Technical Report No. 23-07

Aquatic Biomonitoring at Greens Creek Mine, 2022

by

Jesse W. Lindgren and Erika M. King

February 2023

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

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February 2023

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Cover: Wetland near Greens Creek Mine camp facility, August 15, 2022.

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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 2022, we completed studies at Greens Creek Site 63 and Site 54, and Tributary Creek Site 9 and Site 1847.

The National Weather Service (2023) reports that during 2022, the Juneau area received precipitation (224 cm) about 32% above normal[a] and snowfall (165 cm) about 26% below normal.

Three weeks prior to sampling in 2022, Greens Creek daily mean discharges were the greatest observed since 2001; high streamflow prior to sampling may have influenced results. Mean chlorophyll *a* densities for Site 54 and 63 were similar to values previously observed 2001–2021, and greater than values observed the past few years. Mean chlorophyll *a* density at Site 1847 was the greatest observed while the mean value for Site 9 was similar to previously observed.

Mean benthic macroinvertebrate densities at Greens Creek sites were among the lower values previously observed 2001–2021. Comparing the Tributary Creek periphyton and macroinvertebrate data collected over the last five years, greater abundances at Site 1847 suggests the site consistently provides more suitable habitats for these communities; we recommend discontinuing periphyton and benthic macroinvertebrate sampling at Site 9 and collecting these samples instead at Site 1847, as part of the ongoing annual biomonitoring program.

Juvenile Dolly Varden *Salvelinus malma* abundance at Greens Creek Sites was lower than most previous years; mean fish conditions were similar to previous years. We captured 12 juvenile coho salmon *Oncorhynchus kisutch* at Site 54, confirming adult coho salmon passage through the Greens Creek fishpass. At Tributary Creek Site 9, zero juvenile Dolly Varden were captured during a single trapping event for the first time, coho salmon continue to be the most abundant juvenile fish species; mean fish condition of Dolly Varden and coho salmon were similar to previous years.

At all sample sites in 2022, Dolly Varden median element concentrations were within ranges previously observed, except median lead concentration at Site 54 and 63 which were the greatest values observed 2001–2021. Median element concentrations above values reported for sample sites with mining-related influence elsewhere in Alaska include silver and mercury at Tributary Creek Site 9 and lead and zinc at Greens Creek Sites 63 and 54, as frequently observed historically.

[a] Mean value, 1991–2020.

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; 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 (HGCMC), 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; HGCMC 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 (2020–2022).

PURPOSE

This technical report summarizes the 2022 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 HGCMC's approved IMP (2020).

Figure 1.–Greens Creek Mine area.

AQUATIC BIOMONITORING

In 2022, 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 of Dolly Varden;
- Periphyton biomass, estimated by chlorophyll *a*; and
- Abundance and community composition of benthic macroinvertebrates.

Table 1.–Aquatic biomonitoring study sample sites, 2022.

Location	Biomonitoring reach	Latitude[a]	Longitude[a]
Greens Creek Site 63 (2018–2022)	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[b] (2001–2022)	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 (2001–2022)	Upper extent	58.1055	-134.7450
	Lower extent	58.1050	-134.7450
Tributary Creek Site 1847 (2018–2022)	Periphyton and benthic macroinvertebrates	58.1018	-134.7458

[a] WGS84 datum.

[b] Reference samples were collected at Greens Creek Site 48 2001–2017.

STUDY AREA

We sampled Greens Creek Site 54 and Tributary Creek Site 9 annually since 2001, and Greens Creek reference Site 63 2018–2022, which replaced Greens Creek reference Site 48 where we sampled 2001–2017.[b] 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.[c] 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.[d,e]

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

[c] 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.

[d] Bill Kane, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Habitat Section. Memorandum: 2021 Greens Creek Mine Aquatic Biomonitoring; dated January 3, 2022. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

[e] 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 2021). 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 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 (Giefer and Blossom 2022). 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[f], 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 the 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 (Figures 3, 4) is further stabilizing, and we completed the aquatic biomonitoring studies downstream at Site 63 for a fifth 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 is the only fish species 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 (Figure 5).

[f] Prior to February 16, 1999, the gage was located 9 m upstream and at 3 m greater elevation (USGS 2022).

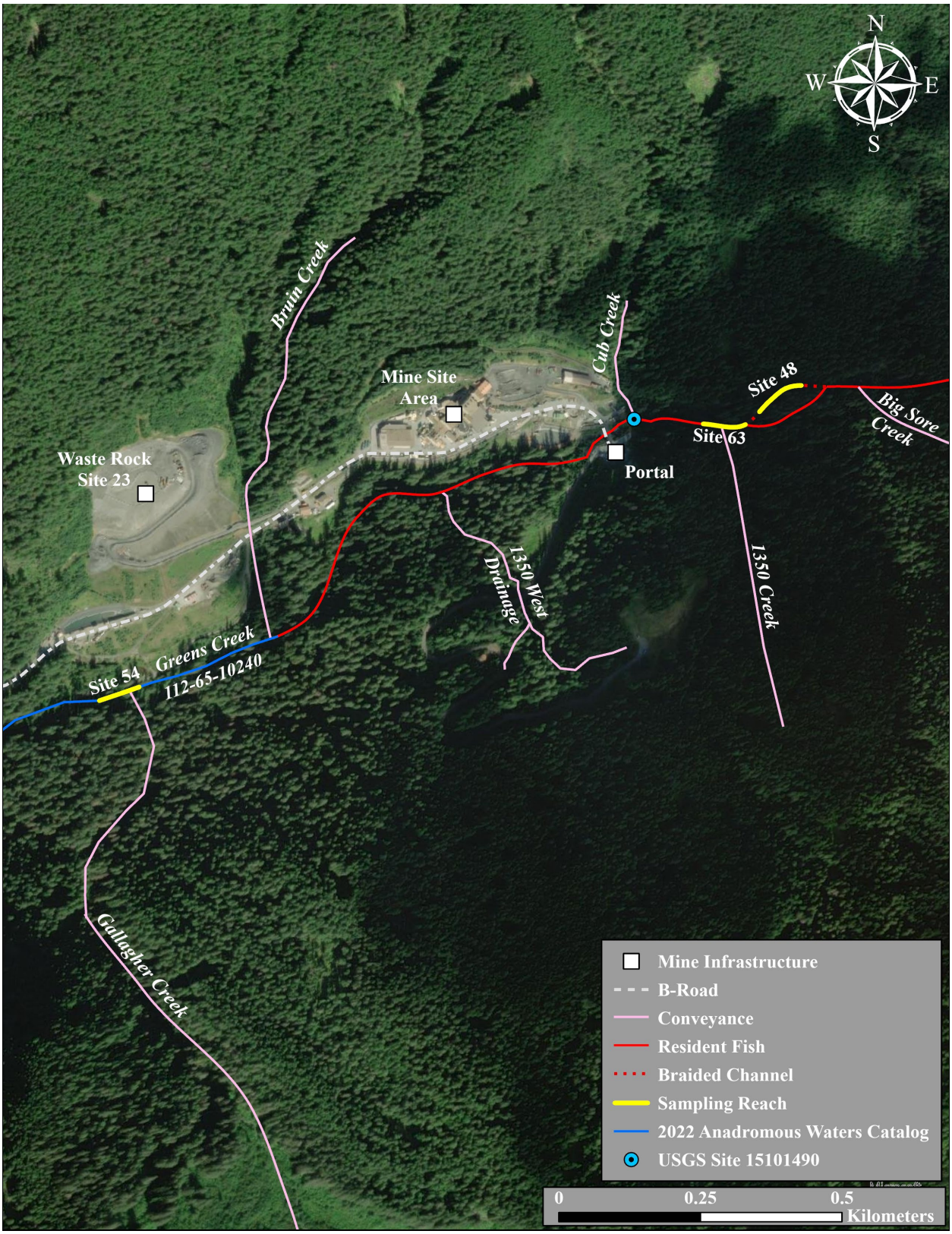

Figure 2.–Greens Creek Sites 48, 63, and 54.

Figure 3.–Greens Creek Site 48 within the abandoned channel braid upstream of Site 63, July 12, 2021.

Figure 4.–Established channel adjacent to the abandoned channel where Greens Creek Site 48 is located, July 12, 2021.

Figure 5.–Greens Creek Site 63 periphyton and benthic macroinvertebrate sample reach, July 12, 2022.

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 2001–2022 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 documented coho salmon, Dolly Varden, cutthroat trout *O. clarkii*, and rainbow trout *O. mykiss* at Site 54.[g] In 2022, we caught 12 juvenile coho salmon demonstrating successful adult coho salmon navigation of the Greens Creek fish pass.[h] Anadromous fish access the site via a fish pass about 5.6 km upriver from the mouth.

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[g] In 2007 and 2008, two cutthroat trout were observed; one rainbow trout was observed in 2020.

