Technical Report No. 21-06

Aquatic Biomonitoring at Greens Creek Mine, 2020

by

William J. Kane

March 2021

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. 21-06

AQUATIC BIOMONITORING AT GREENS CREEK MINE, 2020

by

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March 2021

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

Cover: Staff conducting aquatic biomonitoring studies at Greens Creek Site 63, July 16, 2020.

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Several Habitat Section staff assisted with this project. Habitat Biologists Greg Albrecht, Dylan Krull, and Kelsey Dean assisted with data collection. Mr. Albrecht identified benthic macroinvertebrates and assisted with periphyton processing. Mr. Krull assisted with data entry. Ms. Dean assisted with benthic macroinvertebrate identification, data entry and verification, and reviewed and edited the report. Habitat Section Operations Manager Dr. Al Ott and Southeast Regional Supervisor Kate Kanouse reviewed and edited the report.

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 2020, we completed these studies at Greens Creek Site 63 and Site 54, and Tributary Creek Site 9 and Site 1847.

The National Weather Service (2021) reports the Juneau area experienced the fifth wettest year since records began in 1936, with annual precipitation (197 cm) about 25% above normal[a] and snowfall (232 cm) about 6% above normal.

Among the 2020 Greens Creek samples, mean chlorophyll *a* densities, mean benthic macroinvertebrate densities, and the proportions of sensitive insect species were within the ranges of values previously observed. Among the Tributary Creek samples, mean chlorophyll *a* densities and mean benthic macroinvertebrate densities were within the ranges of values previously observed; the proportions of sensitive insect species were among the lowest observed at Sites 9 and 1847.

Juvenile Dolly Varden char *Salvelinus malma* abundance at Greens Creek sample sites was similar to previous years. At Site 63, mean fish condition of captured Dolly Varden char was the lowest observed; at Site 54 mean fish condition was similar to previous years. Capture results of juvenile coho salmon *Oncorhynchus kisutch* at Site 54 suggest two age classes were present, as observed in most previous years when the fish pass was functional. At Tributary Creek Site 9, abundances of juvenile Dolly Varden char and coho salmon were among the lowest observed in previous years; coho salmon continue to be the most abundant juvenile fish species and the mean fish condition of Dolly Varden char and coho salmon were similar to previous years.

At Greens Creek Site 63, Dolly Varden char element concentrations were generally within the ranges of values previously observed. At Site 54, the median mercury concentration was greater than previously observed. We did not detect significant differences in fish element concentrations between Greens Creek sample sites. Among samples collected at Tributary Creek Site 9, most median element concentrations were greater than previously observed, or among the greatest observed; most median element concentrations also were above values reported for sample sites with mining-related influence elsewhere in Alaska.[b] To further investigate elevated element concentrations detected in 2020, we will work with Hecla Greens Creek Mining Company to collect additional Dolly Varden char samples upstream of Site 9 and sediment samples in Tributary Creek and Greens Creek for element concentration analyses in 2021.

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[a] Mean value, 1981–2010.

[b] Historically, laboratory results for whole body metals concentrations have occasionally indicated sediment contamination, contributing to elevated concentrations (K. Kanouse, Southeast Regional Supervisor, Habitat Section, ADF&G, Douglas, personal communication).

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 General Plan of Operations Integrated Monitoring Plan (IMP; Hecla 2020) and Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2020DB0001 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), Kane and Legere (2019), and Kane (2020).

PURPOSE

This technical report summarizes the 2020 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 ADEC Waste Management Permit 2020DB0001 and Hecla's approved IMP (Hecla 2020).

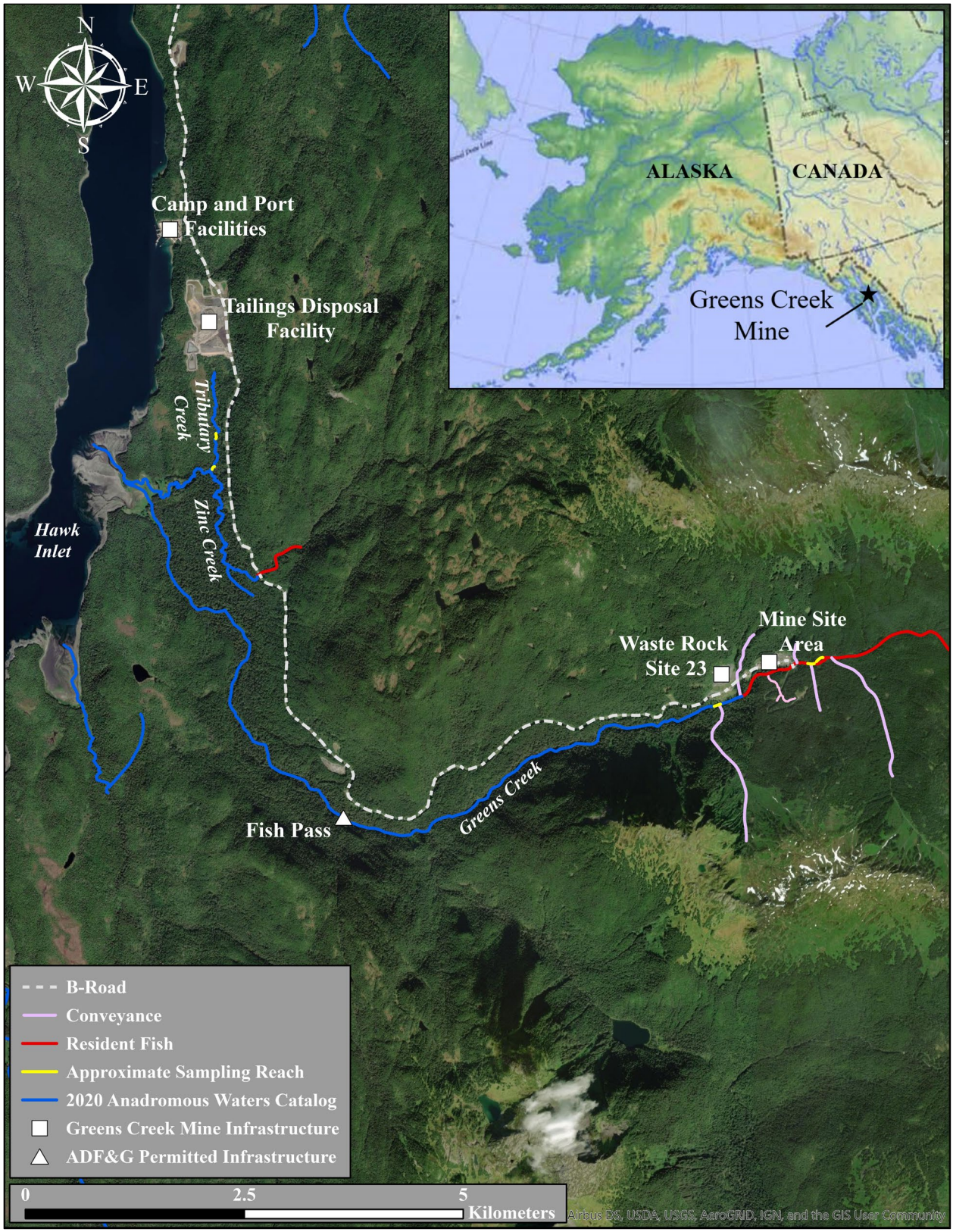

Figure 1.–Greens Creek Mine area map.

AQUATIC BIOMONITORING

In 2020, we completed the following studies at four sample sites (Table 1):

- Abundance and condition of juvenile fish;
- Whole body concentrations of silver, cadmium, copper, mercury, lead, selenium, and zinc;
- Periphyton biomass, estimated by chlorophyll *a*; and
- Abundance and community composition of benthic macroinvertebrates.

Table 1.–Aquatic biomonitoring study sample sites, 2020.

Location	Biomonitoring reach	Latitude	Longitude
Greens Creek Site 63 (2018–2020)	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 (2001–2020)	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 (2001–2020)	Upper extent	58.1055	-134.7450
	Lower extent	58.1050	-134.7450
Tributary Creek Site 1847 (2018–2020)	Periphyton and benthic macroinvertebrates	58.1018	-134.7458

Note: Coordinates in WGS84 datum. At Site 9, we sample fish, periphyton, and benthic macroinvertebrates in the same reach.

STUDY AREA

We sampled Greens Creek Site 54 and Tributary Creek Site 9 annually since 2001, and Greens Creek reference Site 63 2018–2020, which replaced Greens Creek reference Site 48 where we sampled 2001–2017. [c] 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. [d] 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. [e,f]

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

[d] 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.

[e] Bill Kane, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Habitat Section. Memorandum: 2020 Greens Creek Mine Aquatic Biomonitoring; dated January 20, 2021. 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 58.5 km^2 watershed with the main channel measuring 16 km from the alpine headwaters to the mouth in Hawk Inlet (USGS 2021a). 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 in the spring and rain throughout the year. Snowpack influences the magnitude of peak discharge in early summer; rain events during fall also cause peak discharge events.

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 (Giefer and Blossom 2020). 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 discharge 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 and represents about 40% of the watershed draining to Hawk Inlet.

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). The new channel circumventing Site 48 (Figure 3) is further stabilizing, and we completed the aquatic biomonitoring studies downstream at Site 63 for a third consecutive year.

Like Site 48, Site 63 is located near 265 m elevation, 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 of mining activities 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 precludes upstream fish passage. The upper extent of the 50 m juvenile fish study reach was located at the new channel confluence; 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 2021b).

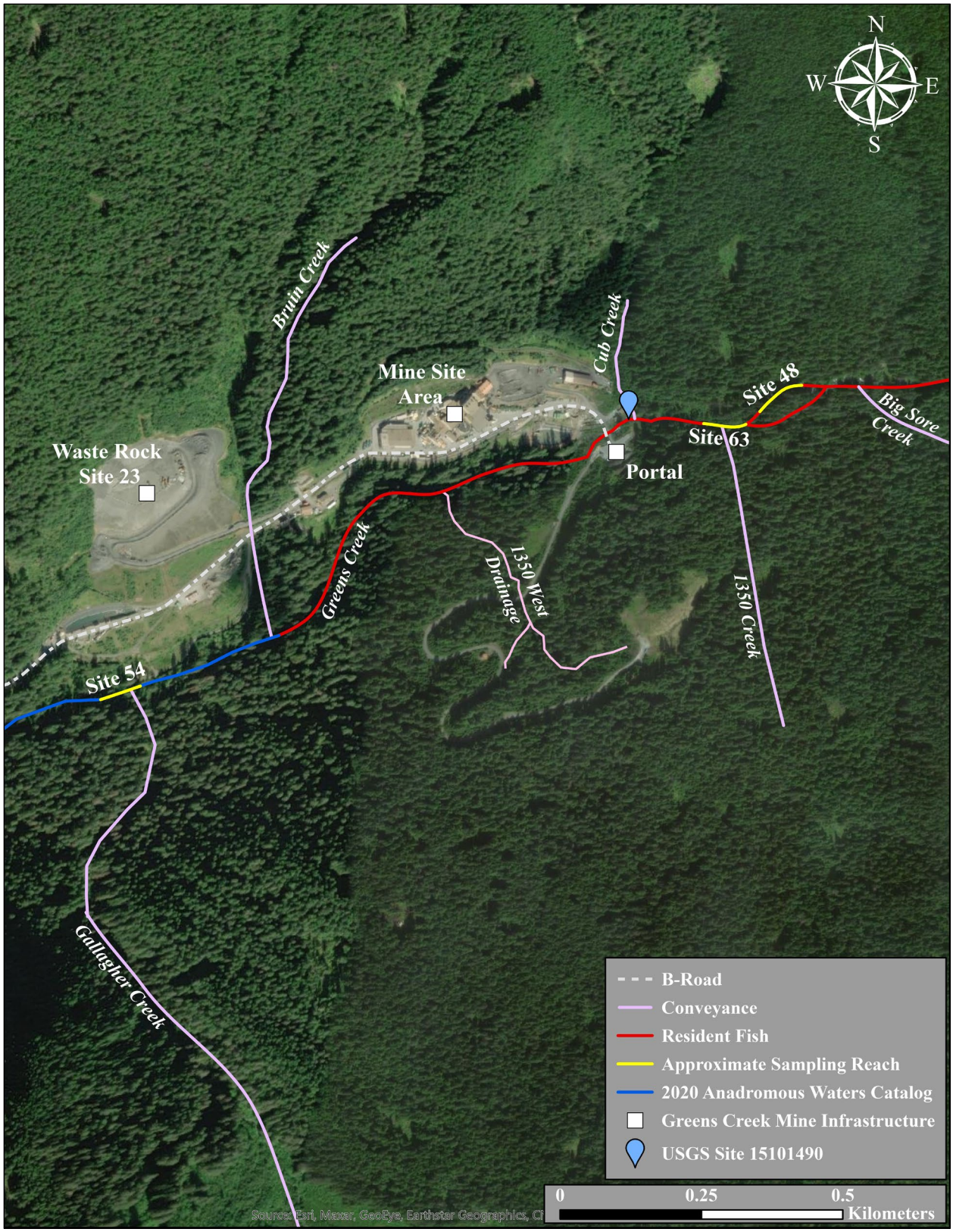

Figure 2.–Greens Creek Sites 48, 63, and 54 map.

Figure 3.–River avulsion and abandoned channel upstream of Greens Creek sampling sites, July 16, 2020. Site 48 is located downstream within the abandoned channel.

Figure 4.–Lower extent of the Greens Creek Site 63 fish sample reach, July 16, 2020.

Figure 5.–Greens Creek Site 63 periphyton and benthic macroinvertebrate sample reach, July 16, 2020.

Greens Creek Site 54

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 2001–2020 at Site 54 are compared to 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. Gallagher Creek enters Greens Creek at the upper extent of the fish sample reach. Periphyton and benthic macroinvertebrate sampling occur about 30 m upstream of the fish sample reach (Figures 6, 7).

Since 2001, we have documented coho salmon, Dolly Varden char, and cutthroat trout *O. clarkii*[h] at Site 54. In 2020, we also observed rainbow trout *O. mykiss*—the first documented presence at the sample site. Anadromous fish access the site via a fish pass about 5.6 km upriver from the mouth.[i]

---

[h] Observed 2007–2008.

[i] 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 2018–2020, demonstrating successful adult coho salmon passage occurred during the prior fall spawning seasons.

Figure 6.–Upper extent of the Greens Creek Site 54 fish sample reach, July 16, 2020.

Figure 7.–Greens Creek Site 54 periphyton and benthic macroinvertebrate sample reach, July 16, 2020.

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 type (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 mean discharge is less than 3 ft^3/s (USFS 2003).

Tributary Creek (Stream No. 112-65-10230-2007) provides habitat for coho salmon, pink salmon, and Dolly Varden char (Giefer and Blossom 2020).

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

Tributary Creek Site 9

Site 9 is located about 1.0 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 and rainbow trout, and sculpin *Cottus* sp. at the site. Periphyton and benthic macroinvertebrate sampling occur within the juvenile fish sampling reach.

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 (Figure 9). The current conditions limit our ability to sample periphyton and benthic macroinvertebrates in riffles. In 2020, we sampled periphyton and benthic macroinvertebrates for the third 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.–Tributary Creek Site 9 sample reach, July 15, 2020.

Tributary Creek Site 1847

Site 1847 is located about 1.4 km downstream of the TDF at about 20 m elevation, and about 50 m upstream of the Tributary Creek mouth (Figure 10). We sampled periphyton and benthic macroinvertebrates 2018–2020 and compare the data to Site 9. We did not sample fish since Site 9 continues to provide suitable fish sampling conditions and is preferred as the upstream sampling site for element concentration analyses.

Figure 10.–Tributary Creek Site 1847 sample reach, July 15, 2020.

METHODS

Data sets are reviewed annually to ensure accuracy and consistency with modifications to methods; corrections and updates are reported 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

Basic water quality data (temperature, conductivity, and pH) were collected with a Hanna HI98194 multiparameter meter; the instrument was calibrated per the manufacturer's instructions prior to sampling.

STREAMFLOW

Sampling and Analysis

Discharge was measured with a SonTek FlowTracker acoustic doppler velocimeter.[j] At least 20 measurement points were collected in equidistant subsections at a site where streamflow was confined to one channel and streambed elevation and streamflow exhibited uniformity; additional measurements were collected where changes in the streambed elevation and water velocity were observed. Following methods described in SonTek (2007), the survey began from either streambank along a measuring tape securely suspended across the stream—perpendicular to flow.

Data Presentation

Discharge measurements are presented for each site, including the daily mean discharge data obtained from USGS Site 15101490. Also presented is a figure of Greens Creek daily mean discharges three weeks prior to the sampling event, including daily mean discharges for the period three weeks prior to sampling events 2001–2019,[k] and a figure presenting the range of Greens Creek daily mean discharges three weeks prior to sampling, 2001–2020.

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 characteristics 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*.

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[j] Prior to 2015 (Kanouse 2015), discharge in Greens Creek and Tributary Creek was measured using a Global Flow Probe Model FP101 flow meter; discharge was estimated using a modification of the methods described in Platts et al. (1983). Due to low streamflow in 2019, Tributary Creek discharge was measured using a collapsible 8-inch Cutthroat flume using methods described in CDPHE (2016)

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

ADEC WMP 2.3.1.2.3 / IMP 5.3

The WMP 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. There are no reference data to compare Tributary Creek Site 9 or Site 1847 data.

Sample Collection and Analysis

Sampling methods are adapted from Barbour et al. (1999). Ten smooth, flat, undisturbed, and perennially wetted rocks were collected from riffle habitats in less than 0.45 m water depth at each sample site and submerged in the creek near the work area in the same orientation as initially collected. To collect a sample from each rock, a 5 × 5 cm square of high-density foam was held on the sample area; the area around the foam was scrubbed with a toothbrush to remove algae and other organisms outside the sample area. The rock was rinsed by submerging it in the stream while holding the foam in place; the toothbrush also was rinsed in the stream.

A 47 mm diameter Type A/E 1 µm glass fiber filter was placed into a Nalgene® filter receptacle attached to a vacuum pump with a gauge. The foam square was removed and the underside of the foam and the sample area were gently scrubbed in a circular pattern with the toothbrush into the filter receptacle. Stream water in a wash bottle was used to rinse loosened periphyton from the foam, rock, toothbrush, and the inside of the filter receptacle onto the filter. The sample area was scrubbed a second time and the rinse cycle was repeated. With most of the water pumped through the filter, maintaining pressure less than 34 kPa, a few drops[l] of saturated magnesium carbonate solution was added to the filter[m]. The glass fiber filter was removed from the receptacle, folded in half with the sample inside, and wrapped in a white coffee filter for additional moisture absorption. The samples were placed in a sealed, labeled plastic bag with desiccant and stored in a light-proof cooler containing frozen icepacks during transportation; samples were stored in a -20°C freezer in the ADF&G Douglas laboratory until processing.

U.S. Environmental Protection Agency (EPA; 1997) protocol was followed for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.[n] Samples were removed from the freezer, cut into small pieces, and placed into individual 15 mL screw cap centrifuge tubes containing 10 mL of 90% buffered acetone. The centrifuge tubes were capped and shaken to ensure complete submersion of the sample. Secured in a vial rack covered with aluminum foil, the samples were stored in a refrigerator for 12–24 hours to allow for saturation and chlorophyll extraction.

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[l] This measurement is not exact as the amount of water and $MgCO_3$ used to create a saturated solution varies and does not affect sample integrity; supernatant solution was used to avoid $MgCO_3$ solids.

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

[n] Deviations from EPA (1997) include samples storage longer than 3.5 weeks, and cutting sample filters to reduce acetone exposure for laboratory staff (as opposed to homogenization).

The samples were centrifuged for 20 min at 500 relative centrifugal force. Prior to sample measurement, two cuvettes containing 90% buffered acetone were placed into a Shimadzu UV-1800 spectrophotometer to calibrate absorbance of the solvent at wavelengths 664 nm, 647 nm, 630 nm, and 750 nm. Each sample supernatant was decanted into an individual cuvette and absorbance was measured at each wavelength. Each sample was treated with 80 µL of 0.1 N hydrochloric acid for 90 seconds to convert the chlorophyll to phaeophytin, and absorbance was measured at wavelengths 665 nm and 750 nm. To minimize stray light and improve resolution, sample cuvettes were cleaned with a nonabrasive wipe prior to placement in the spectrophotometer.

Trichromatic equations were used to estimate Chl-*a*, Chl-*b*, and Chl-*c* densities, correcting for turbidity using the 750 nm absorbance value (APHA 2012, EPA 1997). Chl-*a* densities were corrected when phaeophytin was detected. Each year the estimated detection limit (EDL) is determined by analyzing seven replicate spinach dilution samples; the 2020 EDL for Chl-*a* concentration was 0.25 mg/m^2. When Chl-*a* was not detected in a sample, the concentration is reported as the spectrophotometer EDL and values for Chl-*b* and Chl-*c* are not reported.

To test for differences of mean densities between the 2020 Greens Creek Sites 63 and 54 data, the nonparametric Kruskal-Wallis one-way analysis of variance by ranks test (Neter et al. 1990) was performed using Statistix® 10 analytical software; significant differences are reported when $p \leq 0.05$.

Data Presentation

For each site and by year, mean Chl-*a* densities (mg/m^2) ± 1 SD are presented in a figure. Greens Creek Site 63 data is presented with Site 48; Tributary Creek Site 9 data is presented with Site 1847. Annual sample data and summaries are provided in 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.

ADEC WMP 2.3.1.2.4 / IMP 5.4

The WMP requires annually evaluating BMI abundance and community composition at each site. Mean BMI density and community composition are estimated at each site and compared with annual data among Greens Creek sites. There are no reference data to compare Tributary Creek Site 9 and Site 1847 data.

Sample Collection and Analysis

Eight BMI samples[o] were collected from each site using a Hess stream bottom sampler in riffles and runs with gravel and cobble substrate and varying flow velocities—habitats that support greater BMI densities and taxonomic richness (Barbour et al. 1999). Other habitat types (e.g., pools) were excluded to reduce data variability.

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. After securing the frame on the streambed with the opening facing the upstream current, rocks within the sample area were scoured with a scrub brush; gravel, sand, and silt were disturbed to about 10 cm depth to dislodge macroinvertebrates into the net. The net was rinsed in the stream to ensure all organisms drifted into the cod end, and each sample was transferred from the cod end to a labeled 500 mL plastic bottle. Samples were preserved in 95% ethanol at a ratio of three parts ethanol to one part sample. Samples exceeding the capacity of the cod end were discarded in the field to minimize detritus and substrate in samples and ensure proper sample preservation.

Entire samples were processed with an elutriator system with a 0.3 mm sieve to sort macroinvertebrates from debris[p] and organisms were identified to the lowest practical taxonomic level[q] using Merritt and Cummins (1996) and Stewart and Oswood (2006). Identification and enumeration were independently verified for five random samples.

BMI density was calculated for each sample by dividing the number of macroinvertebrates by 0.086 m^2—the Hess sampling area. Mean density was estimated for each site by calculating the mean density among the eight samples. Taxa richness is reported as the number of taxonomic groups identified to the lowest practical level; terrestrial[r] organisms were excluded from all calculations.

Data Presentation

For each site and by year, mean BMI density ± 1 SD and community composition are illustrated in figures. Greens Creek Site 63 data is presented with Site 48; Tributary Creek Site 9 data with Site 1847. Annual data summaries are provided in Appendix B.

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

[p] 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 12/17/2013. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd St, Douglas, AK.

[q] Insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera to genus, except nonbiting midges to family Chironomidae, and all others to class or order. Damaged and degraded organisms that cannot be identified are not reported.

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

JUVENILE FISH ABUNDANCE AND CONDITION

Age, sex, season, maturation, diet, gut contents, fat reserve, and muscular development affect fish condition. Length and weight data were used to assess fish condition—an index of fish health.

ADEC WMP 2.3.1.2.1 / IMP 5.5

The WMP requires annual monitoring of abundance and condition of juvenile fish by species to detect variations at each site.

Sample Collection and Analysis

Following methods described in Magnus et al. (2006), two-piece 6.35 mm galvanized steel minnow traps baited with disinfected salmon roe[s] were deployed throughout 50 m sample reaches isolated by natural features, such as shallow riffles and debris jams. In areas with high streamflow, rocks were in the bottom of each trap for weight and to provide refuge for captured fish. Bait was contained in a punctured plastic bag to prevent ingestion and reduce the possibility of sample contamination. Prior to the study, several baited minnow traps were set within 15 m of the upstream and downstream sample reach boundaries to capture potential migrants and improve sample reach isolation.[t] After the 1.5 h trapping event, captured fish were transferred to a plastic bucket containing aerated stream water. Fish captured in the boundary traps were excluded from analyses.

Biologists anesthetized fish using 9 mg/L[u] AQUI-S® 20E (10% eugenol), measured and recorded FL to the nearest 1 mm, and species (Pollard et al. 1997). Fish weight also was recorded to the nearest 0.1 g. During recovery, fish were retained in a perforated plastic bucket secured in the creek and released[v] to the sample reach upon study completion.

Fulton's condition factor (K) was calculated 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

Juvenile fish abundance and condition are compared by species for each site and year with data from the historical initial 1.5 h trapping events and presented in figures.[w] Greens Creek Site 63 data are presented with Site 48. Annual data summaries and length-frequency diagrams are provided in Appendix C.

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

[t] 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, baited minnow traps were used.

[u] Implemented as 0.30 mL anesthetic per gal of stream water.

[v] Ten Dolly Varden char were retained for whole body element concentrations at each sample site.

[w] Prior to an approved modification of the IMP in 2020, estimating juvenile fish populations was required—achieved with a depletion method involving three sequential 1.5 h minnow trapping events.

JUVENILE FISH ELEMENT CONCENTRATIONS

ADEC WMP 2.3.1.2.2 / IMP 5.6

The WMP requires annual monitoring of whole body element concentrations in juvenile fish at Greens Creek Sites 63 and 54 and Tributary Creek Site 9 to assess element loading in aquatic communities near the mine. Element bioavailability and bioaccumulation depends on physical and chemical factors and interactions among biological communities (Tchounwou et al. 2012).

Sample Collection and Analysis

Wearing latex gloves, 10 juvenile Dolly Varden char from the abundance trapping event were retained in clean, labeled plastic bags.[x,y] Fish retained were within the size range 85–125 mm FL;[z] an 85 mm fish provides the minimum amount of tissue (about 5 g) required for laboratory analyses, while the maximum length of 125 mm improves the probability of excluding anadromous Dolly Varden char at Greens Creek Site 54 and Tributary Creek Site 9. FL and weight were measured, correcting for bag weight, and stored in a cooler with ice packs during transportation to the ADF&G Douglas laboratory, where samples were transferred to a -20°C freezer.

The samples were shipped in a cooler with ice packs to ALS Environmental in Kelso, WA, maintaining written chain of custody documentation. ALS Environmental individually digested, dried, and analyzed each sample for total silver (Ag), cadmium (Cd), copper (Cu), mercury[aa] (Hg), lead (Pb), selenium (Se), and zinc (Zn) on a dry weight basis following EPA (2002) method 1631E for Hg, and EPA (1998) method 6020A[bb] for other elements. ALS Environmental provided Tier II quality control information, including results for matrix spikes, sample blanks, sample duplicates, and standard reference materials.

To test for differences of median element concentrations among Greens Creek sample sites, the nonparametric Kruskal-Wallis one-way analysis of variance by ranks test (Neter et al. 1990) was performed using Statistix® 10 analytical software; significant differences are reported when $p \leq 0.05$. The Dunns all-pairwise comparison test also was performed to identify differences between sites.

Data Presentation

For each sample site, a figure presents the minimum, median, and maximum of whole body concentrations (mg/kg) for each analyte by year. The annual raw data, presenting the mean value for duplicate sample results, and the 2020 laboratory report are provided in Appendix D.

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

[y] Due to scarcity of Dolly Varden char captured at Tributary Creek Site 9 in 2019 and 2020, some fish samples were collected upstream of the sample reach, as in previous years when necessary to achieve a minimum sample size of six fish.

[z] In order to achieve a minimum sample size, in some years, retained fish samples were outside the designated length range; if less than 90 mm, two fish were analyzed as a composite sample.

[aa] Annual analyses for Hg concentrations began in 2012; Hg data was incidentally received in 2010.

[bb] EPA (1994) method 200.8 was used for analyses 2001–2010, 2012–2015, and 2018–2019.

RESULTS

Three weeks prior to sampling in 2020, Greens Creek daily mean discharges were generally above the 2001–2019 averages (Figure 11). The median daily mean discharge during the three-week period was within the range observed throughout previous years (Figure 12).

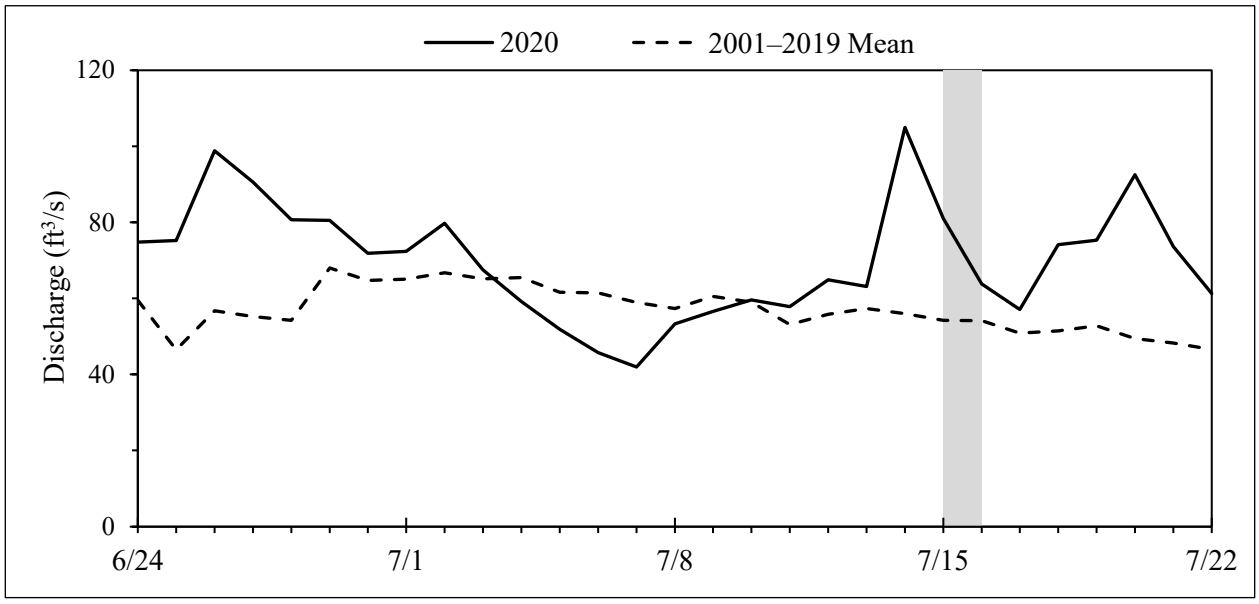

Figure 11.–Greens Creek daily mean discharge three weeks prior to sampling, 2020.
Source: USGS 15101490 (USGS 2021).
Note: 2020 sampling days highlighted in gray (July 15, 16).

