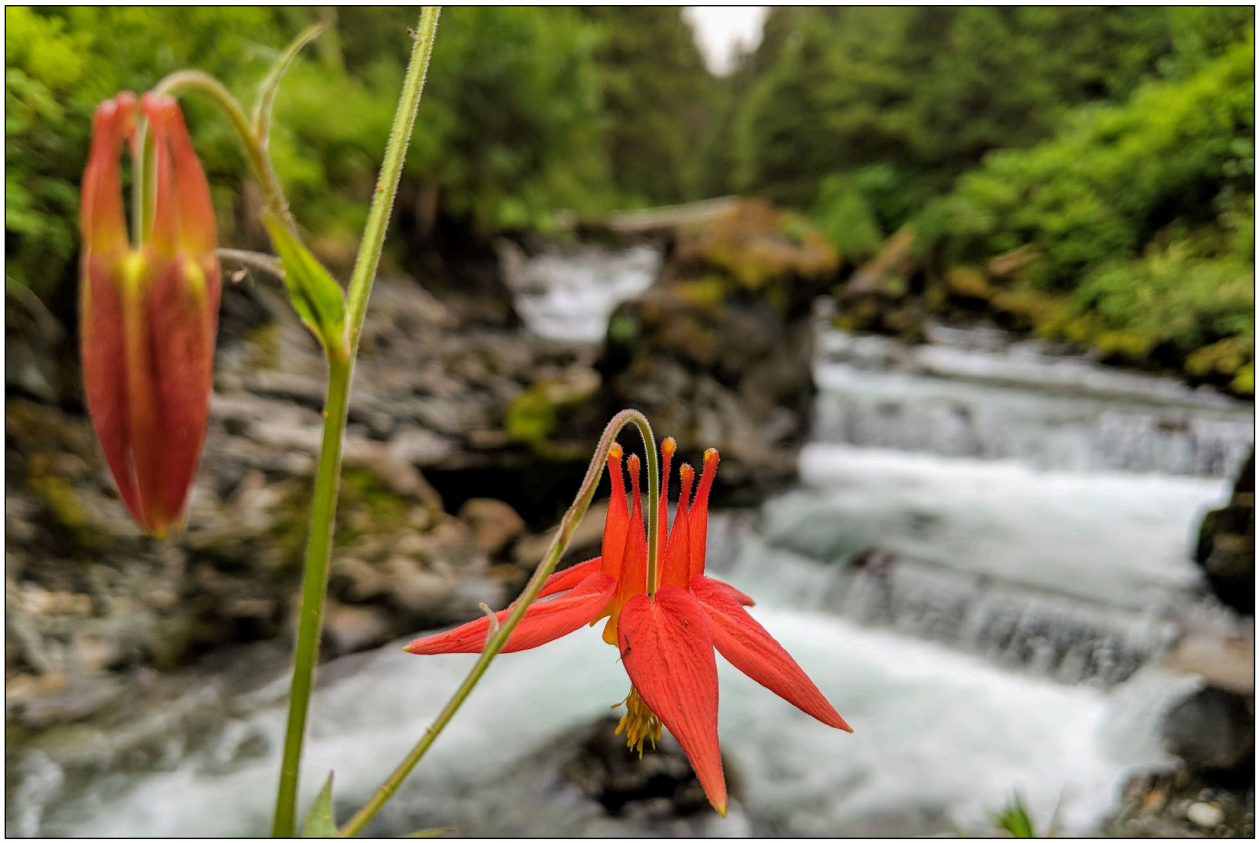
Technical Report No. 20-05

Aquatic Biomonitoring at Greens Creek Mine, 2019

by

William J. Kane



April 2020

Alaska Department of Fish and Game **Habitat Section**

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 Sport Fish and Commercial Fisheries, and the Habitat Section. 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
milligram	mg
milliliter	mL
millimeter	mm
nanometer	nm

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
inch of mercury	inHg
Kilopascal	kPa
Nephelometric Turbidity Unit	NTU
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. 20-05

AQUATIC BIOMONITORING AT GREENS CREEK MINE, 2019

by

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April 2020

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

Cover: Western columbine *Aquilegia formosa* with the Greens Creek fish pass in the background, July 1, 2019.

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ACKNOWLEDGEMENTS

Hecla Greens Creek Mining Company provided financial support and Greens Creek Mine environmental staff Dave Landes, Gunner Fredheim, Doug Maller, and Sydney Cutler provided logistical support and water quality data. Environmental Manager Chris Wallace and Mr. Landes reviewed the draft report.

Several Habitat Section staff assisted with this project. Southeast Regional Supervisor Kate Kanouse, Habitat Biologists Greg Albrecht and Dylan Krull, and Fish and Wildlife Technician Nikki Box assisted with data collection. Mr. Albrecht assisted with periphyton processing, and Habitat Biologist Evan Fritz verified data entry. Habitat Section Operations Manager Dr. Al Ott, Ms. Kanouse, and Mr. Fritz reviewed the report. Matthew Kern of Alder Grove Farm identified benthic macroinvertebrates.

Thank you all for your contribution.

EXECUTIVE SUMMARY

Since 2001, the Alaska Department of Fish and Game Habitat Section completed the aquatic biomonitoring studies the U.S. Forest Service and Alaska Department of Environmental Conservation require for Hecla Greens Creek Mining Company's Greens Creek Mine. This partnership provides the Alaska Department of Fish and Game 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 2019, we completed these studies at Greens Creek Site 63[a] and Site 54, and Tributary Creek Site 9 and Site 1847[b].

The National Weather Service (2020) reports the Juneau area continued to be categorized as in moderate drought during 2019, which began in mid-2017, and experienced warmer than normal temperatures with annual precipitation (154 cm) about 3% below normal and snowfall (110 cm) about 50% below normal. Low snowpack early in the year and little precipitation spring through summer contributed to low streamflows regionwide.

Among the 2019 Greens Creek samples, mean chlorophyll *a* densities, mean benthic macroinvertebrate densities, and the proportions of sensitive insects were within the ranges of values previously observed at Sites 48, 63, and 54. At Tributary Creek Site 9, the 2019 mean chlorophyll *a* density and mean benthic macroinvertebrate density were within the ranges of values previously observed. The Tributary Creek Site 1847 mean chlorophyll *a* density was similar to Site 9, while the Site 1847 mean benthic macroinvertebrate density was greater than Site 9 results, as observed in 2018.

The 2019 Greens Creek juvenile Dolly Varden char *Salvelinus malma* population estimates were similar to previous years at Site 63 and 54. The Site 54 juvenile coho salmon *Oncorhynchus kisutch* population estimate was the greatest observed and capture results suggest two age classes were present. The 2019 Tributary Creek Site 9 juvenile Dolly Varden char population estimate was the lowest observed and coho salmon continue to be the most abundant juvenile fish species. Mean fish condition of Dolly Varden char and coho salmon were similar to previous years at all sites.

Whole body Dolly Varden char element concentrations were generally within the ranges of values previously observed, except for Tributary Creek Site 9 samples where the median mercury concentration was the greatest observed and above the range of values reported for reference and explorations sites elsewhere in Alaska. Among the 2019 Greens Creek samples, we detected significant differences in copper, mercury, and lead concentrations. Comparing all three sites, Tributary Creek Site 9 samples tend to have greater element concentrations and variability than Greens Creek samples, except copper and zinc which were generally greater among Greens Creek samples.

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[a] We began sampling reference Site 63 in 2018 following natural river abandonment at reference Site 48. Like Site 48, Site 63 is located upstream of most mining influence.

[b] We began sampling Site 1847 in 2018 to document periphyton and benthic macroinvertebrate communities as a prospective replacement for sampling Site 9, as low water levels and sediment composition at Site 9 are increasingly limiting our sampling ability.

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, both administered by the U.S. Forest Service (USFS; USFS 2013). The mine has operated since 1989, except between 1993 and 1996 when the mine temporarily closed, and produces gold, lead, silver, and zinc concentrates. Hecla Greens Creek Mining Company (Hecla), a subsidiary of Hecla Mining Company of Coeur d'Alene, ID, 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). The project Plan of Operations Fresh Water Monitoring Program (FWMP; Hecla 2014, Appendix 1) and Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2014DB0003 require aquatic studies in Greens Creek and Tributary Creek near mine facilities to document stream health.

The Alaska Department of Fish and Game (ADF&G) Habitat Section 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), Brewster (2016), Zutz (2017–2018), and Kane and Legere (2019).

PURPOSE

This technical report summarizes the 2019 sample results and documents the condition of biological communities in Greens Creek and Tributary Creek near mine development and operations, satisfying the biological monitoring requirements for Hecla's approved Plan of Operations (Hecla 2014) and ADEC Waste Management Permit 2014DB0003.

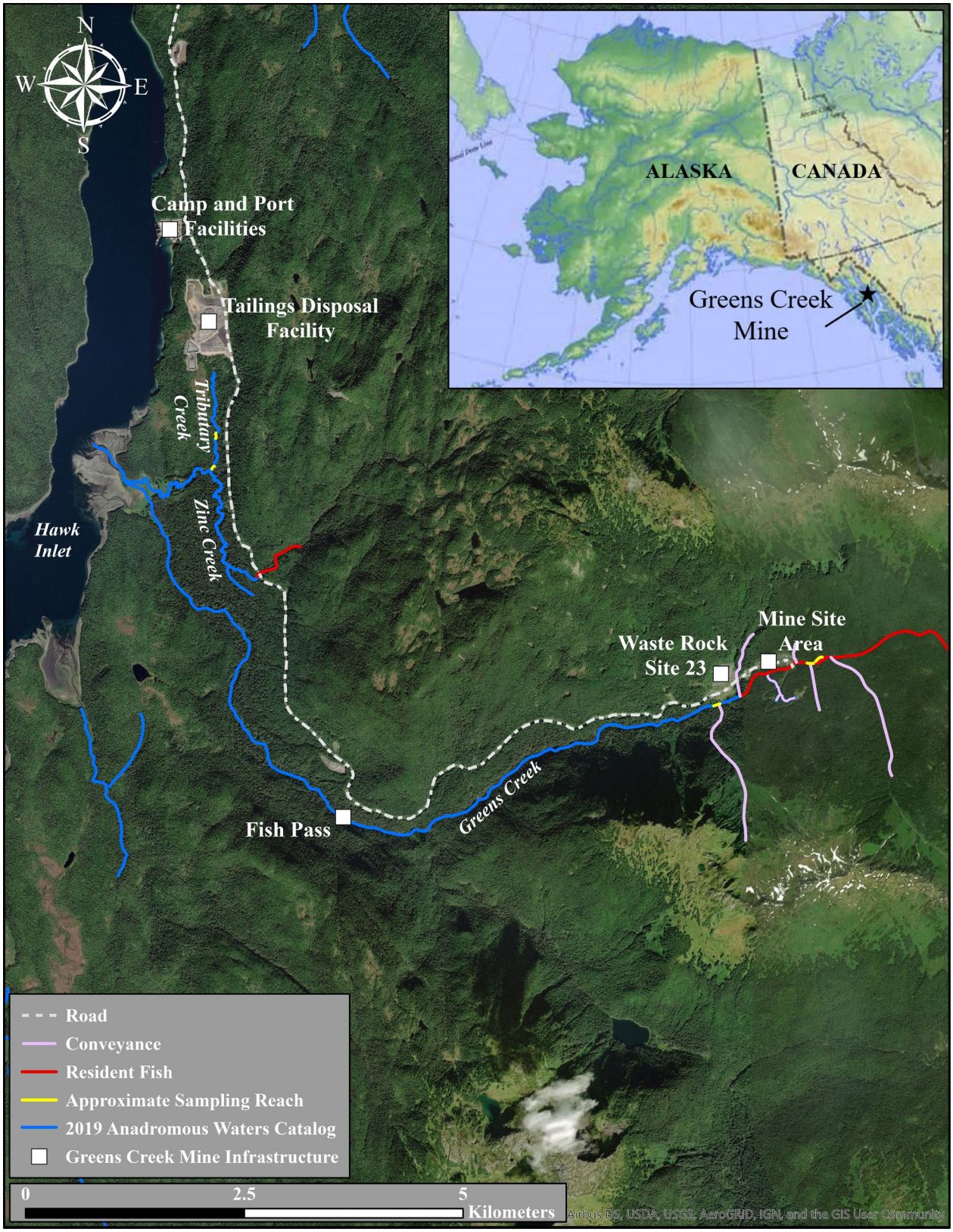

Figure 1.–Greens Creek Mine area map.

AQUATIC BIOMONITORING

In 2019, we completed the following studies at four sample sites (Table 1):

- Abundance and condition of juvenile fish;
- Whole body concentrations of Ag, Cd, Cu, Hg, Pb, Se, and Zn;
- Periphyton biomass, estimated by chlorophyll *a*; and
- Abundance and community composition of benthic macroinvertebrates.

Table 1.–Aquatic biomonitoring study sample sites, 2019.

Location	Biomonitoring reach	Latitude	Longitude
Greens Creek Site 63	Fish – upper extent	58.0827	-134.6286
	Fish – lower extent	58.0832	-134.6295
	Periphyton and benthic macroinvertebrates	58.0831	-134.6300
Greens Creek Site 54	Fish – Upper extent	58.0785	-134.6469
	Fish – Lower extent	58.0783	-134.6478
	Periphyton and benthic macroinvertebrates	58.0783	-134.6466
Tributary Creek Site 9	Upper extent	58.1055	-134.7450
	Lower extent	58.1050	-134.7450
Tributary Creek Site 1847	Periphyton and benthic macroinvertebrates	58.1018	-134.7458

Note: Coordinates in WGS84 datum.

Note: At Site 9, we sample fish, periphyton, and benthic macroinvertebrates in the same reach.

STUDY AREA

We sampled Greens Creek Site 54 and Tributary Site 9 annually since 2001, and Greens Creek reference Site 63 2018–2019,[c] which replaced Greens Creek reference Site 48 where we sampled 2001–2017 (Kane and Legere 2019).[d] Sometime in fall 2017, Greens Creek shifted river left and abandoned the channel at Site 48. The adjacent, newly carved channel was too young and dynamic for sampling biological communities as part of the aquatic biomonitoring program.[e] We also continued sampling Tributary Creek Site 1847 near the stream mouth to investigate periphyton and benthic macroinvertebrate communities in riffle habitats more suitable for sampling than at Site 9.[f]

[c] Bill Kane, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Habitat Section. Memorandum: 2019 Greens Creek Mine Aquatic Biomonitoring; dated October 15, 2019. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

[d] We sampled Greens Creek Site 6 in 2001, 2006, and 2011 (Kanouse 2012).

[e] Kate Kanouse and Johnny Zutz, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: GCM Greens Creek sampling Sites 48 and 63; dated September 7, 2018. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

[f] Kate Kanouse, Habitat Biologist, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: GCM Tributary Creek Sampling Site 1847; dated July 17, 2018. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

Greens Creek

Greens Creek drains a 23.1 km^2 watershed with the main channel measuring 16 km from the alpine headwaters to the mouth in Hawk Inlet (USGS 2020). At each sample site, gradients range from 2% to 4%, cobble is the dominant substrate, and large woody debris is common, characteristic of a medium width mixed control channel type (Paustian 2010). The creek is fed by snowmelt and other drainages, and the magnitude of peak discharge in early summer depends on snowpack depth. Rainfall events during fall also cause peak discharges.

The lower 10 km of Greens Creek (Stream No. 112-65-10240) provides habitat for chum salmon *O. keta*, coho salmon, pink salmon *O. gorbuscha*, and Dolly Varden char (Johnson and Blossom 2019). ADF&G Division of Commercial Fisheries staff survey returning chum and pink salmon in Greens Creek as part of their in-season assessment of salmon run strength (D. Harris, Commercial Fisheries Area Management Biologist, ADF&G, Juneau, personal communication).

Greens Creek stream flow data is recorded at U.S. Geological Survey (USGS) Site 15101490[g], located downstream of Sites 48 and 63, 1350 Creek, Cub Creek, and Hecla's water withdrawal, upstream of mining activities.

Greens Creek Site 48 and Site 63

Prior to river avulsion in fall 2017, we sampled Greens Creek Site 48 which is located upstream of mining activities, except exploratory drilling, near 265 m elevation and about 0.8 km upstream of the mine portal (Figure 2). In 2019, the new channel circumventing Site 48 (Figure 3) appeared similar as in 2018, and we completed the aquatic biomonitoring studies downstream at Site 63 for a second consecutive year.

Like Site 48, Site 63 is located downstream of Big Sore Creek and upstream of mining activities (Figure 2); unlike Site 48, 1350 Creek flows into the Site 63 sampling reach, which was unavoidable due to the limited suitable sampling areas between Big Sore Creek and the portal. Reference data collected at Site 48 and Site 63 are compared to data collected downstream at Site 54. Resident Dolly Varden char is the only fish species we documented at Sites 48 and 63; the infiltration gallery concrete weir near the mine portal blocks upstream fish passage. The upper extent of the 50 m juvenile fish study reach was located at the new channel confluence, and periphyton and macroinvertebrate sampling occur downstream of the fish sample reach (Figures 4, 5).

[g] Prior to February 16, 1999, the gage was located 9 m upstream and at 3 m greater elevation (USGS 2018).

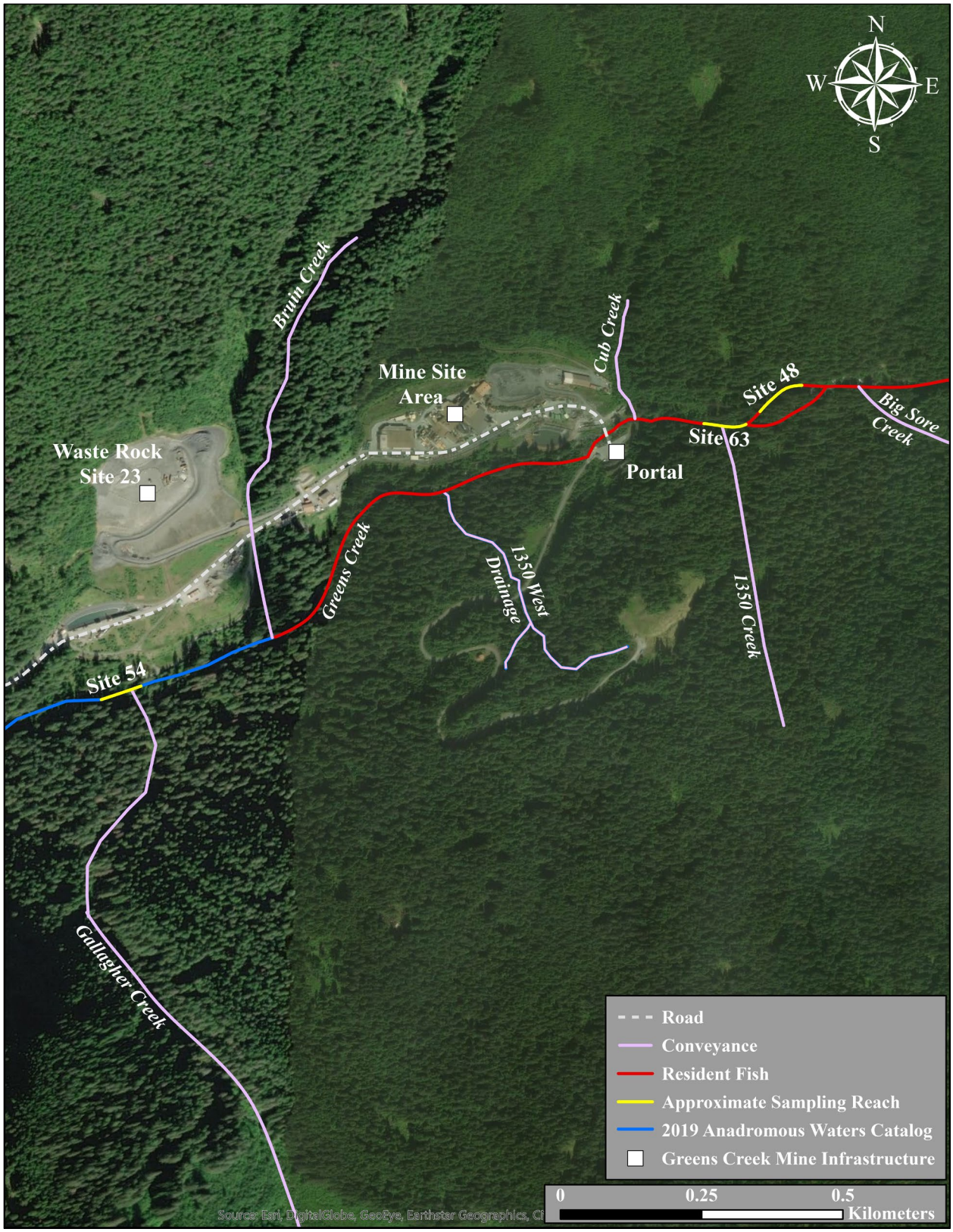

Figure 2.–Greens Creek Sites 48, 63, and 54 map.

Figure 3.–Greens Creek aerial photo, downstream of Site 48, July 9, 2019.

Figure 4.–Greens Creek Site 63 fish sample reach, July 9, 2019.

Figure 5.–Greens Creek Site 63 periphyton and macroinvertebrate sample reach, July 9, 2019.

Greens Creek Site 54

We sampled Greens Creek Site 54 2001–2019. Site 54 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 (Figure 2). Data collected at Site 54 are compared to data collected at reference Site 48 and Site 63 to detect potential changes from waste rock storage areas, storm water ponds, and the mine site upstream. Between Site 48 and Site 54, four tributaries drain to Greens Creek: 1350 Creek, 1350 West Drainage, Cub Creek, and Bruin Creek.

We documented coho salmon, Dolly Varden char, and cutthroat trout *O. clarkii* at Site 54. Anadromous fish access the site via a fish pass about 5.6 km upriver from the mouth. In 1989, Greens Creek Mining Company installed the engineered fish pass as mitigation for impacts to Tributary Creek from the TDF. Three weirs provide step pools for adult coho salmon passage through a natural bedrock chute that prevents upstream fish migration. In November 2005, flood flows caused by a heavy rainstorm damaged the fish pass, limiting upstream adult coho salmon passage in subsequent years. Hecla repaired and fortified the fish pass in March 2016 and inspects the structure seasonally. We observed young-of-year coho salmon in 2017 (Zutz 2018), and two age classes 2018–2019, demonstrating successful adult coho salmon passage occurred during the prior fall spawning seasons.

Periphyton and benthic macroinvertebrate sampling occur about 30 m upstream of the fish sample reach (Figures 6, 7). Gallagher Creek enters Greens Creek within the fish sample reach.

Figure 6.–Greens Creek Site 54 fish sample reach, July 10, 2019.

Figure 7.–Greens Creek Site 54 periphyton and benthic macroinvertebrate sample reach, July 10, 2019.

Tributary Creek

Tributary Creek drains a 1.7 km^2 watershed (USFS 2013) and the main channel measures about 1.6 km between its headwaters and confluence with Zinc Creek (Figure 8). The TDF occupies the headwaters of the creek. Tributary Creek is a lowland stream characterized as a narrow low gradient flood plain channel (Paustian 2010). 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 are less than 5 ft^3/s (USFS 2003).

Tributary Creek (Stream No. 112-65-10230-2007) provides habitat for coho salmon, pink salmon, and Dolly Varden char (Johnson and Blossom 2019).

Figure 8.–Tributary Creek Site 9 and Site 1847 map.

Tributary Creek Site 9

We sampled Tributary Creek Site 9 2001–2019. Site 9 is located about 1.2 km downstream of the TDF at 25 m elevation and is sampled to detect potential changes from the TDF. We documented coho salmon, Dolly Varden char, cutthroat trout, rainbow trout *O. mykiss*, and sculpin *Cottus* sp. at the site. Periphyton and benthic macroinvertebrate sampling occur within the fish sample reach after the juvenile fish population study is complete.

Greens Creek Mine TDF expansions and upstream beaver activity have changed Tributary Creek streamflow patterns and sediment composition at Site 9 since we began sampling in 2001 (Figures 9, 10). The current conditions limit our ability to sample periphyton and benthic macroinvertebrates in riffles. In 2019, we sampled periphyton and benthic macroinvertebrates for the second consecutive year at Tributary Creek Site 1847, downstream of Site 9 near the stream mouth, to investigate periphyton and benthic macroinvertebrate communities in riffle habitats more suitable for sampling than at Site 9.

Figure 9.–One of several beaver dams in Tributary Creek, July 1, 2019.

Figure 10.–Tributary Creek Site 9 sample reach, July 11, 2019.

Tributary Creek Site 1847

We sampled Tributary Creek Site 1847 2018–2019, located within about 50 m of the Tributary Creek mouth (Figure 11). We sampled periphyton and benthic macroinvertebrates and compare the data to the Site 9 data. We did not sample fish since Site 9 continues to provide suitable fish sampling conditions.

Figure 11.–Tributary Creek Site 1847; we used a Cutthroat flume to measure discharge at the lower extent of the periphyton and benthic macroinvertebrate sampling reach, July 11, 2019.

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 2019 results for each site in *Results*.

STREAM FLOW

Sampling and Analysis

In Greens Creek, we measured stream flow with a SonTek FlowTracker acoustic doppler velocimeter.[h] We attempted to record at least 20 measurement points in equidistant subsections and collected additional measurements where we observed changes in the stream bottom elevation and water velocity.

We suspended a fiberglass measuring tape tightly across the stream perpendicular to flow and began the survey from either bank following methods described in SonTek (2007). We surveyed where stream flow was confined to one channel, and usually where the stream bottom elevation and stream flow were uniform across the channel.

In Tributary Creek, we measured stream flow with a collapsible 8-inch Cutthroat flume using methods described in CDPHE (2016).[i] We selected a stream section confined to one channel with uniform flow, placed the flume in the stream parallel to flow, and spread the wing walls upstream. With a portable level, we leveled the flume horizontally and vertically. To prevent water flowing outside the flume, we filled gaps where surface water escaped with substrate using a shovel. We calculated flow rate using charts provided by the manufacturer.

We present discharge[j] measurements for each site and include the mean daily discharge data obtained from USGS Site 15101490. We present a figure of Greens Creek mean daily discharges three weeks prior to sampling in 2019 and include mean daily discharges for the same period, 2001–2019,[k] and include a figure presenting the range of Greens Creek mean daily discharges three weeks prior to sampling, 2001–2019.

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[h] Prior to 2015 (Kanouse 2015), we measured stream flow in Greens Creek and Tributary Creek using a Global Flow Probe Model FP101 flow meter and estimated discharge using a modification of the methods described in Platts et al. (1983).

[i] Prior to 2019 (Kane and Legere 2019), we measured stream flow using a SonTek FlowTracker acoustic doppler velocimeter.

[j] We present discharge data in Imperial units for convention.

[k] Discharge data are not available for Tributary Creek.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Periphyton is composed of primary producing organisms such as algae, cyanobacteria, 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 factors that change throughout the year (Barbour et al. 1999). The concentration of chlorophyll *a* (Chl-*a*) pigment in periphyton samples provides an estimate of active algal biomass (density), while concentrations of chlorophyll *b* (Chl-*b*) and chlorophyll *c* (Chl-*c*) pigments estimate the composition of algal organisms present, such as green algae that produce Chl-*b*, and diatoms and brown algae that produce Chl-*c*.

Requirement FWMP 5.3

The FWMP requires measuring the density (mg/m^2) of chlorophylls *a*, *b*, and *c* in each periphyton sample, comparing the Greens Creek Site 48 and Site 63 Chl-*a* reference data to the Greens Creek Site 54 Chl-*a* data each year, and tracking change over time at each sample site. We do not have reference data to compare Tributary Creek Site 9 or Site 1847 data.

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 and submerged the rocks in the creek with the sample area facing up until sampling. We held a 5 × 5 cm square of high-density foam on the sample area and scrubbed the area around the foam with a toothbrush to remove algae and other organisms outside the sample area, then rinsed the rock by dipping it in the stream while holding the foam in place. We also rinsed the toothbrush in the stream.

We placed a 47 mm diameter Type A/E 1 µm glass fiber filter into a Nalgene® filter holder attached to a vacuum pump with a gauge, then removed the foam square and scrubbed the underside of the foam and the sample area with the toothbrush into the filter holder. We used stream water in a wash bottle to rinse the loosened periphyton from the foam, rock, toothbrush, and the inside of the filter holder onto the filter. We scrubbed the sample area a second time and repeated the rinse cycle. We pumped most of the water through the filter, maintaining pressure less than 34 kPa, and added a few drops[l] of saturated magnesium carbonate solution[m] to the filter before pumping 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 ADF&G Douglas laboratory freezer until processing.

We followed U.S. Environmental Protection Agency (USEPA; USEPA 1997) protocol for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.[n] We removed the samples from the freezer, cut them into small pieces, and placed the filter pieces for each sample into individual 15 mL screw cap centrifuge tubes containing 10 mL of 90% buffered acetone. We capped the centrifuge tubes and shook each tube

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[l] This measurement is not exact as the amount of water and magnesium carbonate used to create a saturated solution varies and does not affect sample integrity. We used supernatant solution to avoid magnesium carbonate solids.

[m] To prevent acidification and conversion of chlorophyll to phaeophytin.

[n] Except we stored the samples longer than 3.5 weeks and we cut the sample filters to reduce acetone exposure for laboratory staff, rather than homogenize them.

vigorously to submerge the filter pieces, placed them in a rack, covered them with aluminum foil, and stored them in a refrigerator overnight to extract the chlorophyll.[o]

The following day, we centrifuged the samples for 20 min at 500 relative centrifugal force, individually decanted the supernatant into a cuvette, and measured each sample absorbance at wavelengths 664 nm, 647 nm, 630 nm, and 750 nm using a Shimadzu UV-1800 spectrophotometer. Prior to measuring samples, we inserted two cuvettes with 90% acetone to correct for the absorbance of the solvent at each wavelength. We treated each sample with 80 µL of 0.1 N hydrochloric acid for 90 seconds to convert the chlorophyll to phaeophytin, and measured absorbance at wavelengths 665 nm and 750 nm.

We used trichromatic equations to estimate Chl-*a,* Chl-*b,* and Chl-*c* concentrations, and corrected for turbidity using the 750 nm absorbance value (APHA 2012, USEPA 1997). We corrected Chl-*a* concentrations when phaeophytin was detected. If Chl-*a* was not detected in a sample, we report the concentration at the estimated detection limit and do not report values for Chl-*b* or Chl-*c*; the 2019 Chl-*a* concentration estimated detection limit was 0.03 mg/m^2. We rounded all values to two decimal places.

We performed the nonparametric Kruskal-Wallis one-way analysis of variance by ranks test, using Statistix® 10 analytical software, to test for differences of mean ranks between the 2019 Greens Creek Sites 63 and 54 data, and across years at each site (Neter et al. 1990). We used the Dunns all-pairwise comparison test to identify differences between years and report significant differences when $p \leq 0.05$.

Data Presentation

For each site and by year, we present mean Chl-*a* density (mg/m^2) ± 1 SD in figures. We present the Greens Creek Site 63 data with Site 48, and the Tributary Creek Site 9 data with Site 1847. Annual sample data and data summaries also are presented (Appendix A).

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 are a food source for fish.

Requirement FWMP 5.4

The FWMP requires annually evaluating BMI abundance and community composition at each site. We estimate mean BMI density and community composition at each site, compare the annual data among Greens Creek sites, and track change over time at all sites. We do not have reference data to compare Tributary Creek Site 9 and Site 1847 data.

Sample Collection and Analysis

We opportunistically collected 8 BMI samples[p] from each site using a Hess sampler in riffles and runs with gravel substrate and different flow velocities: habitats that support greater taxonomic

[o] We allowed samples to saturate for at least 2 h and not more than 24 h.

[p] Prior to 2015, we collected 5 BMI samples each year.

density and richness (Barbour et al. 1999). We do not sample other habitat types (e.g. pools) to reduce variability of the data.

The Hess stream bottom sampler has a 0.086 m^2 sample area and material is captured in a 200 mL cod end, both constructed with 300 µm mesh net. We pushed the sampler into the stream bottom, 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 end, transferred each sample from the cod end to a labeled 500 mL plastic bottle, and preserved the samples in 95% ethanol at a ratio of three parts ethanol to one part sample. We discarded samples when sediment overfilled the cod end.

Contractor Matt Kern of Alder Grove Farm used an elutriator system and 0.5 mm and 0.3 mm sieves to sort macroinvertebrates from debris,[q, r] and identified BMIs to the lowest practical taxonomic level[s] using Merritt and Cummins (1996) and Stewart and Oswood (2006). Habitat Section biologists provided quality control by verifying BMI identification of four samples.

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 BMI density for each site by calculating the mean density among the 8 samples. We report taxa richness as the number of taxonomic groups identified to the lowest practical level and exclude terrestrial organisms[t] from all calculations.

Data Presentation

For each site and by year, we present mean BMI density ± 1 SD and illustrate mean community composition in figures. We present the Greens Creek Site 63 data with Site 48, and the Tributary Creek Site 9 data with Site 1847. Annual data summaries also are presented (Appendix B).

JUVENILE FISH POPULATION

Requirement FWMP 5.5

The FWMP requires estimating juvenile fish populations by species at each site, comparing the annual data among Greens Creek sites each year, and monitoring population change over time at all sample sites. Valid population estimates are contingent upon the ability to satisfy assumptions of the study design each year.

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[q] Gordon Willson-Naranjo and Greg Albrecht, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate elutriation trials amendment; dated December 17, 2013. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd St, Douglas, AK.

[r] Katrina Lee, Administrative Assistant, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate sample enumeration procedures; dated June 28, 2016. Unpublished document can be obtained from the Southeast Regional Supervisor, Habitat Section, 802 3rd St, Douglas, AK.

[s] Insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera to genus, except nonbiting midges to family Chironomidae, and all others to class or order.

[t] Including adult terrestrial insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera.

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 baited with disinfected salmon roe[u] following methods described in Magnus et al. (2006). We placed rocks in the bottom of each trap for weight and to provide refuge for captured fish. We used bait 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.[v] These 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 fish captured in these boundary traps in the population estimates.

We sampled juvenile fish populations using a modification[w] 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. We retrieved each trap, transferred captured fish to a plastic bucket containing aerated stream water, removed the used bait bag, rebaited,[x] and reset each trap in the same location as quickly as possible. We allowed the trap to soak another 1.5 h, then 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 measuring tray to minimize water weight. We retained fish in a perforated plastic bucket secured in the creek and released captured fish[y] 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 traps in all habitat types where water depth and flow allowed.
- Fish did not avoid 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.[z]

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[u] We added 4 oz of Betadyne® to 3 gal of tap water to saturate roe for 15 min, stirring frequently.

[v] 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.

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

[x] On occasion, we did not have enough bait bags for the third pass, so we poked a few more holes in the freshest bags and reused them for the study.

[y] Except, we retained 10 Dolly Varden char for whole body element concentrations at each sample site.

[z] Location dependent on our ability to visually monitor the traps and potential bear interference.

- 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[aa] the following:

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

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 ± 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.

[aa] 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).

Calculating an 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:

$$\chi^2 = \frac{[\mathrm{C}_1 - \mathrm{E}(\mathrm{C}_1)]^2}{\mathrm{E}(\mathrm{C}_1)} + \frac{[\mathrm{C}_2 - \mathrm{E}(\mathrm{C}_2)]^2}{\mathrm{E}(\mathrm{C}_2)} + \frac{[\mathrm{C}_3 - \mathrm{E}(\mathrm{C}_3)]^2}{\mathrm{E}(\mathrm{C}_3)}$$

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^2 value 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 juvenile fish population estimates by species for each site and year in figures. We present the Greens Creek Site 63 data with Site 48. Annual capture data summaries and length frequency diagrams of captured fish also are presented (Appendix C).

JUVENILE FISH CONDITION

Age, sex, season, maturation, diet, gut contents, fat reserve, and muscular development affect fish condition. We used juvenile fish length and weight data to calculate fish condition, an index of fish health.

Requirement FWMP 5.5

The FWMP requires we report mean fish condition by species each year.

Sample Collection and Analysis

We used FL and weight data 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

For each sample site, we present mean fish condition by species. Annual data summaries also are presented (Appendix C).

JUVENILE FISH ELEMENT CONCENTRATIONS

Requirement FWMP 5.6

The FWMP requires annually sampling[bb] 10 juvenile Dolly Varden char within the size range 85–125 mm FL for whole body concentrations of silver (Ag), cadmium (Cd), copper (Cu), mercury[cc] (Hg), lead (Pb), selenium (Se), and zinc (Zn) at each site. An 85 mm fish provides the minimum amount of tissue (about 5 g) required for laboratory analyses, while the maximum fish size of 125 mm improves the likelihood of sampling less than 3-year-old fish at Site 54 and Site 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 retained 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 ADF&G Douglas laboratory freezer.