[h] 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 and 2021, and perhaps two age classes 2018–2020 and 2022, 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 12, 2022.

Figure 7.–Greens Creek Site 54, July 12, 2022.

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 (Stream No. 112-65-10230; Figure 8). The TDF occupies the headwaters of the watershed. 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 present. 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 (Giefer and Blossom 2022).

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

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, 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 2022, we sampled periphyton and benthic macroinvertebrates for the fifth 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 11, 2022.

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 2018–2022 and compare the data to Site 9. We did not sample fish since Site 9 is preferred as the upstream sampling site for Dolly Varden element concentration analyses.

Figure 10.–Tributary Creek Site 1847 sample reach, July 11, 2022.

METHODS

Data sets are reviewed annually to ensure accuracy and consistency; 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

In Greens Creek, discharge was measured with a SonTek FlowTracker acoustic doppler velocimeter.[i] 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.

In Tributary Creek, discharge was measured with a collapsible 20 cm (8 in) Cutthroat flume using methods described in CDPHE (2016).[j] The flume was placed parallel to flow in a stream section confined to one channel with uniform flow, and the wing walls were spread upstream. The flume was leveled horizontally and vertically with a portable level and substrate was packed beyond the wing walls to direct all flow into the flume. Discharge was determined using charts provided by the manufacturer.

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 2001–2022,[k] and a figure presenting the range of Greens Creek daily mean discharges three weeks prior to sampling, 2001–2022.

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[i] From 2010–2015, discharge in Greens Creek and Tributary Creek was estimated using a Global Flow Probe Model FP101 flow meter (Kanouse 2015) and a modification of the methods described in Platts et al. (1983).

[j] From 2016 to 2018, 2020, and in 2021, Tributary Creek discharge was measured using a SonTek FlowTracker acoustic doppler velocimeter.

[k] Continuous discharge data are not available for Tributary Creek.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Periphyton is composed of primary producing organisms such as algae, cyanobacteria, heterotrophic microbes, and detritus attached to the submerged surfaces of aquatic ecosystems. Algal density and community structure are influenced by water and sediment 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*.

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.

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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.

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 to reduce light exposure, the samples were stored in a refrigerator for 12–24 hours to allow for saturation and chlorophyll extraction.

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 2022 EDL for Chl-*a* concentration was 0.22 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.

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.

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

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 identified organisms 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 are 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 added to 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-hour trapping event, captured fish were transferred to a plastic bucket containing aerated stream water. Fish captured in the boundary traps were excluded from reported data. Ten Dolly Varden were retained for whole body element concentration analyses at each sample site.

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 was recorded to the nearest 0.1 g. During recovery, fish were retained in a perforated plastic bucket secured in the creek and released 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-hour trapping events and presented in figures.[v] 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 all years.

[u] Dosage is 0.30 mL anesthetic per 1 gal. of stream water.

[v] Prior to an approved modification of the IMP in 2020, estimating juvenile fish populations was required—achieved with a depletion sampling method involving three sequential 1.5-hour 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 from the abundance trapping event were retained in clean, labeled plastic bags.[w,x] Fish retained were within the size range 85–125 mm FL;[y] an 85 mm fish provides the minimum weight (about 5 g) required for laboratory analyses, while the maximum length of 125 mm improves the probability of excluding anadromous Dolly Varden at Greens Creek Site 54 and Tributary Creek Site 9. FL and weight were measured, correcting for bag weight, and samples were stored in a cooler with ice packs during transportation to the ADF&G Douglas laboratory, where samples were stored in 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[z] (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[aa] for other elements. ALS Environmental provided Tier II quality control information, including results for matrix spikes, sample blanks, sample duplicates, and standard reference materials.

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.[bb,cc] The annual raw data, presenting the mean value for duplicate sample results, and the 2022 laboratory report are provided in Appendix D.

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[w] Prior to 2015, 6 samples were collected at each site.

[x] Due to scarcity of Dolly Varden captured at Tributary Creek Site 9 2019–2022, all fish samples were collected beyond the sample reach, to achieve a sample size of 10 fish. Six fish were captured via electrofishing on August 15, 2022.

[y] To achieve a minimum sample size, in some years, retained fish samples measured less than the designated length range; when less than 85 mm, two fish were analyzed as a composite sample. We discontinued this practice.

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

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

[bb] The 2011 samples were mistakenly homogenized, resulting in one data point for each element analysis.

[cc] In 2012, laboratory contamination in several samples was suspected due to elevated sample results.

RESULTS

Three weeks prior to sampling in 2022, Greens Creek daily mean discharges were above the 2001–2021 means (Figure 11). The daily mean discharge during the three-week period prior to sampling in 2022 was the greatest observed (Figure 12).

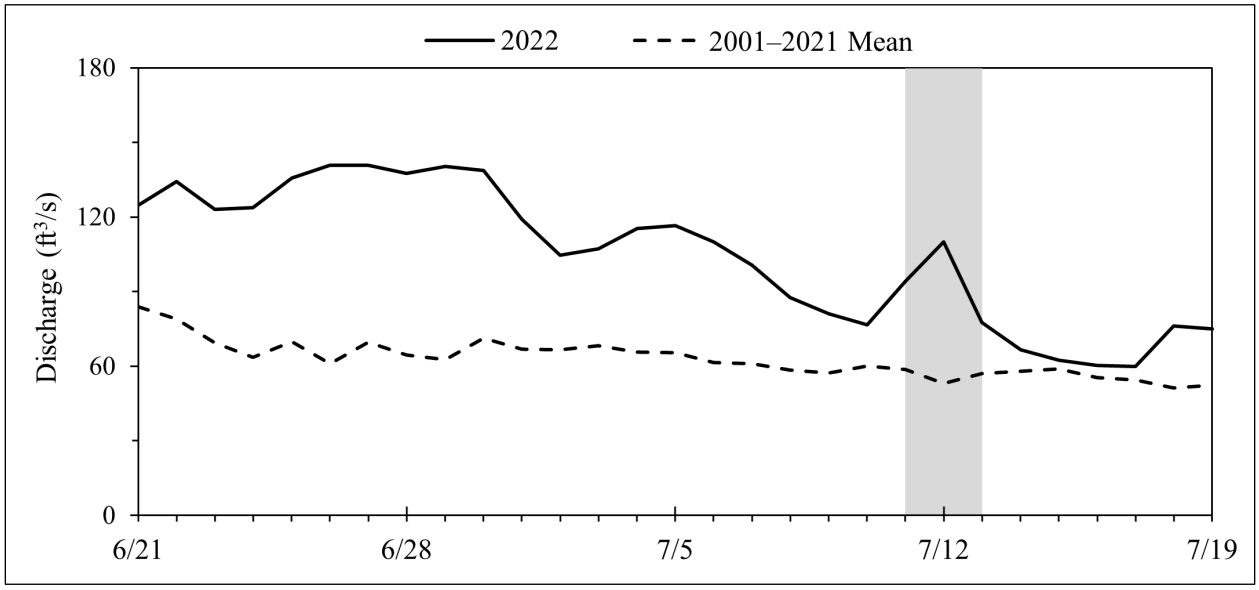

Figure 11.–Greens Creek daily mean discharge three weeks prior to sampling, 2022.
Source: USGS 15101490 (USGS 2023b).
Note: 2022 sampling days highlighted in gray (July 11, 12, 13).

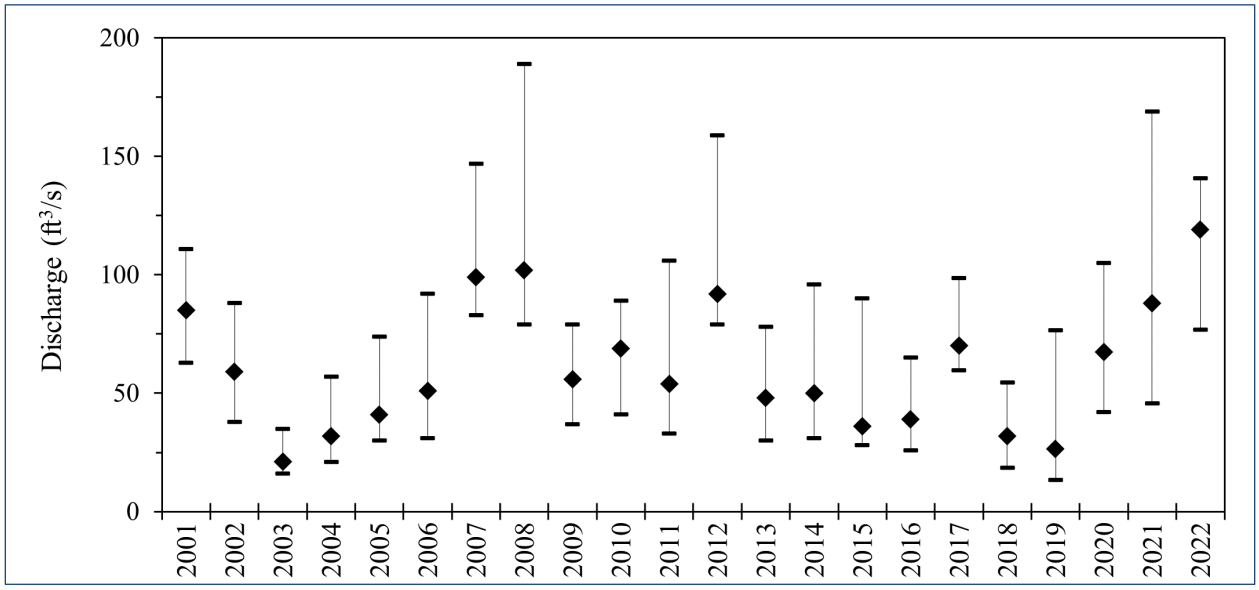

Figure 12.–Greens Creek daily mean discharge three weeks prior to sampling, 2001–2022.
Source: USGS 15101490 (USGS 2023b).
Note: Minimum, median, and maximum discharges presented.

