected to have seeded the Lower Columbia River (LCR) population via the Pend d'Oreille River (Ford and Thorley 2011). These non-native (introduced) populations are considered invasive (a species that can spread to a degree that causes damage to the environment, human economy, or human health) in the Columbia River (Harvey 2009). Within the LCR, northern pike may pose a risk to resident fish including species listed under the Species at Risk Act (SARA) such as white sturgeon (*Acipenser transmontanus*), shorthead sculpin (*Cottus confusus*), Columbia sculpin (*Cottus hubbsi*), and Umatilla dace (*Rhinichthys umatilla*).

1.1 Program Background

In response to the spread of northern pike throughout the Pacific Northwest, including southeastern British Columbia, a number of suppression programs have been initiated in Canada and the United States. Within the Columbia River Basin, northern pike are now known to inhabit the Kettle River in addition to the Pend d'Oreille River and Columbia River; photo evidence also indicates they may have reached Christina Lake via the Kettle River. As of January 2024, over 40,708 northern pike have been removed from the Columbia River Basin in Canada (1,021) and the United States (39,687) through active suppression, angler incentives, and other suppression initiatives (AMEC 2017; Baxter and Lawrence 2018; Wood 2019; S. Jasper, pers. comm. Feb 12 2024; ONA 2023; WDFW and KTI 2023[1], 2023[2]; BC Hydro unpublished data).

1.1.1 United States Suppression Efforts (Pend d'Oreille and Columbia Rivers)

In 2012, the Kalispel Tribe of Indians (KTI) and the Washington Department of Fish and Wildlife (WDFW) began an active suppression program in the Box Canyon Reservoir which has resulted in the removal of 19,613 northern pike as of January 2024 (183 in 2023; WDFW and KTI 2023[1]). An additional program was initiated in the Boundary Reservoir in 2016, which has resulted in the removal of 828 northern pike as of January 2024 (0 in 2023; WDFW and KTI 2023[2]).

In 2015, a dedicated Northern Pike Suppression Program was initiated in Lake Roosevelt to suppress northern pike population growth in the reservoir; this program involved the Colville Confederated Tribes (CCT), Spokane Tribe of Indians (STI), WDFW, and the US Department of Energy – Bonneville Power Administration (BPA). At least 19,246 northern pike have been removed from Lake Roosevelt as of January 2024 (69 in 2023; S. Jasper, pers. comm.).

1.1.2 Canadian Suppression Efforts (Pend d'Oreille and Columbia Rivers)

In 2014, a gillnetting program was initiated in the LCR resulting in the removal of 323 northern pike between 2014 and 2017 (Baxter and Lawrence 2018). An angler reward program, initiated by FLRNORD in 2013/14 and 2015/16, resulted in the removal of an additional 29 northern pike from the LCR and four northern pike from the Pend d'Oreille River (Doutaz 2019).

In 2015 and 2016, additional detection programs were implemented by the Castlegar and District Wildlife Association (CDWA) and Golder Associates (2015), and Okanagan Nation Alliance (ONA 2016). The CDWA and Golder piloted a larval study targeting northern pike in the LCR; however, none were detected (Golder 2015). In 2016, the ONA conducted a juvenile northern pike sampling program in the Robson Reach of the LCR resulting in the capture of one young-of-year (YOY) northern pike; this detection confirmed northern pike recruitment in the LCR (ONA 2016). Doutaz (2019) further supported this finding using microchemistry to determine 98% of northern pike sampled from the Columbia River originated from the Columbia River. Doutaz removed an additional 43 northern pike from the Pend d'Oreille River during 2016 and 2017.

In 2018, suppression efforts occurred in both the Columbia and Pend d'Oreille Rivers and resulted in the removal of 42 northern pike (Wood 2019). An ONA-led angler incentive program was also implemented in 2018, which resulted in the removal of four northern pike; three from the Columbia River and one from the Pend d'Oreille River (ONA 2020). The ONA also conducted a brief adult suppression program in 2018 (3,031 seconds electrofishing and 47.8 hours gillnetting) in the LCR and Pend d'Oreille Rivers, however no northern pike were captured.

In Year 1 (2019) of the ONA Northern Pike Suppression Program 45 northern pike were removed, 10 in the Pend d'Oreille River and 35 in the LCR (ONA 2020). During early detection monitoring in Christina Lake in Year 1 (2019), northern pike were not detected (ONA 2020). In Year 2 (2020), 144 northern pike were removed; six from the Pend d'Oreille River and 138 from the LCR (ONA 2021). In Year 3 (2021), 39 northern pike were removed, one from the Pend d'Oreille River and 38 from the LCR; an email-in angler incentive program was also initiated (no physical submission required due to COVID-19) and resulted in the removal of one northern pike from the Columbia River (ONA 2022). In Year 4 (2022), 179 northern pike were removed from the LCR through gillnetting, backpack electrofishing, and seine netting. An additional three northern pike were submitted through the ONA email-in angler incentive program. In Year 5 (2023), 73 northern pike were removed from the LCR through gillnetting, and one northern pike was submitted through the email-in angler incentive program.

In addition to targeted efforts, 86 northern pike have been opportunistically removed from the Columbia River since 2010 through BC Hydro's Lower Columbia River Fish Population Indexing Surveys (CLBMON-45; BC Hydro unpublished data) and three since 2017 through BC Hydro's Lower Columbia River Fish Stranding Assessment and Ramping Protocol (CLBMON-42A; BC Hydro unpublished data).

In total, from 2010 to 2023, 1,021 northern pike have been removed from the Canadian Columbia River Basin, 941 from the LCR and 80 from the Pend d'Oreille River.

1.2 Project Goals and Objectives

The primary goal of this program is to continue efforts to suppress adult and YOY northern pike in the Columbia and Pend d'Oreille Rivers (within Canada), while working to identify northern pike spawning and rearing locations and to monitor range expansion using environmental DNA (eDNA). Specific goals and objectives include:

Goal 1: *Reduce the population of northern pike in the Columbia and Pend d'Oreille Rivers*

- Objective 1.1: Utilize existing northern pike suppression methodologies from similar programs to ensure comparability (catch-per-unit-effort compared between years and programs)
- Objective 1.2: Investigate and trial new northern pike capture methods that could increase suppression efforts
- Objective 1.3: Identify primary northern pike spawning/rearing habitat to direct active suppression efforts
- Objective 1.4: Minimize mortality of native species and Species at Risk (SARA)

Goal 2: *Monitor for northern pike range expansion at susceptible locations*

- Objective 2.1: Utilize eDNA to monitor for northern pike presence outside of the current known range
- Objective 2.2: Implement a rapid response plan to manage northern pike in newly detected areas

Goal 3: *Promote stewardship and public involvement in northern pike suppression*

- Objective 3.1: Engage local stewardship groups through conferencing, outreach, and education
- Objective 3.2: Continue to develop angler outreach to increase participation in northern pike suppression

2.0 Methods

All methods used for this program were implemented in accordance with Department of Fisheries and Oceans SARA Permit 22-PPAC-0009 (Columbia River) and MFLNRORD Scientific Collection Permit BC23-802944 (Lower Columbia, Lower Kootenay, and Pend d'Oreille Rivers).

2.1 Study Area

Active suppression and early detection monitoring occurred in the LCR, Lower Kootenay River (LKR), and Pend d'Oreille River (Figure 2). eDNA sampling occurred in the same locations as suppression and early detection monitoring, with additional sites in the Kootenay River (upstream of Brilliant Dam), Arrow Lakes

Reservoir (upstream of HLK Dam to Nakusp BC), Kettle River (downstream of Kettle Falls), Christina Lake, and Osoyoos Lake (Figure 3).

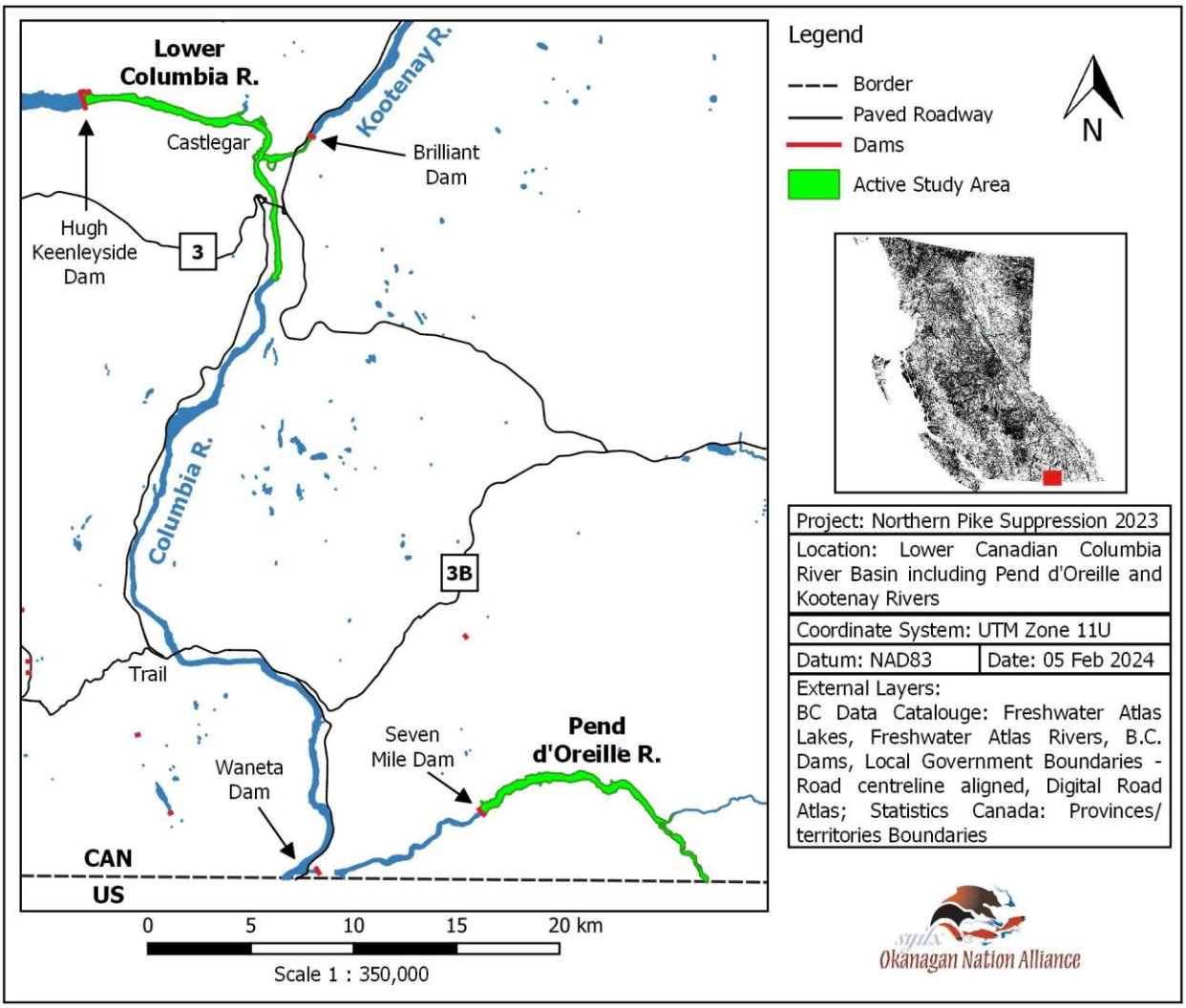

Figure 2. Northern pike early detection monitoring and active suppression study areas within the Columbia River Basin in 2023. Lower Columbia River sampling includes the Lower Kootenay River downstream of Brilliant Dam.

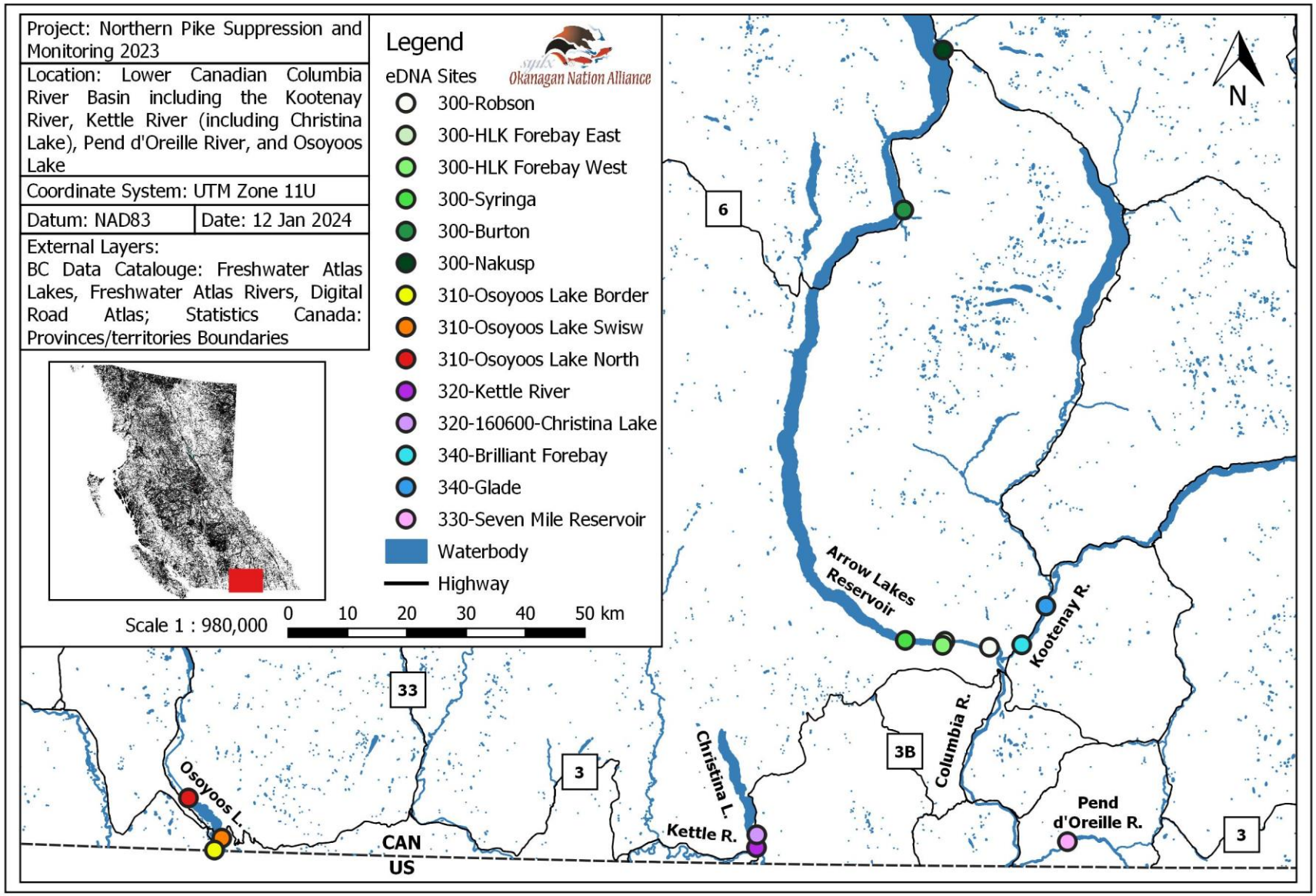

Figure 3. Northern pike eDNA sampling locations (including positive control sites: 300-Robson; 330-Seven Mile Reservoir) within the Columbia River Basin in 2023.

Suppression efforts in the Columbia River in 2023 were focused between HLK Dam and Waterloo Eddy near Castlegar BC, targeting capture locations identified in previous suppression efforts (Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2017; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023). This area includes the lower reach of the Kootenay River between the Columbia/Kootenay River confluences, upstream 2.9 km to Brilliant Dam (see "Lower Columbia R." suppression area in Figure 2); for the purposes of this report, this section of the Kootenay River is referred to as the "Lower Columbia River" or "LCR" sampling area unless specifically stated otherwise.

The Pend d'Oreille River is a tributary of the Columbia River and is approximately 209 km long originating in Lake Pend Oreille near Sandpoint, Idaho. The majority of the river is located in the United States before entering Canada downstream of Boundary Dam north of Metalline Falls, WA. The Pend d'Oreille River flows through southern BC for 24.6 km before draining into the Columbia River just north of the Canada/United States Border. Within the Canadian reach of the Pend d'Oreille there are two reservoirs: Waneta (9.4 km) and Seven Mile (14.4 km). The Waneta Reservoir was formed with the construction of Waneta Dam and extends from the forebay of Waneta Dam (RKm 0.8) to the tailrace of Seven Mile Dam (RKm 10.2). The Seven Mile Reservoir originates behind Seven Mile Dam and extends to the Boundary Dam tailrace (RKm 24.6). In 2023, active suppression was focused in the Seven Mile Reservoir as northern pike were not encountered in Waneta Reservoir sampling during 2022.

Christina Lake is located between Grand Forks and Castlegar, BC, and drains into the Kettle River, a tributary to the Columbia River. The lake is roughly 18 km long and has a surface area of 25.5 km^2 providing high recreational value; locally, Christina Lake is known as the warmest timber-lined lake in BC. Christina Lake was determined a high-priority monitoring location and a candidate for exploratory sampling because of the high potential for northern pike introduction through the Kettle River, which has confirmed northern pike presence. Northern pike monitoring in Christina Lake was limited to eDNA sampling in 2023.

2.2 Early Detection Monitoring and Suppression Timing

Suppression activities began on May 23 2023 in the Pend d'Oreille River and May 26 2023 in the LCR, around the anticipated northern pike spawning window. The Pend d'Oreille River was only sampled in the spring (until May 25 2023), while suppression in the LCR occurred in three seasons: spring (May 26 – Jun 30), summer (Jul 01 – Aug 19), and fall (Aug 20 – Sep 14). Additionally, northern pike may be opportunistically captured and removed during the CLBMON-42A (sampling throughout the year) and the CLBMON-45 Indexing Program (Sep 27 – Nov 15 2023; BC Hydro unpublished data). The email-in angler incentive program occurred between January and December 2023; active participation appeared to be in May.

2.3 Sampling Methods

Gillnetting and backpack electrofishing methods were utilized in 2023 and implemented in a manner that ensured comparability to similar suppression programs (Box Canyon Reservoir, Boundary Reservoir, Lake Roosevelt) and past efforts in the LCR and Pend d'Oreille River. When required, methods were adjusted based on site-specific conditions to improve capture opportunities; comparability of data was considered when using adjusted methods.

2.3.1 Gillnetting

Two different gillnet types were used to target different life stages of northern pike. Spring Pike Index Nets (SPIN) were deployed from May through August to target adult northern pike (Table 1). Individual nets were constructed of five different mesh size panels (2”, 2.5”, 3”, 3.5”, 4”), with a total length of 45.72 m and depth of 1.83 m. Juvenile nets (1” monofilament nets, 45.72 m x 1.83 m) were deployed from July into October to target YOY northern pike. Gillnets were deployed from a 24’ jet-drive river boat at all sites except in Zuckerberg Pond where nets were deployed by hand or from a canoe due to shallow water, poor access, and heavy accumulations of aquatic vegetation (Figure 4).

Table 1. Gillnet panel specifications of the Spring Pike Index Nets used in the Columbia and Pend d’Oreille Rivers including panel length (m), panel depth (m), mesh size (inch; stretched), monofilament material number (indicates type of monofilament from manufacturer), monofilament diameter (mm) and test strength (lbs).

Panel Number	Panel Length (m)	Panel Depth (m)	Mesh Size (inch)	Monofilament Material Number	Diameter (mm)	Net Test Strength (lbs.)
1	9.144	1.83	2.0	#104/#4	0.33	11
2	9.144	1.83	2.5	#104/#4	0.33	11
3	9.144	1.83	3.0	#139/#6	0.40	17
4	9.144	1.83	3.5	#139/#6	0.40	17
5	9.144	1.83	4.0	#139/#6	0.40	17

Figure 4. Example of gillnet deployment via canoe in Zuckerberg Pond, Castlegar BC. Photo by Evan Smith, Okanagan Nation Alliance.

Gillnets were set in areas of known or suspected northern pike habitat (shallow, slow moving, abundant aquatic vegetation). Whenever possible, gillnets were set perpendicular to shore with the shallow end in ~1 m of water. SPIN nets were deployed with the smallest mesh size close to shore and the largest mesh size in deeper water. Gillnets were permitted to soak for up to four hours in the LCR and up to 24 hours in the Pend d'Oreille River in accordance with applicable permitting. Soak times in the LCR were reduced since white sturgeon capture rates were high.

2.3.2 Backpack Electrofishing

Backpack electrofishing was used in Zuckerberg Pond in July to target YOY northern pike. A Smith-Root LR-24 electrofishing unit was used at settings of 45 Hz, 12% duty cycle at 25 W average-output power and then adjusted to increase efficiency. Variables such as conductivity, substrate, temperature, fish size, and species all effect the efficacy of the electrofishing unit (Beaumont et *al*. 2002). Settings were adjusted in accordance with the LR-24 Electrofisher User's Manual (Smith-Root 2021). Settings were higher than those generally recommended for soft-bodied fish; however due to low native bycatch rates (ONA 2020) it was determined the risk to native species was low. If native species were encountered during backpack electrofishing, the power was turned off and resumed when the fish had left the sampling zone (15 m from the electrofisher). Other non-native (invasive) species were opportunistically captured and euthanized if encountered. Effort was measured in seconds, while site length (m), estimated effective width (m) and average depth (m) were also recorded.

2.3.5 Habitat Data Collection

Habitat was classified by recording cover types, benthic profiles, and hydraulics at each sample location. Cover types included interstices, woody debris, aquatic vegetation, and terrestrial vegetation. In sites where multiple cover types were present, only the primary and secondary cover types were recorded. Benthic profile types included drop off, bench, high grade, and low grade. Seven hydraulic types were identified (most adapted from CLBMON-45) and were expanded to include shoreline sites (no identifiable flow). To see a full list of the three habitat classifications, see *Appendix A – Site Habitat Classifications*.

Habitat classifications were specific to a sample location and may vary within a site (e.g., Pike Bay or Buckley Campground) depending on where sampling occurred within a specific site. To classify the habitat within a site, the most frequent habitat classifications recorded were used.

Specific water quality measurements were collected at each site to supplement physical habitat descriptions (Table 2). Weather conditions, sample start time/date, and sample end time/date were recorded at all sites for all methodologies. Long-term water temperature data in Zuckerberg Pond were collected with HOBO Pendant Temperature/Light 64K Data Loggers. Water temperature data for the Pend d'Oreille River were obtained from the United States Geological Survey (USGS) National Water Information System: Web Interface at the International Boundary (Station: 12398600; USGS 2023), while reservoir elevation data were collected from BC Hydro (BC Hydro unpublished data). Water temperature and river elevation data for the Columbia River were obtained from the Water Survey of Canada (WSC) at Birchbank (Station: 08NE049; WSC 2024). The YSI Pro2030 was calibrated at the beginning of the field season.

Table 2. Instruments used to collect habitat and water quality parameters at northern pike monitoring and suppression sites, including associated accuracy.

Instrument	Parameter	Accuracy
Humminbird Helix 7x Chirp GPS G2	Water depth (m)	
	Surface water temperature (°C)	
Garmin 64st	UTM location	± 3 m
YSI Pro2030	Dissolved oxygen (mg/L)	± 2 % of the reading or ± 0.2 mg/L, whichever is greater
	Conductivity (µs/cm)	± 1.0 % of the reading or 1 µS/cm, whichever is greater
Secchi Disc	Water clarity (m)	

2.4 Fish Handling, Processing, and Data Collection

All captured northern pike were euthanized before being scanned for a Passive Integrated Transmitter (PIT) tag, measured (fork length in mm) and weighed (grams). Northern pike were dissected to inspect gonads for sex, stomach contents for prey species, and to remove a cleithrum for aging. Cleithra were stored in a bag with an internal and external label that included the northern pike reference number, date, length, and weight. These samples were stored in a freezer until processing.

All bycatch was identified to species and fork length measurements were taken. Certain species were also weighed and scanned for the presence of a PIT tag (rainbow trout [*Oncorhynchus mykiss*], mountain whitefish [*Prosopium williamsoni*], bull trout [*Salvelinus confluentus*], cutthroat trout [*Oncorhynchus clarkia*], walleye [*Sander vitreus*]). Any native fish caught were processed first to increase survival rate. While gillnetting, if possible, the boat operator would process native fish and release individuals while the net was being retrieved. While sampling in Zuckerberg Pond, native fish species encountered were released in the Columbia River either upstream or downstream of Zuckerberg Pond (to reduce the risk of stranding when the pond becomes isolated). All invasive fish were euthanized and disposed of at the point of capture, with the exception of walleye in the LCR and Pend d'Oreille River as they are regionally managed sportfish.

2.5 Data Management and Mapping

All field data were recorded on project-specific datasheets with supplemental data recorded in field notebooks. Over the course of a field day, pictures of datasheets were taken as a digital backup. At the end of the day, all datasheets were scanned and transferred to the ONA shared network. Field data were entered into a Microsoft Excel database and QA/QC'ed (Quality Assurance/Quality Control), while GPS data were stored in Garmin Basecamp (Version 4.7.4).

All mapping was completed on Q-GIS (Version 3.10.14-A Coruña) with layers obtained from 2023 field data and open-source external layers from the BC Data Catalog and Statistics Canada. All satellite imagery was open source from the ESRI World Imagery service, and the year of the imagery is identified in each map. Individual layers and their source are identified in each map and are included in the references section under *6.1 May Layer Sources*.

2.6 Data Analysis

Microsoft Excel (2016) was used for all summary statistics and graphs; geographical analyses were completed using Q-GIS.

2.6.1 Catch per unit Effort

Gillnet catch-per-unit-effort (CPUE) was calculated as catch per 8-hour period (Equation 1). $CPUE_{8hr}$ was compared to previous years when timing and method of suppression was similar; typically, Apr 01 – Jun 30 (Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2017; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023). The number of northern pike captured and the number removed from the system may vary if northern pike escaped a net or trap during retrieval, or the individual was released for a specific purpose (e.g. mark-recaptures programs, historic angler incentive programs).

Equation 1. Gillnet catch-per-unit-effort equation.

$$CPUE_{8hr} = \frac{Northern\ pike\ captured}{Total\ gillnet\ hours} \times 8\ hours$$

Backpack electrofishing CPUE was expressed as northern pike per hour using the calculation: northern pike captured / hours sampled (sample time in seconds / 60 seconds/ 60 minutes) and was compared to similar effort in 2020 and 2022.

2.6.2 Northern Pike Population Dynamics

A variety of northern pike population dynamics were explored including relative population trends, spawning window variations, growth rate, identification of juvenile habitat, length-age relationships, length-weight relationships (size), condition factor, parasitic relationships, and diet.

The Columbia River northern pike population has previously been calculated using the Lincoln-Petersen mark-recapture method (Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2017). However, the accuracy of these estimates was questionable as two of the five assumptions for the Lincoln-Petersen mark-recapture method were not met: (1) the population is physically (immigration or emigration) and demographically (recruitment or mortality) closed (so that N is constant over the time of sampling), and (2) marks or tags are not lost or missed (Wood 2019). Therefore, due to the complications of addressing these assumptions (primarily the assumption of a closed population), and the requirement to release tagged northern pike, mark-recapture population estimates did not occur between 2018 – 2023 (Wood 2019). Instead, a comparison of spring (Apr 01 – Jun 30) $CPUE_{8hr}$ is used to compare and estimate relative abundance trends between years in the LCR. The Pend d'Oreille River northern pike population has not been estimated.

Analyses of the northern pike spawning windows in the Columbia and Pend d'Oreille Rivers were conducted utilizing current and historic northern pike captures and available water temperature/elevation data. Temporal observations of spawning northern pike were graphed with the corresponding water temperatures/levels at the time to identify possible correlations.

Data on adult (1+ years) northern pike growth rates were collected opportunistically through the capture of previously tagged adults from other studies (e.g., Baxter and Neufeld 2015; Doutaz 2019). The growth rate for re-captured tagged adults is expressed by cm/year and kg/year (Equation 2).

Equation 2. Growth rate equation used to determine length or weight growth of re-captured northern pike.

$$AG = \frac{GP\ at\ second\ capture - GP\ at\ initial\ capture}{Years\ at\ large}$$

$Where,$
$AG = Annual\ Growth\ (length\ in\ cm\ or\ weight\ in\ kg)\ by\ year$
$GP = Growth\ Parameter\ (length\ in\ cm\ or\ weight\ in\ kg)\ of\ northern\ pike$
$Years\ at\ large = \ number\ of\ days\ between\ two\ capture\ events\ \div\ 365\ days$

Growth rates for YOY (0+ years) northern pike were estimated by capturing individuals at the same location over several weeks. Excel was used to calculate a linear regression and determine an equation expressed in cm/day and g/day and was also converted to cm/week and g/week to compare with other growth rate estimates.

Growth rates were compared to previous studies in the LCR for adults (Baxter and Neufeld 2015; Doutaz 2019; ONA 2022), and in Zuckerberg Pond for YOY northern pike (ONA 2021 and 2023).

Northern pike rearing habitat was primarily identified by the density of YOY northern pike captured or observed in a location. Habitat parameters were compared between sites with high YOY presence, and sites with no (or low) YOY presence.

Length/age, length/weight, and condition factor (Equation 3) were graphed to compare between systems. The condition factor equation used a species-specific population-fitted exponent developed by Doyon et *al*. (1988); the qualifier 10^5 transforms the value to bring it closer to 0.

Equation 3. Condition factor equation used to quantify the condition of northern pike in various systems.

$$K_n = \frac{(10^5\ \times W)}{L^3}$$

$Where,$
$K_n = Condition\ factor\ of\ northern\ pike\ n$
$W = Weight\ of\ northern\ pike\ (g)$
$L = Length\ of\ northern\ pike\ (mm)$

Data on northern pike diet in the LCR and Pend d'Oreille River were obtained through observations of euthanized northern pike stomach contents. Stomach contents of northern pike were inspected and prey were identified to species (or family) to the best of the crew's ability. When prey items were intact, notations on length (mm) and weight (g) were recorded. Prey compositions were compared between the LCR and Pend d'Oreille River and between adults and YOY to identify differences in diet.

2.7 eDNA Sampling and Processing

In 2019, an eDNA primer was developed and QA/QC'ed by the ONA kł cp̓əlk̓ stiṁ Fish Health and Diagnostics Laboratory to detect northern pike in the Columbia River (ONA 2020). In 2023, eDNA samples were taken from Osoyoos Lake, Christina Lake, the Kettle River, Arrow Lakes Reservoir, and the Kootenay River; with positive control samples from the LCR and Pend d'Oreille River.

eDNA samples were collected with a Smith-Root backpack eDNA sampling unit (Figure 5) using the procedures outlined in sampler manual (Smith-Root 2022). A target of 2 L of water through a self-preserving (up to 6 months at room temperature) 5 µm filter at a rate of 0.8 L/m was collected for each sample. One site consisted of three replicate samples, and a fourth sample of distilled water to act as a negative control. Samples were sent to the kł cp̓əlk̓ stiṁ Fish Health and Diagnostics Laboratory in Penticton BC for processing.

Lab samples were processed using the Zymo research Quick-DNA/RNA MagBead Kit according to the manufacturer's recommended protocol. Each purified nucleic acid sample was split into two, stored at -80°C, and subsequently used as template in the quantitative polymerase chain reaction (qPCR). These samples were tested for viability using eplant qPCR assay according to Veldhoen et *al.* (2016) then tested for northern pike DNA using the primer developed by Carim et *al.* (2019) and QA/QC'ed by the ONA (2020).

Individuals involved in eDNA collection ensured they had not come into contact with northern pike for at least a week and wore fresh nitrile gloves between each replicate sample, and each site, to reduce cross contamination and instances of false positives. To avoid clogging the filter, collectors stood on shore while collecting the sample.

Figure 5. Smith-Root eDNA backpack sampler used to detect presence of northern pike in the Columbia River Basin. Photo by Shelley Hackett, Okanagan Nation Alliance.

3.0 Results

In 2023, a total of 74 northern pike (74 – LCR and 0 – Pend d'Oreille River) were encountered, 73 of which were euthanized, over 30 crew days. Northern pike were only encountered through gillnetting (74). Most northern pike removed in 2023 were adults (42; 18 from Pike Bay), and of these, 14 were spawn bound, spawning, or spent.

Northern pike were not captured in the LCR during the CLBMON-45 Indexing Program between HLK Dam, Brilliant Dam and the confluence of the Columbia and Kootenay Rivers (Sep 27 – Nov 15 2023; BC Hydro unpublished data). One northern pike was submitted by an angler to ONA as part of the email-in angler incentive program (from the Robson Reach).

Water quality parameters (conductivity, dissolved oxygen, pH, and Secchi depth) were measured, but data are difficult to compare as the different waterbodies were not always sampled in the same month.

3.1 Effort and Catch per Unit Effort

Suppression efforts took place between May 23 and May 25 2022 (Pend d'Oreille River – Seven Mile Reservoir), and May 26 and Sep 14 on the LCR. Gillnetting was the most utilized method to capture northern pike and was the most effective with a CPUE of 0.19 northern pike/hour (Table 3). Northern pike were not encountered during backpack electrofishing or during the CLBMON-45 Indexing Program (boat electrofishing conducted from HLK Dam downstream to the USA / CAN Border, inclusive of the LKR; BC Hydro unpublished data). CPUE for northern pike submitted through the email-in angler incentive program were not estimated. A summary of all effort is available in *Appendix B – Northern Pike Suppression and Monitoring Sites by Method*. Maps of site location are provided in *Appendix C – Maps of Gillnet Suppression Effort*.

Table 3. Summary of northern pike (NP) catch, total effort, and catch-per-unit-effort (CPUE) by method during the Okanagan Nation Alliance monitoring and suppression program from May 23 – Sep 14 2023 (Sep 27 – Nov 15 2023 for CLBMON-45 data).

Sample Method	Waterbodies Sampled	NP Captured	Number of Checks / Passes	Effort Type	Total Effort	CPUE (NP/Effort)
Gillnetting	LCR / PDO	74	282	Hours	879	0.08
Backpack Electrofishing	LCR	0	9	Hours	<1	0.00
CLBMON-45	LCR	0	105	Hours	32	0.00

Compared to the Pend d'Oreille River, the Columbia River had more northern pike captures (Columbia River = 74, Pend d'Oreille River = 0), gillnet effort (Columbia River = 674 hours, Pend d'Oreille River = 205 hours), and higher CPUE (Columbia River = 0.88 norther pike / 8-hours, Pend d'Oreille River = 0.00 northern pike / 8-hours). A description of gillnet effort by season and location is provided in *Appendix D – Summary of Gillnet Effort and Catch-Per-Unit-Effort by Season and Location*.