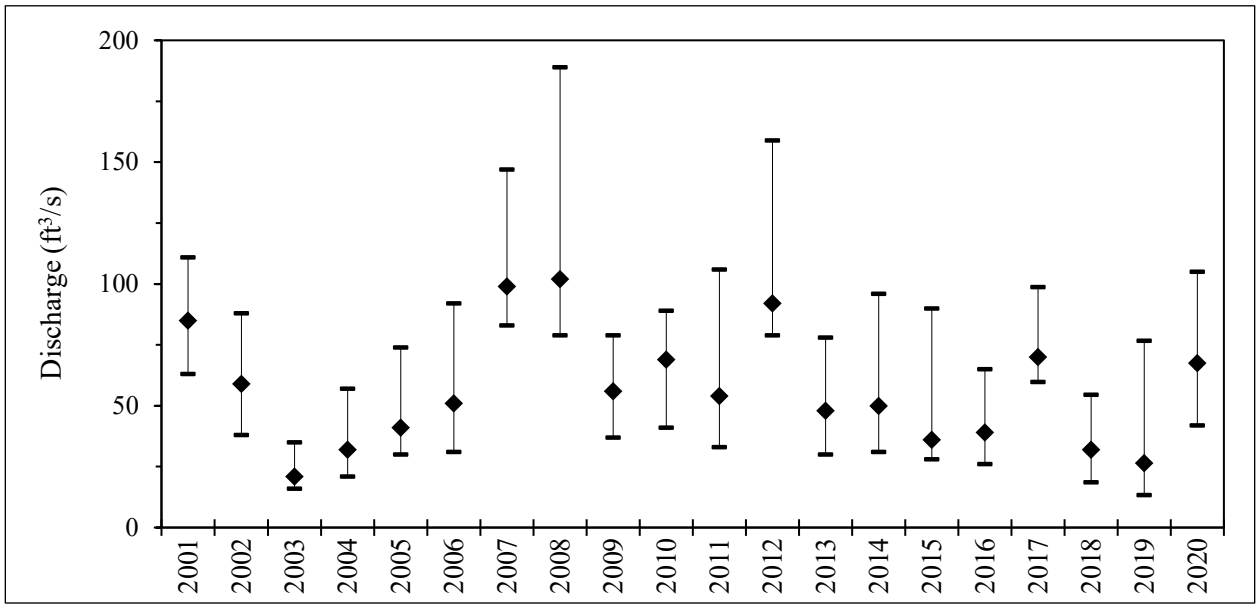

Figure 12.–Greens Creek daily mean discharge three weeks prior to sampling, 2001–2020.
Source: USGS 15101490 (USGS 2021).
Note: Minimum, median, and maximum discharges presented.

GREENS CREEK SITE 48 AND SITE 63

We sampled Greens Creek Site 63 on July 16, 2020, and measured basic water quality and stream discharge at 1405 hours (Table 2). The USGS stream gage recorded a daily mean discharge of 63.8 ft^3/s (USGS 2021).

Table 2.–Greens Creek Site 63 water quality data, 2020.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/16/20	9.6	100	8.01	60.3

Periphyton: Chlorophyll Density and Composition

The 2020 Site 63 mean Chl-*a* density was 2.94 mg/m^2—lower than previously observed at Site 63, though within the range of mean densities observed at Site 48 (Figure 13). The samples contained about 87% Chl-*a*, 11% Chl-*c*, and zero Chl-*b*, similar to mean composition in previous years.

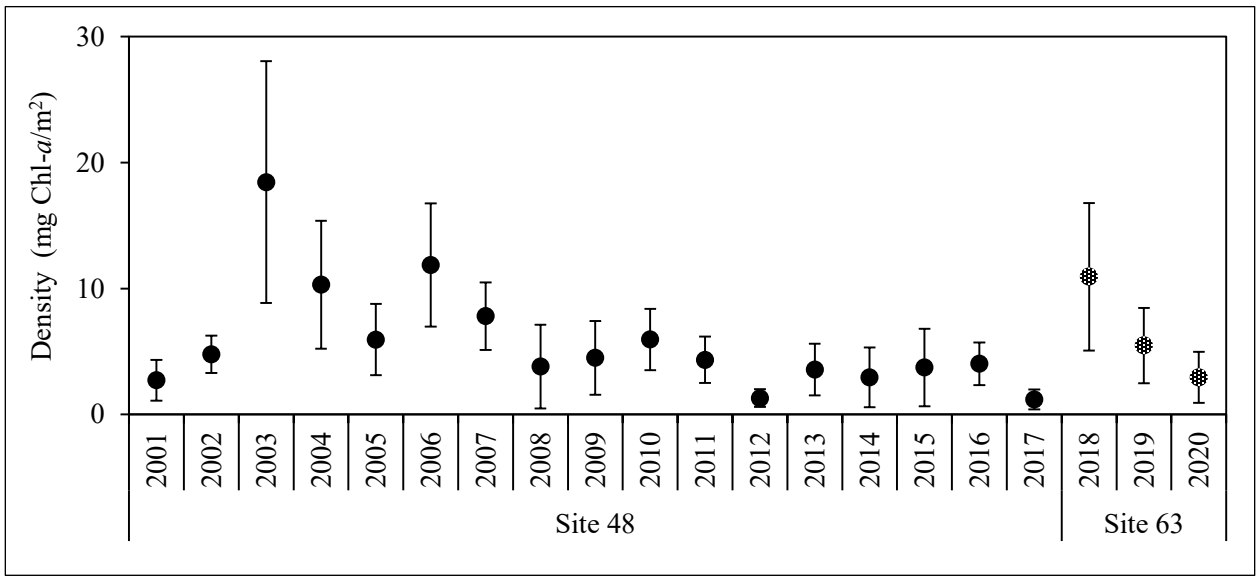

Figure 13.–Greens Creek Site 48 and Site 63 mean chlorophyll *a* densities ± 1 SD, 2001–2020.

Benthic Macroinvertebrate Density and Community Composition

Among the 2020 BMI samples collected at Site 63, we counted 33 taxa—the greatest observed at both sample sites. We estimate mean density at 2,342 BMI/m^2, with EPT insects composing 84% of the samples, the lowest observed at Site 63 though similar to previous years at Site 48 (Figures 14, 15). Dominant taxa were Ephemeroptera: *Drunella* and Diptera: Chironomidae, composing about 36% and 13% of the samples.

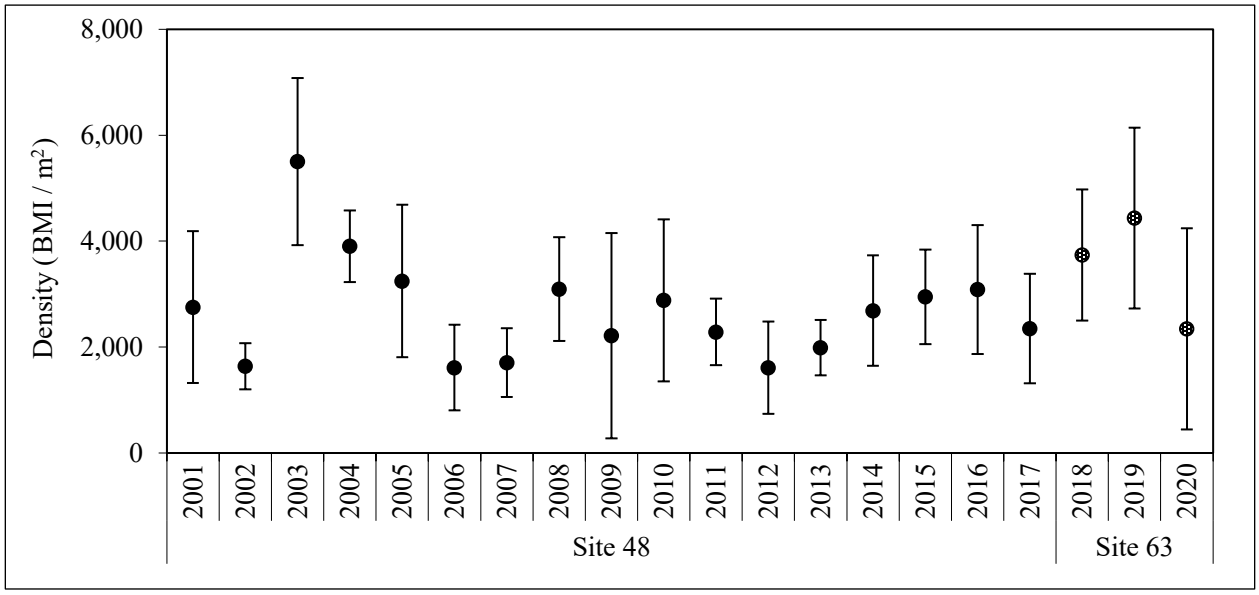

Figure 14.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate densities ± 1 SD, 2001–2020.

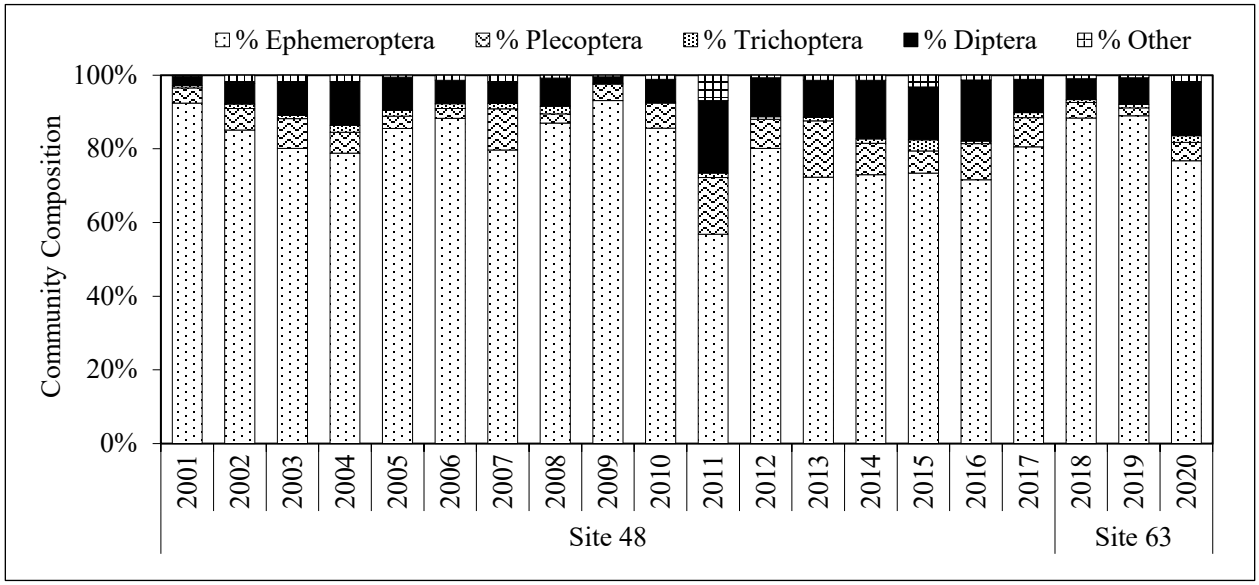

Figure 15.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate community composition, 2001–2020.

Juvenile Fish Abundance and Condition

In 2020 at Site 63, we captured 88 Dolly Varden char, within the range of fish captured in previous years during a single trapping event at Sites 48 and 63 (Figure 16). Mean fish condition among the Dolly Varden char captured was 0.9—lower than previously observed at Sites 48 and 63. The range of length frequencies observed suggests multiple age classes were present, as in previous years at Sites 48 and 63.

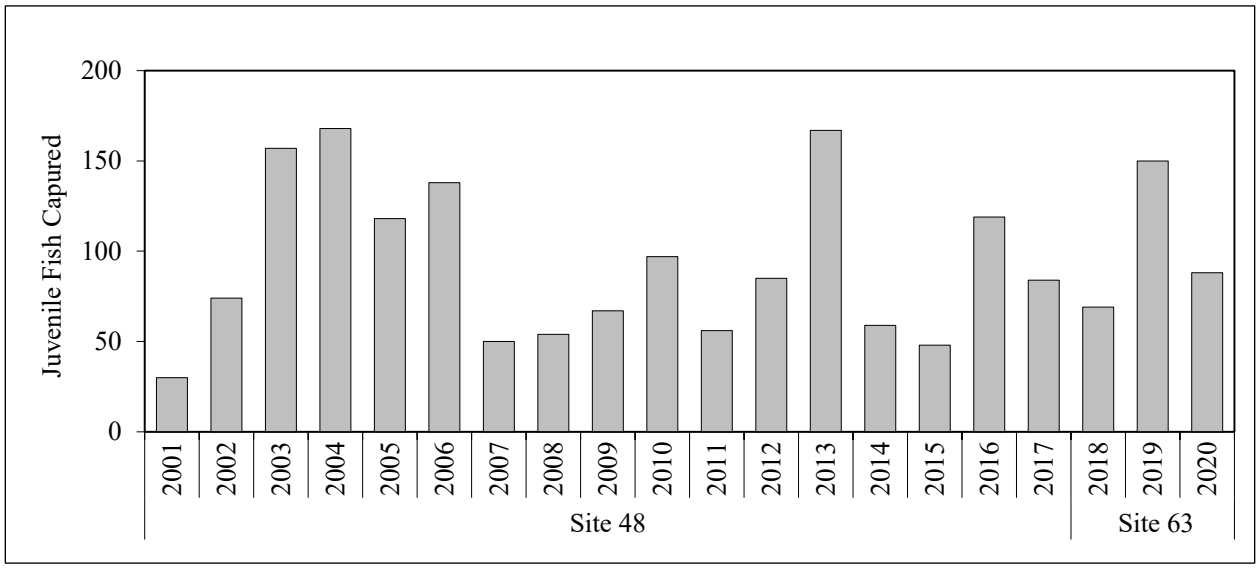

Figure 16.–Greens Creek Site 48 and Site 63 Dolly Varden char captured, 2001–2020.

Juvenile Fish Element Concentrations

Among the 2020 Site 63 whole body Dolly Varden char samples, all median element concentrations were within ranges previously observed at Sites 48 and 63 (Figures 17, 18).

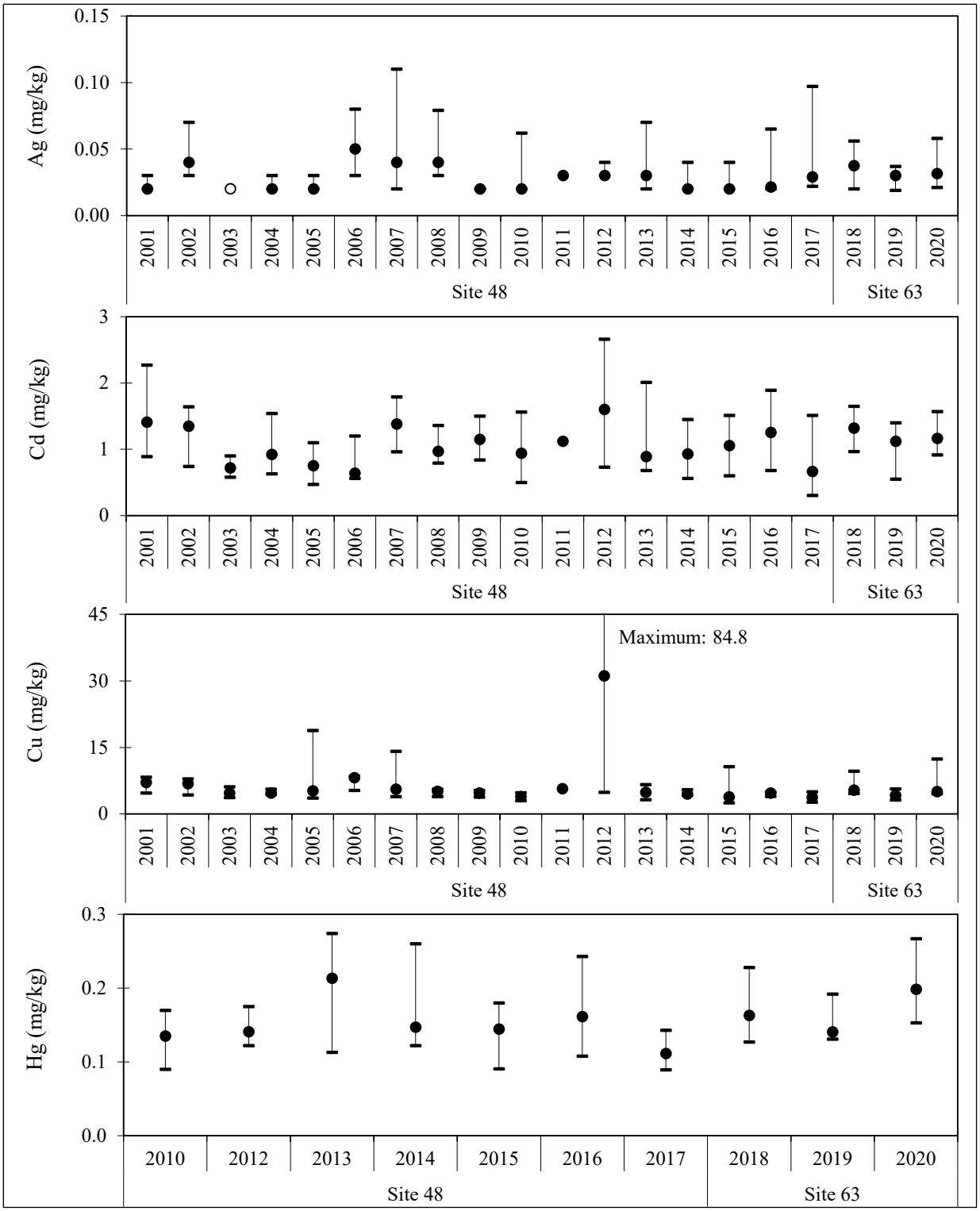

Figure 17.–Greens Creek Site 48 and Site 63 whole body Dolly Varden char Ag, Cd, and Cu concentrations, 2001–2020, and Hg concentrations, 2010, 2012–2020.

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

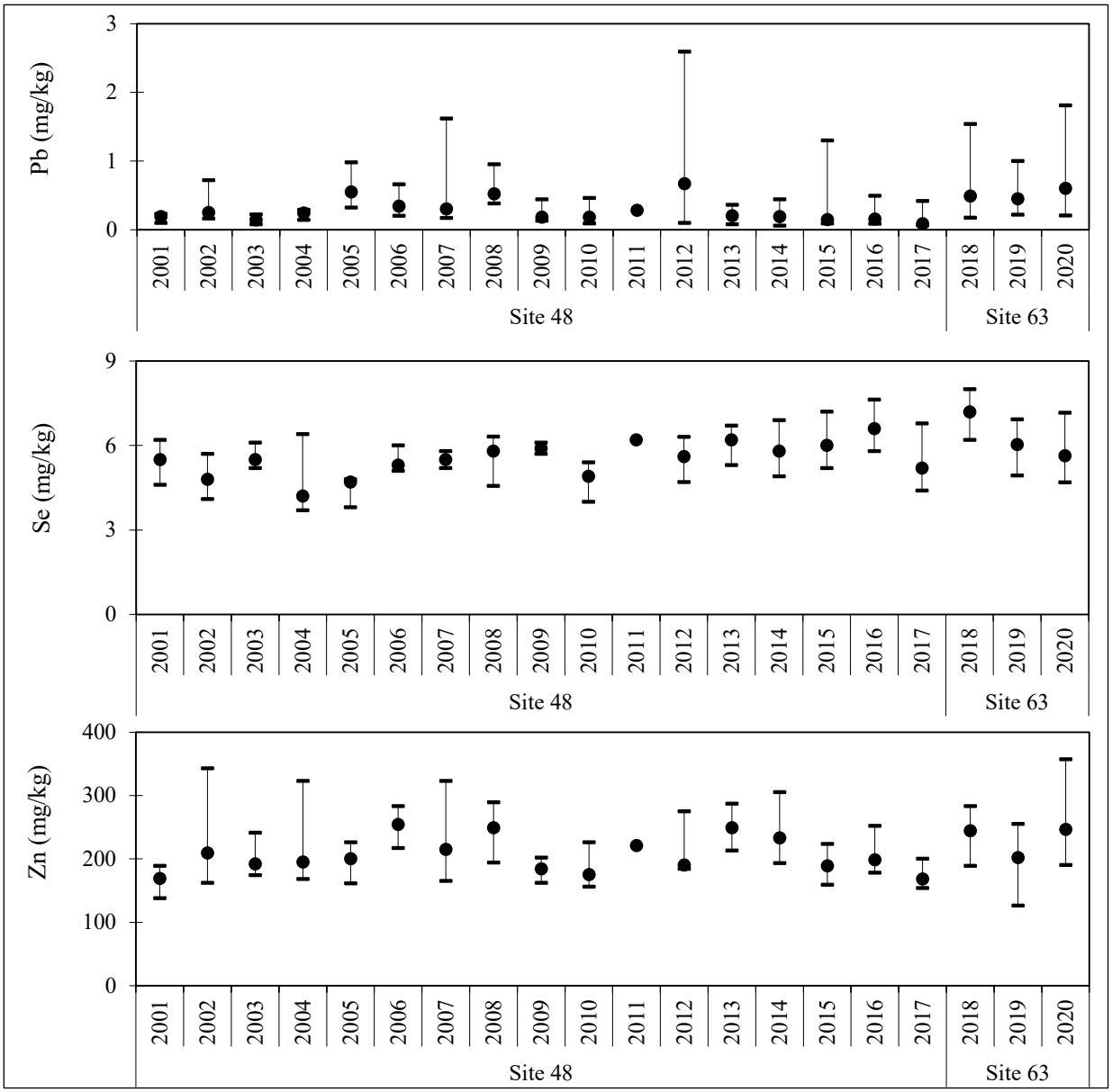

Figure 18.–Greens Creek Site 48 and Site 63 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2020.

Note: Minimum, median, and maximum concentrations presented.

GREENS CREEK SITE 54

We sampled Greens Creek Site 54 on July 16, 2020, and measured basic water quality and stream discharge at 1000 hours (Table 3). The USGS stream gage recorded a daily mean discharge of 63.8 ft^3/s (USGS 2021).

Table 3.–Greens Creek Site 54 water quality data, 2020.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/16/20	8.0	103	7.88	71.9

Periphyton: Chlorophyll Density and Composition

The 2020 Site 54 mean Chl-*a* density was 4.55 mg/m^2, within the range observed in previous years (Figure 19). The samples contained about 94% Chl-*a*, 9% Chl-*c*, and zero Chl-*b*, similar to mean composition in previous years.

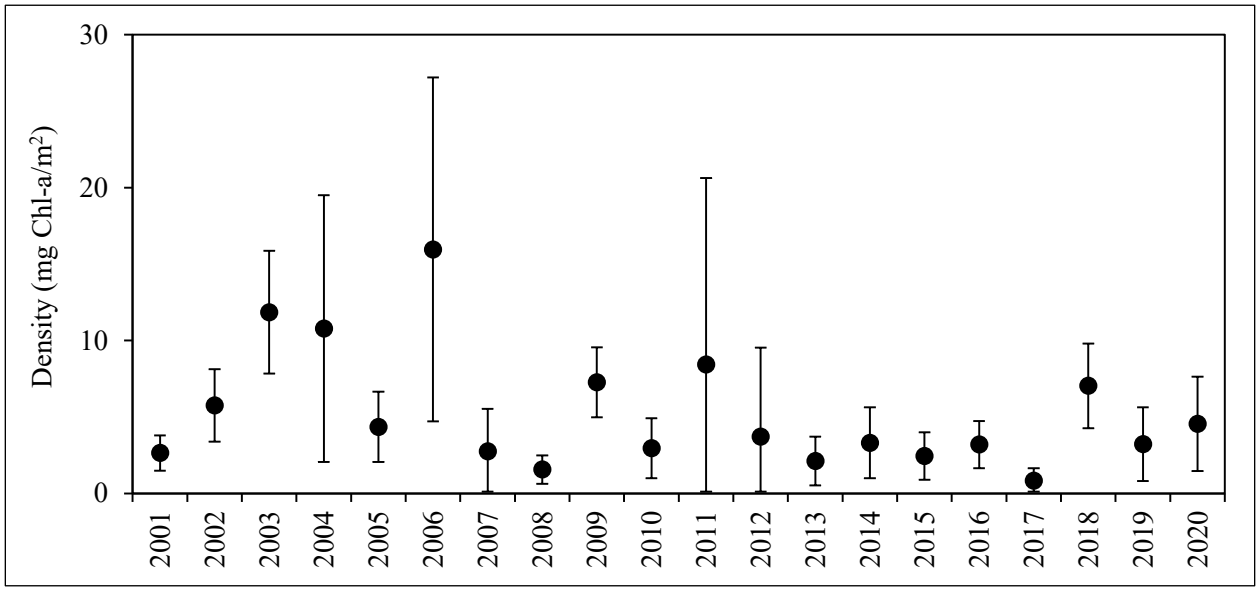

Figure 19.–Greens Creek Site 54 mean chlorophyll *a* densities ± 1 SD, 2001–2020.

Benthic Macroinvertebrate Density and Community Composition

Among the 2020 BMI samples collected as Site 54, we counted 31 taxa and estimate mean density at 3,634 BMI/m^2, with EPT insects composing 83% of the samples—within ranges previously observed (Figures 20, 21). Dominant taxa were Ephemeroptera: *Drunella* and Diptera: Chironomidae, composing about 37% and 15% of the samples.

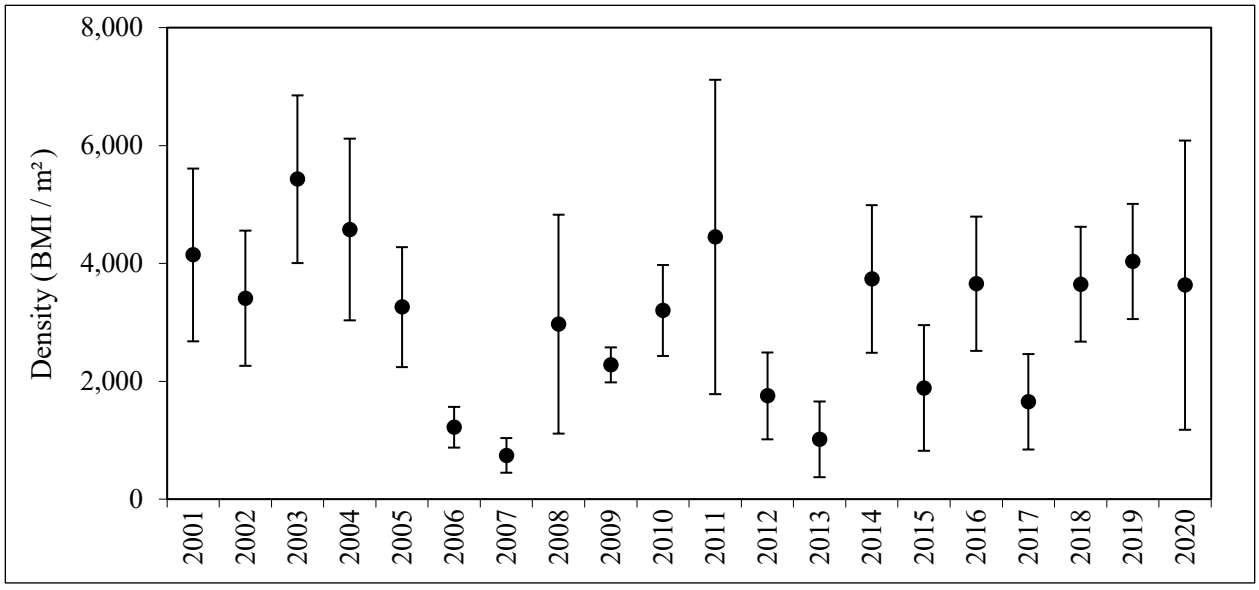

Figure 20.–Greens Creek Site 54 mean benthic macroinvertebrate densities ± 1 SD, 2001–2020.

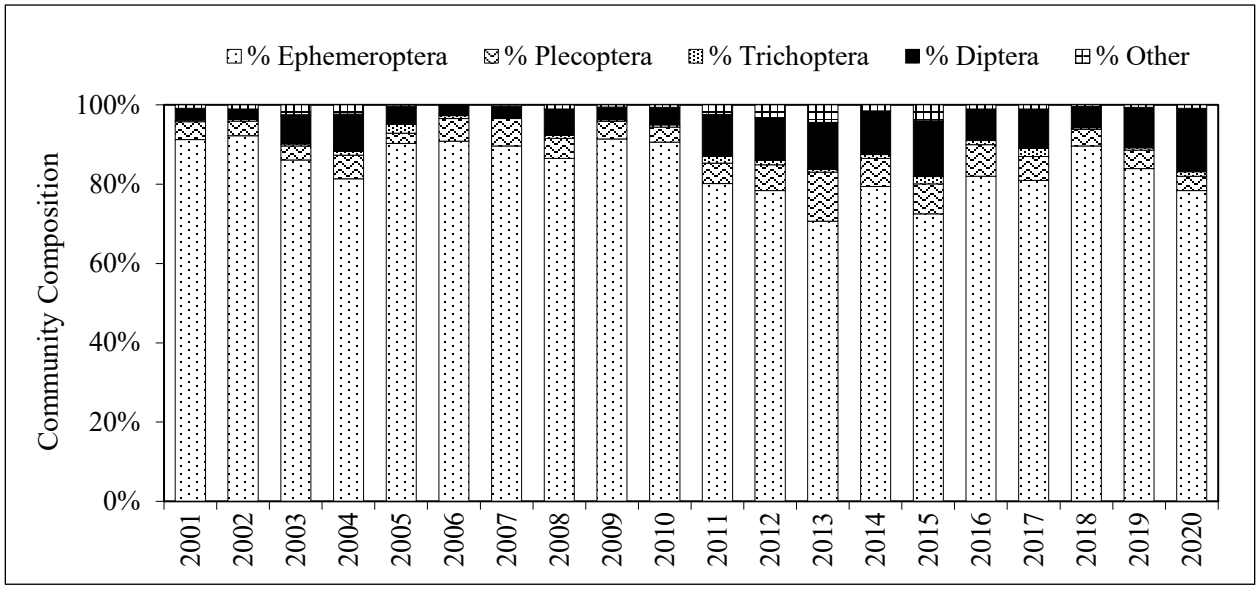

Figure 21.–Greens Creek Site 54 mean benthic macroinvertebrate community composition, 2001–2020.

Juvenile Fish Abundance and Condition

In 2020 at Site 54, we captured 73 Dolly Varden char and 18 juvenile coho salmon—within the range of both species captured in previous years during a single trapping event (Figure 22). The mean fish condition was 1.0 for Dolly Varden char and 1.1 for coho salmon. The range of length frequencies observed for both species suggests multiple age classes were present, as in previous years. We also captured one rainbow trout (135 mm FL)—the first documented at this site.

