

**NEW GOLD RAINY RIVER MINE  
APPENDIX J  
LARGE BODIED FISH TISSUE REPORT**

## **RAINY RIVER MINE 2023 LARGE-BODIED FISH MONITORING PROGRAM**

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## RAINY RIVER MINE 2023 LARGE-BODIED FISH MONITORING PROGRAM



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## EXECUTIVE SUMMARY

The Rainy River Mine (RRM) is a gold-silver mine located in northwestern Ontario in the District of Rainy River, approximately 65 km northwest of Fort Frances and 420 km west of Thunder Bay. The mine is located within the Pinewood River watershed and discharges into the Pinewood River. The mine occupies approximately 6,050 hectares of land and is owned by New Gold Inc. (New Gold).

The objective of the large-bodied fish tissue quality monitoring program is to assess whether the RRM has affected the concentrations of contaminants of potential concern (COPCs; arsenic, boron, cadmium, cobalt, copper, chromium, iron, lead, manganese, mercury, molybdenum, nickel, selenium and zinc) within the tissues of fish that reside in the portion of Pinewood River downstream of the effluent discharge. Concentrations were determined for muscle, liver, and ovary tissues of two sentinel sport fish species, Northern Pike (*Esox Lucius*) and Walleye (*Stizostedion vitreum*).

The results of this study determined that the majority of Northern Pike and Walleye did not exceed the mercury consumption advisory for vulnerable populations (0.5 mg/kg w.w.); however, exceedance of individual fish did occur. This is consistent with the results obtained during baseline assessments. Other than mercury (which typically is a concern in boreal environments due to widespread atmospheric deposition), no other metal benchmark was exceeded.

Mercury concentrations in muscle tissue of Northern Pike and Walleye were not statistically higher during this period of study (2023) to individuals of the same species sampled during baseline studies (2012). However, Walleye captured in 2023 had a statistically higher level of mercury in liver tissue when compared to baseline. Liver tissue mercury concentrations of Northern Pike were not different between the current study (2023) and the baseline period (2012).

Trend analysis demonstrated that there are no increasing trends in mercury concentration within tissue (muscle, liver, ovary) for either Northern Pike or Walleye across years (2012 to 2023).

Overall, the data indicates that the RRM has not significantly impacted the metal tissue concentrations of Northern Pike or Walleye within the Pinewood River.

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## 1.0 Introduction

### 1.1 Site Description

The Rainy River Mine (RRM) is a gold-silver mine located in northwestern Ontario in the District of Rainy River, approximately 65 km northwest of Fort Frances and 420 km west of Thunder Bay (**Figure 1.1**). Located within the Pinewood River watershed, the Pinewood River flows past the RRM and continues for approximately 37 km until the confluence with Rainy River. The mine occupies approximately 6,050 hectares of land and is owned by New Gold Inc. (New Gold).

The RRM began processing ore in September 2017, fifty years after it was first explored in 1967. In 2005, the project was acquired by Rainy River Resources Ltd. with initial baseline studies conducted in 2008. In 2013, the RRM was acquired by New Gold Inc. An Environmental Assessment (EA) report, which included baseline conditions, was submitted in 2014 (AMEC 2014). Provincial and Federal EA approvals were granted in 2015 leading to the RRM site construction. The open pit mine became operational in 2017 and was constructed to include: ore storage facilities, a process plant, a Tailings Management Area (TMA), watercourse diversions, site drainage works, a fuel tank farm, explosives manufacturing facilities, explosives storage facilities, with plans for transition into underground operations (**Figure 1.2**).

The mine became subject to Section 7 of the Metal and Diamond Mining Effluent Regulations (MDMER) in September 2015. Section 7 of the MDMER states, among other things, that “the owner or operator of a mine shall conduct environmental effects monitoring studies of the potential effects of effluent on the fish population, on fish tissue and on the benthic invertebrate community in accordance with the requirements and within the periods set out in Schedule 5”. Consistent with this provision, the RRM submitted its first Environmental Effects Monitoring (EEM) Study Design Report to Environment Canada in September 2016 and subsequently its first EEM Interpretive Report in March 2018. The Second EEM Study Design and Interpretive Reports were submitted in November 2019 and March 2021, respectively with an addendum for the Phase 3 fish survey submitted in September 2021 due to COVID-19 related delays.

The EEM studies at the RRM have demonstrated some influence on surface water quality as a result of mine construction/operation. This was evident through significantly elevated levels of some constituents within the Pinewood River downstream of the RRM effluent discharge, compared to its upstream section (Minnow 2018, Ecometrix 2020). However, during the Phase 2 EEM in September 2020 and Phase 3 EEM in September 2023 (Ecometrix 2024, in progress), dissolved mercury concentrations were below the detection limit and overall quarterly measures of mercury at locations upstream and downstream of the mine discharge do not indicate any elevation in mercury concentrations due to effluent.

Effluent discharge at the mine is intermittent and is regulated by the mine's provincial Amended Environmental Compliance Approval (ECA) Number 2290-CAVKGN issued by the Ministry of Environment Conservation and Parks (MECP) April 14, 2022. This ECA provides flow and seasonal requirements for discharge. Discharge of both treated water and site runoff is intermittent and is based on precipitation rather than mine production with the mine being self-sufficient from a water recycling point of view. For example, EDL2 discharge in 2020, 2021, 2022, and 2023 was limited to 29, 11, 70, and 84 days, respectively. At EDL1, 2020, 2021, 2022, and 2023 discharge was limited to 67, 62, 129, and 93 days, respectively. Generally, the two longest periods of discharge during the year are in late spring (mid-April to early-June) and autumn (late-September to early-November).

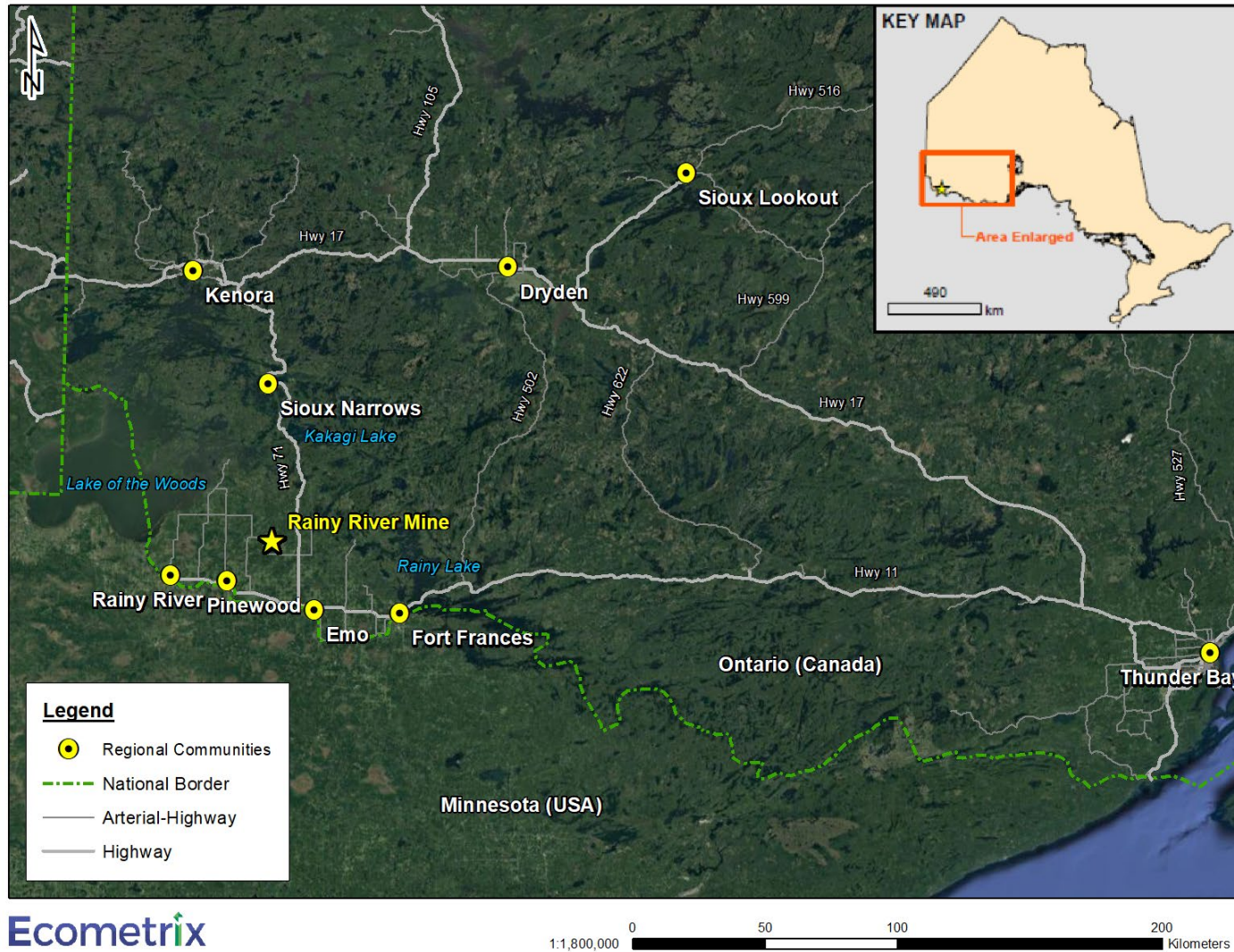


Figure 1.1: Regional Location of the Rainy River Mine.

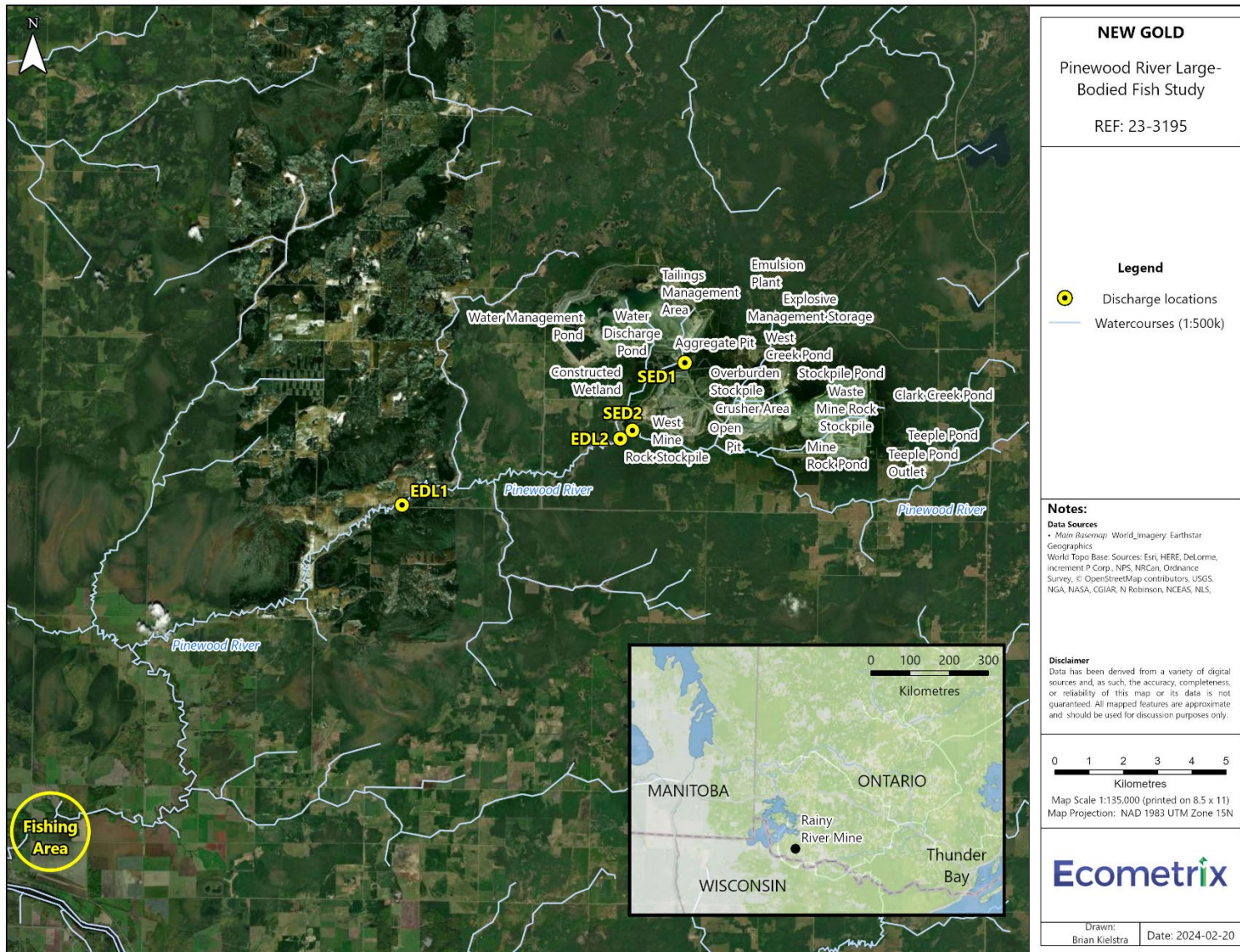


Figure 1.2: Layout of Rainy River Mine with Locations of the Discharge Sites in Relation to the Large-Bodied Fishing Area.

## 1.2 Project Background and Objective

The RRM fish tissue quality monitoring program is a requirement by both the Federal EA Approval and the original provincial ECA. The original ECA (Number 5178-9TUPD9) issued by the MECP on September 1, 2015, was replaced in February 2020 with ECA Number 7004-BC7KQ5 and again in April 2022 with ECA Number 2290-CAVKGN. The requirements comprise both large-bodied and small-bodied fish surveys with the large-bodied fish survey to now be implemented every three years, and the small-bodied fish survey to be implemented annually. Logistical errors have resulted in some changes to the sampling. To date, large-bodied fish surveys were conducted in 2016, 2017, 2018, and 2020, with the new sampling schedule of every three years leading to the current survey, which occurred in 2023. Small-bodied fish surveys were conducted from 2019 to 2023, but not 2018. The next large-bodied fish survey is due to occur in 2026.

The objective of the large-bodied fish tissue quality monitoring program is to assess whether the RRM has affected the concentrations of contaminants of potential concern (COPCs; arsenic, boron, cadmium, cobalt, copper, chromium, iron, lead, manganese, mercury, molybdenum, nickel, selenium, and zinc) within the tissues of fish that reside in the portion of Pinewood River downstream of the effluent discharge. Concentrations are determined by sampling muscle, liver, and ovary tissues of two sentinel sport fish species, Northern Pike, and Walleye. Any potential risk to human health by COPC concentrations that are affected by the RRM are to be described and communicated to stakeholders. This report details the methods and results of the 2023 large-bodied fish tissue study. The 2023 small-bodied fish tissue study is provided under separate cover.

## 1.3 Discharge Configuration

The below explanation of the discharges from the mine as now constituted are provided for context with respect to the tissue study.

RRM now has a total of four discharge locations according to their current provincial permit (**Figure 1.2**):

1. Near SW24, the former location of the water intake pipe (also referred to as Water Discharge Pipeline and EDL1);
2. At the confluence of Loslo Creek with the Pinewood River (also referred to as EDL2);
3. Sediment Pond 1; and,
4. Sediment Pond 2.

Discharges 1 (EDL1) and 2 (EDL2) listed above were equipped with diffusers in December 2019 and September 2020, respectively, and will be the main discharge locations used for the life of the mine. Sediment Pond 2 discharges more continually than either EDL1 or EDL2 but at a lower

annual volume and reports to the Pinewood River just upstream of the EDL2 diffuser. Sediment Pond 1 is capable of discharging to the West Creek Diversion but has not done so since 2020.

## 2.0 Methods

### 2.1 Overall Study Design

The 2023 Large-bodied Fish study included a fish tissue quality assessment in the Pinewood River downstream of the RRM extending to approximately 500 m upstream of the confluence with the Rainy River. As outlined in the Terms of Reference (TOR) (AMEC 2016), and provided as a requirement under the original ECA, tissue samples from fifteen individuals of two sentinel sport fish species, Northern Pike and Walleye, were collected. Tissue samples taken from each individual included muscle, liver, and ovary (if possible). Samples were sent to an analytical laboratory for metal concentration analyses and the results were compared to provincial, federal, and international criteria for the protection of human health (BCMOE 2012, Health Canada 2007, Health Canada 2021, MECP 2015, IRIS 2023) as well as to baseline concentrations (AMEC 2013).

### 2.2 Fish Sampling

Fish sampling was performed under a Ministry of Natural Resources and Forestry (MNRF) License to Collect Fish for Scientific Purposes (License No. 1103657) provided in Appendix A. The fish tissue quality monitoring program was conducted downstream of RRM in Pinewood River from 19 to 21 September 2023. The sampling locations were recorded using a Global Position System (GPS; **Figure 2.1**). Fish were captured by angling and gill netting (100-ft length gill net with a mesh size of 3", or 3 to 5"). All captured fish were identified to species and enumerated. Apart from Walleye and Northern Pike, all fish captured were released at the point of capture. Fifteen adult Northern Pike and 15 Walleye (> 300 mm total length, based on MECP recommendations for the Rainy River; MECP 2015) were retained for further processing; any juveniles or adults caught in excess of the required number (i.e., > 15), were released at the point of capture. Measurements of total and fork length were determined using a standard measuring board and fresh weight was measured using an electronic balance. The sex and any abnormalities for each fish were also noted. Ageing structures were collected from each retained Northern Pike (cleithra) and Walleye (dorsal spine) for subsequent laboratory age analysis. Tissue samples were taken from each individual and included muscle, liver, and ovary (if present). Tissue samples retained for analysis were placed in clean Whirl-Pak<sup>®</sup> bags and frozen until analysis. Liver, muscle, and ovary samples were shipped to Bureau Veritas Laboratories with appropriately completed chain-of-custody (COC) forms for inductively couple plasma mass spectrometry (ICP-MS) for metals analysis and moisture content and cold vapor atomic fluorescence spectroscopy (CVAFS) to determine mercury concentration.

The set and lift date and time as well as depth were recorded for each net set. Standard environmental data such as air temperature, water temperature, and precipitation were also recorded each day of the collections. Documentation for all laboratory analyses is provided in Appendix B. Field survey information and meristic data is provided in Appendix C.



Figure 2.1: Fishing locations on the Pinewood River, Fall 2023.



## 2.3 Meristic Data

Fish catch data were compiled and summarized (Appendix C). Catch records and data on angling effort and gill net set durations were used to calculate total and species-specific catch-per-unit effort (CPUE) for each capture method in the Pinewood River.

## 2.4 Evaluation and Statistical Analysis

### 2.4.1 Comparison to Consumption Guidelines

#### 2.4.1.1 Mercury

The consumption guidelines for the current study are the same as were used previously (Minnow 2019). Mercury is the only metal (i.e., metalloid) with a commercial guideline and multiple consumption level advisories have been established for fish muscle tissue (Health Canada 2007, BCMOE 2012, MECP 2015). Health Canada has established a standard of 0.5 mg/kg wet weight (w.w.) as the maximum acceptable concentration of mercury in commercially sold fish, enforceable by the Canadian Food Inspection Agency (Health Canada 2007). Although this guideline is only applicable to commercially sold fish, 0.5 mg/kg w.w. is also the level at which the MECP recommends a complete consumption restriction for vulnerable populations (i.e., women of childbearing age and children under 15; **Table 2.1**; MECP 2015). Summary statistics included sample size, mean, standard deviation, minimum, and maximum values. Summary statistics were calculated for each parameter by year.

**Table 2.1: Fish consumption advisories for vulnerable and general populations based on fish tissue mercury concentrations.**

Advisory recommended maximum number of meals per month	Fish tissue mercury concentration (mg/kg w.w.)	
	As consumed by vulnerable populations <sup>a</sup>	As consumed by the general population
32	0	0
16	0.06	0.15
12	0.12	0.3
8	0.16	0.4
4	0.25	0.6
2	-	1.2
<b>0</b>	<b>0.5</b>	<b>1.8</b>

Bolded number indicates selected benchmark.

Abbreviations: w.w. = wet weight.

As described in the Guide to Eating Ontario Fish (MECP 2015), and coloured text from USEPA and Environment Canada (2022)

Green text represents ≥ 8 meals per month advisories (“unrestrictive”), light green text represents 1-4 meals per month (“partial restriction”), and red text represents no meals per month (“severe restriction”).

<sup>a</sup> This group includes women of child-bearing age and children younger than 15.

### 2.4.1.2 Other Metals

Concentrations of other metals (i.e., metalloids) in muscle, liver, and ovary tissue were evaluated relative to consumption benchmarks derived from the lowest reported tolerable daily intake (TDI; Health Canada 2021, IRIS 2023) and established consumption rates for fish eating populations (OHM 1990, Richardson 1997, USEPA 1997). With the assumption that typical adult body weight is 70 kg, the Fish Consumption Limit Benchmark is defined as:

Fish Consumption Limit Benchmark =  $\text{TDI mg/kg} \times 70 \text{ kg} / \text{consumption rate (kg)}$ .

The consumption rates are presented in **Table 2.2** and include 6.5 g/day (USEPA 1997), 21.8 g/day (OHM 1990), and 111 g/day (Richardson 1997). A consumption rate of 21.8 g/day, which represents the upper limit consumption rate for Canadian population based on high caloric intake, was chosen to derive benchmark values due to the following rationale:

- Initial investigations conducted during the EA determined that the RRM area does not support a significant commercial or recreational fishery and that no traditional activities are currently undertaken within the RRM area by local First Nation and/or Métis people (AMEC 2014).
- Further discussion with local First Nations community members in August 2016 confirmed that the Pinewood River does not support a significant traditional fishery, and that it is only occasionally used for recreational fishing, with most fishing located near the mouth (Minnow 2017).

The consumption rate of 21.8 g/day results in the derivation of conservative benchmarks, as it is more than double the mean consumption rate for anglers within a general population (8.0 g/d; USEPA 1997) and 21.8 g/day is the highest consumption level considered in development of fish advisories in Ontario.

Benchmarks were derived for 16 of the 18 COPC for which health criteria or TDI values were available, these include: antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, silver, strontium, uranium, and zinc (**Table 2-2**). Chromium, cobalt, and iron do not have applicable health criteria or TDI values (i.e., benchmarks could not be calculated).

**Table 2.2: Fish consumption benchmarks for metals including COPCs in fish tissue.**

Metals	Tolerable daily intake		Fish concentration benchmarks (mg/kg) based on		
	Reference <sup>a</sup>	mg/kg day	6.5 g/day <sup>b</sup>	21.8 g/day <sup>c</sup>	111 g/day <sup>d</sup>
Antimony	IRIS	0.0004	4.3	1.3	0.3
Arsenic	IRIS	0.0003	3.2	1.0	0.2
Barium	HC, IRIS	0.2	2,154	642	126
Beryllium	HC, IRIS	0.002	21.5	6.4	1.3
Boron	IRIS	0.2	2,154	642	126
Cadmium	HC	0.0008	8.6	2.6	0.5
Chromium	none available		-	-	-
Cobalt	none available		-	-	-
Copper	HC	0.426	4,588	1,368	269
Iron	none available		-	-	-
Lead	HC	0.0005	38.8	11.6	2.3
Manganese	HC	0.025	269	80	16
Molybdenum	IRIS	0.005	53.8	16.1	3.2
Nickel*	HC	0.0013	14	4.2	0.8
Selenium	IRIS	0.005	53.8	16.1	3.2
Silver	IRIS	0.005	53.8	16.1	3.2
Strontium	IRIS	0.6	6,462	1,926	378
Uranium	HC	0.0006	6.5	1.9	0.4
Zinc	IRIS	0.3	3,231	963	189

Shaded cells indicate selected benchmark.

Abbreviations: COPC = Contaminants of Potential Concern.

References:

HC = Health Canada (2021); IRIS = IRIS (2023)<sup>a</sup> For values reported by both IRIS (2023) and Health Canada (2021), the lowest value was used to set a conservative benchmark.

<sup>b</sup> USEPA (1997) mean consumption rate for general population; mean value for anglers is 8.0 g/day, 95th percentile for anglers is 25 g/day.

<sup>c</sup> Upper limit consumption rate for Canadian population based on high caloric intake (OHM 1990). Also, the highest consumption level considered in development of fish advisories in Ontario.

<sup>d</sup> Health Canada consumption rate for screening level risk assessments (Richardson 1997). Exceeds the average value for fishing subsistence populations (70 g/day; USEPA 1997).

\* Value based on nickel chloride.

### 2.4.1.3 Evaluation

Comparisons to benchmark values was conducted for all metals for the current year of sampling (2023), and for COPCs across years.