3.2 Distribution and Spawning

In the LCR, adult northern pike were primarily captured along the right downstream bank (river right) between Pike Bay (downstream of Celgar Mill) and the Robson Bridge, and along the left downstream bank (river left) from Balfour Bay to the Robson ferry landing (Figure 6). Adults were also captured in Zuckerberg Pond. Northern pike were not detected in the Pend d'Oreille River in 2023.

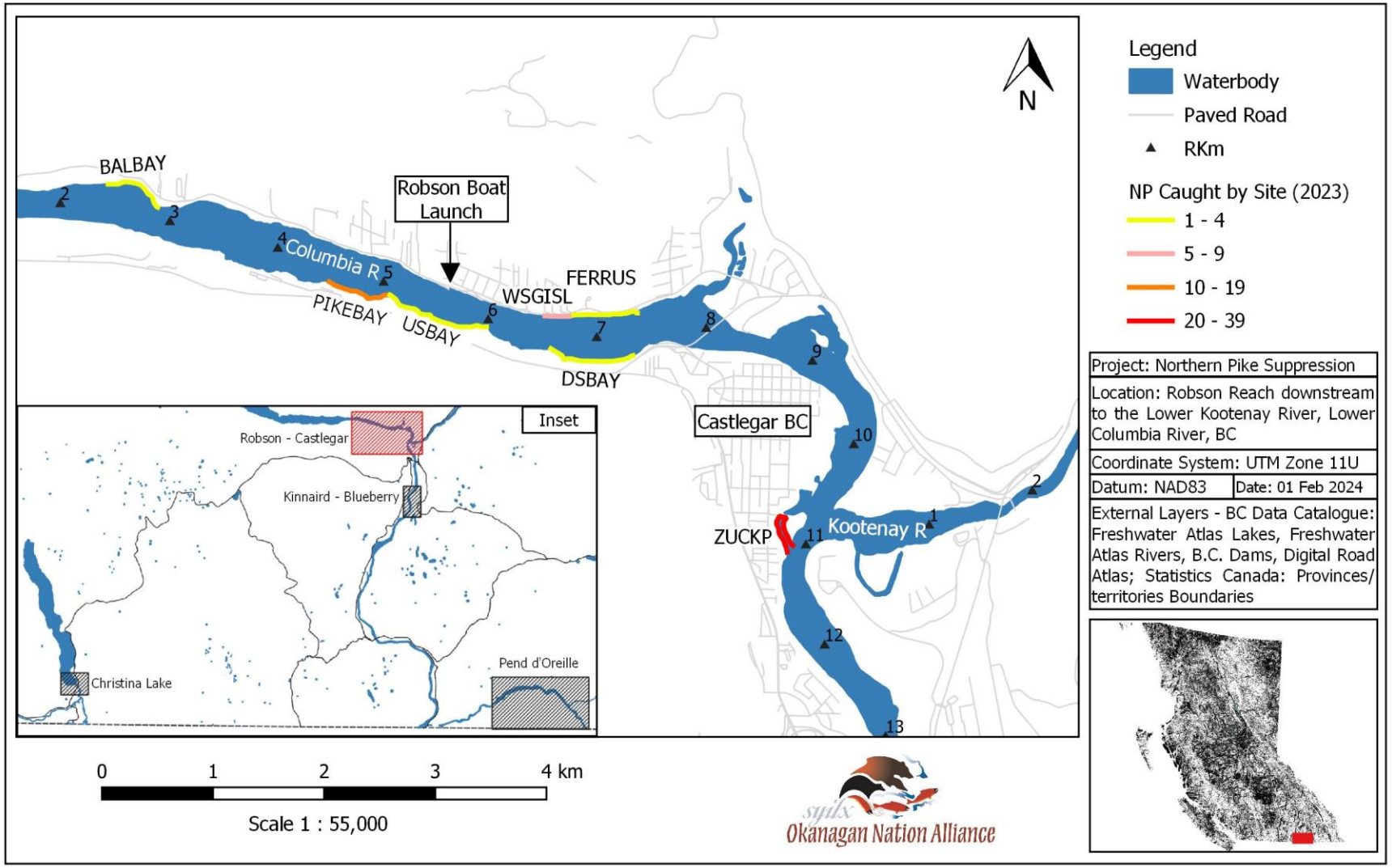

Figure 6. Northern pike (NP) captures by site in the Castlegar area during the Okanagan Nation Alliance monitoring and suppression program and email-in angler incentive program from May 10 to Sep 14 2023.

Based on the spawn-ready (spawn bound, spawning, or spawned out) northern pike caught in the LCR (eight females and five males), the northern pike spawning window likely began around May 30 and ended around or after Jun 16 (Figure 7). Water temperatures during sets in the LCR ranged from 7.6 – 17.1 °C (15.3 – 16.4 °C in Zuckerberg Pond) during this time. Average daily water temperature at the Birchbank station was 10.5 °C on May 30 when the first spawning females were captured. Spawn-ready individuals were captured at Balfour Bay, Pike Bay, Upstream Bay, Sturgeon Islands, Downstream Bay, and Ferry Landing Upstream.

All other individuals captured were YOY, immature, mature in non-spawning condition, or maturing.

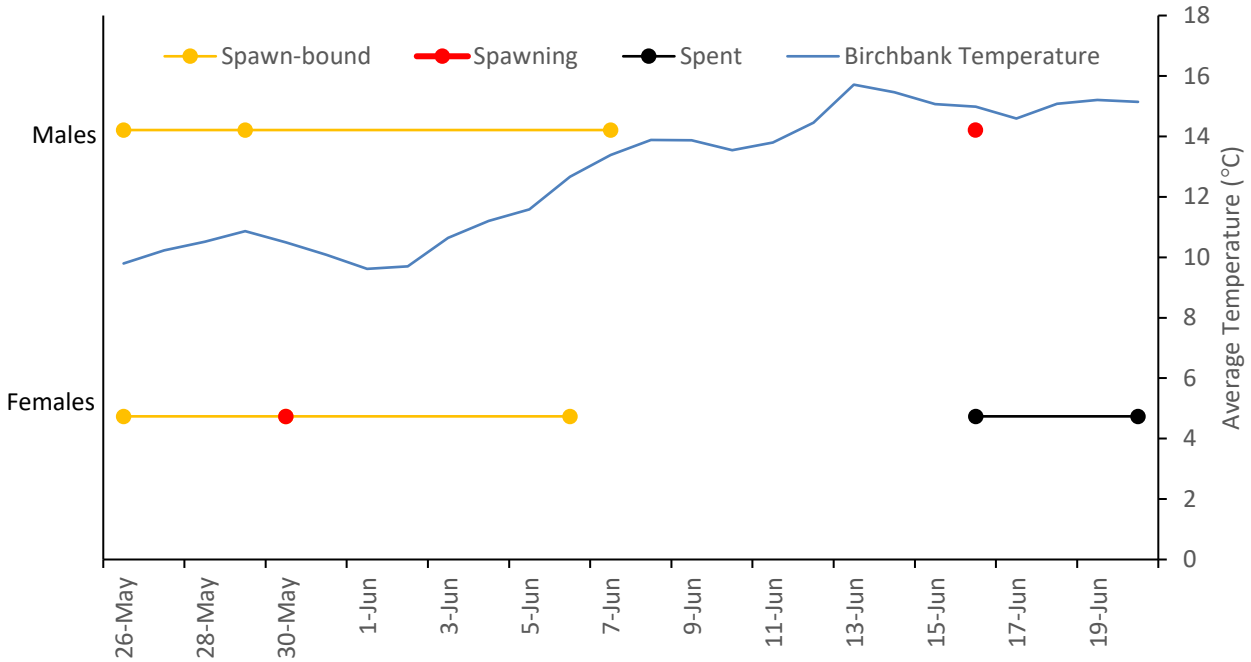

Figure 7. Spring spawning condition of adult northern pike in the Columbia River during the Okanagan Nation Alliance monitoring and suppression program in 2023, compared to average daily water temperature (°C) at Birchbank station (WSC 2024).

3.3 Habitat and Habitat Use

Mean daily water temperatures between Apr 01 – Oct 31 2022 were warmer in the Pend d'Oreille River (17.2 °C ± 0.7 °C with 95% CI, n = 214; USGS 2023) than the LCR (13.1 °C ± 0.6 °C with 95% CI, n = 214; WSC 2024; Figure 8). Average daily water temperatures were within the northern pike optimal temperature for growth and preference (20 °C – 22 °C) for a total of 34 days in the Pend d'Oreille River; however, temperatures did not exceed 18.8 °C in the LCR. Water temperature in the Pend d'Oreille River reached a maximum of 23.6 °C and never exceeded the upper limit for northern pike preference (25 °C; Casselman and Lewis 1996).

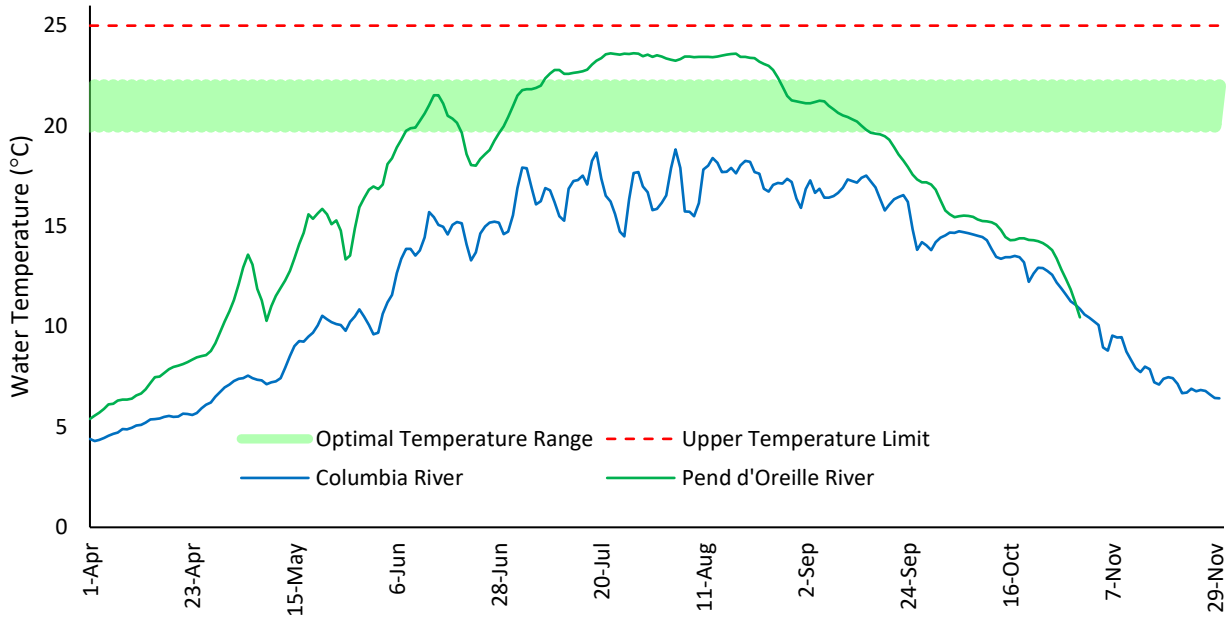

Figure 8. Average daily water temperature (°C) of the Columbia River (WSC 2024) and Pend d'Oreille River (USGS 2023) Apr 01 – Nov 31 2023 with the optimal temperature range for northern pike growth and preference (20 °C – 22 °C), and the upper preferred temperature limit (25 °C; Casselman and Lewis 1996).

In 2023, 18 sites were sampled for northern pike in the Columbia River Basin. Sites were predominately classified as glides with low gradient bathymetric profiles, whose primary cover was aquatic vegetation (Table 4).

Table 4. Sample sites classified by predominant hydraulic habitat, bathymetric profile, and primary cover during the Okanagan Nation Alliance monitoring and suppression program in 2023 including watershed code (300 = Lower Columbia River; 330 = Pend d'Oreille River; 340 = Lower Kootenay River).

Watershed Code	Site	Site Name	River Side	RKm u/s	RKm d/s	Hydraulic Habitat	Bathymetric Profile	Primary Cover
300	BALBAY	Balfour Bay	RL	2.4	2.8	Bay	Low Grade	Aquatic Vegetation
300	PIKEBAY	Pike Bay	RR	4.6	5.1	Glide	Low Grade	Aquatic Vegetation
300	USBAY	Upstream Bay	RR	5.1	6	Glide	Low Grade	Aquatic Vegetation
300	CENBAY	Center Bay	RR	6	6.6	Glide	Low Grade	Aquatic Vegetation
300	WSGISL	Sturgeon Islands	RL	6.5	6.8	Glide	Low Grade	Aquatic Vegetation
300	DSBAY	Downstream Bay	RR	6.6	7.3	Glide	Low Grade	Aquatic Vegetation
300	FERRUS	Ferry Landing Upstream	RL	6.8	7.4	Glide	Low Grade	Aquatic Vegetation
300	WALISL	Waldie Island	RL	8.6	9.2	Bay	Bench	Aquatic Vegetation
300	ZUCKP	Zuckerberg Pond	RR	10.8	11.1	Pond	Low Grade	Aquatic Vegetation
300	WATEDDY	Waterloo Eddy	RL	16.9	17.1	Pond	Low Grade	Aquatic Vegetation
340	LKREDDY	Kootenay Eddy	RR	0.3	0.1	Glide	Low Grade	Aquatic Vegetation
340	LKROX	Kootenay Oxbow	RL	0.8	0.3	Side Channel	Low Grade	Interstices
300	YPALLEY	Yellow Perch Alley	RR	11.2	11	Eddy	Low Grade	
300	BUCKDS	Buckley Downstream	RR	11.4	11.2	Bay	Low Grade	Aquatic Vegetation
300	BUCKCAMP	Buckley Campground	RR	11.7	11.4	Glide	Bench	Aquatic Vegetation
300	MINECAMP	Mine Camp	RL	12	11.7	Bay	Bench	Aquatic Vegetation
300	BURNBAY	Burn Bay	RR	16.9	15	Eddy	Drop-off	Interstices
300	TILLCR	Tillicum Creek	RR	17.5	17.3	Bay	Low Grade	Interstices

Northern pike were encountered in water depths between 1 – 11 m and appeared to occur more frequently in ponds and glides with aquatic vegetation and low gradient bathymetric profiles (Figure 9). These sites are typically found in the Robson Reach in the LCR. Sites with aquatic vegetation as the primary cover and low gradient bathymetric profiles were sampled more than other types.

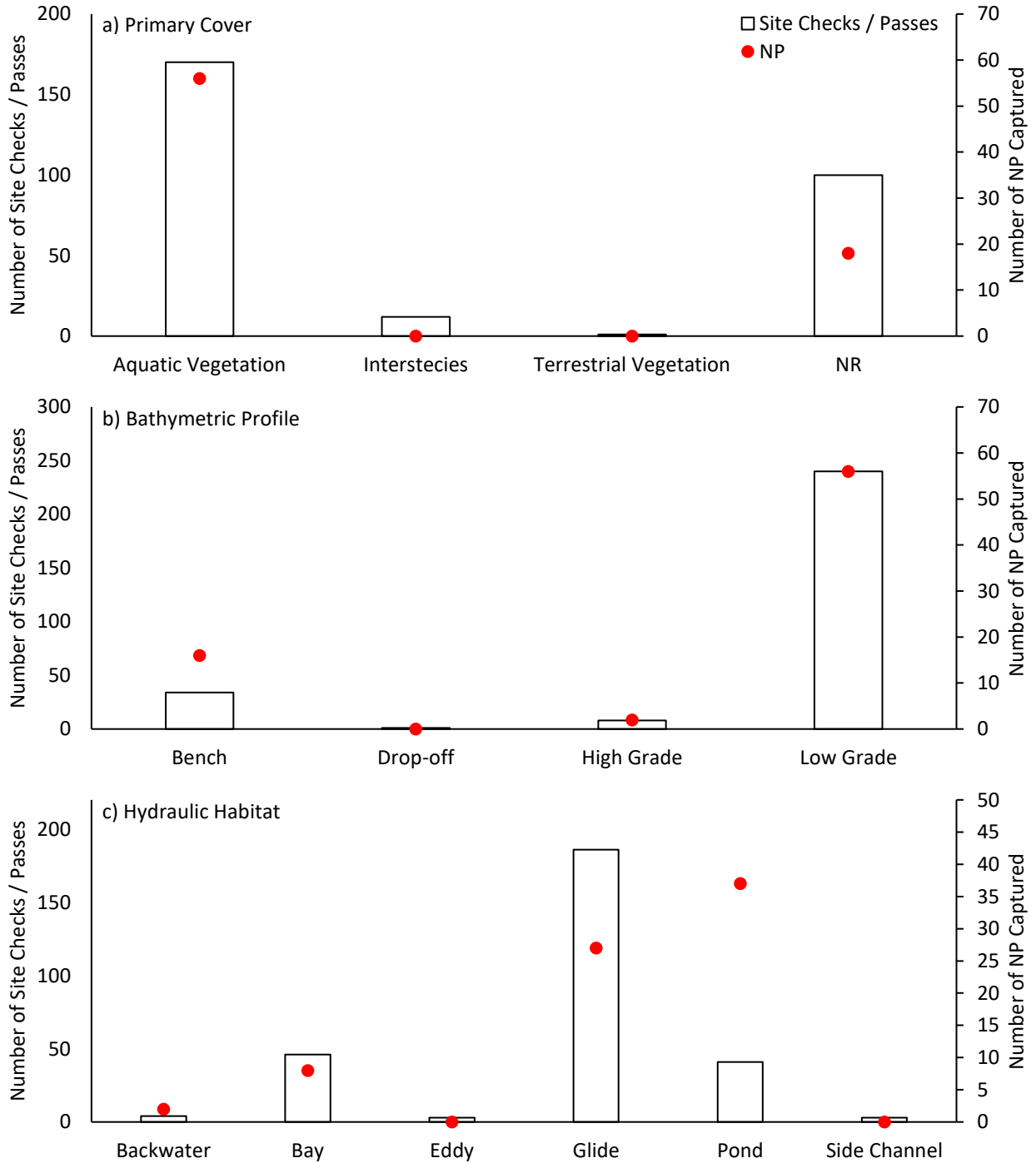

Figure 9. Number of active suppression site checks/passes in the Columbia Basin during the Okanagan Nation Alliance monitoring and suppression program in 2023, categorized by primary cover (a), bathymetric profile (b), and hydraulic habitat (c), and associated number of northern pike (NP) captured.

During suppression activities in 2023, all YOY northern pike were captured in water depth between 0.0 – 3.2 m. Reduced water flows through the LCR isolated Zuckerberg Pond for several periods of time throughout the 2023 suppression season. These periods restrict immigration and emigration from the pond and result in higher water temperatures (ONA 2020).

Due to the abundance of shallow, weedy habitat, non-native species appear to be thriving in Zuckerberg Pond and this location may be seeding the LCR Mainstem. In 2023, all YOY northern pike captured were found in Zuckerberg Pond.

3.4 Population Dynamics and Growth

Of the adult northern pike sexed in the LCR (n = 73), 22 were females, 18 were males, and 2 were unknown. YOY northern pike (31) were all of unknown sex and captures were limited to Zuckerberg Pond.

Northern pike were not aged in 2023. Data will be included in the discussion of future reports.

Length ranged in from 130 mm (YOY in Zuckerberg Pond) – 822 mm (spent female in the Robson Reach). The average length of adult northern pike captured was 529 mm (n = 42) with an average weight of 1,668 g (n = 42; Figure 10). YOY northern pike removed had an average length of 207 mm (n = 31) and an average weight of 91 g (n = 30; Figure 10). All northern pike biological data are available in *Appendix E – Northern Pike Biological Data*.

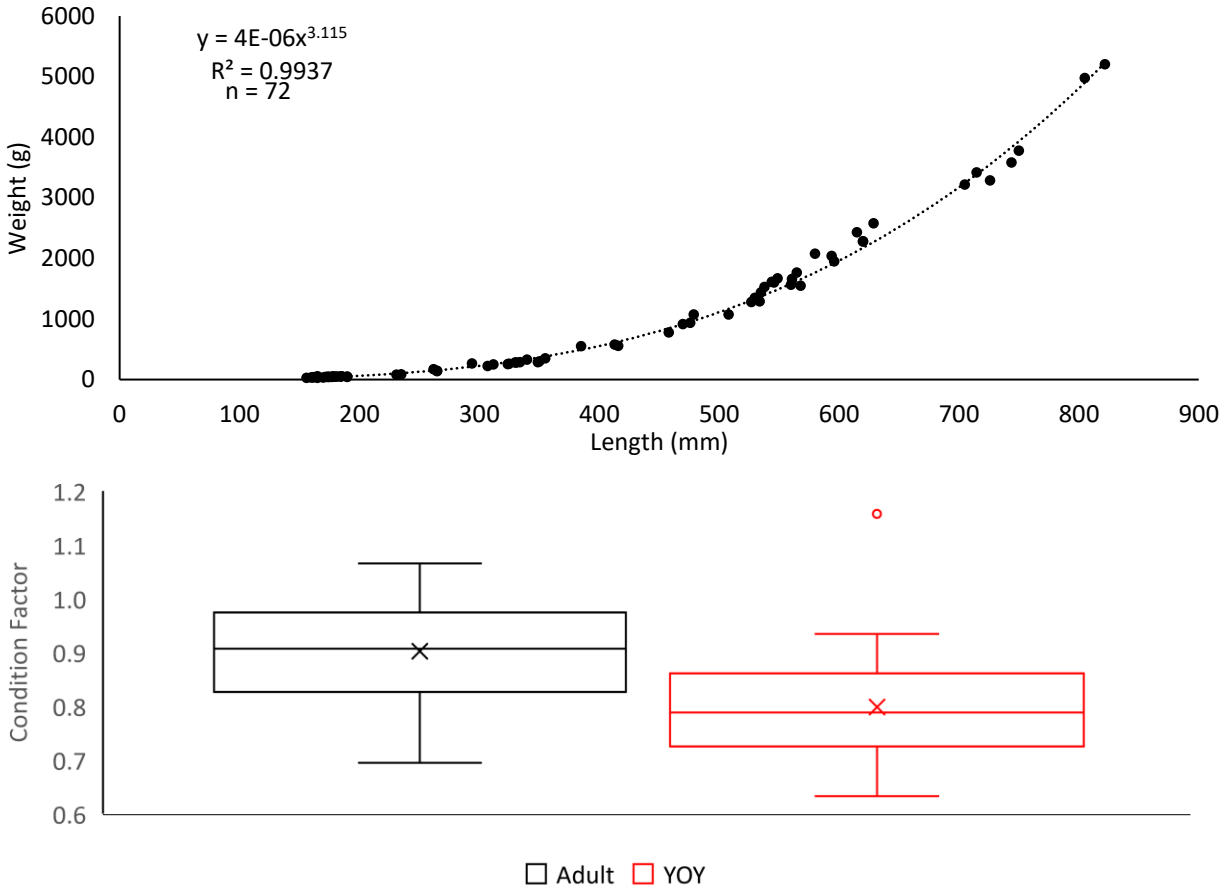

Figure 10. Length and weight (top) and condition factor (bottom) of northern pike removed during the Okanagan Nation Alliance monitoring and suppression program and email-in angler incentive program from May 10 – Sep 14 2023.

Growth rate of YOY northern pike in Zuckerberg Pond was estimated to be 2.0 cm/week and 26.5 g/week, based on the daily average length and weight of northern pike captured between Jul 09 and Sep 16 2023 (Figure 11).

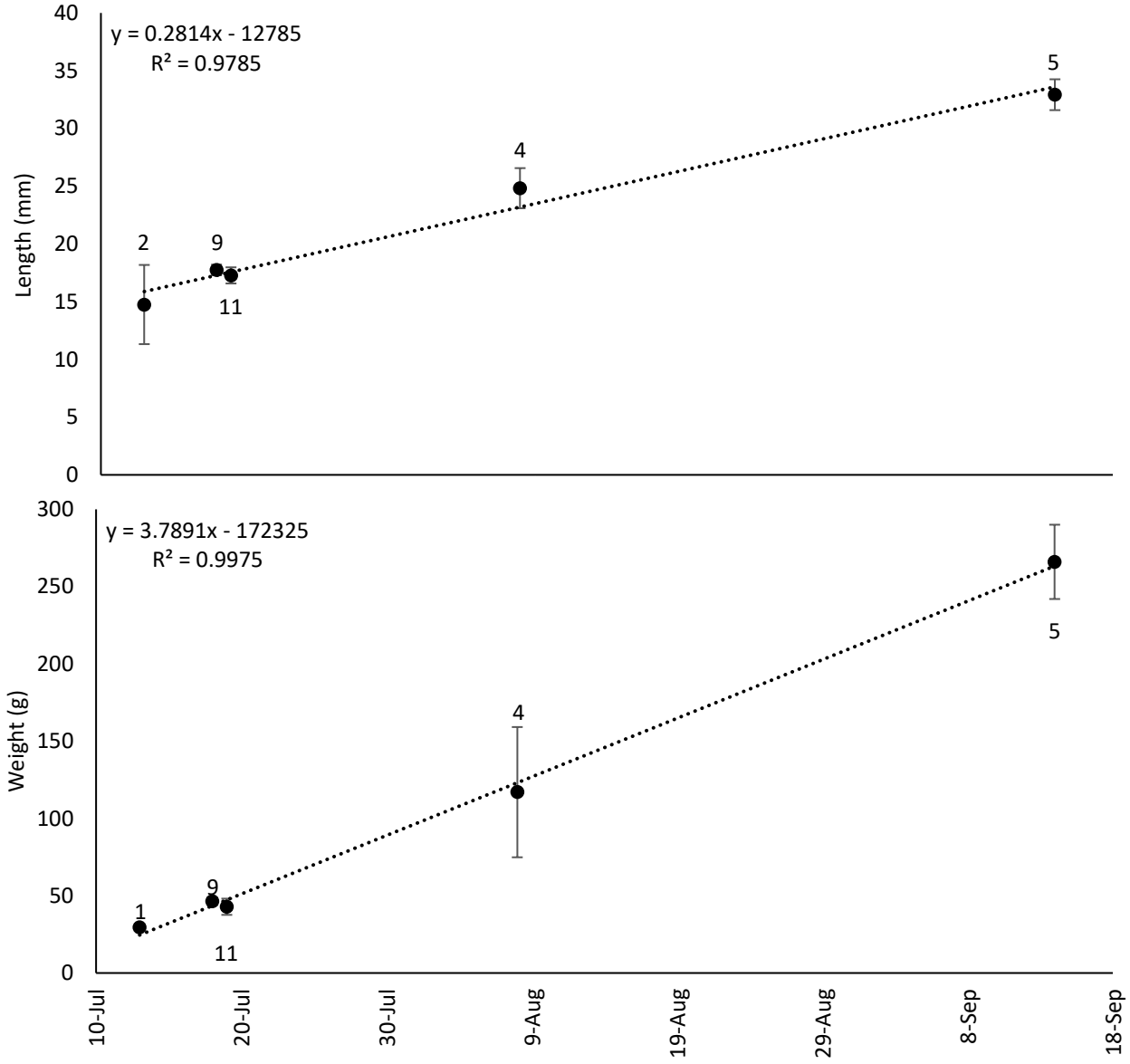

Figure 11. Average fork length (mm; top) and weight (g; bottom) of young-of-year northern pike captured at Zuckerberg Pond (per day) during the Okanagan Nation Alliance monitoring and suppression program between Jul 09 and Sep 16 2023. Averages used to estimate linear growth rates and shown with 95% confidence intervals and sample size.

3.5 Diet and Parasitic Relationships

Fish or fish parts were identified in 55% of inspected northern pike stomachs (n = 73). Identified prey included mountain whitefish, sculpin (*Cottoidea* sp.), kokanee (*Oncorhynchus nerka*), suckers (*Catostomidae* sp.), yellow perch (*Perca flavescens*), redside shiner (*Richardsonius balteatus*), and rainbow trout. Invertebrates were not detected as prey species in 2023.

The dominant identifiable prey species for adult northern pike in the LCR (n = 43) were mountain whitefish (16% of inspected stomach contents; Figure 12). The dominant identifiable prey species for YOY northern pike (n = 30) in the LCR were sculpin (13% of inspected stomach contents).

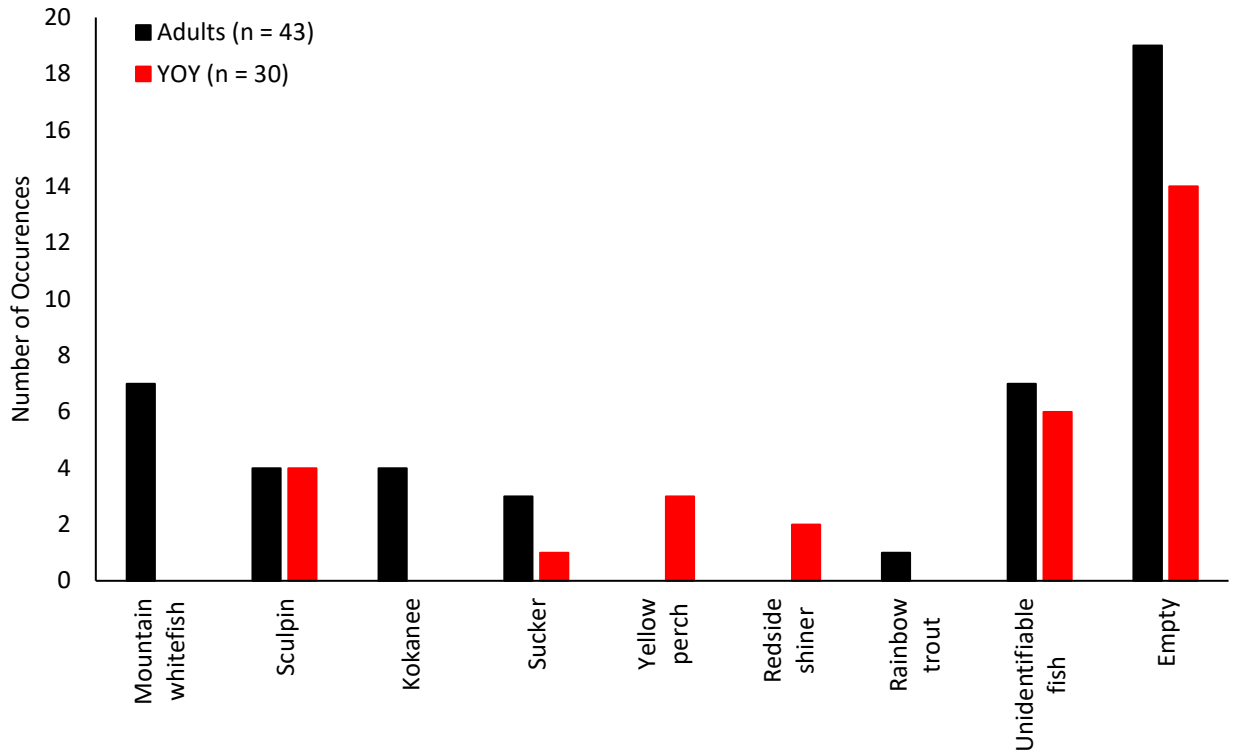

Figure 12. Number of occurrences of prey items (or empty) in inspected adult and young-of-year (YOY) northern pike stomach contents during the Okanagan Nation Alliance monitoring and suppression program and email-in angler incentive program in 2023.

Parasites resembling tapeworms were found in the stomach or intestines of 54.8% of recorded adult and YOY northern pike (n = 73).

3.6 Bycatch

In total 737 fish of 16 different species were captured as bycatch during monitoring and suppression activities. Of the 737 fish, 465 (63.1%) were native species and 272 (36.9%) were non-native species; with mountain whitefish consisting of the highest percentage of total bycatch (24.4%; Table 5). All non-native species (excluding walleye and Lake Whitefish [*Coregonus clupeaformis]*) were euthanized in accordance with applicable permitting. In total, 117 non-native fish (excluding walleye, lake whitefish, and northern pike) were removed during this program. For information regarding total bycatch by location and sample method see *Appendix F – Bycatch Data*.

Table 5. Bycatch species captured during the Okanagan Nation Alliance northern pike monitoring and suppression program from May 23 – Sep 14 2023 for all methods. Superscript numbers indicate the location of capture: Lower Columbia River including Lower Kootenay River "1" and Pend d'Oreille River "2".

Species	Scientific Name	Status	# Caught
Bull trout[1]	*Salvelinus confluentus*	Native	4
Kokanee[1]	*Oncorhynchus nerka*	Native	1
Longnose sucker[1, 2]	*Catostomus catostomus*	Native	156
Mountain whitefish[1]	*Prosopium williamsoni*	Native	180
Northern pikeminnow[1,2]	*Ptychocheilus oregonensis*	Native	32
Peamouth chub[1]	*Mylocheilus caurinus*	Native	1
Rainbow trout[1,2]	*Oncorhynchus mykiss*	Native	57
Sculpin (general)[1]	*Cottoidea* sp.	Native	1
White sturgeon[1]	*Acipenser transmontanus*	Native	33
Lake trout[1]	*Salvelinus namaycush*	Non-native	1
Lake whitefish[1]	*Coregonus clupeaformis*	Non-native	114
Pumpkinseed[2]	*Lepomis gibbosus*	Non-native	14
Smallmouth bass[1,2]	*Micropterus dolomieu*	Non-native	25
Tench[1,2]	*Tinca tinca*	Non-native	19
Walleye[1,2]	*Sander vitreus*	Non-native	41
Yellow perch[1,2]	*Perca flavescens*	Non-native	58

In 2023, 465 native fish from 9 species were captured as bycatch during northern pike suppression efforts. The LCR had the highest number of native species bycatch with 413 fish of 9 species (88.8% of native species bycatch); with the Pend d'Oreille River efforts resulting in 52 fish of three species (11.2% of total native species bycatch).