GREENS CREEK SITE 48 AND SITE 63

We sampled Greens Creek Site 63 on July 12, 2022. Hecla environmental staff measured basic water quality at 1445 hours (Table 2). The USGS stream gage recorded a daily mean discharge of 77.5 ft^3/s (USGS 2023).

Table 2.–Greens Creek Site 63 water quality data, 2022.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/12/22	7.5	81.2	8.2	67[a]

[a] As measured at the Greens Creek weir at 1400 hours.

Periphyton: Chlorophyll Density and Composition

The 2022 Site 63 mean Chl-*a* density was 7.60 mg/m^2—within the range previously observed and greater than recent years 2019–2021 (Figure 13). The samples contained about 88% Chl-*a*, 12% Chl-*c*, and 0% Chl-*b*, similar to mean composition observed in previous years.

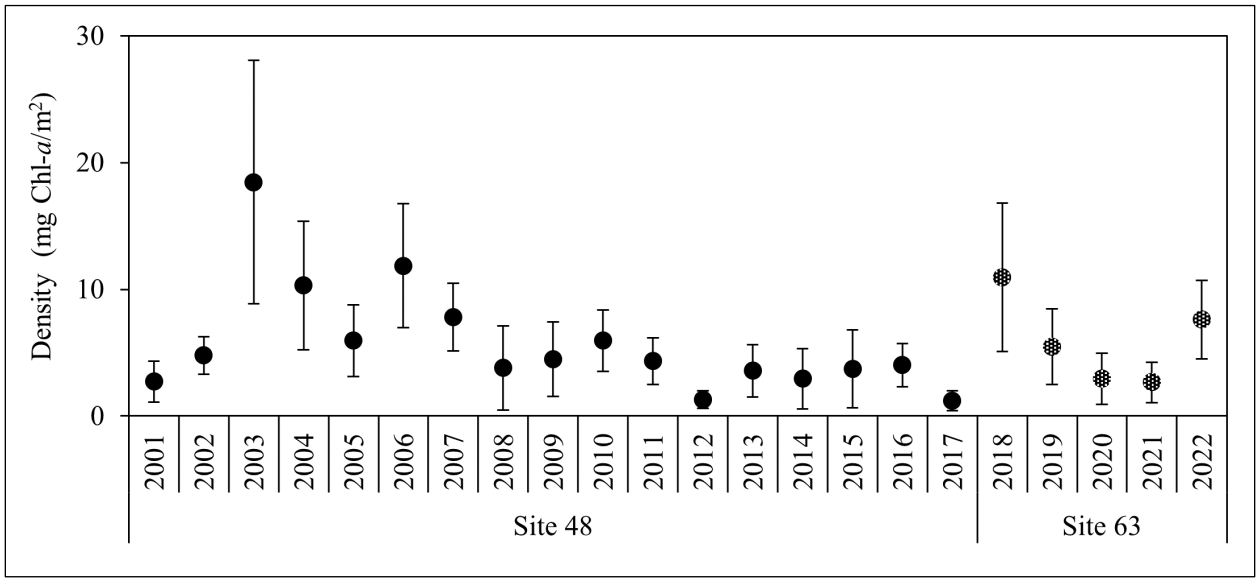

Figure 13.–Greens Creek Site 48 and Site 63 mean chlorophyll *a* densities ± 1 SD, 2001–2022.

Benthic Macroinvertebrate Density and Community Composition

Among the 2022 BMI samples collected at Site 63, we counted 26 taxa—within the range previously observed at Sites 48 and 63. We estimate mean density at 1,690 BMI/m^2, among the lowest observed; EPT insects composed 91% of the samples (Figures 14, 15). Dominant taxa were Ephemeroptera of the family Baetidae (43%) and Heptageniidae (22%).

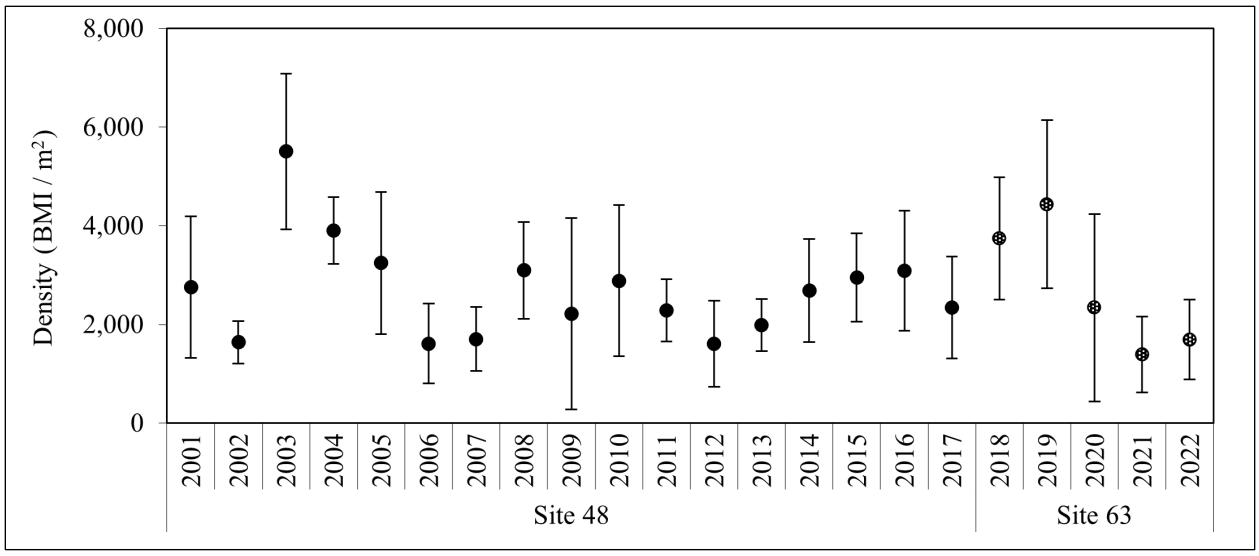

Figure 14.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate densities ± 1 SD, 2001–2022.

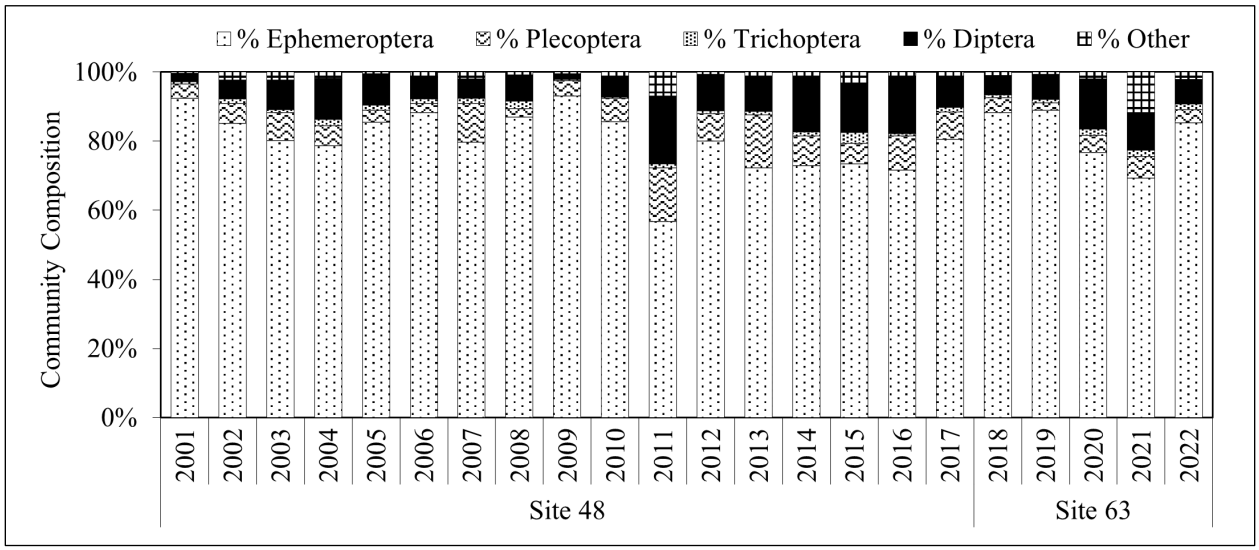

Figure 15.–Greens Creek Site 48 and Site 63 mean benthic macroinvertebrate community composition, 2001–2022.