We shipped the samples in a cooler with frozen ice packs to ALS Environmental in Kelso, WA, 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 USEPA (2002) method 1631E for Hg, and USEPA (1994) method 200.8 for other elements. ALS Environmental provided Tier IV 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® 10 analytical software, to test for equality of population medians between sites (Neter et al. 1990). We used the Dunns all-pairwise comparison test to identify differences between sites and report significant differences when $p \leq 0.05$.

Data Presentation

For each sample site, we present a figure of minimum, median, and maximum whole body concentrations (mg/kg) for each element by year. The annual raw data, presenting the mean value for duplicate sample results, and the 2019 laboratory report also are presented (Appendix D).

[bb] Prior to 2015, we collected 6 Dolly Varden char samples at each site.

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

RESULTS

Three weeks prior to sampling in 2019, Greens Creek mean daily discharges were below the 2001–2018 averages and the median daily discharge during the three-week period was among the lowest observed (USGS 2020; Figures 12, 13).

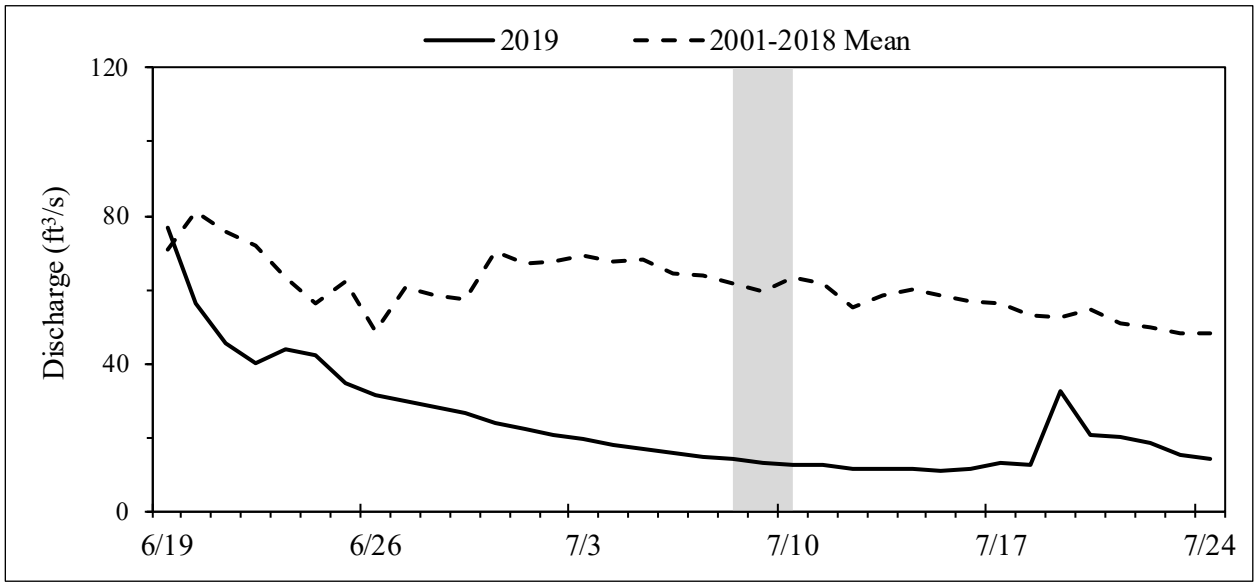

Figure 12.–Greens Creek daily mean discharge three weeks prior to sampling, 2019.
Source: USGS 15101490 (USGS 2020).
Note: 2019 sampling days highlighted in gray.

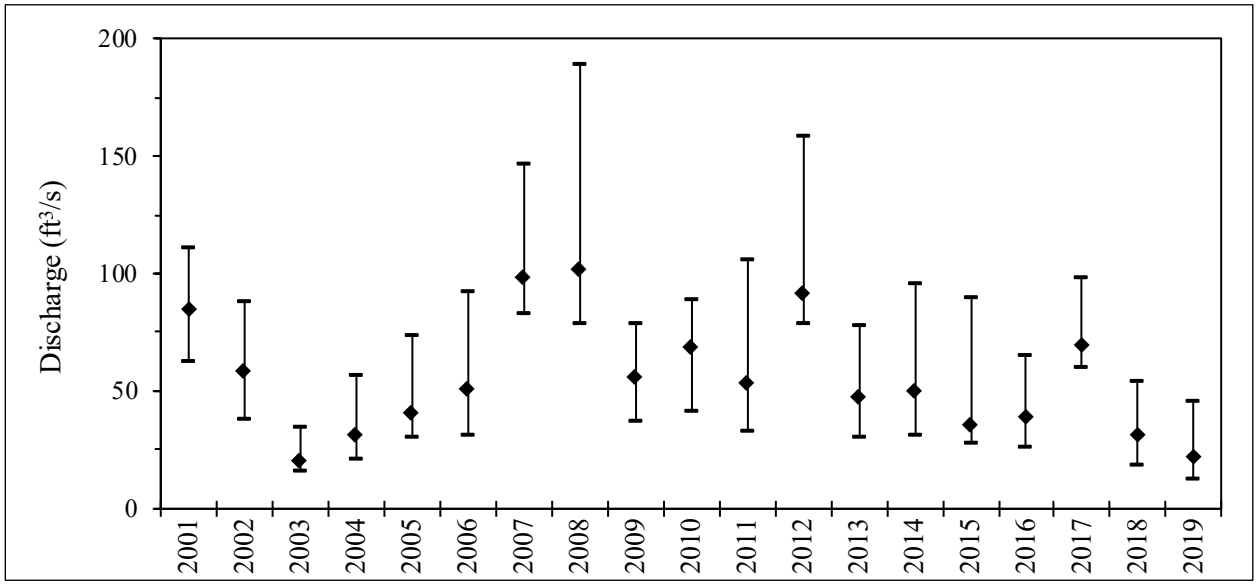

Figure 13.–Greens Creek daily mean discharge three weeks prior to sampling, 2001–2019.
Source: USGS 15101490 (USGS 2020).
Note: Minimum, median, and maximum discharges presented.

GREENS CREEK SITE 48 AND SITE 63

We sampled Greens Creek Site 63 on July 9, 2019. Hecla environmental staff measured basic water quality at 1320 hours (Table 2). We measured stream discharge at 1015 hours (Table 2) and the USGS stream gage recorded a daily mean discharge of 12.8 ft^3/s (USGS 2020).

Table 2.–Greens Creek Site 63 water quality data, 2019.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/09/19	12.2	155.9	7.8	12.4

Periphyton: Chlorophyll Density and Composition

The 2019 Site 63 mean Chl-*a* density at Site 63 was 5.47 mg/m^2, within the range of mean densities previously observed at Site 48 (Figure 14).[dd] The samples contained about 93% Chl-*a*, 7% Chl-*c*, and zero Chl-*b*, similar to mean composition in previous years.

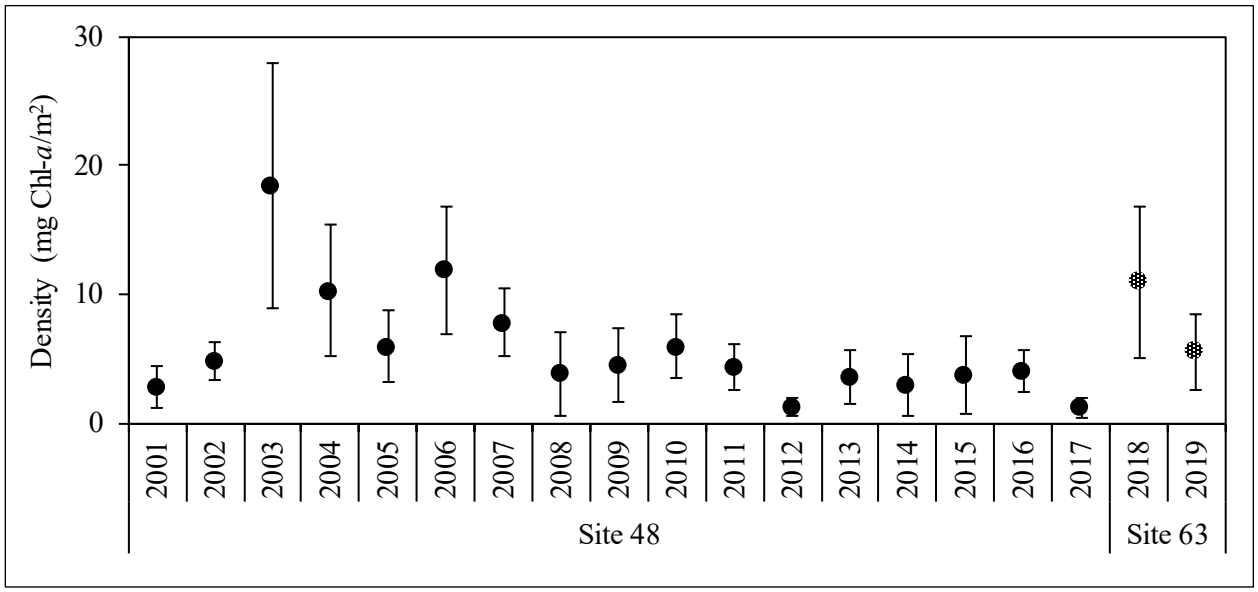

Figure 14.–Greens Creek Site 48 and Site 63 mean chlorophyll *a* densities ± 1 SD, 2001–2019.

[dd] We usually find significant differences in Site 48 and Site 63 Chl- *a* densities between the current year and the 2003 and 2006 data. Chl-*a* densities in 2003 and 2006 were the greatest observed since 2001, which we attribute to natural variation.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Site 63 BMI samples, we counted 28 taxa and estimate mean density at 4,435 BMI/m^2, greater than observed most previous years at Site 48 (Figure 15). EPT insects composed 92% of the samples, also similar to previous results at Site 48 (Figure 16). Dominant taxa were Ephemeroptera: *Drunella* and *Baetis*, composing 36% and 26% of the samples.

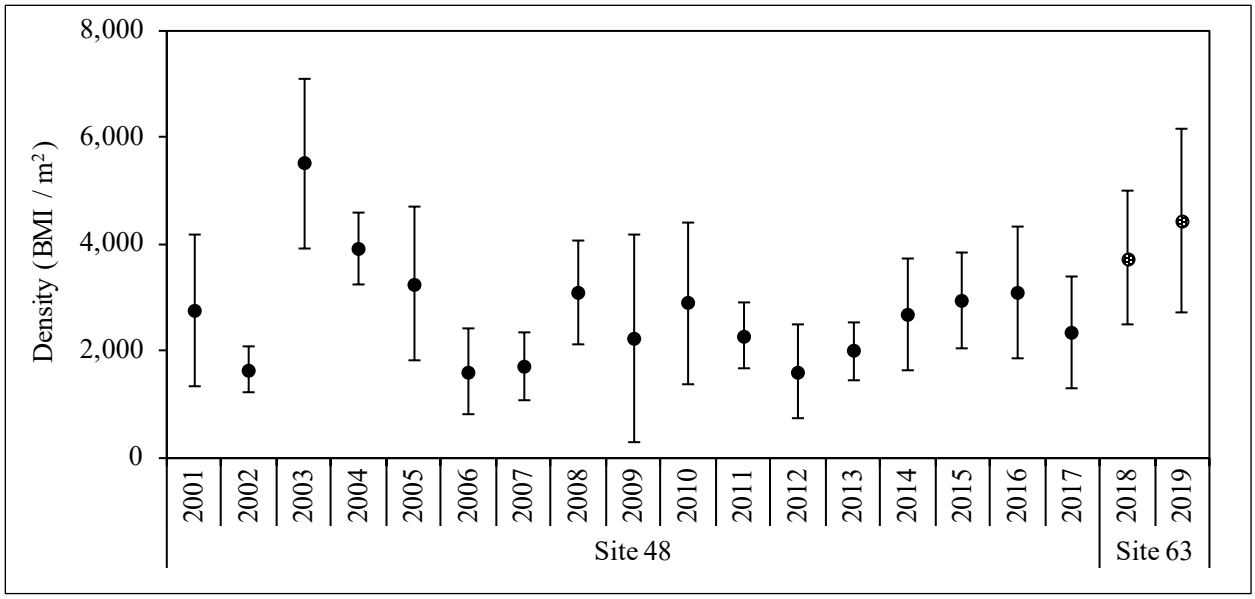

Figure 15.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate densities ± 1 SD, 2001–2019.

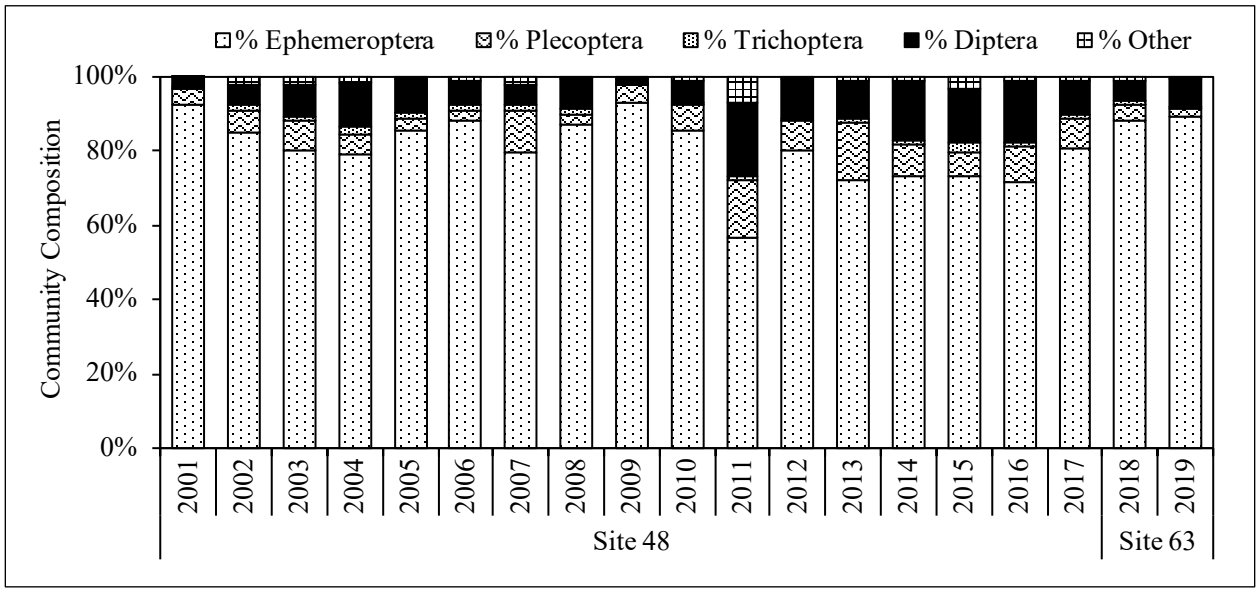

Figure 16.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate community composition, 2001–2019.

Juvenile Fish Populations and Fish Condition

We estimate the 2019 Site 63 Dolly Varden char population at 211 ± 7 fish, greater than the 2018 estimate and within the range of previous estimates at Site 48 (Figure 17). Mean fish condition among the 204 Dolly Varden char we captured was 1.0, and the length frequency diagram suggests multiple age classes were present, as in previous years at Site 48.

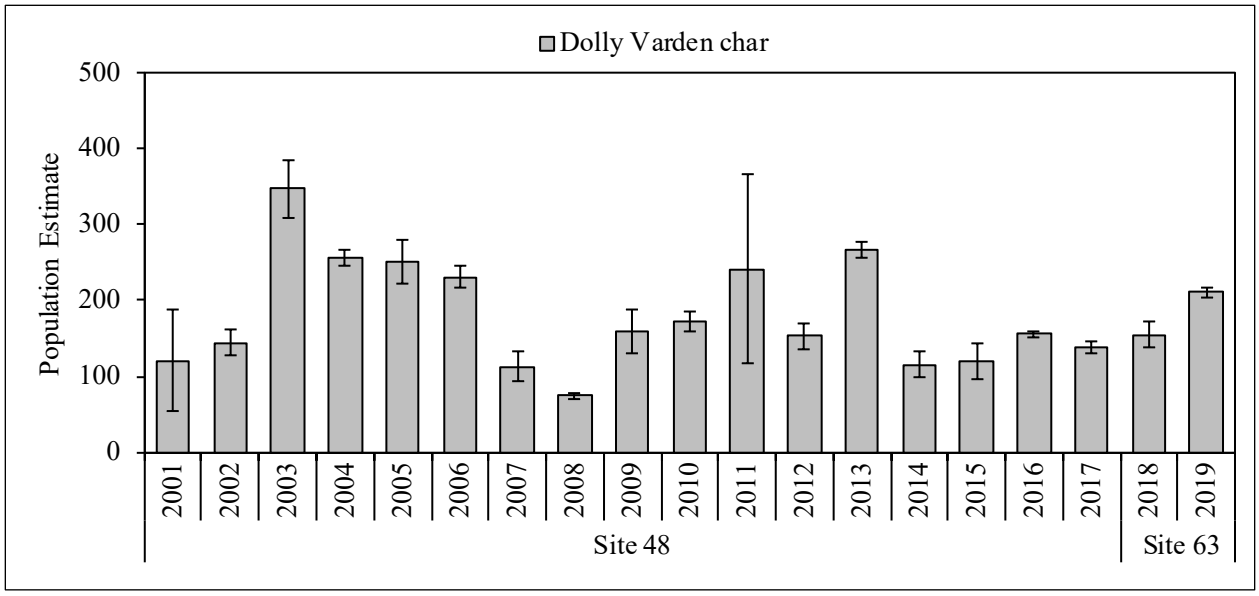

Figure 17.–Greens Creek Site 48 and Site 63 Dolly Varden char population estimates ± 95% CI, 2001–2019.

Juvenile Fish Element Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2019 Site 63 whole body Dolly Varden char samples generally were within the ranges of values previously observed at Sites 48 and 63 (Figures 18, 19).

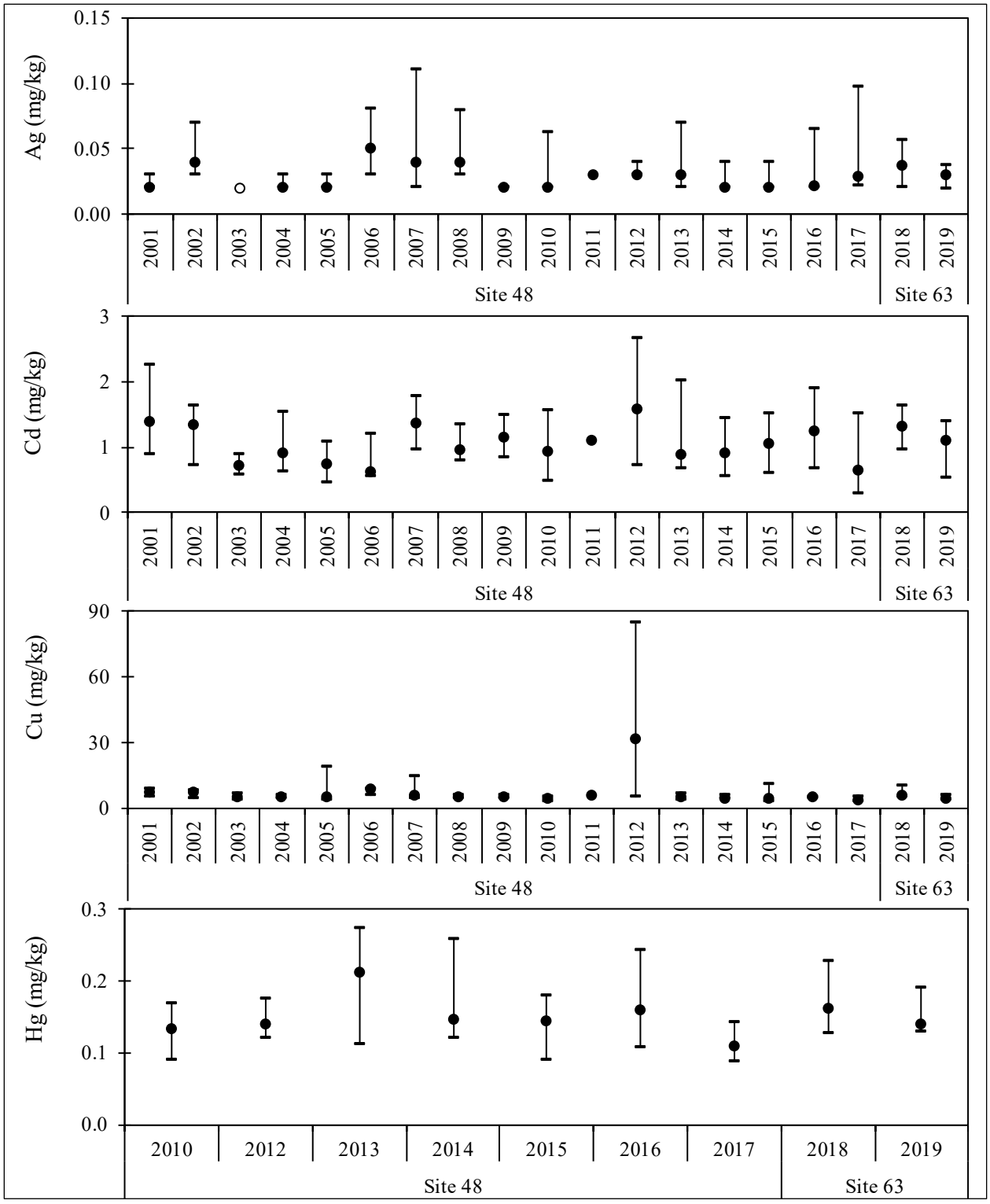

Figure 18.–Greens Creek Site 48 and Site 63 whole body Dolly Varden char Ag, Cd, Cu, and Hg concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented; element concentrations undetected (o) are presented at the method reporting limit.

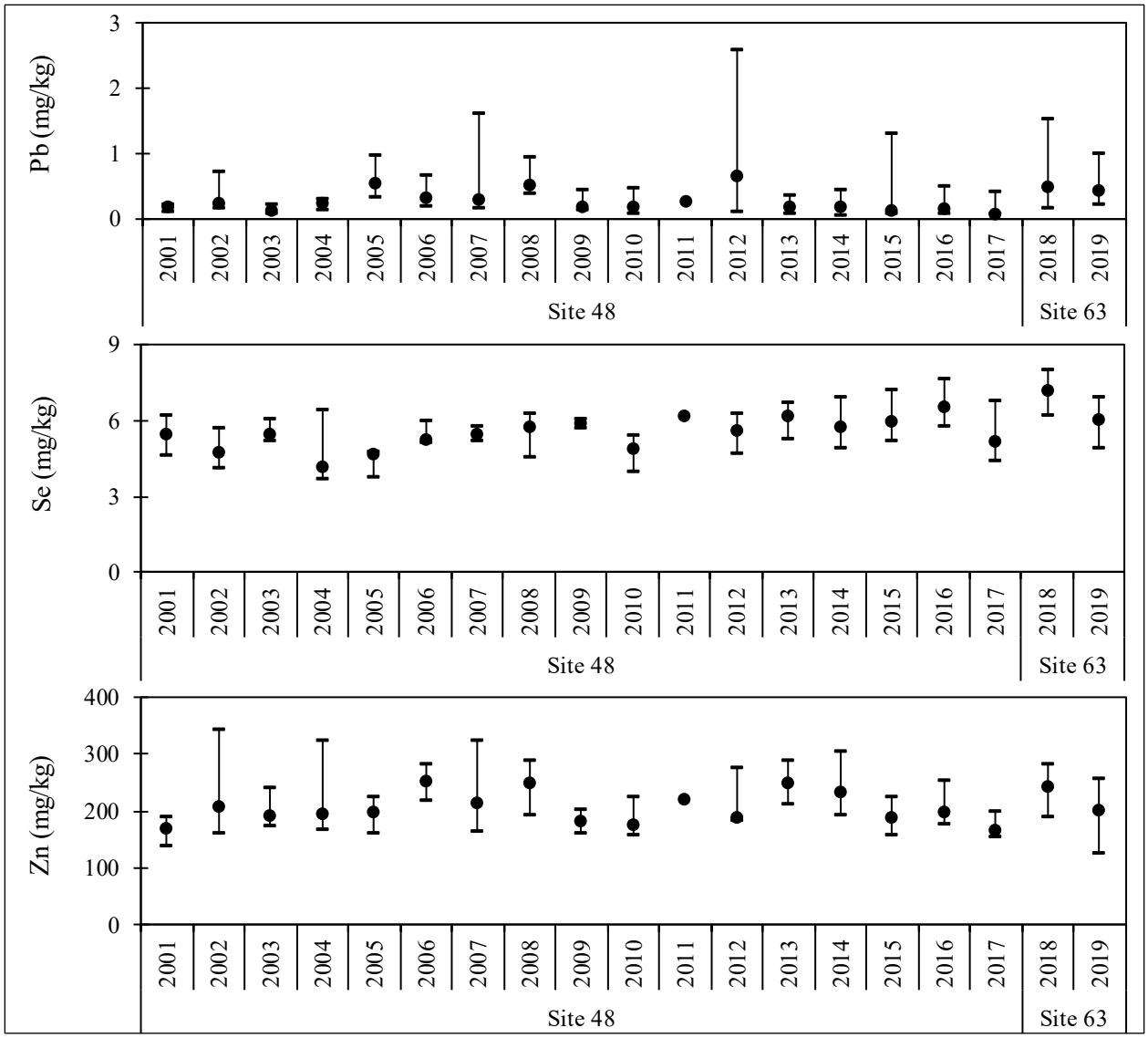

Figure 19.–Greens Creek Site 48 and Site 63 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented.

GREENS CREEK SITE 54

We sampled Greens Creek Site 54 on July 10, 2019. Hecla environmental staff measured basic water quality at 1345 hours (Table 3). We measured stream discharge at 1330 hours (Table 3) and the USGS gage recorded a daily mean discharge of 12.6 ft^3/s.

Table 3.–Greens Creek Site 54 water quality data, 2019.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/10/19	12.6	163.5	7.7	13.0

Periphyton: Chlorophyll Density and Composition

The 2019 Site 54 mean Chl-*a* density was 3.23 mg/m^2, similar to mean densities previously observed (Figure 20).[ee] The samples contained about 91% Chl-*a*, 9% Chl-*c*, and zero Chl-*b*, similar to mean composition in previous years.

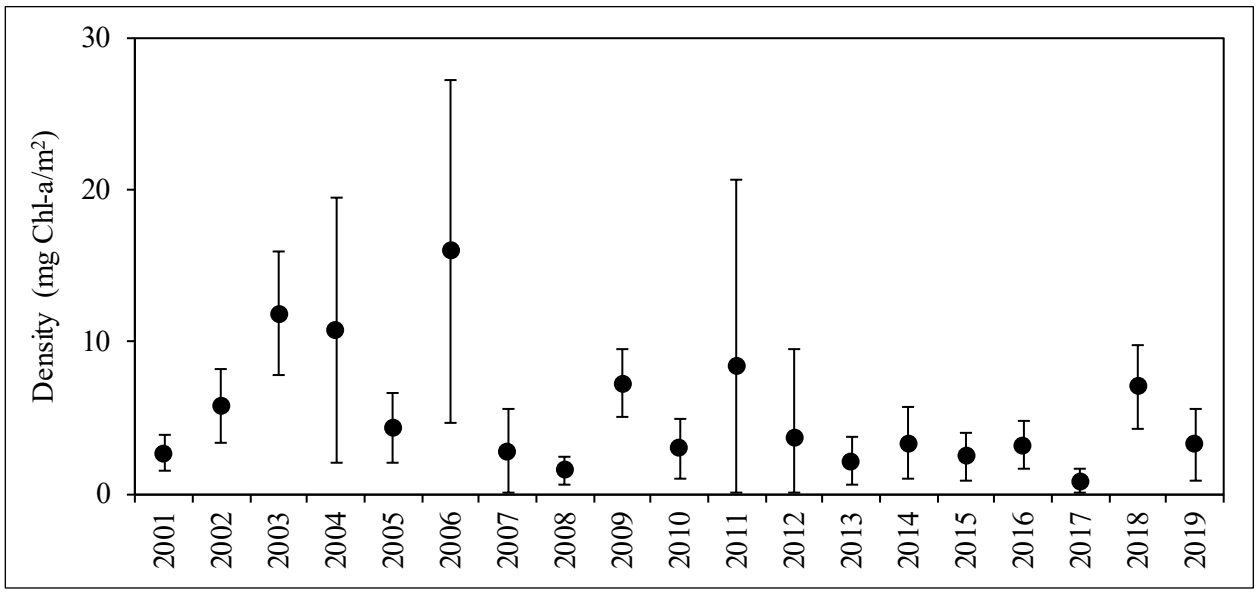

Figure 20.–Greens Creek Site 54 mean chlorophyll *a* densities ± 1 SD, 2001–2019.

[ee] We usually find significant differences in Site 54 Chl-*a* densities between the current year and the 2003 and 2006 data. Chl-*a* densities in 2003 and 2006 were the greatest observed since 2001, which we attribute to natural variation.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Site 54 BMI samples, we counted 29 taxa and estimate mean density at 4,032 BMI/m^2, with EPT insects composing 89% of the samples, within the ranges previously observed (Figures 21, 22). Dominant taxa were Ephemeroptera: *Drunella* and *Baetis*, composing 42% and 22% of the samples.

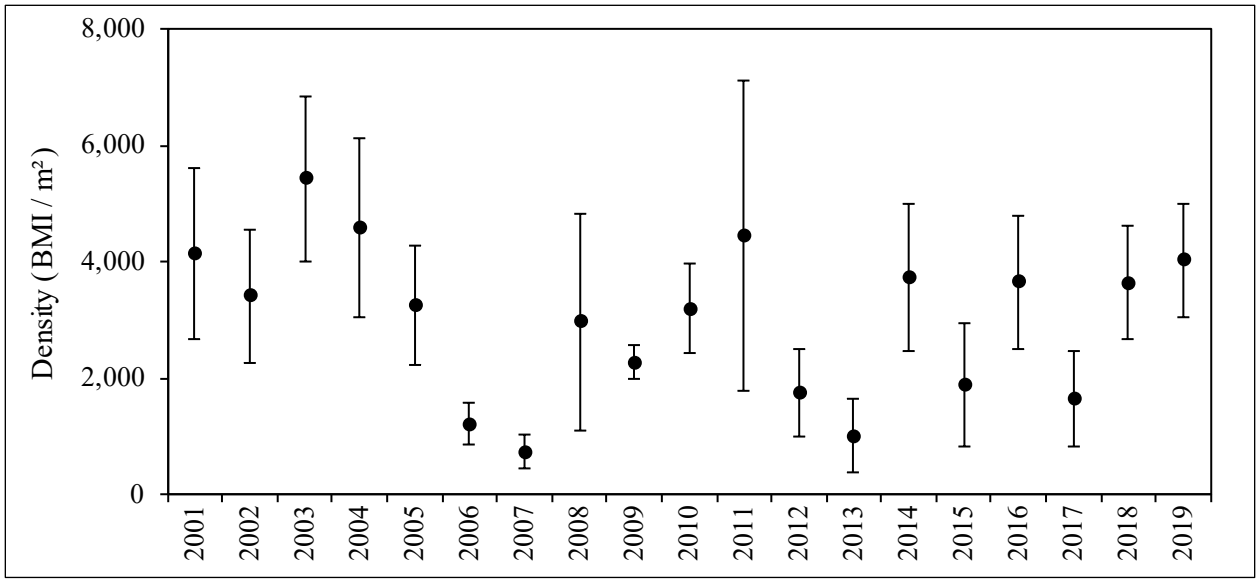

Figure 21.–Greens Creek Site 54 mean benthic macroinvertebrate densities ± 1 SD, 2001–2019.

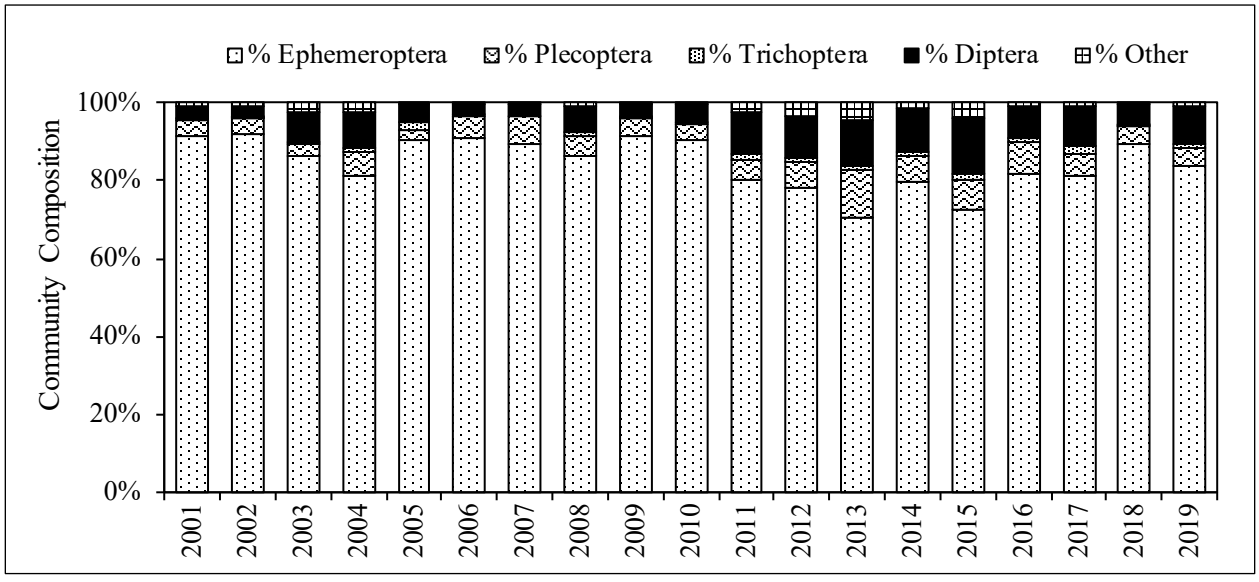

Figure 22.–Greens Creek Site 54 mean benthic macroinvertebrate community composition, 2001–2019.

Juvenile Fish Populations and Fish Condition

We estimate the 2019 Site 54 Dolly Varden char population at 242 ± 6 fish, within the range of previous estimates (Figure 23). Mean condition for the 236 Dolly Varden char we captured was 1.0, and the length frequency diagram suggests multiple age classes were present, as in previous years.

At Site 54 in 2019, we captured 62 juvenile coho salmon and estimate the population at 62 fish, the greatest observed (Figure 23). Mean condition was 1.1 and the length frequency diagram suggests two age classes were present, as in previous years.

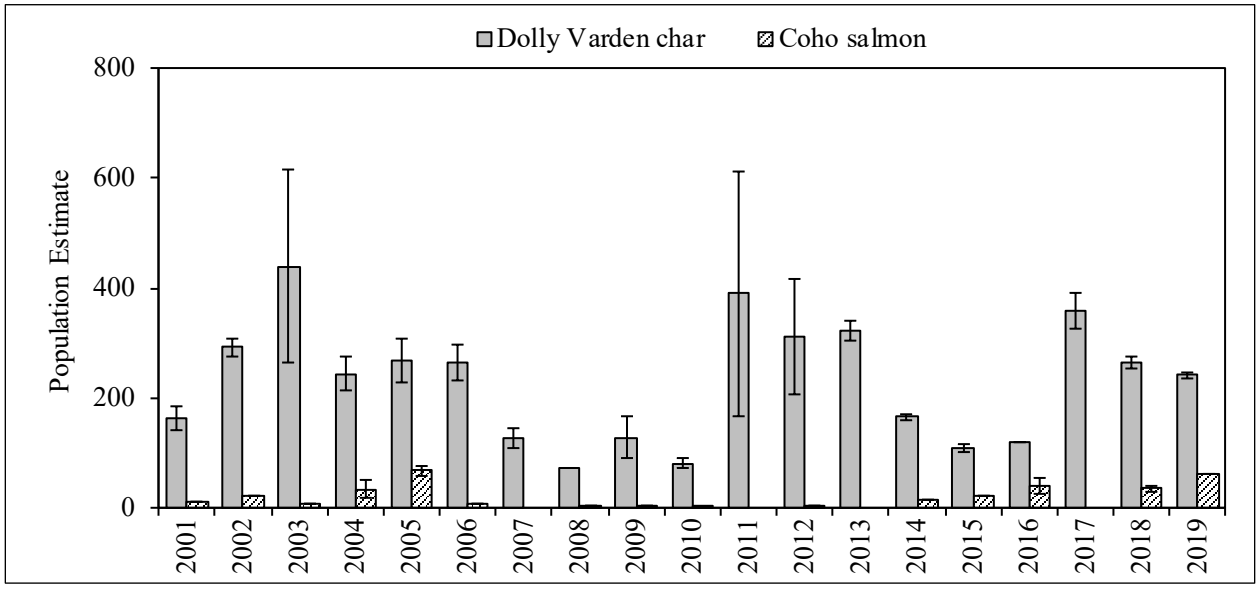

Figure 23.–Greens Creek Site 54 juvenile fish population estimates ± 95% CI, 2001–2019.