The mortality rate of native species for gillnetting was 22.4% (104 individuals). Fish were not captured during electrofishing activities. Mortality of SARA-listed species did not occur.

White sturgeon were scanned for a PIT tag whenever possible, some individuals escaped gillnets before they could be scanned. White sturgeon were removed from gillnets while in the river, and were only brought on-board the vessel when necessary. All white sturgeon were released in good health and gillnet set times were reduced once the occurrence of white sturgeon bycatch increased. To further reduce instances of white sturgeon bycatch, sampling was excluded at sites with multiple white sturgeon captures. For PIT tag information of white sturgeon, see *Appendix G – White Sturgeon PIT Tag Information*.

The LCR had the highest number of non-native species bycatch with 200 fish of six species (73.5% of total non-native species bycatch). The Pend d'Oreille River non-native species bycatch was 72 fish of five species (26.5% of total non-native species bycatch). Zuckerberg Pond bycatch was 38.1% non-native species (26.5% of the total LCR non-native bycatch).

3.7 eDNA Sampling

In total, 56 eDNA samples were taken at 14 sites in spring (Table 6). This was the second season utilizing the Smith-Root eDNA Backpack Sampler. Control samples from the LCR and the Pend d'Oreille River did

not result in positive northern pike detections. Northern pike were not detected in any sample locations in 2023.

Table 6. Northern pike eDNA sample lab results for spring 2023 by watershed code, site, and type including positive control samples taken from the Columbia River and Pend d'Oreille River.

Watershed Code	Site	Type	Sample Date	Lab Result
300	Nakusp	Exploratory	Jun 27	Not detected
300	Burton	Exploratory	Jun 27	Not detected
300	Syringa	Exploratory	Jun 29	Not detected
300	HLK Forebay East	Exploratory	Jun 29	Not detected
300	HLK Forebay West	Exploratory	Jun 29	Not detected
300	Robson	Positive Control	Jun 29	Not detected
310	Osoyoos Lake North	Exploratory		Not detected
310	Osoyoos Lake Swiws	Exploratory		Not detected
310	Osoyoos Lake Border	Exploratory		Not detected
320	Kettle River	Exploratory	Jun 28	Not detected
320-160600	Christina Lake	Exploratory	Jun 28	Not detected
330	Seven Mile Forebay	Positive Control	Jun 28	Not detected
340	Glade	Exploratory	Jun 27	Not detected
340	Brilliant Forebay	Exploratory	Jun 28	Not detected

4.0 Discussion

The 2023 northern pike suppression program season was successful as 73 northern pike were removed from the Columbia River and northern pike were not detected in the Pend d'Oreille River. One additional northern pike was removed through the email-in angler incentive program; northern pike were not encountered during BC Hydro's CLBMON-45 Indexing Program. Methods used in 2023 were similar to past years of the program and yielded many similar results.

4.1 Population and Catch per Unit Effort

The northern pike population in the LCR was suspected to have decreased from 2014 to 2017 (Table 7; Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2017; Baxter and Lawrence 2018), but the accuracy of these estimates is uncertain (Wood 2019).

Table 7. Summary of northern pike population estimates in the Columbia River between 2014 and 2017 using the Lincoln-Petersen mark-recapture method with 95% confidence intervals and their respective sources.

Year	Population Estimate	Minimum Estimate	Maximum Estimate	Northern Pike Removed	Source
2014	725	478	2,759	133	Baxter and Neufeld 2015
2015	410	151	670	116	Baxter 2016
2016	107	59	155	49	Baxter and Doutaz 2017
2017	99	25	172	41	Baxter and Lawrence 2018

For the purposes of this report, comparable $CPUE_{8hr}$ is defined as effort using SPIN nets in April through June in the LCR when water temperatures were > 7 °C. Spring $CPUE_{8hr}$ in 2023 increased by 60.8% from 2022 while effort was 29.9% lower. Spring $CPUE_{8hr}$ was similar to 2019 and 2021 and 82.0% lower than when suppression began in 2014 (Table 8). $CPUE_{8hr}$ in 2023 was higher than it has been since 2016,

potentially due to more northern pike in the system or an increase in the crew's ability to target individuals.

Table 8. Comparable (spring: April – June) northern pike $CPUE_{8hr}$ (northern pike/8-hours) from 2014 to 2023 in the Columbia River.

Year	Total Northern Pike	$CPUE_{8hr}$	Source
2014	92	3.48	Baxter and Neufeld 2015
2015	85	1.52	Baxter 2016
2016	49	1.02	Baxter and Doutaz 2017
2017	18	0.33	Baxter and Lawrence 2018
2018	19	0.41	Wood 2019
2019	14	0.60	ONA 2020
2020	10	0.49	ONA 2021
2021	37	0.61	ONA 2022
2022	30	0.39	ONA 2023
2023	33	0.63	Present

In 2023, 22 female adult northern pike were captured during suppression efforts. Five of these individuals showed indications to be pre-spawning, four showed indications of spawning success (spent). Spawning adults were not captured in Zuckerberg Pond; however, individuals may have spawned and moved out of the pond before suppression activities targeted that area. Suppression efforts indicate that Zuckerberg Pond conditions in 2023 were favorable for northern pike spawning success with 31 YOY removed. Results from YOY removals are comparable but reduced to Zuckerberg Pond's last successful spawning events in 2020 and 2022 (Table 9).

In 2019, 2020, 2022, and 2023 Zuckerberg Pond was identified as an area that provided quality rearing habitat for northern pike and other invasive species. All YOY northern pike captured in 2023 were recovered from Zuckerberg Pond.

Prior to 2019, suppression efforts around Zuckerberg Island were focused on the upstream bay in the LCR Mainstem, and not in Zuckerberg Pond itself (Baxter and Lawrence 2018; Wood 2019). In 2023, northern pike spawning was detected within Zuckerberg Pond with the capture of YOY. Spawning success in Zuckerberg Pond may have been reduced when compared to 2022 with the removal of 31 YOY northern pike compared to 146 in 2022 even though total soak times for gillnet effort were similar (112 hours in 2023 compared to 134 hours in 2022).

Table 9. Reported northern pike removals from 2010 to 2023 by program, in the Columbia River (LCR), Pend d'Oreille River (PDO), and Christina Lake (XL); with their respective data sources. Dashes indicate sampling was not conducted.

Year	Location	Suppression	CLBMON-45*	CLBMON-42A*	Angler Incentive	By Location	Columbia Basin Total	Source
2010	LCR	-	4	0	-	4	4	
2011	LCR	-	8	0	-	8	8	
2012	LCR	-	1	0	-	1	1	
2013	LCR	-	24	0	-	24	24	
2014	LCR	133	9	0	21	163	163	Baxter and Neufeld 2015
2015	LCR	116	3	0	8	127	131	Baxter 2016
	PDO	-	-	-	4	4		
2016	LCR	40	3	0	-	43	43	Baxter and Doutaz 2017
	PDO**	-	-	-	-	-		Doutaz 2019
2017	LCR	35	4	2	-	39	84	Baxter and Lawrence 2018
	PDO**	43	-	-	-	43		Doutaz 2019
2018	LCR	27	2	0	3	32	48	Wood 2019
	PDO	15	-	-	1	16		ONA 2020
2019	LCR	35	17	1	-	52	63	ONA 2020
	PDO	10	-	-	-	10		
	XL	0	-	-	-	0		
2020	LCR	138	2	0	-	140	146	ONA 2021
	PDO	6	-	-	-	6		
2021	LCR	38	5	0	1	44	45	ONA 2022
	PDO	1	-	-	0	1		
	XL	0	-	-	0	0		
2022	LCR	179	4	0	4	187	187	ONA 2023
	PDO	0	-	-	0	0		
2023	LCR	73	0	0	1	74	74	Present
	PDO	0	-	-	0	0		
						Total:	**1,021**	

*BC Hydro unpublished data

** Doutaz (2019) describes the capture of 43 northern pike in the Pend d'Oreille River between 2016 and 2017, but specific location data and captures by year are not available.

Northern pike population estimates in the Pend d'Oreille River (Seven Mile and Waneta Reservoirs) have not been conducted. Spring northern pike $CPUE_{8hr}$ in the Pend d'Oreille River has decreased annually since 2018 (Table 10). Effort in 2021 decreased by 69% from 2020, which may have influenced northern pike captures. Northern pike were not captured in the Pend d'Oreille River in 2022 (98 hours of gillnetting effort) or 2023 (205 hours of gillnetting effort). Northern pike spring CPUE in the Pend d'Oreille River is not available prior to 2018.

A summary of effort by sample type targeting northern pike between 2014 and 2023 is available in *Appendix H – Summary of Northern Pike Suppression Efforts 2014 – 2023*.

Table 10. Comparable (spring: April – June) northern pike $CPUE_{8hr}$ (northern pike/8-hours) from 2018 to 2023 in the Pend d'Oreille River.

Year	Total Northern Pike	$CPUE_{8hr}$	Source
2018	15	0.39	Wood 2019
2019	10	0.15	ONA 2020
2020	6	0.04	ONA 2021
2021	1	0.02	ONA 2022
2022	0	0.00	ONA 2023
2023	0	0.00	Present

4.2 Distribution and Spawning

LCR northern pike capture locations in 2023 were consistent with previous years, with the majority of captures occurring in the Robson Reach (Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2019; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023). Adult northern pike in the LCR are predominantly encountered along the right downstream bank of the Robson Reach between Celgar Mill and Robson Bridge and the left downstream bank between the Robson Community Church and the Robson Bridge (Figure 13). Few adults have been encountered downstream of the Robson Bridge (Figure 14). YOY northern pike are typically captured in Zuckerberg Pond and sporadically throughout the Robson Reach, Waldie Island, and the LKR.

In 2023, northern pike were not encountered in the Seven Mile Reservoir and the Waneta Reservoir was not sampled. Effort was focused in the Seven Mile Reservoir because northern pike were not captured in the Waneta during suppression activities in 2022. The Waneta Reservoir is more difficult to sample, and the deterioration of the boat launch does not allow access for a large work boat. This reduces sampling effort to a canoe or kicker-powered car topper and restricts access to the Waneta Dam forebay area where northern pike were previously captured in greater numbers (Doutaz 2019; UTM data unavailable). In previous years, northern pike were captured west of the Waneta Boat Launch on the left downstream bank in the Waneta Reservoir, but the majority of northern pike in the Pend d'Oreille River have been captured in the Seven Mile Reservoir, primarily at Buckley Campground (Figure 15; Wood 2019; ONA 2020, 2021, 2022, and 2023).

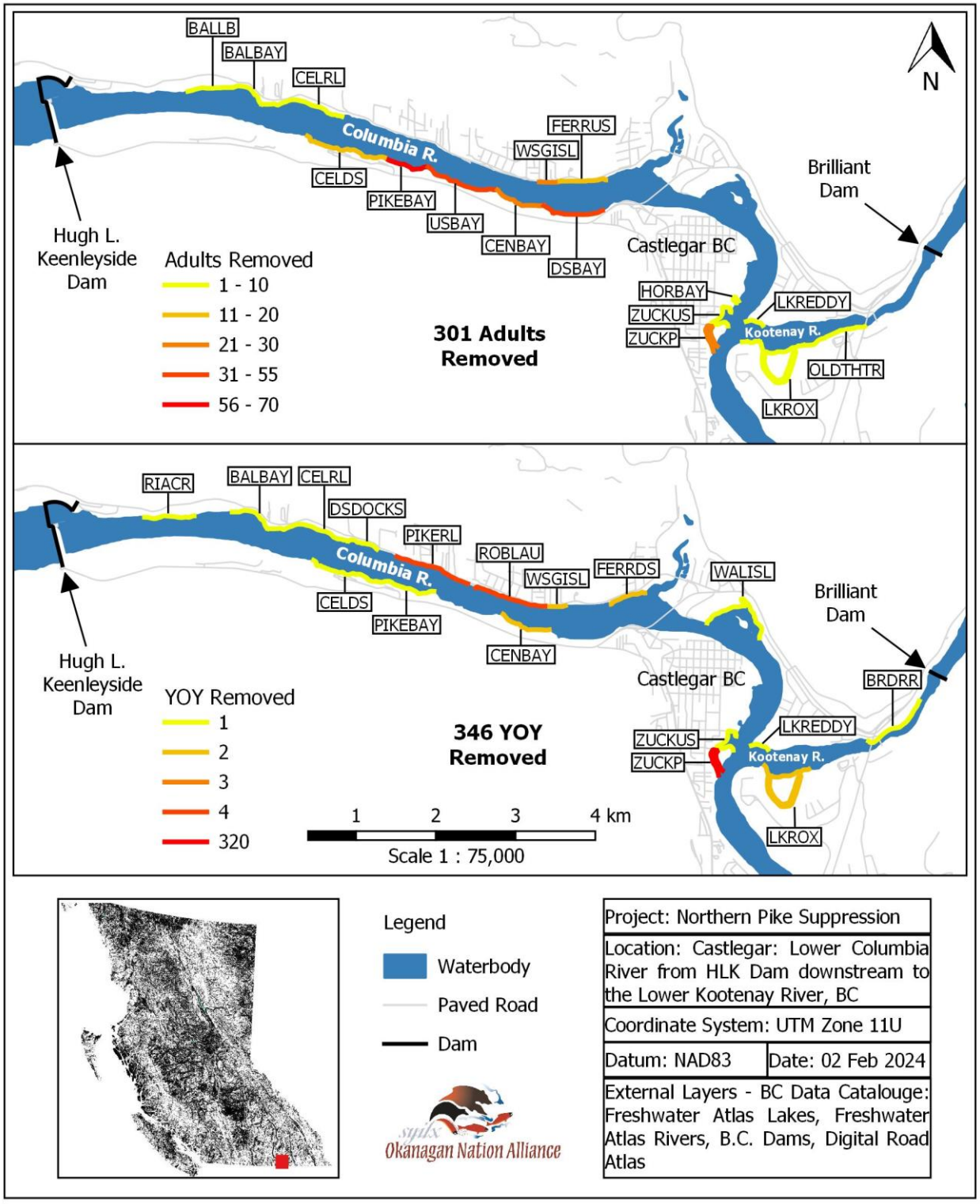

Figure 13. Adult (top) and young-of-year (YOY; bottom) northern pike removals by site (2010 – 2023) in the Castlegar area. Map only portrays northern pike capture data with readily available location data (BC Hydro unpublished data; Baxter 2016; Baxter 2017; Baxter 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023).

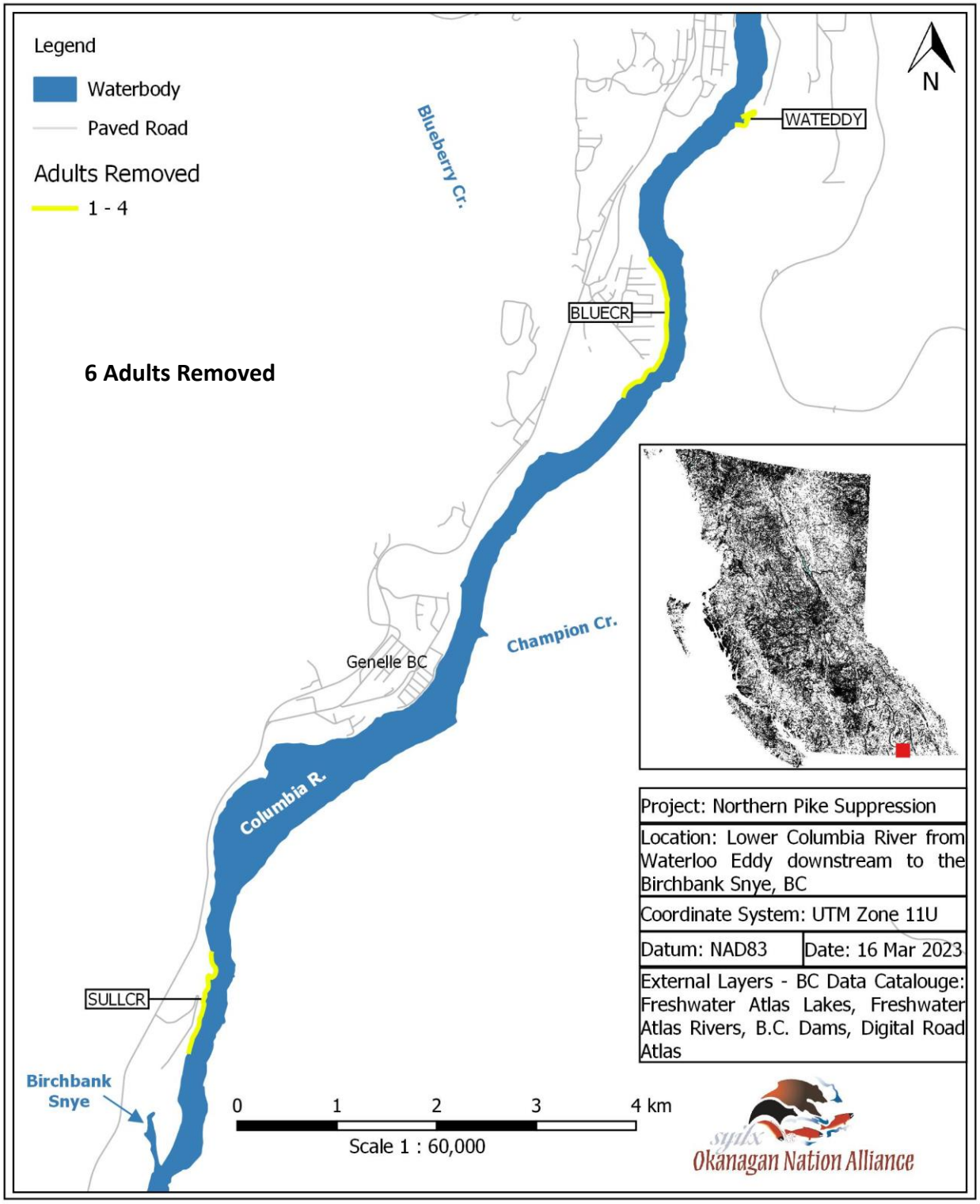

Figure 14. Adult northern pike removals by site (2010 – 2023) in the Genelle area. Map only portrays northern pike capture data with readily available location data (BC Hydro unpublished data; Baxter 2016; Baxter 2017; Baxter 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023).

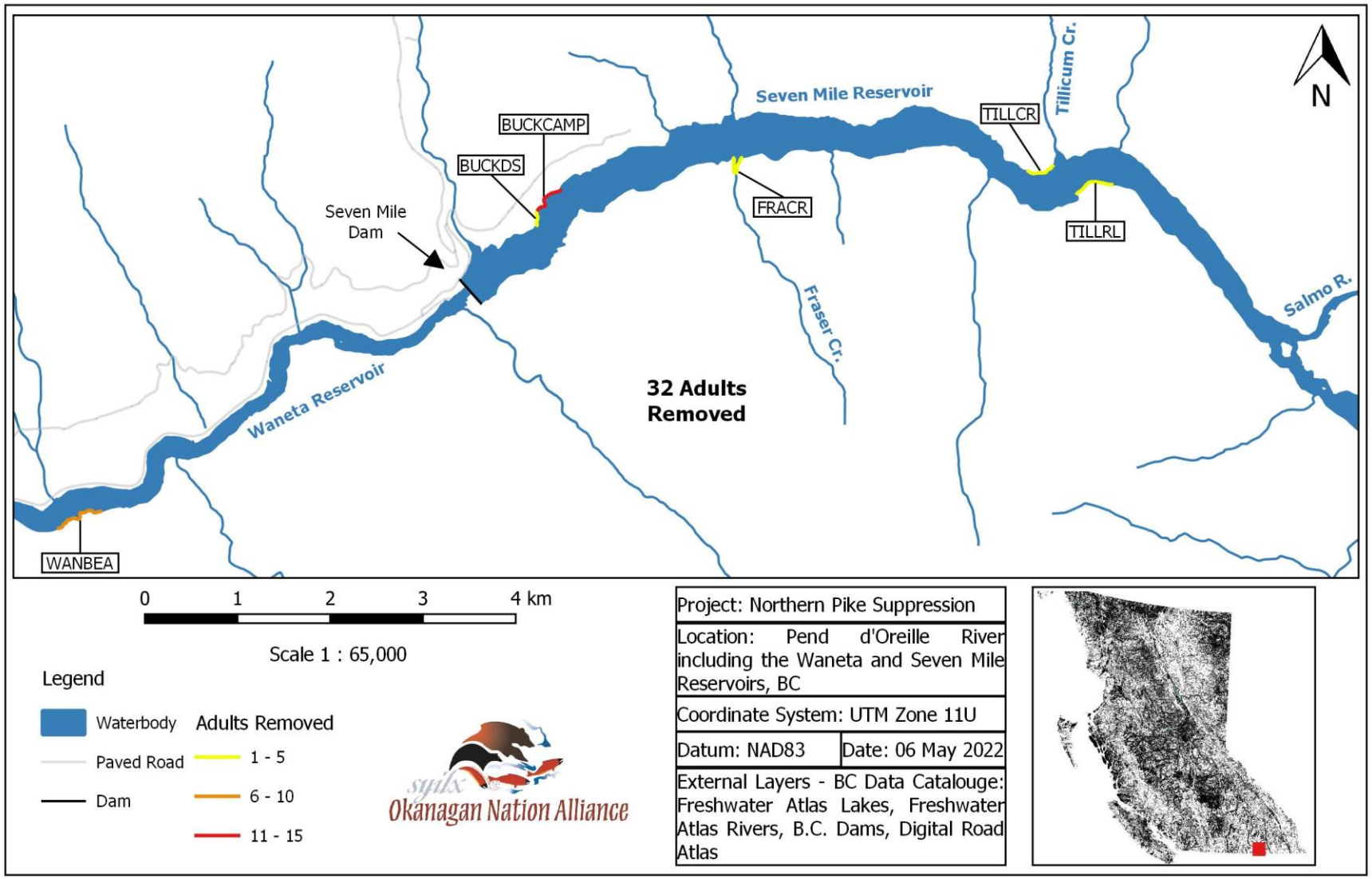

Figure 15. Adult northern pike removals by site (2010 – 2023) in the Pend d'Oreille River. Map only portrays northern pike capture data with readily available location data (Wood 2019; ONA 2020, 2021, 2022, and 2023).

In 2020, water temperature in the Columbia River reached 7 °C on Apr 21, and as suppression activities began 49 days later (Jun 09), the spawning window was not sampled and only spent individuals were captured. In 2021, 2022, and 2023, captured female northern pike were in spawning condition 28 – 30 days after the daily average water temperature reaches 7 °C (Figure 16). In 2021 and 2023, captured males were in spawning condition 49 – 54 days after the daily average water temperature reaches 7 °C, 17 – 26 days after the first spawning females are encountered (Figure 16). In 2022 and 2023, spawn timing was estimated to be mid- to late May; prior to 2022 spawn timing was estimated to begin in early May (Baxter and Neufeld 2015; Wood 2019; ONA 2020 and 2022). This was likely due to cool springs in 2022 and 2023, where water temperatures did not average 7 °C until late April / early May (compared to early to mid April in 2020 and 2021; ONA 2021 and 2022).

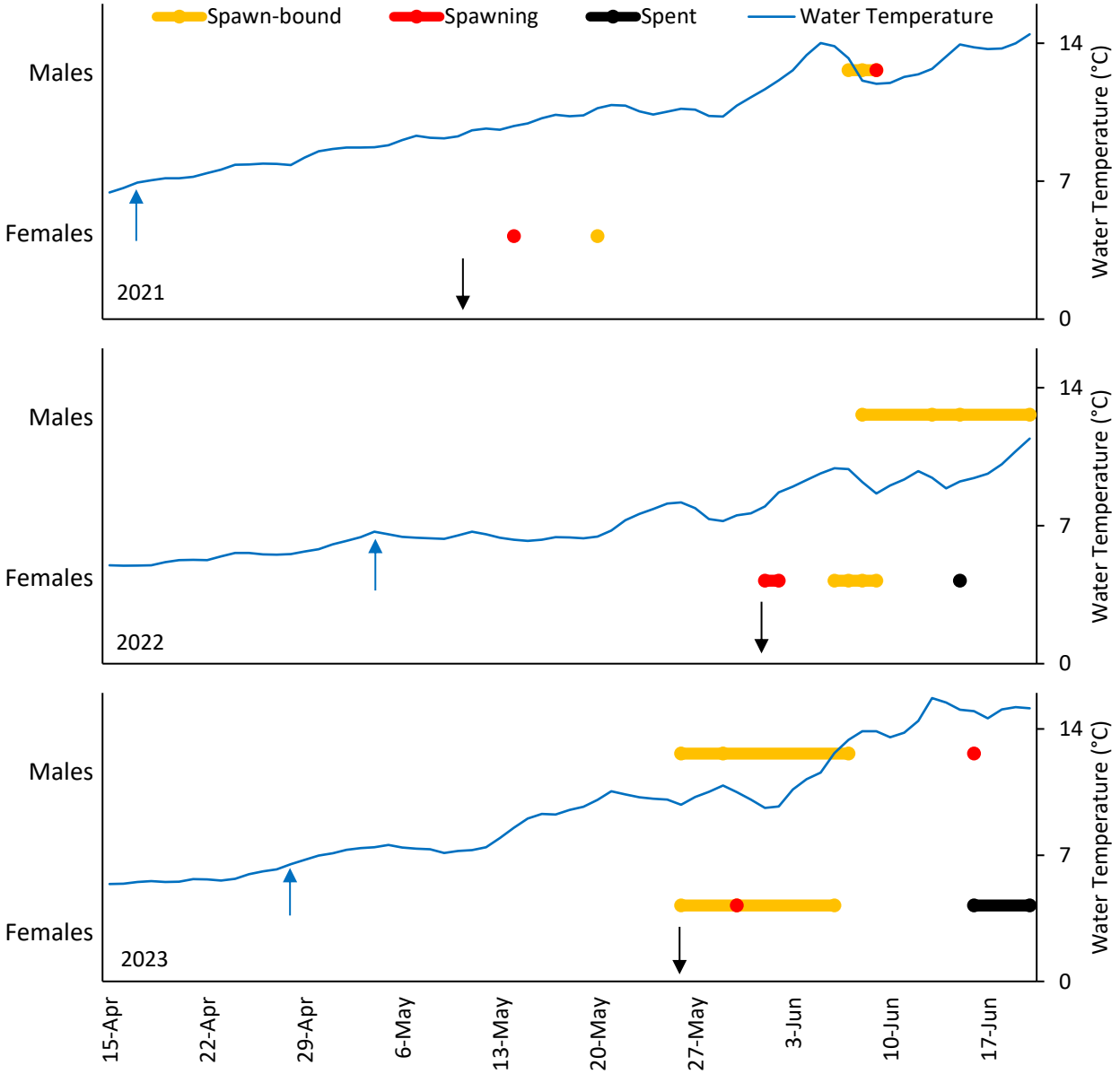

Figure 16. Spawning condition of captured adult northern pike in the Columbia River during the Okanagan Nation Alliance monitoring and suppression program by year from 2021 to 2023, including average daily water temperature (°C) at Birchbank station (WSC 2024). Blue arrows indicate daily average water temperature reaching 7 °C; black arrows indicate the start of sampling (ONA 2022 and 2023).

Additional sampling data are required to verify spawn timing and particularly determine the start of the spawning season; in recent years (since 2020), 2023 was the only year spawn-bound females were captured prior to spawning or spent females.

The locations of adults in spawning condition and YOY northern pike continue to support previous data that the Robson Reach and Zuckerberg Island are northern pike spawning sites (Baxter and Neufeld 2015; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023). To date, the Robson Reach (both banks from HLK to Robson Bridge), Waldie Island, Zuckerberg Island, Millennium Park, and the Kootenay Oxbow have all been identified as potential northern pike spawning locations.

4.3 Habitat and Habitat Use

Water temperatures in the Pend d'Oreille River appear to be more suitable for northern pike growth than the LCR (Figure 17).

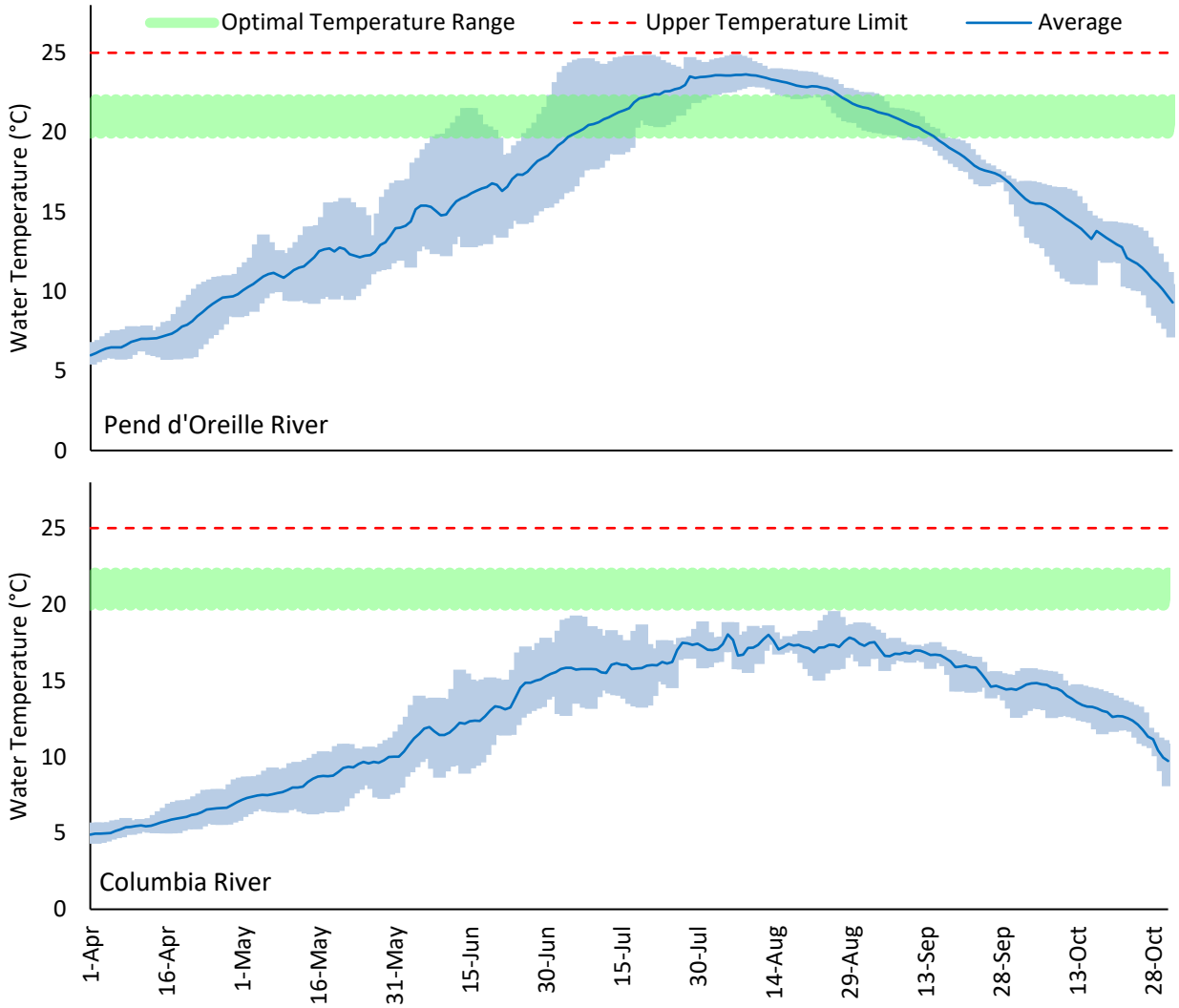

Figure 17. Average daily water temperatures (°C) in the Pend d'Oreille River at the international boundary station (2019-2023; USGS 2023) and in the Columbia River at the Birchbank station (2020-2023; WSC 2024), including daily average minimum and maximum temperature range (light blue area), optimal temperature range for northern pike growth and preference (20 – 20 °C), and the upper preferred temperature limit (25 °C; Casselman and Lewis 1996).

Annually, between 2019 and 2023, the average daily water temperature in the Pend d'Oreille River has been within the northern pike optimal temperature for growth and preference (20 – 22 °C) for 13 to 56 days. Average daily temperature has never exceeded the northern pike preferred upper temperature limit (25 °C; Casselman and Lewis 1996) but reached a high of 24.9 °C on Aug 06 2021. Annually, between 2020 and 2023, the average daily water temperature in the Columbia River was lower than the Pend d'Oreille River and did not reach the northern pike optimal temperature for growth and preference. Average daily temperature in the Columbia River reached a high of 19.6 °C on Aug 26 2020. Spot surface water temperature data collected in the Columbia River indicate that specific shallow water habitats likely experience warmer temperatures than those recorded at the Birchbank station.

In 2023, spot surface water temperature data collected in off-channel habitats supported previous year's findings that Columbia River off-channel habitat may reach the northern pike optimal temperature for growth and preference; Zuckerberg Pond temperatures recorded between 15.0 – 21.2 °C and LKR oxbow temperatures recorded between 10.0 – 23.2 °C). Continuous water temperature monitoring at Zuckerberg Pond has been difficult due to public interference.

General northern pike habitat characteristics (shallow water with low flow and abundant aquatic vegetation) are consistently available in the Columbia and Pend d'Oreille Rivers where northern pike captures occur. More northern pike have been captured in the LCR than the Pend d'Oreille River, though Pend d'Oreille captures are typically larger and older (Figure 18; Wood 2019; ONA 2020, 2021, and 2022). This may indicate recruitment in the LCR is more prevalent than in the Pend d'Oreille River, possibly due to reservoir elevation fluctuations in the Seven Mile and Waneta Reservoirs.

4.4 Population Dynamics and Growth

The relationship between length and weight of all northern pike measured from the LCR and Pend d'Oreille River can be described through a power function equation (Equation 4) and has high fit (R^2 = 0.99; Figure 18).

