Technical Report No. 17-03

Aquatic Biomonitoring at Greens Creek Mine, 2016

By

Johnny Zutz

April 2017

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 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)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
etalii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
idest (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
no data	ND
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

TECHNICAL REPORT NO. 17-03

AQUATIC BIOMONITORING AT GREENS CREEK MINE, 2016

by

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April 2017

This investigation was fully financed by Hecla Greens Creek Mining Company.

Cover: Dolly Varden char captured at Greens Creek Site 48.

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This document should be cited as:
Zutz, J. 2017. Aquatic biomonitoring at Greens Creek Mine, 2016. Alaska Department of Fish and Game, Technical Report No. 17-03, Douglas, AK.

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ACKNOWLEDGEMENTS

Hecla Greens Creek Mining Company provided financial support and Greens Creek Mine environmental staff Chris Wallace, Ted Morales, Gunnar Fredheim, and Cameron Sell provided logistical support. Mr. Fredheim also provided water quality data. U.S. Forest Service Fishery Technician Christina Mounce and intern Sophie Castleton assisted with sampling.

Division of Habitat staff Kate Kanouse directed data collection, performed statistical analyses, and verified data entry, and Greg Albrecht processed the periphyton samples. Division of Habitat Operations Manager Dr. Al Ott and Ms. Kanouse reviewed and edited the report, and Southeast Regional Supervisor Jackie Timothy reviewed and edited the Executive Summary. Nora Foster of NRF Taxonomic Services identified the benthic macroinvertebrates.

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 (Hecla) 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 2016, we completed these studies at Greens Creek sites 48 and 54, and Tributary Creek Site 9.

The National Weather Service reports 2016 was one of the warmest years on record for Juneau, and while total precipitation (163 cm) was normal, total snowfall (69 cm) was about 70% below normal (K. Vaughan, Observation Program Leader, National Weather Service, Juneau, personal communication).

Among the 2016 Greens Creek samples, mean chlorophyll *a* density[a] and mean benthic macroinvertebrate density at each site was within the range of values observed since 2001. At Tributary Creek Site 9, mean chlorophyll *a* density was similar to the 2014 mean and the lowest observed, while mean benthic macroinvertebrate density was the second largest and the proportion of sensitive insects was lowest due to more Diptera (e.g. flies and mosquitos) and Oligochaeta (worms) organisms present, not as a result of fewer sensitive insects.

The 2016 Tributary Creek Site 9 juvenile Dolly Varden char *Salvelinus malma* population estimate was the lowest observed and coho salmon continue to be the most abundant juvenile fish species. The 2016 Dolly Varden char population estimate for Greens Creek Site 48 was within the range observed in previous years. We dropped the holding bucket during our first pass and fish escaped, so we could not estimate the Site 54 Dolly Varden char population, though the number of fish we captured was similar to captures in previous years. We captured 32 juvenile coho salmon *Oncorhynchus kisutch* at Greens Creek Site 54, the greatest number since the fish pass was damaged in late 2005. Mean fish condition of Dolly Varden char and coho salmon was similar among sites.

Median whole body Dolly Varden char selenium concentration at Greens Creek Site 48 was the greatest observed since 2001. All other metals concentrations were within the ranges observed. Comparing all three sites, Tributary Creek Site 9 samples tend to have greater concentrations and variability than Greens Creek samples, except Cu and Zn which were generally greater among Greens Creek Site 48 samples.

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[a] 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. Chlorophyll a 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, within the Tongass National Forest and the Admiralty Island National Monument (USFS 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, a subsidiary of Hecla Mining Company of Coeur d'Alene, Idaho, has owned and operated the mine since April 2008.

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

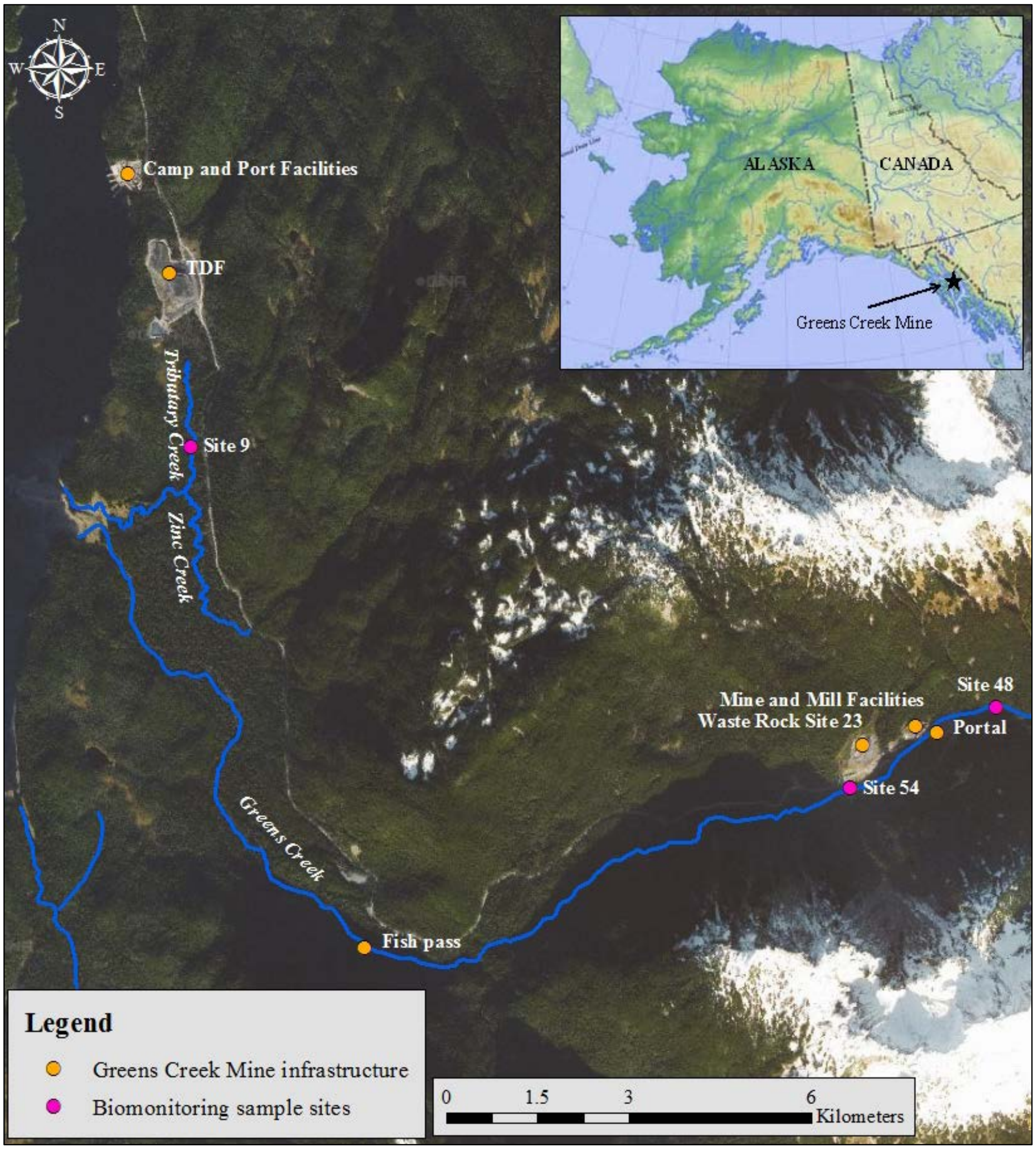

Figure 1.–Greens Creek Mine area map.

The project 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 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), Kanouse (2015) and Brewster (2016).

PURPOSE

The purpose of this technical report is to summarize the 2016 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 approved Plan of Operations (HGCMC 2014) and ADEC Waste Management Permit 2014DB0003.

AQUATIC STUDIES

We completed the following studies:

- chlorophyll *a* 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:

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).

Greens Creek

The Greens Creek watershed is about 58.5 km^2 (USGS 2016) and the main channel measures about 16 km long from the alpine headwaters to the mouth in Hawk Inlet. 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. Rainfall events during the fall also cause peak discharges.

Greens Creek Site 48

Site 48 (Figure 2) 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 about 30 m downstream of the fish sample reach.

Figure 2.–Greens Creek Site 48.

Greens Creek Site 54

Site 54 (Figure 3) 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, storm water ponds, and mine and mill facilities upstream. Between Site 48 and Site 54, there are four tributaries that drain to Greens Creek: 1350 Creek, Cub Creek, Bruin Creek, and Gallagher Creek.

We have documented coho salmon, Dolly Varden char, and cutthroat trout *O. clarkii* at Site 54; and this stream is an ADF&G index stream for chum salmon, O.keta (Stream No. 112-65-10240; Johnson and Litchfield 2016). Anadromous fish access the site via a fish pass about 5.6 km upriver from the mouth.[b] Periphyton and benthic macroinvertebrate sampling occur in riffle habitats about 30 m upstream of the fish sample reach. Gallagher Creek enters Greens Creek within the fish sample reach.

Figure 3.–Greens Creek Site 54.

[b] In 1989, Greens Creek Mining Company installed an engineered fish pass as mitigation for impacts to Tributary Creek from the TDF. Three concrete weirs provide step pools for adult coho salmon passage through a natural bedrock chute that prevents upstream fish migration. In November 2005, flood flows damaged the fish pass during a heavy rainstorm and limited fish passage until Hecla repaired and strengthened the structure in March 2016.

Tributary Creek

The Tributary Creek watershed is about 1.7 km^2 (USFS 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 1–2%, organics and sand are the dominant substrates with gravel present near the mouth, and large and small woody debris are common. Discharge estimates based on field measurements and limited gage data suggest annual stream flows range 1–5 ft^3/s (USFS 2003).

Tributary Creek provides habitat for coho salmon, pink salmon *O. gorbuscha*, and Dolly Varden char (Stream No. 112-65-10230-2007; Johnson and Litchfield 2016).

Tributary Creek Site 9

Site 9 (Figure 4) is located about 1.2 km downstream of the TDF at 25 m elevation, and sampled to detect potential changes from the TDF. We have documented coho salmon, Dolly Varden char, cutthroat and rainbow trout *O. mykiss*, and sculpin *Cottus* sp. at this site. Periphyton and benthic macroinvertebrate sampling occurs within the fish sample reach after the juvenile fish population study is complete.

Figure 4.–Tributary Creek Site 9.

METHODS

We annually review data sets to ensure accuracy and consistency with methods modifications, and report corrections and updates 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.

WATER QUALITY

Hecla staff used field meters to characterize basic water quality at each site during sampling, including temperature, pH, and conductivity. We include the 2016 results for each site in this report.

STREAM FLOW

Sampling and Analysis

We measured stream flow with a SonTek FlowTracker. Prior to 2015 we calculated discharge using a Global Flow Probe FP101 flow meter and a modification[c] of the methods described in Platts et al. (1983). We survey where stream flow is confined to one channel, and usually where the stream bottom elevation and stream flow are continuous across the channel.

We string a fiberglass measuring tape tightly across the survey site perpendicular to the stream, and begin the survey from either bank following methods described in SonTek (2007). We attempt to record at least 20 measurement points, except in Tributary Creek where we record as many measurements as practicable.

Data Presentation

We present the SonTek FlowTracker discharge result at the beginning of each sample site in the *Results* section.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Periphyton is composed of primary producing organisms such as algae, cyanobacteria and heterotrophic microbes, and detritus, attached to the submerged surfaces of aquatic ecosystems. Algal density and community structure are influenced by water and sediment quality through physical, chemical, and biological disturbances that change throughout the year (Barbour et al. 1999). The concentration of chlorophyll *a* pigment in periphyton samples provides an estimate of active algal biomass (density), while concentrations of chlorophylls *b* and *c* estimate the composition of algal organisms present, such as green algae that produce chlorophyll *b*, and diatoms and brown algae that produce chlorophyll *c*.

Requirement FWMP 5.3

The FWMP requires we measure chlorophyll *a* density (mg/m^2) to estimate active algal biomass, and monitor density and proportions of accessory pigments chlorophylls *b* and *c* to detect change over time. We compare Greens Creek Site 48 reference data to Greens Creek Site 54 data, and track change over time at all sample sites. We do not have reference data to compare Tributary Creek Site 9 data.

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[c] We measured stream flow throughout the water column to determine mean velocity, rather than measuring at a specific depth where velocity is assumed to be equal to the mean velocity of the water column.

Sample Collection and Analysis

We collected 10 smooth, flat, undisturbed, and perennially wetted rocks from submerged cobble in riffle habitats in less than 0.45 m water depth at each sample site. We placed a 5 × 5 cm square of high-density foam on each rock and scrubbed the area around the foam with a toothbrush to remove algae and other organisms outside the covered area, then rinsed the rock by dipping it in the stream while holding the foam in place.

We removed the foam square and scrubbed the sample area with a rinsed toothbrush over a 1 µm, 47 mm glass fiber filter attached to a vacuum pump. We used stream water in a wash bottle to rinse the loosened periphyton from the rock, the toothbrush, and the inside of the vacuum pump onto the filter. We pumped most of the water through the filter and added a few drops[d] of saturated magnesium carbonate ($MgCO_3$) solution to the filter to prevent acidification and conversion of chlorophyll to phaeophytin, before we pumped the sample dry. We removed the glass fiber filter, folded it in half with the sample on the inside, and wrapped it in a white coffee filter to absorb additional water. We placed the samples in a sealed, labeled plastic bag with desiccant and stored the samples in a light-proof cooler containing frozen icepacks during transportation, in a camp freezer while onsite, and in a –20°C freezer until we processed them in an ADF&G laboratory.

We followed U.S. Environmental Protection Agency (1997) protocol for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.[e] We removed the samples from the freezer, cut them into small pieces, and placed the filter pieces for each sample into individual centrifuge tubes containing 10 mL of 90% buffered acetone. We capped the centrifuge tubes, placed them in a rack, covered them with aluminum foil, and stored them in a refrigerator for less than 24 h to extract the chlorophyll. We centrifuged the samples for 20 min at 1,600 rpm and read them on a Shimadzu UV-1800 Spectrophotometer at optical densities (OD) 664 nm, OD 647 nm, and OD 630 nm, and used an acetone blank to correct for the solvent. We also read the samples at OD 750 nm to correct for turbidity. We treated each sample with 80 µL of 0.1 N hydrochloric acid to convert the chlorophyll to phaeophytin, and read each sample again at OD 665 nm and OD 750 nm.

We used trichromatic equations to estimate chlorophylls *a*, *b,* and *c* concentration, and corrected chlorophyll *a* concentration when phaeophytin was detected. If chlorophyll *a* was not detected in a sample, we report the concentration at the estimated detection limit and do not report values for chlorophylls *b* or *c*. The 2016 chlorophyll *a* concentration estimated detection limit was 0.19 mg/m^2.

We performed the nonparametric Kruskal-Wallis one-way analysis of variance by ranks test, using Statistix® 9 analytical software, to test for differences of mean ranks between years at each site (Neter et al. 1990). We used the all-pairwise comparison test to identify differences between years and report significant differences when $p \leq 0.05$.

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[d] This measurement is not exact as the amount of water used to saturate the magnesium carbonate is not exact and fixes the sample regardless of the concentration and without affecting sample integrity.

[e] Except we store the samples longer than 3.5 weeks and we cut the sample filters, rather than homogenize them, to reduce risk of acetone exposure.

Data Presentation

We include a figure of Greens Creek mean daily discharge three weeks prior to periphyton sampling in 2016; discharge data are not available for Tributary Creek. We also include a figure of the range of Greens Creek mean daily discharges three weeks prior to sampling, 2001–2016.

For each sample site, we present a figure of mean chlorophyll *a* density (mg/m^2) ± one SD, showing potential outliers. A star (✳) in the figure represents a potential outlier, where chlorophyll *a* density of the sample exceeded the mean for the typical range of data that year by more than three times. We also present a figure of mean proportion of chlorophylls *a*, *b* and *c*. We include possible outlier values in the mean calculations, statistical analyses, and the raw data set (Appendix A).

We compare chlorophyll *a* density and chlorophyll proportions by year among Greens Creek sites 48 and 54 in *Comparisons Among Greens Creek Sites*. We do not compare Greens Creek data with Tributary Creek data as these systems provide different habitats for aquatic life, which affect productivity.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Benthic macroinvertebrates (BMI) classified in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT taxa, have complex and short life cycles and many genera are sensitive to changes in water and sediment quality (Barbour et al. 1999). These organisms are secondary producers, feed on periphyton and other macroinvertebrates, and provide an important food source for fish.

Requirement FWMP 5.4

The FWMP requires we estimate benthic macroinvertebrate density per m^2 and evaluate community composition at each site each year and over time. We compare among Greens Creek sites 48 and 54 data and track change over time at all sites. We did not have a reference site to compare to Tributary Creek Site 9.

Sample Collection and Analysis

We opportunistically collected eight[f] BMI samples from each site using a Hess sampler in riffles with different velocities—habitat with the greatest taxonomic density and richness (Barbour et al. 1999). We do not sample other habitat types, such as pools, to reduce variability.

The Hess stream bottom sampler has a 0.086 m^2 sample area and a 0.3 mm mesh net and cod end. After we pushed the sampler into the stream bottom, we used a brush and scrubbed rocks within the sample area with a brush and disturbed gravels, sand, and silt to about 10 cm depth to dislodge macroinvertebrates into the net. We rinsed the net in the stream to ensure all organisms floated into the cod of the Hess sampler, transferred each sample from the cod end to a labeled 500 mL plastic bottle, and preserved the samples within 95% ethanol at a ratio of three parts ethanol to one part water. We shipped the samples to NRF Taxonomic Services in Fairbanks, Alaska, for sorting and taxonomic identification to the lowest practical[g] level.

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[f] Prior to 2015, we collected five BMI samples each year.

[g] EPT and Diptera insects to genus, except nonbiting midges to family Chironomidae, and all others to order or class.

We calculated BMI density (per m^2) for each sample by dividing the number of BMIs by 0.086 m^2, the Hess sampling area. We estimated benthic macroinvertebrate density for each site by calculating the mean density among the eight samples. We report taxa richness as the number of taxonomic groups identified to the lowest practical level and exclude terrestrial organisms from all calculations.

Data Presentation

We include a figure of mean benthic macroinvertebrate density (insects/m^2) ± one SD, and a figure illustrating percent community composition, for each site. Annual data summaries are included in Appendix B.

We compare annual BMI density and taxa richness data among Greens Creek sites 48 and 54 in *Comparisons Among Greens Creek Sites*. We do not compare Greens Creek data with Tributary Creek data as these systems provide different habitats for aquatic life, which affect productivity.

JUVENILE FISH POPULATION

Requirement FWMP 5.5

The FWMP requires estimating juvenile fish populations by species at each site to monitor changes in populations over time. Valid population estimates are subject to our ability to satisfy assumptions of the study design each year.

Sample Collection and Analysis

We sampled 50 m reaches isolated by natural features, such as shallow riffles and debris jams, using two-piece 6.35 mm galvanized steel minnow traps following methods described in Magnus et al. (2006). We baited the traps with disinfected salmon roe contained in a punctured plastic bag to prevent ingestion and reduce the possibility of sample contamination. Prior to each study, we opportunistically set several baited minnow traps within 15 m of the upstream and downstream sample reach boundaries to capture potential migrants and improve sample reach isolation.[h] The minnow traps remained undisturbed during the study, and upon study completion, we recorded fish captured by species and released fish at capture sites. We did not include the number of fish captured in these traps in the population estimates.

We sampled juvenile fish populations using a modification[i] of a depletion method described by Bryant (2000). Beginning at the downstream end of each reach, we opportunistically set baited minnow traps in all habitat types where water depth and flow allowed, and moved away from the sample site to avoid disturbing fish while the traps soaked for 1.5 h. We retrieved each trap, transferred captured fish in a plastic bucket with aerated stream water, removed the used bait bag, then rebaited and reset each trap in the same location as quickly as possible. We allowed the trap to soak another 1.5 h, and completed the sequence a third time.

We processed captured fish between passes. Biologists anesthetized fish using 9 mg/L AQUI-S 20E (10% eugenol), measured and recorded FL to the nearest 1 mm, weight to the nearest 0.1 g, and species (Pollard et al. 1997). Prior to weighing each fish, we tared the scale and emptied the

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[h] Greens Creek discharge is usually too high to efficiently and effectively isolate sample reaches using a 6.35 mm (0.25 in) mesh net across the stream. Though a mesh net could effectively isolate the Tributary Creek Site 9 sample reach, we also used baited minnow traps.

[i] We sampled shorter reaches, used more minnow traps, and completed three passes instead of four.

measuring tray to minimize water weight. We retained fish in a perforated plastic bucket secured in the creek downstream of the sample reach during the study, and released captured fish[j] to the sample reach upon study completion.

We collected data to meet the assumptions of closure and equal probability of capture (Lockwood and Schneider 2000) during the three passes by ensuring the following:

- Fish emigration and immigration during the sampling period was negligible.
  - Sample reaches were isolated by natural stream features, and we set traps upstream and downstream of sample reaches to capture potential migrants.
- All fish were equally vulnerable to capture during each pass.
  - We set baited minnow traps in all habitat types where water depth and flow allowed.
- Fish did not become more wary of capture with each pass.
  - We maintained trap numbers and placement during all three passes.
  - We completed all three passes as quickly as possible.
  - To avoid disturbing fish, we moved away from sample reaches while the traps soaked.
- Collection effort and conditions which affect collection efficiency remained constant.
  - We retrieved traps beginning at the downstream end of each reach.
  - We moved upstream setting, retrieving, and replacing traps as quickly as possible.
  - We timed each pass exactly 1.5 h.
  - We replaced used bait bags with fresh bait bags and reset each trap in the same location.

We estimated juvenile fish populations using the multiple-pass depletion method developed by Lockwood and Schneider (2000), based on methods developed by Carle and Strub (1978). The repetitive method produces a maximum likelihood estimate (MLE) of fish with a 95% CI.

Let *X* represent an intermediate sum statistic where the total number of passes, *k*, is reduced by the pass number, *i*, and multiplied by the number of fish caught in the pass, $C_{i,}$, for each pass:

$$X = \sum_{i=1}^{k}(k-i)C_i$$

Let *T* represent the total number of fish captured in the minnow traps, all passes. Let *n* represent the predicted population of fish, using *T* as the initial value tested. Using *X*, we calculated the MLE, *N*, by repeated estimations of *n*. The MLE is the smallest integer value of *n* greater than or equal to *T* which satisfies[k] the following:

$$\left[\frac{n+1}{n-T+1}\right]\prod_{i=1}^{k}\left[\frac{kn-X-T+1+(k-i)}{kn-X+2+(k-i)}\right]_i \leq 1.000$$

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[j] Except, we retained ten Dolly Varden char for whole body metals concentrations at each sample site.

[k] Lockwood and Schneider (2000) suggest the result should be rounded to one decimal place (1.0). We use three decimal places (1.000) which is an option in Carle and Strub (1978).

The probability of capture, *p*, is given by the total number of fish captured, divided by an equation where the number of passes is multiplied by the MLE and subtracted by the intermediate statistic, X,

$$p = \frac{T}{kN - X}$$

The variance of *N*, a measure of variability from the mean, is given by:

$$Variance\ of\ N = \frac{N(N-T)T}{T^2 - N(N-T)\left[\frac{(kp)^2}{(1-p)}\right]}$$

We determined the SE of *N* by calculating the square root of the variance of *N*, and the 95% CI for the MLE using $\pm$2(SE). The size of the 95% CI depends on the number of captures each pass; a small 95% CI results when fewer captures steadily occur with each pass, and a large 95% CI results when captures do not steadily decrease and when the number of fish captured on the second or third pass exceed the number of fish captured on the previous pass. A MLE cannot be generated from samples from small populations if we capture few fish (e.g. ≤ 20) during the three passes; in these cases, we present the number of fish captured as the result and do not include a MLE.

Calculating a MLE using three-pass depletion data relies on equal capture probability among passes (Bryant 2000; Carle and Strub 1978; Lockwood and Schneider 2000). To evaluate equal capture probability, we used the goodness of fit test (White et al. 1982) recommended by Lockwood and Schneider (2000), which follows the χ^2 test form. We first calculated expected numbers of fish captured for each pass ($C_1, C_{2.}, C_3$) using variables previously described:

$$E(C_1) = N(1-p)^{i-1}p$$

Then we calculated χ^2,

$$\chi^2 = \frac{[C_1 - E(C_1)]^2}{E(C_1)} + \frac{[C_2 - E(C_2)]^2}{E(C_2)} + \frac{[C_3 - E(C_3)]^2}{E(C_3)}$$

We compare the χ^2 test result against $\chi^2_{0.95}$ with one degree of freedom (Lockwood and Schneider (2000), and if the χ^2value is lower, the goodness of fit test suggests we achieved equal capture probability; if not, the MLE will be biased low.

Data Presentation

We present a figure of juvenile fish population estimates by species for each sample site each year. We also present a comparison of Greens Creek sites 48 and 54 population estimates over time in *Comparisons Among Greens Creek Sites.* We do not compare Greens Creek data with Tributary Creek data as these systems provide different habitats for aquatic life, which affect productivity. Capture data summaries and length frequency diagrams of captured fish are included in Appendix C.

JUVENILE FISH CONDITION

Requirement FWMP 5.5

The FWMP requires we report mean fish condition by species each year. Age, sex, season, maturation, diet, gut contents, fat reserve, and muscular development affect fish condition.

Sample Collection and Analysis

We used FL and weight data collected of fish captured during the juvenile fish population studies, excluding fish measuring less than 40 mm FL. We calculated Fulton's condition factor (K) using the equation given in Anderson and Neumann (1996), where the weight (W) of each fish is divided by the cubed length (L) of the fish, and the product multiplied by 100,000,

$$K = \frac{W}{L^3} \times 100{,}000$$

Data Presentation

We present mean fish condition by species for each site, compare fish condition among Greens Creek sites 48 and 54 in *Comparisons Among Greens Creek Sites*, and include means by species for each site by year in Appendix C.

JUVENILE FISH METALS CONCENTRATIONS

Requirement FWMP 5.6

The FWMP requires we annually sample 10[l] juvenile Dolly Varden char within the size class 85–125 mm for whole body concentrations of silver (Ag), cadmium (Cd), copper (Cu), mercury[m] (Hg), lead (Pb), selenium (Se), and zinc (Zn) at each site. A 85 mm FL fish provides the minimum amount of tissue (about 5 g) required for the laboratory analyses, while the maximum size of 125 mm FL improves the likelihood of sampling less than 3-year-old resident fish at sites 54 and 9 where anadromous Dolly Varden char may be present. We evaluate the data for each site over time and compare the data among all three sites each year.

Sample Collection and Analysis

We wore latex gloves when handling fish and retained 10 juvenile Dolly Varden char measuring 85–125 mm FL captured during the juvenile fish population survey. We packed fish in individually labeled plastic bags, and measured FL and fish weight, correcting for bag weight. We placed all samples from each site in a larger plastic bag labeled with the sample location.

We stored the samples in a cooler containing frozen ice packs during transport, in a camp freezer while onsite, and in a –20 °C laboratory freezer in a Juneau ADF&G lab. We shipped the samples in a cooler with frozen ice packs to ALS Environmental in Kelso, Washington, and maintained written chain of custody documentation. ALS Environmental individually digested, dried, and analyzed each sample for total Ag, Cd, Cu, Hg, Pb, Se, and Zn on a dry weight basis following EPA method 1631E (Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry) for Hg, and EPA method 6020A (Inductively Coupled

[l] Prior to 2015, we collected six Dolly Varden char samples at each site.

[m] We began annually testing for Hg in 2012, and incidentally received Hg data in 2010.

Plasma – Mass Spectrometry) for the other analytes. ALS Environmental provided Tier II quality assurance/quality control information including results for matrix spikes, sample blanks, sample duplicates, and standard reference materials.

We performed the nonparametric Kruskal-Wallis one-way analysis of variance by ranks test, using Statistix® 9 analytical software, to test for equality of population medians between sites (Neter et al. 1990). We used the all-pairwise comparison test to identify differences between sites, and report significant differences when $p \leq 0.05$.

Data Presentation

We present a figure of maximum, median, and minimum whole body concentrations for each analyte by year for each site. We also compare data among sample sites in *Comparison Among Sites.* We include the raw data, presenting the mean value for duplicate sample results, and the laboratory report in Appendix D.

RESULTS

Greens Creek mean daily discharges three weeks prior to sampling in 2016 were lower than the previous 15 year average and the range of mean daily discharges three weeks prior to sampling was similar to the previous three years (USGS 2016; Figures 5, 6). The Natural Resources Conservation Service (USDA 2016) Alaska snow pack map suggests the remaining snow pack near Greens Creek Mine on May 1, 2016 was less than 50% of the 30-year median (1981–2010); peak snowmelt discharge in Greens Creek occurred between May 16 and May 18 (USGS 2016).

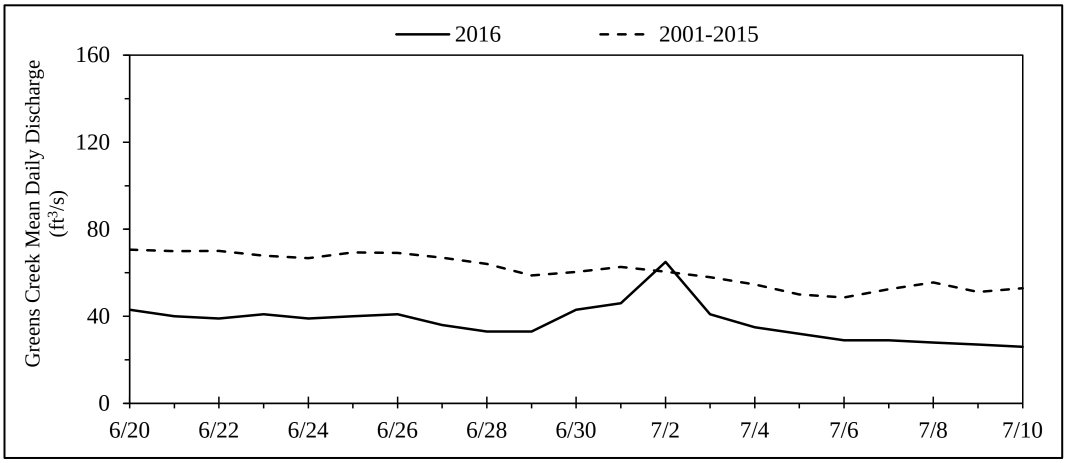

Figure 5.–Greens Creek mean daily discharge three weeks prior to sampling.
Source: USGS Gage 15101490 (USGS 2016).

