

Technical Report No. 16-04

Aquatic Biomonitoring at Greens Creek Mine, 2015

by

Benjamin P. Brewster



April 2016

Alaska Department of Fish and Game

Division of Habitat



Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in reports by the Divisions of Habitat, Sport Fish and of Commercial Fisheries. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figures or figure captions.

Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail-fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	e
		corporate suffixes:		catch per unit effort	CPUE
Weights and measures (English)		Company	Co.	coefficient of variation	CV
cubic feet per second	ft ³ /s	Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient (multiple)	R
inch	in	District of Columbia	D.C.	correlation coefficient (simple)	r
mile	mi	et alii (and others)	et al.	covariance	cov
nautical mile	nmi	et cetera (and so forth)	etc.	degree (angular)	°
ounce	oz	exempli gratia	e.g.	degrees of freedom	df
pound	lb	(for example)		expected value	E
quart	qt	Federal Information Code	FIC	greater than	>
yard	yd	id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
Time and temperature		monetary symbols (U.S.)	\$, ¢	less than	<
day	d	months (tables and figures): first three letters	Jan, ..., Dec	less than or equal to	≤
degrees Celsius	°C	registered trademark	®	logarithm (natural)	ln
degrees Fahrenheit	°F	trademark	™	logarithm (base 10)	log
degrees kelvin	K	United States (adjective)	U.S.	logarithm (specify base)	log ₂ , etc.
hour	h	United States of America (noun)	USA	minute (angular)	'
minute	min	U.S.C.	United States Code	not significant	NS
second	s	U.S. state	use two-letter abbreviations (e.g., AK, WA)	null hypothesis	H ₀
Physics and chemistry				percent	%
all atomic symbols				probability	P
alternating current	AC			probability of a type I error (rejection of the null hypothesis when true)	α
ampere	A			probability of a type II error (acceptance of the null hypothesis when false)	β
calorie	cal			second (angular)	"
direct current	DC			standard deviation	SD
hertz	Hz			standard error	SE
horsepower	hp			variance	
hydrogen ion activity (negative log of)	pH			population	Var
parts per billion	ppb			sample	var
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

TECHNICAL REPORT NO. 16-04

AQUATIC BIOMONITORING AT GREENS CREEK MINE, 2015

by

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Division of Habitat, Region I
802 W. 3rd Street, Douglas, Alaska, 99824
April 2016

This project was financed by Hecla Greens Creek Mining Company.

Cover: Greens Creek Site 54.

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Division of Habitat staff Kate Kanouse and Gordon Willson-Naranjo assisted with data collection, Greg Albrecht and Nicole Legere processed periphyton samples, and Kate Kanouse verified data entry and analyses. Operations Manager Dr. Al Ott, Southeast Regional Supervisor Jackie Timothy, and Kate Kanouse reviewed and edited the report, Nora Foster of NRF Taxonomic Services identified the benthic macroinvertebrates, and Division of Commercial Fisheries Publication Specialist Jim Craig prepared the report for publication.

Thank you all for your contribution.

EXECUTIVE SUMMARY

Since 2001, the Alaska Department of Fish and Game (ADF&G) has completed the aquatic biomonitoring studies the U.S. Forest Service (USFS) and Alaska Department of Environmental Conservation (ADEC) require for Hecla Greens Creek Mining Company's Greens Creek Mine. This partnership provides ADF&G the opportunity to gather and review data, and help identify, assess, and resolve issues that could affect aquatic resources near the mine site.

The aquatic studies include sampling periphyton, benthic macroinvertebrates, and juvenile fish in Greens Creek and Tributary Creek, two streams near mine development and operations. In 2015, we completed these studies at Greens Creek sites 48 and 54, and Tributary Creek Site 9.

The National Weather Service reports 2015 was the second wettest year on record for Juneau, with July the wettest on record.^a

Among the 2015 samples from each site, mean periphyton densities^b, mean benthic macroinvertebrate densities, numbers of macroinvertebrate taxa, and proportions of sensitive aquatic insects were within the ranges of natural variation.

The 2015 juvenile Dolly Varden char *Salvelinus malma* populations at each site were within range of most population estimates from previous years. We captured 21 juvenile coho salmon *Oncorhynchus kitsutch* at Greens Creek Site 54, the greatest number since the fish pass was damaged in late 2005, and coho salmon continue to be the most abundant fish species at Tributary Creek Site 9. Whole body juvenile fish metals concentrations for the 2015 Greens Creek Site 48 and Site 54 samples were similar to or less than values observed in previous years, while several concentrations among the Tributary Creek Site 9 samples were the greatest observed.

^a The Juneau climate summary for the year of 2015. National Oceanic Atmospheric and Administration NWS Juneau, AK Climate Database. <http://www.arh.noaa.gov/wmofcst.php?wmo=CXAK57PAJK&type=public> (accessed February 12, 2016).

^b We usually find significant differences in chlorophyll *a* densities between the current year and the 2003 and 2006 data for Site 48 and Site 54. Periphyton densities at both sites in 2003 and 2006 were the greatest observed since 2001, which we attribute to natural variation.

INTRODUCTION

The Greens Creek Mine is located about 29 km southwest of Juneau by air, near Hawk Inlet on the west side of Admiralty Island, and within the Tongass National Forest and the Admiralty Island National Monument (USDA Forest Service 2013). The mine has operated since 1989, except between 1993 and 1996 when the mine was temporarily closed, and produces gold, lead, silver, and zinc concentrates for export. Hecla Greens Creek Mining Company (Hecla), a subsidiary of Hecla Mining Company, Coeur d'Alene, Idaho, has owned and operated the mine since April 2008.

Most mine infrastructure is located in two drainages that support both resident and anadromous fish: the dry-stack tailings disposal facility (TDF) at the headwaters of Tributary Creek, and the mill, mine facilities, and production rock storage areas adjacent to Greens Creek (Figure 1).



Figure 1.–Greens Creek Mine area map.

The mine's USFS approved Plan of Operations Fresh Water Monitoring Program (FWMP; HGCMC 2014, Appendix 1) and ADEC Waste Management Permit 2014DB0003 require aquatic studies in Greens Creek and Tributary Creek to document stream health near mine facilities.

The Division of Habitat began the aquatic studies for the Greens Creek Mine in 2001. Reports summarizing sampling results from previous years are available in Weber Scannell and Paustian (2002), Jacobs et al. (2003), Durst and Townsend (2004), Durst et al. (2005), Durst and Jacobs (2006–2010), Kanouse (2011–2012), Kanouse and Brewster (2013–2014), and Kanouse (2015).

PURPOSE

The purpose of this technical report is to summarize the 2015 sample results and document the condition of biological communities in Greens Creek and Tributary Creek near mine development and operations. This report satisfies the requirements for Hecla's USFS approved Plan of Operations (HGCMC 2014) and ADEC Waste Management Permit 2014DB0003.

AQUATIC STUDIES

We completed the following studies:

- periphyton density and community composition;
- benthic macroinvertebrate density and community composition;
- juvenile fish populations and fish condition; and
- whole body juvenile Dolly Varden char metals concentrations.

STUDY AREA

We completed the aquatic studies at the following sample sites (Figures 2, 3):

1. Greens Creek Site 48, reference site upstream of mine activities;
2. Greens Creek Site 54, downstream of mine activities; and
3. Tributary Creek Site 9, downstream of the TDF.

We have sampled Site 48, Site 54, and Site 9 annually since 2001. We sampled a fourth site, Greens Creek Site 6, in 2001, 2006, and 2011 (Kanouse 2012).

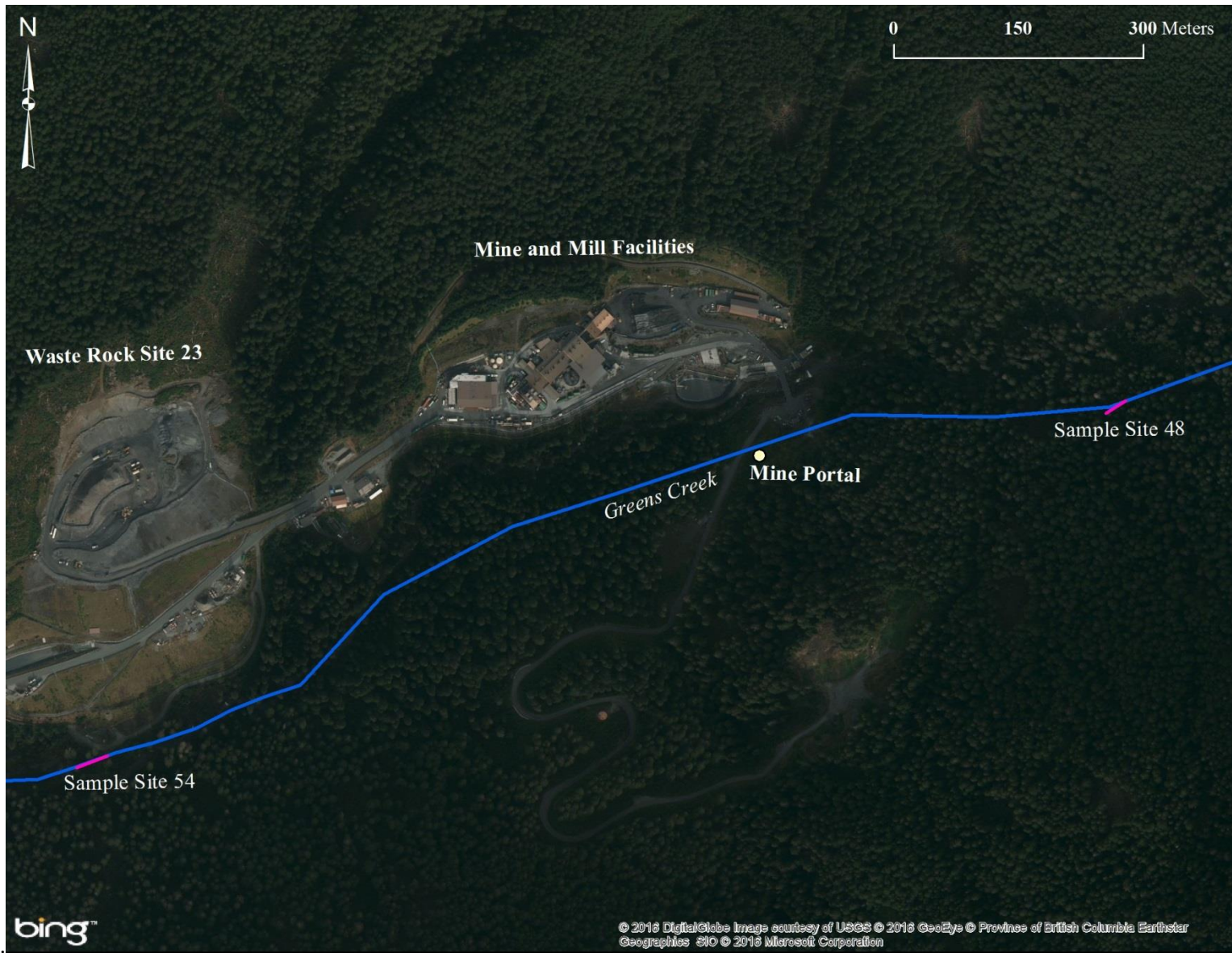


Figure 2.-Map of Greens Creek biomonitoring sample sites and mine facilities



Figure 3.—Map of Tributary Creek biomonitoring sample site and mine facilities.

Greens Creek

The Greens Creek watershed is about 58.5 km² (USGS 2016) and the main channel measures about 16 km long from the alpine headwaters to the mouth at tidewater. At each sample site, gradients range from 2% to 4%, cobble is the dominant substrate, and large woody debris is common. The creek is largely fed by snowmelt and other drainages, and the magnitude of peak discharge in early summer depends on snowpack depth. Rainfall events during the fall also cause peak discharges.

Greens Creek Site 48

Site 48 (Figure 4) is located upstream of all mine activities, except exploratory drilling, near 265 m elevation and about 0.8 km upstream of the mine portal. Reference data collected at Site 48 are compared to data collected downstream at Site 54. Resident Dolly Varden char is the only fish species we have documented at Site 48; the infiltration gallery concrete weir near the mine portal blocks upstream fish passage. Periphyton and benthic macroinvertebrate sampling occur in riffle habitats downstream of the fish sample reach.



Figure 4.—Greens Creek Site 48.

Greens Creek Site 54

Site 54 (Figure 5) is located downstream of the Bruin Creek confluence and adjacent to waste rock storage Site 23, near 225 m elevation and about 1.8 km downstream of the mine portal. Data collected at Site 54 are compared to data collected at reference Site 48 to detect potential changes from waste rock storage areas, stormwater ponds, and mine and mill facilities upstream. We have documented coho salmon, Dolly Varden char, and cutthroat trout *O. clarkii* at Site 54. Anadromous fish access the site via a fish pass about 5.6 km upriver from the mouth, though only limited fish passage has been available since 2005.^c Periphyton and benthic macroinvertebrate sampling occur in riffle habitats upstream of the fish sample reach. Gallagher Creek enters Greens Creek within the fish sample reach.



Figure 5.—Greens Creek Site 54.

^c In 1989, Greens Creek Mining Company installed an engineered fish pass as mitigation for impacts to Tributary Creek from the TDF. Three timber and concrete weirs provided step pools for adult coho salmon passage upstream through a natural bedrock chute that prevents fish migration. In November 2005, flood flows damaged the fish pass during a heavy rainstorm when discharge measured up to 272 ft³/s; mean daily discharge during November generally ranges 20–60 ft³/s, and annual peak snowmelt discharge is usually < 200 ft³/s (USGS 2007).

Tributary Creek

The Tributary Creek watershed is about 1.7 km² (USDA Forest Service 2013) and the main channel measures about 1.6 km between the headwaters and the stream confluence with Zinc Creek. The TDF occupies the original headwaters of the creek. Tributary Creek is a low-energy, lowland stream fed by groundwater, precipitation, and a few hillside drainages. Stream gradient varies from 1% to 2%, organics and sand are the dominant substrates with gravel present near the mouth, and large and small woody debris are common. Tributary Creek provides habitat for chum salmon *O. keta*, coho salmon, pink salmon *O. gorbuscha*, cutthroat trout, rainbow trout *O. mykiss*, Dolly Varden char, and sculpin *Cottus* sp. Discharge estimates based on field measurements and limited gage data suggest annual stream flows range 1–5 ft³/s (USDA Forest Service 2003).

Tributary Creek Site 9

Site 9 (Figure 6) is located 1.2 km downstream of the TDF at about 25 m elevation, and sampled to detect potential changes from the TDF. We have documented coho salmon, Dolly Varden char, cutthroat and rainbow trout, and sculpin at this site. Periphyton and benthic macroinvertebrate sampling occurs within the fish sample reach after the juvenile fish population study is complete.



Figure 6.—Tributary Creek Site 9.

METHODS

We used the methods described in Kanouse (2015), and footnote differences in the *Results* section. Sample data and data summaries are in Appendix A–F.

We occasionally review data sets to ensure accuracy and report corrections in the document and appendices. The most recent technical report presents the current data sets and should be used to analyze data from previous years.

RESULTS

Within three weeks prior to sampling Greens Creek in 2015, mean daily discharges were generally less than the means of the previous 25 years, except prior to and during sampling on July 15–16 (Figure 7). The range of mean daily discharges three weeks prior to sampling in 2015 was similar to the 2014 range and other years (Figure 8). The USDA Natural Resources Conservation Service (2015) Alaska snow pack map suggests the remaining snow pack near Greens Creek Mine on May 1, 2015 was less than 25% of the 30-year median (1981–2010); peak snowmelt discharge in Greens Creek occurred between May 14 and May 23 (USGS 2016).

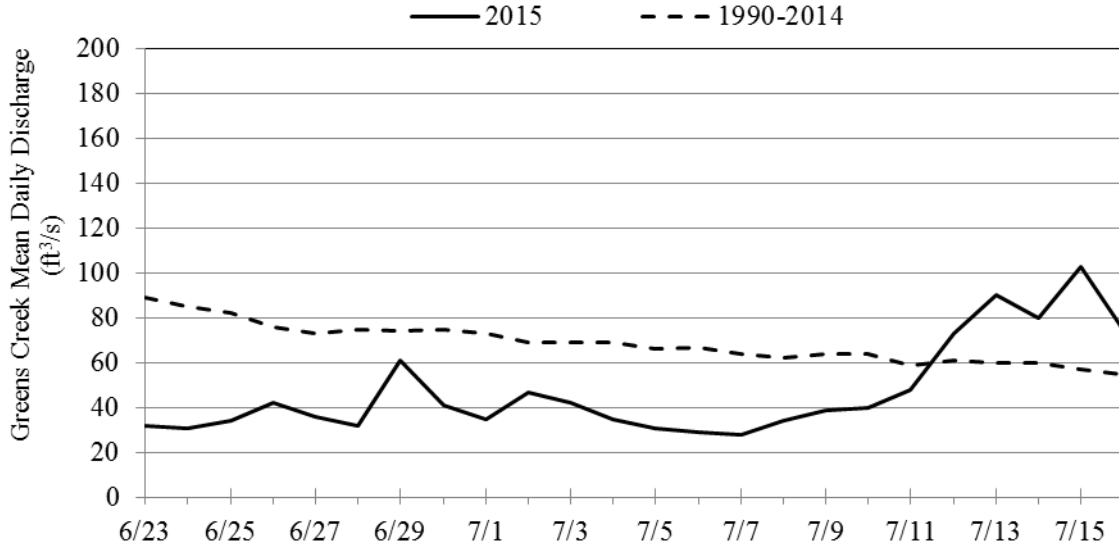


Figure 7.—Greens Creek mean daily discharge (ft³/s) three weeks prior to sampling in 2015, and mean daily discharges for the period 1990–2014.
 Source: USGS Gage 15101490 (USGS 2016).

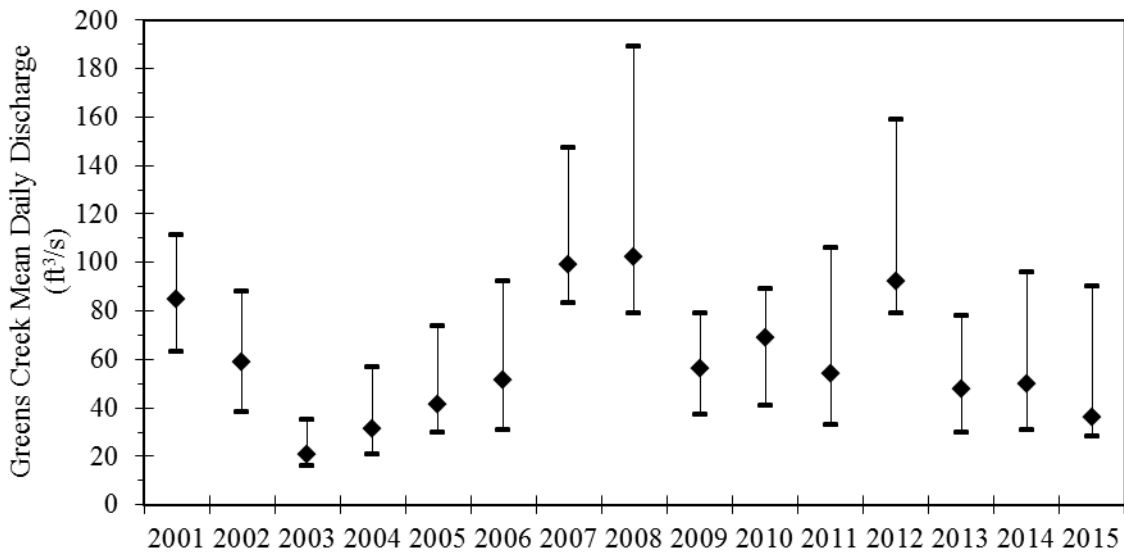


Figure 8.—Greens Creek mean daily discharges three weeks prior to sampling.
 Note: Median, minimum, and maximum mean daily discharges (ft³/s) presented.
 Source: USGS Gage 15101490 (USGS 2016).

GREENS CREEK SITE 48

We sampled Greens Creek Site 48 on July 16, 2015. Hecla personnel recorded the following water quality data at 0840: water temperature 8.9 °C, conductivity 99.2 $\mu\text{S}/\text{cm}$, and pH 8.07 units. Using our flow data^d, we estimate discharge at the sample site was about^e 80 ft^3/s after sampling. The USGS gage, located downstream of Site 48 and Hecla's water withdrawal, recorded 65 ft^3/s at the same time and a mean daily discharge of 75 ft^3/s .

Periphyton Density and Community Composition

The 2015 mean chlorophyll *a* density was 3.73 mg/m^2 , within the range observed since 2001, and proportions of chlorophylls *a*, *b*, and *c* were similar to previous years (Figures 9, 10).

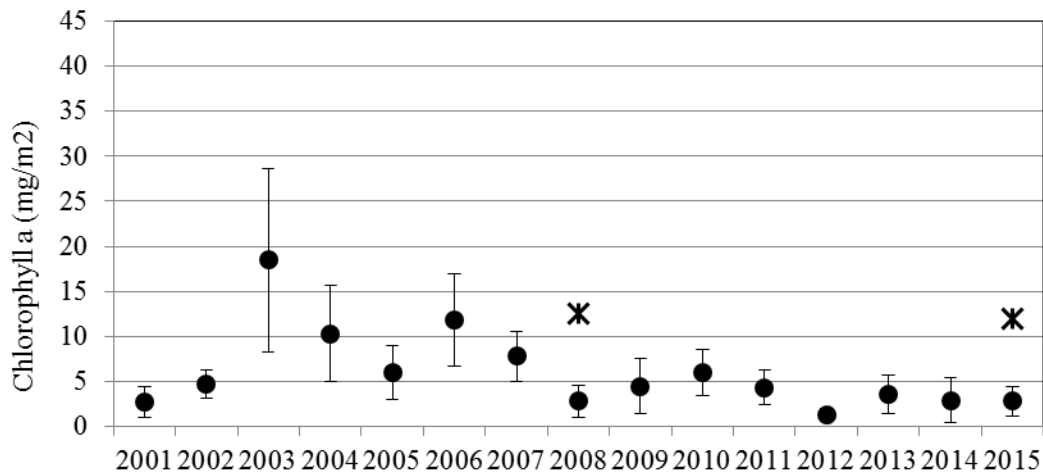


Figure 9.—Greens Creek Site 48 periphyton densities.

note: Mean density \pm one standard deviation, excludes potential outliers (*).

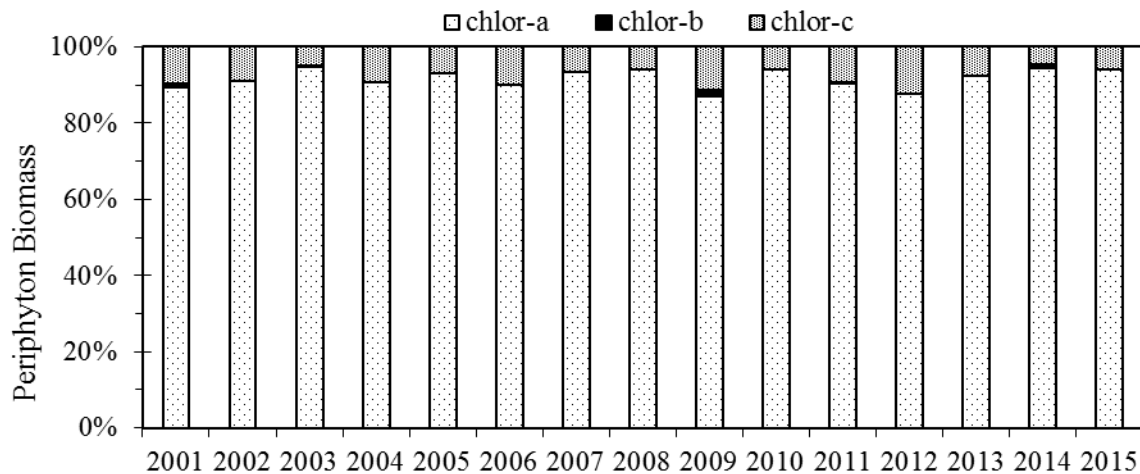


Figure 10.—Greens Creek Site 48 mean chlorophylls *a*, *b*, and *c* proportions.

^d In 2015, we used a SonTek FlowTracker to measure (SonTek 2007) stream discharge.

^e Discharge may be overestimated due to accidental deviation from established sampling methods; we oriented the flow probe perpendicularly to stream flow instead of perpendicularly to the stream channel.

Benthic Macroinvertebrate Density and Community Composition

We observed more insects and taxa among the 2015 samples^f compared to samples from the last four years. We counted 27 taxa and estimate benthic macroinvertebrate density at 2,948 insects/m², of which 82% were EPT insects (Figures 11, 12). Dominant taxa were Ephemeroptera: *Drunella* and *Baetis*, representing 26% and 17% of samples.

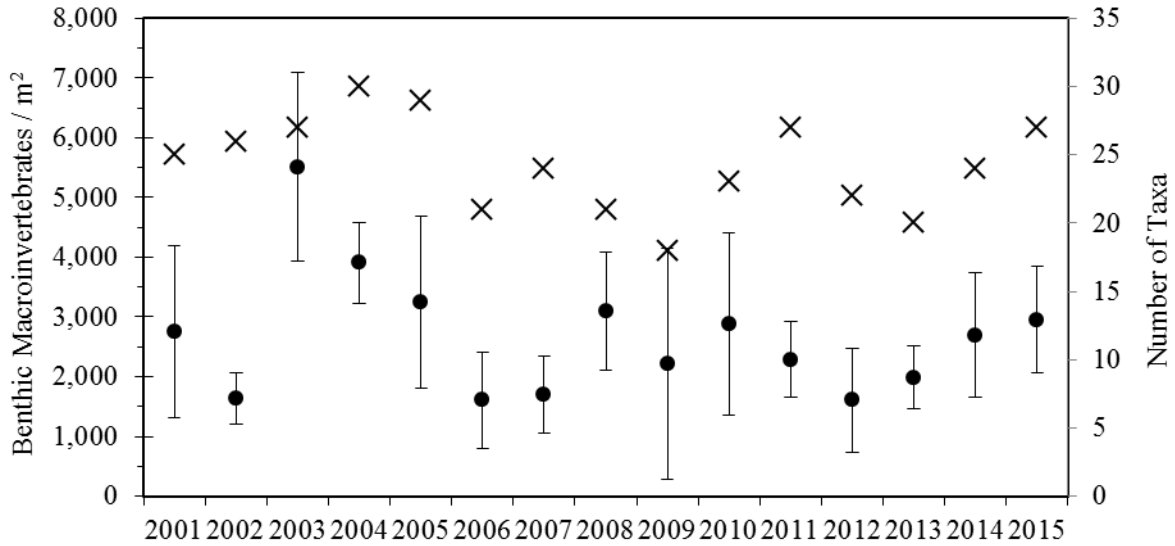


Figure 11.—Greens Creek Site 48 benthic macroinvertebrate densities and taxa.
 Note: Mean density ± one standard deviation, and taxa richness (×).

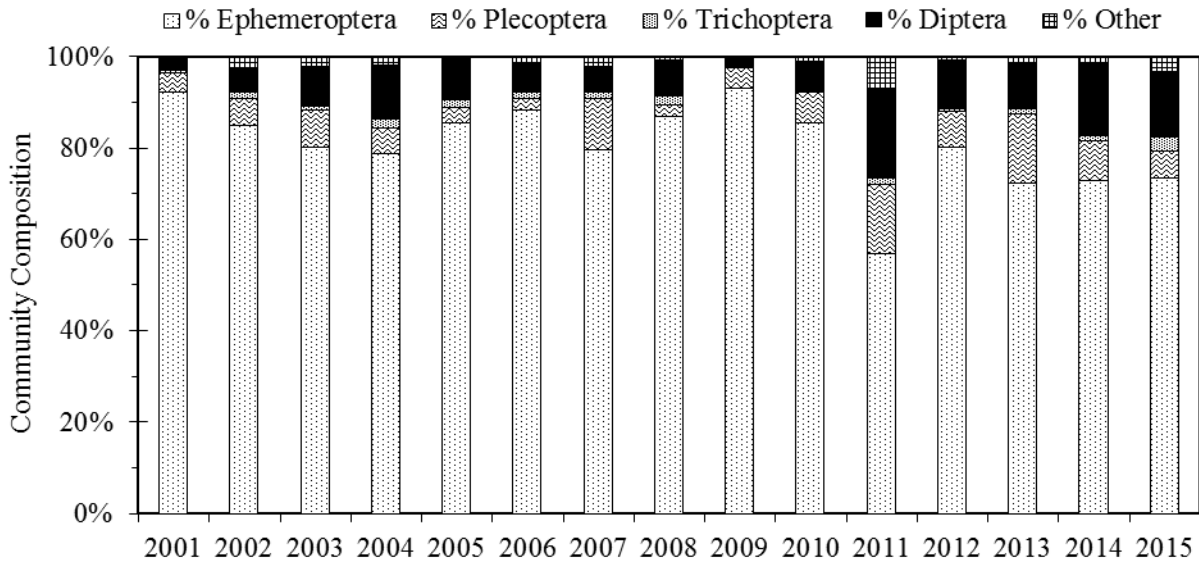


Figure 12.—Greens Creek Site 48 benthic macroinvertebrate community composition.

^f We collected three additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

Juvenile Fish Populations and Fish Condition

We estimate the 2015 juvenile Dolly Varden char population at 120 ± 23 fish, within the range of previous estimates (Figure 13). The length frequency diagram of captured Dolly Varden char suggests multiple age classes were present, as in most^g years. Mean fish condition among the 97 Dolly Varden char we captured was 1.01 g/mm^3 (Appendix C4), similar to mean fish condition observed 2012–2014.

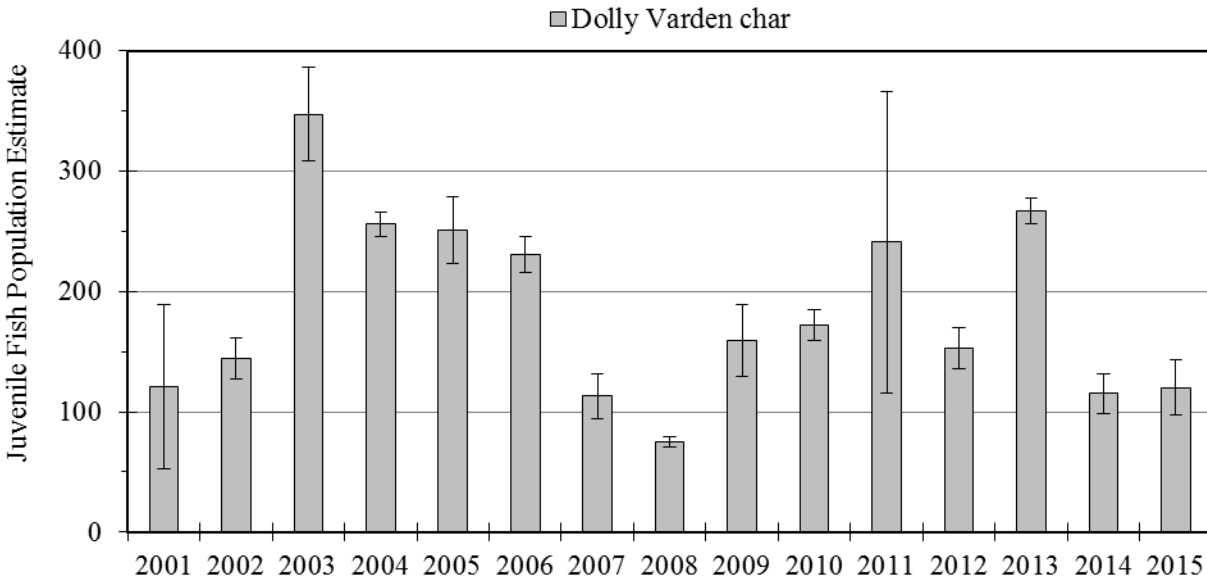


Figure 13.—Greens Creek Site 48 juvenile fish population estimates.

Juvenile Fish Metals Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2015 whole body juvenile Dolly Varden char samples^h were similar to values observed since 2001 (Figure 14).

^g In 2008 and 2012 we did not capture young-of-year fry, which could have escaped the 6.35 mm (1/4 in) mesh minnow traps.

^h We collected four additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

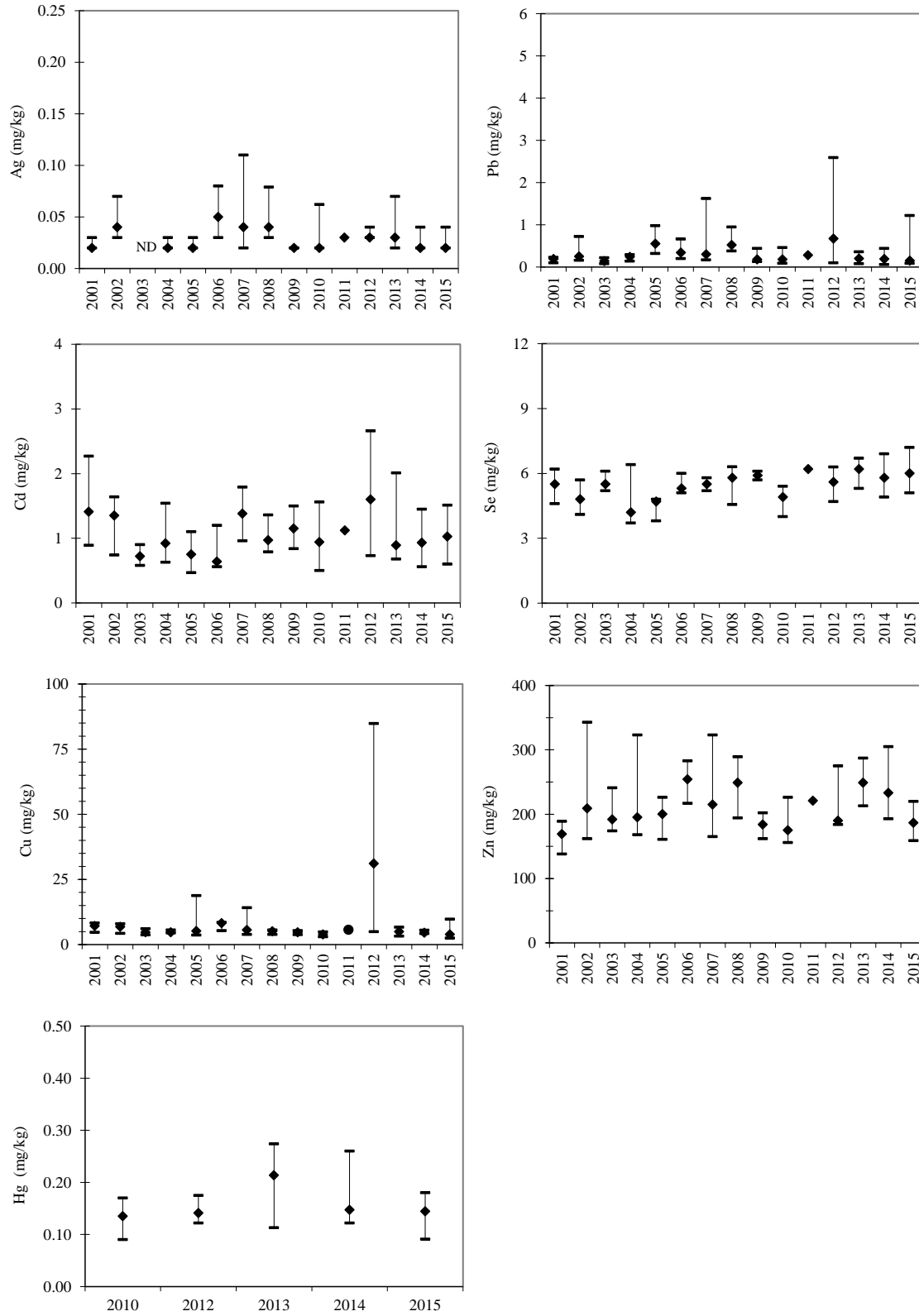


Figure 14.—Greens Creek Site 48 whole body Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum concentrations (mg/kg) presented.