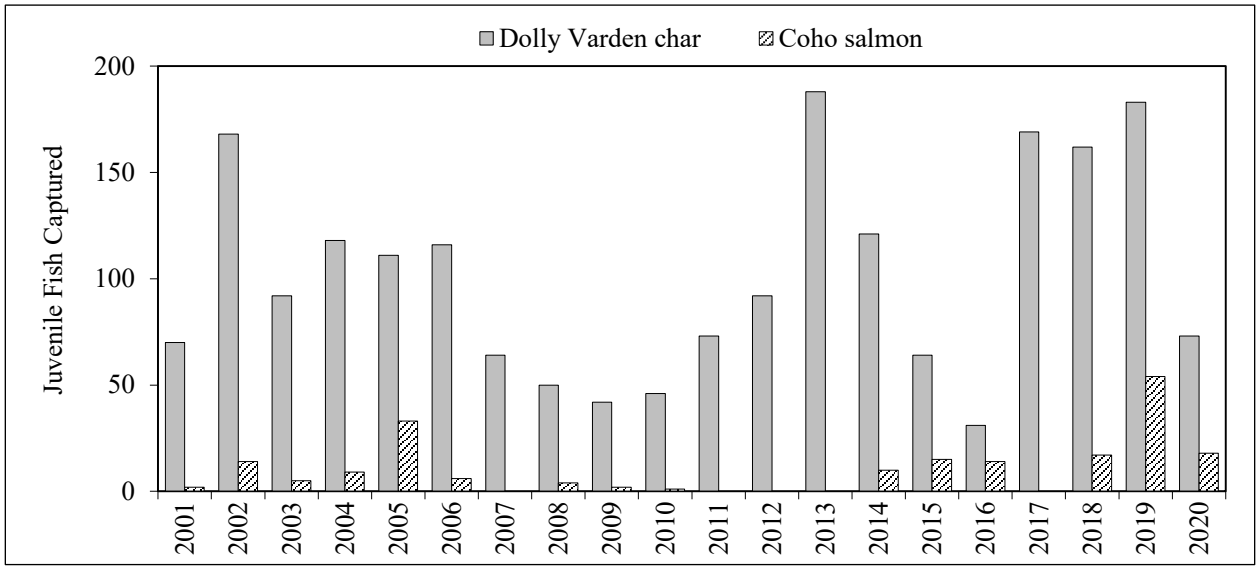

Figure 22.– Greens Creek Site 54 juvenile fish captured, 2001–2020.

Note: 2001–2010 data from a 28 m reach, 2011–2020 data from a 50 m reach. Species other than Dolly Varden char and coho salmon are not illustrated.

Juvenile Fish Element Concentrations

Among the Site 54 whole body Dolly Varden char samples in 2020, the median Hg concentration was greater than observed 2001–2019 and the range of Pb concentrations was greater than previously observed. All other element concentrations were within the ranges of values previously observed (Figures 23, 24).

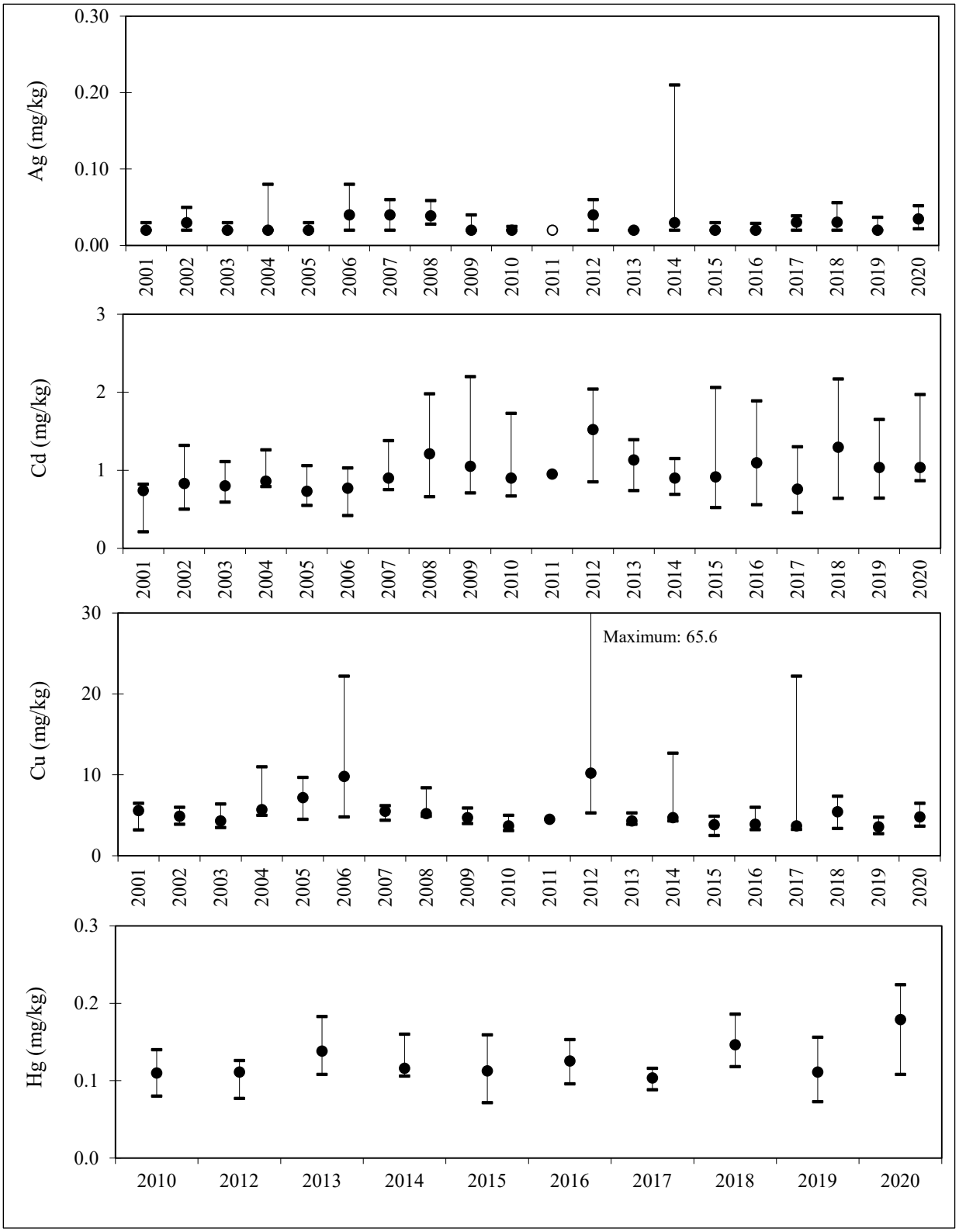

Figure 23.–Greens Creek Site 54 whole body Dolly Varden char Ag, Cd, and Cu concentrations, 2001–2020, and Hg concentrations, 2010, 2012–2020.

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

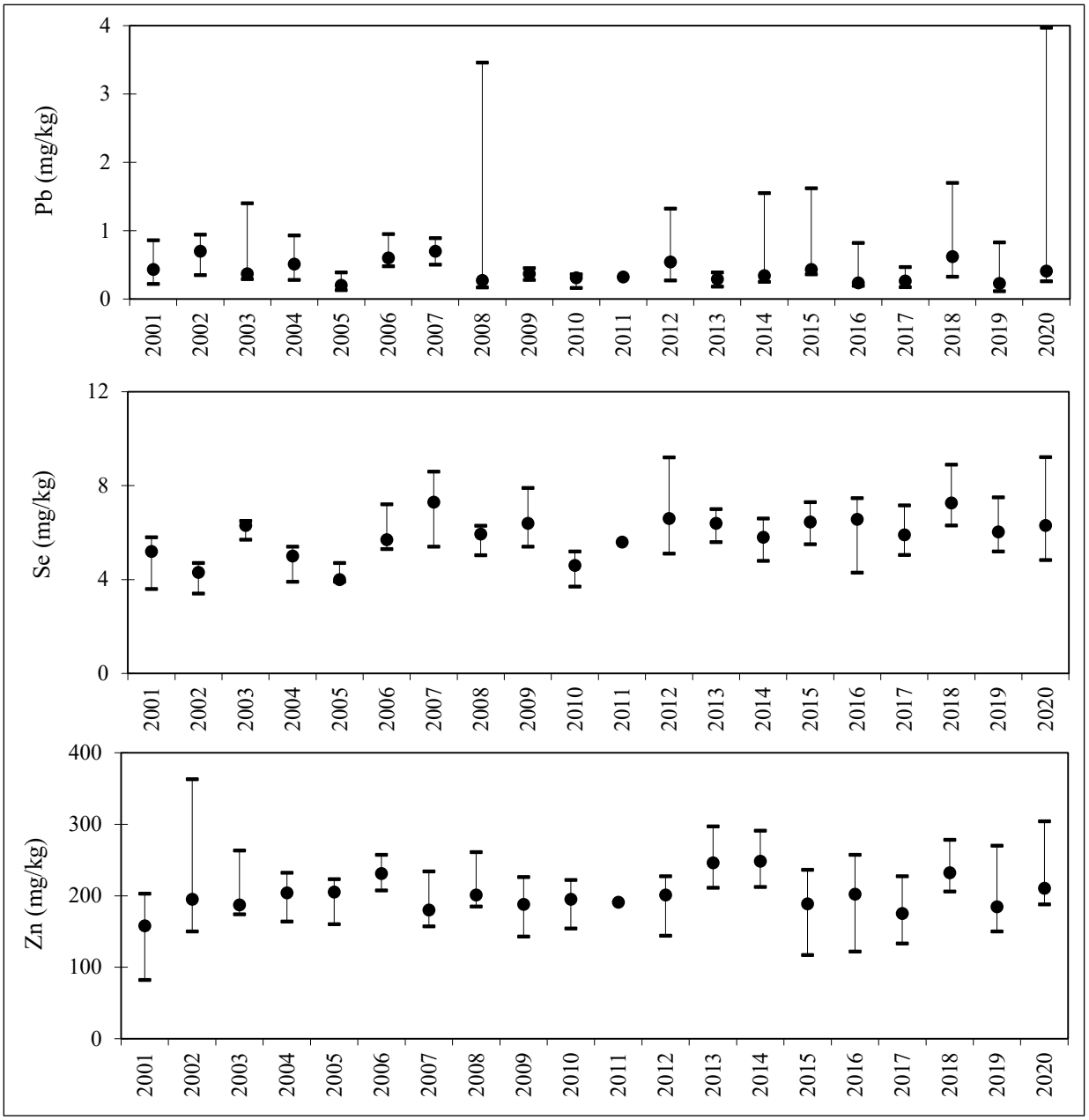

Figure 24.–Greens Creek Site 54 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2020.

Note: Minimum, median, and maximum concentrations presented.

TRIBUTARY CREEK SITE 9 AND SITE 1847

We sampled Tributary Creek Sites 9 and 1847 on July 15, 2020. At Site 9, we measured basic water quality and stream discharge at 1115 hours; at Site 1847, we measured water quality and discharge at 1325 hours (Table 4).

Table 4.–Greens Creek Sites 9 and 1847 water quality data, 2020.

Sample Date	Sample Site	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/15/20	9	11.1	49	6.86	1.9
07/15/20	1847	11.3	54	6.95	2.3

Periphyton: Chlorophyll Density and Composition

At Site 9, the 2020 mean Chl-*a* density was 7.86 mg/m^2, within the range observed since 2001 (Figure 25). 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 2020 mean Chl-*a* density was 7.76 mg/m^2 (Figure 25). The samples contained about 92% Chl-*a*, 8% Chl-*c*, and zero Chl-*b*, similar to the mean composition 2018–2019.

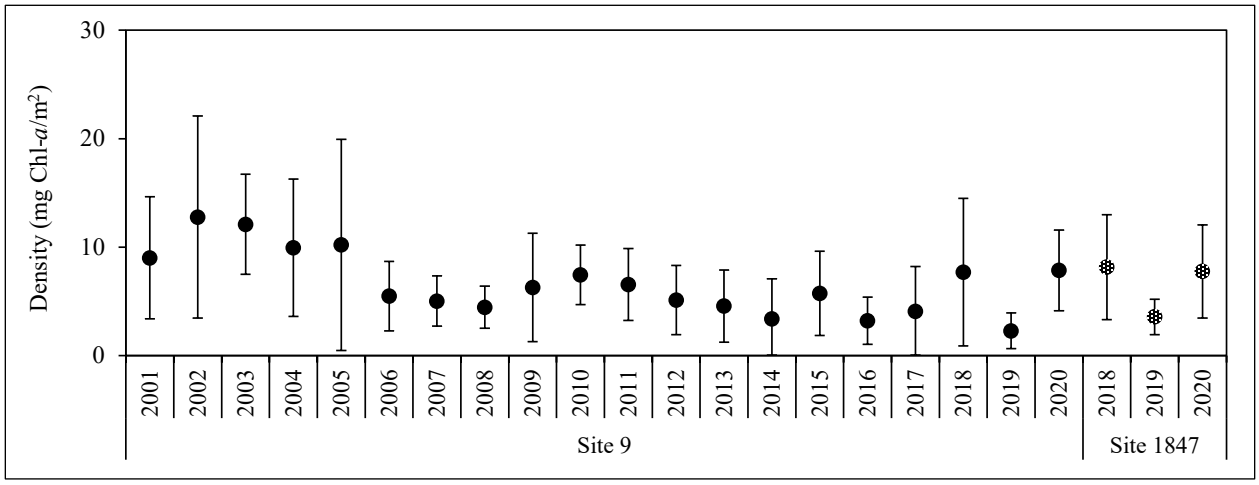

Figure 25.–Tributary Creek Site 9 and Site 1847 mean chlorophyll *a* densities ± 1 SD, 2001–2020.

Benthic Macroinvertebrate Density and Community Composition

Among the 2020 BMI samples collected at Site 9, we counted 32 taxa and estimate mean density at 2,241 BMI/m^2 with EPT insects composing 35% of the samples—among the lowest proportions of EPT insects observed since 2001 (Figures 26, 27). Dominant taxa were Diptera: Chironomidae and Oligochaeta (worms), composing about 40% and 18% of the samples.

Among the 2020 BMI samples collected at Site 1847, we counted 29 taxa and estimate mean density at 2,517 BMI/m^2 with EPT insects composing 42% of the samples—the lowest proportion of EPT insects observed at the sample site. (Figures 26, 27). Dominant taxa were Diptera: Chironomidae and Oligochaeta, composing about 25% and 20% of the samples.

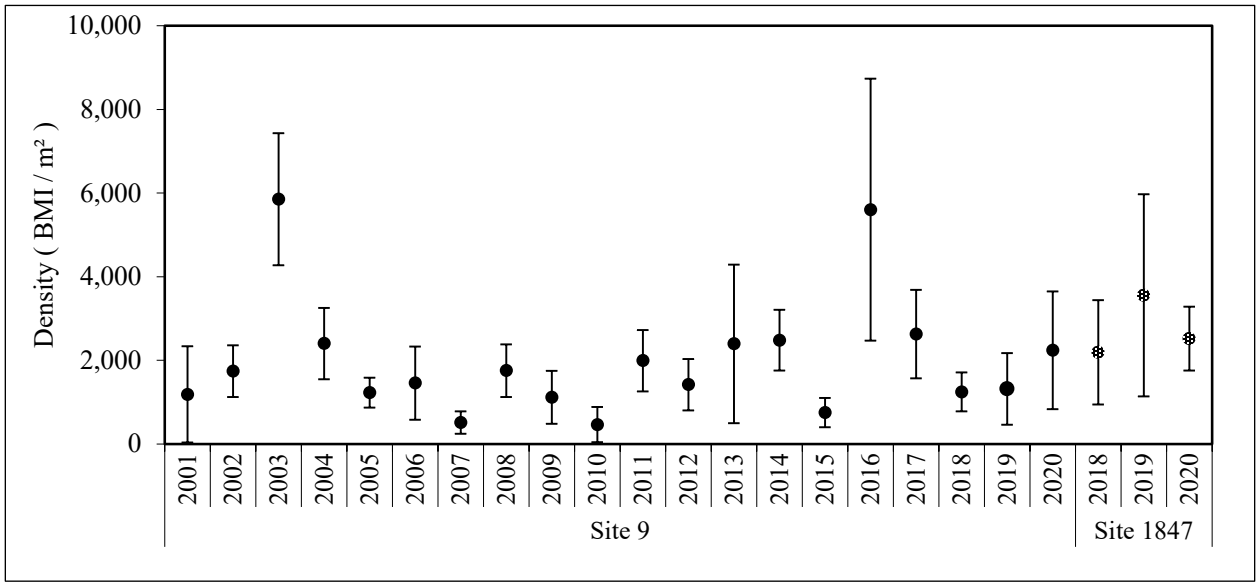

Figure 26.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate densities ± 1 SD, 2001–2020.

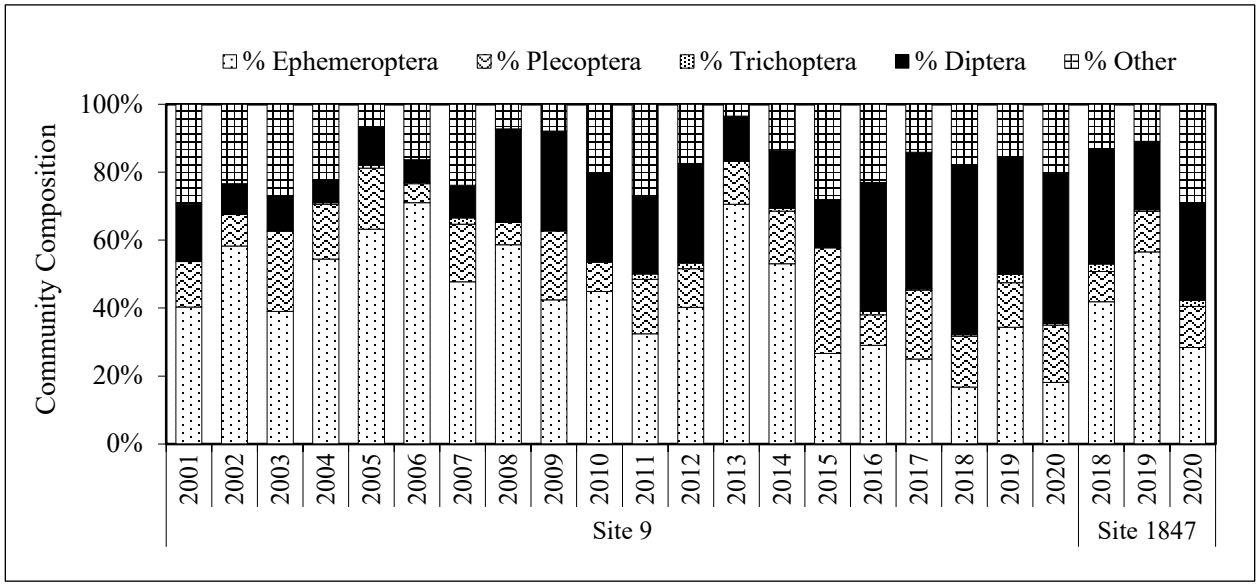

Figure 27.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate community composition, 2001–2020.

Juvenile Fish Abundance and Condition

In 2020 at Site 9, we captured one Dolly Varden char and seven juvenile coho salmon—among the fewest of both species captured in previous years during a single trapping event (Figure 28). The fish condition was 1.0 for the single Dolly Varden char captured. The mean fish condition was 1.3 for coho salmon and the range of length frequencies observed suggests multiple age classes were present, as in previous years.

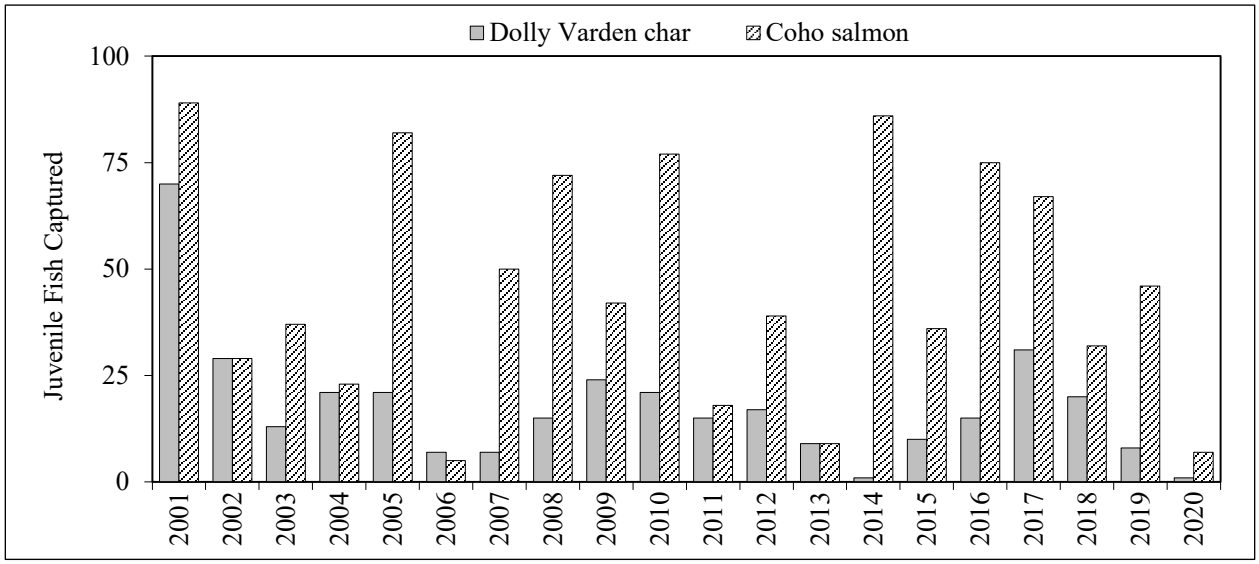

Figure 28.–Tributary Creek Site 9 juvenile fish captured, 2001–2020.

Juvenile Fish Element Concentrations

Among the seven whole body Dolly Varden char samples collected at Site 9 in 2020,[cc] most median concentrations were the greatest or among the greatest observed since sampling began in 2001. Other than Hg, many element concentrations exceeded ranges previously observed (Figures 29, 30).

[cc] Due to scarcity of Dolly Varden char captured at Tributary Creek Site 9 in 2020, six samples were collected upstream of the sample reach, as in previous years when necessary to achieve a minimum sample size of six fish.

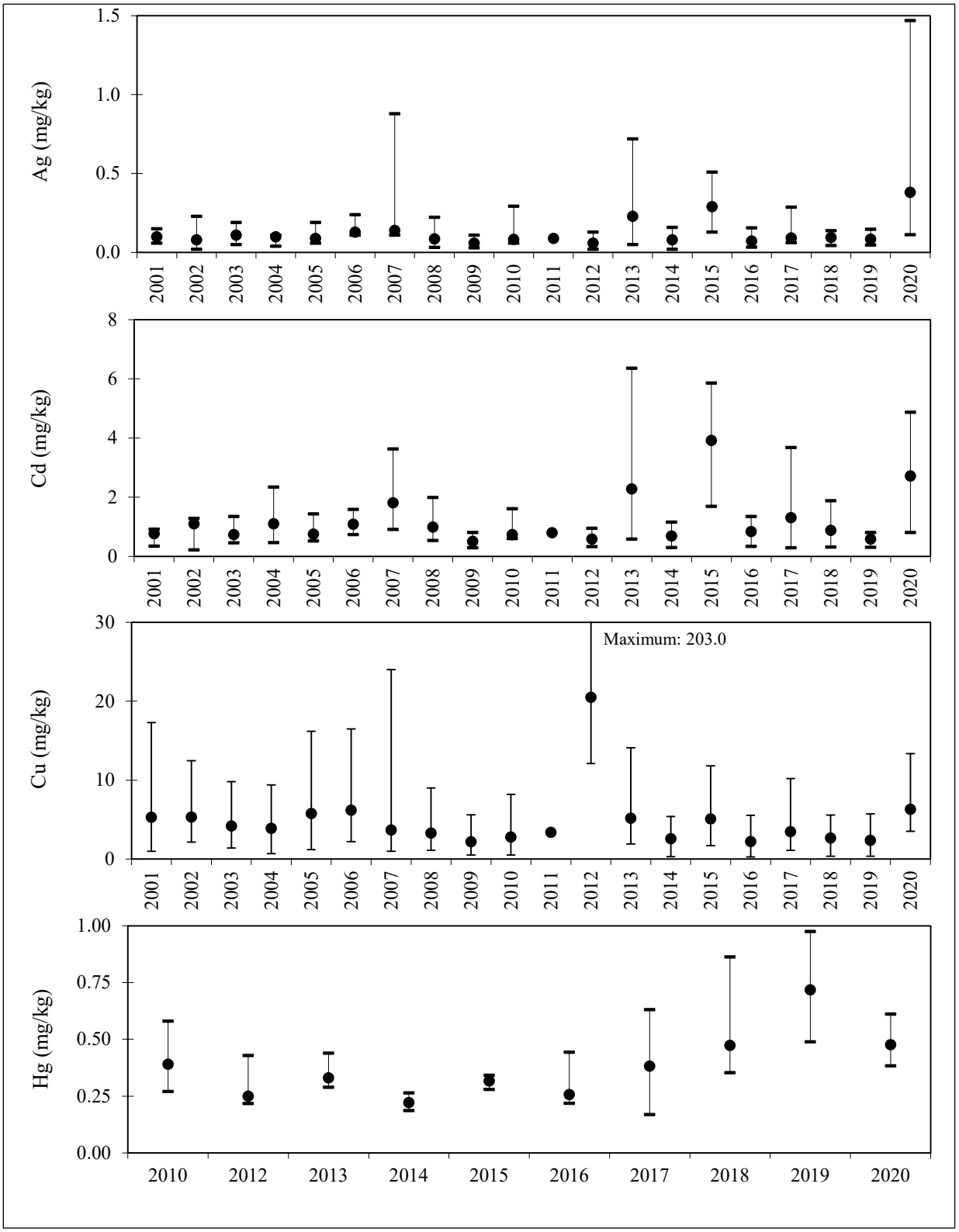

Figure 29.–Tributary Creek Site 9 whole body Dolly Varden char Ag, Cd, and Cu concentrations, 2001–2020, and Hg concentrations, 2010, 2012–2020.

Note: Minimum, median, and maximum concentrations presented.

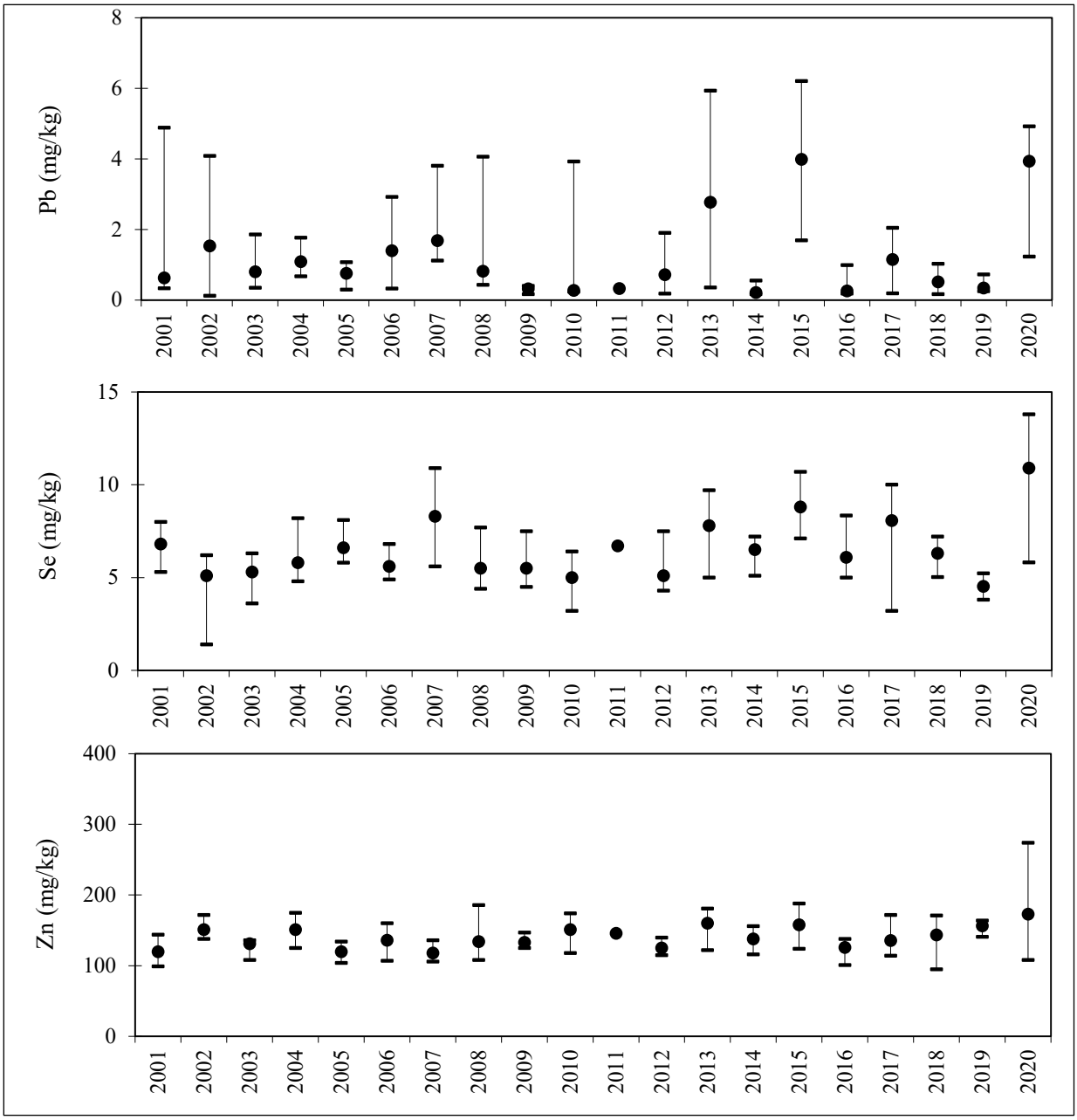

Figure 30.–Tributary Creek Site 9 whole body Dolly Varden char Pb, Se, and Zn concentrations, 2001–2020.

Note: Minimum, median, and maximum concentrations presented.

COMPARISONS AMONG GREENS CREEK SITES

Periphyton: Chlorophyll Density and Composition

Among Greens Creek Sites 63 and 54 in 2020, we did not detect a significant difference in mean Chl-*a* densities. Mean Chl-*a* densities at Sites 48 and 63 and Site 54 generally followed a similar trend 2001–2020 (Figure 31). Periphyton samples collected at Site 48, Site 63, and Site 54 generally contained about 90% Chl-*a,* zero or nearly zero Chl-*b,* and 10% Chl-*c* each year.

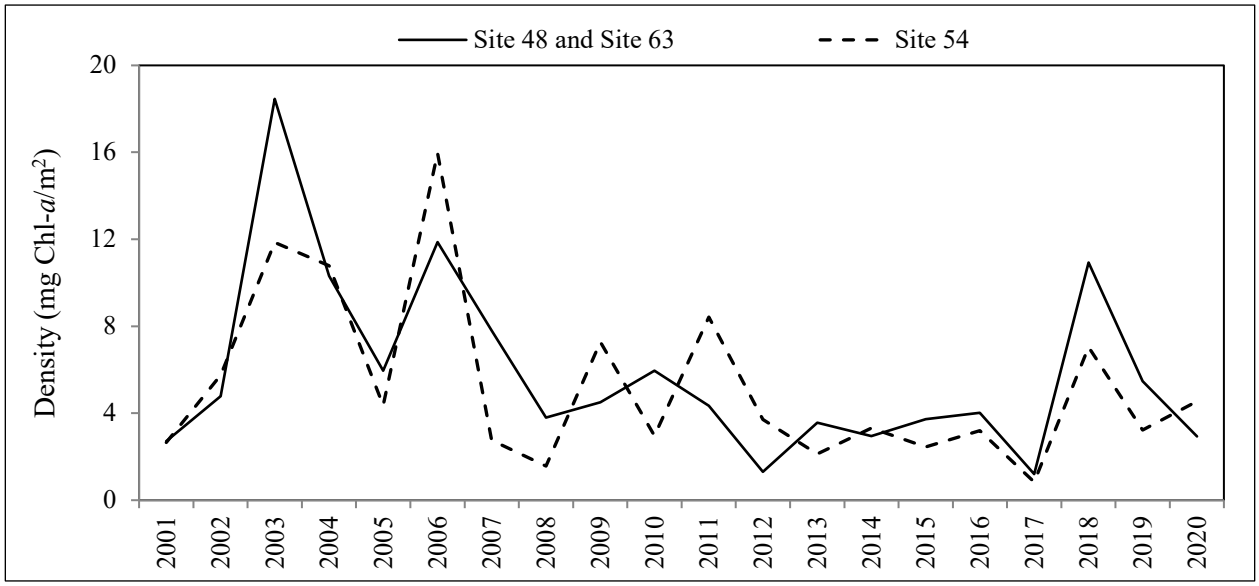

Figure 31.–Greens Creek mean chlorophyll *a* densities, 2001–2020.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2020.