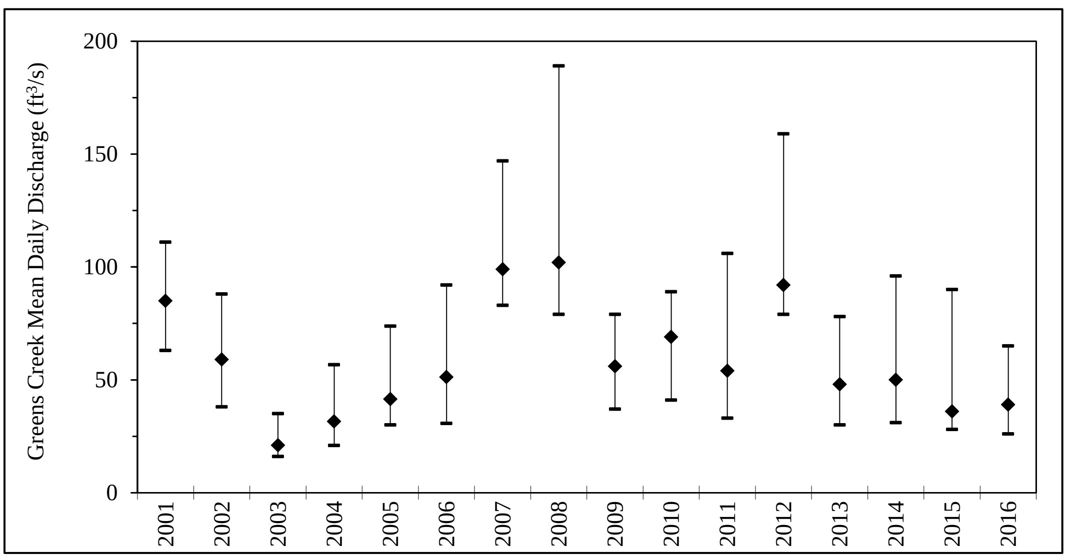

Figure 6.–Greens Creek mean daily discharges three weeks prior to sampling.
Note: Median, minimum, and maximum discharges presented.
Source: USGS Gage 15101490 (USGS 2016).

GREENS CREEK SITE 48

We sampled Greens Creek Site 48 on July 14, 2016. Hecla personnel recorded the following water quality data at 1500: water temperature 10.5 °C, conductivity 121.8 µS/cm, and pH 7.75 standard units. We estimated discharge was 21.8 ft^3/s at 1500, not including a shallow side channel on river right we estimated at less than 0.1 ft^3/s. The USGS stream gage, located downstream of Site 48 and Hecla's water withdrawal and 1350 Creek confluence, recorded 20.3 ft^3/s at 1600. We observed more stream flow through the river left side of the large woody debris jam than in previous years.

Periphyton: Chlorophyll Density and Composition

The 2016 mean chlorophyll *a* density was 4.03 mg/m^2, within the range observed since 2001, and the mean proportion of chlorophylls *a, b,* and *c* were similar to previous years (Figures 7, 8).

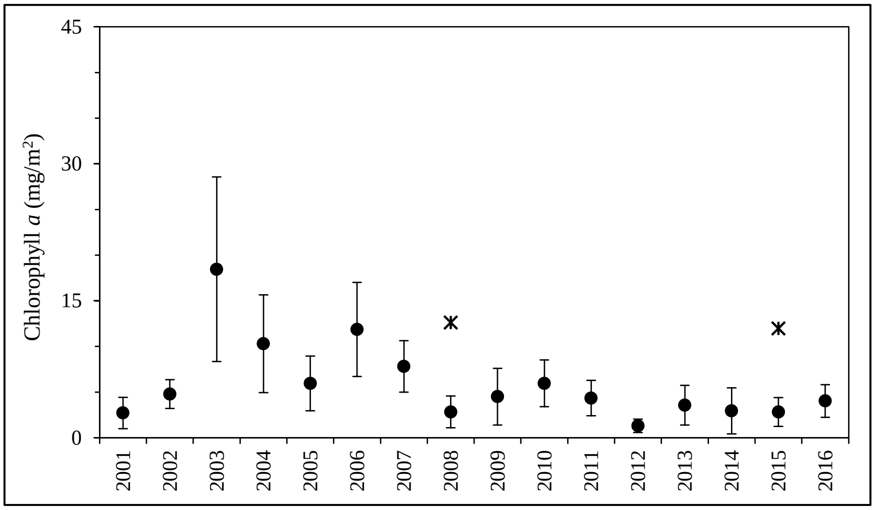

Figure 7.–Greens Creek Site 48 chlorophyll *a* densities.
Note: Mean density ± one SD, excluding potential outliers (∗).

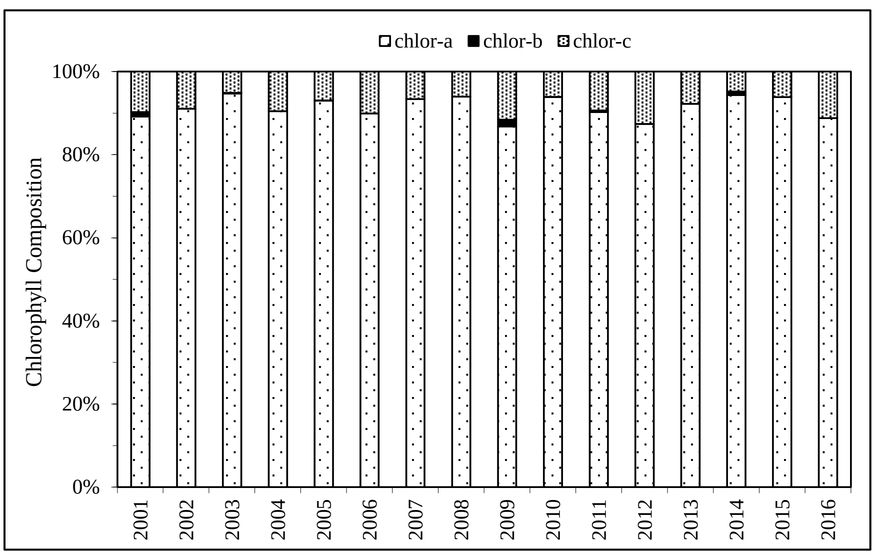

Figure 8.–Greens Creek Site 48 mean chlorophylls *a*, *b*, and *c* proportions.

Benthic Macroinvertebrate Density and Community Composition

Among the 2016 BMI samples, we counted 25 taxa and estimate density at 3,086 BMI/m^2, of which 82% were EPT insects (Figures 9, 10), similar to previous years. Dominant taxa were Ephemeroptera: *Epeorus* and *Drunella*, and Diptera: Chironomidae, representing 27%, 14%, and 14% of the samples.

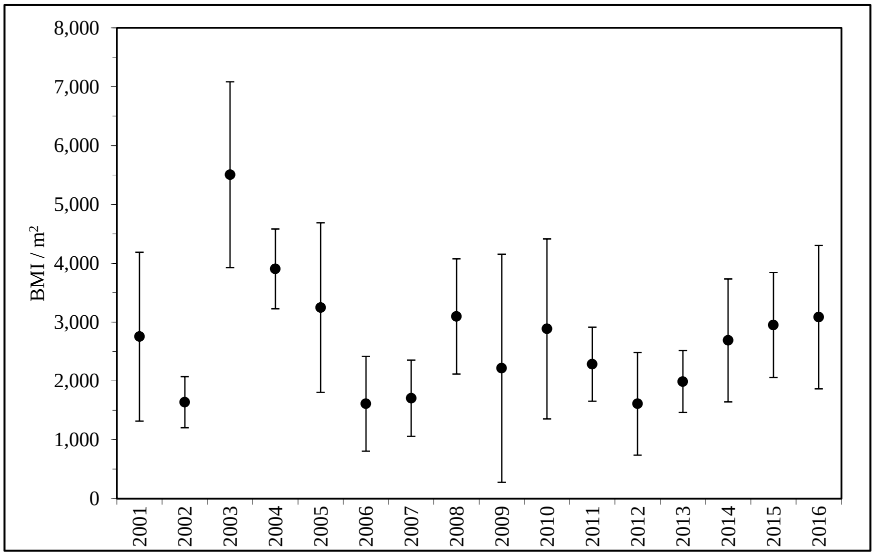

Figure 9.–Greens Creek Site 48 benthic macroinvertebrate densities. *Note:* Mean density ± one SD.

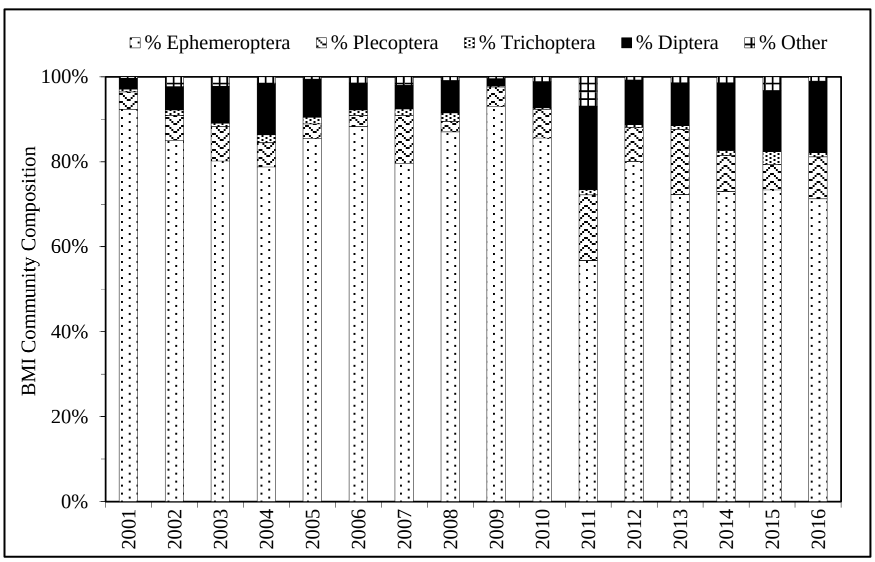

Figure 10.–Greens Creek Site 48 benthic macroinvertebrate community composition.

Juvenile Fish Populations and Fish Condition

We estimate the 2016 juvenile Dolly Varden char population at 156 ± 4 fish, within the range of previous estimates (Figure 11). Mean fish condition among the 153 Dolly Varden char we captured was 1.2. The length frequency diagram of captured Dolly Varden char suggests multiple age classes were present, as in most[n] years.

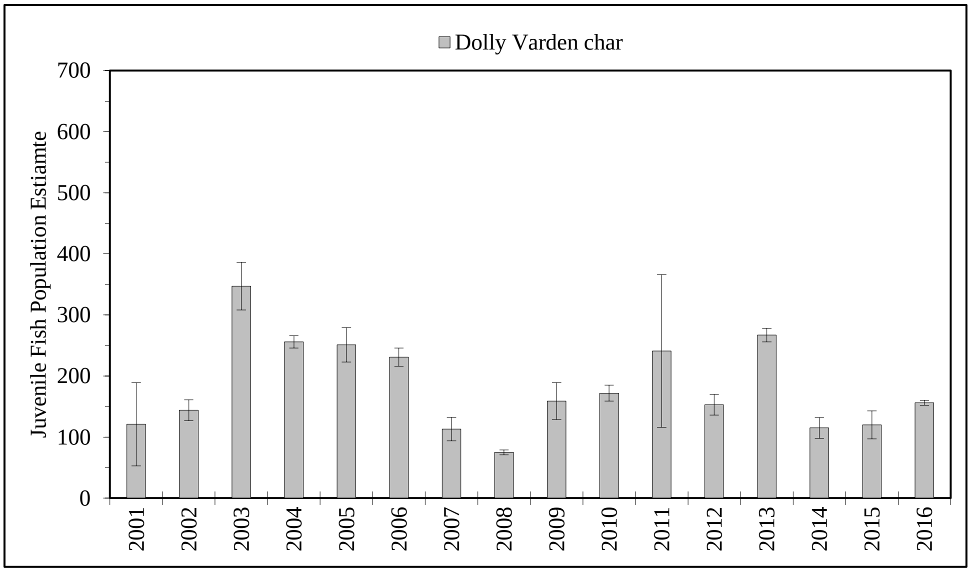

Figure 11.–Greens Creek Site 48 juvenile fish population estimates.

Juvenile Fish Metals Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2016 whole body juvenile Dolly Varden char samples were within the range of values observed since 2001 (Figure 12), and the 2016 median and maximum Se concentrations were the greatest observed.

[n] In 2008 and 2012 we did not capture young-of-year fry, which could have escaped the 6.35 mm mesh minnow traps.

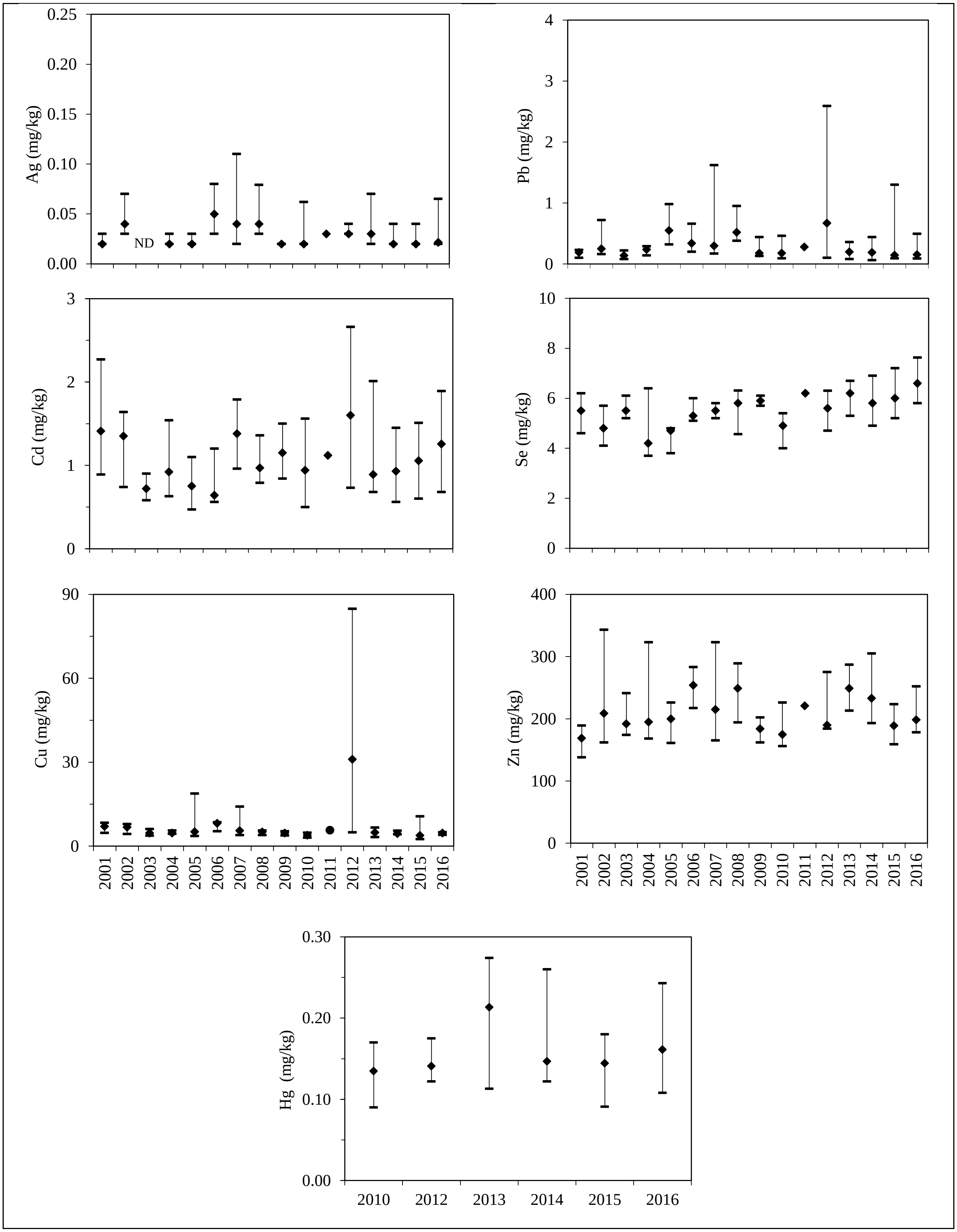

Figure 12.–Greens Creek Site 48 Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum whole body concentrations (mg/kg) presented.

GREENS CREEK SITE 54

We sampled Greens Creek Site 54 on July 12, 2016. Hecla personnel recorded the following water quality data at 1140: water temperature 10.6 °C, conductivity 124.8 µS/cm, and pH 8.03 standard units. We estimated discharge was 18 ft^3/s at 1530. The USGS stream gage, located 0.8 km upstream, recorded 21 ft^3/s at 1530. Compared to sampling last year, we observed more exposed gravel bars, the mouth of Gallagher Creek shifted upstream about 3 m, and Greens Creek shifted farther to river right at the lower end of the fish sample reach.

Periphyton: Chlorophyll Density and Composition

The 2016 mean chlorophyll *a* density was 3.20 mg/m^2, within the range observed since 2001, and the mean proportion of chlorophylls *a, b,* and *c* were similar to previous years (Figures 13, 14).

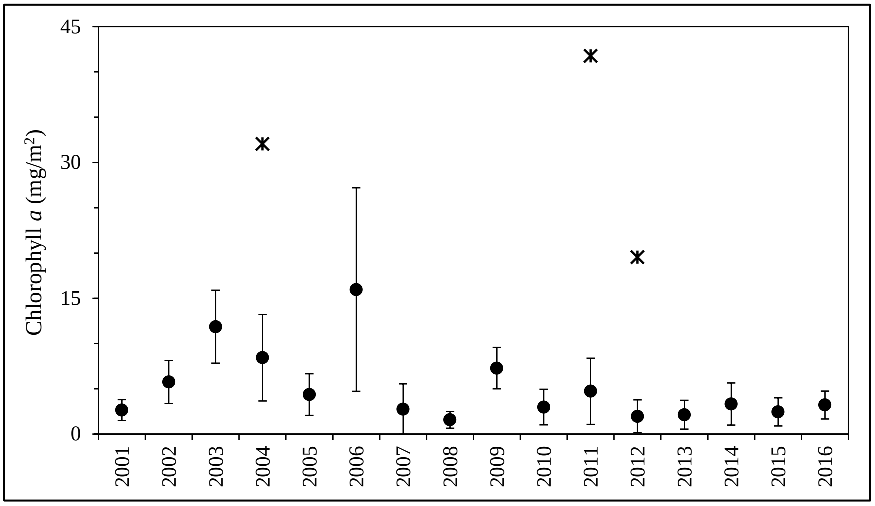

Figure 13.–Greens Creek Site 54 chlorophyll *a* densities.
Note: Mean density ± one SD, excludes potential outliers (∗).

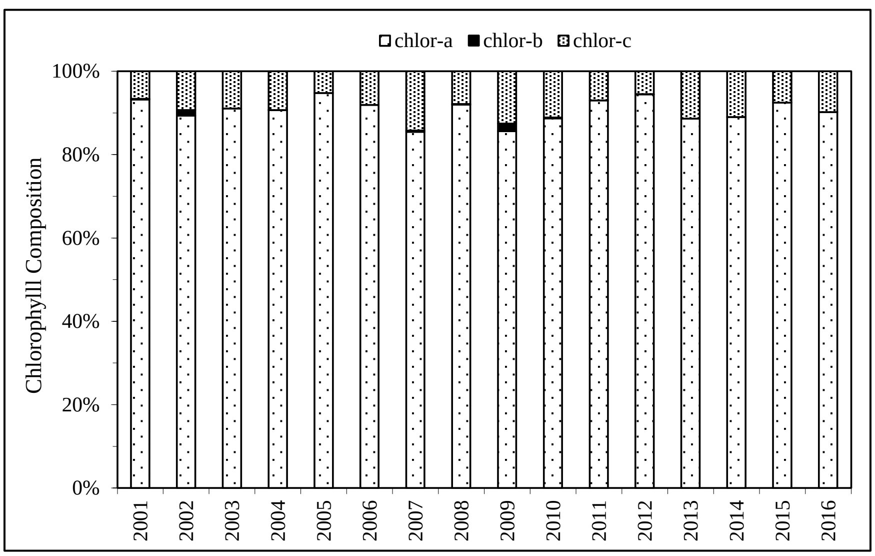

Figure 14.–Greens Creek Site 54 mean chlorophylls *a, b,* and *c* proportions.

Benthic Macroinvertebrate Density and Community Composition

Among the 2016 BMI samples, we counted 30 taxa and estimate density at 3,658 BMI/m^2, of which 91% were EPT insects (Figures 15, 16), similar to previous years. Dominant taxa were Ephemeroptera: *Drunella and Epeorus,* representing 25% and 23% of the samples.

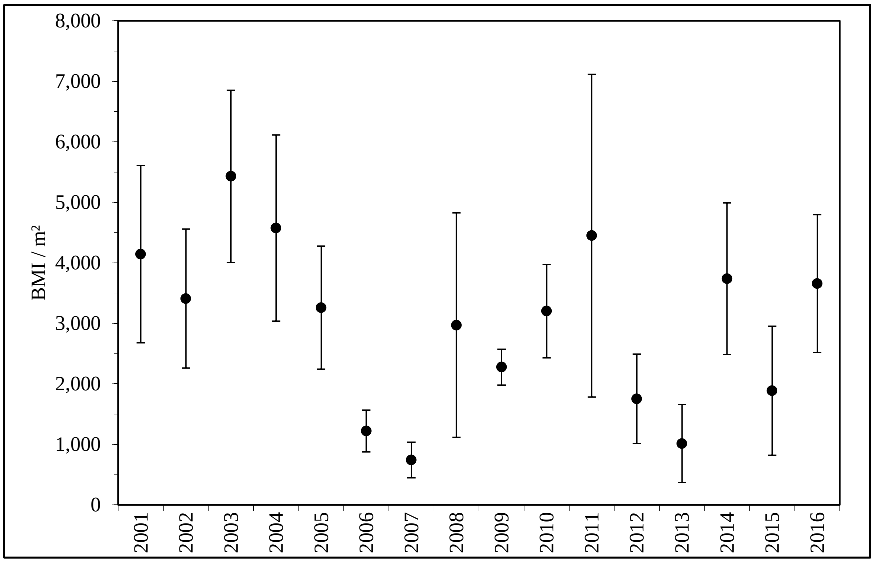

Figure 15.–Greens Creek Site 54 benthic macroinvertebrate densities. *Note:* Mean density ± one SD.

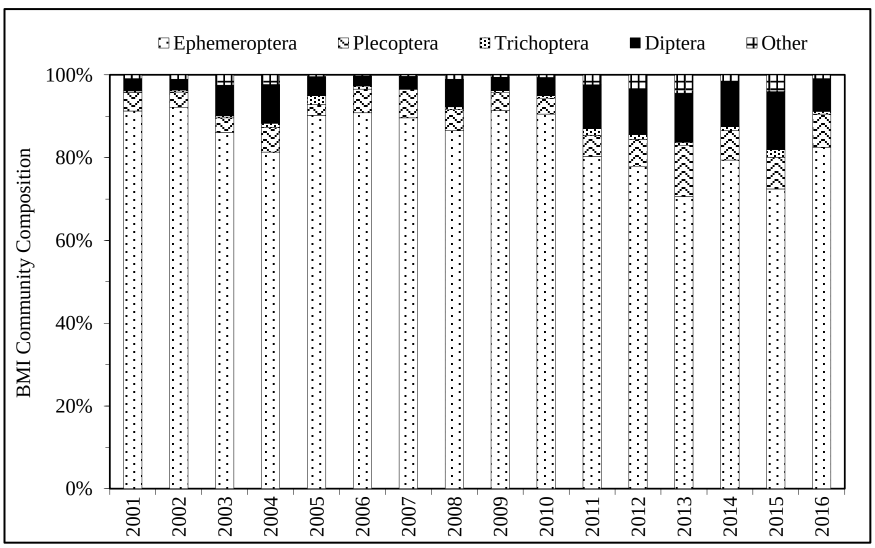

Figure 16.–Greens Creek Site 54 benthic macroinvertebrate community composition.

Juvenile Fish Populations and Fish Condition

We captured 119 Dolly Varden char and estimate the juvenile coho salmon population at 40 ± 13 fish (Figure 17). While carrying a bucket of captured fish during the first population study pass the biologist fell and about half of the fish escaped, negatively affecting the confidence interval for the 2016 Dolly Varden char population estimate. Therefore, we did not estimate the Dolly Varden char population and instead present the total number of fish captured.

Mean fish condition among the Dolly Varden char we captured was 1.1, and the length frequency diagram of Dolly Varden char suggests multiple age classes were present, as in previous years.

We captured 32 juvenile coho salmon, the greatest number since 2005. Mean fish condition was 1.2.

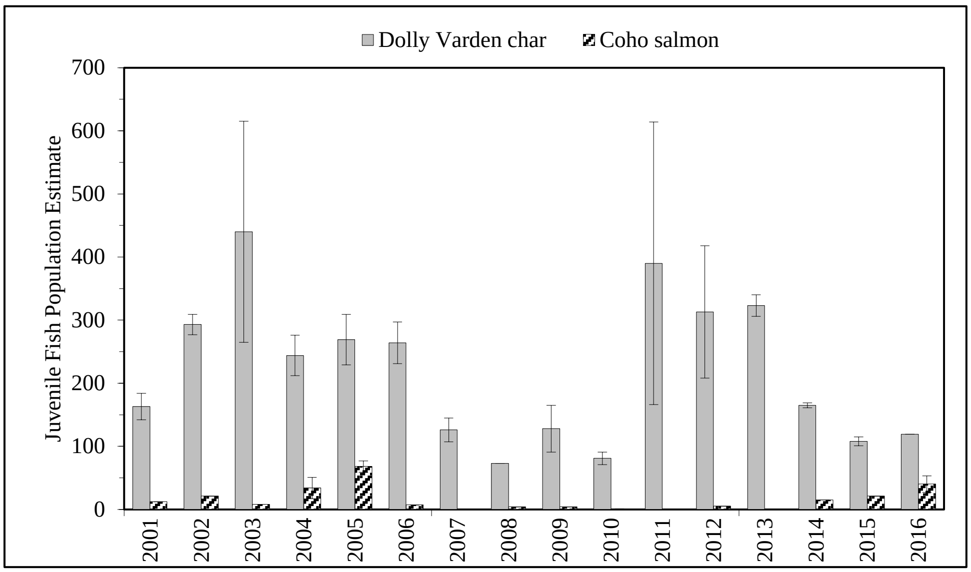

Figure 17.–Greens Creek Site 54 juvenile fish population estimates.
Note: 2001–2010 data from a 28 m reach, 2011–2016 data from a 50 m reach.

Juvenile Fish Metals Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2016 whole body juvenile Dolly Varden char samples were similar to values observed since 2001 (Figure 18).

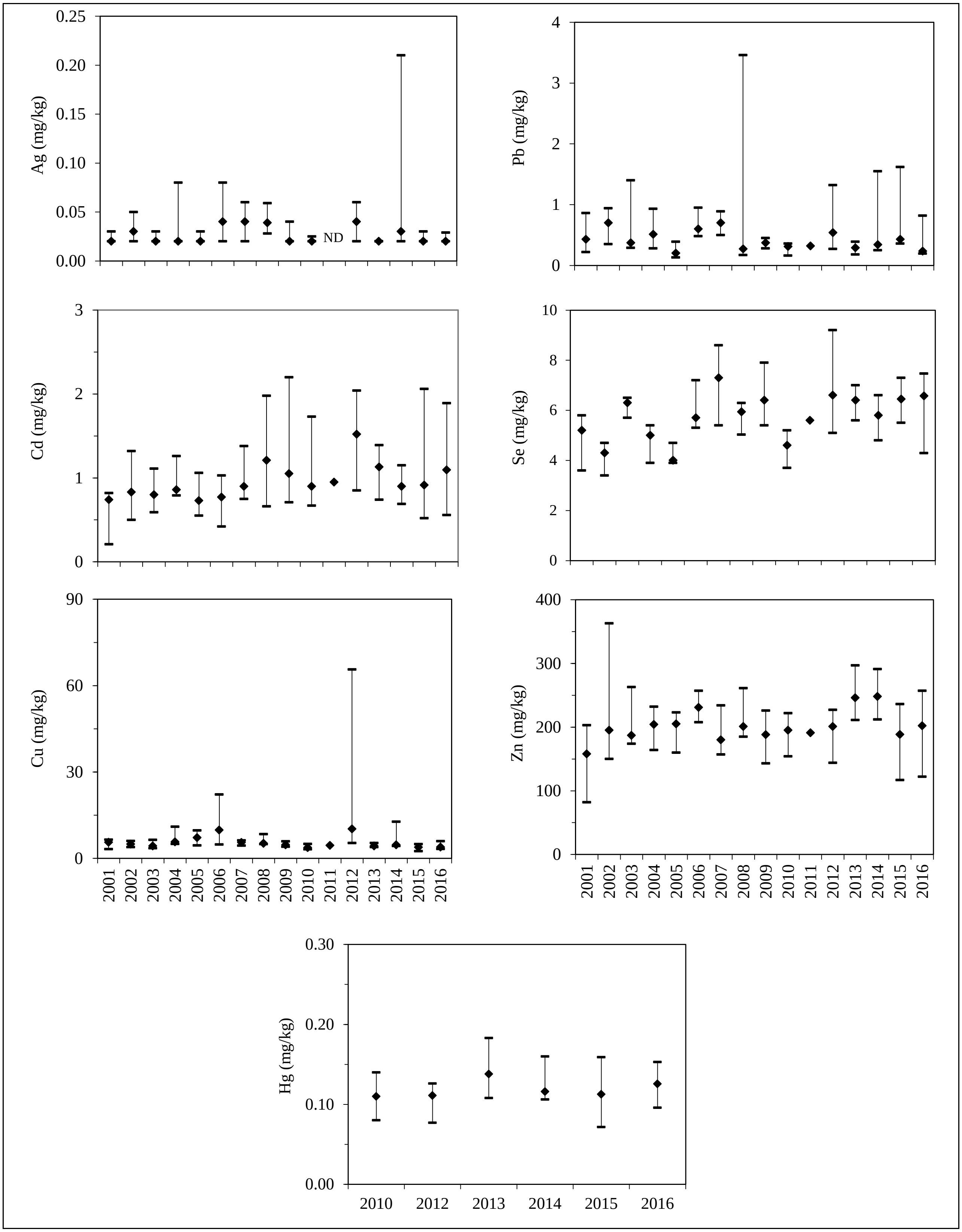

Figure 18.–Greens Creek Site 54 Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum whole body concentrations (mg/kg) presented.