GREENS CREEK SITE 54

We sampled Greens Creek Site 54 on July 15, 2015. Hecla personnel recorded the following water quality data at 1200: water temperature 9.7 °C, conductivity 90.1 $\mu\text{S}/\text{cm}$, and pH 8.00 units. Using our flow dataⁱ, we estimate discharge at the sample site was about^j 106 ft^3/s after sampling. The USGS gage, located 0.8 km upstream, recorded 100.7 ft^3/s at 1400 and a mean daily discharge of 103 ft^3/s .

Periphyton Density and Community Composition

The 2015 mean chlorophyll *a* density was 2.45 mg/m^2 , within the range observed since 2001, and proportions of chlorophylls *a*, *b*, and *c* were similar to previous years (Figures 15, 16).

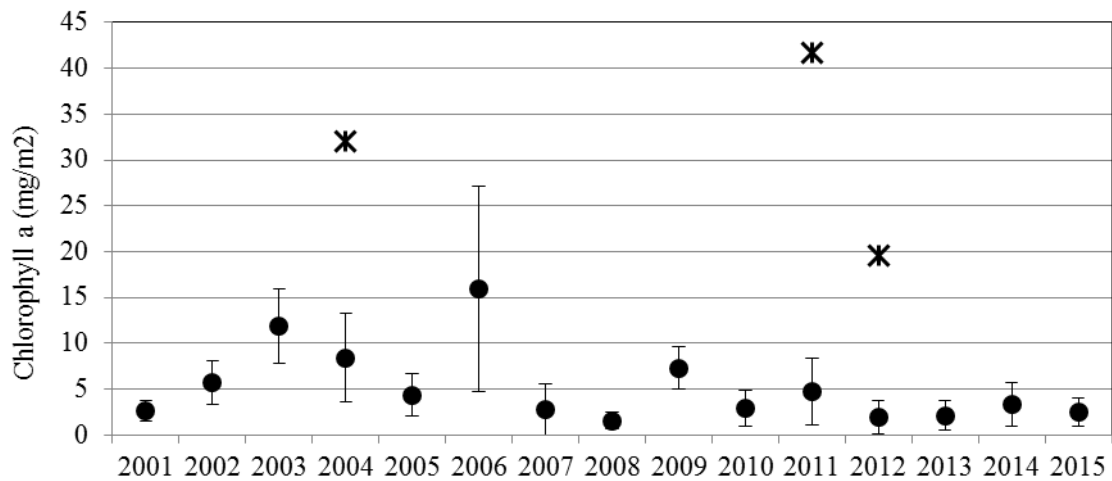


Figure 15.—Greens Creek Site 54 periphyton densities.
 Note: Mean density \pm one standard deviation, excludes potential outliers (*).

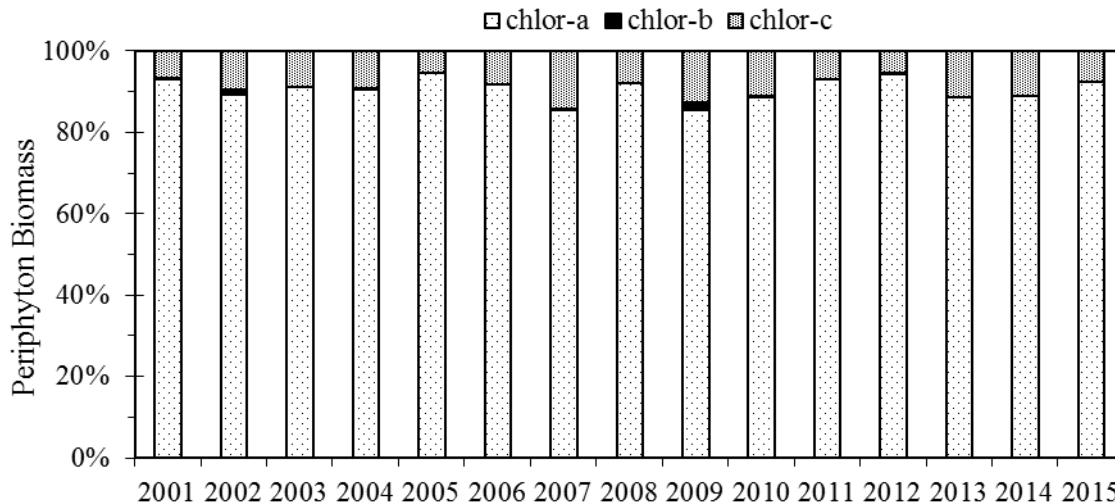


Figure 16.—Greens Creek Site 54 mean chlorophylls *a*, *b*, and *c* proportions.

ⁱ In 2015, we used a SonTek FlowTracker to measure (SonTek 2007) stream discharge.

^j Discharge may be overestimated as several measurements accounted for more than 10% of stream flow, which decreases accuracy of the discharge estimate.

Benthic Macroinvertebrate Density and Community Composition

We observed fewer insects among the 2015 samples^k than the 2014 samples, though within range observed most previous years. We counted 28 taxa and estimate benthic macroinvertebrate density at 1,887 insects/m², of which 82% were EPT insects (Figures 17, 18). Dominant taxa were Ephemeroptera: *Drunella* and *Epeorus*, representing 29% and 16% of samples.

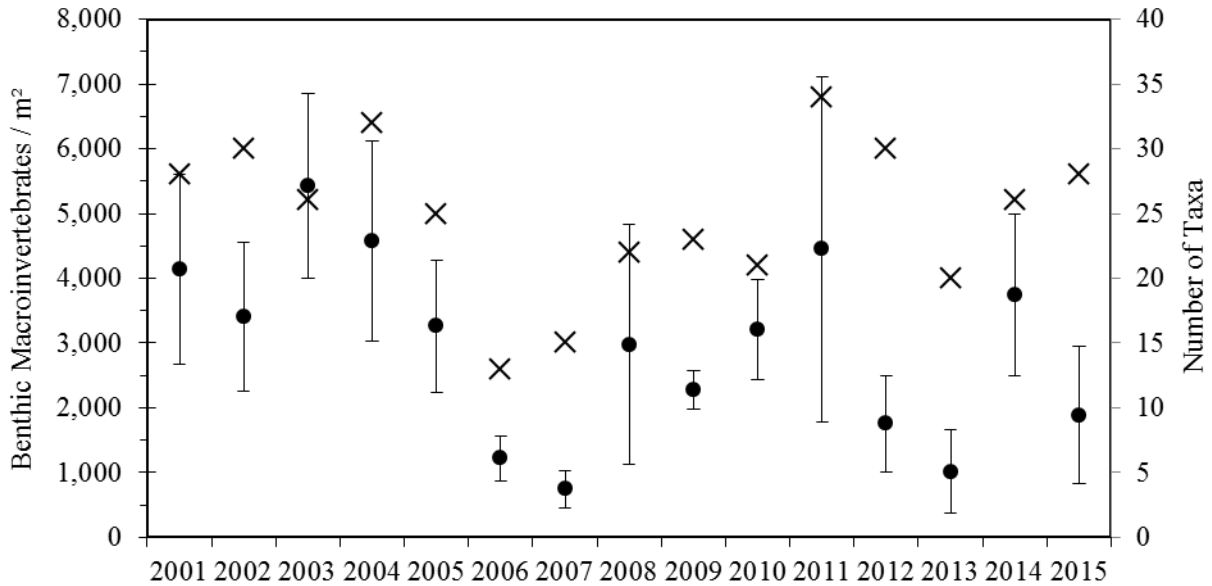


Figure 17.—Greens Creek Site 54 benthic macroinvertebrate densities and taxa.
Note: Mean density \pm one standard deviation, and taxa richness (\times).

^k We collected three additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

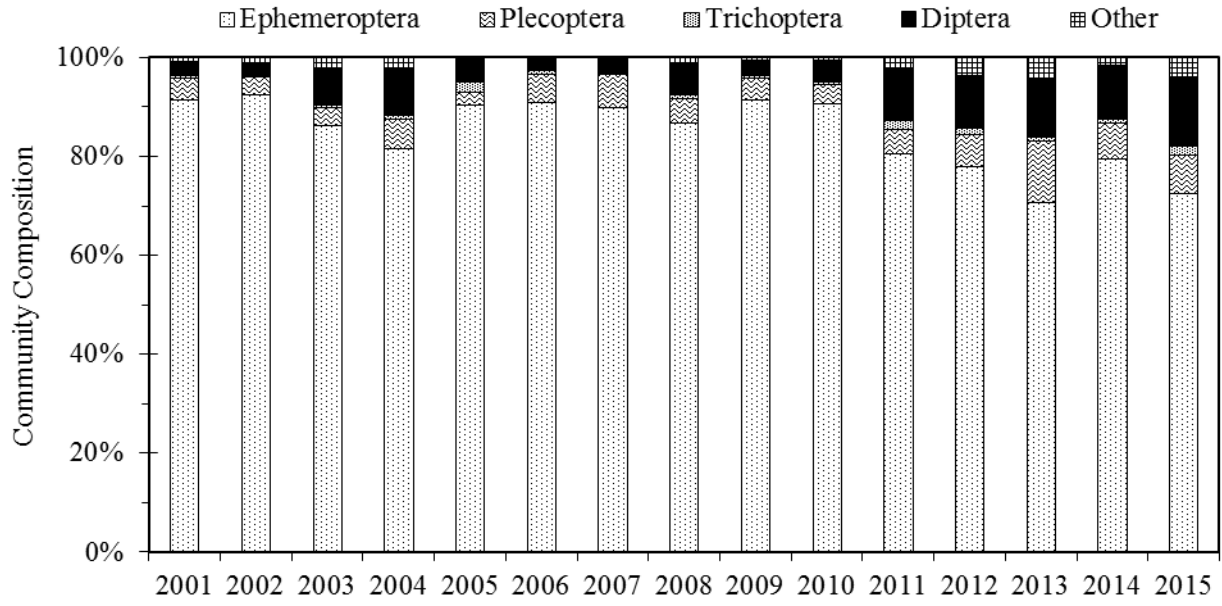


Figure 18.—Greens Creek Site 54 benthic macroinvertebrate community composition.

Juvenile Fish Populations and Fish Condition

We estimate the 2015 juvenile Dolly Varden char population at 108 ± 7 fish, significantly less than the previous four estimates (Figure 19). The length frequency diagram of captured Dolly Varden char suggests multiple age classes were present, as in previous years. Mean fish condition among the 102 Dolly Varden char we captured was 1.00 g/mm^3 , similar to mean fish condition observed 2012–2014.

We captured 21 juvenile coho salmon¹ during the 2015 survey, the greatest number since 2005 (Figure 19). The length frequency diagram of captured fish suggests more than one age class was present (Appendix C6), and mean fish condition was 1.07 g/mm^3 .

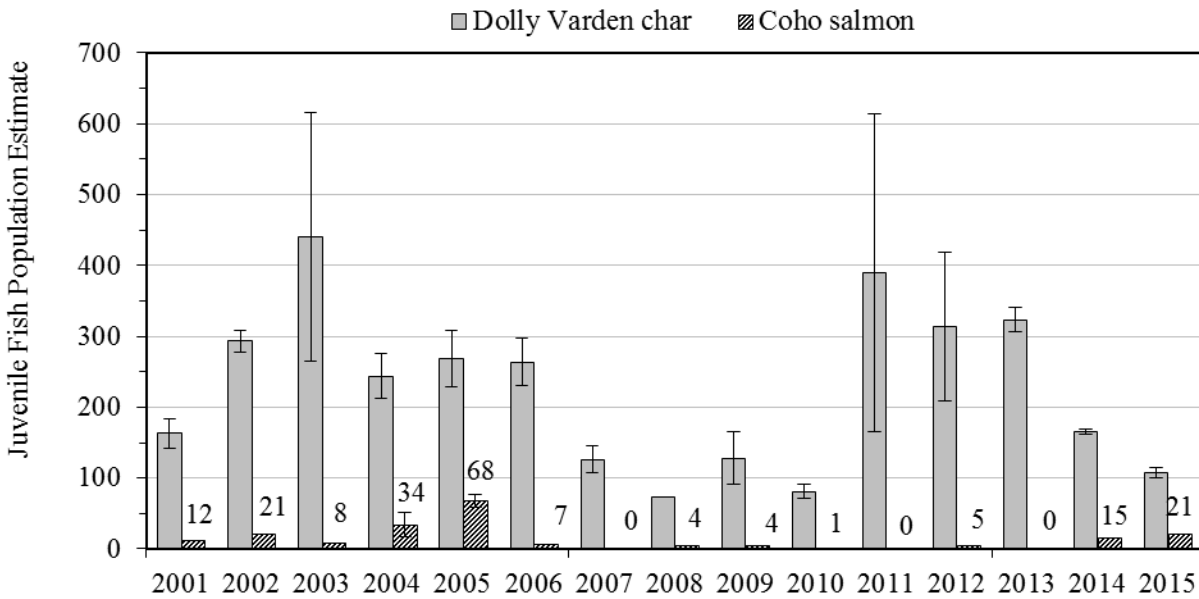


Figure 19.—Greens Creek Site 54 juvenile fish population estimates.
 Note: 2001–2010 data from 28 m sample reach, 2011–2015 data from 50 m sample reach.

Juvenile Fish Metals Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2015 whole body juvenile Dolly Varden char samples^m were similar to values observed since 2001 (Figure 20).

¹ We were unable to calculate the 2015 juvenile coho salmon population estimate due to the small sample size.
^m We collected four additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

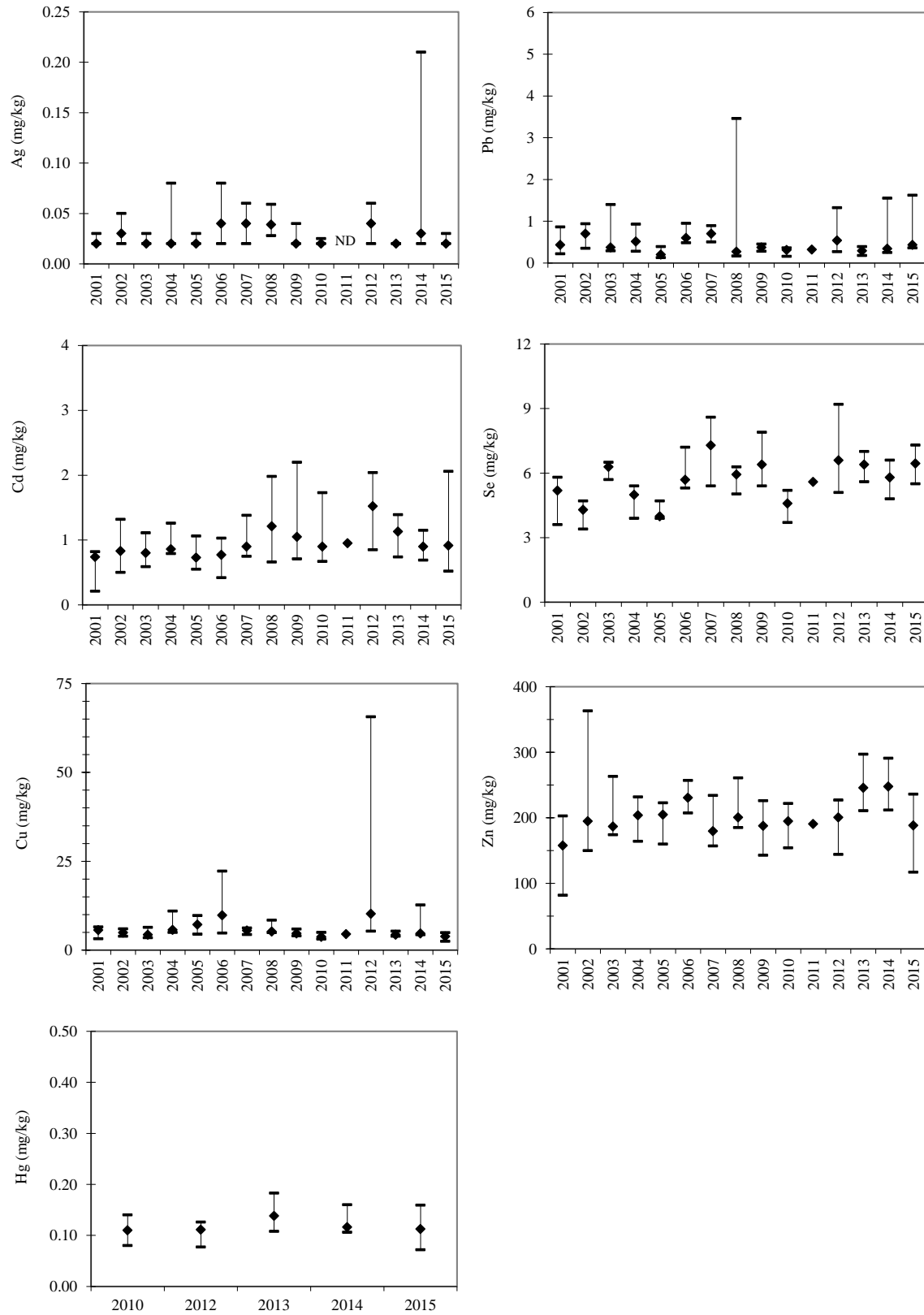


Figure 20.–Greens Creek Site 54 whole body Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum concentrations (mg/kg) presented.

TRIBUTARY CREEK SITE 9

We sampled Tributary Creek Site 9 on July 14, 2015. Hecla personnel recorded the following water quality data at 1500: water temperature 12.8°C, conductivity 65.9 $\mu\text{S}/\text{cm}$, and pH 6.95 units. Using our flow data, we estimate discharge at the sample site was about 1.8 ft^3/s after sampling.

Periphyton Density and Community Composition

The 2015 mean chlorophyll *a* density was 5.75 mg/m^2 , within the range observed since 2001 (Figure 21), and proportions of chlorophylls *a*, *b*, and *c* were similar to previous years (Figure 22).

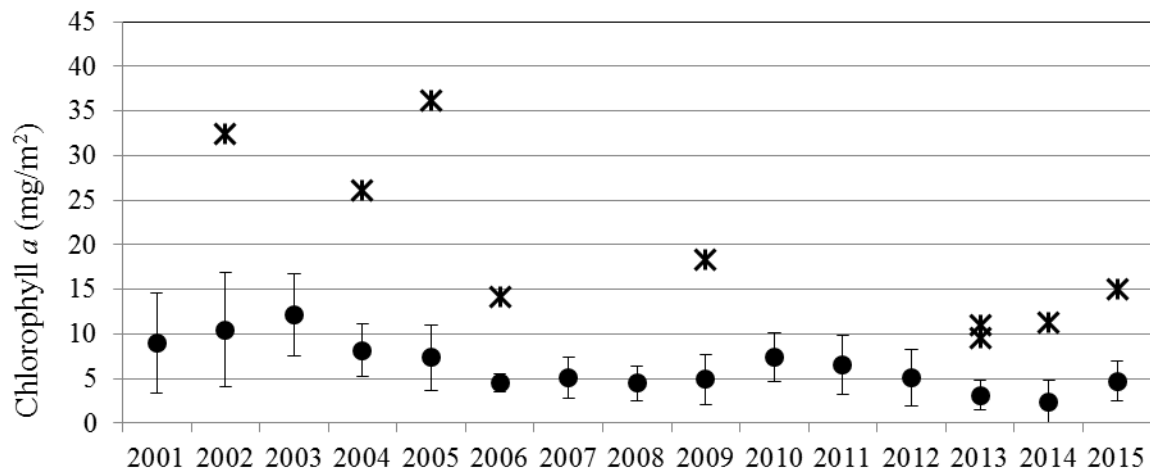


Figure 21.—Tributary Creek Site 9 mean periphyton densities.

Note: Mean density \pm one standard deviation, excludes potential outliers (*).

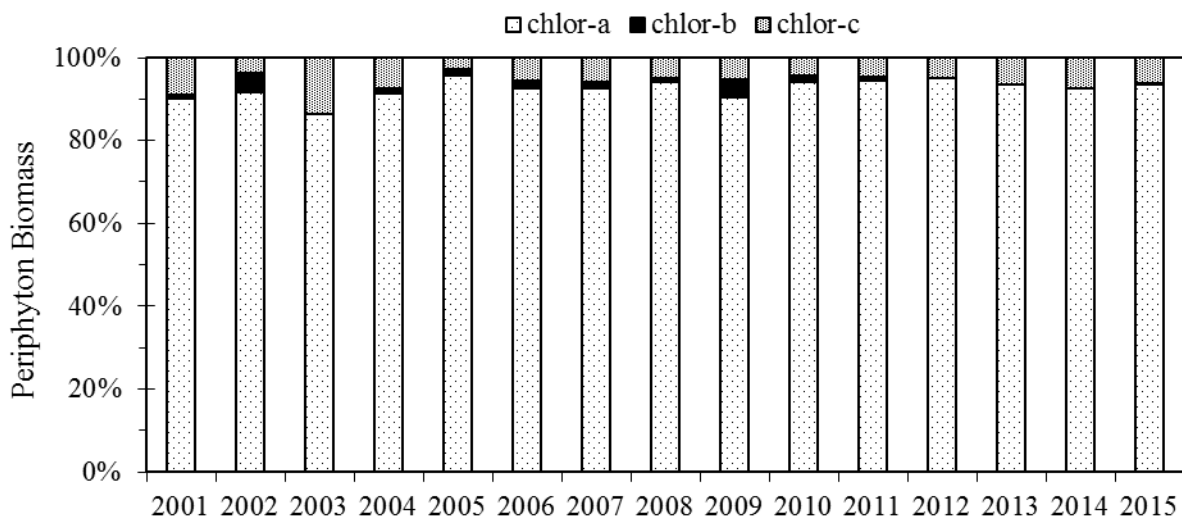


Figure 22.—Tributary Creek Site 9 mean chlorophylls *a*, *b*, and *c* proportions.

Benthic Macroinvertebrate Density and Community Composition

We observedⁿ the lowest number of insects at this site since 2010. We counted 23 taxa and estimate benthic macroinvertebrate density at 749 insects/m², of which 58% were EPT insects (Figures 23, 24). Dominant taxa were Chloroperlidae insects and Oligochaeta, representing 19% and 17% of samples.

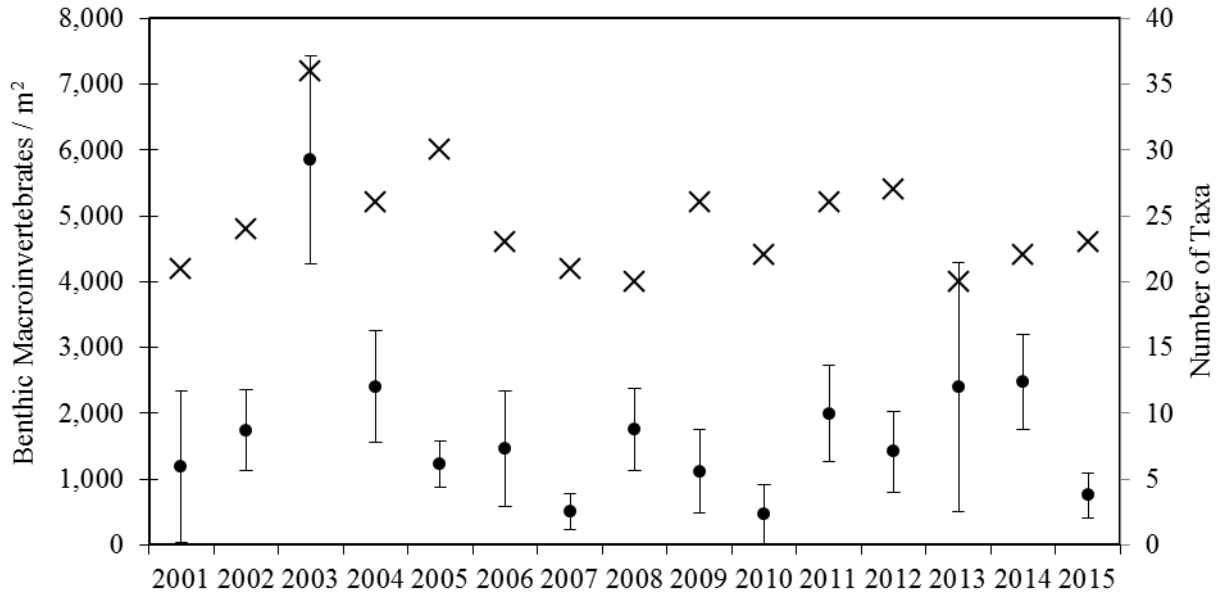


Figure 23.–Tributary Creek Site 9 benthic macroinvertebrate densities and taxa.
 Note: Mean density ± one standard deviation, and taxa richness (×).

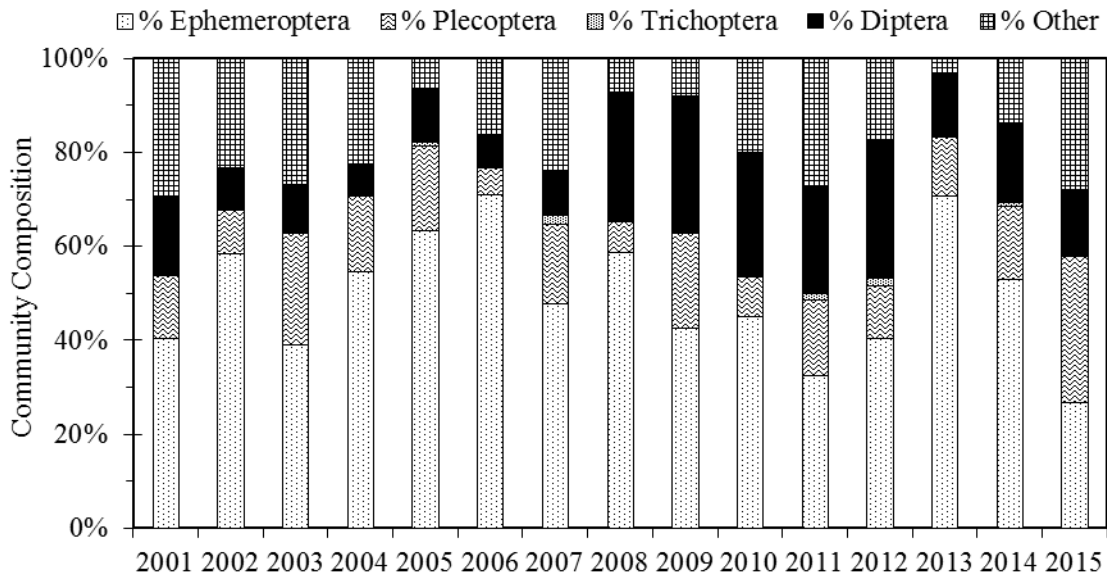


Figure 24.–Tributary Creek Site 9 benthic macroinvertebrate community composition.

ⁿ We collected three additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

Juvenile Fish Populations and Fish Condition

We captured 16 juvenile Dolly Varden char during the 2015 survey (Figure 25), similar to the 2013–2014 survey results. The length frequency diagram of captured fish suggests two age classes were present (Appendix C7), and mean fish condition was 1.20 g/mm³.

We estimate the 2015 juvenile coho salmon population at 95 ± 21 fish, significantly less than the 2014 estimate and within the range observed since 2001 (Figure 25). The length frequency diagram of captured fish suggests two age classes were present, and mean fish condition was 1.37 g/mm³ (Appendix C8).

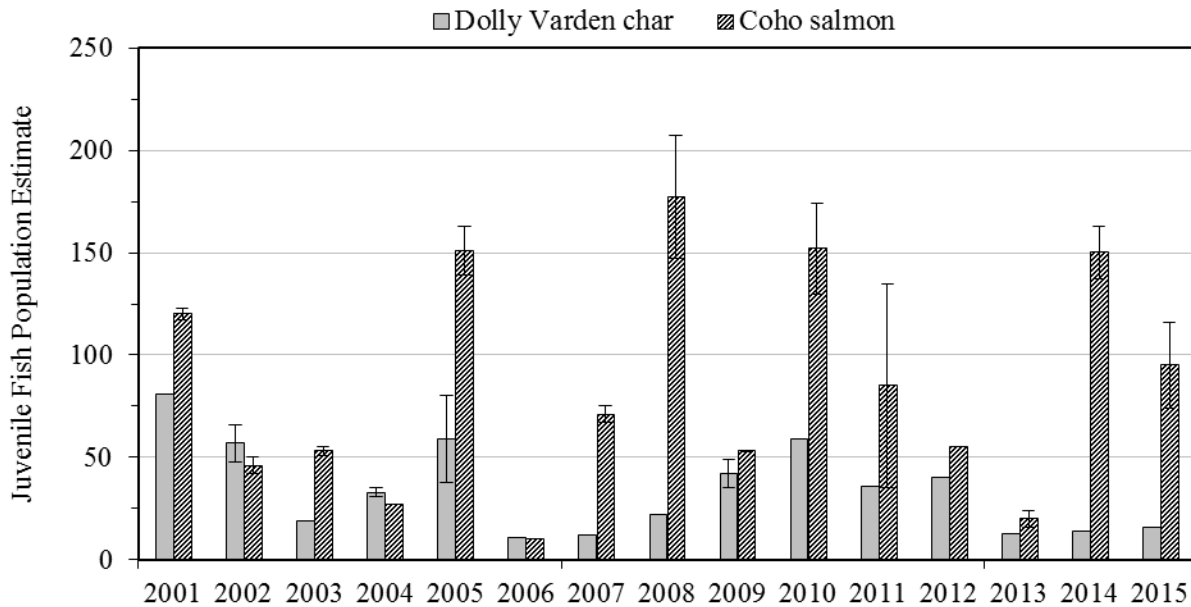


Figure 25.–Tributary Creek Site 9 juvenile fish population estimates.

Juvenile Fish Metals Concentrations

Ag, Cd, Pb, and Se median concentrations among the 2015 whole body juvenile Dolly Varden char samples^o were greater than previous years, while Cu, Hg and Zn concentrations among the samples were similar to values previously observed (Figure 26).

^o We collected four additional samples compared to previous years, per the requirements of the updated FWMP (HGCMC 2014, Appendix 1).

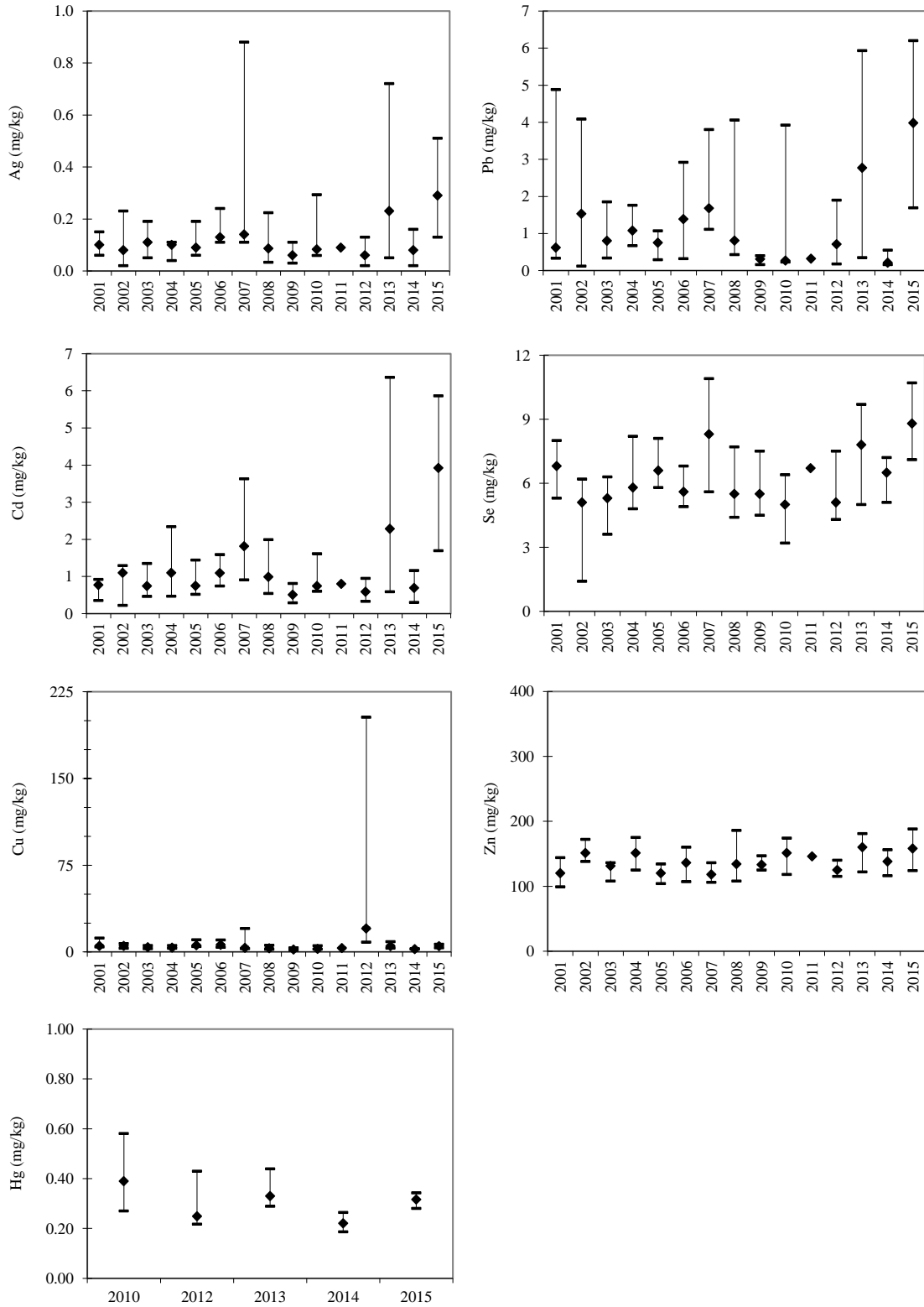


Figure 26.—Tributary Creek Site 9 whole body Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum concentrations (mg/kg) presented.

