

DATE May 1, 2012**PROJECT No.** 11-1365-0012/DCN-066**TO** Veronica Chisholm
De Beers Canada Inc.**CC** Stephen Lines, De Beers Canada Inc.; Gary Ash, John Faithful, Golder Associates Ltd.**FROM** Blair Hersikorn, Kerrie Serben, Golder
Associates Ltd.**2011 FISH TISSUE CHEMISTRY SUPPLEMENTAL MONITORING REPORT FOR THE GAHCHO KUÉ
PROJECT**

1.0 INTRODUCTION

Golder Associates Ltd. collected fish in July 2011 to supplement the baseline fish tissue chemistry results presented in the 2010 Gahcho Kué Project Environmental Impact Statement (EIS) and the 2011 Gahcho Kué Project EIS Update (De Beers 2010, 2011). This technical memorandum summarizes the results of the 2011 Fish Tissue Chemistry Supplemental Monitoring and Analysis, and provides supplemental information to the response prepared to the information request from Fisheries and Oceans Canada and Environment Canada (DFO&EC_32 [a]; De Beers 2012).

This technical memorandum presents the methods used to collect and analyze the fish tissue samples, and the results of the analyses. The analytical chemistry results of fish tissue samples archived in 2004 and analyzed in 2011 are also summarized. In addition, mercury concentrations of the fish tissue samples collected in 2011 are compared to fish length, weight, and age.

It should be noted that mercury bioaccumulates (i.e., is taken up by biological organisms from the environment), and biomagnifies (i.e., accumulates to a greater degree in higher trophic level organisms). While both processes are relevant to understanding changes in tissue contaminant concentrations in a system over time, biomagnification is largely responsible for differences in mercury concentrations between species of different trophic status; therefore, mercury tissue concentrations in forage fish and piscivorous fish should be considered within the appropriate trophic context. Extensive discussion of the present tissue data in the context of biomagnification potential is beyond the scope of this document; however, in the interest of completeness and fully addressing information requested in this technical memorandum, mercury data are regressed with all relevant body parameters reflective of fish size or age (i.e., body weight, length, and age).



2.0 METHODS

2.1 2011 Fish Samples

Fish Collection

Fish collection for tissue chemistry was done in Lake N11, which is downstream of lakes that will be diverted during operations (i.e., Lakes B1, D2 and D3, and E1). Fish from Lake N11 have not been sampled previously for tissue chemistry. Twenty individual lake trout (*Salvelinus namaycush*) and 111 lake chub (*Couesius plumbeus*) were captured. Eight duplicate samples of lake chub were formed, with each sample containing between one and eight fish.

Fish collection methods were as described in the 2011 Fish and Aquatic Resources Supplemental Monitoring Report (Golder 2012). Large-bodied fish were captured using a combination of gill nets and angling, whereas small-bodied fish were captured with minnow traps. All fish collected were weighed and had fork length measured. Aging structures were collected from large-bodied fish.

Tissue Sampling and Chemistry Analysis

Lake Chub

Metal concentrations and moisture content in lake chub were measured on whole-body samples. Collected fish were divided among eight duplicate samples, with each sample having a total sample mass of at least five grams (g) and consisting of at least one fish. When samples required more than one fish, fish of the same size-class were combined. Samples were stored frozen prior to shipment to the analytical laboratory. The following parameters were measured in lake chub:

- total metals (aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, selenium, silver, sodium, strontium, thallium, tin, titanium, uranium, vanadium, and zinc); and
- moisture content.

The analytical laboratory reported the results for individual samples, method blanks, laboratory duplicates, matrix spikes and a certified reference material (Appendix A).

Lake Trout

Two skinless and boneless muscle tissue fillets (weighing approximately 25 grams [g]) were dissected from between the dorsal fin and lateral line. Each fillet was stored separately, frozen in a Ziploc[®] bag. One sample from each lake trout was submitted for tissue chemistry analysis and moisture content (ALS Laboratory Group; Edmonton, Alberta) and one was archived. Liver tissue was also collected from each fish for analysis of total metals and moisture content. The same list of parameters was measured in lake trout muscle and liver tissue by the same analytical laboratory as for lake chub.

Archived Samples Collected in 2004

Liver samples (n = 62) from lake trout and muscle (n = 11) and liver samples (n = 2) from round whitefish (*Prosopium cylindraceum*) collected and archived in 2004 were analyzed for metals. The round whitefish were captured from Kennady Lake, whereas lake trout were captured in Kennady Lake, Lake N16, and Lake 410. Fish capture and collection methods for the archived samples are as described in Annex J of the 2010 Gahcho Kué Project EIS (De Beers 2010). The archived liver samples exceeded the analytical laboratory's recommended holding time of 180 days, but the laboratory confirmed the samples were of sufficient quality to analyze. The same list of parameters was measured by the same analytical laboratory as for lake trout.

Data Analysis

Minimum, maximum, and mean concentrations were calculated for each parameter. Analytical detection limits were substituted for concentrations reported below the analytical detection limits.

Maximum, minimum, and average metal concentrations in muscle tissue were compared to risk-based criteria for fish consumption developed by the U.S. Environmental Protection Agency (US EPA) for the protection of human health (Regional Screening Levels [RSL] for Fish Ingestion; US EPA 2012).

Mercury concentrations in muscle from lake trout and round whitefish were compared to the Canadian Food Inspection Agency (CFIA) human consumption standard for mercury in fish tissue (i.e., 0.5 milligrams per kilogram wet weight [mg/kg ww]; CFIA 2009). Mercury concentrations of fish collected in 2011 were also compared graphically to the age (large-bodied fish only), length, and weight of the fish.

Statistical comparisons could not be made because analytical detection limits differed for some samples, and among years, and concentrations of several parameters were below detection limits for many individual samples.

3.0 RESULTS

3.1 2011 Lake Chub Chemistry

Thirteen parameters were below analytical detection limits in greater than 50 percent (%) of the lake chub samples that were analyzed; these included aluminum, antimony, beryllium, bismuth, cobalt, lead, lithium, silver, thallium, tin, titanium, uranium, and vanadium (Appendix B).

Mercury concentrations in whole-body samples of lake chub ranged from 0.0353 to 0.1490 mg/kg ww, with a mean of 0.0708 mg/kg ww (Table 1). Mercury concentrations were strongly correlated with mean body weight and mean length of fish in the lake chub samples (Appendix C).

Mercury concentrations were graphically compared to fork length and total body weight of fish captured from Lake N11 (Appendix C). In general, larger, heavier, and by inference, older fish had higher total mercury concentrations in their tissues (Table 2). Small-bodied fish were not aged; therefore, a comparison of age and mercury concentration was not possible.

In past baseline studies in the Gahcho Kué Project (Project) area, the only other small-bodied fish collected for tissue chemistry analysis were slimy sculpin (*Cottus cognatus*). They were captured for metal analysis in 2007 and had mean mercury concentrations of 0.0333, 0.0211, 0.0338, and 0.0356 mg/kg ww in samples from Kennady Lake, Lake N16, Kirk Lake, and Lake 410, respectively (Annex J, De Beers 2010). Methods and results of slimy sculpin tissue chemistry analysis are available in Addendum JJ of the 2010 EIS (De Beers 2010).

3.2 2011 Lake Trout Chemistry

Concentrations of most metals were similar among fish caught in 2011 and those caught in previous years in other lakes. Several parameters were below the analytical detection limits in greater than 50% of the individual muscle and liver tissue collected in 2011 (Appendix B). These included the following:

- 2011 lake trout muscle: aluminum, antimony, barium, beryllium, bismuth, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel, silver, thallium, tin, titanium, uranium, and vanadium; and
- 2011 lake trout liver: aluminum, antimony, barium, beryllium, bismuth, chromium, lead, lithium, nickel, tin, titanium, uranium, and vanadium.

For parameters that were detected in more than 50% of the samples analyzed, arsenic and mercury exceeded US EPA RSLs in lake trout muscle (Table 3).

Mercury concentrations ranged from 0.173 to 1.12 mg/kg ww in muscle and from 0.140 to 3.14 mg/kg ww in liver of lake trout collected from Lake N11 in July 2011 (Tables 3 and 4). The mean concentrations were 0.479 mg/kg ww for lake trout muscle tissue and 0.760 mg/kg ww for lake trout liver tissue. Mean concentrations of mercury in lake trout muscle tissue from Lake N11 in 2011 were higher than samples collected from Lake N16 (0.30 mg/kg ww), Lake 410 (0.30 mg/kg ww), and Kennady Lake (0.24 mg/kg ww) in 2004, but lower than those collected from Kirk Lake (0.60 mg/kg ww) in 2005 (De Beers 2010; Annex J).

Mercury concentrations were graphically compared to fork length, total body weight, and the age of fish captured from Lake N11 (Appendix C). In general, larger, heavier, and older fish had higher total mercury concentrations in their tissues (Table 5).

The maximum mercury concentration in lake trout muscle exceeded the CFIA mercury standard for human consumption of fish, whereas the mean concentration was below the standard (Table 3).

3.3 Archived Lake Trout and Round Whitefish Samples from 2004

Similar to the samples collected in 2011, several parameters were below analytical detection limits in greater than 50% of the archived individual lake trout liver samples and round whitefish liver and muscle samples (Appendix B). Parameters below analytical detection limits included the following:

- archived lake trout liver - aluminum, antimony, barium, beryllium, bismuth, chromium, lead, lithium, nickel, tin, uranium, and vanadium;
- archived round whitefish liver- aluminum, antimony, barium, beryllium, bismuth, cadmium, chromium, cobalt, lead, lithium, nickel, selenium, silver, thallium, tin, titanium, uranium, and vanadium; and
- archived round whitefish muscle - aluminum, antimony, beryllium, bismuth, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel, silver, tin, titanium, uranium, and vanadium.

For parameters that were detected in more than 50% of the samples analyzed, arsenic and mercury exceeded US EPA RSLs in archived round whitefish muscle (Table 6).

Maximum and mean mercury concentrations in archived round whitefish muscle tissue exceeded the CFIA mercury standard for human consumption; this was similar to the 2011 lake trout muscle samples, which also exceeded the standards.

Summary statistics for archived round whitefish liver and archived lake trout liver tissue concentrations are presented in Tables 6 and 7, respectively.