For the current year of sampling (2023), the following summary statistics were calculated for all metals: sample size, mean, standard deviation, minimum, and maximum values.

Across years summary statistics includes sample size, mean, and maximum concentrations.

If a maximum concentration exceeded a benchmark, the number of individual fish that exceeded that benchmark are presented. Further evaluation inspected whether the

exceedances were common across years for any particular COPC, or whether the exceedance may be indicative of future concern.

## 2.4.2 Comparison to Baseline

Statistical comparisons of mercury concentrations between the baseline year (2012) and the current year of sampling (2023) were conducted using analysis of covariance (ANCOVA) with fork length as the covariate as prescribed by Environment Canada's Metal Mining Technical Guidance Document (TGD; Environment Canada 2012). Having fork length as a covariate is necessary as mercury is known to bioaccumulate in fish tissue over time (e.g., Evers et al. 2011, Kidd and Batchelar 2012). Important to the ANCOVA procedure, is that the covariate (fork length) have overlapping ranges between years and that the analysis be conducted on the overlapping range (Environment Canada 2012). Therefore, the range of overlap between years should be evaluated for each species and tissue type before applying the ANCOVA procedure. Ovaries were not collected during sampling in 2012 therefore comparison to baseline condition for this tissue type was not possible.

The ANCOVA approach undertaken was a two-step procedure. First, an ANCOVA is fit with an interaction term to determine whether the slopes are parallel between years (i.e., does the linear relationship differ between years?). If a significant interaction between year and the covariate is found (i.e., slopes are different), the difference between years is estimated at the minimum overlapping range and the maximum overlapping covariate values, as prescribed by the TGD (Environment Canada 2012).

In cases where the interaction ANCOVA results in a non-significant interaction between years, a second ANCOVA is fit with the interaction term removed. This allows for us to determine if there is a difference between the estimated least square means of each year (i.e., it was previously determined that concentration responds to fork length similarly between years so this second procedure then tests whether the mean value of the linear relationship is different between years). As per TGD (Environment Canada 2012), a statistical significance was determined at a *P*-value of 0.10. The magnitude of the difference between years was calculated using the following formula:

$$\frac{[(\text{current year least square mean} - \text{baseline least square mean}) / \text{baseline least square mean}] \times 100}{}$$

Outliers were removed if the calculated value for Cook's Distance exceeded  $4/n$ , where  $n$  was the number of fish sampled in either 2012 or 2023. Scatter plots of mercury tissue concentration with fork length were generated to facilitate interpretation of statistical results.

Statistical analyses were conducted using the statistical software program R (version 4.3.1; R Core Team 2022) and packages dplyr (v 1.1.2) and emsR (v 4.0.0), an in-house R package developed to facilitate EEM analyses per TGD (Environment Canada 2012). Figures were generated using R and packages ggplot2 (v. 3.4.2), viridis (v. 0.6.3), patchwork (v. 1.1.2), and geomtextpath (v. 0.1.1).

### 2.4.3 Long-term Trends

To determine if mercury concentration is increasing through time (across years), a one-tailed Mann-Kendall test was performed. Similar to statistical comparisons with baseline (**Section 2.4.2**), statistical significance was determined at a  $P$ -value of 0.10.

The data used in the Mann-Kendall test were least squared mean mercury concentrations generated from an ANCOVA that included year as a factor and fork length as the covariate. Only fish that were over 300 mm were used in this analysis as this was the minimum size for sampling in 2023. To ensure the fork lengths were within a reasonable range, outliers ( $> 1.5x$  interquartile range) were removed from each tissue's dataset. This ensured that trends appropriately incorporated the known effects of fish size on concentrations. To determine least squared means, the statistical assumptions of the linear model (i.e., normality of residuals and variance homogeneity) were evaluated and transformation of data was conducted if necessary.

The least squared mean concentration of each tissue type was then plotted across years along with the Vulnerable Populations Advisory value of 0.5 mg/kg w.w., which is the same as the Health Canada guideline for most commercially available fish (Health Canada, 2007).

In R (version 4.3.1; R Core Team, 2022), the least squared (LS) means were derived using the `lsmeans` (v2.30-0) package and the Mann-Kendall test was conducted using the `Trend` package (v1.1.6).

## 2.5 Data Quality Objectives

The data quality objectives (DQOs) for this study are identified in **Table 2.3**. The DQOs include laboratory objectives, such as hold time, lowest detection limit, precision and accuracy, data entry and reporting review procedures.

**Table 2.3: List of Data Quality Objectives**

Type	Objective
Data Entry	Any spreadsheet that is prepared for statistical analysis will be completely checked (zero tolerance) so that the data is copied over to the appropriate index headings and that the data is presented accurately.
Completeness	Was the data collected as defined in the study design?
Lowest Detection Limit	The reported laboratory detection limits should be the same as were quoted by the laboratory. The detection limits should be less than the benchmarks used in this study.
Blank	Sample blanks should result in non-detects.
Precision	Agreement among repeated measurements. Laboratory duplicates should meet the processing laboratory's DQOs.
Accuracy	Certified reference materials and laboratory control samples should meet the laboratory's DQOs.
Review	<p>All statistical results will be independently reviewed by a senior statistician including confirming the accuracy of the test input parameters, confirming the appropriateness of the tests used (i.e., have all assumptions been met) and confirming the integrity of the test output files.</p> <p>The draft and final report are reviewed by a project principle prior to submission to client.</p>

### 3.0 Results

#### 3.1 Data Quality Objectives

Assessment of the data quality objectives indicate that the data is suitable for the purposes of this report. A few instances occurred where acceptance criteria were not met (**Table 3.1**); however, these instances do not affect the overall quality of the data.

**Table 3.1: Summary of Data Quality Objectives Results**

Type	Outcome
Data Entry	Spreadsheets were reviewed and no data errors were identified.
Completeness	All samples were collected as defined in the study design.
Lowest Detection Limit	Lowest detection limits were attained as quoted by the laboratory, except for Mercury (Hg), which was raised for all Walleye tissue samples and Northern Pike muscle samples (0.001 to 0.01 mg/kg, with one Northern Pike muscle sample detection limit set to 0.05 mg/kg). This change occurred because the analyte had to be diluted to bring it within the calibrated range (see Appendix B). All detection limits were lower than the benchmarks used in this study.
Blank	All method blanks were within limits. Certified lab results are provided in Appendix B.
Precision	There were three instances where laboratory duplicates did not meet acceptance criteria: once for lead, manganese, and nickel. Certified lab results are provided in Appendix B.
Accuracy	There was one instance where reference material did not meet acceptance criteria: tin. There were seven instances where the spiked blank did not meet acceptance criteria: three times for mercury, and once each for beryllium, bismuth, iron, and magnesium. Certified lab results are provided in Appendix B.
Review	Statistical results were reviewed by a senior statistician and reporting was reviewed by the project principle.

#### 3.2 Fish Captured During the 2023 Program

Both gillnets and angling were employed during the 2023 large-bodied fish tissue monitoring program, which resulted in a total of six species being caught (**Table 3.2**). The most abundant species captured was Northern Pike, followed by Walleye and White Sucker (*Catostomus commersoni*).

**Table 3.2: Fishing effort summary of the 2023 large-bodied fish tissue monitoring program.**

Species	Gill Nets		Angling		Total Catch
	Catch	CPUE <sup>a</sup>	Catch	CPUE <sup>b</sup>	
Northern Pike	46	0.0250	1	0.6667	47
Walleye	16	0.0078	0	0.0000	16
Sauger	2	0.0008	0	0.0000	2
White Sucker	7	0.0035	0	0.0000	7
Brown Bullhead	4	0.0014	0	0.0000	4
Shorthead Redhorse	1	0.0007	0	0.0000	1

Abbreviations: CPUE = catch per unit effort (units)

<sup>a</sup> CPUE = catch/foot\*hours

<sup>b</sup> CPUE = catch/rod\*hours

### 3.3 Northern Pike

#### 3.3.1 Comparison to Consumption Benchmarks

##### 3.3.1.1 Current Program Year (2023)

Mean values did not exceed the chosen benchmark guidelines for any metal in any tissue type (**Table 3.3**, **Table 3.4**, and **Table 3.5**). Two fish that had fork lengths of 538 and 701 mm, had muscle tissue with mercury concentrations that exceeded the consumption guideline (0.5 mg/kg) for vulnerable populations at 0.64 and 1.04 mg/kg w.w., respectively (**Table 3.3**, Appendix B). No Northern Pike liver or ovary tissue exceeded any metal benchmark guideline (**Table 3.5**).

**Table 3.3: Metal concentrations in Northern Pike muscle tissue sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Aluminum (Al)	0.2	-	0.2	0.1	<0.2	0.5
Total Antimony (Sb)	0.001	1.300	<0.001	0.000	<0.001	<0.001
Total Arsenic (As)	0.004	1.000	0.089	0.054	0.011	0.212
Total Barium (Ba)	0.01	642.00	0.05	0.04	<0.01	0.13
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001	-	0.002	0.001	<0.001	0.005
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.002	0.001	<0.001	0.003
Total Calcium (Ca)	2.0	-	479	469	65	1790
Total Chromium (Cr)	0.01	7.10	0.03	0.05	<0.01	0.16
Total Cobalt (Co)	0.0013	-	0.0030	0.0012	<0.0013	0.0048
Total Copper (Cu)	0.01	1368.00	0.12	0.06	0.01	0.21
Total Iron (Fe)	0.25	-	2.17	1.35	<0.25	4.74
Total Lead (Pb)	0.001	11.6	0.002	0.001	<0.001	0.005
Total Magnesium (Mg)	0.4	-	270.2	139.9	35.8	569.0
Total Manganese (Mn)	0.01	80.00	0.44	0.44	0.04	1.58



Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Mercury (Hg)*	0.002	0.500	0.399	0.206	0.236	1.040 <sup>1</sup>
Total Molybdenum (Mo)	0.004	16.1	<0.004	0.0000	<0.004	<0.004
Total Nickel (Ni)	0.01	4.20	0.01	0.015	<0.01	0.07
Total Phosphorus (P)	2	-	1982	951	311	3700
Total Potassium (K)	2	-	3499	1679	548	6920
Total Selenium (Se)	0.01	-	0.16	0.09	0.02	0.38
Total Silver (Ag)	0.001	16.100	<0.001	0.000	<0.001	<0.001
Total Sodium (Na)	2	-	307	149	43	615
Total Strontium (Sr)	0.01	926.00	0.22	0.23	0.03	0.86
Total Thallium (Tl)	0.0004	-	0.0015	0.0008	<0.0004	0.0035
Total Tin (Sn)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Titanium (Ti)	0.02	-	0.07	0.03	<0.02	0.12
Total Uranium (U)	0.0004	1.9000	0.00	0.0000	<0.0004	0.00
Total Vanadium (V)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Zinc (Zn)	0.04	963.00	3.81	1.99	0.43	7.16

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min =minimum, Max = maximum.

Summary statistic calculations used MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>1</sup> Two fish exceeded the mercury benchmark [NP1 (0.643 mg/kg w.w.) and NP2 (1.040 mg/kg w.w.): fork length 538 and 701 mm, respectively].

**Table 3.4: Metal concentrations in Northern Pike liver tissue sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Aluminum (Al)	0.2	-	1.2	0.6	0.51	2.3
Total Antimony (Sb)	0.001	1.300	0.00	0.001	<0.001	0.00
Total Arsenic (As)	0.004	1.000	0.039	0.015	0.017	0.067
Total Barium (Ba)	0.01	642.00	0.01	0.00	<0.01	0.02
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001	-	0.006	0.002	0.003	0.012
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.151	0.134	0.04	0.501
Total Calcium (Ca)	2.0	-	55	17	31	92
Total Chromium (Cr)	0.01	7.10	0.02	0.02	<0.01	0.10
Total Cobalt (Co)	0.0013	-	0.0627	0.0249	0.03	0.1250
Total Copper (Cu)	0.01	1368.00	30.47	9.12	14.90	49.50
Total Iron (Fe)	0.25	-	146.44	115.24	29.30	399.00
Total Lead (Pb)	0.001	11.6	0.004	0.003	0.00	0.009
Total Magnesium (Mg)	0.4	-	156.0	17.2	127.0	188.0
Total Manganese (Mn)	0.01	80.00	1.22	0.34	0.73	2.05
Total Mercury (Hg)*	0.002	0.500	0.211	0.111	0.087	0.488
Total Molybdenum (Mo)	0.004	16.1	0.18	0.0466	0.11	0.26

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Nickel (Ni)	0.01	4.20	0.02	0.017	<0.01	0.08
Total Phosphorus (P)	2		2517	240	2200	2910
Total Potassium (K)	2		2627	235	2220	3070
Total Selenium (Se)	0.01		2.04	0.28	1.51	2.45
Total Silver (Ag)	0.001	16.100	0.18	0.071	0.07	0.26
Total Sodium (Na)	2		981	155	770	1230
Total Strontium (Sr)	0.01	926.00	0.04	0.01	0.02	0.05
Total Thallium (Tl)	0.0004		0.0022	0.0006	0.0015	0.0038
Total Tin (Sn)	0.02		0.02	0.00	<0.02	0.02
Total Titanium (Ti)	0.02		0.09	0.01	0.08	0.10
Total Uranium (U)	0.0004	1.9000	0.00	0.0004	<0.0004	0.00
Total Vanadium (V)	0.02		0.26	0.13	0.09	0.57
Total Zinc (Zn)	0.04	963.00	44.64	6.28	36.70	60.50

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min =minimum, Max = maximum.

Summary statistic calculations used MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

**Table 3.5: Metal concentrations in Northern Pike ovaries sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=7)	SD	Min	Max
Total Aluminum (Al)	0.2	-	0.3	0.1	<0.2	0.5
Total Antimony (Sb)	0.001	1.300	<0.001	0.000	<0.001	<0.001
Total Arsenic (As)	0.004	1.000	0.032	0.007	0.024	0.042
Total Barium (Ba)	0.01	642.00	0.02	0.02	<0.01	0.07
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001	-	<0.001	0.000	<0.001	<0.001
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.008	0.002	0.01	0.011
Total Calcium (Ca)	2.0	-	133	46	92	212
Total Chromium (Cr)	0.01	7.10	0.02	0.01	<0.01	0.03
Total Cobalt (Co)	0.0013	-	0.0466	0.0153	0.02	0.0661
Total Copper (Cu)	0.01	1368.00	1.02	0.16	0.85	1.23
Total Iron (Fe)	0.25	-	45.36	12.45	28.10	64.60
Total Lead (Pb)	0.001	11.6	0.002	0.002	<0.001	0.007
Total Magnesium (Mg)	0.4	-	213.6	19.1	191.0	249.0
Total Manganese (Mn)	0.01	80.00	25.64	10.42	16.70	39.80
Total Mercury (Hg)*	0.002	0.500	0.053	0.019	0.029	0.085
Total Molybdenum (Mo)	0.004	16.1	0.03	0.0172	0.02	0.06
Total Nickel (Ni)	0.01	4.20	0.01	0.000	<0.01	0.01
Total Phosphorus (P)	2	-	2710	64	2660	2840
Total Potassium (K)	2	-	3711	209	3360	3940

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=7)	SD	Min	Max
Total Selenium (Se)	0.01	-	0.94	0.34	0.59	1.51
Total Silver (Ag)	0.001	16.100	0.001	0.000	<0.001	0.001
Total Sodium (Na)	2	-	826	109	606	936
Total Strontium (Sr)	0.01	926.00	0.07	0.05	0.03	0.17
Total Thallium (Tl)	0.0004	-	0.0032	0.0010	0.0017	0.0048
Total Tin (Sn)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Titanium (Ti)	0.02	-	0.09	0.01	0.08	0.11
Total Uranium (U)	0.0004	1.9000	<0.0004	0.0000	<0.0004	<0.0004
Total Vanadium (V)	0.02	-	0.03	0.01	<0.02	0.05
Total Zinc (Zn)	0.04	963.00	57.26	8.01	45.20	67.10

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min = minimum, Max = maximum.

Summary statistic calculations used MLD if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

### 3.3.1.2 Across Program Years (2012 to 2023)

Specific trend analysis of mercury bioaccumulation accounting for fish length is presented in **Section 3.3.3**. This section (**3.3.1.2**) provides an overview of potential emerging concerns but is not a trend analysis.

The only mean metal concentration within muscle tissue to exceed across years was mercury during baseline sampling in 2012 (**Table 3.6**). Since then, mean mercury values have remained below the benchmark; however, individual fish have exceeded the benchmark value as indicated by the maximum value column in **Table 3.6**. In addition, nickel concentrations were higher than benchmark in one fish during baseline sampling in 2012.

Mean metal concentrations in liver tissue have not exceeded benchmark concentrations (**Table 3.7**). In recent years (2017, 2018, and 2020) but not the current year (2023), some individual fish liver tissue concentrations exceeded mercury and selenium benchmarks (**Table 3.7**). It should be noted, however, that in previous reports the selenium benchmark was lower (3.60 mg/kg) compared to the one calculated from the 2023 IRIS recommended daily intake (16.10 mg/kg; see **Table 2.2**). Despite this difference, no selenium concentration from any 2023 tissue exceeded the lower benchmark (3.60 mg/kg) that was used in previous years.

No mean or individual fish ovary tissue concentrations have exceeded their respective benchmark values since monitoring began in 2012 (**Table 3.8**).

**Table 3.6: Metal concentrations in Northern Pike muscle tissue sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Bench- mark a,b	Baseline 2012 (n = 70)		2015 (n = 15)		2016 (n = 15)		2017 (n = 15)		2018 (n = 15)		2020 (n = 15)		2023 (n = 15)	
		Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>
Arsenic (As)	1.00	0.1000	0.1000	0.0934	0.1328	0.0862	0.1434	0.0701	0.1290	0.0485	0.0896	0.0817	0.1320	0.0887	0.2120
Boron (B)	642	<0.50	<0.50	<0.22	<0.24	<0.20	<0.20	0.20	0.20	0.20	0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	2.60	<0.010	0.0100	0.0018	0.0073	<0.0013	0.0040	0.0010	0.0014	0.0013	0.0026	0.0012	0.0019	0.0016	0.0029
Chromium (Cr)	7.10	<0.30	0.300	0.024	0.088	0.022	0.075	0.013	0.030	0.010	0.015	0.017	0.114	0.033	0.163
Cobalt (Co)	-	0.0051	0.0080	0.0045	0.0051	<0.0044	0.0051	0.0042	0.0066	0.0049	0.0078	0.0031	0.0044	0.0030	0.0048
Copper (Cu)	1368	0.506	0.900	0.183	0.275	0.154	0.224	0.146	0.387	0.171	0.236	0.104	0.122	0.124	0.210
Iron (Fe)	-	3.23	5.00	2.76	4.35	1.69	2.55	1.71	3.00	3.11	4.68	2.07	3.57	2.17	4.74
Lead (Pb)	11.6	0.0300	0.0300	0.0124	0.0745	<0.0043	0.0047	0.0043	0.0091	0.0069	0.0257	0.0040	0.0040	0.0021	0.0045
Manganese (Mn)	80	0.342	0.670	0.441	1.023	0.364	1.023	0.516	1.300	0.366	0.733	0.659	1.110	0.443	1.580
Mercury (Hg)*	0.50	0.776	4.700 (5)	0.342	0.731 (3)	0.357	0.613 (2)	0.412	1.290 (2)	0.476	0.981 (4)	0.440	0.614 (4)	0.399	1.040 (2)
Molybdenum (Mo)	16.1	0.0514	0.1500	0.0056	0.0096	<0.0043	0.0047	<0.0040	<0.0040	<0.0040	<0.0040	0.0041	0.0052	<0.0040	<0.0040
Nickel (Ni)	4.2	0.103	3.700 (1)	<0.044	0.048	<0.043	0.047	<0.04	<0.04	<0.04	<0.04	0.01	0.01	0.01	0.07
Selenium (Se)	16.1	0.203	0.300	0.207	0.266	0.181	0.219	0.157	0.213	0.163	0.196	0.180	0.227	0.159	0.382
Zinc (Zn)	963	5.00	12.00	4.55	13.62	4.12	6.75	3.62	4.98	4.87	6.93	4.43	5.79	3.81	7.16

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, Max = maximum.

Summary statistic calculations used MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> Number of individual fish in exceedance of benchmark value in parentheses.

**Table 3.7: Metal concentrations in Northern Pike liver tissue sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Bench- mark a,b	Baseline 2012 (n = 70)		2015 (n = 15)		2016 (n = 15)		2017 (n = 15)		2018 (n = 15)		2020 (n = 15)		2023 (n = 15)	
		Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>	Mean	Max <sup>c</sup>
Arsenic (As)	1.00	0.1020	0.2000	0.0435	0.0812	0.0401	0.0556	0.0365	0.0900	0.0367	0.0589	0.0538	0.0850	0.0391	0.0671
Boron (B)	642	<0.50	0.50	<0.28	<0.394	0.26	0.34	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	2.60	0.0357	0.1900	0.0537	0.1362	0.0734	0.1820	0.1020	0.2060	0.1289	0.4445	0.1982	0.4000	0.1515	0.5010
Chromium (Cr)	7.10	<0.300	0.300	0.039	0.146	0.023	0.068	0.036	0.296	0.011	0.018	0.019	0.095	0.016	0.102
Cobalt (Co)	-	0.0361	0.0820	0.0434	0.0810	0.0505	0.0749	0.0590	0.1220	0.0628	0.1326	0.0657	0.1040	0.0627	0.1250
Copper (Cu)	1368	15.465	38.000	24.976	54.026	24.480	45.924	30.853	46.200	35.310	78.100	36.520	69.800	30.473	49.500
Iron (Fe)	-	118.71	360.00	121.97	449.46	202.62	497.84	150.31	369.00	192.35	484.00	230.19	576.00	146.44	399.00
Lead (Pb)	11.6	0.0312	0.0900	0.0439	0.5017	0.0071	0.0170	0.0061	0.0100	0.0043	0.0074	0.0089	0.0415	0.0044	0.0091
Manganese (Mn)	80	1.404	3.000	1.440	2.883	1.141	1.656	1.241	2.160	1.371	2.477	1.289	1.560	1.221	2.050
Mercury (Hg)	0.50	0.148	0.300	0.139	0.386	0.125	0.325	0.258	1.320 (1)	0.297	0.903 (1)	0.306	0.667 (2)	0.211	0.488
Molybdenum (Mo)	16.1	0.1763	0.3000	0.1482	0.2335	0.1790	0.2794	0.2061	0.2980	0.2202	0.3110	0.2272	0.3490	0.1759	0.2630
Nickel (Ni)	4.2	0.050	0.050	<0.057	<0.0788	0.053	0.075	0.048	0.155	0.041	0.053	0.031	0.060	0.025	0.076
Selenium (Se)	16.1	1.439	2.500	1.513	2.338	1.751	2.530	2.201	4.350 (1)	1.988	2.372	2.657	3.790 (2)	2.039	2.450
Zinc (Zn)	963	38.20	72.00	46.92	83.30	37.82	52.51	44.50	55.70	47.99	67.82	61.57	86.40	44.64	60.50

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, Max = maximum.

Summary statistic calculations used MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> Number of individual fish in exceedance of benchmark value in parentheses.

**Table 3.8: Metal concentrations in Northern Pike ovaries sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Bench- mark <sup>a,b</sup>	Baseline 2012 <sup>c</sup>		2015 (n = 9)		2016 (n = 7)		2017 (n = 7)		2018 (n = 9)		2020 (n = 5)		2023 (n = 7)	
		Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>	Mean	Max <sup>d</sup>
Arsenic (As)	1.00	-	-	0.0251	0.0339	0.0223	0.0427	0.0188	0.0252	0.0252	0.0329	0.0296	0.0366	0.0319	0.0416
Boron (B)	642	-	-	<0.22	<0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	2.60	-	-	0.0076	0.0133	0.0060	0.0097	0.0098	0.0133	0.0105	0.0202	0.0155	0.0296	0.0085	0.0108
Chromium (Cr)	7.10	-	-	0.017	0.044	0.018	0.039	0.010	0.010	0.011	0.018	0.017	0.036	0.016	0.033
Cobalt (Co)	-	-	-	0.0673	0.0886	0.0566	0.0802	0.0545	0.0820	0.0699	0.1073	0.0606	0.0874	0.0466	0.0661
Copper (Cu)	1368	-	-	1.184	1.485	1.256	1.380	0.936	1.130	1.047	1.200	0.919	1.060	1.016	1.230
Iron (Fe)	-	-	-	54.85	71.53	51.50	61.22	39.80	53.20	43.21	67.60	42.04	56.80	45.4	64.6
Lead (Pb)	11.6	-	-	0.0076	0.0256	0.0037	0.0039	0.0040	0.0040	0.0050	0.0133	0.0334	0.0354	0.0025	0.0070
Manganese (Mn)	80	-	-	35.439	56.350	33.708	44.460	21.971	29.700	26.905	40.420	25.500	41.100	25.643	39.800
Mercury (Hg)	0.50	-	-	0.031	0.067	0.029	0.052	0.070	0.257	0.082	0.167	0.076	0.094	0.053	0.085
Molybdenum (Mo)	16.1	-	-	0.0416	0.0507	0.0527	0.0621	0.0407	0.0550	0.0535	0.0772	0.0394	0.0575	0.0338	0.0599
Nickel (Ni)	4.2	-	-	<0.044	<0.051	0.041	0.053	<0.040	0.040	<0.040	0.040	0.014	0.015	0.015	0.046
Selenium (Se)	16.1	-	-	1.167	1.705	0.965	1.737	1.171	3.360	0.649	1.080	0.899	1.100	0.945	1.510
Zinc (Zn)	963	-	-	79.96	126.76	70.10	85.46	69.29	80.30	59.57	67.16	74.04	87.20	57.26	67.10

**Notes:**

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, max = maximum.