Benthic Macroinvertebrate Density and Community Composition

From 2001 through 2020, we observed generally similar trends of mean benthic macroinvertebrate density and taxonomic richness among both Greens Creek sample sites (Figures 32, 33). EPT insects usually composed about 90% of annual samples at each site.

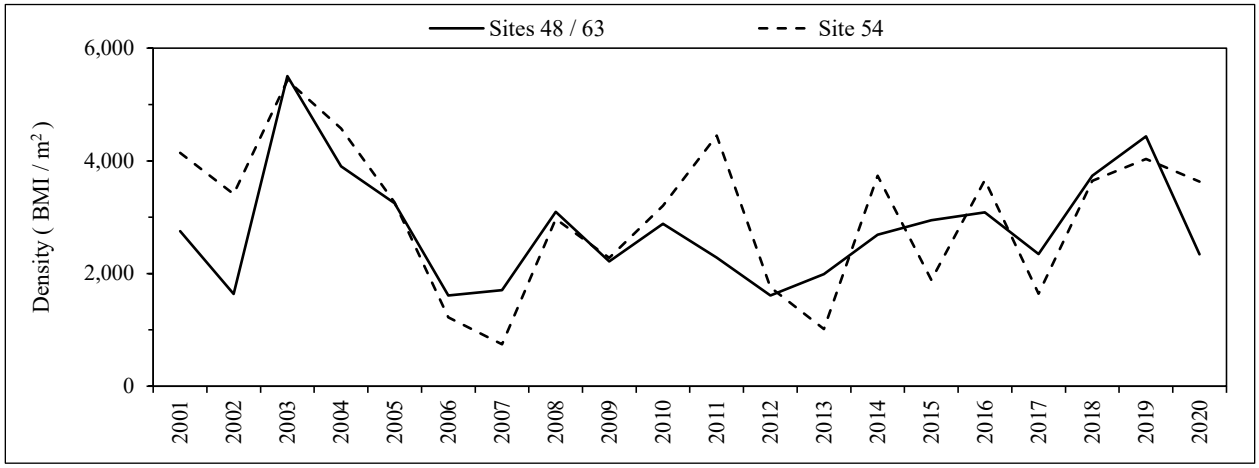

Figure 32.–Greens Creek mean benthic macroinvertebrate densities, 2001–2020.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2020.

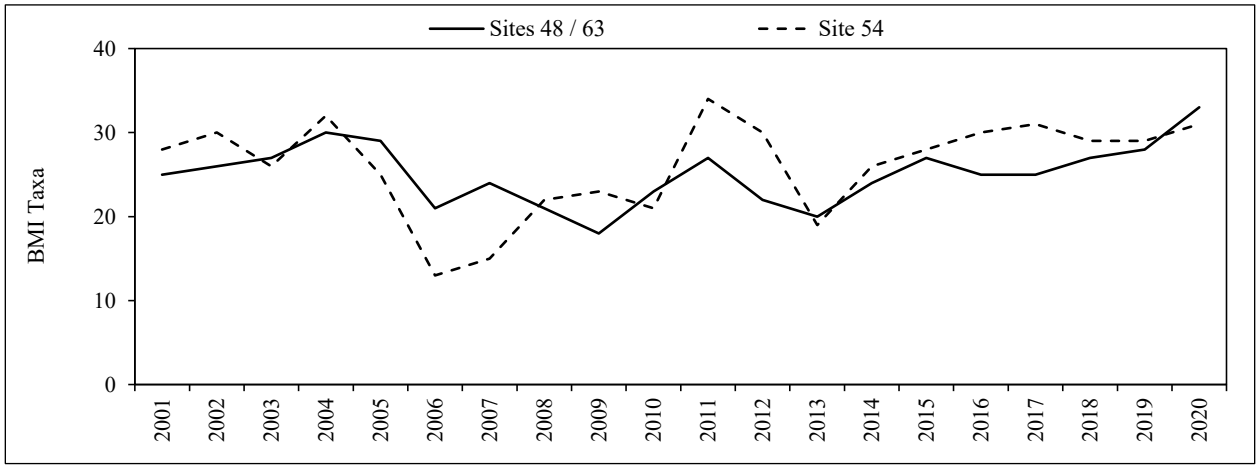

Figure 33.–Greens Creek benthic macroinvertebrate taxa richness, 2001–2020.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2020.

Juvenile Fish Abundance and Condition

In 2020, the number of Dolly Varden char captured during a single trapping event was similar among Greens Creek sample sites and has generally followed a similar trend since sampling began in 2001 (Figure 34). 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.

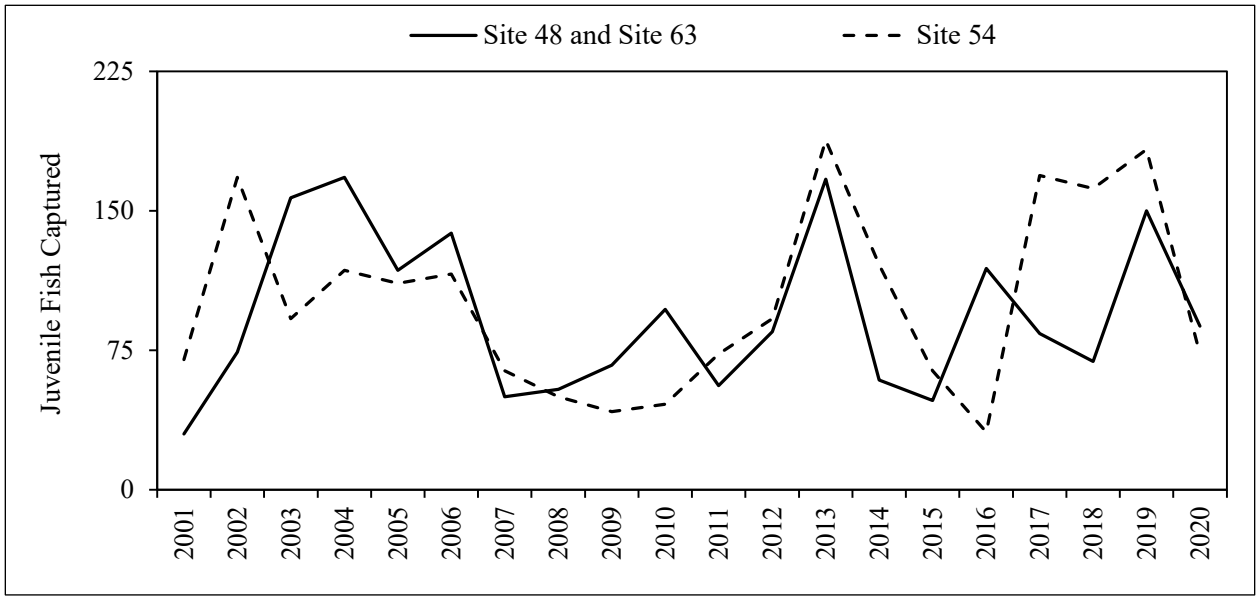

Figure 34.–Greens Creek Dolly Varden char captured, 2001–2020.

Note: Site 54 2001–2010 data extrapolated to 50 m sample reach for comparison. Site 48 data collected 2001–2017, and Site 63 data collected 2018–2020.

Juvenile Fish Element Concentrations

Among the 2020 Greens Creek Site 63 and Site 54 whole body Dolly Varden char element concentrations, we found no significant differences in median element concentrations.

COMPARISONS AMONG SITES

Juvenile Fish Element Concentrations

In 2020, samples collected at Tributary Creek Site 9 contained greater median concentrations of Ag, Cd, Cu, Hg, Pb, Se than observed in samples collected at both Greens Creek sampling sites, and a lower median concentration of Zn than observed at Greens Creek sites (Figure 35). Since 2001, samples collected at Tributary Creek Site 9 have 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 36, 37).

Among samples collected at Tributary Creek Site 9 in 2020, most median element concentrations also were above values reported for sample sites with mining-related influence elsewhere in Alaska (Legere and Timothy 2016). Among samples collected at Greens Creek Sites 54 and 63, median concentrations of Zn were greater than median values for reference and exploration sites, as observed in previous years.

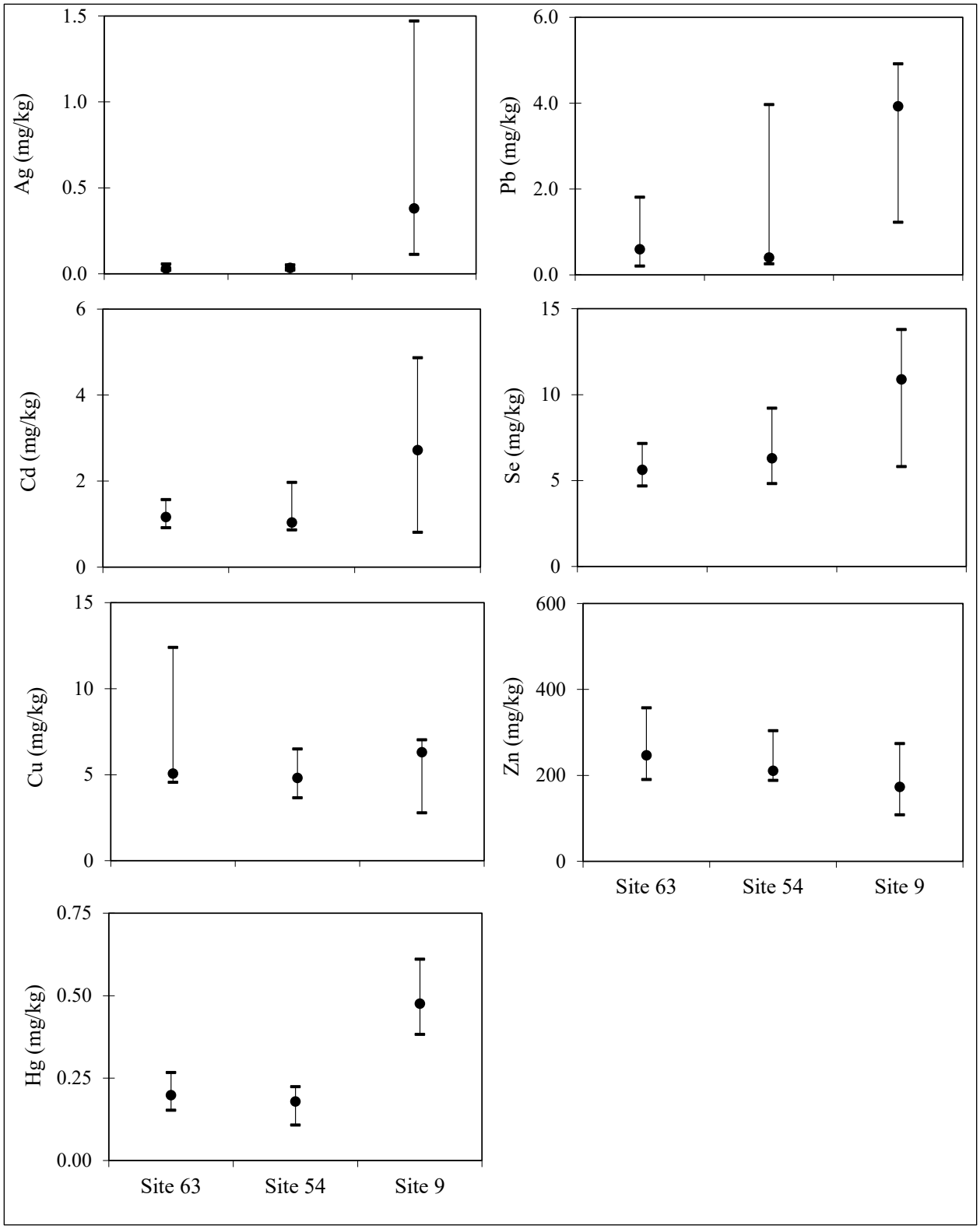

Figure 35.–Greens Creek and Tributary Creek whole body Dolly Varden char element concentrations, 2020.

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

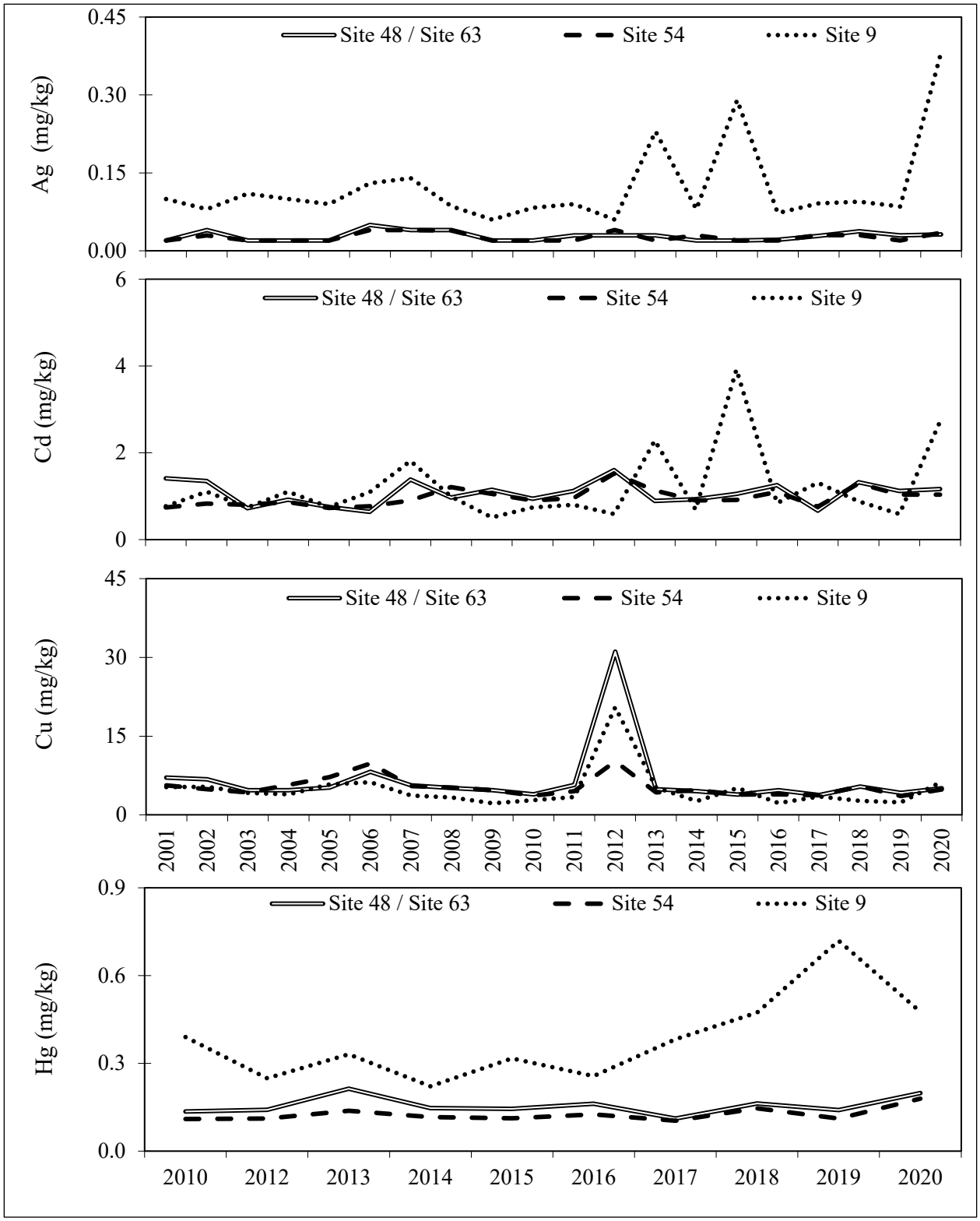

Figure 36.–Greens Creek and Tributary Creek whole body Dolly Varden char median Ag, Cd, and Cu concentrations, 2001–2020, and median Hg concentrations, 2010, 2012–2020.

Note: Solid line 2001–2017 is Site 48; 2018–2020 is Site 63.

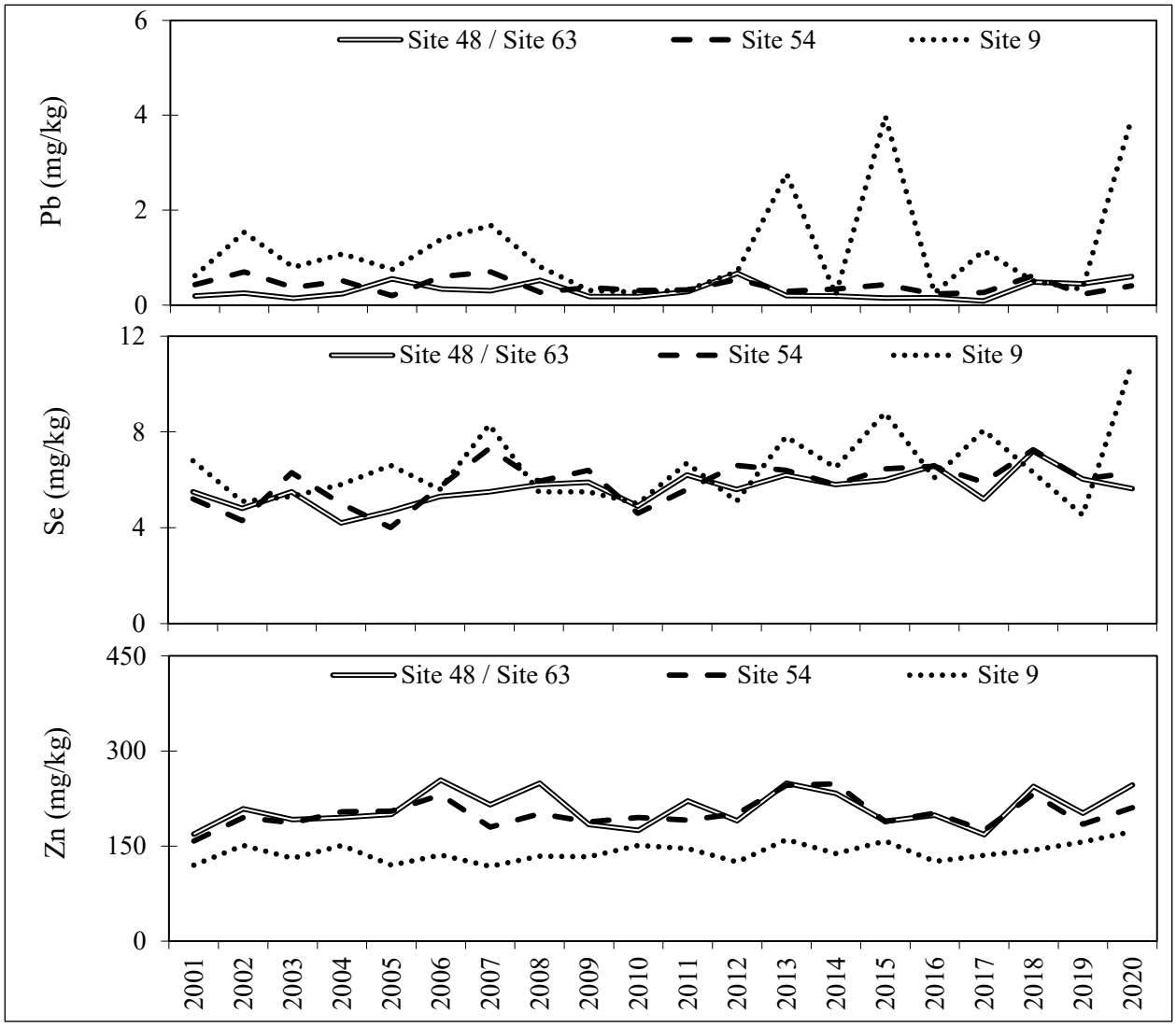

Figure 37.–Greens Creek and Tributary Creek whole body Dolly Varden char median Pb, Se, and Zn concentrations, 2001–2020.

Note: Solid line 2001–2017 is Site 48; 2018–2020 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

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

-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

Appendix A.2.–Greens Creek Site 63 chlorophylls *a*, *b*, and *c* densities, 2018–2020.

	7/11/2018			7/9/2019			7/16/2020		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	ND	ND	ND	4.17	0.00	0.33	3.10	0.00	0.38
	5.45	0.00	0.79	4.59	0.00	0.29	**0.25**	ND	ND
	9.29	0.00	1.77	2.89	0.00	0.30	2.06	0.00	0.25
	7.37	0.00	0.87	4.73	0.00	0.35	3.44	0.00	0.32
	ND	ND	ND	2.78	0.00	0.13	3.74	0.00	0.58
	23.07	0.00	4.01	5.34	0.00	0.48	0.32	0.00	0.08
	8.22	0.00	0.96	2.88	0.00	0.21	5.66	0.00	0.71
	4.38	0.00	0.64	13.03	0.00	1.09	6.94	0.00	0.52
	15.06	0.00	2.28	5.98	0.00	0.75	1.88	0.00	0.21
	14.63	0.00	2.28	8.33	0.00	0.47	2.02	0.00	0.28
mean	10.93	0.00	1.70	5.47	0.00	0.44	2.94	0.00	0.37
minimum	4.38	0.00	0.64	2.78	0.00	0.13	0.25	0.00	0.08
maximum	23.07	0.00	4.01	13.03	0.00	1.09	6.94	0.00	0.71

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

Appendix A.3.–Greens Creek Site 54 chlorophylls *a*, *b*, and *c* densities, 2001–2020.

	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			7/16/2020		
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*
	1.17	0.00	0.08	10.57	0.00	2.03	2.56	0.00	0.19	8.44	0.00	0.61
	0.19	ND	ND	7.05	0.00	1.13	0.75	0.00	0.05	6.93	0.00	0.58
	0.64	0.00	0.11	9.93	0.00	1.57	3.72	0.00	0.28	8.26	0.00	1.05
	2.99	0.00	0.38	8.12	0.00	1.55	8.22	0.00	0.80	2.24	0.00	0.27
	0.43	0.00	0.07	6.84	0.00	0.84	4.62	0.00	0.50	4.78	0.00	0.47
	0.96	0.00	0.09	1.51	0.00	0.29	5.98	0.00	0.90	3.74	0.00	0.50
	0.85	0.00	0.11	8.54	0.00	1.03	0.96	0.00	0.09	7.62	0.00	0.78
	0.19	ND	ND	6.09	0.00	0.98	1.82	0.00	0.13	2.02	0.00	0.19
	0.37	0.00	0.18	3.63	0.00	0.50	1.82	0.00	0.05	0.55	0.00	0.02
	0.55	0.00	0.12	8.12	0.00	1.16	1.82	0.00	0.09	0.96	0.00	0.09
mean	0.83	0.00	0.14	7.04	0.00	1.11	3.23	0.00	0.31	4.55	0.00	0.46
minimum	0.19	0.00	0.07	1.51	0.00	0.29	0.75	0.00	0.05	0.55	0.00	0.02
maximum	2.99	0.00	0.38	10.57	0.00	2.03	8.22	0.00	0.90	8.44	0.00	1.05

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, 2001–2020.

	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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Appendix A.4.–Page 2 of 2.

	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			7/15/2020		
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*
	12.82	0.00	1.07	15.59	0.00	1.74	ND	ND	ND	4.91	0.00	0.23
	1.39	0.00	0.02	4.49	0.00	0.51	1.32	0.00	0.15	11.96	0.00	0.51
	1.50	0.00	0.07	20.40	0.00	2.90	0.21	0.00	0.03	5.98	0.00	0.55
	8.44	0.00	0.56	0.21	0.00	0.00	2.75	0.00	0.06	4.38	0.00	0.22
	3.31	0.07	0.15	5.13	0.00	0.61	ND	ND	ND	14.63	0.00	0.77
	1.39	0.00	0.03	10.25	0.00	1.80	4.59	0.00	0.25	6.19	0.00	0.25
	0.43	0.00	0.00	11.64	0.00	1.82	2.56	0.00	0.12	7.80	0.00	0.36
	0.96	0.00	0.06	7.80	0.00	1.31	ND	ND	ND	3.52	0.00	0.11
	3.10	0.00	0.28	0.43	0.01	0.04	ND	ND	ND	7.37	0.00	0.48
	7.58	0.00	0.69	0.96	0.00	0.05	ND	ND	ND	11.85	0.00	0.57
mean	4.09	0.01	0.29	7.69	0.00	1.08	2.29	0.00	0.12	7.86	0.00	0.41
minimum	0.43	0.00	0.00	0.21	0.00	0.00	0.21	0.00	0.03	3.52	0.00	0.11
maximum	12.82	0.07	1.07	20.40	0.01	2.90	4.59	0.00	0.25	14.63	0.00	0.77

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, 2018–2020.

	7/12/2018			7/11/2019			7/15/2020		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	16.98	0.00	3.10	3.95	0.00	0.40	15.38	1.55	1.02
	9.29	0.00	1.66	2.78	0.00	0.25	5.23	0.00	0.26
	6.09	0.00	0.70	0.75	0.00	0.05	12.50	0.00	1.28
	3.63	0.00	0.28	4.70	0.00	0.52	2.46	0.51	0.13
	12.82	0.00	2.14	5.77	0.00	0.58	8.12	0.00	0.54
	3.63	0.02	0.57	4.49	0.00	0.43	6.41	0.00	0.30
	2.24	0.00	0.33	1.92	0.00	0.09	8.44	0.00	0.61
	ND	ND	ND	4.17	0.00	0.32	6.41	0.00	0.52
	8.01	0.00	0.66	ND	ND	ND	1.71	0.00	0.11
	10.68	0.00	1.29	ND	ND	ND	10.89	0.00	0.58
mean	8.15	0.00	1.19	3.57	0.00	0.33	7.76	0.00	0.71
minimum	2.24	0.00	0.28	0.75	0.00	0.05	1.71	0.00	0.11
maximum	16.98	0.02	3.10	5.77	0.00	0.58	15.38	1.55	1.28

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Greens Creek Site 48 BMI data summary, 2001–2017.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total BMI Taxa	25	26	27	30	29	21	24	21	18	23	27	22	20	24	27	25	25
Mean BMI Taxa / Sample	12	13	18	19	16	11	13	13	10	15	17	13	12	13	17	13	15
Total Ephemeroptera Taxa	6	6	7	6	6	6	7	6	7	7	7	7	7	7	8	8	7
Total Plecoptera Taxa	7	11	6	9	8	4	5	3	5	6	7	7	5	6	6	5	6
Total Trichoptera Taxa	2	2	4	2	4	2	1	2	1	1	2	2	1	1	2	2	3
Total Counts																	
Ephemeroptera	1,094	599	1,897	1,034	902	495	428	887	852	937	558	555	618	844	1,488	1,520	1,300
Plecoptera	49	41	191	74	36	10	75	20	40	81	151	55	131	98	122	209	128
Trichoptera	7	9	20	22	15	7	8	24	1	4	12	5	8	14	62	14	22
Aquatic Diptera	31	39	206	169	101	38	34	79	15	71	193	73	86	184	291	352	146
Other	3	16	53	25	5	10	15	11	2	8	68	5	12	16	65	28	18
% Ephemeroptera	92%	85%	80%	79%	86%	88%	80%	87%	93%	86%	57%	80%	72%	73%	73%	72%	81%
% Plecoptera	4%	6%	8%	6%	3%	3%	11%	2%	5%	7%	15%	8%	15%	8%	6%	10%	8%
% Trichoptera	0.6%	1%	0.8%	2%	2%	1%	2%	2%	0.2%	0.3%	1%	0.7%	0.9%	1%	3%	0.7%	1%
% Aquatic Diptera	3%	6%	9%	12%	9%	6%	6%	8%	2%	6%	20%	11%	10%	16%	14%	17%	9%
% Other	0.3%	2%	2%	2%	0.5%	1%	2%	0.8%	0.4%	1%	7%	0.7%	1%	1%	3%	1%	1%
% EPT	97%	92%	89%	86%	90%	92%	92%	92%	98%	93%	73%	89%	89%	83%	82%	82%	90%
% Chironomidae	1%	4%	7%	11%	8%	3%	4%	6%	1%	5%	17%	9%	9%	15%	9%	14%	9%
% Dominant Taxon	41%	35%	30%	28%	30%	37%	36%	58%	46%	31%	21%	37%	25%	31%	28%	27%	24%
Total BMI	1,184	704	2,367	1,679	1,396	693	733	1,331	953	1,240	982	693	855	1,156	2,028	2,123	1,614
Total Terrestrial Invertebrates	0	4	5	1	24	5	2	8	2	11	4	0	14	32	6	4	27
Total Invertebrates	1,184	708	2,372	1,680	1,420	698	735	1,339	955	1,251	986	693	869	1,188	2,034	2,127	1,641
% Sample BMI	100%	99%	99%	99%	98%	99%	99%	99%	99%	99%	99%	100%	98%	97%	99%	99%	98%
% Sample Terrestrial	0%	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%	0%	2%	3%	1%	1%	2%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69
Mean Invertebrates / m^2	2,753	1,647	5,516	3,907	3,302	1,623	1,709	3,114	2,221	2,909	2,293	1,612	2,021	2,763	2,956	3,092	2,385
Mean BMI / m^2	2,753	1,637	5,505	3,905	3,247	1,612	1,705	3,095	2,216	2,884	2,284	1,612	1,988	2,688	2,948	3,086	2,346
± 1 SD	1,435	434	1,579	677	1,441	807	648	980	1,939	1,530	630	872	526	1,043	892	1,219	1,034

Appendix B.2.–Greens Creek Site 63 BMI data summary, 2018–2020.