Table 1 Summary of Metal Concentrations in Whole-body Lake Chub (n = 8) from Lake N11, Collected in July 2011

Parameter	Units	Detection Limit	Min	Max	Mean
Physical Tests					
% Moisture	%	0.10	74.9	79.1	76.4
Total Metals					
Aluminum	mg/kg ww	2.0	2.0	2.0	2.0
Antimony	mg/kg ww	0.010	0.010	0.010	0.010
Arsenic	mg/kg ww	0.010	0.028	0.039	0.034
Barium	mg/kg ww	0.020	5.01	7.87	6.65
Beryllium	mg/kg ww	0.10	0.10	0.10	0.10
Bismuth	mg/kg ww	0.060	0.060	0.060	0.060
Cadmium	mg/kg ww	0.0060	0.0078	0.0173	0.0098
Calcium	mg/kg ww	2.0	6,950	12,000	8,893
Chromium	mg/kg ww	0.10	0.10	0.32	0.18
Cobalt	mg/kg ww	0.020	0.020	0.030	0.021
Copper	mg/kg ww	0.040	0.552	0.714	0.617
Iron	mg/kg ww	1.0	12.0	26.0	16.5
Lead	mg/kg ww	0.020	0.020	0.020	0.020
Lithium	mg/kg ww	0.10	0.10	0.10	0.10
Magnesium	mg/kg ww	1.0	320	379	353
Manganese	mg/kg ww	0.010	4.64	7.64	6.22
Mercury	mg/kg ww	0.0020	0.0353	0.1490	0.0708
Molybdenum	mg/kg ww	0.010	0.020	0.042	0.027
Nickel	mg/kg ww	0.10	0.19	0.42	0.28
Phosphorus	mg/kg ww	5.0	4,970	8,560	6,208
Potassium	mg/kg ww	20	2,620	2,970	2,786
Selenium	mg/kg ww	0.20	0.26	0.40	0.31
Silver	mg/kg ww	0.050	0.050	0.050	0.050
Sodium	mg/kg ww	20	636	972	839
Strontium	mg/kg ww	0.010	27.4	43.6	35.1
Thallium	mg/kg ww	0.010	0.010	0.010	0.010
Tin	mg/kg ww	0.050	0.050	0.050	0.050
Titanium	mg/kg ww	0.10	0.10	0.10	0.10
Uranium	mg/kg ww	0.0020	0.0020	0.0021	0.0020
Vanadium	mg/kg ww	0.10	0.10	0.10	0.10
Zinc	mg/kg ww	0.10	35.5	50.0	39.9

Notes: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values. mg/kg ww= milligrams per kilogram wet weight; - = not available; % = percent; Min = minimum; Max = maximum.

Table 2 Summary of Mercury Concentrations, Length, and Weight of Lake Chub Samples Collected From Lake N11, July 2011

Sample	Length [mm]	Weight [g]	Mean \pm SD Length [mm]	Mean \pm SD Weight [g]	Mercury Concentration [mg/kg ww]
Bag 1 Lab	108	13.7	108 \pm 2	13.2 \pm 0.6	0.100
	106	12.6			
	109	13.3			
Bag 2 Lab	120	17.8	120 \pm 0	17.8 \pm 0	0.149
Bag 3 Lab	90	7	93 \pm 5	8.4 \pm 1.9	0.0705
	99	10.5			
	91	7.6			
Bag 4 Lab	88	7.2	87 \pm 3	7.1 \pm 0.5	0.0497
	89	7.5			
	83	6.3			
	86	7.2			
Bag 5 Lab	78	4.7	77 \pm 1	4.7 \pm 0.6	0.0401
	75	3.9			
	77	4.8			
	76	5.3			
Bag 6 Lab	65	3.2	65 \pm 1	2.6 \pm 0.5	0.0353
	67	3.2			
	66	2.9			
	63	2.1			
	65	2.3			
	65	2.6			
	63	2.2			
Bag 7 Lab	58	1.6	59 \pm 2	2.0 \pm 0.2	0.0355
	59	2.1			
	58	2.2			
	60	2.2			
	62	1.9			
	57	1.7			
	58	2			
	60	2.2			
Bag 8 Lab	106	11.2	114 \pm 10	15.0 \pm 3.5	0.0859
	125	18.1			
	111	15.6			

Note:

mm = millimetre; g = gram; mg/kg ww = milligrams per kilogram wet weight; - = not available; SD = standard deviation.

Table 3 Summary of Metal Concentrations in Lake Trout Muscle Tissue (n = 20) from Lake N11, Collected in July 2011

Parameter	Units	Detection Limit	Min	Max	Mean	US EPA RSLs for Fish Ingestion ^(a)
Physical Tests						
% Moisture	%	0.10	75.5	79.1	77.0	-
Total Metals						
Aluminum	mg/kg ww	2.0	2.0	2.0	2.0	280
Antimony	mg/kg ww	0.010	0.010	0.010	0.010	0.108 ^(b)
Arsenic	mg/kg ww	0.010	0.019	0.032	0.024	0.021 ^(c)
Barium	mg/kg ww	0.020	0.020	0.022	0.020	54
Beryllium	mg/kg ww	0.10	0.10	0.10	0.10	0.54 ^(d)
Bismuth	mg/kg ww	0.060	0.060	0.060	0.060	-
Cadmium	mg/kg ww	0.0060	0.0060	0.0060	0.0060	0.28 ^(e)
Calcium	mg/kg ww	2.0	52	212	131	-
Chromium	mg/kg ww	0.10	0.10	0.25	0.11	0.063 ^(f)
Cobalt	mg/kg ww	0.020	0.020	0.032	0.021	0.082
Copper	mg/kg ww	0.040	0.188	0.355	0.274	10.8
Iron	mg/kg ww	1.0	1.7	5.0	3.0	190
Lead	mg/kg ww	0.020	0.020	0.020	0.020	1.1 ^(g)
Lithium	mg/kg ww	0.10	0.10	0.10	0.10	0.54
Magnesium	mg/kg ww	1.0	246	301	280	-
Manganese	mg/kg ww	0.010	0.094	0.237	0.148	38 ^(h)
Mercury	mg/kg ww	0.0020	0.173	1.120	0.479	0.028 ⁽ⁱ⁾
Molybdenum	mg/kg ww	0.010	0.010	0.018	0.011	1.36
Nickel	mg/kg ww	0.10	0.10	0.20	0.11	5.4 ^(j)
Phosphorus	mg/kg ww	5.0	2,050	2,940	2,510	-
Potassium	mg/kg ww	20	3,770	4,940	4,153	-
Selenium	mg/kg ww	0.20	0.23	0.33	0.27	1.36
Silver	mg/kg ww	0.050	0.050	0.050	0.050	1.36
Sodium	mg/kg ww	20	190	395	296	-
Strontium	mg/kg ww	0.010	0.068	0.492	0.214	162 ^(k)
Thallium	mg/kg ww	0.010	0.010	0.010	0.010	0.0028 ^(l)
Tin	mg/kg ww	0.050	0.050	0.050	0.050	162
Titanium	mg/kg ww	0.10	0.10	0.10	0.10	-
Uranium	mg/kg ww	0.0020	0.0020	0.0020	0.0020	0.83 ^(m)
Vanadium	mg/kg ww	0.10	0.10	0.10	0.10	1.36 ⁽ⁿ⁾
Zinc	mg/kg ww	0.10	3.25	5.89	4.37	82 ^(o)

Notes: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values. Underlined mercury values exceed Canadian standards for mercury in fish (0.5 mg/kg ww; CFIA 2009). Bold values exceed US EPA RSLs.

- (a) US EPA Regional Screening Levels (RSLs) for Fish Ingestion (US EPA 2011). US EPA RSLs were adjusted by a factor of 0.2 for non-carcinogens and by a factor of 10 for carcinogens.
- (b) RSL is for antimony (metallic).
- (c) RSL is for arsenic (inorganic).
- (d) RSL is for beryllium and compounds.
- (e) RSL is for cadmium (diet).
- (f) RSL is for chromium (VI).
- (g) RSL is for lead acetate.
- (h) RSL is for manganese (diet).
- (i) RSL is for methyl mercury; a RSL for mercury (elemental) was not available.
- (j) RSL is for nickel (soluble salts).
- (k) RSL is for strontium (stable).
- (l) RSL is for thallium (soluble salts). Note that the analytical detection limit for thallium was higher than the RSL.
- (m) RSL is for vanadium and compounds.
- (n) RSL is for zinc and compounds.

RSL= Regional Screening Level; mg/kg ww= milligrams per kilogram wet weight; - = not available; % = percent; Min = minimum; Max = maximum.

Table 4 Summary of Metal Concentrations in the Livers of Lake Trout (n = 20) from Lake N11, July 2011

Parameter	Units	Detection Limit	Min	Max	Mean
Physical Tests					
% Moisture	%	0.10	73.0	78.5	75.7
Total Metals					
Aluminum	mg/kg ww	2.0 to 4.0	2.0	4.0	2.1
Antimony	mg/kg ww	0.010 to 0.020	0.010	0.020	0.011
Arsenic	mg/kg ww	0.010 to 0.020	0.019	0.058	0.033
Barium	mg/kg ww	0.020 to 0.040	0.020	0.040	0.021
Beryllium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.11
Bismuth	mg/kg ww	0.060 to 0.120	0.060	0.120	0.063
Cadmium	mg/kg ww	0.0060 to 0.012	0.073	0.203	0.140
Calcium	mg/kg ww	2.0 to 4.0	46.7	97.6	65.6
Chromium	mg/kg ww	0.10 to 0.20	0.10	0.33	0.12
Cobalt	mg/kg ww	0.020 to 0.040	0.053	0.303	0.156
Copper	mg/kg ww	0.040 to 0.080	6.0	41.0	16.3
Iron	mg/kg ww	1.0 to 2.0	157	667	423
Lead	mg/kg ww	0.020 to 0.040	0.020	0.040	0.022
Lithium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.11
Magnesium	mg/kg ww	1.0 to 2.0	156	209	181
Manganese	mg/kg ww	0.010 to 0.020	1.23	2.22	1.68
Mercury	mg/kg ww	0.0020	0.140	3.140	0.760
Molybdenum	mg/kg ww	0.010 to 0.020	0.103	0.252	0.175
Nickel	mg/kg ww	0.10 to 0.20	0.10	0.22	0.12
Phosphorus	mg/kg ww	5.0	2,800	4,140	3,360
Potassium	mg/kg ww	20	2,580	4,410	3,324
Selenium	mg/kg ww	0.20 to 0.40	1.31	2.98	1.83
Silver	mg/kg ww	0.050 to 0.100	0.050	0.232	0.082
Sodium	mg/kg ww	20 to 40	869	1,560	1,135
Strontium	mg/kg ww	0.010 to 0.020	0.092	0.256	0.148
Thallium	mg/kg ww	0.010 to 0.020	0.023	0.108	0.052
Tin	mg/kg ww	0.050 to 0.100	0.050	0.100	0.053
Titanium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.11
Uranium	mg/kg ww	0.0020 to 0.0040	0.0020	0.0040	0.0021
Vanadium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.11
Zinc	mg/kg ww	0.10 to 0.20	24.6	38.6	32.4

Notes: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values.

mg/kg ww= milligrams per kilogram wet weight; - = not available; % = percent; Min = minimum; Max = maximum.