TRIBUTARY CREEK SITE 9

We sampled Tributary Creek Site 9 on July 11, 2016. Hecla personnel recorded the following water quality data at 1430: water temperature 14.3 °C, conductivity 86.9 µS/cm, and pH 6.94 standard units. Water levels were too low to measure discharge, and we excavated streambed material to place minnow traps and create flowing channels for collecting benthic macroinvertebrates samples. In 2016, the lower end of the fish sample reach had more flow on river left and the beaver dam upstream of the sample reach was larger than in previous years.

Periphyton: Chlorophyll Density and Composition

The 2016 mean chlorophyll *a* density was 3.22 mg/m^2, similar to the mean 2014 value and the lowest value observed since 2001, and mean proportion of chlorophylls *a*, *b,* and *c* were similar to previous years (Figures 19, 20).

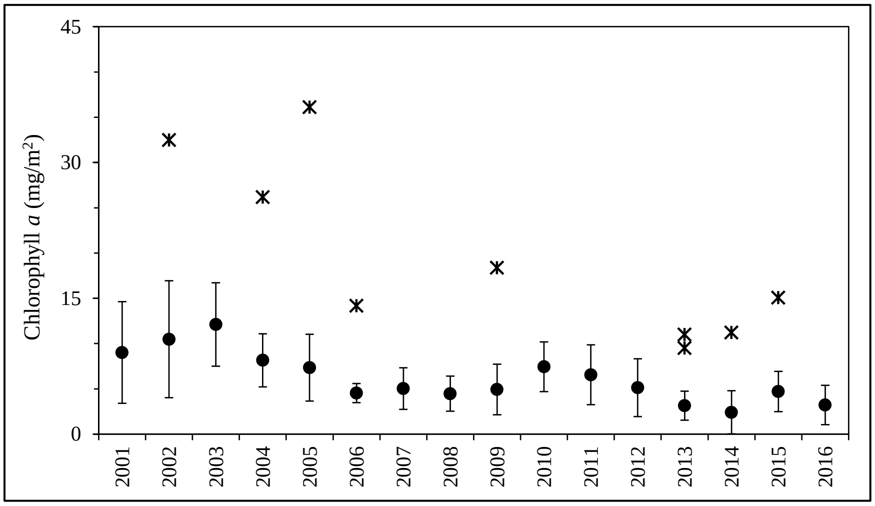

Figure 19.–Tributary Creek Site 9 chlorophyll *a* densities.
Note: Mean density ± one SD, excludes potential outliers (∗).

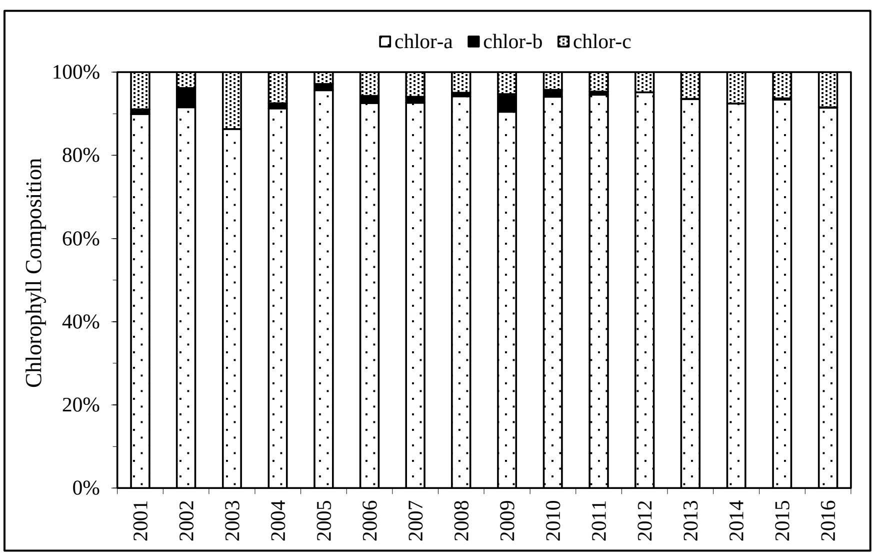

Figure 20.–Tributary Creek Site 9 mean chlorophylls *a*, *b,* and *c* proportions.

Benthic Macroinvertebrate Density and Community Composition

Among the 2016 BMI samples, we counted 29 taxa and estimate density at 5,602 BMI/m^2, similar to 2003 density (Figure 21). EPT insects accounted for 39% of the samples (Figure 22), the lowest observed, however this was due to more Diptera (e.g. flies and mosquitos) and Oligochaeta (worms) organisms present, not as a result of fewer EPT insects. Dominant taxa were and Diptera: Chironomidae and Oligochaeta, representing 29% and 16% of the samples.

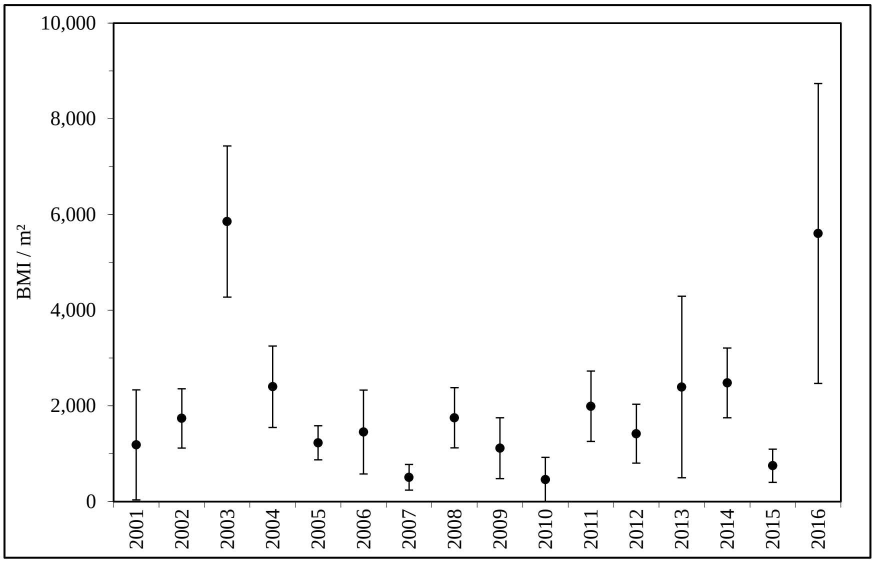

Figure 21.–Tributary Creek Site 9 benthic macroinvertebrate densities.
Note: Mean density ± one SD.

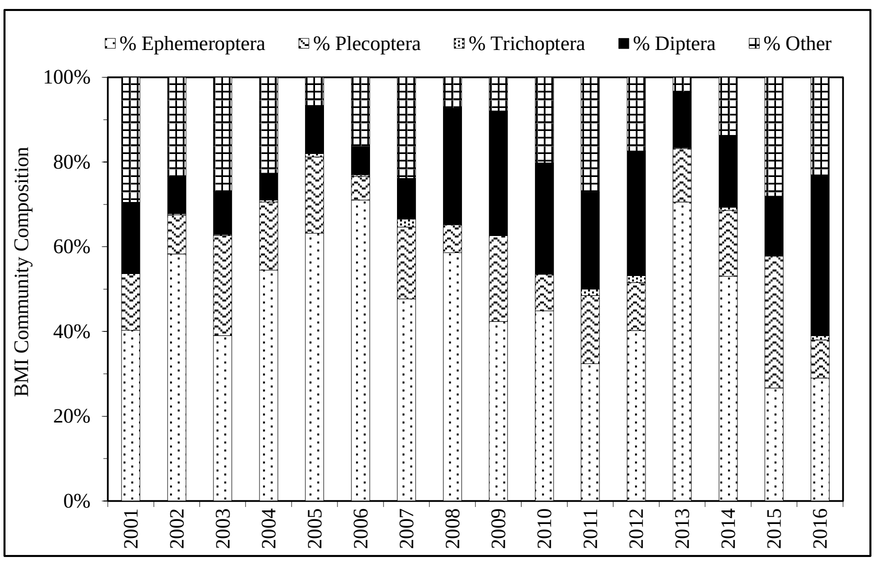

Figure 22.–Tributary Creek Site 9 benthic macroinvertebrate community composition.

Juvenile Fish Populations and Fish Condition

We captured 20 Dolly Varden char, similar to catches the previous three years (Figure 23). Mean fish condition was 1.1.

We estimate the 2016 juvenile coho salmon population at 88 fish, within the range observed since 2001 (Figure 23). Mean fish condition was 1.3 and the length frequency diagram suggests two age classes were present.

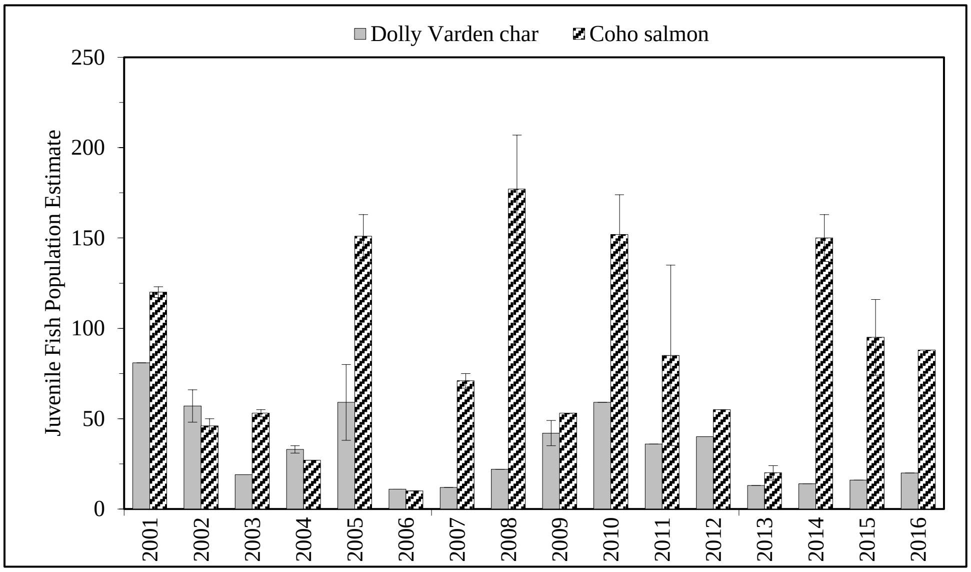

Figure 23.–Tributary Creek Site 9 juvenile fish population estimates.

Juvenile Fish Metals Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2016 whole body juvenile Dolly Varden char samples were similar to values observed since 2001 (Figure 24).

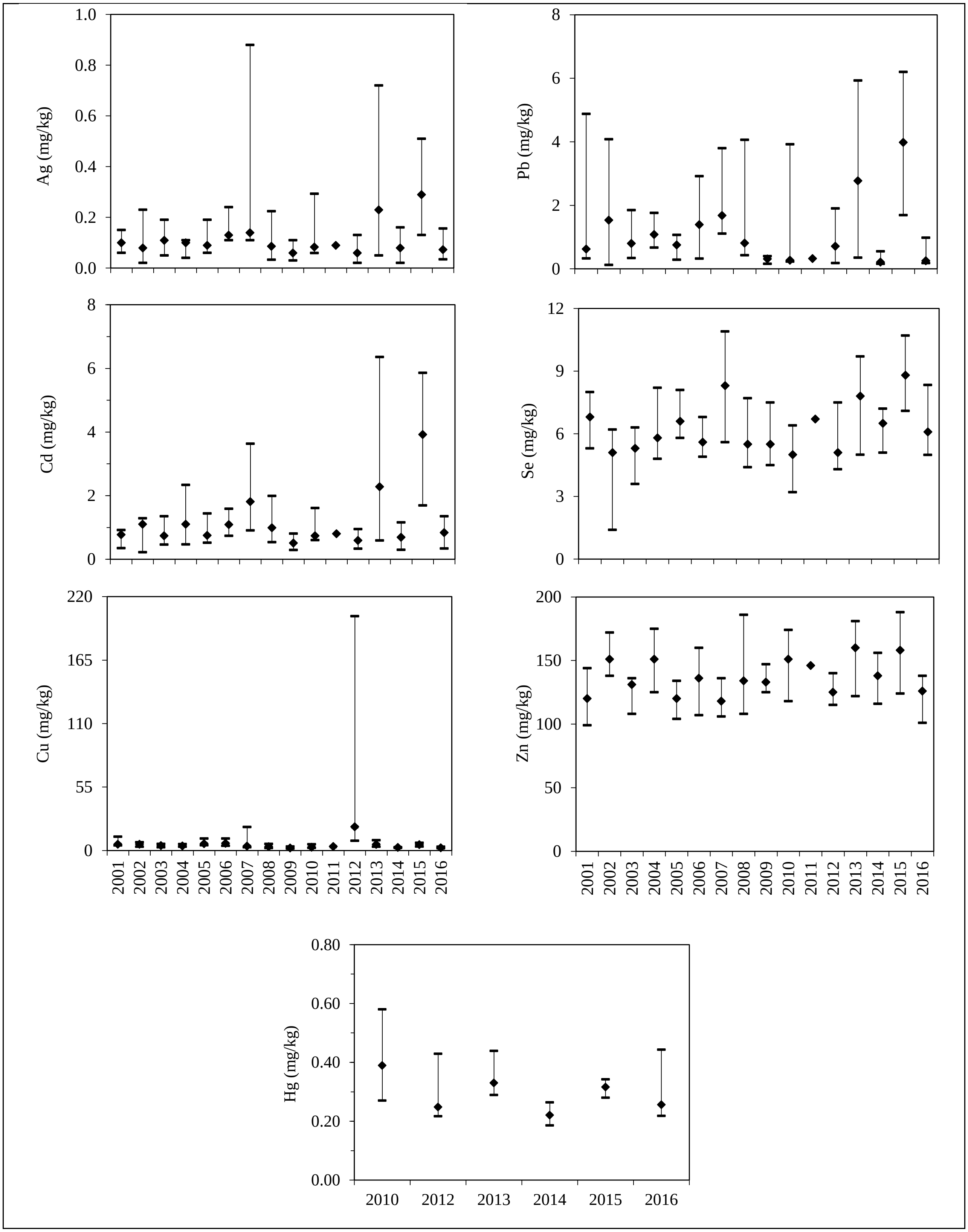

Figure 24.–Tributary Creek Site 9 Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum whole body concentrations (mg/kg) presented.

COMPARISONS AMONG GREENS CREEK SITES

Periphyton: Chlorophyll Density and Composition

Chlorophyll *a* densities among the 2016 samples from Site 48 and Site 54 were not significantly different. Mean chlorophyll *a* densities at Site 48 and Site 54 generally followed a similar trend 2001–2016 (Figure 25), with peak densities observed in 2003, 2004, and 2006. Greens Creek discharges were low prior to sampling in 2003 and 2004 possibly contributing to greater chlorophyll *a* densities those years, while greater discharges during 2007, 2008, and 2012 may explain the lower chlorophyll *a* densities observed those years.

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

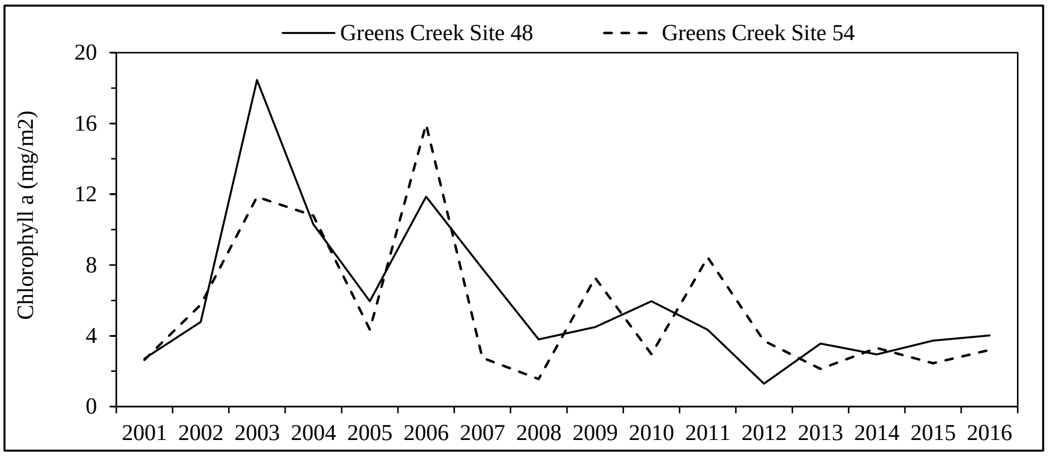

Figure 25.–Greens Creek chlorophyll *a* density comparison.

Benthic Macroinvertebrate Density and Community Composition

Benthic macroinvertebrate density (Figure 26) and taxonomic richness (Figure 27) among samples collected at Site 48 and Site 54 generally follow a similar trend, and EPT insects comprise more than 80% of samples[o].

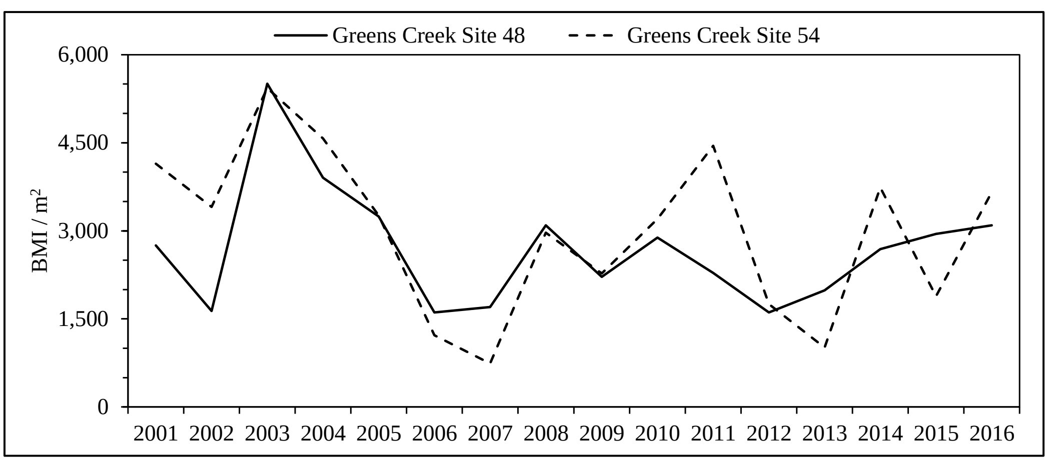

Figure 26.–Greens Creek benthic macroinvertebrate density comparison.

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[o] The one exception was Site 48 with 73% EPT in 2011.

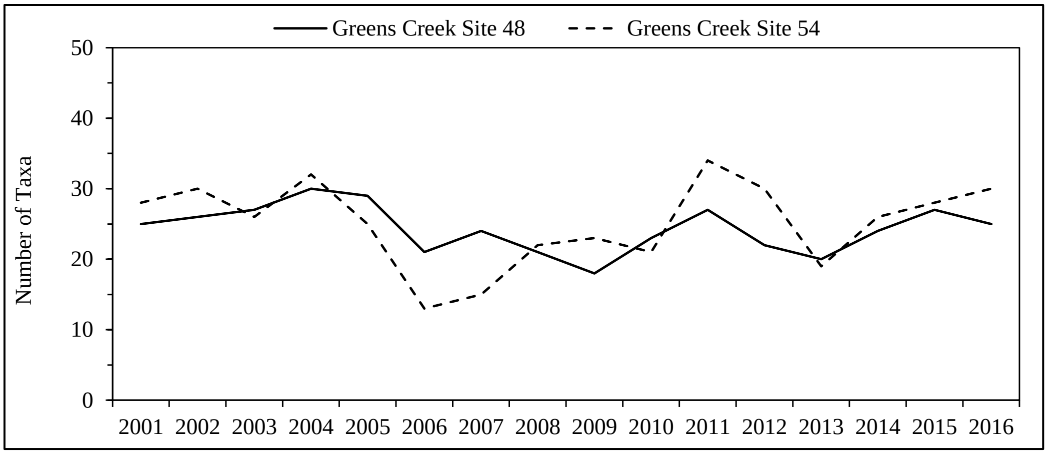

Figure 27.–Greens Creek BMI taxa richness comparison.

Juvenile Fish Populations and Fish Condition

We cannot statistically compare the 2016 Site 54 and Site 48 juvenile Dolly Varden char populations because we were unable to estimate the Site 54 population. Population estimates among sites followed a similar trend from 2001 to 2015 (Figure 28). We captured several age classes of Dolly Varden char at both sites most years, and mean fish condition was similar among sites each year, about 1.0.

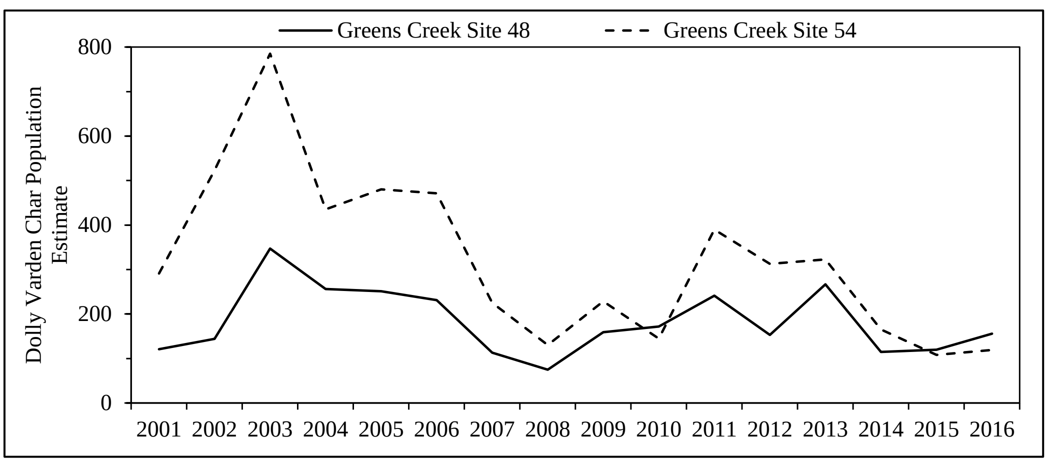

Figure 28.–Greens Creek Dolly Varden char population estimates.
Note: Site 54 2001–2010 data extrapolated to 50 m sample reach for comparison.

Juvenile Fish Metals Concentrations

Comparing the 2016 Greens Creek juvenile Dolly Varden char whole body metals data, the mean ranks for Hg and Pb concentrations were significantly different.

COMPARISONS AMONG SITES

Juvenile Fish Metals Concentrations

Comparing the 2016 Greens Creek and Tributary Creek Dolly Varden char metals data (Figure 29):

- The Site 9 mean ranks for Ag, Cu, Hg, and Zn concentrations were significantly different than the mean ranks for Site 48 and Site 54;
- The Site 9 mean rank for Cd concentration was significantly different than the mean rank for Site 48; and
- The Site 48 mean rank for Pb concentration was significantly different than the mean ranks for Site 54 and Site 9.

The 2016 results were within the range of values reported for reference and exploration sites elsewhere in Alaska (Legere and Timothy 2016).

Since 2001, Tributary Creek Site 9 whole body Dolly Varden char samples had greater concentrations and variability than the Greens Creek samples, except Cu and Zn which were generally greater at Site 48 (Figure 30).

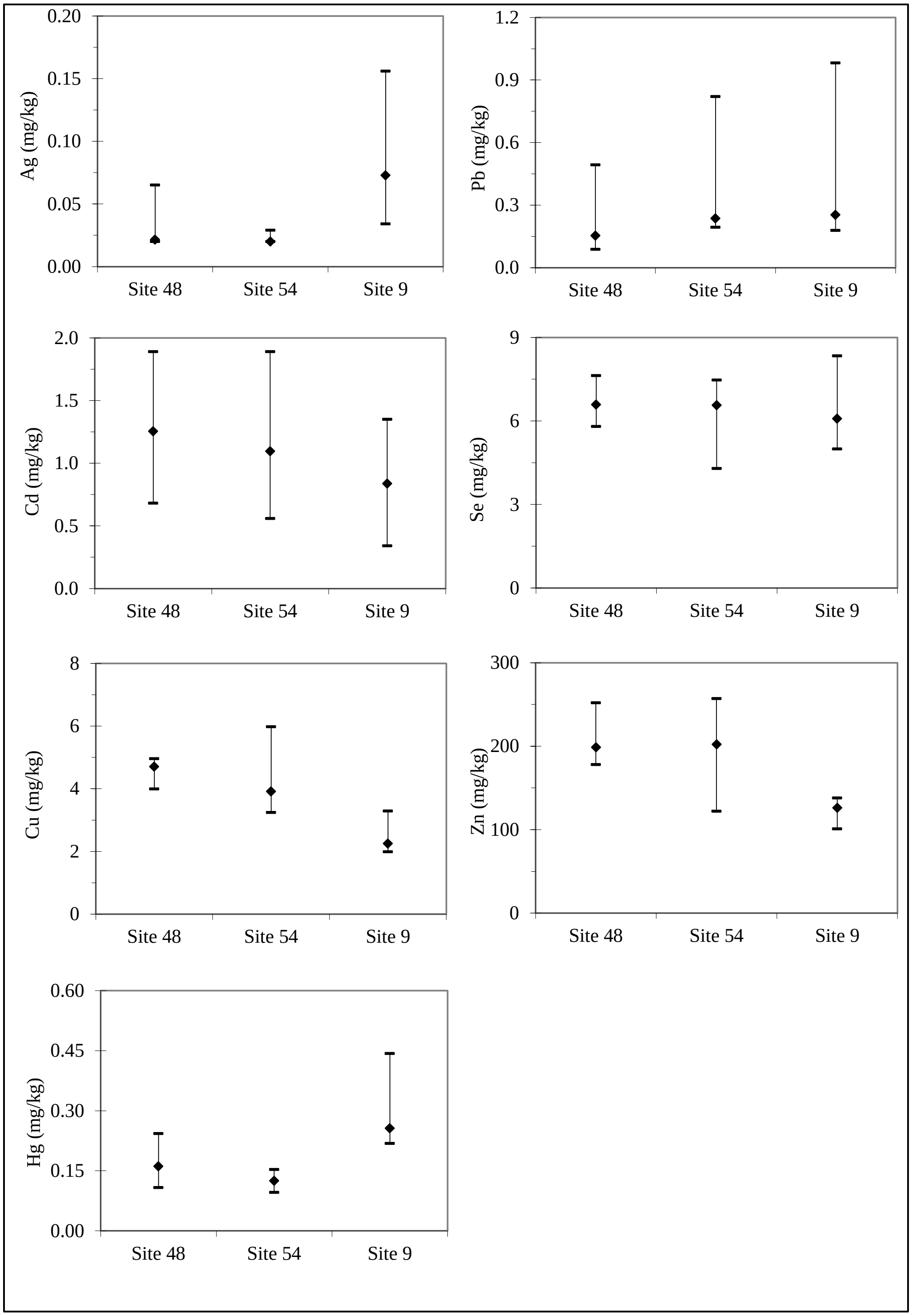

Figure 29.–2016 Greens Creek and Tributary Creek Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum whole body concentrations (mg/kg) presented.