	2018	2019	2020
Total BMI Taxa	27	28	33
Mean BMI Taxa / Sample	14	16	14
Total Ephemeroptera Taxa	8	8	9
Total Plecoptera Taxa	7	6	8
Total Trichoptera Taxa	2	5	3
Total Counts			
Ephemeroptera	2,271	2,715	1,237
Plecoptera	110	65	80
Trichoptera	20	30	29
Aquatic Diptera	144	220	234
Other	26	21	31
% Ephemeroptera	88%	89%	77%
% Plecoptera	4%	2%	5%
% Trichoptera	0.8%	1%	2%
% Aquatic Diptera	6%	7%	15%
% Other	1%	0.7%	1.9%
% EPT	93%	92%	84%
% Chironomidae	5%	7%	12%
% Dominant Taxon	39%	38%	39%
Total BMI	2,571	3,051	1,611
Total Terrestrial Invertebrates	4	6	10
Total Invertebrates	2,575	3,057	1,621
% Sample BMI	99%	100%	99%
% Sample Terrestrial	1%	0%	1%
Total Sample Area (m^2)	0.69	0.69	0.69
Mean Invertebrates / m^2	3,743	4,443	2,356
Mean BMI / m^2	3,737	4,435	2,342
± 1 SD	1,240	1,708	1,899

Appendix B.3.–Greens Creek Site 54 BMI data summary, 2001–2020.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total BMI Taxa	28	30	26	32	25	13	15	22	23	21	34	30	19	26	28	30	31	29	29	31
Mean BMI Taxa / Sample	15	14	16	19	15	9	8	14	13	13	18	14	9	11	14	15	14	14	15	15
Total Ephemeroptera Taxa	7	6	7	6	8	5	6	8	7	6	8	7	5	7	7	8	8	8	9	8
Total Plecoptera Taxa	7	7	7	10	7	3	4	4	7	5	7	10	6	7	6	6	8	7	7	9
Total Trichoptera Taxa	2	2	1	3	3	2	0	2	2	2	5	4	1	3	2	3	4	3	3	2
Total Counts																				
Ephemeroptera	1,627	1,352	2,011	1,601	1,265	477	286	1,105	895	1,247	1,536	591	308	1,277	941	2,072	917	2,249	2,328	1,959
Plecoptera	80	54	82	117	37	30	22	65	43	53	96	49	54	109	99	204	72	105	129	91
Trichoptera	7	6	12	19	31	4	0	9	4	8	32	9	3	15	24	18	22	11	17	29
Aquatic Diptera	53	39	173	184	65	13	10	85	32	61	203	81	52	177	182	201	111	134	282	399
Other	15	15	57	46	4	1	1	13	5	8	46	24	19	24	52	22	14	10	18	22
% Ephemeroptera	91%	92%	86%	81%	90%	91%	90%	87%	91%	91%	80%	78%	71%	80%	72%	82%	81%	90%	84%	78%
% Plecoptera	4%	4%	4%	6%	3%	6%	7%	5%	4%	4%	5%	6%	12%	7%	8%	8%	6%	4%	5%	4%
% Trichoptera	0.4%	0.4%	0.5%	1%	2%	0.8%	0%	0.7%	0.4%	0.6%	2%	1%	0.7%	0.9%	2%	1%	2%	0.4%	1%	1%
% Aquatic Diptera	3%	3%	7%	9%	5%	2%	3%	7%	3%	4%	11%	11%	12%	11%	14%	8%	10%	5%	10%	16%
% Other	0.8%	1%	2%	2%	0.3%	0.2%	0.3%	1%	0.5%	0.6%	2%	4%	4%	1%	4%	0.9%	1%	0.4%	0.6%	1%
% EPT	96%	96%	90%	88%	95%	97%	97%	92%	96%	95%	87%	86%	84%	87%	82%	91%	89%	94%	89%	83%
% Chironomidae	2%	2%	6%	8%	4%	2%	2%	5%	2%	3%	9%	9%	10%	10%	11%	6%	8%	5%	9%	15%
% Dominant Taxon	52%	43%	40%	38%	40%	31%	34%	53%	40%	35%	43%	30%	30%	35%	32%	25%	23%	37%	43%	39%
Total BMI	1,782	1,466	2,335	1,967	1,402	525	319	1,277	979	1,377	1,913	754	436	1,607	1,298	2,517	1,136	2,509	2,774	2,500
Total Terrestrial Invertebrates	0	4	7	1	3	1	6	1	8	9	14	5	8	12	6	3	24	4	1	3
Total Invertebrates	1,782	1,470	2,342	1,968	1,405	526	325	1,278	987	1,386	1,927	759	444	1,619	1,304	2,520	1,160	2,513	2,775	2,503
% Sample BMI	100%	99%	99%	99%	99%	99%	98%	100%	99%	99%	99%	99%	98%	99%	99%	99%	98%	100%	100%	100%
% Sample Terrestrial	0%	1%	1%	1%	1%	1%	2%	0%	1%	1%	1%	1%	2%	1%	1%	1%	2%	0%	0%	0%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69
Total Invertebrates / m^2	4,144	3,419	5,447	4,577	3,267	1,223	756	2,972	2,295	3,223	4,481	1,765	1,033	3,765	1,895	3,663	1,686	3,653	4,033	3,638
Total BMI / m^2	4,144	3,409	5,430	4,575	3,260	1,221	742	2,970	2,277	3,202	4,449	1,753	1,014	3,737	1,887	3,658	1,651	3,647	4,032	3,634
± 1 SD	1,464	1,148	1,422	1,540	1,016	345	293	1,855	297	772	2,668	738	642	1,253	1,065	1,139	809	973	978	2,454

Appendix B.4.–Tributary Creek Site 9 BMI data summary, 2001–2020.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total BMI Taxa	21	24	36	26	30	23	21	20	26	22	26	27	20	22	23	29	29	25	28	32
Mean BMI Taxa / Sample	14	15	21	14	14	11	10	14	13	10	12	15	11	12	11	18	16	14	15	14
Total Ephemeroptera Taxa	6	7	8	5	9	7	5	7	8	7	6	5	7	6	6	7	7	8	7	8
Total Plecoptera Taxa	5	5	5	6	5	2	3	4	5	5	6	6	4	3	6	4	5	3	4	3
Total Trichoptera Taxa	0	2	3	3	4	1	2	1	0	0	2	3	1	3	0	5	3	2	3	4
Total Counts																				
Ephemeroptera	205	436	981	562	334	444	104	441	203	89	277	245	726	565	137	1,128	452	143	311	279
Plecoptera	68	69	593	166	95	35	37	50	97	17	138	69	130	166	160	359	365	128	119	261
Trichoptera	0	2	7	5	4	2	4	1	0	0	13	10	2	8	0	22	7	4	22	6
Aquatic Diptera	86	66	256	66	60	42	21	206	141	52	196	179	135	181	73	1449	727	427	314	683
Other	150	175	679	233	35	102	52	55	38	40	232	106	36	146	145	896	255	153	140	313
% Ephemeroptera	40%	58%	39%	54%	63%	71%	48%	59%	42%	45%	32%	40%	71%	53%	27%	29%	25%	17%	34%	18%
% Plecoptera	13%	9%	24%	16%	18%	6%	17%	7%	20%	9%	16%	11%	13%	16%	31%	9%	20%	15%	13%	17%
% Trichoptera	0%	0.3%	0.3%	0.5%	0.8%	0.3%	2%	0.1%	0%	0%	2%	2%	0.2%	0.8%	0%	0.6%	0.4%	0.5%	2%	0%
% Aquatic Diptera	17%	9%	10%	6%	11%	7%	10%	27%	29%	26%	23%	29%	13%	17%	14%	38%	40%	50%	35%	44%
% Other	30%	23%	27%	23%	7%	16%	24%	7%	8%	20%	27%	17%	3%	14%	28%	23%	14%	18%	15%	20%
% EPT	54%	68%	63%	71%	82%	77%	67%	65%	63%	54%	50%	53%	83%	69%	58%	39%	46%	32%	50%	35%
% Chironomidae	7%	5%	5%	5%	8%	4%	1%	1%	22%	23%	21%	26%	11%	14%	11%	29%	24%	35%	15%	40%
% Dominant Taxon	26%	29%	26%	44%	37%	40%	26%	33%	32%	32%	24%	30%	38%	30%	28%	29%	24%	45%	31%	43%
Total BMI	509	748	2,516	1,032	528	625	218	753	479	198	856	609	1,029	1,066	515	3,854	1,806	855	906	1542
Total Terrestrial Invertebrates	0	5	15	3	12	33	1	5	50	22	2	9	13	13	6	18	3	8	2	4
Total Invertebrates	509	753	2,531	1,035	540	658	219	758	529	220	858	618	1,042	1,079	521	3,872	1,809	863	908	1546
% Sample BMI	100%	99%	99%	99%	98%	95%	99%	99%	91%	90%	99%	99%	99%	99%	99%	99%	99%	99%	100%	100%
% Sample Terrestrial	0%	1%	1%	1%	2%	5%	1%	1%	10%	11%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69
Mean Invertebrates / m^2	1,184	1,751	5,886	2,407	1,256	1,530	509	1,763	1,230	512	1,995	1,437	2,423	2,509	757	5,628	2,629	1,254	1,320	2,247
Mean BMI / m^2	1,184	1,740	5,851	2,400	1,228	1,453	507	1,751	1,114	460	1,991	1,416	2,393	2,479	749	5,602	2,625	1,243	1,317	2,241
± 1 SD	1,148	620	1,579	851	357	878	268	631	636	463	447	615	1,897	727	348	3,133	1,059	464	855	1,409

Appendix B.5.–Tributary Creek Site 1847 BMI data summary, 2018–2020.

	2018	2019	2020
Total BMI Taxa	29	28	29
Mean BMI Taxa / Sample	18	18	16
Total Ephemeroptera Taxa	7	7	8
Total Plecoptera Taxa	4	3	4
Total Trichoptera Taxa	4	3	3
Total Counts			
Ephemeroptera	631	1,382	492
Plecoptera	134	291	210
Trichoptera	34	12	30
Aquatic Diptera	512	493	496
Other	197	268	504
% Ephemeroptera	42%	57%	28%
% Plecoptera	9%	12%	12%
% Trichoptera	2%	0.5%	2%
% Aquatic Diptera	34%	20%	29%
% Other	13%	11%	29%
% EPT	53%	69%	42%
% Chironomidae	29%	14%	25%
% Dominant Taxon	38%	35%	36%
Total BMI	1,508	2,446	1,732
Total Terrestrial Invertebrates	5	1	2
Total Invertebrates	1,513	2,447	1,734
% Sample BMI	99%	100%	100%
% Sample Terrestrial	1%	0%	0%
Total Sample Area (m^2)	0.69	0.69	0.69
Mean Invertebrates / m^2	2,199	3,557	2,520
Mean BMI / m^2	2,192	3,555	2,517
± 1 SD	1,248	2,417	762

APPENDIX C: JUVENILE FISH DATA

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

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	48–139	30	ND
2002	DV	45–160	74	ND
2003	DV	54–180	157	ND
2004	DV	54–158	168	ND
2005	DV	50–149	118	ND
2006	DV	49–150	138	ND
2007	DV	53–154	50	ND
2008	DV	77–137	54	ND
2009	DV	47–142	67	ND
2010	DV	47–170	97	ND
2011	DV	54–155	56	ND
2012	DV	64–148	85	1.0
2013	DV	35–154	167	1.0
2014	DV	52–146	59	1.0
2015	DV	54–165	48	1.0
2016	DV	36–163	119	1.2
2017	DV	52–156	84	1.1

Appendix C.2.–Greens Creek Site 63 Dolly Varden char capture data, 2018–2020.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2018	DV	49–144	69	1.0
2019	DV	62–176	150	1.0
2020	DV	59–149	88	0.9

Appendix C.3.–Greens Creek Site 54 resident fish capture data, 2001–2020.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	27–162	70	ND
2002	DV	33–160	168	ND
2003	DV	51–184	92	ND
2004	DV	52–161	118	ND
2005	DV	52–146	111	ND
2006	DV	49–158	116	ND
2007	DV	50–145	64	ND
	CT	88–104	8	ND
2008	DV	45–131	50	ND
	CT	101–123	4	ND
2009	DV	47–101	42	ND
2010	DV	52–151	46	ND
2011	DV	43–150	73	ND
2012	DV	47–143	92	1.0
2013	DV	50–150	188	1.1
2014	DV	50–158	121	1.0
2015	DV	54–150	64	1.0
2016	DV	55–156	31	1.1
2017	DV	48–151	169	1.1
2018	DV	50–158	162	1.0
2019	DV	61–166	183	1.0
2020	DV	63–158	73	1.0
	RT	135	1	1.0

Appendix C.4.–Greens Creek Site 54 coho salmon capture data, 2001–2020.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	32–95	2	ND
2002	CO	59–85	14	ND
2003	CO	44–52	5	ND
2004	CO	70–95	9	ND
2005	CO	66–93	33	ND
2006	CO	62–88	6	ND
2007	CO	ND	0	ND
2008	CO	53–69	4	ND
2009	CO	67–73	2	ND
2010	CO	77	1	ND
2011	CO	ND	0	ND
2012	CO	67–71	0	1.1
2013	CO	ND	0	ND
2014	CO	70–85	10	1.2
2015	CO	44–100	15	1.1
2016	CO	68–100	14	1.3
2017	CO	ND	0	ND
2018	CO	38–90	17	1.2
2019	CO	44–95	54	1.1
2020	CO	64–94	18	1.1

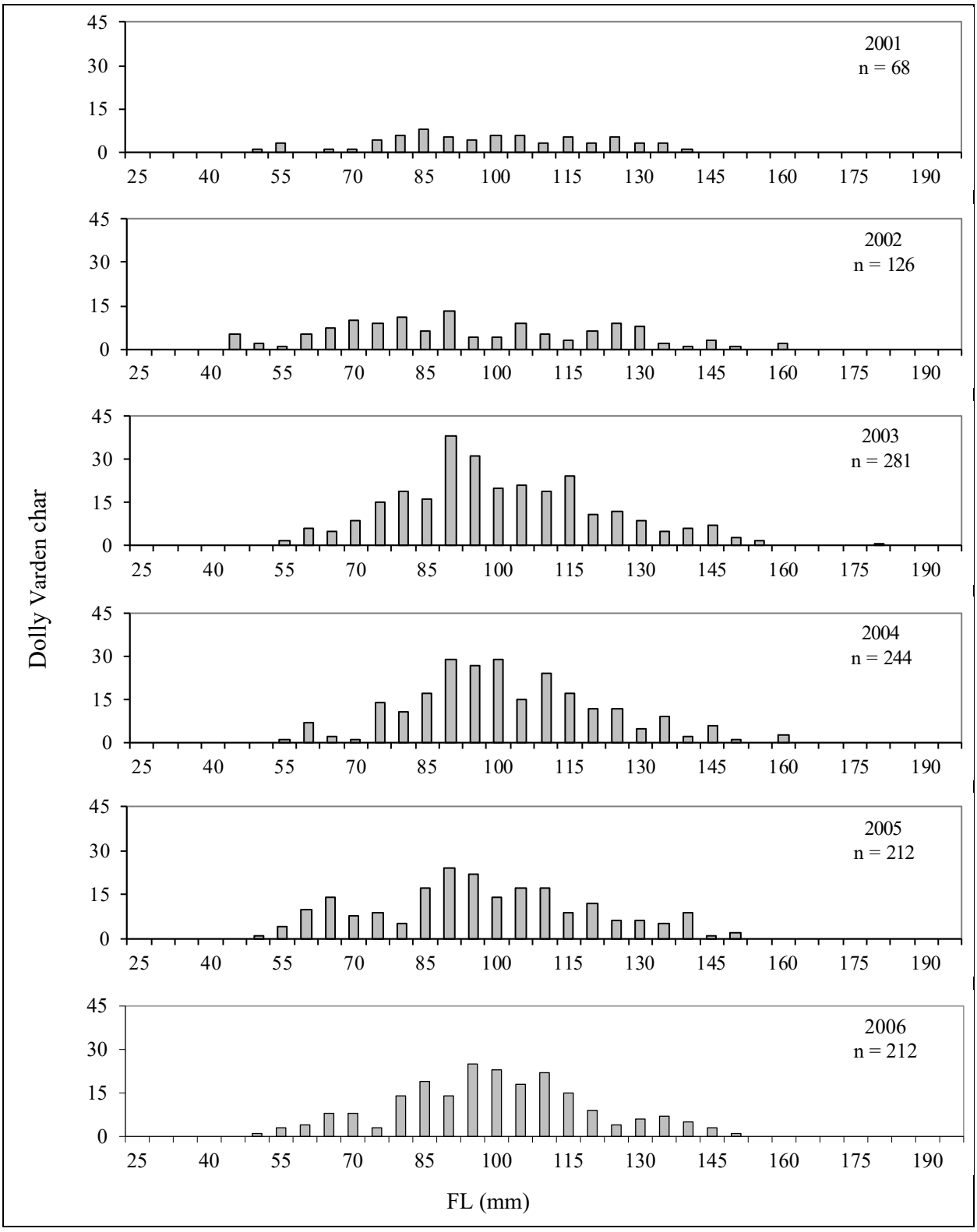
Appendix C.5.–Tributary Creek Site 9 resident fish capture data, 2001–2020.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	58–110	70	ND
	CT	124	1	ND
2002	DV	38–147	29	ND
	CT	124	0	ND
2003	DV	54–114	13	ND
	CT	122	1	ND
2004	DV	64–109	21	ND
	CT	122	1	ND
	RT	86–106	3	ND
2005	DV	59–131	21	ND
	CT	91–103	1	ND
2006	DV	85–117	7	ND
2007	DV	81–158	7	ND
	CT	138	0	ND
2008	DV	60–108	15	ND
	CT	82–112	1	ND
2009	DV	48–98	24	ND
	CT	97	1	ND
2010	DV	58–108	21	ND
	CT	64–89	4	ND
2011	DV	50–125	15	ND
	CT	115	1	ND
2012	DV	66–112	17	1.0
	CT	63–93	4	1.0
2013	DV	52–92	9	1.2
	CT	73–80	0	1.0
2014	DV	37–115	1	1.0
	CT	110–110	0	0.9
	RT	105–110	1	0.7
2015	DV	55–84	10	1.2
2016	DV	76–114	15	1.1
2017	DV	55–117	31	1.1
2018	DV	54–109	20	1.0
2019	DV	59–102	8	1.1
2020	DV	112	1	1.0

Appendix C.6.–Tributary Creek Site 9 coho salmon capture data, 2001–2020.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	39–101	89	ND
2002	CO	27–85	29	ND
2003	CO	46–88	37	ND
2004	CO	40–94	23	ND
2005	CO	39–103	82	ND
2006	CO	69–108	5	ND
2007	CO	38–104	50	ND
2008	CO	41–100	72	ND
2009	CO	38–116	42	ND
2010	CO	39–90	77	ND
2011	CO	38–100	18	ND
2012	CO	46–105	39	1.1
2013	CO	50–91	9	1.4
2014	CO	39–92	86	1.2
2015	CO	38–95	36	1.4
2016	CO	44–97	75	1.3
2017	CO	35–94	67	1.3
2018	CO	37–92	32	1.1
2019	CO	45–85	46	1.2
2020	CO	51–83	7	1.3

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



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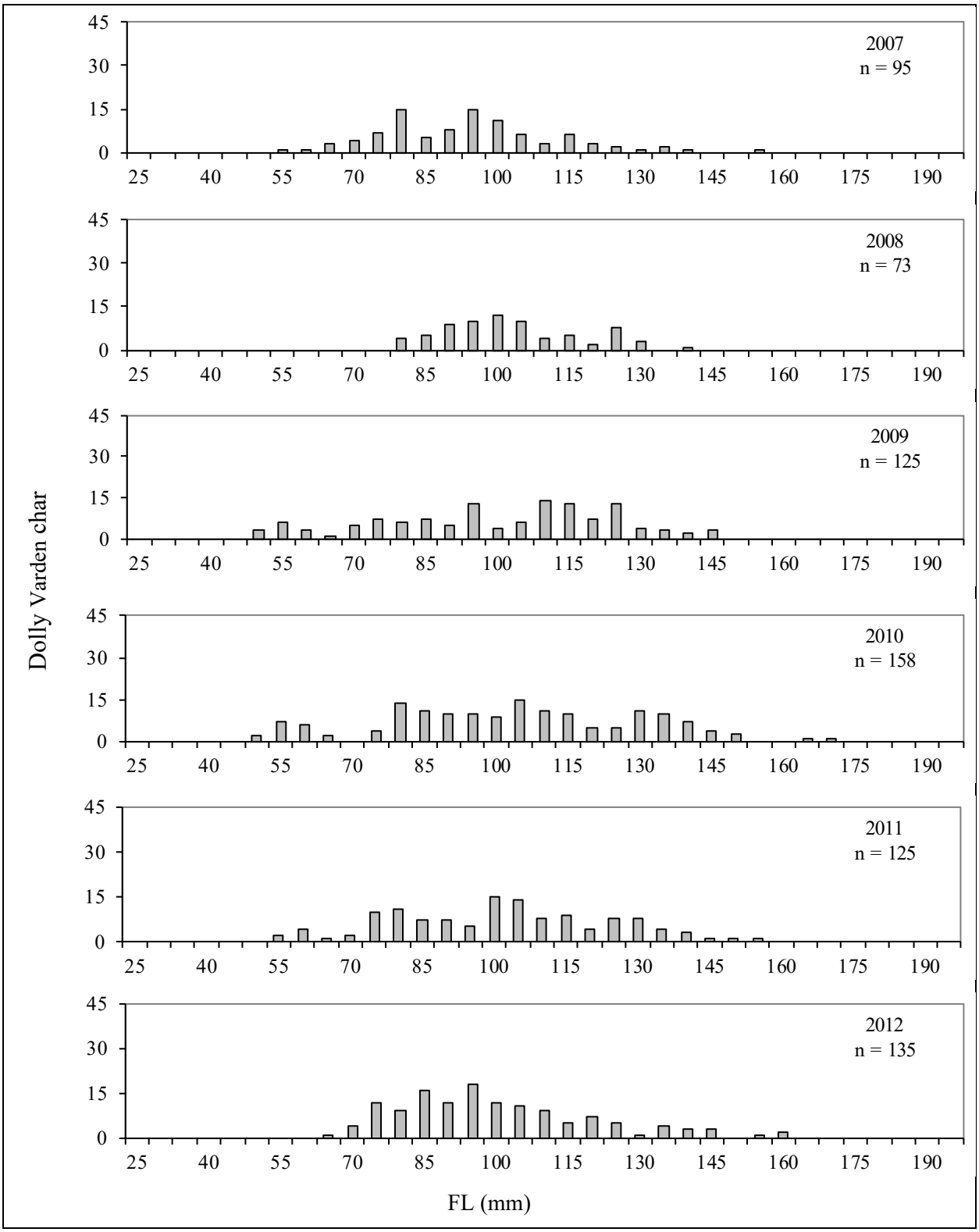
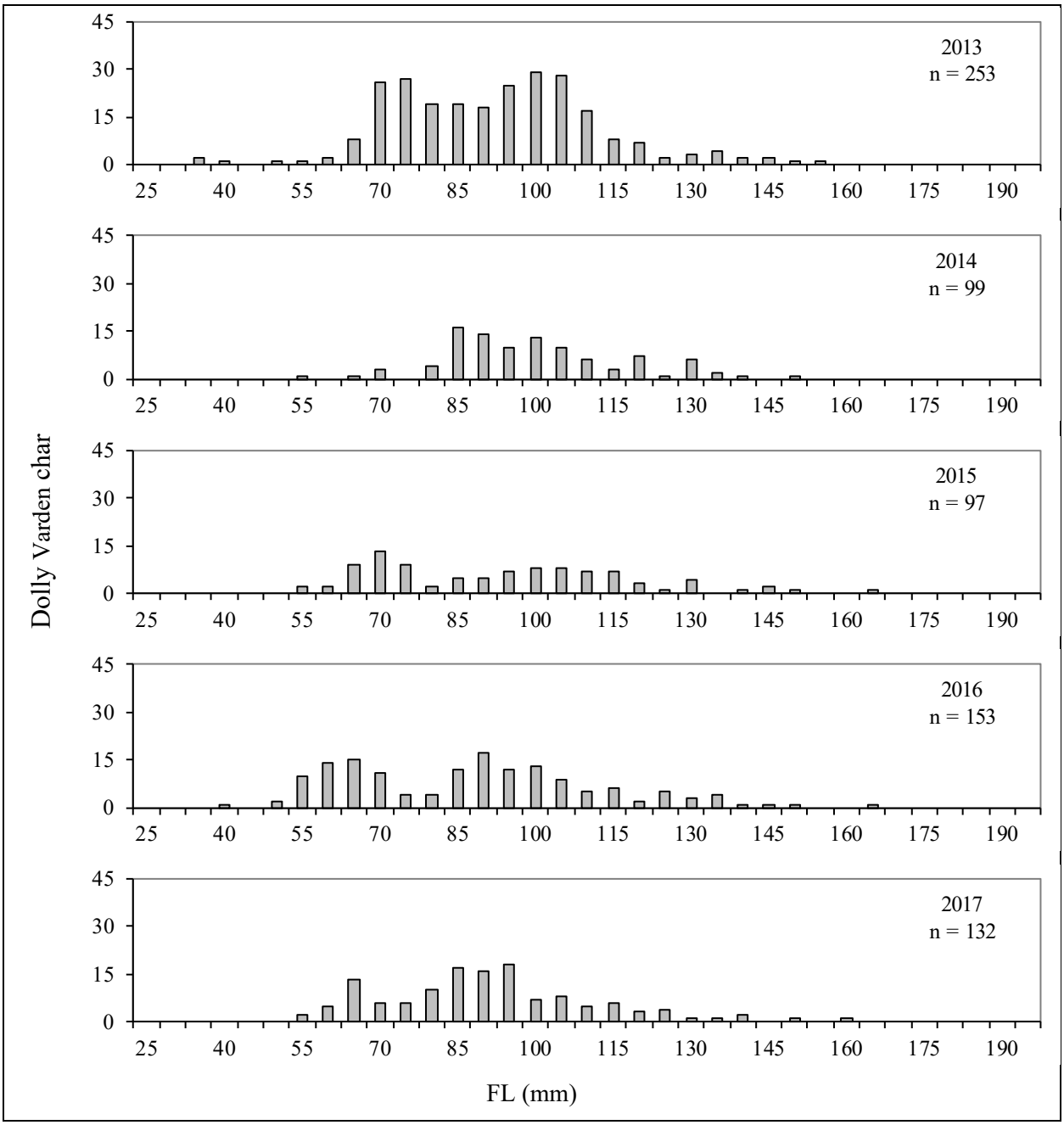
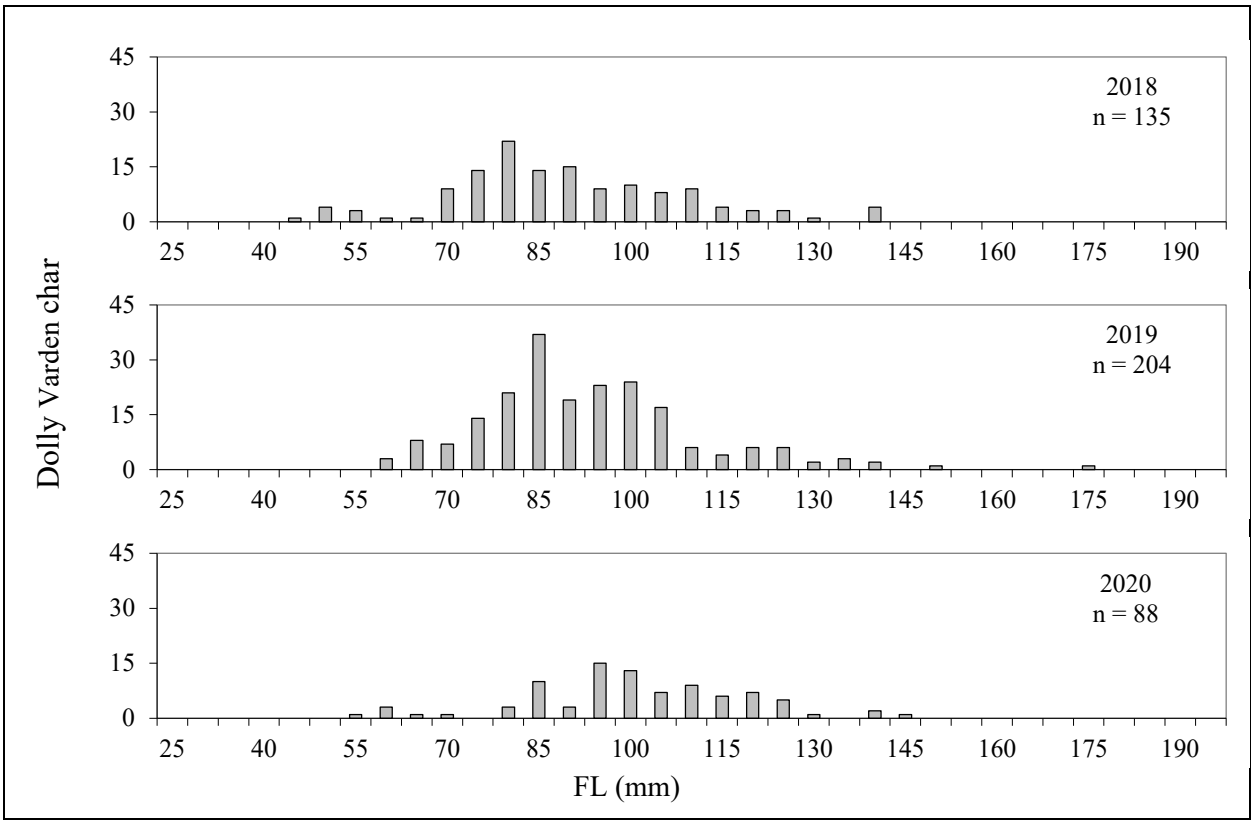

Dolly Varden char
2007
n = 95
2008
n = 73
2009
n = 125
2010
n = 158
2011
n = 125
2012
n = 135
45
30
15
0
25 40 55 70 85 100 115 130 145 160 175 190
FL (mm)

-continued-

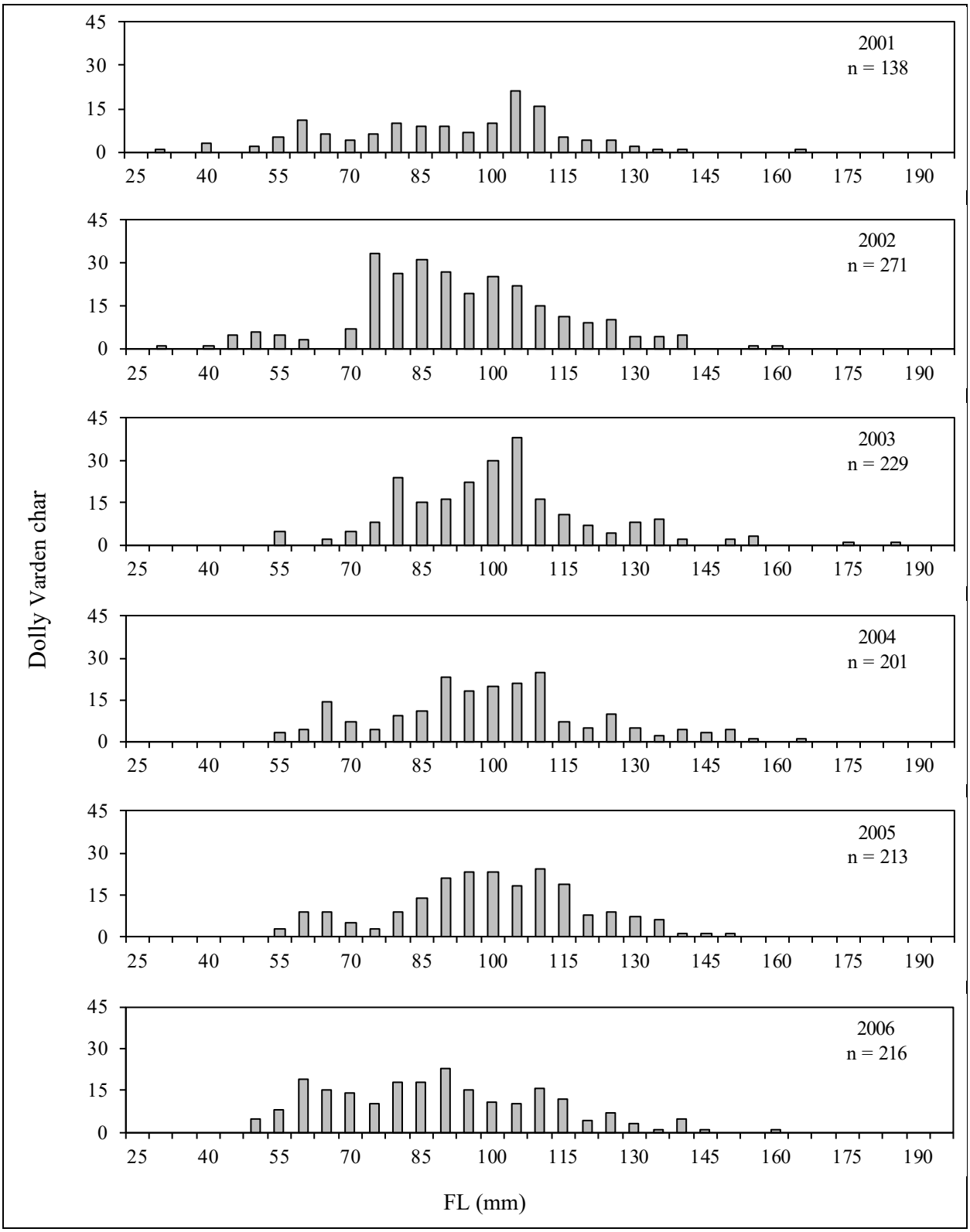

Dolly Varden char
2013
n = 253
2014
n = 99
2015
n = 97
2016
n = 153
2017
n = 132
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

Appendix C.8.–Greens Creek Site 63 Dolly Varden char length frequency distributions, 2018–2020.