Equation 4. Northern pike length and weight power function equation.

$$W = 5 \times 10^{-6} \times L^{3.0894}$$

$where,$
$W = Northern\ Pike\ weight\ (g)$
$L = Northern\ Pike\ length\ (mm)$

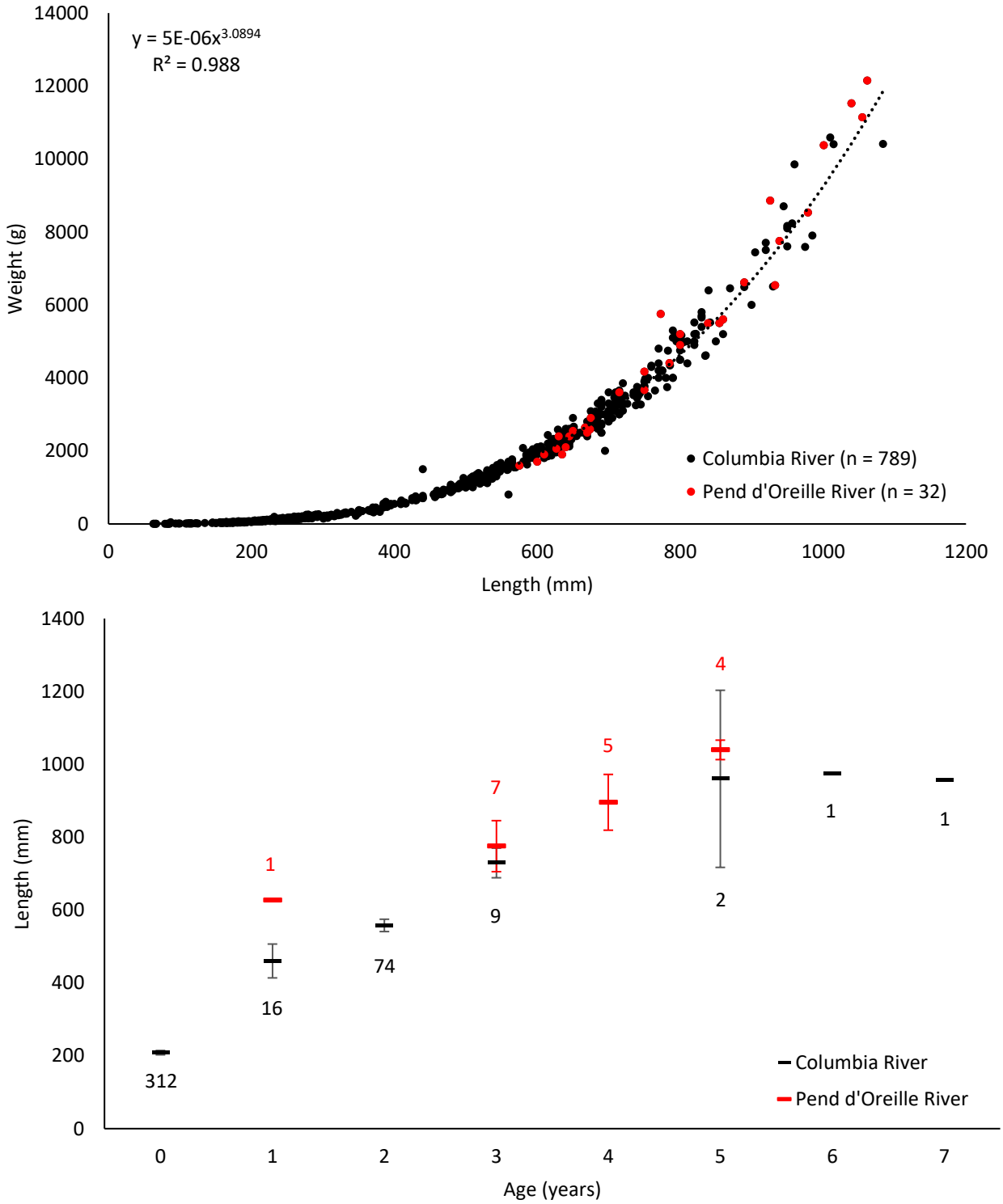

Figure 18. (Top) Size (length by weight) of northern pike in the Columbia River (black) and Pend d'Oreille River (red) captured between 2010 and 2023; where sample size (n) = number of northern pike (BC Hydro unpublished data; Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2019; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023; (Bottom) Age of northern pike in the Columbia River (black) and Pend d'Oreille River (red) with 95% confidence intervals; where sample size (number of northern pike) is represented by the respective colours for all captures between 2019 and 2023 (ONA 2020, 2021, and 2022).

Adult northern pike appeared to be utilizing similar habitats to previous years, primarily areas with depths of 2 – 7 m with aquatic vegetation (Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2017; Baxter and Lawrence 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023). This habitat is abundant in the Robson Reach of the LCR, where the majority of adult northern pike captures have occurred.

The capture of 31 YOY northern pike from Zuckerberg Pond in 2023 supports previous observations that Zuckerberg Pond provides rearing habitat for YOY northern pike (Wood 2019; ONA 2021 and 2023). Kootenay Oxbow, Waldie Island, and the Robson Reach have also been identified as potential YOY northern pike rearing habitats (Baxter and Lawrence 2018; Wood 2019; ONA 2016 and 2021).

The YOY northern pike average daily growth rate in 2023 was higher for length (2.0 cm/week in 2023 compared to 1.8 cm/week in 2022 and 1.2 cm/week in 2020) and weight (26.5 g/week in 2023 compared to 14.3 g/week in 2022 and 9.5 g/week in 2020; Figure 19). These growth rates also appear higher than YOY northern pike studied on two shallow lakes on Manitoulin Island in Lake Huron between 1968 and 1971 (1.04 cm/week; Cassleman and Lewis 1996). Temperature is a significant factor in northern pike growth (Cassleman and Lewis 1996; McPhail 2007) and the variation in growth between 2020, 2022, and 2023 in Zuckerberg Pond is likely due to changes in water temperature. This was the first year that fish were identified as the only prey species of YOY, which may have impact growth rates.

Similarly, YOY northern pike in the LCR Mainstem likely have a lower growth rates, based on the comparison on YOY northern pike size in the LCR Mainstem and Zuckerberg Pond from 2019 (ONA 2020; Figure 20). The comparison of YOY size in the LCR Mainstem and Zuckerberg Pond has not occurred since 2020 because too few YOY have been captured in the LCR Mainstem.

YOY size is significant considering fecundity of northern pike is proportional to body size, which can be 9,000 eggs per pound (454 g; Scott and Crossman 1973). Therefore, individuals rearing in Zuckerberg Pond have the potential to become more prolific spawners, due to their accelerated growth rate, than those rearing in the LCR Mainstem. As a result, suppression activities targeting YOY northern pike should prioritize Zuckerberg Pond and similar habitats.

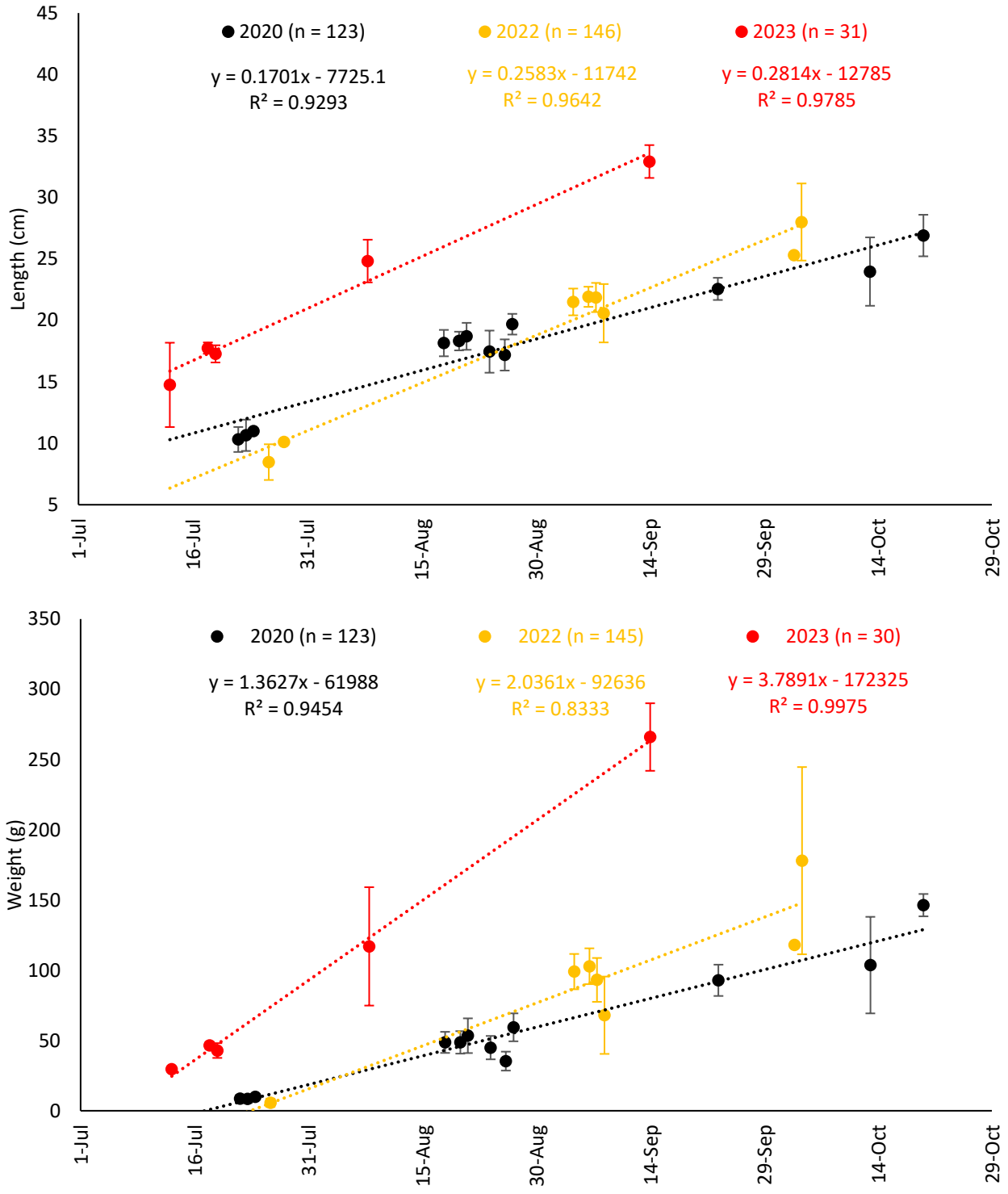

Figure 19. (Top) Average fork length (mm) of young-of-year northern pike captured daily at Zuckerberg Pond between Jul 13 and Oct 20 2020 (black), 2022 (yellow) and 2023 (red) used to estimate linear growth rate. (Bottom) Average weight (g) of young-of-year northern pike captured daily at Zuckerberg Pond between Jul 13 and Oct 20 2020 (black), 2022 (yellow) and 2023 (red), used to estimate weight growth. Averages displayed with 95% confidence intervals and sample size (number of northern pike) is represented in the respective colour (ONA 2021 and 2023).

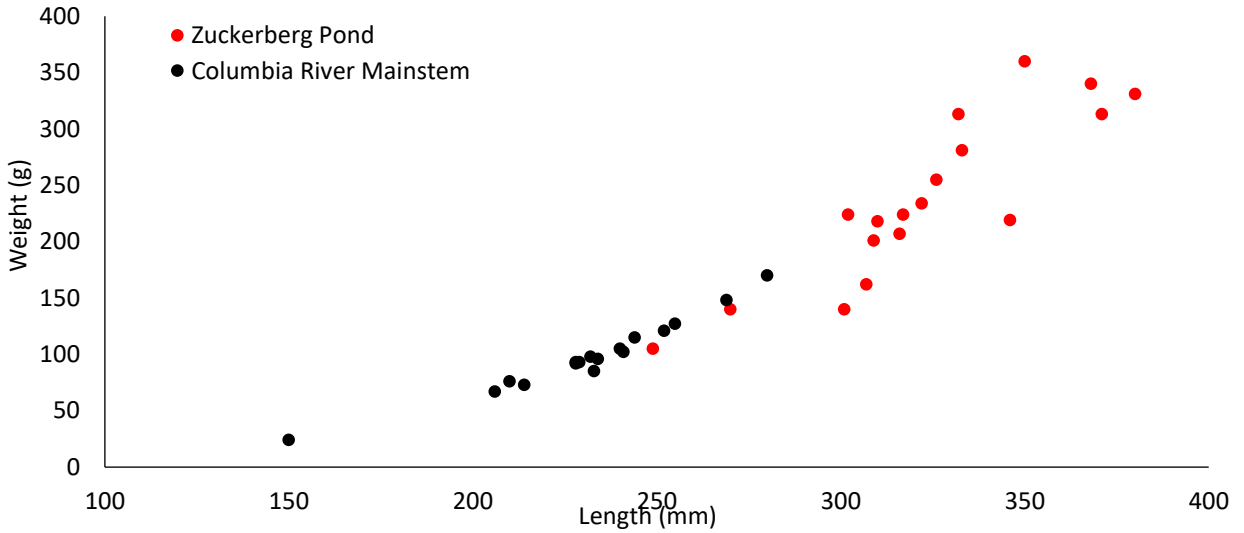

Figure 20. Size (length by weight) of juvenile northern pike captured during the Okanagan Nation Alliance monitoring and suppression program and the CLBMON-45 Indexing Program between Aug 27 and Nov 3 2019. Data includes captures from the Columbia River Mainstem (BC Hydro unpublished data) and Zuckerberg Pond. Figure from ONA (2020).

YOY northern pike were typically found in depths of 0.0 – 3.0 m, with individuals < 150 mm length often in a depth of 0.0 – 0.5 m of water with abundant vegetation; consistent with previous observations (Baxter and Lawrence 2018; ONA 2020, 2021, and 2022). YOY northern pike appear to frequent shallow habitat and move deeper as they grow; a general rule being 10 cm of water depth per 10 mm of body length for every week after peak-spawning until they reach 150 mm (Cassleman and Lewis 1996).

To target YOY northern pike, effort should be focused on habitats that are shallow and possess abundant aquatic vegetation, with priority given to sites with water temperatures higher than the LCR average. Sites capable of reaching the optimum temperature for YOY growth and recruitment (22 – 24 °C) should be a particular priority (Cassleman and Lewis 1996). The Pend d'Oreille River appears to possess suitable YOY northern pike rearing habitat, though none have been encountered during active suppression between 2018 and 2023 (Wood 2019; ONA 2020, 2021, 2022, and 2023).

4.5 Diet and Parasitic Relationships

Analyzed adult northern pike stomachs (n = 297) have primarily been empty since 2010 (64.0%; n = 190), while YOY stomachs (n = 320) were generally full (75.0%; n = 240). Mountain whitefish and sculpin appear to be the preferred prey of adult northern pike (Figure 21). Sculpin appear to be the preferred prey of YOY northern pike followed by yellow perch and invertebrates. The YOY predation rate of yellow perch and invertebrates is high compared soft-bodied fish (e.g. rainbow trout and sucker species), but this is likely due to availability in Zuckerberg Pond. Invertebrate prey items include grasshoppers, aquatic sow bugs, wasps, flying ants, and leeches.

Northern pike stomachs in the Pend d'Oreille River are empty 72.7% of the time (compared to 36.9% of the time in the Columbia River). Empty stomachs may be more common in the Pend d'Oreille River because northern pike are captured while (or near) spawning and may not be eating. Individuals in the LCR are caught into the summer and fall when predation increases (Baxter and Neufeld 2015, Doutaz 2019; Wood 2019; ONA 2020, 2021, 2022, and 2023). Yellow perch, lake whitefish, northern pikeminnow (*Ptychocheilus oregonensis)*, suckers, and invertebrates have been identified in Pend d'Oreille River northern pike stomachs from 2018 – 2020 (Figure 22; Wood 2019; ONA 2020, 2021, and 2022).

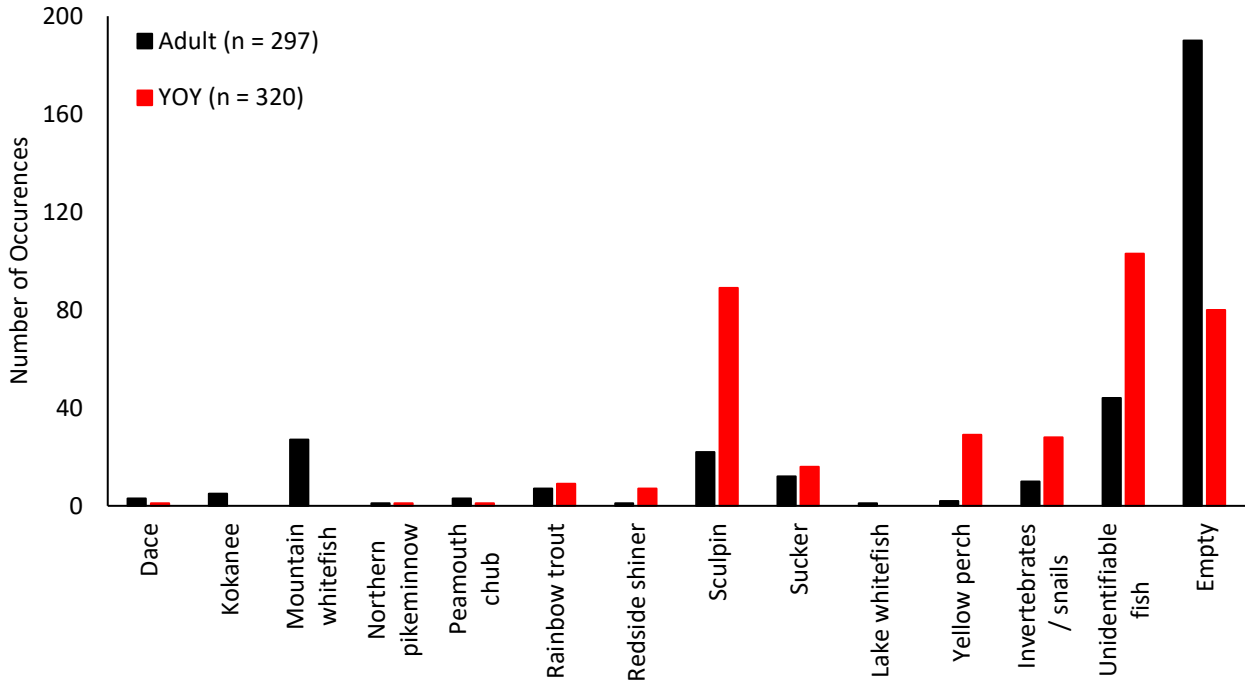

Figure 21. Number of occurrences of prey items in adult (black) and young-of-year (YOY; red) northern pike stomachs from the Columbia River Basin between 2010 and 2023; where n = the number of stomachs analyzed (BC Hydro unpublished data; Baxter and Neufeld 2015; Baxter 2016; Baxter and Doutaz 2019; Baxter and Lawrence 2018; Wood; ONA 2020, 2021, 2022, and 2023).

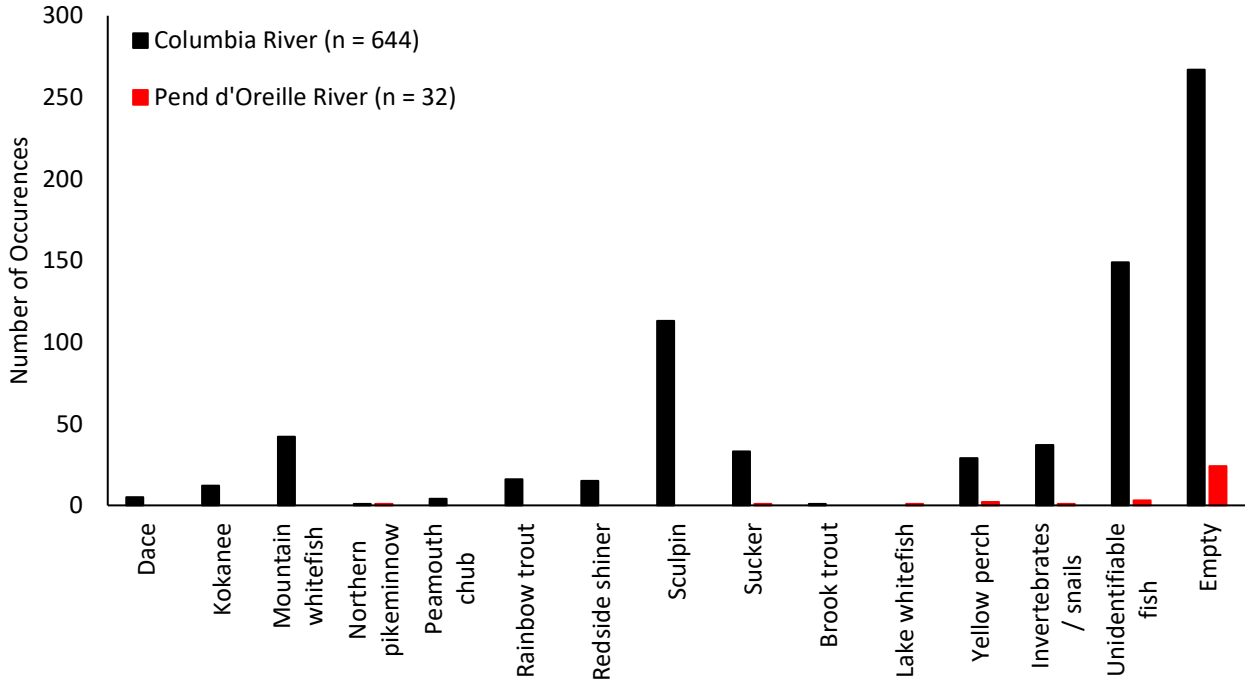

Figure 22. Number of occurrences of prey items in northern pike stomachs from the Columbia River (black) and Pend d'Oreille River (red) between 2010 and 2023; where n = the number of stomachs analyzed (BC Hydro unpublished data; Baxter 2016; Baxter 2017; Baxter 2018; Wood 2019; ONA 2020, 2021, 2022, and 2023).

The predation of sculpin and dace, particularly by YOY northern pike is concerning due to the presence of listed shorthead sculpin and Umatilla dace in the LCR. Though neither species has been positively identified in stomach contents due to the condition of specimens at the time of observation, it is assumed northern pike would consume shorthead sculpin or Umatilla dace if encountered. White sturgeon, another at-risk species, have not been detected in northern pike stomachs in the LCR to date.

A high number of adult northern pike have been observed with parasites in the stomach or intestines in both the LCR and Pend d'Oreille Rivers (Baxter and Neufeld 2015; Wood 2019; ONA 2020, 2021, 2022, and 2023). Parasites were found in 54.8% of inspected northern pike intestines in 2023. In 2014, pathology samples from northern pike in the LCR were sent to Provincial Freshwater Fisheries Society of BC Fish Health Lab for the screening of viral tests, bacterial tests, and parasites; the results of which did not identify any concerns (Baxter and Neufeld 2015). Tapeworms observed in northern pike are likely *Eubothrium* or *Proteocephalus* (Baxter and Neufeld 2015). However, pathology sampling in the Pend d'Oreille River has not occurred, and observations of parasites are more frequent in this location (Wood 2019; ONA 2020).

Parasites can cause behavioural changes and adverse health effects in fish depending on the host and parasite species, concentration, and diversity of parasites in the host, and environmental stressors (pollution, temperatures, angling pressure, etc.; Dick and Watson 1997; Barber et *al*. 2000). Of particular interest is the species *Triaenophorus crassus*, a tapeworm closely associated with whitefish and northern pike (Dick and Watson 1977). *Triaenophorus crassus* typically begins its life cycle by parasitizing a small copepod (*Cyclops bicuspidatus*), and only continues its lifecycle when ingested by a plankton feeding Cisco or Whitefish; the final stage of *Triaenophorus crassus* occurs when it is ingested by a northern pike (Dick and Watson 1977). The possible presence of *Triaenophorus crassus* in the Columbia and Pend d'Oreille Rivers is concerning when considering ongoing salmon re-introduction efforts to the Columbia River above the Grand Coulee Dam by various Tribal and Frist Nation organizations (including the ONA) and Canada and United States governments, as a high percentage of sockeye (*Oncorhynchus nerka*) smolts were documented to be parasitized by *Triaenophorus crassus* in the Wood River Lakes, Alaska (Groot and Margolis 1991). Presently, the Bering Sea drainage (Alaska) is the only know instance of *Triaenophorus crassus* parasitizing sockeye due to the co-existence of sockeye and northern pike in local lakes (Groot and Margolis 1991). Dick and Watson (1977) identified northern pike removal as the easiest way to reduce *Triaenophorus crassus* in waterbodies.

4.6 eDNA Sampling

eDNA sampling in 2023 did not result in any detected northern pike presence, including the positive control sites. Initially, 25 of 42 samples (excluding site blanks) failed the ePlant control qPCR lab tests and were subsequently treated with "OneStep" PCR Inhibitor Removal Kit". Of those that failed, 14 samples continued to fail ePlant qPCR control testing post inhibitor treatment; however, upon re-extracting these samples using a different kit ("Zymo Quick DNA/RNA"), all samples passed ePlant qPCR control testing (Table 11). The lab will continue to monitor failed samples to guide best lab practices in the future.

Table 11. Columbia River Basin northern pike eDNA laboratory test result summary by watershed code (300 = Columbia River; 310 = Okanagan River; 320 = Kettle River; 320-160600 = Christina Lake; 330 = Pend d'Oreille River; 340 = Kootenay River).

Watershed Code	Site	Sample Replicate	1st ePlant Test	2nd ePlant Test	3rd ePlant Test
300	Robson	1	Failed	Passed	
		2	Failed	Failed	Passed
		3	Failed	Failed	Passed
	HLK Forebay East	1	Failed	Failed	Passed
		2	Failed	Failed	Passed
		3	Failed	Failed	Passed
	HLK Forebay West	1	Failed	Failed	Passed
		2	Failed	Failed	Passed
		3	Failed	Passed	
	Syring	1	Failed	Passed	
		2	Failed	Passed	
		3	Failed	Failed	Passed
	Burton	1	Failed	Failed	Passed
		2	Failed	Failed	Passed
		3	Failed	Passed	
	Nakusp	1	Failed	Passed	
		2	Failed	Failed	Passed
		3	Passed		
330	Seven Mile Reservoir	1	Failed	Failed	Passed
		2	Failed	Failed	Passed
		3	Failed	Failed	Passed
310	Osoyoos Lake Border	1	Passed		
		2	Passed		
		3	Passed		
	Osoyoos Lake Swisw	1	Passed		
		2	Passed		
		3	Passed		
	Osoyoos Lake North	1	Passed		
		2	Passed		
		3	Passed		
320	Kettle River	1	Passed		
		2	Passed		
		3	Failed	Passed	
320-160600	Christina Lake	1	Failed	Passed	
		2	Passed		
		3	Passed		
340	Brilliant Forebay	1	Passed		
		2	Failed	Passed	
		3	Passed		
	Glade	1	Failed	Passed	
		2	Passed		
		3	Failed	Passed	

eDNA samples all tested negative for northern pike presence – even at positive control sites (Robson and Seven Mile Reservoir). This may indicate an issue with sample collection or lab testing. Northern pike captures and CPUE in the Pend d'Oreille River have decreased since 2018 to the point where only one northern pike was captured in 2021, zero in 2022 and 2023. This may mean northern pike numbers in the Pend d'Oreille River were low enough to produce a negative eDNA sample and the status of this site as a positive control should be re-assessed. The method for eDNA collection and filtering changed from water sample collection/lab filtering (2020 – 2021; ONA 2021 and 2022) to field filter collection with a Smith-Root eDNA Backpack Sampler. As a result, filter size changed from 0.45 µm (2020 – 2021) to 5.0 µm to avoid clogging. The filter size may have affected the detectability of northern pike eDNA, and a higher volume of water may need to be sampled with the backpack eDNA sampler 5.0 µm filter to achieve proper results.

5.0 Recommendations

The following are recommended to improve the Northern Pike Suppression and Monitoring Program in 2024:

1. Spring sampling effort for adult northern pike should be focused during the spawning window (preferably when adults are spawn-bound) in the LCR (when water temperatures reach 8 °C or 21 – 25 days after Birchbank station temperatures reach 7 °C), Pend d'Oreille River (when water temperatures reach 8 °C, or ~ 1 week after a large drafting event), and Christina Lake (when water

temperatures reach 8 °C) using SPIN nets and boat electrofishing. The timing of the spawning windows may occur concurrently and up to three crews may be required. If three crews are not feasible, priority should be given to the LCR. Night electrofishing should occur in the Pend d'Oreille River and LCR after northern pike start spawning.

Summer and fall sampling effort for YOY northern pike should be focused mid-July to late October using 1" monofilament nets. In the LCR, juvenile nets should be placed in locations where YOY northern pike were previously caught (Figure 13). Night electrofishing for YOY should occur in the Pend d'Oreille River to identify rearing habitat, and in the Robson Reach if other gillnetting or electrofishing programs are not occurring.

Based past efforts, the priority windows are:

a. Pend d'Oreille River April 20 to May 20 & August 20 – October 30
b. Christina Lake April 20 to May 20
c. Columbia River May 15 to June 25 & July 20 – October 30

Actual sampling dates may change based on field conditions and northern pike encounters.

2. Spring northern pike spawn monitoring should occur at locations where YOY have been identified (Figure 13), with exploratory sampling at Birchbank Snye (UTM 11U 447399, 5446340), the Genelle Backchannel (UTM 11U 448658, 5450312) and Fort Sheppard Eddy (UTM 11U 455112, 5431131). The correlation between Zuckerberg Pond's isolation from the LCR Mainstem and the river level measured at Birchbank station should be identified to direct timing of suppression activities. Utilization of a fyke net at the river connection of Zuckerberg Pond should be implemented to capture spawning northern pike and inventory full use of Zuckerberg Pond during identified spawning window.
3. Continue the eDNA sampling program, with consideration of similar programs to avoid duplicate sampling, to monitor northern pike range expansion (through natural migration of the introduced population and/or anthropogenic introductions) in the Columbia Basin at high-risk sites which may include but are not limited to
   - Christina Lake (North) (UTM 11U 405817, 5450693)
   - Christina Creek/Kettle River Confluence (UTM 11U 412140, 5431472)
   - Hugh Keenleyside Dam Forebay (East) (UTM 11U 441778, 5465902)
   - Hugh Keenleyside Dam Forebay (West) (UTM 11U 443334, 5465080)
   - Syringa Provincial Park (UTM 11U 436681, 5465733)
   - Brilliant Headpond (UTM 11U 455230, 5464280)
   - Glade (UTM 11U 460400, 5471570)
   - Revelstoke Wetlands (East) (UTM 11U 417283, 5646158)
   - Revelstoke Wetlands (North) (UTM 11U 415658, 5647599)
   - Revelstoke Wetlands (South) (UTM 11U 417318, 5645621)
   - Osoyoos Lake (North) (UTM 11U 315859 5439243)
   - Osoyoos Lake (Swisw) (UTM 11U 321483 5432479)
   - Osoyoos Lake (Border) (UTM 11U 320247 5430473)

eDNA sampling methods used in 2020 – 2021 should be replicated alongside the Smith-Root eDNA Backpack Sampler to test comparability and effectiveness of these methods. Reducing filter size for the backpack sampler is also recommended.

4. Northern pike monitoring at Christina Lake presents a unique opportunity. The Christina Lake Stewardship Society (CLSS) is highly interested in northern pike monitoring and eager to participate. It is recommended that the ONA partners with CLSS to provide training and equipment so CLSS members can volunteer and contribute to northern pike monitoring in Christina Lake.
5. Continue surveys to increase northern pike habitat data. This will continue to involve the creation of defined sites through the Columbia and Pend d'Oreille Rivers with the documentation of depth, aquatic vegetation/cover types, general hydrologic characteristics, and substrate types at each site. Sites with and without northern pike presence could then be more effectively compared.

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6.1 Map Layer Sources

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Appendix A – Site Habitat Classifications

Table 12. Observed cover types and sub-types at northern pike monitoring and suppression sites.

Cover Type	Definition and Cover Sub-Types	
Woody Debris (WD)	Woody debris that can provide cover for adult or YOY juvenile northern pike; can include logs, docks, submerged root wads, submerged docks, etc.	
Aquatic Vegetation (AV)	Aquatic vegetation in enough abundance to provide cover for northern pike. When possible, identify and record the approximate growth stage and density.	
	Growth Stage	Density
	a = short, stubby, small b = long, large	1 = sparse 2 = intermittent, patchy 3 = dense mat
Terrestrial Vegetation (TV)	Living terrestrial vegetation that is submerged or overhanging providing cover for northern pike. Document availability of submerged and / or overhanging vegetation.	
	Overhanging Vegetation Availability	Submerged Vegetation Availability
	1 = <10 m2 2 = >10 m2	3 = minimal, providing little cover 4 = minimal, providing good cover 5 = abundant, providing little cover 6 = abundant, providing good cover
Interstices (I)	Rocks large enough to provide cover for northern pike. Differentiate between boulders and bedrock.	
	1 = large boulders 2 = bedrock features	

Table 13. Benthic profile descriptions at northern pike monitoring and suppression sites.

Profile Type	Max Water Depth (m)	Definition
Bench (BE)	< 2	Flat benthic profile; water depth is ± 2 m from the start of the net
Low Grade (LG)	2 – 12	Water depth gradually increases from the start of the net
High Grade (HG)	12 – 15	Water depth increases rapidly, yet linearly from the start of the net
Drop Off (DO)	> 15	Water depth suddenly and significantly increases; may be found if sampling extends past the edge of a bench

Table 14. Hydraulic habitat descriptions at northern pike monitoring and suppression sites. Descriptions adapted from BC Hydro's Lower Columbia River Fish Population Indexing Surveys (CLBMON-45).