Juvenile Fish Abundance and Condition

In 2022 at Site 63, we captured 20 Dolly Varden—the fewest fish captured during a single trapping event at Sites 48 and 63 (Figure 16). The mean fish condition factor among the Dolly Varden captured was 1.1—within the range previously observed at Sites 48 and 63. The range of length frequencies observed suggests at least two age classes were present, as in previous years at Sites 48 and 63.

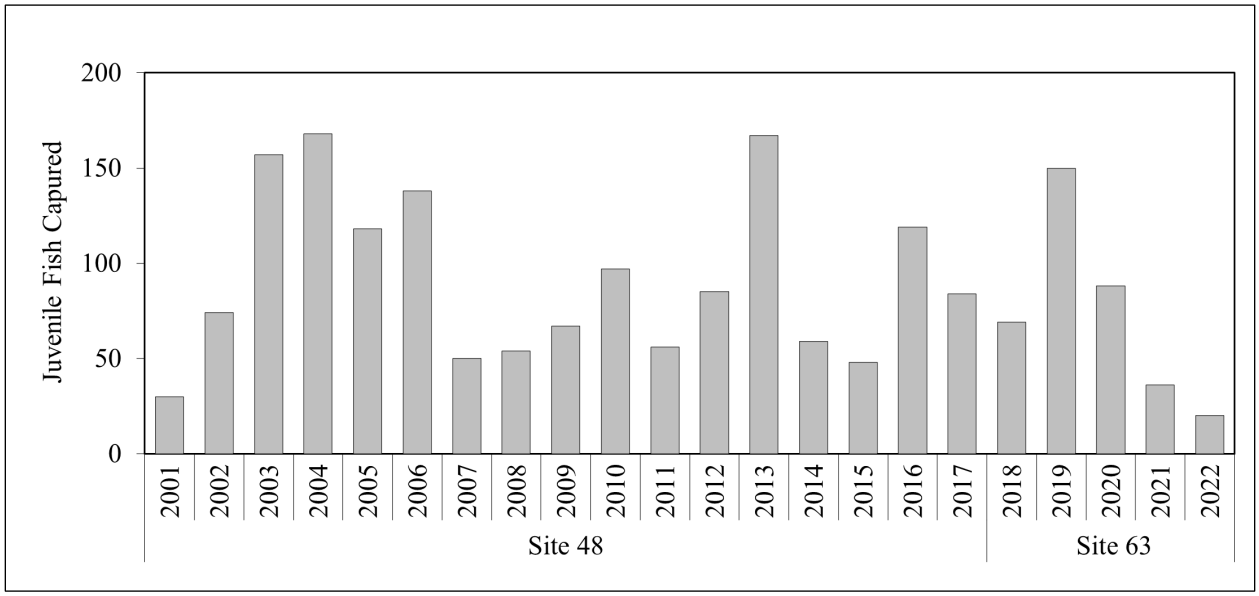

Figure 16.–Greens Creek Site 48 and Site 63 Dolly Varden captured, 2001–2022.

Juvenile Fish Element Concentrations

Among the 2022 Site 63 whole body Dolly Varden samples, all median element concentrations, excluding lead, were within ranges previously observed at Sites 48 and 63; the median lead concentration was the greatest value observed (Figures 17, 18).

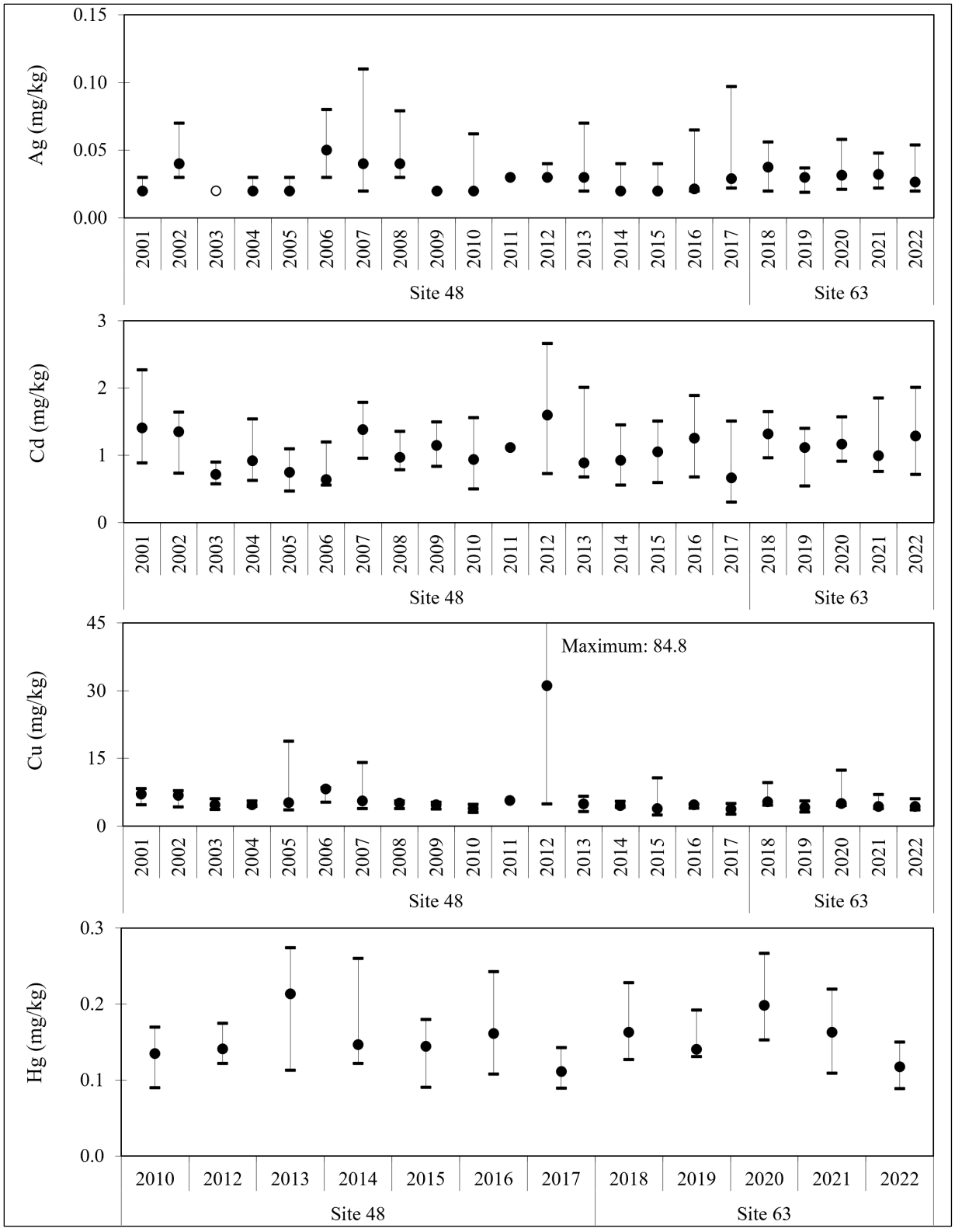

Figure 17.–Greens Creek Site 48 and Site 63 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2022, and Hg concentrations, 2010, 2012–2022.