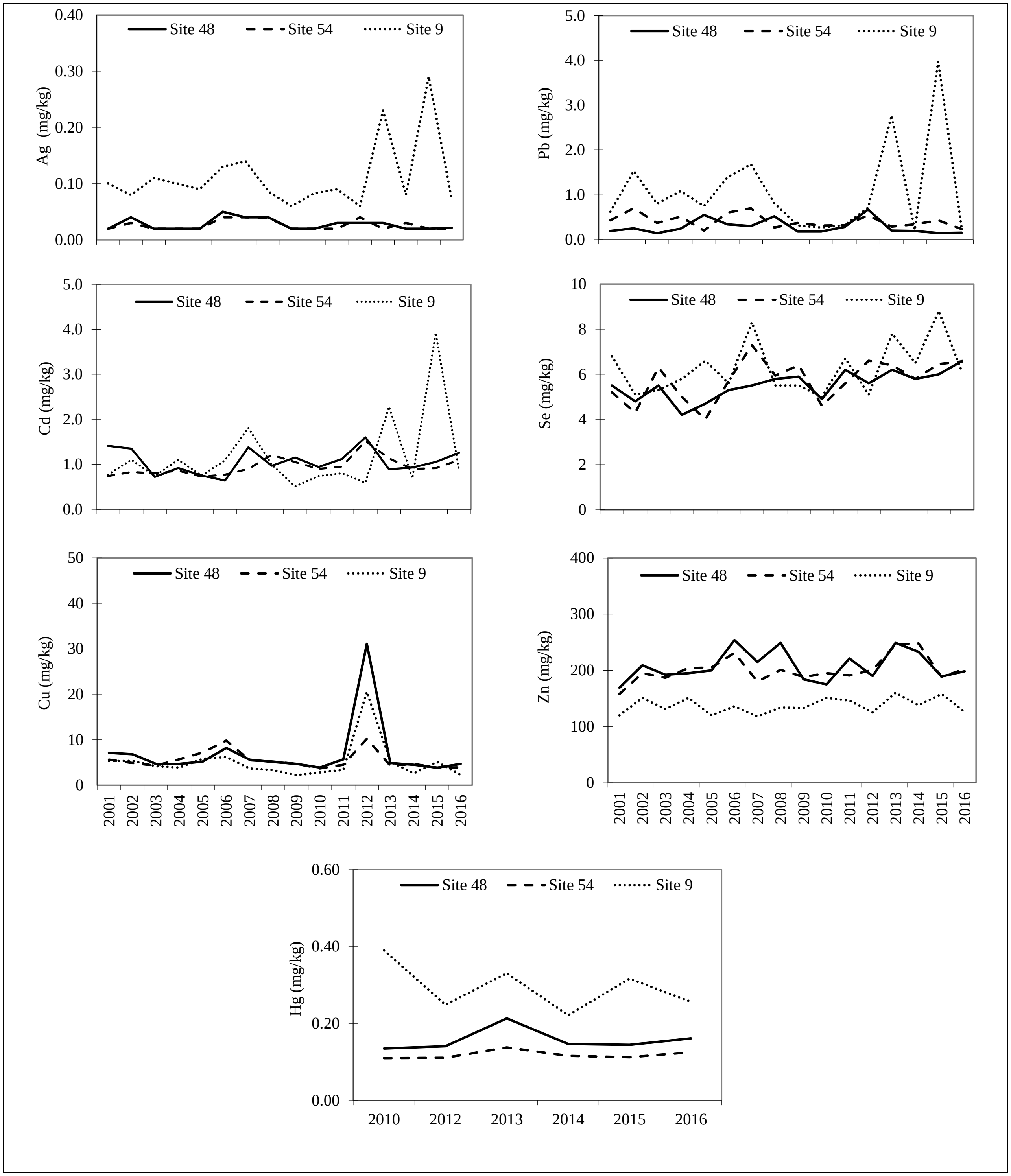

Figure 30.–Greens Creek and Tributary Creek Dolly Varden char median metals concentrations.

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APPENDIX A: PERIPHYTON DATA

Appendix A.1.–Greens Creek Site 48 chlorophylls *a*, *b*, and *c* densities, 2001–2016.

	2001			**2002**			**2003**			**2004**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2005			**2006**			**2007**			**2008**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2009			**2010**			**2011**			**2012**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

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Appendix A.1.–Page 2 of 2.

	2013			**2014**			**2015**			**2016**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	2.03	0.00	0.12	4.81	0.00	0.31	2.14	0.00	0.18	4.38	0.00	0.60
	1.50	0.00	0.11	0.60	0.00	0.12	11.96	0.00	0.90	3.84	0.00	0.43
	4.59	0.00	0.33	1.60	0.00	0.10	4.70	0.00	0.31	7.58	0.00	0.88
	2.03	0.00	0.19	6.62	0.00	0.00	3.31	0.00	0.24	6.51	0.00	0.75
	6.94	0.00	0.38	---	---	---	5.55	0.00	0.25	2.24	0.00	0.26
	6.62	0.00	0.39	5.66	0.00	0.33	2.46	0.00	0.18	2.99	0.00	0.47
	1.60	0.00	0.26	0.55	0.00	0.02	1.38	0.00	0.08	3.20	0.00	0.45
	1.39	0.00	0.07	0.43	0.00	0.07	2.35	0.00	0.05	2.35	0.00	0.31
	3.74	0.00	0.46	1.24	0.00	0.03	2.99	0.00	0.22	2.67	0.00	0.31
	5.23	0.00	0.70	5.02	0.24	0.38	0.43	0.00	0.03	4.49	0.00	0.61
mean	3.57	0.00	0.30	2.95	0.03	0.15	3.73	0.00	0.24	4.03	0.00	0.51
median	2.88	0.00	0.29	1.60	0.00	0.10	2.72	0.00	0.20	3.52	0.00	0.46
max	6.94	0.00	0.70	6.62	0.24	0.38	11.96	0.00	0.90	7.58	0.00	0.88
min	1.39	0.00	0.07	0.43	0.00	0.00	0.43	0.00	0.03	2.24	0.00	0.26

Note: Bolded values are the spectrophotometer estimated detection limit, chlorophyll a not detected.

Appendix A.2.–Greens Creek Site 54 chlorophylls *a*, *b*, and *c* densities, 2001–2016.

	2001			**2002**			**2003**			**2004**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2005			**2006**			**2007**			**2008**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2009			**2010**			**2011**			**2012**		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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
	---	---	---	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	0.12	0.94	2.97	0.01	0.37	8.43	0.00	0.64	3.71	0.00	0.22
median	7.58	0.11	0.96	2.41	0.00	0.27	4.33	0.00	0.39	1.50	0.00	0.10
max	11.32	0.20	1.57	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

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	2013			2014			2015			2016		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	2.56	0.00	0.26	6.51	0.00	0.60	1.07	0.00	0.13	2.46	0.00	0.19
	2.14	0.00	0.23	4.91	0.00	0.92	1.60	0.00	0.23	3.42	0.00	0.36
	1.28	0.00	0.24	4.59	0.00	0.42	1.82	0.00	0.21	5.66	0.00	0.87
	2.14	0.00	0.37	1.82	0.00	0.11	4.27	0.00	0.34	1.17	0.00	0.11
	0.53	0.00	0.02	7.05	0.00	0.56	6.09	0.00	0.43	1.92	0.00	0.17
	0.43	0.00	0.07	2.67	0.00	0.45	2.46	0.00	0.15	5.77	0.00	0.57
	---	---	---	1.50	0.00	0.17	2.24	0.00	0.16	2.24	0.00	0.27
	2.03	0.00	0.28	2.46	0.00	0.20	1.92	0.00	0.10	2.14	0.00	0.12
	5.87	0.00	0.76	**0.05**	---	---	1.33	0.00	0.08	3.52	0.00	0.45
	2.14	0.00	0.21	1.60	0.00	0.26	1.71	0.00	0.15	3.74	0.00	0.36
mean	2.12	0.00	0.27	3.32	0.00	0.41	2.45	0.00	0.20	3.20	0.00	0.35
median	2.14	0.00	0.24	2.56	0.00	0.42	1.87	0.00	0.16	2.94	0.00	0.31
max	5.87	0.00	0.76	7.05	0.00	0.92	6.09	0.00	0.43	5.77	0.00	0.87
min	0.43	0.00	0.02	0.05	0.00	0.11	1.07	0.00	0.08	1.17	0.00	0.11

Note: Bolded values are the spectrophotometer estimated detection limit, chlorophyll a not detected.

Appendix A.3.–Tributary Creek Site 9 chlorophylls *a*, *b*, and *c* densities, 2001–2016.

	2001			2002			2003			2004		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2005			2006			2007			2008		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

	2009			2010			2011			2012		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	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

continued-

	2013			2014			2015			2016		
mg/m²	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*	chlor-*a*	chlor-*b*	chlor-*c*
	11.00	0.00	0.64	---	---	---	5.13	0.00	0.33	5.66	0.00	0.35
	2.88	0.00	0.19	11.21	0.00	0.63	15.06	0.00	0.94	2.24	0.00	0.13
	5.45	0.00	0.40	1.60	0.00	0.17	2.67	0.00	0.14	1.88	0.00	0.21
	5.02	0.00	0.40	5.87	0.00	0.37	3.63	0.00	0.09	1.82	0.00	0.22
	2.24	0.00	0.15	5.98	0.00	0.60	5.55	0.00	0.47	7.80	0.00	0.90
	2.99	0.00	0.17	0.75	0.00	0.06	2.56	0.00	0.11	1.92	0.00	0.26
	9.51	0.00	0.66	1.71	0.00	0.15	2.88	0.21	0.10	1.33	0.00	0.08
	0.32	0.05	0.15	**0.05**	---	---	9.29	0.00	0.87	1.55	0.03	0.16
	3.52	0.00	0.19	0.11	0.00	0.00	6.62	0.00	0.52	3.10	0.00	0.21
	2.78	0.00	0.17	3.20	0.00	0.23	4.06	0.00	0.30	4.91	0.00	0.46
mean	4.57	0.00	0.31	3.39	0.00	0.28	5.75	0.02	0.39	3.22	0.00	0.30
median	3.26	0.00	0.19	1.71	0.00	0.20	4.59	0.00	0.32	2.08	0.00	0.22
max	11.00	0.05	0.66	11.21	0.00	0.63	15.06	0.21	0.94	7.80	0.03	0.90
min	0.32	0.00	0.15	0.05	0.00	0.00	2.56	0.00	0.09	1.33	0.00	0.08

Note: Bolded values are the spectrophotometer estimated detection limit, chlorophyll a not detected.

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–BMI data summary for Greens Creek Site 48, 2001–2016.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total BMI Taxa	25	26	27	30	29	21	24	21	18	23	27	22	20	24	27	25
Mean BMI Taxa/Sample	12	13	18	19	16	11	13	13	10	15	17	13	12	13	17	13
Total Ephemeroptera Taxa	6	6	7	6	6	6	7	6	7	7	7	7	7	7	8	8
Total Plecoptera Taxa	7	11	6	9	8	4	5	3	5	6	7	7	5	6	6	5
Total Trichoptera Taxa	2	2	4	2	4	2	1	2	1	1	2	2	1	1	2	2
Total Counts																
Ephemeroptera	1,094	599	1,897	1,034	902	495	428	887	852	937	558	555	618	844	1,488	1,520
Plecoptera	49	41	191	74	36	10	75	20	40	81	151	55	131	98	122	209
Trichoptera	7	9	20	22	15	7	8	24	1	4	12	5	8	14	62	14
Aquatic Diptera	31	39	206	169	101	38	34	79	15	71	193	73	86	184	291	352
Other	3	16	53	25	5	10	15	11	2	8	68	5	12	16	65	28
% Ephemeroptera	92%	85%	80%	79%	86%	88%	80%	87%	93%	86%	57%	80%	72%	73%	73%	72%
% Plecoptera	4%	6%	8%	6%	3%	3%	11%	2%	5%	7%	15%	8%	15%	8%	6%	10%
% Trichoptera	1%	1%	1%	2%	2%	1%	2%	2%	0%	0%	1%	1%	1%	1%	3%	1%
% Aquatic Diptera	3%	6%	9%	12%	9%	6%	6%	8%	2%	6%	20%	11%	10%	16%	14%	17%
% Other	0%	2%	2%	2%	1%	1%	2%	1%	0%	1%	7%	1%	1%	1%	3%	1%
% EPT	97%	92%	89%	86%	90%	92%	92%	92%	98%	93%	73%	89%	89%	83%	82%	82%
% Chironomidae	1%	4%	7%	11%	8%	3%	4%	6%	1%	5%	17%	9%	9%	15%	9%	14%
% Dominant Taxon	41%	35%	30%	28%	30%	37%	36%	58%	46%	31%	21%	37%	25%	31%	28%	27%
Total Terrestrial Invertebrates	0	4	5	1	24	5	2	8	2	11	4	0	14	32	6	4
Total BMI	1,184	704	2,367	1,679	1,396	693	733	1,331	953	1,240	982	693	855	1,156	2,028	2,123
Total Invertebrates	1,184	708	2,372	1,680	1,420	698	735	1,339	955	1,251	986	693	869	1,188	2,034	2,127
% Sample Aquatic	100%	99%	99.8%	99.9%	98%	99%	99.7%	99%	99.8%	99%	99.6%	100%	98%	97%	99.7%	99.8%
% Sample Terrestrial	0%	1%	0.2%	0.1%	2%	1%	0.3%	1%	0.2%	1%	0.4%	0%	2%	3%	0.3%	0.2%
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	0.69
Number ofTotal Invertebrates / 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	3,092
Number of BMI / 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	3,086
± 1 SD	1,435	434	1,579	677	1,441	807	648	980	1,939	1,530	630	872	526	1,043	892	1,219

Appendix B.2.–BMI data summary for Greens Creek Site 54, 2001–2016.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total BMI Taxa	28	30	26	32	25	13	15	22	23	21	34	30	19	26	28	30
Mean BMI Taxa/Sample	15	14	16	19	15	9	8	14	13	13	18	14	9	11	14	15
Total Ephemeroptera Taxa	7	6	7	6	8	5	6	8	7	6	8	7	5	7	7	8
Total Plecoptera Taxa	7	7	7	10	7	3	4	4	7	5	7	10	6	7	6	6
Total Trichoptera Taxa	2	2	1	3	3	2	0	2	2	2	5	4	1	3	2	3
Total Counts																
Ephemeroptera	1,627	1,352	2,011	1,601	1,265	477	286	1,105	895	1,247	1,536	591	308	1,277	941	2,072
Plecoptera	80	54	82	117	37	30	22	65	43	53	96	49	54	109	99	204
Trichoptera	7	6	12	19	31	4	0	9	4	8	32	9	3	15	24	18
Aquatic Diptera	53	39	173	184	65	13	10	85	32	61	203	81	52	177	182	201
Other	15	15	57	46	4	1	1	13	5	8	46	24	19	24	52	22
% Ephemeroptera	91%	92%	86%	81%	90%	91%	90%	87%	91%	91%	80%	78%	71%	80%	72%	82%
% Plecoptera	4%	4%	4%	6%	3%	6%	7%	5%	4%	4%	5%	6%	12%	7%	8%	8%
% Trichoptera	0%	0%	1%	1%	2%	1%	0%	1%	0%	1%	2%	1%	1%	1%	2%	1%
% Aquatic Diptera	3%	3%	7%	9%	5%	2%	3%	7%	3%	4%	11%	11%	12%	11%	14%	8%
% Other	1%	1%	2%	2%	0%	0%	0%	1%	1%	1%	2%	4%	4%	1%	4%	1%
% EPT	96%	96%	90%	88%	95%	97%	97%	92%	96%	95%	87%	86%	84%	87%	82%	91%
% Chironomidae	2%	2%	6%	8%	4%	2%	2%	5%	2%	3%	9%	9%	10%	10%	11%	6%
% Dominant Taxon	52%	43%	40%	38%	40%	31%	34%	53%	40%	35%	43%	30%	30%	35%	32%	25%
Total Terrestrial Invertebrates	0	4	7	1	3	1	6	1	8	9	14	5	8	12	6	3
Total BMI	1,782	1,466	2,335	1,967	1,402	525	319	1,277	979	1,377	1,913	754	436	1,607	1,298	2,517
Total Invertebrates	1,782	1,470	2,342	1,968	1,405	526	325	1,278	987	1,386	1,927	759	444	1,619	1,304	2,520
% Sample Aquatic	100%	99.7%	99.7%	99.9%	99.8%	99.8%	98%	100%	99%	99%	99%	99.6%	98%	99%	99.5%	99.9%
% Sample Terrestrial	0%	0.3%	0.3%	0.1%	0.2%	0.2%	2%	0%	1%	1%	1%	0.4%	2%	1%	0.5%	0.1%
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	0.69
Number ofTotal Invertebrates / 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	3,663
Number of BMI / 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	3,658
± 1 SD	1,464	1,148	1,422	1,540	1,016	345	293	1,855	297	772	2,668	738	642	1,253	1,065	1,139

Appendix B.3.–BMI data summary for Tributary Creek Site 9, 2001–2016.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total BMI Taxa	21	24	36	26	30	23	21	20	26	22	26	27	20	22	23	29
Mean BMI Taxa/Sample	14	15	21	14	14	11	10	14	13	10	12	15	11	12	11	18
Total Ephemeroptera Taxa	6	7	8	5	9	7	5	7	8	7	6	5	7	6	6	7
Total Plecoptera Taxa	5	5	5	6	5	2	3	4	5	5	6	6	4	3	6	4
Total Trichoptera Taxa	0	2	3	3	4	1	2	1	0	0	2	3	1	3	0	5
Total Counts																
Ephemeroptera	205	436	981	562	334	444	104	441	203	89	277	245	726	565	137	1,128
Plecoptera	68	69	593	166	95	35	37	50	97	17	138	69	130	166	160	359
Trichoptera	0	2	7	5	4	2	4	1	0	0	13	10	2	8	0	22
Aquatic Diptera	86	66	256	66	60	42	21	206	141	52	196	179	135	181	73	1449
Other	150	175	679	233	35	102	52	55	38	40	232	106	36	146	145	896
% Ephemeroptera	40%	58%	39%	54%	63%	71%	48%	59%	42%	45%	32%	40%	71%	53%	27%	29%
% Plecoptera	13%	9%	24%	16%	18%	6%	17%	7%	20%	9%	16%	11%	13%	16%	31%	9%
% Trichoptera	0%	0%	0%	0%	1%	0%	2%	0%	0%	0%	2%	2%	0%	1%	0%	1%
% Aquatic Diptera	17%	9%	10%	6%	11%	7%	10%	27%	29%	26%	23%	29%	13%	17%	14%	38%
% Other	30%	23%	27%	23%	7%	16%	24%	7%	8%	20%	27%	17%	3%	14%	28%	23%
% EPT	54%	68%	63%	71%	82%	77%	67%	65%	63%	54%	50%	53%	83%	69%	58%	39%
% Chironomidae	7%	5%	5%	5%	8%	4%	1%	1%	22%	23%	21%	26%	11%	14%	11%	29%
% Dominant Taxon	26%	29%	26%	44%	37%	40%	26%	33%	32%	32%	24%	30%	38%	30%	28%	29%
Total Terrestrial Invertebrates	0	5	15	3	12	33	1	5	50	22	2	9	13	13	6	18
Total BMI	509	748	2,516	1,032	528	625	218	753	479	198	856	609	1,029	1,066	515	3,854
Total Invertebrates	509	753	2,531	1,035	540	658	219	758	529	220	858	618	1,042	1,079	521	3,872
% Sample Aquatic	100%	99%	99%	99.7%	98%	95%	99.5%	99%	91%	90%	99.8%	99%	99%	99%	99%	99.5%
% Sample Terrestrial	0%	1%	1%	0.3%	2%	5%	0.5%	1%	10%	11%	0.2%	1%	1%	1%	1%	0.5%
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	0.69
Number ofTotal Invertebrates / 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	5,628
Number of BMI / 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	5,602
± 1 SD	1,148	620	1,579	851	357	878	268	631	636	463	447	615	1,897	727	348	3,133

APPENDIX C: JUVENILE FISH DATA

Appendix C.1.–Greens Creek Site 48 juvenile Dolly Varden char capture data, 2001–2016.

Year	FL (mm)	Number of Fish Captured				Population	Condition
		Set 1	Set 2	Set 3	Total	Estimate	Factor
2001	48-139	30	16	22	68	121±68	ND
2002	45-160	74	29	23	126	144±17	ND
2003	54-180	157	72	56	285	347±39	ND
2004	54-158	168	48	28	244	256±10	ND
2005	50-149	118	56	38	212	251±28	ND
2006	49-150	138	40	34	212	231±15	ND
2007	53-154	50	29	16	95	113±19	ND
2008	77-137	54	10	9	73	75±4	ND
2009	47-142	67	31	28	126	159±30	ND
2010	47-170	97	41	20	158	172±13	ND
2011	54-155	56	28	41	125	241±125	ND
2012	64-148	85	22	28	135	153±17	1.0
2013	35-154	167	61	25	253	267±11	1.0
2014	52-146	59	19	21	99	115±17	1.0
2015	54-165	48	32	17	97	120±23	1.0
2016	36-163	119	17	17	153	156±4	1.2

Appendix C.2.–Greens Creek Site 54 juvenile Dolly Varden char capture data, 2001–2016.

		Number of Fish Captured				Population	Condition
Year	FL (mm)	Set 1	Set 2	Set 3	Total	Estimate	Factor
2001	27-162	70	49	19	138	163±21	ND
2002	33-160	168	72	31	271	293±16	ND
2003	51-184	92	81	59	232	440±175	ND
2004	52-161	118	36	47	201	244±32	ND
2005	52-146	111	59	43	213	269±40	ND
2006	49-158	116	61	40	217	264±33	ND
2007	50-145	64	19	24	107	126±19	ND
2008	45-131	50	15	6	71	73	ND
2009	47-101	42	32	19	93	128±37	ND
2010	52-151	46	13	14	73	81±10	ND
2011	43-150	73	43	57	173	390±224	ND
2012	47-143	92	39	58	189	313±105	1.0
2013	50-150	188	67	42	297	323±17	1.1
2014	50-158	121	28	13	162	165±4	1.0
2015	54-150	64	29	9	102	108±7	1.0
2016	55-156	31	52	36	119	ND	1.1

Appendix C.3.–Greens Creek Site 54 juvenile coho salmon capture data, 2001–2016.

		Number of Fish Captured				Population	Condition
Year	FL (mm)	Set 1	Set 2	Set 3	Total	Estimate	Factor
2001	32-95	2	6	4	12	ND	ND
2002	59-85	14	6	1	21	21	ND
2003	44-52	5	3	0	8	ND	ND
2004	70-95	9	9	6	24	34±17	ND
2005	66-93	33	20	8	61	68±9	ND
2006	62-88	6	0	1	7	ND	ND
2007	ND	0	0	0	0	ND	ND
2008	53-69	4	0	0	4	ND	ND
2009	67-73	2	2	0	4	ND	ND
2010	77	1	0	0	1	ND	ND
2011	ND	0	0	0	0	ND	ND
2012	67-71	0	3	2	5	ND	1.1
2013	ND	0	0	0	0	ND	ND
2014	70-85	10	4	1	15	ND	1.2
2015	44-100	15	5	1	21	ND	1.1
2016	68-100	14	12	6	32	40±13	1.3

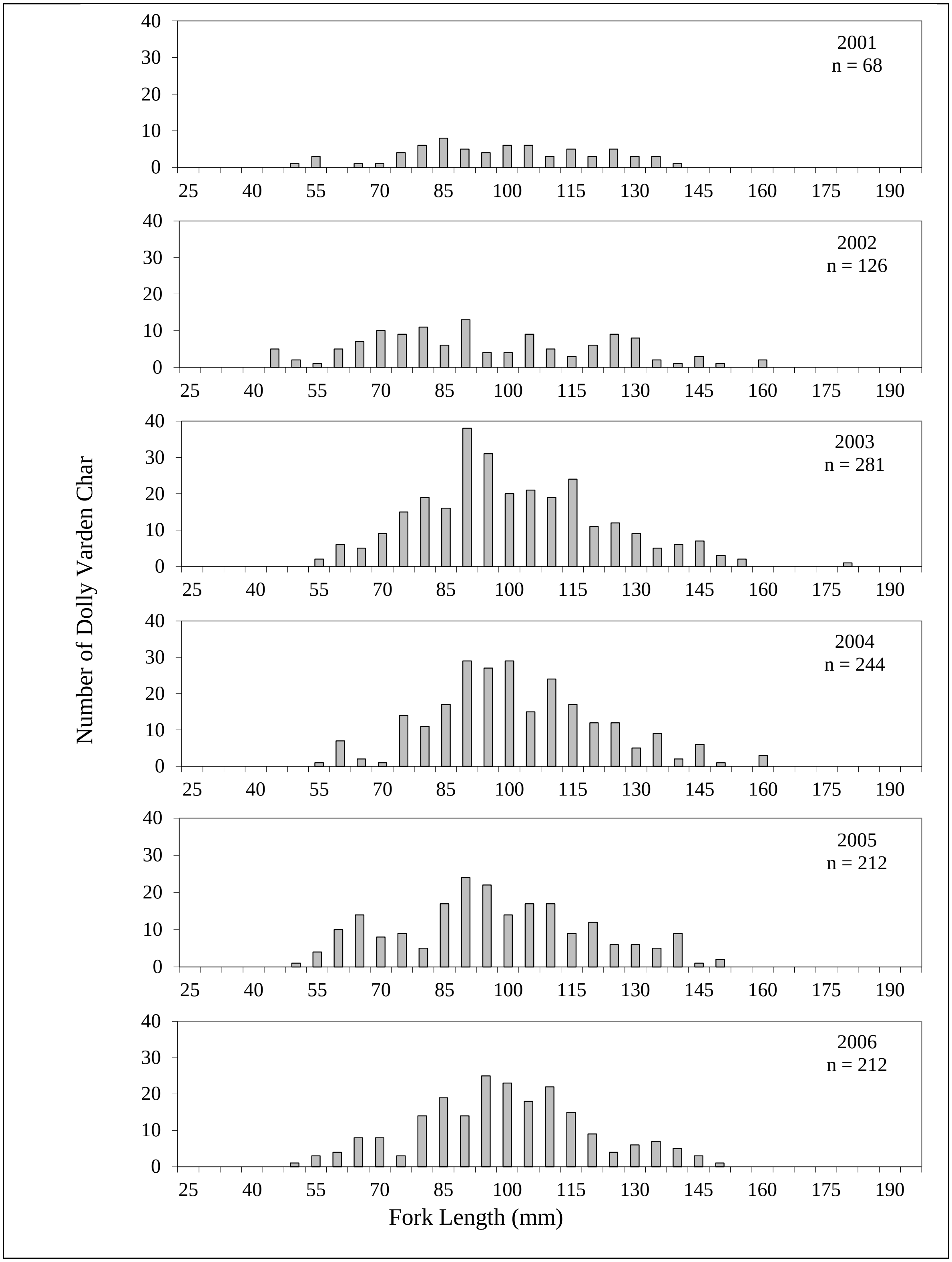
Appendix C.4.–Tributary Creek Site 9 resident fish capture data, 2001–2016.

			Number of Fish Captured				Population	Condition
Year	Species	FL (mm)	Set 1	Set 2	Set 3	Total	Estimate	Factor
2001	DV	58-110	70	4	7	81	81	ND
	CT	124	1	0	0	1	ND	ND
2002	DV	38-147	29	14	8	51	57±9	ND
	CT	124	0	0	1	1	ND	ND
2003	DV	54-114	13	4	2	19	ND	ND
	CT	122	1	0	0	1	ND	ND
2004	DV	64-109	21	6	5	32	33±2	ND
	CT	122	1	0	0	1	ND	ND
	RT	86-106	3	1	0	4	ND	ND
2005	DV	59-131	21	12	11	44	59±21	ND
	CT	91-103	1	1	0	2	ND	ND
2006	DV	85-117	7	3	1	11	ND	ND
2007	DV	81-158	7	5	0	12	ND	ND
	CT	138	0	0	1	1	ND	ND
2008	DV	60-108	15	4	3	22	22	ND
	CT	82-112	1	0	2	3	ND	ND
2009	DV	48-98	24	5	9	38	42±7	ND
	CT	97	1	0	0	1	ND	ND
2010	DV	58-108	21	7	31	59	59	ND
	CT	64-89	4	1	0	5	ND	ND
2011	DV	50-125	15	7	14	36	36	ND
	CT	115	1	0	0	1	ND	ND
2012	DV	66-112	17	11	12	40	40	1.0
	CT	63-93	4	0	1	5	ND	1.0
2013	DV	52-92	9	2	2	13	ND	1.2
	CT	73-80	0	2	0	2	ND	1.0
2014	DV	37-115	1	12	1	14	ND	1.0
	CT	110-110	0	1	1	2	ND	0.9
	RT	105-110	1	0	1	2	ND	0.7
2015	DV	55-84	10	5	1	16	ND	1.2
2016	DV	76-114	15	2	3	20	ND	1.1

Appendix C.5.–Tributary Creek Site 9 juvenile coho salmon capture data, 2001–2016.

		Number of Fish Captured				Population	Condition
Year	FL (mm)	Set 1	Set 2	Set 3	Total	Estimate	Factor
2001	39-101	89	18	11	118	120±3	ND
2002	27-85	29	9	6	44	46±4	ND
2003	46-88	37	11	4	52	53±2	ND
2004	40-94	23	2	2	27	27	ND
2005	39-103	82	42	15	139	151±12	ND
2006	69-108	5	4	1	10	ND	ND
2007	38-104	50	10	9	69	71±4	ND
2008	41-100	72	44	26	142	177±30	ND
2009	38-116	42	9	2	53	53	ND
2010	39-90	77	21	30	128	152±22	ND
2011	38-100	18	18	13	49	85±50	ND
2012	46-105	39	9	7	55	55	1.1
2013	50-91	9	6	3	18	20±4	1.4
2014	39-92	86	26	24	136	150±13	1.2
2015	38-95	36	27	13	76	95±21	1.4
2016	44-97	75	6	7	88	88	1.3

Appendix C.6.–Length frequency of Dolly Varden char captured at Greens Creek Site 48, 2001–2016.