Hydraulic Habitat Type	Definition
Eddy (E)	A main-channel habitat which represents large (< 30 m in diameter) areas of counter-current flows with depths generally > 5 m; produced by major bank irregularities and are available at all flow stages, although current velocities within eddy are dependent on flow levels. High quality areas for adult and sub-adult salmonid life-stages. High availability of instream cover.
Sidechannel (SC)	Off-channel habitat that is separate from the mainstem and has an in-flow and out-flow. SC habitats generally present at higher flow stages: characterized by low-

	nil velocity, variable depths (generally < 4 m) and predominantly depositional substrates (i.e., sand/silt/gravel); often supports growth of aquatic vegetation; very important areas for rearing and feeding.
Snye (SN)	A side channel area that is separated from the mainstem at the upstream end but retains a connection at the lower end. SN habitats generally present only at lower flow stages since area is a flowing side channel at higher flows; characterized by low-nil velocity, variable depths (generally < 3 m) and predominately depositional substrates (i.e., sand/silt/gravel); often supports growths of aquatic vegetation; very important areas for rearing and feeding.
Glide (G)	A main-channel habitat where current is present and flows parallel to the riverbanks. Available at all water levels and typically have a medium velocity, variable depths (1 to > 20 m), and commonly associated with armoured/stable substrates (i.e., bedrock/boulder/cobble); supports growth of aquatic vegetation; important for rearing and feeding.
Bay (B)	A main-channel habitat with parallel banks perpendicular to flow, often > 30 m in diameter and commonly associated with tributary confluences. Generally characterized with depositional sediments, low-nil velocity, variable depths, and little aquatic vegetation. Generally shielded from wind.
Pond (P)	Off-channel habitat that is completely disconnected from the mainstem; generally present at lower flows. Characterized by depositional sediments, mil velocities, shallow depths (< 3 m), and an abundance of aquatic and terrestrial vegetation.
Turbulent (T)	Mainstem habitat characterized by high velocities, armoured/stable substrates, variable water depths (> 3 m), low-nil aquatic vegetation, and minimal cover; more prevalent at higher flows.
Backwater (BW)	Main-channel habitat adjacent to the main flow characterized by nil flow; depositional sediments, present of abundant aquatic vegetation, and generally is not associated with a confluence. Differentiated from an eddy by a lack of flow, but physically similar.
Shoreline (SL)	Habitat with no detectable flow (i.e., lakes shores); flow is not detectable throughout the width of the waterbody at the sampling location.

Appendix B – Northern Pike Suppression and Monitoring Sites by Method

Appendix B-1: Gillnet Sites

Table 15. Gillnet sites during the Okanagan Nation Alliance monitoring and suppression program in 2023 including watershed (Columbia River [300], Pend d'Oreille River [330], and Kootenay River[340]), site, set, location, set/pull times and temperature (°C), net type, set depths (m), and northern pike (NP) captures.

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
1	330	TILLCR	GN_PDO_001_1	469549	5432389	469577	5432364	23-May	11:45	14.8	23-May	14:26	14.8	SPIN	3.8	9.2	0
2	330	MINECAMP	GN_PDO_002_1	464536	5431792	464576	5431814	23-May	11:59	15.2	23-May	14:44	14.9	SPIN	3.4	8.3	0
3	330	BUCKDS	GN_PDO_003_1	463958	5431708	463972	5431669	23-May	12:06	14.9	23-May	14:57	15.3	SPIN	2.6	10.7	0
4	330	TILLCR	GN_PDO_004_1	469532	5432364	469571	5432338	23-May	15:20	14.9	24-May	12:44	14.9	SPIN	3.3	9.5	0
5	330	BURNBAY	GN_PDO_005_1	468850	5432554	468795	5432566	23-May	15:31	14.8	24-May	14:10	14.8	SPIN	2.9	16.2	0
6	330	MINECAMP	GN_PDO_006_1	464550	5431783	464533	5431816	23-May	15:42	15.4	24-May	8:41	14.8	SPIN	2.9	7.2	0
7	330	BUCKDS	GN_PDO_007_1	463953	5431756	463990	5431732	23-May	15:57	15.5	24-May	9:45	14.8	SPIN	5.4	13.6	0
8	330	YPALLEY	GN_PDO_008_1`	463932	5431627	463923	5431582	23-May	16:02	15.2	24-May	10:32	14.8	SPIN	3.2	11.2	0
9	330	MINECAMP	GN_PDO_009_1	464493	5431855	464539	5431838	24-May	9:22	14.7	24-May	17:20	14.7	SPIN	0.0	10.0	0
10	330	MINECAMP	GN_PDO_009_2	464493	5431855	464539	5431838	24-May	17:20	14.7	25-May	13:15	14.7	SPIN	0.0	10.0	0
11	330	BUCKDS	GN_PDO_010_1	463965	5431761	464002	5431747	24-May	10:23	14.7	24-May	15:35	14.7	SPIN	0.0	8.5	0
12	330	BUCKDS	GN_PDO_010_2	463965	5431761	464002	5431747	24-May	15:35	14.7	25-May	10:54	14.7	SPIN	0.0	8.5	0
13	330	BUCKDS	GN_PDO_011_1	463954	5431663	463997	5431681	24-May	11:03	14.7	24-May	15:00	14.7	SPIN	0.0	8.8	0
14	330	BUCKDS	GN_PDO_011_2	463954	5431663	463997	5431681	24-May	15:00	14.7	25-May	11:18	14.6	SPIN	0.0	8.8	0
15	330	BUCKCAMP	GN_PDO_012_1	464078	5431940	464084	5431904	24-May	16:46	14.7	25-May	11:59	14.6	SPIN	0.0	3.3	0
16	330	BUCKDS	GN_PDO_013_1	463976	5431724	463996	5431756	25-May	11:42	14.6	25-May	15:09	14.6	SPIN	0.0	8.4	0
17	300	PIKEBAY	GN_LCR_001_1	448447	5464772	448464	5464812	26-May	11:03	11.3	26-May	13:36	12.0	SPIN	0.6	3.3	2
18	300	USBAY	GN_LCR_002_1	448921	5464637	448970	5464647	26-May	11:10	11.4	26-May	14:04	12.0	SPIN	1.1	3.5	0
19	300	DSBAY	GN_LCR_003_1	450572	5464213	450560	5464255	26-May	11:18	11.2	26-May	14:17	11.8	SPIN	1.6	3.7	0
20	300	WSGISL	GN_LCR_004_1	450218	5464564	450269	5464556	26-May	11:26	11.1	26-May	14:35	11.7	SPIN	2.0	11.7	0
21	300	WSGISL	GN_LCR_005_1	450152	5464599	450173	5464555	26-May	11:33	11.1	26-May	14:50	12.0	SPIN	2.0	10.8	0
22	300	BALBAY	GN_LCR_006_1	446336	5465757	446359	5465735	29-May	9:35	11.3	29-May	11:57	11.1	SPIN	1.9	2.8	0
23	300	BALBAY	GN_LCR_007_1	446377	5465719	446404	5465682	29-May	9:44	11.1	29-May	12:12	10.3	SPIN	2.8	9.3	0
24	300	PIKEBAY	GN_LCR_008_1	448453	5464792	448441	5464841	29-May	9:53	11.1	29-May	12:27	10.8	SPIN	1.3	10.2	0
25	300	PIKEBAY	GN_LCR_008_2	448453	5464792	448441	5464841	29-May	12:27	10.8	29-May	14:34	10.5	SPIN	1.3	10.2	0
26	300	PIKEBAY	GN_LCR_009_1	448452	5464827	448493	5464808	29-May	10:00	11.1	29-May	12:41	10.6	SPIN	2.0	6.4	0
27	300	PIKEBAY	GN_LCR_009_2	448452	5464827	448493	5464808	29-May	12:41	10.6	29-May	14:38	10.4	SPIN	2.0	6.4	0
28	300	CENBAY	GN_LCR_010_1	449601	5464474	449622	5464470	29-May	10:08	11.1	29-May	12:48	10.6	SPIN	5.7	6.8	0
29	300	WSGISL	GN_LCR_011_1	450151	5464598	450157	5464550	29-May	10:15	11.1	29-May	13:06	11.0	SPIN	2.0	9.4	1
30	300	WSGISL	GN_LCR_011_2	450151	5464598	450157	5464550	29-May	13:06	11.0	29-May	15:07	10.7	SPIN	2.0	9.4	0
31	300	WSGISL	GN_LCR_012_1	450265	5464588	450267	5464544	29-May	10:21	11.2	29-May	13:27	11.0	SPIN	2.0	10.4	2
32	300	WSGISL	GN_LCR_012_2	450265	5464588	450267	5464544	29-May	13:27	11.0	29-May	15:16	10.8	SPIN	2.0	10.4	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
33	300	BALBAY	GN_LCR_013_1	446439	5465698	446396	5465697	29-May	12:07	10.6	29-May	14:08	10.8	SPIN	2.1	8.7	0
34	300	FERRUS	GN_LCR_014_1	450465	5464576	450473	5464532	30-May	9:49	9.1	30-May	12:10	8.8	SPIN	2.0	9.9	1
35	300	FERRUS	GN_LCR_014_2	450465	5464576	450473	5464532	30-May	12:10	8.8	30-May	14:12	8.8	SPIN	2.0	9.9	0
36	300	WSGISL	GN_LCR_015_1	450260	5464576	450312	5464537	30-May	9:54	9.2	30-May	12:30	8.8	SPIN	3.4	11.1	0
37	300	WSGISL	GN_LCR_015_2	450260	5464576	450312	5464537	30-May	12:30	8.8	30-May	14:28	8.5	SPIN	3.4	11.1	0
38	300	WSGISL	GN_LCR_016_1	450156	5464594	450251	5464566	30-May	10:00	9.0	30-May	12:47	8.9	SPIN	2.0	10.0	1
39	300	WSGISL	GN_LCR_016_2	450156	5464594	450251	5464566	30-May	12:47	8.9	30-May	14:36	8.9	SPIN	2.0	10.0	0
40	300	USBAY	GN_LCR_017_1	449039	5464613	449079	5464631	30-May	10:07	9.9	30-May	13:04	8.8	SPIN	2.0	11.2	1
41	300	USBAY	GN_LCR_017_2	449039	5464613	449079	5464631	30-May	13:04	8.8	30-May	14:44	8.8	SPIN	2.0	11.2	0
42	300	PIKEBAY	GN_LCR_018_1	448475	5464803	448444	5464831	30-May	10:14	8.8	30-May	13:22	8.4	SPIN	1.8	11.4	0
43	300	PIKEBAY	GN_LCR_018_2	448475	5464803	448444	5464831	30-May	13:22	8.4	30-May	14:56	8.4	SPIN	1.8	11.4	1
44	300	PIKEBAY	GN_LCR_019_1	448276	5464875	448309	5464896	30-May	10:23	8.9	30-May	13:34	8.6	SPIN	1.9	9.1	0
45	300	BALBAY	GN_LCR_020_1	446474	5465672	446440	5465654	30-May	10:30	8.2	30-May	13:45	8.2	SPIN	3.1	10.8	1
46	300	BALBAY	GN_LCR_020_2	446474	5465672	446440	5465654	30-May	13:45	8.2	30-May	15:32	8.1	SPIN	3.1	10.8	0
47	300	ZUCKP	GN_LCR_021_1	452186	5462770	452148	5462793	31-May	9:21	15.3	31-May	12:55	15.3	SPIN	0.0	2.5	0
48	300	ZUCKP	GN_LCR_022_1	452130	5462712	452169	5462720	31-May	9:31	15.3	31-May	13:13	15.3	SPIN	0.0	2.1	0
49	300	ZUCKP	GN_LCR_023_1	452183	5462620	452187	5462611	31-May	9:46	15.3	31-May	13:30	15.3	SPIN	0.0	2.7	0
50	300	ZUCKP	GN_LCR_024_1	452221	5462557	452193	5462603	31-May	9:58	15.3	31-May	13:40	15.3	SPIN	0.0	2.1	0
51	300	BALBAY	GN_LCR_025_1	446471	5465675	446438	5465662	1-Jun	9:08	8.0	1-Jun	11:30	8.1	SPIN	2.0	10.2	0
52	300	BALBAY	GN_LCR_025_2	446471	5465675	446438	5465662	1-Jun	11:30	8.1	1-Jun	13:59	7.6	SPIN	2.0	10.2	0
53	300	PIKEBAY	GN_LCR_026_1	448305	5464865	448341	5464891	1-Jun	9:17	8.0	1-Jun	11:47	8.0	SPIN	1.7	12.0	0
54	300	PIKEBAY	GN_LCR_026_2	448305	5464865	448341	5464891	1-Jun	11:47	8.0	1-Jun	14:10	8.0	SPIN	1.7	12.0	0
55	300	PIKEBAY	GN_LCR_027_1	448462	5464794	448467	5464836	1-Jun	9:26	7.9	1-Jun	12:02	7.9	SPIN	1.3	9.2	0
56	300	PIKEBAY	GN_LCR_027_2	448462	5464794	448467	5464836	1-Jun	12:02	7.9	1-Jun	14:20	7.8	SPIN	1.3	9.2	0
57	300	USBAY	GN_LCR_028_1	448730	5464747	448767	5464764	1-Jun	9:39	7.9	1-Jun	12:07	8.0	SPIN	1.4	10.0	0
58	300	USBAY	GN_LCR_028_2	448730	5464747	448767	5464764	1-Jun	12:07	8.0	1-Jun	14:30	8.0	SPIN	1.4	10.0	0
59	300	WSGISL	GN_LCR_029_1	450156	5464593	450176	5464551	1-Jun	9:46	8.0	1-Jun	12:18	8.2	SPIN	1.3	7.2	0
60	300	WSGISL	GN_LCR_029_2	450156	5464593	450176	5464551	1-Jun	12:18	8.2	1-Jun	14:38	8.2	SPIN	1.3	7.2	0
61	300	WSGISL	GN_LCR_030_1	450269	5464584	450276	5464542	1-Jun	9:51	7.9	1-Jun	12:29	8.0	SPIN	2.1	10.1	0
62	300	WSGISL	GN_LCR_030_2	450269	5464584	450276	5464542	1-Jun	12:29	8.0	1-Jun	14:48	7.9	SPIN	2.1	10.1	0
63	300	FERRUS	GN_LCR_031_1	450522	5464561	450534	5464551	1-Jun	10:00	7.9	1-Jun	12:38	8.0	SPIN	3.4	8.3	0
64	300	WALISL	GN_LCR_032_1	452328	5464508	452319	5464461	1-Jun	12:50	8.2	1-Jun	15:01	9.0	SPIN	3.4	7.4	0
65	300	PIKEBAY	GN_LCR_033_1	448192	5464925	448239	5464907	2-Jun	9:02	8.8	2-Jun	12:15	9.5	SPIN	2.4	8.6	0
66	300	PIKEBAY	GN_LCR_033_2	448192	5464925	448239	5464907	2-Jun	12:15	9.5	2-Jun	14:22	9.9	SPIN	2.4	8.6	2
67	300	PIKEBAY	GN_LCR_034_1	448436	5464817	448474	5464833	2-Jun	9:09	8.7	2-Jun	12:24	9.4	SPIN	1.8	7.6	0
68	300	PIKEBAY	GN_LCR_034_2	448436	5464817	448474	5464833	2-Jun	12:24	9.4	2-Jun	14:34	10.0	SPIN	1.8	7.6	1
69	300	USBAY	GN_LCR_035_1	448776	5464721	448738	5464754	2-Jun	9:16	8.6	2-Jun	12:35	9.4	SPIN	1.5	4.0	0
70	300	USBAY	GN_LCR_035_2	448776	5464721	448738	5464754	2-Jun	12:35	9.4	2-Jun	14:48	9.7	SPIN	1.5	4.0	0
71	300	WSGISL	GN_LCR_036_1	450165	5464593	450173	5464549	2-Jun	9:23	8.4	2-Jun	12:45	9.6	SPIN	1.8	10.4	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
72	300	WSGISL	GN_LCR_036_2	450165	5464593	450173	5464549	2-Jun	12:45	9.6	2-Jun	14:59	10.0	SPIN	1.8	10.4	0
73	300	WSGISL	GN_LCR_037_1	450238	5464587	450235	5464554	2-Jun	9:30	8.4	2-Jun	12:54	9.3	SPIN	1.3	8.5	0
74	300	WSGISL	GN_LCR_037_2	450238	5464587	450235	5464554	2-Jun	12:54	9.3	2-Jun	15:08	9.5	SPIN	1.3	8.5	0
75	300	WALISL	GN_LCR_038_1	452280	5464534	452297	5464494	2-Jun	9:42	8.0	2-Jun	13:07	10.2	SPIN	2.1	6.8	0
76	300	LKROX	GN_LKR_001_1	452841	5462457	452852	5462435	2-Jun	9:52	10.3	2-Jun	13:19	10.8	SPIN	1.4	1.8	0
77	300	PIKEBAY	GN_LCR_039_1	448184	5464930	448225	5464908	5-Jun	9:40	11.1	5-Jun	11:55	11.4	SPIN	4.8	5.2	0
78	300	PIKEBAY	GN_LCR_039_2	448184	5464930	448225	5464908	5-Jun	11:55	11.4	5-Jun	14:01	11.3	SPIN	4.8	5.2	0
79	300	PIKEBAY	GN_LCR_040_1	448266	5464889	448325	5464891	5-Jun	9:48	10.9	5-Jun	12:10	11.5	SPIN	2.1	8.4	0
80	300	PIKEBAY	GN_LCR_040_2	448266	5464889	448325	5464891	5-Jun	12:10	11.5	5-Jun	14:12	11.3	SPIN	2.1	8.4	0
81	300	PIKEBAY	GN_LCR_041_1	448474	5464813	448542	5464836	5-Jun	9:53	10.8	5-Jun	12:30	11.1	SPIN	1.8	11.1	1
82	300	PIKEBAY	GN_LCR_041_2	448474	5464813	448542	5464836	5-Jun	12:30	11.1	5-Jun	14:22	11.7	SPIN	1.8	11.1	0
83	300	WSGISL	GN_LCR_042_1	450148	5464593	450176	5464545	5-Jun	10:02	10.7	5-Jun	12:42	11.1	SPIN	1.8	9.8	0
84	300	WSGISL	GN_LCR_043_1	450241	5464581	450271	5464555	5-Jun	10:11	10.8	5-Jun	12:54	11.1	SPIN	1.8	11.1	0
85	300	WSGISL	GN_LCR_043_2	450241	5464581	450271	5464555	5-Jun	12:54	11.1	5-Jun	14:42	11.1	SPIN	1.8	11.1	0
86	300	FERRUS	GN_LCR_44_1	450418	5464571	450418	5464546	5-Jun	10:19	10.6	5-Jun	13:15	11.0	SPIN	2.1	7.4	0
87	300	FERRUS	GN_LCR_045_1	450327	5464584	450363	5464551	5-Jun	13:22	11.0	5-Jun	14:52	11.1	SPIN	1.8	9.4	0
88	300	PIKEBAY	GN_LCR_046_1	448444	5464819	448505	5464824	6-Jun	9:13	13.5	6-Jun	11:52	13.9	SPIN	2.1	5.6	0
89	300	PIKEBAY	GN_LCR_046_2	448444	5464819	448505	5464824	6-Jun	11:52	13.9	6-Jun	13:55	15.7	SPIN	2.1	5.6	0
90	300	USBAY	GN_LCR_047_1	448733	5464757	448782	5464744	6-Jun	9:21	13.5	6-Jun	12:05	13.8	SPIN	2.1	8.2	0
91	300	USBAY	GN_LCR_047_2	448733	5464757	448782	5464744	6-Jun	12:05	13.8	6-Jun	14:03	14.5	SPIN	2.1	8.2	0
92	300	USBAY	GN_LCR_048_1	448916	5464673	448972	5464670	6-Jun	9:29	13.5	6-Jun	12:33	13.8	SPIN	1.3	9.1	1
93	300	USBAY	GN_LCR_048_2	448916	5464673	448972	5464670	6-Jun	12:33	13.8	6-Jun	14:13	13.9	SPIN	1.3	9.1	0
94	300	CENBAY	GN_LCR_049_1	449808	5464380	449873	5464375	6-Jun	9:39	13.5	6-Jun	12:48	13.9	SPIN	1.3	8.4	0
95	300	DSBAY	GN_LCR_050_1	450219	5464277	450254	5464272	6-Jun	9:46	13.5	6-Jun	13:01	13.8	SPIN	3.4	9.2	0
96	300	WSGISL	GN_LCR_051_1	450231	5464569	450283	5464567	6-Jun	9:52	13.5	6-Jun	13:14	13.8	SPIN	2.7	5.6	1
97	300	WSGISL	GN_LCR_051_2	450231	5464569	450283	5464567	6-Jun	13:14	13.8	6-Jun	14:59	13.8	SPIN	2.7	5.6	0
98	300	WSGISL	GN_LCR_052_1	450280	5464580	450325	5464548	6-Jun	13:21	13.8	6-Jun	15:09	13.7	SPIN	2.1	8.8	0
99	300	PIKEBAY	GN_LCR_053_1	448224	5464923	448283	5464899	7-Jun	9:20	14.3	7-Jun	11:49	14.4	SPIN	3.1	5.4	0
100	300	PIKEBAY	GN_LCR_053_2	448224	5464923	448283	5464899	7-Jun	11:49	14.4	7-Jun	14:00	14.7	SPIN	3.1	5.4	0
101	300	PIKEBAY	GN_LCR_054_1	448445	5464822	448507	5464817	7-Jun	9:28	14.2	7-Jun	12:04	14.4	SPIN	2.1	5.5	0
102	300	PIKEBAY	GN_LCR_054_2	448445	5464822	448507	5464817	7-Jun	12:04	14.4	7-Jun	14:10	15.6	SPIN	2.1	5.5	0
103	300	USBAY	GN_LCR_055_1	449017	5464628	449075	5464606	7-Jun	9:35	14.2	7-Jun	12:32	14.4	SPIN	2.1	9.0	1
104	300	USBAY	GN_LCR_055_2	449017	5464628	449075	5464606	7-Jun	12:32	14.4	7-Jun	14:22	15.0	SPIN	2.1	9.0	0
105	300	DSBAY	GN_LCR_056_1	450161	5464308	450192	5464322	7-Jun	9:47	14.1	7-Jun	12:54	14.8	SPIN	1.3	8.2	1
106	300	DSBAY	GN_LCR_056_2	450161	5464308	450192	5464322	7-Jun	12:54	14.8	7-Jun	14:40	14.8	SPIN	1.3	8.2	0
107	300	WSGISL	GN_LCR_057_1	450229	5464578	450264	5464565	7-Jun	9:56	14.1	7-Jun	13:11	14.4	SPIN	1.3	5.6	0
108	300	WSGISL	GN_LCR_057_2	450229	5464578	450264	5464565	7-Jun	13:11	14.4	7-Jun	14:52	14.8	SPIN	1.3	5.6	1
109	300	WSGISL	GN_LCR_058_1	450124	5464596	450169	5464553	7-Jun	10:03	14.1	7-Jun	13:20	14.5	SPIN	1.3	9.0	0
110	300	PIKEBAY	GN_LCR_059_1	448171	5464931	448210	5464927	9-Jun	10:33	14.5	9-Jun	12:05	14.5	SPIN	3.1	6.2	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
111	300	PIKEBAY	GN_LCR_059_2	448171	5464931	448210	5464927	9-Jun	12:05	14.5	9-Jun	14:27	14.4	SPIN	3.1	6.2	0
112	300	PIKEBAY	GN_LCR_060_1	448483	5464817	448452	5464858	9-Jun	10:38	14.4	9-Jun	12:18	14.4	SPIN	1.8	13.2	0
113	300	PIKEBAY	GN_LCR_060_2	448483	5464817	448452	5464858	9-Jun	12:18	14.4	9-Jun	14:34	14.4	SPIN	1.8	13.2	0
114	300	USBAY	GN_LCR_061_1	448918	5464671	448958	5464669	9-Jun	10:44	14.4	9-Jun	12:28	14.4	SPIN	1.7	7.4	0
115	300	USBAY	GN_LCR_061_2	448918	5464671	448958	5464669	9-Jun	12:28	14.4	9-Jun	14:47	14.4	SPIN	1.7	7.4	0
116	300	USBAY	GN_LCR_062_1	449034	5464621	449084	5464636	9-Jun	10:48	14.4	9-Jun	12:45	14.4	SPIN	1.4	10.3	1
117	300	USBAY	GN_LCR_062_2	449034	5464621	449084	5464636	9-Jun	12:45	14.4	9-Jun	14:53	14.4	SPIN	1.4	10.3	0
118	300	DSBAY	GN_LCR_063_1	450165	5464313	450205	5464332	9-Jun	10:54	14.5	9-Jun	13:47	14.4	SPIN	3.4	13.2	0
119	300	WSGISL	GN_LCR_064_1	450161	5464592	450166	5464546	9-Jun	10:58	14.5	9-Jun	13:59	14.6	SPIN	1.3	9.7	0
120	300	WSGISL	GN_LCR_065_1	450228	5464576	450258	5464571	9-Jun	11:05	14.4	9-Jun	14:07	14.4	SPIN	1.3	4.8	0
121	300	FERRUS	GN_LCR_066_1	450326	5464577	450326	5464540	9-Jun	11:12	14.4	9-Jun	14:20	14.3	SPIN	1.6	9.5	0
122	300	PIKEBAY	GN_LCR_067_1	448223	5464917	448271	5464907	12-Jun	9:27	15.0	12-Jun	11:54	15.3	SPIN	3.1	4.6	0
123	300	PIKEBAY	GN_LCR_068_1	448424	5464829	448471	5464836	12-Jun	9:34	14.8	12-Jun	12:09	15.1	SPIN	1.3	8.4	0
124	300	USBAY	GN_LCR_069_1	448918	5464672	448972	5464671	12-Jun	9:42	14.6	12-Jun	12:24	15.0	SPIN	0.8	8.6	0
125	300	USBAY	GN_LCR_069_2	448918	5464672	448972	5464671	12-Jun	12:24	15.0	12-Jun	14:05	15.3	SPIN	0.8	8.6	0
126	300	USBAY	GN_LCR_070_1	449044	5464619	449100	5464610	12-Jun	9:47	14.5	12-Jun	12:34	15.0	SPIN	1.2	6.8	0
127	300	USBAY	GN_LCR_070_2	449044	5464619	449100	5464610	12-Jun	12:34	15.0	12-Jun	14:14	15.3	SPIN	1.2	6.8	0
128	300	DSBAY	GN_LCR_071_1	450166	5464307	450216	5464303	12-Jun	9:57	14.4	12-Jun	12:53	14.8	SPIN	0.8	10.1	0
129	300	DSBAY	GN_LCR_071_2	450166	5464307	450216	5464303	12-Jun	12:53	14.8	12-Jun	14:27	15.1	SPIN	0.8	10.1	0
130	300	DSBAY	GN_LCR_072_1	450280	5464253	450336	5464269	12-Jun	10:04	14.2	12-Jun	13:08	15.0	SPIN	1.1	7.2	0
131	300	DSBAY	GN_LCR_072_2	450280	5464253	450336	5464269	12-Jun	13:08	15.0	12-Jun	14:38	15.0	SPIN	1.1	7.2	0
132	300	WSGISL	GN_LCR_073_1	450150	5464596	450175	5464546	12-Jun	10:10	14.4	12-Jun	13:22	15.1	SPIN	1.0	8.8	0
133	300	WSGISL	GN_LCR_074_1	450232	5464569	450269	5464565	12-Jun	10:17	14.0	12-Jun	13:35	14.8	SPIN	0.8	5.2	0
134	300	BALBAY	GN_LCR_075_1	446484	5465646	446437	5465679	13-Jun	9:13	16.4	13-Jun	11:08	16.4	SPIN	1.3	7.0	0
135	300	PIKEBAY	GN_LCR_076_1	448515	5464814	448461	5464828	13-Jun	9:26	16.3	13-Jun	11:41	16.6	SPIN	1.0	7.0	1
136	300	PIKEBAY	GN_LCR_076_2	448515	5464814	448461	5464828	13-Jun	11:41	16.6	13-Jun	13:06	16.8	SPIN	1.0	7.0	0
137	300	CENBAY	GN_LCR_077_1	449981	5464344	449928	5464354	13-Jun	9:34	16.2	13-Jun	12:00	17.1	SPIN	1.6	5.1	0
138	300	DSBAY	GN_LCR_078_1	450204	5464282	450239	5464279	13-Jun	9:45	16.0	13-Jun	12:15	16.7	SPIN	4.0	7.0	0
139	300	DSBAY	GN_LCR_079_1	450344	5464237	450374	5464246	13-Jun	9:50	16.0	13-Jun	12:23	16.7	SPIN	1.1	5.2	0
140	300	WSGISL	GN_LCR_080_1	450233	5464567	450275	5464540	13-Jun	9:58	15.9	13-Jun	12:42	16.4	SPIN	1.6	8.1	0
141	300	FERRUS	GN_LCR_081_1	450342	5464579	450306	5464553	13-Jun	10:06	16.0	13-Jun	12:50	16.3	SPIN	1.3	8.1	0
142	300	ZUCKP	GN_LCR_082_1	452179	5462753	452161	5462794	14-Jun	9:38	16.3	14-Jun	11:52	16.3	SPIN	0.0	2.1	0
143	300	ZUCKP	GN_LCR_083_1	452139	5462701	452145	5462750	14-Jun	9:58	16.3	14-Jun	11:58	16.3	SPIN	0.0	2.1	0
144	300	ZUCKP	GN_LCR_084_1	452150	5462666	452189	5462638	14-Jun	10:03	16.4	14-Jun	12:20	16.3	SPIN	0.0	1.8	2
145	300	ZUCKP	GN_LCR_084_2	452150	5462666	452189	5462638	14-Jun	12:20	16.3	14-Jun	14:28	16.3	SPIN	0.0	1.8	2
146	300	ZUCKP	GN_LCR_085_1	452193	5462657	452199	5462601	14-Jun	12:22	16.4	14-Jun	14:46	16.4	SPIN	0.1	2.2	1
147	300	BALBAY	GN_LCR_086_1	446479	5465658	446445	5465668	16-Jun	9:17	15.4	16-Jun	11:35	15.5	SPIN	1.7	6.4	0
148	300	PIKEBAY	GN_LCR_087_1	448521	5464812	448481	5464833	16-Jun	9:28	15.2	16-Jun	12:01	15.5	SPIN	1.1	6.7	1
149	300	PIKEBAY	GN_LCR_087_2	448521	5464812	448481	5464833	16-Jun	12:01	15.5	16-Jun	14:07	15.6	SPIN	1.1	6.7	1