Table 5 Summary of Mercury Concentrations in Muscle and Liver Tissue, Length, Weight, and Age of Lake Trout collected from Lake N11, July 2011

Sample	Mercury Concentration in Muscle Tissue [mg/kg ww]	Mercury Concentration in Liver Tissue [mg/kg ww]	Length [mm]	Weight [g]	Age [yrs]
GK11ULKTR001	<u>0.791</u>	1.050	645	3,020	16
GK11ULKTR002	<u>0.558</u>	0.425	543	1,750	11
GK11ULKTR003	0.383	0.330	551	1,720	14
GK11ULKTR004	<u>0.932</u>	1.670	623	2,510	15
GK11ULKTR005	<u>0.608</u>	1.300	570	1,775	16
GK11ULKTR006	0.309	0.390	512	1,380	11
GK11ULKTR007	<u>0.794</u>	1.470	595	2,250	13
GK11ULKTR008	0.474	1.160	561	1,978	13
GK11ULKTR009	0.328	0.377	522	1,620	10
GK11ULKTR010	0.326	0.312	467	1,025	11
GK11ULKTR011	<u>0.634</u>	0.888	477	1,220	-
GK11ULKTR012	0.285	0.229	490	1,310	8
GK11ULKTR013	0.173	0.140	411	760	6
GK11ULKTR014	0.305	0.416	570	1,950	8
GK11ULKTR015	1.12	3.14	677	2,950	19
GK11ULKTR016	0.363	0.427	571	1,800	12
GK11ULKTR017	0.404	0.605	505	1,200	10
GK11ULKTR018	0.218	0.341	400	580	7
GK11ULKTR019	0.294	0.332	453	820	8
GK11ULKTR020	0.288	0.204	516	1,380	9

Notes: Underlined mercury values exceed Canadian standards for mercury in fish (0.5 mg/kg ww; CFIA 2009). Screening to the mercury standard was only applied to muscle tissue concentrations.

mg/kg ww = milligrams per kilogram wet weight; - = not available; mm = millimetre; g = gram; yrs = years.

Table 6 Summary of Metal Concentrations in Round Whitefish Muscle (n = 11) and Liver (n = 2) from Kennady Lake, August 2004

Parameter	Units	Detection Limit	Muscle			Liver			US EPA RSLs for Fish Ingestion ^(a)
			Min	Max	Mean	Min	Max	Mean	
Physical Tests									
% Moisture	%	0.10	73.3	78.7	76.9	-	-	-	-
Total Metals									
Aluminum	mg/kg ww	2.0 to 20	2.0	2.0	2.0	6.0	20	13	280
Antimony	mg/kg ww	0.010 to 0.10	0.010	0.010	0.010	0.040	0.1	0.070	0.108 ^(b)
Arsenic	mg/kg ww	0.010 to 0.10	0.029	0.065	0.042	0.141	0.19	0.166	0.021 ^(c)
Barium	mg/kg ww	0.020 to 0.20	0.026	0.148	0.071	0.080	0.20	0.14	54
Beryllium	mg/kg ww	0.10 to 1.0	0.10	0.10	0.10	0.40	1.0	0.70	0.54 ^(d)
Bismuth	mg/kg ww	0.060 to 0.6	0.060	0.060	0.060	0.24	0.6	0.42	-
Cadmium	mg/kg ww	0.0060 to 0.06	0.0060	0.0060	0.0060	0.042	0.060	0.051	0.28 ^(e)
Calcium	mg/kg ww	2.0 to 20	113.0	669.0	351	59.6	63.0	61.3	-
Chromium	mg/kg ww	0.10 to 1.0	0.10	0.10	0.10	1.0	2.18	1.59	0.063 ^(f)
Cobalt	mg/kg ww	0.020 to 0.20	0.020	0.020	0.020	0.087	0.200	0.144	0.082
Copper	mg/kg ww	0.040 to 0.40	0.271	2.350	0.776	1.48	1.59	1.54	10.8
Iron	mg/kg ww	1.0 to 10	1.8	3.2	2.5	83	251	167	190
Lead	mg/kg ww	0.020 to 0.20	0.02	0.20	0.08	0.080	0.20	0.14	1.1 ^(g)
Lithium	mg/kg ww	0.10 to 1.0	0.10	0.10	0.10	0.40	1.0	0.70	0.54
Magnesium	mg/kg ww	1.0 to 10	307	376	336	148	160	154	-
Manganese	mg/kg ww	0.010 to 0.10	0.070	0.207	0.132	1.50	1.62	1.56	38 ^(h)
Mercury	mg/kg ww	0.0020	0.0887	0.1420	0.1137	0.130	0.140	0.135	0.028 ⁽ⁱ⁾
Molybdenum	mg/kg ww	0.010 to 0.10	0.010	0.010	0.010	0.280	0.346	0.313	1.36
Nickel	mg/kg ww	0.10 to 1.0	0.10	0.71	0.16	1.00	1.70	1.35	5.4 ^(j)
Phosphorus	mg/kg ww	5.0 to 50	2,680	3,520	3,079	2,460	2,690	2,575	-
Potassium	mg/kg ww	20 to 200	4,020	6,820	5,217	2,030	2,040	2,035	-
Selenium	mg/kg ww	0.20 to 2.0	0.23	0.33	0.28	1.01	2.0	1.51	1.36
Silver	mg/kg ww	0.050 to 0.50	0.050	0.050	0.050	0.20	0.50	0.35	1.36
Sodium	mg/kg ww	20 to 200	252	390	308	770	980	875	-
Strontium	mg/kg ww	0.010 to 0.10	0.254	2.170	1.049	0.310	0.317	0.314	162 ^(k)

Table 6 Summary of Metal Concentrations in Round Whitefish Muscle and Liver from Kennady Lake, August 2004 (continued)

Parameter	Units	Detection Limit	Muscle			Liver			US EPA RSLs for Fish Ingestion ^(a)
			Min	Max	Mean	Min	Max	Mean	
Thallium	mg/kg ww	0.010 to 0.10	0.010	0.012	0.011	0.062	0.10	0.081	0.0028 ^(l)
Tin	mg/kg ww	0.050 to 0.50	0.050	0.150	0.063	0.20	0.50	0.35	162
Titanium	mg/kg ww	0.10 to 1.0	0.10	0.10	0.10	0.30	1.0	0.65	-
Uranium	mg/kg ww	0.0020 to 0.020	0.0020	0.0020	0.0020	0.0080	0.020	0.0140	0.83 ^(m)
Vanadium	mg/kg ww	0.10 to 1.0	0.10	0.10	0.10	0.40	1.0	0.70	1.36 ⁽ⁿ⁾
Zinc	mg/kg ww	0.10 to 1.0	3.16	4.05	3.58	19.0	21.0	20.0	82 ^(o)

Notes: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values. Bold values exceed US EPA RSLs. Screening to RSLs was only applied to muscle tissue concentrations.

- (a) US EPA Regional Screening Levels (RSLs) for Fish Ingestion (US EPA 2011). US EPA RSLs were adjusted by a factor of 0.2 for non-carcinogens and by a factor of 10 for carcinogens.
- (b) RSL is for antimony (metallic).
- (c) RSL is for arsenic (inorganic).
- (d) RSL is for beryllium and compounds.
- (e) RSL is for cadmium (diet).
- (f) RSL is for chromium (VI).
- (g) RSL is for lead acetate.
- (h) RSL is for manganese (diet).
- (i) RSL is for methyl mercury; a RSL for mercury (elemental) was not available.
- (j) RSL is for nickel (soluble salts).
- (k) RSL is for strontium (stable).
- (l) RSL is for thallium (soluble salts).
- (m) RSL is for vanadium and compounds.
- (n) RSL is for zinc and compounds.

RSL= Regional Screening Level; mg/kg ww= milligrams per kilogram wet weight; - = parameter was not measured; % = percent; Min = minimum; Max = maximum.

Table 7 Summary of Metal Concentrations in the Livers of Lake Trout (n = 62) from Kennady Lake, Lake N16, and Lake 410, in 2004

Parameter	Units	Detection Limit	Min	Max	Mean
Physical Tests					
% Moisture	%	0.10	65.0	81.6	75.3
Total Metals					
Aluminum	mg/kg ww	2.0 to 4.0	2.0	9.3	2.4
Antimony	mg/kg ww	0.010 to 0.020	0.010	0.020	0.010
Arsenic	mg/kg ww	0.010 to 0.020	0.020	0.101	0.050
Barium	mg/kg ww	0.020 to 0.040	0.020	0.070	0.023
Beryllium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.10
Bismuth	mg/kg ww	0.060 to 0.120	0.060	0.120	0.062
Cadmium	mg/kg ww	0.0060 to 0.0120	0.032	0.436	0.164
Calcium	mg/kg ww	2.0 to 4.0	30.4	628	88.3
Chromium	mg/kg ww	0.10 to 0.20	0.10	1.16	0.20
Cobalt	mg/kg ww	0.020 to 0.040	0.059	0.362	0.168
Copper	mg/kg ww	0.040 to 0.080	4.04	62.2	16.2
Iron	mg/kg ww	1.0 to 2.0	126	2680	626
Lead	mg/kg ww	0.020 to 0.040	0.020	0.225	0.032
Lithium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.10
Magnesium	mg/kg ww	1.0 to 2.0	116	236	175
Manganese	mg/kg ww	0.010 to 0.020	0.69	3.10	1.70
Mercury	mg/kg ww	0.0020	0.096	4.62	0.843
Molybdenum	mg/kg ww	0.010 to 0.020	0.078	0.343	0.183
Nickel	mg/kg ww	0.10 to 0.20	0.10	1.02	0.19
Phosphorus	mg/kg ww	5.0	2,180	4,720	3,449
Potassium	mg/kg ww	20	2,100	4,770	3,120
Selenium	mg/kg ww	0.20 to 0.40	0.66	5.46	2.11
Silver	mg/kg ww	0.050 to 0.100	0.050	0.484	0.116
Sodium	mg/kg ww	20 to 40	733	1,640	1,164
Strontium	mg/kg ww	0.010 to 0.020	0.065	0.823	0.169
Thallium	mg/kg ww	0.010 to 0.020	0.024	0.233	0.080
Tin	mg/kg ww	0.050 to 0.100	0.050	0.100	0.052
Titanium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.10
Uranium	mg/kg ww	0.0020 to 0.0040	0.0020	0.0047	0.0022
Vanadium	mg/kg ww	0.10 to 0.20	0.10	0.20	0.11
Zinc	mg/kg ww	0.10 to 0.20	18.5	58.9	34.4

Note: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values. mg/kg ww= milligrams per kilogram wet weight; - = parameter was not measured; % = percent; Min = minimum; Max = maximum.