COMPARISONS AMONG GREENS CREEK SITES

Periphyton Density and Community Composition

Periphyton densities among the 2015 samples from Site 48 and Site 54 were not significantly different. Mean periphyton densities at Site 48 and Site 54 between 2001 and 2014 generally followed a similar trend (Figure 27), with peak densities observed in 2003, 2004, and 2006. Greens Creek discharges prior to sampling in 2003 and 2004 were low and may explain the greater periphyton densities those years, while greater discharges during 2007, 2008, and 2012 may explain the lower periphyton densities observed those years.

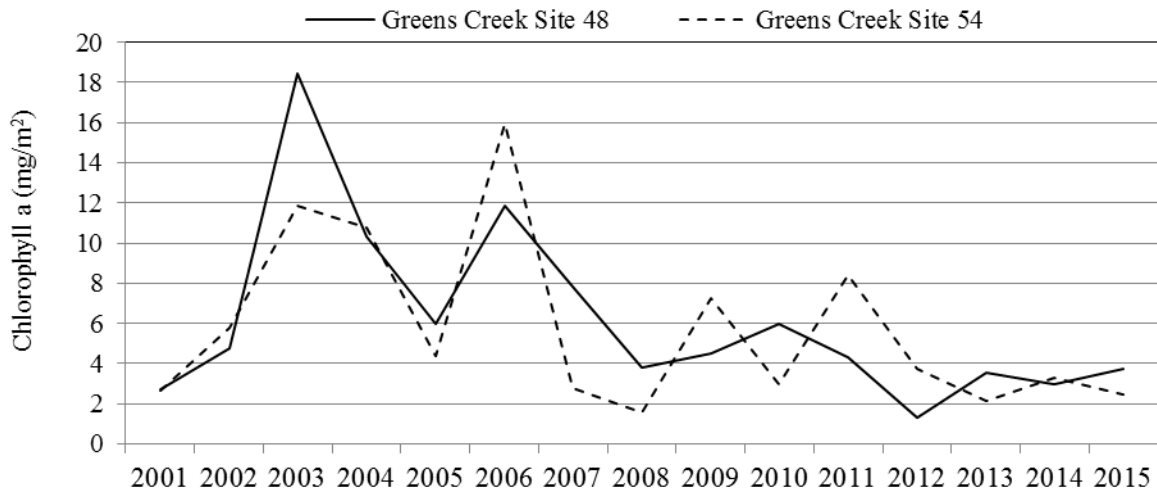


Figure 27.—Greens Creek periphyton densities comparison.

Periphyton samples collected at Site 48 and Site 54 have generally contained > 90% chlorophyll *a*, zero or nearly zero chlorophyll *b*, and < 10% chlorophyll *c* each year.

Benthic Macroinvertebrate Density and Community Composition

Benthic macroinvertebrate density (Figure 28) and taxonomic richness (Figure 29) among samples collected at Site 48 and Site 54 generally follow a similar trend between years, and EPT insects usually comprise more than 80% of samples.

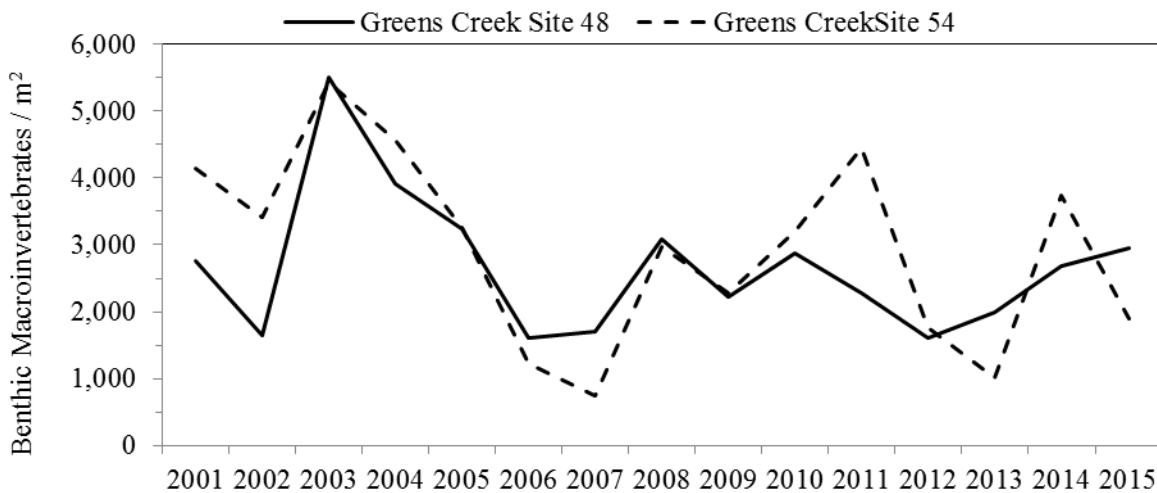


Figure 28.—Greens Creek benthic macroinvertebrate densities comparison.

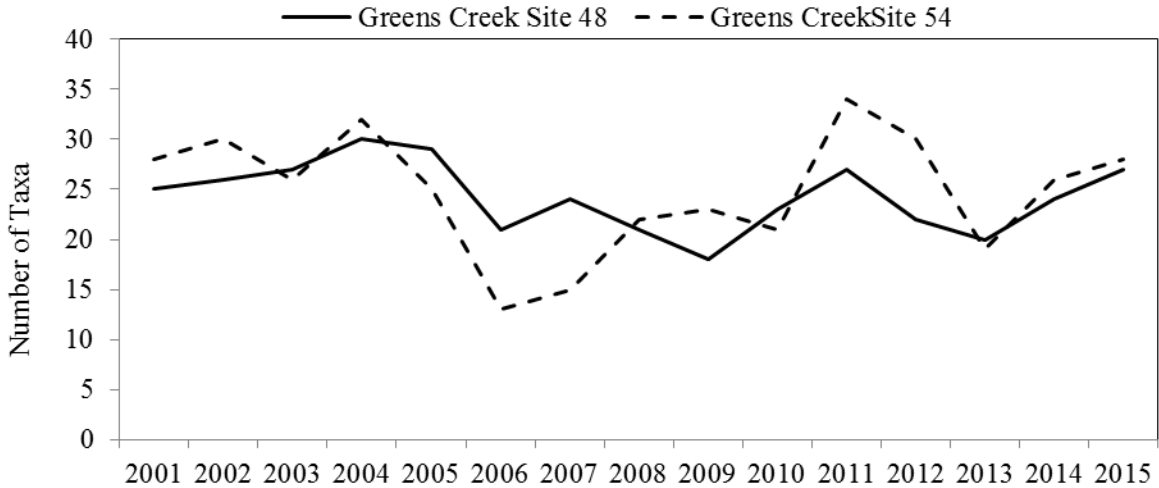


Figure 29.—Greens Creek benthic macroinvertebrate taxa richness comparison.

Juvenile Fish Populations and Fish Condition

The 2015 Site 54 and Site 48 juvenile Dolly Varden char population estimates were not significantly different. Population estimates among sites followed a similar trend from 2001 to 2015 (Figure 30). We captured several age classes of Dolly Varden char at both sites most years, and mean fish condition was similar among sites each year.

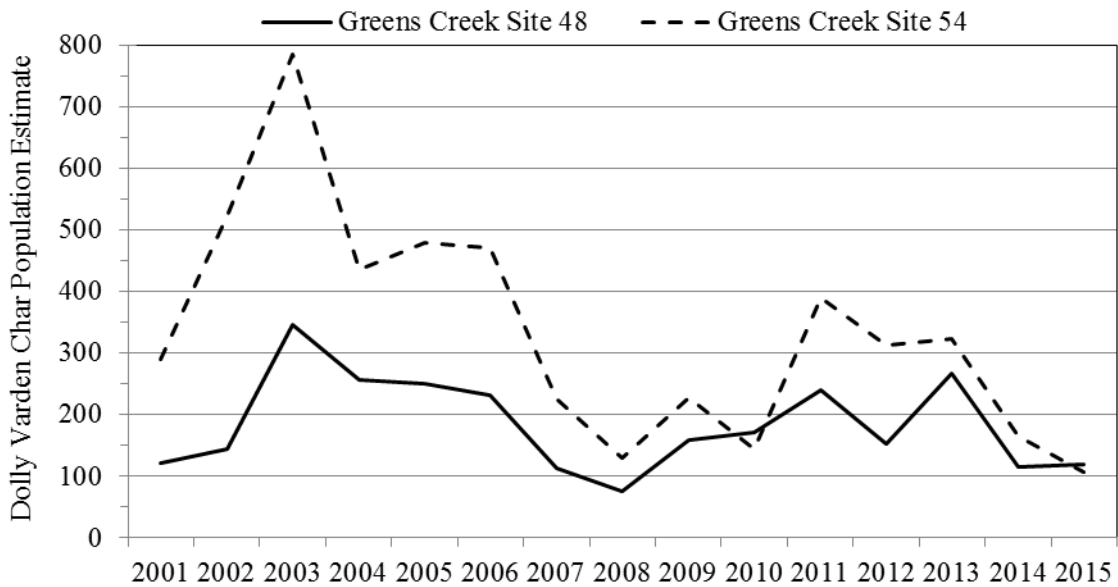


Figure 30.—Greens Creek juvenile Dolly Varden char population estimates.
 Note: Site 54 2001–2010 data extrapolated to a 50 m sample reach for comparison.

COMPARISON AMONG SITES

Juvenile Fish Metals Concentrations

Comparing the 2015 Greens Creek juvenile Dolly Varden char whole body metals data, the Site 48 mean ranks for Pb and Se concentrations were significantly less than the Site 54 mean ranks. We observed greater ranges of Cd and Zn concentrations among the Site 54 samples than the Site 48 samples, and a greater range of Cu concentrations among the Site 48 samples.

Comparing the 2015 Greens Creek and Tributary Creek data, the Site 9 mean rank for Zn concentrations was significantly less than the Site 54 and Site 48 mean ranks, and the Site 9 mean ranks for Ag, Cd, Cu,^P Hg, Pb, and Se concentrations were significantly greater than the Site 48 and Site 54 mean ranks. The 2015 median concentrations for all three sites were greater than or similar to median concentrations observed among the samples collected from 2011 to 2013 in Upper Slate Creek (Figure 31) near Kensington Gold Mine (Timothy and Kanouse 2014).

Since 2001, Tributary Creek Site 9 whole body juvenile fish samples had greater concentrations and variability than Greens Creek samples, except Cu and Zn which were generally greater at Site 48 (Figure 32).

^P Though we identified a significant difference among the 2015 Cu data for all sites, the test did not reveal which mean ranks were significantly different.

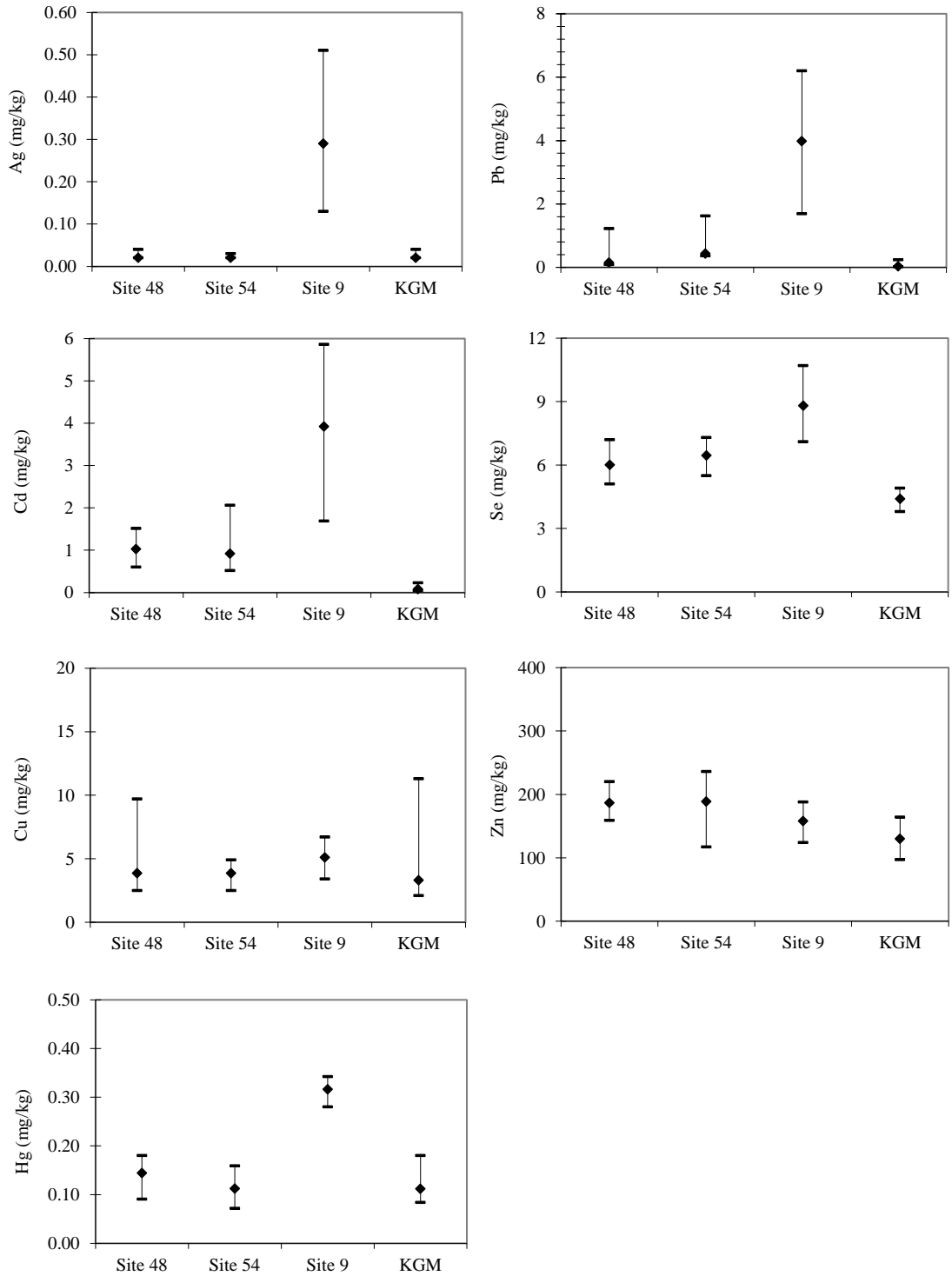


Figure 31.—2015 Greens Creek and Tributary Creek whole body juvenile Dolly Varden char metals concentrations.

Note: Median, minimum, and maximum concentrations (mg/kg) presented. Reference data (KGM) are Upper Slate Creek whole body juvenile Dolly Varden char samples collected 2011–2013 near Kensington Gold Mine (Timothy and Kanouse 2014).

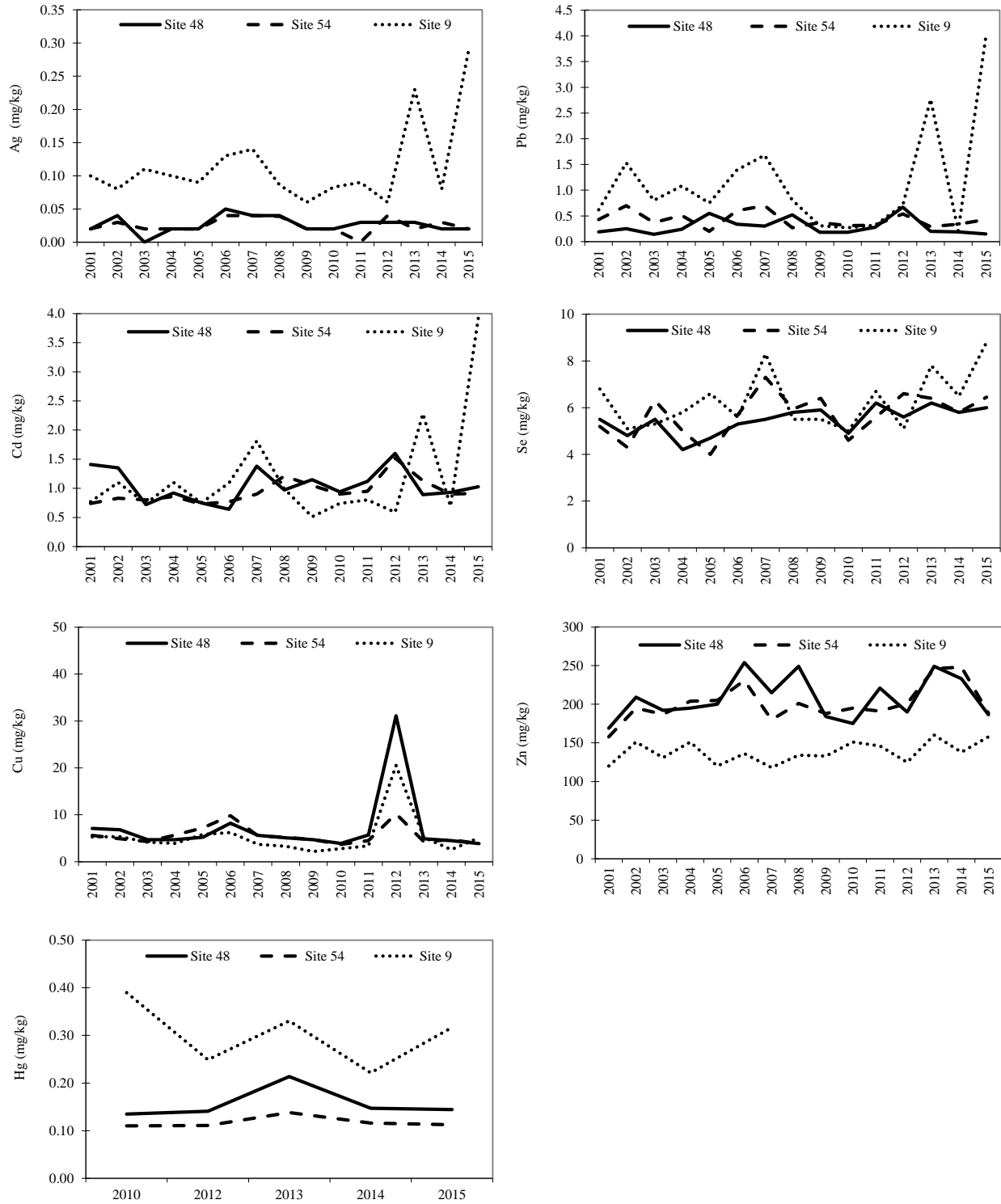


Figure 32.—Greens Creek and Tributary Creek whole body juvenile Dolly Varden char median metals concentrations.

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APPENDIX A: PERIPHYTON DATA

Appendix A1.–Greens Creek Site 48 chlorophylls *a*, *b*, and *c* densities, 2001–2015.

mg/m ²	2001			2002			2003			2004		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	1.91	0.01	0.14	5.34	0.00	0.29	12.92	0.00	1.26	18.05	0.00	2.03
	1.83	0.00	0.18	4.27	0.00	0.21	8.65	0.03	1.57	6.73	0.00	0.69
	5.61	0.00	0.69	6.62	0.00	0.71	3.84	0.09	0.39	8.97	0.00	0.90
	0.31	0.08	0.06	2.99	0.00	0.25	12.18	0.01	0.64	12.82	0.00	1.45
	2.96	0.04	0.36	5.34	0.00	0.75	17.19	0.00	0.72	5.45	0.00	0.62
	5.44	0.00	0.62	6.62	0.00	0.75	17.19	0.02	0.86	20.40	0.00	2.15
	3.38	0.00	0.47	6.09	0.00	0.73	33.21	0.00	2.14	6.30	0.00	0.45
	1.87	0.03	0.15	---	---	---	24.24	0.13	0.99	11.64	0.00	1.38
	2.63	0.14	0.14	2.99	0.00	0.36	19.76	0.00	0.57	7.48	0.00	0.65
	1.23	0.02	0.16	2.78	0.00	0.15	35.35	0.00	0.89	5.23	0.00	0.55
mean	2.72	0.03	0.30	4.78	0.00	0.47	18.46	0.03	1.00	10.31	0.00	1.09
median	2.27	0.02	0.17	5.34	0.00	0.36	17.19	0.00	0.88	8.22	0.00	0.79
max	5.61	0.14	0.69	6.62	0.00	0.75	35.35	0.13	2.14	20.40	0.00	2.15
min	0.31	0.00	0.06	2.78	0.00	0.15	3.84	0.00	0.39	5.23	0.00	0.45
mg/m ²	2005			2006			2007			2008		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	0.85	0.00	0.01	8.33	0.00	0.80	6.62	0.00	0.16	1.50	0.00	0.09
	4.70	0.00	0.51	11.43	0.00	0.71	5.55	0.00	0.23	4.70	0.00	0.16
	6.62	0.00	0.27	10.68	0.00	1.25	7.48	0.00	0.33	2.67	0.00	0.24
	6.19	0.00	0.51	20.08	0.00	2.04	11.64	0.00	1.39	2.14	0.00	0.17
	11.11	0.00	0.92	10.57	0.00	0.98	6.94	0.00	0.47	0.85	0.00	0.02
	5.66	0.00	0.51	14.10	0.00	1.72	11.11	0.00	0.54	12.60	0.00	0.33
	7.69	0.00	0.53	16.98	0.00	1.76	11.75	0.01	0.60	2.78	0.00	0.19
	5.13	0.00	0.29	5.23	0.00	1.74	4.81	0.00	0.29	6.30	0.00	0.74
	2.46	0.02	0.28	16.87	0.00	1.73	8.12	0.00	1.10	1.28	0.00	0.14
	9.08	0.00	0.63	4.38	0.00	0.54	4.06	0.00	0.43	3.20	0.00	0.37
mean	5.95	0.00	0.45	11.87	0.00	1.33	7.81	0.00	0.55	3.80	0.00	0.25
median	5.93	0.00	0.51	11.05	0.00	1.49	7.21	0.00	0.45	2.73	0.00	0.18
max	11.11	0.02	0.92	20.08	0.00	2.04	11.75	0.01	1.39	12.60	0.00	0.74
min	0.85	0.00	0.01	4.38	0.00	0.54	4.06	0.00	0.16	0.85	0.00	0.02
mg/m ²	2009			2010			2011			2012		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	3.20	0.00	0.49	8.54	0.00	0.44	4.49	0.00	0.50	0.36	---	---
	1.50	0.00	0.25	4.59	0.00	0.61	6.51	0.00	0.59	0.69	0.00	0.10
	4.17	0.11	0.59	5.13	0.00	0.27	2.88	0.00	0.30	1.29	0.00	0.12
	5.66	0.07	0.73	3.10	0.00	0.26	2.59	0.17	0.05	2.56	0.00	0.39
	3.42	0.06	0.50	7.58	0.00	0.29	3.31	0.00	0.36	0.85	0.00	0.00
	8.22	0.13	0.95	5.55	0.00	0.55	5.13	0.00	0.55	1.60	0.00	0.26
	0.43	0.11	0.11	10.68	0.00	0.64	7.16	0.00	1.06	1.82	0.00	0.29
	1.39	0.18	0.29	7.69	0.00	0.41	5.66	0.00	0.49	1.92	0.00	0.28
	7.80	0.00	0.89	3.63	0.00	0.25	0.85	0.00	0.11	0.32	0.00	0.08
	9.18	0.17	1.19	3.10	0.02	0.15	4.81	0.00	0.49	1.60	0.00	0.16
mean	4.50	0.08	0.60	5.96	0.00	0.39	4.34	0.02	0.45	1.30	0.00	0.19
median	3.79	0.09	0.55	5.34	0.00	0.35	4.65	0.00	0.49	1.45	0.00	0.16
max	9.18	0.18	1.19	10.68	0.02	0.64	7.16	0.17	1.06	2.56	0.00	0.39
min	0.43	0.00	0.11	3.10	0.00	0.15	0.85	0.00	0.05	0.32	0.00	0.00
mg/m ²	2013			2014			2015					
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>			
	2.03	0.00	0.12	4.81	0.00	0.31	2.14	0.00	0.18			
	1.50	0.00	0.11	0.60	0.00	0.12	11.96	0.00	0.90			
	4.59	0.00	0.33	1.60	0.00	0.10	4.70	0.00	0.31			
	2.03	0.00	0.19	6.62	0.00	0.00	3.31	0.00	0.24			
	6.94	0.00	0.38	---	---	---	5.55	0.00	0.25			
	6.62	0.00	0.39	5.66	0.00	0.33	2.46	0.00	0.18			
	1.60	0.00	0.26	0.55	0.00	0.02	1.38	0.00	0.08			
	1.39	0.00	0.07	0.43	0.00	0.07	2.35	0.00	0.05			
	3.74	0.00	0.46	1.24	0.00	0.03	2.99	0.00	0.22			
	5.23	0.00	0.70	5.02	0.24	0.38	0.43	0.00	0.03			
mean	3.57	0.00	0.30	2.95	0.03	0.15	3.73	0.00	0.24			
median	2.88	0.00	0.29	1.60	0.00	0.10	2.72	0.00	0.20			
max	6.94	0.00	0.70	6.62	0.24	0.38	11.96	0.00	0.90			
min	1.39	0.00	0.07	0.43	0.00	0.00	0.43	0.00	0.03			

Note: Bold value is the estimated detection limit, chlorophyll *a* was not detected in the sample.

Appendix A2.–Greens Creek Site 54 chlorophylls *a*, *b*, and *c* densities, 2001–2015.

mg/m ²	2001			2002			2003			2004		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	1.60	0.01	0.15	2.88	0.00	0.30	13.24	0.00	1.05	17.19	0.00	2.02
	3.10	0.05	0.41	9.61	0.00	1.02	8.33	0.00	0.79	9.72	0.00	0.93
	3.61	0.00	0.21	8.12	0.00	0.24	14.20	0.00	1.45	8.76	0.00	0.67
	2.97	0.00	0.29	4.49	0.00	0.38	6.09	0.00	0.62	32.04	0.00	3.66
	1.88	0.00	0.01	5.34	0.00	0.53	15.49	0.00	1.74	5.23	0.00	0.42
	1.78	0.00	0.19	2.46	0.87	1.26	10.68	0.00	1.06	3.74	0.00	0.31
	4.95	0.00	0.22	6.51	0.00	0.64	5.55	0.00	0.39	12.82	0.00	1.35
	1.46	0.00	0.10	4.91	0.00	0.40	16.34	0.00	1.72	1.92	0.03	0.09
	1.69	0.00	0.14	4.81	0.00	0.45	12.60	0.00	1.07	10.47	0.00	1.09
	3.48	0.00	0.16	8.44	0.00	0.79	16.02	0.00	1.75	5.98	0.00	0.53
mean	2.65	0.01	0.19	5.76	0.09	0.60	11.85	0.00	1.16	10.79	0.00	1.11
median	2.42	0.00	0.17	5.13	0.00	0.49	12.92	0.00	1.07	9.24	0.00	0.80
max	4.95	0.05	0.41	9.61	0.87	1.26	16.34	0.00	1.75	32.04	0.03	3.66
min	1.46	0.00	0.01	2.46	0.00	0.24	5.55	0.00	0.39	1.92	0.00	0.09
mg/m ²	2005			2006			2007			2008		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	10.36	0.00	0.54	19.54	0.00	1.62	0.43	0.04	0.04	2.99	0.00	0.29
	2.56	0.00	0.26	5.66	0.00	0.76	0.24	---	---	1.17	0.02	0.00
	3.31	0.00	0.17	28.73	0.00	1.19	1.39	0.04	0.11	1.50	0.00	0.19
	2.88	0.00	0.12	23.28	0.00	2.63	4.27	0.00	0.48	1.71	0.00	0.13
	5.66	0.00	0.38	4.59	0.00	0.47	0.24	---	---	2.24	0.00	0.09
	2.99	0.00	0.13	27.34	0.00	2.22	3.31	0.00	0.38	2.14	0.00	0.11
	4.27	0.00	0.18	4.27	0.00	0.38	8.01	0.00	0.98	2.46	0.00	0.25
	4.38	0.00	0.31	8.86	0.00	0.94	0.24	---	---	0.96	0.00	0.01
	4.06	0.00	0.16	31.72	0.00	3.17	2.99	0.00	0.39	0.24	---	---
	3.10	0.00	0.16	5.55	0.00	0.68	6.41	0.00	0.81	0.24	---	---
mean	4.36	0.00	0.24	15.96	0.00	1.40	2.75	0.01	0.46	1.57	0.00	0.13
median	3.68	0.00	0.17	14.20	0.00	1.06	2.19	0.00	0.39	1.61	0.00	0.12
max	10.36	0.00	0.54	31.72	0.00	3.17	8.01	0.04	0.98	2.99	0.02	0.29
min	2.56	0.00	0.12	4.27	0.00	0.38	0.24	0.00	0.04	0.24	0.00	0.00
mg/m ²	2009			2010			2011			2012		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	8.01	0.11	1.06	2.67	0.00	0.29	9.61	0.00	0.64	5.54	0.00	0.24
	7.58	0.11	1.13	6.73	0.00	0.69	0.43	0.00	0.06	0.11	0.00	0.04
	6.84	0.07	0.89	4.38	0.00	0.74	3.42	0.00	0.32	2.65	0.00	0.11
	9.18	0.09	0.96	2.14	0.00	0.25	3.42	0.00	0.33	1.82	0.00	0.10
	---	0.47	2.21	5.23	0.00	0.67	41.76	0.00	3.02	1.07	0.00	0.04
	8.33	0.15	1.11	1.71	0.04	0.25	5.23	0.00	0.64	1.17	0.00	0.13
	11.32	0.20	1.57	1.39	0.02	0.11	10.36	0.00	0.45	0.75	0.00	0.06
	5.34	0.17	0.66	3.20	0.00	0.46	7.16	0.00	0.53	19.54	0.00	1.10
	4.49	0.10	0.63	2.03	0.00	0.21	0.64	0.00	0.07	4.06	0.00	0.30
	4.38	0.10	0.43	0.21	0.01	0.05	2.24	0.00	0.29	0.43	0.01	0.04
mean	7.27	0.16	1.06	2.97	0.01	0.37	8.43	0.00	0.64	3.71	0.00	0.22
median	7.58	0.11	1.01	2.41	0.00	0.27	4.33	0.00	0.39	1.50	0.00	0.10
max	11.32	0.47	2.21	6.73	0.04	0.74	41.76	0.00	3.02	19.54	0.01	1.10
min	4.38	0.07	0.43	0.21	0.00	0.05	0.43	0.00	0.06	0.11	0.00	0.04
mg/m ²	2013			2014			2015					
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>			
	2.56	0.00	0.26	6.51	0.00	0.60	1.07	0.00	0.13			
	2.14	0.00	0.23	4.91	0.00	0.92	1.60	0.00	0.23			
	1.28	0.00	0.24	4.59	0.00	0.42	1.82	0.00	0.21			
	2.14	0.00	0.37	1.82	0.00	0.11	4.27	0.00	0.34			
	0.53	0.00	0.02	7.05	0.00	0.56	6.09	0.00	0.43			
	0.43	0.00	0.07	2.67	0.00	0.45	2.46	0.00	0.15			
	---	---	---	1.50	0.00	0.17	2.24	0.00	0.16			
	2.03	0.00	0.28	2.46	0.00	0.20	1.92	0.00	0.10			
	5.87	0.00	0.76	0.05	---	---	1.33	0.00	0.08			
	2.14	0.00	0.21	1.60	0.00	0.26	1.71	0.00	0.15			
mean	2.12	0.00	0.27	3.32	0.00	0.41	2.45	0.00	0.20			
median	2.14	0.00	0.24	2.56	0.00	0.42	1.87	0.00	0.16			
max	5.87	0.00	0.76	7.05	0.00	0.92	6.09	0.00	0.43			
min	0.43	0.00	0.02	0.05	0.00	0.11	1.07	0.00	0.08			

Note: Bold values are the estimated detection limits, chlorophyll *a* was not detected in the samples.