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
150	300	USBAY	GN_LCR_088_1	448973	5464649	448926	5464676	16-Jun	9:35	15.1	16-Jun	12:20	15.4	SPIN	0.9	3.4	0
151	300	USBAY	GN_LCR_088_2	448973	5464649	448926	5464676	16-Jun	12:20	15.4	16-Jun	14:20	15.4	SPIN	0.9	3.4	0
152	300	USBAY	GN_LCR_089_1	449137	5464579	449100	5464611	16-Jun	9:42	15.1	16-Jun	12:33	15.5	SPIN	1.3	6.0	0
153	300	USBAY	GN_LCR_089_2	449137	5464579	449100	5464611	16-Jun	12:33	15.5	16-Jun	14:28	15.5	SPIN	1.3	6.0	0
154	300	DSBAY	GN_LCR_090_1	450245	5464265	450204	5464295	16-Jun	9:53	15.1	16-Jun	12:41	16.2	SPIN	0.9	7.2	0
155	300	DSBAY	GN_LCR_090_2	450245	5464265	450204	5464295	16-Jun	12:41	16.2	16-Jun	14:35	16.2	SPIN	0.9	7.2	0
156	300	DSBAY	GN_LCR_091_1	450558	5464239	450531	5464264	16-Jun	10:00	15.1	16-Jun	12:53	15.6	SPIN	0.9	6.0	1
157	300	DSBAY	GN_LCR_091_2	450558	5464239	450531	5464264	16-Jun	12:53	15.6	16-Jun	14:43	15.9	SPIN	0.9	6.0	0
158	300	WSGISL	GN_LCR_092_1	450252	5464578	450273	5464538	16-Jun	10:07	15.0	16-Jun	13:16	15.4	SPIN	0.6	8.0	0
159	300	FERRUS	GN_LCR_093_1	450495	5464587	450533	5464557	16-Jun	10:14	15.1	16-Jun	13:30	15.5	SPIN	1.2	6.5	1
160	300	FERRUS	GN_LCR_093_2	450495	5464587	450533	5464557	16-Jun	13:30	15.5	16-Jun	15:02	15.6	SPIN	1.2	6.5	0
161	300	BALBAY	GN_LCR_094_1	446418	5465706	446385	5465680	20-Jun	9:12	15.6	20-Jun	11:55	15.2	SPIN	0.6	7.9	1
162	300	BALBAY	GN_LCR_094_2	446418	5465706	446385	5465680	20-Jun	11:55	15.2	20-Jun	15:05	14.5	SPIN	0.6	7.9	1
163	300	PIKEBAY	GN_LCR_095_1	448509	5464814	448464	5464837	20-Jun	9:23	16.1	20-Jun	12:34	15.6	SPIN	0.6	7.1	1
164	300	USBAY	GN_LCR_096_1	449127	5464587	449088	5464613	20-Jun	9:30	16.3	20-Jun	12:58	15.9	SPIN	0.9	8.1	0
165	300	CENBAY	GN_LCR_097_1	449871	5464362	449922	5464360	20-Jun	9:40	16.5	20-Jun	13:13	16.2	SPIN	0.9	3.6	0
166	300	DSBAY	GN_LCR_098_1	450471	5464245	450462	5464282	20-Jun	9:53	16.6	20-Jun	13:36	16.3	SPIN	0.6	7.2	0
167	300	DSBAY	GN_LCR_099_1	450578	5464241	450579	5464290	20-Jun	10:00	16.6	20-Jun	13:56	16.3	SPIN	0.9	6.0	0
168	300	WSGISL	GN_LCR_100_1	450282	5464577	450321	5464537	20-Jun	10:05	16.5	20-Jun	14:18	16.1	SPIN	0.6	8.2	0
169	300	FERRUS	GN_LCR_101_1	450515	5464584	450510	5464544	20-Jun	10:11	16.6	20-Jun	14:37	16.1	SPIN	0.9	6.4	0
170	300	ZUCKP	GN_LCR_102_1	452193	5462657	452199	5462601	21-Jun	15:32	-	21-Jun	19:55	-	SPIN	0.0	2.1	0
171	300	PIKEBAY	GN_LCR_103_1	448239	5464904	448284	5464897	30-Jun	9:37	13.4	30-Jun	11:47	13.6	SPIN	2.5	4.7	0
172	300	PIKEBAY	GN_LCR_103_2	448239	5464904	448284	5464897	30-Jun	11:47	13.6	30-Jun	13:53	13.8	SPIN	2.5	4.7	0
173	300	PIKEBAY	GN_LCR_104_1	448511	5464809	448470	5464832	30-Jun	9:45	13.5	30-Jun	11:54	13.6	SPIN	2.1	8.4	0
174	300	PIKEBAY	GN_LCR_104_2	448511	5464809	448470	5464832	30-Jun	11:54	13.6	30-Jun	14:00	13.8	SPIN	2.1	8.4	0
175	300	DSBAY	GN_LCR_105_1	450386	5464232	450334	5464254	30-Jun	9:54	13.4	30-Jun	12:05	13.6	SPIN	2.1	6.7	0
176	300	DSBAY	GN_LCR_105_2	450386	5464232	450334	5464254	30-Jun	12:05	13.6	30-Jun	14:15	13.8	SPIN	2.1	6.7	0
177	300	DSBAY	GN_LCR_106_1	450474	5464239	450435	5464256	30-Jun	10:01	13.4	30-Jun	12:12	13.6	SPIN	2.5	7.6	0
178	300	DSBAY	GN_LCR_106_2	450474	5464239	450435	5464256	30-Jun	12:12	13.6	30-Jun	14:25	13.9	SPIN	2.5	7.6	0
179	300	WSGISL	GN_LCR_107_1	450281	5464586	450313	5464538	30-Jun	10:07	13.4	30-Jun	12:20	13.9	SPIN	2.7	11.1	0
180	300	WSGISL	GN_LCR_107_2	450281	5464586	450313	5464538	30-Jun	12:20	13.9	30-Jun	14:32	13.9	SPIN	2.7	11.1	0
181	300	FERRUS	GN_LCR_108_1	450499	5464598	450539	5464560	30-Jun	10:13	13.4	30-Jun	12:29	13.6	SPIN	2.1	7.6	0
182	300	FERRUS	GN_LCR_108_2	450499	5464598	450539	5464560	30-Jun	12:29	13.6	30-Jun	14:40	14.1	SPIN	2.1	7.6	0
183	300	ZUCKP	JGN_LCR_001_1	452153	5462794	452125	5462759	13-Jul	11:30	20.9	13-Jul	14:35	20.9	JUVE	0.0	1.0	0
184	300	ZUCKP	JGN_LCR_002_1	452194	5462805	452188	5462778	13-Jul	11:43	20.9	13-Jul	14:49	20.9	JUVE	0.0	1.5	1
185	300	ZUCKP	JGN_LCR_003_1	452210	5462605	452180	5462620	13-Jul	12:45	20.9	13-Jul	15:20	20.9	JUVE	0.0	2.1	1
186	300	ZUCKP	GN_LCR_109_1	452159	5462794	452180	5462768	13-Jul	10:31	20.9	13-Jul	13:51	20.9	SPIN	0.0	2.4	1
187	300	ZUCKP	GN_LCR_110_1	452139	5462727	452161	5462737	13-Jul	10:44	20.9	13-Jul	14:05	20.9	SPIN	0.0	2.1	0
188	300	BALBAY	GN_LCR_111_1	446454	5465687	446412	5465695	14-Jul	9:59	16.3	14-Jul	12:30	16.3	SPIN	4.2	5.7	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
189	300	PIKEBAY	GN_LCR_112_1	448529	5464795	448508	5464834	14-Jul	10:12	16.1	14-Jul	12:34	16.1	SPIN	2.0	10.0	0
190	300	PIKEBAY	GN_LCR_112_2	448529	5464795	448508	5464834	14-Jul	12:34	16.1	14-Jul	14:34	16.4	SPIN	2.0	10.0	0
191	300	PIKEBAY	JGN_LCR_004_1	448436	5464773	448478	5464778	14-Jul	10:21	16.2	14-Jul	12:50	16.4	JUVE	0.6	2.3	0
192	300	PIKEBAY	JGN_LCR_004_2	448436	5464773	448478	5464778	14-Jul	12:50	16.4	14-Jul	14:29	16.5	JUVE	0.6	2.3	0
193	300	DSBAY	GN_LCR_113_1	450431	5464218	450413	5464254	14-Jul	10:29	16.2	14-Jul	12:57	16.1	SPIN	2.1	8.6	1
194	300	DSBAY	GN_LCR_113_2	450431	5464218	450413	5464254	14-Jul	12:57	16.1	14-Jul	14:45	16.3	SPIN	2.1	8.6	0
195	300	FERRUS	GN_LCR_114_1	450488	5464597	450525	5464594	14-Jul	10:37	16.2	14-Jul	13:20	16.2	SPIN	3.0	3.4	0
196	300	FERRUS	GN_LCR_114_2	450488	5464597	450525	5464594	14-Jul	13:20	16.2	14-Jul	14:48	16.2	SPIN	3.0	3.4	0
197	340	LKROX	GN_LKR_002_1	452964	5462155	452935	5462186	14-Jul	10:54	20.3	14-Jul	13:38	23.2	SPIN	0.4	1.4	0
198	340	LKREDDY	GN_LKR_003_1	452812	5462838	452775	5462810	14-Jul	11:09	20.0	14-Jul	13:46	20.2	SPIN	0.8	8.1	0
199	340	LKREDDY	GN_LKR_004_1	452669	5462876	452715	5462865	14-Jul	11:15	19.4	14-Jul	14:08	19.6	SPIN	1.0	4.6	0
200	300	ZUCKP	JGN_LCR_005_1	452202	5462802	452185	5462764	18-Jul	9:42	21.2	18-Jul	12:07	21.2	JUVE	0.0	2.2	3
201	300	ZUCKP	JGN_LCR_005_2	452202	5462802	452185	5462764	18-Jul	12:07	21.2	18-Jul	15:01	21.2	JUVE	0.0	2.3	0
202	300	ZUCKP	JGN_LCR_006_1	452154	5462800	452129	5462760	18-Jul	9:48	21.2	18-Jul	12:28	21.2	JUVE	0.0	2.4	5
203	300	ZUCKP	JGN_LCR_006_2	452154	5462800	452129	5462760	18-Jul	12:28	21.2	18-Jul	15:10	21.2	JUVE	0.0	2.2	1
204	300	ZUCKP	JGN_LCR_007_1	452185	5462667	452184	5462626	18-Jul	10:10	21.2	18-Jul	13:00	21.2	JUVE	0.0	2.3	0
205	300	ZUCKP	JGN_LCR_008_1	452161	5462630	452198	5462608	18-Jul	10:14	21.2	18-Jul	13:10	21.2	JUVE	0.0	2.5	0
206	300	ZUCKP	GN_LCR_115_1	452169	5462812	452158	5462777	18-Jul	10:29	21.2	18-Jul	13:26	21.2	SPIN	0.0	2.6	0
207	300	ZUCKP	JGN_LCR_009_1	452215	5462797	452172	5462785	19-Jul	9:30	20.8	19-Jul	12:30	20.8	JUVE	0.0	2.6	1
208	300	ZUCKP	JGN_LCR_009_2	452215	5462797	452172	5462785	19-Jul	12:30	20.8	19-Jul	15:01	20.8	JUVE	0.0	2.6	0
209	300	ZUCKP	JGN_LCR_010_1	452151	5462795	452129	5462743	19-Jul	9:48	20.8	19-Jul	15:06	20.8	JUVE	0.0	2.1	7
210	300	ZUCKP	JGN_LCR_011_1	452171	5462812	452154	5462765	19-Jul	10:00	20.8	19-Jul	13:30	20.8	JUVE	0.0	3.2	1
211	300	ZUCKP	GN_LCR_116_1	452194	5462599	452232	5462612	19-Jul	10:16	20.8	19-Jul	13:40	20.8	SPIN	0.0	2.6	0
212	300	ZUCKP	JGN_LCR_012_1	452145	5462687	452169	5462652	19-Jul	10:24	20.8	19-Jul	14:05	20.8	JUVE	0.0	2.4	2
213	300	PIKEBAY	GN_LCR_117_1	448457	5464770	448472	5464808	27-Jul	9:24	17.1	27-Jul	11:38	17.2	SPIN	1.8	3.7	2
214	300	PIKEBAY	GN_LCR_117_2	448457	5464770	448472	5464808	27-Jul	11:38	17.2	27-Jul	14:16	17.5	SPIN	1.8	3.7	0
215	300	DSBAY	GN_LCR_118_1	450459	5464207	450498	5464245	27-Jul	9:40	16.9	27-Jul	11:51	18.2	SPIN	1.3	4.1	0
216	300	DSBAY	GN_LCR_118_2	450459	5464207	450498	5464245	27-Jul	11:51	18.2	27-Jul	14:29	17.3	SPIN	1.3	4.1	0
217	340	LKROX	GN_LKR_005_1	452860	5462496	452870	5462535	27-Jul	9:55	20.8	27-Jul	12:15	19.2	SPIN	1.2	2.7	0
218	340	LKROX	GN_LKR_005_2	452860	5462496	452870	5462535	27-Jul	12:15	19.2	27-Jul	13:53	22.2	SPIN	1.2	2.7	0
219	340	LKROX	GN_LKR_006_1	453113	5462553	453072	5462533	27-Jul	10:03	21.0	27-Jul	12:35	21.3	SPIN	1.0	1.5	0
220	300	WATEDDY	JGN_LCR_013_1	453303	5456758	453269	5456781	27-Jul	10:20	17.8	27-Jul	13:20	18.5	JUVE	1.3	3.0	0
221	300	WATEDDY	GN_LCR_119_1	453298	5456770	453287	5456815	27-Jul	10:29	17.7	27-Jul	13:26	18.4	JUVE	1.9	5.5	0
222	300	PIKEBAY	GN_LCR_120_1	448453	5464770	448476	5464799	28-Jul	9:10	17.4	28-Jul	10:58	17.2	SPIN	1.0	3.7	0
223	300	PIKEBAY	GN_LCR_121_1	448532	5464794	448509	5464815	28-Jul	9:17	17.2	28-Jul	11:03	17.2	SPIN	2.4	4.5	0
224	340	LKROX	GN_LKR_007_1	452861	5462480	452852	5462532	28-Jul	9:31	20.4	28-Jul	11:32	21.5	SPIN	0.9	2.2	0
225	300	WATEDDY	JGN_LCR_014_1	453306	5456754	453275	5456776	28-Jul	9:48	17.9	28-Jul	12:01	18.3	JUVE	1.3	3.8	0
226	300	WATEDDY	GN_LCR_122_1	453310	5456756	453276	5456801	28-Jul	9:55	17.9	28-Jul	12:11	18.4	SPIN	2.7	5.3	0
227	300	WATEDDY	GN_LCR_123_1	453333	5456821	453287	5456805	28-Jul	10:03	18.0	28-Jul	12:21	18.6	SPIN	4.3	7.2	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U)				Set			Pull			Net Type	Depth (m)		# NP
				Start		End											
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
228	300	BALBAY	GN_LCR_124_1	446265	5465783	446286	5465759	1-Aug	9:24	14.5	1-Aug	11:43	14.5	SPIN	3.2	3.4	0
229	300	BALBAY	GN_LCR_125_1	446379	5465756	446342	5465730	1-Aug	9:29	14.4	1-Aug	11:50	14.6	SPIN	3.1	4.0	0
230	300	PIKEBAY	GN_LCR_126_1	448145	5464934	448181	5464948	1-Aug	9:37	15.1	1-Aug	12:16	15.0	SPIN	3.1	8.0	1
231	300	PIKEBAY	GN_LCR_126_2	448145	5464934	448181	5464948	1-Aug	12:16	15.0	1-Aug	14:00	15.6	SPIN	3.1	8.0	0
232	300	PIKEBAY	GN_LCR_127_1	448459	5464768	448446	5464820	1-Aug	9:46	15.0	1-Aug	12:34	14.9	SPIN	1.3	6.4	0
233	300	PIKEBAY	GN_LCR_127_2	448459	5464768	448446	5464820	1-Aug	12:34	14.9	1-Aug	14:18	15.3	SPIN	1.3	6.4	1
234	300	PIKEBAY	GN_LCR_128_1	448526	5464798	448492	5464824	1-Aug	9:52	14.9	1-Aug	12:46	14.9	SPIN	2.7	6.5	0
235	300	PIKEBAY	GN_LCR_128_2	448526	5464798	448492	5464824	1-Aug	12:46	14.9	1-Aug	14:34	15.2	SPIN	2.7	6.5	0
236	300	USBAY	GN_LCR_129_1	449015	5464617	449059	5464634	1-Aug	9:59	15.8	1-Aug	13:02	14.9	SPIN	2.8	10.1	0
237	300	USBAY	GN_LCR_129_2	449015	5464617	449059	5464634	1-Aug	13:02	14.9	1-Aug	14:42	15.1	SPIN	2.8	10.1	0
238	300	DSBAY	GN_LCR_130_1	450462	5464211	450467	5464245	1-Aug	10:07	15.0	1-Aug	13:18	14.9	SPIN	2.3	6.5	0
239	300	DSBAY	GN_LCR_130_2	450462	5464211	450467	5464245	1-Aug	13:18	14.9	1-Aug	15:21	15.1	SPIN	2.3	6.5	0
240	300	WALISL	JGN_LCR_015_1	452755	5464339	452745	5464297	1-Aug	10:25	15.0	1-Aug	13:42	15.1	JUVE	0.3	0.7	0
241	300	DSBAY	GN_LCR_131_1	450480	5464196	450482	5464239	1-Aug	13:30	15.1	1-Aug	15:31	15.1	SPIN	1.4	4.0	0
242	300	PIKEBAY	GN_LCR_132_1	448144	5464915	448181	5464928	2-Aug	9:07	15.2	2-Aug	11:40	15.4	SPIN	2.3	6.8	0
243	300	PIKEBAY	GN_LCR_132_2	448144	5464915	448181	5464928	2-Aug	11:40	15.4	2-Aug	14:04	15.6	SPIN	2.3	6.8	0
244	300	PIKEBAY	GN_LCR_133_1	448436	5464769	448427	5464818	2-Aug	9:14	15.1	2-Aug	11:55	15.3	SPIN	0.6	4.0	0
245	300	PIKEBAY	GN_LCR_133_2	448436	5464769	448427	5464818	2-Aug	11:55	15.3	2-Aug	14:08	15.4	SPIN	0.6	4.0	0
246	300	PIKEBAY	GN_LCR_134_1	448456	5464817	448500	5464806	2-Aug	9:19	15.1	2-Aug	12:06	15.3	SPIN	2.7	3.4	1
247	300	PIKEBAY	GN_LCR_134_2	448456	5464817	448500	5464806	2-Aug	12:06	15.3	2-Aug	14:15	15.2	SPIN	2.7	3.4	1
248	300	USBAY	GN_LCR_135_1	448905	5464650	448946	5464654	2-Aug	9:26	15.1	2-Aug	12:22	15.3	SPIN	1.6	3.7	1
249	300	USBAY	GN_LCR_135_2	448905	5464650	448946	5464654	2-Aug	12:22	15.3	2-Aug	14:31	15.5	SPIN	1.6	3.7	0
250	300	CENBAY	GN_LCR_136_1	449744	5464342	449764	5464397	2-Aug	9:35	15.1	2-Aug	12:36	15.3	SPIN	2.2	3.0	0
251	300	CENBAY	GN_LCR_136_2	449744	5464342	449764	5464397	2-Aug	12:36	15.3	2-Aug	14:37	16.0	SPIN	2.2	3.0	0
252	300	DSBAY	GN_LCR_137_1	450205	5464265	450245	5464274	2-Aug	9:44	15.1	2-Aug	12:50	15.3	SPIN	3.0	7.0	0
253	300	DSBAY	GN_LCR_137_2	450205	5464265	450245	5464274	2-Aug	12:50	15.3	2-Aug	14:45	15.4	SPIN	3.0	7.0	0
254	300	DSBAY	GN_LCR_138_1	450377	5464214	450391	5464251	2-Aug	9:50	15.1	2-Aug	13:07	15.2	SPIN	0.6	8.5	0
255	300	DSBAY	GN_LCR_138_2	450377	5464214	450391	5464251	2-Aug	13:07	15.2	2-Aug	14:53	15.2	SPIN	0.6	8.5	0
256	300	USBAY	JGN_LCR_016_1	448729	5464718	448763	5464703	2-Aug	10:03	15.2	2-Aug	13:25	15.2	JUVE	0.6	2.0	0
257	300	PIKEBAY	GN_LCR_139_1	448165	5464925	448200	5464915	3-Aug	9:00	15.6	3-Aug	11:18	15.7	SPIN	3.8	6.0	0
258	300	PIKEBAY	GN_LCR_139_2	448165	5464925	448200	5464915	3-Aug	11:18	15.7	3-Aug	13:23	15.7	SPIN	3.8	6.0	0
259	300	PIKEBAY	GN_LCR_140_1	448290	5464890	448324	5464877	3-Aug	9:06	15.6	3-Aug	11:25	15.7	SPIN	3.6	4.4	0
260	300	PIKEBAY	GN_LCR_140_2	448290	5464890	448324	5464877	3-Aug	11:25	15.7	3-Aug	13:32	15.7	SPIN	3.6	4.4	0
261	300	PIKEBAY	GN_LCR_141_1	448443	5464819	448393	5464834	3-Aug	9:11	15.6	3-Aug	11:35	15.6	SPIN	2.8	3.4	0
262	300	PIKEBAY	GN_LCR_141_2	448443	5464819	448393	5464834	3-Aug	11:35	15.6	3-Aug	13:45	15.7	SPIN	2.8	3.4	1
263	300	PIKEBAY	GN_LCR_142_1	448492	5464797	448454	5464824	3-Aug	9:16	15.5	3-Aug	11:42	15.7	SPIN	2.8	5.2	0
264	300	PIKEBAY	GN_LCR_142_2	448492	5464797	448454	5464824	3-Aug	11:42	15.7	3-Aug	13:58	15.7	SPIN	2.8	5.2	0
265	300	USBAY	GN_LCR_143_1	448914	5464642	448961	5464654	3-Aug	9:24	15.6	3-Aug	11:50	15.6	SPIN	1.0	4.5	0
266	300	USBAY	GN_LCR_143_2	448914	5464642	448961	5464654	3-Aug	11:50	15.6	3-Aug	14:10	15.9	SPIN	1.0	4.5	0

Ref.	Watershed Code	Site	Set	Location (UTM Zone 11U) Start		Location (UTM Zone 11U) End		Set			Pull			Net Type	Depth (m)		# NP
				Easting	Northing	Easting	Northing	Date	Time	Temp (°C)	Date	Time	Temp (°C)		Min	Max	
267	300	CENBAY	GN_LCR_144_1	449542	5464485	449582	5464476	3-Aug	9:31	15.6	3-Aug	11:59	15.6	SPIN	0.0	3.7	0
268	300	CENBAY	GN_LCR_144_2	449542	5464485	449582	5464476	3-Aug	11:59	15.6	3-Aug	14:18	15.9	SPIN	0.0	3.7	0
269	300	CENBAY	GN_LCR_145_1	449916	5464341	449865	5464341	3-Aug	9:37	15.6	3-Aug	12:05	15.6	SPIN	2.9	3.4	0
270	300	CENBAY	GN_LCR_145_2	449916	5464341	449865	5464341	3-Aug	12:05	15.6	3-Aug	14:30	15.7	SPIN	2.9	3.4	0
271	300	DSBAY	GN_LCR_146_1	450510	5464236	450556	5464243	3-Aug	9:44	15.6	3-Aug	12:24	15.6	SPIN	3.3	4.0	0
272	300	DSBAY	GN_LCR_146_2	450510	5464236	450556	5464243	3-Aug	12:24	15.6	3-Aug	14:42	15.6	SPIN	3.3	4.0	0
273	300	ZUCKP	JGN_LCR_017_1	452150	5462799	452126	5462758	8-Aug	9:40	20.3	8-Aug	12:10	20.3	JUVE	0.0	1.9	0
274	300	ZUCKP	JGN_LCR_017_2	452150	5462799	452126	5462758	8-Aug	12:10	20.3	8-Aug	14:16	20.3	JUVE	0.0	1.9	2
275	300	ZUCKP	JGN_LCR_018_1	452204	5462811	452171	5462777	8-Aug	9:44	20.3	8-Aug	12:23	20.3	JUVE	0.0	2.1	0
276	300	ZUCKP	JGN_LCR_019_1	452180	5462696	452140	5462702	8-Aug	10:05	20.3	8-Aug	12:44	20.3	JUVE	0.0	2.2	1
277	300	ZUCKP	JGN_LCR_019_2	452180	5462696	452140	5462702	8-Aug	12:44	20.3	8-Aug	14:46	20.3	JUVE	0.0	2.2	1
278	300	ZUCKP	JGN_LCR_020_1	452189	5462603	452168	5462663	8-Aug	10:17	20.3	8-Aug	13:20	20.3	JUVE	0.0	2.0	0
279	300	ZUCKP	JGN_LCR_021_1	452209	5462581	452180	5462636	8-Aug	10:36	20.3	8-Aug	13:57	20.3	JUVE	0.0	2.1	0
280	300	ZUCKP	JGN_LCR_022_1	452172	5462808	452153	5462770	14-Sep	10:07	17.3	14-Sep	12:20	17.3	JUVE	0.0	2.4	2
281	300	ZUCKP	JGN_LCR_022_2	452172	5462808	452153	5462770	14-Sep	12:20	17.3	14-Sep	14:39	17.3	JUVE	0.0	2.4	0
282	300	ZUCKP	JGN_LCR_023_1	452195	5462616	452175	5462657	14-Sep	10:16	17.3	14-Sep	12:45	17.3	JUVE	0.0	1.3	3

Appendix B-2: Backpack Electrofishing Sites

Table 16. Columbia River backpack electrofishing site during the Okanagan Nation Alliance monitoring and suppression program in 2023 including site, set, location, electrofishing specifications, date, time, depth (m), and northern pike (NP) captured.

Ref.	Site	Set	Location (UTM Zone 11U) Start		Location (UTM Zone 11U) End		Electrofishing Specifications			Date	Time Start	Time End	Average Depth (m)	# NP
			Easting	Northing	Easting	Northing	Time (s)	Voltage	Hz					
283	ZUCKP	EF_LCR_1	452196	5462803	452185	5462771	575	240	45	7/13/2022	13:08	13:35	0.5	0

Appendix C – Maps of Gillnet Suppression Effort

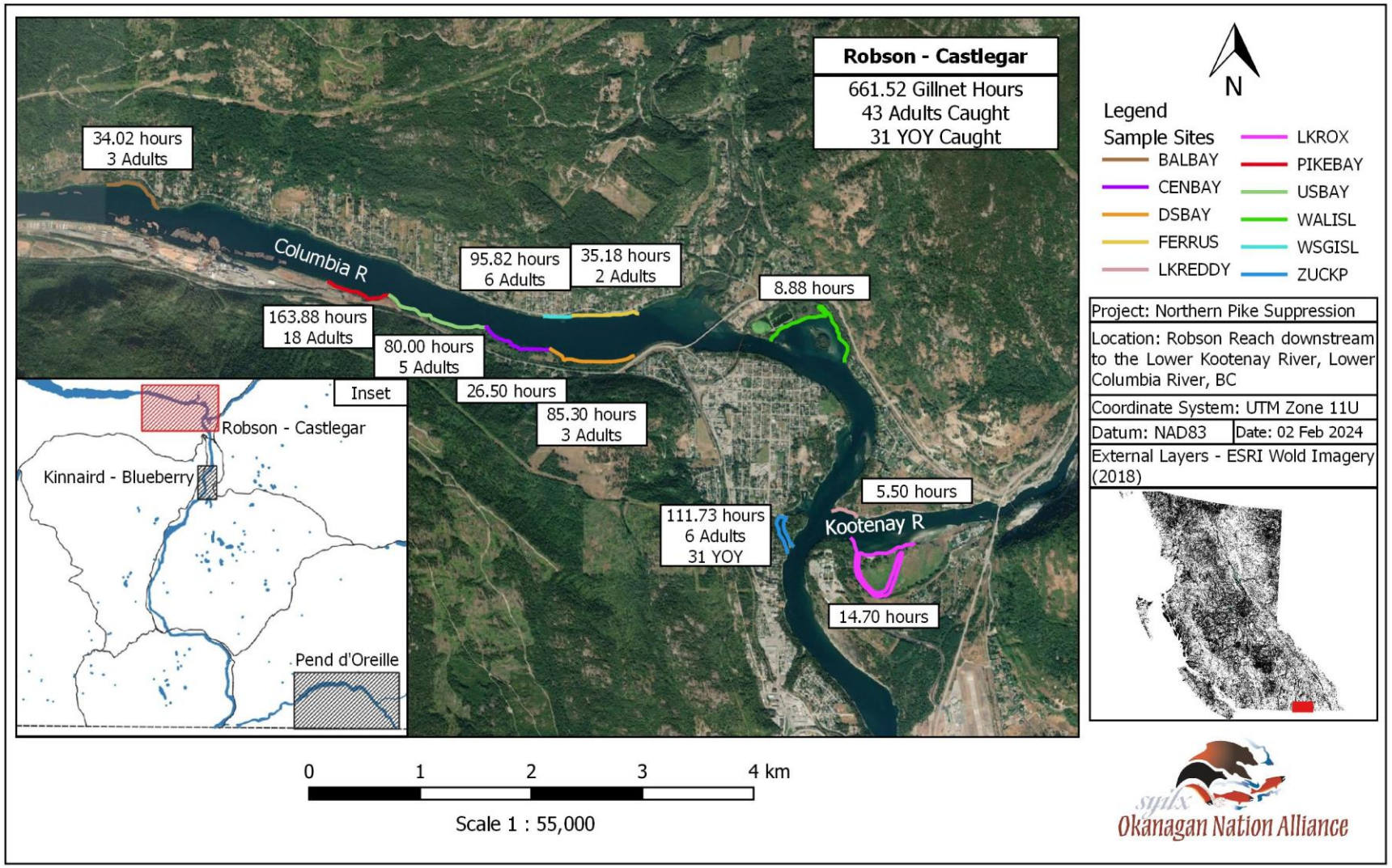

Figure 23. Gillnet effort (soaking hours) in the Robson to Castlegar area by site during the Okanagan Nation Alliance monitoring and suppression program in 2023 including northern pike captured by stage (adult or young-of-year [YOY]).

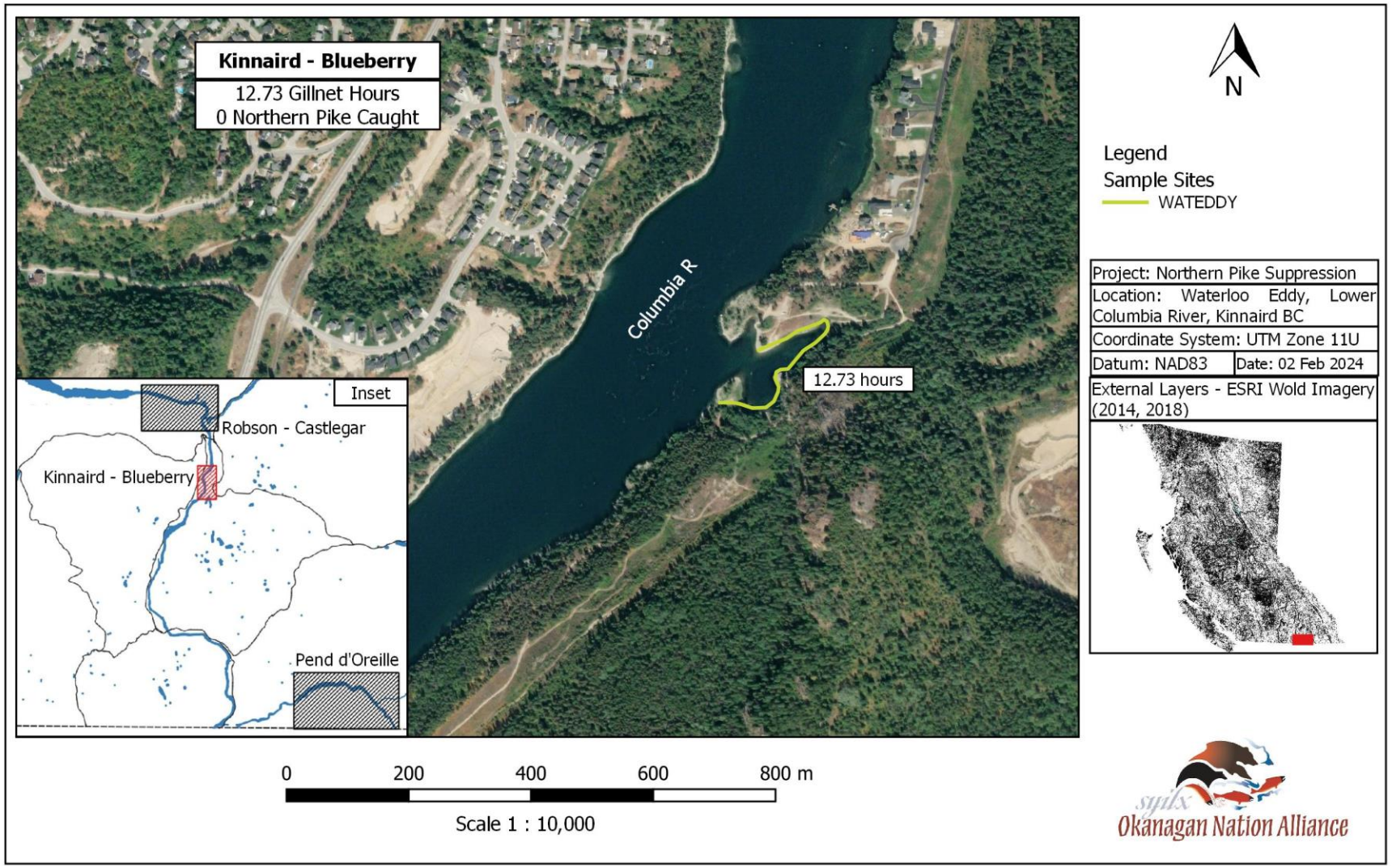

Figure 24. Gillnet effort (soaking hours) in the Kinnaird area by site during the Okanagan Nation Alliance monitoring and suppression program in 2023 including northern pike captured by stage (adult or young-of-year [YOY]).

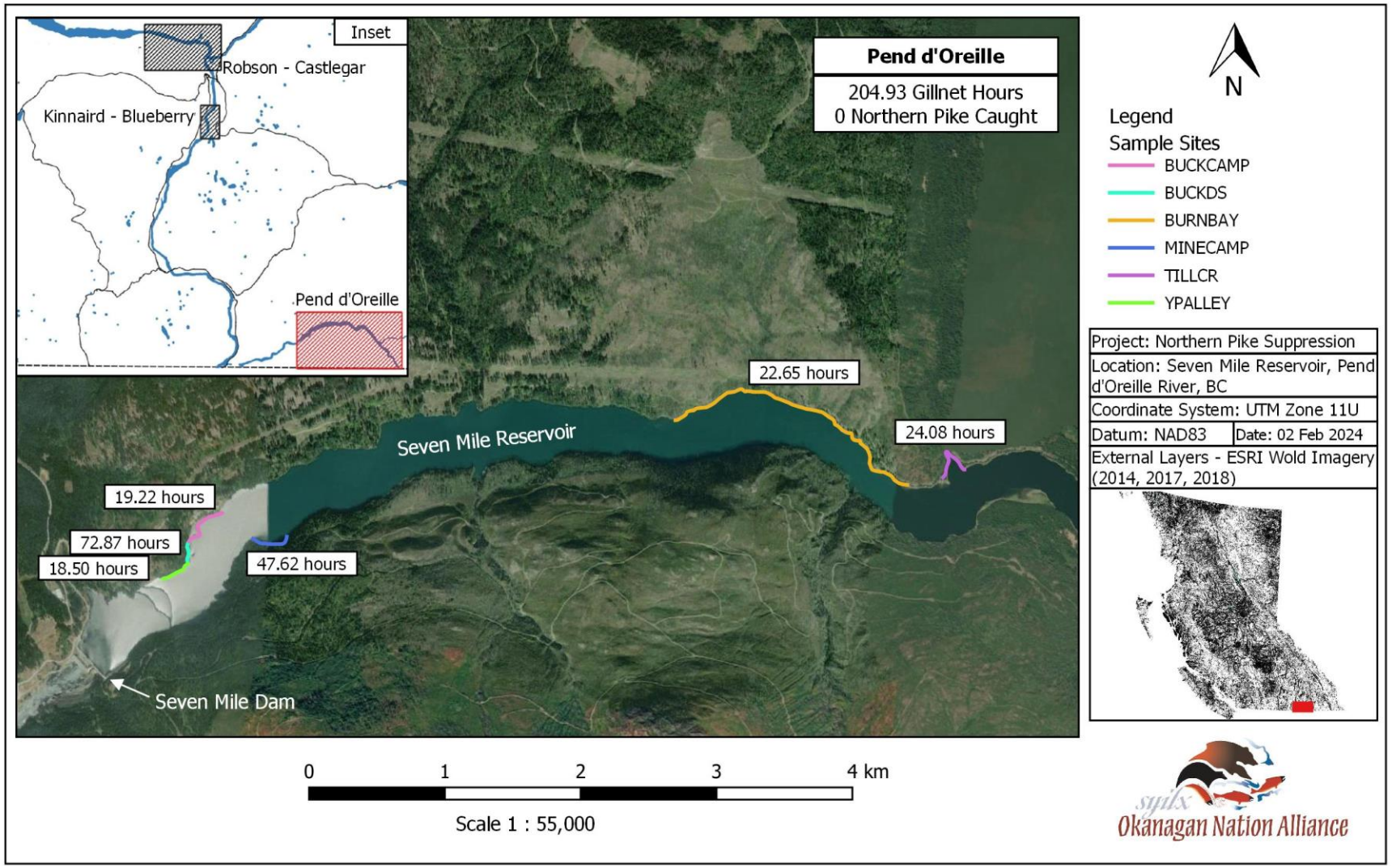

Figure 25. Gillnet effort (soaking hours) in the Seven Mile Reservoir, Pend d'Oreille River, by site during the Okanagan Nation Alliance monitoring and suppression program in 2023 including northern pike captured by stage (adult or young-of-year [YOY]).