4.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

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APPENDIX A

Analytical Chemistry Reports

APPENDIX B

Fish Tissue Chemistry Results

Appendix B Table 1 Metal Concentrations in Whole-body Lake Chub from Lake N11, Collected in July 2011

Parameter	Units	Detection Limit	Bag 1 Lab	Bag 2 Lab	Bag 3 Lab	Bag 4 Lab	Bag 5 Lab	Bag 6 Lab	Bag 7 Lab	Bag 8 Lab
Physical Tests										
% Moisture	%	0.10	74.9	77.2	75.5	75.3	75.4	76.8	79.1	76.8
Total Metals										
Aluminum	mg/kg ww	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Antimony	mg/kg ww	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	mg/kg ww	0.010	0.035	0.039	0.028	0.031	0.033	0.031	0.034	0.039
Barium	mg/kg ww	0.020	7.87	7.81	7.36	7.04	6.46	5.56	5.01	6.08
Beryllium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	mg/kg ww	0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Cadmium	mg/kg ww	0.0060	0.0096	0.0173	0.0088	0.0095	0.0078	0.0078	0.0079	0.0098
Calcium	mg/kg ww	2.0	11200	12000	9500	8770	6950	6980	7160	8580
Chromium	mg/kg ww	0.10	0.18	0.30	0.14	<0.10	0.13	0.16	0.32	<0.10
Cobalt	mg/kg ww	0.020	<0.020	0.030	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Copper	mg/kg ww	0.040	0.586	0.714	0.609	0.616	0.649	0.622	0.552	0.588
Iron	mg/kg ww	1.0	18.1	26.0	17.4	14.6	13.5	12.0	14.4	15.8
Lead	mg/kg ww	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	mg/kg ww	1.0	362	362	344	347	379	370	320	338
Manganese	mg/kg ww	0.010	7.64	7.22	6.21	6.38	5.22	5.41	4.64	7.07
Mercury	mg/kg ww	0.0020	0.100	0.149	0.0705	0.0497	0.0401	0.0353	0.0355	0.0859
Molybdenum	mg/kg ww	0.010	0.028	0.042	0.026	0.020	0.023	0.026	0.033	0.021
Nickel	mg/kg ww	0.10	0.30	0.42	0.25	0.22	0.22	0.25	0.37	0.19
Phosphorus	mg/kg ww	5.0	8,560	7,710	6,430	5,920	4,970	5,140	5,230	5,700
Potassium	mg/kg ww	20	2,620	2,890	2,860	2,620	2,740	2,780	2,810	2,970
Selenium	mg/kg ww	0.20	0.33	0.40	0.28	0.30	0.29	0.26	0.26	0.36
Silver	mg/kg ww	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Sodium	mg/kg ww	20	932	972	953	833	835	722	636	826
Strontium	mg/kg ww	0.010	43.6	42.4	38.3	38.2	31.8	28.7	27.4	30.3
Thallium	mg/kg ww	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Tin	mg/kg ww	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Titanium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium	mg/kg ww	0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	mg/kg ww	0.10	39.2	50.0	42.4	37.7	35.5	36.0	38.9	39.6

< = less than; mg/kg ww = milligrams per kilogram wet weight; Bag 1 Lab = lake chub sample identifier.

Appendix B Table 2 Metal Concentrations in Lake Trout Muscle Tissue from Lake N11, Collected in July 2011.

Parameter	Units	DL	GK11ULKTR 001	GK11ULKTR 002	GK11ULKTR 003	GK11ULKTR 004	GK11ULKTR 005	GK11ULKTR 006	GK11ULKTR 007	GK11ULKTR 008	GK11ULKTR 009	GK11ULKTR 010	GK11ULKTR 011	GK11ULKTR 012	GK11ULKTR 013	GK11ULKTR 014	GK11ULKTR 015	GK11ULKTR 016	GK11ULKTR 017	GK11ULKTR 018	GK11ULKTR 019	GK11ULKTR 020
Physical Tests																						
% Moisture	%	0.10	76.9	75.9	77.5	78.9	78.5	77.4	76.5	78.7	76.6	76.4	78.2	76.4	76.8	76.3	79.1	76.1	76.0	75.9	75.5	75.8
Total Metals																						
Aluminum	mg/kg ww	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Antimony	mg/kg ww	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	mg/kg ww	0.010	0.028	0.025	0.024	0.028	0.024	0.026	0.027	0.032	0.023	0.019	0.019	0.022	0.020	0.020	0.030	0.029	0.022	0.021	0.019	0.022
Barium	mg/kg ww	0.020	0.022	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Beryllium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	mg/kg ww	0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Cadmium	mg/kg ww	0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060
Calcium	mg/kg ww	2.0	90.6	138	128	208	179	161	84.3	86.0	163	212	110	144	111	65.2	176	118	51.8	116	162	107
Chromium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt	mg/kg ww	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.032	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Copper	mg/kg ww	0.040	0.247	0.341	0.265	0.298	0.188	0.252	0.264	0.255	0.310	0.277	0.282	0.355	0.281	0.282	0.312	0.252	0.264	0.260	0.225	0.265
Iron	mg/kg ww	1.0	2.5	2.6	3.9	4.6	3.2	2.5	2.5	3.0	3.2	2.6	5.0	2.8	2.8	2.0	4.4	2.5	2.4	2.6	1.7	2.3
Lead	mg/kg ww	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	mg/kg ww	1.0	277	271	272	266	263	283	282	270	273	301	272	297	298	280	246	279	274	300	295	299
Manganese	mg/kg ww	0.010	0.116	0.120	0.190	0.237	0.128	0.163	0.118	0.192	0.178	0.139	0.122	0.145	0.175	0.125	0.184	0.130	0.094	0.133	0.128	0.138
Mercury	mg/kg ww	0.0020	0.791	0.558	0.383	0.932	0.608	0.309	0.794	0.474	0.328	0.326	0.634	0.285	0.173	0.305	1.12	0.363	0.404	0.218	0.294	0.288
Molybdenum	mg/kg ww	0.010	<0.010	0.015	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.018	<0.010	<0.010	<0.010	<0.010	0.014
Nickel	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	<0.10	<0.10	<0.10	<0.10	<0.10
Phosphorus	mg/kg ww	5.0	2,330	2,480	2,650	2,620	2,640	2,360	2,440	2,050	2,610	2,540	2,940	2,590	2,510	2,480	2,360	2,480	2,370	2,690	2,550	2,500
Potassium	mg/kg ww	20	3,860	4,190	4,510	4,410	4,340	3,870	3,910	3,770	4,240	4,130	4,940	4,170	4,280	4,010	3,990	4,010	3,870	4,390	4,030	4,130
Selenium	mg/kg ww	0.20	0.25	0.29	0.24	0.26	0.28	0.28	0.25	0.24	0.28	0.33	0.26	0.23	0.31	0.24	0.31	0.24	0.27	0.29	0.29	0.25
Silver	mg/kg ww	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Sodium	mg/kg ww	20	294	311	372	392	312	314	269	305	283	253	350	279	284	271	395	258	190	256	275	247
Strontium	mg/kg ww	0.010	0.144	0.295	0.150	0.252	0.278	0.278	0.080	0.122	0.324	0.492	0.165	0.268	0.200	0.094	0.272	0.175	0.068	0.185	0.275	0.154
Thallium	mg/kg ww	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010
Tin	mg/kg ww	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Titanium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium	mg/kg ww	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg ww	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	mg/kg ww	0.10	3.50	3.93	4.54	5.89	4.99	5.36	3.33	4.29	3.91	4.89	4.49	4.88	5.67	3.38	4.11	5.04	3.25	3.92	4.50	3.48

mg/kg ww = milligrams per kilogram wet weight; < = less than; GK11ULKTR001 = individual fish biomarker; - = parameter was not measured.

Appendix B Table 3 Metal Concentrations in Lake Trout Liver Tissue from Lake N11, July 2011.

Parameter	Units	Detection Limit	GK11ULKTR001	GK11ULKTR002	GK11ULKTR003	GK11ULKTR004	GK11ULKTR005	GK11ULKTR006	GK11ULKTR007	GK11ULKTR008	GK11ULKTR009	GK11ULKTR010	GK11ULKTR011	GK11ULKTR012	GK11ULKTR013	GK11ULKTR014	GK11ULKTR015	GK11ULKTR016	GK11ULKTR017	GK11ULKTR018	GK11ULKTR019	GK11ULKTR020	
Physical Tests																							
% Moisture	%	0.10	74.3	73.9	73.3	75.0	76.6	78.5	76.0	77.1	76.1	78.1	76.6	74.1	-	76.2	73.0	76.3	74.5	-	-	77.5	
Total Metals																							
Aluminum	mg/kg ww	2.0 to 4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0	
Antimony	mg/kg ww	0.010 to 0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.010	<0.010	
Arsenic	mg/kg ww	0.010 to 0.020	0.023	0.025	0.026	0.026	0.019	0.021	0.031	0.026	0.030	0.024	0.029	0.049	0.047	0.036	0.029	0.041	0.037	0.058	0.039	0.048	
Barium	mg/kg ww	0.020 to 0.040	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.040	<0.020	<0.020	
Beryllium	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	
Bismuth	mg/kg ww	0.060 to 0.120	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.120	<0.060	<0.060	
Cadmium	mg/kg ww	0.0060 to 0.012	0.109	0.103	0.163	0.188	0.167	0.123	0.160	0.185	0.0933	0.0733	0.138	0.0990	0.0740	0.185	0.203	0.162	0.160	0.138	0.129	0.152	
Calcium	mg/kg ww	2.0 to 4.0	81.3	47.1	49.8	64.6	69.9	49.5	82.9	97.4	47.4	79.3	97.6	62.9	60.9	60.3	57.8	64.6	80.5	52.0	59.6	46.7	
Chromium	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.13	<0.10	<0.10	0.10	<0.10	<0.20	<0.10	0.33
Cobalt	mg/kg ww	0.020 to 0.040	0.160	0.178	0.119	0.299	0.170	0.147	0.303	0.134	0.107	0.173	0.160	0.094	0.053	0.175	0.116	0.141	0.203	0.102	0.120	0.156	
Copper	mg/kg ww	0.040 to 0.080	15.2	12.0	18.3	24.8	16.6	14.1	12.6	7.64	17.3	10.4	41.0	16.7	6.03	14.8	26.1	22.5	22.0	8.61	7.74	11.4	
Iron	mg/kg ww	1.0 to 2.0	373	301	591	667	575	390	442	520	193	405	620	205	157	444	606	451	437	402	474	199	
Lead	mg/kg ww	0.020 to 0.040	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.021	<0.020	<0.020	<0.020	<0.020	0.034	<0.020	<0.020	<0.040	<0.020	
Lithium	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	
Magnesium	mg/kg ww	1.0 to 2.0	202	178	175	193	165	156	176	165	167	173	209	209	176	204	186	192	161	180	176	169	
Manganese	mg/kg ww	0.010 to 0.020	2.10	1.92	1.58	1.80	1.23	1.45	1.89	1.46	2.22	1.25	1.83	1.53	1.87	1.65	1.60	1.65	1.72	1.75	1.54	1.55	
Mercury	mg/kg ww	0.0020	1.05	0.425	0.330	1.67	1.30	0.390	1.47	1.16	0.377	0.312	0.888	0.229	0.140	0.416	3.14	0.427	0.605	0.341	0.332	0.204	
Molybdenum	mg/kg ww	0.010 to 0.020	0.103	0.182	0.184	0.183	0.160	0.144	0.125	0.192	0.137	0.142	0.142	0.212	0.153	0.180	0.252	0.191	0.219	0.200	0.196	0.205	
Nickel	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	0.11	<0.10	0.21	<0.10	0.22	
Phosphorus	mg/kg ww	5.0	3,760	3,350	3,450	3,660	3,030	3,040	3,380	2,800	3,160	3,120	3,650	4,140	3,230	3,650	2,950	3,070	3,400	3,420	3,510	3,430	
Potassium	mg/kg ww	20	3,550	3,220	3,500	3,350	2,580	2,900	3,080	2,830	3,270	3,000	4,000	4,410	2,880	3,640	2,990	3,430	3,320	3,520	3,550	3,460	
Selenium	mg/kg ww	0.20 to 0.40	1.37	1.93	2.30	2.55	1.43	1.53	1.40	1.43	1.46	1.87	1.31	2.06	1.76	1.66	2.98	1.84	2.46	1.62	1.50	2.04	
Silver	mg/kg ww	0.050 to 0.100	0.079	<0.050	0.071	0.083	0.081	0.075	0.065	<0.050	0.089	<0.050	0.232	0.096	<0.050	0.052	0.104	0.100	0.110	<0.10	<0.050	<0.050	
Sodium	mg/kg ww	20 to 40	894	1,090	915	999	1,210	1,300	1,050	1,290	1,280	1,560	1,040	1,070	1,560	1,190	1,060	985	1,090	1,100	869	1,140	
Strontium	mg/kg ww	0.010 to 0.020	0.174	0.134	0.097	0.153	0.153	0.146	0.119	0.215	0.129	0.256	0.157	0.156	0.192	0.134	0.101	0.146	0.133	0.140	0.133	0.092	
Thallium	mg/kg ww	0.010 to 0.020	0.051	0.031	0.054	0.055	0.023	0.035	0.056	0.037	0.053	0.024	0.038	0.108	0.077	0.046	0.045	0.063	0.062	0.054	0.041	0.096	
Tin	mg/kg ww	0.050 to 0.100	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.050	
Titanium	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	
Uranium	mg/kg ww	0.0020 to 0.0040	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040	<0.0020	<0.0020	
Vanadium	mg/kg ww	0.10 to 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	
Zinc	mg/kg ww	0.10 to 0.20	36.5	30.8	31.6	36.8	36.1	31.6	31.8	26.4	29.7	30.3	38.6	35.0	24.6	33.6	34.6	34.1	35.4	29.6	28.2	31.7	