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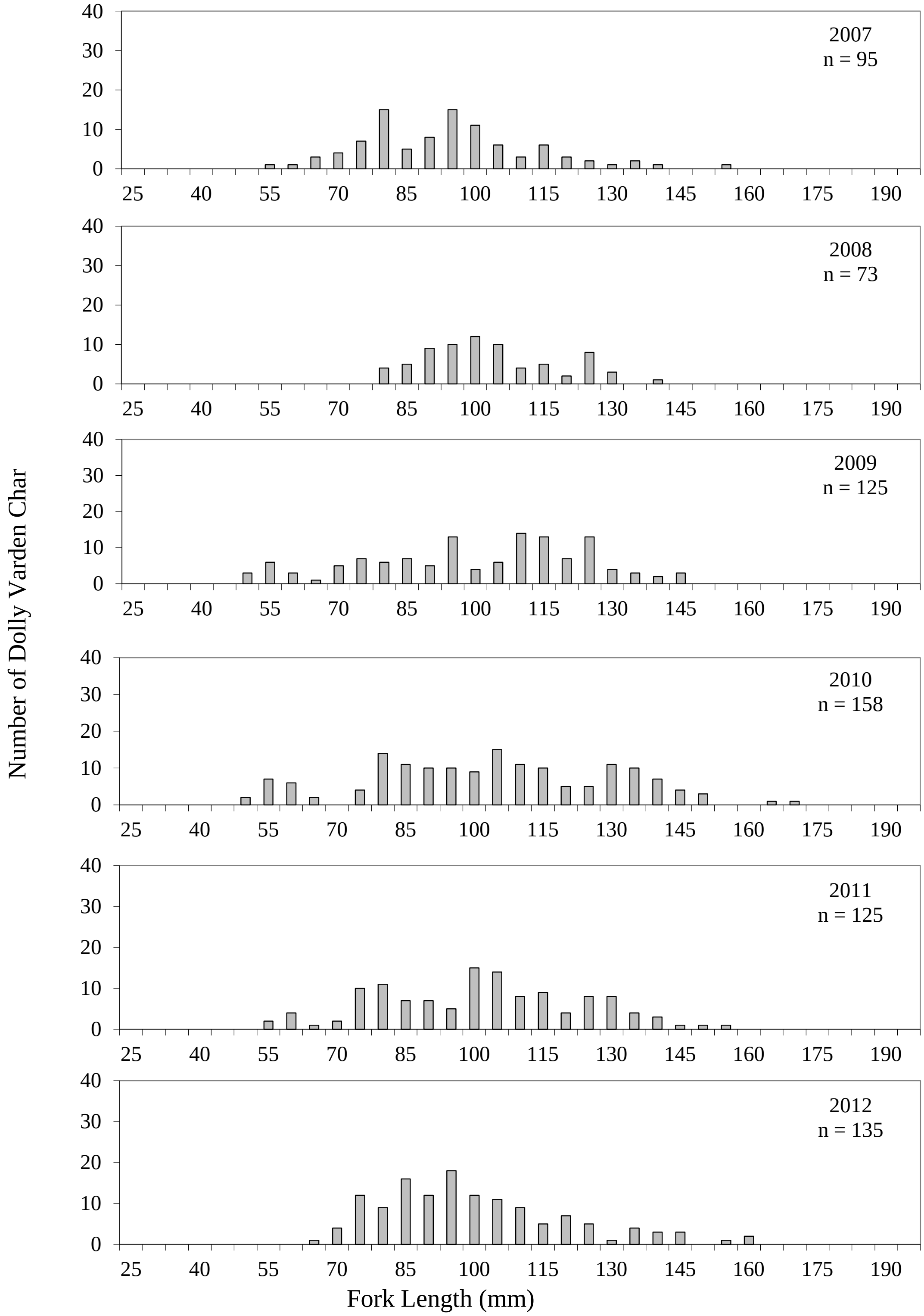
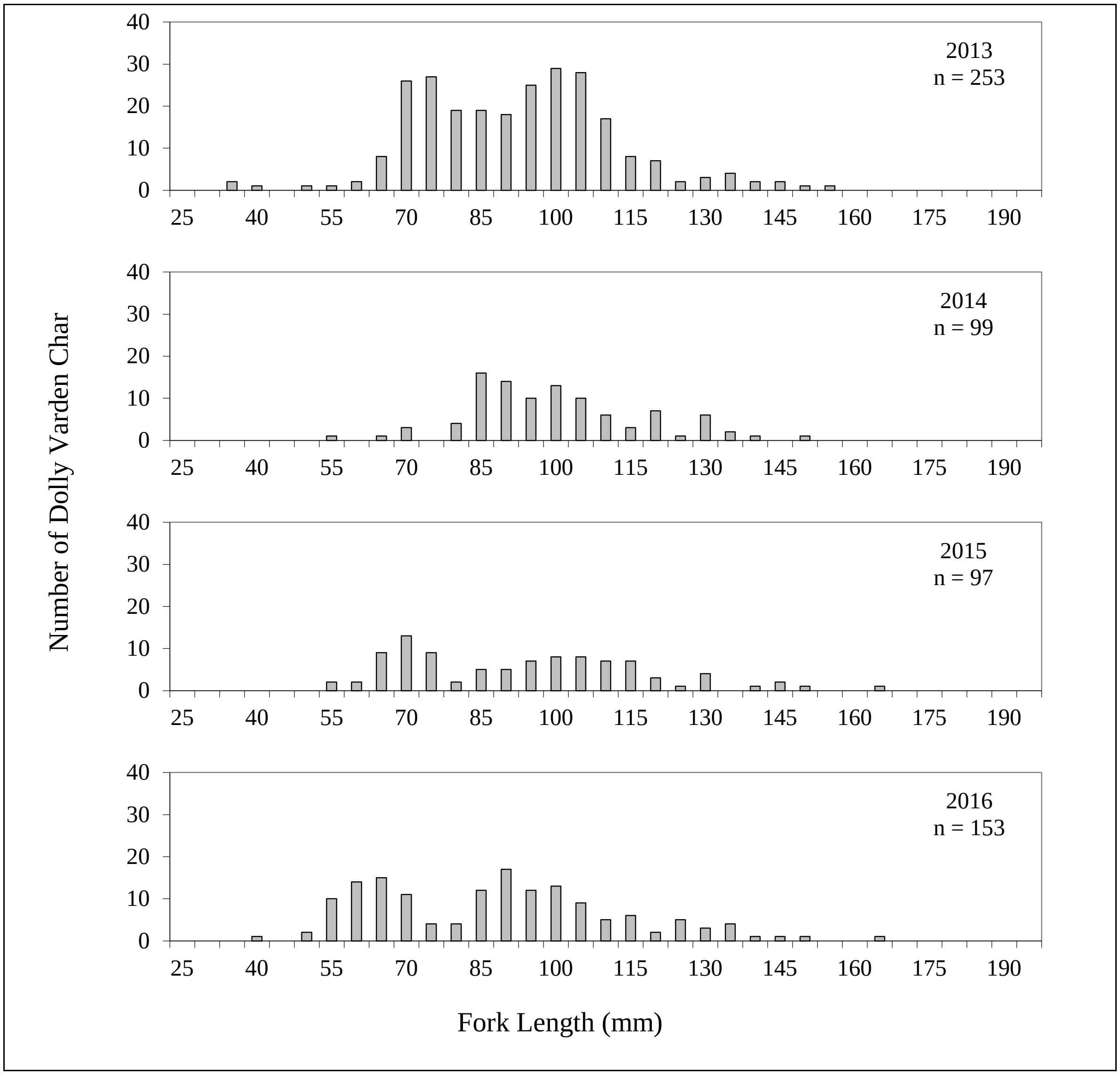
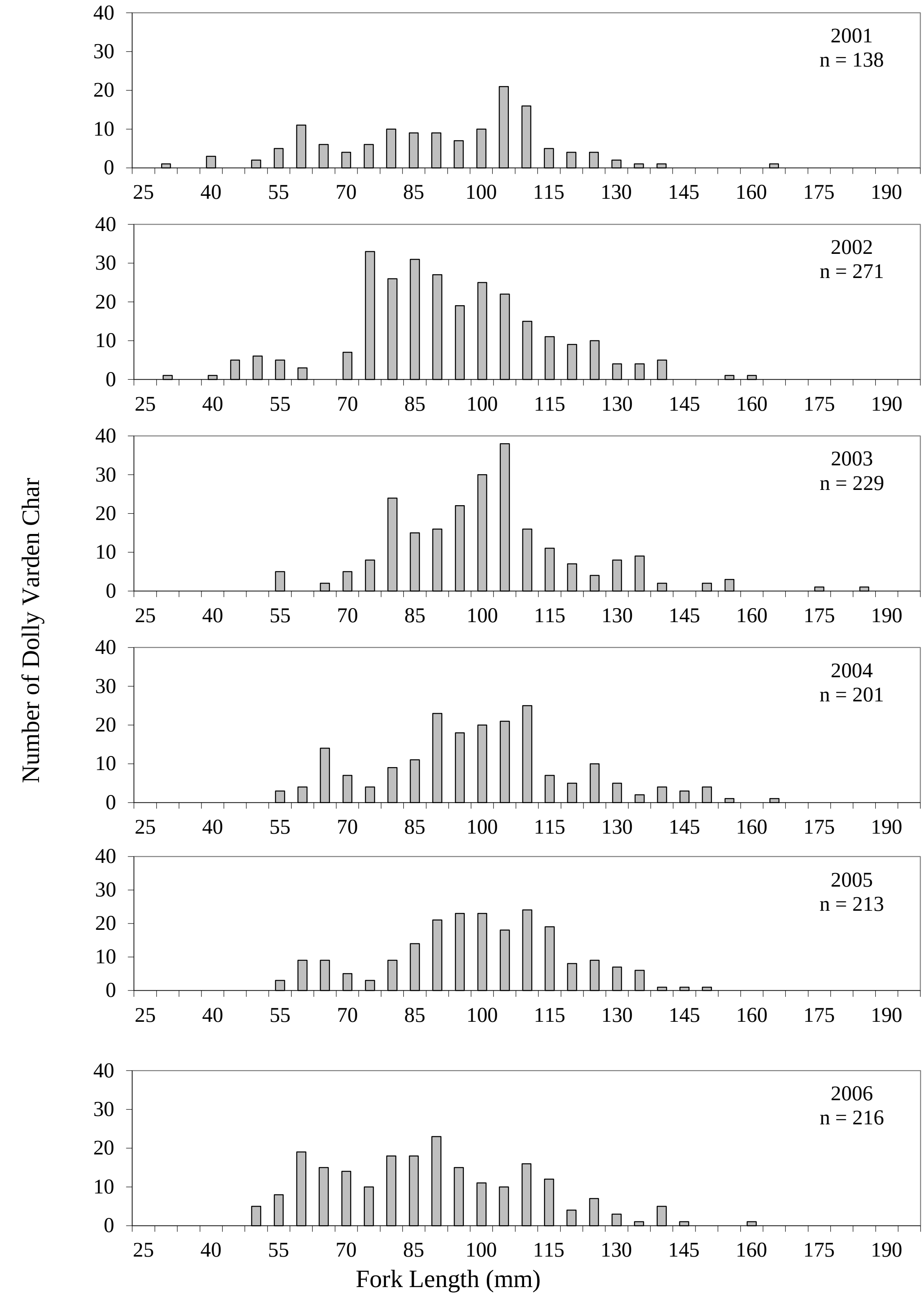

Number of Dolly Varden Char
2007
n = 95
2008
n = 73
2009
n = 125
2010
n = 158
2011
n = 125
2012
n = 135
0
10
20
30
40
25
40
55
70
85
100
115
130
145
160
175
190
Fork Length (mm)

-continued-

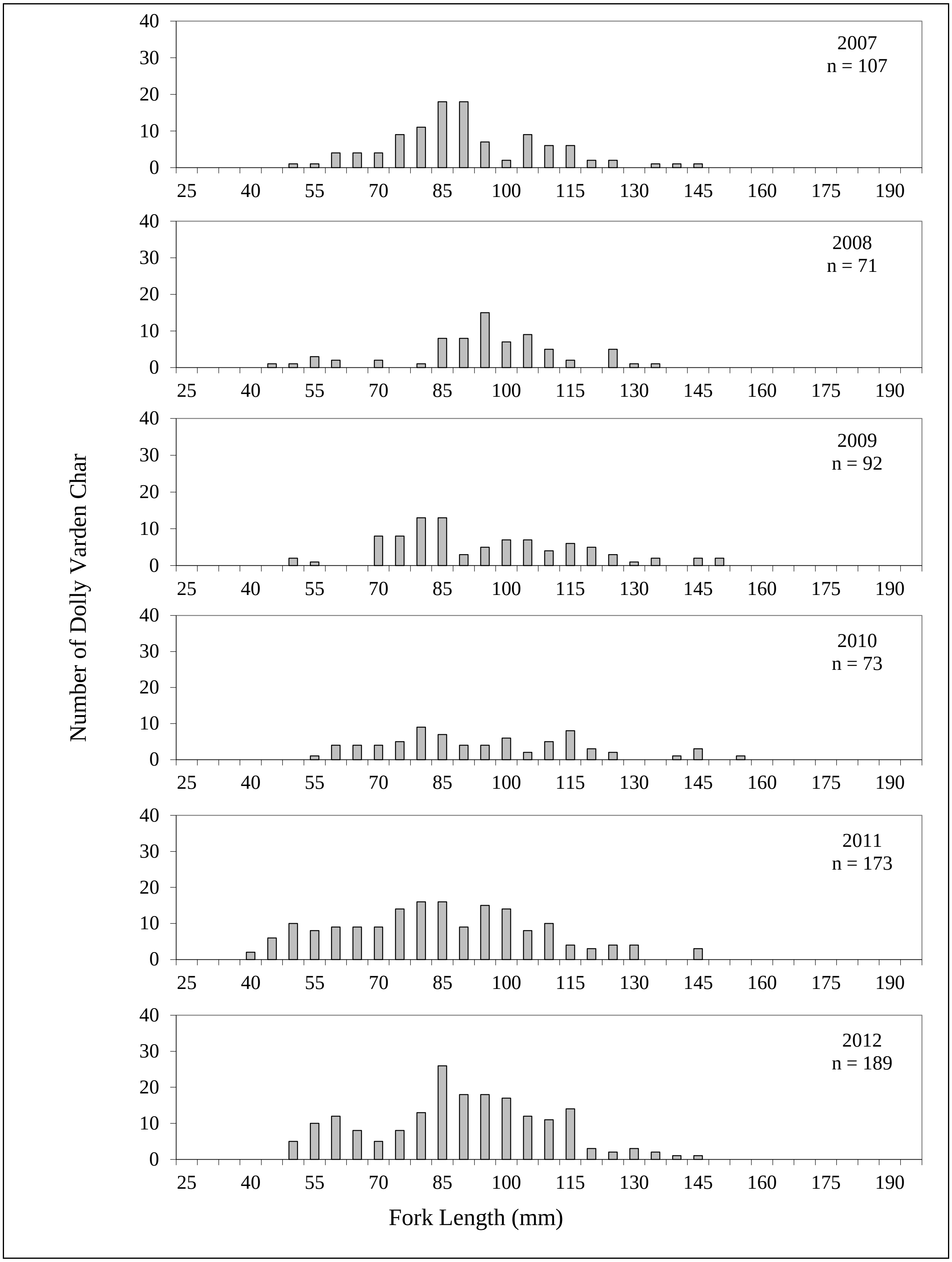
Appendix C.6.–Page 3 of 3.



Appendix C.7.–Length frequency of Dolly Varden char captured at Greens Creek Site 54, 2001–2016.

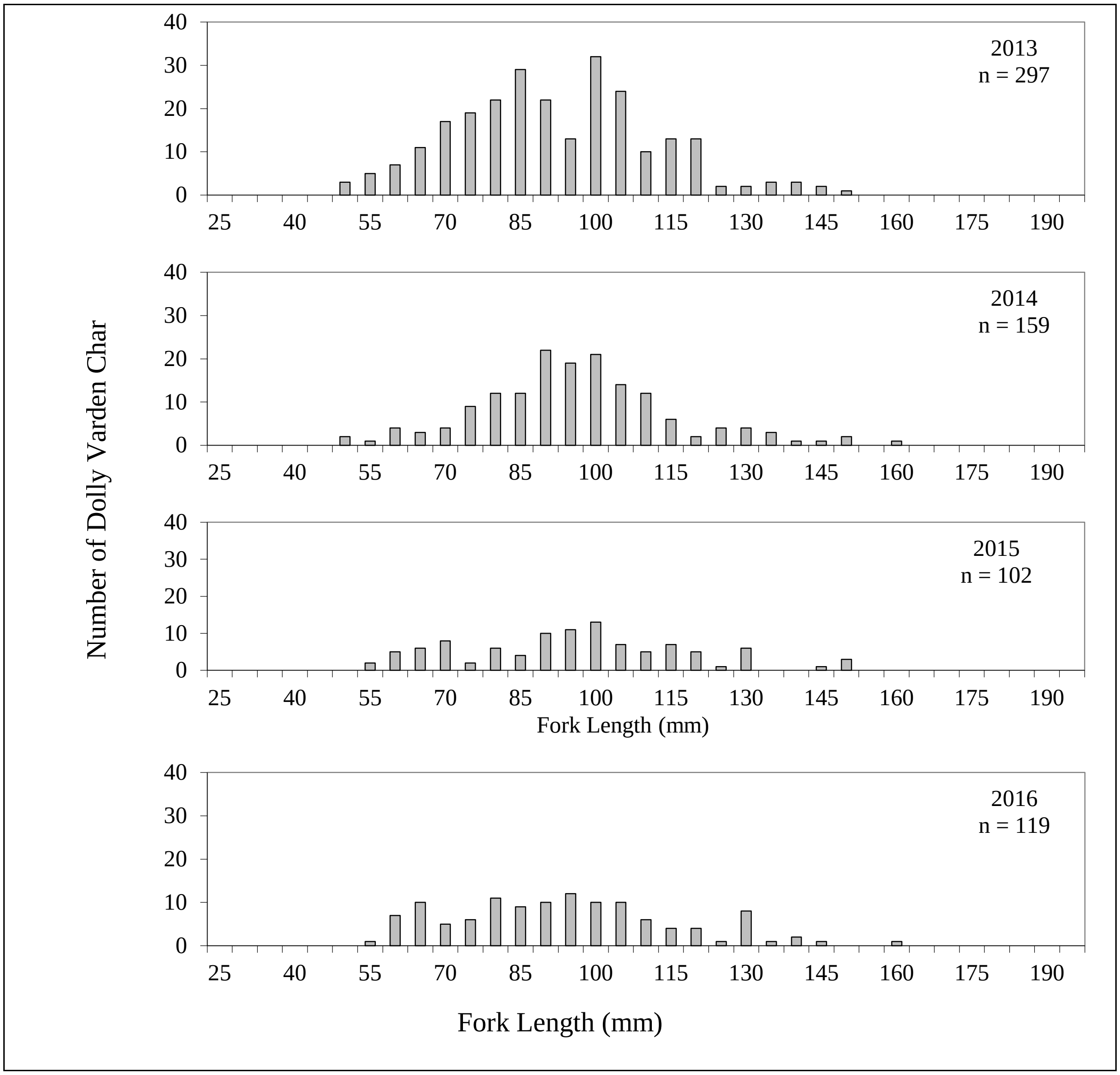


-continued-

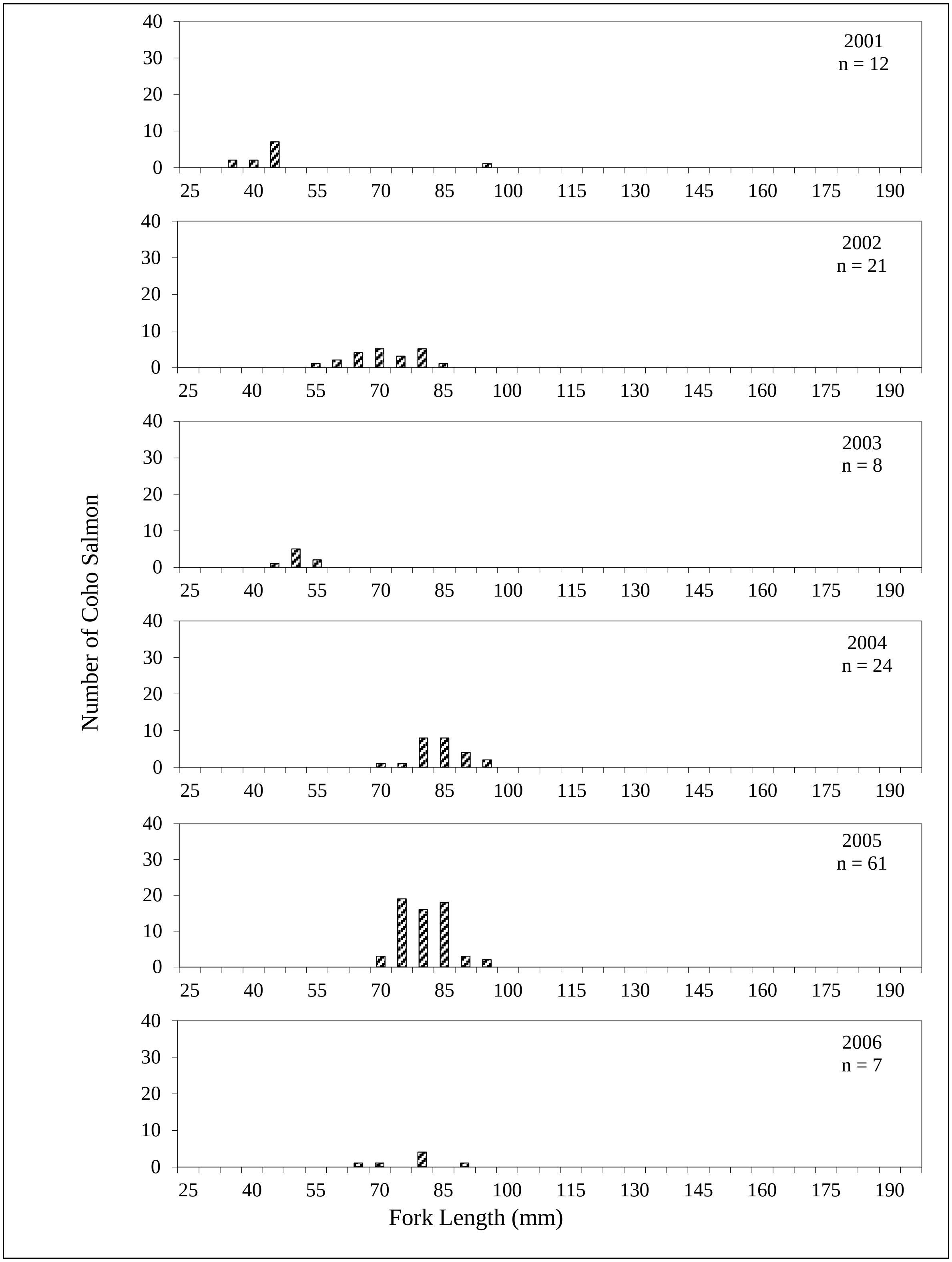

2007
n = 107
2008
n = 71
2009
n = 92
2010
n = 73
2011
n = 173
2012
n = 189
Number of Dolly Varden Char
Fork Length (mm)
0
10
20
30
40
25
40
55
70
85
100
115
130
145
160
175
190

-continued-

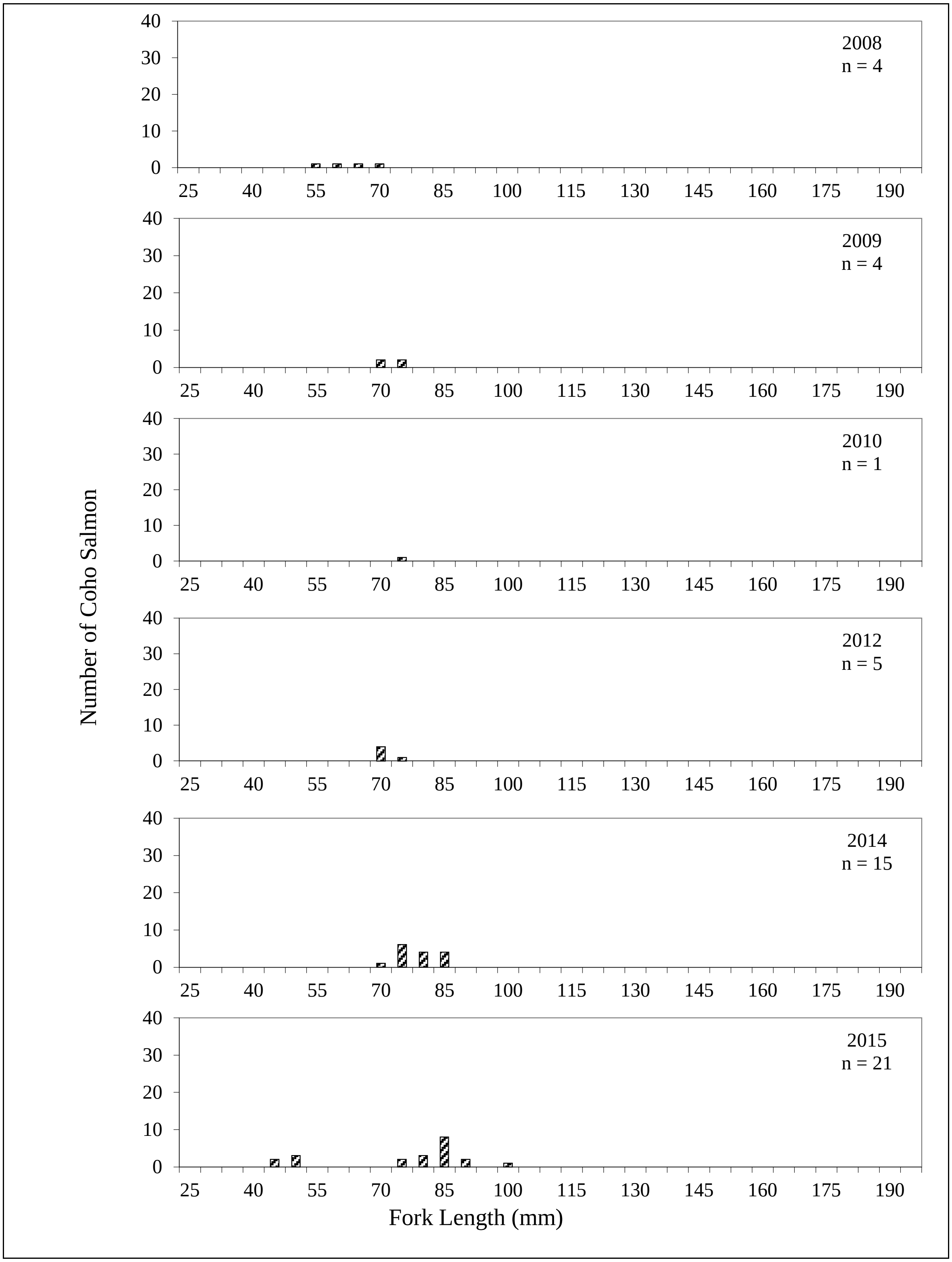
Appendix C.7.–Page 3 of 3.



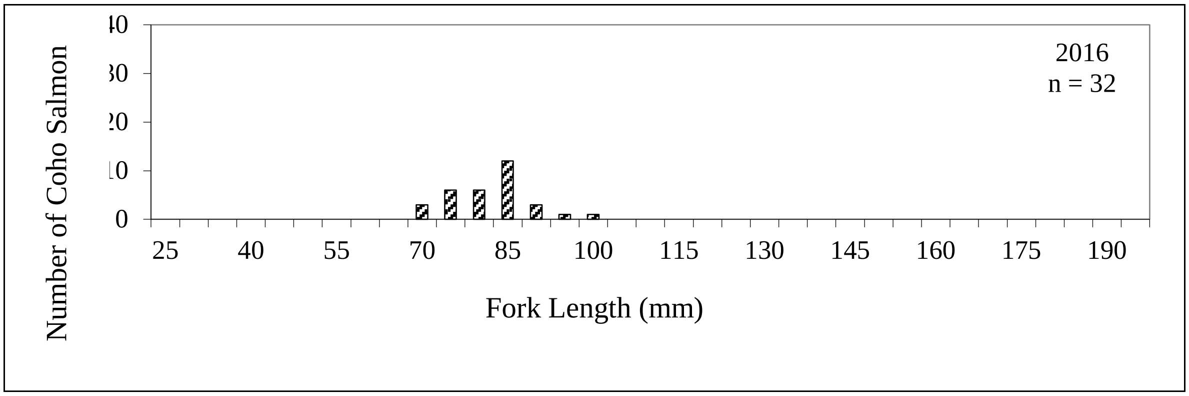
Appendix C.8.–Length frequency of coho salmon captured at Greens Creek Site 54, 2001–2016.