Note: 2001–2010 data from a 28 m reach, 2011–2019 data from a 50 m reach.

Note: Though we did not capture juvenile coho salmon at Site 54 in 2017, we observed many young-of-year within the sampling reach.

Juvenile Fish Element Concentrations

Ag, Cd, Cu, Hg, Pb, Se, and Zn concentrations among the 2019 Site 54 whole body Dolly Varden char samples were within the ranges of values previously observed (Figures 24, 25).

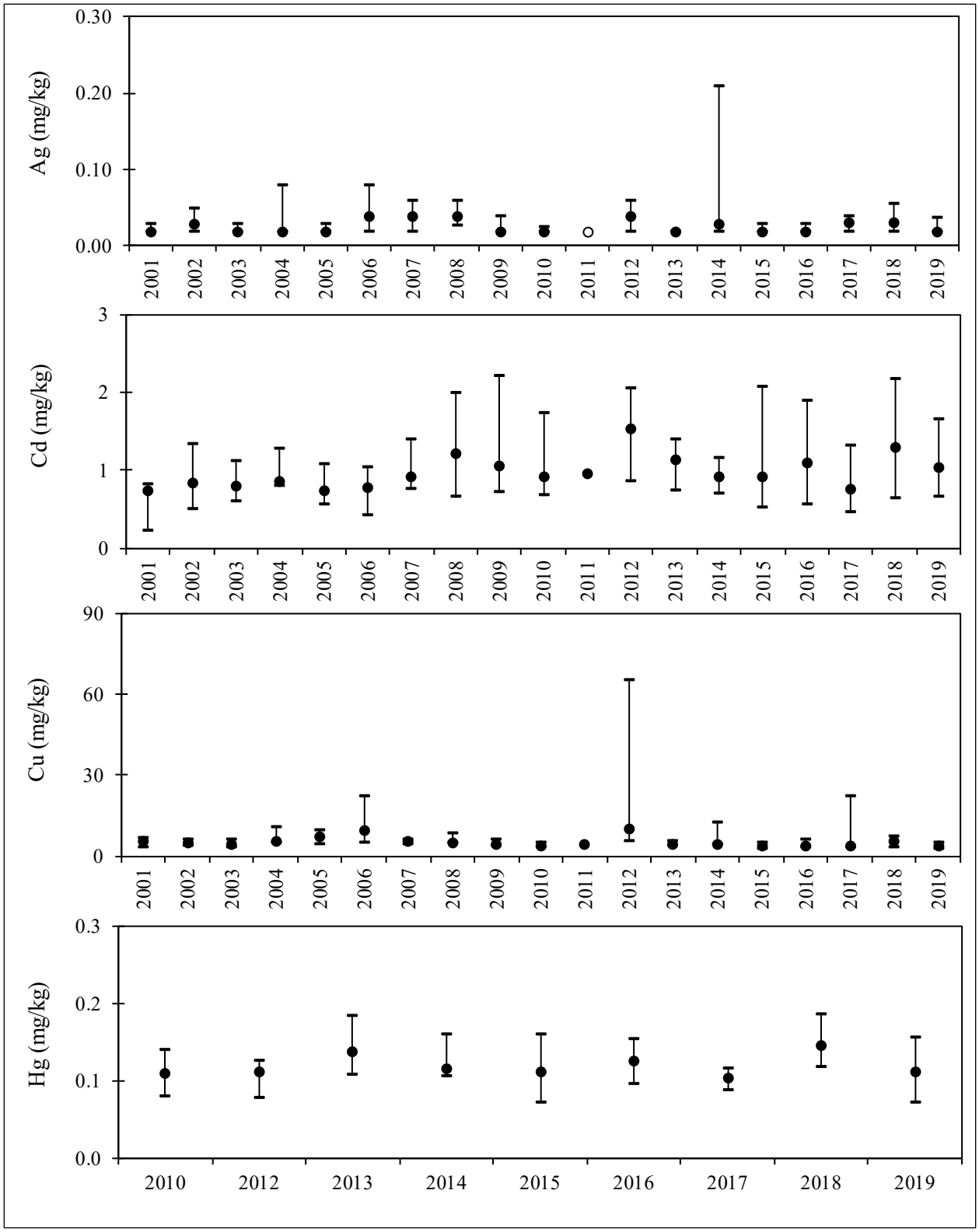

Figure 24.–Greens Creek Site 54 whole body Dolly Varden char Ag, Cd, Cu, and Hg concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented; element concentrations undetected (o) are presented at the method reporting limit.

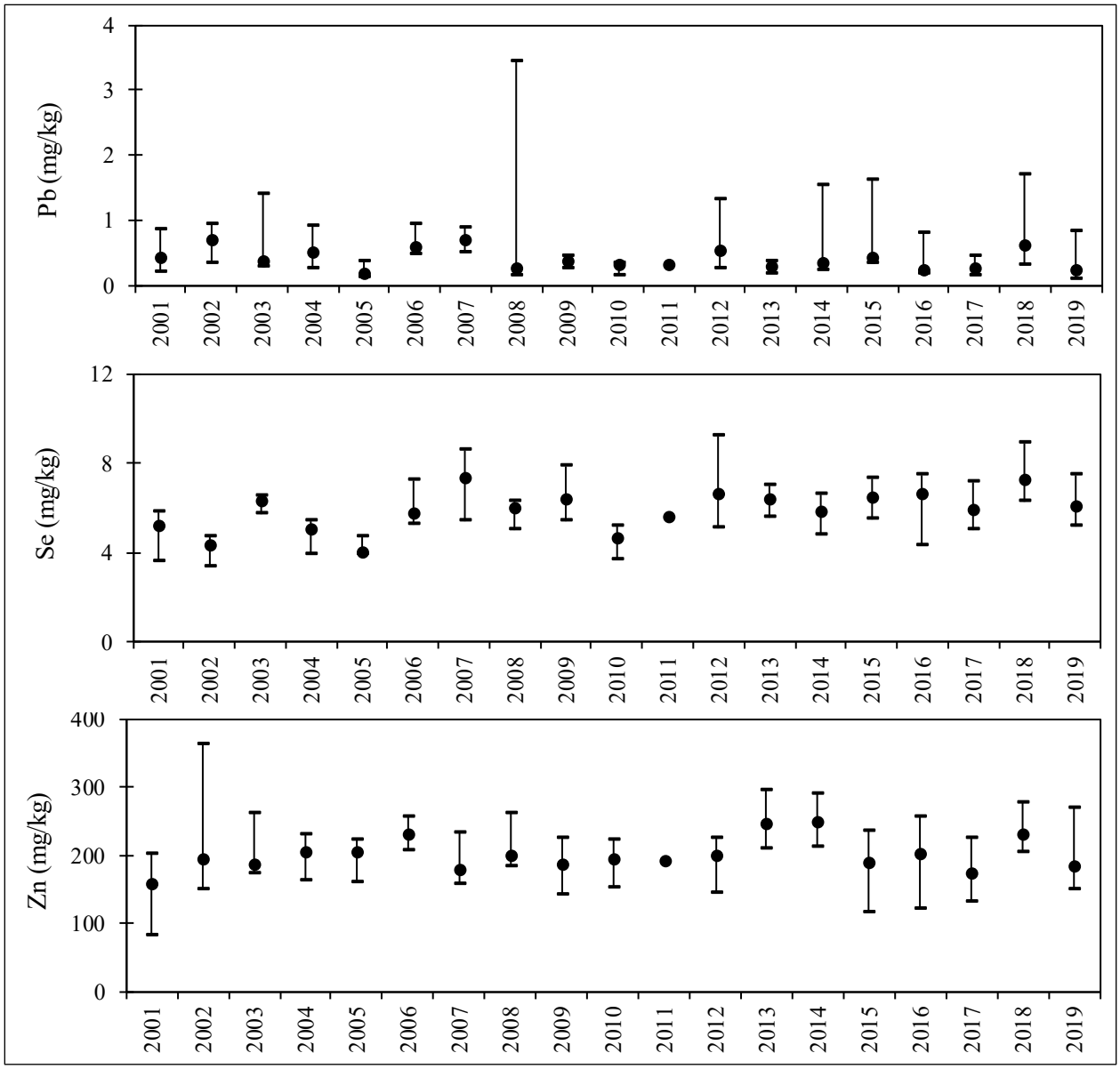

Figure 25.–Greens Creek Site 54 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented.

TRIBUTARY CREEK SITE 9 AND SITE 1847

We sampled Tributary Creek Sites 9 and 1847 on July 11, 2019. At Site 9, Hecla environmental staff measured basic water quality at 1410 hours and we measured stream discharge at 1430 hours; at Site 1847, water quality data was not collected and we measured discharge at 1100 hours (Table 4).

Table 4.–Greens Creek Sites 9 and 1847 water quality data, 2019.

Sample Date	Sample Site	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/11/19	9	15.7	107.3	7.1	0.04
07/11/19	1847	ND	ND	ND	0.04

Periphyton: Chlorophyll Density and Composition

At Site 9, the 2019 mean Chl-*a* density was 2.29 mg/m^2, within the range observed since 2001 (Figure 26).[ff] The samples contained about 95% Chl-*a*, 5% Chl-*c*, and zero Chl-*b*, similar to mean composition in previous years.

At Site 1847, the 2019 mean Chl-*a* density was 3.57 mg/m^2 (Figure 26).[gg] The samples contained about 92% Chl-*a*, 8% Chl-*c*, and zero Chl-*b*, similar to the mean composition in 2018.

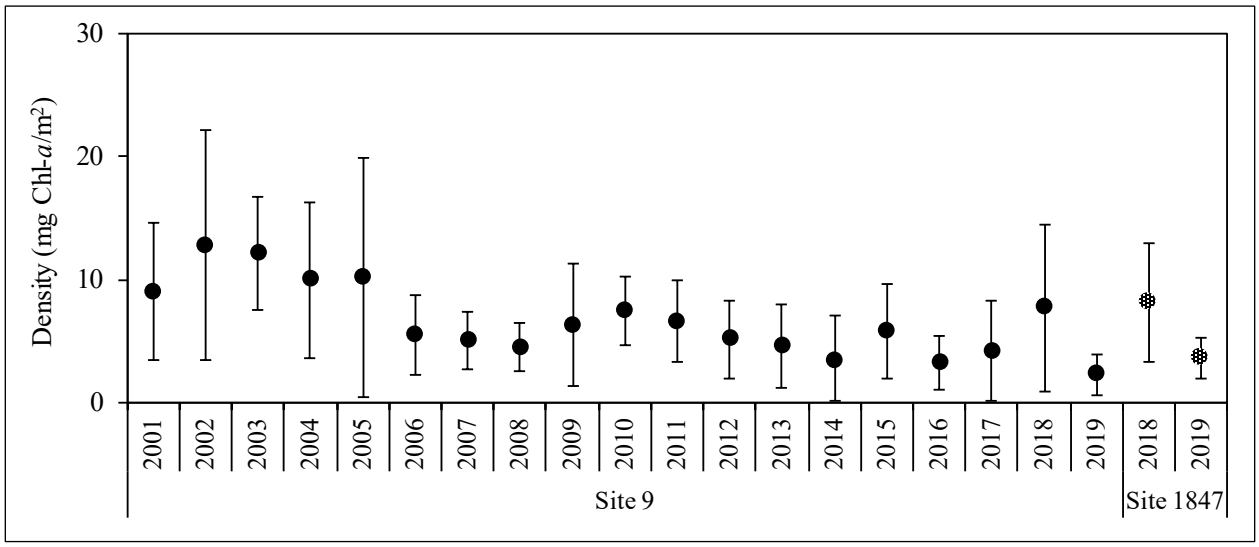

Figure 26.–Tributary Creek Site 9 and Site 1847 mean chlorophyll *a* densities ± 1 SD, 2001–2019.

[ff] The 2019 Site 9 data set includes 5 sample results; elevated turbidity invalidated 4 samples and an error in laboratory processing invalidated 1 sample.

[gg] The 2019 Site 1847 data set includes 8 sample results; elevated turbidity invalidated 2 samples during laboratory processing.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Site 9 BMI samples, we counted 28 taxa and estimate mean density at 1,317 BMI/m^2 with EPT insects composing 50% of the samples, similar to previous years (Figures 27, 28). Dominant taxa were Diptera: *Prosimulium* and Chironomidae, and Ephemeroptera: *Baetis*, composing 16%, 16%, and 15% of the samples.

Among the 2019 Site 1847 BMI samples, we counted 28 taxa and estimate mean density at 3,557 BMI/m^2 with EPT insects composing 69% of the samples, greater than in 2018 (Figures 29, 30). Dominant taxa were Ephemeroptera: *Cinygmula* and *Baetis*, and Diptera: Chironomidae, composing 32%, 11%, and 14% of the samples.

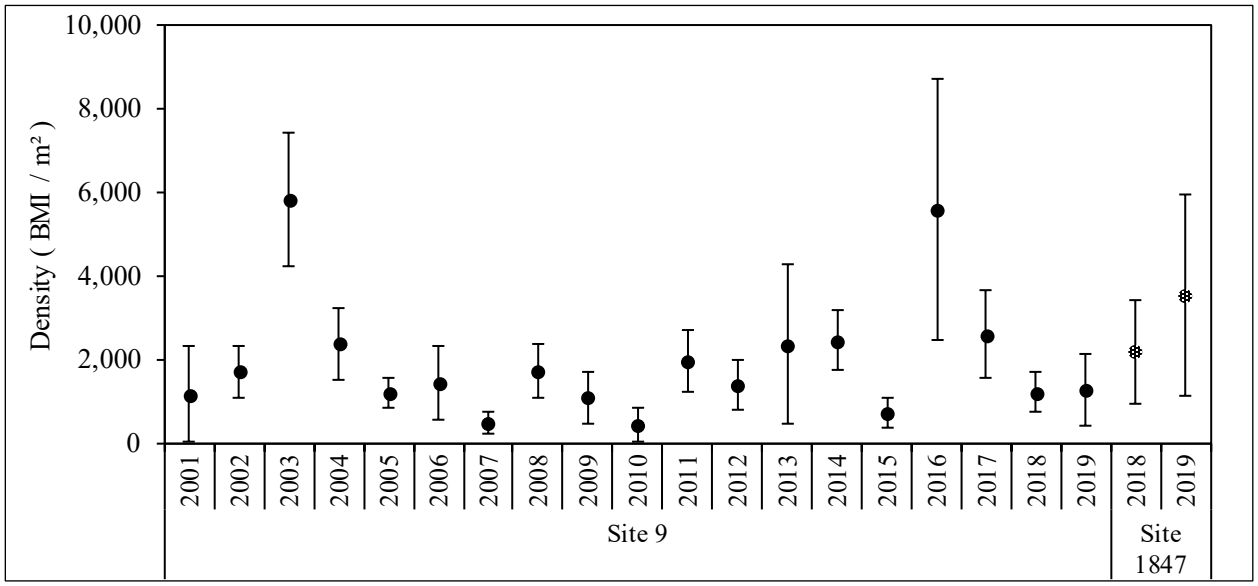

Figure 27.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate densities ± 1 SD, 2001–2019.

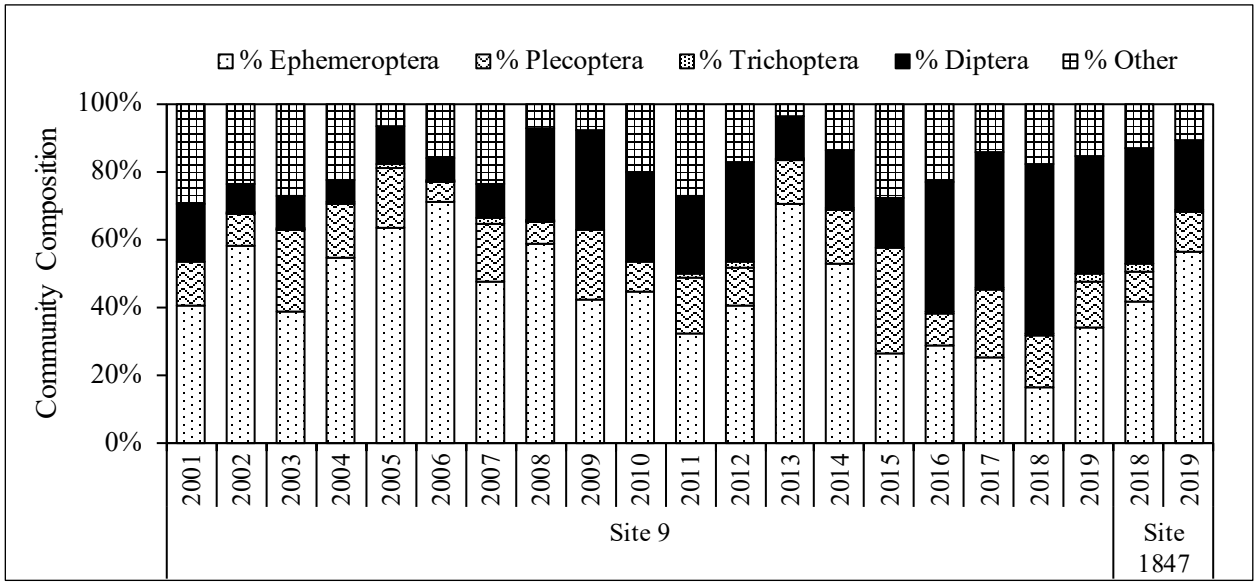

Figure 28.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate community composition, 2001–2019.

Juvenile Fish Populations and Fish Condition

In 2019 at Site 9, we captured 8 Dolly Varden char, too few fish to estimate a population and the lowest observed 2001–2019 (Figure 29). Mean condition was 1.1 and the length frequency diagram suggests multiple age classes were present, as in previous years.

In 2019 at Site 9, we captured 50 coho salmon and estimate the population at 50 fish, within the range observed since 2001 (Figure 29). Mean condition was 1.1 and the length frequency diagram suggests two age classes were present, as in previous years.

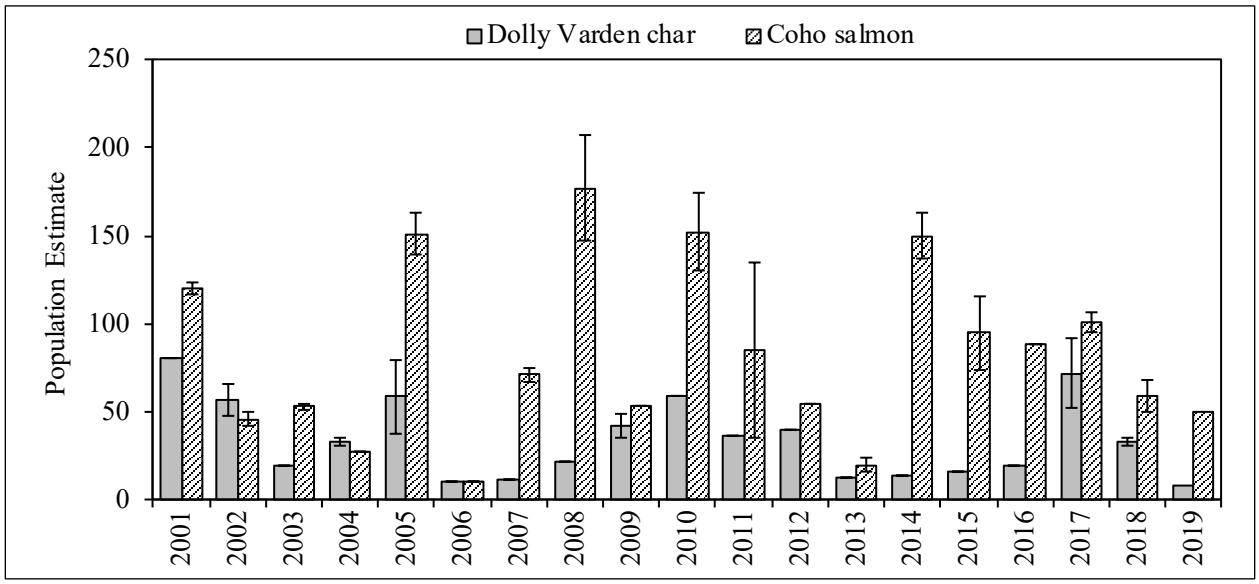

Figure 29.–Tributary Creek Site 9 juvenile fish population estimates ± 95% CI, 2001–2019.

Juvenile Fish Element Concentrations

Ag, Cd, Cu, Pb, and Zn concentrations among the 2019 whole body Dolly Varden char samples were within the range of values previously observed (Figures 30, 31). The 2019 median and maximum Hg concentrations were greater than previously observed and the median Se concentration was lower than previously observed.

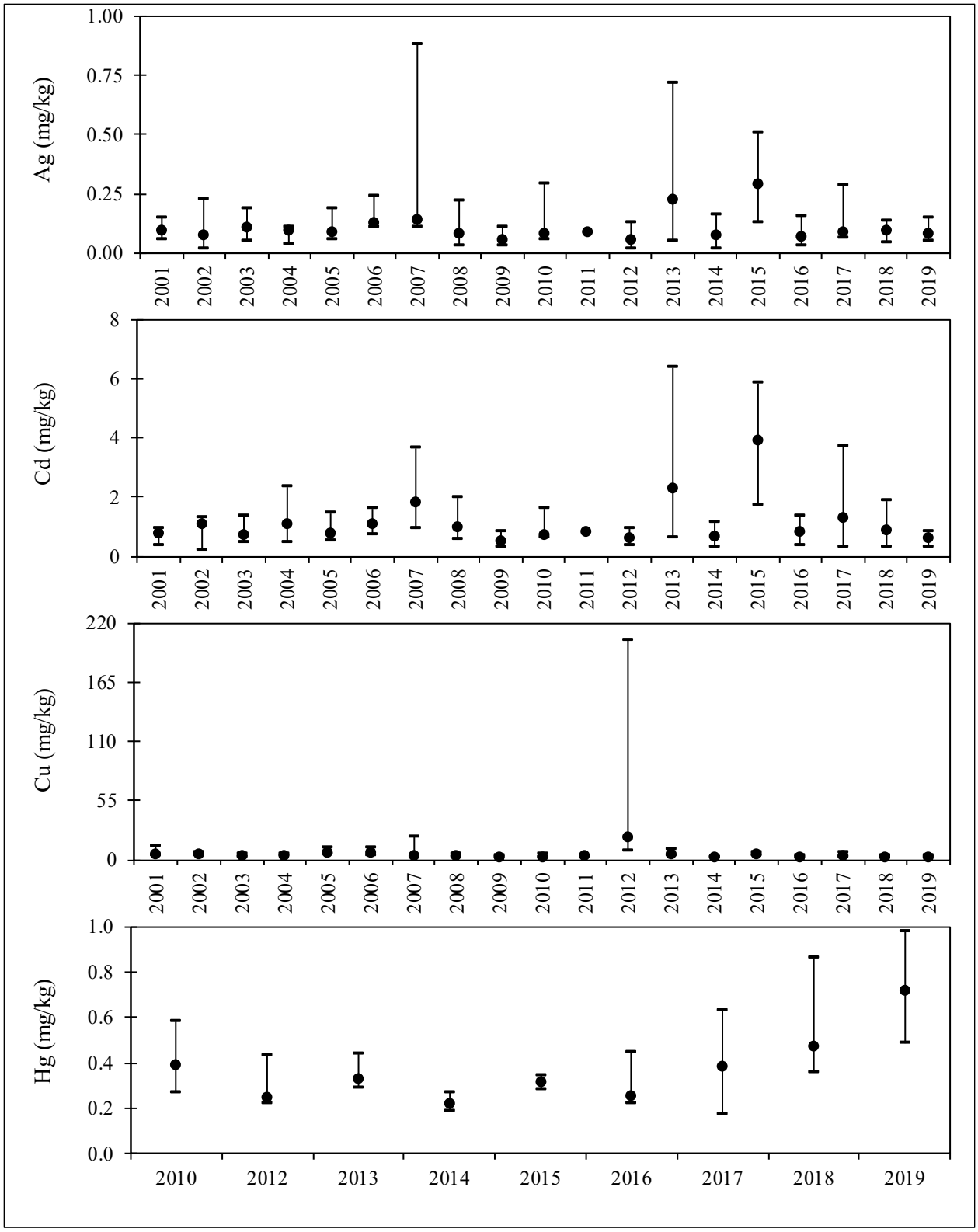

Figure 30.–Tributary Creek Site 9 whole body Dolly Varden char Ag, Cd, Cu, and Hg concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented.

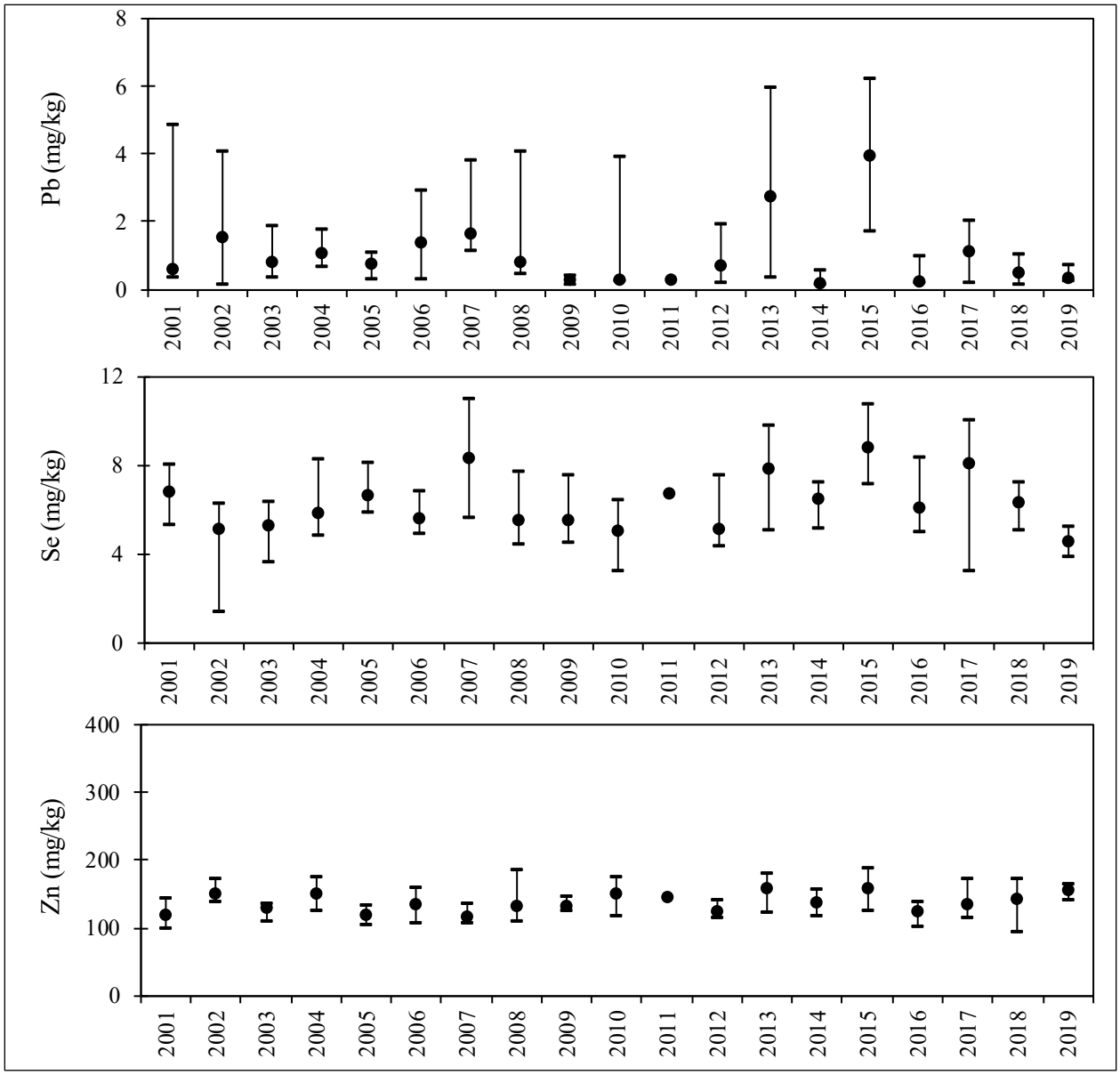

Figure 31.–Tributary Creek Site 9 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2019.

Note: Minimum, median, and maximum concentrations presented.

COMPARISONS AMONG GREENS CREEK SITES

Periphyton: Chlorophyll Density and Composition

The 2019 Site 63 Chl-*a* mean rank was significantly different compared to the Site 54 Chl-*a* mean rank. Mean Chl-*a* densities at Site 48/63 and Site 54 generally followed a similar trend 2001–2019 (Figure 32). Greens Creek discharges were low prior to sampling in 2003, 2004, and 2018 and may have contributed to greater Chl-*a* densities those years, while greater discharges prior to sampling in 2007, 2008, 2012, and 2017 may explain lower Chl-*a* densities observed those years. Though streamflows prior to sampling were lower in 2019 than 2018, we observed lower mean Chl-*a* densities in 2019.

Periphyton samples collected at Site 48, Site 63, and Site 54 generally contained about 90% Chl-*a,* zero or nearly zero Chl-*b,* and about 10% Chl-*c* each year.

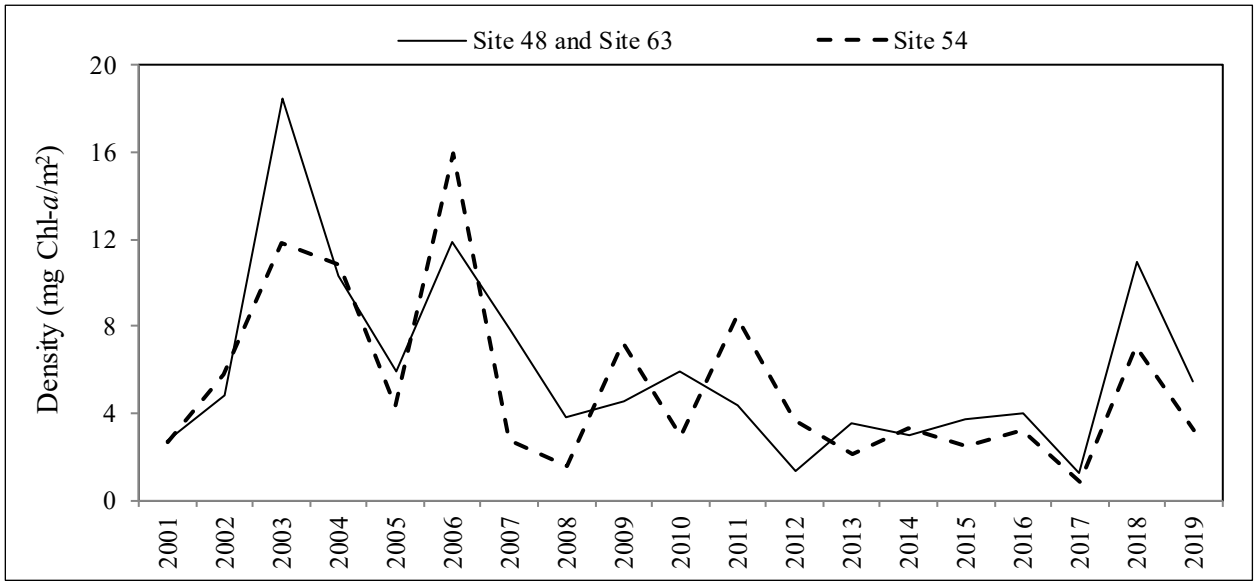

Figure 32.–Greens Creek mean chlorophyll *a* densities, 2001–2019.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2019.

Benthic Macroinvertebrate Density and Community Composition

Mean benthic macroinvertebrate density and taxonomic richness among Site 48 and Site 54 samples generally followed similar trends 2001–2017; we also observed similar mean densities and richness among Site 63 and Site 54 samples 2018–2019 (Figures 33, 34). EPT insects usually composed more than 80% of the organisms among annual samples at each site.

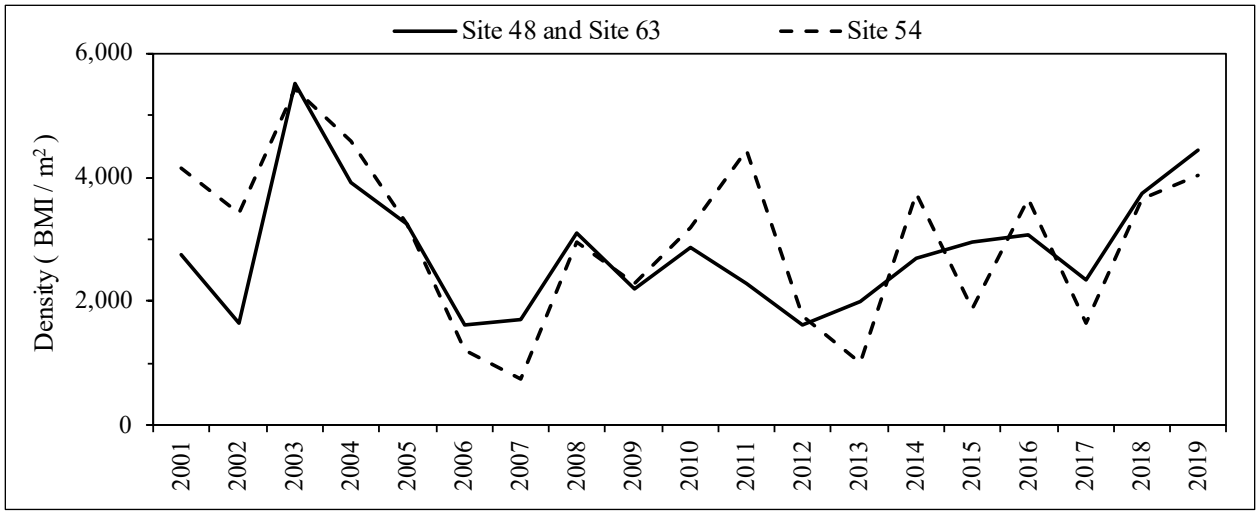

Figure 33.–Greens Creek mean benthic macroinvertebrate densities, 2001–2019.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2019.

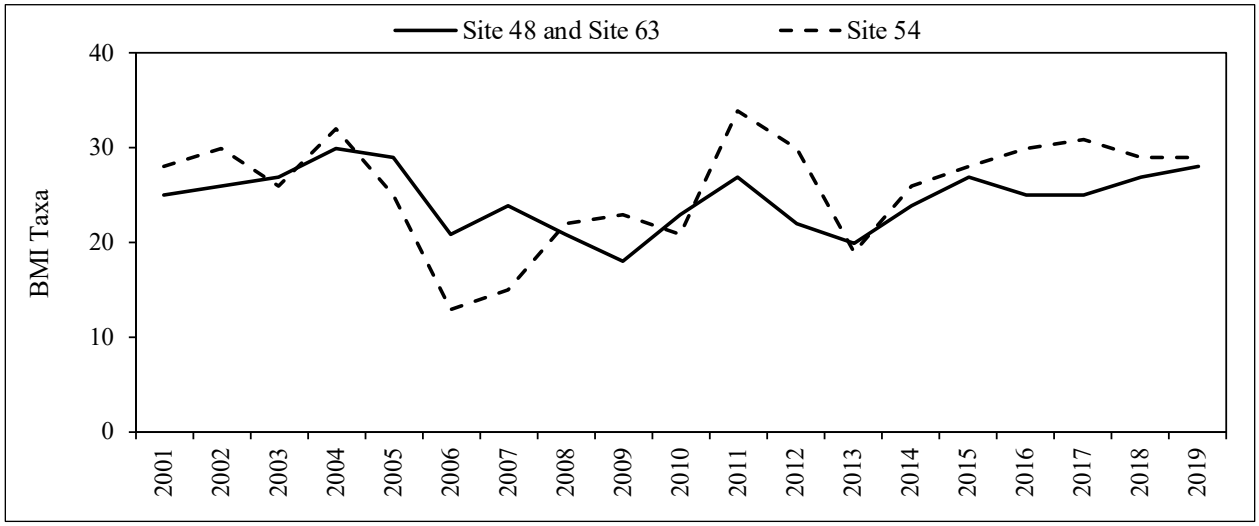

Figure 34.–Greens Creek benthic macroinvertebrate taxa richness, 2001–2019.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2019.