Appendix A3.–Tributary Creek Site 9 chlorophylls *a*, *b*, and *c* densities, 2001–2015.

mg/m ²	2001			2002			2003			2004		
	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>
	6.62	0.00	0.79	8.91	0.00	0.52	9.61	0.00	1.26	9.40	0.22	0.80
	11.15	0.00	1.20	16.43	0.95	1.28	17.19	0.00	0.79	5.77	0.00	0.42
	15.05	0.00	1.47	12.65	0.17	0.00	7.69	0.00	0.29	5.45	0.00	0.48
	16.58	0.23	1.51	5.44	0.45	0.07	8.76	0.00	1.11	6.09	0.03	0.38
	3.15	0.00	0.33	23.72	1.21	0.84	10.47	0.00	1.92	14.52	0.02	1.40
	2.59	0.06	0.28	12.75	0.40	0.22	10.79	0.00	1.88	6.51	0.17	0.40
	1.61	0.00	0.01	32.53	0.00	1.89	22.64	0.00	3.98	10.36	0.13	0.80
	6.66	0.00	0.43	4.40	1.50	0.00	12.39	0.00	2.43	6.84	0.04	0.36
	15.21	0.81	1.44	2.94	0.30	0.17	8.54	0.00	1.69	26.17	0.51	2.61
	11.55	0.00	1.51	8.01	1.47	0.27	13.03	0.00	3.86	8.44	0.22	0.53
mean	9.02	0.11	0.90	12.78	0.64	0.53	12.11	0.00	1.92	9.95	0.14	0.82
median	8.90	0.00	0.99	10.78	0.43	0.25	10.63	0.00	1.78	7.64	0.09	0.51
max	16.58	0.81	1.51	32.53	1.50	1.89	22.64	0.00	3.98	26.17	0.51	2.61
min	1.61	0.00	0.01	2.94	0.00	0.00	7.69	0.00	0.29	5.45	0.00	0.36
mg/m ²	2005			2006			2007			2008		
	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>
	6.09	0.00	0.25	3.42	0.25	0.19	---	---	---	2.35	0.00	0.12
	8.01	1.28	0.18	4.08	0.40	0.20	5.45	0.08	0.23	6.94	0.00	0.27
	1.82	0.13	0.07	6.94	0.00	0.40	7.26	0.00	0.54	6.30	0.24	0.34
	9.08	0.06	0.29	4.11	0.01	0.32	---	---	---	6.41	0.00	0.25
	4.70	0.00	0.10	4.17	0.00	0.39	---	---	---	2.46	0.12	0.19
	4.70	0.00	0.12	4.78	0.00	0.29	0.85	0.16	0.11	6.19	0.05	0.39
	7.80	0.00	0.20	14.16	0.00	0.57	6.41	0.06	0.24	4.06	0.00	0.13
	14.85	0.00	0.46	4.34	0.01	0.21	7.05	0.24	0.65	4.59	0.00	0.37
	36.10	0.10	1.12	5.23	0.00	0.56	5.02	0.00	0.26	1.60	0.00	0.00
	8.97	0.00	0.26	3.66	0.37	0.26	3.20	0.00	0.23	3.74	0.00	0.28
mean	10.21	0.16	0.31	5.49	0.10	0.34	5.03	0.08	0.32	4.46	0.04	0.23
median	7.90	0.00	0.23	4.25	0.00	0.30	5.45	0.06	0.24	4.33	0.00	0.26
max	36.10	1.28	1.12	14.16	0.40	0.57	7.26	0.24	0.65	6.94	0.24	0.39
min	1.82	0.00	0.07	3.42	0.00	0.19	0.85	0.00	0.11	1.60	0.00	0.00
mg/m ²	2009			2010			2011			2012		
	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>
	2.03	0.10	0.16	12.82	0.00	0.39	4.81	0.47	0.08	3.63	0.00	0.25
	5.45	0.17	0.38	6.62	0.00	0.39	3.84	0.00	0.12	8.97	0.00	0.33
	4.38	0.24	0.30	7.69	0.00	0.43	4.91	0.00	0.34	10.68	0.00	0.48
	7.05	0.58	0.33	5.66	0.12	0.32	10.47	0.03	0.50	3.74	0.00	0.25
	9.08	0.36	0.49	9.72	0.88	0.40	5.13	0.00	0.37	1.28	0.00	0.04
	8.76	0.41	0.62	5.98	0.00	0.20	1.71	0.00	0.01	1.71	0.00	0.12
	2.14	0.08	0.09	5.55	0.00	0.40	6.30	0.00	0.44	5.66	0.00	0.29
	18.37	0.66	0.78	10.57	0.28	0.34	9.61	0.00	0.35	6.09	0.00	0.26
	2.35	0.18	0.16	4.06	0.05	0.16	12.50	0.00	0.87	2.14	0.00	0.21
	3.20	0.20	0.33	5.77	0.00	0.32	6.30	0.00	0.17	7.37	0.00	0.40
mean	6.28	0.30	0.36	7.44	0.13	0.34	6.56	0.05	0.33	5.13	0.00	0.26
median	4.91	0.22	0.33	6.30	0.00	0.37	5.71	0.00	0.35	4.70	0.00	0.26
max	18.37	0.66	0.78	12.82	0.88	0.43	12.50	0.47	0.87	10.68	0.00	0.48
min	2.03	0.08	0.09	4.06	0.00	0.16	1.71	0.00	0.01	1.28	0.00	0.04
mg/m ²	2013			2014			2015					
	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>	chl- <i>a</i>	chl- <i>b</i>	chl- <i>c</i>			
	11.00	0.00	0.64	---	---	---	5.13	0.00	0.33			
	2.88	0.00	0.19	11.21	0.00	0.63	15.06	0.00	0.94			
	5.45	0.00	0.40	1.60	0.00	0.17	2.67	0.00	0.14			
	5.02	0.00	0.40	5.87	0.00	0.37	3.63	0.00	0.09			
	2.24	0.00	0.15	5.98	0.00	0.60	5.55	0.00	0.47			
	2.99	0.00	0.17	0.75	0.00	0.06	2.56	0.00	0.11			
	9.51	0.00	0.66	1.71	0.00	0.15	2.88	0.21	0.10			
	0.32	0.05	0.15	0.05	---	---	9.29	0.00	0.87			
	3.52	0.00	0.19	0.11	0.00	0.00	6.62	0.00	0.52			
	2.78	0.00	0.17	3.20	0.00	0.23	4.06	0.00	0.30			
mean	4.57	0.00	0.31	3.39	0.00	0.28	5.75	0.02	0.39			
median	3.26	0.00	0.19	1.71	0.00	0.20	4.59	0.00	0.32			
max	11.00	0.05	0.66	11.21	0.00	0.63	15.06	0.21	0.94			
min	0.32	0.00	0.15	0.05	0.00	0.00	2.56	0.00	0.09			

Note: Bold value is the estimated detection limit, chlorophyll *a* was not detected in the sample.

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B1.–Greens Creek Site 48 benthic macroinvertebrate data summaries, 2001–2015.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Benthic Macroinvertebrate Taxa Counted	25	26	27	30	29	21	24	21	18	23	27	22	20	24	27
Mean Aquatic Insect Taxa/Sample	12	13	18	19	16	11	13	13	10	15	17	13	12	13	17
Total Ephemeroptera Taxa Counted	6	6	7	6	6	6	7	6	7	7	7	7	7	7	8
Total Plecoptera Taxa Counted	7	11	6	9	8	4	5	3	5	6	7	7	5	6	6
Total Trichoptera Taxa Counted	2	2	4	2	4	2	1	2	1	1	2	2	1	1	2
Ephemeroptera Counted	1,094	599	1,897	1,034	902	495	428	887	852	937	558	555	618	844	1,488
Plecoptera Counted	49	41	191	74	36	10	75	20	40	81	151	55	131	98	122
Trichoptera Counted	7	9	20	22	15	7	8	24	1	4	12	5	8	14	62
Aquatic Diptera Counted	31	39	206	169	101	38	34	79	15	71	193	73	86	184	291
Other Insects Counted	3	16	53	25	5	10	15	11	2	8	68	5	12	16	65
% Ephemeroptera	92%	85%	80%	79%	86%	88%	80%	87%	93%	86%	57%	80%	72%	73%	73%
% Plecoptera	4%	6%	8%	6%	3%	3%	11%	2%	5%	7%	15%	8%	15%	8%	6%
% Trichoptera	1%	1%	1%	2%	2%	1%	2%	2%	0%	0%	1%	1%	1%	1%	3%
% Aquatic Diptera	3%	6%	9%	12%	9%	6%	6%	8%	2%	6%	20%	11%	10%	16%	14%
% Other	0%	2%	2%	2%	1%	1%	2%	1%	0%	1%	7%	1%	1%	1%	3%
% EPT	97%	92%	89%	86%	90%	92%	92%	92%	98%	93%	73%	89%	89%	83%	82%
% Chironomidae	1%	4%	7%	11%	8%	3%	4%	6%	1%	5%	17%	9%	9%	15%	9%
% Dominant Taxon	41%	35%	30%	28%	30%	37%	36%	58%	46%	31%	21%	37%	25%	31%	28%
Total Terrestrial Invertebrates Counted	0	4	5	1	24	5	2	8	2	11	4	0	14	32	6
Total Benthic Macroinvertebrates Counted	1,184	704	2,367	1,679	1,396	693	733	1,331	953	1,240	982	693	855	1,156	2,028
Total Invertebrates Counted	1,184	708	2,372	1,680	1,420	698	735	1,339	955	1,251	986	693	869	1,188	2,034
% Sample Aquatic	100%	99%	100%	100%	98%	99%	100%	99%	100%	99%	100%	100%	98%	97%	99.7%
% Sample Terrestrial	0%	1%	0%	0%	2%	1%	0%	1%	0%	1%	0%	0%	2%	3%	0.3%
Total Sample Area (m ²)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69
Est. Number of Total Insects / m ²	2,753	1,647	5,516	3,907	3,302	1,623	1,709	3,114	2,221	2,909	2,293	1,612	2,021	2,763	2,956
Est. Number of Benthic Macroinvertebrates / m ²	2,753	1,637	5,505	3,905	3,247	1,612	1,705	3,095	2,216	2,884	2,284	1,612	1,988	2,688	2,948
± 1 Standard Deviation	1,435	434	1,579	677	1,441	807	648	980	1,939	1,530	630	872	526	1,043	892

Appendix B2.–Greens Creek Site 54 benthic macroinvertebrate data summaries, 2001–2015.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Aquatic Insect Taxa Counted	28	30	26	32	25	13	15	22	23	21	34	30	19	26	28
Mean Aquatic Insect Taxa/Sample	15	14	16	19	15	9	8	14	13	13	18	14	9	11	14
Total Ephemeroptera Taxa Counted	7	6	7	6	8	5	6	8	7	6	8	7	5	7	7
Total Plecoptera Taxa Counted	7	7	7	10	7	3	4	4	7	5	7	10	6	7	6
Total Trichoptera Taxa Counted	2	2	1	3	3	2	0	2	2	2	5	4	1	3	2
Ephemeroptera Counted	1627	1352	2011	1601	1265	477	286	1105	895	1247	1536	591	308	1,277	941
Plecoptera Counted	80	54	82	117	37	30	22	65	43	53	96	49	54	109	99
Trichoptera Counted	7	6	12	19	31	4	0	9	4	8	32	9	3	15	24
Aquatic Diptera Counted	53	39	173	184	65	13	10	85	32	61	203	81	52	177	182
Other Insects Counted	15	15	57	46	4	1	1	13	5	8	46	24	19	24	52
% Ephemeroptera	91%	92%	86%	81%	90%	91%	90%	87%	91%	91%	80%	78%	71%	80%	72%
% Plecoptera	4%	4%	4%	6%	3%	6%	7%	5%	4%	4%	5%	6%	12%	7%	8%
% Trichoptera	0%	0%	1%	1%	2%	1%	0%	1%	0%	1%	2%	1%	1%	1%	2%
% Aquatic Diptera	3%	3%	7%	9%	5%	2%	3%	7%	3%	4%	11%	11%	12%	11%	14%
% Other	1%	1%	2%	2%	0%	0%	0%	1%	1%	1%	2%	4%	4%	1%	4%
% EPT	96%	96%	90%	88%	95%	97%	97%	92%	96%	95%	87%	86%	84%	87%	82%
% Chironomidae	2%	2%	6%	8%	4%	2%	2%	5%	2%	3%	9%	9%	10%	10%	11%
% Dominant Taxon	52%	43%	40%	38%	40%	31%	34%	53%	40%	35%	43%	30%	30%	35%	32%
Total Terrestrial Insects Counted	0	4	7	1	3	1	6	1	8	9	14	3	8	12	6
Total Aquatic Insects Counted	1,782	1,466	2,335	1,967	1,402	525	319	1,277	979	1,377	1,913	764	436	1,607	1,298
Total Insects Counted	1,782	1,470	2,342	1,968	1,405	526	325	1,278	987	1,386	1,927	797	444	1,619	1,304
% Sample Aquatic	100%	100%	100%	100%	100%	100%	98%	100%	99%	99%	99%	100%	98%	99%	100%
% Sample Terrestrial	0%	0%	0%	0%	0%	0%	2%	0%	1%	1%	1%	0%	2%	1%	0%
Total Sample Area (m ²)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69
Est. Number of Total Insects / m ²	4,144	3,419	5,447	4,577	3,267	1,223	756	2,972	2,295	3,223	4,481	1,765	1,033	3,765	1,895
Est. Number of Aquatic Insects / m ²	4,144	3,409	5,430	4,575	3,260	1,221	742	2,970	2,277	3,202	4,449	1,753	1,014	3,737	1,887
± 1 Standard Deviation	1,464	1,148	1,422	1,540	1,016	345	293	1,855	297	772	2,668	738	642	1,253	1,065

Appendix B3.—Tributary Creek Site 9 benthic macroinvertebrate data summaries, 2001–2015.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Aquatic Insect Taxa Counted	21	24	36	26	30	23	21	20	26	22	26	27	20	22	23
Mean Aquatic Insect Taxa/Sample	14	15	21	14	14	11	10	14	13	10	12	15	11	12	11
Total Ephemeroptera Taxa Counted	6	7	8	5	9	7	5	7	8	7	6	5	7	6	6
Total Plecoptera Taxa Counted	5	5	5	6	5	2	3	4	5	5	6	6	4	3	6
Total Trichoptera Taxa Counted	0	2	3	3	4	1	2	1	0	0	2	3	1	3	0
Ephemeroptera Counted	205	436	981	562	334	444	104	441	203	89	277	245	726	565	137
Plecoptera Counted	68	69	593	166	95	35	37	50	97	17	138	69	130	166	160
Trichoptera Counted	0	2	7	5	4	2	4	1	0	0	13	10	2	8	0
Aquatic Diptera Counted	86	66	256	66	60	42	21	206	141	52	196	179	135	181	73
Other Insects Counted	150	175	679	233	35	102	52	55	38	40	232	106	36	146	145
% Ephemeroptera	40%	58%	39%	54%	63%	71%	48%	59%	42%	45%	32%	40%	71%	53%	27%
% Plecoptera	13%	9%	24%	16%	18%	6%	17%	7%	20%	9%	16%	11%	13%	16%	31%
% Trichoptera	0%	0%	0%	0%	1%	0%	2%	0%	0%	0%	2%	2%	0%	1%	0%
% Aquatic Diptera	17%	9%	10%	6%	11%	7%	10%	27%	29%	26%	23%	29%	13%	17%	14%
% Other	30%	23%	27%	23%	7%	16%	24%	7%	8%	20%	27%	17%	3%	14%	28%
% EPT	54%	68%	63%	71%	82%	77%	67%	65%	63%	54%	50%	53%	83%	69%	58%
% Chironomidae	7%	5%	5%	5%	8%	4%	1%	1%	22%	23%	21%	26%	11%	14%	11%
% Dominant Taxon	26%	29%	26%	44%	37%	40%	26%	33%	32%	32%	24%	30%	38%	30%	28%
Total Terrestrial Insects Counted	0	5	15	3	12	33	1	5	50	22	2	9	13	13	6
Total Aquatic Insects Counted	509	748	2,516	1032	528	625	218	753	479	198	856	609	1,029	1,066	515
Total Insects Counted	509	753	2,531	1035	540	658	219	758	529	220	858	618	1,042	1,079	521
% Sample Aquatic	100%	99%	99%	100%	98%	95%	100%	99%	91%	90%	100%	99%	99%	99%	99%
% Sample Terrestrial	0%	1%	1%	0%	2%	5%	0%	1%	10%	11%	0%	1%	1%	1%	1%
Total Sample Area (m ²)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69
Est. Number of Total Insects / m ²	1,184	1,751	5,886	2,407	1,256	1,530	509	1,763	1,230	512	1,995	1,437	2,423	2,509	757
Est. Number of Aquatic Insects / m ²	1,184	1,740	5,851	2,400	1,228	1,453	507	1,751	1,114	460	1,991	1,416	2,393	2,479	749
± 1 Standard Deviation	1,148	620	1,579	851	357	878	268	631	636	463	447	615	1,897	727	348

APPENDIX C: JUVENILE FISH CAPTURE DATA

Appendix C1.–Greens Creek Site 48 juvenile fish capture data, 2001–2015.

Year	Species	FL (mm)	Number of Fish Captured				Population Estimate	Condition (g/mm ³)
			Set 1	Set 2	Set 3	Total		
2001	DV	48-139	30	16	22	68	121±68	n/a
2002	DV	45-160	74	29	23	126	144±17	n/a
2003	DV	54-180	157	72	56	285	347±39	n/a
2004	DV	54-158	168	48	28	244	256±10	n/a
2005	DV	50-149	118	56	38	212	251±28	n/a
2006	DV	49-150	138	40	34	212	231±15	n/a
2007	DV	53-154	50	29	16	95	113±19	n/a
2008	DV	77-137	54	10	9	73	75±4	n/a
2009	DV	47-142	67	31	28	126	159±30	n/a
2010	DV	47-170	97	41	20	158	172±13	n/a
2011	DV	54-155	56	28	41	125	241±125	n/a
2012	DV	64-148	85	22	28	135	153±17	1.03
2013	DV	35-154	167	61	25	253	267±11	1.01
2014	DV	52-146	59	19	21	99	115±17	1.03
2015	DV	54-165	48	32	17	97	120±23	1.01

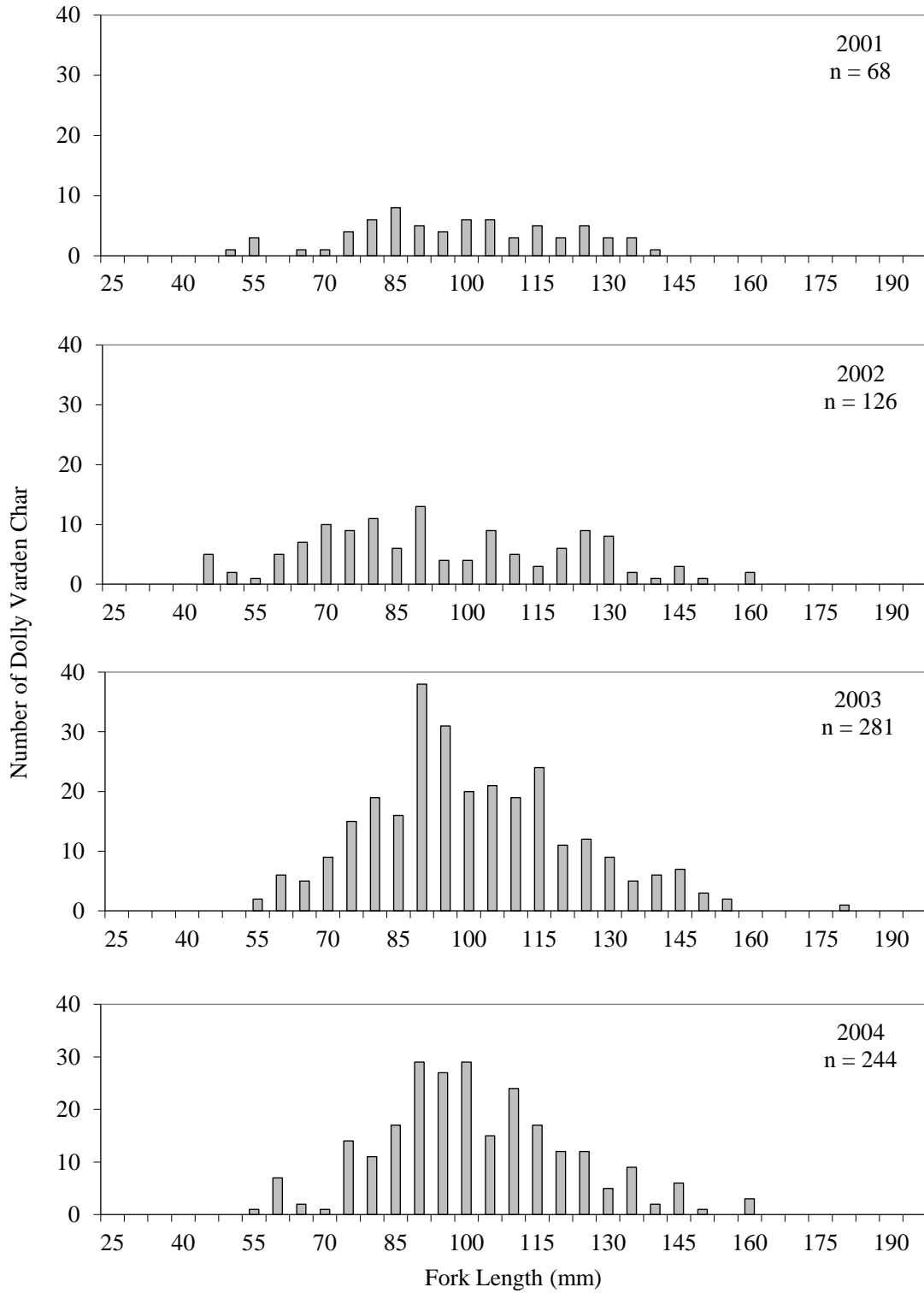
Appendix C2.–Greens Creek Site 54 juvenile fish capture data, 2001–2015.

Year	Species	FL (mm)	Number of Fish Captured				Total	Population Estimate	Condition (g/mm ³)
			Set 1	Set 2	Set 3				
2001	DV	27-162	70	49	19	138	163±21	n/a	
	CO	32-95	2	6	4	12	---	n/a	
2002	DV	33-160	168	72	31	271	293±16	n/a	
	CO	59-85	14	6	1	21	21	n/a	
2003	DV	51-184	92	81	59	232	440±175	n/a	
	CO	44-52	5	3	0	8	---	n/a	
2004	DV	52-161	118	36	47	201	244±32	n/a	
	CO	70-95	9	9	6	24	34±17	n/a	
2005	DV	52-146	111	59	43	213	269±40	n/a	
	CO	66-93	33	20	8	61	68±9	n/a	
2006	DV	49-158	116	61	40	217	264±33	n/a	
	CO	62-88	6	0	1	7	---	n/a	
2007	DV	50-145	64	19	24	107	126±19	n/a	
	CO	---	0	0	0	0	---	n/a	
2008	DV	45-131	50	15	6	71	73	n/a	
	CO	53-69	4	0	0	4	---	n/a	
2009	DV	47-101	42	32	19	93	128±37	n/a	
	CO	67-73	2	2	0	4	---	n/a	
2010	DV	52-151	46	13	14	73	81±10	n/a	
	CO	77	1	0	0	1	---	n/a	
2011	DV	43-150	73	43	57	173	390±224	n/a	
	CO	---	0	0	0	0	---	n/a	
2012	DV	47-143	92	39	58	189	313±105	0.99	
	CO	67-71	0	3	2	5	---	1.08	
2013	DV	50-150	188	67	42	297	323±17	1.05	
	CO	---	0	0	0	0	---	n/a	
2014	DV	50-158	121	28	13	162	165±4	1.03	
	CO	70-85	10	4	1	15	---	1.16	
2015	DV	54-150	64	29	9	102	108±7	1.00	
	CO	100	15	5	1	21	---	1.07	

Appendix C3.–Tributary Creek Site 9 juvenile fish capture data, 2001–2015.

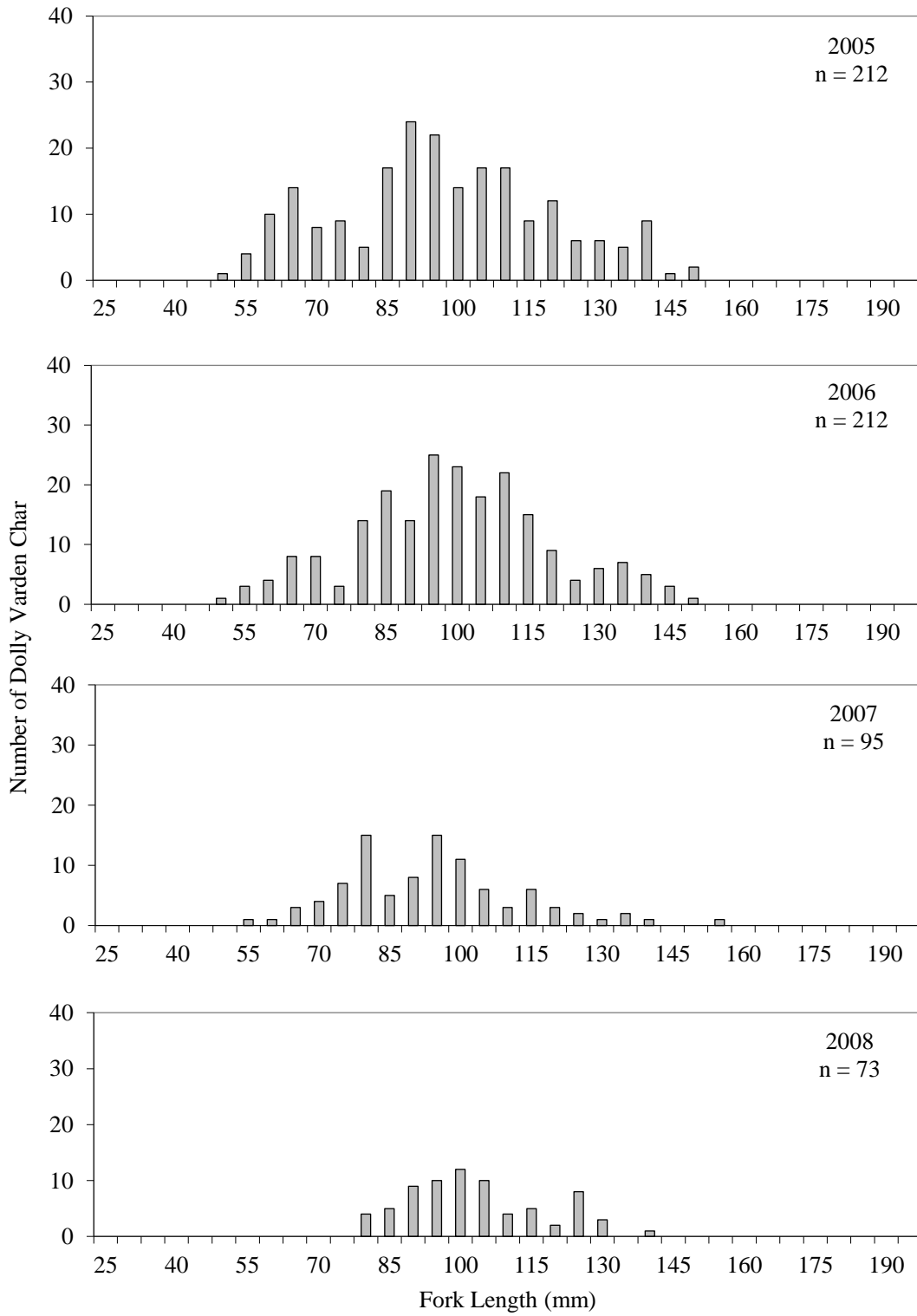
Year	Species	FL (mm)	Number of Fish Captured				Population Condition	
			Set 1	Set 2	Set 3	Total	Estimate	(g/mm ³)
2001	DV	58-110	70	4	7	81	81	n/a
	CO	39-101	89	18	11	118	120±3	n/a
	CT	124	1	0	0	1	---	n/a
2002	DV	38-147	29	14	8	51	57±9	n/a
	CO	27-85	29	9	6	44	46±4	n/a
	CT	124	0	0	1	1	---	n/a
2003	DV	54-114	13	4	2	19	19	n/a
	CO	46-88	37	11	4	52	53±2	n/a
	CT	122	1	0	0	1	---	n/a
2004	DV	64-109	21	6	5	32	33±2	n/a
	CO	40-94	23	2	2	27	27	n/a
	CT	122	1	0	0	1	---	n/a
	RT	86-106	3	1	0	4	---	n/a
2005	DV	59-131	21	12	11	44	59±21	n/a
	CO	39-103	82	42	15	139	151±12	n/a
	CT	91-103	1	1	0	2	---	n/a
2006	DV	85-117	7	3	1	11	---	n/a
	CO	69-108	5	4	1	10	---	n/a
2007	DV	81-158	7	5	0	12	---	n/a
	CO	38-104	50	10	9	69	71±4	n/a
	CT	138	0	0	1	1	---	n/a
2008	DV	60-108	15	4	3	22	22	n/a
	CO	41-100	72	44	26	142	177±30	n/a
	CT	82-112	1	0	2	3	---	n/a
2009	DV	48-98	24	5	9	38	42±7	n/a
	CO	38-116	42	9	2	53	53	n/a
	CT	97	1	0	0	1	---	n/a
2010	DV	58-108	21	7	31	59	59	n/a
	CO	39-90	77	21	30	128	152±22	n/a
	CT	64-89	4	1	0	5	---	n/a
2011	DV	50-125	15	7	14	36	36	n/a
	CO	38-100	18	18	13	49	85±50	n/a
	CT	115	1	0	0	1	---	n/a
2012	DV	66-112	17	11	12	40	40	1.00
	CO	46-105	39	9	7	55	55	1.14
	CT	63-93	4	0	1	5	---	0.97
2013	DV	52-92	9	2	2	13	---	1.23
	CO	50-91	9	6	3	18	20±4	1.43
	CT	73-80	0	2	0	2	---	0.97
2014	DV	37-115	1	12	1	14	---	0.99
	CO	39-92	86	26	24	136	150±13	1.16
	CT	110-110	0	1	1	2	---	0.87
	RT	105-110	1	0	1	2	---	0.69
2015	DV	55-84	10	5	1	16	16	1.20
	CO	38-95	36	27	13	76	95±21	1.37

Appendix C4.—Length frequency diagrams of Dolly Varden char captured at Greens Creek Site 48, 2001–2015.