Summary statistic calculations used MDL if reported as &lt;MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> No ovaries were sampled during baseline (2012).

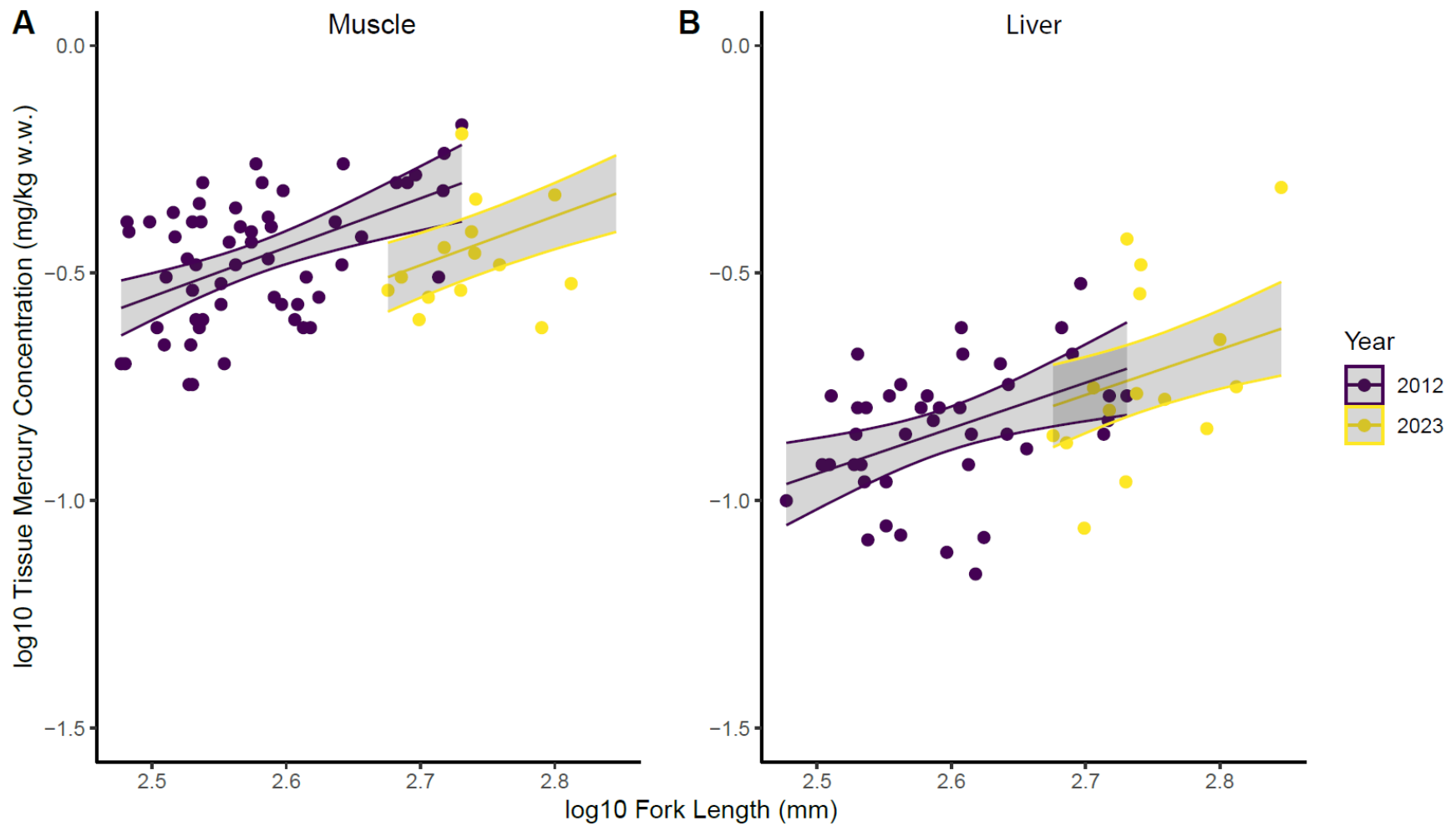
<sup>d</sup> Number of individual fish in exceedance of benchmark value in parentheses.

### 3.3.2 Mercury Comparison of Current Year (2023) to Baseline (2012)

The Northern Pike mercury concentrations and fork length were  $\text{Log}_{10}$  transformed to best meet the assumptions of ANCOVA (i.e., normality of residuals and variance homogeneity). The overlap of the fork length (i.e., the covariate) between 2012 and 2023 was minimal; Northern Pike collected in 2023 (liver and muscle:  $n = 15$ , mean = 559 mm, SD = 64.6 mm) were significantly ( $p < 0.0001$ ) longer than the  $>300\text{mm}$  fish collected in 2012 (liver:  $n = 41$ , mean = 397 mm, SD = 60.9 mm; muscle:  $n = 57$ , mean = 382 mm, SD = 60.9 mm), based on Welch Two Sample t-testing. The overlapping range of 2012 and 2023 fork lengths was determined to be 474 to 538 mm for both liver and muscle analyses, leaving only 8 replicates per year (**Figure 3.1**). Thus, ANCOVAs were performed on the full dataset and on only the samples that overlapped between years. No outliers were identified for either year or tissue (Cook's Distance  $< 4/n$ ). There were no major statistical differences between the two analyses, and the slope comparison was more robust with more datapoints. As such, **Table 3.9** contains the ANCOVA results from the full dataset.

There was no statistical difference in Northern Pike mean liver tissue mercury concentration between the current study year (2023) and baseline (2012; **Table 3.9**).

Mean muscle tissue mercury concentration of Northern Pike sampled in the current study (2023) was statistically lower than Northern Pike sampled during the baseline study (2012; **Table 3.9**).



**Figure 3.1: Scatter plots of Northern Pike mercury concentrations in (A) muscle and (B) liver versus fork length, sampled from the Pinewood River during baseline (2012) and the current sampling program year (2023).**

Note: trend lines and errors were derived from the ANCOVAs and gray shaded areas are the standard errors as calculated by geom\_smooth in the ggplot2 package in R (2022).



**Table 3.9: Statistical differences between Northern Pike sampled within the Pinewood River during baseline (2012) and the current sampling program year (2023).**

Variables		Sample Size		Test	ANCOVA Statistics		Response Mean			Minimum Detectable Effect Size (%)		Test P-value (Year)	Magnitude of Difference (%) <sup>a</sup>
Response	Covariate	2012	2020		Interaction Model	Covariate Value for Comparisons	Statistic	2012	2023	Decrease	Increase		Relative to Baseline (2012) <sup>f</sup>
												Interaction P-value	
Log <sub>10</sub> Muscle Mercury (mg/kg w.w.)	Log <sub>10</sub> Fork Length (mm)	57	15	ANCOVA	0.322	409	Adjusted Mean	0.371	0.264	-24.5	32.5	0.011	-28.7
Log <sub>10</sub> Liver Mercury (mg/kg w.w.)	Log <sub>10</sub> Fork Length (mm)	41	15	ANCOVA	0.120	431	Adjusted Mean	0.156	0.149	-19.2	23.7	0.691	-6.0

Notes:

Shaded cell indicates P-value < 0.10

Mean and covariate values have been back transformed for ease of interpretation.

Statistics were conducted on all fish that had > 300 mm fork length.

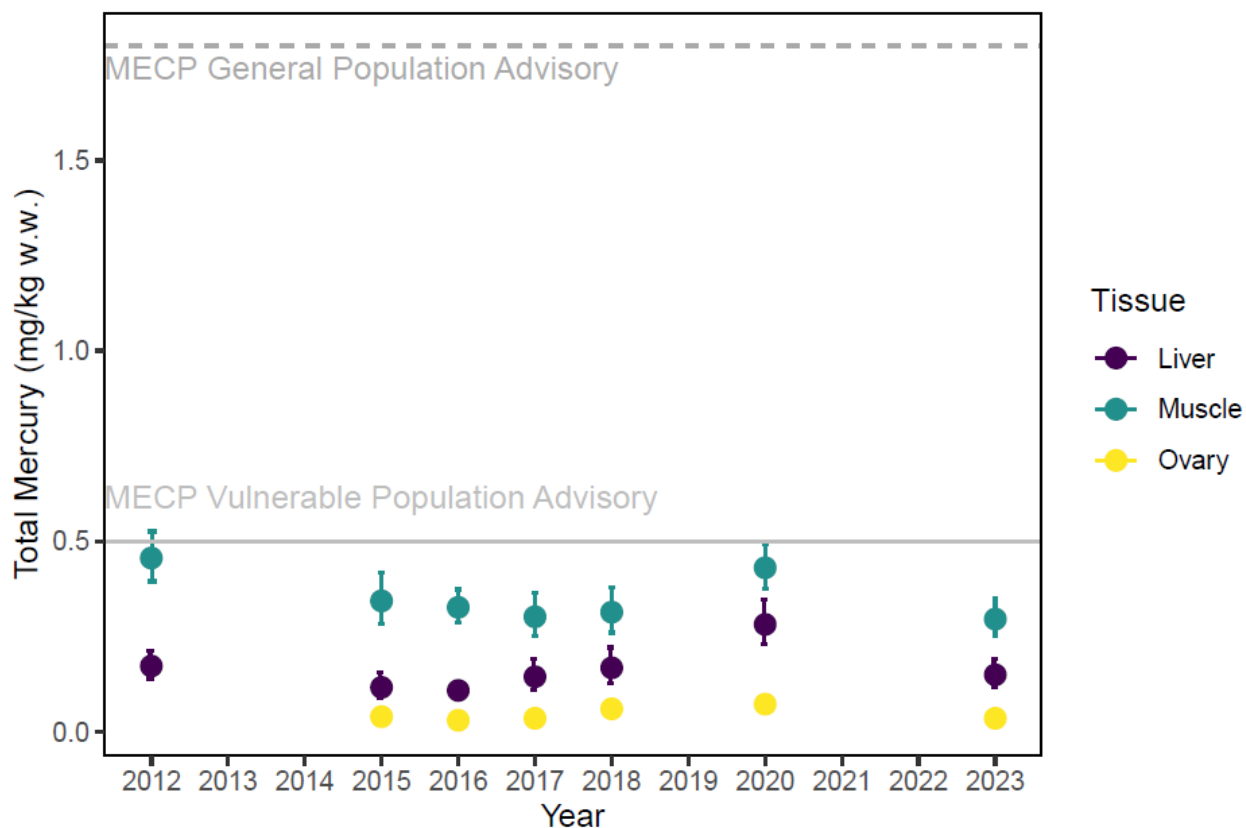
<sup>a</sup> Magnitude of difference is calculated based on the transformed data used to determine statistical significance.

### 3.3.3 Long-term Mercury Trend Analysis

The Northern Pike data was  $\text{Log}_{10}$  transformed to best meet the assumptions of the linear model (i.e., normality of residuals and variance homogeneity) and was used to derive the least square mean of mercury concentration per tissue type for each year. As stated in **Section 2.4.3**, because mercury bioaccumulates, it requires that analysis of trends be standardized to a common body length among datasets. As the fork lengths varied from year-to-year, particularly for 2023, outliers ( $> 1.5x$  interquartile range) were removed from the dataset to find an appropriate data range. This resulted in four fish removed from each of the muscle and liver analyses and one from the ovary analysis (all from 2023). The resulting Northern Pike liver, muscle and ovary mercury least squared means were calculated for average fork lengths of 479, 486, and 539 mm, respectively.

Liver mercury concentrations were lower in 2016 (LS mean 0.109, confidence interval (CI) 0.089 - 0.132) compared to baseline (LS 0.173, CI 0.139 - 0.213) but increased to the highest yearly concentration in 2020 (LS 0.282, CI 0.230 - 0.346; **Figure 3.2**, purple ). Muscle mercury concentrations in 2012 (LS 0.456, CI 0.395 - 0.526) were higher than those in 2016 (LS 0.327, CI 0.286 - 0.373), 2017 (LS 0.302, CI 0.251 - 0.364), 2018 (LS 0.314, CI 0.261 - 0.378), and the current year (2023; LS 0.296, CI 0.251 - 0.341), 2020 (LS 0.431, CI 0.375 - 0.493) muscle mercury concentrations were higher than 2016, 2017, and 2023 (**Figure 3.2**, teal ). Ovary mercury concentrations were highest in 2018 (mean 0.060, CI 0.050 - 0.074; compared to all years but 2015 and 2020) and 2020 (mean 0.072, CI 0.058 - 0.093; compared to all years but 2018) (**Figure 3.2**, yellow ). This apparent cyclic pattern, particularly for muscle, may be due to the import of methylated mercury with dissolved organic carbon from the surrounding soils/landscape during years of increased precipitation. As expected for mercury, the concentration in all tissue types fluctuate synchronously through time, with muscle, liver, and ovaries having highest, intermediate, and lowest concentrations, respectively (**Figure 3.2**). For example, mercury concentrations were higher in muscle compared to liver in perch (*Perca flaviatilis*), ruffe (*Gymnocephalus cernuus*), three-spined stickleback (*Gasterosteus aculeatus* L.), and nine-spined stickleback (*Pungitius punitius*) (Voigt 2007).

Mann-Kendall trend analysis did not result in a significant increasing trend between 2012 and 2023 for any tissue type (**Table 3.10**).



**Figure 3.2: Scatter plot of least squared mean mercury tissue concentrations in Northern Pike sampled in the Pinewood River between baseline (2012) and the current sampling program (2023).**

Note: Least squared (LS) means were calculated using fish that had fork lengths >300 mm and after fork length outliers were removed from each tissue. Ovaries were not sampled during the baseline (2012) year. Error bars represent LS mean confidence intervals.

**Table 3.10: Statistical results of Mann-Kendall trend analyses of least squared mean mercury tissue concentrations in Northern Pike sampled in the Pinewood River between baseline (2012) and the current sampling program (2023).**

Tissue	MK-statistic	z-statistic	P-value	Trend
Muscle	-11	-1.502	0.133	No
Liver	5	0.601	0.548	No
Ovary	4	0.574	0.566	No

Notes:  
 Trend analysis for upward trend only (one-tail test).  
 Shaded cell indicates P-value < 0.10  
 Statistics conducted on data presented in Figure 3-2.

## 3.4 Walleye

### 3.4.1 Comparison to Consumption Benchmarks

#### 3.4.1.1 Current Program Year (2023)

Mean concentrations did not exceed the designated benchmark for any metal in any tissue type (**Table 3.11**, **Table 3.12**, and **Table 3.13**). Two fish with fork lengths of 438 and 533 mm had muscle mercury concentrations that exceeded the consumption guidelines of 0.5 mg/kg for vulnerable populations (0.716 and 0.753 mg/kg w.w., respectively; **Table 3.11**, Appendix B). No individual liver or ovary tissue exceeded benchmark guidelines (**Table 3.12**, **Table 3.13**).

**Table 3.11: Metal concentrations in Walleye muscle tissue sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Aluminum (Al)	0.2	-	0.2	0.1	<0.2	0.5
Total Antimony (Sb)	0.001	1.300	<0.001	0.000	<0.001	<0.001
Total Arsenic (As)	0.004	1.000	0.061	0.034	0.026	0.160
Total Barium (Ba)	0.01	642.00	0.01	0.01	<0.01	0.03
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001	-	0.002	0.000	0.001	0.003
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.001	0.000	<0.001	0.001
Total Calcium (Ca)	2.0	-	244	225	78	867
Total Chromium (Cr)	0.01	7.10	0.12	0.376	<0.01	1.47
Total Cobalt (Co)	0.0013	-	0.0015	0.0008	<0.0013	0.0046
Total Copper (Cu)	0.01	1368.00	0.11	0.01	0.09	0.13
Total Iron (Fe)	0.25	-	2.12	2.83	0.91	12.10
Total Lead (Pb)	0.001	11.6	0.002	0.002	<0.001	0.006
Total Magnesium (Mg)	0.4	-	314.7	20.9	270.0	346.0
Total Manganese (Mn)	0.01	80.00	0.11	0.05	0.04	0.21
Total Mercury (Hg)*	0.002	0.500	0.386	0.160	0.194	0.753 <sup>1</sup>
Total Molybdenum (Mo)	0.004	16.1	<0.004	0.0000	<0.004	<0.004
Total Nickel (Ni)	0.01	4.20	0.01	0.004	<0.01	0.03
Total Phosphorus (P)	2	-	2287	151	1940	2580
Total Potassium (K)	2	-	4416	258	3860	4780
Total Selenium (Se)	0.01	-	0.23	0.02	0.17	0.26
Total Silver (Ag)	0.001	16.100	<0.001	0.000	<0.001	<0.001
Total Sodium (Na)	2	-	307	68	197	453
Total Strontium (Sr)	0.01	926.00	0.07	0.09	<0.01	0.30
Total Thallium (Tl)	0.0004	-	0.0034	0.0006	0.0016	0.0041
Total Tin (Sn)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Titanium (Ti)	0.02	-	0.08	0.01	0.06	0.09
Total Uranium (U)	0.0004	1.9000	<0.0004	0.0000	<0.0004	<0.0004
Total Vanadium (V)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Zinc (Zn)	0.04	963.00	2.78	0.22	2.17	3.05

**Notes:**

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min = minimum, Max = maximum.

Summary statistics considered less than MDL if reported as &lt;MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>1</sup> Two fish exceeded the mercury benchmark [WA1 (0.753 mg/kg w.w.) and WA3 (0.716 mg/kg w.w.), fork length 533 mm and 438 mm, respectively].

**Table 3.12: Metal concentrations in Walleye liver tissue sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=15)	SD	Min	Max
Total Aluminum (Al)	0.2	-	0.4	0.3	<0.2	1.3
Total Antimony (Sb)	0.001	1.300	<0.001	0.000	<0.001	<0.001
Total Arsenic (As)	0.004	1.000	0.033	0.015	<0.004	0.068
Total Barium (Ba)	0.01	642.00	0.01	0.01	<0.01	0.04
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001	-	0.001	0.000	<0.001	0.002
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.164	0.122	0.00	0.463
Total Calcium (Ca)	2.0	-	118	70	11	320
Total Chromium (Cr)	0.01	7.10	0.02	0.021	<0.01	0.08
Total Cobalt (Co)	0.0013	-	0.1271	0.0643	0.01	0.2470
Total Copper (Cu)	0.01	1368.00	1.98	2.85	0.14	12.20
Total Iron (Fe)	0.25	-	106.12	41.18	7.45	172.00
Total Lead (Pb)	0.001	11.6	0.003	0.003	<0.001	0.014
Total Magnesium (Mg)	0.4	-	154.3	41.1	15.1	190.0
Total Manganese (Mn)	0.01	80.00	1.05	0.31	0.12	1.38
Total Mercury (Hg)*	0.002	0.500	0.117	0.065	0.074	0.332
Total Molybdenum (Mo)	0.004	16.1	0.11	0.034	0.01	0.16
Total Nickel (Ni)	0.01	4.20	0.01	0.011	<0.01	0.05
Total Phosphorus (P)	2	-	2391	628	257	2830
Total Potassium (K)	2	-	2661	690	208	3180
Total Selenium (Se)	0.01	-	0.78	0.21	0.08	1.00
Total Silver (Ag)	0.001	16.100	0.00	0.008	<0.001	0.03
Total Sodium (Na)	2	-	1102	308	113	1400
Total Strontium (Sr)	0.01	926.00	0.06	0.03	<0.01	0.14
Total Thallium (Tl)	0.0004	-	0.0077	0.0026	0.0009	0.0119
Total Tin (Sn)	0.02	-	<0.02	0.00	<0.02	<0.02
Total Titanium (Ti)	0.02	-	0.08	0.02	<0.02	0.11
Total Uranium (U)	0.0004	1.9000	0.00	0.0003	<0.0004	0.00
Total Vanadium (V)	0.02	-	0.02	0.01	<0.02	0.07
Total Zinc (Zn)	0.04	963.00	16.39	4.80	1.69	23.90

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min = minimum, Max = maximum.

Summary statistics considered less than MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

**Table 3.13: Metal concentrations in ovaries of Walleye sampled from the Pinewood River, 2023.**

Parameter	Lowest Detection Limit	Benchmark <sup>a,b</sup>	Mean (n=2)	SD	Min	Max
Total Aluminum (Al)	0.2		0.3	0.1	<0.2	0.3
Total Antimony (Sb)	0.001	1.300	<0.001	0.000	<0.001	<0.001
Total Arsenic (As)	0.004	1.000	0.013	0.011	0.005	0.020
Total Barium (Ba)	0.01	642.00	0.02	0.01	<0.01	0.02
Total Beryllium (Be)	0.001	6.400	<0.001	0.000	<0.001	<0.001
Total Bismuth (Bi)	0.001		<0.001	0.000	<0.001	<0.001
Total Boron (B)	0.2	642.0	<0.2	0.0	<0.2	<0.2
Total Cadmium (Cd)	0.001	2.600	0.005	0.006	<0.001	0.009
Total Calcium (Ca)	2.0		158	173	35	280
Total Chromium (Cr)	0.01	7.10	<0.01	0.000	<0.01	<0.01
Total Cobalt (Co)	0.0013		0.0271	0.0334	0.00	0.0507
Total Copper (Cu)	0.01	1368.00	0.32	0.35	0.07	0.57
Total Iron (Fe)	0.25		13.38	14.60	3.05	23.70
Total Lead (Pb)	0.001	11.6	0.001	0.001	<0.001	0.002
Total Magnesium (Mg)	0.4		163.0	195.2	25.0	301.0
Total Manganese (Mn)	0.01	80.00	1.48	1.86	0.17	2.79
Total Mercury (Hg)*	0.002	0.500	0.036	0.033	0.013	0.059
Total Molybdenum (Mo)	0.004	16.1	0.01	0.0059	<0.004	0.01
Total Nickel (Ni)	0.01	4.20	<0.01	0.000	<0.01	<0.01
Total Phosphorus (P)	2		1329	1544	237	2420
Total Potassium (K)	2		1802	2133	293	3310
Total Selenium (Se)	0.01		0.28	0.30	0.06	0.49
Total Silver (Ag)	0.001	16.100	<0.001	0.000	<0.001	<0.001
Total Sodium (Na)	2		572	564	173	971
Total Strontium (Sr)	0.01	926.00	0.03	0.02	0.01	0.05
Total Thallium (Tl)	0.0004		0.0024	0.0026	0.0006	0.0043
Total Tin (Sn)	0.02		<0.02	0.00	<0.02	<0.02
Total Titanium (Ti)	0.02		0.04	0.03	<0.02	0.07
Total Uranium (U)	0.0004	1.9000	<0.0004	0.0000	<0.0004	<0.0004
Total Vanadium (V)	0.02		<0.02	0.00	<0.02	<0.02
Total Zinc (Zn)	0.04	963.00	16.82	20.63	2.23	31.40

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: SD = standard deviation, n = sample size, Min = minimum, Max = maximum.

Summary statistics considered less than MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

### 3.4.1.2 Across Program Years (2012 to 2023)

Specific trend analysis of mercury bioaccumulation accounting for fish length is presented in **Section 3.4.3**. This section (**3.4.1.2**) provides an overview of potential emerging concerns but is not a trend analysis.

For muscle tissue, the only mean metal concentration to exceed the benchmark across years was mercury during baseline sampling in 2012 (**Table 3.14**). Mean muscle mercury values have remained below benchmark since 2012; however, individual Walleye have exceeded the benchmark value as indicated by the maximum value column in **Table 3.14**.