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

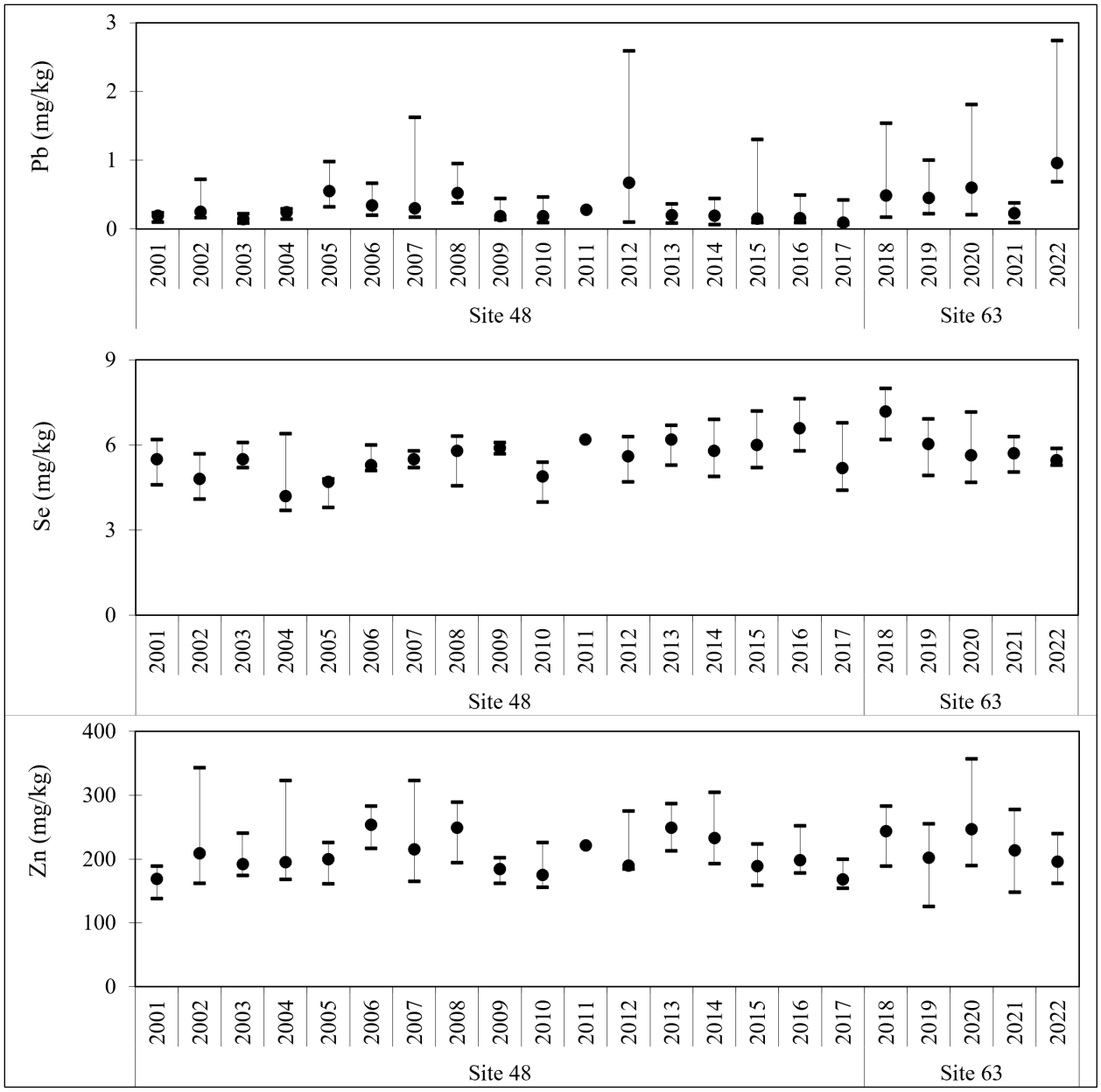

Figure 18.–Greens Creek Site 48 and Site 63 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2022.

Note: Minimum, median, and maximum concentrations presented.

GREENS CREEK SITE 54

We sampled Greens Creek Site 54 on July 12, 2022. Hecla environmental staff measured basic water quality at 1213 hours; we measured stream discharge at 1100 hours (Table 3). The USGS stream gage recorded a daily mean discharge of 77.5 ft^3/s (USGS 2023).

Table 3.–Greens Creek Site 54 water quality data, 2022.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/12/22	7.1	82.2	–[a]	86

[a] No pH value because of probe malfunction. On July 19, HGCMC measured 8.0 pH with a new probe.

Periphyton: Chlorophyll Density and Composition

The 2022 Site 54 mean Chl-*a* density was 7.73 mg/m^2—greater than recently observed 2019–2021 (Figure 19). The samples contained about 86% Chl-*a*, 14% Chl-*c*, and 0% Chl-*b*, similar to mean composition observed in previous years.

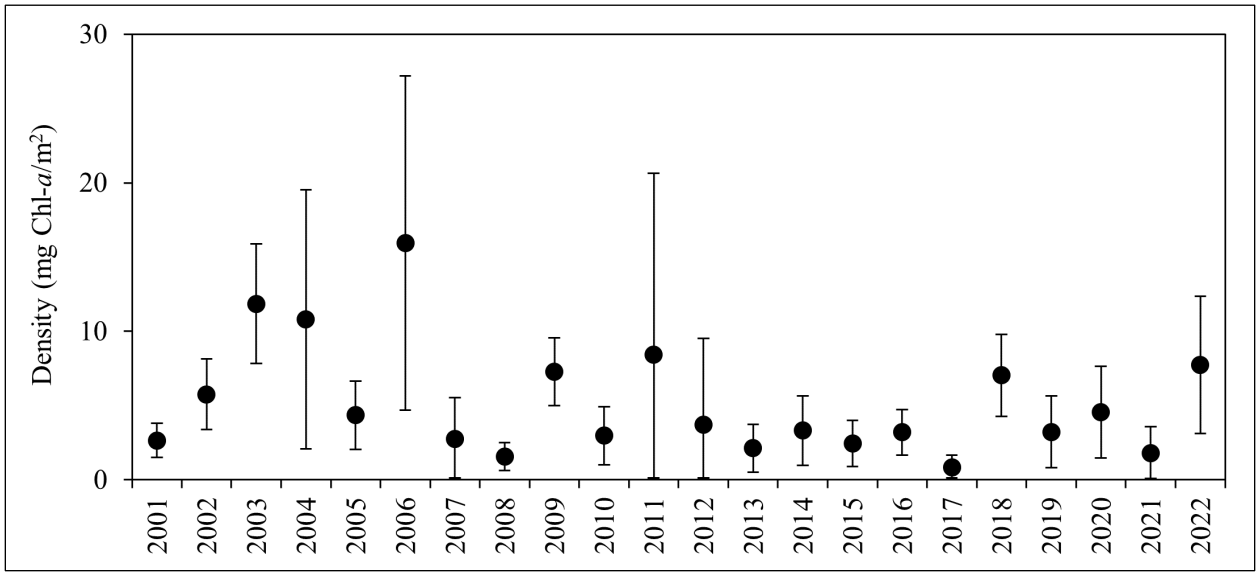

Figure 19.–Greens Creek Site 54 mean chlorophyll *a* densities ± 1 SD, 2001–2022.

Benthic Macroinvertebrate Density and Community Composition

Among the 2022 BMI samples collected at Site 54, we counted 22 taxa and estimate mean density at 1,427 BMI/m^2, with EPT insects composing 92% of the samples—all among the lowest previously observed (Figures 20, 21). The dominant taxon was Ephemeroptera of the family Baetidae composing 53% of the samples.

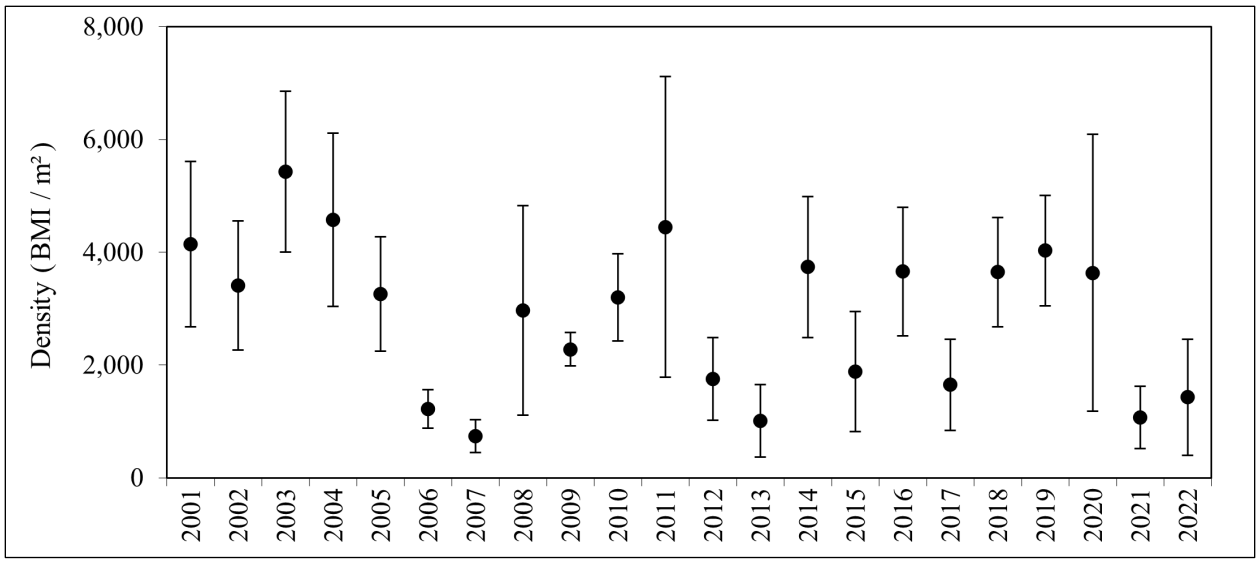

Figure 20.–Greens Creek Site 54 mean benthic macroinvertebrate densities ± 1 SD, 2001–2022.