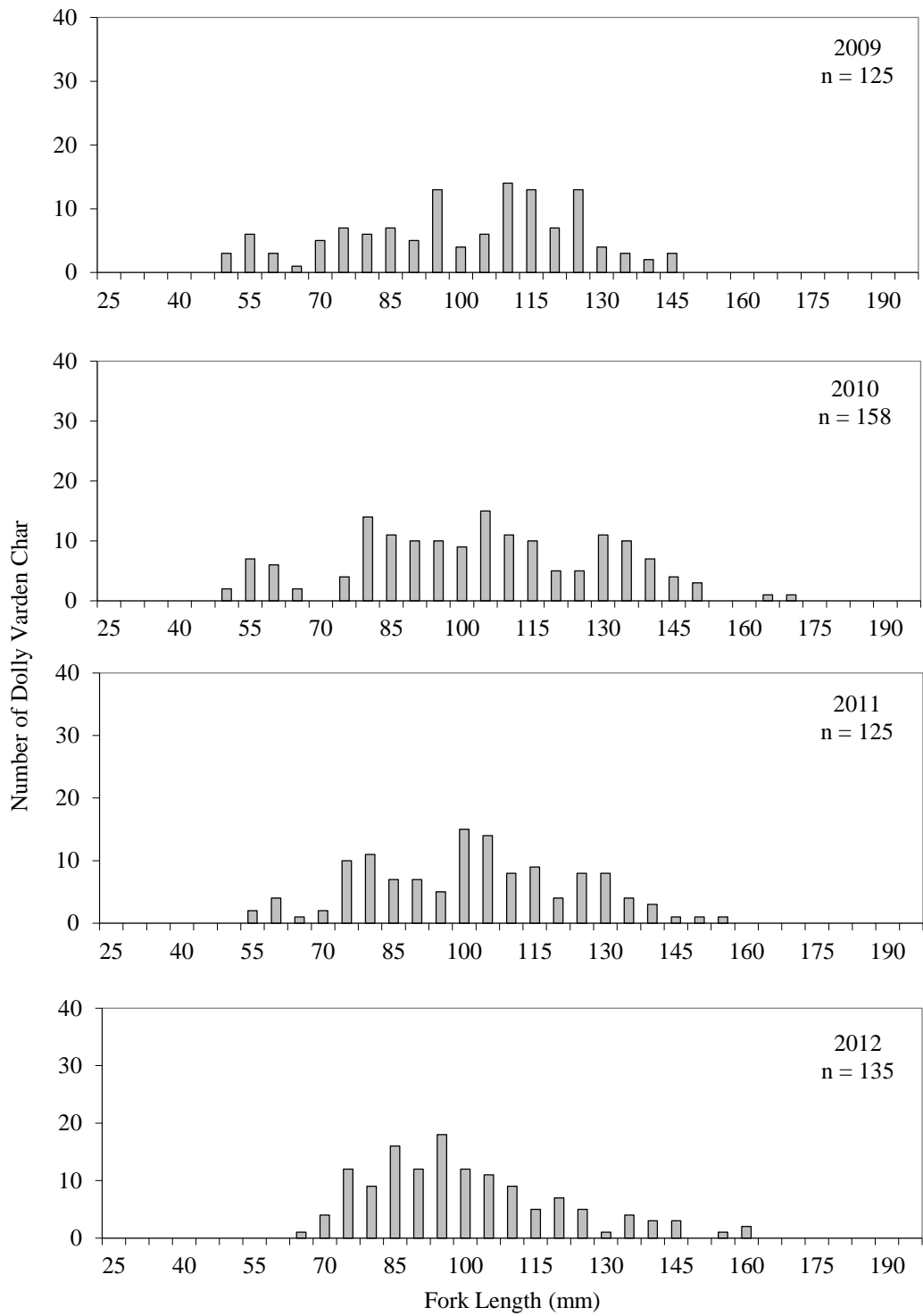
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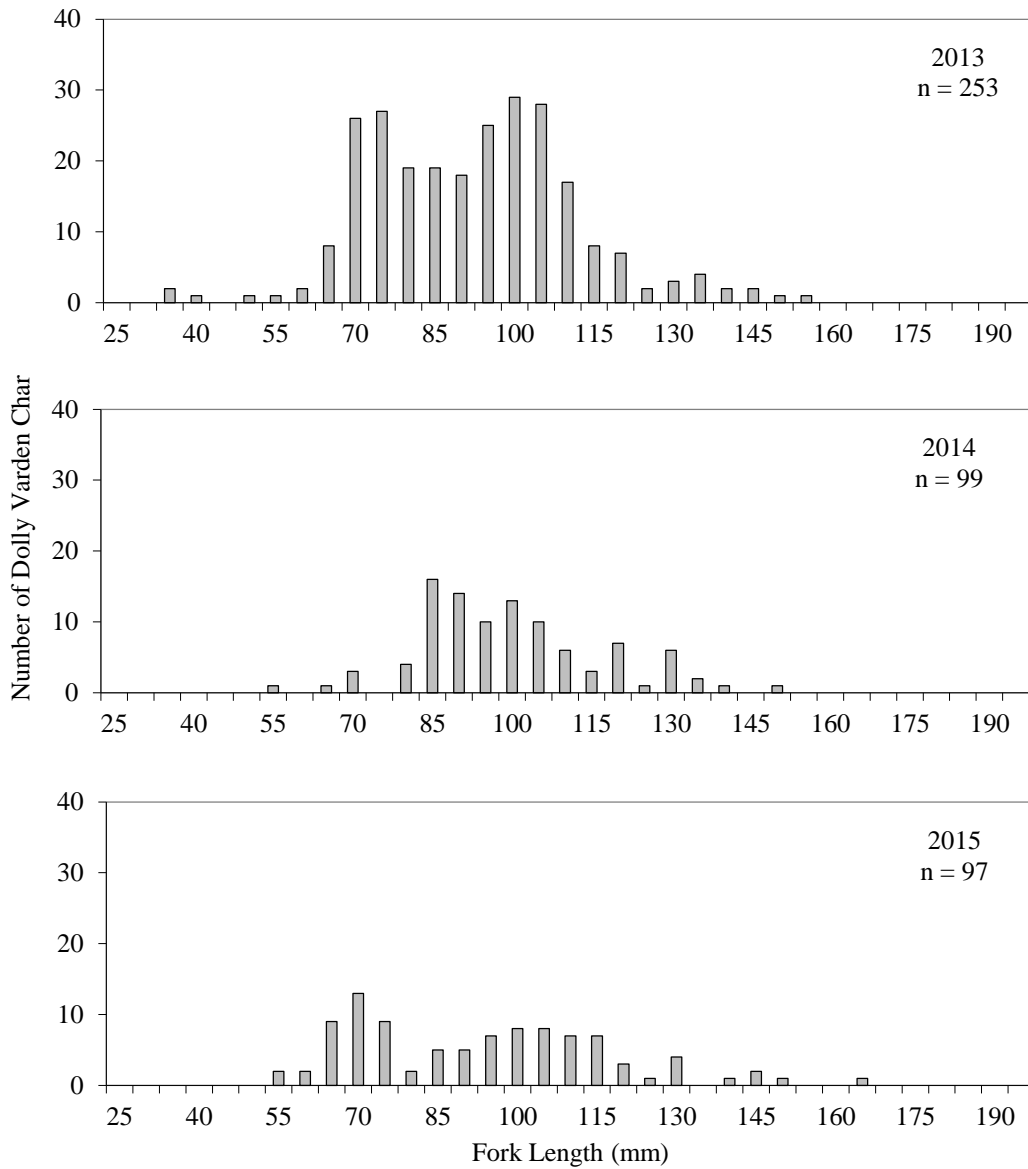
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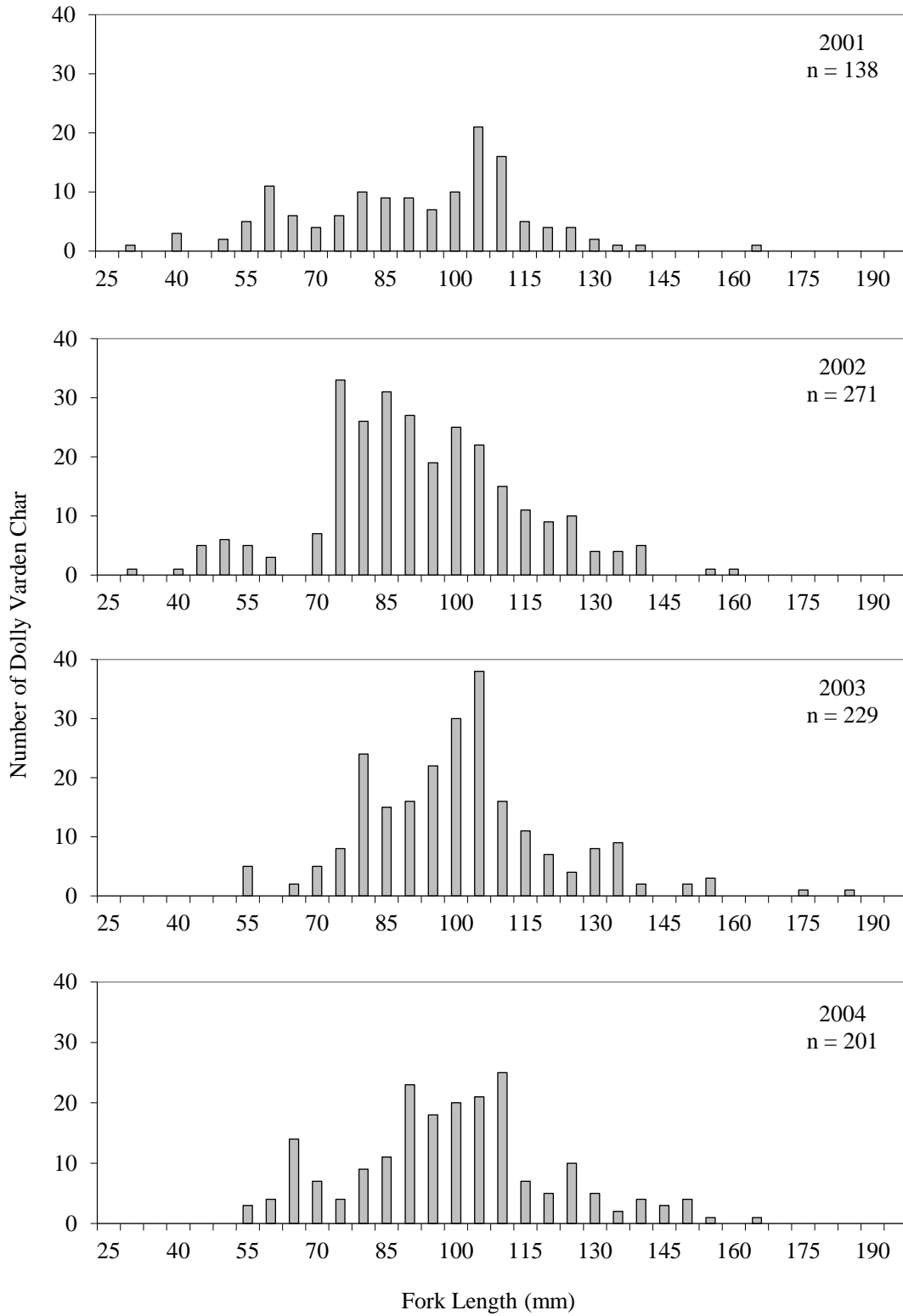


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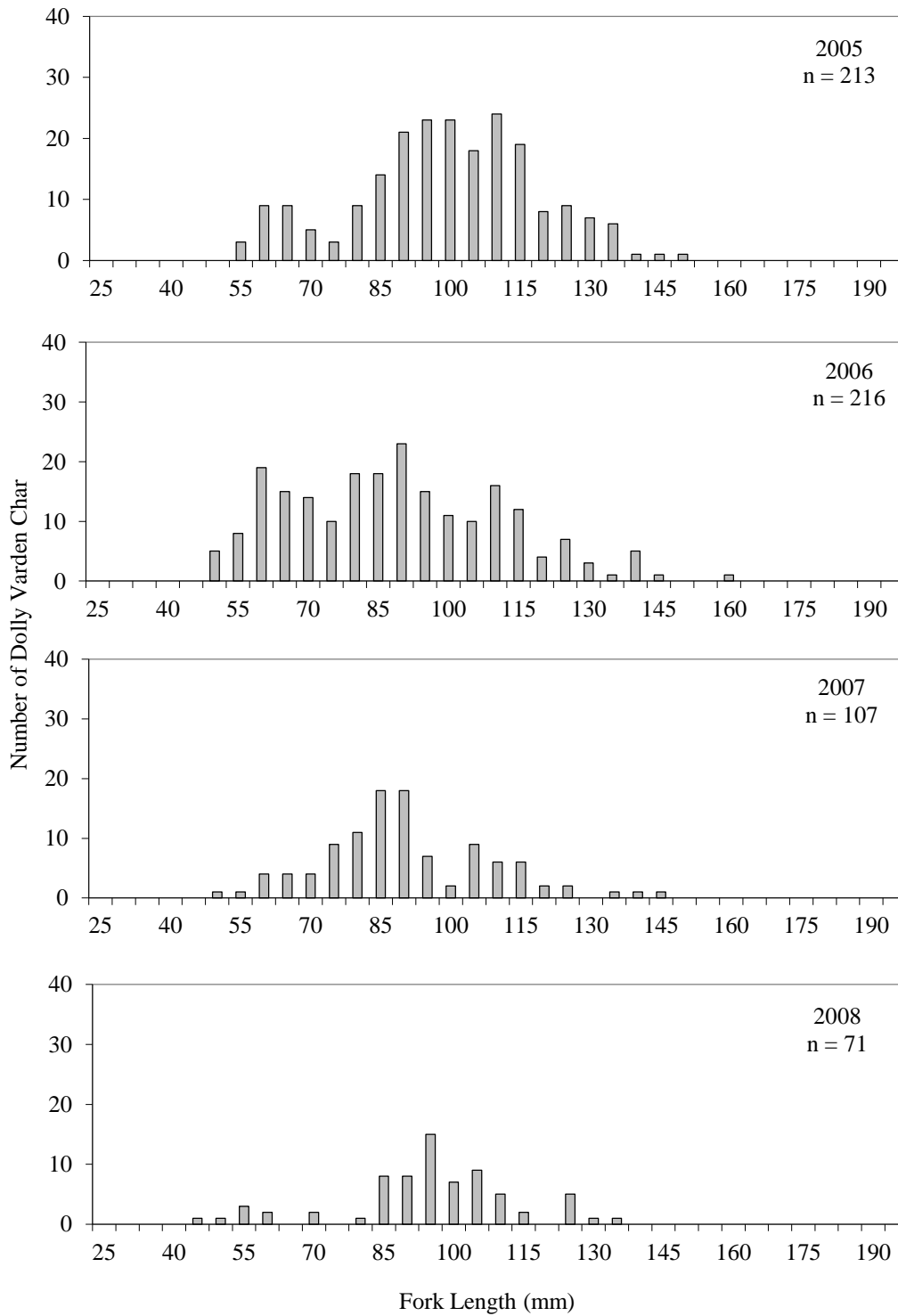


Appendix C5.—Length frequency diagrams of Dolly Varden char captured at Greens Creek Site 54, 2001–2015.



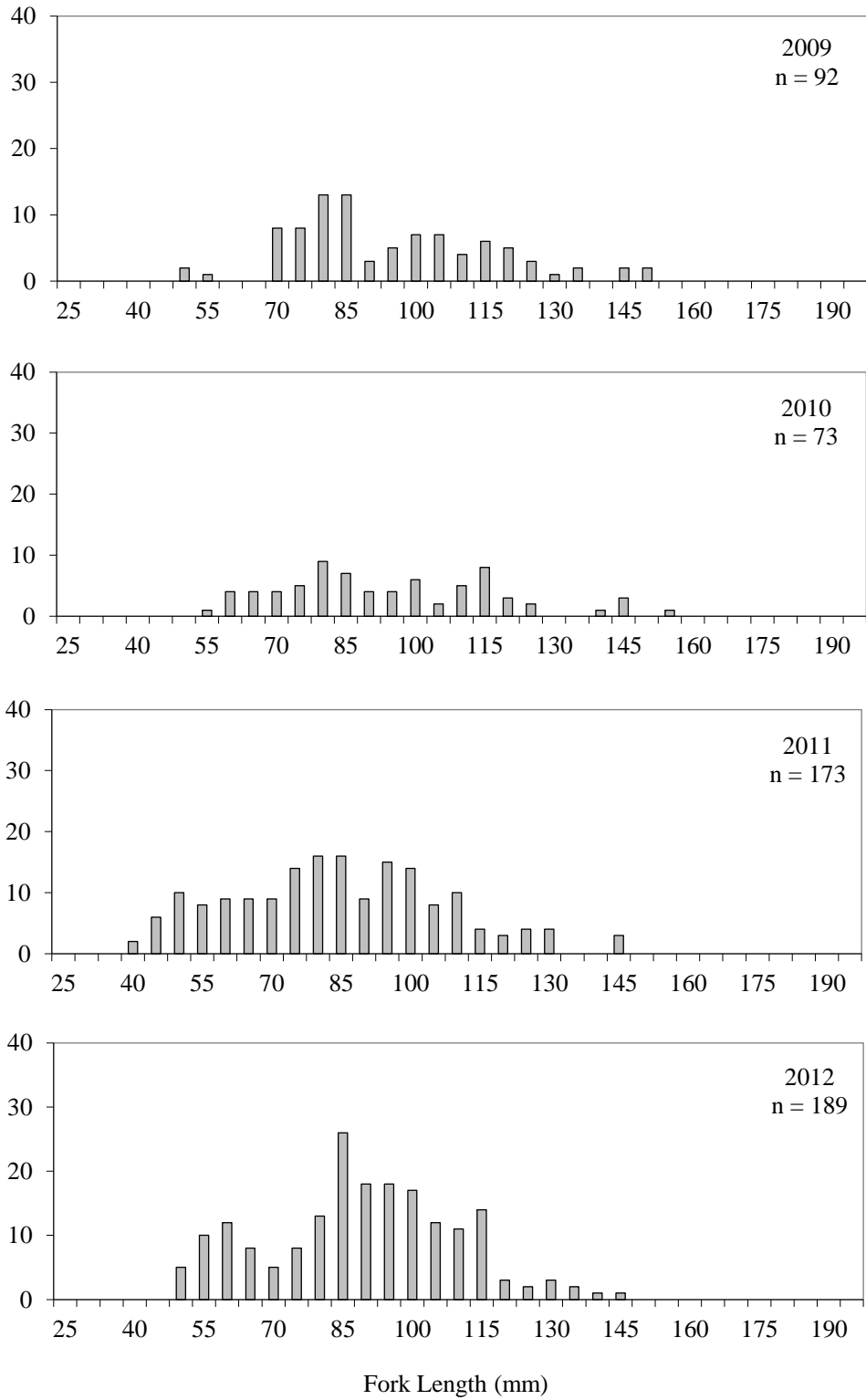
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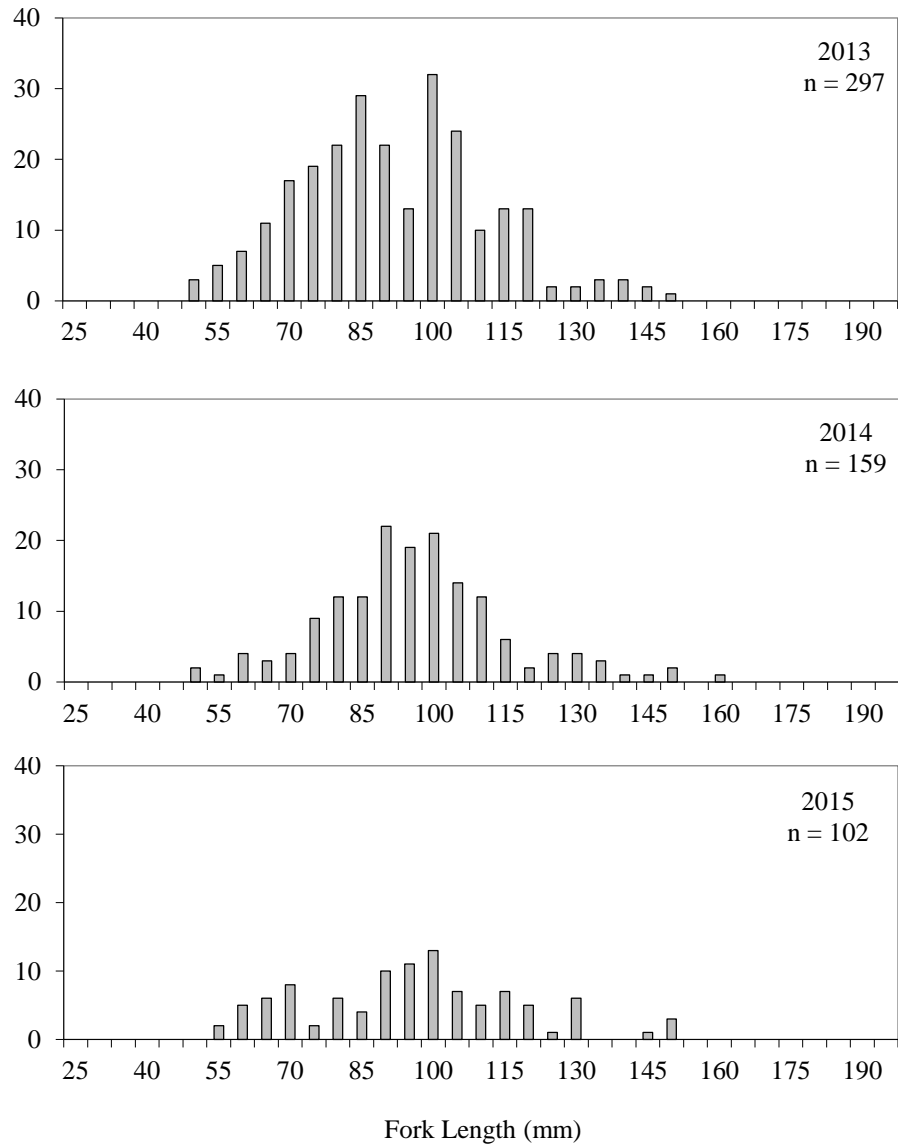
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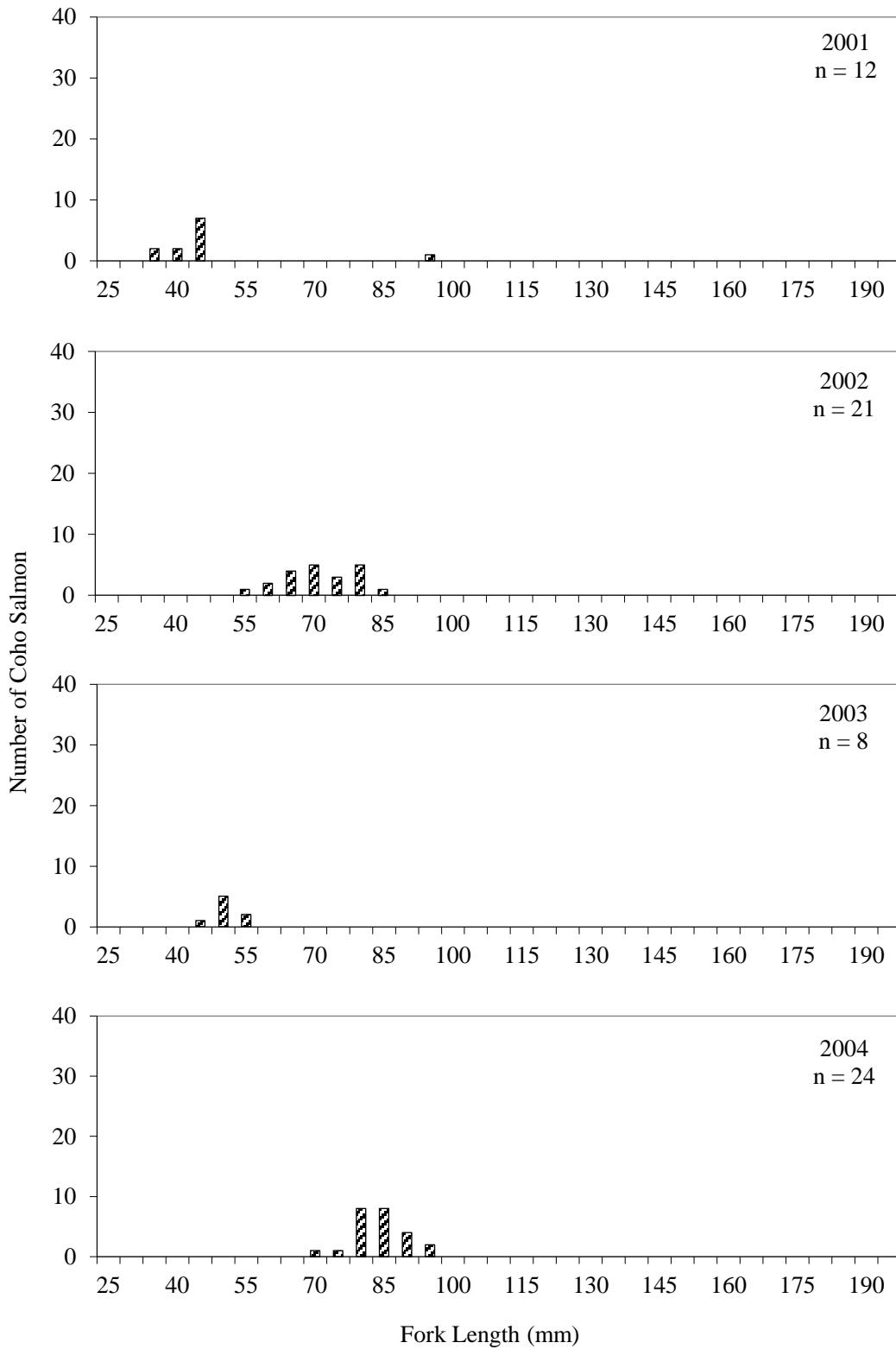


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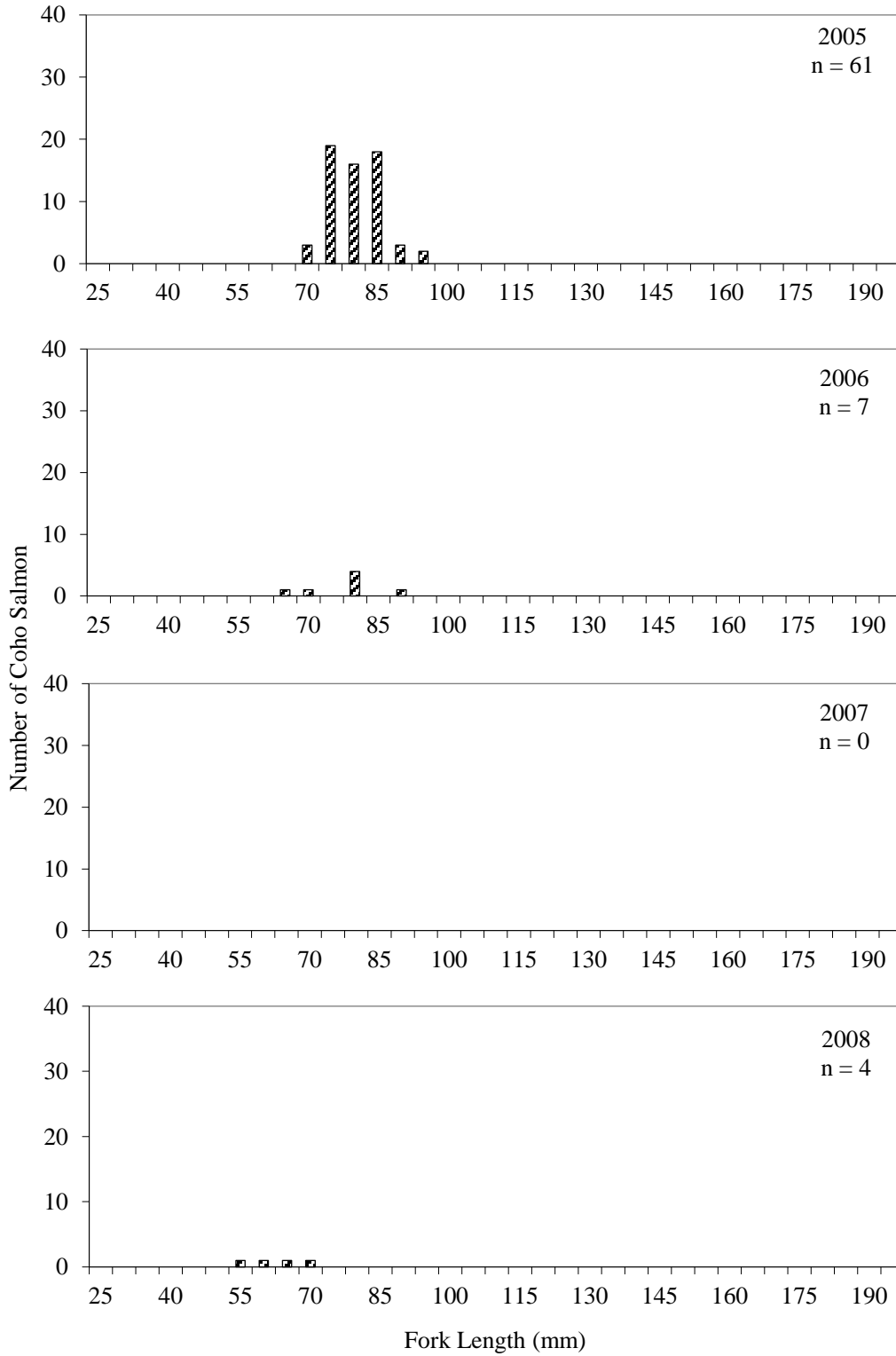


Appendix C6.—Length frequency diagrams of coho salmon captured at Greens Creek Site 54, 2001–2015.



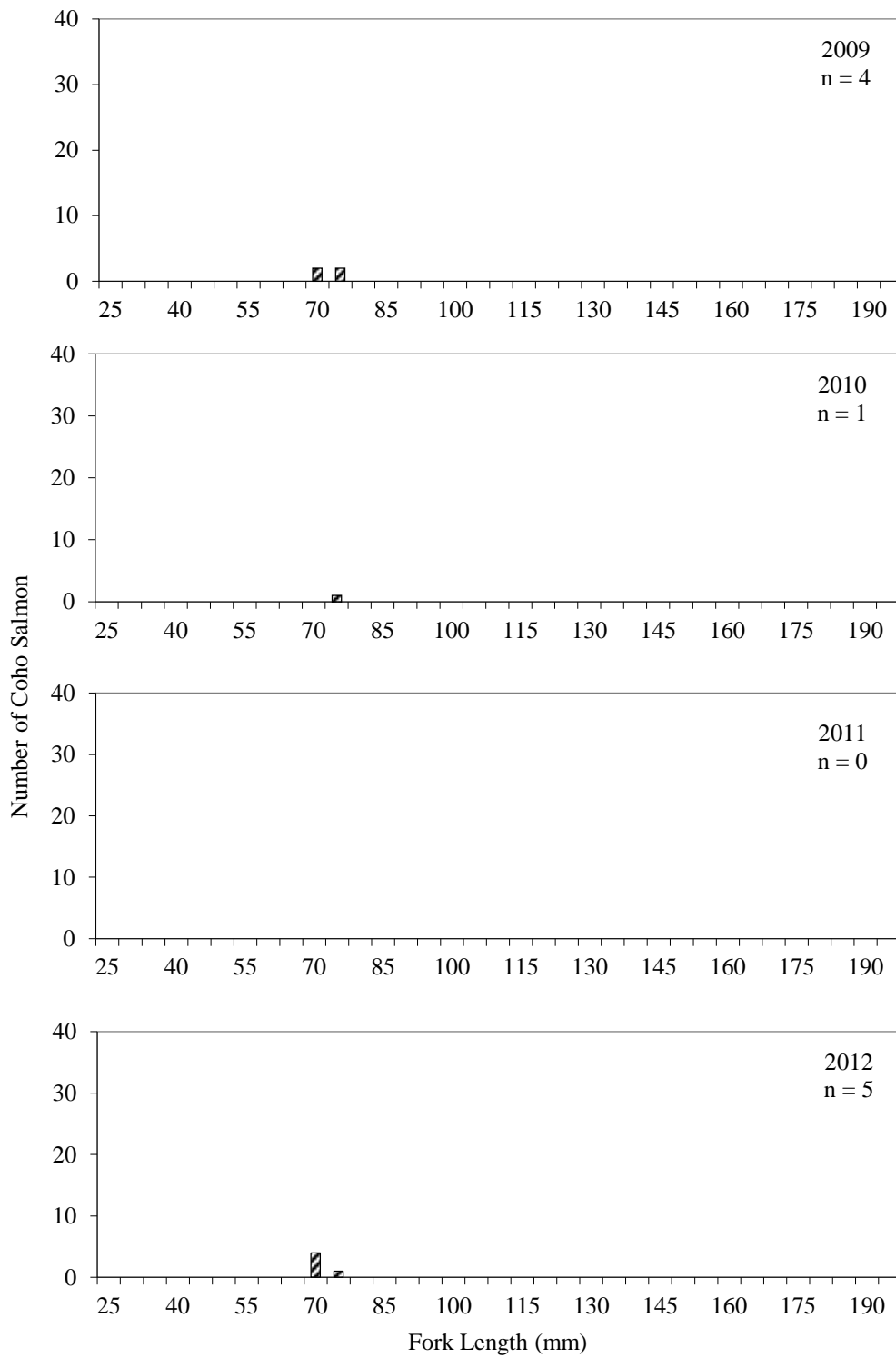
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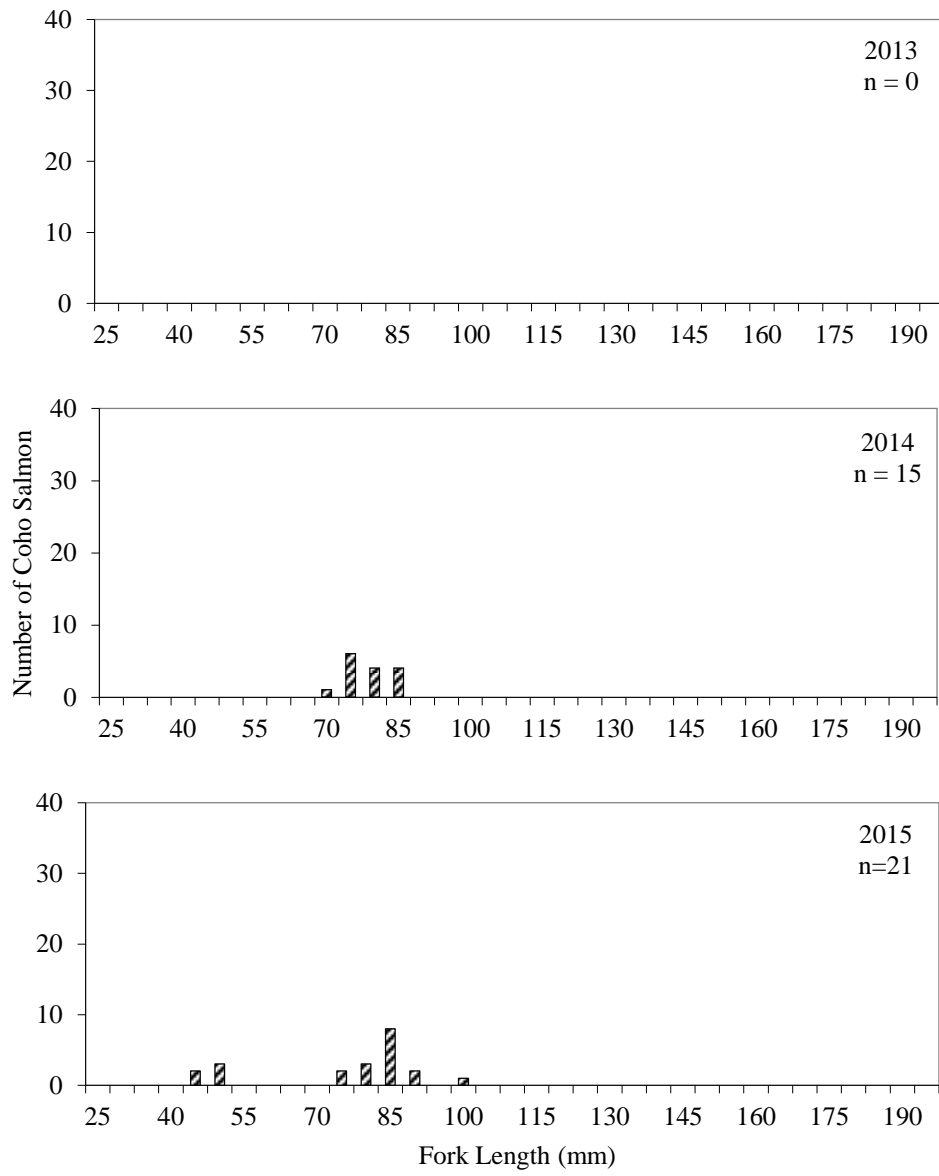
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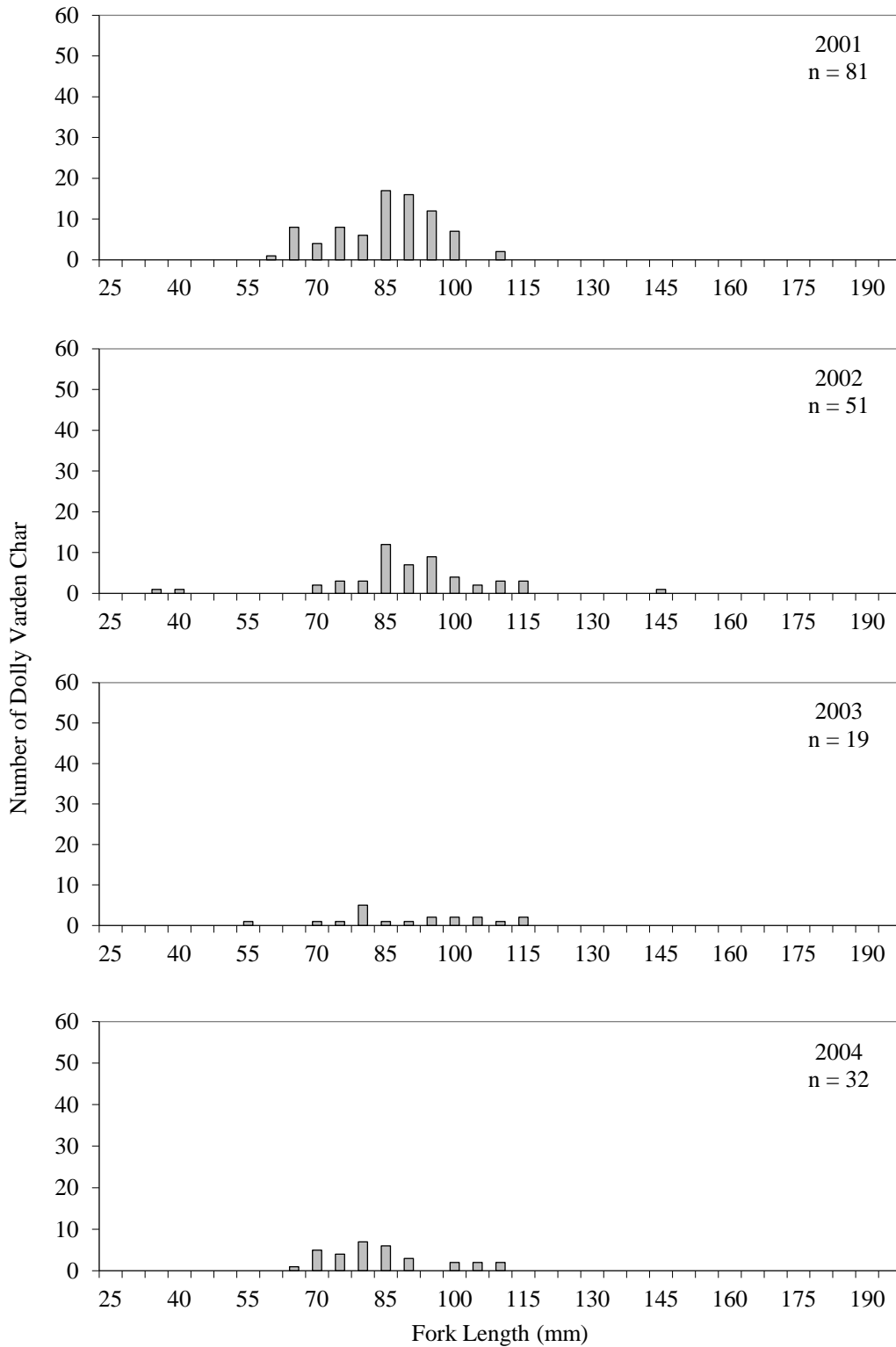