For liver tissue, no mean metal concentration has exceeded benchmark concentrations (**Table 3.15**). However, some individual fish have exceeded the mercury benchmark concentration in liver since baseline sampling began in 2012 (**Table 3.15**). In the current year, 2023, there were no Walleye that had liver concentrations above the benchmark.

For ovaries, no mean or individual concentrations have exceeded their respective benchmark values since monitoring for ovaries began in 2015 (**Table 3.16**).



**Table 3.14: Metal concentrations in muscle tissue of Walleye sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Benchmark <sub>a,b</sub>	Baseline 2012 (n = 15)		2015 (n = 1)		2016 (n = 15)		2017 (n = 15)		2018 (n = 15)		2020 (n = 15)		2023 (n=15)	
		Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Arsenic (As)	1.00	0.1000	0.1000	0.1022	0.1022	0.0374	0.0700	0.0457	0.0915	0.0420	0.0670	0.0594	0.1620	0.0606	0.16000
Boron (B)	56.20	<0.50	0.50	<0.21	<0.21	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	3.20	<0.0010	0.0100	<0.0010	0.0010	0.0011	0.0023	0.0010	0.0017	0.0010	0.0010	0.0010	0.0011	0.0010	0.0013
Chromium (Cr)	3.20	<0.300	0.300	<0.010	0.010	0.014	0.045	0.010	0.012	0.011	0.027	0.012	0.034	0.122	1.470
Cobalt (Co)	-	<0.005	0.0050	<0.0042	0.0042	0.0042	0.0045	<0.0040	0.0040	0.0040	0.0040	0.0014	0.0020	0.0015	0.0046
Copper (Cu)	292	0.540	1.100	0.146	0.146	0.134	0.162	0.121	0.160	0.139	0.228	0.105	0.113	0.112	0.13
Iron (Fe)	-	3.20	5.00	2.15	2.15	1.02	1.91	1.60	2.51	1.84	4.24	1.60	3.17	2.12	12.10
Lead (Pb)	11.6	<0.0300	0.0300	0.0067	0.0067	0.0047	0.0113	0.0052	0.0079	0.0069	0.0415	0.0040	0.0040	0.0021	0.0061
Manganese (Mn)	392	0.307	1.800	0.163	0.163	0.089	0.112	0.127	0.222	0.139	0.204	0.110	0.156	0.112	0.212
Mercury (Hg)*	0.50	0.567 (4)	1.800 (4)	0.299	0.299	0.346	0.484	0.393	1.210 (3)	0.337	0.674 (2)	0.480	1.880 (4)	0.386	0.753 (2)
Molybdenum (Mo)	16.1	<0.050	0.0500	<0.0042	0.0042	0.0045	0.0090	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.004	<0.004
Nickel (Ni)	3.5	<0.050	0.050	<0.042	<0.042	0.051	0.065	0.071	0.495	<0.040	0.040	0.022	0.153	0.011	0.027
Selenium (Se)	3.60	0.213	0.300	0.295	0.295	0.206	0.275	0.222	0.301	0.219	0.304	0.221	0.267	0.228	0.258
Zinc (Zn)	963	3.53	5.00	3.16	3.16	2.80	3.36	2.60	3.19	3.20	3.65	2.88	3.07	2.78	3.05

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, Max = maximum.

Summary statistics considered less than MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> Number of individual fish in exceedance of benchmark value in parentheses.

**Table 3.15: Metal concentrations in Walleye liver tissue sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Benchmark <sup>a,b</sup>	Baseline 2012 (n = 13)		2015 (n = 1)		2016 (n = 15)		2017 (n = 15)		2018 (n = 15)		2020 (n = 15)		2023 (n=15)	
		Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Arsenic (As)	1.00	<0.100 0	0.1000	0.0603	0.0603	0.069 3	0.116 9	0.047 5	0.0880	0.0758	0.156 2	0.056 4	0.1140	0.0332	0.0676
Boron (B)	56.20	0.50	0.50	<0.20	<0.20	<0.20	0.30	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	3.20	0.1123	0.2000	0.5810	0.5810	0.103 4	0.438 6	0.401 3	2.2700	0.1403	0.329 0	0.227 4	0.5550	0.1640	0.4630
Chromium (Cr)	3.20	<0.300	0.300	<0.040	<0.040	0.027	0.061	0.027	0.065	0.013	0.058	0.011	0.014	0.018	0.075
Cobalt (Co)	-	0.1342	0.3000	0.2340	0.2340	0.127 7	0.341 8	0.203 0	0.3750	0.1590	0.333 3	0.186 4	0.4110	0.1271	0.2470
Copper (Cu)	292	1.985	3.000	3.120	3.120	1.976	7.968	1.665	2.350	1.772	2.818	2.240	13.000	1.976	12.200
Iron (Fe)	-	84.00	130.00	120.00	120.00	69.93	136.5 3	93.30	242.00	118.47	190.4 9	138.2 2	213.00	106.12	172.00
Lead (Pb)	11.6	0.0300	0.0300	<0.010 0	<0.010 0	0.007 9	0.015 2	0.007 5	0.0121	<0.004 0	0.004 0	0.005 4	0.0164	0.0030	0.0139
Manganese (Mn)	392	1.946	2.500	4.220	4.220	1.494	2.773	1.689	2.720	1.593	2.440	1.283	2.090	1.052	1.380
Mercury (Hg)	0.50	0.326	1.100 (4)	0.128	0.128	0.091	0.163	0.194	0.842 (1)	0.138	0.254	0.226	1.440 (1)	0.117	0.332
Molybdenum (Mo)	16.1	0.1392	0.2100	0.1320	0.1320	0.121 1	0.178 2	0.142 6	0.2060	0.1614	0.235 2	0.129 8	0.1870	0.107	0.160
Nickel (Ni)	3.5	<0.05	0.050	<0.040	0.040	0.049	0.061	0.043	0.073	<0.040	0.040	0.023	0.100	0.013	0.053
Selenium (Se)	3.60	0.792	1.100	1.130	1.130	0.682	0.870	0.840	1.080	0.824	1.236	0.928	1.200	0.776	1.000
Zinc (Zn)	963	19.23	22.00	45.60	45.60	15.93	19.00	18.09	21.40	19.13	25.45	18.81	26.50	16.39	23.90

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, Max = maximum.

Summary statistics considered less than MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> Number of individual fish in exceedance of benchmark value in parentheses.

**Table 3.16: Metal concentration in Walleye ovaries sampled from the Pinewood River, baseline (2012) to present (2023).**

COPC	Benchmark <sup>a,b</sup>	Baseline 2012 <sup>c</sup>		2016 (n = 8)		2015 <sup>d</sup>		2017 (n = 3)		2018 (n = 6)		2020 (n = 8)		2023 (n = 2)	
		Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Arsenic (As)	1.00	-	-	0.0432	0.0546	-	-	0.0137	0.0201	0.0332	0.0521	0.0383	0.0625	0.0128	0.0202
Boron (B)	56.20	-	-	0.30	0.32	-	-	<0.20	<0.20	0.27	0.60	0.42	1.95	<0.20 <sub>0</sub>	<0.20
Cadmium (Cd)	3.20	-	-	0.0020	0.0045	-	-	0.0038	0.0071	0.0022	0.0040	0.0061	0.0119	0.0051	0.0092
Chromium (Cr)	3.20	-	-	0.015	0.016	-	-	<0.01 <sub>0</sub>	<0.01 <sub>0</sub>	0.018	0.057	0.047	0.113	<0.01 <sub>0</sub>	<0.01 <sub>0</sub>
Cobalt (Co)	-	-	-	0.0596	0.0748	-	-	0.0369	0.0416	0.0564	0.0696	0.0598	0.1230	0.0271	0.0507
Copper (Cu)	292	-	-	0.717	0.832	-	-	0.692	0.780	0.871	1.072	0.868	1.120	0.323	0.573
Iron (Fe)	-	-	-	24.50	31.02	-	-	25.57	33.30	27.48	39.72	31.14	53.90	13.38	23.70
Lead (Pb)	11.6	-	-	0.0060	0.0065	-	-	0.0040	0.0040	0.0054	0.0126	0.0234	0.0383	0.0014	0.0018
Manganese (Mn)	392	-	-	4.198	7.052	-	-	1.843	2.060	3.733	8.140	1.177	4.130	1.478	2.790
Mercury (Hg)	0.50	-	-	0.025	0.031	-	-	0.098	0.176	0.037	0.055	0.115	0.455	0.036	0.059
Molybdenum (Mo)	16.1	-	-	0.0125	0.0158	-	-	0.0087	0.0103	0.0182	0.0289	0.0146	0.0209	0.0082	0.0123
Nickel (Ni)	3.5	-	-	0.060	0.065	-	-	<0.04 <sub>0</sub>	<0.04 <sub>0</sub>	0.044	0.067	0.041	0.156	<0.01 <sub>0</sub>	<0.01 <sub>0</sub>
Selenium (Se)	3.60	-	-	0.830	0.956	-	-	0.484	0.550	0.954	1.905	1.141	1.680	0.278	0.491
Zinc (Zn)	963	-	-	30.52	35.33	-	-	26.87	31.40	57.60	162.94	149.15	232.00	16.82	31.40

Notes:

Shaded cell indicates values higher than the benchmark value.

Abbreviations: n = sample size, Max = maximum.

Summary statistics considered less than MDL if reported as <MDL.

Units (mg/kg w.w.).

<sup>a</sup> Mercury guideline for women of child-bearing age and children under 15 (based on Table 2.1; MECP 2015).

<sup>b</sup> Consumption Benchmark References based on Table 2.2.

<sup>c</sup> No ovaries were sampled during baseline (2012).

<sup>d</sup> No females were captured in 2015.

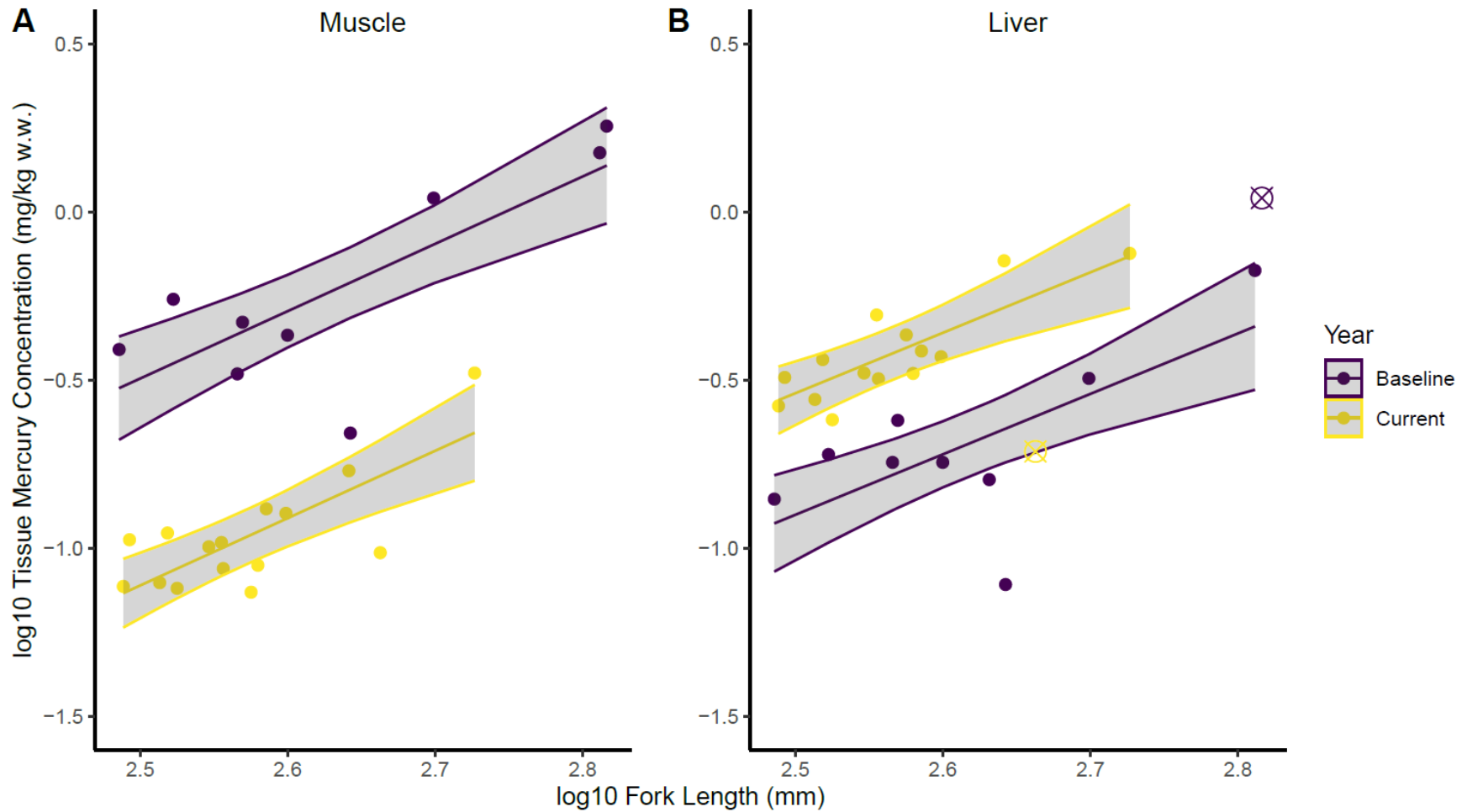
<sup>e</sup> Number of individual fish in exceedance of benchmark value in parentheses.

### 3.4.2 Mercury Comparison of Current Year (2023) to Baseline (2012)

The Walleye mercury concentrations and lengths were  $\text{Log}_{10}$  transformed to best meet the assumptions of ANCOVA (i.e., normality of residuals and variance homogeneity). Walleye fork lengths from 2012 ranged from 211 to 655 mm for muscle ( $n = 15$ ) and 248 to 655 mm ( $n = 13$ ) for liver. However, to keep consistent with the 2023 survey in which only Walleye  $> 300$  mm were sampled ( $n = 15$ ), here we only assess 2012 Walleye that were  $> 300$  mm (muscle  $n = 9$ ; liver  $n = 10$ ). Two 2012 muscle and liver samples were from fish that were longer than the 2023 Walleye (see **Figure 3.3**). Thus, ANCOVAs were performed on the full  $> 300$  mm datasets and on datasets in which these two 2012 samples were removed. When using the full dataset, one liver outlier (Cook's Distance  $> 4/n$ ) was removed from each year (**Table 3.17**). When using the overlapping dataset, one muscle outlier was removed from each year and two liver outliers were removed from 2023. The ANCOVA revealed no major statistical differences between the full dataset and the overlapping range, so the data presented in **Table 3.17** was from the full dataset ( $> 300$  mm).

Walleye muscle tissue had significantly lower mercury concentrations in the current year of study (2023) compared to baseline (2012; **Table 3.17**).

In contrast, mean Walleye mercury concentrations in liver tissue were significantly elevated in the current year of sampling (2023) compared to baseline (2012; **Table 3.17**).



**Figure 3.3: Scatter plots of Walleye mercury concentrations in (A) muscle and (B) liver tissue versus fork length, sampled from the Pinewood River during baseline (2012) and the current sampling program year (2023).**

Note: All fork lengths >300 mm were plotted. Trend lines and errors were derived from the ANCOVAs and gray shaded areas are the standard errors as calculated by geom\_smooth in the ggplot2 package in R (2022). Unfilled circles with 'X's are studentized outliers (PIN-17-GN1-18-L - 2012, WA5 -2023).

**Table 3.17: Statistical differences between Walleye sampled from the Pinewood River during baseline (2012) and the current sampling program year (2023).**

Variables		Sample Size		Test	ANCOVA Statistics		Response Mean			Minimum Detectable Effect Size (%)		Test P-value (Year)	Magnitude of Difference (%) <sup>a</sup>
Response	Covariate	2012 <sup>b</sup>	2023		Interaction Model	Covariate Value for Comparisons	Statistic	2012	2023	Decrease	Increase		Relative to Baseline (2012)
					Interaction P-value								
Log <sub>10</sub> Muscle Mercury (mg/kg w.w.)	Log <sub>10</sub> Fork Length (mm)	9	15	ANCOVA	0.865	394	Adjusted Mean	0.495	0.120	-36.2	56.7	<0.001	-75.8
Log <sub>10</sub> Liver Mercury (mg/kg w.w.)	Log <sub>10</sub> Fork Length (mm)	10	15	ANCOVA	0.245	395		0.202	0.404	-40.8	68.9	<0.001	100.5
		9	14	ANCOVA <sup>1</sup>	0.728	384		0.178	0.409	-34.8	53.3	<0.001	129.8

Notes:

Shaded cell indicates P-value < 0.10

Mean and covariate values have been back transformed for ease of interpretation.

Statistics were conducted on all 2012 and 2023 fish that had a fork length > 300 mm.

<sup>a</sup> Magnitude of difference is calculated on based on the transformed data used to determine statistical significance.

<sup>b</sup> Sample size differed between muscle and liver tissue in 2012 as some fish did not have both muscle and liver tissue data.

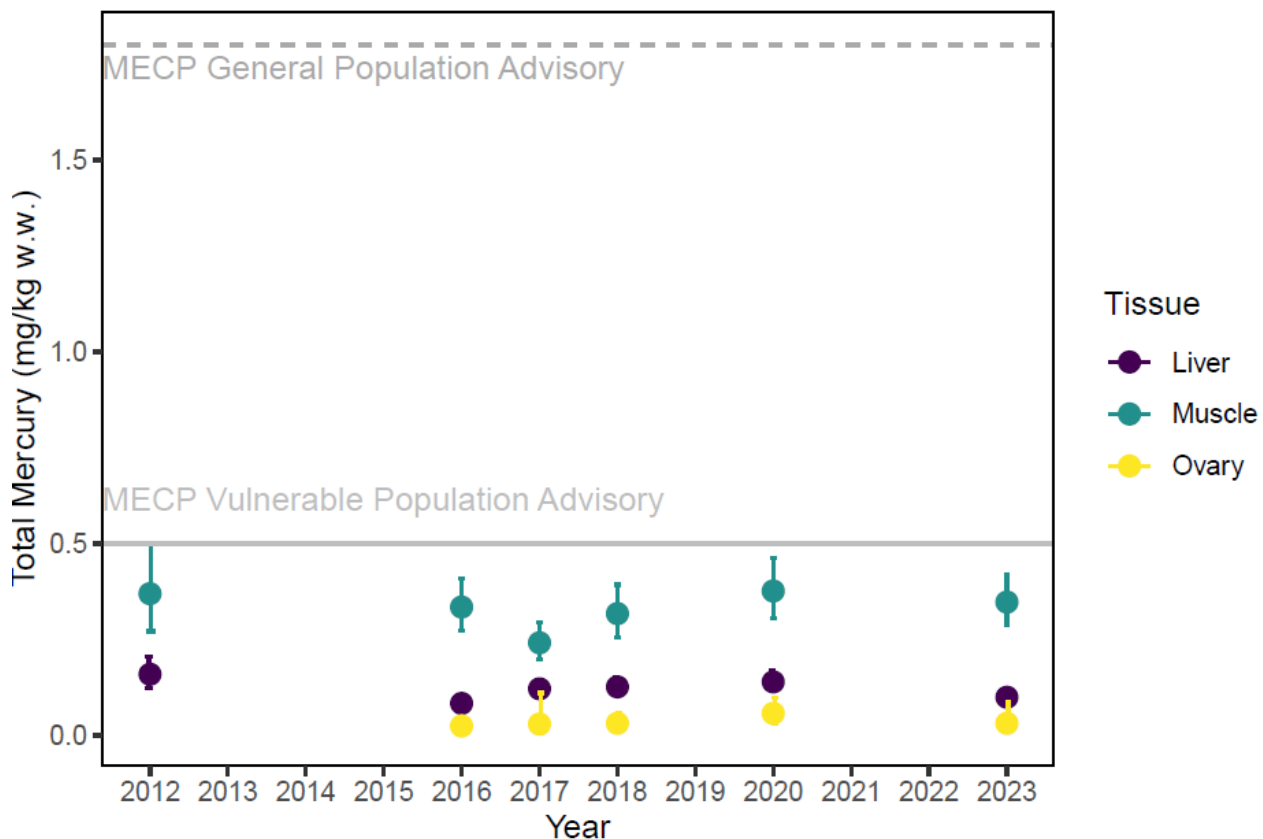
<sup>1</sup> Two studentized outlier was identified and removed from the dataset (WA5 – 2012; WA13 -2023).

### 3.4.3 Long-term Mercury Trend Analysis

The Walleye mercury concentrations and fork lengths were  $\text{Log}_{10}$  transformed to best meet the assumptions of the linear model (i.e., normality of residuals and variance homogeneity) that was used to derive the least squared mean of mercury concentration per tissue type for each year. As stated in **Section 2.4.3**, because mercury bioaccumulates, the trends analyses need to be standardized to a common body length among datasets. The fork lengths each year were variable, particularly for fish that had ovaries. Thus, to determine an appropriate fork length range for comparison, each tissue was assessed for outliers (i.e.,  $> 1.5x$  interquartile range), resulting in five and six fish removed from the muscle and liver analyses, respectively. This resulted in the following fork length ranges for muscle, liver, and ovary: 308 to 460 mm, 308 to 478 mm, and 324 to 533 mm, respectively. The resulting Walleye liver, muscle, and ovary mercury least squared means were calculated for average fork lengths of 373, 370, and 407 mm, respectively.

Similar to Northern Pike, liver mercury concentrations in Walleye were higher at baseline (2012; LS mean 0.160, CI 0.124 - 0.205) compared to 2016 (LS mean 0.084, CI 0.070 - 0.101) and 2023 (LS mean 0.100, CI 0.085 - 0.118), although there were no elevated levels in 2020 (**Figure 3.4**; purple ). Unlike the Northern Pike, Walleye muscle mercury concentrations were only higher in 2020 (LS mean 0.377, CI 0.304 - 0.463) compared to 2017 (LS mean 0.242, CI 0.198 - 0.294; **Figure 3.4**; teal ). There has been little change in Walleye ovary mercury concentrations (**Figure 3.4**; yellow ). Muscle, liver, and ovaries had the highest, intermediate, and lowest concentrations, respectively. (**Figure 3.4**).

Mann-Kendall trend analysis did not result in a significant increasing trend for any tissue type since the baseline study (**Table 3.18**).



**Figure 3.4: Scatter plot of least squared mean mercury tissue concentrations in Walleye sampled from the Pinewood River between baseline (2012) and the current sampling program (2023).**

Note: Least squared (LS) means were calculated on fish with fork lengths > 300 mm and with outliers (> 1.5 x interquartile range) removed. Ovaries were not sampled during the baseline year (2012) and no females were capture in 2015. Error bars represent the LS means confidence intervals.

**Table 3.18: Statistical results of Mann-Kendall trend analyses of least squared mean mercury tissue concentrations in Walleye sampled from the Pinewood River between baseline (2012) and the current sampling program (2023).**

Tissue	MK-statistic	z-statistic	p-value	Trend
Muscle	1	0.000	1.000	No
Liver	-1	0.000	1.000	No
Ovary	7	1.516	0.130	No

Notes:  
 Trend analysis for upward trend only (one-tail test).  
 Shaded cell indicates *P*-value < 0.10  
 Statistics conducted on data presented in Figure 3-4.



## 4.0 Conclusions and Recommendations

### 4.1 Conclusions

Overall, the data indicates that the RRM has not significantly impacted the metal tissue concentrations for Northern Pike or Walleye of the Pinewood River within the study area. A summary table of the overall findings is presented in **Table 4.1**.

**Table 4.1: Summary Results from the Pinewood River large-bodied fish tissue monitoring program, 2023.**

Species	Tissue Type	Exceedance of Consumption Guideline in 2023?				Mercury Greater than Baseline?	Increasing Mercury Trend?
		Mercury <sup>a</sup>		Other Metals			
		Mean	Individual Fish	Mean	Individual Fish		
Northern Pike	Muscle	No	2 of 15 fish	No	No	No	No
	Liver	No	No	No	No	No	No
	Ovary	No	No	No	No	- <sup>1</sup>	No
Walleye	Muscle	No	2 of 15 fish	No	No	No	No
	Liver	No	No	No	No	Yes	No
	Ovary	No	No	No	No	- <sup>1</sup>	No

Notes:

<sup>a</sup> This was based on the 'no-eat' Vulnerable Population Advisory of 0.5 mg/kg w.w., No fish exceeded the General Population Advisory of 1.8 mg/kg w.w.

<sup>1</sup> Ovaries were not collected during baseline monitoring (2012).