Appendix D – Summary of Gillnet Effort and Catch-Per-Unit-Effort by Season and Location

Table 17. Summary of gillnet effort by season during the Okanagan Nation Alliance monitoring and suppression program in 2023 including watershed, location, the number of net checks, total number of northern pike (NP) caught, total net hours, catch-per-unit-effort (CPUE; NP/hours and NP/8 hours). Mainstem includes the Lower Kootenay River, Kootenay River Oxbow, Waldie Island, and Waterloo Eddy. The Robson Reach is from Hugh L. Keenleyside Dam to the Robson Bridge

	Watershed	Location	# of Net Checks	Total NP Caught	Total Net Hours	CPUE (NP/hr)	CPUE (NP/8hr)
Spring (Apr 19-Jun 30)	Lower Columbia River	Mainstem	156	28	391	0.07	0.57
		Robson Reach	153	28	382	0.07	0.59
		Zuckerberg Pond	10	5	30	0.17	1.33
	Pend d'Oreille River	Seven Mile Reservoir	16	0	205	0.00	0.00
Summer (Jul 01-Aug19)	Lower Columbia River	Mainstem	72	9	172	0.05	0.42
		Zuckerberg Pond	25	27	75	0.36	2.90
Fall (Aug 20-Oct 04)	Lower Columbia River	Zuckerberg Pond	3	5	7	0.71	5.70
Total (Apr 19-Oct 30)	Lower Columbia River	Mainstem	228	37	563	0.07	0.53
		Zuckerberg Pond	38	37	112	0.33	2.65
	Pend d'Oreille River	Seven Mile Reservoir	16	0	205	0.00	0.00
	All Sites	**Total**	**282**	**74**	**879**	**0.08**	**0.67**

Appendix E – Northern Pike Biological Data

Table 18. Columbia River northern pike biological and sample information of individuals captured during the Okanagan Nation Alliance monitoring and suppression program and email-in angler incentive program between May 10 and Sep 14 2023 including the project, site, location, date, method of capture, fork length (mm), weight (g), release code (N = not released; Y = released), stage (A = adult; YOY = young-of-year), sex (M = male; F = female), maturity (IM = immature; MT = maturing; M = mature; SB = spawn-bound; S = spawning; ST = spent; U = undetermined), and stomach contents.

Program	Ref.	Site	UTM (Zone 11U) Easting	UTM (Zone 11U) Northing	Pike Ref.	Date	Method	Length	Weight	Release	Stage	Sex	Maturity	Stomach Contents
Suppression	17	PIKEBAY	448447	5464772	NP_2023_LCR_001	26-May	gillnet	546	1600	N	A	M	SB	Rainbow Trout
Suppression	17	PIKEBAY	448447	5464772	NP_2023_LCR_002	26-May	gillnet	534	1291	N	A	F	SB	Empty
Suppression	29	WSGISL	450151	5464598	NP_2023_LCR_003	29-May	gillnet	476	935	N	A	M	M	Sculpin
Suppression	31	WSGISL	450265	5464588	NP_2023_LCR_004	29-May	gillnet	715	3420	N	A	M	SB	Empty
Suppression	31	WSGISL	450265	5464588	NP_2023_LCR_005	29-May	gillnet	750	3780	N	A	M	SB	Mountain Whitefish
Suppression	34	FERRUS	450465	5464576	NP_2023_LCR_006	30-May	gillnet	620	2280	N	A	F	S	Empty
Suppression	40	USBAY	449039	5464613	NP_2023_LCR_007	30-May	gillnet	568	1550	N	A	M	M	Empty
Suppression	45	BALBAY	446474	5465672	NP_2023_LCR_008	30-May	gillnet	744	3584	N	A	F	S	Mountain Whitefish / Kokanee
Suppression	43	PIKEBAY	448475	5464803	NP_2023_LCR_009	30-May	gillnet	620	2285	N	A	F	SB	Empty
Suppression	38	WSGISL	450156	5464594	NP_2023_LCR_010	30-May	gillnet			Y				
Suppression	66	PIKEBAY	448192	5464925	NP_2023_LCR_011	2-Jun	gillnet	458	780	N	A	F	MT	Empty
Suppression	66	PIKEBAY	448192	5464925	NP_2023_LCR_012	2-Jun	gillnet	470	915	N	A	F	MT	Unidentifiable fish parts
Suppression	68	PIKEBAY	448436	5464817	NP_2023_LCR_013	2-Jun	gillnet	726	3289	N	A	M	M	Empty
Suppression	81	PIKEBAY	448474	5464813	NP_2023_LCR_014	5-Jun	gillnet	629	2579	N	A	F	M	Mountain Whitefish
Suppression	92	USBAY	448916	5464673	NP_2023_LCR_015	6-Jun	gillnet	560	1565	N	A	F	SB	Empty
Suppression	96	WSGISL	450231	5464569	NP_2023_LCR_016	6-Jun	gillnet	312	251	N	A	F	MT	Largescale sucker
Suppression	103	USBAY	449017	5464628	NP_2023_LCR_017	7-Jun	gillnet	535	1436	N	A	F	MT	Empty
Suppression	105	DSBAY	450161	5464308	NP_2023_LCR_018	7-Jun	gillnet	508	1074	N	A	M	S	Empty
Suppression	108	WSGISL	450229	5464578	NP_2023_LCR_019	7-Jun	gillnet	265	146	N	A	U	IM	Empty
Suppression	116	USBAY	449034	5464621	NP_2023_LCR_020	9-Jun	gillnet	479	1075	N	A	M	M	Sculpin
Suppression	135	PIKEBAY	448515	5464814	NP_2023_LCR_021	13-Jun	gillnet	385	552	N	A	M	M	Mountain Whitefish
Suppression	144	ZUCKP	452189	5462638	NP_2023_LCR_022	14-Jun	gillnet	330	283	N	A	F	MT	Salmonid/sculpin
Suppression	144	ZUCKP	452150	5462666	NP_2023_LCR_023	14-Jun	gillnet	413	577	N	A	F	MT	Empty
Suppression	145	ZUCKP	452150	5462666	NP_2023_LCR_024	14-Jun	gillnet	355	350	N	A	F	MT	Unidentifiable fish parts
Suppression	145	ZUCKP	452150	5462666	NP_2023_LCR_025	14-Jun	gillnet	294	267	N	A	U	MT	Unidentifiable fish parts
Suppression	146	ZUCKP	452193	5462657	NP_2023_LCR_026	14-Jun	gillnet	350	298	N	A	M	MT	Empty
Suppression	148	PIKEBAY	448481	5464833	NP_2023_LCR_027	16-Jun	gillnet	527	1282	N	A	M	S	Longnose sucker

Program	Ref.	Site	UTM (Zone 11U) Easting	UTM (Zone 11U) Northing	Pike Ref.	Date	Method	Length	Weight	Release	Stage	Sex	Maturity	Stomach Contents
Suppression	156	DSBAY	450558	5464239	NP_2023_LCR_028	16-Jun	gillnet	822	5203	N	A	F	ST	Mountain Whitefish
Suppression	159	FERRUS	450495	5464587	NP_2023_LCR_029	16-Jun	gillnet	324	256	N	A	F	MT	Unidentifiable fish parts
Suppression	149	PIKEBAY	448521	5464812	NP_2023_LCR_030	16-Jun	gillnet	530	1350	N	A	F	MT	Empty
Suppression	161	BALBAY	446418	5465706	NP_2023_LCR_031	20-Jun	gillnet	805	4978	N	A	F	ST	Empty
Suppression	163	PIKEBAY	448464	5464837	NP_2023_LCR_032	20-Jun	gillnet	596	1950	N	A	M	M	Mountain Whitefish
Suppression	162	BALBAY	446385	5465680	NP_2023_LCR_033	20-Jun	gillnet	538	1530	N	A	F	ST	Unidentifiable fish parts
Suppression	186	ZUCKP	452159	5462794	NP_2023_LCR_034	13-Jul	gillnet	130		N	YOY	U	IM	
Suppression	184	ZUCKP	452194	5462805	NP_2023_LCR_035	13-Jul	gillnet	165	29.5	N	YOY	U	IM	Unidentifiable fish parts
Suppression	185	ZUCKP	452210	5462605	NP_2023_LCR_036	13-Jul	gillnet	416	557	N	A	M	IM	Empty
Suppression	193	DSBAY	450431	5464218	NP_2023_LCR_037	14-Jul	gillnet	615	2430	N	A	M	M	Mountain Whitefish
Suppression	200	ZUCKP	452202	5462802	NP_2023_LCR_038	18-Jul	gillnet	184	51	N	YOY	U	IM	Unidentifiable fish parts
Suppression	200	ZUCKP	452202	5462802	NP_2023_LCR_039	18-Jul	gillnet	180	49	N	YOY	U	IM	Unidentifiable fish parts
Suppression	200	ZUCKP	452202	5462802	NP_2023_LCR_040	18-Jul	gillnet	165	52	N	YOY	U	IM	Unidentifiable fish parts
Suppression	202	ZUCKP	452154	5462800	NP_2023_LCR_041	18-Jul	gillnet	178	47	N	YOY	U	IM	Sculpin
Suppression	202	ZUCKP	452154	5462800	NP_2023_LCR_042	18-Jul	gillnet	190	47	N	YOY	U	IM	Sculpin
Suppression	202	ZUCKP	452154	5462800	NP_2023_LCR_043	18-Jul	gillnet	174	41	N	YOY	U	IM	Empty
Suppression	202	ZUCKP	452154	5462800	NP_2023_LCR_044	18-Jul	gillnet	175	42	N	YOY	U	IM	Empty
Suppression	202	ZUCKP	452154	5462800	NP_2023_LCR_045	18-Jul	gillnet	177	44	N	YOY	U	IM	Unidentifiable fish parts
Suppression	203	ZUCKP	452154	5462800	NP_2023_LCR_046	18-Jul	gillnet	174	45	N	YOY	U	IM	Empty
Suppression	207	ZUCKP	452215	5462797	NP_2023_LCR_047	19-Jul	gillnet	156	29.5	N	YOY	U	IM	Sculpin
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_048	19-Jul	gillnet	160	35	N	YOY	U	IM	Empty
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_049	19-Jul	gillnet	170	34	N	YOY	U	IM	Empty
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_050	19-Jul	gillnet	181	51	N	YOY	U	IM	Shiner
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_051	19-Jul	gillnet	185	56	N	YOY	U	IM	Longnose sucker
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_052	19-Jul	gillnet	178	47	N	YOY	U	IM	Empty
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_053	19-Jul	gillnet	172	45	N	YOY	U	IM	Empty
Suppression	209	ZUCKP	452151	5462795	NP_2023_LCR_054	19-Jul	gillnet	185	55	N	YOY	U	IM	Empty
Suppression	210	ZUCKP	452171	5462812	NP_2023_LCR_055	19-Jul	gillnet	161	36	N	YOY	U	IM	Yellow perch
Suppression	212	ZUCKP	452145	5462687	NP_2023_LCR_056	19-Jul	gillnet	190	44	N	YOY	U	IM	Yellow perch
Suppression	212	ZUCKP	452145	5462687	NP_2023_LCR_057	19-Jul	gillnet	162	39	N	YOY	U	IM	Empty
Suppression	213	PIKEBAY	448472	5464808	NP_2023_LCR_058	27-Jul	gillnet	549	1670	N	A	M	M	Kokanee
Suppression	213	PIKEBAY	448472	5464808	NP_2023_LCR_059	27-Jul	gillnet	561	1660	N	A	M	M	Sculpin
Suppression	230	PIKEBAY	448145	5464934	NP_2023_LCR_060	1-Aug	gillnet	580	2079	N	A	F	M	Longnose sucker

Program	Ref.	Site	UTM (Zone 11U) Easting	UTM (Zone 11U) Northing	Pike Ref.	Date	Method	Length	Weight	Release	Stage	Sex	Maturity	Stomach Contents
Suppression	233	PIKEBAY	448446	5464820	NP_2023_LCR_061	1-Aug	gillnet	594	2042	N	A	F	M	Empty
Suppression	246	PIKEBAY	448500	5464806	NP_2023_LCR_062	2-Aug	gillnet	565	1766	N	A	M	M	Kokanee
Suppression	248	USBAY	448946	5464654	NP_2023_LCR_063	2-Aug	gillnet	544	1610	N	A	M	M	Unidentifiable fish parts
Suppression	247	PIKEBAY	448456	5464817	NP_2023_LCR_064	2-Aug	gillnet	705	3220	N	A	F	ST	Kokanee
Suppression	262	PIKEBAY	448443	5464819	NP_2023_LCR_065	3-Aug	gillnet	340	330	N	A	F	MT	Empty
Suppression	276	ZUCKP	452180	5462696	NP_2023_LCR_066	8-Aug	gillnet	265	137	N	YOY	U	IM	Empty
Suppression	274	ZUCKP	452150	5462799	NP_2023_LCR_067	8-Aug	gillnet	235	85	N	YOY	U	IM	Redside Shiner
Suppression	274	ZUCKP	452150	5462799	NP_2023_LCR_068	8-Aug	gillnet	262	168	N	YOY	U	IM	Unidentifiable fish parts
Suppression	277	ZUCKP	452180	5462696	NP_2023_LCR_069	8-Aug	gillnet	231	78	N	YOY	U	IM	Yellow perch
Suppression	280	ZUCKP	452172	5462808	NP_2023_LCR_070	14-Sep	gillnet	349	287	N	YOY	U	IM	Sculpin
Suppression	280	ZUCKP	452172	5462808	NP_2023_LCR_071	14-Sep	gillnet	331	279	N	YOY	U	IM	Empty
Suppression	282	ZUCKP	452195	5462616	NP_2023_LCR_072	14-Sep	gillnet	334	284	N	YOY	U	IM	Empty
Suppression	282	ZUCKP	452195	5462616	NP_2023_LCR_073	14-Sep	gillnet	307	221	N	YOY	U	IM	Empty
Suppression	282	ZUCKP	452195	5462616	NP_2023_LCR_074	14-Sep	gillnet	325	259	N	YOY	U	IM	Empty
Incentive	1	WSGISL	450286	5464527	2023_NP_Incentive_01	10-May	angling	543	1302	N	A			Empty

Appendix F – Bycatch Data

Table 19. Gillnet bycatch during the Okanagan Nation Alliance northern pike monitoring and suppression program in 2023 by species including watershed (Columbia River [300], Pend d'Oreille River [330], and Kootenay River [340]), site, set, stage (A = adult; J = juvenile), and minimum and maximum fork lengths (mm) and weights (g).

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
2	330	MINECAMP	GN_PDO_002_1	SMALLMOUTH BASS	A	2	220	240		225
3	330	BUCKDS	GN_PDO_003_1	SMALLMOUTH BASS	A	1	375	375		
4	330	TILLCR	GN_PDO_004_1	LONGNOSE SUCKER	A	1	467	467	1167	1167
4	330	TILLCR	GN_PDO_004_1	NORTHERN PIKEMINNOW	A	1	437	437	1211	1211
4	330	TILLCR	GN_PDO_004_1	RAINBOW TROUT	A	1	203	203	114	114
4	330	TILLCR	GN_PDO_004_1	SMALLMOUTH BASS	A	1	306	306	322	322
4	330	TILLCR	GN_PDO_004_1	WALLEYE	A	2	291	412	240	742
4	330	TILLCR	GN_PDO_004_1	YELLOW PERCH	A	2	194	197		
5	330	BURNBAY	GN_PDO_005_1	LONGNOSE SUCKER	A	2	430	480	1150	1620
5	330	BURNBAY	GN_PDO_005_1	PUMPKINSEED	A	1	98	98	40	40
5	330	BURNBAY	GN_PDO_005_1	SMALLMOUTH BASS	A	4	198	245	130	205
5	330	BURNBAY	GN_PDO_005_1	WALLEYE	A	4	350	385	490	700
5	330	BURNBAY	GN_PDO_005_1	YELLOW PERCH	A	1	195	195	100	100
6	330	MINECAMP	GN_PDO_006_1	LONGNOSE SUCKER	A	8	388	438	742	1036
6	330	MINECAMP	GN_PDO_006_1	SMALLMOUTH BASS	J	1	183	183		
7	330	BUCKDS	GN_PDO_007_1	LONGNOSE SUCKER	A	4	384	464	1157	1238
7	330	BUCKDS	GN_PDO_007_1	NORTHERN PIKEMINNOW	A	1	305	305		
7	330	BUCKDS	GN_PDO_007_1	PUMPKINSEED	A	1	146	146	82	82
7	330	BUCKDS	GN_PDO_007_1	SMALLMOUTH BASS	A	3	204	235		
7	330	BUCKDS	GN_PDO_007_1	WALLEYE	A	3	273	296	207	276
8	330	YPALLEY	GN_PDO_008_1	LONGNOSE SUCKER	A	2	430	452		
8	330	YPALLEY	GN_PDO_008_1	NORTHERN PIKEMINNOW	A	1	413	413		
8	330	YPALLEY	GN_PDO_008_1	PUMPKINSEED	A	2	117	134		
8	330	YPALLEY	GN_PDO_008_1	SMALLMOUTH BASS	A	1	223	223		
8	330	YPALLEY	GN_PDO_008_1	WALLEYE	A	1	402	402		
8	330	YPALLEY	GN_PDO_008_1	YELLOW PERCH	A	2	187	231		
9	330	MINECAMP	GN_PDO_009_1	LONGNOSE SUCKER	A	2	417	421		
9	330	MINECAMP	GN_PDO_009_1	PUMPKINSEED	A	3	120	135		
10	330	MINECAMP	GN_PDO_009_2	LONGNOSE SUCKER	A	8	372	455		
10	330	MINECAMP	GN_PDO_009_2	NORTHERN PIKEMINNOW	A	1	371	371		
10	330	MINECAMP	GN_PDO_009_2	PUMPKINSEED	A	2	115	115		
10	330	MINECAMP	GN_PDO_009_2	RAINBOW TROUT	J	1	210	210		
10	330	MINECAMP	GN_PDO_009_2	SMALLMOUTH BASS	A	2	265	368		
10	330	MINECAMP	GN_PDO_009_2	TENCH	A	3	304	340		
10	330	MINECAMP	GN_PDO_009_2	WALLEYE	A	3	265	385		
10	330	MINECAMP	GN_PDO_009_2	YELLOW PERCH	A	1	185	185		

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
11	330	BUCKDS	GN_PDO_010_1	LONGNOSE SUCKER	A	3	419	451		
11	330	BUCKDS	GN_PDO_010_1	SMALLMOUTH BASS	A	1	336	336		
11	330	BUCKDS	GN_PDO_010_1	YELLOW PERCH	A	1	199	199		
12	330	BUCKDS	GN_PDO_010_2	LONGNOSE SUCKER	A	2	410	449		
12	330	BUCKDS	GN_PDO_010_2	SMALLMOUTH BASS	A	3	231	311		
12	330	BUCKDS	GN_PDO_010_2	TENCH	A	2	250	253		
12	330	BUCKDS	GN_PDO_010_2	WALLEYE	A	1	536	536	1618	1618
13	330	BUCKDS	GN_PDO_011_1	SMALLMOUTH BASS	A	1	256	256		
14	330	BUCKDS	GN_PDO_011_2	LONGNOSE SUCKER	A	7	389	456		
14	330	BUCKDS	GN_PDO_011_2	NORTHERN PIKEMINNOW	A	1	436	436		
14	330	BUCKDS	GN_PDO_011_2	PUMPKINSEED	A	1	124	124		
14	330	BUCKDS	GN_PDO_011_2	SMALLMOUTH BASS	A	1	331	331		
14	330	BUCKDS	GN_PDO_011_2	TENCH	J	1	158	158		
15	330	BUCKCAMP	GN_PDO_012_1	LONGNOSE SUCKER	A	6	380	440		
15	330	BUCKCAMP	GN_PDO_012_1	PUMPKINSEED	A	4	115	125		
15	330	BUCKCAMP	GN_PDO_012_1	TENCH	A	5	226	481		
15	330	BUCKCAMP	GN_PDO_012_1	YELLOW PERCH	A	2	193	221		
16	330	BUCKDS	GN_PDO_013_1	SMALLMOUTH BASS	A	3	237	290		
17	300	PIKEBAY	GN_LCR_001_1	RAINBOW TROUT	A	1	397	397	730	730
18	300	USBAY	GN_LCR_002_1	MOUNTAIN WHITEFISH	A	1	376	376	770	770
19	300	DSBAY	GN_LCR_003_1	MOUNTAIN WHITEFISH	A	3	304	356	349	580
19	300	DSBAY	GN_LCR_003_1	RAINBOW TROUT	A	2	384	415	656	710
20	300	WSGISL	GN_LCR_004_1	LAKE WHITEFISH	A	2	415	440		
20	300	WSGISL	GN_LCR_004_1	MOUNTAIN WHITEFISH	A	1	349	349	520	520
21	300	WSGISL	GN_LCR_005_1	LAKE WHITEFISH	A	2	415	418		
21	300	WSGISL	GN_LCR_005_1	LONGNOSE SUCKER	A	2	342	448		
21	300	WSGISL	GN_LCR_005_1	MOUNTAIN WHITEFISH	J	1	222	222	116	116
22	300	BALBAY	GN_LCR_006_1	BULL TROUT	A	1	418	418	735	735
23	300	BALBAY	GN_LCR_007_1	LAKE WHITEFISH	A	2	405	410		
23	300	BALBAY	GN_LCR_007_1	MOUNTAIN WHITEFISH	J	2	230	245	138	187
23	300	BALBAY	GN_LCR_007_1	MOUNTAIN WHITEFISH	A	2	272	335	247	455
24	300	PIKEBAY	GN_LCR_008_1	LAKE WHITEFISH	A	4	400	440		
25	300	PIKEBAY	GN_LCR_008_2	LAKE WHITEFISH	A	1	420	420		
25	300	PIKEBAY	GN_LCR_008_2	RAINBOW TROUT	A	1	320	320	385	385
26	300	PIKEBAY	GN_LCR_009_1	LAKE WHITEFISH	A	3	454	480		
26	300	PIKEBAY	GN_LCR_009_1	RAINBOW TROUT	A	1	270	270	220	220
27	300	PIKEBAY	GN_LCR_009_2	LAKE WHITEFISH	A	2	418	424		
27	300	PIKEBAY	GN_LCR_009_2	WHITE STURGEON	A	1				
28	300	CENBAY	GN_LCR_010_1	LAKE WHITEFISH	A	1	428	428		
28	300	CENBAY	GN_LCR_010_1	MOUNTAIN WHITEFISH	A	2	298	348	330	580

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
29	300	WSGISL	GN_LCR_011_1	LAKE WHITEFISH	A	1	503	503	1020	1020
29	300	WSGISL	GN_LCR_011_1	WHITE STURGEON	A	1				
31	300	WSGISL	GN_LCR_012_1	MOUNTAIN WHITEFISH	A	1	395	395	810	810
32	300	WSGISL	GN_LCR_012_2	LAKE WHITEFISH	A	1	415	415		
33	300	BALBAY	GN_LCR_013_1	LONGNOSE SUCKER	A	1	440	440		
33	300	BALBAY	GN_LCR_013_1	MOUNTAIN WHITEFISH	A	3	322	372	430	580
34	300	FERRUS	GN_LCR_014_1	LAKE WHITEFISH	A	2	385	403		
34	300	FERRUS	GN_LCR_014_1	LONGNOSE SUCKER	A	1	407	407		
34	300	FERRUS	GN_LCR_014_1	MOUNTAIN WHITEFISH	A	1	390	390	708	708
34	300	FERRUS	GN_LCR_014_1	RAINBOW TROUT	A	1	385	385	520	520
35	300	WSGISL	GN_LCR_014_2	LAKE WHITEFISH	A	1	405	405		
36	300	WSGISL	GN_LCR_015_1	LAKE WHITEFISH	A	1	395	395		
36	300	WSGISL	GN_LCR_015_1	MOUNTAIN WHITEFISH	A	1	318	318	385	385
36	300	WSGISL	GN_LCR_015_1	RAINBOW TROUT	A	1	368	368	600	600
37	300	WSGISL	GN_LCR_015_2	MOUNTAIN WHITEFISH	A	1	353	353	583	583
39	300	WSGISL	GN_LCR_016_2	LAKE WHITEFISH	A	2	426	447		
40	300	USBAY	GN_LCR_017_1	LAKE WHITEFISH	A	2	435	448		
40	300	USBAY	GN_LCR_017_1	MOUNTAIN WHITEFISH	A	1	353	353	530	530
41	300	USBAY	GN_LCR_017_2	LAKE WHITEFISH	A	2	414	424		
41	300	USBAY	GN_LCR_017_2	RAINBOW TROUT	A	1	475	475	985	985
42	300	PIKEBAY	GN_LCR_018_1	LAKE WHITEFISH	A	2	435	473		
43	300	PIKEBAY	GN_LCR_018_2	LAKE WHITEFISH	A	1	405	405		
43	300	PIKEBAY	GN_LCR_018_2	RAINBOW TROUT	A	1	432	432	850	850
44	300	PIKEBAY	GN_LCR_019_1	LAKE WHITEFISH	A	3	419	442		
44	300	PIKEBAY	GN_LCR_019_1	MOUNTAIN WHITEFISH	A	2	268	285	220	246
45	300	BALBAY	GN_LCR_020_1	LAKE WHITEFISH	A	2	410	412		
45	300	BALBAY	GN_LCR_020_1	MOUNTAIN WHITEFISH	A	1	280	280	235	235
46	300	BALBAY	GN_LCR_020_2	LAKE WHITEFISH	A	1	435	435		
46	300	BALBAY	GN_LCR_020_2	LONGNOSE SUCKER	A	1	400	400		
47	300	ZUCKP	GN_LCR_021_1	LAKE WHITEFISH	A	6	418	456		
47	300	ZUCKP	GN_LCR_021_1	NORTHERN PIKEMINNOW	A	2	260	268		
47	300	ZUCKP	GN_LCR_021_1	WALLEYE	A	1	412	412	715	715
48	300	ZUCKP	GN_LCR_022_1	LAKE WHITEFISH	A	3	420	434		
48	300	ZUCKP	GN_LCR_022_1	WALLEYE	A	2	474	484	1053	1188
49	300	ZUCKP	GN_LCR_023_1	LAKE WHITEFISH	A	2	414	433		
51	300	BALBAY	GN_LCR_025_1	LAKE WHITEFISH	A	1	412	412		
51	300	BALBAY	GN_LCR_025_1	MOUNTAIN WHITEFISH	A	1	276	276	250	250
52	300	BALBAY	GN_LCR_025_2	MOUNTAIN WHITEFISH	A	1	333	333	500	500
53	300	PIKEBAY	GN_LCR_026_1	LAKE WHITEFISH	A	1	453	453		
53	300	PIKEBAY	GN_LCR_026_1	MOUNTAIN WHITEFISH	A	1	312	312	400	400

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
54	300	PIKEBAY	GN_LCR_026_2	RAINBOW TROUT	A	1	390	390	656	656
56	300	PIKEBAY	GN_LCR_027_2	MOUNTAIN WHITEFISH	A	2	305	306	420	435
57	300	USBAY	GN_LCR_028_1	MOUNTAIN WHITEFISH	A	1	280	280	323	323
57	300	USBAY	GN_LCR_028_1	RAINBOW TROUT	A	1	334	334	415	415
60	300	WSGISL	GN_LCR_029_2	MOUNTAIN WHITEFISH	A	1	336	336	518	518
61	300	WSGISL	GN_LCR_030_1	MOUNTAIN WHITEFISH	A	1	350	350	493	493
62	300	WSGISL	GN_LCR_030_2	MOUNTAIN WHITEFISH	A	1	370	370	649	649
62	300	WSGISL	GN_LCR_030_2	RAINBOW TROUT	A	1	363	363	520	520
63	300	FERRUS	GN_LCR_031_1	MOUNTAIN WHITEFISH	A	1	343	343	485	485
64	300	WALISL	GN_LCR_032_1	LAKE WHITEFISH	A	2	438	447		
64	300	WALISL	GN_LCR_032_1	MOUNTAIN WHITEFISH	A	1	363	363	715	715
65	300	PIKEBAY	GN_LCR_033_1	MOUNTAIN WHITEFISH	A	2	289	299	269	348
65	300	PIKEBAY	GN_LCR_033_1	RAINBOW TROUT	A	1	300	300	300	300
67	300	PIKEBAY	GN_LCR_034_1	LAKE WHITEFISH	A	2	400	425		
70	300	USBAY	GN_LCR_035_2	LAKE WHITEFISH	A	2	414	455		
71	300	WSGISL	GN_LCR_036_1	RAINBOW TROUT	A	2	308	368	304	570
72	300	WSGISL	GN_LCR_036_2	RAINBOW TROUT	A	1	317	317	325	325
73	300	WSGISL	GN_LCR_037_1	LONGNOSE SUCKER	A	1	417	417		
73	300	WSGISL	GN_LCR_037_1	MOUNTAIN WHITEFISH	A	2	364	411	607	945
74	300	WSGISL	GN_LCR_037_2	RAINBOW TROUT	A	1	387	387	683	683
75	300	WALISL	GN_LCR_038_1	LAKE WHITEFISH	A	1	464	464		
77	300	PIKEBAY	GN_LCR_039_1	LAKE WHITEFISH	A	2	434	438		
78	300	PIKEBAY	GN_LCR_039_2	LAKE WHITEFISH	A	2	425	498		
79	300	PIKEBAY	GN_LCR_040_1	LAKE WHITEFISH	A	5	408	498		
79	300	PIKEBAY	GN_LCR_040_1	LONGNOSE SUCKER	A	1	430	430		
79	300	PIKEBAY	GN_LCR_040_1	RAINBOW TROUT	A	2	372	411	618	714
80	300	PIKEBAY	GN_LCR_040_2	LAKE WHITEFISH	A	2	391	424		
81	300	PIKEBAY	GN_LCR_041_1	LAKE WHITEFISH	A	2	416	428		
81	300	PIKEBAY	GN_LCR_041_1	LONGNOSE SUCKER	A	1	405	405		
82	300	PIKEBAY	GN_LCR_041_2	LAKE WHITEFISH	A	1	410	410		
82	300	PIKEBAY	GN_LCR_041_2	RAINBOW TROUT	A	1	300	300	290	290
83	300	WSGISL	GN_LCR_042_1	LAKE WHITEFISH	A	1	404	404		
83	300	WSGISL	GN_LCR_042_1	RAINBOW TROUT	A	1	357	357	530	530
84	300	WSGISL	GN_LCR_043_1	LONGNOSE SUCKER	A	2	398	420		
84	300	WSGISL	GN_LCR_043_1	MOUNTAIN WHITEFISH	A	1	381	381	695	695
84	300	WSGISL	GN_LCR_043_1	PEAMOUTH CHUB	A	1	210	210		
85	300	WSGISL	GN_LCR_043_2	LAKE WHITEFISH	A	1	417	417		
86	300	FERRUS	GN_LCR_044_1	MOUNTAIN WHITEFISH	A	2	340	343	491	500
87	300	FERRUS	GN_LCR_045_1	LAKE WHITEFISH	A	1	422	422		
87	300	FERRUS	GN_LCR_045_1	MOUNTAIN WHITEFISH	J	1	230	230	166	166

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
87	300	FERRUS	GN_LCR_045_1	RAINBOW TROUT	A	1	375	375	540	540
88	300	PIKEBAY	GN_LCR_046_1	RAINBOW TROUT	A	1	388	388	670	670
90	300	USBAY	GN_LCR_047_1	MOUNTAIN WHITEFISH	A	1	349	349	610	610
92	300	USBAY	GN_LCR_048_1	LAKE WHITEFISH	A	1	424	424		
92	300	USBAY	GN_LCR_048_1	MOUNTAIN WHITEFISH	A	3	270	393	293	980
93	300	USBAY	GN_LCR_048_2	MOUNTAIN WHITEFISH	A	1	461	461	1169	1169
93	300	USBAY	GN_LCR_048_2	RAINBOW TROUT	A	2	332	370	405	595
94	300	CENBAY	GN_LCR_049_1	LAKE WHITEFISH	A	2	415	431		
94	300	CENBAY	GN_LCR_049_1	MOUNTAIN WHITEFISH	A	1	278	278	278	278
97	300	WSGISL	GN_LCR_051_2	LAKE WHITEFISH	A	1	430	430		
97	300	WSGISL	GN_LCR_051_2	LONGNOSE SUCKER	A	2	320	428		
97	300	WSGISL	GN_LCR_051_2	NORTHERN PIKEMINNOW	A	1	390	390		
100	300	PIKEBAY	GN_LCR_053_2	LAKE WHITEFISH	A	1	424	424		
101	300	PIKEBAY	GN_LCR_054_1	LAKE WHITEFISH	A	1	440	440		
101	300	PIKEBAY	GN_LCR_054_1	RAINBOW TROUT	A	1	413	413	770	770
102	300	PIKEBAY	GN_LCR_054_2	LAKE WHITEFISH	A	1	435	435		
102	300	PIKEBAY	GN_LCR_054_2	LONGNOSE SUCKER	A	1	450	450		
102	300	PIKEBAY	GN_LCR_054_2	RAINBOW TROUT	A	1	373	373	609	609
103	300	USBAY	GN_LCR_055_1	LAKE WHITEFISH	A	1	430	430		
103	300	USBAY	GN_LCR_055_1	MOUNTAIN WHITEFISH	A	1	380	380	659	659
103	300	USBAY	GN_LCR_055_1	MOUNTAIN WHITEFISH	J	1	168	168	70	70
103	300	USBAY	GN_LCR_055_1	RAINBOW TROUT	A	1	305	305	290	290
104	300	USBAY	GN_LCR_055_2	LAKE WHITEFISH	A	1	417	417		
105	300	DSBAY	GN_LCR_056_1	LAKE WHITEFISH	A	2	414	420		
105	300	DSBAY	GN_LCR_056_1	WHITE STURGEON	A	1				
106	300	DSBAY	GN_LCR_056_2	LAKE WHITEFISH	A	1	435	435		
107	300	WSGISL	GN_LCR_057_1	NORTHERN PIKEMINNOW	A	1	361	361		
108	300	WSGISL	GN_LCR_057_2	BULL TROUT	A	1	457	457	1196	1196
108	300	WSGISL	GN_LCR_057_2	LAKE WHITEFISH	A	1	439	439		
108	300	WSGISL	GN_LCR_057_2	LONGNOSE SUCKER	A	1	444	444		
108	300	WSGISL	GN_LCR_057_2	RAINBOW TROUT	A	1	425	425	927	927
112	300	PIKEBAY	GN_LCR_060_1	MOUNTAIN WHITEFISH	A	1	270	270	284	284
112	300	PIKEBAY	GN_LCR_060_1	WHITE STURGEON	J	2				
113	300	PIKEBAY	GN_LCR_060_2	LAKE WHITEFISH	A	2	409	410		
113	300	PIKEBAY	GN_LCR_060_2	MOUNTAIN WHITEFISH	A	1	355	355	650	650
114	300	USBAY	GN_LCR_061_1	MOUNTAIN WHITEFISH	A	1	350	350	624	624
115	300	USBAY	GN_LCR_061_2	LAKE WHITEFISH	A	1	425	425		
116	300	USBAY	GN_LCR_062_1	LAKE WHITEFISH	A	1	430	430		
116	300	USBAY	GN_LCR_062_1	WALLEYE	A	1	415	415	730	730
116	300	USBAY	GN_LCR_062_1	WHITE STURGEON	A	2				