Note: From 2001 through 2019, three consecutive trapping events compose sample populations while one trapping event composes the sample population in 2020.

Appendix C.9.–Greens Creek Site 54 Dolly Varden char length frequency distributions, 2001–2020.



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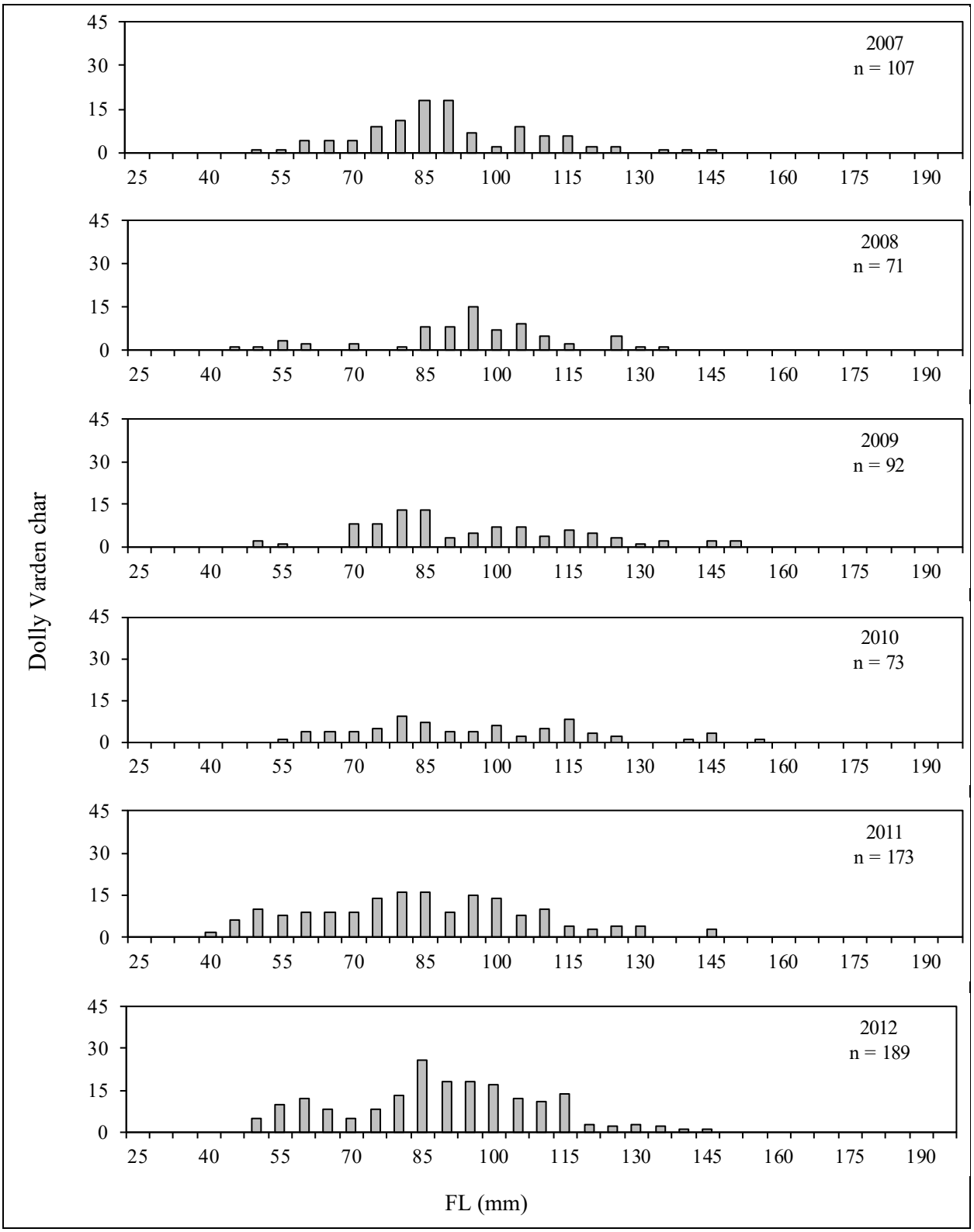
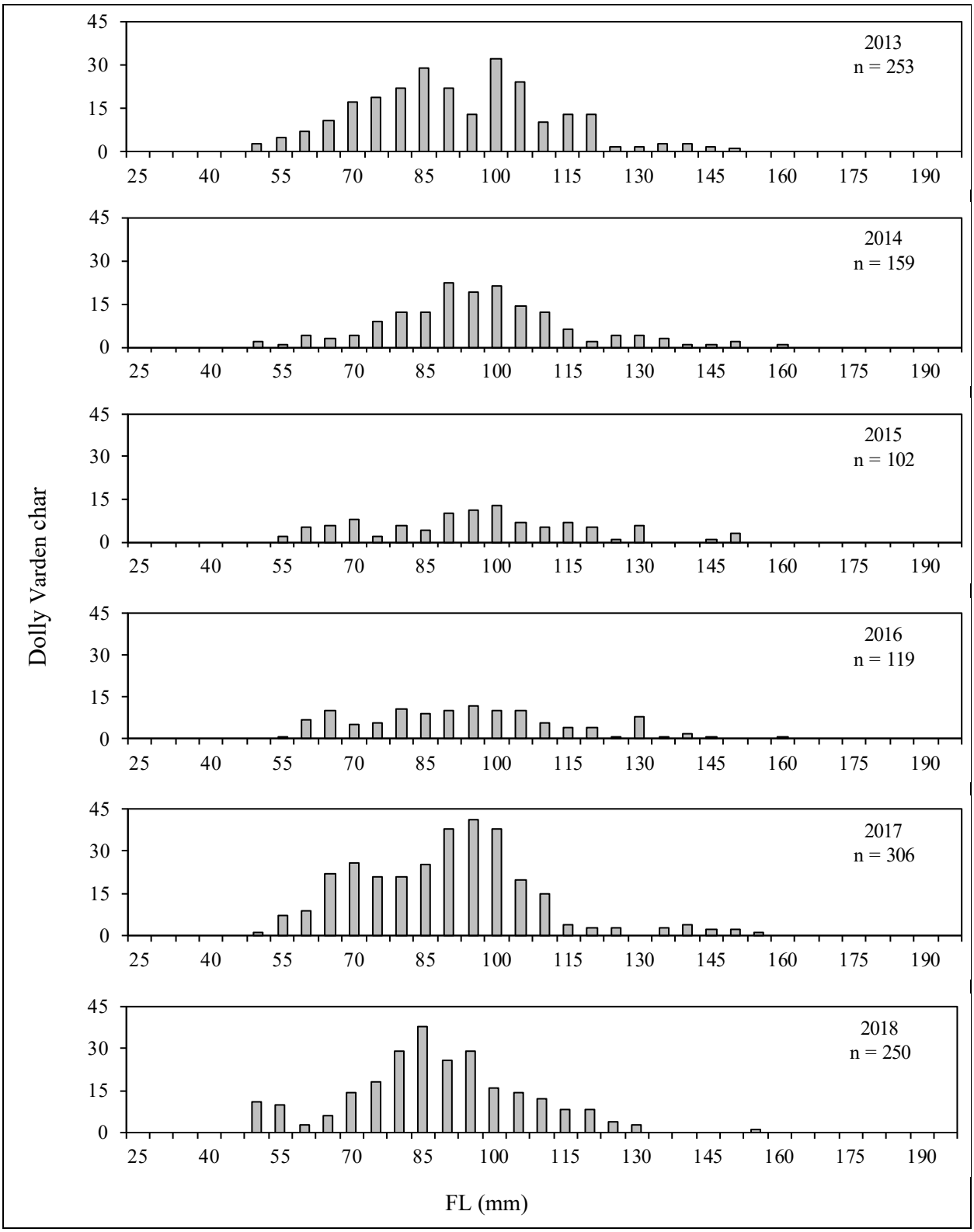
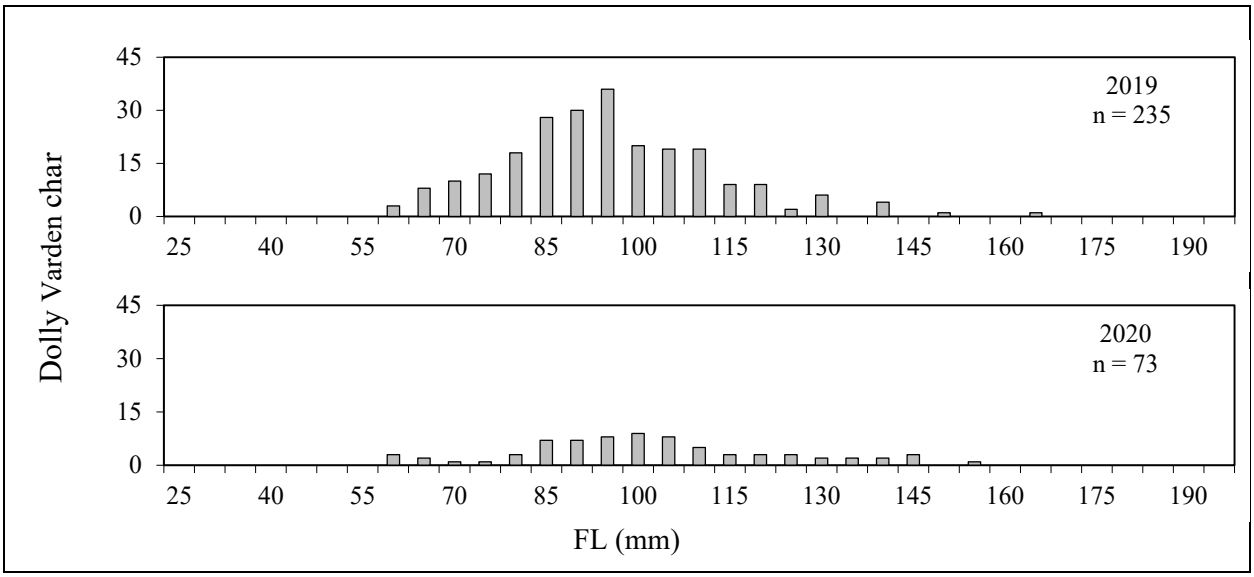

Dolly Varden char
2007
n = 107
2008
n = 71
2009
n = 92
2010
n = 73
2011
n = 173
2012
n = 189
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

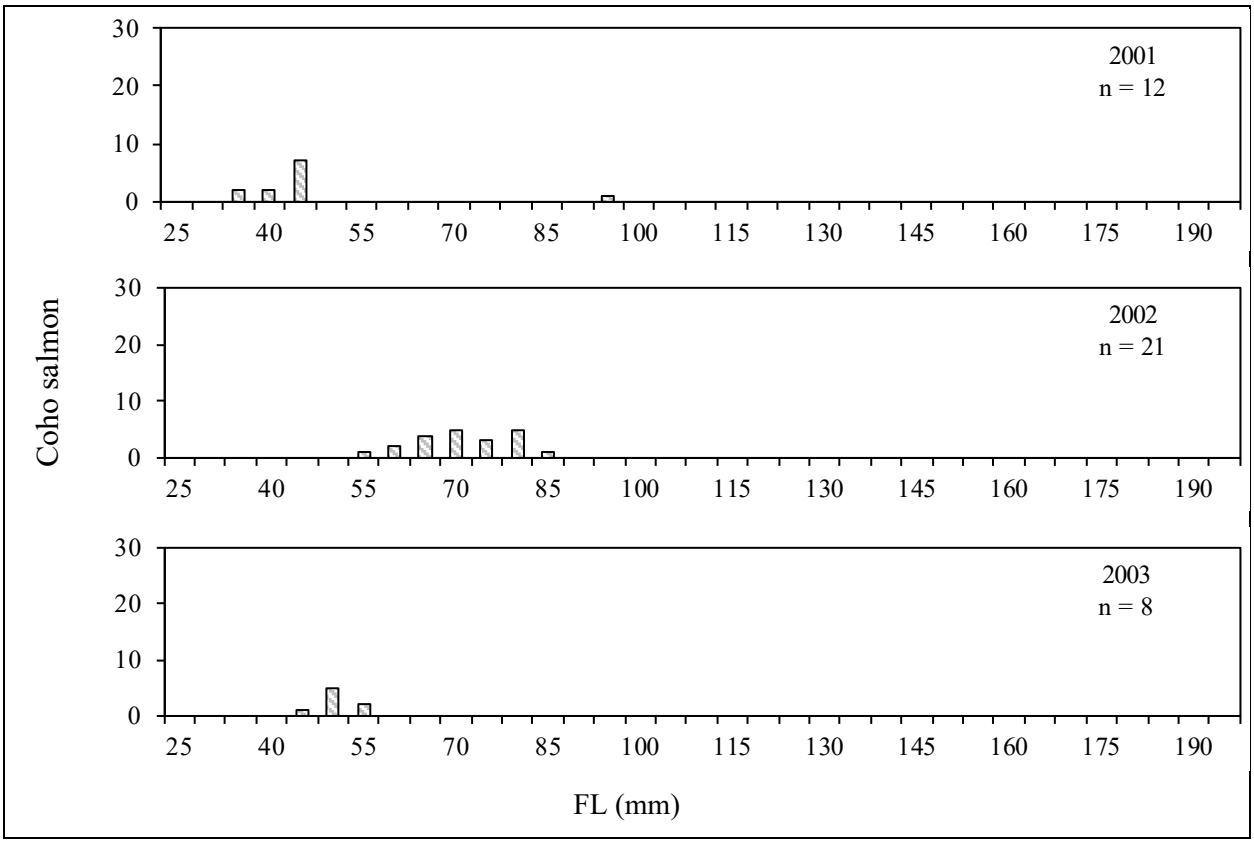

Dolly Varden char
2013
n = 253
2014
n = 159
2015
n = 102
2016
n = 119
2017
n = 306
2018
n = 250
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Note: From 2001 through 2019, three consecutive trapping events compose sample populations while one trapping event composes the sample population in 2020.

Appendix C.10.–Greens Creek Site 54 coho salmon length frequency distributions, 2001–2020.



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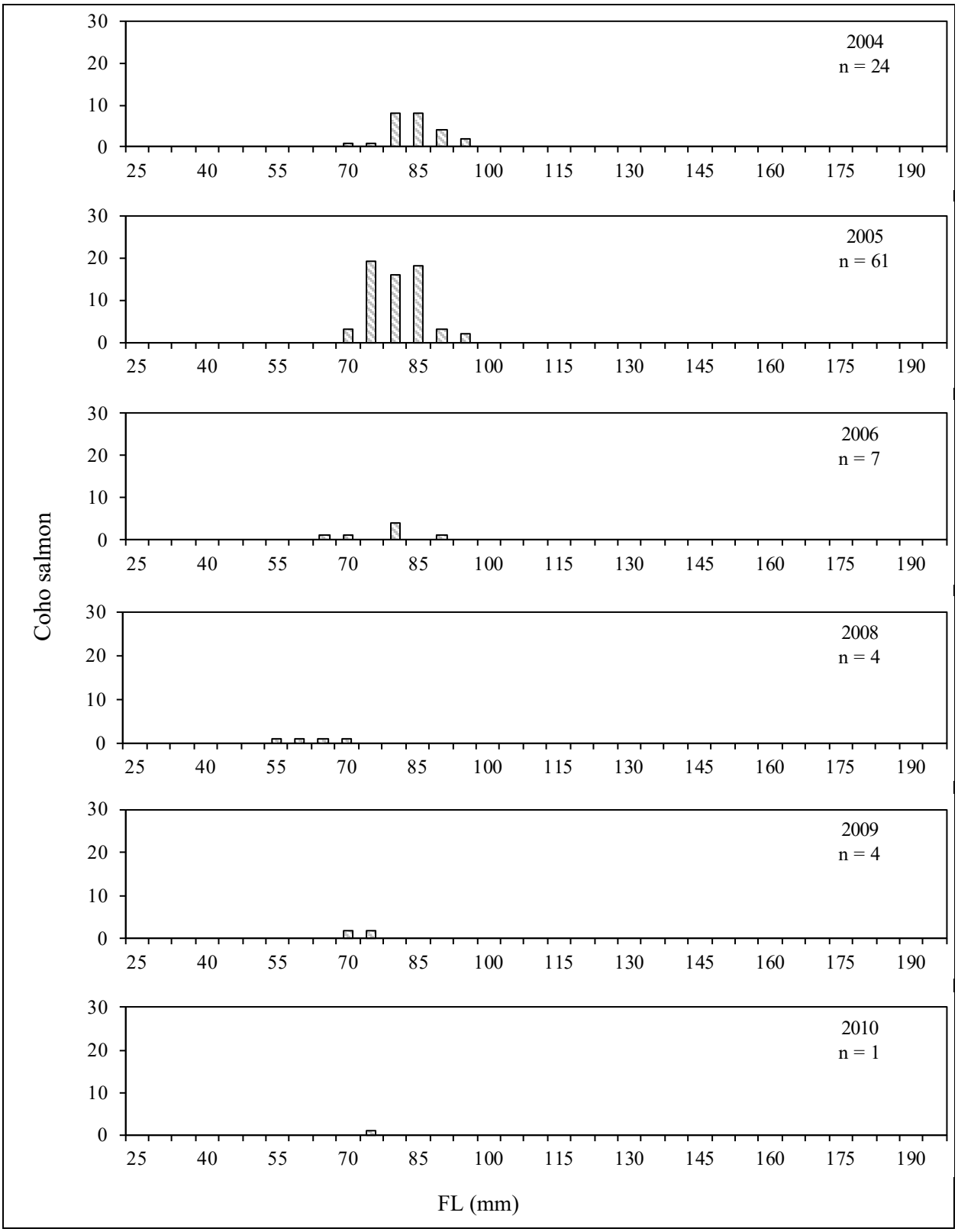
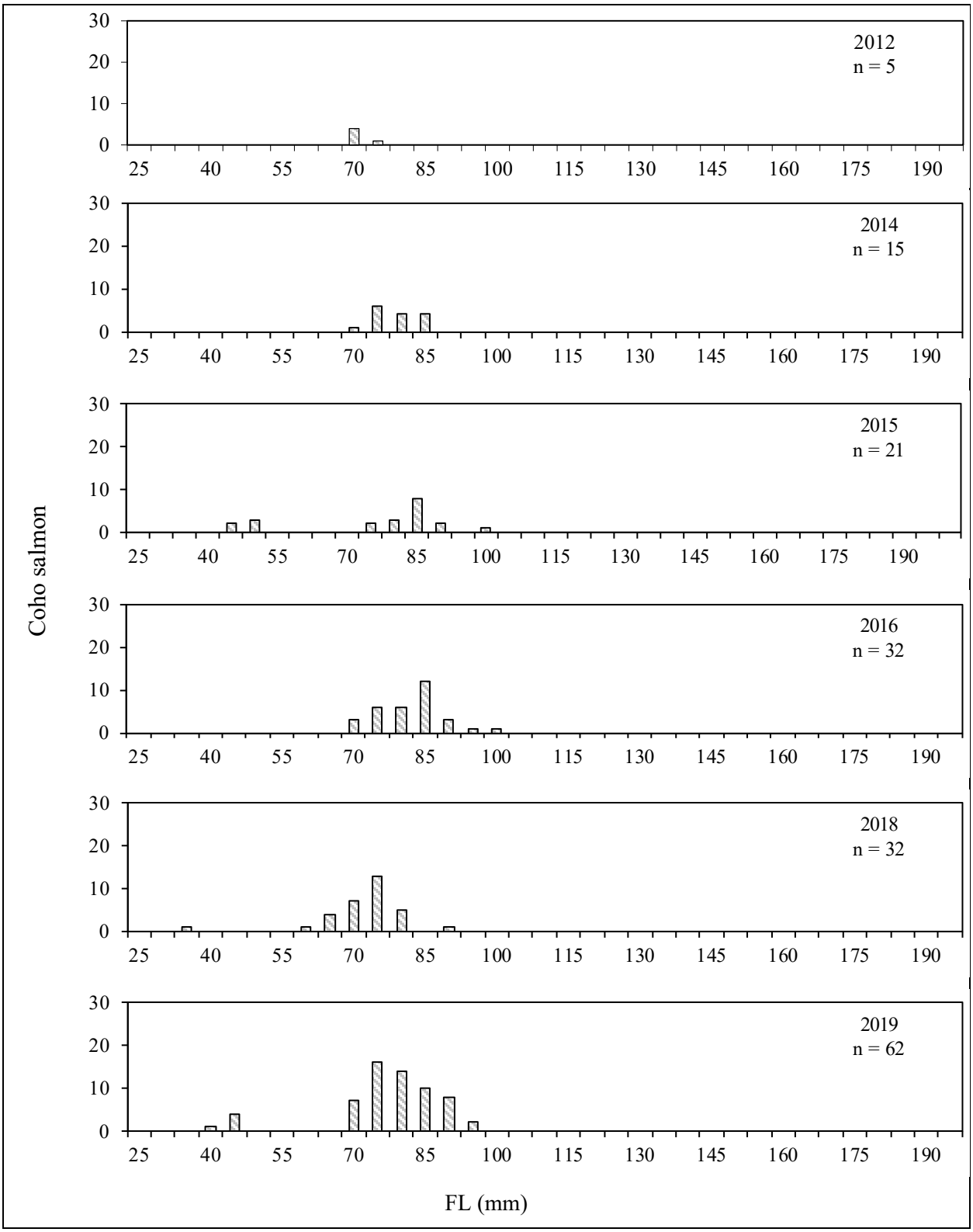
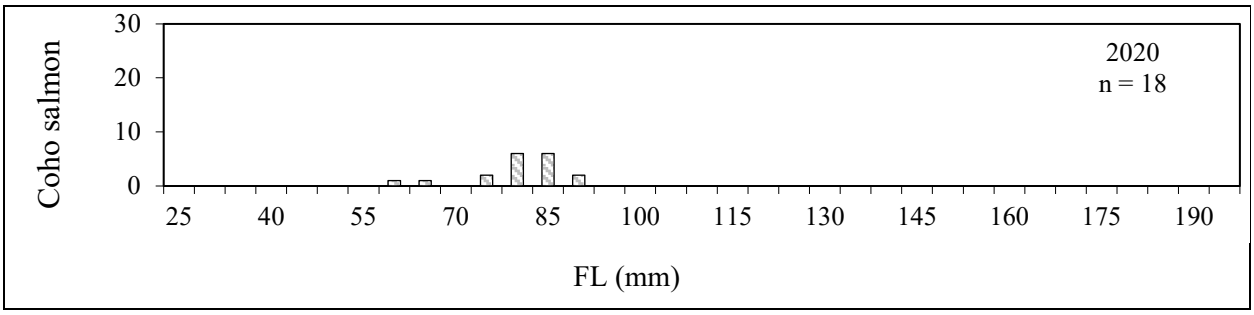

Coho salmon
2004
n = 24
2005
n = 61
2006
n = 7
2008
n = 4
2009
n = 4
2010
n = 1
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

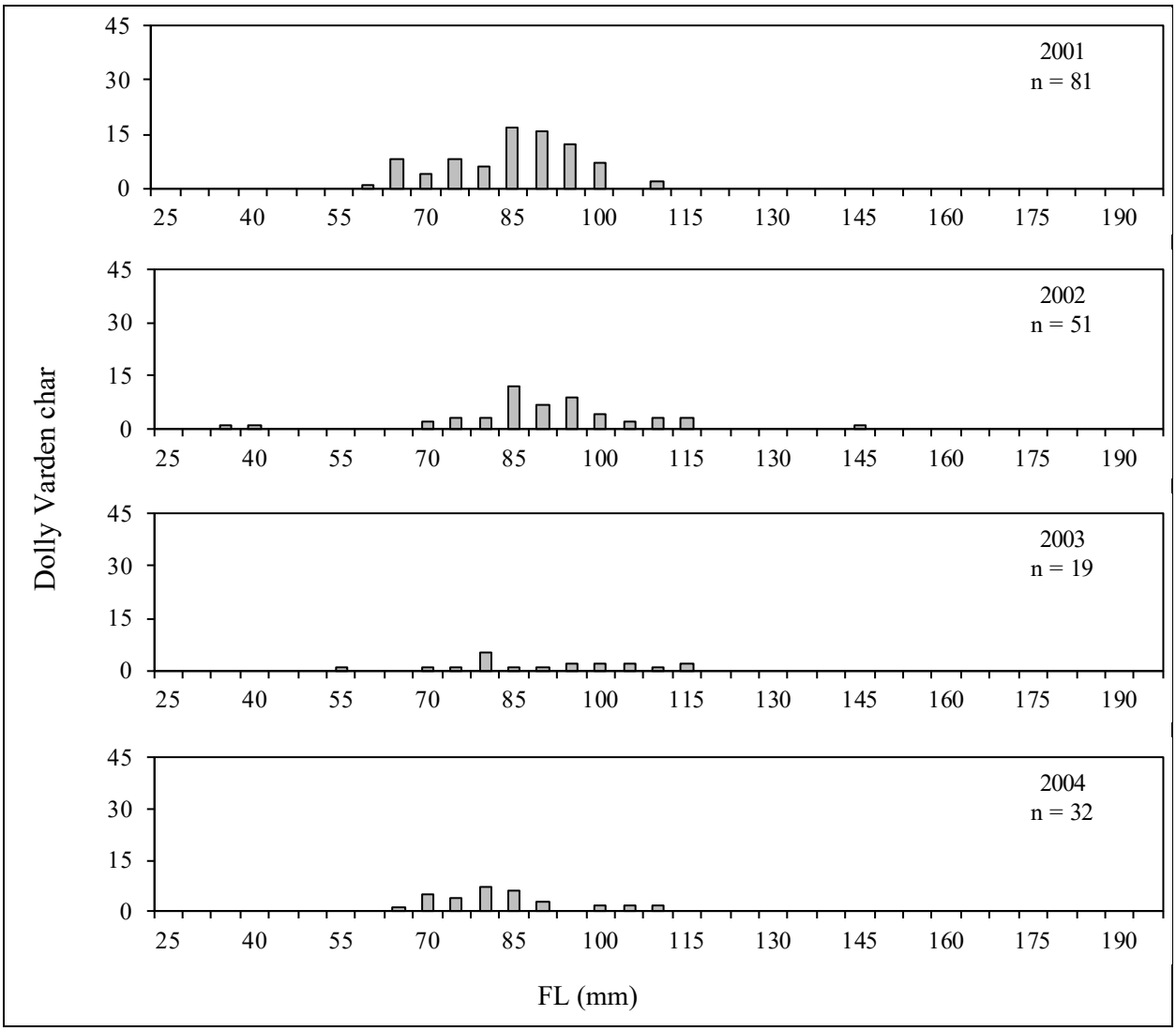

Coho salmon
2012
n = 5
2014
n = 15
2015
n = 21
2016
n = 32
2018
n = 32
2019
n = 62
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Note: From 2001 through 2019, three consecutive trapping events compose sample populations while one trapping event composes the sample population in 2020.

Appendix C.11.–Tributary Creek Site 9 Dolly Varden char length frequency distributions, 2001–2020.