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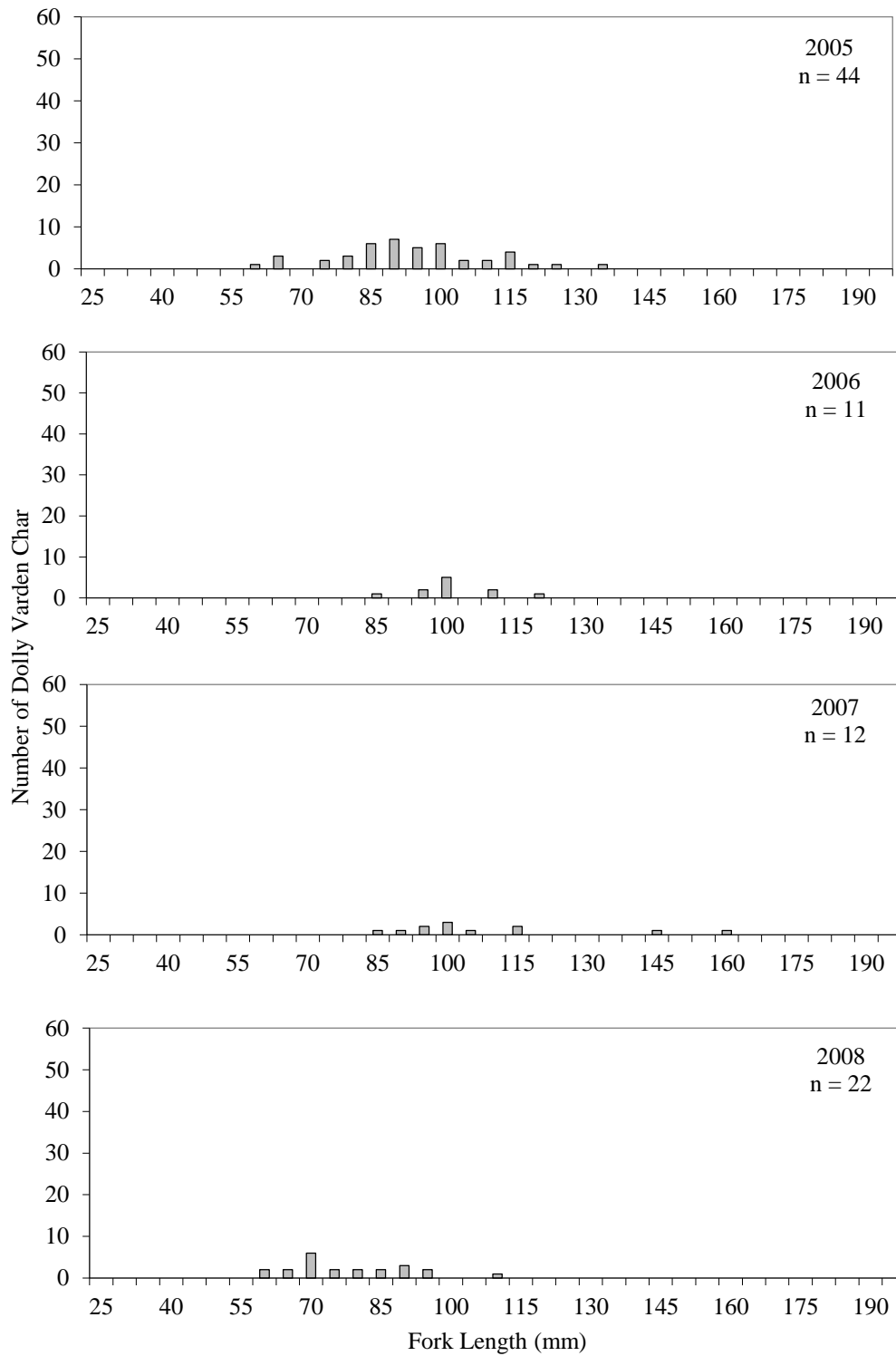


Appendix C7.—Length frequency diagrams of Dolly Varden char captured at Tributary Creek Site 9, 2001–2015.



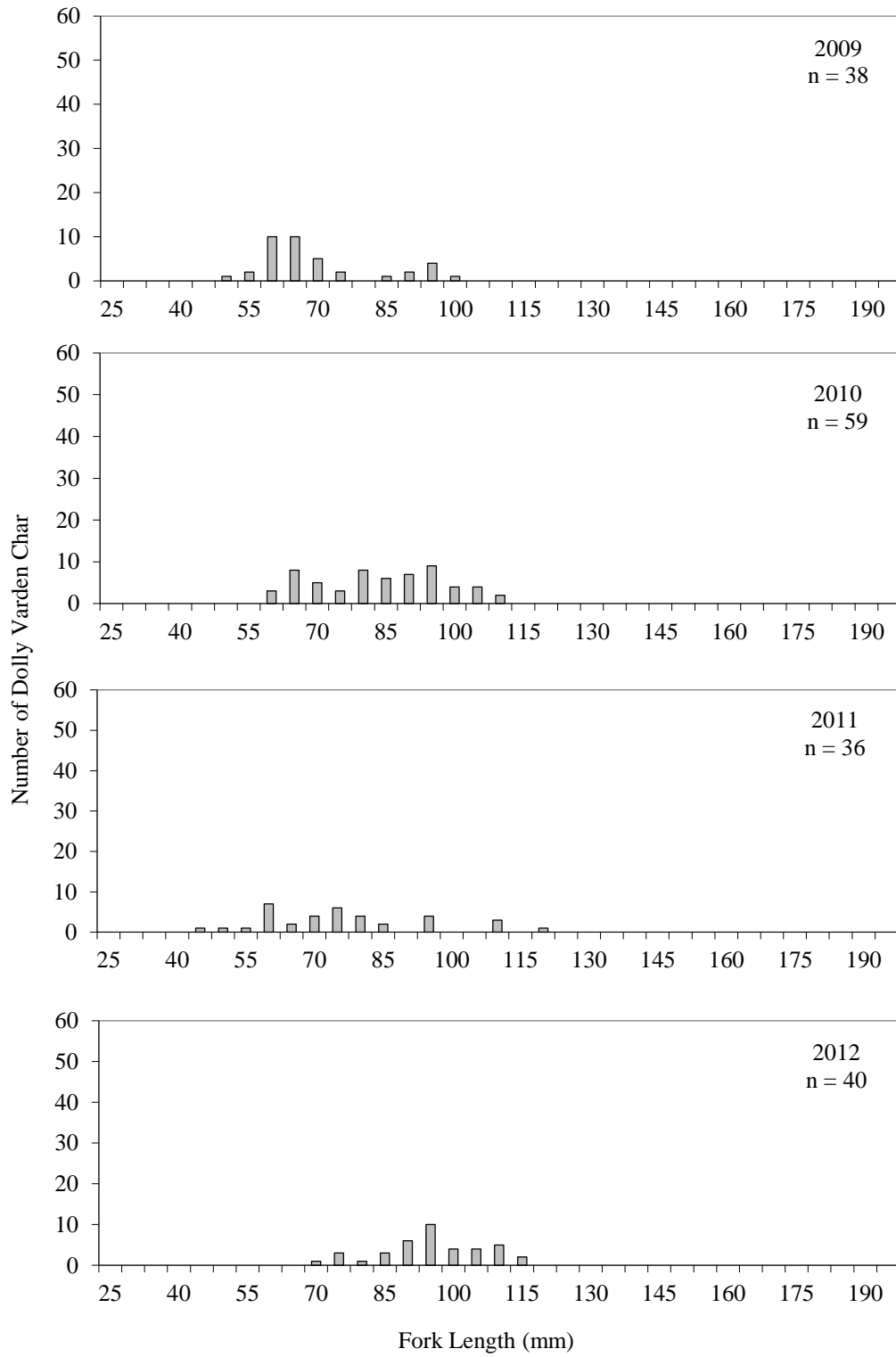
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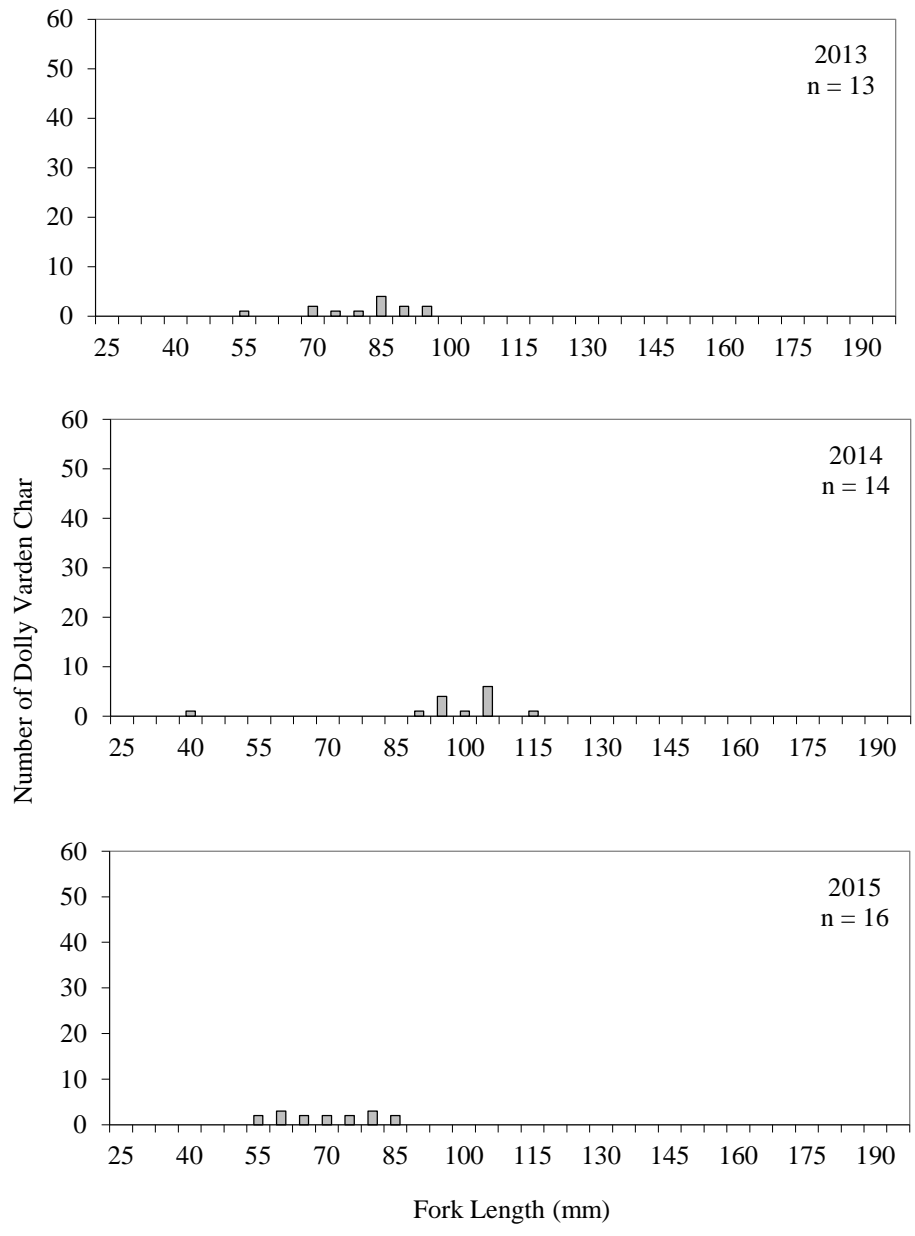
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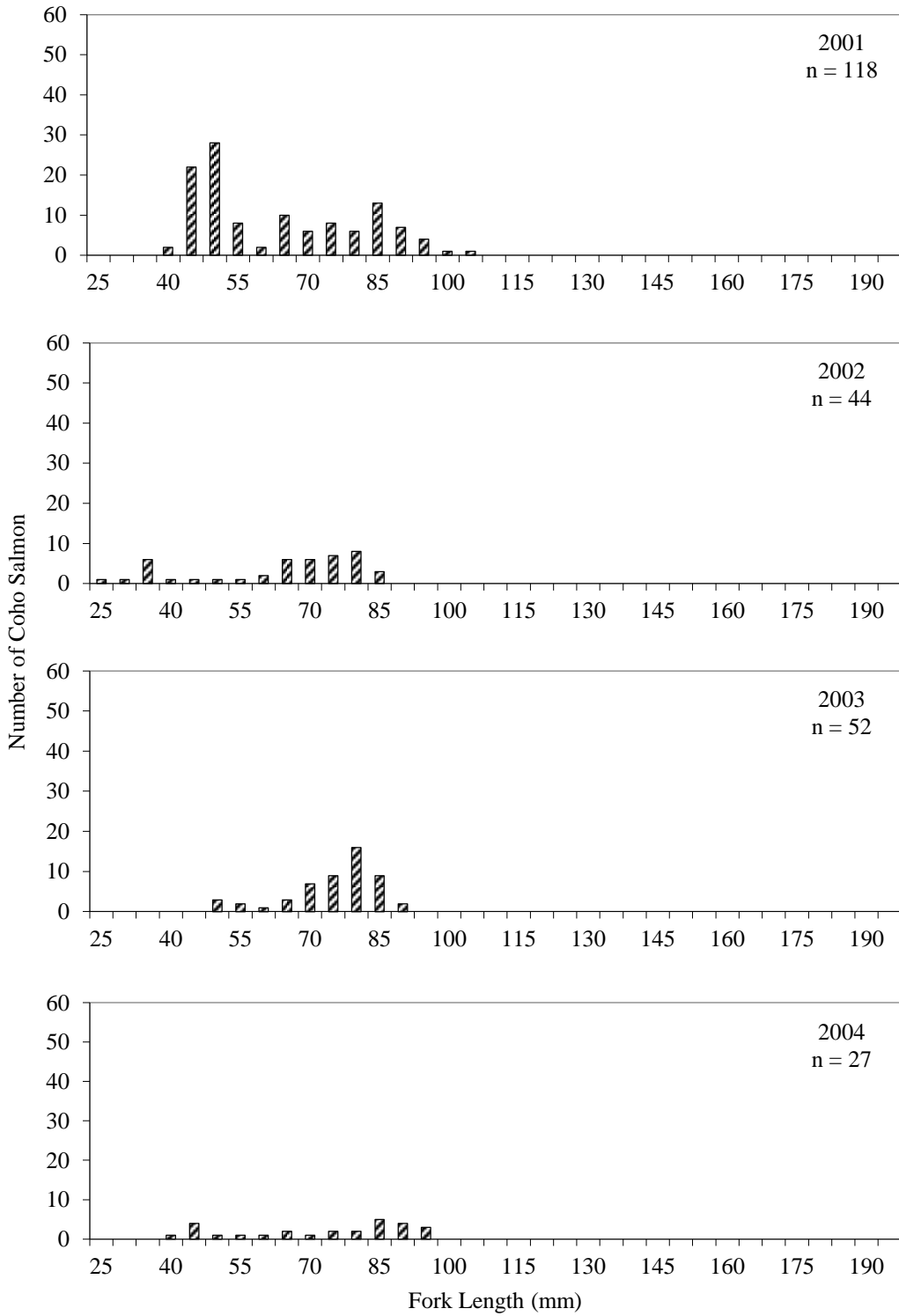


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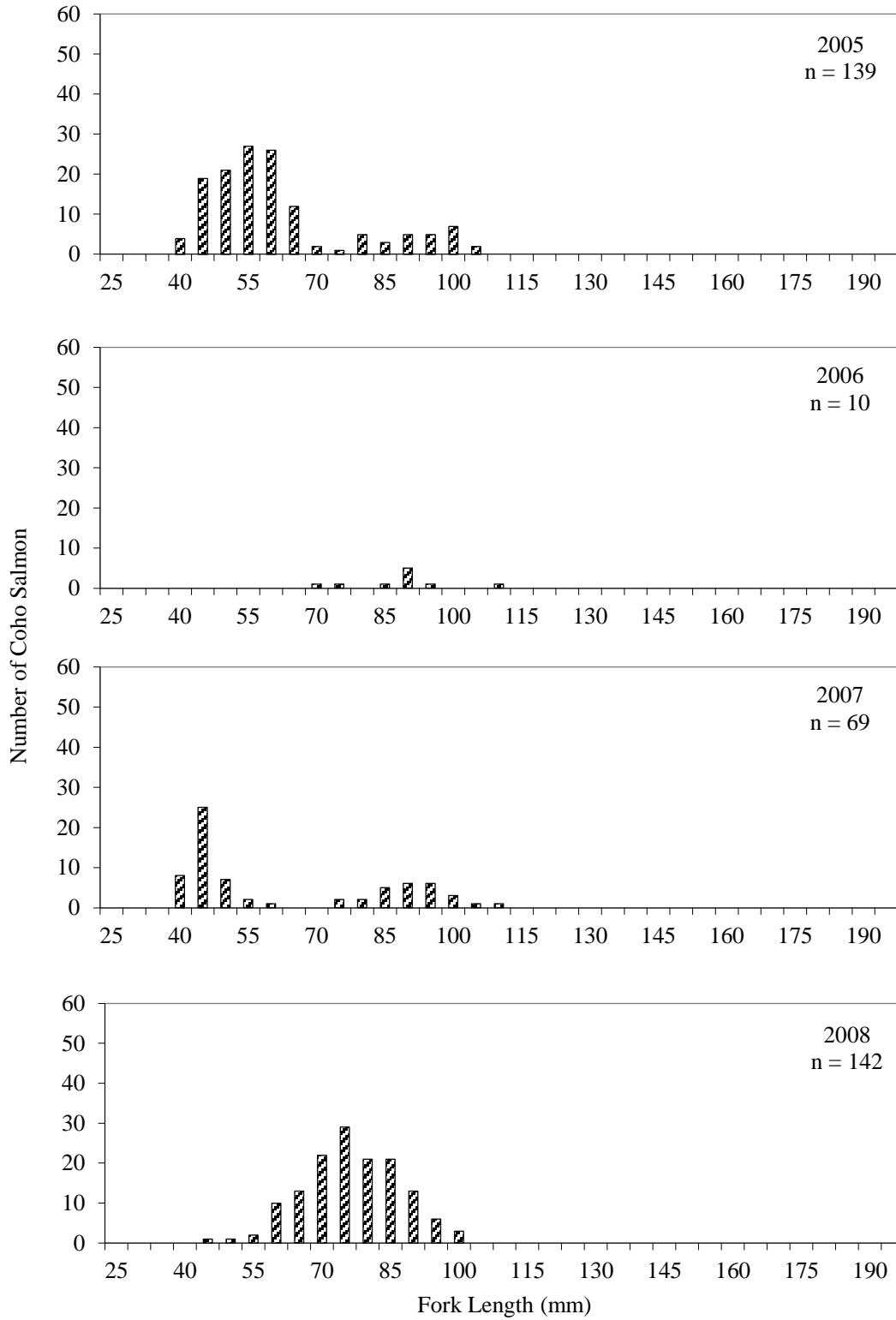


Appendix C8.—Length frequency diagrams of coho salmon captured at Tributary Creek Site 9, 2001–2015.



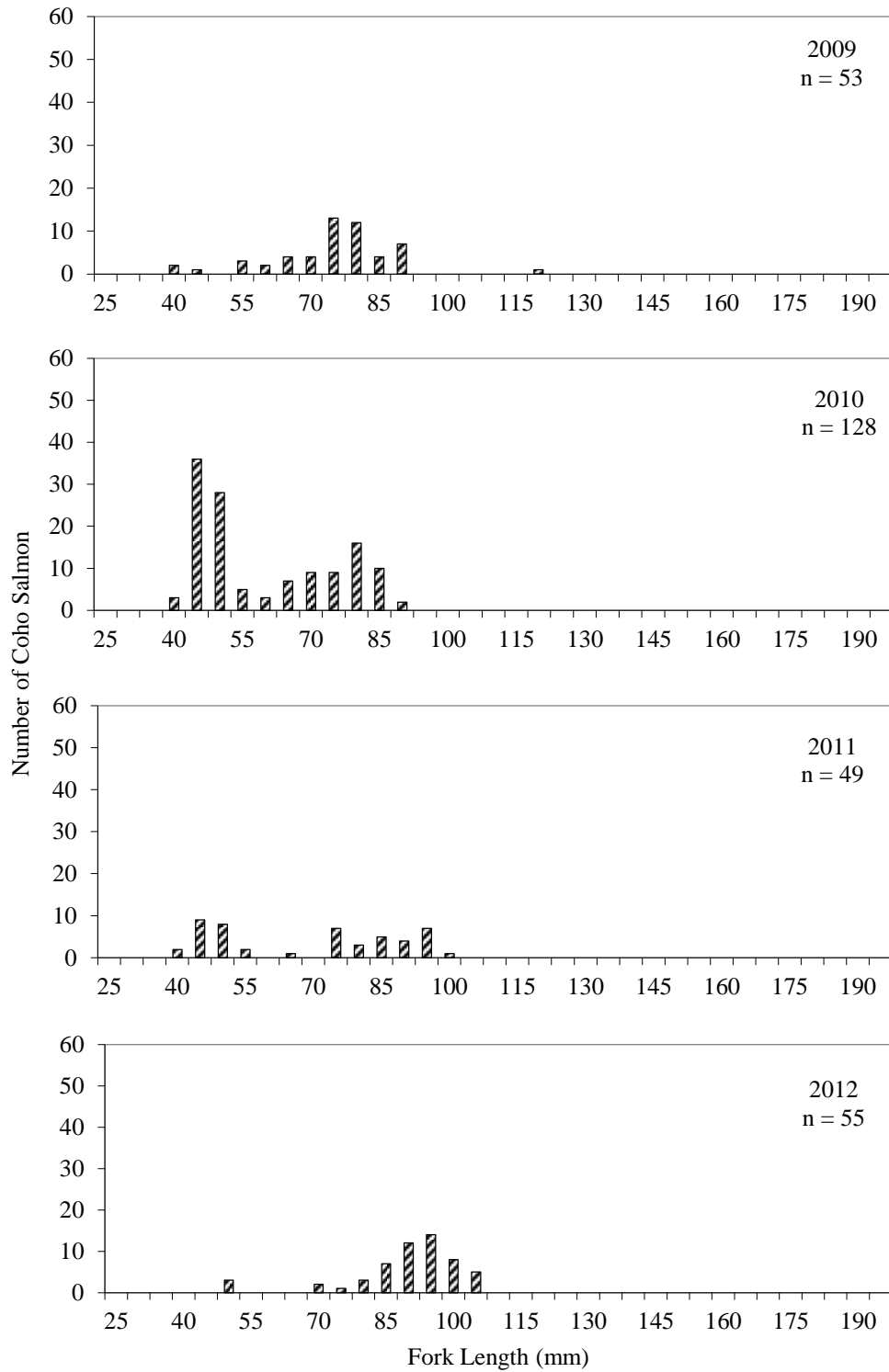
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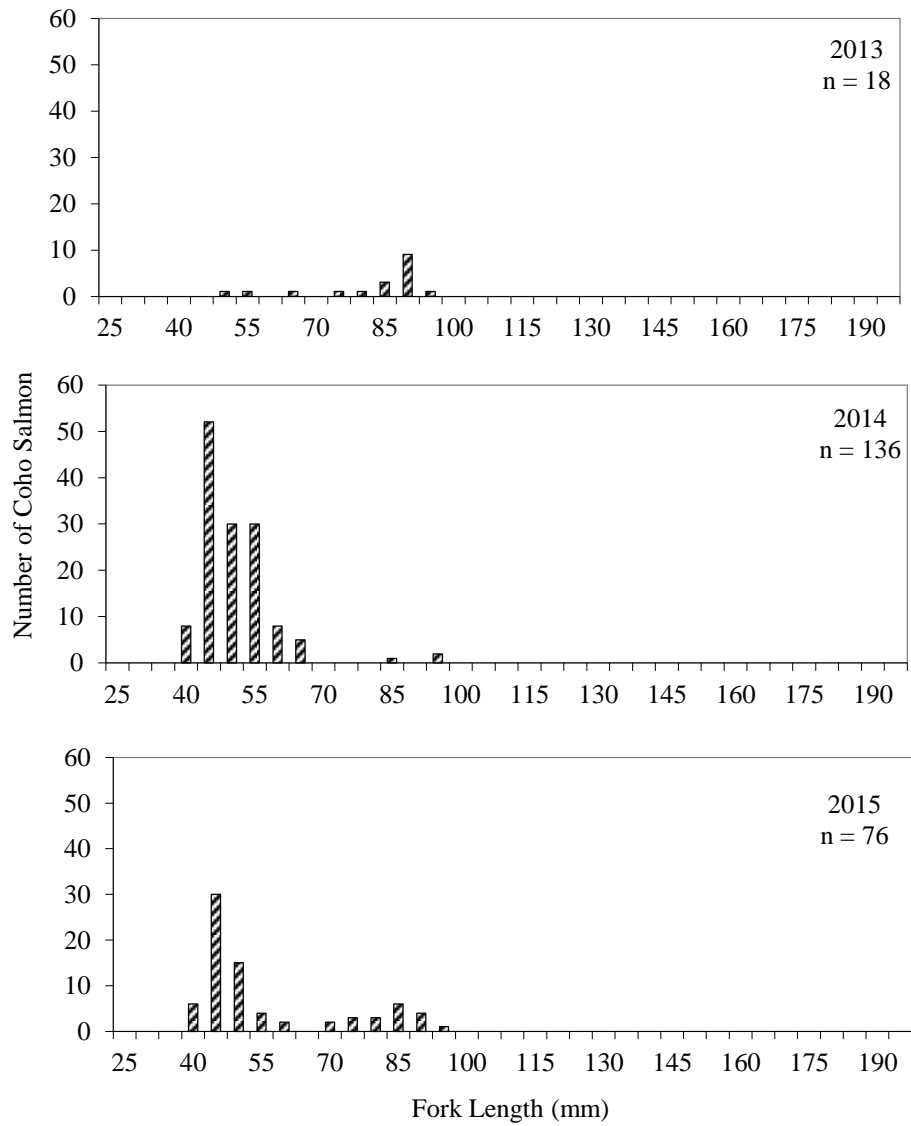
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Appendix C8. Page 3 of 4.



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**APPENDIX D: JUVENILE FISH METALS CONCENTRATIONS
DATA AND LABORATORY REPORT**

Appendix D1.–Whole body metals and Se concentrations data for juvenile Dolly Varden char samples collected at Greens Creek Site 48, 2001–2015.

Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/01	1	131	26.0	0.02	1.76	8.3	---	0.20	6.1	180
7/23/01	2	137	28.8	0.03	0.89	7.2	---	0.17	4.6	146
7/23/01	3	119	18.8	0.02	2.27	5.7	---	0.20	6.2	189
7/23/01	4	121	21.1	0.02	1.56	6.9	---	0.17	5.2	182
7/23/01	5	111	13.7	0.03	0.89	4.7	---	0.23	5.4	138
7/23/01	6	121	21.1	<0.02	1.26	7.4	---	0.10	5.6	157
7/24/02	1	133	23.2	0.03	1.64	6.8	---	0.72	4.8	239
7/24/02	2	120	15.0	0.07	0.85	7.0	---	0.28	4.1	210
7/24/02	3	122	17.5	0.03	0.74	4.3	---	0.17	4.9	162
7/24/02	4	127	20.8	0.04	1.40	6.1	---	0.16	4.7	185
7/24/02	5	134	24.8	0.05	1.30	7.9	---	0.46	4.3	208
7/24/02	6	128	21.7	0.04	1.56	6.8	---	0.22	5.7	343
7/22/03	1	90	8.9	<0.02	0.65	4.2	---	0.14	5.6	191
7/22/03	2	98	9.9	<0.02	0.90	5.1	---	0.22	5.5	180
7/22/03	3	103	12.1	<0.02	0.82	5.6	---	0.16	5.4	241
7/22/03	4	112	12.5	<0.02	0.78	6.1	---	0.11	6.1	192
7/22/03	5	108	11.9	<0.02	0.63	3.9	---	0.14	5.2	174
7/22/03	6	100	10.5	<0.02	0.58	3.7	---	0.08	5.5	218
7/22/04	1	96	8.6	<0.02	0.63	4.7	---	0.15	4.3	206
7/22/04	2	88	6.8	<0.02	0.83	5.6	---	0.26	4.0	175
7/22/04	3	101	11.5	<0.02	1.54	4.6	---	0.21	4.1	183
7/22/04	4	98	9.3	<0.02	0.80	5.2	---	0.28	3.7	168
7/22/04	5	93	7.6	<0.02	1.25	4.4	---	0.14	6.4	220
7/22/04	6	91	7.5	0.03	1.01	4.5	---	0.29	5.6	323
7/22/05	1	103	19.7	0.02	0.66	4.4	---	0.44	4.2	183
7/22/05	2	96	13.1	<0.02	0.84	14.5	---	0.98	4.8	220
7/22/05	3	119	15.6	0.02	0.89	4.4	---	0.66	4.8	226
7/22/05	4	114	17.1	0.02	0.59	6.0	---	0.32	4.8	178
7/22/05	5	111	15.3	0.03	1.10	18.8	---	0.79	4.6	217
7/22/05	6	125	16.9	0.03	0.47	3.6	---	0.36	3.8	161
7/20/06	1	110	15.8	0.04	0.56	8.5	---	0.37	5.4	244
7/20/06	2	110	15.4	0.05	1.20	8.3	---	0.31	6.0	217
7/20/06	3	113	16.1	0.04	0.65	6.3	---	0.24	5.4	264
7/20/06	4	132	25.0	0.06	0.63	8.1	---	0.66	5.2	232
7/20/06	5	104	12.8	0.08	0.96	8.5	---	0.37	5.1	283
7/20/06	6	114	16.7	0.03	0.63	5.3	---	0.20	5.1	270
7/21/07	1	122	17.9	0.03	1.16	5.5	---	0.17	5.5	221
7/21/07	2	95	10.4	0.02	1.42	3.9	---	0.29	5.8	165
7/21/07	3	135	22.8	0.09	1.35	14.1	---	1.37	5.3	166
7/21/07	4	98	9.9	0.03	0.96	5.7	---	0.27	5.2	269
7/21/07	5	105	13.2	0.11	1.79	11.4	---	1.62	5.4	323
7/21/07	6	99	10.0	0.04	1.43	5.2	---	0.31	5.7	208

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Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/22/08	1	112	16.4	0.069	1.23	5.2	---	0.95	5.72	289.0
7/22/08	2	123	21.3	0.039	0.79	3.9	---	0.57	4.56	194.0
7/22/08	3	105	14.0	0.079	0.82	4.6	---	0.52	5.88	199.5
7/22/08	4	124	20.6	0.041	0.87	4.9	---	0.42	6.31	244.0
7/22/08	5	115	16.9	0.030	1.36	5.3	---	0.51	5.36	254.0
7/22/08	6	122	19.8	0.037	1.07	5.6	---	0.38	6.11	260.0
7/21/09	1	120	20.1	<0.02	1.05	5.2	---	0.22	5.9	186
7/21/09	2	121	20.7	<0.02	1.40	5.3	---	0.44	5.7	173
7/21/09	3	119	17.9	0.02	1.10	4.5	---	0.13	5.9	182
7/21/09	4	108	13.6	<0.02	1.20	4.1	---	0.15	5.7	162
7/21/09	5	109	14.6	<0.02	1.50	4.9	---	0.17	5.9	186
7/21/09	6	110	15.2	<0.02	0.84	3.8	---	0.18	6.1	202
7/21/10	1	103	11.9	0.020	1.56	4.8	0.09	0.16	5.0	226
7/21/10	2	109	16.1	<0.020	0.50	3.0	0.15	0.20	5.4	170
7/21/10	3	108	13.9	0.040	0.91	4.2	0.17	0.30	5.0	180
7/21/10	4	105	13.8	<0.020	0.98	3.4	0.13	0.09	4.6	163
7/21/10	5	98	10.8	0.062	0.90	4.8	0.14	0.46	4.8	213
7/21/10	6	93	9.1	<0.020	0.96	3.6	0.10	0.09	4.0	156
7/22/11	1-6	88-112	---	0.03	1.12	5.7	---	0.28	6.2	221
7/24/12	1	109	11.3	0.03	2.26	27.0	0.134	0.16	5.5	186
7/24/12	2	123	18.3	0.03	1.37	4.9	0.122	0.10	5.7	184
7/24/12	3	110	9.8	0.03	1.83	25.6	0.159	2.59	5.6	275
7/24/12	4	103	10.6	0.03	0.99	76.8	0.175	0.30	5.1	189
7/24/12	5	104	10.7	0.03	2.66	84.8	0.122	1.05	6.3	242
7/24/12	6	116	15.8	0.04	0.73	35.1	0.148	1.03	4.7	190
7/25/13	1	145	20.6	<0.02	0.68	3.7	0.214	0.17	5.3	237
7/25/13	2	115	17.9	0.07	0.97	6.1	0.238	0.24	5.8	239
7/25/13	3	115	14.3	<0.02	0.81	4.0	0.180	0.08	6.7	258
7/25/13	4	105	11.4	<0.02	0.68	3.2	0.213	0.14	6.4	213
7/25/13	5	109	13.0	0.04	2.01	6.6	0.113	0.36	6.2	271
7/25/13	6	105	12.4	0.04	1.75	5.7	0.274	0.22	6.2	287
7/25/14	1	110	13.0	0.04	0.55	4.5	0.146	0.11	5.3	234
7/25/14	2	100	10.5	<0.02	0.93	4.2	0.148	0.19	6.9	213
7/25/14	3	106	10.7	<0.02	1.22	4.8	0.199	0.38	5.7	232
7/25/14	4	105	11.3	<0.02	1.45	4.2	0.122	0.44	6.1	193
7/25/14	5	100	10.4	<0.02	0.92	4.5	0.134	0.06	4.9	237
7/25/14	6	120	14.8	0.04	0.75	5.5	0.260	0.18	5.9	305
7/16/15	1	105	12.4	<0.02	0.60	2.5	0.114	0.13	6.2	159
7/16/15	2	104	11.7	0.04	1.11	10.7	0.100	1.30	5.8	205
7/16/15	3	100	11.7	0.03	1.05	3.8	0.152	0.14	6.1	187
7/16/15	4	105	11.3	0.03	1.39	4.2	0.154	0.36	6.1	198
7/16/15	5	105	12.7	<0.02	1.06	4.0	0.128	0.12	5.7	169
7/16/15	6	100	10.4	0.02	1.49	3.9	0.165	0.37	5.4	191
7/16/15	7	104	9.6	<0.02	0.85	3.1	0.091	0.09	5.2	175
7/16/15	8	85	8.6	0.03	0.90	3.6	0.139	0.27	5.9	172
7/16/15	9	102	10.3	<0.02	1.51	3.7	0.180	0.15	7.2	192
7/16/15	10	120	16.3	<0.02	0.86	4.0	0.150	0.14	6.4	223

Appendix D2.–Whole body metals and Se concentrations data for juvenile Dolly Varden char samples collected at Greens Creek Site 54, 2001–2015.

Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/01	1	121	21.5	0.03	0.46	4.3	---	0.33	5.7	126
7/23/01	2	119	19.3	0.02	0.21	3.2	---	0.22	3.6	82
7/23/01	3	107	15.7	0.03	0.73	6.3	---	0.59	4.7	144
7/23/01	4	109	13.6	0.02	0.82	5.4	---	0.86	4.9	172
7/23/01	5	105	13.5	<0.02	0.79	6.5	---	0.45	5.8	203
7/23/01	6	138	27.5	<0.02	0.74	5.8	---	0.40	5.4	171
7/24/02	1	118	18.0	0.03	0.50	4.4	---	0.94	3.4	363
7/24/02	2	128	22.3	0.03	0.52	4.5	---	0.35	4.7	150
7/24/02	3	115	17.7	0.05	0.95	6.0	---	0.66	4.4	161
7/24/02	4	115	18.9	0.03	1.03	5.2	---	0.66	4.2	216
7/24/02	5	124	21.1	0.05	1.32	5.2	---	0.74	3.9	194
7/24/02	6	123	20.9	0.02	0.70	3.9	---	0.78	4.4	195
7/22/03	1	123	21.1	0.03	0.85	6.4	---	1.40	6.1	188
7/22/03	2	101	10.6	<0.02	0.67	4.2	---	0.32	6.4	174
7/22/03	3	88	9.2	<0.02	0.75	4.3	---	0.35	6.5	186
7/22/03	4	109	14.8	<0.02	1.11	5.8	---	0.38	5.7	188
7/22/03	5	95	10.6	<0.02	0.59	3.5	---	0.29	5.7	174
7/22/03	6	92	9.7	<0.02	0.91	4.1	---	0.43	6.5	263
7/21/04	1	103	9.9	0.02	0.79	11.0	---	0.57	4.6	232
7/21/04	2	104	10.0	<0.02	0.88	5.5	---	0.54	5.0	206
7/21/04	3	86	6.6	<0.02	1.26	5.1	---	0.36	5.3	164
7/21/04	4	96	9.3	0.03	0.79	5.9	---	0.28	5.4	191
7/21/04	5	93	9.9	<0.02	0.83	5.0	---	0.48	3.9	202
7/21/04	6	104	12.9	0.08	1.12	7.0	---	0.93	4.9	217
7/22/05	1	120	12.3	0.03	0.72	5.0	---	0.27	4.0	160
7/22/05	2	106	12.1	0.02	0.63	4.5	---	0.13	3.9	200
7/22/05	3	113	20.8	<0.02	0.73	8.8	---	0.17	4.7	223
7/22/05	4	114	17.9	<0.02	0.82	9.7	---	0.17	3.9	222
7/22/05	5	112	16.1	0.03	1.06	8.8	---	0.22	4.4	209
7/22/05	6	118	22.3	0.02	0.55	5.5	---	0.39	3.9	185
7/20/06	1	137	27.3	0.06	0.42	4.8	---	0.51	5.7	208
7/20/06	2	112	14.9	0.04	0.75	16.0	---	0.95	7.2	223
7/20/06	3	102	12.0	0.02	0.93	22.2	---	0.52	6.3	239
7/20/06	4	114	19.6	0.04	1.03	7.6	---	0.85	5.3	252
7/20/06	5	98	12.3	0.08	0.54	10.9	---	0.48	5.4	223
7/20/06	6	115	16.9	0.04	0.78	8.6	---	0.68	5.6	257
7/20/07	1	102	11.8	0.04	0.88	5.3	---	0.54	5.6	157
7/20/07	2	125	21.1	0.03	0.97	5.2	---	0.83	7.5	234
7/20/07	3	97	10.7	0.06	0.81	5.7	---	0.89	8.6	185
7/20/07	4	123	19.7	0.02	0.75	4.4	---	0.50	7.1	175
7/20/07	5	104	12.5	0.03	0.92	5.6	---	0.57	7.8	174
7/20/07	6	110	15.1	0.04	1.38	6.2	---	0.82	5.4	191

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Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/22/08	1	123	21.9	0.039	0.66	5.3	---	0.26	5.53	185.0
7/22/08	2	94	10.8	0.039	1.04	5.1	---	0.28	6.07	203.0
7/22/08	3	123	21.5	0.028	1.53	4.9	---	3.46	6.29	261.0
7/22/08	4	97	11.2	0.029	1.34	5.0	---	0.17	5.90	198.5
7/22/08	5	108	16.0	0.045	1.98	6.3	---	0.23	5.97	220.0
7/22/08	6	108	14.2	0.059	1.07	8.4	---	1.31	5.03	195.0
7/21/09	1	132	26.9	0.04	1.10	4.8	---	0.33	5.4	213
7/21/09	2	141	32.3	0.02	0.71	4.5	---	0.45	7.9	143
7/21/09	3	116	17.9	<0.02	0.99	4.2	---	0.40	6.3	153
7/21/09	4	117	17.7	0.03	1.00	5.9	---	0.39	6.8	200
7/21/09	5	119	22.1	<0.02	1.20	4.0	---	0.28	6.5	176
7/21/09	6	103	13.0	0.02	2.20	5.3	---	0.35	5.9	226
7/20/10	1	115	16.0	<0.020	0.80	3.4	0.08	0.37	4.6	159
7/20/10	2	112	12.8	0.022	0.67	3.1	0.09	0.34	3.7	154
7/20/10	3	118	12.6	<0.020	0.98	3.6	0.12	0.25	5.2	190
7/20/10	4	108	10.6	<0.020	1.31	3.8	0.10	0.16	4.1	212
7/20/10	5	115	12.3	<0.020	1.73	5.0	0.12	0.36	4.4	222
7/20/10	6	94	9.0	0.025	0.77	4.0	0.14	0.31	4.8	199
7/21/11	1-6	95-117	---	<0.02	0.95	4.5	---	0.32	5.6	191
7/23/12	1	132	24.2	0.02	0.85	7.7	0.0768	0.41	9.2	144
7/23/12	2	118	17.3	0.04	1.03	7.7	0.109	0.57	6.3	199
7/23/12	3	109	13.1	0.06	2.04	19.2	0.112	1.32	7.4	215
7/23/12	4	97	9.1	0.03	2.04	65.6	0.126	0.50	6.2	227
7/23/12	5	115	15.4	0.04	1.22	12.6	0.123	1.10	6.9	202
7/23/12	6	119	18.3	0.03	1.81	5.3	0.0798	0.27	5.1	191
7/24/13	1	117	16.9	<0.02	1.39	4.2	0.131	0.30	5.6	247
7/24/13	2	117	17.6	0.02	0.74	3.9	0.183	0.39	7.0	297
7/24/13	3	94	11.3	<0.02	1.27	4.3	0.172	0.28	6.6	262
7/24/13	4	118	18.9	<0.02	0.89	3.9	0.145	0.33	6.0	211
7/24/13	5	105	10.3	0.02	1.18	5.3	0.108	0.27	6.4	245
7/24/13	6	116	15.3	0.02	1.07	4.5	0.126	0.18	6.4	225
7/24/14	1	125	21.2	0.08	0.93	12.7	0.121	1.55	5.7	212
7/25/14	2	104	10.8	0.04	1.15	4.5	0.111	0.37	4.8	247
7/25/14	3	110	11.5	0.21	0.85	4.3	0.119	0.30	6.2	291
7/25/14	4	110	14.9	<0.02	0.69	4.8	0.113	0.25	5.9	248
7/25/14	5	104	10.5	<0.02	1.03	5.0	0.106	0.28	5.7	250
7/25/14	6	135	24.1	0.02	0.86	4.4	0.160	0.49	6.6	243
7/15/15	1	110	11.3	0.02	0.92	4.7	0.121	0.59	6.3	236
7/15/15	2	105	11.5	<0.02	0.52	2.5	0.116	0.36	7.0	117
7/15/15	3	110	11.7	<0.02	0.67	3.0	0.106	0.36	6.4	171
7/15/15	4	105	12.0	0.03	1.16	3.8	0.109	1.62	7.3	221
7/15/15	5	100	10.7	<0.02	2.06	4.9	0.106	0.37	6.6	198
7/15/15	6	95	8.4	<0.02	0.91	3.4	0.096	0.38	5.5	176
7/15/15	7	100	8.2	<0.02	0.60	3.6	0.119	0.49	5.8	219
7/15/15	8	92	9.9	0.02	0.84	4.7	0.072	0.47	6.5	153
7/15/15	9	90	7.1	0.03	1.32	3.9	0.159	1.08	7.2	204
7/15/15	10	88	6.2	0.02	1.13	4.0	0.119	0.39	6.4	179

Appendix D3.–Whole body metals and Se concentrations data for juvenile Dolly Varden char samples collected at Tributary Creek Site 9, 2001–2015.

Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/21/01	1	97	9.1	0.09	0.35	4.3	---	0.56	6.8	127
7/21/01	2	97	9.7	0.10	0.77	5.2	---	0.67	8.0	118
7/21/01	3	97	9.5	0.15	0.92	5.4	---	4.88	5.3	144
7/21/01	4	98	10.4	0.15	0.86	6.7	---	2.19	---	99
7/21/01	5	86	6.4	0.08	0.76	4.9	---	0.33	6.2	106
7/21/01	6	93	7.8	0.06	0.37	12.0	---	0.38	6.8	122
7/24/02	1	103	10.8	0.02	0.22	3.7	---	0.12	1.4	144
7/24/02	2	97	10.4	0.07	1.20	5.5	---	1.66	3.3	172
7/24/02	3	100	11.2	0.13	1.06	6.1	---	3.40	5.0	138
7/24/02	4	90	7.9	0.23	1.29	7.1	---	4.08	5.2	168
7/24/02	5	90	9.2	0.08	1.15	5.2	---	1.39	6.2	150
7/24/02	6	100	9.3	0.04	0.84	3.2	---	0.33	5.4	152
7/23/03	1	106	10.7	0.06	0.46	2.8	---	0.34	6.3	134
7/23/03	2	89	6.8	0.10	1.01	4.0	---	0.82	6.0	131
7/23/03	3	112	17.4	0.16	1.35	4.4	---	1.85	5.7	108
7/23/03	4	95	11.6	0.19	0.69	5.6	---	1.30	3.6	136
7/23/03	5	91	9.5	0.05	0.72	4.4	---	0.56	4.9	131
7/23/03	6	84	8.4	0.12	0.76	3.9	---	0.78	4.7	125
7/21/04	1	84	5.5	0.10	0.96	3.2	---	1.19	5.4	169
7/21/04	2	96	8.5	0.10	1.24	3.8	---	0.67	5.9	138
7/21/04	3	105	14.1	0.10	2.02	4.0	---	1.76	5.8	125
7/21/04	4	85	5.8	0.04	0.47	3.7	---	0.93	4.8	175
7/21/04	5	81	6.4	0.09	2.34	4.3	---	1.44	8.2	140
7/21/04	6	86	10.4	0.11	0.83	5.5	---	0.97	5.8	161
7/23/05	1	97	11.1	0.06	0.70	10.4	---	0.29	6.4	104
7/23/05	2	113	16.8	0.10	0.63	4.7	---	0.97	6.1	122
7/23/05	3	115	18.8	0.07	0.52	6.3	---	0.53	5.8	109
7/23/05	4	117	20.5	0.19	0.79	9.9	---	1.07	6.7	117
7/23/05	5	101	11.7	0.07	1.44	5.2	---	1.00	8.1	130
7/23/05	6	107	13.7	0.10	1.29	4.6	---	0.46	8.0	134
7/21/06	1	99	12.9	0.12	0.74	4.0	---	0.32	6.3	120
7/21/06	2	96	11.6	0.12	0.76	7.7	---	1.32	6.8	157
7/21/06	3	94	10.9	0.18	1.59	10.3	---	2.48	4.9	160
7/21/06	4	100	10.9	0.11	1.34	8.5	---	1.46	5.2	142
7/21/06	5	97	11.7	0.14	0.88	4.6	---	0.96	5.2	107
7/21/06	6	117	20.8	0.24	1.29	4.3	---	2.92	5.9	130
7/20/07	1	98	12.4	0.11	0.91	2.7	---	1.10	7.8	106
7/20/07	2	89	8.9	0.12	1.72	3.3	---	1.80	5.6	136
7/20/07	3	114	14.1	0.15	2.76	3.4	---	1.28	8.7	122
7/20/07	4	81	7.1	0.14	1.90	4.2	---	2.03	7.0	114
7/20/07	5	114	14.6	0.88	3.63	3.9	---	1.56	10.9	131
7/20/07	6	93	10.6	0.14	1.50	20.3	---	3.80	9.4	107

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Appendix D3.–Page 2 of 2.

Sample Date	Sample Number	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/08	1	103	12.9	0.224	1.99	4.2	---	3.47	7.66	169.0
7/23/08	2	108	14.8	0.095	0.96	3.2	---	0.86	5.82	143.0
7/23/08	3	88	8.9	0.076	0.93	3.3	---	0.75	4.41	186.0
7/23/08	4	86	9.3	0.220	1.91	5.7	---	4.06	5.71	119.0
7/23/08	5	92	9.6	0.073	1.01	2.7	---	0.61	5.20	125.0
7/23/08	6	90	8.7	0.033	0.54	2.2	---	0.43	4.80	108.0
7/22/09	1	83	6.9	0.04	0.29	1.7	---	0.24	5.4	127
7/22/09	2	91	8.6	0.06	0.55	2.1	---	0.16	5.1	137
7/22/09	3	91	8.5	0.11	0.36	2.0	---	0.23	7.5	138
7/22/09	4	98	10.3	0.09	0.81	3.4	---	0.38	5.8	147
7/22/09	5	91	8.6	0.03	0.47	2.2	---	0.40	4.5	125
7/22/09	6	90	7.8	0.06	0.60	2.2	---	0.38	5.6	129
7/20/10	1	87	7.4	0.293	1.61	5.4	0.43	3.92	6.4	151
7/20/10	2	94	10.9	0.124	0.82	2.5	0.58	0.24	5.7	174
7/20/10	3	90	8.5	0.084	0.73	2.9	0.35	0.29	5.3	125
7/20/10	4	90	8.2	0.059	0.60	2.3	0.27	0.33	4.7	151
7/20/10	5	108	13.5	0.081	0.66	2.6	0.54	0.25	3.2	118
7/20/10	6	105	11.6	0.076	0.75	3.1	0.27	0.23	3.9	150
7/21/11	1-6	85-115	---	0.090	0.80	3.4	---	0.32	6.7	146
7/26/12	1	89	7.3	<0.02	0.33	18.4	0.429	0.18	4.3	123
7/26/12	2	122	16.5	0.03	0.60	8.4	0.257	0.54	4.8	126
7/26/12	3	74,75	8.1	0.05	0.76	42.4	0.217	1.65	4.9	140
7/26/12	4	105	11.7	0.13	0.57	22.6	0.241	0.74	7.5	128
7/26/12	5	98	9.9	0.07	0.95	203	0.235	1.90	5.5	115
7/26/12	6	86,112	20.2	0.06	0.53	8.5	0.278	0.67	5.3	116
7/23/13	1	90	10.1	0.72	6.36	7.5	0.418	5.93	9.7	179
7/23/13	2	92	10.4	0.27	1.57	3.8	0.329	1.60	6.9	122
7/23/13	3	85	7.8	0.19	2.41	5.8	0.297	3.90	8.6	153
7/23/13	4	82,52	8.0	0.05	0.59	3.3	0.439	0.35	5.0	152
7/23/13	5	82	6.6	0.48	4.67	8.9	0.332	4.87	9.6	181
7/23/13	6	81	5.5	0.13	2.14	4.6	0.289	1.64	5.6	166
7/23/14	1	105	13.1	0.16	0.82	2.7	0.186	0.16	7.1	145
7/23/14	2	105	11.5	0.02	0.69	2.3	0.188	0.18	5.1	140
7/23/14	3	104	9.1	0.09	0.69	2.6	0.247	0.22	7.2	116
7/23/14	4	94	8.4	0.06	1.16	2.4	0.264	0.33	6.7	156
7/23/14	5	95	8.3	0.12	0.54	2.8	0.215	0.55	6.2	135
7/23/14	6	105	11.4	0.04	0.30	2.6	0.228	0.19	5.3	117
7/14/15	1	77,60	12.4	0.22	3.92	3.8	0.285	3.30	7.1	188
7/14/15	2	77	5.7	0.33	4.40	5.2	0.321	4.93	9.1	157
7/14/15	3	84	7.2	0.22	2.54	5.3	0.338	2.84	7.9	134
7/14/15	4	63,69	81.0	0.48	4.73	6.7	0.338	6.20	10.6	173
7/14/15	5	82	6.9	0.36	3.76	4.6	0.342	4.80	8.5	153
7/14/15	6	55,75	7.7	0.25	4.03	5.3	0.280	3.42	7.8	165
7/14/15	7	90	9.3	0.28	1.81	3.4	0.304	1.69	9.2	124
7/14/15	8	80	6.8	0.30	3.92	5.1	0.312	4.87	9.7	159
7/14/15	9	75,75	8.9	0.13	1.69	4.2	0.322	1.86	7.2	142
7/14/15	10	75,75	12.8	0.51	5.86	5.1	0.293	4.54	10.7	175



ALS Environmental
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November 09, 2015

Analytical Report for Service Request No: K1510910

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
803 3rd Street
P.O. Box 110024
Douglas, AK 99824

RE: Hecla Greens Creek Mine Biomonitoring / Greens Creek Site 48

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory September 30, 2015
For your reference, these analyses have been assigned our service request number **K1510910**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager



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Acronyms

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State Certifications, Accreditations, And Licenses

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Chain of Custody

Total Solids

Metals

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
 - i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
 - i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses**

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
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ALS ENVIRONMENTAL

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/
Greens Creek Site 48
Sample Matrix: Animal Tissue

Service Request No.: K1510910
Date Received: 09/30/15

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

Sample Receipt

Ten animal tissue samples were received for analysis at ALS Environmental on 09/30/15. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at -20°C upon receipt at the laboratory.

Total Metals

Matrix Spike Recovery Exceptions:

The control criteria for matrix spike recovery of Zinc for sample Greens Creek Site 48 Sample # 10 were not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

No other anomalies associated with the analysis of these samples were observed.

Approved by _____





Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Greens Creek Biomonitoring 2015

Juvenile Fish for Whole Body Metals

Basis, all samples: Dry Weight, Report %Solids

Requested Analysis: Ag,Cd,Cu,Hg,Pb,Se,Zn

121510910

Matrix	Collector	Date Collected	Sample Number	Sample Location	Analysis Requested	FK Length (mm)	Weight (g)
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #1	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #2	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #3	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #4	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #5	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #6	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #7	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	9.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #8	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	85	8.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #9	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	102	10.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #10	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	120	16.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #1	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #2	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.5
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #3	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #4	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.0
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #5	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #6	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	95	8.4
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #7	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	8.2
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #8	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	92	9.9
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #9	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	90	7.1
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #10	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	88	6.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	12.4
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	60	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #2	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	5.7
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #3	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	84	7.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #4	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	63	81

PROJECT NAME <u>Hecla Greens Creek Mine Biomonitoring</u>	
PROJECT NUMBER	
PROJECT MANAGER <u>Kate Kanouse</u>	
COMPANY NAME <u>Alaska Dept of Fish and Game</u>	
ADDRESS <u>802 3rd Street</u>	
CITY/STATE/ZIP <u>Juneau, AK 99801</u>	
E-MAIL ADDRESS <u>kate.kanouse@alaska.gov</u>	
PHONE # <u>907-465-4290</u> FAX #	
SAMPLER'S SIGNATURE <u>Benjamin Brant</u>	

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semi-volatile Organics by GC/MS 625 <input type="checkbox"/> 8270 <input type="checkbox"/> 8270LL <input type="checkbox"/> SIM PAH <input type="checkbox"/>	Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/>	Hydrocarbons Gas <input type="checkbox"/> 8021 <input type="checkbox"/>	Oil & Grease/TRPH Diesel <input type="checkbox"/> Oil <input type="checkbox"/>	PCBs 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/>	Aroclors <input type="checkbox"/>	Pesticides/Herbicides 608 <input type="checkbox"/> 8081 <input type="checkbox"/>	Chlorophenolics Tr <input type="checkbox"/> 8141 <input type="checkbox"/> 8151 <input type="checkbox"/>	Metals, Total or Dissolved (See List below) PCP <input type="checkbox"/>	Cyanide <input type="checkbox"/>	Hex-Chrom (circle) pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS, Turb. (circle) NH3-N, COD, TKN, TOC, DOC, NO2+NO3, I-Phos	Alkalinity AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	Dioxins/Furans 1613 <input type="checkbox"/> CO3 <input type="checkbox"/> HCO3 <input type="checkbox"/>	Dissolved Gases 8290 <input type="checkbox"/>	RSK 175 <input type="checkbox"/> Methane <input type="checkbox"/> CO2 <input type="checkbox"/> Ethane <input type="checkbox"/> Ethene <input type="checkbox"/>	REMARKS	
<u>See attached list of juvenile fish whole body samples</u>					<u>30</u>																	

<p>REPORT REQUIREMENTS</p> <p><input type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required</p> <p><input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required</p> <p><input type="checkbox"/> III. CLP Like Summary (no raw data)</p> <p><input type="checkbox"/> IV. Data Validation Report</p> <p><input type="checkbox"/> V. EDD</p>	<p>INVOICE INFORMATION</p> <p>P.O. # <u>P.O. Box 32199</u></p> <p>Bill To: <u>Chris Wallace</u> <u>Juneau, AK 99803</u></p>	<p>Circle which metals are to be analyzed:</p> <p>Total Metals: Al As Sb Ba Be B Ca <u>Cd</u> Co Cr <u>Cu</u> Fe <u>Pb</u> Mg Mn Mo Ni K <u>Ag</u> Na <u>Se</u> Sr Ti Sn V <u>Zn</u> Hg</p> <p>Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg</p> <p>*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)</p> <p>SPECIAL INSTRUCTIONS/COMMENTS: <u>Dry weight basis. Report % solids</u> <u>Send ecopy to Kate Kanouse, ADFG Habitat</u> <u>kate.kanouse@alaska.gov</u></p> <p><input type="checkbox"/> Sample Shipment contains USDA regulated soil samples (check box if applicable)</p>
<p>TURNAROUND REQUIREMENTS</p> <p><input type="checkbox"/> 24 hr. <input type="checkbox"/> 48 hr.</p> <p><input type="checkbox"/> 5 day</p> <p><input checked="" type="checkbox"/> Standard (15 working days)</p> <p><input type="checkbox"/> Provide FAX Results</p> <p>Requested Report Date _____</p>		

<p>RELINQUISHED BY: <u>10:00</u></p> <p><u>Benjamin Brant</u> Signature <u>Benjamin Brant</u> Printed Name</p> <p><u>9/29/15</u> Date/Time <u>ADFG</u> Firm</p>	<p>RECEIVED BY:</p> <p><u>Kelly Reed</u> Signature <u>Kelly Reed</u> Printed Name</p> <p><u>9/30/15 09:20</u> Date/Time <u>ADFG</u> Firm</p>	<p>RELINQUISHED BY:</p> <p>_____ Signature _____ Printed Name</p> <p>_____ Date/Time _____ Firm</p>	<p>RECEIVED BY:</p> <p>_____ Signature _____ Printed Name</p> <p>_____ Date/Time _____ Firm</p>
--	---	--	--



Cooler Receipt and Preservation Form

Client / Project: Alaska Dept. Fish & Game Service Request K15 10910

Received: 9/30/15 Opened: 9/30/15 By: KR Unloaded: 9/30/15 By: KR

- 1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
- 2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
- 3. Were custody seals on coolers? *NA* *Y* *N* If yes, how many and where? 1 F
 If present, were custody seals intact? *Y* *N* If present, were they signed and dated? *Y* *N*

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID	Tracking Number	NA	Filed
-1.3	1.0	-	-	+0.3	360	<input checked="" type="radio"/> NA	808857519131		

- 4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* packing paper
- 5. Were custody papers properly filled out (ink, signed, etc.)? *NA* *Y* *N*
- 6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* *NA* *Y* *N*
- 7. Were all sample labels complete (i.e analysis, preservation, etc.)? *NA* *Y* *N*
- 8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* *NA* *Y* *N*
- 9. Were appropriate bottles/containers and volumes received for the tests indicated? *NA* *Y* *N*
- 10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* *NA* *Y* *N*
- 11. Were VOA vials received without headspace? *Indicate in the table below.* *NA* *Y* *N*
- 12. Was C12/Res negative? *NA* *Y* *N*

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____



Total Solids

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
Sample Matrix: Animal Tissue
Analysis Method: Calculation
Prep Method: None

Service Request: K1510910
Date Collected: 07/16/15
Date Received: 09/30/15
Units: Percent
Basis: Wet

Moisture

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Greens Creek Site 48 Sample # 1	K1510910-001	77.4	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 2	K1510910-002	72.4	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 3	K1510910-003	78.2	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 4	K1510910-004	75.9	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 5	K1510910-005	77.8	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 6	K1510910-006	78.2	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 7	K1510910-007	75.9	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 8	K1510910-008	78.8	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 9	K1510910-009	77.4	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 10	K1510910-010	77.8	-	1	10/19/15 18:10	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
Sample Matrix: Animal Tissue
Analysis Method: Freeze Dry
Prep Method: None

Service Request: K1510910
Date Collected: 07/16/15
Date Received: 09/30/15
Units: Percent
Basis: Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Greens Creek Site 48 Sample # 1	K1510910-001	22.6	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 2	K1510910-002	27.6	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 3	K1510910-003	21.8	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 4	K1510910-004	24.1	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 5	K1510910-005	22.2	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 6	K1510910-006	21.8	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 7	K1510910-007	24.1	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 8	K1510910-008	21.2	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 9	K1510910-009	22.6	-	1	10/19/15 18:10	
Greens Creek Site 48 Sample # 10	K1510910-010	22.2	-	1	10/19/15 18:10	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
Sample Matrix: Animal Tissue

Service Request: K1510910
Date Collected: 07/16/15
Date Received: 09/30/15
Date Analyzed: 10/19/15

Replicate Sample Summary

Inorganic Parameters

Sample Name: Greens Creek Site 48 Sample # 10
Lab Code: K1510910-010

Units: Percent
Basis: Wet

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1510910-010DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Total Solids	Freeze Dry	-	22.2	21.2	21.7	5	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



Metals

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ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
Sample Matrix: Animal tissue

Service Request: K1510910
Date Collected: 07/16/15
Date Received: 09/30/15

Mercury, Total

Prep Method: METHOD
Analysis Method: 1631E
Test Notes:

Units: ng/g
Basis: Dry

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Greens Creek Site 48 Sample # 1	K1510910-001	4.8	5	10/28/15	10/29/15	114	
Greens Creek Site 48 Sample # 2	K1510910-002	4.5	5	10/28/15	10/29/15	100	
Greens Creek Site 48 Sample # 3	K1510910-003	4.9	5	10/28/15	10/29/15	152	
Greens Creek Site 48 Sample # 4	K1510910-004	4.7	5	10/28/15	10/29/15	154	
Greens Creek Site 48 Sample # 5	K1510910-005	5.0	5	10/28/15	10/29/15	128	
Greens Creek Site 48 Sample # 6	K1510910-006	5.0	5	10/28/15	10/29/15	165	
Greens Creek Site 48 Sample # 7	K1510910-007	4.9	5	10/28/15	10/29/15	90.8	
Greens Creek Site 48 Sample # 8	K1510910-008	54	5	10/28/15	10/29/15	139	
Greens Creek Site 48 Sample # 9	K1510910-009	4.9	5	10/28/15	10/29/15	180	
Greens Creek Site 48 Sample # 10	K1510910-010	4.6	5	10/28/15	10/29/15	150	
Method Blank 1	K1510910-MB1	1.0	1	10/28/15	10/29/15	ND	
Method Blank 2	K1510910-MB2	1.0	1	10/28/15	10/29/15	ND	
Method Blank 3	K1510910-MB3	1.0	1	10/28/15	10/29/15	ND	

ALS Group USA, Corp.
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 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
Sample Matrix: Animal tissue

Service Request: K1510910
Date Collected: 07/16/15
Date Received: 09/30/15
Date Extracted: 10/28/15
Date Analyzed: 10/29/15

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals

Sample Name: Greens Creek Site 48 Sample # 5 Units: ng/g
 Lab Code: K1510910-005MS, K1510910-005MSD Basis: Dry
 Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery		ALS Acceptance Limits	Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	MS	DMS			
Mercury	METHOD	1631E	4.8	247	239	128	345	350	88	93	70-130	1	

ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
LCS Matrix: Water

Service Request: K1510910
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Initial) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	5.53	111	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
LCS Matrix: Water

Service Request: K1510910
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Final) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	4.96	99	70-130	

ALS Group USA, Corp.
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 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
LCS Matrix: Animal tissue

Service Request: K1510910
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29/15

Quality Control Sample (QCS) Summary
 Total Metals

Sample Name: Quality Control Sample Units: ng/g
 Lab Code: Basis: Dry
 Test Notes:

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	292	240	82	70-130	

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 1 **Lab Code:** K1510910-001

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.60		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	2.5		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.13		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.2		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	159		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 2 **Lab Code:** K1510910-002

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.00		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	9.7		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	1.22		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.1		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.04		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	186		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 3 **Lab Code:** K1510910-003

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.05		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.8		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.14		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	6.1		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.03		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	187		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 4 **Lab Code:** K1510910-004

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.39		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.2		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.36		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.1		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.03		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	198		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
 Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 5 **Lab Code:** K1510910-005

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.06		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.0		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.12		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.7		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	169		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 6 **Lab Code:** K1510910-006

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.49		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.9		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.37		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.4		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	191		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 7 **Lab Code:** K1510910-007

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.85		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.1		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.09		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.2		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	175		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 8 **Lab Code:** K1510910-008

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.90		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.6		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.27		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	5.9		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.03		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	172		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 9 **Lab Code:** K1510910-009

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.51		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.7		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.15		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	7.2		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	192		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:** 07/16/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 48 Sample # 1 **Lab Code:** K1510910-010

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.86		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.1		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.15		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.3		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	220		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Date Collected:**
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:**
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Method Blank **Lab Code:** KQ1512494-01

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Copper	200.8	0.1	5.0	10/28/15	10/30/15	0.1	U	
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	1.0	U	
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	0.5	U	

Comments:

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Greens Creek Site 48 Sampl **Lab Code:** K1510910-002S

Analyte	Control Limit %R	Spike Result C	Sample Result C	Spike Added	%R	Q	Method
Cadmium	70 - 130	5.69	1.00	4.75	98.7		200.8
Copper	70 - 130	29.7	9.7	23.7	84.4		200.8
Lead	70 - 130	42.78	1.22	47.47	87.6		200.8
Selenium	70 - 130	23.3	5.1	15.9	114.5		200.8
Silver	70 - 130	4.28	0.04	4.75	89.3		200.8
Zinc	70 - 130	239.4	186.4	47.5	111.6		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Greens Creek Site 48 Sampl **Lab Code:** K1510910-010S

Analyte	Control Limit %R	Spike Result C	Sample Result C	Spike Added	%R	Q	Method
Cadmium	70 - 130	5.44	0.86	4.89	93.7		200.8
Copper	70 - 130	24.2	4.1	24.4	82.4		200.8
Lead	70 - 130	42.65	0.15	48.86	87.0		200.8
Selenium	70 - 130	23.9	6.3	16.3	108.0		200.8
Silver	70 - 130	4.13	0.02 U	4.89	84.5		200.8
Zinc		255.6	220.5	48.9	71.8		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Greens Creek Site 48 Samp **Lab Code:** K1510910-002D

Analyte	Control Limit	Sample (S) C	Duplicate (D) C	RPD	Q	Method
Cadmium	30	1.00	1.22	19.8		200.8
Copper	30	9.7	11.6	17.8		200.8
Lead	30	1.22	1.38	12.3		200.8
Selenium	30	5.1	6.4	22.6		200.8
Silver		0.04	0.04	0.0		200.8
Zinc	30	186.4	224.3	18.5		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

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DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510910
Project No.: Greens Creek Site 48 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Greens Creek Site 48 Samp **Lab Code:** K1510910-010D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Cadmium	30	0.86		0.85		1.2		200.8
Copper	30	4.1		3.9		5.0		200.8
Lead	30	0.15		0.13		14.3		200.8
Selenium	30	6.3		6.4		1.6		200.8
Silver		0.02	U	0.02	U			200.8
Zinc	30	220.5		226.9		2.9		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 7 -

LABORATORY CONTROL SAMPLE

Client: Alaska Department of Fish and Ga **Service Request:** K1510910

Project No.: Greens Creek Site 48

Project Name: Hecla Greens Creek Mine Biomonit

Aqueous LCS Source: **ALS MIXED**

Solid LCS Source:

Analyte	Aqueous (ug/L)			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Cadmium	50.0	47.6	95.2					
Copper	250.0	220.0	88.0					
Lead	500.0	482.1	96.4					
Selenium	167.0	165.9	99.3					
Silver	50.0	44.0	88.0					
Zinc	500.0	445.8	89.2					

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
LCS Matrix: Tissue

Service Request: K1510910
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510910-SRM1 Basis: Dry
 Test Notes: Dorm-4 Solids = 94.5%
 Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	0.306	0.313	102	0.233 - 0.385	
Copper	PSEP Tissue	200.8	15.9	14.8	93	12.0 - 20.2	
Lead	PSEP Tissue	200.8	0.416	0.33	79	0.290 - 0.563	
Selenium	PSEP Tissue	200.8	3.56	4.19	118	2.58 - 4.68	
Zinc	PSEP Tissue	200.8	52.20	52.3	100	39.2 - 66.5	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 48
LCS Matrix: Tissue

Service Request: K1510910
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510910-SRM2 Basis: Dry
 Test Notes: Tort-3 Solids = 99.1%
 Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	42.3	40.3	95	32.4-52.9	
Copper	PSEP Tissue	200.8	497	408	82	380-623	
Lead	PSEP Tissue	200.8	0.225	0.186	83	0.166-0.292	
Selenium	PSEP Tissue	200.8	10.9	11.5	106	7.9-14.3	
Zinc	PSEP Tissue	200.8	136	128	94	104-170	



ALS Environmental
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November 09, 2015

Analytical Report for Service Request No: K1510913

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
803 3rd Street
P.O. Box 110024
Douglas, AK 99824

RE: Hecla Greens Creek Mine Biomonitoring / Greens Creek Site 54

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory September 30, 2015
For your reference, these analyses have been assigned our service request number **K1510913**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager



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Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
 - i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses**

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
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ALS ENVIRONMENTAL

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/
Greens Creek Site 54
Sample Matrix: Animal Tissue

Service Request No.: K1510913
Date Received: 09/30/15

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

Sample Receipt

Ten animal tissue samples were received for analysis at ALS Environmental on 09/30/15. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at -20°C upon receipt at the laboratory.