mg/kg ww = milligrams per kilogram wet weight; < = less than; GK11ULKTR001 = individual fish biomarker; - = parameter was not measured.

Appendix B Table 4 Metal Concentrations in Round Whitefish Muscle and Liver Tissues from Kennady Lake, August 2004

Parameter	Units	Detection Limit	WFKL-AUG 14-#1 FISH	WFKL-AUG 14-#2 FISH	WFKL-AUG 14-#3 FISH	WFKL-AUG 14-#4 FISH	WFKL-AUG 14-#5 FISH	WFKL-AUG 14-#6 FISH	WF 04-09-14-1 FISH	WF 04-09-14-2 FISH	WF 04-09-14-3 FISH	WF 04-09-14-4 FISH	WF 04-09-14-5 FISH	WF 04-09-14-1 LIVER	WF 04-09-14-2 LIVER
			Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle	Muscle
Physical Tests															
% Moisture	%	0.10	76.3	78.7	78.6	76.9	76.1	78.1	76.0	73.3	76.9	77.3	77.9	-	-
Total Metals															
Aluminum	mg/kg ww	2.0 to 20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<6.0
Antimony	mg/kg ww	0.04 to 0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.1	<0.040
Arsenic	mg/kg ww	0.04 to 0.010	0.029	0.046	0.043	0.044	0.065	0.044	0.037	0.043	0.035	0.037	0.035	0.19	0.141
Barium	mg/kg ww	0.020 to 0.20	0.035	0.097	0.065	0.048	0.075	0.026	0.148	0.113	0.089	0.038	0.050	<0.20	<0.080
Beryllium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	<0.40
Bismuth	mg/kg ww	0.060 to 0.6	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.60	<0.24
Cadmium	mg/kg ww	0.0060 to 0.06	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.060	0.042
Calcium	mg/kg ww	2.0 to 20	149	538	297	281	384	113	669	627	377	182	249	63.0	59.6
Chromium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	2.18
Cobalt	mg/kg ww	0.020 to 0.20	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.20	0.087
Copper	mg/kg ww	0.040 to 0.40	0.271	0.283	1.06	0.365	2.35	0.466	1.42	0.761	0.702	0.455	0.407	1.59	1.48
Iron	mg/kg ww	1.0 to 10	3.1	2.6	2.3	2.1	3.2	2.3	2.8	2.8	2.3	1.8	2.2	83	251
Lead	mg/kg ww	0.020 to 0.20	<0.020	<0.020	0.037	<0.020	0.075	<0.020	0.051	0.020	<0.020	<0.020	<0.020	<0.20	<0.080
Lithium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	<0.40
Magnesium	mg/kg ww	1.0 to 10	320	330	367	331	375	329	321	376	331	310	307	160	148
Manganese	mg/kg ww	0.010 to 0.10	0.081	0.149	0.128	0.111	0.136	0.070	0.193	0.177	0.207	0.099	0.104	1.50	1.62
Mercury	mg/kg ww	0.0020	0.125	0.125	0.0989	0.109	0.142	0.142	0.107	0.117	0.0962	0.0887	0.0999	0.140	0.130
Molybdenum	mg/kg ww	0.010 to 0.10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.28	0.346
Nickel	mg/kg ww	0.10 to 1.0	0.71	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	1.70
Phosphorus	mg/kg ww	5.0 to 50	3,520	2,910	3,430	2,680	3,320	2,980	2,710	3,140	2,920	3,380	2,880	2,690	2,460
Potassium	mg/kg ww	20 to 200	6,820	4,430	5,520	4,590	5,330	5,140	4,020	5,030	4,980	6,230	5,300	2,040	2,030
Selenium	mg/kg ww	0.20 to 2.0	0.23	0.28	0.30	0.25	0.29	0.28	0.28	0.33	0.31	0.27	0.31	<2.0	1.01
Silver	mg/kg ww	0.050 0.50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.50	<0.20
Sodium	mg/kg ww	20 to 200	287	288	370	276	390	330	295	360	259	252	284	980	770
Strontium	mg/kg ww	0.010 to 0.10	0.439	1.48	0.931	0.790	1.07	0.254	2.17	1.89	1.33	0.546	0.642	0.31	0.317
Thallium	mg/kg ww	0.010 to 0.10	<0.010	0.010	0.011	0.011	0.012	<0.010	<0.010	0.012	0.012	<0.010	<0.010	<0.10	0.062
Tin	mg/kg ww	0.050 to 0.50	<0.050	<0.050	<0.050	<0.050	0.150	<0.050	0.089	<0.050	<0.050	<0.050	<0.050	<0.50	<0.20
Titanium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	<0.30
Uranium	mg/kg ww	0.0020 to 0.020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.020	<0.0080
Vanadium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0	<0.40
Zinc	mg/kg ww	0.10 to 1.0	3.16	3.66	3.94	3.49	4.05	3.44	3.99	3.65	3.34	3.21	3.44	21.0	19.0

mg/kg ww= milligrams per kilogram wet weight; < = less than; GK11ULKTR001 = individual fish biomarker; - = parameter was not measured.

Appendix B Table 5 Metal Concentrations in Lake Trout Liver Tissues from Kennady Lake, Lake N16, and Lake 410, in 2004.