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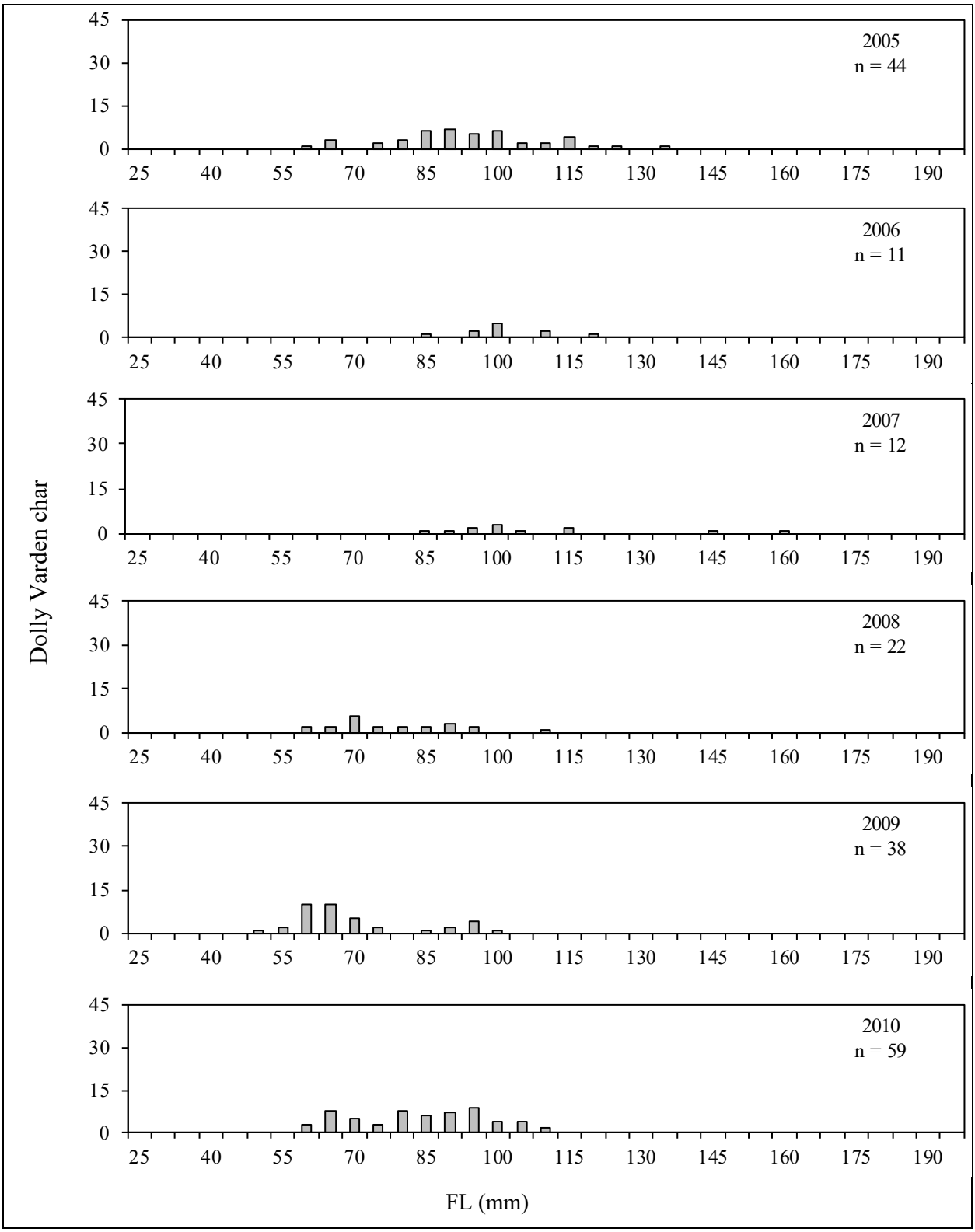
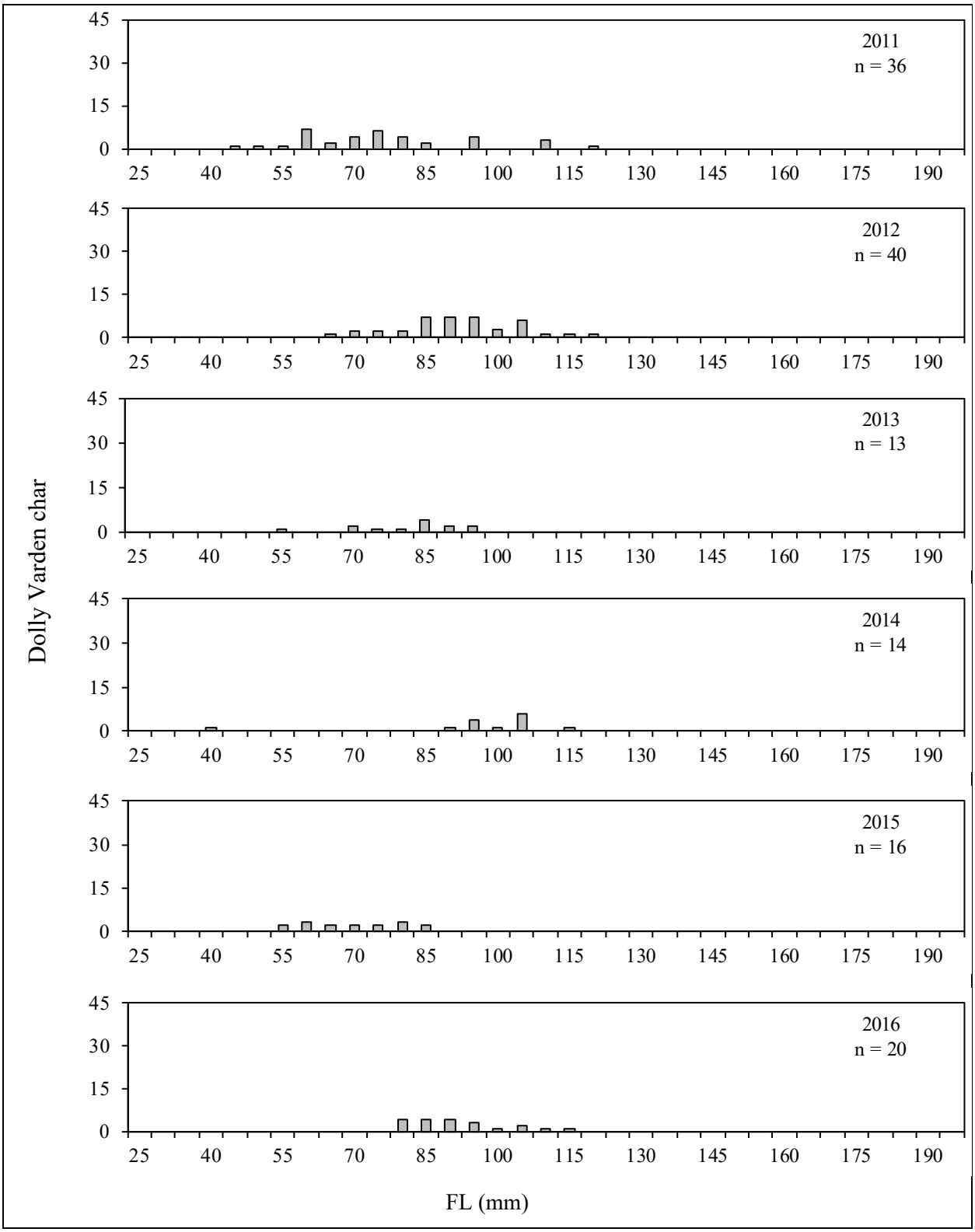
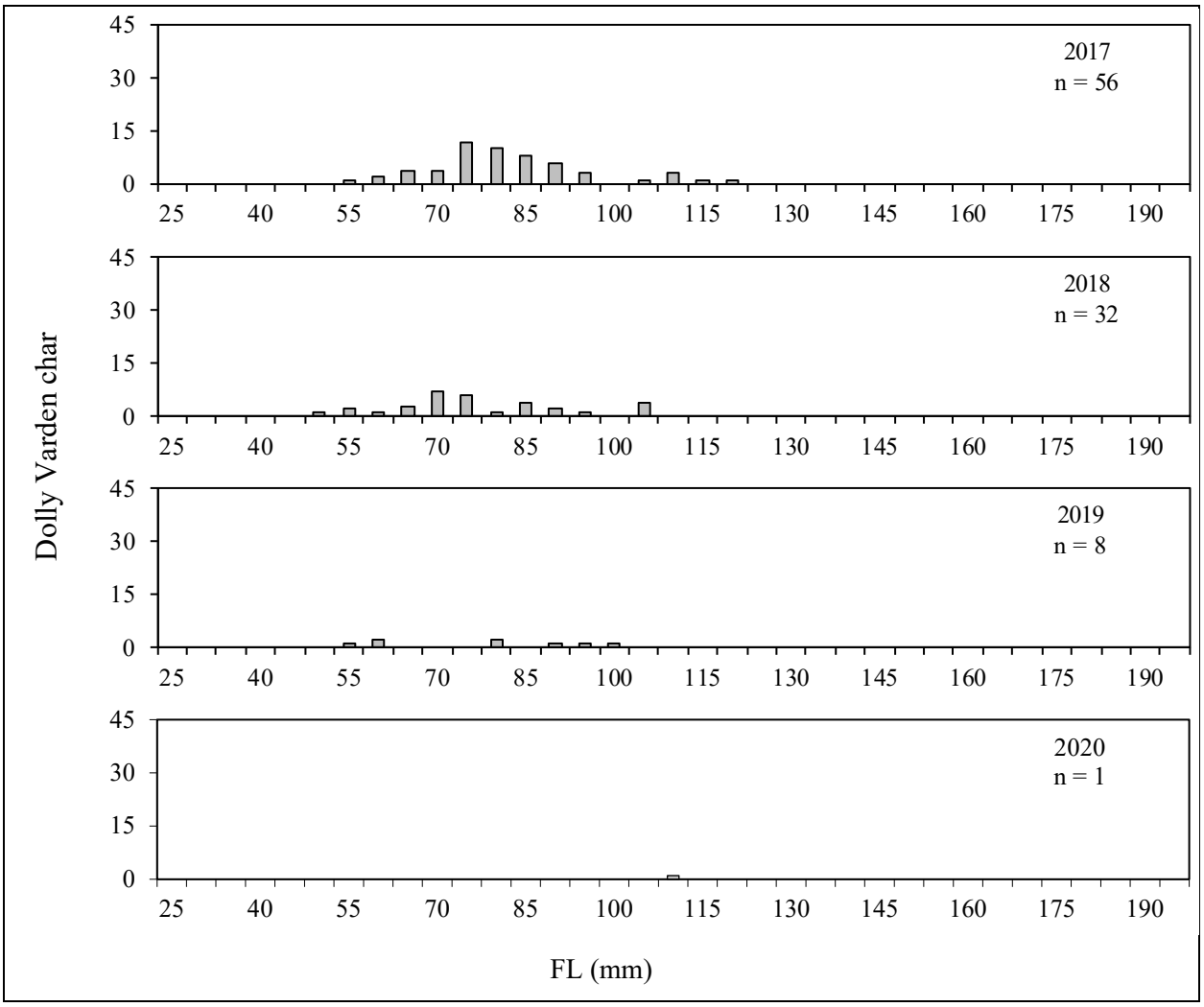

Dolly Varden char
2005
n = 44
2006
n = 11
2007
n = 12
2008
n = 22
2009
n = 38
2010
n = 59
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

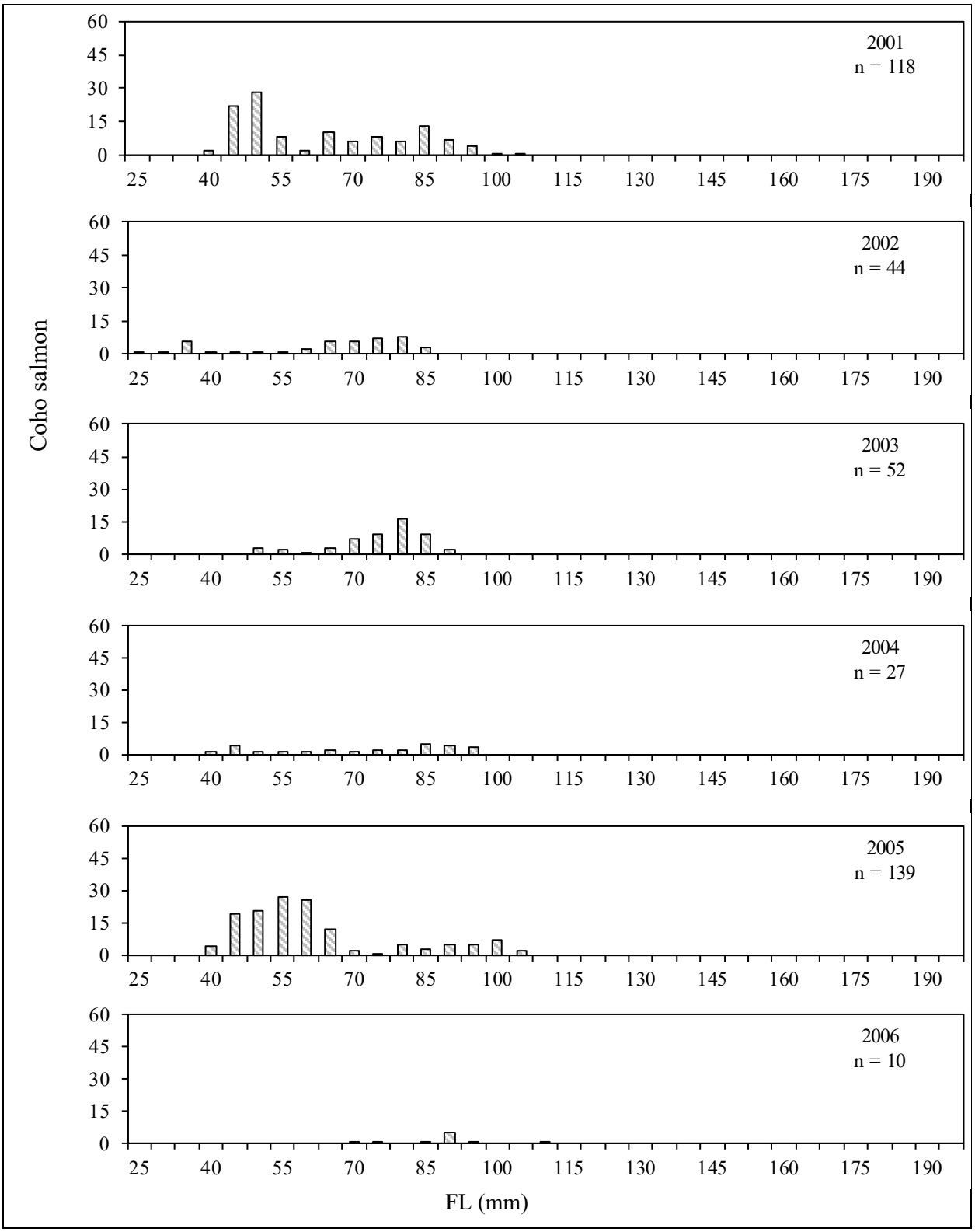

Dolly Varden char
2011
n = 36
2012
n = 40
2013
n = 13
2014
n = 14
2015
n = 16
2016
n = 20
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Note: From 2001 through 2019, three consecutive trapping events compose sample populations while one trapping event composes the sample population in 2020.

Appendix C.12.–Tributary Creek Site 9 coho salmon length frequency distributions, 2001–2020.



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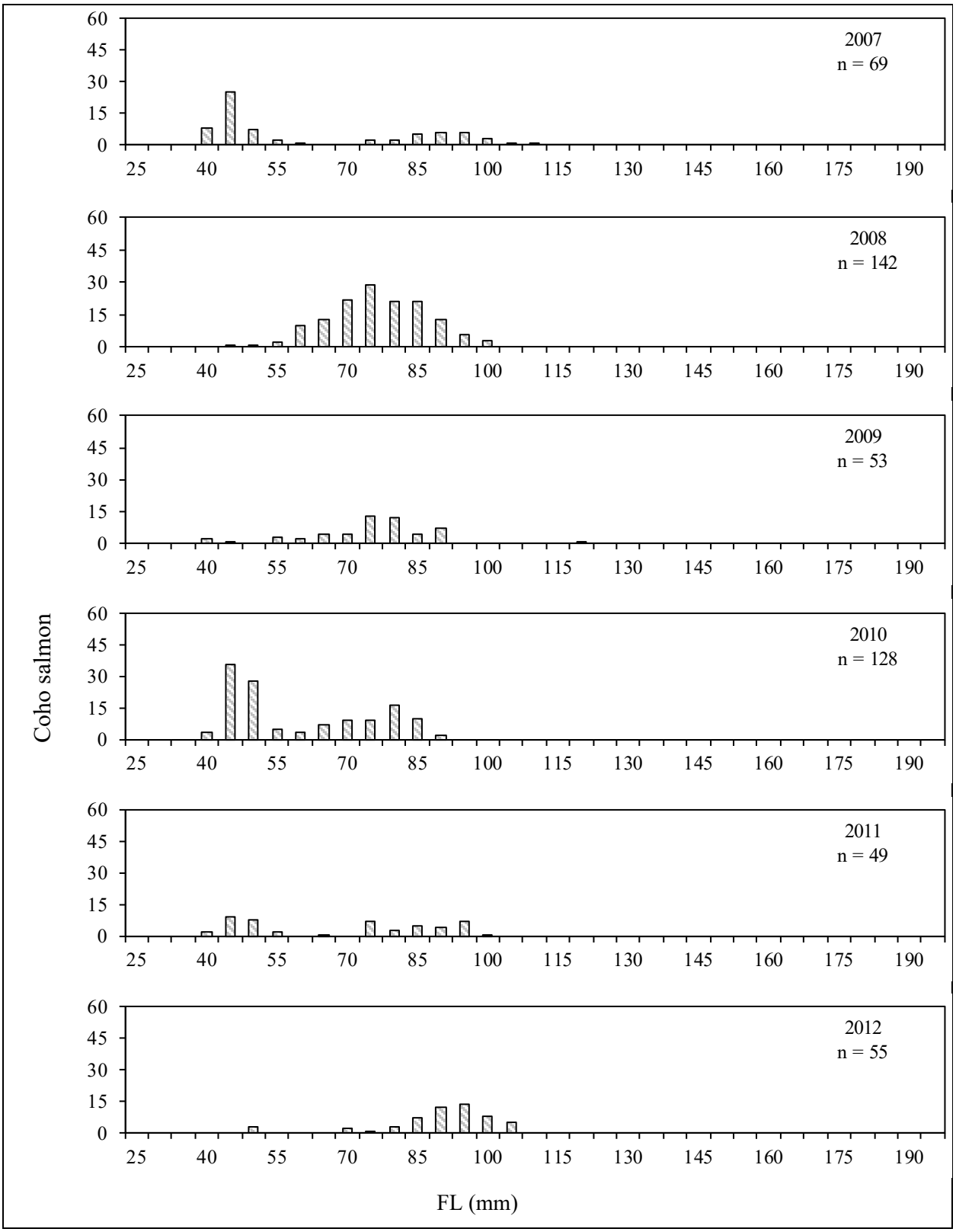
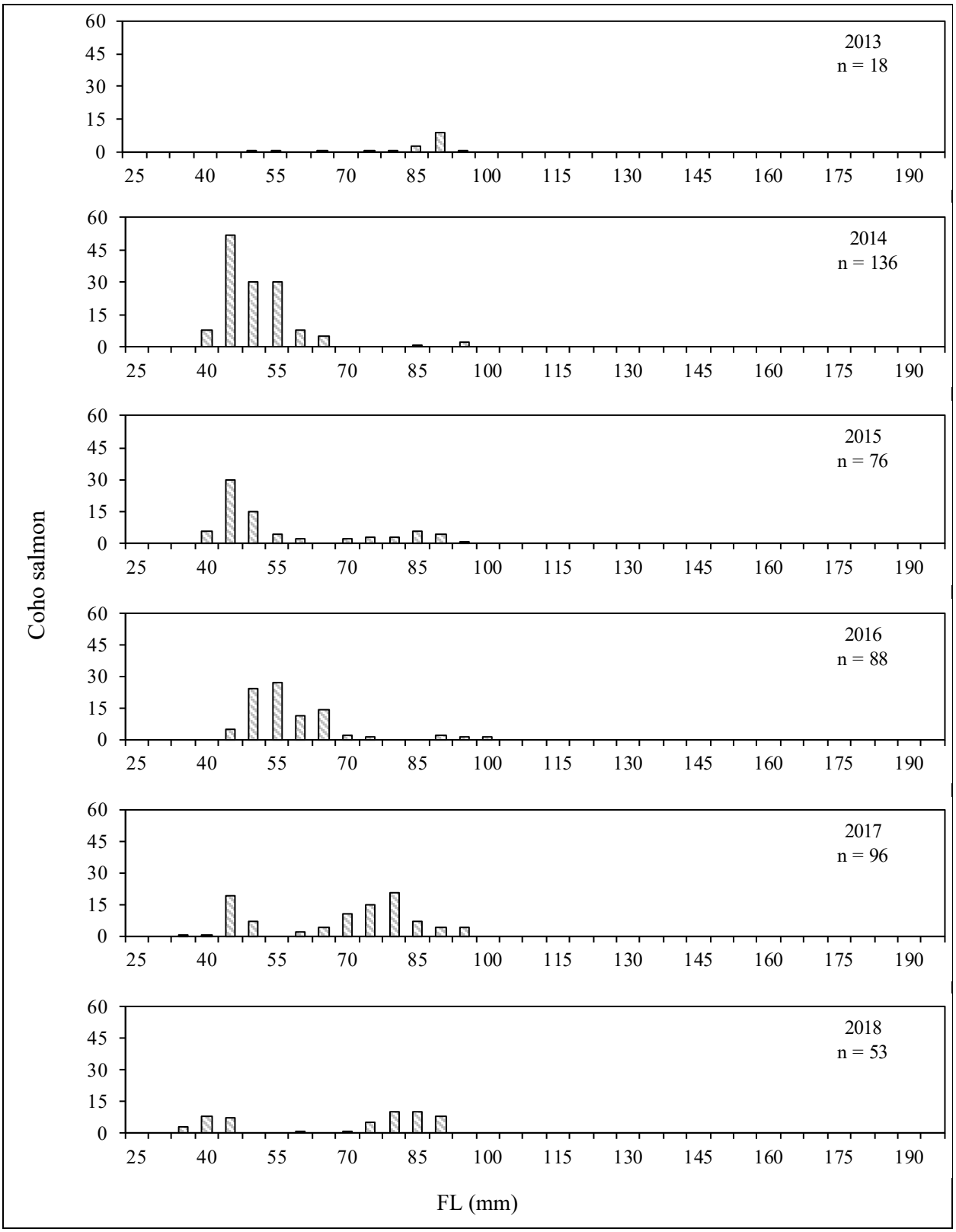
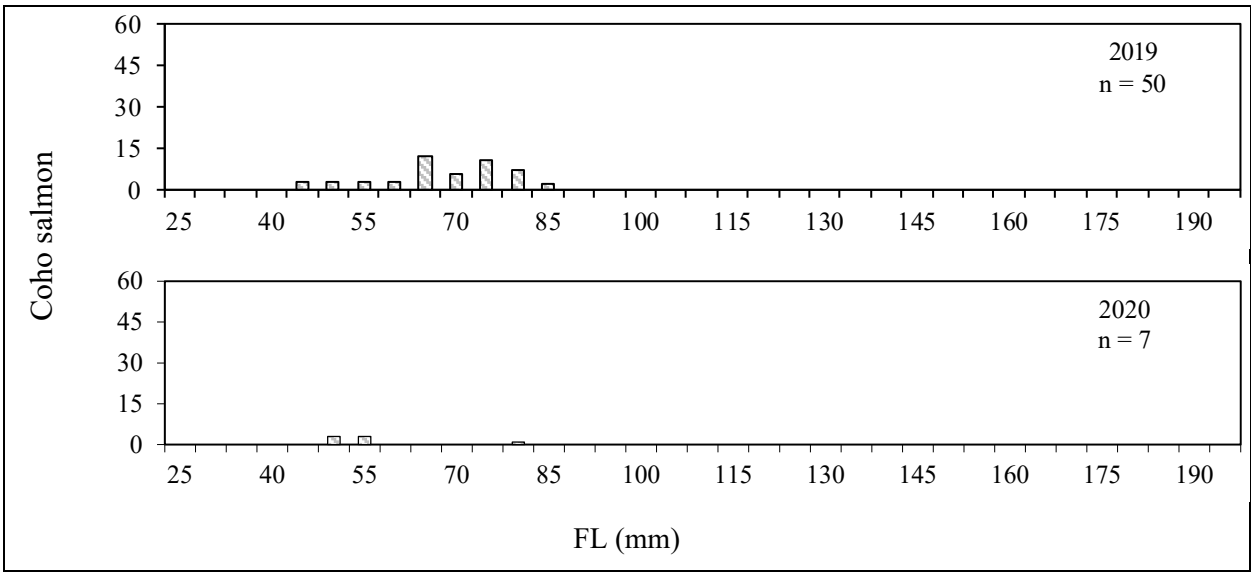

Coho salmon
2007
n = 69
2008
n = 142
2009
n = 53
2010
n = 128
2011
n = 49
2012
n = 55
0
15
30
45
60
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2013
n = 18
2014
n = 136
2015
n = 76
2016
n = 88
2017
n = 96
2018
n = 53
0
15
30
45
60
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-



Note: From 2001 through 2019, three consecutive trapping events compose sample populations while one trapping event composes the sample population in 2020.

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, 2018–2020.

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
07/16/20	125	20.6	0.027	1.31	4.7	0.267	0.59	5.9	271
07/16/20	125	18.1	0.034	0.91	4.9	0.244	0.21	5.4	224
07/16/20	100	10.5	0.029	1.18	5.2	0.153	0.21	5.2	219
07/16/20	124	17.4	0.058	1.15	12.4	0.174	1.81	4.7	204
07/16/20	129	18.8	0.039	1.04	4.9	0.190	0.61	5.2	204
07/16/20	109	11.4	0.053	1.33	4.7	0.195	1.28	6.3	290
07/16/20	119	14.3	0.040	1.09	6.4	0.240	0.77	5.8	269
07/16/20	95	7.8	0.023	1.03	4.6	0.203	0.50	7.2	190
07/16/20	97	7.5	0.027	1.57	6.0	0.176	0.62	5.3	357
07/16/20	105	12.7	0.021	1.35	5.8	0.202	0.33	6.2	311

Appendix D.3.–Greens Creek Site 54 Dolly Varden char element concentrations, 2001–2020.

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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Appendix D.3.–Page 4 of 4.

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
07/16/20	92	7.1	0.027	1.97	4.95	0.192	0.279	5.83	304
07/16/20	98	9.6	0.035	1.88	6.5	0.193	0.322	4.83	241
07/16/20	100	10.7	0.022	0.867	3.66	0.132	0.33	9.22	198
07/16/20	126	17.7	0.022	1.05	4.13	0.148	0.729	7.39	211
07/16/20	116	14.2	0.035	1.61	4.43	0.224	0.581	6.76	193
07/16/20	92	7.6	0.033	0.88	4.5	0.153	3.97	5.5	207
07/16/20	112	14.2	0.037	0.963	5.1	0.197	0.352	6.08	212
07/16/20	110	11.8	0.035	0.896	5.23	0.183	0.257	6.27	251
07/16/20	104	11.9	0.052	1.23	5.85	0.175	0.721	6.33	210
07/16/20	102	9.8	0.037	1.02	4.68	0.108	0.463	7.13	188

Appendix D.4.–Tributary Creek Site 9 Dolly Varden char element concentrations, 2001–2020.

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
07/15/20	112	13.6	0.113	0.81	2.79	0.611	1.230	7.19	108
07/15/20	161	41.7	0.262	1.810	3.89	0.476	1.970	5.8	176
07/15/20	120	16.9	0.616	4.52	6.35	0.383	4.920	10.9	222
07/15/20	98	10.2	0.381	2.720	5.99	0.462	3.190	11.2	130
07/15/20	119	19.2	0.517	2.78	7.04	0.489	4.78	13.8	173
07/15/20	93	7.7	1.47	4.87	6.31	0.487	4.04	11.4	274
07/15/20	87	6.6	0.357	1.68	6.68	0.425	3.93	9.31	163

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January 20, 2021

Analytical Report for Service Request No: K2007936
Revised Service Request No: K2007936.01

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

RE: 2020 Greens Creek Biomonitoring

Dear Bill,

Enclosed is the revised report for the sample(s) submitted to our laboratory September 10, 2020 For your reference, these analyses have been assigned our service request number **K2007936.**

The missing mercury results are now included. Also, the results for selenium were missing from the SRM reports-those have been corrected.

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.

We apologize for any inconvenience this may have created.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

REVISED
3:27 pm, Jan 20, 2021

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Acronyms

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

Inorganic Data Qualifiers

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

Metals Data Qualifiers

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

Organic Data Qualifiers

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

Additional Petroleum Hydrocarbon Specific Qualifiers

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

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

Agency	Web Site	Number
Alaska 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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ALS Environmental

Client: Alaska Department of Fish and Game
Project: 2020 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2007936
Date Received: 09/10/2020

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 II level requested by the client.

Sample Receipt:

Twenty seven animal tissue samples were received for analysis at ALS Environmental on 09/10/2020. 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:

Method 6020A, 10/16/2020: Method Blanks KQ2015603-01 and KQ2015605-01 contained low levels of Copper above the Method Reporting Limit (MRL). All but three samples associated with these Method Blanks contained Copper at levels greater than ten times the blank levels. For these samples no additional corrective action was required. The three samples affected by the Method Blank detections were re-digested and re-analyzed.