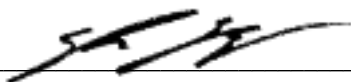
Total Metals

Matrix Spike Recovery Exceptions:

The control criteria for matrix spike recovery of Zinc for the Batch QC sample were not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

No other anomalies associated with the analysis of these samples were observed.

Approved by _____





Chain of Custody

ALS Environmental—Kelso Laboratory
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Greens Creek Biomonitoring 2015
 Juvenile Fish for Whole Body Metals
 Basis, all samples: Dry Weight, Report %Solids
 Requested Analysis: Ag,Cd,Cu,Hg,Pb,Se,Zn

1510913

Matrix	Collector	Date Collected	Sample Number	Sample Location	Analysis Requested	FK Length (mm)	Weight (g)
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #1	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #2	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #3	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #4	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #5	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #6	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #7	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	9.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #8	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	85	8.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #9	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	102	10.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #10	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	120	16.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #1	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #2	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.5
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #3	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #4	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.0
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #5	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #6	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	95	8.4
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #7	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	8.2
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #8	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	92	9.9
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #9	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	90	7.1
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #10	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	88	6.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	12.4
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	60	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #2	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	5.7
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #3	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	84	7.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #4	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	63	81



CHAIN OF CUSTODY

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PAGE 1 OF 3 COC# _____

SR# K1510913

PROJECT NAME	<u>Hecla Greens Creek Mine Biomonitoring</u>				
PROJECT NUMBER					
PROJECT MANAGER	<u>Kate Kanouse</u>				
COMPANY NAME	<u>Alaska Dept of Fish and Game</u>				
ADDRESS	<u>802 3rd Street</u>				
CITY/STATE/ZIP	<u>Juneau, AK 99801</u>				
E-MAIL ADDRESS	<u>kate.kanouse@alaska.gov</u>				
PHONE #	<u>907-465-4290</u>				
SAMPLER'S SIGNATURE	<u>Benjamin Brewster</u>				
SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	REMARKS
<u>See attached list of</u>				<u>30</u>	
<u>Juvenile fish whole</u>					
<u>body samples</u>					

REPORT REQUIREMENTS ___ I. Routine Report: Method Blank, Surrogate, as required <input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required ___ III. CLP Like Summary (no raw data) ___ IV. Data Validation Report ___ V. EDD	INVOICE INFORMATION P.O. # <u>PO Box 32199</u> Bill To: <u>Chris Wallace</u> <u>Juneau, AK 99803</u>	Circle which metals are to be analyzed: Total Metals: Al As Sb Ba Be B Ca <u>Cd</u> Co Cr <u>Cu</u> Fe <u>Pb</u> Mg Mn Mo Ni K <u>Ag</u> Na <u>Se</u> Sr Ti Sn V <u>Zn</u> Hg Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg
	TURNAROUND REQUIREMENTS ___ 24 hr. ___ 48 hr. ___ 5 day <input checked="" type="checkbox"/> Standard (15 working days) ___ Provide FAX Results Requested Report Date _____	*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE) SPECIAL INSTRUCTIONS/COMMENTS: <u>Dry weight basis. Report % solids</u> <u>Send copy to Kate Kanouse, ADFG Habitat</u> <u>kate.kanouse@alaska.gov</u>

RELINQUISHED BY: <u>Benjamin Brewster</u> Signature: _____ Date/Time: <u>9/29/15</u> Printed Name: _____ Firm: <u>ADFG</u>	RECEIVED BY: <u>Kelly Reed</u> Signature: _____ Date/Time: <u>9/30/15 09:20</u> Printed Name: _____ Firm: _____	RELINQUISHED BY: Signature: _____ Date/Time: _____ Printed Name: _____ Firm: _____	RECEIVED BY: Signature: _____ Date/Time: _____ Printed Name: _____ Firm: _____
--	---	---	---



Cooler Receipt and Preservation Form

Client / Project: Alaska Dept. Fish & Game Service Request K15 10913

Received: 9/30/15 Opened: 9/30/15 By: KR Unloaded: 9/30/15 By: KR

- 1. Samples were received via? Mail Fed Ex UPS DHL PDX Courier Hand Delivered
- 2. Samples were received in: (circle) Cooler Box Envelope Other _____ NA
- 3. Were custody seals on coolers? NA Y N If yes, how many and where? 1 F
 If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID	Tracking Number	NA	Filed
<u>-1.3</u>	<u>1.0</u>	<u>-</u>	<u>-</u>	<u>+0.3</u>	<u>360</u>	<u>NA</u>	<u>808857519131</u>		

- 4. Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves packing paper
- 5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
- 6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
- 7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
- 8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
- 9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
- 10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
- 11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
- 12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____



Total Solids

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Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
Sample Matrix: Animal Tissue
Analysis Method: Calculation
Prep Method: None

Service Request: K1510913
Date Collected: 07/15/15
Date Received: 09/30/15

Units: Percent
Basis: Wet

Moisture

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Greens Creek Site 54 Sample # 1	K1510913-001	77.7	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 2	K1510913-002	76.2	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 3	K1510913-003	76.1	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 4	K1510913-004	76.1	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 5	K1510913-005	78.7	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 6	K1510913-006	76.1	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 7	K1510913-007	77.4	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 8	K1510913-008	76.3	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 9	K1510913-009	77.4	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 10	K1510913-010	77.3	-	1	10/19/15 18:10	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
Sample Matrix: Animal Tissue
Analysis Method: Freeze Dry
Prep Method: None

Service Request: K1510913
Date Collected: 07/15/15
Date Received: 09/30/15
Units: Percent
Basis: Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Greens Creek Site 54 Sample # 1	K1510913-001	22.3	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 2	K1510913-002	23.8	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 3	K1510913-003	23.9	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 4	K1510913-004	23.9	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 5	K1510913-005	21.3	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 6	K1510913-006	23.9	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 7	K1510913-007	22.6	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 8	K1510913-008	23.7	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 9	K1510913-009	22.6	-	1	10/19/15 18:10	
Greens Creek Site 54 Sample # 10	K1510913-010	22.7	-	1	10/19/15 18:10	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
Sample Matrix: Animal Tissue

Service Request: K1510913
Date Collected: 07/15/15
Date Received: 09/30/15
Date Analyzed: 10/19/15

Replicate Sample Summary

Inorganic Parameters

Sample Name: Greens Creek Site 54 Sample # 2
Lab Code: K1510913-002

Units: Percent
Basis: Wet

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K1510913-002DUP Result	Average	RPD	RPD Limit
Total Solids	Freeze Dry	-	23.8	24.6	24.2	3	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



Metals

ALS Environmental—Kelso Laboratory
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ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
Sample Matrix: Animal tissue

Service Request: K1510913
Date Collected: 07/15/15
Date Received: 09/30/15

Mercury, Total

Prep Method: METHOD
Analysis Method: 1631E
Test Notes:

Units: ng/g
Basis: Dry

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Greens Creek Site 54 Sample # 1	K1510913-001	4.9	5	10/27/15	10/29/15	121	
Greens Creek Site 54 Sample # 2	K1510913-002	4.8	5	10/27/15	10/29/15	116	
Greens Creek Site 54 Sample # 3	K1510913-003	4.7	5	10/27/15	10/29/15	106	
Greens Creek Site 54 Sample # 4	K1510913-004	5.0	5	10/27/15	10/29/15	109	
Greens Creek Site 54 Sample # 5	K1510913-005	4.9	5	10/27/15	10/29/15	106	
Greens Creek Site 54 Sample # 6	K1510913-006	4.3	5	10/27/15	10/29/15	96.3	
Greens Creek Site 54 Sample # 7	K1510913-007	4.6	5	10/27/15	10/29/15	119	
Greens Creek Site 54 Sample # 8	K1510913-008	4.8	5	10/27/15	10/29/15	71.6	
Greens Creek Site 54 Sample # 9	K1510913-009	4.4	5	10/27/15	10/29/15	159	
Greens Creek Site 54 Sample # 10	K1510913-010	4.8	5	10/27/15	10/29/15	119	
Method Blank 1	K1510913-MB1	1.0	1	10/27/15	10/29/15	ND	
Method Blank 2	K1510913-MB2	1.0	1	10/27/15	10/29/15	ND	
Method Blank 3	K1510913-MB3	1.0	1	10/27/15	10/29/15	ND	

ALS Group USA, Corp.
dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
Sample Matrix: Animal tissue

Service Request: K1510913
Date Collected: 07/15/15
Date Received: 09/30/15
Date Extracted: 10/27/15
Date Analyzed: 10/29/15

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals

Sample Name: Greens Creek Site 54 Sample # 2 Units: ng/g
 Lab Code: K1510913-002MS, K1510913-002MSD Basis: Dry
 Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery		ALS Acceptance Limits	Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	MS	DMS			
Mercury	METHOD	1631E	4.8	247	242	116	325	348	85	96	70-130	7	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
LCS Matrix: Water

Service Request: K1510913
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Initial) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	5.53	111	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
LCS Matrix: Water

Service Request: K1510913
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Final) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	5.49	110	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
LCS Matrix: Animal tissue

Service Request: K1510913
Date Collected: NA
Date Received: NA
Date Extracted: 10/27/15
Date Analyzed: 10/29/15

Quality Control Sample (QCS) Summary
 Total Metals

Sample Name: Quality Control Sample Units: ng/g
 Lab Code: Basis: Dry
 Test Notes:

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	292	242	83	70-130	

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 1 **Lab Code:** K1510913-001

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.92		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.7		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.59		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.3		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	236		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga Service Request: K1510913
 Project No.: Greens Creek Site 54 Date Collected: 07/15/15
 Project Name: Hecla Greens Creek Mine Biomonit Date Received: 09/30/15
 Matrix: TISSUE Units: mg/Kg
 Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 2 Lab Code: K1510913-002

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.52		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	2.5		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.36		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	7.0		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	117		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga Service Request: K1510913
Project No.: Greens Creek Site 54 Date Collected: 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit Date Received: 09/30/15
Matrix: TISSUE Units: mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 3 Lab Code: K1510913-003

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.67		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.0		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.36		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	6.4		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	171		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 4 **Lab Code:** K1510913-004

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.16		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.8		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	1.62		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	7.3		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.03		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	221		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 5 **Lab Code:** K1510913-005

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	2.06		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.9		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.37		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.6		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	198		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 6 **Lab Code:** K1510913-006

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.91		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.4		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.38		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.5		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	176		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 7 **Lab Code:** K1510913-007

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.60		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.6		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.49		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	5.8		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	219		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 8 **Lab Code:** K1510913-008

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.84		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.7		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.47		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	6.5		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	153		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 9 **Lab Code:** K1510913-009

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.32		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	3.9		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	1.08		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	7.2		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.03		
Zinc	200.8	0.4	5.0	10/28/15	10/30/15	204		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:** 07/15/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Greens Creek Site 54 Sample # 1 **Lab Code:** K1510913-010

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.13		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.0		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.39		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	6.4		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	179		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Date Collected:**
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:**
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Method Blank **Lab Code:** KQ1512494-01

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Copper	200.8	0.1	5.0	10/28/15	10/30/15	0.1	U	
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	1.0	U	
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	0.5	U	

Comments:

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC1S

Lab Code: K1510910-002S

Analyte	Control Limit %R	Spike Result C	Sample Result C	Spike Added	%R	Q	Method
Cadmium	70 - 130	5.69	1.00	4.75	98.7		200.8
Copper	70 - 130	29.7	9.7	23.7	84.4		200.8
Lead	70 - 130	42.78	1.22	47.47	87.6		200.8
Selenium	70 - 130	23.3	5.1	15.9	114.5		200.8
Silver	70 - 130	4.28	0.04	4.75	89.3		200.8
Zinc	70 - 130	239.4	186.4	47.5	111.6		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC2S

Lab Code: K1510910-010S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Cadmium	70 - 130	5.44		0.86		4.89	93.7		200.8
Copper	70 - 130	24.2		4.1		24.4	82.4		200.8
Lead	70 - 130	42.65		0.15		48.86	87.0		200.8
Selenium	70 - 130	23.9		6.3		16.3	108.0		200.8
Silver	70 - 130	4.13		0.02	U	4.89	84.5		200.8
Zinc		255.6		220.5		48.9	71.8		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals
- 6 -
DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC1D

Lab Code: K1510910-002D

Analyte	Control Limit	Sample (S) C	Duplicate (D) C	RPD	Q	Method
Cadmium	30	1.00	1.22	19.8		200.8
Copper	30	9.7	11.6	17.8		200.8
Lead	30	1.22	1.38	12.3		200.8
Selenium	30	5.1	6.4	22.6		200.8
Silver		0.04	0.04	0.0		200.8
Zinc	30	186.4	224.3	18.5		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

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DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510913
Project No.: Greens Creek Site 54 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC2D

Lab Code: K1510910-010D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Cadmium	30	0.86		0.85		1.2		200.8
Copper	30	4.1		3.9		5.0		200.8
Lead	30	0.15		0.13		14.3		200.8
Selenium	30	6.3		6.4		1.6		200.8
Silver		0.02	U	0.02	U			200.8
Zinc	30	220.5		226.9		2.9		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

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LABORATORY CONTROL SAMPLE

Client: Alaska Department of Fish and Ga **Service Request:** K1510913

Project No.: Greens Creek Site 54

Project Name: Hecla Greens Creek Mine Biomonit

Aqueous LCS Source: **ALS MIXED**

Solid LCS Source:

Analyte	Aqueous (ug/L)			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Cadmium	50.0	47.6	95.2					
Copper	250.0	220.0	88.0					
Lead	500.0	482.1	96.4					
Selenium	167.0	165.9	99.3					
Silver	50.0	44.0	88.0					
Zinc	500.0	445.8	89.2					

ALS Group USA, Corp.
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 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
LCS Matrix: Tissue

Service Request: K1510913
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510913-SRM1 Basis: Dry
 Test Notes: Dorm-4 Solids = 94.5%
 Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	0.306	0.313	102	0.233 - 0.385	
Copper	PSEP Tissue	200.8	15.9	14.8	93	12.0 - 20.2	
Lead	PSEP Tissue	200.8	0.416	0.33	79	0.290 - 0.563	
Selenium	PSEP Tissue	200.8	3.56	4.19	118	2.58 - 4.68	
Zinc	PSEP Tissue	200.8	52.20	52.3	100	39.2 - 66.5	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Greens Creek Site 54
LCS Matrix: Tissue

Service Request: K1510913
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510913-SRM2 Basis: Dry
 Test Notes: Tort-3 Solids = 99.1%
 Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	42.3	40.3	95	32.4-52.9	
Copper	PSEP Tissue	200.8	497	408	82	380-623	
Lead	PSEP Tissue	200.8	0.225	0.186	83	0.166-0.292	
Selenium	PSEP Tissue	200.8	10.9	11.5	106	7.9-14.3	
Zinc	PSEP Tissue	200.8	136	128	94	104-170	



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November 09, 2015

Analytical Report for Service Request No: K1510914

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
803 3rd Street
P.O. Box 110024
Douglas, AK 99824

RE: Hecla Greens Creek Mine Biomonitoring / Tributary Creek Site 9

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory September 30, 2015
For your reference, these analyses have been assigned our service request number **K1510914**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager



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Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
 - i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
 - i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses**

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjllabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
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ALS ENVIRONMENTAL

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/
Tributary Creek Site 9
Sample Matrix: Animal Tissue

Service Request No.: K1510914
Date Received: 09/30/15

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

Sample Receipt

Ten animal tissue samples were received for analysis at ALS Environmental on 09/30/15. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at -20°C upon receipt at the laboratory.

Total Metals

Matrix Spike Recovery Exceptions:

The matrix spike recovery of Copper for the Batch QC sample (BQC1) was outside control criteria. Recovery in the Laboratory The associated QA/QC results (e.g. SRM samples, LCS, method blank, calibration standards, etc.) indicate the analysis was in control. No further corrective action was appropriate.

The matrix spike recovery of Silver for the Batch QC sample (BQC2) was outside control criteria. Recovery in the Laboratory The associated QA/QC results (e.g. LCS, method blank, calibration standards, etc.) indicate the analysis was in control. No further corrective action was appropriate.

No other anomalies associated with the analysis of these samples were observed.

Approved by _____





Chain of Custody

ALS Environmental—Kelso Laboratory
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Greens Creek Biomonitoring 2015

Juvenile Fish for Whole Body Metals

Basis, all samples: Dry Weight, Report %Solids

Requested Analysis: Ag,Cd,Cu,Hg,Pb,Se,Zn

K1510914

Matrix	Collector	Date Collected	Sample Number	Sample Location	Analysis Requested	FK Length (mm)	Weight (g)
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #1	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #2	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #3	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	11.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #4	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #5	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.7
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #6	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.4
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #7	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	104	9.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #8	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	85	8.6
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #9	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	102	10.3
Whole Body	ADF&G	7/16/2015	Greens Creek Site 48 sample #10	Greens Creek Site 48	Ag,Cd,Cu,Hg,Pb,Se,Zn	120	16.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #1	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.3
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #2	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	11.5
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #3	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	110	11.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #4	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	105	12.0
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #5	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	10.7
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #6	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	95	8.4
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #7	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	100	8.2
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #8	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	92	9.9
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #9	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	90	7.1
Whole Body	ADF&G	7/15/2015	Greens Creek Site 54 sample #10	Greens Creek Site 54	Ag,Cd,Cu,Hg,Pb,Se,Zn	88	6.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	12.4
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #1	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	60	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #2	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	77	5.7
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #3	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	84	7.2
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #4	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	63	81

121510 914

Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #4	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	69	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #5	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	82	6.9
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #6	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	55	7.68
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #6	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	75	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #7	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	90	9.25
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #8	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	80	6.78
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #9	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	75	8.86
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #9	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	75	Combined
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #10	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	75	12.84
Whole Body	ADF&G	7/14/2015	Tributary Creek Site 9 sample #10	Tributary Creek Site 9	Ag,Cd,Cu,Hg,Pb,Se,Zn	75	Combined



Cooler Receipt and Preservation Form

Client / Project: Alaska Dept. Fish & Game Service Request K15 10914

Received: 9/30/15 Opened: 9/30/15 By: KR Unloaded: 9/30/15 By: KE

- 1. Samples were received via? Mail Fed Ex UPS DHL PDX Courier Hand Delivered
- 2. Samples were received in: (circle) Cooler Box Envelope Other NA
- 3. Were custody seals on coolers? NA Y N If yes, how many and where? 1 F
- If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID	Tracking Number	NA	Filed
<u>-1.3</u>	<u>-1.0</u>	<u>-</u>	<u>-</u>	<u>+0.3</u>	<u>360</u>	<u>NA</u>	<u>808857519131</u>		

- 4. Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves packing paper
- 5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
- 6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
- 7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
- 8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
- 9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
- 10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
- 11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
- 12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____



Total Solids

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
Sample Matrix: Animal Tissue
Analysis Method: Calculation
Prep Method: None

Service Request: K1510914
Date Collected: 07/14/15
Date Received: 09/30/15
Units: Percent
Basis: Wet

Moisture

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Tributary Creek Site 9 Sample # 1	K1510914-001	79.2	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 2	K1510914-002	75.1	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 3	K1510914-003	75.2	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 4	K1510914-004	76.5	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 5	K1510914-005	73.3	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 6	K1510914-006	77.8	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 7	K1510914-007	75.8	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 8	K1510914-008	73.6	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 9	K1510914-009	77.0	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 10	K1510914-010	75.0	-	1	10/19/15 18:10	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
Sample Matrix: Animal Tissue
Analysis Method: Freeze Dry
Prep Method: None

Service Request: K1510914
Date Collected: 07/14/15
Date Received: 09/30/15
Units: Percent
Basis: Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Tributary Creek Site 9 Sample # 1	K1510914-001	20.8	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 2	K1510914-002	24.9	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 3	K1510914-003	24.8	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 4	K1510914-004	23.5	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 5	K1510914-005	26.7	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 6	K1510914-006	22.2	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 7	K1510914-007	24.2	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 8	K1510914-008	26.4	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 9	K1510914-009	23.0	-	1	10/19/15 18:10	
Tributary Creek Site 9 Sample # 10	K1510914-010	25.0	-	1	10/19/15 18:10	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
Sample Matrix: Animal Tissue

Service Request: K1510914
Date Collected: 07/14/15
Date Received: 09/30/15
Date Analyzed: 10/19/15

Replicate Sample Summary

Inorganic Parameters

Sample Name: Tributary Creek Site 9 Sample # 10
Lab Code: K1510914-010

Units: Percent
Basis: Wet

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K1510914-010DUP Result	Average	RPD	RPD Limit
Total Solids	Freeze Dry	-	25.0	23.8	24.4	5	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



Metals

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ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
Sample Matrix: Animal tissue

Service Request: K1510914
Date Collected: 07/14/15
Date Received: 09/30/15

Mercury, Total

Prep Method: METHOD
Analysis Method: 1631E
Test Notes:

Units: ng/g
Basis: Dry

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tributary Creek Site 9 Sample # 1	K1510914-001	4.9	5	10/27/15	10/29/15	285	
Tributary Creek Site 9 Sample # 2	K1510914-002	5.0	5	10/27/15	10/29/15	321	
Tributary Creek Site 9 Sample # 3	K1510914-003	4.7	5	10/27/15	10/29/15	338	
Tributary Creek Site 9 Sample # 4	K1510914-004	4.9	5	10/27/15	10/29/15	338	
Tributary Creek Site 9 Sample # 5	K1510914-005	4.5	5	10/27/15	10/29/15	342	
Tributary Creek Site 9 Sample # 6	K1510914-006	4.8	5	10/27/15	10/29/15	280	
Tributary Creek Site 9 Sample # 7	K1510914-007	4.9	5	10/27/15	10/29/15	304	
Tributary Creek Site 9 Sample # 8	K1510914-008	4.6	5	10/27/15	10/29/15	312	
Tributary Creek Site 9 Sample # 9	K1510914-009	4.9	5	10/27/15	10/29/15	322	
Tributary Creek Site 9 Sample # 10	K1510914-010	5.0	5	10/27/15	10/29/15	293	
Method Blank 1	K1510914-MB1	1.0	1	10/27/15	10/29/15	ND	
Method Blank 2	K1510914-MB2	1.0	1	10/27/15	10/29/15	ND	
Method Blank 3	K1510914-MB3	1.0	1	10/27/15	10/29/15	ND	

ALS Group USA, Corp.
dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
Sample Matrix: Animal tissue

Service Request: K1510914
Date Collected: 07/14/15
Date Received: 09/30/15
Date Extracted: 10/27/15
Date Analyzed: 10/29/15

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals

Sample Name: Tributary Creek Site 9 Sample # 10 Units: ng/g
 Lab Code: K1510914-010MS, K1510914-010MSD Basis: Dry
 Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery		ALS Acceptance Limits	Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	MS	DMS			
Mercury	METHOD	1631E	4.9	235	243	293	523	479	98	77	70-130	9	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
LCS Matrix: Water

Service Request: K1510914
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Initial) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	5.53	111	70-130	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
LCS Matrix: Water

Service Request: K1510914
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/29/15

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Final) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	5.49	110	70-130	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
LCS Matrix: Animal tissue

Service Request: K1510914
Date Collected: NA
Date Received: NA
Date Extracted: 10/27/15
Date Analyzed: 10/29/15

Quality Control Sample (QCS) Summary
 Total Metals

Sample Name: Quality Control Sample Units: ng/g
 Lab Code: Basis: Dry
 Test Notes:

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	292	242	83	70-130	

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-001

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	3.92		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	3.8		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	3.30		
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	7.1		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.22		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	188		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga Service Request: K1510914
Project No.: Tributary Creek Site 9 Date Collected: 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit Date Received: 09/30/15
Matrix: TISSUE Units: mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # Lab Code: K1510914-002

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	4.40		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	5.2		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	4.93		
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	9.1		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.33		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	157		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-003

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	2.54		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	5.3		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	2.84		
Selenium	200.8	0.9	5.0	10/28/15	10/29/15	7.9		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.22		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	134		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-004

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	4.73		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	6.7		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	6.20		
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	10.6		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.48		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	173		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-005

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	3.76		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	4.6		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	4.80		
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	8.5		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.36		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	153		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga Service Request: K1510914
Project No.: Tributary Creek Site 9 Date Collected: 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit Date Received: 09/30/15
Matrix: TISSUE Units: mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # Lab Code: K1510914-006

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	4.03		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	5.3		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	3.42		
Selenium	200.8	0.9	5.0	10/28/15	10/29/15	7.8		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.25		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	165		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-007

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	1.81		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	3.4		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	1.69		
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	9.2		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.28		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	124		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-008

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	3.92		
Copper	200.8	0.1	5.0	10/28/15	10/29/15	5.1		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	4.87		
Selenium	200.8	0.9	5.0	10/28/15	10/29/15	9.7		
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.30		
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	159		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-009

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	1.69		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	4.2		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	1.86		
Selenium	200.8	0.9	5.0	10/28/15	10/30/15	7.2		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.13		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	142		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:** 07/14/15
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:** 09/30/15
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Tributary Creek Site 9 Sample # **Lab Code:** K1510914-010

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/30/15	5.86		
Copper	200.8	0.1	5.0	10/28/15	10/30/15	5.1		
Lead	200.8	0.02	5.0	10/28/15	10/30/15	4.54		
Selenium	200.8	1.0	5.0	10/28/15	10/30/15	10.7		
Silver	200.8	0.02	5.0	10/28/15	10/30/15	0.51		
Zinc	200.8	0.5	5.0	10/28/15	10/30/15	175		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Date Collected:**
Project Name: Hecla Greens Creek Mine Biomonit **Date Received:**
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: Method Blank **Lab Code:** KQ1512495-01

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Cadmium	200.8	0.02	5.0	10/28/15	10/29/15	0.02	U	
Copper	200.8	0.1	5.0	10/28/15	10/29/15	0.1	U	
Lead	200.8	0.02	5.0	10/28/15	10/30/15	0.02	U	
Selenium	200.8	1.0	5.0	10/28/15	10/29/15	1.0	U	
Silver	200.8	0.02	5.0	10/28/15	10/29/15	0.02	U	
Zinc	200.8	0.5	5.0	10/28/15	10/29/15	0.5	U	

Comments:

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC1S

Lab Code: K1510827-057S

Analyte	Control Limit %R	Spike Result C	Sample Result C	Spike Added	%R	Q	Method
Cadmium	70 - 130	4.98	0.57	4.81	91.7		200.8
Copper	70 - 130	32.6	16.2	24.0	68.3	N	200.8
Lead	70 - 130	45.46	4.00	48.08	86.2		200.8
Selenium	70 - 130	21.1	4.5	16.1	103.1		200.8
Silver	70 - 130	3.65	0.20	4.81	71.7		200.8
Zinc	70 - 130	226.3	180.1	48.1	96.0		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC2S

Lab Code: K1510827-059S

Analyte	Control Limit %R	Spike Result C	Sample Result C	Spike Added	%R	Q	Method
Cadmium	70 - 130	4.77	0.32	4.70	94.7		200.8
Copper	70 - 130	27.5	7.3	23.5	86.0		200.8
Lead	70 - 130	44.13	1.99	47.02	89.6		200.8
Selenium	70 - 130	18.3	2.0	15.7	103.8		200.8
Silver	70 - 130	3.01	0.05	4.70	63.0	N	200.8
Zinc	70 - 130	109.2	67.0	47.0	89.8		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC1D

Lab Code: K1510827-057D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Cadmium	30	0.57		0.61		6.8		200.8
Copper	30	16.2		18.5		13.3		200.8
Lead	30	4.00		3.77		5.9		200.8
Selenium		4.5		4.4		2.2		200.8
Silver	30	0.20		0.21		4.9		200.8
Zinc	30	180.1		182.4		1.3		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 6 -

DUPLICATES

Client: Alaska Department of Fish and Ga **Service Request:** K1510914
Project No.: Tributary Creek Site 9 **Units:** MG/KG
Project Name: Hecla Greens Creek Mine Biomonit **Basis:** DRY
Matrix: TISSUE

Sample Name: Batch QC2D

Lab Code: K1510827-059D

Analyte	Control Limit	Sample (S) C	Duplicate (D) C	RPD	Q	Method
Cadmium	30	0.32	0.33	3.1		200.8
Copper	30	7.3	7.8	6.6		200.8
Lead	30	1.99	2.27	13.1		200.8
Selenium		2.0	2.1	4.9		200.8
Silver		0.05	0.05	0.0		200.8
Zinc	30	67.0	71.3	6.2		200.8

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

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LABORATORY CONTROL SAMPLE

Client: Alaska Department of Fish and Ga **Service Request:** K1510914

Project No.: Tributary Creek Site 9

Project Name: Hecla Greens Creek Mine Biomonit

Aqueous LCS Source: **ALS MIXED**

Solid LCS Source:

Analyte	Aqueous (ug/L)			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Cadmium	50.0	47.2	94.4					
Copper	250.0	219.6	87.8					
Lead	500.0	477.9	95.6					
Selenium	167.0	162.2	97.1					
Silver	50.0	44.3	88.6					
Zinc	500.0	444.9	89.0					

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
LCS Matrix: Tissue

Service Request: K1510914
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510914-SRM1 Basis: Dry
 Test Notes: Dorm-4 Solids = 94.5%
 Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	0.306	0.303	99	0.233 - 0.385	
Copper	PSEP Tissue	200.8	15.9	13.3	84	12.0 - 20.2	
Lead	PSEP Tissue	200.8	0.416	0.300	72	0.290 - 0.563	
Selenium	PSEP Tissue	200.8	3.56	3.59	101	2.58 - 4.68	
Zinc	PSEP Tissue	200.8	52.20	46.4	89	39.2 - 66.5	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: Hecla Greens Creek Mine Biomonitoring/Tributary Creek Site 9
LCS Matrix: Tissue

Service Request: K1510914
Date Collected: NA
Date Received: NA
Date Extracted: 10/28/15
Date Analyzed: 10/29,30/15

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1510914-SRM2 Basis: Dry
 Test Notes: Tort-3 Solids = 99.1%
 Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	200.8	42.3	38.5	91	32.4-52.9	
Copper	PSEP Tissue	200.8	497	408	82	380-623	
Lead	PSEP Tissue	200.8	0.225	0.182	81	0.166-0.292	
Selenium	PSEP Tissue	200.8	10.9	10.6	97	7.9-14.3	
Zinc	PSEP Tissue	200.8	136	123	90	104-170	