#### 4.1.1 Comparison to Consumption Benchmarks (All Metals)

Some fish exceeded the mercury consumption advisory for vulnerable populations (0.5 mg/kg w.w.); however, this also occurred during baseline sampling. Although the vulnerable population advisory was chosen as the benchmark for comparison it is important to note that it is approximately three times lower than the same advisory for the general population (1.8 mg/kg w.w.), which no fish exceeded. None of the metals had a mean value that exceeded the selected benchmarks (**Table 4.1**).

#### 4.1.2 Mercury Comparison between Current Year (2023) and Baseline (2012)

Statistical comparisons of the current sampling program (2023) to baseline did not indicate increased mercury concentrations within muscle tissue of Northern Pike or Walleye (**Table 4.1**). Mean mercury concentration of liver tissue between the current study (2023) and baseline (2012) was statistically different for Walleye but not for Northern Pike. This difference may be part of the natural oscillation of mercury concentrations in fish tissue in the Pinewood River and it appears that the baseline year (2012) and the current sampling year (2023) are indicative of high temporal events of this oscillation. For example, 2020 statistical analyses produced

opposite results: statistically higher mercury concentrations in Northern Pike but not Walleye. Thus, continued monitoring is necessary to determine future trends.

### 4.1.3 Long-term Mercury Trend Analysis

Mercury concentration within tissue (muscle, liver, ovary) did not demonstrate a significant increasing trend for Northern Pike or Walleye (**Table 4.1**).

## 4.2 Recommendations

Based on the results and understanding attained from the analysis of the 2023 Large-Bodied Fish Monitoring Program the following recommendations are provided:

1. Continued monitoring of muscle, liver, and ovary tissues for Northern Pike and Walleye. Currently, the monitoring program has been conducted over 11 years with sampling occurring during 7 of these years. The dataset is approaching the robustness needed to conduct a technical assessment of monitoring performance regarding temporal frequency and sample size requirements.
2. Continue to foster community engagement in monitoring activities.

## 5.0 References

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## Appendix A Licence to Collect Fish for Scientific Purposes

## Licence to Collect Fish for Scientific Purposes Schedule A – Licence Conditions

Licence No. 1103657  
Local Reference No. DR-2023-FWCA-00009  
Issuer Account No. 10003212

This licence is subject to the conditions listed below.

1. This licence is valid only for the persons, species, numbers, areas, and calendar year indicated.
2. Mandatory report forms (Ontario Central Forms Repository - Form Identification ([gov.on.ca](http://gov.on.ca))) documenting the sampling conducted under this licence must be submitted to the licence issuer within 30 days of the termination date, but in no case later than January 31 next following the year of issue. The digital Mandatory Report form (Part 1) must be completed for each Sampling Program and the digital Site Collection Reports (Part 2) must be completed for each collection site and date. A separate map clearly indicating the location of each collection site must be attached to the Site Collection Reports. Submit Mandatory Report forms to [megan.pistilli@ontario.ca](mailto:megan.pistilli@ontario.ca) or the Fort Frances work centre MNRF office. The submission of a satisfactory report is a prerequisite to any subsequent renewals.
3. Sampling locations must be reported in GPS format using Projection: Universal Transverse Mercator (UTM); Datum: North American 1983 (NAD 83), Canadian Transformation (CNT); Zone: 15N, 16N, 17N, or 18N Units: Metres.
4. Before carrying out any operation under this licence, any person authorized under this licence is required to consult with the Dryden Fort Frances Atikokan District Ministry of Natural Resources & Forestry contact at least one week prior to anticipated start of sampling. Also, any person authorized under this licence must advise the respective contact of the date, time and location of all sampling.
5. A copy of the signed original licence must be carried by the licensed person when working at the designated sites. An assistant of the licensed person who is carrying out activities under this licence during the absence of the licensed person shall carry the licence on his or her person.
6. Capture gear and live holding containers must be inspected regularly, and live holding traps must be inspected at least once daily. All collection gear shall be clearly marked with the licensed person's name and the licence number of this licence.
7. This licence is not valid in Provincial Parks, Conservation Reserves, National Parks, National Historic canals and waterways, National Marine Conservation Areas, or Conservation Authority property without the written permission from the authorized person in charge of the area concerned.
8. This licence does not allow access to any property without permission of the landowner.
9. This licence ONLY allows for the following capture gear to be used:
  - a. *Gillnets and angling*
10. Name of assistants covered under this licence are as follows: Caroline Farkas, Dion Kelly, Nicholas Edmunds, Evan Versteeg, Brian Kielstra, Colin Dempster, Nichole Wiemann, and Robert Eakins. Any changes to assistants must be confirmed in writing before sampling commences.
11. All gear and equipment used for fish collection shall be de-contaminated using the decontamination methods outlined for watercraft and watercraft equipment in the document entitled Best Management Practices for Preventing the Spread of Aquatic Invasive Species – Guidance for Watercraft Users (2021).
12. Due to potential spawning activity by resident or migratory fish species, visual inspection of all sampling areas must be done prior to sampling. Should spawning activity or redds be observed, all sampling must be stopped in order to prevent disturbance to the fish and habitats. This condition does not apply to migratory pacific salmon and rainbow trout originating from the Great Lakes.
13. Any fish released, must be released to the waters where originally captured. All captured fish will be released alive at the capture site except for voucher specimens, approved permanent collections and/or when further examination is necessary in the laboratory. Voucher specimens shall be deposited in the Royal Ontario Museum collection for taxonomic verification and voucher retention.
14. Any person acting under the authority of this licence, shall immediately report the capture of any invasive species (e.g. ruffe, tubenose goby, round goby, rusty crayfish, Asian carp, etc.) found outside its previously known range (as determined by the distribution information available at: [www.eddmaps.org/ontario/distribution](http://www.eddmaps.org/ontario/distribution) to the local Ministry of Natural Resources and Forestry - Fort Frances work centre. Any such specimens captured outside of their established range (not already naturalized) shall be euthanized (and eviscerated if required) and kept for identification purposes.
15. Unless specifically authorized by a separate Endangered Species Act (ESA) authorization (i.e., Registry or permit) and/or federal Species at Risk Act (SARA) permit, no person shall attempt to catch a Species at Risk listed as extirpated, endangered or threatened.
16. Unless specifically authorized by a separate Endangered Species Act (ESA) authorization (i.e., Registry or permit) and/or federal Species at Risk Act (SARA) permit, any Species at Risk that are incidentally captured must be photographed and immediately released at the point of capture. The photographs, including capture coordinates and date caught, must be forwarded to the local Ministry of Natural Resources and Forestry - Fort Frances work centre office for identification and confirmation.

## Licence to Collect Fish for Scientific Purposes Schedule A – Licence Conditions

Licence No. 1103657  
Local Reference No. DR-2023-FWCA-00009  
Issuer Account No. 10003212

17. Unless specifically authorized by a separate Endangered Species Act (ESA) authorization (i.e., Registry or permit) and/or federal Species at Risk Act (SARA) permit, sampling must cease when a Species at Risk is caught and the Ministry of Environment, Conservation and Parks (MECP) immediately notified to obtain required ESA/SARA permits prior to the continuation of sampling.
18. All aquatic Species at Risk must also be reported to the Ministry of Natural Resources and Forestry Natural Heritage Information Centre on the appropriate form at: <https://www.ontario.ca/page/report-rare-species-animals-and-plants>
19. This licence does not authorize the possession of specially protected fish under the Ontario Fishery Regulations, 2007.
20. The following NDMRF Class Animal Care Protocols will be adhered to as appropriate for the project activity:
  - Capture Methods - Impounding Gear
  - Capture Methods - Seining
  - Capture Methods – Electrofishing
  - Containment – Short Term Containment

### Signature of Licensee

x Joe Tetreault

### Date

27-June-2023

## Appendix B Laboratory Analyses





Your Project #: 23-3195  
 Site Location: Rainy River Mine  
 Your C.O.C. #: 794704

**Attention: Joseph Tetreault**

EcoMetrix Incorporated  
 6800 Campobello Rd  
 Mississauga, ON  
 CANADA L5N 2L8

**Report Date: 2023/12/15**  
 Report #: R7957546  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C3Y3397**

**Received: 2023/11/02, 09:20**

Sample Matrix: Tissue  
 # Samples Received: 69

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Mercury in Tissue by CVAF - Wet Wt (1)	68	N/A	2023/12/13	BBY7SOP-00012	EPA 245.7
Mercury in Tissue by CVAF - Wet Wt (1)	1	N/A	2023/12/14	BBY7SOP-00012	EPA 245.7
Elements by CRC ICPMS - Tissue Wet Wt (1)	29	2023/12/07	2023/12/10	BBY7SOP-00021 / BBY7SOP-00002	EPA 6020b R2 m
Elements by CRC ICPMS - Tissue Wet Wt (1)	34	2023/12/08	2023/12/10	BBY7SOP-00021 / BBY7SOP-00002	EPA 6020b R2 m
Elements by CRC ICPMS - Tissue Wet Wt (1)	6	2023/12/08	2023/12/13	BBY7SOP-00021 / BBY7SOP-00002	EPA 6020b R2 m
Moisture in Tissue (Subcontracted) (1, 2)	9	2023/12/07	2023/12/08	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Moisture in Tissue (Subcontracted) (1, 2)	20	2023/12/07	2023/12/09	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Moisture in Tissue (Subcontracted) (1, 2)	40	2023/12/08	2023/12/09	BBY8SOP-00017	BCMOE BCLM Dec2000 m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your Project #: 23-3195  
Site Location: Rainy River Mine  
Your C.O.C. #: 794704

**Attention: Joseph Tetreault**

EcoMetrix Incorporated  
6800 Campobello Rd  
Mississauga, ON  
CANADA L5N 2L8

**Report Date: 2023/12/15**  
Report #: R7957546  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C3Y3397**

**Received: 2023/11/02, 09:20**

- (1) This test was performed by Bureau Veritas Burnaby, 4606 Canada Way , Burnaby, BC, V5G 1K5
- (2) Offsite analysis requires that subcontracted moisture be reported.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:  
Colby Coutu, Project Manager  
Email: Colby.Coutu@bureauveritas.com  
Phone# (905)817-5844

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This report has been generated and distributed using a secure automated process.  
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For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH234	XMH234	XMH235	XMH236	XMH237		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA1-L</b>	<b>WA1-L Lab-Dup</b>	<b>WA2-L</b>	<b>WA3-L</b>	<b>WA4-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	0.50	0.48	<0.20	<0.20	0.27	0.20	9116089
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Arsenic (As)	mg/kg	0.0921	0.0865	0.0643	0.0392	0.0444	0.0040	9116089
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	<0.010	0.015	<0.010	0.017	0.010	9116089
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0025	0.0025	0.0024	0.0026	0.0018	0.0010	9116089
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116089
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0013	<0.0010	<0.0010	<0.0010	0.0010	0.0010	9116089
Total (Wet Wt) Calcium (Ca)	mg/kg	78.1	81.5	135	194	238	2.0	9116089
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	1.47	0.010	9116089
Total (Wet Wt) Cobalt (Co)	mg/kg	<0.0013	<0.0013	<0.0013	<0.0013	0.0046	0.0013	9116089
Total (Wet Wt) Copper (Cu)	mg/kg	0.094	0.101	0.119	0.127	0.120	0.010	9116089
Total (Wet Wt) Iron (Fe)	mg/kg	2.38	1.92	1.06	1.49	12.1	0.25	9116089
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0022	0.0010	9116089
Total (Wet Wt) Magnesium (Mg)	mg/kg	270	281	316	326	285	0.40	9116089
Total (Wet Wt) Manganese (Mn)	mg/kg	0.044	0.049	0.091	0.104	0.212	0.010	9116089
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0040	9116089
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	0.027	0.010	9116089
Total (Wet Wt) Phosphorus (P)	mg/kg	1940	2000	2300	2270	2140	2.0	9116089
Total (Wet Wt) Potassium (K)	mg/kg	3860	4020	4350	4350	4250	2.0	9116089
Total (Wet Wt) Selenium (Se)	mg/kg	0.227	0.234	0.242	0.258	0.212	0.010	9116089
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Sodium (Na)	mg/kg	357	374	387	346	197	2.0	9116089
Total (Wet Wt) Strontium (Sr)	mg/kg	<0.010	<0.010	0.026	0.039	0.080	0.010	9116089
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00155	0.00162	0.00340	0.00398	0.00369	0.00040	9116089
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Titanium (Ti)	mg/kg	0.071	0.071	0.073	0.072	0.072	0.020	9116089
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	9116089
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Zinc (Zn)	mg/kg	2.17	2.31	2.68	3.03	2.87	0.040	9116089
Mercury (Hg)	mg/kg	0.753 (1)	0.748	0.494 (2)	0.716 (2)	0.241 (2)	0.010	9116090

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate  
 (1) Detection limits raised due to dilution to bring analyte within the calibrated range.  
 Matrix spike non calculable due to high concentration of original analyte.  
 (2) Detection limits raised due to dilution to bring analyte within the calibrated range.



**RESULTS OF ANALYSES OF TISSUE**

Bureau Veritas ID		XMH234	XMH234	XMH235	XMH236	XMH237		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA1-L</b>	<b>WA1-L Lab-Dup</b>	<b>WA2-L</b>	<b>WA3-L</b>	<b>WA4-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	81	82	81	82	81	0.30	9116091

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH238	XMH239	XMH240	XMH241	XMH242		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA5-L</b>	<b>WA6-L</b>	<b>WA7-L</b>	<b>WA8-L</b>	<b>WA9-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	0.43	<0.20	0.31	<0.20	0.20	9116089
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Arsenic (As)	mg/kg	0.0347	0.0577	0.0453	0.0570	0.0396	0.0040	9116089
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.014	<0.010	0.026	<0.010	0.010	9116089
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0019	0.0022	0.0018	0.0016	0.0025	0.0010	9116089
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116089
Total (Wet Wt) Cadmium (Cd)	mg/kg	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Calcium (Ca)	mg/kg	131	259	103	867	388	2.0	9116089
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	0.055	<0.010	0.178	<0.010	0.010	9116089
Total (Wet Wt) Cobalt (Co)	mg/kg	<0.0013	0.0016	<0.0013	0.0014	<0.0013	0.0013	9116089
Total (Wet Wt) Copper (Cu)	mg/kg	0.105	0.102	0.109	0.104	0.117	0.010	9116089
Total (Wet Wt) Iron (Fe)	mg/kg	1.08	2.03	1.02	3.04	0.97	0.25	9116089
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	0.0061	0.0018	0.0032	0.0019	0.0010	9116089
Total (Wet Wt) Magnesium (Mg)	mg/kg	311	346	303	340	314	0.40	9116089
Total (Wet Wt) Manganese (Mn)	mg/kg	0.102	0.152	0.075	0.196	0.113	0.010	9116089
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0040	9116089
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116089
Total (Wet Wt) Phosphorus (P)	mg/kg	2150	2360	2210	2580	2460	2.0	9116089
Total (Wet Wt) Potassium (K)	mg/kg	4190	4580	4450	4320	4700	2.0	9116089
Total (Wet Wt) Selenium (Se)	mg/kg	0.218	0.241	0.245	0.231	0.226	0.010	9116089
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Sodium (Na)	mg/kg	360	453	310	335	265	2.0	9116089
Total (Wet Wt) Strontium (Sr)	mg/kg	0.021	0.077	0.016	0.296	0.123	0.010	9116089
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00315	0.00373	0.00302	0.00413	0.00324	0.00040	9116089
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Titanium (Ti)	mg/kg	0.058	0.089	0.072	0.088	0.081	0.020	9116089
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	9116089
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Zinc (Zn)	mg/kg	2.75	2.83	2.90	2.90	2.83	0.040	9116089
Mercury (Hg)	mg/kg	0.332 (1)	0.386 (1)	0.371 (1)	0.319 (1)	0.331 (1)	0.010	9116090

<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	71	79	78	78	79	0.30	9116091

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 (1) Detection limits raised due to dilution to bring analyte within the calibrated range.



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH243	XMH244	XMH245	XMH246	XMH247		
Sampling Date		2023/09/20	2023/09/20	2023/09/21	2023/09/21	2023/09/21		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA10-L</b>	<b>WA12-L</b>	<b>WA13-L</b>	<b>WA14-L</b>	<b>WA15-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116089
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Arsenic (As)	mg/kg	0.0727	0.0255	0.160	0.0355	0.0489	0.0040	9116089
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.023	<0.010	<0.010	<0.010	0.010	9116089
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0011	0.0017	0.0015	0.0019	0.0019	0.0010	9116089
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116089
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Calcium (Ca)	mg/kg	214	628	89.5	110	113	2.0	9116089
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116089
Total (Wet Wt) Cobalt (Co)	mg/kg	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.0013	9116089
Total (Wet Wt) Copper (Cu)	mg/kg	0.109	0.112	0.111	0.109	0.130	0.010	9116089
Total (Wet Wt) Iron (Fe)	mg/kg	1.09	1.26	1.03	1.14	0.91	0.25	9116089
Total (Wet Wt) Lead (Pb)	mg/kg	0.0016	0.0048	<0.0010	0.0028	<0.0010	0.0010	9116089
Total (Wet Wt) Magnesium (Mg)	mg/kg	307	298	309	330	339	0.40	9116089
Total (Wet Wt) Manganese (Mn)	mg/kg	0.094	0.142	0.054	0.100	0.103	0.010	9116089
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0040	9116089
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116089
Total (Wet Wt) Phosphorus (P)	mg/kg	2260	2330	2230	2300	2420	2.0	9116089
Total (Wet Wt) Potassium (K)	mg/kg	4410	4140	4380	4720	4780	2.0	9116089
Total (Wet Wt) Selenium (Se)	mg/kg	0.255	0.189	0.174	0.211	0.252	0.010	9116089
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Sodium (Na)	mg/kg	245	322	250	278	258	2.0	9116089
Total (Wet Wt) Strontium (Sr)	mg/kg	0.054	0.232	0.015	0.010	0.014	0.010	9116089
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00338	0.00336	0.00410	0.00373	0.00328	0.00040	9116089
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Titanium (Ti)	mg/kg	0.078	0.083	0.074	0.068	0.083	0.020	9116089
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	9116089
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Zinc (Zn)	mg/kg	2.60	2.87	2.61	3.05	2.90	0.040	9116089
Mercury (Hg)	mg/kg	0.265 (1)	0.322 (1)	0.194 (1)	0.431 (1)	0.364 (1)	0.010	9116090

<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	80	80	80	80	79	0.30	9116091

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 (1) Detection limits raised due to dilution to bring analyte within the calibrated range.



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH248	XMH249	XMH250	XMH251	XMH252		
Sampling Date		2023/09/21	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA16-L</b>	<b>WA1-Liver</b>	<b>WA2-Liver</b>	<b>WA3-Liver</b>	<b>WA4-Liver</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	1.29	0.76	0.53	0.26	0.20	9116089
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Arsenic (As)	mg/kg	0.0923	0.0316	0.0333	0.0372	0.0462	0.0040	9116089
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.035	0.010	0.016	0.019	0.010	9116089
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0019	0.0021	0.0012	0.0017	0.0012	0.0010	9116089
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116089
Total (Wet Wt) Cadmium (Cd)	mg/kg	<0.0010	0.463	0.121	0.204	0.125	0.0010	9116089
Total (Wet Wt) Calcium (Ca)	mg/kg	109	112	80.9	177	320	2.0	9116089
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	0.012	0.010	9116089
Total (Wet Wt) Cobalt (Co)	mg/kg	<0.0013	0.160	0.128	0.223	0.0711	0.0013	9116089
Total (Wet Wt) Copper (Cu)	mg/kg	0.115	1.11	1.02	1.22	1.62	0.010	9116089
Total (Wet Wt) Iron (Fe)	mg/kg	1.15	81.5	112	172	132	0.25	9116089
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	0.0025	0.0058	0.0027	0.0023	0.0010	9116089
Total (Wet Wt) Magnesium (Mg)	mg/kg	327	190	149	163	168	0.40	9116089
Total (Wet Wt) Manganese (Mn)	mg/kg	0.095	1.37	0.956	0.985	1.13	0.010	9116089
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	0.106	0.0884	0.114	0.135	0.0040	9116089
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116089
Total (Wet Wt) Phosphorus (P)	mg/kg	2360	2830	2300	2750	2740	2.0	9116089
Total (Wet Wt) Potassium (K)	mg/kg	4760	2880	2710	2790	2710	2.0	9116089
Total (Wet Wt) Selenium (Se)	mg/kg	0.240	0.837	0.780	1.00	0.889	0.010	9116089
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116089
Total (Wet Wt) Sodium (Na)	mg/kg	237	1320	1110	1290	988	2.0	9116089
Total (Wet Wt) Strontium (Sr)	mg/kg	0.013	0.047	0.059	0.078	0.142	0.010	9116089
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00337	0.00417	0.00687	0.00895	0.00777	0.00040	9116089
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116089
Total (Wet Wt) Titanium (Ti)	mg/kg	0.084	0.113	0.087	0.103	0.093	0.020	9116089
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	0.00170	<0.00040	<0.00040	<0.00040	0.00040	9116089
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	0.067	<0.020	0.023	<0.020	0.020	9116089
Total (Wet Wt) Zinc (Zn)	mg/kg	2.66	17.8	14.9	18.5	18.5	0.040	9116089
Mercury (Hg)	mg/kg	0.277 (1)	0.332 (1)	0.104 (1)	0.170 (1)	0.076 (1)	0.010	9116090

<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	80	78	78	77	78	0.30	9116091

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 (1) Detection limits raised due to dilution to bring analyte within the calibrated range.



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH253		XMH254	XMH255	XMH256	XMH257		
Sampling Date		2023/09/20		2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704		794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA5-Liver</b>	<b>QC Batch</b>	<b>WA6-Liver</b>	<b>WA7-Liver</b>	<b>WA8-Liver</b>	<b>WA9-Liver</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg	0.22	9116089	0.29	0.27	0.26	0.27	0.20	9116093
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	9116089	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Arsenic (As)	mg/kg	0.0185	9116089	0.0676	0.0381	0.0201	0.0325	0.0040	9116093
Total (Wet Wt) Barium (Ba)	mg/kg	0.022	9116089	<0.010	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	9116089	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	9116089	0.0012	<0.0010	<0.0010	0.0012	0.0010	9116093
Total (Wet Wt) Boron (B)	mg/kg	<0.20	9116089	<0.20	<0.20	<0.20	<0.20	0.20	9116093
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0644	9116089	0.288	0.112	0.190	0.0535	0.0010	9116093
Total (Wet Wt) Calcium (Ca)	mg/kg	92.6	9116089	73.1	92.8	122	60.0	2.0	9116093
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	9116089	<0.010	<0.010	0.063	<0.010	0.010	9116093
Total (Wet Wt) Cobalt (Co)	mg/kg	0.123	9116089	0.247	0.149	0.0891	0.194	0.0013	9116093
Total (Wet Wt) Copper (Cu)	mg/kg	1.15	9116089	1.46	1.37	1.11	1.21	0.010	9116093
Total (Wet Wt) Iron (Fe)	mg/kg	83.3	9116089	125	141	86.7	99.0	0.25	9116093
Total (Wet Wt) Lead (Pb)	mg/kg	0.0014	9116089	0.0025	0.0022	0.0023	0.0021	0.0010	9116093
Total (Wet Wt) Magnesium (Mg)	mg/kg	149	9116089	164	169	146	153	0.40	9116093
Total (Wet Wt) Manganese (Mn)	mg/kg	1.09	9116089	1.32	1.07	0.776	1.04	0.010	9116093
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.0858	9116089	0.160	0.119	0.0830	0.111	0.0040	9116093
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	9116089	0.010	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Phosphorus (P)	mg/kg	2220	9116089	2530	2550	2260	2380	2.0	9116093
Total (Wet Wt) Potassium (K)	mg/kg	2970	9116089	3180	2810	2840	2780	2.0	9116093
Total (Wet Wt) Selenium (Se)	mg/kg	0.746	9116089	0.834	0.851	0.686	0.764	0.010	9116093
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	9116089	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Sodium (Na)	mg/kg	941	9116089	1020	1140	995	1180	2.0	9116093
Total (Wet Wt) Strontium (Sr)	mg/kg	0.044	9116089	0.037	0.045	0.057	0.029	0.010	9116093
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00752	9116089	0.0119	0.00769	0.00766	0.00839	0.00040	9116093
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	9116089	<0.020	<0.020	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Titanium (Ti)	mg/kg	0.078	9116089	0.077	0.079	0.078	0.085	0.020	9116093
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	9116089	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	9116093
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	9116089	<0.020	<0.020	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Zinc (Zn)	mg/kg	13.6	9116089	18.2	16.8	14.0	16.2	0.040	9116093
Mercury (Hg)	mg/kg	0.101 (1)	9116090	0.131	0.127	0.087	0.089	0.010	9116094

<b>PHYSICAL PROPERTIES</b>									
Moisture-Subcontracted	%	77	9116091	79	77	77	80	0.30	9116095

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 (1) Detection limits raised due to dilution to bring analyte within the calibrated range.





BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397

Report Date: 2023/12/15

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH258	XMH259	XMH260	XMH261	XMH262		
Sampling Date		2023/09/20	2023/09/20	2023/09/21	2023/09/21	2023/09/21		
COC Number		794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>WA10-Liver</b>	<b>WA12-Liver</b>	<b>WA13-Liver</b>	<b>WA14-Liver</b>	<b>WA15-Liver</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	0.33	0.37	0.64	0.36	<0.20	0.20	9116093
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Arsenic (As)	mg/kg	0.0281	0.0320	0.0459	0.0235	<0.0040	0.0040	9116093
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	0.0013	<0.0010	0.0011	<0.0010	0.0010	9116093
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116093
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.303	0.0317	0.199	0.0785	0.0047	0.0010	9116093
Total (Wet Wt) Calcium (Ca)	mg/kg	121	140	125	73.9	10.5	2.0	9116093
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Cobalt (Co)	mg/kg	0.118	0.0581	0.0596	0.133	0.0093	0.0013	9116093
Total (Wet Wt) Copper (Cu)	mg/kg	1.36	1.73	12.2	1.36	0.142	0.010	9116093
Total (Wet Wt) Iron (Fe)	mg/kg	87.9	133	56.9	122	7.45	0.25	9116093
Total (Wet Wt) Lead (Pb)	mg/kg	0.0018	0.0139	0.0019	0.0014	<0.0010	0.0010	9116093
Total (Wet Wt) Magnesium (Mg)	mg/kg	170	188	181	146	15.1	0.40	9116093
Total (Wet Wt) Manganese (Mn)	mg/kg	1.26	1.15	1.38	1.01	0.117	0.010	9116093
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.120	0.125	0.0919	0.108	0.0136	0.0040	9116093
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Phosphorus (P)	mg/kg	2640	2760	2760	2230	257	2.0	9116093
Total (Wet Wt) Potassium (K)	mg/kg	2620	2880	2870	2870	208	2.0	9116093
Total (Wet Wt) Selenium (Se)	mg/kg	0.755	0.916	0.782	0.852	0.075	0.010	9116093
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	0.0303	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Sodium (Na)	mg/kg	1300	1260	1400	1320	113	2.0	9116093
Total (Wet Wt) Strontium (Sr)	mg/kg	0.053	0.068	0.067	0.031	<0.010	0.010	9116093
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00739	0.00889	0.0111	0.00766	0.00085	0.00040	9116093
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Titanium (Ti)	mg/kg	0.101	0.088	0.091	0.064	<0.020	0.020	9116093
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	0.00074	<0.00040	<0.00040	0.00040	9116093
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	0.023	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Zinc (Zn)	mg/kg	17.0	20.3	23.9	15.9	1.69	0.040	9116093
Mercury (Hg)	mg/kg	0.077	0.106	0.097	0.074	0.111	0.010	9116094

<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	80	81	80	80	84	0.30	9116095

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch



RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH263	XMH264	XMH265	XMH266		XMH267		
Sampling Date		2023/09/21	2023/09/20	2023/09/21	2023/09/20		2023/09/20		
COC Number		794704	794704	794704	794704		794704		
	<b>UNITS</b>	<b>WA16-Liver</b>	<b>WA1-G</b>	<b>WA13-G</b>	<b>NP1-L</b>	<b>RDL</b>	<b>NP2-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg	0.26	0.30	<0.20	0.24	0.20	<0.20	0.20	9116093
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Arsenic (As)	mg/kg	0.0397	0.0202	0.0053	0.102	0.0040	0.0112	0.0040	9116093
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.023	<0.010	0.028	0.010	<0.010	0.010	9116093
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	<0.0010	<0.0010	0.0027	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	0.20	<0.20	0.20	9116093
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.222	0.0092	<0.0010	0.0026	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Calcium (Ca)	mg/kg	166	280	35.0	148	2.0	65.4	2.0	9116093
Total (Wet Wt) Chromium (Cr)	mg/kg	0.075	<0.010	<0.010	<0.010	0.010	<0.010	0.010	9116093
Total (Wet Wt) Cobalt (Co)	mg/kg	0.145	0.0507	0.0034	0.0044	0.0013	<0.0013	0.0013	9116093
Total (Wet Wt) Copper (Cu)	mg/kg	1.58	0.573	0.072	0.211	0.010	0.023	0.010	9116093
Total (Wet Wt) Iron (Fe)	mg/kg	152	23.7	3.05	4.74	0.25	<0.25	0.25	9116093
Total (Wet Wt) Lead (Pb)	mg/kg	0.0012	0.0018	<0.0010	0.0011	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Magnesium (Mg)	mg/kg	164	301	25.0	286	0.40	36.3	0.40	9116093
Total (Wet Wt) Manganese (Mn)	mg/kg	1.13	2.79	0.165	0.150	0.010	0.038 (1)	0.010	9116093
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.151	0.0123	<0.0040	<0.0040	0.0040	<0.0040	0.0040	9116093
Total (Wet Wt) Nickel (Ni)	mg/kg	0.053	<0.010	<0.010	<0.010	0.010	<0.010	0.010	9116093
Total (Wet Wt) Phosphorus (P)	mg/kg	2660	2420	237	2150	2.0	311	2.0	9116093
Total (Wet Wt) Potassium (K)	mg/kg	2790	3310	293	3950	2.0	641	2.0	9116093
Total (Wet Wt) Selenium (Se)	mg/kg	0.878	0.491	0.064	0.198	0.010	0.019	0.010	9116093
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Sodium (Na)	mg/kg	1160	971	173	336	2.0	75.6	2.0	9116093
Total (Wet Wt) Strontium (Sr)	mg/kg	0.068	0.045	0.014	0.045	0.010	0.027	0.010	9116093
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00874	0.00429	0.00059	0.00140	0.00040	<0.00040	0.00040	9116093
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	0.020	<0.020	0.020	9116093
Total (Wet Wt) Titanium (Ti)	mg/kg	0.091	0.067	<0.020	0.074	0.020	<0.020	0.020	9116093
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	<0.00040	0.00040	9116093
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	<0.020	<0.020	0.020	<0.020	0.020	9116093
Total (Wet Wt) Zinc (Zn)	mg/kg	18.5	31.4	2.23	3.73	0.040	0.503	0.040	9116093
Mercury (Hg)	mg/kg	0.079	0.059	0.013	0.643	0.010	1.04 (2)	0.050	9116094

PHYSICAL PROPERTIES

Moisture-Subcontracted	%	81	79	77	80	0.30	78	0.30	9116095
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) Duplicate exceeds acceptance criteria due to sample non homogeneity. Reanalysis yields similar results.

(2) Matrix spike non calculable due to high concentration of original analyte.



RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH267			XMH268	XMH269	XMH270		
Sampling Date		2023/09/20			2023/09/20	2023/09/20	2023/09/20		
COC Number		794704			794704	794704	794704		
	UNITS	NP2-L Lab-Dup	RDL	QC Batch	NP3-L	NP4-L	NP5-L	RDL	QC Batch

Metals									
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	0.20	9116093	<0.20	<0.20	<0.20	0.20	9116093
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	0.0010	9116093	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Arsenic (As)	mg/kg	0.0112	0.0040	9116093	0.0177	0.104	0.0914	0.0040	9116093
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.010	9116093	0.015	<0.010	0.013	0.010	9116093
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	0.0010	9116093	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	0.0010	9116093	<0.0010	0.0011	0.0024	0.0010	9116093
Total (Wet Wt) Boron (B)	mg/kg	<0.20	0.20	9116093	<0.20	<0.20	<0.20	0.20	9116093
Total (Wet Wt) Cadmium (Cd)	mg/kg	<0.0010	0.0010	9116093	<0.0010	0.0013	0.0014	0.0010	9116093
Total (Wet Wt) Calcium (Ca)	mg/kg	104	2.0	9116093	169	111	172	2.0	9116093
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	0.010	9116093	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Cobalt (Co)	mg/kg	<0.0013	0.0013	9116093	<0.0013	0.0018	0.0040	0.0013	9116093
Total (Wet Wt) Copper (Cu)	mg/kg	0.017	0.010	9116093	0.014	0.138	0.180	0.010	9116093
Total (Wet Wt) Iron (Fe)	mg/kg	<0.25	0.25	9116093	<0.25	1.45	2.23	0.25	9116093
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	0.0010	9116093	<0.0010	<0.0010	0.0014	0.0010	9116093
Total (Wet Wt) Magnesium (Mg)	mg/kg	38.2	0.40	9116093	35.8	283	251	0.40	9116093
Total (Wet Wt) Manganese (Mn)	mg/kg	0.061 (1)	0.010	9116093	0.134	0.085	0.153	0.010	9116093
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	0.0040	9116093	<0.0040	<0.0040	<0.0040	0.0040	9116093
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	0.010	9116093	<0.010	<0.010	<0.010	0.010	9116093
Total (Wet Wt) Phosphorus (P)	mg/kg	335	2.0	9116093	339	2000	2000	2.0	9116093
Total (Wet Wt) Potassium (K)	mg/kg	663	2.0	9116093	548	3740	3760	2.0	9116093
Total (Wet Wt) Selenium (Se)	mg/kg	0.018	0.010	9116093	0.018	0.144	0.175	0.010	9116093
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	0.0010	9116093	<0.0010	<0.0010	<0.0010	0.0010	9116093
Total (Wet Wt) Sodium (Na)	mg/kg	90.2	2.0	9116093	43.0	330	421	2.0	9116093
Total (Wet Wt) Strontium (Sr)	mg/kg	0.044	0.010	9116093	0.089	0.034	0.074	0.010	9116093
Total (Wet Wt) Thallium (Tl)	mg/kg	<0.00040	0.00040	9116093	<0.00040	0.00177	0.00078	0.00040	9116093
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	0.020	9116093	<0.020	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Titanium (Ti)	mg/kg	<0.020	0.020	9116093	<0.020	0.074	0.071	0.020	9116093
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	0.00040	9116093	0.00046	<0.00040	<0.00040	0.00040	9116093
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	0.020	9116093	<0.020	<0.020	<0.020	0.020	9116093
Total (Wet Wt) Zinc (Zn)	mg/kg	0.451	0.040	9116093	0.431	3.29	4.70	0.040	9116093
Mercury (Hg)	mg/kg	1.16 (2)	0.050	9116094	0.236	0.296	0.467	0.010	9116094

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate  
 (1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.  
 (2) Detection limits raised due to dilution to bring analyte within the calibrated range.



**RESULTS OF ANALYSES OF TISSUE**

Bureau Veritas ID		XMH267			XMH268	XMH269	XMH270		
Sampling Date		2023/09/20			2023/09/20	2023/09/20	2023/09/20		
COC Number		794704			794704	794704	794704		
	<b>UNITS</b>	<b>NP2-L Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP3-L</b>	<b>NP4-L</b>	<b>NP5-L</b>	<b>RDL</b>	<b>QC Batch</b>

**PHYSICAL PROPERTIES**

Moisture-Subcontracted	%				80	79	81	0.30	9116095
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RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH271	XMH272	XMH273			XMH273		
Sampling Date		2023/09/20	2023/09/20	2023/09/20			2023/09/20		
COC Number		794704	794704	794704			794704		
	<b>UNITS</b>	<b>NP6-L</b>	<b>NP7-L</b>	<b>NP8-L</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP8-L Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	0.41	<0.20	0.20	9116093			
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	0.0010	9116093			
Total (Wet Wt) Arsenic (As)	mg/kg	0.121	0.0907	0.0151	0.0040	9116093			
Total (Wet Wt) Barium (Ba)	mg/kg	0.023	0.132	<0.010	0.010	9116093			
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	0.0010	9116093			
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0017	0.0026	<0.0010	0.0010	9116093			
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	0.20	9116093			
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0025	0.0016	<0.0010	0.0010	9116093			
Total (Wet Wt) Calcium (Ca)	mg/kg	244	364	135	2.0	9116093			
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	0.015	<0.010	0.010	9116093			
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0027	0.0040	<0.0013	0.0013	9116093			
Total (Wet Wt) Copper (Cu)	mg/kg	0.127	0.163	0.011	0.010	9116093			
Total (Wet Wt) Iron (Fe)	mg/kg	2.10	2.62	<0.25	0.25	9116093			
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	0.0033	<0.0010	0.0010	9116093			
Total (Wet Wt) Magnesium (Mg)	mg/kg	301	315	41.4	0.40	9116093			
Total (Wet Wt) Manganese (Mn)	mg/kg	0.214	0.378	0.081	0.010	9116093			
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	<0.0040	<0.0040	0.0040	9116093			
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	0.010	9116093			
Total (Wet Wt) Phosphorus (P)	mg/kg	2100	2180	336	2.0	9116093			
Total (Wet Wt) Potassium (K)	mg/kg	3770	3930	669	2.0	9116093			
Total (Wet Wt) Selenium (Se)	mg/kg	0.202	0.184	0.020	0.010	9116093			
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	<0.0010	0.0010	9116093			
Total (Wet Wt) Sodium (Na)	mg/kg	406	333	75.0	2.0	9116093			
Total (Wet Wt) Strontium (Sr)	mg/kg	0.124	0.181	0.062	0.010	9116093			
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00155	0.00111	0.00047	0.00040	9116093			
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	0.020	9116093			
Total (Wet Wt) Titanium (Ti)	mg/kg	0.060	0.082	<0.020	0.020	9116093			
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	0.00040	9116093			
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	<0.020	0.020	9116093			
Total (Wet Wt) Zinc (Zn)	mg/kg	3.37	4.52	0.467	0.040	9116093			
Mercury (Hg)	mg/kg	0.459	0.281	0.325	0.010	9116094			

<b>PHYSICAL PROPERTIES</b>									
Moisture-Subcontracted	%	80	79	79	0.30	9116095	79	0.30	9116095

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate



RESULTS OF ANALYSES OF TISSUE

Table with 11 columns: Bureau Veritas ID, Sampling Date, COC Number, UNITS, NP9-L, RDL, QC Batch, NP9-L Lab-Dup, RDL, QC Batch, NP10-L, RDL, QC Batch. Rows include XMH274 and XMH275 data for 2023/09/20.

Table titled 'Metals' with 11 columns: Element, Unit, Value 1, RDL 1, QC Batch 1, Value 2, RDL 2, QC Batch 2, Value 3, RDL 3, QC Batch 3. Lists 33 elements including Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Uranium, Vanadium, and Zinc.

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate  
(1) Duplicate exceeds acceptance criteria due to sample non homogeneity. Reanalysis yields similar results.  
(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.  
(3) Matrix spike non calculable due to high concentration of original analyte.



**BUREAU  
VERITAS**

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH274			XMH274			XMH275		
Sampling Date		2023/09/20			2023/09/20			2023/09/20		
COC Number		794704			794704			794704		
	<b>UNITS</b>	<b>NP9-L</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP9-L Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP10-L</b>	<b>RDL</b>	<b>QC Batch</b>

#### PHYSICAL PROPERTIES

Moisture-Subcontracted	%	79	0.30	9116099				79	0.30	9116099
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RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate



**RESULTS OF ANALYSES OF TISSUE**

Bureau Veritas ID		XMH275			XMH276	XMH277	XMH278		
Sampling Date		2023/09/20			2023/09/20	2023/09/20	2023/09/20		
COC Number		794704			794704	794704	794704		
	<b>UNITS</b>	<b>NP10-L Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP11-L</b>	<b>NP12-L</b>	<b>NP13-L</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg				<0.20	0.46	<0.20	0.20	9116097
Total (Wet Wt) Antimony (Sb)	mg/kg				<0.0010	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Arsenic (As)	mg/kg				0.0756	0.0802	0.0520	0.0040	9116097
Total (Wet Wt) Barium (Ba)	mg/kg				0.061	0.046	0.077	0.010	9116097
Total (Wet Wt) Beryllium (Be)	mg/kg				<0.0010	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Bismuth (Bi)	mg/kg				0.0031	0.0024	0.0019	0.0010	9116097
Total (Wet Wt) Boron (B)	mg/kg				<0.20	<0.20	<0.20	0.20	9116097
Total (Wet Wt) Cadmium (Cd)	mg/kg				0.0015	0.0012	0.0011	0.0010	9116097
Total (Wet Wt) Calcium (Ca)	mg/kg				795	593	765	2.0	9116097
Total (Wet Wt) Chromium (Cr)	mg/kg				<0.010	0.081	<0.010	0.010	9116097
Total (Wet Wt) Cobalt (Co)	mg/kg				0.0028	0.0040	0.0028	0.0013	9116097
Total (Wet Wt) Copper (Cu)	mg/kg				0.127	0.121	0.122	0.010	9116097
Total (Wet Wt) Iron (Fe)	mg/kg				1.79	2.70	1.93	0.25	9116097
Total (Wet Wt) Lead (Pb)	mg/kg				0.0024	0.0038	0.0033	0.0010	9116097
Total (Wet Wt) Magnesium (Mg)	mg/kg				354	296	315	0.40	9116097
Total (Wet Wt) Manganese (Mn)	mg/kg				0.720	0.515	0.835	0.010	9116097
Total (Wet Wt) Molybdenum (Mo)	mg/kg				<0.0040	<0.0040	<0.0040	0.0040	9116097
Total (Wet Wt) Nickel (Ni)	mg/kg				<0.010	<0.010	<0.010	0.010	9116097
Total (Wet Wt) Phosphorus (P)	mg/kg				2620	2240	2440	2.0	9116097
Total (Wet Wt) Potassium (K)	mg/kg				4190	3810	4000	2.0	9116097
Total (Wet Wt) Selenium (Se)	mg/kg				0.186	0.167	0.155	0.010	9116097
Total (Wet Wt) Silver (Ag)	mg/kg				<0.0010	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Sodium (Na)	mg/kg				398	297	296	2.0	9116097
Total (Wet Wt) Strontium (Sr)	mg/kg				0.363	0.286	0.398	0.010	9116097
Total (Wet Wt) Thallium (Tl)	mg/kg				0.00169	0.00152	0.00163	0.00040	9116097
Total (Wet Wt) Tin (Sn)	mg/kg				<0.020	<0.020	<0.020	0.020	9116097
Total (Wet Wt) Titanium (Ti)	mg/kg				0.071	0.095	0.071	0.020	9116097
Total (Wet Wt) Uranium (U)	mg/kg				<0.00040	<0.00040	<0.00040	0.00040	9116097
Total (Wet Wt) Vanadium (V)	mg/kg				<0.020	<0.020	<0.020	0.020	9116097
Total (Wet Wt) Zinc (Zn)	mg/kg				4.77	4.76	4.74	0.040	9116097
Mercury (Hg)	mg/kg				0.357	0.247	0.312	0.010	9116098

<b>PHYSICAL PROPERTIES</b>									
Moisture-Subcontracted	%	78	0.30	9116099	79	80	80	0.30	9116099

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate





BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH279	XMH280	XMH281	XMH282	XMH283	XMH284		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704	794704		
	<b>UNITS</b>	<b>NP14-L</b>	<b>NP15-L</b>	<b>NP1-LIVER</b>	<b>NP2-LIVER</b>	<b>NP3-LIVER</b>	<b>NP4-LIVER</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg	0.29	<0.20	2.16	2.05	1.09	1.74	0.20	9116097
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	0.0045	0.0019	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Arsenic (As)	mg/kg	0.107	0.0837	0.0622	0.0171	0.0367	0.0336	0.0040	9116097
Total (Wet Wt) Barium (Ba)	mg/kg	0.063	<0.010	0.014	<0.010	0.010	<0.010	0.010	9116097
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0023	0.0021	0.0117	0.0063	0.0049	0.0045	0.0010	9116097
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116097
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0015	0.0011	0.501	0.100	0.142	0.101	0.0010	9116097
Total (Wet Wt) Calcium (Ca)	mg/kg	906	153	51.9	48.8	70.2	46.6	2.0	9116097
Total (Wet Wt) Chromium (Cr)	mg/kg	0.163	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9116097
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0034	0.0028	0.0980	0.125	0.0437	0.0413	0.0013	9116097
Total (Wet Wt) Copper (Cu)	mg/kg	0.127	0.131	34.7	14.9	26.8	23.5	0.010	9116097
Total (Wet Wt) Iron (Fe)	mg/kg	3.14	1.57	255	39.1	41.7	140	0.25	9116097
Total (Wet Wt) Lead (Pb)	mg/kg	0.0027	<0.0010	0.0088	0.0027	0.0028	0.0017	0.0010	9116097
Total (Wet Wt) Magnesium (Mg)	mg/kg	322	303	135	159	176	170	0.40	9116097
Total (Wet Wt) Manganese (Mn)	mg/kg	0.891	0.135	2.05	0.813	1.22	1.25	0.010	9116097
Total (Wet Wt) Molybdenum (Mo)	mg/kg	<0.0040	<0.0040	0.232	0.115	0.136	0.131	0.0040	9116097
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	0.050	0.022	0.015	0.015	0.010	9116097
Total (Wet Wt) Phosphorus (P)	mg/kg	2510	2160	2320	2630	2910	2840	2.0	9116097
Total (Wet Wt) Potassium (K)	mg/kg	4040	4170	2500	2700	2880	3070	2.0	9116097
Total (Wet Wt) Selenium (Se)	mg/kg	0.185	0.166	2.30	1.54	1.92	2.45	0.010	9116097
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	<0.0010	0.224	0.0671	0.177	0.144	0.0010	9116097
Total (Wet Wt) Sodium (Na)	mg/kg	360	271	1190	1050	1030	1010	2.0	9116097
Total (Wet Wt) Strontium (Sr)	mg/kg	0.383	0.054	0.041	0.025	0.047	0.029	0.010	9116097
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00247	0.00210	0.00204	0.00146	0.00193	0.00165	0.00040	9116097
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	9116097
Total (Wet Wt) Titanium (Ti)	mg/kg	0.079	0.073	0.092	0.094	0.094	0.091	0.020	9116097
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	0.00087	0.00187	0.00050	0.00066	0.00040	9116097
Total (Wet Wt) Vanadium (V)	mg/kg	<0.020	<0.020	0.572	0.430	0.259	0.321	0.020	9116097
Total (Wet Wt) Zinc (Zn)	mg/kg	6.26	4.23	45.1	39.0	45.2	36.7	0.040	9116097
Mercury (Hg)	mg/kg	0.288	0.289	0.376	0.488	0.144	0.178	0.010	9116098

<b>PHYSICAL PROPERTIES</b>									
Moisture-Subcontracted	%	80	78	73	78	77	75	0.30	9116099