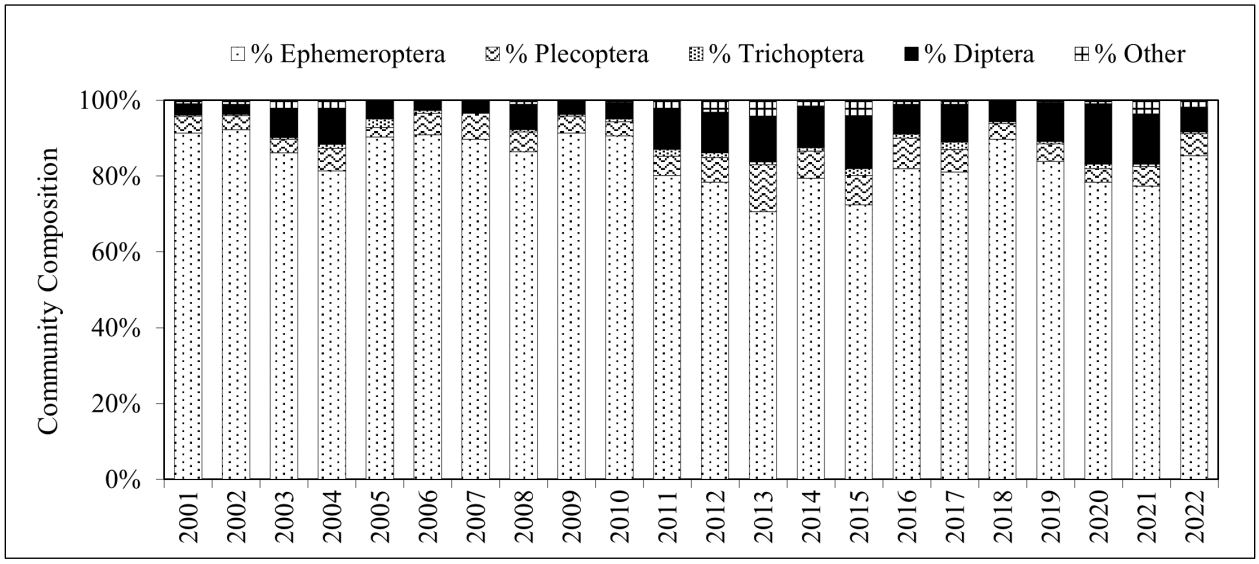

Figure 21.–Greens Creek Site 54 mean benthic macroinvertebrate community composition, 2001–2022.

Juvenile Fish Abundance and Condition

In 2022 at Site 54, we captured 47 Dolly Varden and 12 juvenile coho salmon (61–86 mm FL)[dd]—within the range of both species captured in previous years during a single trapping event (Figure 22). The mean fish condition factor for Dolly Varden was 1.0; the mean fish condition factor for the juvenile coho salmon was 1.2. The range of length frequencies observed for Dolly Varden suggests multiple age classes were present, as in previous years.

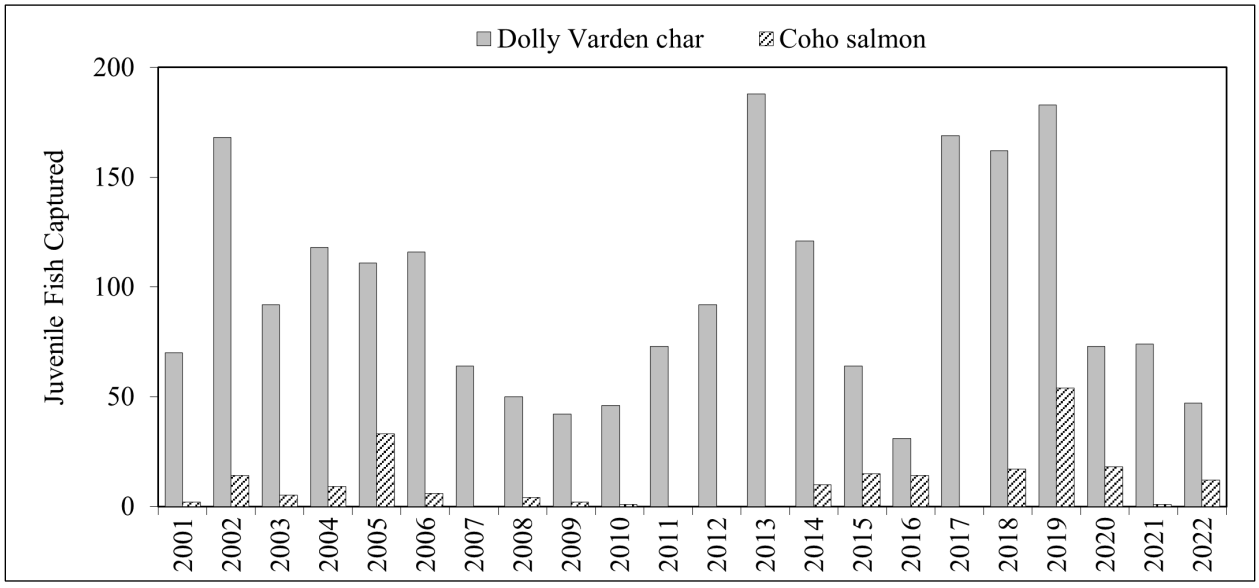

Figure 22.– Greens Creek Site 54 juvenile fish captured, 2001–2022.

Note: 2001–2010 data were from a 28 m reach, while 2011–2022 data from a 50 m reach. Species other than Dolly Varden and coho salmon are not illustrated.

Juvenile Fish Element Concentrations

Among the 2022 Site 54 whole body Dolly Varden samples, all median element concentrations, excluding lead, were within ranges previously observed at Sites 48 and 63; The median lead concentration and range of concentrations were the greatest observed (Figures 23, 24).

[dd] During historical sampling events, juvenile coho salmon were occasionally observed within the sampling reach while none were captured (Zutz 2017).