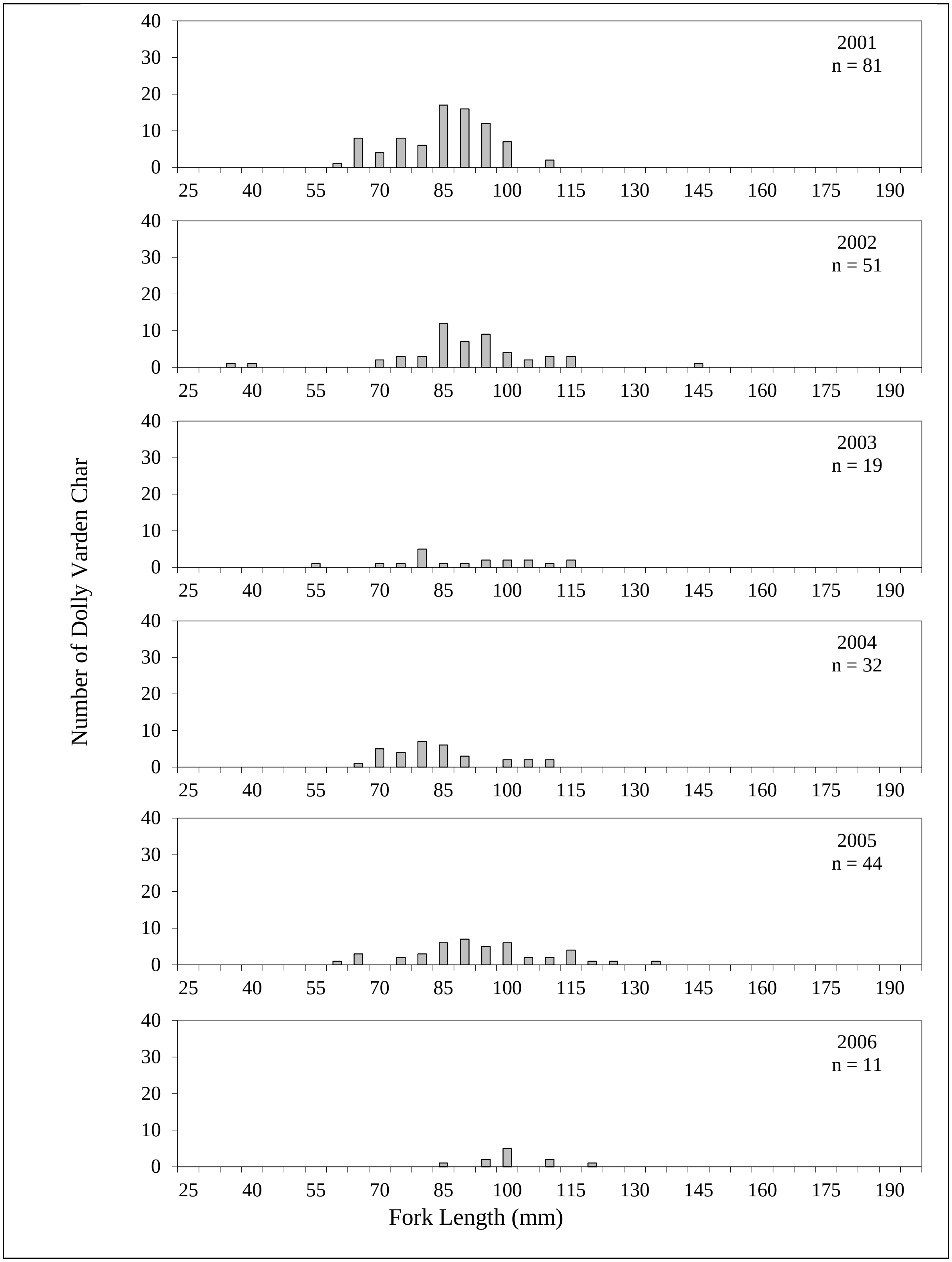
-continued-


2008
n = 4
2009
n = 4
2010
n = 1
2012
n = 5
2014
n = 15
2015
n = 21
Number of Coho Salmon
Fork Length (mm)
0
10
20
30
40
25
40
55
70
85
100
115
130
145
160
175
190

-continued-


2016
n = 32
Number of Coho Salmon
Fork Length (mm)
0
10
20
30
40
25
40
55
70
85
100
115
130
145
160
175
190

Appendix C.9.–Length frequency of Dolly Varden char captured at Tributary Creek Site 9, 2001–2016.



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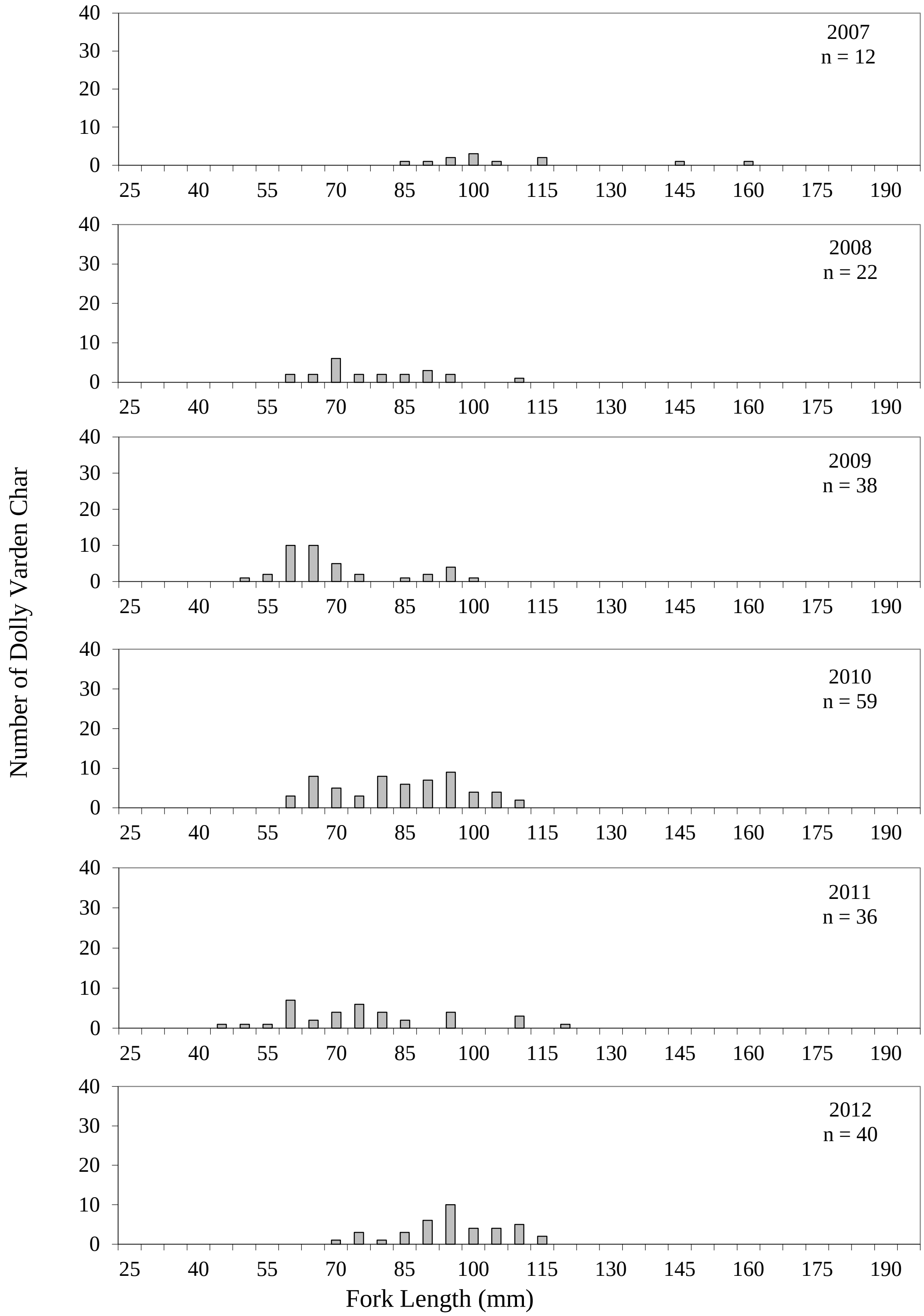
Appendix C.9.–Page 2 of 3.



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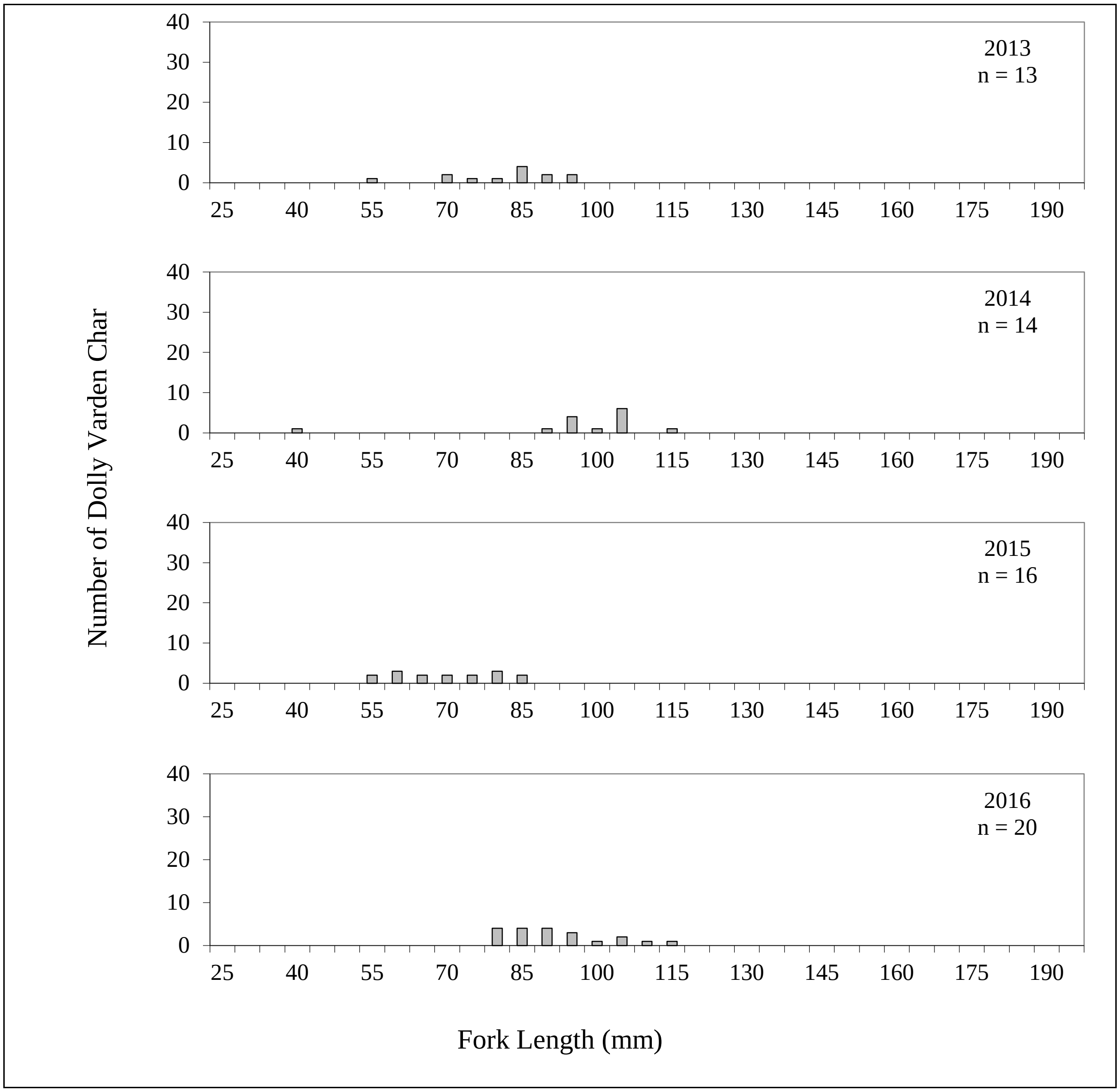
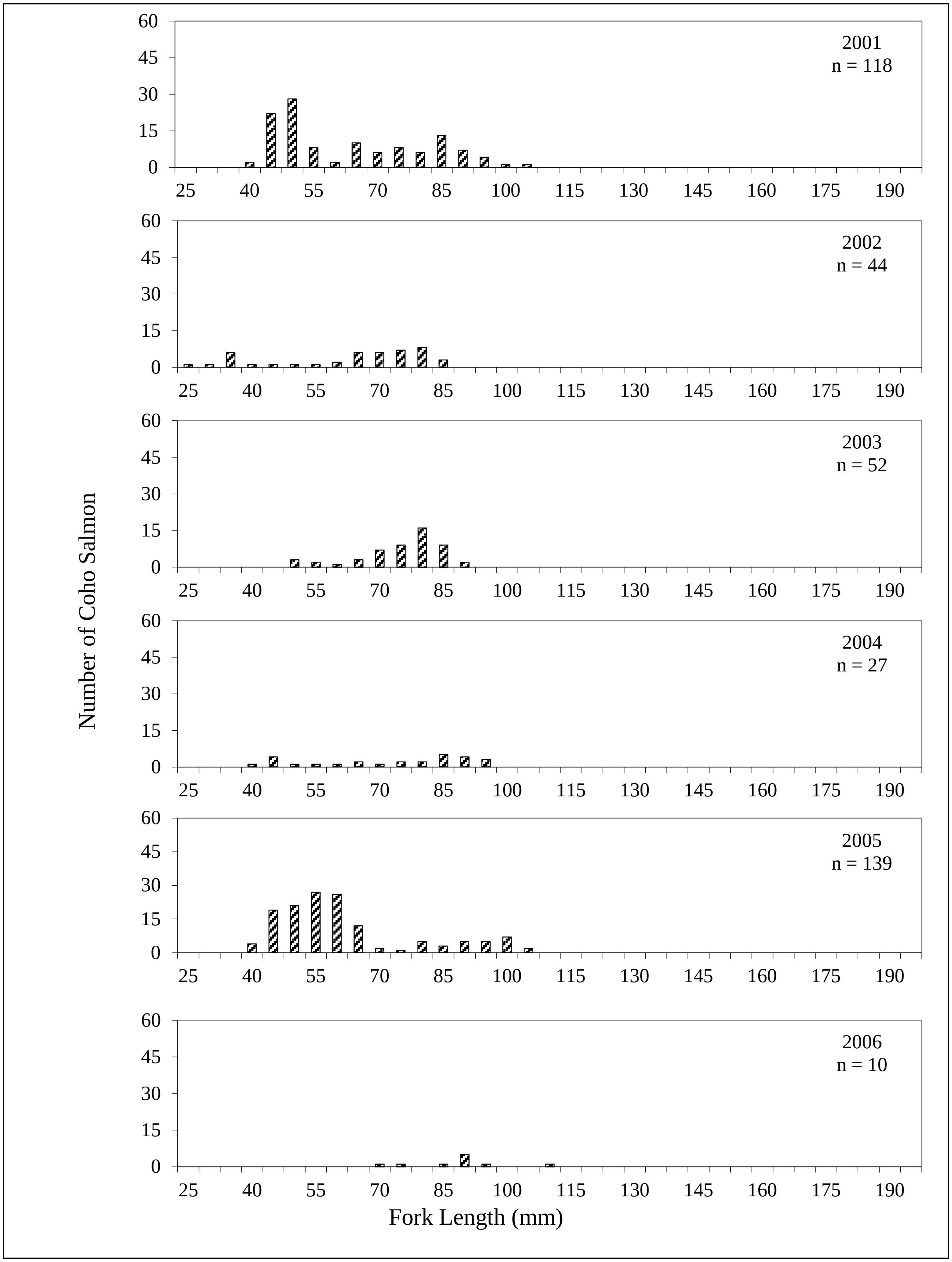
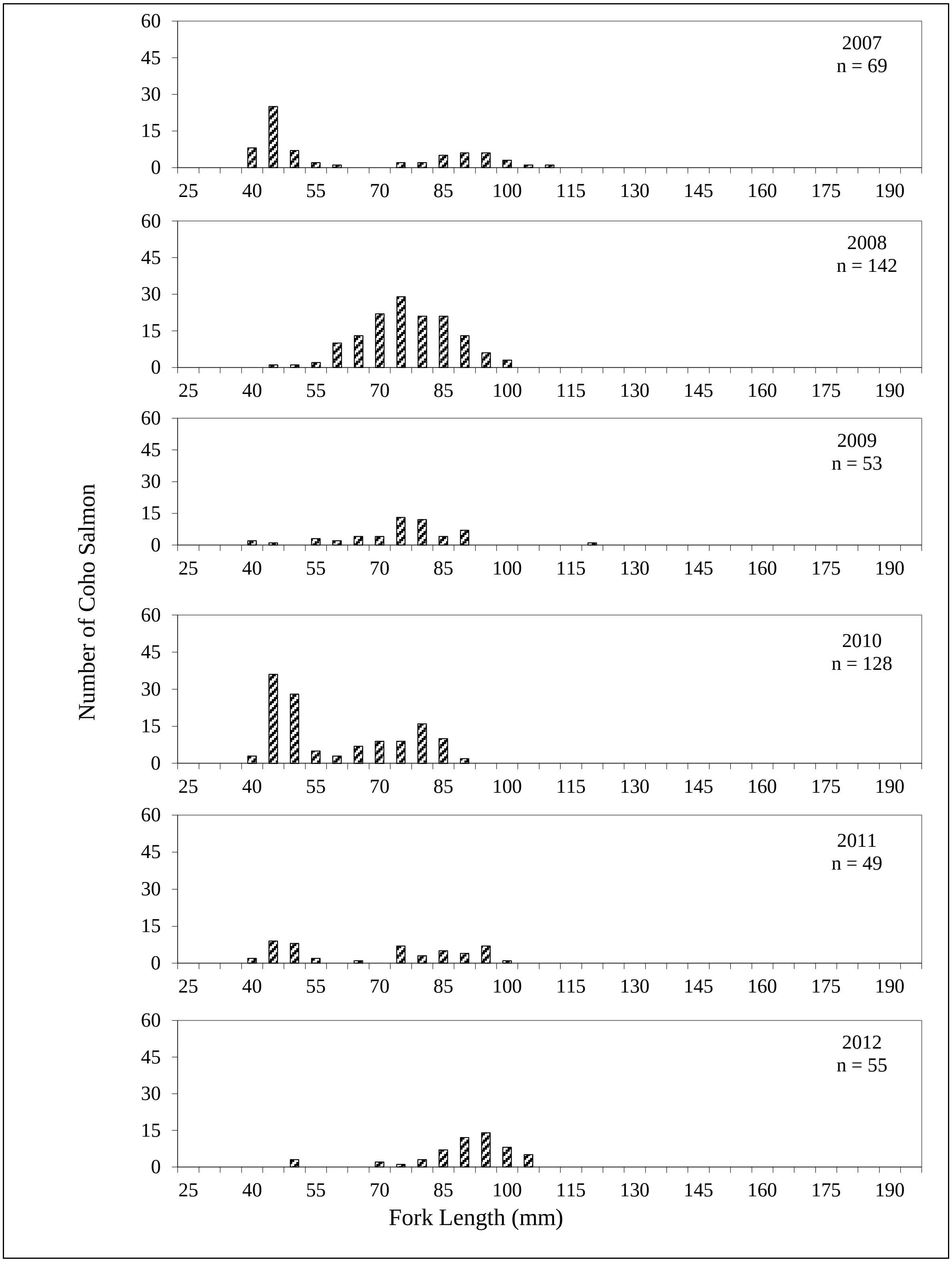
Appendix C.9.–Page 3 of 3.



Appendix C.10.–Length frequency of coho salmon captured at Tributary Creek Site 9, 2001–2016.

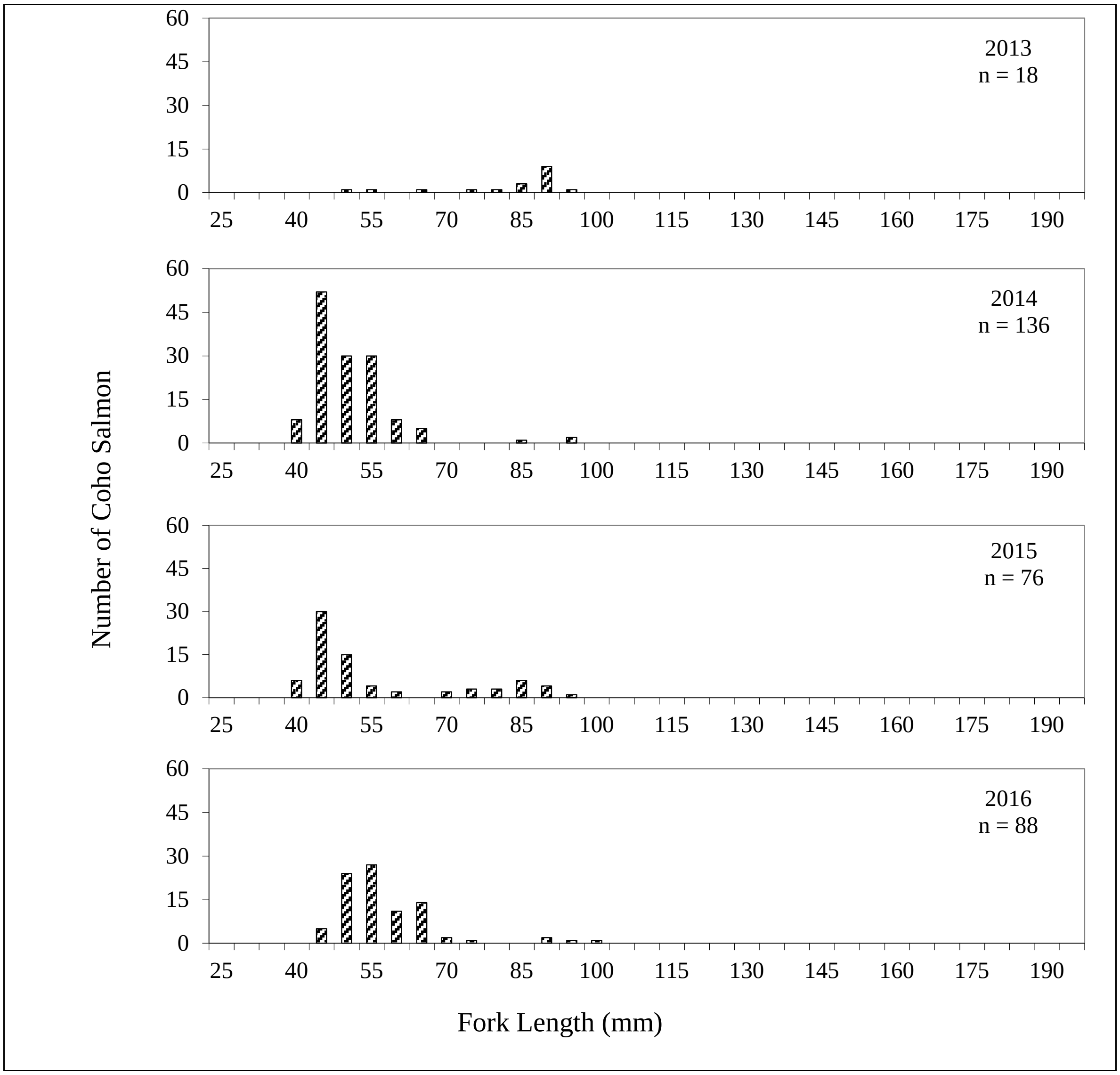


-continued-


2007
n = 69
2008
n = 142
2009
n = 53
2010
n = 128
2011
n = 49
2012
n = 55
Number of Coho Salmon
0 15 30 45 60
25 40 55 70 85 100 115 130 145 160 175 190
Fork Length (mm)

-continued-

Appendix C.10.–Page 3 of 3.



APPENDIX D: JUVENILE FISH METALS CONCENTRATIONS DATA AND LAB REPORTS

Appendix D.1.–Greens Creek Site 48 whole body juvenile Dolly Varden char metals and Se concentrations, 2001–2016.

Sample Date	Sample No.	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	ND	0.20	6.1	180
7/23/01	2	137	28.8	0.03	0.89	7.2	ND	0.17	4.6	146
7/23/01	3	119	18.8	0.02	2.27	5.7	ND	0.20	6.2	189
7/23/01	4	121	21.1	0.02	1.56	6.9	ND	0.17	5.2	182
7/23/01	5	111	13.7	0.03	0.89	4.7	ND	0.23	5.4	138
7/23/01	6	121	21.1	<0.02	1.26	7.4	ND	0.10	5.6	157
7/24/02	1	133	23.2	0.03	1.64	6.8	ND	0.72	4.8	239
7/24/02	2	120	15.0	0.07	0.85	7.0	ND	0.28	4.1	210
7/24/02	3	122	17.5	0.03	0.74	4.3	ND	0.17	4.9	162
7/24/02	4	127	20.8	0.04	1.40	6.1	ND	0.16	4.7	185
7/24/02	5	134	24.8	0.05	1.30	7.9	ND	0.46	4.3	208
7/24/02	6	128	21.7	0.04	1.56	6.8	ND	0.22	5.7	343
7/22/03	1	90	8.9	<0.02	0.65	4.2	ND	0.14	5.6	191
7/22/03	2	98	9.9	<0.02	0.90	5.1	ND	0.22	5.5	180
7/22/03	3	103	12.1	<0.02	0.82	5.6	ND	0.16	5.4	241
7/22/03	4	112	12.5	<0.02	0.78	6.1	ND	0.11	6.1	192
7/22/03	5	108	11.9	<0.02	0.63	3.9	ND	0.14	5.2	174
7/22/03	6	100	10.5	<0.02	0.58	3.7	ND	0.08	5.5	218
7/22/04	1	96	8.6	<0.02	0.63	4.7	ND	0.15	4.3	206
7/22/04	2	88	6.8	<0.02	0.83	5.6	ND	0.26	4.0	175
7/22/04	3	101	11.5	<0.02	1.54	4.6	ND	0.21	4.1	183
7/22/04	4	98	9.3	<0.02	0.80	5.2	ND	0.28	3.7	168
7/22/04	5	93	7.6	<0.02	1.25	4.4	ND	0.14	6.4	220
7/22/04	6	91	7.5	0.03	1.01	4.5	ND	0.29	5.6	323
7/22/05	1	103	19.7	0.02	0.66	4.4	ND	0.44	4.2	183
7/22/05	2	96	13.1	<0.02	0.84	14.5	ND	0.98	4.8	220
7/22/05	3	119	15.6	0.02	0.89	4.4	ND	0.66	4.8	226
7/22/05	4	114	17.1	0.02	0.59	6.0	ND	0.32	4.8	178
7/22/05	5	111	15.3	0.03	1.10	18.8	ND	0.79	4.6	217
7/22/05	6	125	16.9	0.03	0.47	3.6	ND	0.36	3.8	161
7/20/06	1	110	15.8	0.04	0.56	8.5	ND	0.37	5.4	244
7/20/06	2	110	15.4	0.05	1.20	8.3	ND	0.31	6.0	217
7/20/06	3	113	16.1	0.04	0.65	6.3	ND	0.24	5.4	264
7/20/06	4	132	25.0	0.06	0.63	8.1	ND	0.66	5.2	232
7/20/06	5	104	12.8	0.08	0.96	8.5	ND	0.37	5.1	283
7/20/06	6	114	16.7	0.03	0.63	5.3	ND	0.20	5.1	270

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Appendix D.1.–Page 2 of 3.

Sample Date	Sample No.	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)
7/21/07	1	122	17.9	0.03	1.16	5.5	ND	0.17	5.5	221
7/21/07	2	95	10.4	0.02	1.42	3.9	ND	0.29	5.8	165
7/21/07	3	135	22.8	0.09	1.35	14.1	ND	1.37	5.3	166
7/21/07	4	98	9.9	0.03	0.96	5.7	ND	0.27	5.2	269
7/21/07	5	105	13.2	0.11	1.79	11.4	ND	1.62	5.4	323
7/21/07	6	99	10.0	0.04	1.43	5.2	ND	0.31	5.7	208
7/22/08	1	112	16.4	0.069	1.23	5.2	ND	0.95	5.72	289.0
7/22/08	2	123	21.3	0.039	0.79	3.9	ND	0.57	4.56	194.0
7/22/08	3	105	14.0	0.079	0.82	4.6	ND	0.52	5.88	199.5
7/22/08	4	124	20.6	0.041	0.87	4.9	ND	0.42	6.31	244.0
7/22/08	5	115	16.9	0.030	1.36	5.3	ND	0.51	5.36	254.0
7/22/08	6	122	19.8	0.037	1.07	5.6	ND	0.38	6.11	260.0
7/21/09	1	120	20.1	<0.02	1.05	5.2	ND	0.22	5.9	186
7/21/09	2	121	20.7	<0.02	1.40	5.3	ND	0.44	5.7	173
7/21/09	3	119	17.9	0.02	1.10	4.5	ND	0.13	5.9	182
7/21/09	4	108	13.6	<0.02	1.20	4.1	ND	0.15	5.7	162
7/21/09	5	109	14.6	<0.02	1.50	4.9	ND	0.17	5.9	186
7/21/09	6	110	15.2	<0.02	0.84	3.8	ND	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	ND	0.03	1.12	5.7	ND	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

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Appendix D.1.–Page 3 of 3.

Sample Date	Sample No.	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)
7/25/14	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
7/14/16	1	84	7.3	<0.020	1.28	4.72	0.180	0.157	7.63	252
7/14/16	2	82	6.1	0.023	0.921	4.82	0.160	0.147	5.83	222
7/14/16	3	98	10.1	0.021	1.09	3.99	0.108	0.150	6.30	189
7/14/16	4	93	7.9	<0.020	1.44	4.49	0.163	0.205	6.77	197
7/14/16	5	88	6.9	0.035	1.50	4.65	0.243	0.493	7.63	185
7/14/16	6	84	7.3	0.023	0.681	4.12	0.150	0.088	6.42	200
7/14/16	7	94	8.8	0.065	1.21	4.69	0.172	0.143	7.19	194
7/14/16	8	86	7.6	0.022	1.89	4.96	0.210	0.295	7.27	251
7/14/16	9	93	9.4	<0.020	1.23	4.85	0.127	0.193	5.8	205
7/14/16	10	101	9.8	<0.020	1.32	4.72	0.114	0.134	6.28	178

Appendix D.2.–Greens Creek Site 54 whole body juvenile Dolly Varden char metals and Se concentrations, 2001–2016.