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397

Report Date: 2023/12/15

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH285	XMH286	XMH287	XMH288	XMH289		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704	794704		
	UNITS	NP5-LIVER	NP6-LIVER	NP7-LIVER	NP8-LIVER	NP9-LIVER	RDL	QC Batch
<b>Metals</b>								
Total (Wet Wt) Aluminum (Al)	mg/kg	0.94	2.28	0.63	1.32	1.45	0.20	9116097
Total (Wet Wt) Antimony (Sb)	mg/kg	0.0017	0.0021	0.0018	<0.0010	0.0011	0.0010	9116097
Total (Wet Wt) Arsenic (As)	mg/kg	0.0430	0.0616	0.0338	0.0264	0.0671	0.0040	9116097
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	<0.010	0.020	0.012	<0.010	0.010	9116097
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116097
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0055	0.0081	0.0047	0.0035	0.0067	0.0010	9116097
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9116097
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0772	0.393	0.101	0.117	0.284	0.0010	9116097
Total (Wet Wt) Calcium (Ca)	mg/kg	66.2	44.1	62.5	92.4	50.3	2.0	9116097
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	0.013	<0.010	<0.010	<0.010	0.010	9116097
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0780	0.0699	0.0554	0.0329	0.0694	0.0013	9116097
Total (Wet Wt) Copper (Cu)	mg/kg	43.2	33.1	30.3	20.6	49.5	0.010	9116097
Total (Wet Wt) Iron (Fe)	mg/kg	36.1	258	62.3	29.3	399	0.25	9116097
Total (Wet Wt) Lead (Pb)	mg/kg	0.0056	0.0048	0.0042	0.0016	0.0056	0.0010	9116097
Total (Wet Wt) Magnesium (Mg)	mg/kg	183	149	147	154	146	0.40	9116097
Total (Wet Wt) Manganese (Mn)	mg/kg	1.43	1.37	1.45	0.815	1.51	0.010	9116097
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.181	0.263	0.199	0.115	0.215	0.0040	9116097
Total (Wet Wt) Nickel (Ni)	mg/kg	0.023	0.025	0.022	0.018	0.024	0.010	9116097
Total (Wet Wt) Phosphorus (P)	mg/kg	2830	2490	2370	2480	2300	2.0	9116097
Total (Wet Wt) Potassium (K)	mg/kg	2620	2420	2760	2480	2260	2.0	9116097
Total (Wet Wt) Selenium (Se)	mg/kg	1.91	2.01	1.87	2.36	1.99	0.010	9116097
Total (Wet Wt) Silver (Ag)	mg/kg	0.218	0.240	0.260	0.0660	0.248	0.0010	9116097
Total (Wet Wt) Sodium (Na)	mg/kg	1230	1070	958	794	1200	2.0	9116097
Total (Wet Wt) Strontium (Sr)	mg/kg	0.038	0.046	0.039	0.044	0.044	0.010	9116097
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00172	0.00223	0.00183	0.00293	0.00221	0.00040	9116097
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	0.021	0.020	9116097
Total (Wet Wt) Titanium (Ti)	mg/kg	0.095	0.084	0.082	0.076	0.081	0.020	9116097
Total (Wet Wt) Uranium (U)	mg/kg	0.00097	0.00040	<0.00040	0.00065	<0.00040	0.00040	9116097
Total (Wet Wt) Vanadium (V)	mg/kg	0.303	0.348	0.201	0.168	0.255	0.020	9116097
Total (Wet Wt) Zinc (Zn)	mg/kg	55.1	46.3	45.1	43.3	60.5	0.040	9116097
Mercury (Hg)	mg/kg	0.226	0.330	0.177	0.167	0.285	0.010	9116098
<b>PHYSICAL PROPERTIES</b>								
Moisture-Subcontracted	%	80	68	76	74	75	0.30	9116099
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397  
Report Date: 2023/12/15

EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH290	XMH291	XMH292	XMH293		XMH294		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20		2023/09/20		
COC Number		794704	794704	794704	794704		794704		
	<b>UNITS</b>	<b>NP10-LIVER</b>	<b>NP11-LIVER</b>	<b>NP12-LIVER</b>	<b>NP13-LIVER</b>	<b>QC Batch</b>	<b>NP14-LIVER</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Total (Wet Wt) Aluminum (Al)	mg/kg	0.51	1.44	0.58	1.09	9116097	0.51	0.20	9116100
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	0.0021	<0.0010	0.0015	9116097	0.0013	0.0010	9116100
Total (Wet Wt) Arsenic (As)	mg/kg	0.0219	0.0400	0.0304	0.0280	9116097	0.0522	0.0040	9116100
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	<0.010	0.015	<0.010	9116097	<0.010	0.010	9116100
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	9116097	<0.0010	0.0010	9116100
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0041	0.0078	0.0031	0.0035	9116097	0.0048	0.0010	9116100
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	9116097	<0.20	0.20	9116100
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0904	0.121	0.0352	0.0688	9116097	0.0811	0.0010	9116100
Total (Wet Wt) Calcium (Ca)	mg/kg	30.7	39.3	78.0	45.2	9116097	67.3	2.0	9116100
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	9116097	0.102	0.010	9116100
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0356	0.0622	0.0463	0.0777	9116097	0.0563	0.0013	9116100
Total (Wet Wt) Copper (Cu)	mg/kg	20.9	29.8	24.4	33.4	9116097	38.7	0.010	9116100
Total (Wet Wt) Iron (Fe)	mg/kg	86.7	122	95.4	328	9116097	116	0.25	9116100
Total (Wet Wt) Lead (Pb)	mg/kg	0.0012	0.0039	0.0081	0.0091	9116097	0.0043	0.0010	9116100
Total (Wet Wt) Magnesium (Mg)	mg/kg	144	148	188	152	9116097	162	0.40	9116100
Total (Wet Wt) Manganese (Mn)	mg/kg	0.730	1.04	1.38	1.05	9116097	1.29	0.010	9116100
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.112	0.190	0.161	0.205	9116097	0.210	0.0040	9116100
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	0.021	0.015	0.023	9116097	0.076	0.010	9116100
Total (Wet Wt) Phosphorus (P)	mg/kg	2230	2280	2760	2440	9116097	2680	2.0	9116100
Total (Wet Wt) Potassium (K)	mg/kg	2520	2610	2890	2700	9116097	2780	2.0	9116100
Total (Wet Wt) Selenium (Se)	mg/kg	2.18	2.24	1.51	2.34	9116097	1.92	0.010	9116100
Total (Wet Wt) Silver (Ag)	mg/kg	0.0916	0.234	0.0988	0.194	9116097	0.258	0.0010	9116100
Total (Wet Wt) Sodium (Na)	mg/kg	770	846	1050	835	9116097	882	2.0	9116100
Total (Wet Wt) Strontium (Sr)	mg/kg	0.017	0.026	0.045	0.027	9116097	0.045	0.010	9116100
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00199	0.00169	0.00218	0.00219	9116097	0.00376	0.00040	9116100
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	9116097	<0.020	0.020	9116100
Total (Wet Wt) Titanium (Ti)	mg/kg	0.080	0.077	0.085	0.102	9116097	0.089	0.020	9116100
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	9116097	0.00047	0.00040	9116100
Total (Wet Wt) Vanadium (V)	mg/kg	0.088	0.306	0.150	0.134	9116097	0.128	0.020	9116100
Total (Wet Wt) Zinc (Zn)	mg/kg	38.0	39.0	44.1	41.5	9116097	46.6	0.040	9116100
Mercury (Hg)	mg/kg	0.172	0.158	0.087	0.134	9116098	0.139 (1)	0.010	9116101

#### PHYSICAL PROPERTIES

Moisture-Subcontracted	%	71	67	76	68	9116099	74	0.30	9104403
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) Detection limits raised due to dilution to bring analyte within the calibrated range.



RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH295		XMH296			XMH296		
Sampling Date		2023/09/20		2023/09/20			2023/09/20		
COC Number		794704		794704			794704		
	UNITS	NP15-LIVER	RDL	NP2-G	RDL	QC Batch	NP2-G Lab-Dup	RDL	QC Batch

Metals									
Total (Wet Wt) Aluminum (Al)	mg/kg	0.73	0.20	0.33	0.20	9116100	0.30	0.20	9116100
Total (Wet Wt) Antimony (Sb)	mg/kg	0.0010	0.0010	<0.0010	0.0010	9116100	<0.0010	0.0010	9116100
Total (Wet Wt) Arsenic (As)	mg/kg	0.0320	0.0040	0.0235	0.0040	9116100	0.0236	0.0040	9116100
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	0.010	0.012	0.010	9116100	<0.010	0.010	9116100
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	0.0010	<0.0010	0.0010	9116100	<0.0010	0.0010	9116100
Total (Wet Wt) Bismuth (Bi)	mg/kg	0.0037	0.0010	<0.0010	0.0010	9116100	<0.0010	0.0010	9116100
Total (Wet Wt) Boron (B)	mg/kg	<0.20	0.20	<0.20	0.20	9116100	<0.20	0.20	9116100
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0591	0.0010	0.0055	0.0010	9116100	0.0057	0.0010	9116100
Total (Wet Wt) Calcium (Ca)	mg/kg	34.5	2.0	172	2.0	9116100	98.8	2.0	9116100
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	0.010	<0.010	0.010	9116100	<0.010	0.010	9116100
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0483	0.0013	0.0225	0.0013	9116100	0.0217	0.0013	9116100
Total (Wet Wt) Copper (Cu)	mg/kg	33.3	0.010	0.849	0.010	9116100	0.818	0.010	9116100
Total (Wet Wt) Iron (Fe)	mg/kg	188	0.25	28.1	0.25	9116100	27.0	0.25	9116100
Total (Wet Wt) Lead (Pb)	mg/kg	0.0020	0.0010	0.0012	0.0010	9116100	<0.0010	0.0010	9116100
Total (Wet Wt) Magnesium (Mg)	mg/kg	127	0.40	211	0.40	9116100	203	0.40	9116100
Total (Wet Wt) Manganese (Mn)	mg/kg	0.913	0.010	16.7	0.010	9116100	14.5	0.010	9116100
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.173	0.0040	0.0238	0.0040	9116100	0.0224	0.0040	9116100
Total (Wet Wt) Nickel (Ni)	mg/kg	0.013	0.010	0.046 (1)	0.010	9116100	0.018 (2)	0.010	9116100
Total (Wet Wt) Phosphorus (P)	mg/kg	2200	2.0	2750	2.0	9116100	2620	2.0	9116100
Total (Wet Wt) Potassium (K)	mg/kg	2220	2.0	3770	2.0	9116100	3670	2.0	9116100
Total (Wet Wt) Selenium (Se)	mg/kg	2.05	0.010	0.594	0.010	9116100	0.568	0.010	9116100
Total (Wet Wt) Silver (Ag)	mg/kg	0.140	0.0010	<0.0010	0.0010	9116100	<0.0010	0.0010	9116100
Total (Wet Wt) Sodium (Na)	mg/kg	798	2.0	893	2.0	9116100	876	2.0	9116100
Total (Wet Wt) Strontium (Sr)	mg/kg	0.024	0.010	0.059 (1)	0.010	9116100	0.032 (2)	0.010	9116100
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00281	0.00040	0.00323	0.00040	9116100	0.00308	0.00040	9116100
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	0.020	<0.020	0.020	9116100	<0.020	0.020	9116100
Total (Wet Wt) Titanium (Ti)	mg/kg	0.078	0.020	0.089	0.020	9116100	0.085	0.020	9116100
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	0.00040	<0.00040	0.00040	9116100	<0.00040	0.00040	9116100
Total (Wet Wt) Vanadium (V)	mg/kg	0.184	0.020	0.025	0.020	9116100	0.024	0.020	9116100
Total (Wet Wt) Zinc (Zn)	mg/kg	44.1	0.040	57.7	0.040	9116100	54.4	0.040	9116100
Mercury (Hg)	mg/kg	0.110 (3)	0.010	0.0847	0.0010	9116101	0.0866	0.0010	9116101

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate  
 (1) Duplicate exceeds acceptance criteria due to sample non homogeneity. Reanalysis yields similar results.  
 (2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.  
 (3) Detection limits raised due to dilution to bring analyte within the calibrated range



**RESULTS OF ANALYSES OF TISSUE**

Bureau Veritas ID		XMH295		XMH296			XMH296		
Sampling Date		2023/09/20		2023/09/20			2023/09/20		
COC Number		794704		794704			794704		
	<b>UNITS</b>	<b>NP15-LIVER</b>	<b>RDL</b>	<b>NP2-G</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP2-G Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>

<b>PHYSICAL PROPERTIES</b>									
Moisture-Subcontracted	%	58	0.30	84	0.30	9104403			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate									



RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH297				XMH297				XMH298		
Sampling Date		2023/09/20				2023/09/20				2023/09/20		
COC Number		794704				794704				794704		
	<b>UNITS</b>	<b>NP3-G</b>	<b>RDL</b>	<b>QC Batch</b>		<b>NP3-G Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>NP4-G</b>	<b>RDL</b>	<b>QC Batch</b>	

<b>Metals</b>											
Total (Wet Wt) Aluminum (Al)	mg/kg	0.21	0.20	9116100					0.52	0.20	9116100
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	0.0010	9116100					<0.0010	0.0010	9116100
Total (Wet Wt) Arsenic (As)	mg/kg	0.0416	0.0040	9116100					0.0362	0.0040	9116100
Total (Wet Wt) Barium (Ba)	mg/kg	0.073	0.010	9116100					0.010	0.010	9116100
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	0.0010	9116100					<0.0010	0.0010	9116100
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	0.0010	9116100					<0.0010	0.0010	9116100
Total (Wet Wt) Boron (B)	mg/kg	<0.20	0.20	9116100					<0.20	0.20	9116100
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0100	0.0010	9116100					0.0093	0.0010	9116100
Total (Wet Wt) Calcium (Ca)	mg/kg	212	2.0	9116100					91.9	2.0	9116100
Total (Wet Wt) Chromium (Cr)	mg/kg	0.030	0.010	9116100					0.033	0.010	9116100
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0496	0.0013	9116100					0.0517	0.0013	9116100
Total (Wet Wt) Copper (Cu)	mg/kg	1.21	0.010	9116100					0.850	0.010	9116100
Total (Wet Wt) Iron (Fe)	mg/kg	56.8	0.25	9116100					42.3	0.25	9116100
Total (Wet Wt) Lead (Pb)	mg/kg	0.0016	0.0010	9116100					0.0032	0.0010	9116100
Total (Wet Wt) Magnesium (Mg)	mg/kg	249	0.40	9116100					191	0.40	9116100
Total (Wet Wt) Manganese (Mn)	mg/kg	39.8	0.010	9116100					17.3	0.010	9116100
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.0493	0.0040	9116100					0.0201	0.0040	9116100
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	0.010	9116100					<0.010	0.010	9116100
Total (Wet Wt) Phosphorus (P)	mg/kg	2680	2.0	9116100					2690	2.0	9116100
Total (Wet Wt) Potassium (K)	mg/kg	3360	2.0	9116100					3940	2.0	9116100
Total (Wet Wt) Selenium (Se)	mg/kg	1.51	0.010	9116100					0.805	0.010	9116100
Total (Wet Wt) Silver (Ag)	mg/kg	<0.0010	0.0010	9116100					<0.0010	0.0010	9116100
Total (Wet Wt) Sodium (Na)	mg/kg	780	2.0	9116100					860	2.0	9116100
Total (Wet Wt) Strontium (Sr)	mg/kg	0.171	0.010	9116100					0.040	0.010	9116100
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00267	0.00040	9116100					0.00336	0.00040	9116100
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	0.020	9116100					<0.020	0.020	9116100
Total (Wet Wt) Titanium (Ti)	mg/kg	0.078	0.020	9116100					0.082	0.020	9116100
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	0.00040	9116100					<0.00040	0.00040	9116100
Total (Wet Wt) Vanadium (V)	mg/kg	0.023	0.020	9116100					0.045	0.020	9116100
Total (Wet Wt) Zinc (Zn)	mg/kg	67.1	0.040	9116100					45.2	0.040	9116100
Mercury (Hg)	mg/kg	0.0344	0.0010	9116101					0.0517	0.0010	9116101

<b>PHYSICAL PROPERTIES</b>										
Moisture-Subcontracted	%	80	0.30	9104403	79	0.30	9104403	83	0.30	9104403

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate



BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397

Report Date: 2023/12/15

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

### RESULTS OF ANALYSES OF TISSUE

Bureau Veritas ID		XMH299	XMH300	XMH301	XMH302		
Sampling Date		2023/09/20	2023/09/20	2023/09/20	2023/09/20		
COC Number		794704	794704	794704	794704		
	UNITS	NP5-G	NP8-G	NP10-G	NP12-G	RDL	QC Batch
<b>Metals</b>							
Total (Wet Wt) Aluminum (Al)	mg/kg	<0.20	<0.20	0.36	0.21	0.20	9116100
Total (Wet Wt) Antimony (Sb)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116100
Total (Wet Wt) Arsenic (As)	mg/kg	0.0309	0.0361	0.0309	0.0240	0.0040	9116100
Total (Wet Wt) Barium (Ba)	mg/kg	<0.010	<0.010	0.027	0.021	0.010	9116100
Total (Wet Wt) Beryllium (Be)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116100
Total (Wet Wt) Bismuth (Bi)	mg/kg	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	9116100
Total (Wet Wt) Boron (B)	mg/kg	<0.20	<0.20	<0.20	<0.20	0.20	9116100
Total (Wet Wt) Cadmium (Cd)	mg/kg	0.0081	0.0108	0.0086	0.0069	0.0010	9116100
Total (Wet Wt) Calcium (Ca)	mg/kg	129	91.5	96.4	139	2.0	9116100
Total (Wet Wt) Chromium (Cr)	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	9116100
Total (Wet Wt) Cobalt (Co)	mg/kg	0.0661	0.0309	0.0460	0.0595	0.0013	9116100
Total (Wet Wt) Copper (Cu)	mg/kg	1.11	0.913	0.953	1.23	0.010	9116100
Total (Wet Wt) Iron (Fe)	mg/kg	41.6	35.5	48.6	64.6	0.25	9116100
Total (Wet Wt) Lead (Pb)	mg/kg	<0.0010	<0.0010	0.0024	0.0070	0.0010	9116100
Total (Wet Wt) Magnesium (Mg)	mg/kg	209	196	216	223	0.40	9116100
Total (Wet Wt) Manganese (Mn)	mg/kg	35.3	16.9	18.7	34.8	0.010	9116100
Total (Wet Wt) Molybdenum (Mo)	mg/kg	0.0449	0.0163	0.0221	0.0599	0.0040	9116100
Total (Wet Wt) Nickel (Ni)	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	9116100
Total (Wet Wt) Phosphorus (P)	mg/kg	2670	2660	2840	2680	2.0	9116100
Total (Wet Wt) Potassium (K)	mg/kg	3480	3800	3790	3840	2.0	9116100
Total (Wet Wt) Selenium (Se)	mg/kg	0.830	0.674	0.899	1.30	0.010	9116100
Total (Wet Wt) Silver (Ag)	mg/kg	0.0011	<0.0010	0.0011	0.0010	0.0010	9116100
Total (Wet Wt) Sodium (Na)	mg/kg	936	878	827	606	2.0	9116100
Total (Wet Wt) Strontium (Sr)	mg/kg	0.061	0.034	0.037	0.063	0.010	9116100
Total (Wet Wt) Thallium (Tl)	mg/kg	0.00173	0.00481	0.00392	0.00243	0.00040	9116100
Total (Wet Wt) Tin (Sn)	mg/kg	<0.020	<0.020	<0.020	<0.020	0.020	9116100
Total (Wet Wt) Titanium (Ti)	mg/kg	0.089	0.087	0.105	0.092	0.020	9116100
Total (Wet Wt) Uranium (U)	mg/kg	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	9116100
Total (Wet Wt) Vanadium (V)	mg/kg	0.031	<0.020	<0.020	0.035	0.020	9116100
Total (Wet Wt) Zinc (Zn)	mg/kg	49.9	55.9	66.5	58.5	0.040	9116100
Mercury (Hg)	mg/kg	0.0628	0.0453	0.0597	0.0291	0.0010	9116101
<b>PHYSICAL PROPERTIES</b>							
Moisture-Subcontracted	%	84	84	82	82	0.30	9104403
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							



### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	-3.3°C
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**Results relate only to the items tested.**





BUREAU  
VERITAS

Bureau Veritas Job #: C3Y3397

Report Date: 2023/12/15

### QUALITY ASSURANCE REPORT

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9104403	Moisture-Subcontracted	2023/12/08							1.6	20		
9116089	Total (Wet Wt) Aluminum (Al)	2023/12/10	77	75 - 125	112	75 - 125	<0.20	mg/kg	4.4	40		
9116089	Total (Wet Wt) Antimony (Sb)	2023/12/10	83	75 - 125	103	75 - 125	<0.0010	mg/kg	NC	40	91	75 - 125
9116089	Total (Wet Wt) Arsenic (As)	2023/12/10	84	75 - 125	103	75 - 125	<0.0040	mg/kg	6.3	40	91	75 - 125
9116089	Total (Wet Wt) Barium (Ba)	2023/12/10	78	75 - 125	101	75 - 125	<0.010	mg/kg	NC	40		
9116089	Total (Wet Wt) Beryllium (Be)	2023/12/10	72 (1)	75 - 125	99	75 - 125	<0.0010	mg/kg	NC	40		
9116089	Total (Wet Wt) Bismuth (Bi)	2023/12/10	74 (1)	75 - 125	97	75 - 125	<0.0010	mg/kg	2.0	40		
9116089	Total (Wet Wt) Boron (B)	2023/12/10	79	75 - 125	101	75 - 125	<0.20	mg/kg	NC	40		
9116089	Total (Wet Wt) Cadmium (Cd)	2023/12/10	79	75 - 125	99	75 - 125	<0.0010	mg/kg	27	40	87	75 - 125
9116089	Total (Wet Wt) Calcium (Ca)	2023/12/10	87	75 - 125	110	75 - 125	<2.0	mg/kg	4.2	60	93	75 - 125
9116089	Total (Wet Wt) Chromium (Cr)	2023/12/10	79	75 - 125	103	75 - 125	<0.010	mg/kg	NC	40		
9116089	Total (Wet Wt) Cobalt (Co)	2023/12/10	78	75 - 125	104	75 - 125	<0.0013	mg/kg	NC	40	83	75 - 125
9116089	Total (Wet Wt) Copper (Cu)	2023/12/10	77	75 - 125	104	75 - 125	<0.010	mg/kg	6.3	40	88	75 - 125
9116089	Total (Wet Wt) Iron (Fe)	2023/12/10	69 (1)	75 - 125	114	75 - 125	<0.25	mg/kg	22	40	92	75 - 125
9116089	Total (Wet Wt) Lead (Pb)	2023/12/10	76	75 - 125	97	75 - 125	<0.0010	mg/kg	NC	40	81	75 - 125
9116089	Total (Wet Wt) Magnesium (Mg)	2023/12/10	74 (1)	75 - 125	109	75 - 125	<0.40	mg/kg	4.2	40		
9116089	Total (Wet Wt) Manganese (Mn)	2023/12/10	77	75 - 125	100	75 - 125	<0.010	mg/kg	11	40	85	75 - 125
9116089	Total (Wet Wt) Molybdenum (Mo)	2023/12/10	82	75 - 125	99	75 - 125	<0.0040	mg/kg	NC	40	87	75 - 125
9116089	Total (Wet Wt) Nickel (Ni)	2023/12/10	78	75 - 125	106	75 - 125	<0.010	mg/kg	NC	40		
9116089	Total (Wet Wt) Phosphorus (P)	2023/12/10	113	75 - 125	106	75 - 125	<2.0	mg/kg	3.1	40	89	75 - 125
9116089	Total (Wet Wt) Potassium (K)	2023/12/10	86	75 - 125	110	75 - 125	<2.0	mg/kg	4.0	40	94	75 - 125
9116089	Total (Wet Wt) Selenium (Se)	2023/12/10	91	75 - 125	107	75 - 125	<0.010	mg/kg	3.0	40	93	75 - 125
9116089	Total (Wet Wt) Silver (Ag)	2023/12/10	80	75 - 125	103	75 - 125	<0.0010	mg/kg	NC	40	89	75 - 125
9116089	Total (Wet Wt) Sodium (Na)	2023/12/10	94	75 - 125	112	75 - 125	<2.0	mg/kg	4.6	40	99	75 - 125
9116089	Total (Wet Wt) Strontium (Sr)	2023/12/10	78	75 - 125	97	75 - 125	<0.010	mg/kg	NC	60	91	75 - 125
9116089	Total (Wet Wt) Thallium (Tl)	2023/12/10	78	75 - 125	98	75 - 125	<0.00040	mg/kg	4.4	40	85	75 - 125
9116089	Total (Wet Wt) Tin (Sn)	2023/12/10	78	75 - 125	95	75 - 125	<0.020	mg/kg	NC	40	85	75 - 125
9116089	Total (Wet Wt) Titanium (Ti)	2023/12/10	75	75 - 125	104	75 - 125	<0.020	mg/kg	0.38	40		
9116089	Total (Wet Wt) Uranium (U)	2023/12/10	79	75 - 125	99	75 - 125	<0.00040	mg/kg	NC	40	92	75 - 125
9116089	Total (Wet Wt) Vanadium (V)	2023/12/10	79	75 - 125	103	75 - 125	<0.020	mg/kg	NC	40	83	75 - 125
9116089	Total (Wet Wt) Zinc (Zn)	2023/12/10	86	75 - 125	112	75 - 125	<0.040	mg/kg	6.4	40	89	75 - 125



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### QUALITY ASSURANCE REPORT(CONT'D)