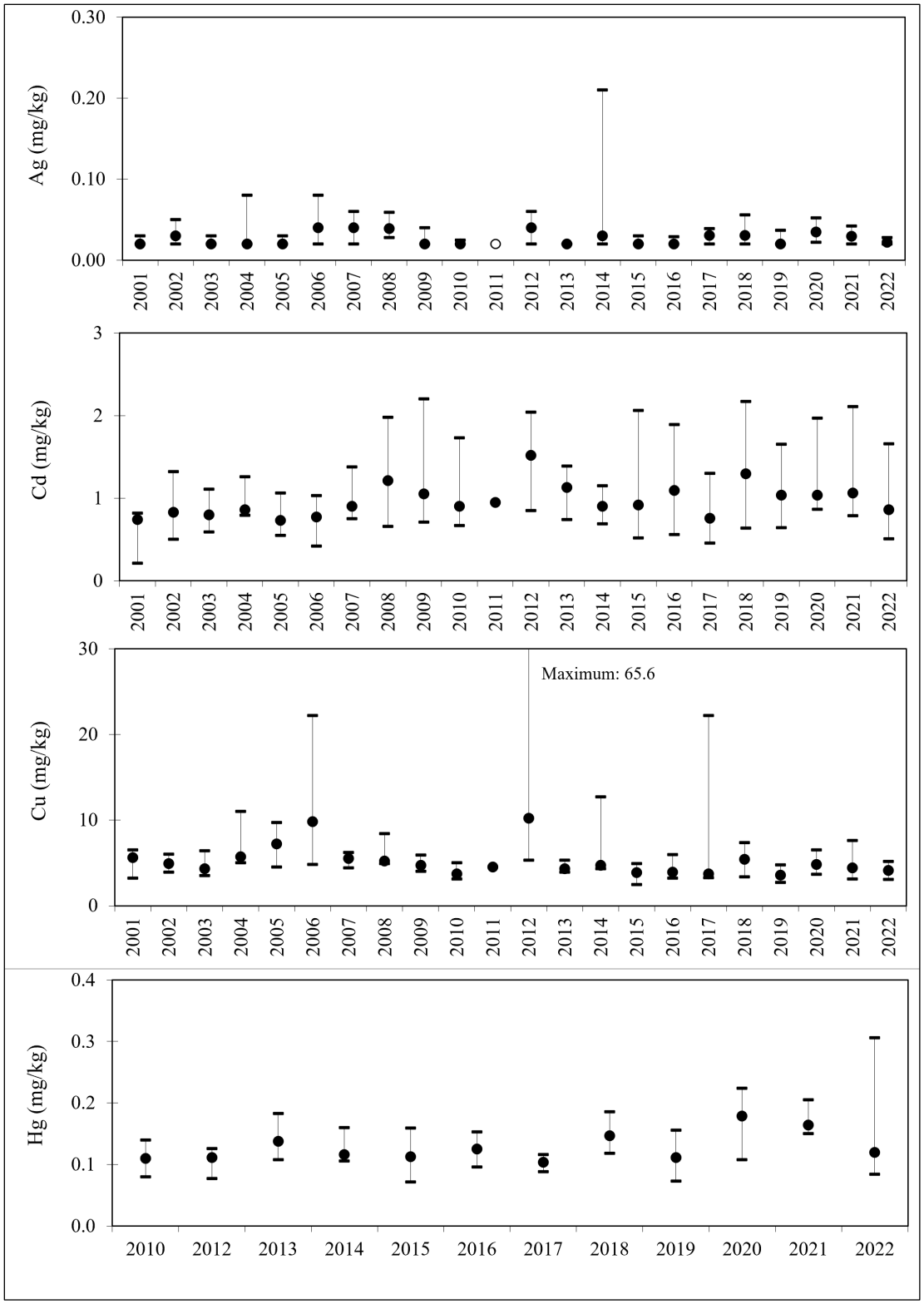

Figure 23.–Greens Creek Site 54 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2022, and Hg concentrations, 2010, 2012–2022.

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

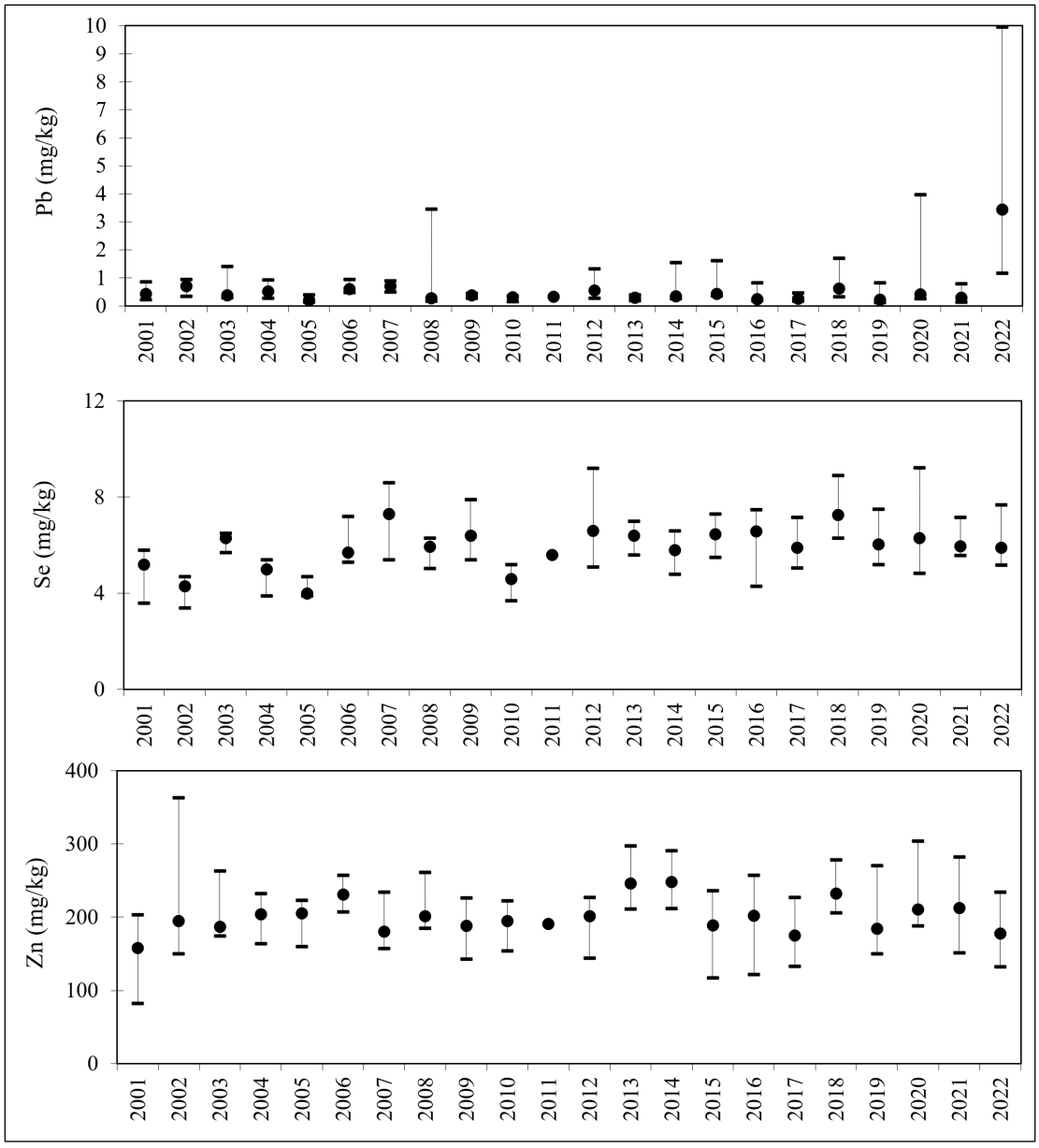

Figure 24.–Greens Creek Site 54 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2022.

Note: Minimum, median, and maximum concentrations presented.

TRIBUTARY CREEK SITE 9 AND SITE 1847

We sampled Tributary Creek Sites 9 on July 11, 2022, and 1847 on July 13, 2022. At Site 9, we measured stream discharge at 1300 hours and basic water quality at 0945 hours. At Site 1847, we measured discharge at 1145 hours and water quality at 1200 hours (Table 4).

Table 4.–Greens Creek Sites 9 and 1847 water quality data, 2022.

Sample Date	Sample Site	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/11/22	9	12.3	54	6.8	1.95
07/13/22	1847	11.9	60	6.8	1.03

Periphyton: Chlorophyll Density and Composition

At Site 9, the 2022 mean Chl-*a* density was 9.51 mg/m^2—within the upper range previously observed (Figure 25). The samples contained about 94% Chl-*a*, 6% Chl-*c*, and zero Chl-*b*, similar to mean composition observed in previous years.

At Site 1847, the 2022 mean Chl-*a* density was 19.94 mg/m^2—the greatest value observed (Figure 25). The samples contained about 91% Chl-*a*, 9% Chl-*c*, and zero Chl-*b*, similar to mean composition observed in previous years 2018–2021.

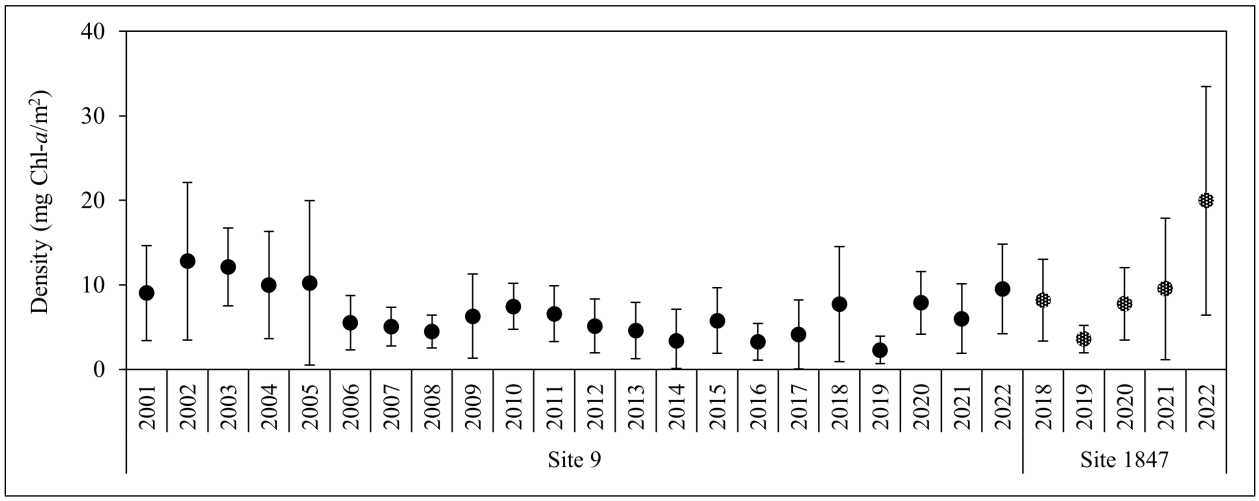

Figure 25.–Tributary Creek Site 9 and Site 1847 mean chlorophyll *a* densities ± 1 SD, 2001–2022.