Juvenile Fish Populations and Fish Condition

The 2019 Site 54 Dolly Varden char population estimate was significantly greater than the Site 63 population estimate, as in 2018. Population estimates at Site 48 and Site 54 generally followed a similar trend from 2001 to 2016, and we usually captured more Dolly Varden char at Site 54 (Figure 35). We captured several age classes of Dolly Varden char at all sites most years, and mean fish condition was similar among sites each year, about 1.0.

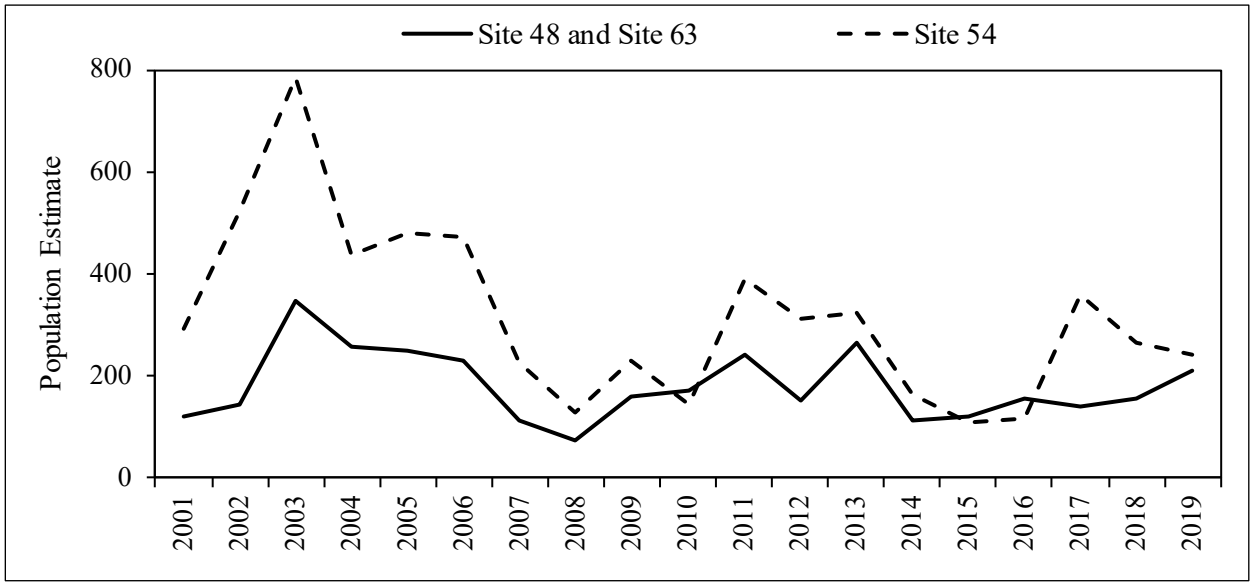

Figure 35.–Greens Creek Dolly Varden char population estimates, 2001–2019.
Note: Site 54 2001–2010 data extrapolated to 50 m sample reach for comparison.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2019.

Juvenile Fish Element Concentrations

Among the 2019 Greens Creek Site 63 and Site 54 whole body Dolly Varden char element concentrations, we found significant differences in the mean ranks for Cu, Hg, and Pb concentrations.

COMPARISONS AMONG SITES

Juvenile Fish Element Concentrations

Among the 2019 Greens Creek and Tributary Creek whole body Dolly Varden char element concentrations data (Figure 36), the Site 9 mean ranks for Ag, Cd, Hg, Se, and Zn concentrations were significantly different than the mean ranks for Site 63 and Site 54. The Site 9 mean rank for Cu was significantly different than the mean rank for Site 63, and the Site 54 mean rank for Pb was significantly different than mean ranks for Site 63 and Site 9.

The 2019 mean Hg concentration at Site 9 was above the range of values reported for reference and exploration sites elsewhere in Alaska (Legere and Timothy 2016).

Since 2001, the Tributary Creek Site 9 whole body Dolly Varden char samples contained greater concentrations and variability than the Greens Creek samples, except Cu and Zn which were generally greater at Site 48 and Site 63 (Figures 37, 38).

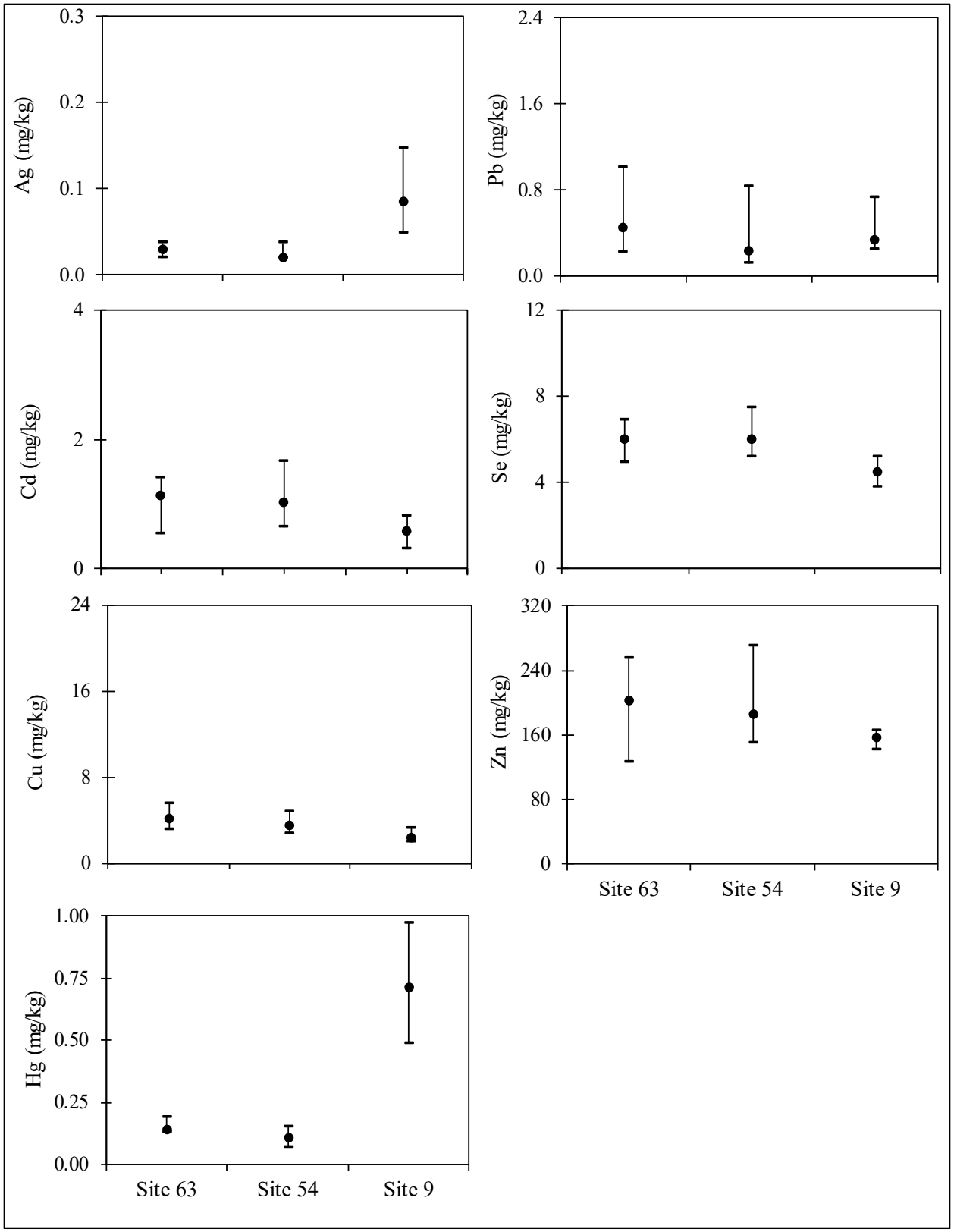

Figure 36.–Greens Creek and Tributary Creek whole body Dolly Varden char element concentrations, 2019.

Note: Minimum, median, and maximum whole body concentrations presented.

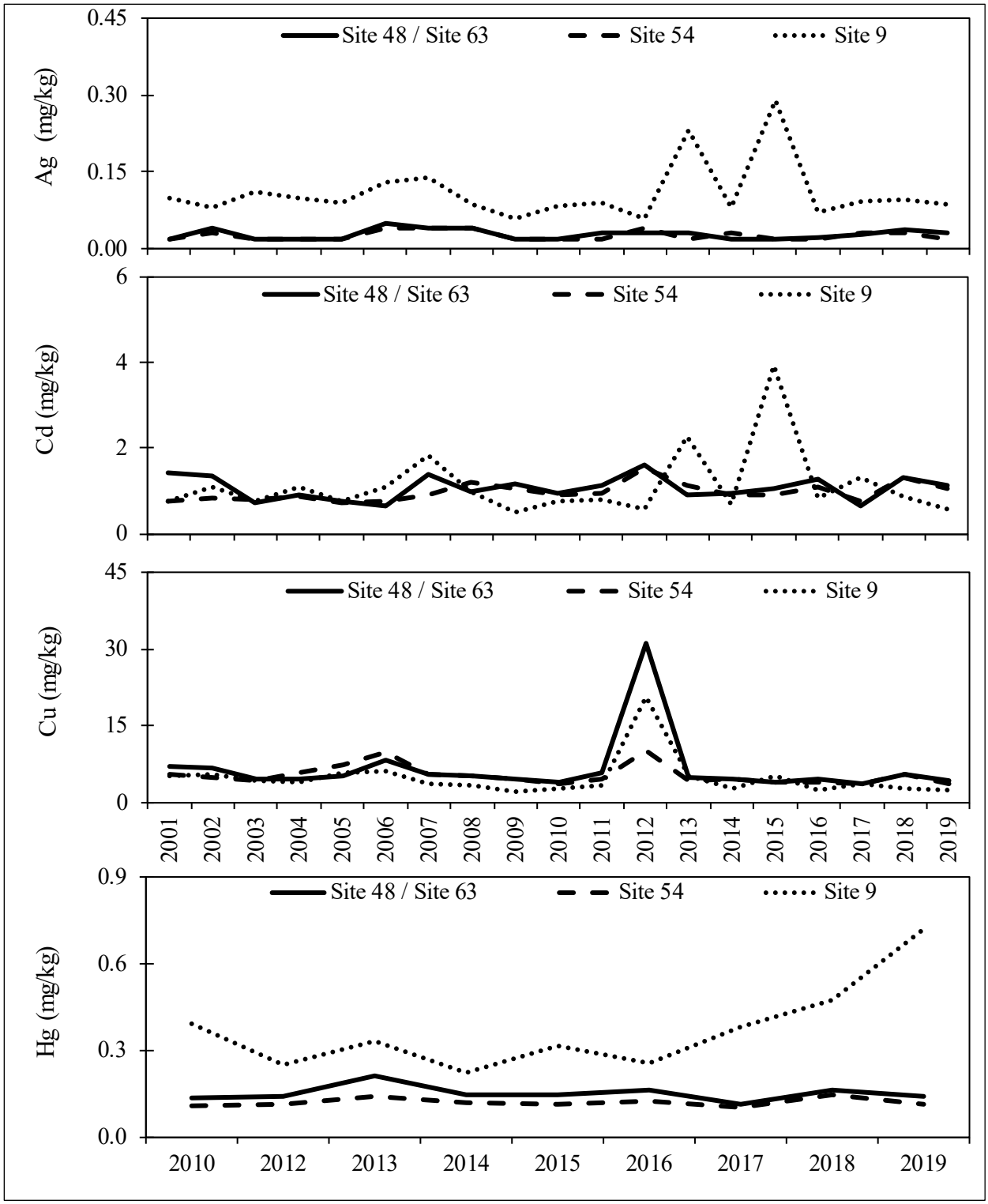

Figure 37.–Greens Creek and Tributary Creek whole body Dolly Varden char median Ag, Cd, and Cu concentrations, 2001–2019, and Hg concentrations, 2010–2019.

Note: Solid line 2001–2017 is Site 48 and 2018–2019 is Site 63.

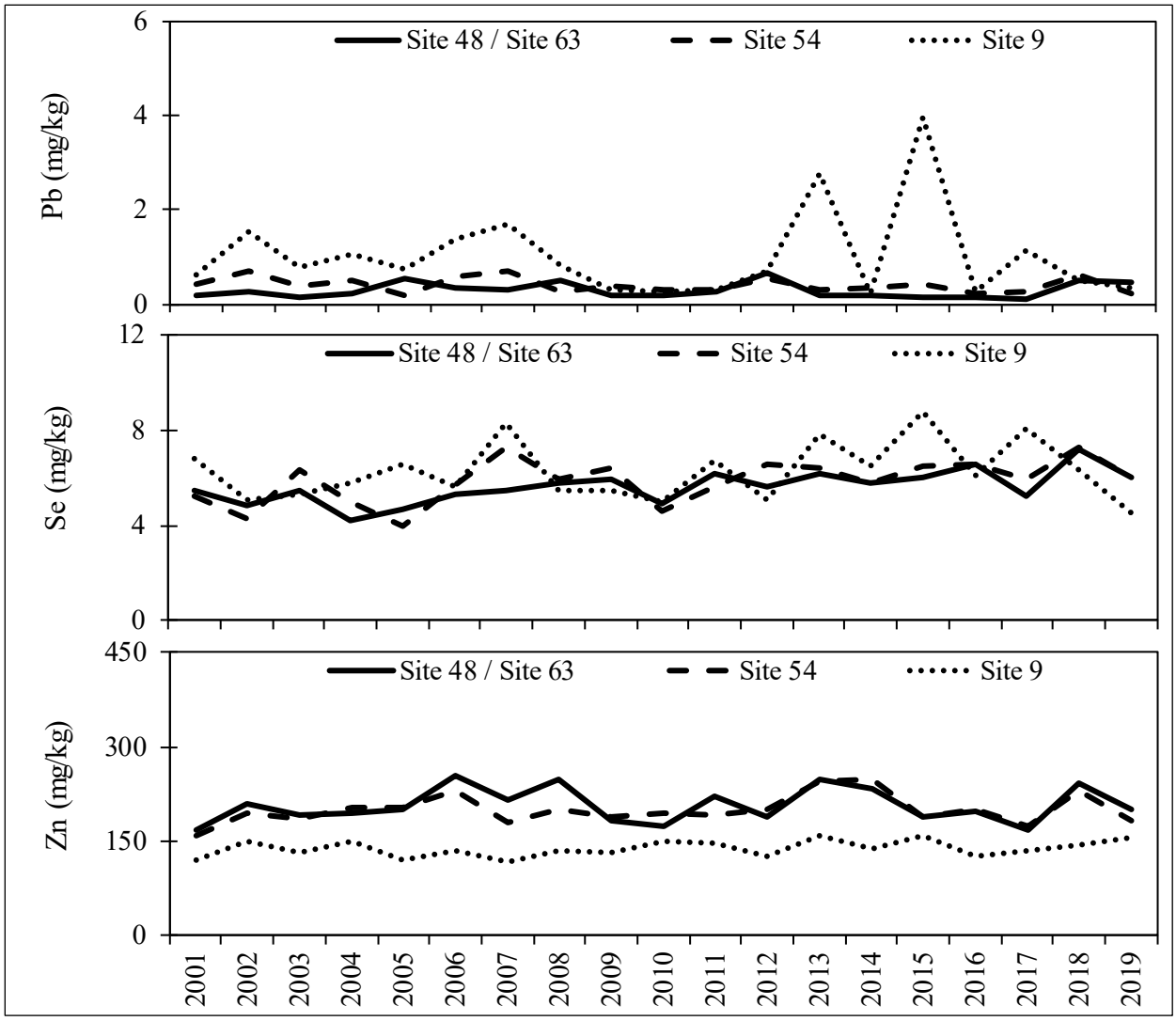

Figure 38.–Greens Creek and Tributary Creek whole body Dolly Varden char median Pb, Se, and Zn concentrations, 2001–2019.

Note: Solid line 2001–2017 is Site 48 and 2018–2019 is Site 63.

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APPENDIX A: CHLOROPHYLL DATA

Appendix A.1.–Greens Creek Site 48 chlorophylls *a*, *b*, and *c* densities, 2001–2017.

	7/23/2001			**7/23/2002**			**7/22/2003**			**7/21/2004**		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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	ND	ND	ND	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	18.45	0.03	1.00	10.31	0.00	1.09
minimum	0.31	0.00	0.06	2.78	0.00	0.15	3.84	0.00	0.39	5.23	0.00	0.45
maximum	5.61	0.14	0.69	6.62	0.00	0.75	35.35	0.13	2.14	20.40	0.00	2.15

	7/22/2005			**7/20/2006**			**7/20/2007**			**7/22/2008**		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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
minimum	0.85	0.00	0.01	4.38	0.00	0.54	4.06	0.00	0.16	0.85	0.00	0.02
maximum	11.11	0.02	0.92	20.08	0.00	2.04	11.75	0.01	1.39	12.60	0.00	0.74

	7/21/2009			**7/20/2010**			**7/21/2011**			**7/21/2012**		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	3.20	0.00	0.49	8.54	0.00	0.44	4.49	0.00	0.50	**0.36**	ND	ND
	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
minimum	0.43	0.00	0.11	3.10	0.00	0.15	0.85	0.00	0.05	0.32	0.00	0.00
maximum	9.18	0.18	1.19	10.68	0.02	0.64	7.16	0.17	1.06	2.56	0.00	0.39

-continued-

Appendix A.1.–Page 2 of 2.

	7/24/2013			7/24/2014			7/15/2015			7/12/2016		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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	ND	ND	ND	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
minimum	1.39	0.00	0.07	0.43	0.00	0.00	0.43	0.00	0.03	2.24	0.00	0.26
maximum	6.94	0.00	0.70	6.62	0.24	0.38	11.96	0.00	0.90	7.58	0.00	0.88

	7/12/2017		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*
	0.55	0.00	0.02
	0.64	0.00	0.07
	0.43	0.01	0.04
	2.99	0.00	0.39
	0.96	0.00	0.09
	0.64	0.00	0.16
	2.14	0.00	0.28
	1.70	0.00	0.26
	0.96	0.00	0.09
	0.96	0.00	0.10
mean	1.20	0.00	0.15
minimum	0.43	0.00	0.02
maximum	2.99	0.01	0.39

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.2.–Greens Creek Site 63 chlorophylls *a*, *b*, and *c* densities, 2018–2019.

	7/11/2018			7/9/2019		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	ND	ND	ND	4.17	0.00	0.33
	5.45	0.00	0.79	4.59	0.00	0.29
	9.29	0.00	1.77	2.89	0.00	0.30
	7.37	0.00	0.87	4.73	0.00	0.35
	ND	ND	ND	2.78	0.00	0.13
	23.07	0.00	4.01	5.34	0.00	0.48
	8.22	0.00	0.96	2.88	0.00	0.21
	4.38	0.00	0.64	13.03	0.00	1.09
	15.06	0.00	2.28	5.98	0.00	0.75
	14.63	0.00	2.28	8.33	0.00	0.47
mean	10.93	0.00	1.70	5.47	0.00	0.44
minimum	4.38	0.00	0.64	2.78	0.00	0.13
maximum	23.07	0.00	4.01	13.03	0.00	1.09

Appendix A.3.–Greens Creek Site 54 chlorophylls *a*, *b*, and *c* densities, 2001–2019.

	7/23/2001			7/23/2002			7/22/2003			7/21/2004		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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
minimum	1.46	0.00	0.01	2.46	0.00	0.24	5.55	0.00	0.39	1.92	0.00	0.09
maximum	4.95	0.05	0.41	9.61	0.87	1.26	16.34	0.00	1.75	32.04	0.03	3.66

	7/22/2005			7/20/2006			7/20/2007			7/22/2008		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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**	ND	ND	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**	ND	ND	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**	ND	ND	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**	ND	ND
	3.10	0.00	0.16	5.55	0.00	0.68	6.41	0.00	0.81	**0.24**	ND	ND
mean	4.36	0.00	0.24	15.95	0.00	1.41	2.75	0.01	0.46	1.57	0.00	0.13
minimum	2.56	0.00	0.12	4.27	0.00	0.38	0.24	0.00	0.04	0.24	0.00	0.00
maximum	10.36	0.00	0.54	31.72	0.00	3.17	8.01	0.04	0.98	2.99	0.02	0.29

	7/21/2009			7/20/2010			7/21/2011			7/21/2012		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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
	ND	ND	ND	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	2.04	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
minimum	4.38	0.07	0.43	0.21	0.00	0.05	0.43	0.00	0.06	0.11	0.00	0.04
maximum	11.32	0.20	1.57	6.73	0.04	0.74	41.76	0.00	3.02	19.54	0.01	1.10

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	7/24/2013			7/24/2014			7/15/2015			7/12/2016		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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
	ND	ND	ND	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**	ND	ND	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
minimum	0.43	0.00	0.02	0.05	0.00	0.11	1.07	0.00	0.08	1.17	0.00	0.11
maximum	5.87	0.00	0.76	7.05	0.00	0.92	6.09	0.00	0.43	5.77	0.00	0.87

	7/12/2017			7/10/2018			7/10/2019		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	1.17	0.00	0.08	10.57	0.00	2.03	2.56	0.00	0.19
	0.19	ND	ND	7.05	0.00	1.13	0.75	0.00	0.05
	0.64	0.00	0.11	9.93	0.00	1.57	3.72	0.00	0.28
	2.99	0.00	0.38	8.12	0.00	1.55	8.22	0.00	0.80
	0.43	0.00	0.07	6.84	0.00	0.84	4.62	0.00	0.50
	0.96	0.00	0.09	1.51	0.00	0.29	5.98	0.00	0.90
	0.85	0.00	0.11	8.54	0.00	1.03	0.96	0.00	0.09
	0.19	ND	ND	6.09	0.00	0.98	1.82	0.00	0.13
	0.37	0.00	0.18	3.63	0.00	0.50	1.82	0.00	0.05
	0.55	0.00	0.12	8.12	0.00	1.16	1.82	0.00	0.09
mean	0.83	0.00	0.14	7.04	0.00	1.11	3.23	0.00	0.31
minimum	0.19	0.00	0.07	1.51	0.00	0.29	0.75	0.00	0.05
maximum	2.99	0.00	0.38	10.57	0.00	2.03	8.22	0.00	0.90

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.4.–Tributary Creek Site 9 chlorophylls *a*, *b*, and *c* densities, 2001–2019.

	7/23/2001			7/23/2002			7/23/2003			7/21/2004		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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	0.65	0.53	12.11	0.00	1.92	9.96	0.13	0.82
minimum	1.61	0.00	0.01	2.94	0.00	0.00	7.69	0.00	0.29	5.45	0.00	0.36
maximum	16.58	0.81	1.51	32.53	1.50	1.89	22.64	0.00	3.98	26.17	0.51	2.61

	7/23/2005			7/21/2006			7/20/2007			7/23/2008		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	6.09	0.00	0.25	3.42	0.25	0.19	ND	ND	ND	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	ND	ND	ND	6.41	0.00	0.25
	4.70	0.00	0.10	4.17	0.00	0.39	ND	ND	ND	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
minimum	1.82	0.00	0.07	3.42	0.00	0.19	0.85	0.00	0.11	1.60	0.00	0.00
maximum	36.10	1.28	1.12	14.16	0.40	0.57	7.26	0.24	0.65	6.94	0.24	0.39

	7/22/2009			7/20/2010			7/20/2011			7/26/2012		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*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
minimum	2.03	0.08	0.09	4.06	0.00	0.16	1.71	0.00	0.01	1.28	0.00	0.04
maximum	18.37	0.66	0.78	12.82	0.88	0.43	12.50	0.47	0.87	10.68	0.00	0.48

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	7/23/2013			7/23/2014			7/14/2015			7/11/2016		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	11.00	0.00	0.64	ND	ND	ND	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**	ND	ND	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	0.01	0.31	3.39	0.00	0.28	5.75	0.02	0.39	3.22	0.00	0.30
minimum	0.32	0.00	0.15	0.05	0.00	0.00	2.56	0.00	0.09	1.33	0.00	0.08
maximum	11.00	0.05	0.66	11.21	0.00	0.63	15.06	0.21	0.94	7.80	0.03	0.90

	7/11/2017			7/12/2018			7/11/2019		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	12.82	0.00	1.07	15.59	0.00	1.74	ND	ND	ND
	1.39	0.00	0.02	4.49	0.00	0.51	1.32	0.00	0.15
	1.50	0.00	0.07	20.40	0.00	2.90	0.21	0.00	0.03
	8.44	0.00	0.56	0.21	0.00	0.00	2.75	0.00	0.06
	3.31	0.07	0.15	5.13	0.00	0.61	ND	ND	ND
	1.39	0.00	0.03	10.25	0.00	1.80	4.59	0.00	0.25
	0.43	0.00	0.00	11.64	0.00	1.82	2.56	0.00	0.12
	0.96	0.00	0.06	7.80	0.00	1.31	ND	ND	ND
	3.10	0.00	0.28	0.43	0.01	0.04	ND	ND	ND
	7.58	0.00	0.69	0.96	0.00	0.05	ND	ND	ND
mean	4.09	0.01	0.29	7.69	0.00	1.08	2.29	0.00	0.12
minimum	0.43	0.00	0.00	0.21	0.00	0.00	0.21	0.00	0.03
maximum	12.82	0.07	1.07	20.40	0.01	2.90	4.59	0.00	0.25

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.5.–Tributary Creek Site 1847 chlorophylls *a*, *b*, and *c* densities, 2018–2019.

	7/12/2018			**7/11/2019**		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	16.98	0.00	3.10	3.95	0.00	0.40
	9.29	0.00	1.66	2.78	0.00	0.25
	6.09	0.00	0.70	0.75	0.00	0.05
	3.63	0.00	0.28	4.70	0.00	0.52
	12.82	0.00	2.14	5.77	0.00	0.58
	3.63	0.02	0.57	4.49	0.00	0.43
	2.24	0.00	0.33	1.92	0.00	0.09
	ND	ND	ND	4.17	0.00	0.32
	8.01	0.00	0.66	ND	ND	ND
	10.68	0.00	1.29	ND	ND	ND
mean	8.15	0.00	1.19	3.57	0.00	0.33
minimum	2.24	0.00	0.28	0.75	0.00	0.05
maximum	16.98	0.02	3.10	5.77	0.00	0.58

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Greens Creek Site 48 BMI data summary, 2001–2019.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total BMI Taxa	25	26	27	30	29	21	24	21	18	23
Mean BMI Taxa / Sample	12	13	18	19	16	11	13	13	10	15
Total Ephemeroptera Taxa	6	6	7	6	6	6	7	6	7	7
Total Plecoptera Taxa	7	11	6	9	8	4	5	3	5	6
Total Trichoptera Taxa	2	2	4	2	4	2	1	2	1	1
Total Counts										
Ephemeroptera	1,094	599	1,897	1,034	902	495	428	887	852	937
Plecoptera	49	41	191	74	36	10	75	20	40	81
Trichoptera	7	9	20	22	15	7	8	24	1	4
Aquatic Diptera	31	39	206	169	101	38	34	79	15	71
Other	3	16	53	25	5	10	15	11	2	8
% Ephemeroptera	92%	85%	80%	79%	86%	88%	80%	87%	93%	86%
% Plecoptera	4%	6%	8%	6%	3%	3%	11%	2%	5%	7%
% Trichoptera	0.6%	1%	0.8%	2%	2%	1%	2%	2%	0.2%	0.3%
% Aquatic Diptera	3%	6%	9%	12%	9%	6%	6%	8%	2%	6%
% Other	0.3%	2%	2%	2%	0.5%	1%	2%	0.8%	0.4%	1%
% EPT	97%	92%	89%	86%	90%	92%	92%	92%	98%	93%
% Chironomidae	1%	4%	7%	11%	8%	3%	4%	6%	1%	5%
% Dominant Taxon	41%	35%	30%	28%	30%	37%	36%	58%	46%	31%
Total BMI	1,184	704	2,367	1,679	1,396	693	733	1,331	953	1,240
Total Terrestrial Invertebrates	0	4	5	1	24	5	2	8	2	11
Total Invertebrates	1,184	708	2,372	1,680	1,420	698	735	1,339	955	1,251
% Sample BMI	100%	99%	99%	99%	98%	99%	99%	99%	99%	99%
% Sample Terrestrial	0%	1%	1%	1%	2%	1%	1%	1%	1%	1%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Mean Invertebrates / m^2	2,753	1,647	5,516	3,907	3,302	1,623	1,709	3,114	2,221	2,909
Mean BMI / m^2	2,753	1,637	5,505	3,905	3,247	1,612	1,705	3,095	2,216	2,884
± 1 SD	1,435	434	1,579	677	1,441	807	648	980	1,939	1,530

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	2011	2012	2013	2014	2015	2016	2017
Total BMI Taxa	27	22	20	24	27	25	25
Mean BMI Taxa / Sample	17	13	12	13	17	13	15
Total Ephemeroptera Taxa	7	7	7	7	8	8	7
Total Plecoptera Taxa	7	7	5	6	6	5	6
Total Trichoptera Taxa	2	2	1	1	2	2	3
Total Counts							
Ephemeroptera	558	555	618	844	1,488	1,520	1,300
Plecoptera	151	55	131	98	122	209	128
Trichoptera	12	5	8	14	62	14	22
Aquatic Diptera	193	73	86	184	291	352	146
Other	68	5	12	16	65	28	18
% Ephemeroptera	57%	80%	72%	73%	73%	72%	81%
% Plecoptera	15%	8%	15%	8%	6%	10%	8%
% Trichoptera	1%	0.7%	0.9%	1%	3%	0.7%	1%
% Aquatic Diptera	20%	11%	10%	16%	14%	17%	9%
% Other	7%	0.7%	1%	1%	3%	1%	1%
% EPT	73%	89%	89%	83%	82%	82%	90%
% Chironomidae	17%	9%	9%	15%	9%	14%	9%
% Dominant Taxon	21%	37%	25%	31%	28%	27%	24%
Total BMI	982	693	855	1,156	2,028	2,123	1,614
Total Terrestrial Invertebrates	4	0	14	32	6	4	27
Total Invertebrates	986	693	869	1,188	2,034	2,127	1,641
% Sample BMI	99%	100%	98%	97%	99%	99%	98%
% Sample Terrestrial	1%	0%	2%	3%	1%	1%	2%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.69	0.69	0.69
Mean Invertebrates / m^2	2,293	1,612	2,021	2,763	2,956	3,092	2,385
Mean BMI / m^2	2,284	1,612	1,988	2,688	2,948	3,086	2,346
± 1 SD	630	872	526	1,043	892	1,219	1,034

Appendix B.2.–Greens Creek Site 63 BMI data summary, 2018–2019.

	2018	2019
Total BMI Taxa	27	28
Mean BMI Taxa / Sample	14	16
Total Ephemeroptera Taxa	8	8
Total Plecoptera Taxa	7	6
Total Trichoptera Taxa	2	5
Total Counts		
Ephemeroptera	2,271	2,715
Plecoptera	110	65
Trichoptera	20	30
Aquatic Diptera	144	220
Other	26	21
% Ephemeroptera	88%	89%
% Plecoptera	4%	2%
% Trichoptera	0.8%	1%
% Aquatic Diptera	6%	7%
% Other	1%	0.7%
% EPT	93%	92%
% Chironomidae	5%	7%
% Dominant Taxon	39%	38%
Total BMI	2,571	3,051
Total Terrestrial Invertebrates	4	6
Total Invertebrates	2,575	3,057
% Sample BMI	99%	100%
% Sample Terrestrial	1%	0%
Total Sample Area (m^2)	0.69	0.69
Mean Invertebrates / m^2	3,743	4,443
Mean BMI / m^2	3,737	4,435
± 1 SD	1,240	1,708

Appendix B.3.–Greens Creek Site 54 BMI data summary, 2001–2019.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total BMI Taxa	28	30	26	32	25	13	15	22	23	21
Mean BMI Taxa / Sample	15	14	16	19	15	9	8	14	13	13
Total Ephemeroptera Taxa	7	6	7	6	8	5	6	8	7	6
Total Plecoptera Taxa	7	7	7	10	7	3	4	4	7	5
Total Trichoptera Taxa	2	2	1	3	3	2	0	2	2	2
Total Counts										
Ephemeroptera	1,627	1,352	2,011	1,601	1,265	477	286	1,105	895	1,247
Plecoptera	80	54	82	117	37	30	22	65	43	53
Trichoptera	7	6	12	19	31	4	0	9	4	8
Aquatic Diptera	53	39	173	184	65	13	10	85	32	61
Other	15	15	57	46	4	1	1	13	5	8
% Ephemeroptera	91%	92%	86%	81%	90%	91%	90%	87%	91%	91%
% Plecoptera	4%	4%	4%	6%	3%	6%	7%	5%	4%	4%
% Trichoptera	0.4%	0.4%	0.5%	1%	2%	0.8%	0%	0.7%	0.4%	0.6%
% Aquatic Diptera	3%	3%	7%	9%	5%	2%	3%	7%	3%	4%
% Other	0.8%	1%	2%	2%	0.3%	0.2%	0.3%	1%	0.5%	0.6%
% EPT	96%	96%	90%	88%	95%	97%	97%	92%	96%	95%
% Chironomidae	2%	2%	6%	8%	4%	2%	2%	5%	2%	3%
% Dominant Taxon	52%	43%	40%	38%	40%	31%	34%	53%	40%	35%
Total BMI	1,782	1,466	2,335	1,967	1,402	525	319	1,277	979	1,377
Total Terrestrial Invertebrates	0	4	7	1	3	1	6	1	8	9
Total Invertebrates	1,782	1,470	2,342	1,968	1,405	526	325	1,278	987	1,386
% Sample BMI	100%	99%	99%	99%	99%	99%	98%	100%	99%	99%
% Sample Terrestrial	0%	1%	1%	1%	1%	1%	2%	0%	1%	1%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Total Invertebrates / m^2	4,144	3,419	5,447	4,577	3,267	1,223	756	2,972	2,295	3,223
Total BMI / m^2	4,144	3,409	5,430	4,575	3,260	1,221	742	2,970	2,277	3,202
± 1 SD	1,464	1,148	1,422	1,540	1,016	345	293	1,855	297	772

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	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total BMI Taxa	34	30	19	26	28	30	31	29	29
Mean BMI Taxa / Sample	18	14	9	11	14	15	14	14	15
Total Ephemeroptera Taxa	8	7	5	7	7	8	8	8	9
Total Plecoptera Taxa	7	10	6	7	6	6	8	7	7
Total Trichoptera Taxa	5	4	1	3	2	3	4	3	3
Total Counts									
Ephemeroptera	1,536	591	308	1,277	941	2,072	917	2,249	2,328
Plecoptera	96	49	54	109	99	204	72	105	129
Trichoptera	32	9	3	15	24	18	22	11	17
Aquatic Diptera	203	81	52	177	182	201	111	134	282
Other	46	24	19	24	52	22	14	10	18
% Ephemeroptera	80%	78%	71%	80%	72%	82%	81%	90%	84%
% Plecoptera	5%	6%	12%	7%	8%	8%	6%	4%	5%
% Trichoptera	2%	1%	0.7%	0.9%	2%	1%	2%	0.4%	0.6%
% Aquatic Diptera	11%	11%	12%	11%	14%	8%	10%	5%	10%
% Other	2%	4%	4%	1%	4%	0.9%	1%	0.4%	0.6%
% EPT	87%	86%	84%	87%	82%	91%	89%	94%	89%
% Chironomidae	9%	9%	10%	10%	11%	6%	8%	5%	9%
% Dominant Taxon	43%	30%	30%	35%	32%	25%	23%	37%	43%
Total BMI	1,913	754	436	1,607	1,298	2,517	1,136	2,509	2,774
Total Terrestrial Invertebrates	14	5	8	12	6	3	24	4	1
Total Invertebrates	1,927	759	444	1,619	1,304	2,520	1,160	2,513	2,775
% Sample BMI	99%	99%	98%	99%	99%	99%	98%	100%	100%
% Sample Terrestrial	1%	1%	2%	1%	1%	1%	2%	0%	0%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69
Total Invertebrates / m^2	4,481	1,765	1,033	3,765	1,895	3,663	1,686	3,653	4,033
Total BMI / m^2	4,449	1,753	1,014	3,737	1,887	3,658	1,651	3,647	4,032
± 1 SD	2,668	738	642	1,253	1,065	1,139	809	973	978

Appendix B.4.–Tributary Creek Site 9 BMI data summary, 2001–2019.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total BMI Taxa	21	24	36	26	30	23	21	20	26	22
Mean BMI Taxa / Sample	14	15	21	14	14	11	10	14	13	10
Total Ephemeroptera Taxa	6	7	8	5	9	7	5	7	8	7
Total Plecoptera Taxa	5	5	5	6	5	2	3	4	5	5
Total Trichoptera Taxa	0	2	3	3	4	1	2	1	0	0
Total Counts										
Ephemeroptera	205	436	981	562	334	444	104	441	203	89
Plecoptera	68	69	593	166	95	35	37	50	97	17
Trichoptera	0	2	7	5	4	2	4	1	0	0
Aquatic Diptera	86	66	256	66	60	42	21	206	141	52
Other	150	175	679	233	35	102	52	55	38	40
% Ephemeroptera	40%	58%	39%	54%	63%	71%	48%	59%	42%	45%
% Plecoptera	13%	9%	24%	16%	18%	6%	17%	7%	20%	9%
% Trichoptera	0%	0.3%	0.3%	0.5%	0.8%	0.3%	2%	0.1%	0%	0%
% Aquatic Diptera	17%	9%	10%	6%	11%	7%	10%	27%	29%	26%
% Other	30%	23%	27%	23%	7%	16%	24%	7%	8%	20%
% EPT	54%	68%	63%	71%	82%	77%	67%	65%	63%	54%
% Chironomidae	7%	5%	5%	5%	8%	4%	1%	1%	22%	23%
% Dominant Taxon	26%	29%	26%	44%	37%	40%	26%	33%	32%	32%
Total BMI	509	748	2,516	1,032	528	625	218	753	479	198
Total Terrestrial Invertebrates	0	5	15	3	12	33	1	5	50	22
Total Invertebrates	509	753	2,531	1,035	540	658	219	758	529	220
% Sample BMI	100%	99%	99%	99%	98%	95%	99%	99%	91%	90%
% Sample Terrestrial	0%	1%	1%	1%	2%	5%	1%	1%	10%	11%
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
Mean Invertebrates / m^2	1,184	1,751	5,886	2,407	1,256	1,530	509	1,763	1,230	512
Mean BMI / m^2	1,184	1,740	5,851	2,400	1,228	1,453	507	1,751	1,114	460
± 1 SD	1,148	620	1,579	851	357	878	268	631	636	463

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	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total BMI Taxa	26	27	20	22	23	29	29	25	28
Mean BMI Taxa / Sample	12	15	11	12	11	18	16	14	15
Total Ephemeroptera Taxa	6	5	7	6	6	7	7	8	7
Total Plecoptera Taxa	6	6	4	3	6	4	5	3	4
Total Trichoptera Taxa	2	3	1	3	0	5	3	2	3
Total Counts									
Ephemeroptera	277	245	726	565	137	1,128	452	143	311
Plecoptera	138	69	130	166	160	359	365	128	119
Trichoptera	13	10	2	8	0	22	7	4	22
Aquatic Diptera	196	179	135	181	73	1449	727	427	314
Other	232	106	36	146	145	896	255	153	140
% Ephemeroptera	32%	40%	71%	53%	27%	29%	25%	17%	34%
% Plecoptera	16%	11%	13%	16%	31%	9%	20%	15%	13%
% Trichoptera	2%	2%	0.2%	0.8%	0%	0.6%	0.4%	0.5%	2%
% Aquatic Diptera	23%	29%	13%	17%	14%	38%	40%	50%	35%
% Other	27%	17%	3%	14%	28%	23%	14%	18%	15%
% EPT	50%	53%	83%	69%	58%	39%	46%	32%	50%
% Chironomidae	21%	26%	11%	14%	11%	29%	24%	35%	15%
% Dominant Taxon	24%	30%	38%	30%	28%	29%	24%	45%	31%
Total BMI	856	609	1,029	1,066	515	3,854	1,806	855	906
Total Terrestrial Invertebrates	2	9	13	13	6	18	3	8	2
Total Invertebrates	858	618	1,042	1,079	521	3,872	1,809	863	908
% Sample BMI	99%	99%	99%	99%	99%	99%	99%	99%	100%
% Sample Terrestrial	1%	1%	1%	1%	1%	1%	1%	1%	0%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69
Mean Invertebrates / m^2	1,995	1,437	2,423	2,509	757	5,628	2,629	1,254	1,320
Mean BMI / m^2	1,991	1,416	2,393	2,479	749	5,602	2,625	1,243	1,317
± 1 SD	447	615	1,897	727	348	3,133	1,059	464	855

Appendix B.5.–Tributary Creek Site 1847 BMI data summary, 2018–2019.