Parameter	Units	Detection Limit	2004 LKTR LIVER 7-LIVER	2004 LKTR LIVER KL2-LIVER	2004 LKTR LIVER KL3-LIVER	2004 LKTR LIVER L410-1 LIVER	2004 LKTR LIVER L410-2 LIVER	2004 LKTR LIVER L410-3 LIVER	LKTR LIVER L410-4 LIVER	2004 LKTR LIVER L410-9 LIVER	2004 LKTR LIVER L410-10 LIVER	2004 LKTR LIVER CL1 LIVER	2004 LKTR LIVER CL2 LIVER	2004 LKTR LIVER CL3 LIVER	2004 LKTR LIVER CL4 LIVER	2004 LKTR LIVER CL5 LIVER	2004 LKTR LIVER CL6 LIVER	2004 LKTR LIVER CL7 LIVER	2004 LKTR LIVER CL8 LIVER	2004 LKTR LIVER CL9 LIVER	2004 LKTR LIVER CL10 LIVER	2004 LKTR LIVER L410-5 LIVER	2004 LKTR LIVER L410-6 LIVER
Physical tests																							
% Moisture	%	0.1	75.8	75.1	78.8	75.2	-	73.7	-	72.5	74.1	77.1	-	74.3	-	74.4	-	-	-	-	-	-	73.9
Total Metal																							
Aluminum	mg/kg ww	2.0 to 20	<2.0	<2.0	2.3	5.3	6.1	2.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0
Antimony	mg/kg ww	0.04 to 0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.010	<0.010
Arsenic	mg/kg ww	0.04 to 0.010	0.048	0.040	0.033	0.101	0.064	0.032	0.044	0.089	0.020	0.050	0.052	0.042	0.046	0.044	0.034	0.039	0.044	0.041	0.087	0.072	0.028
Barium	mg/kg ww	0.020 to 0.20	<0.020	<0.020	<0.020	0.021	<0.020	<0.020	<0.020	<0.020	0.021	<0.020	0.023	<0.020	<0.020	<0.020	0.026	<0.020	0.025	0.024	0.070	<0.020	<0.020
Beryllium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10
Bismuth	mg/kg ww	0.060 to 0.6	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.12	<0.060	<0.060
Cadmium	mg/kg ww	0.0060 to 0.06	0.115	0.0733	0.181	0.230	0.240	0.128	0.154	0.107	0.120	0.165	0.155	0.312	0.219	0.255	0.212	0.119	0.0985	0.243	0.150	0.231	0.104
Calcium	mg/kg ww	2.0 to 20	43.5	56.4	64.7	178	72.4	628	80.1	69.5	121	46.0	74.5	48.7	49.6	96.1	50.7	108	40.0	222	77.4	178	131
Chromium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	0.44	0.11	0.20	<0.10	<0.10	0.29	0.11	<0.10	0.15	0.22	<0.10	<0.10	0.13	<0.10	0.99	1.16	<0.10
Cobalt	mg/kg ww	0.020 to 0.20	0.122	0.084	0.193	0.118	0.271	0.227	0.362	0.146	0.242	0.136	0.148	0.104	0.125	0.196	0.115	0.179	0.160	0.096	0.274	0.110	0.193
Copper	mg/kg ww	0.040 to 0.40	16.8	5.56	27.5	62.2	29.1	8.10	20.4	27.6	18.3	17.3	18.5	8.86	17.6	6.16	23.3	12.4	11.4	21.0	50.1	18.2	9.20
Iron	mg/kg ww	1.0 to 10	424	192	885	579	1440	484	587	261	226	618	355	522	493	603	597	508	378	943	914	1070	323
Lead	mg/kg ww	0.020 to 0.20	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.040	<0.020	<0.020
Lithium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10
Magnesium	mg/kg ww	1.0 to 10	193	178	126	196	236	180	181	218	190	182	200	176	176	195	195	199	170	204	192	205	199
Manganese	mg/kg ww	0.010 to 0.10	1.61	1.97	1.00	1.79	2.02	1.75	1.75	2.29	1.68	1.38	1.87	1.46	2.01	1.66	1.94	1.97	1.29	2.10	2.88	1.81	1.67
Mercury	mg/kg ww	0.002	0.147	0.121	1.07	1.02	0.730	4.62	0.790	0.465	0.786	1.59	0.807	3.62	0.545	0.801	0.254	0.326	0.425	0.785	0.419	1.59	1.17
Molybdenum	mg/kg ww	0.010 to 0.10	0.182	0.119	0.189	0.172	0.290	0.148	0.219	0.153	0.134	0.154	0.148	0.127	0.158	0.202	0.198	0.166	0.186	0.214	0.320	0.343	0.141
Nickel	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	0.36	0.10	0.17	<0.10	<0.10	0.21	<0.10	<0.10	0.75	0.23	<0.10	<0.10	0.14	<0.10	0.67	1.02	<0.10
Phosphorus	mg/kg ww	5.0 to 50	4,040	4,410	2,550	4,060	4,450	3,620	3,680	4,040	3,600	3,810	4,140	3,860	3,260	3,600	4,720	4,110	2,980	3,880	3,760	3,640	3,670
Potassium	mg/kg ww	20 to 200	3,460	4,770	2,540	3,510	3,740	3,130	2,910	3,450	2,900	3,790	3,250	3,490	2,810	3,140	4,390	3,510	2,510	3,670	3,200	3,100	3,010
Selenium	mg/kg ww	0.20 to 2.0	1.58	1.01	1.99	1.61	2.44	3.04	2.07	1.37	1.53	1.61	1.74	2.66	1.06	2.25	1.53	1.94	1.84	1.76	2.41	2.57	2.02
Silver	mg/kg ww	0.050 0.50	0.130	<0.050	0.233	0.205	0.278	<0.050	0.137	0.090	0.105	0.103	0.148	<0.050	0.096	<0.050	0.095	0.067	0.090	0.160	0.31	0.164	<0.050
Sodium	mg/kg ww	20 to 200	733	751	1,540	902	1,160	1,030	1,110	880	1,330	1,140	1,080	1,170	1,200	1,250	919	1,120	1,030	947	1,130	1,200	1,090
Strontium	mg/kg ww	0.010 to 0.10	0.118	0.107	0.152	0.320	0.101	0.823	0.133	0.108	0.194	0.074	0.121	0.095	0.086	0.131	0.089	0.201	0.070	0.385	0.135	0.277	0.254
Thallium	mg/kg ww	0.010 to 0.10	0.117	0.067	0.043	0.060	0.225	0.082	0.089	0.108	0.073	0.058	0.064	0.142	0.031	0.073	0.083	0.087	0.087	0.083	0.066	0.135	0.058
Tin	mg/kg ww	0.050 to 0.50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.050
Titanium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10
Uranium	mg/kg ww	0.0020 to 0.020	<0.0020	<0.0020	<0.0020	0.0031	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040	<0.0020	<0.0020
Vanadium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10
Zinc	mg/kg ww	0.10 to 1.0	29.9	27.4	37.7	49.0	58.9	43.2	42.6	43.7	37.4	31.9	38.9	28.2	33.6	32.1	47.8	38.0	39.5	41.5	49.1	38.8	39.8

Appendix B Table 5 Metal Concentrations in Lake Trout Liver Tissues from Kennady Lake, Lake N16, and Lake 410, in 2004 (continued)

Parameter	Units	Detection Limit	2004 LKTR LIVER L410-7 LIVER	2004 LKTR LIVER L410-8 LIVER	2004 LKTR LIVER KLA RELABELLED KL4 LIVER	2004 LKTR LIVER CL-LT-1-08-09-04 LIVER	2004 LKTR LIVER CL-LT-2-08-09-04 LIVER	2004 LKTR LIVER CL-LT-3-08-09-04 LIVER	2004 LKTR LIVER CL-LT-4-08-09-04 LIVER	2004 LKTR LIVER CL-LT-5-08-09-04 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#1 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#3 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#4 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#5 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#9 LIVER	2004 LKTR LIVER LT-CONT-AUG 12-#10 LIVER	2004 LKTR LIVER 410 LT-8-08-09-04	2004 LKTR LIVER 410 LT-10-08-09-04	2004 LKTR LIVER LT-410-AUG 13-#1 LIVER	2004 LKTR LIVER LT-410-AUG 13-#2 LIVER	2004 LKTR LIVER LT-410-AUG 13-#3 LIVER	2004 LKTR LIVER LT-410-AUG 13-#4 LIVER	2004 LKTR LIVER LT-410-AUG 13-#5 LIVER
Physical tests																							
% Moisture	%	0.1	-	-	-	-	70.1	74.9	-	75.0	-	73.1	79.4	-	68.4	65.0	-	75.3	74.5	68.8	74.8	80.9	74.5
Total Metal																							
Aluminum	mg/kg ww	2.0 to 20	<2.0	2.0	<2.0	3.8	<2.0	<2.0	2.5	<2.0	<2.0	2.1	3.4	<2.0	<2.0	<2.0	<4.0	2.5	2.1	<2.0	<2.0	2.0	<2.0
Antimony	mg/kg ww	0.04 to 0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	mg/kg ww	0.04 to 0.010	0.071	0.062	0.084	0.069	0.046	0.069	0.058	0.045	0.047	0.044	0.053	0.041	0.045	0.057	0.068	0.038	0.034	0.033	0.036	0.047	0.034
Barium	mg/kg ww	0.020 to 0.20	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.067	<0.020	<0.020	<0.020	<0.020	<0.040	<0.020	<0.020	<0.020	<0.020	<0.020	0.022
Beryllium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	mg/kg ww	0.060 to 0.6	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.12	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Cadmium	mg/kg ww	0.0060 to 0.06	0.103	0.145	0.156	0.340	0.225	0.252	0.157	0.136	0.0837	0.436	0.386	0.0859	0.291	0.111	0.059	0.118	0.114	0.0594	0.0725	0.163	0.0578
Calcium	mg/kg ww	2.0 to 20	45.1	63.6	68.0	64.1	96.4	46.5	149	57.5	60.1	54.2	64.9	56.6	62.8	55.3	119	68.5	106	41.1	50.1	151	72.6
Chromium	mg/kg ww	0.10 to 1.0	0.21	<0.10	0.24	0.18	0.20	0.16	<0.10	0.71	<0.10	0.13	0.17	0.54	0.13	<0.10	<0.20	0.35	<0.10	<0.10	0.20	<0.10	0.19
Cobalt	mg/kg ww	0.020 to 0.20	0.195	0.269	0.156	0.242	0.251	0.248	0.336	0.266	0.188	0.308	0.247	0.119	0.133	0.185	0.075	0.192	0.115	0.155	0.090	0.075	0.108
Copper	mg/kg ww	0.040 to 0.40	16.4	18.5	10.2	23.3	7.86	43.9	9.40	23.6	6.32	21.6	10.5	13.7	25.4	9.88	9.21	8.27	7.40	9.20	10.2	18.9	6.62
Iron	mg/kg ww	1.0 to 10	347	620	513	968	1,570	1,000	822	529	244	1,220	1,630	214	1,000	160	201	719	539	313	285	460	176
Lead	mg/kg ww	0.020 to 0.20	<0.020	<0.020	<0.020	0.102	0.039	0.064	0.108	0.225	0.059	0.020	<0.020	<0.020	0.044	0.073	<0.040	0.070	0.022	<0.020	<0.020	<0.020	0.023
Lithium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	mg/kg ww	1.0 to 10	172	192	173	171	176	152	231	143	186	174	138	159	187	156	161	132	212	116	133	135	127
Manganese	mg/kg ww	0.010 to 0.10	3.10	1.83	1.75	2.09	1.94	1.35	3.04	1.91	1.71	2.83	1.19	1.43	1.73	1.59	1.22	1.10	2.49	0.688	0.946	1.16	1.06
Mercury	mg/kg ww	0.002	0.342	0.677	0.130	1.07	1.99	2.50	0.341	0.475	0.292	2.13	1.39	0.105	1.64	0.291	0.216	0.261	0.661	0.276	0.308	0.659	0.232
Molybdenum	mg/kg ww	0.010 to 0.10	0.189	0.129	0.214	0.304	0.140	0.197	0.159	0.302	0.213	0.226	0.225	0.210	0.243	0.183	0.134	0.155	0.115	0.124	0.136	0.175	0.128
Nickel	mg/kg ww	0.10 to 1.0	0.21	<0.10	0.18	<0.10	0.19	0.11	<0.10	0.62	<0.10	<0.10	<0.10	0.43	<0.10	<0.10	<0.20	0.27	<0.10	<0.10	0.17	<0.10	0.17
Phosphorus	mg/kg ww	5.0 to 50	3570	3890	3720	3760	3410	2800	4180	2940	3640	3530	2700	2910	3450	2840	3490	2290	4110	2180	2430	2590	2280
Potassium	mg/kg ww	20 to 200	2740	3400	2810	3450	2490	2750	3740	2720	3210	3310	2620	2610	3330	2340	2670	2100	3650	2370	2350	2340	2450
Selenium	mg/kg ww	0.20 to 2.0	2.93	1.85	1.83	2.19	3.21	3.01	1.18	1.78	1.78	3.29	2.82	1.66	4.75	2.23	1.98	1.32	0.90	1.24	1.43	1.60	1.29
Silver	mg/kg ww	0.050 to 0.50	0.109	0.149	0.078	0.158	<0.050	0.484	<0.050	0.177	0.054	0.122	0.056	0.057	0.140	0.068	<0.10	<0.050	<0.050	<0.050	<0.050	0.083	<0.050
Sodium	mg/kg ww	20 to 200	1,210	1,100	1,490	1,050	1,510	1,330	1,220	1,270	978	1,080	1,140	870	790	1,220	1,630	1,430	1,130	1,170	1,280	1,600	1,250
Strontium	mg/kg ww	0.010 to 0.10	0.070	0.113	0.199	0.108	0.198	0.091	0.200	0.127	0.185	0.088	0.111	0.147	0.110	0.134	0.375	0.170	0.179	0.139	0.152	0.291	0.243
Thallium	mg/kg ww	0.010 to 0.10	0.233	0.168	0.049	0.056	0.036	0.039	0.156	0.033	0.074	0.024	0.034	0.045	0.045	0.095	0.075	0.045	0.140	0.069	0.060	0.048	0.070
Tin	mg/kg ww	0.050 to 0.50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Titanium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium	mg/kg ww	0.0020 to 0.020	<0.0020	<0.0020	<0.0020	0.0047	<0.0020	<0.0020	0.0030	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg ww	0.10 to 1.0	<0.10	0.12	<0.10	0.13	0.10	<0.10	0.14	0.12	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	mg/kg ww	0.10 to 1.0	35.9	43.1	35.3	33.3	31.9	40.9	34.7	35.2	32.0	33.4	30.5	31.4	45.2	30.8	34.6	27.8	32.6	24.3	27.5	35.0	25.5