Sample Date	Sample No.	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	ND	0.33	5.7	126
7/23/01	2	119	19.3	0.02	0.21	3.2	ND	0.22	3.6	82
7/23/01	3	107	15.7	0.03	0.73	6.3	ND	0.59	4.7	144
7/23/01	4	109	13.6	0.02	0.82	5.4	ND	0.86	4.9	172
7/23/01	5	105	13.5	<0.02	0.79	6.5	ND	0.45	5.8	203
7/23/01	6	138	27.5	<0.02	0.74	5.8	ND	0.40	5.4	171
7/24/02	1	118	18.0	0.03	0.50	4.4	ND	0.94	3.4	363
7/24/02	2	128	22.3	0.03	0.52	4.5	ND	0.35	4.7	150
7/24/02	3	115	17.7	0.05	0.95	6.0	ND	0.66	4.4	161
7/24/02	4	115	18.9	0.03	1.03	5.2	ND	0.66	4.2	216
7/24/02	5	124	21.1	0.05	1.32	5.2	ND	0.74	3.9	194
7/24/02	6	123	20.9	0.02	0.70	3.9	ND	0.78	4.4	195
7/22/03	1	123	21.1	0.03	0.85	6.4	ND	1.40	6.1	188
7/22/03	2	101	10.6	<0.02	0.67	4.2	ND	0.32	6.4	174
7/22/03	3	88	9.2	<0.02	0.75	4.3	ND	0.35	6.5	186
7/22/03	4	109	14.8	<0.02	1.11	5.8	ND	0.38	5.7	188
7/22/03	5	95	10.6	<0.02	0.59	3.5	ND	0.29	5.7	174
7/22/03	6	92	9.7	<0.02	0.91	4.1	ND	0.43	6.5	263
7/21/04	1	103	9.9	0.02	0.79	11.0	ND	0.57	4.6	232
7/21/04	2	104	10.0	<0.02	0.88	5.5	ND	0.54	5.0	206
7/21/04	3	86	6.6	<0.02	1.26	5.1	ND	0.36	5.3	164
7/21/04	4	96	9.3	0.03	0.79	5.9	ND	0.28	5.4	191
7/21/04	5	93	9.9	<0.02	0.83	5.0	ND	0.48	3.9	202
7/21/04	6	104	12.9	0.08	1.12	7.0	ND	0.93	4.9	217
7/22/05	1	120	12.3	0.03	0.72	5.0	ND	0.27	4.0	160
7/22/05	2	106	12.1	0.02	0.63	4.5	ND	0.13	3.9	200
7/22/05	3	113	20.8	<0.02	0.73	8.8	ND	0.17	4.7	223
7/22/05	4	114	17.9	<0.02	0.82	9.7	ND	0.17	3.9	222
7/22/05	5	112	16.1	0.03	1.06	8.8	ND	0.22	4.4	209
7/22/05	6	118	22.3	0.02	0.55	5.5	ND	0.39	3.9	185
7/20/06	1	137	27.3	0.06	0.42	4.8	ND	0.51	5.7	208
7/20/06	2	112	14.9	0.04	0.75	16.0	ND	0.95	7.2	223
7/20/06	3	102	12.0	0.02	0.93	22.2	ND	0.52	6.3	239
7/20/06	4	114	19.6	0.04	1.03	7.6	ND	0.85	5.3	252
7/20/06	5	98	12.3	0.08	0.54	10.9	ND	0.48	5.4	223
7/20/06	6	115	16.9	0.04	0.78	8.6	ND	0.68	5.6	257

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Appendix D.2.–Page 2 of 3.

Sample Date	Sample No.	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)
7/20/07	1	102	11.8	0.04	0.88	5.3	ND	0.54	5.6	157
7/20/07	2	125	21.1	0.03	0.97	5.2	ND	0.83	7.5	234
7/20/07	3	97	10.7	0.06	0.81	5.7	ND	0.89	8.6	185
7/20/07	4	123	19.7	0.02	0.75	4.4	ND	0.50	7.1	175
7/20/07	5	104	12.5	0.03	0.92	5.6	ND	0.57	7.8	174
7/20/07	6	110	15.1	0.04	1.38	6.2	ND	0.82	5.4	191
7/22/08	1	123	21.9	0.039	0.66	5.3	ND	0.26	5.53	185.0
7/22/08	2	94	10.8	0.039	1.04	5.1	ND	0.28	6.07	203.0
7/22/08	3	123	21.5	0.028	1.53	4.9	ND	3.46	6.29	261.0
7/22/08	4	97	11.2	0.029	1.34	5.0	ND	0.17	5.90	198.5
7/22/08	5	108	16.0	0.045	1.98	6.3	ND	0.23	5.97	220.0
7/22/08	6	108	14.2	0.059	1.07	8.4	ND	1.31	5.03	195.0
7/21/09	1	132	26.9	0.04	1.10	4.8	ND	0.33	5.4	213
7/21/09	2	141	32.3	0.02	0.71	4.5	ND	0.45	7.9	143
7/21/09	3	116	17.9	<0.02	0.99	4.2	ND	0.40	6.3	153
7/21/09	4	117	17.7	0.03	1.00	5.9	ND	0.39	6.8	200
7/21/09	5	119	22.1	<0.02	1.20	4.0	ND	0.28	6.5	176
7/21/09	6	103	13.0	0.02	2.20	5.3	ND	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	ND	<0.02	0.95	4.5	ND	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

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Sample Date	Sample No.	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)
7/24/14	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
7/12/16	1	127	21.5	<0.020	0.913	3.24	0.0958	0.194	4.29	122
7/12/16	2	113	16.2	0.024	1.01	3.49	0.130	0.295	6.23	154
7/12/16	3	117	15.8	<0.020	1.44	4.22	0.146	0.232	7.03	210
7/12/16	4	104	12.1	<0.019	0.626	3.39	0.153	0.220	6.18	173
7/12/16	5	101	9.0	<0.020	1.49	4.57	0.129	0.305	6.66	257
7/12/16	6	95	8.7	<0.020	0.558	3.26	0.101	0.226	6.01	194
7/12/16	7	99	11.1	0.029	1.89	5.98	0.110	0.820	7.47	210
7/12/16	8	86	8.8	0.022	1.52	5.21	0.101	0.359	6.48	226
7/12/16	9	107	10.0	<0.020	0.983	3.60	0.127	0.239	7.10	182
7/12/16	10	97	8.9	<0.019	1.18	4.60	0.124	0.215	6.93	244

Appendix D.3.–Tributary Creek whole body juvenile Dolly Varden char metals and Se concentrations, 2001–2016.

Sample Date	Sample No.	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	ND	0.56	6.8	127
7/21/01	2	97	9.7	0.10	0.77	5.2	ND	0.67	8.0	118
7/21/01	3	97	9.5	0.15	0.92	5.4	ND	4.88	5.3	144
7/21/01	4	98	10.4	0.15	0.86	6.7	ND	2.19	---	99
7/21/01	5	86	6.4	0.08	0.76	4.9	ND	0.33	6.2	106
7/21/01	6	93	7.8	0.06	0.37	12.0	ND	0.38	6.8	122
7/24/02	1	103	10.8	0.02	0.22	3.7	ND	0.12	1.4	144
7/24/02	2	97	10.4	0.07	1.20	5.5	ND	1.66	3.3	172
7/24/02	3	100	11.2	0.13	1.06	6.1	ND	3.40	5.0	138
7/24/02	4	90	7.9	0.23	1.29	7.1	ND	4.08	5.2	168
7/24/02	5	90	9.2	0.08	1.15	5.2	ND	1.39	6.2	150
7/24/02	6	100	9.3	0.04	0.84	3.2	ND	0.33	5.4	152
7/23/03	1	106	10.7	0.06	0.46	2.8	ND	0.34	6.3	134
7/23/03	2	89	6.8	0.10	1.01	4.0	ND	0.82	6.0	131
7/23/03	3	112	17.4	0.16	1.35	4.4	ND	1.85	5.7	108
7/23/03	4	95	11.6	0.19	0.69	5.6	ND	1.30	3.6	136
7/23/03	5	91	9.5	0.05	0.72	4.4	ND	0.56	4.9	131
7/23/03	6	84	8.4	0.12	0.76	3.9	ND	0.78	4.7	125
7/21/04	1	84	5.5	0.10	0.96	3.2	ND	1.19	5.4	169
7/21/04	2	96	8.5	0.10	1.24	3.8	ND	0.67	5.9	138
7/21/04	3	105	14.1	0.10	2.02	4.0	ND	1.76	5.8	125
7/21/04	4	85	5.8	0.04	0.47	3.7	ND	0.93	4.8	175
7/21/04	5	81	6.4	0.09	2.34	4.3	ND	1.44	8.2	140
7/21/04	6	86	10.4	0.11	0.83	5.5	ND	0.97	5.8	161
7/23/05	1	97	11.1	0.06	0.70	10.4	ND	0.29	6.4	104
7/23/05	2	113	16.8	0.10	0.63	4.7	ND	0.97	6.1	122
7/23/05	3	115	18.8	0.07	0.52	6.3	ND	0.53	5.8	109
7/23/05	4	117	20.5	0.19	0.79	9.9	ND	1.07	6.7	117
7/23/05	5	101	11.7	0.07	1.44	5.2	ND	1.00	8.1	130
7/23/05	6	107	13.7	0.10	1.29	4.6	ND	0.46	8.0	134
7/21/06	1	99	12.9	0.12	0.74	4.0	ND	0.32	6.3	120
7/21/06	2	96	11.6	0.12	0.76	7.7	ND	1.32	6.8	157
7/21/06	3	94	10.9	0.18	1.59	10.3	ND	2.48	4.9	160
7/21/06	4	100	10.9	0.11	1.34	8.5	ND	1.46	5.2	142
7/21/06	5	97	11.7	0.14	0.88	4.6	ND	0.96	5.2	107
7/21/06	6	117	20.8	0.24	1.29	4.3	ND	2.92	5.9	130

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Appendix D.3.–Page 2 of 3.

Sample Date	Sample No.	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)
7/20/07	1	98	12.4	0.11	0.91	2.7	ND	1.10	7.8	106
7/20/07	2	89	8.9	0.12	1.72	3.3	ND	1.80	5.6	136
7/20/07	3	114	14.1	0.15	2.76	3.4	ND	1.28	8.7	122
7/20/07	4	81	7.1	0.14	1.90	4.2	ND	2.03	7.0	114
7/20/07	5	114	14.6	0.88	3.63	3.9	ND	1.56	10.9	131
7/20/07	6	93	10.6	0.14	1.50	20.3	ND	3.80	9.4	107
7/23/08	1	103	12.9	0.224	1.99	4.2	ND	3.47	7.66	169.0
7/23/08	2	108	14.8	0.095	0.96	3.2	ND	0.86	5.82	143.0
7/23/08	3	88	8.9	0.076	0.93	3.3	ND	0.75	4.41	186.0
7/23/08	4	86	9.3	0.220	1.91	5.7	ND	4.06	5.71	119.0
7/23/08	5	92	9.6	0.073	1.01	2.7	ND	0.61	5.20	125.0
7/23/08	6	90	8.7	0.033	0.54	2.2	ND	0.43	4.80	108.0
7/22/09	1	83	6.9	0.04	0.29	1.7	ND	0.24	5.4	127
7/22/09	2	91	8.6	0.06	0.55	2.1	ND	0.16	5.1	137
7/22/09	3	91	8.5	0.11	0.36	2.0	ND	0.23	7.5	138
7/22/09	4	98	10.3	0.09	0.81	3.4	ND	0.38	5.8	147
7/22/09	5	91	8.6	0.03	0.47	2.2	ND	0.40	4.5	125
7/22/09	6	90	7.8	0.06	0.60	2.2	ND	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	ND	0.090	0.80	3.4	ND	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

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Sample Date	Sample No.	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)
7/23/14	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
7/11/16	1	97	8.1	0.057	0.341	1.99	0.250	0.222	6.34	136
7/11/16	2	90	6.3	0.068	0.898	2.68	0.219	0.493	5.61	115
7/11/16	3	105	11.5	0.139	0.438	2.23	0.315	0.333	7.48	124
7/11/16	4	94	9.4	0.134	1.30	2.76	0.234	0.982	7.12	134
7/11/16	5	94	10.3	0.078	0.783	2.35	0.334	0.189	6.62	125
7/11/16	6	114	16.4	0.109	1.03	2.19	0.232	0.285	5.83	131
7/11/16	7	87	6.5	0.051	0.494	2.09	0.363	0.190	4.99	101
7/11/16	8	89	6.5	0.034	0.577	2.17	0.249	0.198	5.61	138
7/11/16	9	102	11.1	0.156	0.892	3.29	0.443	0.368	5.4	127
7/11/16	10	87	6.1	0.059	1.35	2.27	0.263	0.179	8.34	125

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September 26, 2016

Analytical Report for Service Request No: K1609289

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
802 3rd Street
P.O. Box 110024
Douglas, AK 99811-0024

RE: 2016 Greens Creek Mine Biomonitoring / 160004158

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory August 11, 2016
For your reference, these analyses have been assigned our service request number **K1609289.**

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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Table of Contents

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	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
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
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/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
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Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS ENVIRONMENTAL

Client:	Alaska Department of Fish and Game	**Service Request No.:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/ 160004158	**Date Received:**	08/11/16
Sample Matrix:	Animal Tissue		

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).

<u>Sample Receipt</u>

Twenty animal tissue samples were received for analysis at ALS Environmental on 08/11/16. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at –20ºC upon receipt at the laboratory.

<u>Total Metals</u>

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for the replicate analysis of Copper in sample 071216GC54DV1 was outside the normal ALS control limits (23% RPD versus a control limit of 20%). The samples were homogenized, freeze dried, then ground prior to digestion, however this was not sufficient to achieve a completely uniform distribution of Copper in the tissue.

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

Approved by______________________________

Chain of Custody

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ALS Environmental

CHAIN OF CUSTODY

SR# K1609289

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PAGE ____ OF ____ COC# ____

PROJECT NAME: 2016 Greens Creek Mine Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: Hecla / AK Dept. of Fish and Game
ADDRESS: 802 3rd St
CITY/STATE/ZIP: Juneau, AK 99801
E-MAIL ADDRESS: Kate.Kanouse@alaska.gov
PHONE #: (907) 465-4290 FAX #:
SAMPLER'S SIGNATURE: Kate Kanouse

Analysis columns: NUMBER OF CONTAINERS; Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☐; Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐; Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐; Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐; PCBs Aroclors☐ Congeners☐; Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐; Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐; Metals, Total or Dissolved (See List below); Cyanide☐ Hex-Chrom☐; (circle) pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.; (circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos; TOX 9020☐ AOX 1650☐ 506☐; Alkalinity☐ CO_3☐ HCO_3☐; Dioxins/Furans 1613☐ 8290☐; Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐ CO_2☐; REMARKS

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Metals, Total or Dissolved	REMARKS
See attachment 1 of 1 of juvenile fish whole body individual samples					30	X	

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
X II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. #
Bill To: Chris Wallace, Hecla Greens Creek Mining Company

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
X Standard (15 working days)
___ Provide FAX Results

Requested Report Date ____

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca (Cd) Co Cr (Cu) Fe (Pb) Mg Mn Mo Ni K (Ag) Na (Se) Sr Tl Sn V (Zn) (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 Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: Kate Kanouse Date/Time: 8/9/16 0800	Signature: [signature] Date/Time: 8-11-16 0940	Signature: Date/Time:	Signature: Date/Time:
Printed Name: Kate Kanouse Firm: ADFG	Printed Name: C. Sugh Firm: ALS	Printed Name: Firm:	Printed Name: Firm:

COC Attachment 1 of 1

K1609289

Project Name	2016 Greens Creek Mine Biomonitoring
Project Manager	Kate Kanouse
Company Name	Alaska Department of Fish and Game
Phone No.	(907) 465-4290
Sample Type	Whole body juvenile Dolly Varden char
Analysis	Total metals, dry weight basis, report percent solids

Matrix	Sample Date	Sample Site	Sample ID #	Total Metals	Fork Length (mm)	Weight (g)
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	8.1
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	6.3
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	11.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	9.4
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	10.3
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	114	16.4
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	6.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	89	6.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	102	11.1
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	6.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	127	21.5
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	113	16.2
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	117	15.8
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	12.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	9.0
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	11.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	8.8
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	107	10.0
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	8.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.3
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	82	6.1
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	10.1
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	7.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	88	6.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.3
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.8
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	7.6
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	9.4
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	9.8

ALS

PC Shar

Cooler Receipt and Preservation Form

Client Hecla Service Request K16 09289

Received: 8-11-16 Opened: 8-11-16 By: eg Unloaded: 8-11-16 By: eg

1. Samples were received via? *USPS* ***Fed Ex*** (circled) *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** (circled) *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA **Y** (circled) N If yes, how many and where? 1 front

   If present, were custody seals intact? **Y** (circled) N If present, were they signed and dated? **Y** (circled) N

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA (circled)	Tracking Number NA	Filed
-0.3	-0.7	—	—	-0.4	350		783780211976	

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* ***Gel Packs*** (circled) *Wet Ice* *Dry Ice* *Sleeves* ______
5. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** (circled) N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA **Y** (circled) N

   If applicable, tissue samples were received: *Frozen* ***Partially Thawed*** (circled) *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA **Y** (circled) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA **Y** (circled) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** (circled) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* **NA** (circled) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* **NA** (circled) Y N
12. Was C12/Res negative? **NA** (circled) 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: ______

7/25/16

Page ____ *of* ____

Total Solids

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www.alsglobal.com

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16 - 07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
Analysis Method:	Calculation	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Moisture

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
071216GC54DV1	K1609289-001	**70.1**	-	1	08/24/16 09:45	
071216GC54DV2	K1609289-002	**78.5**	-	1	08/24/16 09:45	
071216GC54DV3	K1609289-003	**77.1**	-	1	08/24/16 09:45	
071216GC54DV4	K1609289-004	**78.0**	-	1	08/24/16 09:45	
071216GC54DV5	K1609289-005	**77.1**	-	1	08/24/16 09:45	
071216GC54DV6	K1609289-006	**77.3**	-	1	08/24/16 09:45	
071216GC54DV7	K1609289-007	**77.5**	-	1	08/24/16 09:45	
071216GC54DV8	K1609289-008	**79.7**	-	1	08/24/16 09:45	
071216GC54DV9	K1609289-009	**77.5**	-	1	08/24/16 09:45	
071216GC54DV10	K1609289-010	**78.5**	-	1	08/24/16 09:45	
071216GC48DV1	K1609289-011	**78.3**	-	1	08/24/16 09:45	
071216GC48DV2	K1609289-012	**78.7**	-	1	08/24/16 09:45	
071216GC48DV3	K1609289-013	**77.2**	-	1	08/24/16 09:45	
071216GC48DV4	K1609289-014	**76.9**	-	1	08/24/16 09:45	
071216GC48DV5	K1609289-015	**78.3**	-	1	08/24/16 09:45	
071216GC48DV6	K1609289-016	**77.0**	-	1	08/24/16 09:45	
071216GC48DV7	K1609289-017	**78.1**	-	1	08/24/16 09:45	
071216GC48DV8	K1609289-018	**77.3**	-	1	08/24/16 09:45	
071216GC48DV9	K1609289-019	**77.9**	-	1	08/24/16 09:45	
071216GC48DV10	K1609289-020	**76.6**	-	1	08/24/16 09:45	

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dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16 - 07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
071216GC54DV1	K1609289-001	**29.9**	-	1	08/24/16 09:45	
071216GC54DV2	K1609289-002	**21.5**	-	1	08/24/16 09:45	
071216GC54DV3	K1609289-003	**22.9**	-	1	08/24/16 09:45	
071216GC54DV4	K1609289-004	**22.0**	-	1	08/24/16 09:45	
071216GC54DV5	K1609289-005	**22.9**	-	1	08/24/16 09:45	
071216GC54DV6	K1609289-006	**22.7**	-	1	08/24/16 09:45	
071216GC54DV7	K1609289-007	**22.5**	-	1	08/24/16 09:45	
071216GC54DV8	K1609289-008	**20.3**	-	1	08/24/16 09:45	
071216GC54DV9	K1609289-009	**22.5**	-	1	08/24/16 09:45	
071216GC54DV10	K1609289-010	**21.5**	-	1	08/24/16 09:45	
071216GC48DV1	K1609289-011	**21.7**	-	1	08/24/16 09:45	
071216GC48DV2	K1609289-012	**21.3**	-	1	08/24/16 09:45	
071216GC48DV3	K1609289-013	**22.8**	-	1	08/24/16 09:45	
071216GC48DV4	K1609289-014	**23.1**	-	1	08/24/16 09:45	
071216GC48DV5	K1609289-015	**21.7**	-	1	08/24/16 09:45	
071216GC48DV6	K1609289-016	**23.0**	-	1	08/24/16 09:45	
071216GC48DV7	K1609289-017	**21.9**	-	1	08/24/16 09:45	
071216GC48DV8	K1609289-018	**22.7**	-	1	08/24/16 09:45	
071216GC48DV9	K1609289-019	**22.1**	-	1	08/24/16 09:45	
071216GC48DV10	K1609289-020	**23.4**	-	1	08/24/16 09:45	

Metals

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ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal tissue	**Date Received:**	08/11/16

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Dry
Test Notes:			

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
071216GC54DV1	K1609289-001	5.0	5	08/29/16	08/30/16	95.8	
071216GC54DV2	K1609289-002	4.9	5	08/29/16	08/30/16	130	
071216GC54DV3	K1609289-003	5.0	5	08/29/16	08/30/16	146	
071216GC54DV4	K1609289-004	4.9	5	08/29/16	08/30/16	153	
071216GC54DV5	K1609289-005	5.0	5	08/29/16	08/30/16	129	
071216GC54DV6	K1609289-006	5.0	5	08/29/16	08/30/16	101	
071216GC54DV7	K1609289-007	4.9	5	08/29/16	08/30/16	110	
071216GC54DV8	K1609289-008	5.0	5	08/29/16	08/30/16	101	
071216GC54DV9	K1609289-009	5.0	5	08/29/16	08/30/16	127	
071216GC54DV10	K1609289-010	4.9	5	08/29/16	08/30/16	124	
071216GC48DV1	K1609289-011	5.0	5	08/29/16	08/30/16	180	
071216GC48DV2	K1609289-012	4.9	5	08/29/16	08/30/16	160	
071216GC48DV3	K1609289-013	5.0	5	08/29/16	08/30/16	108	
071216GC48DV4	K1609289-014	4.8	5	08/29/16	08/30/16	163	
071216GC48DV5	K1609289-015	4.9	5	08/29/16	08/30/16	243	
071216GC48DV6	K1609289-016	5.0	5	08/29/16	08/30/16	150	
071216GC48DV7	K1609289-017	5.0	5	08/29/16	08/30/16	172	
071216GC48DV8	K1609289-018	4.9	5	08/29/16	08/30/16	210	
071216GC48DV9	K1609289-019	4.9	5	08/29/16	08/30/16	127	
071216GC48DV10	K1609289-020	5.0	5	08/29/16	08/30/16	114	
Method Blank 1	K1609289-MB1	1.0	1	08/29/16	08/30/16	ND	
Method Blank 2	K1609289-MB2	1.0	1	08/29/16	08/30/16	ND	
Method Blank 3	K1609289-MB3	1.0	1	08/29/16	08/30/16	ND	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal tissue	**Date Received:**	08/11/16
		Date Extracted:	08/29/16
		Date Analyzed:	08/30/16

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	071216GC54DV1		Units:	ng/g
Lab Code:	K1609289-001MS,	K1609289-001MSD	Basis:	Dry
Test Notes:				

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	Percent Recovery ALS Acceptance Limits	Relative Percent Difference	Result Notes
Mercury	METHOD	1631E	5.0	240	250	95.8	340	358	102	105	70-130	5	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal tissue	**Date Received:**	08/11/16
		Date Extracted:	08/29/16
		Date Analyzed:	08/30/16

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	071216GC54DV2		Units:	ng/g
Lab Code:	K1609289-002MS,	K1609289-002MSD	Basis:	Dry
Test Notes:				

									Percent Recovery				
	Prep	Analysis		Spike Level		Sample	Spike Result				ALS Acceptance	Relative Percent	Result
Analyte	**Method**	**Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	4.9	250	240	130	388	382	103	105	70-130	2	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	08/30/16

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 Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.98	100	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	08/30/16

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 Percent Recovery Acceptance Limits**	**Result Notes**
Mercury	METHOD	1631E	5.00	4.39	88	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	08/29/16
		Date Analyzed:	08/30/16

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 Percent Recovery Acceptance Limits**	**Result Notes**
Mercury	METHOD	1631E	292	289	99	70-130	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV1	**Basis:**	Dry, per Method
Lab Code:	K1609289-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.904**	mg/Kg	0.020	5	09/07/16 10:10	09/02/16	
Copper	6020A	**2.86**	mg/Kg	0.10	5	09/07/16 10:10	09/02/16	
Lead	6020A	**0.176**	mg/Kg	0.020	5	09/07/16 10:10	09/02/16	
Selenium	6020A	**4.2**	mg/Kg	1.0	5	09/07/16 10:10	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 10:10	09/02/16	
Zinc	6020A	**115**	mg/Kg	0.50	5	09/07/16 10:10	09/02/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV2	**Basis:**	Dry, per Method
Lab Code:	K1609289-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.01**	mg/Kg	0.019	5	09/07/16 10:54	09/02/16	
Copper	6020A	**3.49**	mg/Kg	0.096	5	09/07/16 10:54	09/02/16	
Lead	6020A	**0.295**	mg/Kg	0.019	5	09/07/16 10:54	09/02/16	
Selenium	6020A	**6.23**	mg/Kg	0.96	5	09/07/16 10:54	09/02/16	
Silver	6020A	**0.024**	mg/Kg	0.019	5	09/07/16 10:54	09/02/16	
Zinc	6020A	**154**	mg/Kg	0.48	5	09/07/16 10:54	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV3	**Basis:**	Dry, per Method
Lab Code:	K1609289-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.44**	mg/Kg	0.020	5	09/07/16 10:59	09/02/16	
Copper	6020A	**4.22**	mg/Kg	0.098	5	09/07/16 10:59	09/02/16	
Lead	6020A	**0.232**	mg/Kg	0.020	5	09/07/16 10:59	09/02/16	
Selenium	6020A	**7.03**	mg/Kg	0.98	5	09/07/16 10:59	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 10:59	09/02/16	
Zinc	6020A	**210**	mg/Kg	0.49	5	09/07/16 10:59	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV4	**Basis:**	Dry, per Method
Lab Code:	K1609289-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.626**	mg/Kg	0.019	5	09/07/16 11:03	09/02/16	
Copper	6020A	**3.39**	mg/Kg	0.096	5	09/07/16 11:03	09/02/16	
Lead	6020A	**0.220**	mg/Kg	0.019	5	09/07/16 11:03	09/02/16	
Selenium	6020A	**6.18**	mg/Kg	0.96	5	09/07/16 11:03	09/02/16	
Silver	6020A	ND U	mg/Kg	0.019	5	09/07/16 11:03	09/02/16	
Zinc	6020A	**173**	mg/Kg	0.48	5	09/07/16 11:03	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV5	**Basis:**	Dry, per Method
Lab Code:	K1609289-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.49**	mg/Kg	0.020	5	09/07/16 11:08	09/02/16	
Copper	6020A	**4.57**	mg/Kg	0.099	5	09/07/16 11:08	09/02/16	
Lead	6020A	**0.305**	mg/Kg	0.020	5	09/07/16 11:08	09/02/16	
Selenium	6020A	**6.66**	mg/Kg	0.99	5	09/07/16 11:08	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 11:08	09/02/16	
Zinc	6020A	**257**	mg/Kg	0.50	5	09/07/16 11:08	09/02/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV6	**Basis:**	Dry, per Method
Lab Code:	K1609289-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.558**	mg/Kg	0.020	5	09/07/16 11:13	09/02/16	
Copper	6020A	**3.26**	mg/Kg	0.099	5	09/07/16 11:13	09/02/16	
Lead	6020A	**0.226**	mg/Kg	0.020	5	09/07/16 11:13	09/02/16	
Selenium	6020A	**6.01**	mg/Kg	0.99	5	09/07/16 11:13	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 11:13	09/02/16	
Zinc	6020A	**194**	mg/Kg	0.49	5	09/07/16 11:13	09/02/16	

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Superset Reference:

Client: Alaska Department of Fish and Game
Service Request: K1609289
Project: 2016 Greens Creek Mine Biomonitoring/160004158
Date Collected: 07/12/16
Sample Matrix: Animal Tissue
Date Received: 08/11/16 09:40

Sample Name: 071216GC54DV7
Basis: Dry, per Method
Lab Code: K1609289-007

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.89**	mg/Kg	0.020	5	09/07/16 11:18	09/02/16	
Copper	6020A	**5.98**	mg/Kg	0.099	5	09/07/16 11:18	09/02/16	
Lead	6020A	**0.820**	mg/Kg	0.020	5	09/07/16 11:18	09/02/16	
Selenium	6020A	**7.47**	mg/Kg	0.99	5	09/07/16 11:18	09/02/16	
Silver	6020A	**0.029**	mg/Kg	0.020	5	09/07/16 11:18	09/02/16	
Zinc	6020A	**210**	mg/Kg	0.49	5	09/07/16 11:18	09/02/16	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV8	**Basis:**	Dry, per Method
Lab Code:	K1609289-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.52**	mg/Kg	0.019	5	09/07/16 11:23	09/02/16	
Copper	6020A	**5.21**	mg/Kg	0.097	5	09/07/16 11:23	09/02/16	
Lead	6020A	**0.359**	mg/Kg	0.019	5	09/07/16 11:23	09/02/16	
Selenium	6020A	**6.48**	mg/Kg	0.97	5	09/07/16 11:23	09/02/16	
Silver	6020A	**0.022**	mg/Kg	0.019	5	09/07/16 11:23	09/02/16	
Zinc	6020A	**226**	mg/Kg	0.49	5	09/07/16 11:23	09/02/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Service Request: K1609289
Project: 2016 Greens Creek Mine Biomonitoring/160004158
Date Collected: 07/12/16
Sample Matrix: Animal Tissue
Date Received: 08/11/16 09:40