	2018	2019
Total BMI Taxa	29	28
Mean BMI Taxa / Sample	18	18
Total Ephemeroptera Taxa	7	7
Total Plecoptera Taxa	4	3
Total Trichoptera Taxa	4	3
Total Counts		
Ephemeroptera	631	1,382
Plecoptera	134	291
Trichoptera	34	12
Aquatic Diptera	512	493
Other	197	268
% Ephemeroptera	42%	57%
% Plecoptera	9%	12%
% Trichoptera	2%	0.5%
% Aquatic Diptera	34%	20%
% Other	13%	11%
% EPT	53%	69%
% Chironomidae	29%	14%
% Dominant Taxon	38%	35%
Total BMI	1,508	2,446
Total Terrestrial Invertebrates	5	1
Total Invertebrates	1,513	2,447
% Sample BMI	99%	100%
% Sample Terrestrial	1%	0%
Total Sample Area (m^2)	0.69	0.69
Mean Invertebrates / m^2	2,199	3,557
Mean BMI / m^2	2,192	3,555
± 1 SD	1,248	2,417

APPENDIX C: JUVENILE FISH DATA

Appendix C.1.–Greens Creek Site 48 Dolly Varden char capture data, 2001–2017.

		Number of Fish Captured				Population	Condition
Year	FL (mm)	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
2017	52-156	84	36	12	132	139±8	1.1

Appendix C.2.–Greens Creek Site 63 Dolly Varden char capture data, 2018–2019.

		Number of Fish Captured				Population	Condition
Year	FL (mm)	Set 1	Set 2	Set 3	Total	Estimate	Factor
2018	49–144	69	54	13	136	155±17	1.0
2019	62–176	150	30	24	204	211±7	1.0

Appendix C.3.–Greens Creek Site 54 Dolly Varden char capture data, 2001–2019.

		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
2017	48–151	169	88	49	306	358±32	1.1
2018	50–158	162	64	24	250	264±11	1.0
2019	61–166	183	22	31	236	242±6	1.0

Appendix C.4.–Greens Creek Site 54 coho salmon capture data, 2001–2019.

		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±0	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
2017	ND	0	0	0	0	ND	ND
2018	38–90	17	11	4	32	35±5	1.2
2019	44–95	54	6	2	62	62±0	1.1

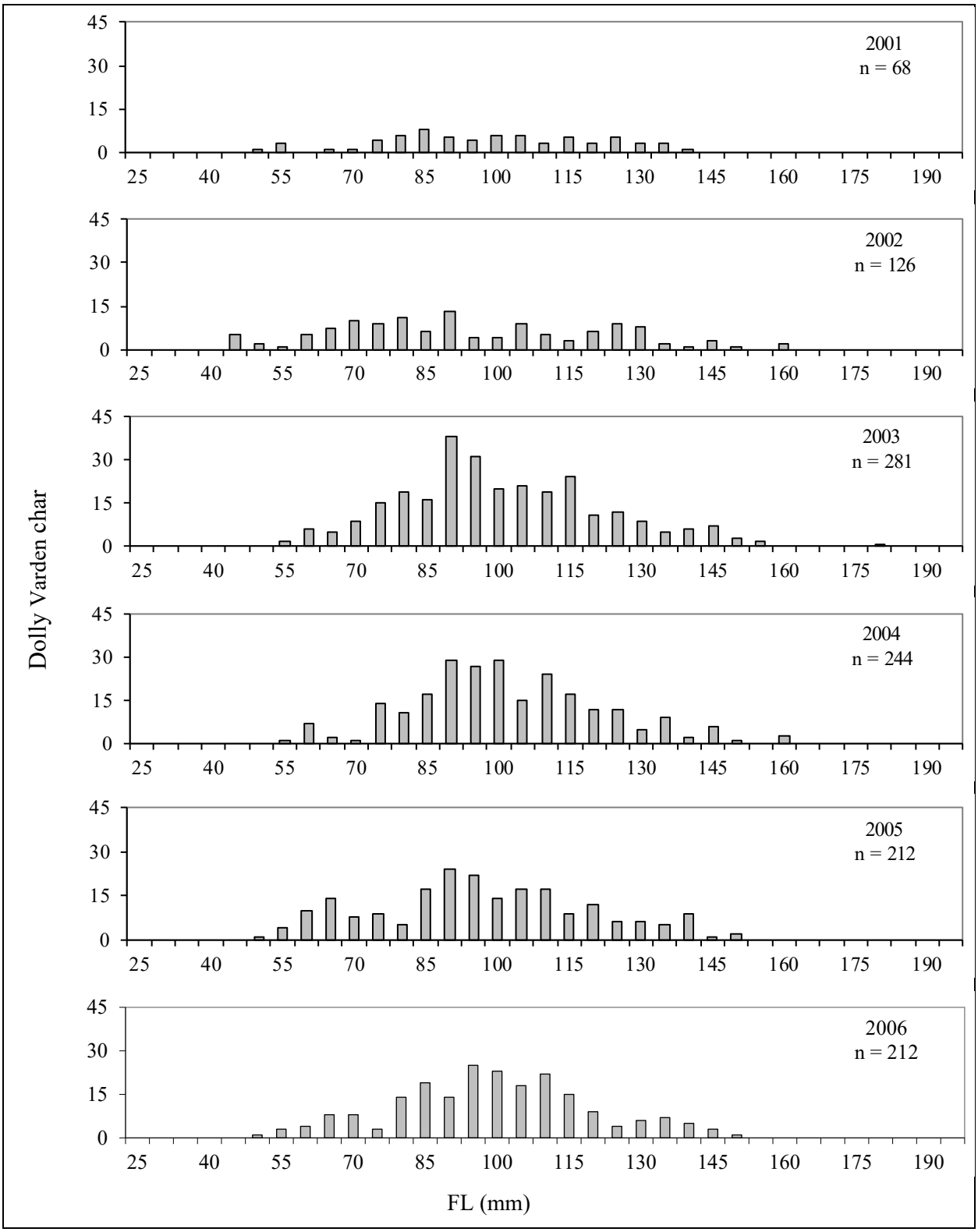
Appendix C.5.–Tributary Creek Site 9 resident fish capture data, 2001–2019.

			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
2017	DV	55–117	31	9	16	56	72±20	1.1
2018	DV	54–109	20	9	3	32	33±2	1.0
2019	DV	59–102	8	0	0	8	ND	1.1

Appendix C.6.–Tributary Creek Site 9 coho salmon capture data, 2001–2019.

Year	FL (mm)	Number of Fish Captured				Population Estimate	Condition Factor
		Set 1	Set 2	Set 3	Total		
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±0	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±0	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±0	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±0	1.3
2017	35–94	67	14	15	96	101±6	1.3
2018	37–92	32	11	10	53	59±9	1.1
2019	45–85	46	2	2	50	50±0	1.2

Appendix C.7.–Greens Creek Site 48 Dolly Varden char length frequency, 2001–2017.



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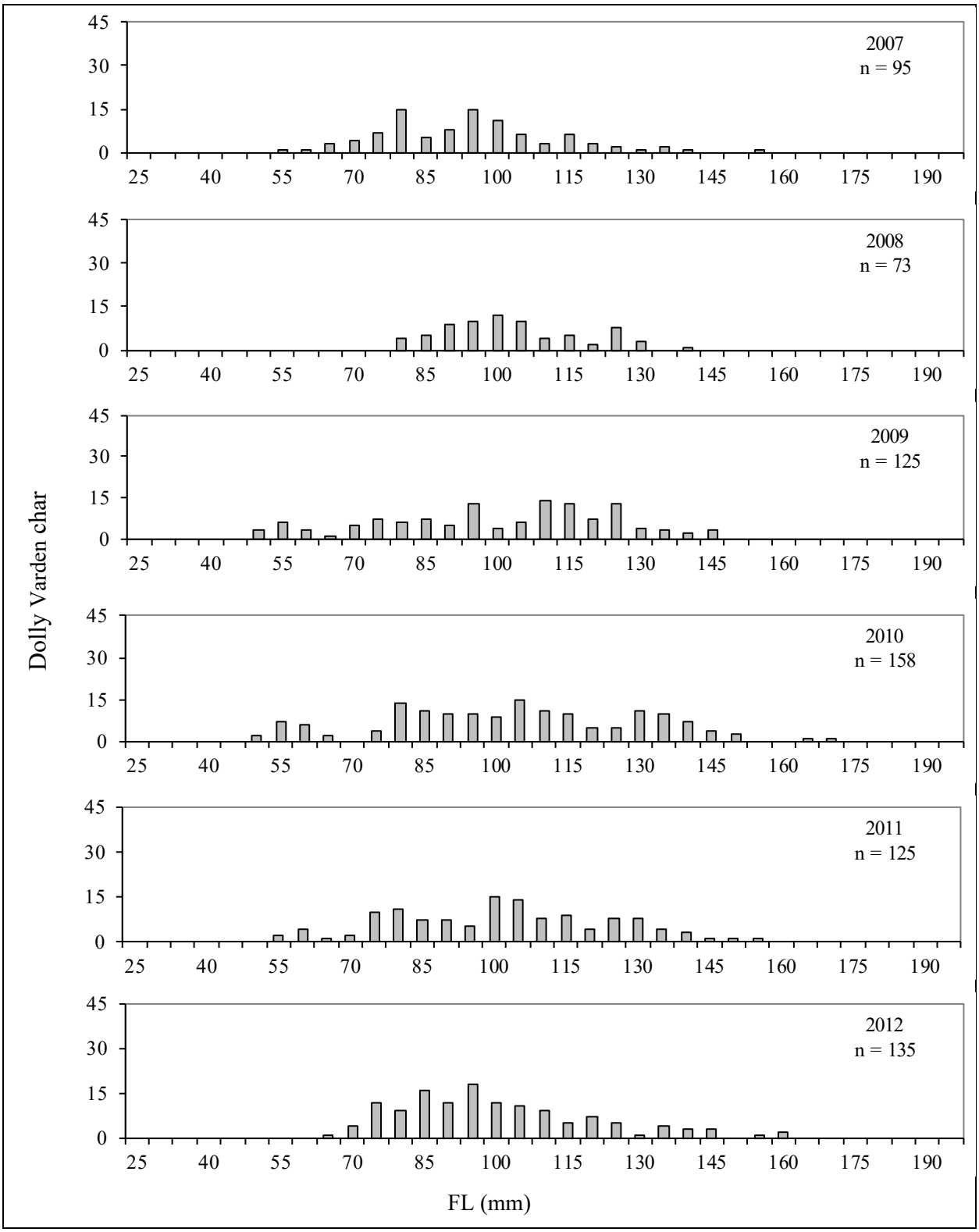
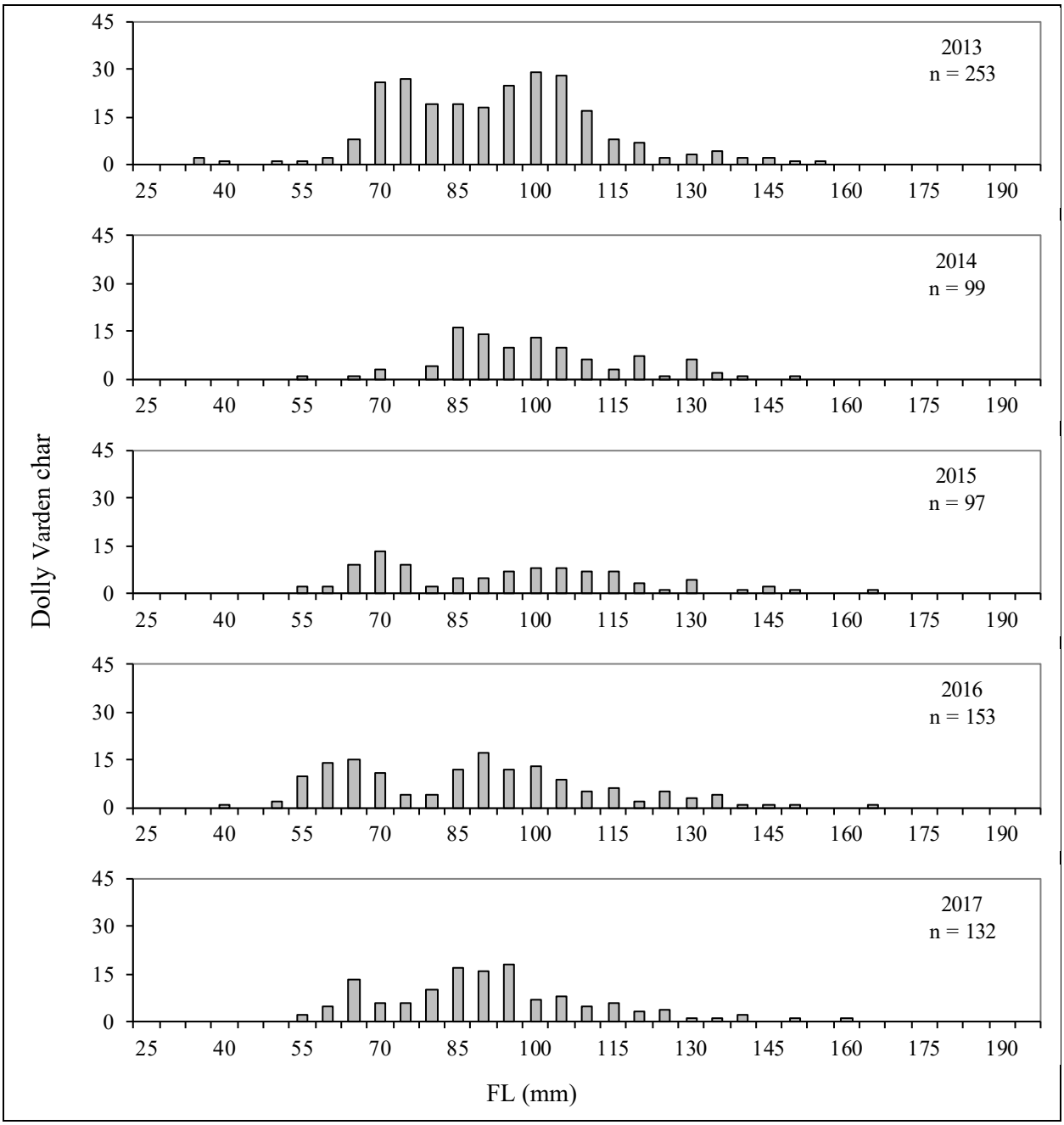
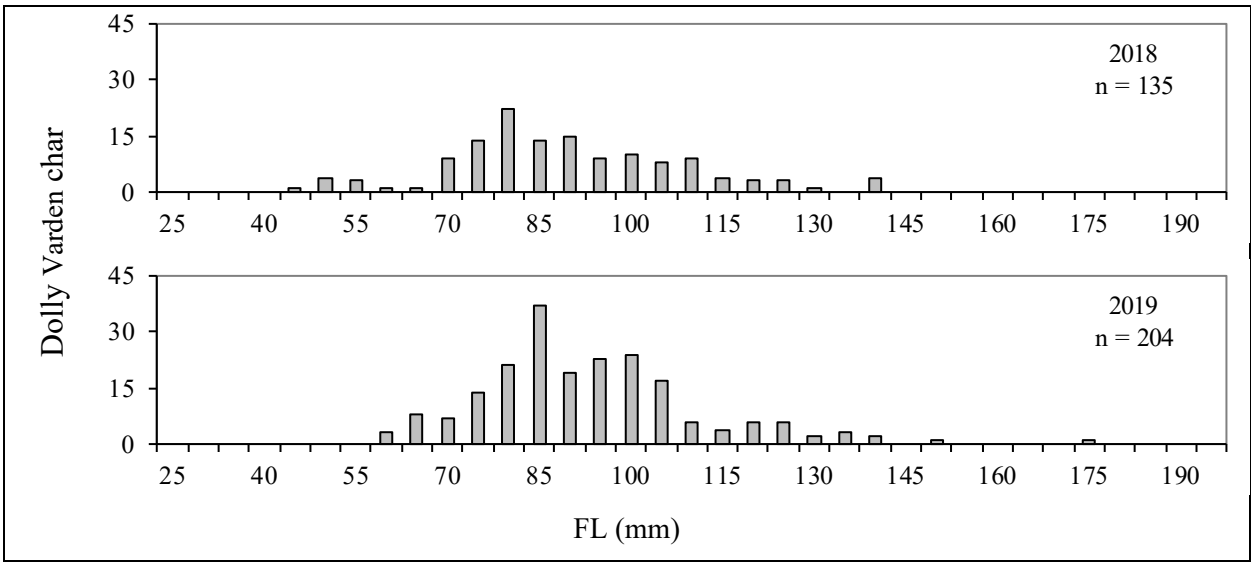

Dolly Varden char
2007
n = 95
2008
n = 73
2009
n = 125
2010
n = 158
2011
n = 125
2012
n = 135
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

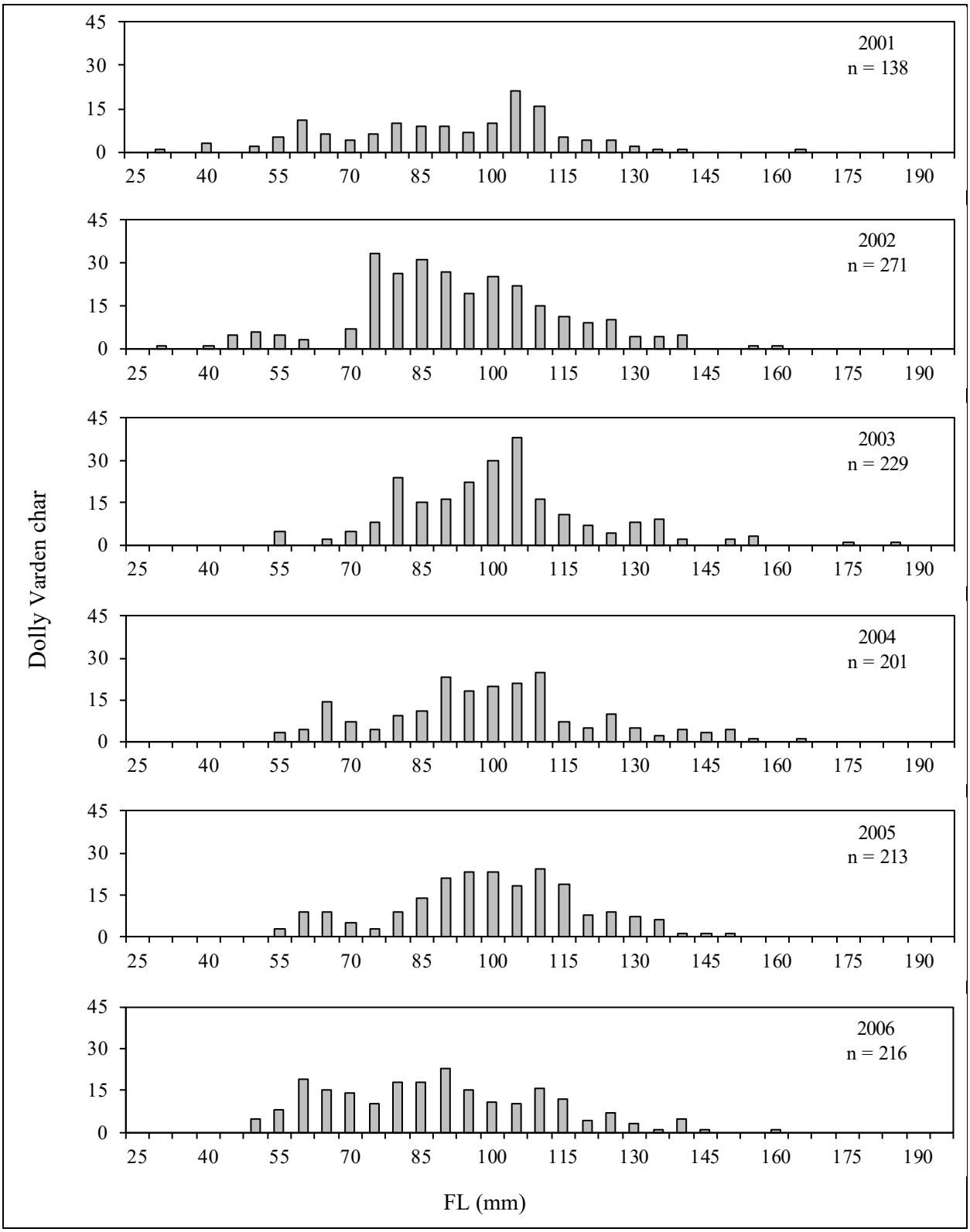
-continued-


Dolly Varden char
2013
n = 253
2014
n = 99
2015
n = 97
2016
n = 153
2017
n = 132
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

Appendix C.8.–Greens Creek Site 63 Dolly Varden char length frequency, 2018–2019.



Appendix C.9.–Greens Creek Site 54 Dolly Varden char length frequency, 2001–2019.



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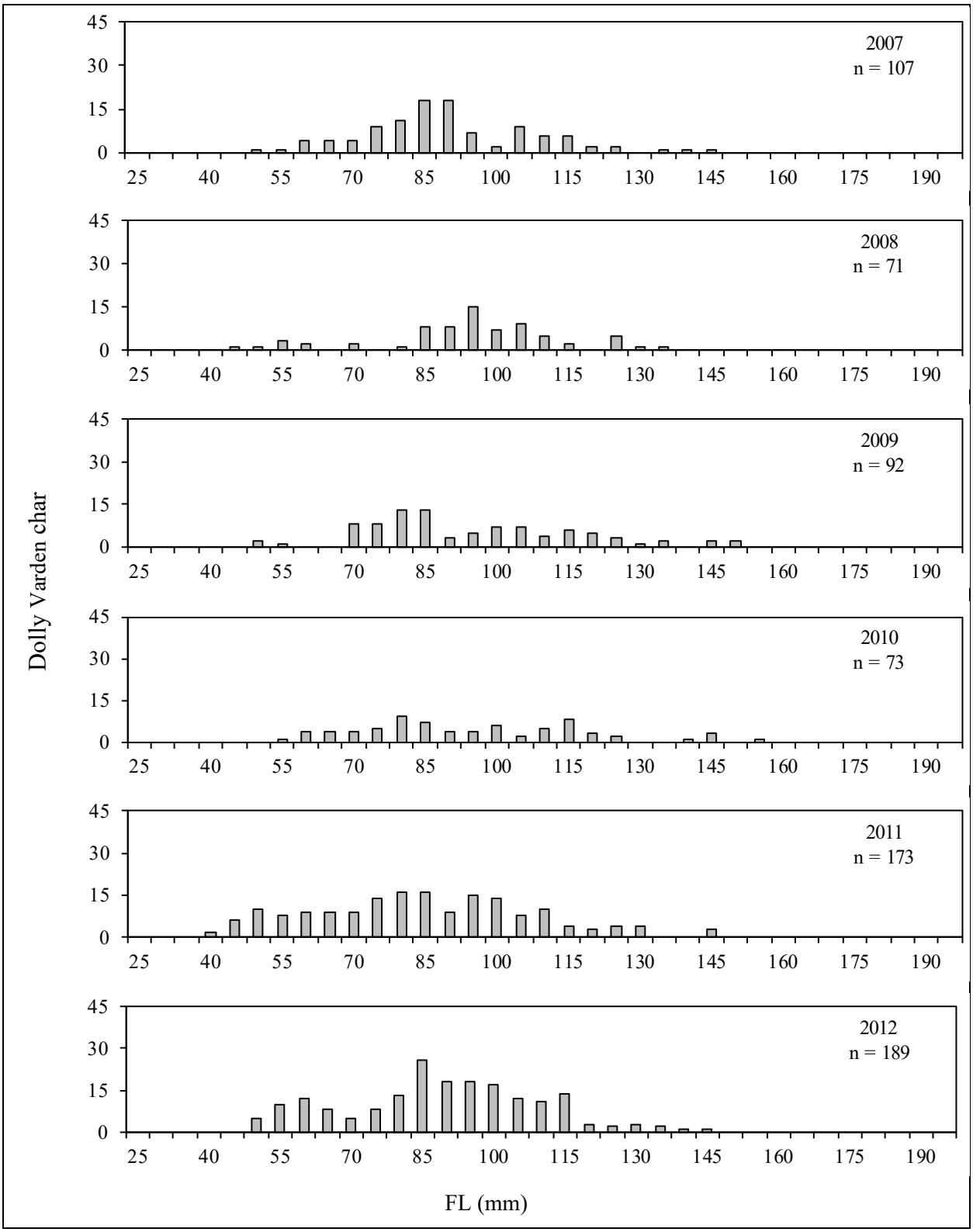
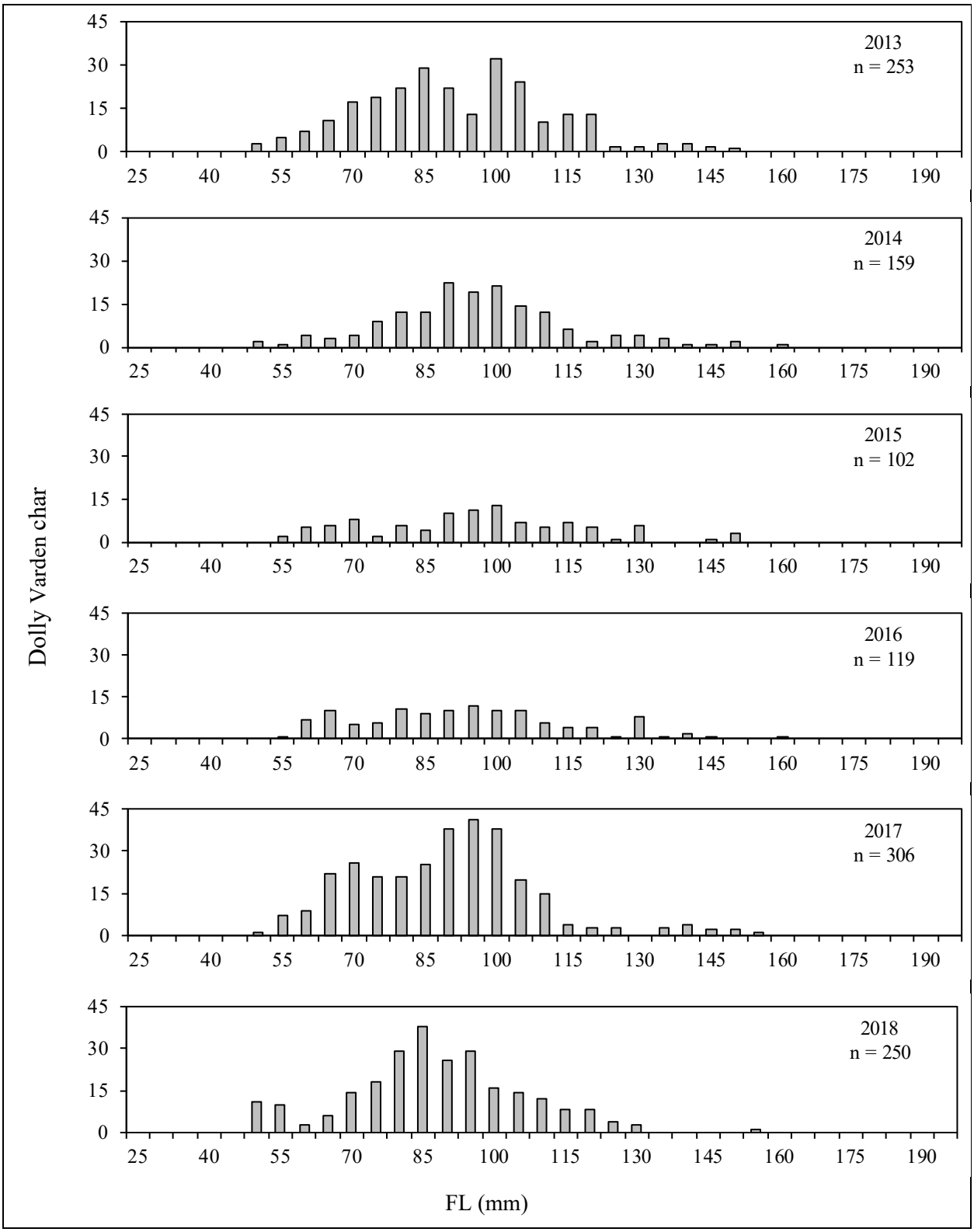
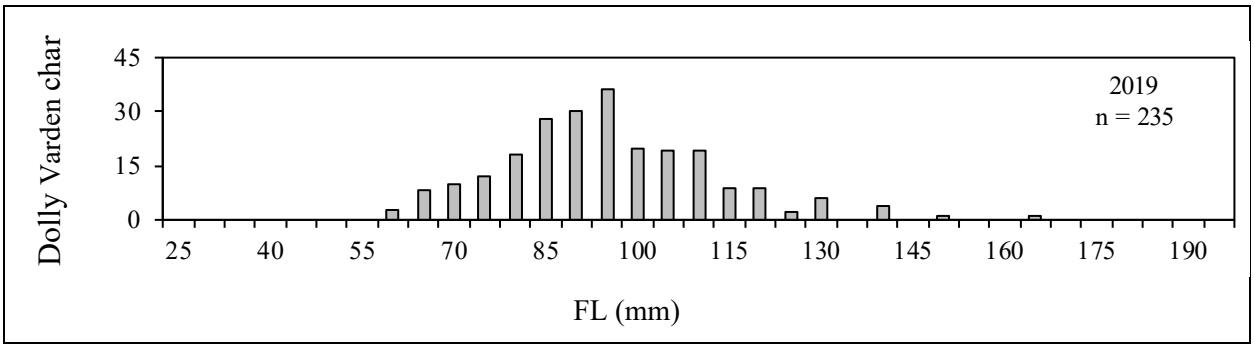

Dolly Varden char
2007
n = 107
2008
n = 71
2009
n = 92
2010
n = 73
2011
n = 173
2012
n = 189
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

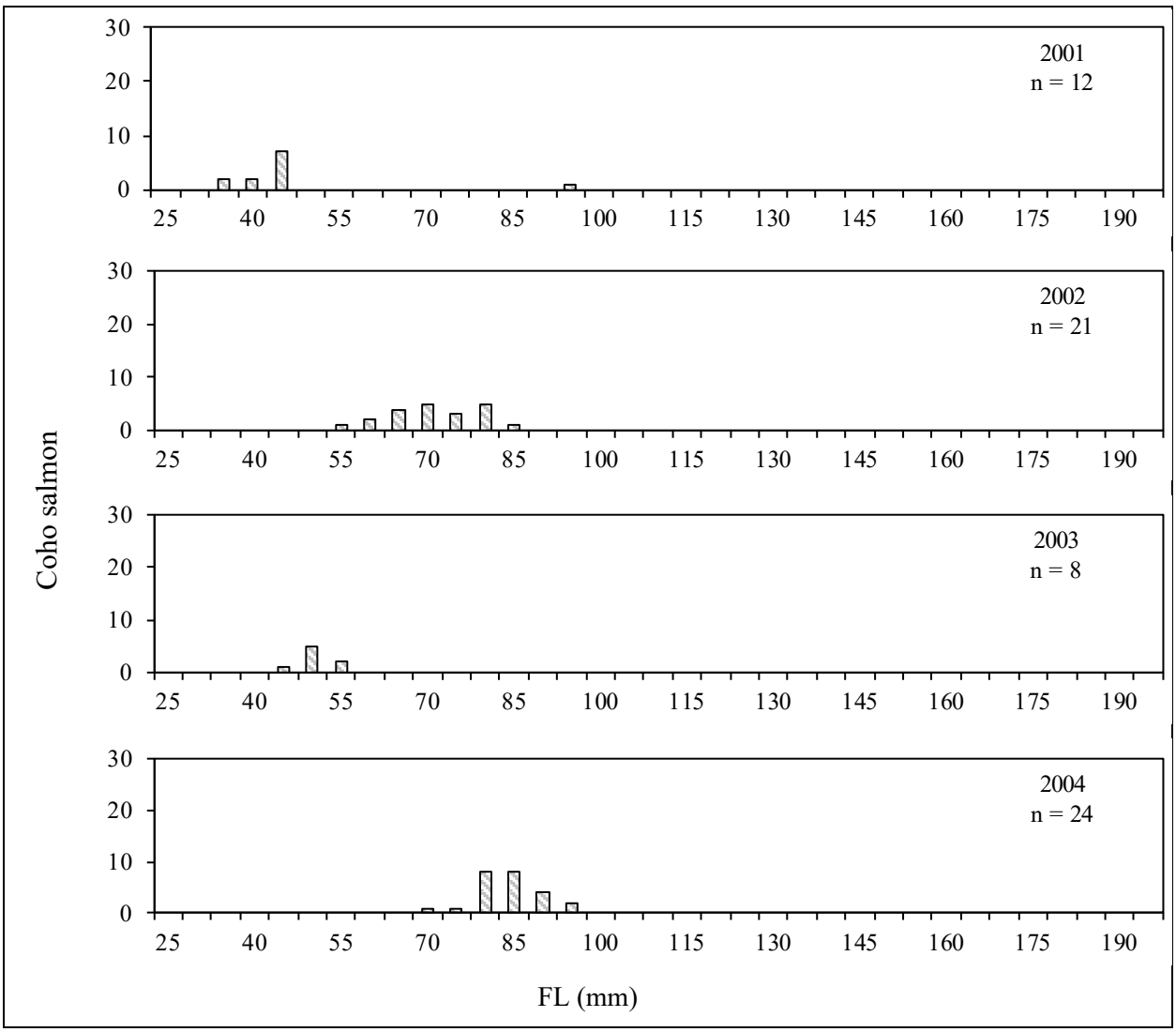
-continued-


Dolly Varden char
2013
n = 253
2014
n = 159
2015
n = 102
2016
n = 119
2017
n = 306
2018
n = 250
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Appendix C.10.–Greens Creek Site 54 coho salmon length frequency, 2001–2019.