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
117	300	USBAY	GN_LCR_062_2	LAKE WHITEFISH	A	1	457	457		
118	300	DSBAY	GN_LCR_063_1	LAKE WHITEFISH	A	1	405	405		
118	300	DSBAY	GN_LCR_063_1	LONGNOSE SUCKER	A	1	460	460		
118	300	DSBAY	GN_LCR_063_1	MOUNTAIN WHITEFISH	A	2	300	355	381	677
118	300	DSBAY	GN_LCR_063_1	WHITE STURGEON	A	5				
119	300	WSGISL	GN_LCR_064_1	LAKE WHITEFISH	A	1				
119	300	WSGISL	GN_LCR_064_1	MOUNTAIN WHITEFISH	A	1	333	333	452	452
119	300	WSGISL	GN_LCR_064_1	WHITE STURGEON	A	1				
121	300	FERRUS	GN_LCR_066_1	LONGNOSE SUCKER	A	1	373	373		
121	300	FERRUS	GN_LCR_066_1	WHITE STURGEON	A	2				
122	300	PIKEBAY	GN_LCR_067_1	LONGNOSE SUCKER	A	1	388	388		
122	300	PIKEBAY	GN_LCR_067_1	MOUNTAIN WHITEFISH	A	1	395	395	650	650
123	300	PIKEBAY	GN_LCR_068_1	RAINBOW TROUT	A	2	330	485	400	950
124	300	USBAY	GN_LCR_069_1	MOUNTAIN WHITEFISH	A	1	270	270	255	255
124	300	USBAY	GN_LCR_069_1	MOUNTAIN WHITEFISH	J	1	245	245	200	200
126	300	USBAY	GN_LCR_070_1	MOUNTAIN WHITEFISH	J	2	223	229	153	157
126	300	USBAY	GN_LCR_070_1	RAINBOW TROUT	A	1	391	391	675	675
127	300	USBAY	GN_LCR_070_2	MOUNTAIN WHITEFISH	A	2	250	362	223	661
127	300	USBAY	GN_LCR_070_2	RAINBOW TROUT	A	1	395	395	666	666
129	300	DSBAY	GN_LCR_071_2	MOUNTAIN WHITEFISH	J	1	242	242	202	202
129	300	DSBAY	GN_LCR_071_2	MOUNTAIN WHITEFISH	A	1	265	265	266	266
130	300	DSBAY	GN_LCR_072_1	MOUNTAIN WHITEFISH	A	2	315	355	458	702
130	300	DSBAY	GN_LCR_072_1	RAINBOW TROUT	A	1	430	430	854	854
131	300	DSBAY	GN_LCR_072_2	MOUNTAIN WHITEFISH	A	2	390	410	760	988
131	300	DSBAY	GN_LCR_072_2	NORTHERN PIKEMINNOW	A	1	430	430		
133	300	WSGISL	GN_LCR_074_1	LONGNOSE SUCKER	A	1	437	437		
133	300	WSGISL	GN_LCR_074_1	MOUNTAIN WHITEFISH	A	1	270	270	280	280
133	300	WSGISL	GN_LCR_074_1	NORTHERN PIKEMINNOW	A	2	413	418		
134	300	BALBAY	GN_LCR_075_1	LAKE WHITEFISH	A	1	420	420		
134	300	BALBAY	GN_LCR_075_1	RAINBOW TROUT	A	1	437	437	950	950
135	300	PIKEBAY	GN_LCR_076_1	LAKE WHITEFISH	A	1	432	432		
135	300	PIKEBAY	GN_LCR_076_1	MOUNTAIN WHITEFISH	J	1	225	225	161	161
135	300	PIKEBAY	GN_LCR_076_1	MOUNTAIN WHITEFISH	A	2	314	361	427	668
137	300	CENBAY	GN_LCR_077_1	MOUNTAIN WHITEFISH	A	1	358	358	484	484
138	300	DSBAY	GN_LCR_078_1	NORTHERN PIKEMINNOW	A	1	313	313		
138	300	DSBAY	GN_LCR_078_1	WHITE STURGEON	A	1				
139	300	DSBAY	GN_LCR_079_1	MOUNTAIN WHITEFISH	A	2	250	283	220	255
140	300	WSGISL	GN_LCR_080_1	MOUNTAIN WHITEFISH	A	1	365	365	653	653
140	300	WSGISL	GN_LCR_080_1	WHITE STURGEON	A	3				
144	300	ZUCKP	GN_LCR_084_1	YELLOW PERCH	A	1	184	184		

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
145	300	ZUCKP	GN_LCR_084_2	YELLOW PERCH	A	1	178	178	88	88
146	300	ZUCKP	GN_LCR_085_1	YELLOW PERCH	A	1	190	190		
147	300	BALBAY	GN_LCR_086_1	MOUNTAIN WHITEFISH	A	1	290	290	265	265
147	300	BALBAY	GN_LCR_086_1	RAINBOW TROUT	A	4	280	386	262	670
148	300	PIKEBAY	GN_LCR_087_1	MOUNTAIN WHITEFISH	A	1	325	325	443	443
148	300	PIKEBAY	GN_LCR_087_1	RAINBOW TROUT	A	1				
150	300	USBAY	GN_LCR_088_1	LONGNOSE SUCKER	A	1	412	412		
150	300	USBAY	GN_LCR_088_1	MOUNTAIN WHITEFISH	A	1	275	275	300	300
150	300	USBAY	GN_LCR_088_1	WHITE STURGEON	A	2				
153	300	USBAY	GN_LCR_089_2	MOUNTAIN WHITEFISH	A	1	382	382	718	718
154	300	DSBAY	GN_LCR_090_1	MOUNTAIN WHITEFISH	A	1	330	330	522	522
155	300	DSBAY	GN_LCR_090_2	MOUNTAIN WHITEFISH	A	1	350	350	630	630
155	300	DSBAY	GN_LCR_090_2	RAINBOW TROUT	A	1	440	440	900	900
155	300	DSBAY	GN_LCR_090_2	WHITE STURGEON	A	1				
156	300	DSBAY	GN_LCR_091_1	LONGNOSE SUCKER	A	1	427	427		
156	300	DSBAY	GN_LCR_091_1	MOUNTAIN WHITEFISH	A	1	345	345	565	565
158	300	WSGISL	GN_LCR_092_1	RAINBOW TROUT	A	3	445	535	949	1585
159	300	FERRUS	GN_LCR_093_1	LONGNOSE SUCKER	A	1	420	420		
159	300	FERRUS	GN_LCR_093_1	MOUNTAIN WHITEFISH	A	1	323	323	670	670
161	300	BALBAY	GN_LCR_094_1	LAKE WHITEFISH	A	2	410	434		
161	300	BALBAY	GN_LCR_094_1	LONGNOSE SUCKER	A	1	413	413		
161	300	BALBAY	GN_LCR_094_1	MOUNTAIN WHITEFISH	A	1	310	310	317	317
161	300	BALBAY	GN_LCR_094_1	WHITE STURGEON	A	1				
162	300	BALBAY	GN_LCR_094_2	MOUNTAIN WHITEFISH	A	3	332	406	538	1250
163	300	PIKEBAY	GN_LCR_095_1	LONGNOSE SUCKER	A	3	295	458		
163	300	PIKEBAY	GN_LCR_095_1	MOUNTAIN WHITEFISH	A	4	266	380	225	885
163	300	PIKEBAY	GN_LCR_095_1	RAINBOW TROUT	A	2	272	410	255	727
163	300	PIKEBAY	GN_LCR_095_1	WALLEYE	A	4	380	429	672	880
164	300	USBAY	GN_LCR_096_1	WALLEYE	A	2	380	426	825	1109
165	300	CENBAY	GN_LCR_097_1	MOUNTAIN WHITEFISH	A	1	303	303	410	410
165	300	CENBAY	GN_LCR_097_1	MOUNTAIN WHITEFISH	J	1	233	233	187	187
165	300	CENBAY	GN_LCR_097_1	RAINBOW TROUT	A	1	395	395	760	760
166	300	DSBAY	GN_LCR_098_1	LONGNOSE SUCKER	A	2	374	381		
166	300	DSBAY	GN_LCR_098_1	MOUNTAIN WHITEFISH	A	1	309	309	510	510
166	300	DSBAY	GN_LCR_098_1	WALLEYE	A	10	363	480	582	1397
167	300	DSBAY	GN_LCR_099_1	LONGNOSE SUCKER	A	2	340	477		
167	300	DSBAY	GN_LCR_099_1	MOUNTAIN WHITEFISH	A	4	296	395	471	955
167	300	DSBAY	GN_LCR_099_1	WHITE STURGEON	A	2				
168	300	WSGISL	GN_LCR_100_1	LAKE WHITEFISH	A	1	415	415		
168	300	WSGISL	GN_LCR_100_1	MOUNTAIN WHITEFISH	A	1	325	325	554	554

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
168	300	WSGISL	GN_LCR_100_1	WALLEYE	A	2	370	418	710	990
169	300	FERRUS	GN_LCR_101_1	WALLEYE	A	3	407	425	864	940
171	300	PIKEBAY	GN_LCR_103_1	MOUNTAIN WHITEFISH	A	1	280	280	312	312
173	300	PIKEBAY	GN_LCR_104_1	LAKE WHITEFISH	A	1	463	463		
173	300	PIKEBAY	GN_LCR_104_1	MOUNTAIN WHITEFISH	A	1	335	335	600	600
174	300	PIKEBAY	GN_LCR_104_2	LAKE WHITEFISH	A	1	445	445		
174	300	PIKEBAY	GN_LCR_104_2	MOUNTAIN WHITEFISH	A	1	280	280	292	292
175	300	DSBAY	GN_LCR_105_1	RAINBOW TROUT	A	1	350	350	532	532
176	300	DSBAY	GN_LCR_105_2	LAKE WHITEFISH	A	1	450	450		
176	300	DSBAY	GN_LCR_105_2	RAINBOW TROUT	J	1	205	205	123	123
176	300	DSBAY	GN_LCR_105_2	WHITE STURGEON	A	1				
177	300	DSBAY	GN_LCR_106_1	LAKE WHITEFISH	A	2	406	410		
178	300	DSBAY	GN_LCR_106_2	LONGNOSE SUCKER	A	1	390	390		
178	300	DSBAY	GN_LCR_106_2	MOUNTAIN WHITEFISH	A	1	384	384	496	496
179	300	WSGISL	GN_LCR_107_1	RAINBOW TROUT	A	1	401	401	730	730
184	300	ZUCKP	JGN_LCR_002_1	YELLOW PERCH	J	13	99	109		
185	300	ZUCKP	JGN_LCR_003_1	RAINBOW TROUT	J	1	165	155	52	52
188	300	BALBAY	GN_LCR_111_1	BULL TROUT	A	1	731	731	4150	4150
188	300	BALBAY	GN_LCR_111_1	LAKE WHITEFISH	A	1	444	444		
188	300	BALBAY	GN_LCR_111_1	MOUNTAIN WHITEFISH	A	3	265	360	262	580
188	300	BALBAY	GN_LCR_111_1	NORTHERN PIKEMINNOW	A	1	345	345		
189	300	PIKEBAY	GN_LCR_112_1	LAKE WHITEFISH	A	3	410	454		
189	300	PIKEBAY	GN_LCR_112_1	MOUNTAIN WHITEFISH	A	3	292	410	360	1222
189	300	PIKEBAY	GN_LCR_112_1	MOUNTAIN WHITEFISH	J	1	229	229	159	159
189	300	PIKEBAY	GN_LCR_112_1	RAINBOW TROUT	A	1	350	350	466	466
190	300	PIKEBAY	GN_LCR_112_2	LAKE WHITEFISH	A	1	416	416		
190	300	PIKEBAY	GN_LCR_112_2	MOUNTAIN WHITEFISH	A	1	392	392	880	880
193	300	DSBAY	GN_LCR_113_1	LAKE WHITEFISH	A	1	419	419		
193	300	DSBAY	GN_LCR_113_1	MOUNTAIN WHITEFISH	A	4	265	353	270	642
195	300	FERRUS	GN_LCR_114_1	LONGNOSE SUCKER	J	1	225	225		
196	300	FERRUS	GN_LCR_114_2	MOUNTAIN WHITEFISH	A	1	398	398	906	906
198	340	LKREDDY	GN_LKR_003_1	LAKE WHITEFISH	A	2	439	445		
198	340	LKREDDY	GN_LKR_003_1	MOUNTAIN WHITEFISH	A	3	264	416	230	840
199	340	LKREDDY	GN_LKR_004_1	LONGNOSE SUCKER	A	1	436	436		
202	300	ZUCKP	JGN_LCR_006_1	LONGNOSE SUCKER	J	4	115	120		
202	300	ZUCKP	JGN_LCR_006_1	NORTHERN PIKEMINNOW	J	3	111	129		
202	300	ZUCKP	JGN_LCR_006_1	TENCH	J	5	101	124		
202	300	ZUCKP	JGN_LCR_006_1	YELLOW PERCH	J	3	109	115		
203	300	ZUCKP	JGN_LCR_006_2	LONGNOSE SUCKER	J	14	118	140		
203	300	ZUCKP	JGN_LCR_006_2	RAINBOW TROUT	J	1	145	145	39	39

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
205	300	ZUCKP	JGN_LCR_008_1	YELLOW PERCH	J	2	108	110		
209	300	ZUCKP	JGN_LCR_010_1	LONGNOSE SUCKER	J	7	105	137		
209	300	ZUCKP	JGN_LCR_010_1	TENCH	J	2	99	105		
210	300	ZUCKP	JGN_LCR_011_1	LONGNOSE SUCKER	J	6	116	141		
211	300	ZUCKP	GN_LCR_116_1	YELLOW PERCH	A	1	186	186		
212	300	ZUCKP	JGN_LCR_012_1	LONGNOSE SUCKER	J	2	115	129		
212	300	ZUCKP	JGN_LCR_012_1	TENCH	J	1	126	126		
213	300	PIKEBAY	GN_LCR_117_1	MOUNTAIN WHITEFISH	A	1	334	334	484	484
214	300	PIKEBAY	GN_LCR_117_2	MOUNTAIN WHITEFISH	A	1	300	300	450	450
215	300	DSBAY	GN_LCR_118_1	LAKE WHITEFISH	A	1	418	418		
215	300	DSBAY	GN_LCR_118_1	LONGNOSE SUCKER	A	1	370	370		
215	300	DSBAY	GN_LCR_118_1	MOUNTAIN WHITEFISH	A	1	250	250	245	245
215	300	DSBAY	GN_LCR_118_1	MOUNTAIN WHITEFISH	J	1	247	247	274	274
216	300	DSBAY	GN_LCR_118_2	MOUNTAIN WHITEFISH	A	2	266	270	265	306
216	300	DSBAY	GN_LCR_118_2	RAINBOW TROUT	A	1	441	441	940	940
217	340	LKROX	GN_LKR_005_1	SMALLMOUTH BASS	A	1	310	310		
219	340	LKROX	GN_LKR_006_1	WHITE STURGEON	A	1				
220	300	WATEDDY	JGN_LCR_013_1	LONGNOSE SUCKER	J	1	135	135		
220	300	WATEDDY	JGN_LCR_013_1	YELLOW PERCH	J	6	129	148		
221	300	WATEDDY	GN_LCR_119_1	LONGNOSE SUCKER	J	1	240	240		
221	300	WATEDDY	GN_LCR_119_1	YELLOW PERCH	A	1	176	176		
225	300	WATEDDY	JGN_LCR_014_1	LONGNOSE SUCKER	J	1	145	145		
226	300	WATEDDY	GN_LCR_122_1	LAKE TROUT	A	1	332	332		
227	300	WATEDDY	GN_LCR_123_1	LONGNOSE SUCKER	A	2	265	399		
228	300	BALBAY	GN_LCR_124_1	WHITE STURGEON	A	1				
229	300	BALBAY	GN_LCR_125_1	WHITE STURGEON	A	1				
230	300	PIKEBAY	GN_LCR_126_1	LONGNOSE SUCKER	A	1	328	328		
230	300	PIKEBAY	GN_LCR_126_1	MOUNTAIN WHITEFISH	A	2	350	380	640	906
230	300	PIKEBAY	GN_LCR_126_1	WALLEYE	A	2	383	430	553	880
230	300	PIKEBAY	GN_LCR_126_1	WHITE STURGEON	A	2				
231	300	PIKEBAY	GN_LCR_126_2	LONGNOSE SUCKER	A	1	365	365		
231	300	PIKEBAY	GN_LCR_126_2	WHITE STURGEON	A	1				
233	300	PIKEBAY	GN_LCR_127_2	MOUNTAIN WHITEFISH	A	1	273	273	245	245
234	300	PIKEBAY	GN_LCR_128_1	LONGNOSE SUCKER	A	3	352	430		
234	300	PIKEBAY	GN_LCR_128_1	MOUNTAIN WHITEFISH	A	2	274	383	327	840
236	300	USBAY	GN_LCR_129_1	MOUNTAIN WHITEFISH	A	6	258	380	300	880
237	300	USBAY	GN_LCR_129_2	MOUNTAIN WHITEFISH	A	2	298	309	341	353
238	300	DSBAY	GN_LCR_130_1	LONGNOSE SUCKER	A	1	314	314		
238	300	DSBAY	GN_LCR_130_1	MOUNTAIN WHITEFISH	J	1	220	220	180	180
238	300	DSBAY	GN_LCR_130_1	MOUNTAIN WHITEFISH	A	2	355	390	630	945

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
239	300	DSBAY	GN_LCR_130_2	KOKANEE	A	1	245	245	180	180
239	300	DSBAY	GN_LCR_130_2	LONGNOSE SUCKER	A	3	384	401		
239	300	DSBAY	GN_LCR_130_2	WHITE STURGEON	A	1				
241	300	DSBAY	GN_LCR_131_1	LONGNOSE SUCKER	A	1	359	359		
242	300	PIKEBAY	GN_LCR_132_1	LONGNOSE SUCKER	A	2	375	384		
242	300	PIKEBAY	GN_LCR_132_1	MOUNTAIN WHITEFISH	A	3	275	390	300	870
243	300	PIKEBAY	GN_LCR_132_2	MOUNTAIN WHITEFISH	A	3	345	381	600	800
244	300	PIKEBAY	GN_LCR_133_1	MOUNTAIN WHITEFISH	J	1	185	185	100	100
245	300	PIKEBAY	GN_LCR_133_2	MOUNTAIN WHITEFISH	J	1	225	225	136	136
247	300	PIKEBAY	GN_LCR_134_2	MOUNTAIN WHITEFISH	A	1	335	335	674	674
248	300	USBAY	GN_LCR_135_1	LONGNOSE SUCKER	A	1	357	357		
252	300	DSBAY	GN_LCR_137_1	LONGNOSE SUCKER	A	1	320	320		
253	300	DSBAY	GN_LCR_137_2	MOUNTAIN WHITEFISH	A	1	280	280	339	339
254	300	DSBAY	GN_LCR_138_1	MOUNTAIN WHITEFISH	A	5	266	415	235	915
255	300	DSBAY	GN_LCR_138_2	BULL TROUT	A	1	555	555	1840	1840
255	300	DSBAY	GN_LCR_138_2	LONGNOSE SUCKER	A	1	335	335		
255	300	DSBAY	GN_LCR_138_2	MOUNTAIN WHITEFISH	A	1	289	289	298	298
257	300	PIKEBAY	GN_LCR_139_1	MOUNTAIN WHITEFISH	A	1	335	335	525	525
258	300	PIKEBAY	GN_LCR_139_2	MOUNTAIN WHITEFISH	A	3	280	384	338	700
260	300	PIKEBAY	GN_LCR_140_2	LONGNOSE SUCKER	A	1	392	392		
260	300	PIKEBAY	GN_LCR_140_2	MOUNTAIN WHITEFISH	A	2	323	386	415	990
263	300	PIKEBAY	GN_LCR_142_1	MOUNTAIN WHITEFISH	A	1	290	290	382	382
264	300	PIKEBAY	GN_LCR_142_2	LONGNOSE SUCKER	A	1	378	378		
264	300	PIKEBAY	GN_LCR_142_2	MOUNTAIN WHITEFISH	A	4	302	422	520	1120
265	300	USBAY	GN_LCR_143_1	MOUNTAIN WHITEFISH	J	1	224	224	120	120
266	300	USBAY	GN_LCR_143_2	MOUNTAIN WHITEFISH	A	1	252	252	220	220
268	300	CENBAY	GN_LCR_144_2	LONGNOSE SUCKER	A	1	378	378		
268	300	CENBAY	GN_LCR_144_2	MOUNTAIN WHITEFISH	A	5	268	394	318	1000
270	300	CENBAY	GN_LCR_145_2	MOUNTAIN WHITEFISH	J	1	208	208	140	280
270	300	CENBAY	GN_LCR_145_2	MOUNTAIN WHITEFISH	A	2	265	272	280	333
270	300	CENBAY	GN_LCR_145_2	RAINBOW TROUT	A	1	382	381	510	510
271	300	DSBAY	GN_LCR_146_1	LONGNOSE SUCKER	A	1	418	418		
272	300	DSBAY	GN_LCR_146_2	LONGNOSE SUCKER	J	2	209	211		
273	300	ZUCKP	JGN_LCR_017_1	LONGNOSE SUCKER	J	1	117	117		
273	300	ZUCKP	JGN_LCR_017_1	YELLOW PERCH	J	1	128	128		
274	300	ZUCKP	JGN_LCR_017_2	NORTHERN PIKEMINNOW	J	2	115	124		
274	300	ZUCKP	JGN_LCR_017_2	YELLOW PERCH	J	4	114	130		
275	300	ZUCKP	JGN_LCR_018_1	LONGNOSE SUCKER	J	2	116	124		
276	300	ZUCKP	JGN_LCR_019_1	LONGNOSE SUCKER	J	11	107	134		
276	300	ZUCKP	JGN_LCR_019_1	NORTHERN PIKEMINNOW	J	4	112	126		

Ref.	Watershed Code	Site	Set	Species	Stage	Number	Length Min (mm)	Length Max (mm)	Weight Min (g)	Weight Max (g)
276	300	ZUCKP	JGN_LCR_019_1	YELLOW PERCH	J	5	124	134		
277	300	ZUCKP	JGN_LCR_019_2	LONGNOSE SUCKER	J	5	117	136		
277	300	ZUCKP	JGN_LCR_019_2	NORTHERN PIKEMINNOW	J	4	123	134		
277	300	ZUCKP	JGN_LCR_019_2	SCULPIN	A	1	106	106		
277	300	ZUCKP	JGN_LCR_019_2	YELLOW PERCH	J	4	89	140		
278	300	ZUCKP	JGN_LCR_020_1	NORTHERN PIKEMINNOW	J	2	127	127		
279	300	ZUCKP	JGN_LCR_021_1	NORTHERN PIKEMINNOW	J	3	126	131		
280	300	ZUCKP	JGN_LCR_022_1	YELLOW PERCH	J	5	92	99		
281	300	ZUCKP	JGN_LCR_022_2	YELLOW PERCH	J	1	98	98		

Appendix G – White Sturgeon PIT Tag Information

Table 20. White Sturgeon captured in the Columbia River via gillnetting during the Okanagan Nation Alliance northern pike monitoring and suppression program in 2023 including site, set, date, location, length estimate (m), and PIT tag number (if recorded).

#	Ref.	Site	Set	Date	Easting	Northing	Length Estimate (m)	PIT Tag Number
1	27	PIKEBAY	GN_LCR_009_2	29-May	448493	5464808		4239283922
2	29	WSGISL	GN_LCR_011_1	29-May	450157	5464550	2.3	
3	105	DSBAY	GN_LCR_056_1	7-Jun	450192	5464322	0.9	985121013464642
4	112	PIKEBAY	GN_LCR_060_1	9-Jun	448452	5464858	0.8	985120030477422
5	112	PIKEBAY	GN_LCR_060_1	9-Jun	448452	5464858	0.8	985121012199690
6	116	USBAY	GN_LCR_062_1	9-Jun	449084	5464636	0.8	985120032576488
7	116	USBAY	GN_LCR_062_1	9-Jun	449084	5464636	0.8	900254000095194
8	118	DSBAY	GN_LCR_063_1	9-Jun	450205	5464332	1.1	985120814173029
9	118	DSBAY	GN_LCR_063_1	9-Jun	450205	5464332	0.8	985120150039941
10	118	DSBAY	GN_LCR_063_1	9-Jun	450205	5464332	1.1	985120020997415
11	118	DSBAY	GN_LCR_063_1	9-Jun	450205	5464332	0.9	985120023694490
12	118	DSBAY	GN_LCR_063_1	9-Jun	450205	5464332	1.5	
13	119	WSGISL	GN_LCR_064_1	9-Jun	450166	5464546	1.4	
14	121	FERRUS	GN_LCR_066_1	9-Jun	450326	5464540	0.6	989002007687143
15	121	FERRUS	GN_LCR_066_1	9-Jun	450326	5464540	0.9	985120032543475
16	138	DSBAY	GN_LCR_078_1	13-Jun	450239	5464279	1.1	985120027524130
17	140	WSGISL	GN_LCR_080_1	13-Jun	450275	5464540	0.9	985120030481317
18	140	WSGISL	GN_LCR_080_1	13-Jun	450275	5464540	0.9	985120029838916
19	140	WSGISL	GN_LCR_080_1	13-Jun	450275	5464540	0.9	985120019254046
20	150	USBAY	GN_LCR_088_1	16-Jun	448926	5464676	0.9	985120023806323
21	150	USBAY	GN_LCR_088_1	16-Jun	448926	5464676	1.8	
22	155	DSBAY	GN_LCR_090_2	16-Jun	450204	5464295	0.9	985120029762845
23	161	BALBAY	GN_LCR_094_1	20-Jun	446385	5465680	1.2	985120019262127
24	167	DSBAY	GN_LCR_099_1	20-Jun	450579	5464290	0.5	989001006617148
25	167	DSBAY	GN_LCR_099_1	20-Jun	450579	5464290	0.9	985120026973492
26	176	DSBAY	GN_LCR_105_2	30-Jun	450334	5464254	1.8	42393CO757
27	219	LKROX	GN_LKR_006_1	27-Jul	453072	5462533	1.1	985121029667956
28	228	BALBAY	GN_LCR_124_1	1-Aug	446286	5465759	1.1	985121012171710
29	229	BALBAY	GN_LCR_125_1	1-Aug	446342	5465730	1.8	
30	230	PIKEBAY	GN_LCR_126_1	1-Aug	448181	5464948	1.2	985120030386339
31	230	PIKEBAY	GN_LCR_126_1	1-Aug	448181	5464948	0.8	985121006312933
32	231	PIKEBAY	GN_LCR_126_2	1-Aug	448181	5464948	1.4	
33	239	DSBAY	GN_LCR_130_2	1-Aug	450467	5464245	2.0	

Appendix H – Summary of Northern Pike Suppression Efforts 2014-2023

Appendix H-1: Gillnetting

Table 21. Gillnet effort in the Canadian Columbia River Basin by year (2014 – 2023) including location (LCR = Lower Columbia River; PDO = Pend d'Oreille River; XL = Christina Lake), effort (hours), number of northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour) and respective sources. CPUE is calculated using number of northern pike captured, not removed.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2014	LCR	475	133	0.19	Baxter 2016
2015	LCR	659	116	0.20	Baxter 2016
2016	LCR	407	39	0.13	Baxter and Doutaz 2017
	PDO*	130.1	0	-	Doutaz 2019
2017	LCR	676	35	0.05	Baxter and Lawrence 2018
	PDO*	61.88	43	-	Doutaz 2019
2018	LCR	525.3	22	0.04	Wood 2019
	PDO	308.4	15	0.05	
	LCR	11.2	0	0.00	ONA 2018
	PDO	36.6	0	0.00	
2019	LCR	357.8	34	0.10	ONA 2020
	PDO	625.7	10	0.02	
	XL	41.3	0	0.00	
2020	LCR	373.9	125	0.33	ONA 2021
	PDO	1,317.1	6	0.005	
2021	LCR	645.6	38	0.06	ONA 2022
	PDO	386.3	1	0.003	
	XL	63.32	0	0.00	
2022	LCR	769.4	168	0.21	ONA 2023
	PDO	97.8	0	0.00	
2023	LCR	674.2	73	0.11	Present
	PDO	204.9	0	0.00	

* Doutaz (2019) describes the capture of 43 northern pike in the Pend d'Oreille River between 2016 and 2017, but specific location data and captures by year are not available.

Appendix H-2: Boat Electrofishing

Table 22. Boat electrofishing effort in the Canadian Columbia River Basin by year (2015-2023), including location (LCR = Lower Columbia River; PDO = Pend d'Oreille River; XL = Christina Lake), effort (seconds), number of northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (s)	NP Removed	CPUE (NP/hr)	Source
2015-2017	No Sampling Conducted				
2018	LCR	19,867	5	0.91	Wood 2019
	LCR	3,032	0	0.00	ONA 2018
2019	LCR	832	0	0.00	ONA 2020
	PDO	10,714	0	0.00	
	XL	3,594	0	0.00	
2020-2023	No Sampling Conducted				

Appendix H-3: Backpack Electrofishing

Table 23. Backpack electrofishing effort in the Columbia River (LCR) by year (2015 – 2023), including effort (seconds), number of northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (s)	NP Removed	CPUE (NP/hr)	Source
2015	LCR	1,734	0	0.00	Golder 2015
2016-2019	No Sampling Conducted				
2020	LCR	7,428	12	5.82	ONA 2021
2021	No Sampling Conducted				
2022	LCR	39,240	10	0.92	ONA 2023
2023	LCR	575	0	0.00	Present

Appendix H-4: Fyke Netting

Table 24. Fyke net effort in the Columbia River (LCR) by year (2015 – 2023), including effort (hours), number of northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2015	No Sampling Conducted				
2016	LCR	1,625	1	<0.001	ONA 2016
2017-2019	No Sampling Conducted				
2020	LCR	21.52	0	0.00	ONA 2021
2021-2023	No Sampling Conducted				

Appendix H-5: Angling

Table 25. Angling effort (during suppression activities) in the Columbia River Basin by year (2015 – 2023) including location (LCR = Lower Columbia River; PDO = Pend d'Oreille River), effort (hours), northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2015-2017	No Sampling Conducted				
2018	LCR	24	0	0.00	Wood 2019
	PDO	7.5	0	0.00	
2019	LCR	12	1	0.08	ONA 2020
	PDO	15	0	0.00	
2020	PDO	3	0	0.00	ONA 2021
2021	LCR	1	0	0.00	ONA 2022
	PDO	3	0	0.00	
2022	LCR	11.3	0	0.00	ONA 2023
	PDO	9.5	0	0.00	
2023	No Sampling Conducted				

Appendix H-6: Minnow Trapping

Table 26. Minnow trap effort in the Columbia River (LCR) by year (2015 – 2023) including effort (hours), number of northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2015	LCR	74.4	0	0.00	Golder 2015
2016-2019	No Sampling Conducted				
2020	LCR	277.6	1	0.004	ONA 2021
2021	No Sampling Conducted				
2022	LCR	236.4	0	0	ONA 2023
2023	Sampling Conducted				

Appendix H-7: Seine Netting

Table 27. Seine net effort in the Columbia River (LCR) by year (2015 – 2023) including effort (m), northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/m), and respective sources.

Year	Location	Effort (m)	NP Removed	CPUE (NP/m)	Source
2015	No Sampling Conducted				
2016	LCR	300	0	0.00	ONA 2016
2017-2018	No Sampling Conducted				
2019	LCR	60	0	0.00	ONA 2020
2020	No Sampling Conducted				
2021	LCR	296	0	0.00	ONA 2022
2022	LCR	200	1	.0005	ONA 2023
2023	No Sampling Conducted				

Appendix H-8: Light Trapping

Table 28. Light trap effort in the Columbia River (LCR) by year (2015 – 2023) including effort (hours), northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2015	LCR	136.2	0	0.00	Golder 2015
2016-2019	No Sampling Conducted				
2020	LCR	48.0	0	0.00	ONA 2021
2021-2023	No Sampling Conducted				

Appendix H-9: Dip Netting

Table 29. Dip net effort in the Columbia River (LCR) by year (2015 – 2023) including effort (m), northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/m), and respective sources.

Year	Location	Effort (m)	NP Removed	CPUE (NP/m)	Source
2015	LCR	460	0	0.00	Golder 2015
2016-2023	No Sampling Conducted				

Appendix H-10: Planking Towing

Table 30. Plankton tow effort in the Columbia River (LCR) by year (2015 – 2023) including effort (seconds), northern pike (NP) removed), catch-per-unit-effort (CPUE; NP/hour), and respective sources.

Year	Location	Effort (s)	NP Removed	CPUE (NP/hr)	Source
2015	LCR	840	0	0.00	Golder 2015
2016-2023	No Sampling Conducted				

Appendix H-11: N-Trapping

Table 31. N-Trap effort in the Columbia River (LCR) by year (2015 – 2023) including effort (hours), northern pike (NP) removed, catch-per-unit-effort (CPUE; NP/hr), and respective sources.

Year	Location	Effort (hr)	NP Removed	CPUE (NP/hr)	Source
2015-2021	No Sampling Conducted				
2022	LCR	48.8	0	0.00	ONA 2023
2023	No Sampling Conducted				