Sample Name: 071216GC54DV9
Basis: Dry, per Method
Lab Code: K1609289-009

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.983**	mg/Kg	0.020	5	09/07/16 11:28	09/02/16	
Copper	6020A	**3.60**	mg/Kg	0.099	5	09/07/16 11:28	09/02/16	
Lead	6020A	**0.239**	mg/Kg	0.020	5	09/07/16 11:28	09/02/16	
Selenium	6020A	**7.10**	mg/Kg	0.99	5	09/07/16 11:28	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 11:28	09/02/16	
Zinc	6020A	**182**	mg/Kg	0.50	5	09/07/16 11:28	09/02/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC54DV10	**Basis:**	Dry, per Method
Lab Code:	K1609289-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.18**	mg/Kg	0.019	5	09/07/16 11:32	09/02/16	
Copper	6020A	**4.60**	mg/Kg	0.097	5	09/07/16 11:32	09/02/16	
Lead	6020A	**0.215**	mg/Kg	0.019	5	09/07/16 11:32	09/02/16	
Selenium	6020A	**6.93**	mg/Kg	0.97	5	09/07/16 11:32	09/02/16	
Silver	6020A	ND U	mg/Kg	0.019	5	09/07/16 11:32	09/02/16	
Zinc	6020A	**244**	mg/Kg	0.49	5	09/07/16 11:32	09/02/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV1	**Basis:**	Dry, per Method
Lab Code:	K1609289-011		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.28**		mg/Kg	0.020	5	09/07/16 11:47	09/02/16	
Copper	6020A	**4.72**		mg/Kg	0.098	5	09/07/16 11:47	09/02/16	
Lead	6020A	**0.157**		mg/Kg	0.020	5	09/07/16 11:47	09/02/16	
Selenium	6020A	**7.63**		mg/Kg	0.98	5	09/07/16 11:47	09/02/16	
Silver	6020A	ND	U	mg/Kg	0.020	5	09/07/16 11:47	09/02/16	
Zinc	6020A	**252**		mg/Kg	0.49	5	09/07/16 11:47	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV2	**Basis:**	Dry, per Method
Lab Code:	K1609289-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.921**	mg/Kg	0.020	5	09/07/16 11:52	09/02/16	
Copper	6020A	**4.82**	mg/Kg	0.100	5	09/07/16 11:52	09/02/16	
Lead	6020A	**0.147**	mg/Kg	0.020	5	09/07/16 11:52	09/02/16	
Selenium	6020A	**5.83**	mg/Kg	1.00	5	09/07/16 11:52	09/02/16	
Silver	6020A	**0.023**	mg/Kg	0.020	5	09/07/16 11:52	09/02/16	
Zinc	6020A	**222**	mg/Kg	0.50	5	09/07/16 11:52	09/02/16	

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Superset Reference:

Client:	Alaska Department of Fish and Game		**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158		**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue		**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV3		**Basis:**	Dry, per Method
Lab Code:	K1609289-013			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.09**	mg/Kg	0.019	5	09/07/16 11:57	09/02/16	
Copper	6020A	**3.99**	mg/Kg	0.096	5	09/07/16 11:57	09/02/16	
Lead	6020A	**0.150**	mg/Kg	0.019	5	09/07/16 11:57	09/02/16	
Selenium	6020A	**6.30**	mg/Kg	0.96	5	09/07/16 11:57	09/02/16	
Silver	6020A	**0.021**	mg/Kg	0.019	5	09/07/16 11:57	09/02/16	
Zinc	6020A	**189**	mg/Kg	0.48	5	09/07/16 11:57	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV4	**Basis:**	Dry, per Method
Lab Code:	K1609289-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.44**	mg/Kg	0.020	5	09/08/16 12:02	09/02/16	
Copper	6020A	**4.49**	mg/Kg	0.100	5	09/08/16 12:02	09/02/16	
Lead	6020A	**0.205**	mg/Kg	0.020	5	09/08/16 12:02	09/02/16	
Selenium	6020A	**6.77**	mg/Kg	1.00	5	09/08/16 12:02	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/08/16 12:02	09/02/16	
Zinc	6020A	**197**	mg/Kg	0.50	5	09/08/16 12:02	09/02/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV5	**Basis:**	Dry, per Method
Lab Code:	K1609289-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.50**	mg/Kg	0.019	5	09/08/16 12:06	09/02/16	
Copper	6020A	**4.65**	mg/Kg	0.096	5	09/08/16 12:06	09/02/16	
Lead	6020A	**0.493**	mg/Kg	0.019	5	09/08/16 12:06	09/02/16	
Selenium	6020A	**7.63**	mg/Kg	0.96	5	09/08/16 12:06	09/02/16	
Silver	6020A	**0.035**	mg/Kg	0.019	5	09/08/16 12:06	09/02/16	
Zinc	6020A	**185**	mg/Kg	0.48	5	09/08/16 12:06	09/02/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV6	**Basis:**	Dry, per Method
Lab Code:	K1609289-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.681**	mg/Kg	0.020	5	09/08/16 12:11	09/02/16	
Copper	6020A	**4.12**	mg/Kg	0.099	5	09/08/16 12:11	09/02/16	
Lead	6020A	**0.088**	mg/Kg	0.020	5	09/08/16 12:11	09/02/16	
Selenium	6020A	**6.42**	mg/Kg	0.99	5	09/08/16 12:11	09/02/16	
Silver	6020A	**0.023**	mg/Kg	0.020	5	09/08/16 12:11	09/02/16	
Zinc	6020A	**200**	mg/Kg	0.50	5	09/08/16 12:11	09/02/16	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV7	**Basis:**	Dry, per Method
Lab Code:	K1609289-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.21**	mg/Kg	0.019	5	09/08/16 12:16	09/02/16	
Copper	6020A	**4.69**	mg/Kg	0.097	5	09/08/16 12:16	09/02/16	
Lead	6020A	**0.143**	mg/Kg	0.019	5	09/08/16 12:16	09/02/16	
Selenium	6020A	**7.19**	mg/Kg	0.97	5	09/08/16 12:16	09/02/16	
Silver	6020A	**0.065**	mg/Kg	0.019	5	09/08/16 12:16	09/02/16	
Zinc	6020A	**194**	mg/Kg	0.49	5	09/08/16 12:16	09/02/16	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV8	**Basis:**	Dry, per Method
Lab Code:	K1609289-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.89**	mg/Kg	0.019	5	09/08/16 12:21	09/02/16	
Copper	6020A	**4.96**	mg/Kg	0.097	5	09/08/16 12:21	09/02/16	
Lead	6020A	**0.295**	mg/Kg	0.019	5	09/08/16 12:21	09/02/16	
Selenium	6020A	**7.27**	mg/Kg	0.97	5	09/08/16 12:21	09/02/16	
Silver	6020A	**0.022**	mg/Kg	0.019	5	09/08/16 12:21	09/02/16	
Zinc	6020A	**251**	mg/Kg	0.49	5	09/08/16 12:21	09/02/16	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV9	**Basis:**	Dry, per Method
Lab Code:	K1609289-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.23**	mg/Kg	0.020	5	09/08/16 12:26	09/02/16	
Copper	6020A	**4.85**	mg/Kg	0.10	5	09/08/16 12:26	09/02/16	
Lead	6020A	**0.193**	mg/Kg	0.020	5	09/08/16 12:26	09/02/16	
Selenium	6020A	**5.8**	mg/Kg	1.0	5	09/08/16 12:26	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/08/16 12:26	09/02/16	
Zinc	6020A	**205**	mg/Kg	0.50	5	09/08/16 12:26	09/02/16	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/14/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071216GC48DV10	**Basis:**	Dry, per Method
Lab Code:	K1609289-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.32**	mg/Kg	0.020	5	09/08/16 12:31	09/02/16	
Copper	6020A	**4.72**	mg/Kg	0.099	5	09/08/16 12:31	09/02/16	
Lead	6020A	**0.134**	mg/Kg	0.020	5	09/08/16 12:31	09/02/16	
Selenium	6020A	**6.28**	mg/Kg	0.99	5	09/08/16 12:31	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/08/16 12:31	09/02/16	
Zinc	6020A	**178**	mg/Kg	0.49	5	09/08/16 12:31	09/02/16	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry, per Method
Lab Code:	KQ1610643-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND U	mg/Kg	0.020	5	09/07/16 09:22	09/02/16	
Copper	6020A	ND U	mg/Kg	0.10	5	09/07/16 09:22	09/02/16	
Lead	6020A	ND U	mg/Kg	0.020	5	09/07/16 09:22	09/02/16	
Selenium	6020A	ND U	mg/Kg	1.0	5	09/07/16 09:22	09/02/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 09:22	09/02/16	
Zinc	6020A	ND U	mg/Kg	0.50	5	09/07/16 09:22	09/02/16	

ALS Group USA, Corp.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
		Date Analyzed:	09/07/16

Replicate Sample Summary
Total Metals

Sample Name:	071216GC54DV1	**Units:**	mg/Kg
Lab Code:	K1609289-001	**Basis:**	Dry, per Method

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1610643-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.904	0.922	0.913	2	20
Copper	6020A	0.099	2.86	3.62	3.24	23 *	20
Lead	6020A	0.020	0.176	0.213	0.194	19	20
Selenium	6020A	0.99	4.21	4.37	4.29	4	20
Silver	6020A	0.020	ND U	ND U	ND	-	20
Zinc	6020A	0.50	115	130	122	12	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.

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Superset Reference:

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/12/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
		Date Analyzed:	09/7/16
		Date Extracted:	09/2/16

Matrix Spike Summary
Total Metals

Sample Name:	071216GC54DV1	**Units:**	mg/Kg
Lab Code:	K1609289-001	**Basis:**	Dry, per Method
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1610643-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.904	5.80	4.97	99	75-125
Copper	2.86	26.5	24.8	95	75-125
Lead	0.176	44.9	49.7	90	75-125
Selenium	4.21	21.8	16.6	106	75-125
Silver	ND U	4.46	4.97	90	75-125
Zinc	115	171	49.7	113	75-125

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.

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Analyzed:**	09/07/16
Sample Matrix:	Animal Tissue	**Date Extracted:**	09/02/16

Lab Control Sample Summary
Total Metals

Analysis Method:	6020A	**Units:**	mg/Kg
Prep Method:	PSEP Metals	**Basis:**	Dry, per Method
		Analysis Lot:	513189

Lab Control Sample
KQ1610643-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	4.99	5.00	100	80-120
Copper	24.8	25.0	99	80-120
Lead	45.8	50.0	92	80-120
Selenium	16.4	16.7	98	80-120
Silver	4.67	5.00	93	80-120
Zinc	47.6	50.0	95	80-120

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/02/16
		Date Analyzed:	09/08/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609289-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	6020A	0.306	0.315	103	0.233 - 0.385	
Copper	PSEP Tissue	6020A	15.9	15.5	97	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.390	94	0.290 - 0.563	
Selenium	PSEP Tissue	7742	3.56	3.91	110	2.58 - 4.68	
Zinc	PSEP Tissue	6020A	52.2	53.4	102	39.2 - 66.5	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609289
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/02/16
		Date Analyzed:	09/08/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609289-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	6020A	42.3	42.1	100	32.4-52.9	
Copper	PSEP Tissue	6020A	497	454	91	380-623	
Lead	PSEP Tissue	6020A	0.225	0.178	79	0.166-0.292	
Selenium	PSEP Tissue	7742	10.9	11.2	103	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	133	98	104-170	

ALS Environmental
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September 30, 2016

Analytical Report for Service Request No: K1609288

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
802 3rd Street
P.O. Box 110024
Douglas, AK 99811-0024

RE: 2016 Greens Creek Mine Biomonitoring / 160004158

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory August 11, 2016
For your reference, these analyses have been assigned our service request number **K1609288.**

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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Table of Contents

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	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
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
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/anlayte is offered by that state.

Chain of Custody

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CHAIN OF CUSTODY

ALS Environmental

SR# K1609288

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PAGE ______ OF ______ COC# ______

PROJECT NAME: 2016 Greens Creek Mine Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: Hecla / AK. Dept. of Fish and Game
ADDRESS: 802 3rd St.
CITY/STATE/ZIP: Juneau, AK 99801
E-MAIL ADDRESS: Kate.Kanouse@alaska.gov
PHONE #: (907) 465-4290 FAX #:
SAMPLER'S SIGNATURE: Kate Kanouse

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS		Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, Total or Dissolved (See List below)	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS, Turb.	(circle) NH3-N, COD, TKN, TOC, DOC, NO2+NO3, T-Phos	TOX 9020☐ AOX 1650☐	Alkalinity☐ CO3☐ HCO3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐ CO2☐			REMARKS
see attachment	1 of	1 of			30									X										
juvenile fish	whole	body																						
individual samples																								

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
X II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. #
Bill To: Chris Wallace Hecla Greens Creek Mining Company

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
X Standard (15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca (Cd) Co Cr (Cu) Fe (Pb) Mg Mn Mo Ni K (Ag) Na (Se) Sr Tl Sn V (Zn) (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 Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ______ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

Container Supply Number 70617

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 8/9/16 0800	Signature: [signature] Date/Time: 8-11-16 09:40	Signature: Date/Time:	Signature: Date/Time:
Printed Name: Kate Kanouse Firm: ADFG	Printed Name: C. Suzuki Firm: ALS	Printed Name: Firm:	Printed Name: Firm:

1160928 8

Project Name	2016 Greens Creek Mine Biomonitoring
Project Manager	Kate Kanouse
Company Name	Alaska Department of Fish and Game
Phone No.	(907) 465-4290
Sample Type	Whole body juvenile Dolly Varden char
Analysis	Total metals, dry weight basis, report percent solids

Matrix	Sample Date	Sample Site	Sample ID #	Total Metals	Fork Length (mm)	Weight (g)
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	8.1
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	6.3
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	11.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	9.4
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	10.3
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	114	16.4
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	6.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	89	6.5
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	102	11.1
Whole Body	7/11/2016	Tributary Creek Site 9	071116TC9DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	6.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	127	21.5
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	113	16.2
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	117	15.8
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	12.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	9.0
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	11.1
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	8.8
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	107	10.0
Whole Body	7/12/2016	Greens Creek Site 54	071216GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	8.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.3
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	82	6.1
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	10.1
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	7.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	88	6.9
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.3
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.8
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	7.6
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	9.4
Whole Body	7/14/2016	Greens Creek Site 48	071416GC48DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	9.8

(ALS)

PC Shar

Cooler Receipt and Preservation Form

Client Hecla Service Request K16 09288

Received: 8-11-16 Opened: 8-11-16 By: es Unloaded: 8-11-16 By: es

1. Samples were received via? *USPS* *Fed Ex* (circled) *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* (circled) *Box* *Envelope* *Other* ______ NA
3. Were custody seals on coolers? NA Y (circled) N If yes, how many and where? 1 front

   If present, were custody seals intact? Y (circled) N If present, were they signed and dated? Y (circled) N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA (circled)	Tracking Number NA	Filed
-0.3	-0.7	—	—	-0.4	350		7837 8021 1976	

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* (circled) *Wet Ice* *Dry Ice* *Sleeves* ______
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y (circled) N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA Y (circled) N

   If applicable, tissue samples were received: *Frozen* *Partially Thawed* (circled) *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y (circled) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y (circled) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y (circled) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA (circled) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA (circled) Y N
12. Was C12/Res negative? NA (circled) 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: ______

7/25/16

Page ____ *of* ____

Total Solids

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

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
Analysis Method:	Calculation	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Moisture

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
071116TC9DV1	K1609288-001	**78.2**	-	1	08/24/16 09:45	
071116TC9DV2	K1609288-002	**77.5**	-	1	08/24/16 09:45	
071116TC9DV3	K1609288-003	**77.7**	-	1	08/24/16 09:45	
071116TC9DV4	K1609288-004	**77.6**	-	1	08/24/16 09:45	
071116TC9DV5	K1609288-005	**76.4**	-	1	08/24/16 09:45	
071116TC9DV6	K1609288-006	**76.7**	-	1	08/24/16 09:45	
071116TC9DV7	K1609288-007	**77.1**	-	1	08/24/16 09:45	
071116TC9DV8	K1609288-008	**78.4**	-	1	08/24/16 09:45	
071116TC9DV9	K1609288-009	**77.7**	-	1	08/24/16 09:45	
071116TC9DV10	K1609288-010	**77.4**	-	1	08/24/16 09:45	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
071116TC9DV1	K1609288-001	**21.8**	-	1	08/24/16 09:45	
071116TC9DV2	K1609288-002	**22.5**	-	1	08/24/16 09:45	
071116TC9DV3	K1609288-003	**22.3**	-	1	08/24/16 09:45	
071116TC9DV4	K1609288-004	**22.4**	-	1	08/24/16 09:45	
071116TC9DV5	K1609288-005	**23.6**	-	1	08/24/16 09:45	
071116TC9DV6	K1609288-006	**23.3**	-	1	08/24/16 09:45	
071116TC9DV7	K1609288-007	**22.9**	-	1	08/24/16 09:45	
071116TC9DV8	K1609288-008	**21.6**	-	1	08/24/16 09:45	
071116TC9DV9	K1609288-009	**22.3**	-	1	08/24/16 09:45	
071116TC9DV10	K1609288-010	**22.6**	-	1	08/24/16 09:45	

Metals

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal tissue	**Date Received:**	08/11/16

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Dry
Test Notes:			

Sample Name	**Lab Code**	**MRL**	**Dilution Factor**	**Date Extracted**	**Date Analyzed**	**Result**	**Result Notes**
071116TC9DV1	K1609288-001	4.9	5	08/30/16	08/30/16	250	
071116TC9DV2	K1609288-002	5.0	5	08/30/16	08/30/16	219	
071116TC9DV3	K1609288-003	5.0	5	08/30/16	08/30/16	315	
071116TC9DV4	K1609288-004	5.0	5	08/30/16	08/30/16	234	
071116TC9DV5	K1609288-005	5.0	5	08/30/16	08/30/16	334	
071116TC9DV6	K1609288-006	4.8	5	08/30/16	08/30/16	232	
071116TC9DV7	K1609288-007	4.9	5	08/30/16	08/30/16	363	
071116TC9DV8	K1609288-008	4.9	5	08/30/16	08/30/16	249	
071116TC9DV9	K1609288-009	4.9	5	08/30/16	08/30/16	443	
071116TC9DV10	K1609288-010	5.0	5	08/30/16	08/30/16	263	
Method Blank 1	K1609288-MB1	1.0	1	08/30/16	08/30/16	ND	
Method Blank 2	K1609288-MB2	1.0	1	08/30/16	08/30/16	ND	
Method Blank 3	K1609288-MB3	1.0	1	08/30/16	08/30/16	ND	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	08/30/16
		Date Analyzed:	08/30/16

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Batch QC		Units:	ng/g
Lab Code:	E1600717-002MS,	E1600717-002MSD	Basis:	Dry
Test Notes:				

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	Percent Recovery ALS Acceptance Limits	Relative Percent Difference	Result Notes
Mercury	METHOD	1631E	5.0	250	250	38.6	297	295	103	103	70-130	<1	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	08/30/16

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 Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	5.13	103	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	08/30/16

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 Percent Recovery Acceptance Limits**	**Result Notes**
Mercury	METHOD	1631E	5.00	4.87	97	70-130	

Client: Alaska Department of Fish and Game
Project: 2016 Greens Creek Mine Biomonitoring/160004158
LCS Matrix: Animal tissue

Service Request: K1609288
Date Collected: NA
Date Received: NA
Date Extracted: 08/30/16
Date Analyzed: 08/30/16

Quality Control Sample (QCS) Summary
Total Metals

Sample Name: Quality Control Sample
Lab Code:
Test Notes:

Units: ng/g
Basis: Dry

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	285	98	70-130	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV1	**Basis:**	Dry, per Method
Lab Code:	K1609288-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.341**	mg/Kg	0.020	5	09/07/16 05:45	09/01/16	
Copper	6020A	**1.99**	mg/Kg	0.099	5	09/07/16 05:45	09/01/16	
Lead	6020A	**0.222**	mg/Kg	0.020	5	09/07/16 05:45	09/01/16	
Selenium	6020A	**6.34**	mg/Kg	0.99	5	09/07/16 05:45	09/01/16	
Silver	6020A	**0.057**	mg/Kg	0.020	5	09/07/16 05:45	09/01/16	
Zinc	6020A	**136**	mg/Kg	0.50	5	09/07/16 05:45	09/01/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV2	**Basis:**	Dry, per Method
Lab Code:	K1609288-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.898**	mg/Kg	0.020	5	09/07/16 05:49	09/01/16	
Copper	6020A	**2.68**	mg/Kg	0.098	5	09/07/16 05:49	09/01/16	
Lead	6020A	**0.493**	mg/Kg	0.020	5	09/07/16 05:49	09/01/16	
Selenium	6020A	**5.61**	mg/Kg	0.98	5	09/07/16 05:49	09/01/16	
Silver	6020A	**0.068**	mg/Kg	0.020	5	09/07/16 05:49	09/01/16	
Zinc	6020A	**115**	mg/Kg	0.49	5	09/07/16 05:49	09/01/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV3	**Basis:**	Dry, per Method
Lab Code:	K1609288-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.438**	mg/Kg	0.020	5	09/07/16 05:54	09/01/16	
Copper	6020A	**2.23**	mg/Kg	0.098	5	09/07/16 05:54	09/01/16	
Lead	6020A	**0.333**	mg/Kg	0.020	5	09/07/16 05:54	09/01/16	
Selenium	6020A	**7.48**	mg/Kg	0.98	5	09/07/16 05:54	09/01/16	
Silver	6020A	**0.139**	mg/Kg	0.020	5	09/07/16 05:54	09/01/16	
Zinc	6020A	**124**	mg/Kg	0.49	5	09/07/16 05:54	09/01/16	

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Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV4	**Basis:**	Dry, per Method
Lab Code:	K1609288-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.30**	mg/Kg	0.019	5	09/07/16 05:59	09/01/16	
Copper	6020A	**2.76**	mg/Kg	0.094	5	09/07/16 05:59	09/01/16	
Lead	6020A	**0.982**	mg/Kg	0.019	5	09/07/16 05:59	09/01/16	
Selenium	6020A	**7.12**	mg/Kg	0.94	5	09/07/16 05:59	09/01/16	
Silver	6020A	**0.134**	mg/Kg	0.019	5	09/07/16 05:59	09/01/16	
Zinc	6020A	**134**	mg/Kg	0.47	5	09/07/16 05:59	09/01/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV5	**Basis:**	Dry, per Method
Lab Code:	K1609288-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.785**	mg/Kg	0.020	5	09/07/16 06:04	09/01/16	
Copper	6020A	**2.33**	mg/Kg	0.099	5	09/07/16 06:04	09/01/16	
Lead	6020A	**0.180**	mg/Kg	0.020	5	09/07/16 06:04	09/01/16	
Selenium	6020A	**6.64**	mg/Kg	0.99	5	09/07/16 06:04	09/01/16	
Silver	6020A	**0.077**	mg/Kg	0.020	5	09/07/16 06:04	09/01/16	
Zinc	6020A	**124**	mg/Kg	0.50	5	09/07/16 06:04	09/01/16	

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Superset Reference:

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV6	**Basis:**	Dry, per Method
Lab Code:	K1609288-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.03**	mg/Kg	0.020	5	09/07/16 06:43	09/01/16	
Copper	6020A	**2.19**	mg/Kg	0.099	5	09/07/16 06:43	09/01/16	
Lead	6020A	**0.285**	mg/Kg	0.020	5	09/07/16 06:43	09/01/16	
Selenium	6020A	**5.83**	mg/Kg	0.99	5	09/07/16 06:43	09/01/16	
Silver	6020A	**0.109**	mg/Kg	0.020	5	09/07/16 06:43	09/01/16	
Zinc	6020A	**131**	mg/Kg	0.50	5	09/07/16 06:43	09/01/16	

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Superset Reference:

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV7	**Basis:**	Dry, per Method
Lab Code:	K1609288-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.494**	mg/Kg	0.019	5	09/07/16 06:48	09/01/16	
Copper	6020A	**2.09**	mg/Kg	0.097	5	09/07/16 06:48	09/01/16	
Lead	6020A	**0.190**	mg/Kg	0.019	5	09/07/16 06:48	09/01/16	
Selenium	6020A	**4.99**	mg/Kg	0.97	5	09/07/16 06:48	09/01/16	
Silver	6020A	**0.051**	mg/Kg	0.019	5	09/07/16 06:48	09/01/16	
Zinc	6020A	**101**	mg/Kg	0.49	5	09/07/16 06:48	09/01/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Service Request: K1609288
Project: 2016 Greens Creek Mine Biomonitoring/160004158
Date Collected: 07/11/16
Sample Matrix: Animal Tissue
Date Received: 08/11/16 09:40

Sample Name: 071116TC9DV8
Basis: Dry, per Method
Lab Code: K1609288-008

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.577**	mg/Kg	0.020	5	09/07/16 06:52	09/01/16	
Copper	6020A	**2.17**	mg/Kg	0.099	5	09/07/16 06:52	09/01/16	
Lead	6020A	**0.198**	mg/Kg	0.020	5	09/07/16 06:52	09/01/16	
Selenium	6020A	**5.61**	mg/Kg	0.99	5	09/07/16 06:52	09/01/16	
Silver	6020A	**0.034**	mg/Kg	0.020	5	09/07/16 06:52	09/01/16	
Zinc	6020A	**138**	mg/Kg	0.50	5	09/07/16 06:52	09/01/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV9	**Basis:**	Dry, per Method
Lab Code:	K1609288-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.892**	mg/Kg	0.020	5	09/07/16 06:57	09/01/16	
Copper	6020A	**3.29**	mg/Kg	0.10	5	09/07/16 06:57	09/01/16	
Lead	6020A	**0.368**	mg/Kg	0.020	5	09/07/16 06:57	09/01/16	
Selenium	6020A	**5.4**	mg/Kg	1.0	5	09/07/16 06:57	09/01/16	
Silver	6020A	**0.156**	mg/Kg	0.020	5	09/07/16 06:57	09/01/16	
Zinc	6020A	**127**	mg/Kg	0.50	5	09/07/16 06:57	09/01/16	

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Superset Reference:

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16 09:40
Sample Name:	071116TC9DV10	**Basis:**	Dry, per Method
Lab Code:	K1609288-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.35**	mg/Kg	0.020	5	09/07/16 07:02	09/01/16	
Copper	6020A	**2.27**	mg/Kg	0.099	5	09/07/16 07:02	09/01/16	
Lead	6020A	**0.179**	mg/Kg	0.020	5	09/07/16 07:02	09/01/16	
Selenium	6020A	**8.34**	mg/Kg	0.99	5	09/07/16 07:02	09/01/16	
Silver	6020A	**0.059**	mg/Kg	0.020	5	09/07/16 07:02	09/01/16	
Zinc	6020A	**125**	mg/Kg	0.50	5	09/07/16 07:02	09/01/16	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry, per Method
Lab Code:	KQ1610485-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND U	mg/Kg	0.020	5	09/07/16 05:06	09/01/16	
Copper	6020A	ND U	mg/Kg	0.10	5	09/07/16 05:06	09/01/16	
Lead	6020A	ND U	mg/Kg	0.020	5	09/07/16 05:06	09/01/16	
Selenium	6020A	ND U	mg/Kg	1.0	5	09/07/16 05:06	09/01/16	
Silver	6020A	ND U	mg/Kg	0.020	5	09/07/16 05:06	09/01/16	
Zinc	6020A	ND U	mg/Kg	0.50	5	09/07/16 05:06	09/01/16	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
		Date Analyzed:	09/07/16

Replicate Sample Summary
Total Metals

Sample Name:	071116TC9DV5	**Units:**	mg/Kg
Lab Code:	K1609288-005	**Basis:**	Dry, per Method

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1610485-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.785	0.780	0.783	<1	20
Copper	6020A	0.098	2.33	2.36	2.35	1	20
Lead	6020A	0.020	0.180	0.198	0.189	9	20
Selenium	6020A	0.98	6.64	6.60	6.62	<1	20
Silver	6020A	0.020	0.077	0.078	0.078	1	20
Zinc	6020A	0.49	124	126	125	2	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.

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Superset Reference:

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	07/11/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/11/16
		Date Analyzed:	09/7/16
		Date Extracted:	09/1/16

Matrix Spike Summary
Total Metals

Sample Name:	071116TC9DV5	**Units:**	mg/Kg
Lab Code:	K1609288-005	**Basis:**	Dry, per Method
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1610485-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.785	5.65	4.93	99	75-125
Copper	2.33	25.7	24.7	95	75-125
Lead	0.180	43.1	49.3	87	75-125
Selenium	6.64	24.6	16.4	109	75-125
Silver	0.077	4.67	4.93	93	75-125
Zinc	124	176	49.3	105	75-125

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.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Analyzed:**	09/07/16
Sample Matrix:	Animal Tissue	**Date Extracted:**	09/01/16

Lab Control Sample Summary
Total Metals

Analysis Method:	6020A	**Units:**	mg/Kg
Prep Method:	PSEP Metals	**Basis:**	Dry, per Method
		Analysis Lot:	513189

Lab Control Sample
KQ1610485-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	4.84	5.00	97	80-120
Copper	24.8	25.0	99	80-120
Lead	46.9	50.0	94	80-120
Selenium	15.8	16.7	95	80-120
Silver	4.77	5.00	95	80-120
Zinc	47.8	50.0	96	80-120

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/01/16
		Date Analyzed:	09/07/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609288-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	6020A	0.306	0.311	102	0.233 - 0.385	
Copper	PSEP Tissue	6020A	15.9	16.0	101	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.295	71	0.290 - 0.563	
Selenium	PSEP Tissue	7742	3.56	4.39	123	2.58 - 4.68	
Zinc	PSEP Tissue	6020A	52.2	56.0	107	39.2 - 66.5	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1609288
Project:	2016 Greens Creek Mine Biomonitoring/160004158	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/01/16
		Date Analyzed:	09/07/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609288-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	6020A	42.3	41.7	99	32.4-52.9	
Copper	PSEP Tissue	6020A	497	457	92	380-623	
Lead	PSEP Tissue	6020A	0.225	0.192	85	0.166-0.292	
Selenium	PSEP Tissue	7742	10.9	12.3	113	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	135	99	104-170	