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9116090	Mercury (Hg)	2023/12/13	8.3 (2)	75 - 125	98	75 - 125	<0.0010	mg/kg	0.63	40	65	59 - 141
9116091	Moisture-Subcontracted	2023/12/09							0.74	20		
9116093	Total (Wet Wt) Aluminum (Al)	2023/12/13			104	75 - 125	<0.20	mg/kg	NC	40		
9116093	Total (Wet Wt) Antimony (Sb)	2023/12/13			102	75 - 125	<0.0010	mg/kg	NC	40	78	N/A
9116093	Total (Wet Wt) Arsenic (As)	2023/12/13			97	75 - 125	<0.0040	mg/kg	0.20	40	91	N/A
9116093	Total (Wet Wt) Barium (Ba)	2023/12/13			97	75 - 125	<0.010	mg/kg	NC	40		
9116093	Total (Wet Wt) Beryllium (Be)	2023/12/13			99	75 - 125	<0.0010	mg/kg	NC	40		
9116093	Total (Wet Wt) Bismuth (Bi)	2023/12/13			95	75 - 125	<0.0010	mg/kg	NC	40		
9116093	Total (Wet Wt) Boron (B)	2023/12/13			101	75 - 125	<0.20	mg/kg	NC	40		
9116093	Total (Wet Wt) Cadmium (Cd)	2023/12/13			98	75 - 125	<0.0010	mg/kg	NC	40	91	N/A
9116093	Total (Wet Wt) Calcium (Ca)	2023/12/13			104	75 - 125	<2.0	mg/kg	46	60	94	N/A
9116093	Total (Wet Wt) Chromium (Cr)	2023/12/13			102	75 - 125	<0.010	mg/kg	NC	40		
9116093	Total (Wet Wt) Cobalt (Co)	2023/12/13			103	75 - 125	<0.0013	mg/kg	NC	40	87	N/A
9116093	Total (Wet Wt) Copper (Cu)	2023/12/13			104	75 - 125	<0.010	mg/kg	29	40	93	N/A
9116093	Total (Wet Wt) Iron (Fe)	2023/12/13			113	75 - 125	<0.25	mg/kg	NC	40	99	N/A
9116093	Total (Wet Wt) Lead (Pb)	2023/12/13			96	75 - 125	<0.0010	mg/kg	NC	40	104	N/A
9116093	Total (Wet Wt) Magnesium (Mg)	2023/12/13			105	75 - 125	<0.40	mg/kg	4.9	40		
9116093	Total (Wet Wt) Manganese (Mn)	2023/12/13			99	75 - 125	<0.010	mg/kg	47 (2)	40	88	N/A
9116093	Total (Wet Wt) Molybdenum (Mo)	2023/12/13			99	75 - 125	<0.0040	mg/kg	NC	40	88	N/A
9116093	Total (Wet Wt) Nickel (Ni)	2023/12/13			103	75 - 125	<0.010	mg/kg	NC	40		
9116093	Total (Wet Wt) Phosphorus (P)	2023/12/13			100	75 - 125	<2.0	mg/kg	7.4	40	90	N/A
9116093	Total (Wet Wt) Potassium (K)	2023/12/13			110	75 - 125	<2.0	mg/kg	3.3	40	97	N/A
9116093	Total (Wet Wt) Selenium (Se)	2023/12/13			106	75 - 125	<0.010	mg/kg	2.1	40	100	N/A
9116093	Total (Wet Wt) Silver (Ag)	2023/12/13			101	75 - 125	<0.0010	mg/kg	NC	40	93	N/A
9116093	Total (Wet Wt) Sodium (Na)	2023/12/13			109	75 - 125	<2.0	mg/kg	18	40	104	N/A
9116093	Total (Wet Wt) Strontium (Sr)	2023/12/13			93	75 - 125	<0.010	mg/kg	48	60	87	N/A
9116093	Total (Wet Wt) Thallium (Tl)	2023/12/13			96	75 - 125	<0.00040	mg/kg	NC	40	86	N/A
9116093	Total (Wet Wt) Tin (Sn)	2023/12/13			98	75 - 125	<0.020	mg/kg	NC	40	50	N/A
9116093	Total (Wet Wt) Titanium (Ti)	2023/12/13			100	75 - 125	<0.020	mg/kg	NC	40		
9116093	Total (Wet Wt) Uranium (U)	2023/12/13			100	75 - 125	<0.00040	mg/kg	NC	40	96	N/A
9116093	Total (Wet Wt) Vanadium (V)	2023/12/13			101	75 - 125	<0.020	mg/kg	NC	40	88	N/A



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### QUALITY ASSURANCE REPORT(CONT'D)

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9116093	Total (Wet Wt) Zinc (Zn)	2023/12/13			111	75 - 125	<0.040	mg/kg	11	40	94	N/A
9116094	Mercury (Hg)	2023/12/14	-250 (2)	75 - 125	98	75 - 125	<0.0010	mg/kg	11 (3)	40	64	59 - 141
9116095	Moisture-Subcontracted	2023/12/09							0.13	20		
9116097	Total (Wet Wt) Aluminum (Al)	2023/12/10			97	75 - 125	<0.20	mg/kg	NC	40		
9116097	Total (Wet Wt) Antimony (Sb)	2023/12/10			96	75 - 125	<0.0010	mg/kg	NC	40	86	N/A
9116097	Total (Wet Wt) Arsenic (As)	2023/12/10			95	75 - 125	<0.0040	mg/kg	2.3	40	90	N/A
9116097	Total (Wet Wt) Barium (Ba)	2023/12/10			91	75 - 125	<0.010	mg/kg	36	40		
9116097	Total (Wet Wt) Beryllium (Be)	2023/12/10			91	75 - 125	<0.0010	mg/kg	NC	40		
9116097	Total (Wet Wt) Bismuth (Bi)	2023/12/10			90	75 - 125	<0.0010	mg/kg	4.6	40		
9116097	Total (Wet Wt) Boron (B)	2023/12/10			93	75 - 125	<0.20	mg/kg	NC	40		
9116097	Total (Wet Wt) Cadmium (Cd)	2023/12/10			96	75 - 125	<0.0010	mg/kg	16	40	93	N/A
9116097	Total (Wet Wt) Calcium (Ca)	2023/12/10			98	75 - 125	<2.0	mg/kg	32	60	93	N/A
9116097	Total (Wet Wt) Chromium (Cr)	2023/12/10			97	75 - 125	<0.010	mg/kg	NC	40		
9116097	Total (Wet Wt) Cobalt (Co)	2023/12/10			100	75 - 125	<0.0013	mg/kg	15	40	90	N/A
9116097	Total (Wet Wt) Copper (Cu)	2023/12/10			101	75 - 125	<0.010	mg/kg	18	40	96	N/A
9116097	Total (Wet Wt) Iron (Fe)	2023/12/10			104	75 - 125	<0.25	mg/kg	32	40	101	N/A
9116097	Total (Wet Wt) Lead (Pb)	2023/12/10			92	75 - 125	<0.0010	mg/kg	44 (2)	40	89	N/A
9116097	Total (Wet Wt) Magnesium (Mg)	2023/12/10			104	75 - 125	<0.40	mg/kg	9.6	40		
9116097	Total (Wet Wt) Manganese (Mn)	2023/12/10			95	75 - 125	<0.010	mg/kg	30	40	91	N/A
9116097	Total (Wet Wt) Molybdenum (Mo)	2023/12/10			92	75 - 125	<0.0040	mg/kg	NC	40	89	N/A
9116097	Total (Wet Wt) Nickel (Ni)	2023/12/10			101	75 - 125	<0.010	mg/kg	NC	40		
9116097	Total (Wet Wt) Phosphorus (P)	2023/12/10			94	75 - 125	<2.0	mg/kg	9.3	40	93	N/A
9116097	Total (Wet Wt) Potassium (K)	2023/12/10			115	75 - 125	<2.0	mg/kg	3.9	40	98	N/A
9116097	Total (Wet Wt) Selenium (Se)	2023/12/10			104	75 - 125	<0.010	mg/kg	1.4	40	99	N/A
9116097	Total (Wet Wt) Silver (Ag)	2023/12/10			99	75 - 125	<0.0010	mg/kg	NC	40	95	N/A
9116097	Total (Wet Wt) Sodium (Na)	2023/12/10			104	75 - 125	<2.0	mg/kg	6.3	40	108	N/A
9116097	Total (Wet Wt) Strontium (Sr)	2023/12/10			87	75 - 125	<0.010	mg/kg	27	60	88	N/A
9116097	Total (Wet Wt) Thallium (Tl)	2023/12/10			93	75 - 125	<0.00040	mg/kg	4.5	40	88	N/A
9116097	Total (Wet Wt) Tin (Sn)	2023/12/10			95	75 - 125	<0.020	mg/kg	NC	40	83	N/A
9116097	Total (Wet Wt) Titanium (Ti)	2023/12/10			100	75 - 125	<0.020	mg/kg	15	40		
9116097	Total (Wet Wt) Uranium (U)	2023/12/10			97	75 - 125	<0.00040	mg/kg	NC	40	92	N/A



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### QUALITY ASSURANCE REPORT(CONT'D)

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9116097	Total (Wet Wt) Vanadium (V)	2023/12/10			97	75 - 125	<0.020	mg/kg	NC	40	90	N/A
9116097	Total (Wet Wt) Zinc (Zn)	2023/12/10			110	75 - 125	<0.040	mg/kg	14	40	96	N/A
9116098	Mercury (Hg)	2023/12/13	1730 (2)	75 - 125	92	75 - 125	<0.0010	mg/kg	24	40	61	59 - 141
9116099	Moisture-Subcontracted	2023/12/09							0.76	20		
9116100	Total (Wet Wt) Aluminum (Al)	2023/12/10			107	75 - 125	<0.20	mg/kg	11	40		
9116100	Total (Wet Wt) Antimony (Sb)	2023/12/10			102	75 - 125	<0.0010	mg/kg	NC	40	103	N/A
9116100	Total (Wet Wt) Arsenic (As)	2023/12/10			100	75 - 125	<0.0040	mg/kg	0.47	40	96	N/A
9116100	Total (Wet Wt) Barium (Ba)	2023/12/10			100	75 - 125	<0.010	mg/kg	16	40		
9116100	Total (Wet Wt) Beryllium (Be)	2023/12/10			101	75 - 125	<0.0010	mg/kg	NC	40		
9116100	Total (Wet Wt) Bismuth (Bi)	2023/12/10			98	75 - 125	<0.0010	mg/kg	NC	40		
9116100	Total (Wet Wt) Boron (B)	2023/12/10			104	75 - 125	<0.20	mg/kg	NC	40		
9116100	Total (Wet Wt) Cadmium (Cd)	2023/12/10			97	75 - 125	<0.0010	mg/kg	3.7	40	91	N/A
9116100	Total (Wet Wt) Calcium (Ca)	2023/12/10			111	75 - 125	<2.0	mg/kg	54	60	94	N/A
9116100	Total (Wet Wt) Chromium (Cr)	2023/12/10			99	75 - 125	<0.010	mg/kg	NC	40		
9116100	Total (Wet Wt) Cobalt (Co)	2023/12/10			101	75 - 125	<0.0013	mg/kg	3.8	40	83	N/A
9116100	Total (Wet Wt) Copper (Cu)	2023/12/10			101	75 - 125	<0.010	mg/kg	3.8	40	88	N/A
9116100	Total (Wet Wt) Iron (Fe)	2023/12/10			108	75 - 125	<0.25	mg/kg	4.3	40	95	N/A
9116100	Total (Wet Wt) Lead (Pb)	2023/12/10			97	75 - 125	<0.0010	mg/kg	21	40	91	N/A
9116100	Total (Wet Wt) Magnesium (Mg)	2023/12/10			109	75 - 125	<0.40	mg/kg	4.0	40		
9116100	Total (Wet Wt) Manganese (Mn)	2023/12/10			99	75 - 125	<0.010	mg/kg	14	40	87	N/A
9116100	Total (Wet Wt) Molybdenum (Mo)	2023/12/10			100	75 - 125	<0.0040	mg/kg	6.1	40	98	N/A
9116100	Total (Wet Wt) Nickel (Ni)	2023/12/10			101	75 - 125	<0.010	mg/kg	87 (2)	40		
9116100	Total (Wet Wt) Phosphorus (P)	2023/12/10			109	75 - 125	<2.0	mg/kg	5.0	40	93	N/A
9116100	Total (Wet Wt) Potassium (K)	2023/12/10			108	75 - 125	<2.0	mg/kg	2.7	40	96	N/A
9116100	Total (Wet Wt) Selenium (Se)	2023/12/10			97	75 - 125	<0.010	mg/kg	4.5	40	94	N/A
9116100	Total (Wet Wt) Silver (Ag)	2023/12/10			99	75 - 125	<0.0010	mg/kg	NC	40	92	N/A
9116100	Total (Wet Wt) Sodium (Na)	2023/12/10			110	75 - 125	<2.0	mg/kg	1.9	40	98	N/A
9116100	Total (Wet Wt) Strontium (Sr)	2023/12/10			100	75 - 125	<0.010	mg/kg	60	60	95	N/A
9116100	Total (Wet Wt) Thallium (Tl)	2023/12/10			99	75 - 125	<0.00040	mg/kg	4.8	40	85	N/A
9116100	Total (Wet Wt) Tin (Sn)	2023/12/10			94	75 - 125	<0.020	mg/kg	NC	40	191 (4)	N/A
9116100	Total (Wet Wt) Titanium (Ti)	2023/12/10			97	75 - 125	<0.020	mg/kg	4.2	40		



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### QUALITY ASSURANCE REPORT(CONT'D)

EcoMetrix Incorporated

Client Project #: 23-3195

Site Location: Rainy River Mine

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9116100	Total (Wet Wt) Uranium (U)	2023/12/10			100	75 - 125	<0.00040	mg/kg	NC	40	94	N/A
9116100	Total (Wet Wt) Vanadium (V)	2023/12/10			101	75 - 125	<0.020	mg/kg	2.6	40	84	N/A
9116100	Total (Wet Wt) Zinc (Zn)	2023/12/10			115	75 - 125	<0.040	mg/kg	5.9	40	92	N/A
9116101	Mercury (Hg)	2023/12/13	94	75 - 125	111	75 - 125	<0.0010	mg/kg	2.2	40	90	59 - 141

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference  $\leq 2x$  RDL).

(1) Matrix spike exceeds acceptance limits due to matrix interference.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

(4) Reference outside acceptance criteria - re-analysis yields similar results.



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Bureau Veritas Job #: C3Y3397  
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EcoMetrix Incorporated  
Client Project #: 23-3195  
Site Location: Rainy River Mine

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, BBY Scientific Specialist

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



# Custody Tracking Form



T794704-H

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

First Sample: WA1-L  
Last Sample: NP12-G  
Sample Count: 69

Relinquished By				Received By			
Print JOE TETREAU	[Signature]	Date	2023/11/02	Print SPDPA BASTON-A	[Signature]	Date	2023/11/02
		Time (24 HR)	09:10			Time (24 HR)	09:20
Print	Print	Date		Print	Print	Date	
Print	Print	Time (24 HR)		Print	Print	Time (24 HR)	
Print	Print	Date		Print	Print	Date	
Print	Print	Time (24 HR)		Print	Print	Time (24 HR)	

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at [www.bvna.com](http://www.bvna.com).

**Triage Information**

Sampled By (Print) JOE TETREAU      # of Coolers/Pkgs: 1

Rush       Immediate Test       Food Residue

Micro       Food Chemistry

**\*\*\* LABORATORY USE ONLY \*\*\***

Received At:

Labeled By:

Verified By:

Lab Comments:

Custody Seal		Cooling Media	Temperature °C		
Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3
N	N	N	-5	-3	-2
Drinking Water Metals Preservation Check Done (Circle)      YES      NO					

02-Nov-23 09:20  
Colby Coutu  
C3Y3397  
A1V F7-46

COR FCD-00383/4

## Appendix C Fish Catch and Meristic Data



Table C-1: Fish meristic and sampling data for Northern Pike caught in Pinewood River, September 2023

Species	Date Sampled	Station ID	Fish ID	Fork Length (mm)	Total Length (mm)	Body Weight (g/kg)	Left Tissue Weight (g)	Right Tissue Weight (g)	Liver Weight (g)	Gonad Weight (g)	Sex <sup>a</sup>	Maturity <sup>b</sup>	Aging Structures <sup>c</sup>	Abnormalities
Northern Pike	2023-09-19	PineR-ANI	NP1	538	573	0.96	25.347	37.167	7.578	-	M	M	SC,CI	-
	2023-09-20	PineR-GN1	NP2	701	705	2.4	39.664	36.515	27.577	48.3	F	M	SC,CI	-
	2023-09-20	PineR-GN2	NP3	617	657	1.94	31.962	29.122	20.19	36.755	F	M	SC,CI	Full Brown Bullhead in stomach
	2023-09-20	PineR-GN3	NP4	649	685	1.81	34.83	31.306	22.64	20.378	F	M	SC,CI	-
	2023-09-20	PineR-GN2	NP5	631	667	1.515	28.014	30.582	14.457	22.401	F	M	SC,CI	blackspot, liver cysts
	2023-09-20	PineR-GN4	NP6	551	582	1.035	25.611	33.315	8.343	-	M	M	SC,CI	-
	2023-09-20	PineR-GN3	NP7	508	537	0.885	24.617	20.948	8.459	-	M	M	SC,CI	*508
	2023-09-20	PineR-GN3	NP8	574	607	1.185	27.188	27.315	12.107	19.723	F	M	SC,CI	Blackspot
	2023-09-20	PineR-GN1	NP9	550	585	0.97	30.574	21.417	7.258	-	M	M	SC,CI	blackspot
	2023-09-20	PineR-GN1	NP10	547	583	1.175	30.782	36.378	12.169	16.195	F	M	SC,CI	-
	2023-09-20	PineR-GN3	NP11	522	551	0.945	29.61	42.419	9.04	-	M	M	SC,CI	-
	2023-09-20	PineR-GN3	NP12	500	530	0.78	30.344	26.705	10.313	10.37	F	M	SC,CI	Blackspot
	2023-09-20	PineR-GN4	NP13	485	513	0.765	30.552	44.437	7.372	-	M	M	SC,CI	-
	2023-09-20	PineR-GN3	NP14	474	499	0.705	26.775	27.858	6.51	-	M	M	SC,CI	-
	2023-09-20	PineR-GN1	NP15	537	570	1.115	25.772	32.55	10.587	-	M	M	SC,CI	-
<b>Sample Size</b>				15	15	15	15	15	15	7				
<b>Mean</b>				559	590	1.212	29.443	31.869	12.307	24.875				
<b>Standard Deviation</b>				65	63	0.491	4.031	6.779	6.329	13.093				
<b>Standard Error</b>				17	16	0.127	1.041	1.750	1.634	4.949				
<b>Minimum</b>				474	499	0.705	24.617	20.948	6.51	10.37				
<b>Maximum</b>				701	705	2.4	39.664	44.437	27.577	48.3				

Abbreviations:

<sup>a</sup>M = Male, F = Female

<sup>b</sup>IM = Immature, M = Mature

<sup>c</sup>SC = Scales, CI = Cleithrum

Table C-2: Fish meristic and sampling data for Walleye caught in Pinewood River, September 2023

Species	Date Sampled	Station ID	Fish ID	Fork Length (mm)	Total Length (mm)	Body Weight (g/kg)	Left Tissue Weight (g)	Right Tissue Weight (g)	Liver Weight (g)	Gonad Weight (g)	Sex <sup>a</sup>	Maturity <sup>b</sup>	Aging Structures <sup>c</sup>	Abnormalities
Walleye	2023-09-20	PineR-GN1	WA1	533	570	1.64	32.982	40.461	22.188	42.511	F	M	SC,DR,O	-
	2023-09-20	PineR-GN1	WA2	359	378	0.56	26.752	27.614	7.658	-	M	M	SC,DR,O	-
	2023-09-20	PineR-GN1	WA3	438	469	0.99	28.527	38.579	9.055	-	M	M	SC,DR,O	-
	2023-09-20	PineR-GN3	WA4	335	352	0.39	18.236	19.954	4.821	-	F	IM	SC,DR,O	-
	2023-09-20	PineR-GN1	WA5	352	388	0.535	36.154	35.649	9.861	-	F	IM	SC,DR,O	-
	2023-09-20	PineR-GN4	WA6	385	44	0.56	22.545	27.093	6.55	-	F	IM	SC,DR,O	-
	2023-09-20	PineR-GN3	WA7	397	420	0.44	25.13	37.182	6.757	-	F	IM	SC,DR,O	-
	2023-09-20	PineR-GN3	WA8	360	381	0.545	22.704	22.175	9.939	-	M	M	SC,DR,O	-
	2023-09-20	PineR-GN3	WA9	380	389	0.53	28.215	30.696	7.447	-	F	IM	SC,DR,O	-
	2023-09-20	PineR-GN1	WA10	308	333	0.345	18.214	21.435	4.804	-		IM	SC,DR,O	Fish in Stomach
	2023-09-20	PineR-GN3	WA11	324	342	0.375	22.971	24.645	4.876	-	F	IM	SC,DR	Fish in Stomach
	2023-09-20	PineR-GN4	WA12	311	328	0.35	15.727	25.412	4.055	-	F	IM	SC,DR,O	-
	2023-09-21	PineR-GN7	WA13	460	489	1.165	39.746	37.806	20.671	36.866	F	M	SC,DR,O	Fish in Stomach
	2023-09-21	PineR-GN5	WA14	376	401	0.56	34.269	35.154	10.589	-	M	IM	SC,DR,O	-
	2023-09-21	PineR-GN7	WA15	330	352	0.43	27.336	25.953	5.469	-	F	IM	SC,DR,O	Blackspot slight
	2023-09-21	PineR-GN7	WA16	326	347	0.4	22.669	27.222	4.861	-	F	IM	SC,DR,O	Blackspot slight
<b>Sample Size</b>				16	16	16	16	16	16	2				
<b>Mean</b>				373	374	0.613	26.386	29.814	8.725	39.689				
<b>Standard Deviation</b>				61	109	0.354	6.786	6.720	5.382	3.992				
<b>Standard Error</b>				15	27	0.089	1.696	1.680	1.345	2.823				
<b>Minimum</b>				308	44	0.345	15.727	19.954	4.055	36.866				
<b>Maximum</b>				533	570	1.64	39.746	40.461	22.188	42.511				

Abbreviations:

<sup>a</sup>M = Male, F = Female

<sup>b</sup>IM = Immature, M = Mature

<sup>c</sup>SC = Scales, DR = Dorsal Rays, O = Otoliths

**Table C-3: Fish catch summary at all sampling stations in Pinewood River, September 2023.**

Station ID	Gear	Net Length (ft)	Mesh size (inch)	Species	Catch	Set Date	Set Time	Lift Date	Lift Time	Fishing Duration (hrs)
PINRGN1-23	Gillnet	150	3,4,5"	Northern Pike	15	2023-09-19	12:40	2023-09-20	9:00	20.33
				Walleye	5					
				White Sucker	2					
				Brown Bullhead	3					
				Sauger	1					
PINRGN2-23	Gillnet	75	3,4,5"	Northern Pike	5	2023-09-19	12:55	2023-09-20	11:05	22.17
				White Sucker	1					
PINRGN3-23	Gillnet	100	3"	Northern Pike	9	2023-09-19	13:15	2023-09-20	12:00	22.75
				Walleye	5					
				White Sucker	1					
				Brown Bullhead	1					
PINRGN4-23	Gillnet	50	3"	Northern Pike	6	2023-09-19	13:20	2023-09-20	13:25	24.08
				Walleye	1					
PINRGN5-23	Gillnet	100	3"	Northern Pike	5	2023-09-20	13:20	2023-09-21	9:20	20.00
				Walleye	1					
				White Sucker	1					
				Sauger	1					
PINRGN6-23	Gillnet	50	3"	Northern Pike	5	2023-09-20	14:05	2023-09-21	10:10	20.08
PINRGN7-23	Gillnet	75	3,4,5"	Northern Pike	1	2023-09-20	14:20	2023-09-21	10:35	20.25
				Walleye	4					
				White Sucker	2					
				Shorthead Redhorse	1					
PINRAN1-23	Angling	-	-	Northern Pike	1	2023-09-19	14:00	2023-09-19	15:30	1.5

**Table C-4: Fish sampling locations on the Pinewood River, September 2023.**

<b>Location</b>	<b>Latitude (Decimal Degrees)</b>	<b>Longitude (Desimal Degrees)</b>	<b>Elevation (m above sea level)</b>
PINRGN1-23	48.727672	-94.281322	329.3
PINRGN2-23	48.729087	-94.284295	330.3
PINRGN3-23	48.726066	-94.288964	329.3
PINRGN4-23	48.725287	-94.291025	329.3
PINRGN5-23	48.726066	-94.288964	329.3
PINRGN6-23	48.725459	-94.292538	328.3
PINRGN7-23	48.724772	-94.296872	325.3
PINRAN1-23	48.724961	-94.296133	326.3