Method 6020A, 10/16/2020: The matrix spike recovery of Zinc for sample Tributary Creek Site 9 DV Metals Fish #2 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

Approved by _____ Date 10/22/2020

Chain of Custody

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CHAIN OF CUSTODY

SR# K2007936

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

PAGE 1 OF 2 COC#

PROJECT NAME: 2020 Greens Creek Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Bill Kane
COMPANY NAME: AK Dept. of Fish + Game
ADDRESS: 802 3rd St.
CITY/STATE/ZIP: Douglas, AK 99824
E-MAIL ADDRESS: william.kane@alaska.gov
PHONE #: 907.465.6474 FAX #:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, Total or Dissolved (See List below)	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO_4, P, 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	Alkalinity☐ CO_3☐ HCO_3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐	CO_2☐			REMARKS
See attachment 1 of 1 for					27								X		6020A							X	Hg-1631E		
Whole body juvenile fish																									
individual samples																									

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
CWallace@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 Bill Kane and Chris Wallace

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

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time 9/8/20 0800	Signature	Date/Time 9/10/20	Signature	Date/Time	Signature	Date/Time
Printed Name Bill Kane	Firm ADF&G	Printed Name	Firm ACS 1041	Printed Name	Firm	Printed Name	Firm

Attachment 1 of 1

Project Name:	2020 Greens Creek Mine Biomonitoring		
Project Manager:	Bill Kane	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:	william.kane@alaska.gov; (907) 465-6474		

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #1	2020TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	112	13.6
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #2	2020TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	161	41.7
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #3	2020TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	120	16.9
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #4	2020TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	10.2
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #5	2020TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	119	19.2
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #6	2020TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	7.7
Whole Body	7/15/2020	Tributary Creek Site 9 DV Metals Fish #7	2020TC9DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	6.6
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #1	2020GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	92	7.1
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #2	2020GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	9.6
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #3	2020GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.7
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #4	2020GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	126	17.7
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #5	2020GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	116	14.2
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #6	2020GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	92	7.6
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #7	2020GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	112	14.2
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #8	2020GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	110	11.8
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #9	2020GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	11.9
Whole Body	7/16/2020	Greens Creek Site 54 DV Metals Fish #10	2020GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	102	9.8
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #1	2020GC63DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	125	20.6
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #2	2020GC63DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	125	18.1
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #3	2020GC63DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.5
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #4	2020GC63DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	124	17.4
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #5	2020GC63DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	129	18.8
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #6	2020GC63DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	109	11.4
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #7	2020GC63DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	119	14.3
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #8	2020GC63DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	7.8
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #9	2020GC63DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	7.5
Whole Body	7/16/2020	Greens Creek Site 63 DV Metals Fish #10	2020GC63DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	12.7

PM MH

Cooler Receipt and Preservation Form

Client AK Dept of Fish & Game Service Request K2007936

Received: 9/10/20 Opened: 9/10/20 By: Unloaded: 9/10/20 By:

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 Front
   If present, were custody seals intact? (Y) N If present, were they signed and dated? (Y) N
4. Was a Temperature Blank present in cooler? NA (Y) N If yes, notate the temperature in the appropriate column below:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA Y (N)
   If no, were they received on ice and same day as collected? If not, notate the cooler # below and notify the PM. NA Y (N)

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
14.8	—	IR02	1907	X	Y	2966 0398 3582	

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

Sample ID on Bottle	Sample ID on COC	Identified by:

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

Notes, Discrepancies, Resolutions:_____

Total Solids

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20 - 07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
Tributary Creek Site 9 DV Metals Fish #1	K2007936-001	**24.3**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #2	K2007936-002	**19.7**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #3	K2007936-003	**16.0**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #4	K2007936-004	**22.7**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #5	K2007936-005	**23.7**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #6	K2007936-006	**20.4**	-	-	1	10/12/20	
Tributary Creek Site 9 DV Metals Fish #7	K2007936-007	**21.7**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #1	K2007936-008	**20.3**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #2	K2007936-009	**21.9**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #3	K2007936-010	**21.6**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #4	K2007936-011	**22.8**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #5	K2007936-012	**21.1**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #6	K2007936-013	**22.0**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #7	K2007936-014	**22.5**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #8	K2007936-015	**21.4**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #9	K2007936-016	**20.7**	-	-	1	10/12/20	
Greens Creek Site 54 DV Metals Fish #10	K2007936-017	**23.5**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #1	K2007936-018	**20.8**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #2	K2007936-019	**21.6**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #3	K2007936-020	**22.2**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #4	K2007936-021	**28.5**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #5	K2007936-022	**23.5**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #6	K2007936-023	**20.9**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #7	K2007936-024	**21.7**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #8	K2007936-025	**23.6**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #9	K2007936-026	**22.0**	-	-	1	10/12/20	
Greens Creek Site 63 DV Metals Fish #10	K2007936-027	**21.0**	-	-	1	10/12/20	

Metals

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REVISED
3:28 pm, Jan 20, 2021

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15-07/16/20
Sample Matrix:	Animal tissue	**Date Received:**	09/10/20

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
Tributary Creek Site 9 DV Metals Fish #1	K2007936-001	9.5	0.86	10	10/16/20	10/19/20	611	
Tributary Creek Site 9 DV Metals Fish #2	K2007936-002	10.0	0.90	10	10/16/20	10/19/20	476	
Tributary Creek Site 9 DV Metals Fish #3	K2007936-003	9.9	0.89	10	10/16/20	10/19/20	383	
Tributary Creek Site 9 DV Metals Fish #4	K2007936-004	9.6	0.86	10	10/16/20	10/19/20	462	
Tributary Creek Site 9 DV Metals Fish #5	K2007936-005	9.9	0.89	10	10/16/20	10/19/20	489	
Tributary Creek Site 9 DV Metals Fish #6	K2007936-006	9.7	0.87	10	10/16/20	10/19/20	487	
Tributary Creek Site 9 DV Metals Fish #7	K2007936-007	9.8	0.88	10	10/16/20	10/19/20	425	
Greens Creek Site 54 DV Metals Fish #1	K2007936-008	9.9	0.89	10	10/16/20	10/19/20	192	
Greens Creek Site 54 DV Metals Fish #2	K2007936-009	9.8	0.88	10	10/16/20	10/19/20	193	
Greens Creek Site 54 DV Metals Fish #3	K2007936-010	9.9	0.89	10	10/16/20	10/19/20	132	
Greens Creek Site 54 DV Metals Fish #4	K2007936-011	9.9	0.89	10	10/16/20	10/19/20	148	
Greens Creek Site 54 DV Metals Fish #5	K2007936-012	9.8	0.88	10	10/16/20	10/19/20	224	
Greens Creek Site 54 DV Metals Fish #6	K2007936-013	9.8	0.88	10	10/16/20	10/19/20	153	
Greens Creek Site 54 DV Metals Fish #7	K2007936-014	9.7	0.87	10	10/16/20	10/19/20	197	
Greens Creek Site 54 DV Metals Fish #8	K2007936-015	9.8	0.88	10	10/16/20	10/19/20	183	
Greens Creek Site 54 DV Metals Fish #9	K2007936-016	9.5	0.85	10	10/16/20	10/19/20	175	
Greens Creek Site 54 DV Metals Fish #10	K2007936-017	9.5	0.85	10	10/16/20	10/19/20	108	
Greens Creek Site 63 DV Metals Fish #1	K2007936-018	10.0	0.90	10	10/16/2020	10/19/2020	267	
Greens Creek Site 63 DV Metals Fish #2	K2007936-019	9.8	0.88	10	10/16/2020	10/19/2020	244	
Greens Creek Site 63 DV Metals Fish #3	K2007936-020	9.7	0.87	10	10/16/2020	10/19/2020	153	
Method Blank 1	K2007636-MB1	1.0	0.09	1	10/16/2020	10/19/2020	ND	
Method Blank 2	K2007636-MB2	1.0	0.09	1	10/16/2020	10/19/2020	ND	
Method Blank 3	K2007636-MB3	1.0	0.09	1	10/16/2020	10/19/2020	ND	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal tissue	**Date Received:**	09/10/20
		Date Extracted:	10/16/20
		Date Analyzed:	10/19/20

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	Units:	ng/g
Lab Code:	K2007936-002MS, K2007936-002DMS	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	ALS Acceptance Limits	Relative Percent Difference	Result Notes
Mercury	METHOD	1631E	9.8	244	244	476	725	706	102	94	70-130	3	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal tissue	**Date Received:**	09/10/20
		Date Extracted:	10/16/20
		Date Analyzed:	10/19/20

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #3	Units:	ng/g
Lab Code:	K2007936-003MS, K2007936-003DMS	Basis:	Dry
Test Notes:			

									Percent Recovery				
	Prep	Analysis		Spike Level		Sample	Spike Result				ALS Acceptance	Relative Percent	Result
Analyte	**Method**	**Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	9.6	243	241	383	614	612	95	95	70-130	<1	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/19/20

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	5.40	108	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/19/20

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	5.31	106	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	10/16/20
		Date Analyzed:	10/19/20

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: TORT-3

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

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal tissue	**Date Received:**	09/10/20

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
Greens Creek Site 63 DV Metals Fish #4	K2007936-021	9.7	0.87	10	10/16/20	10/19/20	174	
Greens Creek Site 63 DV Metals Fish #5	K2007936-022	9.9	0.89	10	10/16/20	10/19/20	190	
Greens Creek Site 63 DV Metals Fish #6	K2007936-023	9.9	0.89	10	10/16/20	10/19/20	195	
Greens Creek Site 63 DV Metals Fish #7	K2007936-024	10.0	0.90	10	10/16/20	10/19/20	240	
Greens Creek Site 63 DV Metals Fish #8	K2007936-025	9.8	0.88	10	10/16/20	10/19/20	203	
Greens Creek Site 63 DV Metals Fish #9	K2007936-026	9.8	0.88	10	10/16/20	10/19/20	176	
Greens Creek Site 63 DV Metals Fish #10	K2007936-027	9.6	0.87	10	10/16/20	10/19/20	202	
Method Blank 1	K2007936-MB1	1.0	0.09	1	10/16/20	10/19/20	ND	
Method Blank 2	K2007936-MB2	1.0	0.09	1	10/16/20	10/19/20	ND	
Method Blank 3	K2007936-MB3	1.0	0.09	1	10/16/20	10/19/20	ND	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal tissue	**Date Received:**	09/10/20
		Date Extracted:	10/16/20
		Date Analyzed:	10/19/20

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 63 DV Metals Fish #8	Units:	ng/g
Lab Code:	K2007936-025MS, K2007936-025DMS	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	9.7	243	242	203	443	427	99	93	70-130	4	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/19/20

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	5.33	107	70-130	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/19/20

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	5.15	103	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	10/16/20
		Date Analyzed:	10/19/20

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	283	97	70-130	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2007936-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.811**	mg/Kg	0.020	0.004	5	10/16/20 17:38	10/15/20	
Copper	6020A	**2.79**	mg/Kg	0.097	0.029	5	10/22/20 11:28	10/21/20	
Lead	6020A	**1.23**	mg/Kg	0.020	0.003	5	10/16/20 17:38	10/15/20	
Selenium	6020A	**7.19**	mg/Kg	1.0	0.2	5	10/16/20 17:38	10/15/20	
Silver	6020A	**0.113**	mg/Kg	0.020	0.008	5	10/16/20 17:38	10/15/20	
Zinc	6020A	**108**	mg/Kg	0.50	0.08	5	10/16/20 17:38	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2007936-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.86**	mg/Kg	0.019	0.004	5	10/16/20 17:40	10/15/20	
Copper	6020A	**4.18**	mg/Kg	0.097	0.029	5	10/16/20 17:40	10/15/20	
Lead	6020A	**2.04**	mg/Kg	0.019	0.003	5	10/16/20 17:40	10/15/20	
Selenium	6020A	**6.02**	mg/Kg	0.97	0.19	5	10/16/20 17:40	10/15/20	
Silver	6020A	**0.275**	mg/Kg	0.019	0.008	5	10/16/20 17:40	10/15/20	
Zinc	6020A	**182**	mg/Kg	0.49	0.08	5	10/16/20 17:40	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2007936-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**4.52**	mg/Kg	0.019	0.004	5	10/16/20 17:57	10/15/20	
Copper	6020A	**6.35**	mg/Kg	0.097	0.029	5	10/16/20 17:57	10/15/20	
Lead	6020A	**4.92**	mg/Kg	0.019	0.003	5	10/16/20 17:57	10/15/20	
Selenium	6020A	**10.9**	mg/Kg	0.97	0.19	5	10/16/20 17:57	10/15/20	
Silver	6020A	**0.616**	mg/Kg	0.019	0.008	5	10/16/20 17:57	10/15/20	
Zinc	6020A	**222**	mg/Kg	0.49	0.08	5	10/16/20 17:57	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2007936-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.72**	mg/Kg	0.020	0.004	5	10/16/20 18:00	10/15/20	
Copper	6020A	**5.99**	mg/Kg	0.099	0.030	5	10/16/20 18:00	10/15/20	
Lead	6020A	**3.19**	mg/Kg	0.020	0.003	5	10/16/20 18:00	10/15/20	
Selenium	6020A	**11.2**	mg/Kg	0.99	0.20	5	10/16/20 18:00	10/15/20	
Silver	6020A	**0.381**	mg/Kg	0.020	0.008	5	10/16/20 18:00	10/15/20	
Zinc	6020A	**130**	mg/Kg	0.50	0.08	5	10/16/20 18:00	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2007936-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.78**	mg/Kg	0.020	0.004	5	10/16/20 18:02	10/15/20	
Copper	6020A	**7.04**	mg/Kg	0.099	0.030	5	10/16/20 18:02	10/15/20	
Lead	6020A	**4.78**	mg/Kg	0.020	0.003	5	10/16/20 18:02	10/15/20	
Selenium	6020A	**13.8**	mg/Kg	0.99	0.20	5	10/16/20 18:02	10/15/20	
Silver	6020A	**0.517**	mg/Kg	0.020	0.008	5	10/16/20 18:02	10/15/20	
Zinc	6020A	**173**	mg/Kg	0.49	0.08	5	10/16/20 18:02	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2007936-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**4.87**	mg/Kg	0.020	0.004	5	10/16/20 18:04	10/15/20	
Copper	6020A	**6.31**	mg/Kg	0.10	0.03	5	10/16/20 18:04	10/15/20	
Lead	6020A	**4.04**	mg/Kg	0.020	0.003	5	10/16/20 18:04	10/15/20	
Selenium	6020A	**11.4**	mg/Kg	1.0	0.2	5	10/16/20 18:04	10/15/20	
Silver	6020A	**1.47**	mg/Kg	0.020	0.008	5	10/16/20 18:04	10/15/20	
Zinc	6020A	**274**	mg/Kg	0.50	0.08	5	10/16/20 18:04	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Tributary Creek Site 9 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2007936-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.68**	mg/Kg	0.020	0.004	5	10/16/20 18:07	10/15/20	
Copper	6020A	**6.68**	mg/Kg	0.098	0.029	5	10/16/20 18:07	10/15/20	
Lead	6020A	**3.93**	mg/Kg	0.020	0.003	5	10/16/20 18:07	10/15/20	
Selenium	6020A	**9.31**	mg/Kg	0.98	0.20	5	10/16/20 18:07	10/15/20	
Silver	6020A	**0.357**	mg/Kg	0.020	0.008	5	10/16/20 18:07	10/15/20	
Zinc	6020A	**163**	mg/Kg	0.49	0.08	5	10/16/20 18:07	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2007936-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.97**	mg/Kg	0.020	0.004	5	10/16/20 18:09	10/15/20	
Copper	6020A	**4.95**	mg/Kg	0.099	0.030	5	10/16/20 18:09	10/15/20	
Lead	6020A	**0.279**	mg/Kg	0.020	0.003	5	10/16/20 18:09	10/15/20	
Selenium	6020A	**5.83**	mg/Kg	0.99	0.20	5	10/16/20 18:09	10/15/20	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	10/16/20 18:09	10/15/20	
Zinc	6020A	**304**	mg/Kg	0.50	0.08	5	10/16/20 18:09	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2007936-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.88**	mg/Kg	0.020	0.004	5	10/16/20 18:12	10/15/20	
Copper	6020A	**6.50**	mg/Kg	0.098	0.029	5	10/16/20 18:12	10/15/20	
Lead	6020A	**0.322**	mg/Kg	0.020	0.003	5	10/16/20 18:12	10/15/20	
Selenium	6020A	**4.83**	mg/Kg	0.98	0.20	5	10/16/20 18:12	10/15/20	
Silver	6020A	**0.035**	mg/Kg	0.020	0.008	5	10/16/20 18:12	10/15/20	
Zinc	6020A	**241**	mg/Kg	0.49	0.08	5	10/16/20 18:12	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2007936-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.867**	mg/Kg	0.020	0.004	5	10/16/20 18:14	10/15/20	
Copper	6020A	**3.66**	mg/Kg	0.099	0.030	5	10/22/20 11:29	10/21/20	
Lead	6020A	**0.330**	mg/Kg	0.020	0.003	5	10/16/20 18:14	10/15/20	
Selenium	6020A	**9.22**	mg/Kg	0.99	0.20	5	10/16/20 18:14	10/15/20	
Silver	6020A	**0.022**	mg/Kg	0.020	0.008	5	10/16/20 18:14	10/15/20	
Zinc	6020A	**198**	mg/Kg	0.49	0.08	5	10/16/20 18:14	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2007936-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.05**	mg/Kg	0.020	0.004	5	10/16/20 18:17	10/15/20	
Copper	6020A	**4.17**	mg/Kg	0.098	0.029	5	10/22/20 11:31	10/21/20	
Lead	6020A	**0.729**	mg/Kg	0.020	0.003	5	10/16/20 18:17	10/15/20	
Selenium	6020A	**7.39**	mg/Kg	0.98	0.20	5	10/16/20 18:17	10/15/20	
Silver	6020A	**0.022**	mg/Kg	0.020	0.008	5	10/16/20 18:17	10/15/20	
Zinc	6020A	**211**	mg/Kg	0.49	0.08	5	10/16/20 18:17	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2007936-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.61**	mg/Kg	0.019	0.004	5	10/16/20 18:19	10/15/20	
Copper	6020A	**4.43**	mg/Kg	0.097	0.029	5	10/16/20 18:19	10/15/20	
Lead	6020A	**0.581**	mg/Kg	0.019	0.003	5	10/16/20 18:19	10/15/20	
Selenium	6020A	**6.76**	mg/Kg	0.97	0.19	5	10/16/20 18:19	10/15/20	
Silver	6020A	**0.035**	mg/Kg	0.019	0.008	5	10/16/20 18:19	10/15/20	
Zinc	6020A	**193**	mg/Kg	0.49	0.08	5	10/16/20 18:19	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2007936-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.880**	mg/Kg	0.020	0.004	5	10/16/20 18:26	10/15/20	
Copper	6020A	**4.50**	mg/Kg	0.10	0.03	5	10/16/20 18:26	10/15/20	
Lead	6020A	**3.97**	mg/Kg	0.020	0.003	5	10/16/20 18:26	10/15/20	
Selenium	6020A	**5.5**	mg/Kg	1.0	0.2	5	10/16/20 18:26	10/15/20	
Silver	6020A	**0.033**	mg/Kg	0.020	0.008	5	10/16/20 18:26	10/15/20	
Zinc	6020A	**207**	mg/Kg	0.50	0.08	5	10/16/20 18:26	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2007936-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.963**	mg/Kg	0.020	0.004	5	10/16/20 18:29	10/15/20	
Copper	6020A	**5.10**	mg/Kg	0.098	0.029	5	10/16/20 18:29	10/15/20	
Lead	6020A	**0.352**	mg/Kg	0.020	0.003	5	10/16/20 18:29	10/15/20	
Selenium	6020A	**6.08**	mg/Kg	0.98	0.20	5	10/16/20 18:29	10/15/20	
Silver	6020A	**0.037**	mg/Kg	0.020	0.008	5	10/16/20 18:29	10/15/20	
Zinc	6020A	**212**	mg/Kg	0.49	0.08	5	10/16/20 18:29	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2007936-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.896**	mg/Kg	0.020	0.004	5	10/16/20 18:31	10/15/20	
Copper	6020A	**5.23**	mg/Kg	0.098	0.029	5	10/16/20 18:31	10/15/20	
Lead	6020A	**0.257**	mg/Kg	0.020	0.003	5	10/16/20 18:31	10/15/20	
Selenium	6020A	**6.27**	mg/Kg	0.98	0.20	5	10/16/20 18:31	10/15/20	
Silver	6020A	**0.035**	mg/Kg	0.020	0.008	5	10/16/20 18:31	10/15/20	
Zinc	6020A	**251**	mg/Kg	0.49	0.08	5	10/16/20 18:31	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2007936-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.23**	mg/Kg	0.020	0.004	5	10/16/20 18:34	10/15/20	
Copper	6020A	**5.85**	mg/Kg	0.099	0.030	5	10/16/20 18:34	10/15/20	
Lead	6020A	**0.721**	mg/Kg	0.020	0.003	5	10/16/20 18:34	10/15/20	
Selenium	6020A	**6.33**	mg/Kg	0.99	0.20	5	10/16/20 18:34	10/15/20	
Silver	6020A	**0.052**	mg/Kg	0.020	0.008	5	10/16/20 18:34	10/15/20	
Zinc	6020A	**210**	mg/Kg	0.50	0.08	5	10/16/20 18:34	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 54 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2007936-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.02**	mg/Kg	0.020	0.004	5	10/16/20 18:36	10/15/20	
Copper	6020A	**4.68**	mg/Kg	0.099	0.030	5	10/16/20 18:36	10/15/20	
Lead	6020A	**0.463**	mg/Kg	0.020	0.003	5	10/16/20 18:36	10/15/20	
Selenium	6020A	**7.13**	mg/Kg	0.99	0.20	5	10/16/20 18:36	10/15/20	
Silver	6020A	**0.037**	mg/Kg	0.020	0.008	5	10/16/20 18:36	10/15/20	
Zinc	6020A	**188**	mg/Kg	0.50	0.08	5	10/16/20 18:36	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2007936-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.31**	mg/Kg	0.020	0.004	5	10/16/20 18:39	10/15/20	
Copper	6020A	**4.69**	mg/Kg	0.099	0.030	5	10/16/20 18:39	10/15/20	
Lead	6020A	**0.594**	mg/Kg	0.020	0.003	5	10/16/20 18:39	10/15/20	
Selenium	6020A	**5.86**	mg/Kg	0.99	0.20	5	10/16/20 18:39	10/15/20	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	10/16/20 18:39	10/15/20	
Zinc	6020A	**271**	mg/Kg	0.50	0.08	5	10/16/20 18:39	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2007936-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.914**	mg/Kg	0.020	0.004	5	10/16/20 18:41	10/15/20	
Copper	6020A	**4.85**	mg/Kg	0.099	0.030	5	10/16/20 18:41	10/15/20	
Lead	6020A	**0.212**	mg/Kg	0.020	0.003	5	10/16/20 18:41	10/15/20	
Selenium	6020A	**5.43**	mg/Kg	0.99	0.20	5	10/16/20 18:41	10/15/20	
Silver	6020A	**0.034**	mg/Kg	0.020	0.008	5	10/16/20 18:41	10/15/20	
Zinc	6020A	**224**	mg/Kg	0.49	0.08	5	10/16/20 18:41	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2007936-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.18**	mg/Kg	0.020	0.004	5	10/16/20 18:44	10/15/20	
Copper	6020A	**5.22**	mg/Kg	0.099	0.030	5	10/16/20 18:44	10/15/20	
Lead	6020A	**0.206**	mg/Kg	0.020	0.003	5	10/16/20 18:44	10/15/20	
Selenium	6020A	**5.19**	mg/Kg	0.99	0.20	5	10/16/20 18:44	10/15/20	
Silver	6020A	**0.029**	mg/Kg	0.020	0.008	5	10/16/20 18:44	10/15/20	
Zinc	6020A	**219**	mg/Kg	0.49	0.08	5	10/16/20 18:44	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2007936-021		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.15**	mg/Kg	0.020	0.004	5	10/16/20 19:08	10/15/20	
Copper	6020A	**12.4**	mg/Kg	0.099	0.030	5	10/16/20 19:08	10/15/20	
Lead	6020A	**1.81**	mg/Kg	0.020	0.003	5	10/16/20 19:08	10/15/20	
Selenium	6020A	**4.69**	mg/Kg	0.99	0.20	5	10/16/20 19:08	10/15/20	
Silver	6020A	**0.058**	mg/Kg	0.020	0.008	5	10/16/20 19:08	10/15/20	
Zinc	6020A	**204**	mg/Kg	0.50	0.08	5	10/16/20 19:08	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2007936-022		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.05**	mg/Kg	0.020	0.004	5	10/16/20 19:10	10/15/20	
Copper	6020A	**5.05**	mg/Kg	0.098	0.030	5	10/16/20 19:10	10/15/20	
Lead	6020A	**0.628**	mg/Kg	0.020	0.003	5	10/16/20 19:10	10/15/20	
Selenium	6020A	**5.06**	mg/Kg	0.98	0.20	5	10/16/20 19:10	10/15/20	
Silver	6020A	**0.040**	mg/Kg	0.020	0.008	5	10/16/20 19:10	10/15/20	
Zinc	6020A	**202**	mg/Kg	0.49	0.08	5	10/16/20 19:10	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2007936-023		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.33**	mg/Kg	0.020	0.004	5	10/16/20 19:28	10/15/20	
Copper	6020A	**4.70**	mg/Kg	0.099	0.030	5	10/16/20 19:28	10/15/20	
Lead	6020A	**1.28**	mg/Kg	0.020	0.003	5	10/16/20 19:28	10/15/20	
Selenium	6020A	**6.30**	mg/Kg	0.99	0.20	5	10/16/20 19:28	10/15/20	
Silver	6020A	**0.053**	mg/Kg	0.020	0.008	5	10/16/20 19:28	10/15/20	
Zinc	6020A	**290**	mg/Kg	0.49	0.08	5	10/16/20 19:28	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2007936-024		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.09**	mg/Kg	0.020	0.004	5	10/16/20 19:30	10/15/20	
Copper	6020A	**6.42**	mg/Kg	0.098	0.029	5	10/16/20 19:30	10/15/20	
Lead	6020A	**0.774**	mg/Kg	0.020	0.003	5	10/16/20 19:30	10/15/20	
Selenium	6020A	**5.84**	mg/Kg	0.98	0.20	5	10/16/20 19:30	10/15/20	
Silver	6020A	**0.040**	mg/Kg	0.020	0.008	5	10/16/20 19:30	10/15/20	
Zinc	6020A	**269**	mg/Kg	0.49	0.08	5	10/16/20 19:30	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2007936-025		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.03**	mg/Kg	0.020	0.004	5	10/16/20 19:33	10/15/20	
Copper	6020A	**4.57**	mg/Kg	0.099	0.030	5	10/16/20 19:33	10/15/20	
Lead	6020A	**0.496**	mg/Kg	0.020	0.003	5	10/16/20 19:33	10/15/20	
Selenium	6020A	**7.16**	mg/Kg	0.99	0.20	5	10/16/20 19:33	10/15/20	
Silver	6020A	**0.023**	mg/Kg	0.020	0.008	5	10/16/20 19:33	10/15/20	
Zinc	6020A	**190**	mg/Kg	0.49	0.08	5	10/16/20 19:33	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2007936-026		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.57**	mg/Kg	0.020	0.004	5	10/16/20 19:35	10/15/20	
Copper	6020A	**6.00**	mg/Kg	0.10	0.03	5	10/16/20 19:35	10/15/20	
Lead	6020A	**0.616**	mg/Kg	0.020	0.003	5	10/16/20 19:35	10/15/20	
Selenium	6020A	**5.33**	mg/Kg	1.0	0.2	5	10/16/20 19:35	10/15/20	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	10/16/20 19:35	10/15/20	
Zinc	6020A	**357**	mg/Kg	0.50	0.08	5	10/16/20 19:35	10/15/20	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20 10:40
Sample Name:	Greens Creek Site 63 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2007936-027		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.35**	mg/Kg	0.020	0.004	5	10/16/20 19:37	10/15/20	
Copper	6020A	**5.76**	mg/Kg	0.10	0.03	5	10/16/20 19:37	10/15/20	
Lead	6020A	**0.332**	mg/Kg	0.020	0.003	5	10/16/20 19:37	10/15/20	
Selenium	6020A	**6.15**	mg/Kg	1.0	0.2	5	10/16/20 19:37	10/15/20	
Silver	6020A	**0.021**	mg/Kg	0.020	0.008	5	10/16/20 19:37	10/15/20	
Zinc	6020A	**311**	mg/Kg	0.50	0.08	5	10/16/20 19:37	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2015603-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND U	mg/Kg	0.020	0.004	5	10/16/20 17:28	10/15/20	
Copper	6020A	**0.41**	mg/Kg	0.10	0.03	5	10/16/20 17:28	10/15/20	
Lead	6020A	ND U	mg/Kg	0.020	0.003	5	10/16/20 17:28	10/15/20	
Selenium	6020A	ND U	mg/Kg	1.0	0.2	5	10/16/20 17:28	10/15/20	
Silver	6020A	ND U	mg/Kg	0.020	0.008	5	10/16/20 17:28	10/15/20	
Zinc	6020A	ND U	mg/Kg	0.5	0.08	5	10/16/20 17:28	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2015605-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND U	mg/Kg	0.020	0.004	5	10/16/20 18:58	10/15/20	
Copper	6020A	**0.29**	mg/Kg	0.10	0.03	5	10/16/20 18:58	10/15/20	
Lead	6020A	ND U	mg/Kg	0.020	0.003	5	10/16/20 18:58	10/15/20	
Selenium	6020A	ND U	mg/Kg	1.0	0.2	5	10/16/20 18:58	10/15/20	
Silver	6020A	ND U	mg/Kg	0.020	0.008	5	10/16/20 18:58	10/15/20	
Zinc	6020A	ND U	mg/Kg	0.5	0.08	5	10/16/20 18:58	10/15/20	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2016086-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Copper	6020A	ND U	mg/Kg	0.10	0.03	5	10/22/20 11:21	10/21/20	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/16/20

Replicate Sample Summary

Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	**Units:**	mg/Kg
Lab Code:	K2007936-002	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2015603-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.019	0.004	1.86	1.75	1.81	6	20
Copper	6020A	0.10	0.03	4.18	3.59	3.89	15	20
Lead	6020A	0.019	0.003	2.04	1.90	1.97	7	20
Selenium	6020A	1.0	0.2	6.02	5.62	5.82	7	20
Silver	6020A	0.019	0.008	0.275	0.249	0.262	10	20
Zinc	6020A	0.5	0.08	182	170	176	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:**	K2007936
Project	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/16/20

Replicate Sample Summary

Total Metals

Sample Name:	Greens Creek Site 63 DV Metals Fish #5	**Units:**	mg/Kg
Lab Code:	K2007936-022	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2015605-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.004	1.05	1.02	1.04	3	20
Copper	6020A	0.10	0.03	5.05	4.77	4.91	6	20
Lead	6020A	0.020	0.003	0.628	0.585	0.607	7	20
Selenium	6020A	1.0	0.2	5.06	5.24	5.15	3	20
Silver	6020A	0.020	0.008	0.040	0.037	0.039	8	20
Zinc	6020A	0.5	0.08	202	205	204	1	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:**	K2007936
Project	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/22/20

Replicate Sample Summary

Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #4	**Units:**	mg/Kg
Lab Code:	K2007936-011	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2016086-05 Result	Average	RPD	RPD Limit
Copper	6020A	0.10	0.03	4.17	4.09	4.13	2	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:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/15/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/16/20
		Date Extracted:	10/15/20

Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	**Units:**	mg/Kg
Lab Code:	K2007936-002	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2015603-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	1.86	6.40	4.93	92	75-125
Copper	4.18	25.8	24.7	88	75-125
Lead	2.04	47.2	49.3	91	75-125
Selenium	6.02	22.8	16.4	102	75-125
Silver	0.275	4.82	4.93	92	75-125
Zinc	182	212	49.3	60 N	75-125

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

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

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

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/16/20
		Date Extracted:	10/15/20

Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 63 DV Metals Fish #5	**Units:**	mg/Kg
Lab Code:	K2007936-022	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2015605-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	1.05	5.91	4.98	98	75-125
Copper	5.05	29.1	24.9	97	75-125
Lead	0.628	47.6	49.8	94	75-125
Selenium	5.06	23.1	16.6	109	75-125
Silver	0.040	4.84	4.98	96	75-125
Zinc	202	257	49.8	110 #	75-125

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

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

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

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	07/16/20
Sample Matrix:	Animal Tissue	**Date Received:**	09/10/20
		Date Analyzed:	10/22/20
		Date Extracted:	10/21/20

Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #4	**Units:**	mg/Kg
Lab Code:	K2007936-011	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2016086-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Copper	4.17	27.3	24.6	94	75-125

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

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

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

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Client: Alaska Department of Fish and Game
Project: 2020 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2007936
Date Analyzed: 10/16/20

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2015603-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	4.81	5.00	96	80-120
Copper	6020A	23.4	25.0	94	80-120
Lead	6020A	47.8	50.0	96	80-120
Selenium	6020A	16.9	16.7	101	80-120
Silver	6020A	4.80	5.00	96	80-120
Zinc	6020A	47.5	50.0	95	80-120

Client: Alaska Department of Fish and Game
Project: 2020 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2007936
Date Analyzed: 10/16/20

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2015605-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	4.66	5.00	93	80-120
Copper	6020A	23.1	25.0	93	80-120
Lead	6020A	46.8	50.0	94	80-120
Selenium	6020A	17.4	16.7	104	80-120
Silver	6020A	4.75	5.00	95	80-120
Zinc	6020A	45.8	50.0	92	80-120

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Analyzed:**	10/22/20
Sample Matrix:	Animal Tissue		

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2016086-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Copper	6020A	23.7	25.0	95	80-120

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/15/2020
		Date Analyzed:	10/16/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2015603-03	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
Cadmium	PSEP Tissue	6020A	0.299	0.292	98	0.225 - 0.380	
Copper	PSEP Tissue	6020A	15.7	14.7	94	12.2 - 19.4	
Lead	PSEP Tissue	6020A	0.40	0.37	92	0.274 - 0.559	
Selenium	PSEP Tissue	6020A	3.45	3.71	108	2.44 - 4.62	
Silver	PSEP Tissue	6020A	0.0252	0.0280	111	0.0162 - 0.0362	
Zinc	PSEP Tissue	6020A	51.6	48.8	95	39.0 - 65.3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/15/2020
		Date Analyzed:	10/16/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2015603-04	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
Cadmium	PSEP Tissue	6020A	42.3	38.8	92	32.4-52.9	
Copper	PSEP Tissue	6020A	497	453	91	380-623	
Lead	PSEP Tissue	6020A	0.225	0.188	84	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.3	94	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	125	92	104-170	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/15/2020
		Date Analyzed:	10/16/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2015605-03	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
Cadmium	PSEP Tissue	6020A	0.299	0.304	102	0.225 - 0.380	
Copper	PSEP Tissue	6020A	15.7	15.6	99	12.2 - 19.4	
Lead	PSEP Tissue	6020A	0.40	0.39	97	0.274 - 0.559	
Selenium	PSEP Tissue	6020A	3.45	3.83	111	2.44 - 4.62	
Silver	PSEP Tissue	6020A	0.0252	0.0279	111	0.0162 - 0.0362	
Zinc	PSEP Tissue	6020A	51.6	50.9	99	39.0 - 65.3	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/15/2020
		Date Analyzed:	10/16/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2015605-04	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
Cadmium	PSEP Tissue	6020A	42.3	40.7	96	32.4-52.9	
Copper	PSEP Tissue	6020A	497	481	97	380-623	
Lead	PSEP Tissue	6020A	0.225	0.200	89	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	11.1	102	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	131	96	104-170	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/21/2020
		Date Analyzed:	10/22/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2016086-03	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	6020A	15.7	15.4	98	12.2 - 19.4	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2007936
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	10/21/2020
		Date Analyzed:	10/22/2020

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2016086-04	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	6020A	497	451	91	380-623	