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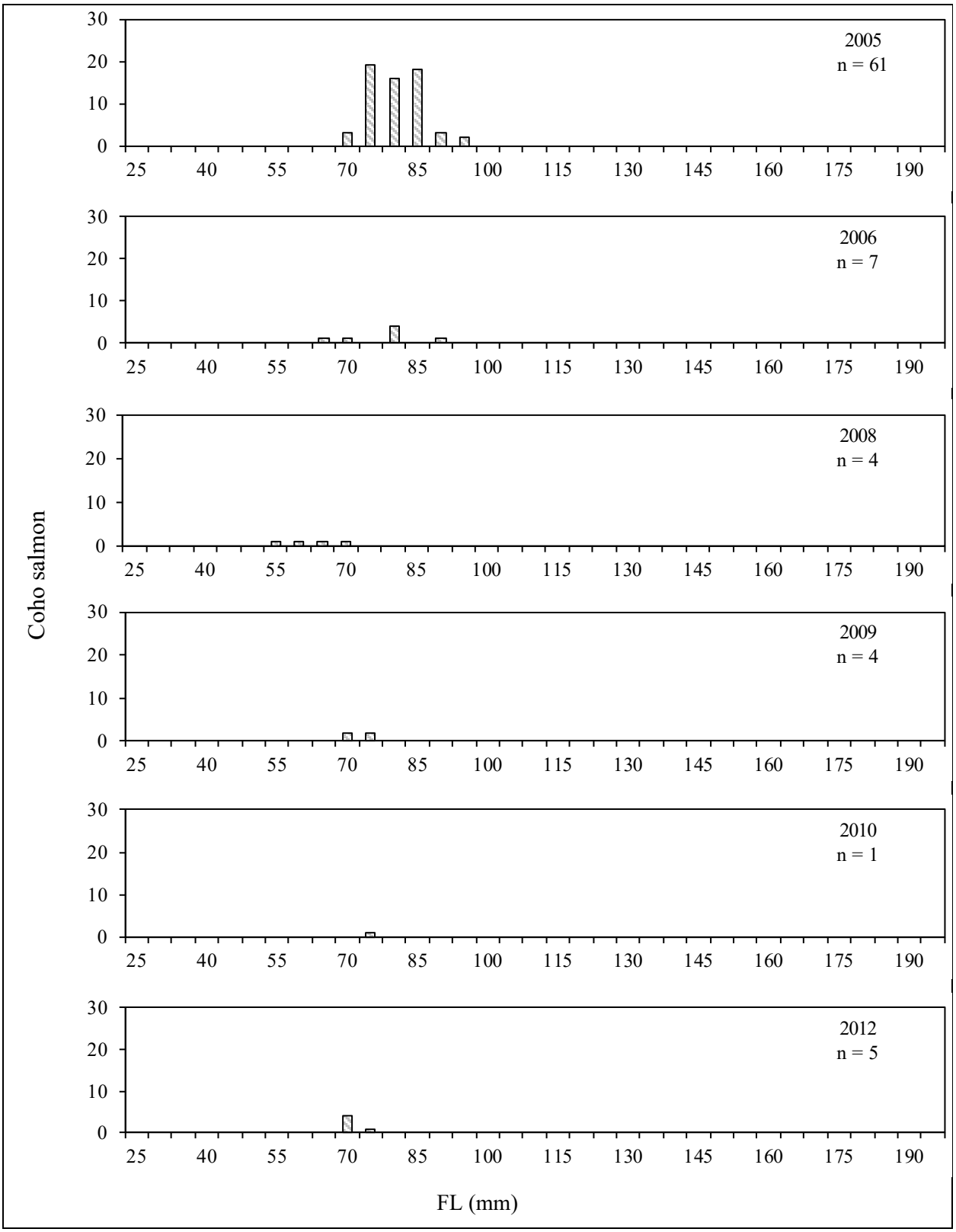
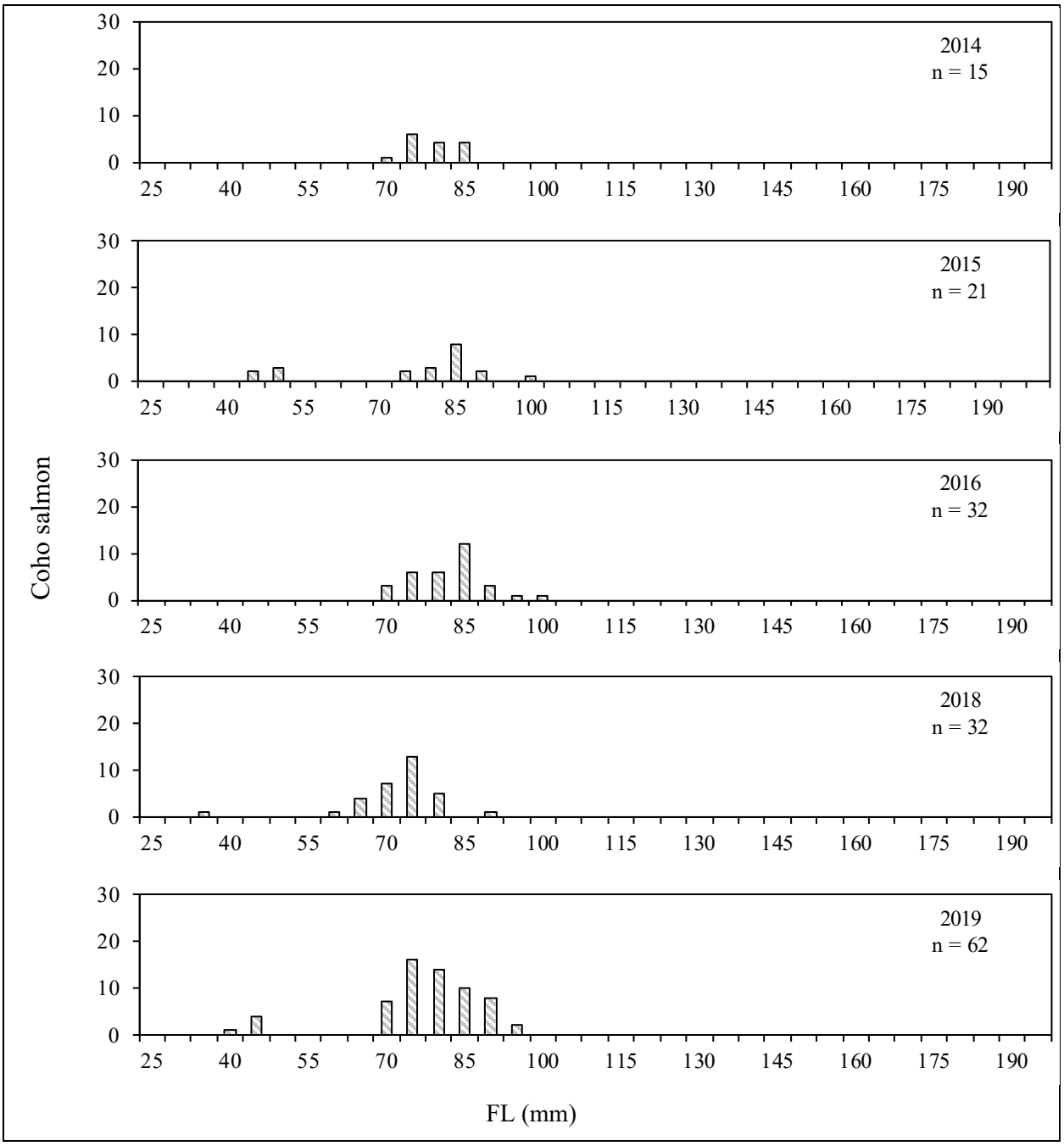
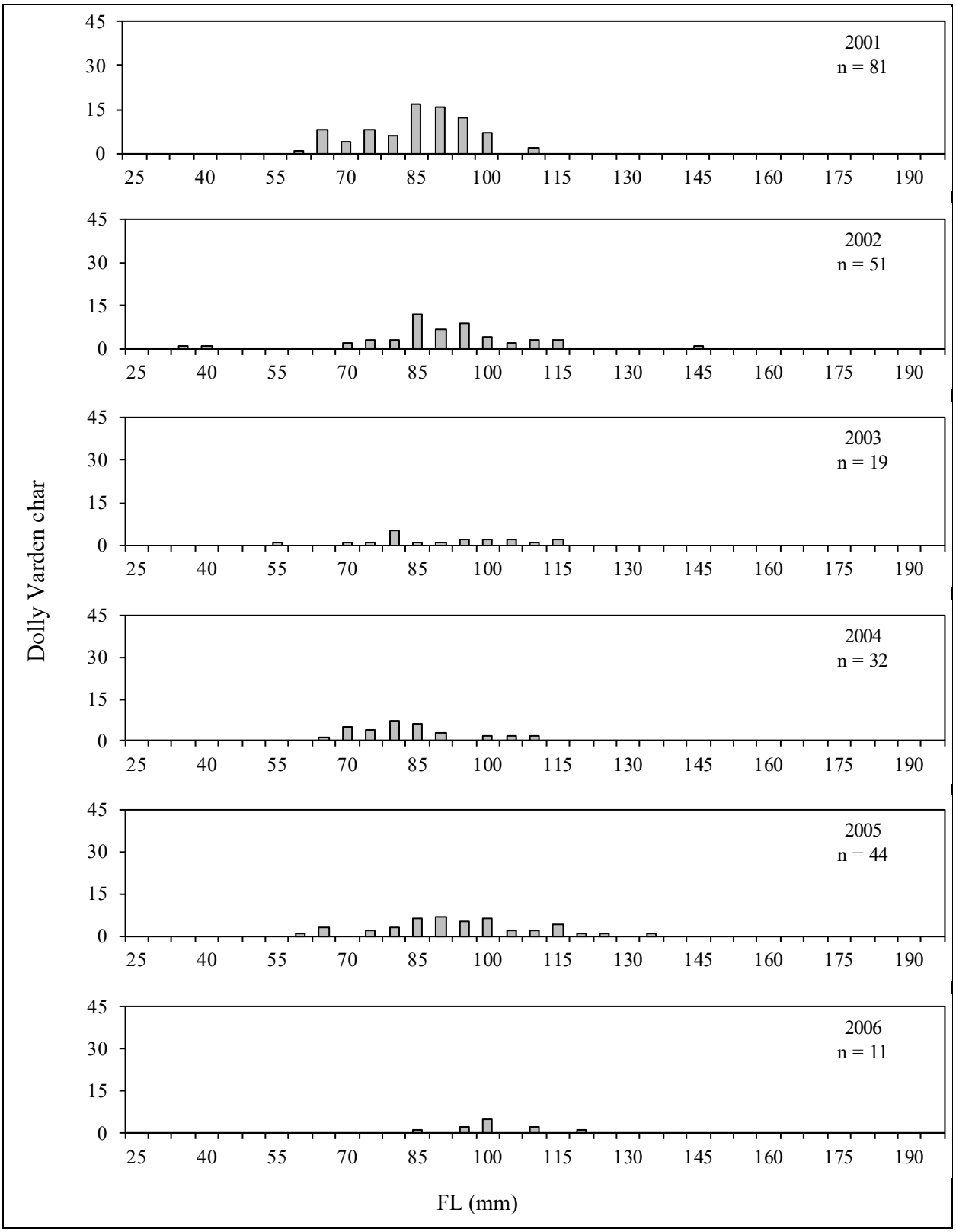

Coho salmon
2005
n = 61
2006
n = 7
2008
n = 4
2009
n = 4
2010
n = 1
2012
n = 5
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2014
n = 15
2015
n = 21
2016
n = 32
2018
n = 32
2019
n = 62
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

Appendix C.11.–Tributary Creek Site 9 Dolly Varden char length frequency, 2001–2019.



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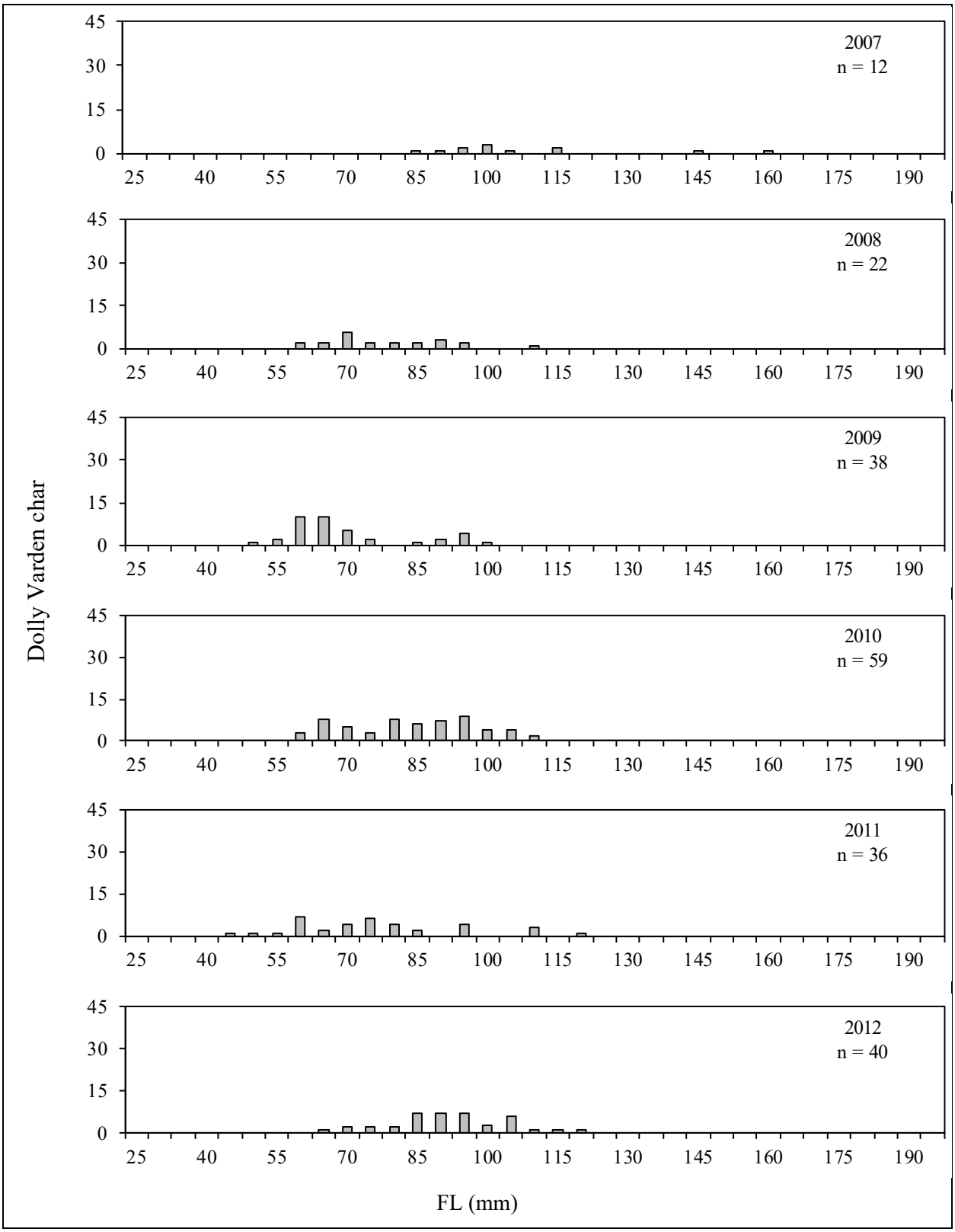
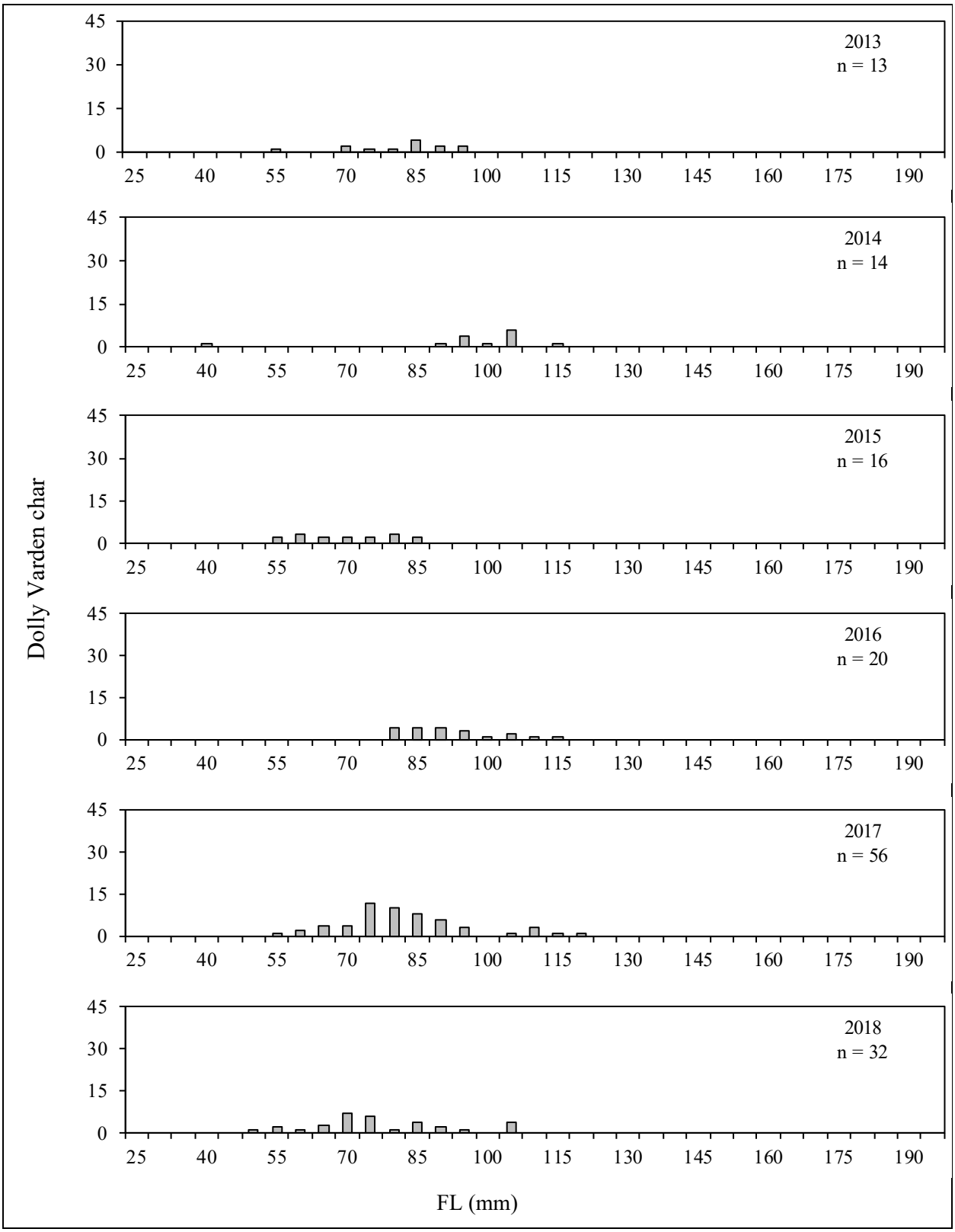
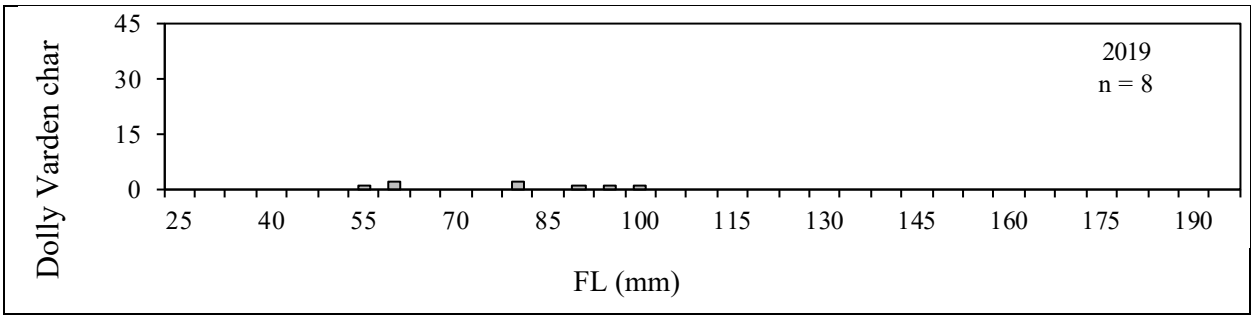

Dolly Varden char
2007
n = 12
2008
n = 22
2009
n = 38
2010
n = 59
2011
n = 36
2012
n = 40
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

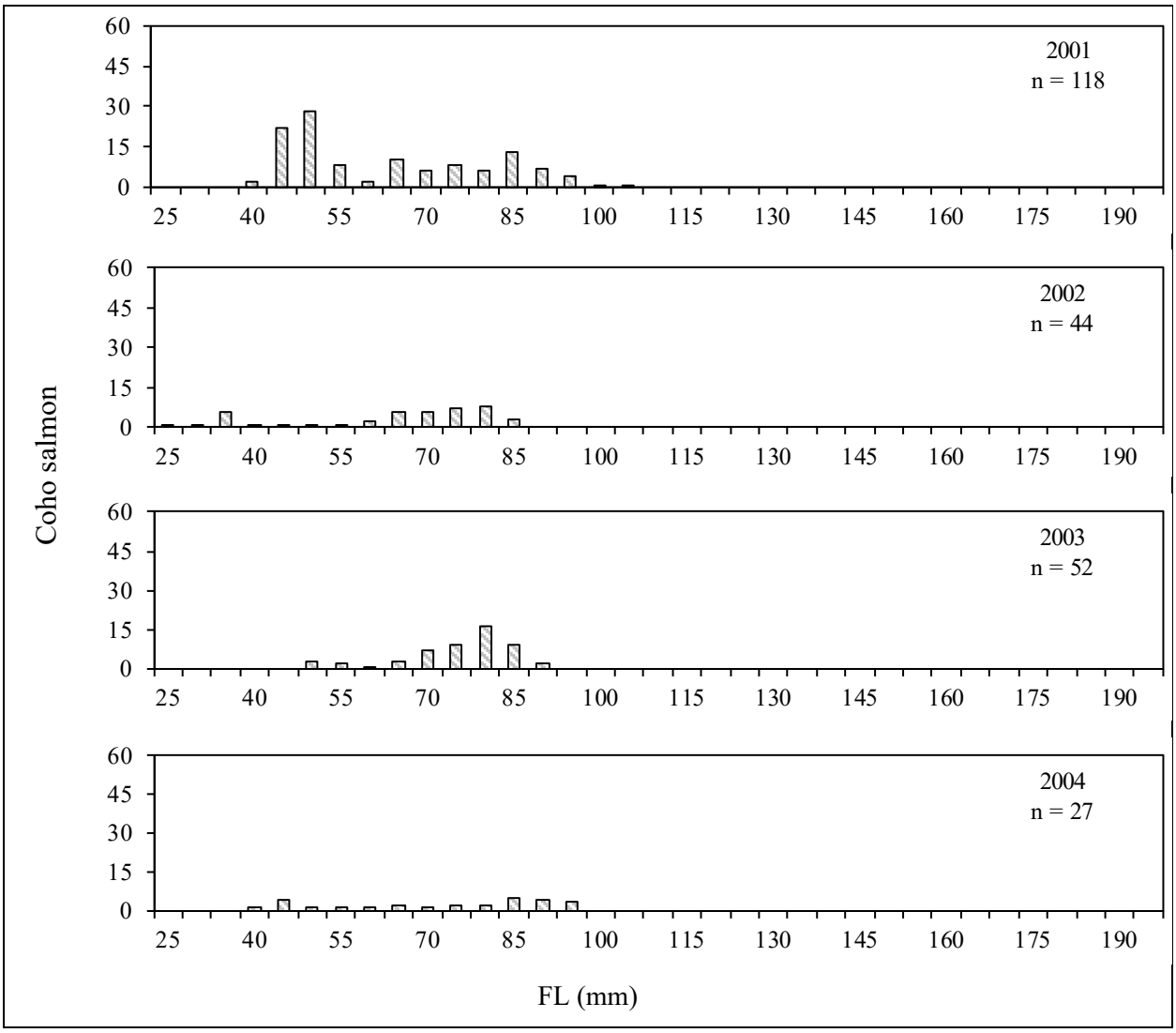
-continued-


Dolly Varden char
2013
n = 13
2014
n = 14
2015
n = 16
2016
n = 20
2017
n = 56
2018
n = 32
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Appendix C.12.–Tributary Creek Site 9 coho salmon length frequency, 2001–2019.



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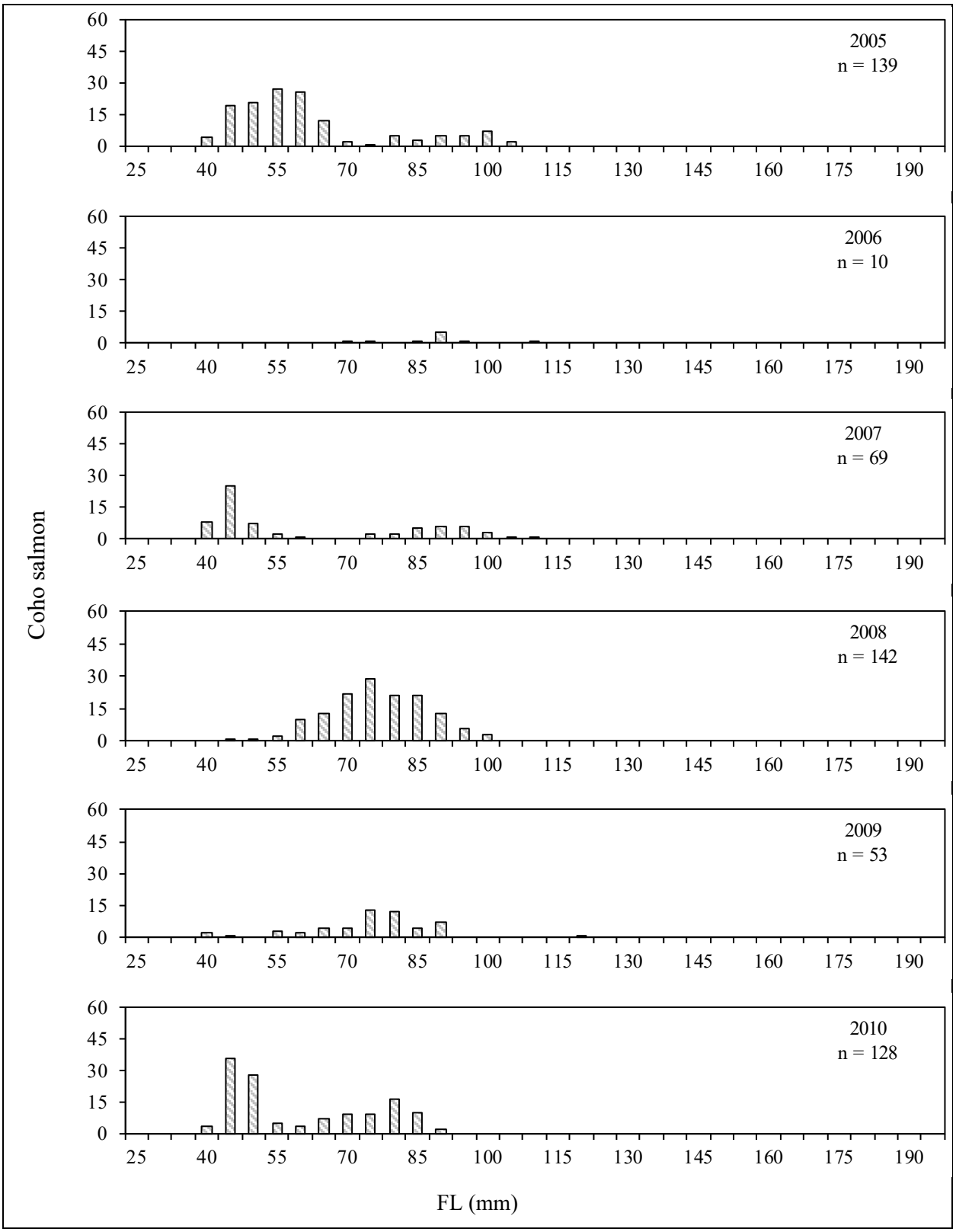
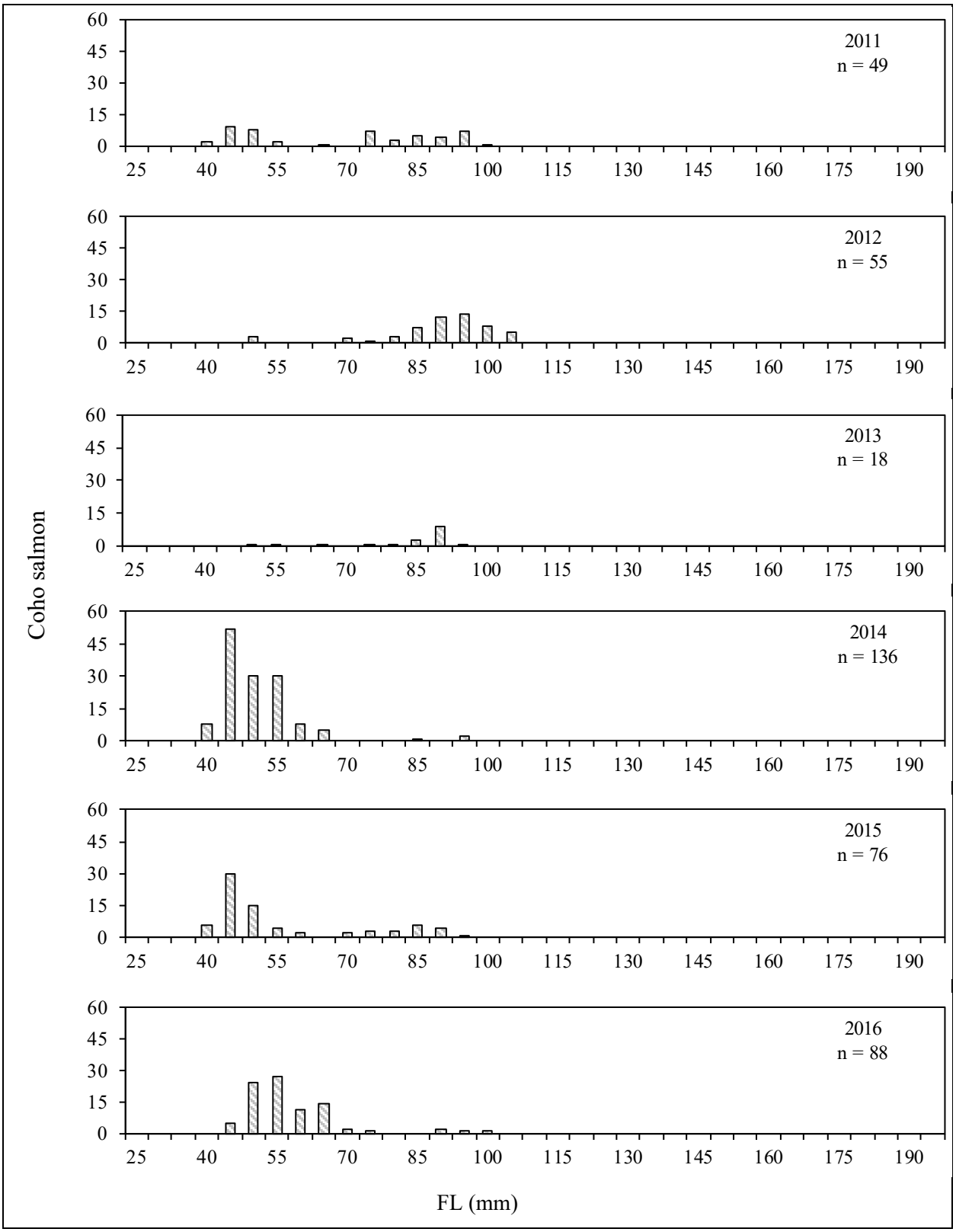
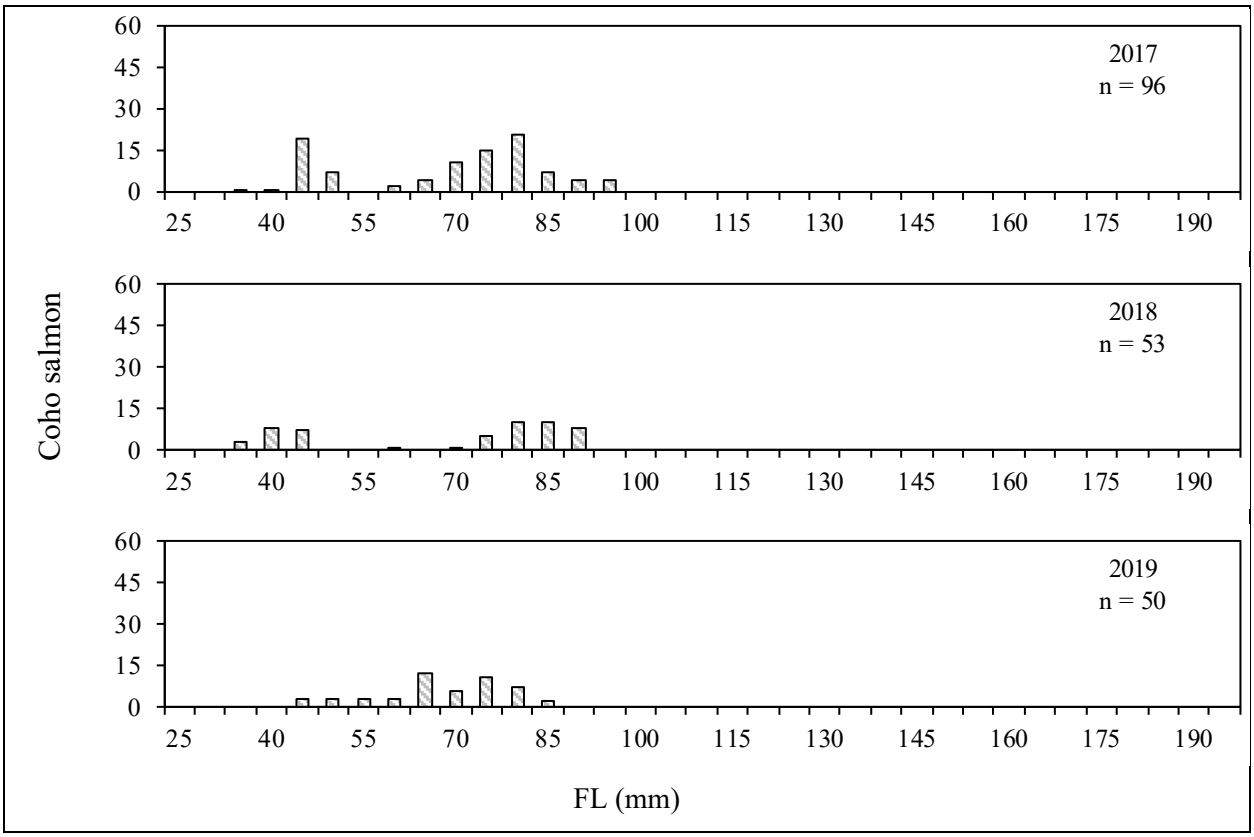

Coho salmon
2005
n = 139
2006
n = 10
2007
n = 69
2008
n = 142
2009
n = 53
2010
n = 128
0
15
30
45
60
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2011
n = 49
2012
n = 55
2013
n = 18
2014
n = 136
2015
n = 76
2016
n = 88
0
15
30
45
60
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2017
n = 96
2018
n = 53
2019
n = 50
0
15
30
45
60
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

APPENDIX D: JUVENILE FISH ELEMENT CONCENTRATIONS DATA AND LAB REPORT

Appendix D.1.–Greens Creek Site 48 Dolly Varden char element concentrations, 2001–2017.