Appendix B Table 5 Metal Concentrations in Lake Trout Liver Tissues from Kennady Lake, Lake N16, and Lake 410, in 2004 (continued)

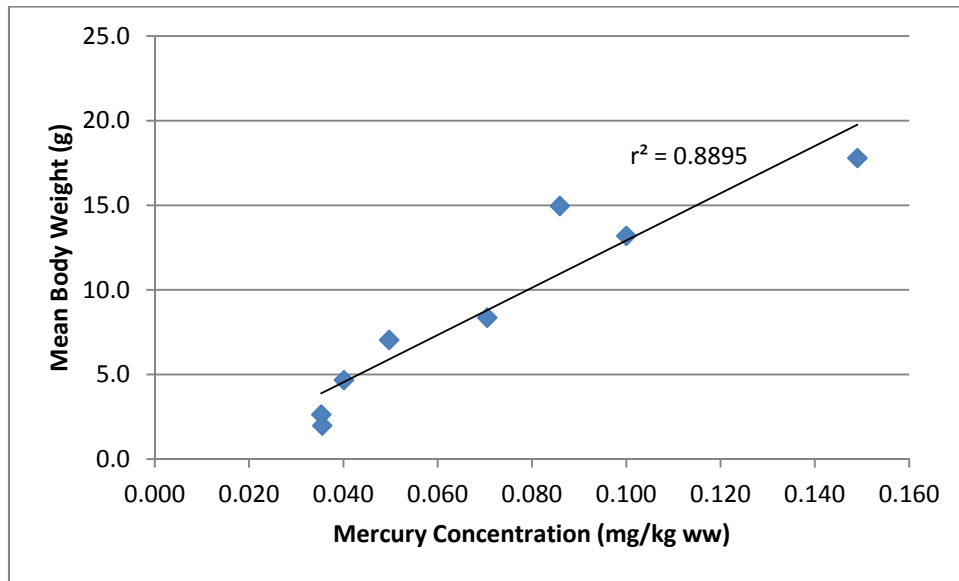
Parameter	Units	Detection Limit	2004 LKTR LIVER LT-410-AUG 13-#6 LIVER	2004 LKTR LIVER KL-5 LIVER	2004 LKTR LIVER LT-KL-AUG 14-#1 LIVER	2004 LKTR LIVER LT-KL-AUG 14-#2 LIVER	2004 LKTR LIVER LT-KL-AUG 14-#3 LIVER	2004 LKTR LIVER LT-KL-AUG 14-#4 LIVER	2004 LKTR LIVER LT-KL-AUG 14-#5 LIVER	2004 LKTR LIVER LT-KL-9017-#1 LIVER	2004 LKTR LIVER LT-KL-9017-#2 LIVER	2004 LKTR LIVER LT-KL-9017-#3 LIVER	2004 LKTR LIVER LT-KL-9018-#1 LIVER	2004 LKTR LIVER LT-KL-9020-#1 LIVER	2004 LKTR LIVER LT-KL-9020-#2 LIVER	2004 LKTR LIVER LT-KL-9020-#3 LIVER	2004 LKTR LIVER LT-KL-9020-#4 LIVER	2004 LKTR LIVER LT-KL-9020-#5 LIVER	2004 LKTR LIVER LT-KL-9020-#6 LIVER	2004 LKTR LIVER LT-KL-9020-#7 LIVER	LKTR LIVER LT-KL-9020-#8 LIVER	2004 LKTR LIVER LAKE TROUT, KENNEDY LAKE, SEP 12
Physical tests																						
% Moisture	%	0.1	-	70.4	81.1	81.6	76.9	78.7	81.0	75.8	75.3	78.7	78.5	78.5	71.3	77.0	73.9	-	75.9	-	-	76.1
Total Metal																						
Aluminum	mg/kg ww	2.0 to 20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	9.3	<2.0	<2.0	4.5
Antimony	mg/kg ww	0.04 to 0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	mg/kg ww	0.04 to 0.010	0.040	0.043	0.043	0.042	0.049	0.052	0.054	0.050	0.039	0.068	0.043	0.042	0.039	0.047	0.049	0.058	0.055	0.051	0.049	0.052
Barium	mg/kg ww	0.020 to 0.20	<0.020	<0.020	0.027	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.041	<0.020	<0.020	<0.020
Beryllium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	mg/kg ww	0.060 to 0.6	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Cadmium	mg/kg ww	0.0060 to 0.06	0.0404	0.179	0.132	0.0988	0.0849	0.117	0.175	0.256	0.111	0.334	0.167	0.115	0.104	0.0758	0.0323	0.317	0.256	0.145	0.157	0.117
Calcium	mg/kg ww	2.0 to 20	47.5	155	57.5	89.8	48.6	117	75.1	40.9	43.9	47.2	88.1	99.1	50.9	30.4	43.2	33.2	243	50.3	47.9	76.1
Chromium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	0.41	0.24	<0.10	0.16	0.53	<0.10	0.14	<0.10	0.30	<0.10	<0.10	0.10	<0.10	<0.10	0.18	0.16	<0.10	0.16
Cobalt	mg/kg ww	0.020 to 0.20	0.088	0.123	0.150	0.361	0.113	0.104	0.151	0.165	0.129	0.212	0.065	0.081	0.107	0.059	0.069	0.130	0.288	0.154	0.148	0.194
Copper	mg/kg ww	0.040 to 0.40	9.58	24.0	6.69	7.83	12.0	8.90	10.8	36.5	18.9	6.63	24.3	6.51	25.1	8.84	4.04	10.3	11.5	16.1	7.03	8.41
Iron	mg/kg ww	1.0 to 10	170	399	603	266	379	519	606	1170	363	2680	763	199	193	242	126	942	1590	608	501	548
Lead	mg/kg ww	0.020 to 0.20	0.021	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.026	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.061	0.029	<0.020	0.044
Lithium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	mg/kg ww	1.0 to 10	150	159	150	188	190	167	176	197	193	190	153	150	160	144	137	174	179	182	193	185
Manganese	mg/kg ww	0.010 to 0.10	1.28	1.49	1.51	1.71	1.62	1.67	1.91	2.04	1.81	1.75	1.49	1.03	1.51	1.16	0.918	1.89	1.71	1.75	1.64	1.74
Mercury	mg/kg ww	0.002	0.178	1.51	0.0955	0.131	0.137	0.257	0.321	1.67	1.18	0.365	0.925	1.80	2.74	1.66	0.150	0.266	0.316	0.160	0.182	0.146
Molybdenum	mg/kg ww	0.010 to 0.10	0.123	0.186	0.183	0.078	0.184	0.191	0.228	0.213	0.117	0.287	0.165	0.080	0.157	0.101	0.104	0.211	0.276	0.183	0.204	0.236
Nickel	mg/kg ww	0.10 to 1.0	<0.10	<0.10	0.32	0.18	<0.10	0.14	0.42	<0.10	0.12	0.21	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	0.14	<0.10	0.13
Phosphorus	mg/kg ww	5.0 to 50	2,800	3,000	3,850	3,260	3,170	2,860	3,070	3,650	3,530	3,440	3,280	2,900	3,990	3,270	2,460	3,680	3,560	3,750	4,220	3,530
Potassium	mg/kg ww	20 to 200	2,160	2,790	3,690	3,490	2,990	2,540	2,620	3,710	3,410	3,370	3,300	2,800	3,290	3,110	2,580	3,550	3,270	3,790	3,810	3,420
Selenium	mg/kg ww	0.20 to 2.0	1.61	4.48	1.33	0.66	1.99	1.42	1.76	5.46	3.57	1.91	2.14	2.21	3.80	2.00	1.84	1.42	3.65	1.36	1.67	2.39
Silver	mg/kg ww	0.050 to 0.50	<0.050	0.178	0.051	0.083	0.130	0.071	0.091	0.309	0.102	0.055	0.312	<0.050	0.165	<0.050	<0.050	0.111	0.159	0.192	0.069	0.062
Sodium	mg/kg ww	20 to 200	1,190	1,040	1,460	1,480	1,470	1,560	1,640	794	1,100	1,330	1,200	1,310	1,130	1,110	1,220	873	1,080	1,000	927	806
Strontium	mg/kg ww	0.010 to 0.10	0.167	0.250	0.181	0.149	0.151	0.312	0.181	0.065	0.084	0.094	0.167	0.162	0.087	0.069	0.156	0.081	0.378	0.107	0.110	0.152
Thallium	mg/kg ww	0.010 to 0.10	0.086	0.115	0.031	0.088	0.078	0.047	0.064	0.086	0.128	0.061	0.084	0.053	0.096	0.083	0.083	0.080	0.095	0.064	0.058	0.074
Tin	mg/kg ww	0.050 to 0.50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Titanium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium	mg/kg ww	0.0020 to 0.020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0030	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg ww	0.10 to 1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10
Zinc	mg/kg ww	0.10 to 1.0	25.8	32.0	30.2	22.9	26.8	28.5	28.0	42.4	33.3	31.8	37.4	22.2	36.7	20.7	18.5	28.5	41.4	35.7	29.1	30.3

Note: Values below the analytical detection limit were replaced with the analytical detection limit when calculating summary values.
mg/kg ww = milligrams per kilogram wet weight; < = less than; - = parameter was not measured.