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

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Sample Date	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	122	17.9	0.03	1.16	5.5	ND	0.17	5.5	221
7/21/07	95	10.4	0.02	1.42	3.9	ND	0.29	5.8	165
7/21/07	135	22.8	0.09	1.35	14.1	ND	1.37	5.3	166
7/21/07	98	9.9	0.03	0.96	5.7	ND	0.27	5.2	269
7/21/07	105	13.2	0.11	1.79	11.4	ND	1.62	5.4	323
7/21/07	99	10.0	0.04	1.43	5.2	ND	0.31	5.7	208
7/22/08	112	16.4	0.069	1.23	5.2	ND	0.95	5.72	289.0
7/22/08	123	21.3	0.039	0.79	3.9	ND	0.57	4.56	194.0
7/22/08	105	14.0	0.079	0.82	4.6	ND	0.52	5.88	199.5
7/22/08	124	20.6	0.041	0.87	4.9	ND	0.42	6.31	244.0
7/22/08	115	16.9	0.030	1.36	5.3	ND	0.51	5.36	254.0
7/22/08	122	19.8	0.037	1.07	5.6	ND	0.38	6.11	260.0
7/21/09	120	20.1	<0.02	1.05	5.2	ND	0.22	5.9	186
7/21/09	121	20.7	<0.02	1.40	5.3	ND	0.44	5.7	173
7/21/09	119	17.9	0.02	1.10	4.5	ND	0.13	5.9	182
7/21/09	108	13.6	<0.02	1.20	4.1	ND	0.15	5.7	162
7/21/09	109	14.6	<0.02	1.50	4.9	ND	0.17	5.9	186
7/21/09	110	15.2	<0.02	0.84	3.8	ND	0.18	6.1	202
7/21/10	103	11.9	0.020	1.56	4.8	0.09	0.16	5.0	226
7/21/10	109	16.1	<0.020	0.50	3.0	0.15	0.20	5.4	170
7/21/10	108	13.9	0.040	0.91	4.2	0.17	0.30	5.0	180
7/21/10	105	13.8	<0.020	0.98	3.4	0.13	0.09	4.6	163
7/21/10	98	10.8	0.062	0.90	4.8	0.14	0.46	4.8	213
7/21/10	93	9.1	<0.020	0.96	3.6	0.10	0.09	4.0	156
7/22/11	88-112	ND	0.03	1.12	5.7	ND	0.28	6.2	221
7/24/12	109	11.3	0.03	2.26	27.0	0.134	0.16	5.5	186
7/24/12	123	18.3	0.03	1.37	4.9	0.122	0.10	5.7	184
7/24/12	110	9.8	0.03	1.83	25.6	0.159	2.59	5.6	275
7/24/12	103	10.6	0.03	0.99	76.8	0.175	0.30	5.1	189
7/24/12	104	10.7	0.03	2.66	84.8	0.122	1.05	6.3	242
7/24/12	116	15.8	0.04	0.73	35.1	0.148	1.03	4.7	190
7/25/13	145	20.6	<0.02	0.68	3.7	0.214	0.17	5.3	237
7/25/13	115	17.9	0.07	0.97	6.1	0.238	0.24	5.8	239
7/25/13	115	14.3	<0.02	0.81	4.0	0.180	0.08	6.7	258
7/25/13	105	11.4	<0.02	0.68	3.2	0.213	0.14	6.4	213
7/25/13	109	13.0	0.04	2.01	6.6	0.113	0.36	6.2	271
7/25/13	105	12.4	0.04	1.75	5.7	0.274	0.22	6.2	287

-continued-

Sample Date	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	110	13.0	0.04	0.55	4.5	0.146	0.11	5.3	234
7/25/14	100	10.5	<0.02	0.93	4.2	0.148	0.19	6.9	213
7/25/14	106	10.7	<0.02	1.22	4.8	0.199	0.38	5.7	232
7/25/14	105	11.3	<0.02	1.45	4.2	0.122	0.44	6.1	193
7/25/14	100	10.4	<0.02	0.92	4.5	0.134	0.06	4.9	237
7/25/14	120	14.8	0.04	0.75	5.5	0.260	0.18	5.9	305
7/16/15	105	12.4	<0.02	0.60	2.5	0.114	0.13	6.2	159
7/16/15	104	11.7	0.04	1.11	10.7	0.100	1.30	5.8	205
7/16/15	100	11.7	0.03	1.05	3.8	0.152	0.14	6.1	187
7/16/15	105	11.3	0.03	1.39	4.2	0.154	0.36	6.1	198
7/16/15	105	12.7	<0.02	1.06	4.0	0.128	0.12	5.7	169
7/16/15	100	10.4	0.02	1.49	3.9	0.165	0.37	5.4	191
7/16/15	104	9.6	<0.02	0.85	3.1	0.091	0.09	5.2	175
7/16/15	85	8.6	0.03	0.90	3.6	0.139	0.27	5.9	172
7/16/15	102	10.3	<0.02	1.51	3.7	0.180	0.15	7.2	192
7/16/15	120	16.3	<0.02	0.86	4.0	0.150	0.14	6.4	223
7/14/16	84	7.3	<0.020	1.28	4.72	0.180	0.157	7.63	252
7/14/16	82	6.1	0.023	0.921	4.82	0.160	0.147	5.83	222
7/14/16	98	10.1	0.021	1.09	3.99	0.108	0.150	6.30	189
7/14/16	93	7.9	<0.020	1.44	4.49	0.163	0.205	6.77	197
7/14/16	88	6.9	0.035	1.50	4.65	0.243	0.493	7.63	185
7/14/16	84	7.3	0.023	0.681	4.12	0.150	0.088	6.42	200
7/14/16	94	8.8	0.065	1.21	4.69	0.172	0.143	7.19	194
7/14/16	86	7.6	0.022	1.89	4.96	0.210	0.295	7.27	251
7/14/16	93	9.4	<0.020	1.23	4.85	0.127	0.193	5.8	205
7/14/16	101	9.8	<0.020	1.32	4.72	0.114	0.134	6.28	178
7/13/17	95	8.7	0.054	0.649	3.74	0.115	0.189	5.79	172
7/13/17	91	8.0	0.097	1.51	3.86	0.118	0.417	5.98	169
7/13/17	102	10.0	0.024	0.746	3.92	0.0919	0.089	5.37	168
7/13/17	105	13.1	0.022	1.00	4.98	0.143	0.237	6.78	194
7/13/17	94	8.6	<0.020	0.456	2.81	0.106	0.064	4.5	166
7/13/17	99	9.9	0.023	1.03	3.93	0.111	0.087	5.39	200
7/13/17	98	10.8	0.022	0.462	2.68	0.101	0.064	4.4	168
7/13/17	124	18.8	0.034	0.655	3.77	0.123	0.087	5.02	154
7/13/17	99	10.7	<0.020	0.673	3.48	0.0893	0.067	4.69	165
7/13/17	95	9.8	0.044	0.305	3.18	0.112	0.126	4.73	159

Appendix D.2.–Greens Creek Site 63 Dolly Varden char element concentrations, 2018–2019.

Sample Date	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)
07/13/18	92	7.0	0.038	1.55	6.52	0.175	0.635	7.50	283
07/13/18	95	8.0	0.056	1.13	5.15	0.169	0.906	6.56	236
07/13/18	105	11.5	0.045	1.63	7.10	0.181	1.29	7.5	250
07/13/18	87	6.5	0.021	1.65	4.65	0.127	0.263	7.4	244
07/13/18	97	8.2	0.044	1.44	5.42	0.157	1.54	7.38	244
07/13/18	90	6.8	0.026	1.18	4.60	0.149	0.324	7.00	195
07/13/18	105	10.6	0.025	1.10	5.33	0.178	0.172	6.2	247
07/13/18	95	8.1	<0.020	1.43	4.89	0.134	0.187	8.0	189
07/13/18	110	13.0	0.037	0.964	9.61	0.146	0.340	6.6	190
07/13/18	104	10.1	0.043	1.21	5.57	0.228	1.30	6.40	250
07/09/19	105	10.3	<0.019	1.22	5.43	0.132	0.594	6.31	255
07/09/19	121	16.5	0.029	0.892	4.24	0.192	0.537	5.75	209
07/09/19	95	8.7	0.020	1.02	3.78	0.138	0.382	5.99	203
07/09/19	110	16.5	0.031	0.549	3.15	0.163	0.327	6.93	126
07/09/19	101	10.8	0.022	0.800	3.34	0.134	0.266	6.08	169
07/09/19	99	12.8	0.037	1.40	5.05	0.135	1.00	6.10	207
07/09/19	100	12.0	<0.019	1.40	4.64	0.131	0.218	5.44	201
07/09/19	120	16.8	0.032	1.32	5.63	0.143	0.329	6.27	182
07/09/19	95	10.1	0.034	1.34	4.10	0.162	0.514	5.46	229
07/09/19	107	14.2	0.032	0.709	3.94	0.174	0.570	4.93	180

Appendix D.3.–Greens Creek Site 54 Dolly Varden char element concentrations, 2001–2019.

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

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Sample Date	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	102	11.8	0.04	0.88	5.3	ND	0.54	5.6	157
7/20/07	125	21.1	0.03	0.97	5.2	ND	0.83	7.5	234
7/20/07	97	10.7	0.06	0.81	5.7	ND	0.89	8.6	185
7/20/07	123	19.7	0.02	0.75	4.4	ND	0.50	7.1	175
7/20/07	104	12.5	0.03	0.92	5.6	ND	0.57	7.8	174
7/20/07	110	15.1	0.04	1.38	6.2	ND	0.82	5.4	191
7/22/08	123	21.9	0.039	0.66	5.3	ND	0.26	5.53	185.0
7/22/08	94	10.8	0.039	1.04	5.1	ND	0.28	6.07	203.0
7/22/08	123	21.5	0.028	1.53	4.9	ND	3.46	6.29	261.0
7/22/08	97	11.2	0.029	1.34	5.0	ND	0.17	5.90	198.5
7/22/08	108	16.0	0.045	1.98	6.3	ND	0.23	5.97	220.0
7/22/08	108	14.2	0.059	1.07	8.4	ND	1.31	5.03	195.0
7/21/09	132	26.9	0.04	1.10	4.8	ND	0.33	5.4	213
7/21/09	141	32.3	0.02	0.71	4.5	ND	0.45	7.9	143
7/21/09	116	17.9	<0.02	0.99	4.2	ND	0.40	6.3	153
7/21/09	117	17.7	0.03	1.00	5.9	ND	0.39	6.8	200
7/21/09	119	22.1	<0.02	1.20	4.0	ND	0.28	6.5	176
7/21/09	103	13.0	0.02	2.20	5.3	ND	0.35	5.9	226
7/20/10	115	16.0	<0.020	0.80	3.4	0.08	0.37	4.6	159
7/20/10	112	12.8	0.022	0.67	3.1	0.09	0.34	3.7	154
7/20/10	118	12.6	<0.020	0.98	3.6	0.12	0.25	5.2	190
7/20/10	108	10.6	<0.020	1.31	3.8	0.10	0.16	4.1	212
7/20/10	115	12.3	<0.020	1.73	5.0	0.12	0.36	4.4	222
7/20/10	94	9.0	0.025	0.77	4.0	0.14	0.31	4.8	199
7/21/11	95-117	ND	<0.02	0.95	4.5	ND	0.32	5.6	191
7/23/12	132	24.2	0.02	0.85	7.7	0.0768	0.41	9.2	144
7/23/12	118	17.3	0.04	1.03	7.7	0.109	0.57	6.3	199
7/23/12	109	13.1	0.06	2.04	19.2	0.112	1.32	7.4	215
7/23/12	97	9.1	0.03	2.04	65.6	0.126	0.50	6.2	227
7/23/12	115	15.4	0.04	1.22	12.6	0.123	1.10	6.9	202
7/23/12	119	18.3	0.03	1.81	5.3	0.0798	0.27	5.1	191
7/24/13	117	16.9	<0.02	1.39	4.2	0.131	0.30	5.6	247
7/24/13	117	17.6	0.02	0.74	3.9	0.183	0.39	7.0	297
7/24/13	94	11.3	<0.02	1.27	4.3	0.172	0.28	6.6	262
7/24/13	118	18.9	<0.02	0.89	3.9	0.145	0.33	6.0	211
7/24/13	105	10.3	0.02	1.18	5.3	0.108	0.27	6.4	245
7/24/13	116	15.3	0.02	1.07	4.5	0.126	0.18	6.4	225

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Sample Date	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	125	21.2	0.08	0.93	12.7	0.121	1.55	5.7	212
7/25/14	104	10.8	0.04	1.15	4.5	0.111	0.37	4.8	247
7/25/14	110	11.5	0.21	0.85	4.3	0.119	0.30	6.2	291
7/25/14	110	14.9	<0.02	0.69	4.8	0.113	0.25	5.9	248
7/25/14	104	10.5	<0.02	1.03	5.0	0.106	0.28	5.7	250
7/25/14	135	24.1	0.02	0.86	4.4	0.160	0.49	6.6	243
7/15/15	110	11.3	0.02	0.92	4.7	0.121	0.59	6.3	236
7/15/15	105	11.5	<0.02	0.52	2.5	0.116	0.36	7.0	117
7/15/15	110	11.7	<0.02	0.67	3.0	0.106	0.36	6.4	171
7/15/15	105	12.0	0.03	1.16	3.8	0.109	1.62	7.3	221
7/15/15	100	10.7	<0.02	2.06	4.9	0.106	0.37	6.6	198
7/15/15	95	8.4	<0.02	0.91	3.4	0.096	0.38	5.5	176
7/15/15	100	8.2	<0.02	0.60	3.6	0.119	0.49	5.8	219
7/15/15	92	9.9	0.02	0.84	4.7	0.072	0.47	6.5	153
7/15/15	90	7.1	0.03	1.32	3.9	0.159	1.08	7.2	204
7/15/15	88	6.2	0.02	1.13	4.0	0.119	0.39	6.4	179
7/12/16	127	21.5	<0.020	0.913	3.24	0.0958	0.194	4.29	122
7/12/16	113	16.2	0.024	1.01	3.49	0.130	0.295	6.23	154
7/12/16	117	15.8	<0.020	1.44	4.22	0.146	0.232	7.03	210
7/12/16	104	12.1	<0.019	0.626	3.39	0.153	0.220	6.18	173
7/12/16	101	9.0	<0.020	1.49	4.57	0.129	0.305	6.66	257
7/12/16	95	8.7	<0.020	0.558	3.26	0.101	0.226	6.01	194
7/12/16	99	11.1	0.029	1.89	5.98	0.110	0.820	7.47	210
7/12/16	86	8.8	0.022	1.52	5.21	0.101	0.359	6.48	226
7/12/16	107	10.0	<0.020	0.983	3.60	0.127	0.239	7.10	182
7/12/16	97	8.9	<0.019	1.18	4.60	0.124	0.215	6.93	244
7/12/17	103	11.5	0.028	0.745	3.39	0.0996	0.189	6.36	173
7/12/17	96	8.8	0.030	0.771	3.69	0.103	0.327	5.9	160
7/12/17	93	8.1	0.039	0.487	3.25	0.116	0.468	5.1	133
7/12/17	96	10.4	0.020	0.674	3.30	0.107	0.173	5.7	177
7/12/17	84	6.5	0.028	0.724	3.72	0.110	0.403	5.18	192
7/12/17	109	14.1	0.033	0.454	3.29	0.0882	0.212	5.05	150
7/12/17	90	9.0	0.035	1.30	5.34	0.0929	0.281	7.16	227
7/12/17	97	9.9	0.029	0.893	3.79	0.0901	0.246	6.3	178
7/12/17	101	10.6	0.031	0.869	4.27	0.104	0.222	6.4	167
7/12/17	115	14.1	0.039	1.20	22.2	0.109	0.444	5.9	191

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Sample Date	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)
07/12/18	125	18.7	0.024	1.11	5.65	0.171	0.325	6.3	230
07/12/18	90	6.3	<0.02	2.17	6.05	0.154	1.15	7.86	260
07/12/18	90	7.5	0.032	1.75	5.47	0.139	1.08	8.0	225
07/12/18	95	8.1	0.037	0.729	3.37	0.183	1.70	6.46	278
07/12/18	110	14.1	0.040	0.639	3.82	0.156	0.568	6.4	208
07/12/18	95	9.7	0.026	1.28	7.36	0.119	0.769	7.32	258
07/12/18	95	7.1	0.023	1.31	4.78	0.130	0.452	7.2	234
07/12/18	85	6.9	0.029	0.726	4.22	0.118	0.675	6.84	206
07/12/18	100	10.1	0.056	1.35	5.40	0.186	0.421	7.99	241
07/12/18	105	12.9	0.036	1.45	6.08	0.136	0.538	8.9	217
07/10/19	100	10.4	0.037	1.28	4.77	0.149	0.828	5.91	201
07/10/19	90	7.2	<0.020	1.65	4.55	0.142	0.318	6.25	270
07/10/19	95	8.7	<0.020	1.06	3.53	0.0808	0.231	6.05	188
07/10/19	111	13.4	<0.020	0.983	3.75	0.0727	0.274	5.53	150
07/10/19	89	7.7	<0.020	1.07	3.61	0.116	0.340	6.00	181
07/10/19	87	4.2	<0.020	1.01	3.62	0.0785	0.178	6.4	178
07/10/19	101	10.3	<0.020	0.642	3.42	0.117	0.114	7.5	168
07/10/19	103	9.9	<0.020	0.662	2.74	0.156	0.227	5.60	168
07/10/19	96	9.5	<0.020	1.58	3.09	0.105	0.157	6.28	194
07/10/19	94	8.5	<0.020	0.863	3.05	0.106	0.114	5.2	216

Appendix D.4.–Tributary Creek Site 9 Dolly Varden char element concentrations, 2001–2019.

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

-continued-

Sample Date	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	98	12.4	0.11	0.91	2.7	ND	1.10	7.8	106
7/20/07	89	8.9	0.12	1.72	3.3	ND	1.80	5.6	136
7/20/07	114	14.1	0.15	2.76	3.4	ND	1.28	8.7	122
7/20/07	81	7.1	0.14	1.90	4.2	ND	2.03	7.0	114
7/20/07	114	14.6	0.88	3.63	3.9	ND	1.56	10.9	131
7/20/07	93	10.6	0.14	1.50	20.3	ND	3.80	9.4	107
7/23/08	103	12.9	0.224	1.99	4.2	ND	3.47	7.66	169.0
7/23/08	108	14.8	0.095	0.96	3.2	ND	0.86	5.82	143.0
7/23/08	88	8.9	0.076	0.93	3.3	ND	0.75	4.41	186.0
7/23/08	86	9.3	0.220	1.91	5.7	ND	4.06	5.71	119.0
7/23/08	92	9.6	0.073	1.01	2.7	ND	0.61	5.20	125.0
7/23/08	90	8.7	0.033	0.54	2.2	ND	0.43	4.80	108.0
7/22/09	83	6.9	0.04	0.29	1.7	ND	0.24	5.4	127
7/22/09	91	8.6	0.06	0.55	2.1	ND	0.16	5.1	137
7/22/09	91	8.5	0.11	0.36	2.0	ND	0.23	7.5	138
7/22/09	98	10.3	0.09	0.81	3.4	ND	0.38	5.8	147
7/22/09	91	8.6	0.03	0.47	2.2	ND	0.40	4.5	125
7/22/09	90	7.8	0.06	0.60	2.2	ND	0.38	5.6	129
7/20/10	87	7.4	0.293	1.61	5.4	0.43	3.92	6.4	151
7/20/10	94	10.9	0.124	0.82	2.5	0.58	0.24	5.7	174
7/20/10	90	8.5	0.084	0.73	2.9	0.35	0.29	5.3	125
7/20/10	90	8.2	0.059	0.60	2.3	0.27	0.33	4.7	151
7/20/10	108	13.5	0.081	0.66	2.6	0.54	0.25	3.2	118
7/20/10	105	11.6	0.076	0.75	3.1	0.27	0.23	3.9	150
7/21/11	85-115	ND	0.090	0.80	3.4	ND	0.32	6.7	146
7/26/12	89	7.3	<0.02	0.33	18.4	0.429	0.18	4.3	123
7/26/12	122	16.5	0.03	0.60	8.4	0.257	0.54	4.8	126
7/26/12	74,75	8.1	0.05	0.76	42.4	0.217	1.65	4.9	140
7/26/12	105	11.7	0.13	0.57	22.6	0.241	0.74	7.5	128
7/26/12	98	9.9	0.07	0.95	203	0.235	1.90	5.5	115
7/26/12	86,112	20.2	0.06	0.53	8.5	0.278	0.67	5.3	116
7/23/13	90	10.1	0.72	6.36	7.5	0.418	5.93	9.7	179
7/23/13	92	10.4	0.27	1.57	3.8	0.329	1.60	6.9	122
7/23/13	85	7.8	0.19	2.41	5.8	0.297	3.90	8.6	153
7/23/13	82,52	8.0	0.05	0.59	3.3	0.439	0.35	5.0	152
7/23/13	82	6.6	0.48	4.67	8.9	0.332	4.87	9.6	181
7/23/13	81	5.5	0.13	2.14	4.6	0.289	1.64	5.6	166

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Sample Date	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	105	13.1	0.16	0.82	2.7	0.186	0.16	7.1	145
7/23/14	105	11.5	0.02	0.69	2.3	0.188	0.18	5.1	140
7/23/14	104	9.1	0.09	0.69	2.6	0.247	0.22	7.2	116
7/23/14	94	8.4	0.06	1.16	2.4	0.264	0.33	6.7	156
7/23/14	95	8.3	0.12	0.54	2.8	0.215	0.55	6.2	135
7/23/14	105	11.4	0.04	0.30	2.6	0.228	0.19	5.3	117
7/14/15	77,60	12.4	0.22	3.92	3.8	0.285	3.30	7.1	188
7/14/15	77	5.7	0.33	4.40	5.2	0.321	4.93	9.1	157
7/14/15	84	7.2	0.22	2.54	5.3	0.338	2.84	7.9	134
7/14/15	63,69	81.0	0.48	4.73	6.7	0.338	6.20	10.6	173
7/14/15	82	6.9	0.36	3.76	4.6	0.342	4.80	8.5	153
7/14/15	55,75	7.7	0.25	4.03	5.3	0.280	3.42	7.8	165
7/14/15	90	9.3	0.28	1.81	3.4	0.304	1.69	9.2	124
7/14/15	80	6.8	0.30	3.92	5.1	0.312	4.87	9.7	159
7/14/15	75,75	8.9	0.13	1.69	4.2	0.322	1.86	7.2	142
7/14/15	75,75	12.8	0.51	5.86	5.1	0.293	4.54	10.7	175
7/11/16	97	8.1	0.057	0.341	1.99	0.250	0.222	6.34	136
7/11/16	90	6.3	0.068	0.898	2.68	0.219	0.493	5.61	115
7/11/16	105	11.5	0.139	0.438	2.23	0.315	0.333	7.48	124
7/11/16	94	9.4	0.134	1.30	2.76	0.234	0.982	7.12	134
7/11/16	94	10.3	0.078	0.783	2.35	0.334	0.189	6.62	125
7/11/16	114	16.4	0.109	1.03	2.19	0.232	0.285	5.83	131
7/11/16	87	6.5	0.051	0.494	2.09	0.363	0.190	4.99	101
7/11/16	89	6.5	0.034	0.577	2.17	0.249	0.198	5.61	138
7/11/16	102	11.1	0.156	0.892	3.29	0.443	0.368	5.4	127
7/11/16	87	6.1	0.059	1.35	2.27	0.263	0.179	8.34	125
7/11/17	109	12.9	0.080	1.15	2.76	0.269	0.484	10.0	114
7/11/17	78	5.4	0.191	2.78	3.60	0.408	2.04	8.8	145
7/11/17	78	5.7	0.089	2.34	6.71	0.310	1.57	7.89	160
7/11/17	109	12.4	0.094	1.29	2.40	0.631	0.413	6.15	122
7/11/17	84	6.2	0.079	1.16	2.62	0.400	0.412	7.39	121
7/11/17	117	17.8	0.288	3.68	3.21	0.439	1.72	9.25	148
7/11/17	87	7.4	0.191	2.02	4.01	0.261	1.30	8.6	126
7/11/17	94	9.2	0.068	0.292	3.55	0.169	0.183	3.2	163
7/11/17	73	4.1	0.062	0.817	3.85	0.364	0.988	5.5	172
7/11/17	83	6.7	0.096	1.33	3.44	0.457	1.80	8.25	118

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Sample Date	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)
07/12/18	105	12.4	0.096	0.705	2.31	0.490	0.385	6.3	154
07/12/18	81	6.7	0.115	1.09	2.80	0.577	0.963	7.2	160
07/12/18	92	9.4	0.070	0.313	2.90	0.406	0.196	5.03	109
07/12/18	106	11.9	0.044	0.509	2.32	0.457	0.353	5.40	137
07/12/18	85	7.5	0.085	1.30	2.80	0.353	1.02	6.00	171
07/12/18	92	8.3	0.108	0.969	2.84	0.863	0.381	6.70	94.8
07/12/18	85	6.4	0.093	1.36	2.73	0.364	0.871	6.31	144
07/12/18	108	11.6	0.084	0.793	2.53	0.435	0.162	6.2	143
07/12/18	86	5.8	0.096	1.88	2.63	0.771	0.636	6.4	128
07/12/18	109	12.5	0.139	0.708	2.37	0.664	0.945	6.4	154
07/11/19	84	12.4	0.048	0.584	2.45	0.710	0.280	4.15	147
07/11/19	102	6.7	0.078	0.617	2.04	0.727	0.385	4.91	161
07/11/19	97	9.4	0.114	0.810	3.32	0.489	0.695	3.81	164
07/11/19	91	11.9	0.093	0.596	2.35	0.775	0.245	5.23	152
07/11/19	124	7.5	0.147	0.305	2.57	0.550	0.723	4.09	141
07/11/19	69, 75	8.3	0.058	0.552	2.03	0.975	0.244	4.92	162

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September 23, 2019

Analytical Report for Service Request No: K1907706

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

RE: 2019 Greens Creek Mine Biomonitoring

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory August 21, 2019
For your reference, these analyses have been assigned our service request number **K1907706.**

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 3356. You may also contact me via email at Kurt.Clarkson@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Kurt Clarkson
Sr. 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 DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	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	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	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/EnvironmentalLabCertification/	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)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
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

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Client: Alaska Department of Fish and Game
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K1907706
Date Received: 08/21/2019

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier level IV requested by the client.

Sample Receipt:

Twenty six animal tissue samples were received for analysis at ALS Environmental on 08/21/2019. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by Kent Clawson Date 09/23/2019

Chain of Custody

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K1907706

Project Name:	2019 Greens Creek Mine Biomonitoring		**Attachment 1 of 1**
Project Manager:	Kate Kanouse	Sample Type:	Whole body juvenile Dolly Varden char
Company Name:	Alaska Department of Fish and Game	Analysis:	Total metals, dry weight basis, report percent solids
Contact Information:	kate.kanouse@alaska.gov, (907) 465-4290		

	Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
1	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #1	2019TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.1
2	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #2	2019TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	102	14.2
3	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #3	2019TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	7.8
4	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #4	2019TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	91	10.0
5	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #5	2019TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	124	19.3
6	Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #6	2019TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	69, 75[a]	7.8
7	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #1	2019GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.4
8	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #2	2019GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	7.2
9	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #3	2019GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
10	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #4	2019GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	111	13.4
11	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #5	2019GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	89	7.7
12	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #6	2019GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	4.2
13	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #7	2019GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	10.3
14	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #8	2019GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	103	9.9
15	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #9	2019GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	96	9.5
16	Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #10	2019GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.5
17	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #1	2019GC63DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	10.3
18	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #2	2019GC63DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	121	16.5
19	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #3	2019GC63DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
20	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #4	2019GC63DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	110	16.5
21	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #5	2019GC63DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	10.8
22	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #6	2019GC63DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	12.8
23	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #7	2019GC63DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	12.0
24	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #8	2019GC63DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	120	16.8
25	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #9	2019GC63DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	10.1
26	Whole Body	7/13/2018	Greens Creek Site 63 DV Metals Fish #10	2019GC63DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	107	14.2

[a] Composite sample of two fish.

Received: 8/21/19 0940
Cody Graves ALS

Project Name:	2019 Greens Creek Mine Biomonitoring		**Attachment 1 of 1 CORRECTED**
Project Manager:	Kate Kanouse	Sample Type:	Whole body juvenile Dolly Varden char
Company Name:	Alaska Department of Fish and Game	Analysis:	Total metals, dry weight basis, report percent solids
Contact Information:	kate.kanouse@alaska.gov, (907) 465-4290		

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #1	2019TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	84	7.1
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #2	2019TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	102	14.2
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #3	2019TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	7.8
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #4	2019TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	91	10.0
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #5	2019TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	124	19.3
Whole Body	7/11/2019	Tributary Creek Site 9 DV Metals Fish #6	2019TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	69, 75[a]	7.8
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #1	2019GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.4
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #2	2019GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	7.2
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #3	2019GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #4	2019GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	111	13.4
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #5	2019GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	89	7.7
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #6	2019GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	4.2
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #7	2019GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	10.3
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #8	2019GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	103	9.9
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #9	2019GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	96	9.5
Whole Body	7/10/2019	Greens Creek Site 54 DV Metals Fish #10	2019GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.5
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #1	2019GC63DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	10.3
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #2	2019GC63DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	121	16.5
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #3	2019GC63DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.7
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #4	2019GC63DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	110	16.5
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #5	2019GC63DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	10.8
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #6	2019GC63DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	12.8
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #7	2019GC63DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	12.0
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #8	2019GC63DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	120	16.8
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #9	2019GC63DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	10.1
Whole Body	7/9/2019	Greens Creek Site 63 DV Metals Fish #10	2019GC63DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	107	14.2

[a] Composite sample of two fish.

CHAIN OF CUSTODY

ALS Environmental

1317 South 13th Ave., Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

SR# K1907706

PAGE 1 OF 2 COC#

PROJECT NAME: 2019 Greens Creek Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: AK Dept. of Fish & Game
ADDRESS: 802 3rd St
CITY/STATE/ZIP: Douglas, AK 99824
E-MAIL ADDRESS: kate.kanouse@alaska.gov
PHONE #: (907) 465-4290 FAX #:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8270LL☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐ BTEX☐ 8021☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics Tri☐ Tetra☐ PCP☐	Metals, Total or Dissolved (See List below) 6020A	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☐	Hg - 1631E	REMARKS
See attachment 1 of 1 for whole body juvenile fish individual samples					26								X							X		

REPORT REQUIREMENTS

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

INVOICE INFORMATION

P.O. # Hecla Greens Creek
Bill To: Chris Wallace
cw@hecla-mining.com

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
✓ 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:

Please send report to Kate Kanouse and Chris Wallace.

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

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature	Signature
Date/Time: 8/20/19 0930	Date/Time: 8/21/19 0940	Date/Time	Date/Time
Printed Name: Greg Albrecht	Printed Name: Cat Graves	Printed Name	Printed Name
Firm: ADFG	Firm: ALS	Firm	Firm

PC KC

Cooler Receipt and Preservation Form

Client AK Dept. of Game & Fish Service Request *K19* 07706

Received: 8/21/19 Opened: 8/21/19 By: CG Unloaded: 8/21/19 By: CG

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

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number NA	Filed
1.1	1.1			0.0	381		789254557572	

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

Sample ID on Bottle	Sample ID on COC	Identified by:

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

Notes, Discrepancies, & Resolutions: _____

Total Solids

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

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19 - 07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
2019TC9DV1	K1907706-001	**20.7**	-	1	08/26/19 16:53	
2019TC9DV2	K1907706-002	**20.3**	-	1	08/26/19 16:53	
2019TC9DV3	K1907706-003	**22.4**	-	1	08/26/19 16:53	
2019TC9DV4	K1907706-004	**20.8**	-	1	08/26/19 16:53	
2019TC9DV5	K1907706-005	**21.4**	-	1	08/26/19 16:53	
2019TC9DV6	K1907706-006	**21.9**	-	1	08/26/19 16:53	
2019GC54DV1	K1907706-007	**21.8**	-	1	08/26/19 16:53	
2019GC54DV2	K1907706-008	**21.5**	-	1	08/26/19 16:53	
2019GC54DV3	K1907706-009	**22.8**	-	1	08/26/19 16:53	
2019GC54DV4	K1907706-010	**24.8**	-	1	08/26/19 16:53	
2019GC54DV5	K1907706-011	**21.0**	-	1	08/26/19 16:53	
2019GC54DV6	K1907706-012	**23.3**	-	1	08/26/19 16:53	
2019GC54DV7	K1907706-013	**22.5**	-	1	08/26/19 16:53	
2019GC54DV8	K1907706-014	**20.7**	-	1	08/26/19 16:53	
2019GC54DV9	K1907706-015	**23.1**	-	1	08/26/19 16:53	
2019GC54DV10	K1907706-016	**22.5**	-	1	08/26/19 16:53	
2019GC63DV1	K1907706-017	**21.2**	-	1	08/26/19 16:53	
2019GC63DV2	K1907706-018	**22.4**	-	1	08/26/19 16:53	
2019GC63DV3	K1907706-019	**22.2**	-	1	08/26/19 16:53	
2019GC63DV4	K1907706-020	**23.2**	-	1	08/26/19 16:53	
2019GC63DV5	K1907706-021	**23.4**	-	1	08/26/19 16:53	
2019GC63DV6	K1907706-022	**21.6**	-	1	08/26/19 16:53	
2019GC63DV7	K1907706-023	**24.7**	-	1	08/26/19 16:53	
2019GC63DV8	K1907706-024	**22.5**	-	1	08/26/19 16:53	
2019GC63DV9	K1907706-025	**21.3**	-	1	08/26/19 16:53	
2019GC63DV10	K1907706-026	**18.1**	-	1	08/26/19 16:53	

Metals

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

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09-77/19
Sample Matrix:	Animal tissue	**Date Received:**	08/21/19

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
2019TC9DV1	K1907706-001	10.0	10	09/04/19	09/17/19	710	
2019TC9DV2	K1907706-002	9.9	10	09/04/19	09/17/19	727	
2019TC9DV3	K1907706-003	9.8	10	09/04/19	09/17/19	489	
2019TC9DV4	K1907706-004	10.0	10	09/04/19	09/17/19	775	
2019TC9DV5	K1907706-005	9.9	10	09/04/19	09/17/19	550	
2019TC9DV6	K1907706-006	10.0	10	09/04/19	09/17/19	975	
2019GC54DV1	K1907706-007	9.6	10	09/04/19	09/17/19	149	
2019GC54DV2	K1907706-008	10.0	10	09/04/19	09/17/19	142	
2019GC54DV3	K1907706-009	10.0	10	09/04/19	09/17/19	80.8	
2019GC54DV4	K1907706-010	9.8	10	09/04/19	09/17/19	72.7	
2019GC54DV5	K1907706-011	9.9	10	09/04/19	09/17/19	116	
2019GC54DV6	K1907706-012	9.6	10	09/04/19	09/17/19	78.5	
2019GC54DV7	K1907706-013	9.8	10	09/04/19	09/17/19	117	
2019GC54DV8	K1907706-014	9.9	10	09/04/19	09/17/19	156	
2019GC54DV9	K1907706-015	9.8	10	09/04/19	09/17/19	105	
2019GC54DV10	K1907706-016	9.9	10	09/04/19	09/17/19	106	
2019GC63DV1	K1907706-017	9.7	10	09/04/19	09/17/19	132	
2019GC63DV2	K1907706-018	9.9	10	09/04/19	09/17/19	192	
2019GC63DV3	K1907706-019	9.9	10	09/04/19	09/17/19	138	
2019GC63DV4	K1907706-020	9.7	10	09/04/19	09/17/19	163	
Method Blank 1	K1907706-MB1	1.0	1	09/04/19	09/17/19	ND	
Method Blank 2	K1907706-MB2	1.0	1	09/04/19	09/17/19	ND	
Method Blank 3	K1907706-MB3	1.0	1	09/04/19	09/17/19	ND	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal tissue	**Date Received:**	08/21/19
		Date Extracted:	09/04/19
		Date Analyzed:	09/17/19

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	2019TC9DV2		Units:	ng/g
Lab Code:	K1907706-002MS,	K1907706-002DMS	Basis:	Dry
Test Notes:				

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Result Notes**
Mercury	METHOD	1631E	10	249	249	727	1040	1000	126	110	70-130	4	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal tissue	**Date Received:**	08/21/19
		Date Extracted:	09/04/19
		Date Analyzed:	09/17/19

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	2019GC54DV7	Units:	ng/g
Lab Code:	K1907706-013MS, K1907706-013DMS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	Result
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	10	249	249	117	372	375	102	104	70-130	<1	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/17/19

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	5.17	103	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/17/19

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	4.94	99	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/04/19
		Date Analyzed:	09/17/19

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 99.1%		

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	279	96	70-130	

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal tissue	**Date Received:**	08/21/19

Mercury, Total

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

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
2019GC63DV5	K1907706-021	10.0		10	09/04/19	09/13/19	134	
2019GC63DV6	K1907706-022	9.7		10	09/04/19	09/13/19	135	
2019GC63DV7	K1907706-023	9.9		10	09/04/19	09/13/19	131	
2019GC63DV8	K1907706-024	9.8		10	09/04/19	09/13/19	143	
2019GC63DV9	K1907706-025	9.7		10	09/04/19	09/13/19	162	
2019GC63DV10	K1907706-026	9.9		10	09/04/19	09/13/19	174	
Method Blank 1	K1907706-MB1	1.0		1	09/04/19	09/17/19	ND	
Method Blank 2	K1907706-MB2	1.0		1	09/04/19	09/17/19	ND	
Method Blank 3	K1907706-MB3	1.0		1	09/04/19	09/17/19	ND	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal tissue	**Date Received:**	08/21/19
		Date Extracted:	09/04/19
		Date Analyzed:	09/13/19

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	2019GC63DV5	Units:	ng/g
Lab Code:	K1907706-021MS, K1907706-021DMS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	Result
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	9.8	248	245	134	392	379	104	100	70-130	3	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/13/19

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	5.08	102	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/13/19

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	4.95	99	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/04/19
		Date Analyzed:	09/13/19

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 99.1%		

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	277	95	70-130	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV1	**Basis:**	Dry
Lab Code:	K1907706-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.584**	mg/Kg	0.019	5	09/16/19 15:04	09/10/19	
Copper	200.8	**2.45**	mg/Kg	0.097	5	09/20/19 11:52	09/18/19	
Lead	200.8	**0.280**	mg/Kg	0.019	5	09/16/19 15:04	09/10/19	
Selenium	200.8	**4.15**	mg/Kg	0.97	5	09/16/19 15:04	09/10/19	
Silver	200.8	**0.048**	mg/Kg	0.019	5	09/20/19 11:52	09/18/19	
Zinc	200.8	**147**	mg/Kg	0.49	5	09/16/19 15:04	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV2	**Basis:**	Dry
Lab Code:	K1907706-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.617**	mg/Kg	0.020	5	09/16/19 15:11	09/10/19	
Copper	200.8	**2.04**	mg/Kg	0.10	5	09/20/19 11:54	09/18/19	
Lead	200.8	**0.385**	mg/Kg	0.020	5	09/16/19 15:11	09/10/19	
Selenium	200.8	**4.91**	mg/Kg	1.0	5	09/16/19 15:11	09/10/19	
Silver	200.8	**0.078**	mg/Kg	0.020	5	09/20/19 11:54	09/18/19	
Zinc	200.8	**161**	mg/Kg	0.50	5	09/16/19 15:11	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV3	**Basis:**	Dry
Lab Code:	K1907706-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.810**	mg/Kg	0.020	5	09/16/19 15:13	09/10/19	
Copper	200.8	**3.32**	mg/Kg	0.097	5	09/20/19 11:55	09/18/19	
Lead	200.8	**0.695**	mg/Kg	0.020	5	09/16/19 15:13	09/10/19	
Selenium	200.8	**3.81**	mg/Kg	0.99	5	09/16/19 15:13	09/10/19	
Silver	200.8	**0.114**	mg/Kg	0.019	5	09/20/19 11:55	09/18/19	
Zinc	200.8	**164**	mg/Kg	0.49	5	09/16/19 15:13	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV4	**Basis:**	Dry
Lab Code:	K1907706-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.596**	mg/Kg	0.020	5	09/16/19 15:16	09/10/19	
Copper	200.8	**2.35**	mg/Kg	0.098	5	09/20/19 11:57	09/18/19	
Lead	200.8	**0.245**	mg/Kg	0.020	5	09/16/19 15:16	09/10/19	
Selenium	200.8	**5.23**	mg/Kg	1.0	5	09/16/19 15:16	09/10/19	
Silver	200.8	**0.093**	mg/Kg	0.020	5	09/20/19 11:57	09/18/19	
Zinc	200.8	**152**	mg/Kg	0.50	5	09/16/19 15:16	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV5	**Basis:**	Dry
Lab Code:	K1907706-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.305**	mg/Kg	0.020	5	09/16/19 15:18	09/10/19	
Copper	200.8	**2.57**	mg/Kg	0.097	5	09/20/19 11:59	09/18/19	
Lead	200.8	**0.723**	mg/Kg	0.020	5	09/16/19 15:18	09/10/19	
Selenium	200.8	**4.09**	mg/Kg	1.0	5	09/16/19 15:18	09/10/19	
Silver	200.8	**0.147**	mg/Kg	0.019	5	09/20/19 11:59	09/18/19	
Zinc	200.8	**141**	mg/Kg	0.50	5	09/16/19 15:18	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019TC9DV6	**Basis:**	Dry
Lab Code:	K1907706-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.571**	mg/Kg	0.020	5	09/16/19 15:28	09/10/19	
Copper	200.8	**1.99**	mg/Kg	0.099	5	09/20/19 12:04	09/18/19	
Lead	200.8	**0.239**	mg/Kg	0.020	5	09/16/19 15:28	09/10/19	
Selenium	200.8	**4.99**	mg/Kg	0.99	5	09/16/19 15:28	09/10/19	
Silver	200.8	**0.056**	mg/Kg	0.020	5	09/20/19 12:04	09/18/19	
Zinc	200.8	**156**	mg/Kg	0.50	5	09/16/19 15:28	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV1	**Basis:**	Dry
Lab Code:	K1907706-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.28**	mg/Kg	0.019	5	09/16/19 15:35	09/10/19	
Copper	200.8	**4.77**	mg/Kg	0.099	5	09/20/19 12:08	09/18/19	
Lead	200.8	**0.828**	mg/Kg	0.019	5	09/16/19 15:35	09/10/19	
Selenium	200.8	**5.91**	mg/Kg	0.97	5	09/16/19 15:35	09/10/19	
Silver	200.8	**0.037**	mg/Kg	0.020	5	09/20/19 12:08	09/18/19	
Zinc	200.8	**201**	mg/Kg	0.49	5	09/16/19 15:35	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV2	**Basis:**	Dry
Lab Code:	K1907706-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.65**	mg/Kg	0.020	5	09/16/19 15:37	09/10/19	
Copper	200.8	**4.55**	mg/Kg	0.10	5	09/20/19 12:10	09/18/19	
Lead	200.8	**0.318**	mg/Kg	0.020	5	09/16/19 15:37	09/10/19	
Selenium	200.8	**6.25**	mg/Kg	1.0	5	09/16/19 15:37	09/10/19	
Silver	200.8	ND	U mg/Kg	0.020	5	09/20/19 12:10	09/18/19	
Zinc	200.8	**270**	mg/Kg	0.50	5	09/16/19 15:37	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV3	**Basis:**	Dry
Lab Code:	K1907706-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.06**	mg/Kg	0.019	5	09/16/19 15:40	09/10/19	
Copper	200.8	**3.53**	mg/Kg	0.10	5	09/20/19 12:12	09/18/19	
Lead	200.8	**0.231**	mg/Kg	0.019	5	09/16/19 15:40	09/10/19	
Selenium	200.8	**6.05**	mg/Kg	0.97	5	09/16/19 15:40	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:12	09/18/19	
Zinc	200.8	**188**	mg/Kg	0.49	5	09/16/19 15:40	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV4	**Basis:**	Dry
Lab Code:	K1907706-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.983**	mg/Kg	0.019	5	09/16/19 15:42	09/10/19	
Copper	200.8	**3.75**	mg/Kg	0.099	5	09/20/19 12:13	09/18/19	
Lead	200.8	**0.274**	mg/Kg	0.019	5	09/16/19 15:42	09/10/19	
Selenium	200.8	**5.53**	mg/Kg	0.96	5	09/16/19 15:42	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:13	09/18/19	
Zinc	200.8	**150**	mg/Kg	0.48	5	09/16/19 15:42	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV5	**Basis:**	Dry
Lab Code:	K1907706-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.07**	mg/Kg	0.020	5	09/16/19 15:44	09/10/19	
Copper	200.8	**3.61**	mg/Kg	0.099	5	09/20/19 12:15	09/18/19	
Lead	200.8	**0.340**	mg/Kg	0.020	5	09/16/19 15:44	09/10/19	
Selenium	200.8	**6.00**	mg/Kg	0.98	5	09/16/19 15:44	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:15	09/18/19	
Zinc	200.8	**181**	mg/Kg	0.49	5	09/16/19 15:44	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV6	**Basis:**	Dry
Lab Code:	K1907706-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.01**	mg/Kg	0.020	5	09/16/19 15:47	09/10/19	
Copper	200.8	**3.62**	mg/Kg	0.099	5	09/20/19 12:17	09/18/19	
Lead	200.8	**0.178**	mg/Kg	0.020	5	09/16/19 15:47	09/10/19	
Selenium	200.8	**6.4**	mg/Kg	1.0	5	09/16/19 15:47	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:17	09/18/19	
Zinc	200.8	**178**	mg/Kg	0.50	5	09/16/19 15:47	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV7	**Basis:**	Dry
Lab Code:	K1907706-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.642**	mg/Kg	0.020	5	09/16/19 15:54	09/10/19	
Copper	200.8	**3.42**	mg/Kg	0.099	5	09/20/19 12:18	09/18/19	
Lead	200.8	**0.114**	mg/Kg	0.020	5	09/16/19 15:54	09/10/19	
Selenium	200.8	**7.5**	mg/Kg	1.0	5	09/16/19 15:54	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:18	09/18/19	
Zinc	200.8	**168**	mg/Kg	0.50	5	09/16/19 15:54	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV8	**Basis:**	Dry
Lab Code:	K1907706-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.662**	mg/Kg	0.020	5	09/16/19 15:57	09/10/19	
Copper	200.8	**2.74**	mg/Kg	0.098	5	09/20/19 12:23	09/18/19	
Lead	200.8	**0.227**	mg/Kg	0.020	5	09/16/19 15:57	09/10/19	
Selenium	200.8	**5.60**	mg/Kg	0.99	5	09/16/19 15:57	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:23	09/18/19	
Zinc	200.8	**168**	mg/Kg	0.50	5	09/16/19 15:57	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV9	**Basis:**	Dry
Lab Code:	K1907706-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.58**	mg/Kg	0.020	5	09/16/19 15:59	09/10/19	
Copper	200.8	**3.09**	mg/Kg	0.098	5	09/20/19 12:25	09/18/19	
Lead	200.8	**0.157**	mg/Kg	0.020	5	09/16/19 15:59	09/10/19	
Selenium	200.8	**6.28**	mg/Kg	1.0	5	09/16/19 15:59	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:25	09/18/19	
Zinc	200.8	**194**	mg/Kg	0.50	5	09/16/19 15:59	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/10/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC54DV10	**Basis:**	Dry
Lab Code:	K1907706-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.863**	mg/Kg	0.020	5	09/16/19 16:01	09/10/19	
Copper	200.8	**3.05**	mg/Kg	0.098	5	09/20/19 12:27	09/18/19	
Lead	200.8	**0.114**	mg/Kg	0.020	5	09/16/19 16:01	09/10/19	
Selenium	200.8	**5.2**	mg/Kg	1.0	5	09/16/19 16:01	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 12:27	09/18/19	
Zinc	200.8	**216**	mg/Kg	0.50	5	09/16/19 16:01	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV1	**Basis:**	Dry
Lab Code:	K1907706-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.22**	mg/Kg	0.020	5	09/16/19 16:04	09/10/19	
Copper	200.8	**5.43**	mg/Kg	0.097	5	09/20/19 12:28	09/18/19	
Lead	200.8	**0.594**	mg/Kg	0.020	5	09/16/19 16:04	09/10/19	
Selenium	200.8	**6.31**	mg/Kg	0.99	5	09/16/19 16:04	09/10/19	
Silver	200.8	ND U	mg/Kg	0.019	5	09/20/19 12:28	09/18/19	
Zinc	200.8	**255**	mg/Kg	0.49	5	09/16/19 16:04	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV2	**Basis:**	Dry
Lab Code:	K1907706-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.892**	mg/Kg	0.019	5	09/16/19 16:06	09/10/19	
Copper	200.8	**4.24**	mg/Kg	0.10	5	09/20/19 12:30	09/18/19	
Lead	200.8	**0.537**	mg/Kg	0.019	5	09/16/19 16:06	09/10/19	
Selenium	200.8	**5.75**	mg/Kg	0.93	5	09/16/19 16:06	09/10/19	
Silver	200.8	**0.029**	mg/Kg	0.020	5	09/20/19 12:30	09/18/19	
Zinc	200.8	**209**	mg/Kg	0.47	5	09/16/19 16:06	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV3	**Basis:**	Dry
Lab Code:	K1907706-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.02**	mg/Kg	0.020	5	09/16/19 16:08	09/10/19	
Copper	200.8	**3.78**	mg/Kg	0.099	5	09/20/19 12:32	09/18/19	
Lead	200.8	**0.382**	mg/Kg	0.020	5	09/16/19 16:08	09/10/19	
Selenium	200.8	**5.99**	mg/Kg	0.98	5	09/16/19 16:08	09/10/19	
Silver	200.8	**0.020**	mg/Kg	0.020	5	09/20/19 12:32	09/18/19	
Zinc	200.8	**203**	mg/Kg	0.49	5	09/16/19 16:08	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV4	**Basis:**	Dry
Lab Code:	K1907706-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.529**	mg/Kg	0.019	5	09/16/19 16:11	09/10/19	
Copper	200.8	**3.05**	mg/Kg	0.098	5	09/20/19 12:33	09/18/19	
Lead	200.8	**0.327**	mg/Kg	0.019	5	09/16/19 16:11	09/10/19	
Selenium	200.8	**6.75**	mg/Kg	0.97	5	09/16/19 16:11	09/10/19	
Silver	200.8	**0.031**	mg/Kg	0.020	5	09/20/19 12:33	09/18/19	
Zinc	200.8	**124**	mg/Kg	0.49	5	09/16/19 16:11	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV5	**Basis:**	Dry
Lab Code:	K1907706-021		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.800**	mg/Kg	0.020	5	09/16/19 16:32	09/10/19	
Copper	200.8	**3.34**	mg/Kg	0.098	5	09/16/19 16:32	09/10/19	
Lead	200.8	**0.266**	mg/Kg	0.020	5	09/16/19 16:32	09/10/19	
Selenium	200.8	**6.08**	mg/Kg	0.98	5	09/16/19 16:32	09/10/19	
Silver	200.8	**0.022**	mg/Kg	0.020	5	09/16/19 16:32	09/10/19	
Zinc	200.8	**169**	mg/Kg	0.49	5	09/16/19 16:32	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV6	**Basis:**	Dry
Lab Code:	K1907706-022		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.40**	mg/Kg	0.020	5	09/16/19 16:35	09/10/19	
Copper	200.8	**5.05**	mg/Kg	0.098	5	09/16/19 16:35	09/10/19	
Lead	200.8	**1.00**	mg/Kg	0.020	5	09/16/19 16:35	09/10/19	
Selenium	200.8	**6.10**	mg/Kg	0.98	5	09/16/19 16:35	09/10/19	
Silver	200.8	**0.037**	mg/Kg	0.020	5	09/16/19 16:35	09/10/19	
Zinc	200.8	**207**	mg/Kg	0.49	5	09/16/19 16:35	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV7	**Basis:**	Dry
Lab Code:	K1907706-023		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.40**	mg/Kg	0.019	5	09/16/19 16:37	09/10/19	
Copper	200.8	**4.64**	mg/Kg	0.097	5	09/16/19 16:37	09/10/19	
Lead	200.8	**0.218**	mg/Kg	0.019	5	09/16/19 16:37	09/10/19	
Selenium	200.8	**5.44**	mg/Kg	0.97	5	09/16/19 16:37	09/10/19	
Silver	200.8	ND U	mg/Kg	0.019	5	09/16/19 16:37	09/10/19	
Zinc	200.8	**201**	mg/Kg	0.48	5	09/16/19 16:37	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV8	**Basis:**	Dry
Lab Code:	K1907706-024		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.31**	mg/Kg	0.019	5	09/16/19 16:40	09/10/19	
Copper	200.8	**5.57**	mg/Kg	0.095	5	09/16/19 16:40	09/10/19	
Lead	200.8	**0.331**	mg/Kg	0.019	5	09/16/19 16:40	09/10/19	
Selenium	200.8	**6.27**	mg/Kg	0.95	5	09/16/19 16:40	09/10/19	
Silver	200.8	**0.031**	mg/Kg	0.019	5	09/16/19 16:40	09/10/19	
Zinc	200.8	**180**	mg/Kg	0.47	5	09/16/19 16:40	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV9	**Basis:**	Dry
Lab Code:	K1907706-025		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**1.34**	mg/Kg	0.020	5	09/16/19 16:52	09/10/19	
Copper	200.8	**4.10**	mg/Kg	0.099	5	09/16/19 16:52	09/10/19	
Lead	200.8	**0.514**	mg/Kg	0.020	5	09/16/19 16:52	09/10/19	
Selenium	200.8	**5.46**	mg/Kg	0.99	5	09/16/19 16:52	09/10/19	
Silver	200.8	**0.034**	mg/Kg	0.020	5	09/16/19 16:52	09/10/19	
Zinc	200.8	**229**	mg/Kg	0.50	5	09/16/19 16:52	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19 09:40
Sample Name:	2019GC63DV10	**Basis:**	Dry
Lab Code:	K1907706-026		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	**0.709**	mg/Kg	0.019	5	09/16/19 16:54	09/10/19	
Copper	200.8	**3.94**	mg/Kg	0.097	5	09/16/19 16:54	09/10/19	
Lead	200.8	**0.570**	mg/Kg	0.019	5	09/16/19 16:54	09/10/19	
Selenium	200.8	**4.93**	mg/Kg	0.97	5	09/16/19 16:54	09/10/19	
Silver	200.8	**0.032**	mg/Kg	0.019	5	09/16/19 16:54	09/10/19	
Zinc	200.8	**180**	mg/Kg	0.48	5	09/16/19 16:54	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ1912735-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	ND U	mg/Kg	0.020	5	09/16/19 14:54	09/10/19	
Lead	200.8	ND U	mg/Kg	0.020	5	09/16/19 14:54	09/10/19	
Selenium	200.8	ND U	mg/Kg	1.0	5	09/16/19 14:54	09/10/19	
Zinc	200.8	ND U	mg/Kg	0.5	5	09/16/19 14:54	09/10/19	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ1912736-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	200.8	ND U	mg/Kg	0.020	5	09/16/19 16:23	09/10/19	
Copper	200.8	ND U	mg/Kg	0.10	5	09/16/19 16:23	09/10/19	
Lead	200.8	ND U	mg/Kg	0.020	5	09/16/19 16:23	09/10/19	
Selenium	200.8	ND U	mg/Kg	1.0	5	09/16/19 16:23	09/10/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/16/19 16:23	09/10/19	
Zinc	200.8	ND U	mg/Kg	0.5	5	09/16/19 16:23	09/10/19	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ1913324-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Copper	200.8	ND U	mg/Kg	0.10	5	09/20/19 11:45	09/18/19	
Silver	200.8	ND U	mg/Kg	0.020	5	09/20/19 11:45	09/18/19	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19

Replicate Sample Summary
Total Metals

Sample Name:	2019TC9DV6	**Units:**	mg/Kg
Lab Code:	K1907706-006	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1912735-05 Result	Average	RPD	RPD Limit
Cadmium	200.8	0.019	0.571	0.533	0.552	7	20
Lead	200.8	0.019	0.239	0.248	0.244	4	20
Selenium	200.8	1.0	4.99	4.85	4.92	3	20
Zinc	200.8	0.5	156	168	162	7	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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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19

Replicate Sample Summary

Total Metals

Sample Name:	2019GC63DV4	**Units:**	mg/Kg
Lab Code:	K1907706-020	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1912735-07 Result	Average	RPD	RPD Limit
Cadmium	200.8	0.020	0.529	0.569	0.549	7	20
Lead	200.8	0.020	0.327	0.326	0.327	<1	20
Selenium	200.8	1.0	6.75	7.10	6.93	5	20
Zinc	200.8	0.5	124	127	126	2	20

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19

Replicate Sample Summary
Total Metals

Sample Name:	2019GC63DV8	**Units:**	mg/Kg
Lab Code:	K1907706-024	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1912736-05 Result	Average	RPD	RPD Limit
Cadmium	200.8	0.020	1.31	1.32	1.32	<1	20
Copper	200.8	0.10	5.57	5.69	5.63	2	20
Lead	200.8	0.020	0.331	0.326	0.329	2	20
Selenium	200.8	1.0	6.27	6.27	6.27	<1	20
Silver	200.8	0.020	0.031	0.032	0.032	3	20
Zinc	200.8	0.5	180	184	182	2	20

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/20/19

Replicate Sample Summary

Total Metals

Sample Name:	2019TC9DV6	**Units:**	mg/Kg
Lab Code:	K1907706-006	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1913324-05 Result	Average	RPD	RPD Limit
Copper	200.8	0.10	1.99	2.07	2.03	4	20
Silver	200.8	0.020	0.056	0.059	0.058	5	20

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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:**	K1907706
Project	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/20/19

Replicate Sample Summary

Total Metals

Sample Name:	2019GC63DV4	**Units:**	mg/Kg
Lab Code:	K1907706-020	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1913324-07 Result	Average	RPD	RPD Limit
Copper	200.8	0.10	3.05	3.24	3.15	6	20
Silver	200.8	0.019	0.031	0.031	0.031	<1	20

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19
		Date Extracted:	09/10/19

Matrix Spike Summary
Total Metals

Sample Name:	2019TC9DV6	**Units:**	mg/Kg
Lab Code:	K1907706-006	**Basis:**	Dry
Analysis Method:	200.8		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1912735-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.571	5.05	4.82	93	70-130
Lead	0.239	44.0	48.2	91	70-130
Selenium	4.99	21.7	16.1	104	70-130
Zinc	156	208	48.2	107	70-130

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19
		Date Extracted:	09/10/19

Matrix Spike Summary
Total Metals

Sample Name:	2019GC63DV4	**Units:**	mg/Kg
Lab Code:	K1907706-020	**Basis:**	Dry
Analysis Method:	200.8		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1912735-08

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.529	5.15	4.79	96	70-130
Lead	0.327	44.8	47.9	93	70-130
Selenium	6.75	24.1	16.0	109	70-130
Zinc	124	168	47.9	92	70-130

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/16/19
		Date Extracted:	09/10/19

Matrix Spike Summary
Total Metals

Sample Name:	2019GC63DV8	**Units:**	mg/Kg
Lab Code:	K1907706-024	**Basis:**	Dry
Analysis Method:	200.8		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1912736-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	1.31	5.94	4.85	95	70-130
Copper	5.57	27.5	24.3	90	70-130
Lead	0.331	45.2	48.5	92	70-130
Selenium	6.27	23.5	16.2	106	70-130
Silver	0.031	4.70	4.85	96	70-130
Zinc	180	218	48.5	78	70-130

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/11/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/20/19
		Date Extracted:	09/18/19

Matrix Spike Summary
Total Metals

Sample Name:	2019TC9DV6	**Units:**	mg/Kg
Lab Code:	K1907706-006	**Basis:**	Dry
Analysis Method:	200.8		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1913324-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Copper	1.99	25.1	24.7	94	70-130
Silver	0.056	4.66	4.93	93	70-130

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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:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	07/09/19
Sample Matrix:	Animal Tissue	**Date Received:**	08/21/19
		Date Analyzed:	09/20/19
		Date Extracted:	09/18/19

Matrix Spike Summary
Total Metals

Sample Name:	2019GC63DV4	**Units:**	mg/Kg
Lab Code:	K1907706-020	**Basis:**	Dry
Analysis Method:	200.8		
Prep Method:	PSEP Metals		

Matrix Spike
KQ1913324-08

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Copper	3.05	26.3	24.5	95	70-130
Silver	0.031	4.57	4.90	93	70-130

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
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K1907706
Date Analyzed: 09/16/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ1912735-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	200.8	4.55	5.00	91	85-115
Lead	200.8	45.7	50.0	91	85-115
Selenium	200.8	15.9	16.7	96	85-115
Zinc	200.8	45.7	50.0	91	85-115

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K1907706
Date Analyzed: 09/16/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ1912736-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	200.8	4.84	5.00	97	85-115
Copper	200.8	23.7	25.0	95	85-115
Lead	200.8	48.7	50.0	97	85-115
Selenium	200.8	16.9	16.7	102	85-115
Silver	200.8	5.03	5.00	101	85-115
Zinc	200.8	47.0	50.0	94	85-115

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K1907706
Date Analyzed: 09/20/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ1913324-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Copper	200.8	23.9	25.0	95	85-115
Silver	200.8	4.90	5.00	98	85-115

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/10/19
		Date Analyzed:	09/16/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1912735-03	Basis:	Dry
Test Notes:	Dorm-4 Solids = 93.8%		

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	6.87	6.38	93	5.14 - 8.77	
Cadmium	PSEP Tissue	200.8	0.299	0.289	97	0.225 - 0.380	
Lead	PSEP Tissue	200.8	0.40	0.403	100	0.274 - 0.559	
Selenium	PSEP Tissue	200.8	3.45	3.59	104	2.44 - 4.62	
Zinc	PSEP Tissue	200.8	51.6	50.0	97	39.0 - 65.3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/10/19
		Date Analyzed:	09/16/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1912735-04	Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	59.5	61.2	103	44.6-76.0	
Cadmium	PSEP Tissue	200.8	42.3	38.8	92	32.4-52.9	
Lead	PSEP Tissue	200.8	0.225	0.189	84	0.166-0.292	
Selenium	PSEP Tissue	200.8	10.9	10.3	94	7.9-14.3	
Zinc	PSEP Tissue	200.8	136	125	92	104-170	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/10/19
		Date Analyzed:	09/16/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1912736-03	Basis:	Dry
Test Notes:	Dorm-4 Solids = 93.8%		

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	6.87	6.47	94	5.14 - 8.77	
Cadmium	PSEP Tissue	200.8	0.299	0.314	105	0.225 - 0.380	
Copper	PSEP Tissue	200.8	15.7	15.2	97	12.2 - 19.4	
Lead	PSEP Tissue	200.8	0.40	0.431	107	0.274 - 0.559	
Selenium	PSEP Tissue	200.8	3.45	3.72	108	2.44 - 4.62	
Silver	PSEP Tissue	200.8	0.0252	0.0300	119	0.0162 - 0.0362	
Zinc	PSEP Tissue	200.8	51.6	49.3	96	39.0 - 65.3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/10/19
		Date Analyzed:	09/16/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1912736-04	Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	59.5	60.5	102	44.6-76.0	
Cadmium	PSEP Tissue	200.8	42.3	39.1	92	32.4-52.9	
Copper	PSEP Tissue	200.8	497	447	90	380-623	
Lead	PSEP Tissue	200.8	0.225	0.195	87	0.166-0.292	
Selenium	PSEP Tissue	200.8	10.9	10.5	96	7.9-14.3	
Zinc	PSEP Tissue	200.8	136	123	90	104-170	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/18/19
		Date Analyzed:	09/20/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1913324-03	Basis:	Dry
Test Notes:	Dorm-4 Solids = 93.8%		

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Copper	PSEP Tissue	200.8	15.7	15.1	96	12.2 - 19.4	
Silver	PSEP Tissue	200.8	0.0252	0.0260	103	0.0162 - 0.0362	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K1907706
Project:	2019 Greens Creek Mine Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/18/19
		Date Analyzed:	09/20/19

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ1913324-04	Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Copper	PSEP Tissue	200.8	497	441	89	380-623	

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Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K1907706
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 344091
Analytical Method: 200.8 **Extraction Date:** 09/10/19 09:30

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2019TC9DV1	K1907706-001	7/11/19	8/21/19	0.3090 g	30 mL	
2019TC9DV2	K1907706-002	7/11/19	8/21/19	0.3010 g	30 mL	
2019TC9DV3	K1907706-003	7/11/19	8/21/19	0.3040 g	30 mL	
2019TC9DV4	K1907706-004	7/11/19	8/21/19	0.3010 g	30 mL	
2019TC9DV5	K1907706-005	7/11/19	8/21/19	0.3010 g	30 mL	
2019TC9DV6	K1907706-006	7/11/19	8/21/19	0.3030 g	30 mL	
2019GC54DV1	K1907706-007	7/10/19	8/21/19	0.3090 g	30 mL	
2019GC54DV2	K1907706-008	7/10/19	8/21/19	0.3010 g	30 mL	
2019GC54DV3	K1907706-009	7/10/19	8/21/19	0.3080 g	30 mL	
2019GC54DV4	K1907706-010	7/10/19	8/21/19	0.3120 g	30 mL	
2019GC54DV5	K1907706-011	7/10/19	8/21/19	0.3060 g	30 mL	
2019GC54DV6	K1907706-012	7/10/19	8/21/19	0.3000 g	30 mL	
2019GC54DV7	K1907706-013	7/10/19	8/21/19	0.3000 g	30 mL	
2019GC54DV8	K1907706-014	7/10/19	8/21/19	0.3030 g	30 mL	
2019GC54DV9	K1907706-015	7/10/19	8/21/19	0.3010 g	30 mL	
2019GC54DV10	K1907706-016	7/10/19	8/21/19	0.3000 g	30 mL	
2019GC63DV1	K1907706-017	7/9/19	8/21/19	0.3040 g	30 mL	
2019GC63DV2	K1907706-018	7/9/19	8/21/19	0.3210 g	30 mL	
2019GC63DV3	K1907706-019	7/9/19	8/21/19	0.3070 g	30 mL	
2019GC63DV4	K1907706-020	7/9/19	8/21/19	0.3080 g	30 mL	
Method Blank	KQ1912735-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ1912735-02LCS	NA	NA	0.3000 g	30 mL	
Duplicate	KQ1912735-05DUP	7/11/19	8/21/19	0.3110 g	30 mL	
Matrix Spike	KQ1912735-06MS	7/11/19	8/21/19	0.3110 g	30 mL	
Duplicate	KQ1912735-07DUP	7/9/19	8/21/19	0.3050 g	30 mL	
Matrix Spike	KQ1912735-08MS	7/9/19	8/21/19	0.3130 g	30 mL	
Standard Reference Material	KQ1912735-03SRM	NA	NA	0.3090 g	30 mL	
Standard Reference Material	KQ1912735-04SRM	NA	NA	0.3090 g	30 mL	

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K1907706
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 344736
Analytical Method: 200.8 **Extraction Date:** 09/18/19 16:21

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2019TC9DV1	K1907706-001	7/11/19	8/21/19	0.3100 g	30 mL	
2019TC9DV2	K1907706-002	7/11/19	8/21/19	0.3010 g	30 mL	
2019TC9DV3	K1907706-003	7/11/19	8/21/19	0.3080 g	30 mL	
2019TC9DV4	K1907706-004	7/11/19	8/21/19	0.3060 g	30 mL	
2019TC9DV5	K1907706-005	7/11/19	8/21/19	0.3090 g	30 mL	
2019TC9DV6	K1907706-006	7/11/19	8/21/19	0.3030 g	30 mL	
2019GC54DV1	K1907706-007	7/10/19	8/21/19	0.3030 g	30 mL	
2019GC54DV2	K1907706-008	7/10/19	8/21/19	0.3010 g	30 mL	
2019GC54DV3	K1907706-009	7/10/19	8/21/19	0.3010 g	30 mL	
2019GC54DV4	K1907706-010	7/10/19	8/21/19	0.3040 g	30 mL	
2019GC54DV5	K1907706-011	7/10/19	8/21/19	0.3040 g	30 mL	
2019GC54DV6	K1907706-012	7/10/19	8/21/19	0.3030 g	30 mL	
2019GC54DV7	K1907706-013	7/10/19	8/21/19	0.3020 g	30 mL	
2019GC54DV8	K1907706-014	7/10/19	8/21/19	0.3060 g	30 mL	
2019GC54DV9	K1907706-015	7/10/19	8/21/19	0.3070 g	30 mL	
2019GC54DV10	K1907706-016	7/10/19	8/21/19	0.3050 g	30 mL	
2019GC63DV1	K1907706-017	7/9/19	8/21/19	0.3090 g	30 mL	
2019GC63DV2	K1907706-018	7/9/19	8/21/19	0.3010 g	30 mL	
2019GC63DV3	K1907706-019	7/9/19	8/21/19	0.3040 g	30 mL	
2019GC63DV4	K1907706-020	7/9/19	8/21/19	0.3070 g	30 mL	
Method Blank	KQ1913324-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ1913324-02LCS	NA	NA	0.3000 g	30 mL	
Duplicate	KQ1913324-05DUP	7/11/19	8/21/19	0.3060 g	30 mL	
Matrix Spike	KQ1913324-06MS	7/11/19	8/21/19	0.3040 g	30 mL	
Duplicate	KQ1913324-07DUP	7/9/19	8/21/19	0.3090 g	30 mL	
Matrix Spike	KQ1913324-08MS	7/9/19	8/21/19	0.3060 g	30 mL	
Standard Reference Material	KQ1913324-03SRM	NA	NA	0.3040 g	30 mL	
Standard Reference Material	KQ1913324-04SRM	NA	NA	0.3060 g	30 mL	

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Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K1907706
Project: 2019 Greens Creek Mine Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 344092
Analytical Method: 200.8 **Extraction Date:** 09/10/19 09:30

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2019GC63DV5	K1907706-021	7/9/19	8/21/19	0.3050 g	30 mL	
2019GC63DV6	K1907706-022	7/9/19	8/21/19	0.3060 g	30 mL	
2019GC63DV7	K1907706-023	7/9/19	8/21/19	0.3100 g	30 mL	
2019GC63DV8	K1907706-024	7/9/19	8/21/19	0.3160 g	30 mL	
2019GC63DV9	K1907706-025	7/9/19	8/21/19	0.3020 g	30 mL	
2019GC63DV10	K1907706-026	7/9/19	8/21/19	0.3100 g	30 mL	
Method Blank	KQ1912736-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ1912736-02LCS	NA	NA	0.3000 g	30 mL	
Duplicate	KQ1912736-05DUP	7/9/19	8/21/19	0.3030 g	30 mL	
Matrix Spike	KQ1912736-06MS	7/9/19	8/21/19	0.3090 g	30 mL	
Standard Reference Material	KQ1912736-03SRM	NA	NA	0.3080 g	30 mL	
Standard Reference Material	KQ1912736-04SRM	NA	NA	0.3230 g	30 mL	