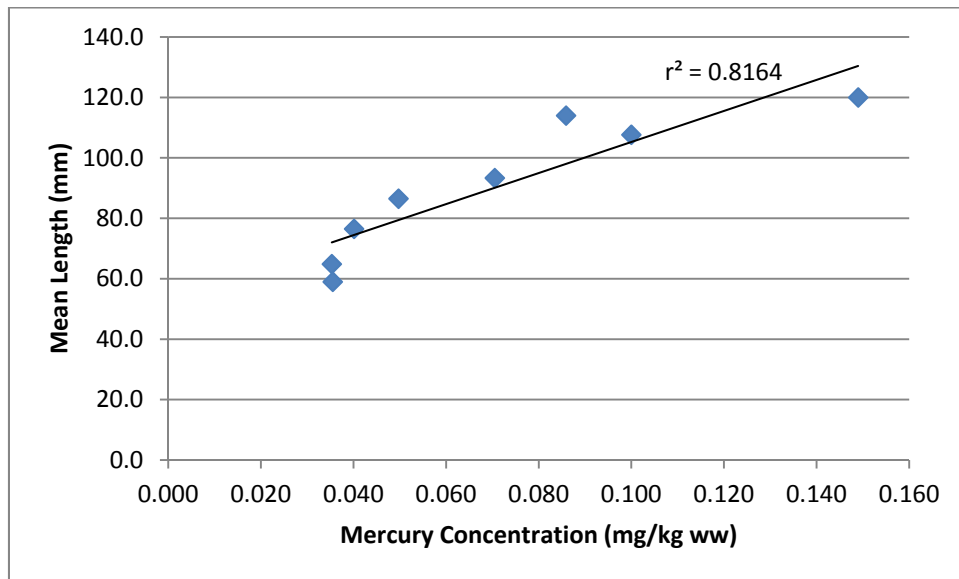
APPENDIX C

Mercury Comparison Plots

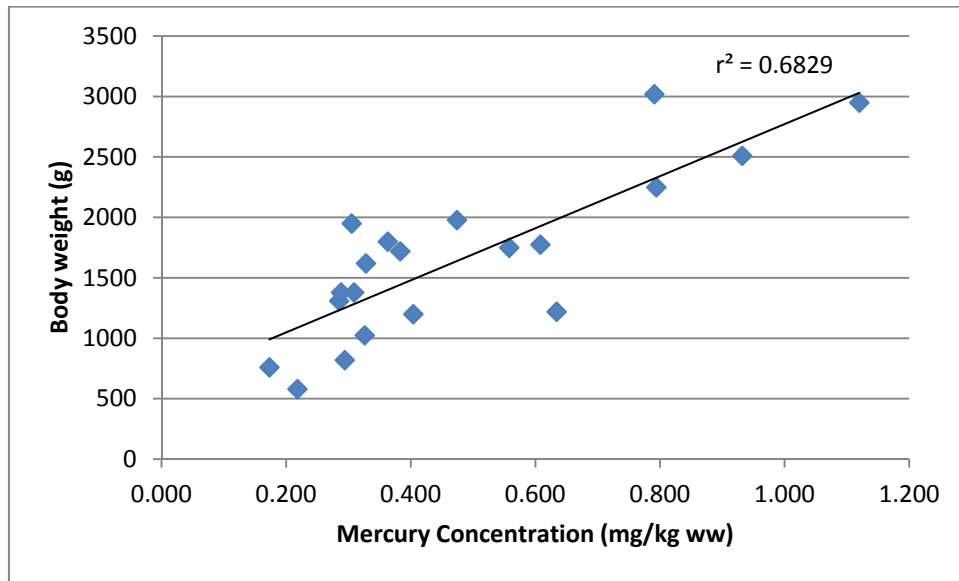
Appendix Figure 1 Whole Body Mercury Concentrations versus Mean Body Weight of Lake Chub (n = 8) Captured in Lake N11, July 2011.



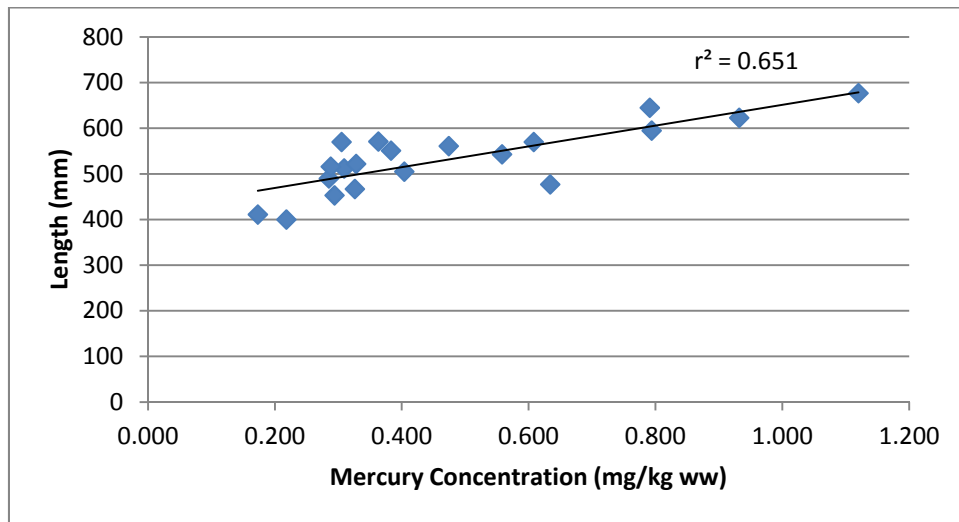
Appendix Figure 2 Whole Body Mercury Concentrations versus Mean Length of Lake Chub (n = 8) Captured in Lake N11, July 2011.



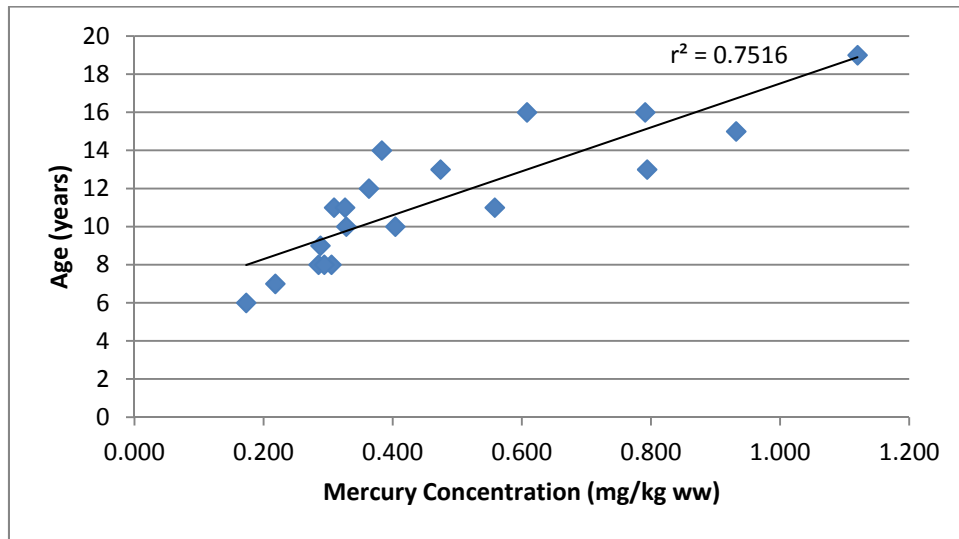
Appendix Figure 3 Mercury Concentrations in Muscle Tissue versus Body Weight of Lake Trout (n = 20)
Captured in Lake N11, July 2011.



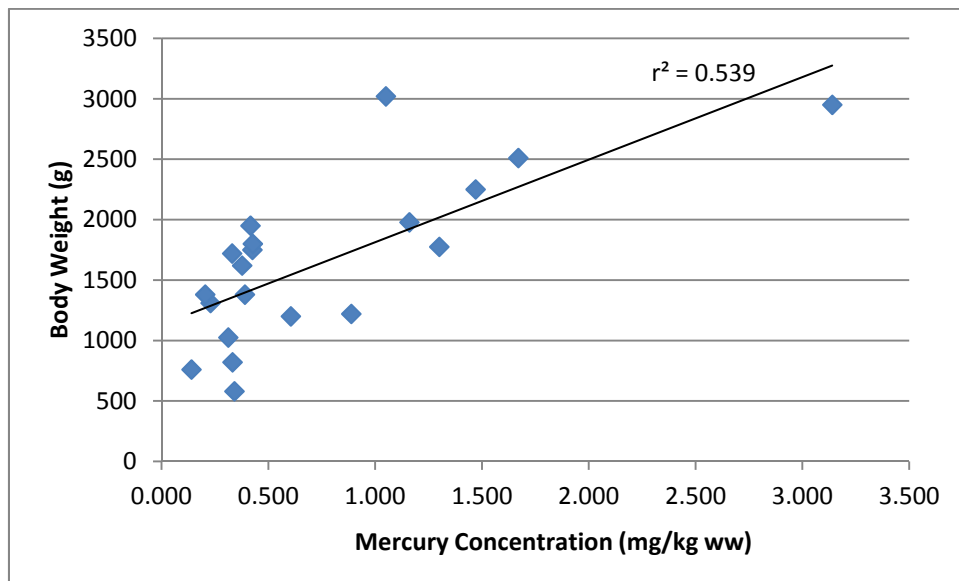
Appendix Figure 4 Mercury Concentrations in Muscle Tissue versus Length of Lake Trout Captured (n = 20) in
Lake N11, July 2011.



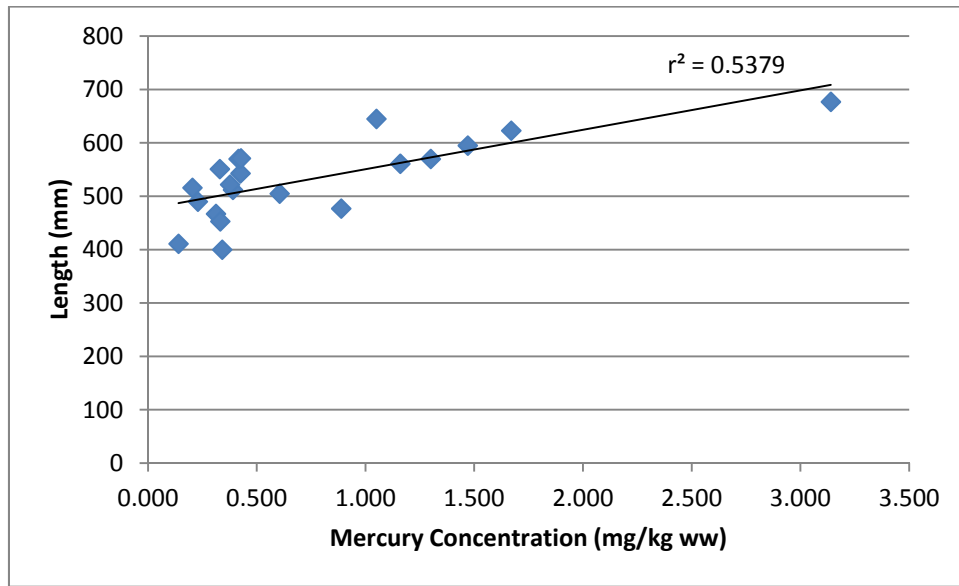
Appendix Figure 5 Mercury Concentrations in Muscle Tissue versus Age of Lake Trout (n = 19) Captured in Lake N11, July 2011.



Appendix Figure 6 Mercury Concentrations in Liver Tissue versus Body Weight of Lake Trout (n = 20) Captured in Lake N11, July 2011.



Appendix Figure 7 Mercury Concentrations in Liver Tissue versus Length of Lake Trout (n = 20) Captured in Lake N11, July 2011.



Appendix Figure 8 Mercury Concentrations in Liver Tissue versus Age of Lake Trout (n = 19) Captured in Lake N11, July 2011.