Benthic Macroinvertebrate Density and Community Composition

Among the 2022 BMI samples collected at Site 9, we counted 26 taxa and estimate mean density at 2,330 BMI/m^2 with EPT insects composing 48% of the samples—all within ranges previously observed (Figures 26, 27). Dominant taxa were Diptera of the family Simuliidae (24%) and Chironomidae (16%).

Among the 2022 BMI samples collected at Site 1847, we counted 26 taxa and estimate mean density at 3,653 BMI/m^2 with EPT insects composing 66% of the samples—both within the ranges previously observed (Figures 26, 27). Dominant taxa were Ephemeroptera of the family Heptageniidae (31%) and Diptera of the family Chironomidae (23%).

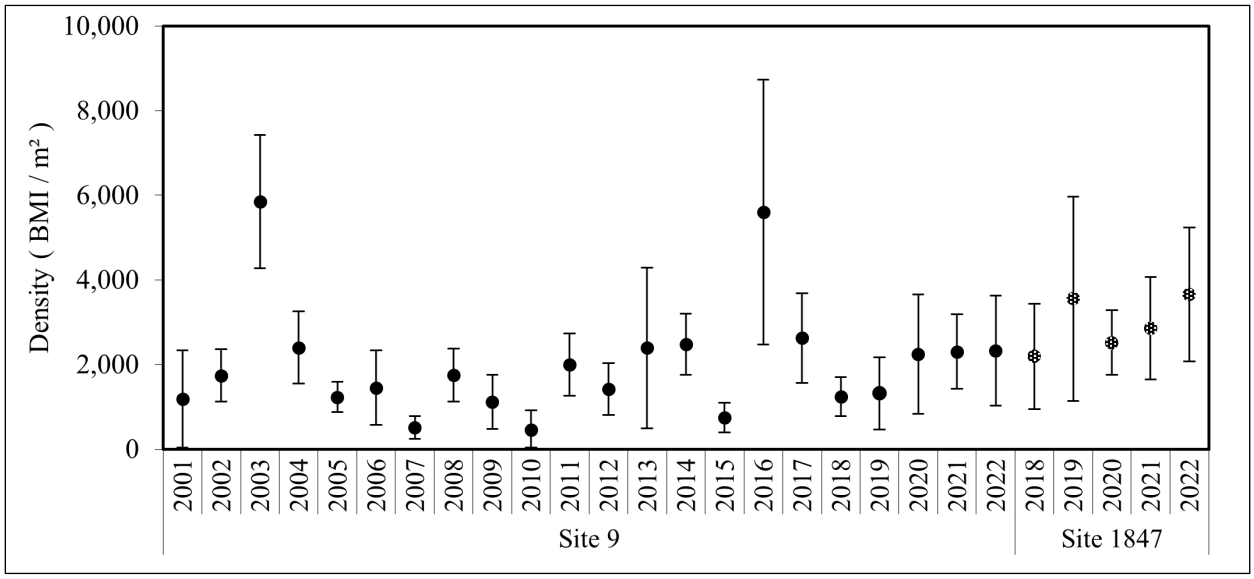

Figure 26.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate densities ± 1 SD, 2001–2022.

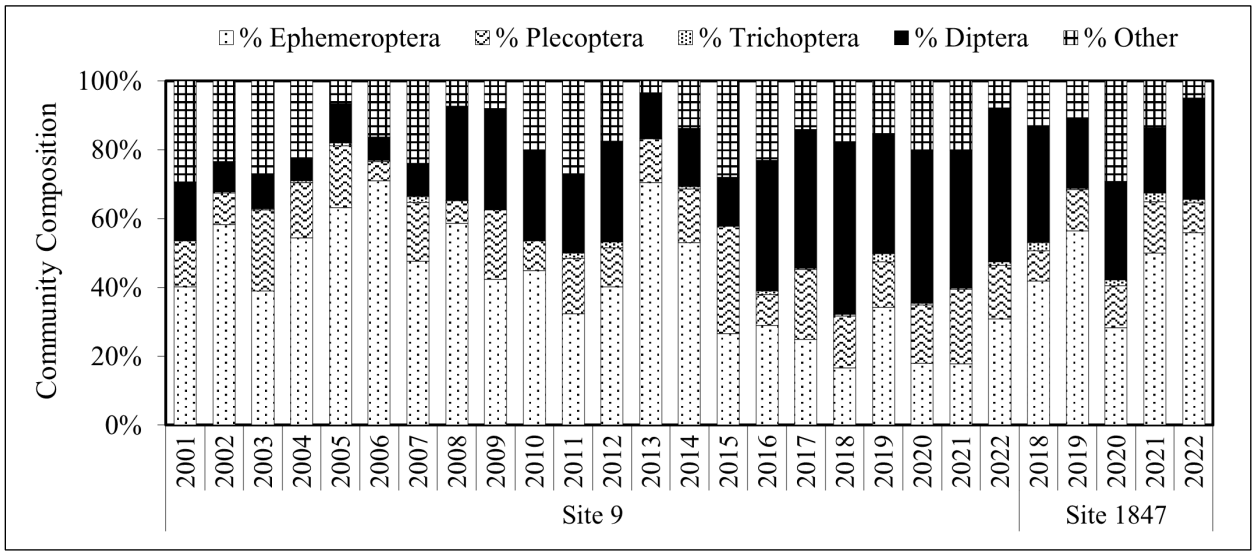

Figure 27.–Tributary Creek Site 9 and Site 1847 mean benthic macroinvertebrate community composition, 2001–2022.

Juvenile Fish Abundance and Condition

In 2022 at Site 9, we captured zero Dolly Varden and 26 juvenile coho salmon—the first year no Dolly Varden were captured during a single trapping event (Figure 28). The mean fish condition factor was 1.2 for coho salmon. The range of length frequencies observed suggests two age classes of coho salmon were present.

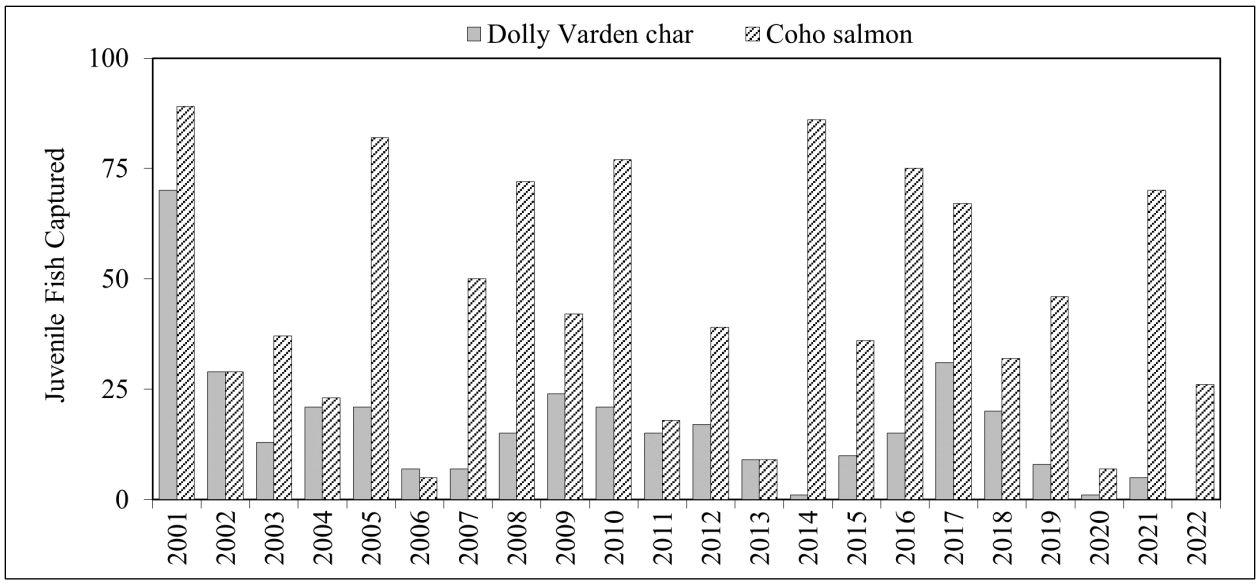

Figure 28.–Tributary Creek Site 9 juvenile fish captured, 2001–2022.

Juvenile Fish Element Concentrations

Among the 10 whole body Dolly Varden samples collected at Site 9 in 2022,[ee] all median element concentrations were within ranges previously observed (Figures 29, 30).

[ee] Due to scarcity of Dolly Varden captured at Tributary Creek Site 9 in 2022, ten samples were collected upstream and downstream of the sample reach, as in previous years when necessary to achieve a minimum sample size of six fish. After sampling Site 9 on July 11, we returned on August 15, 2022 to capture an additional six fish via a backpack electrofisher between Site 1847 and Site 9, for a total of 10 samples collected in 2022.

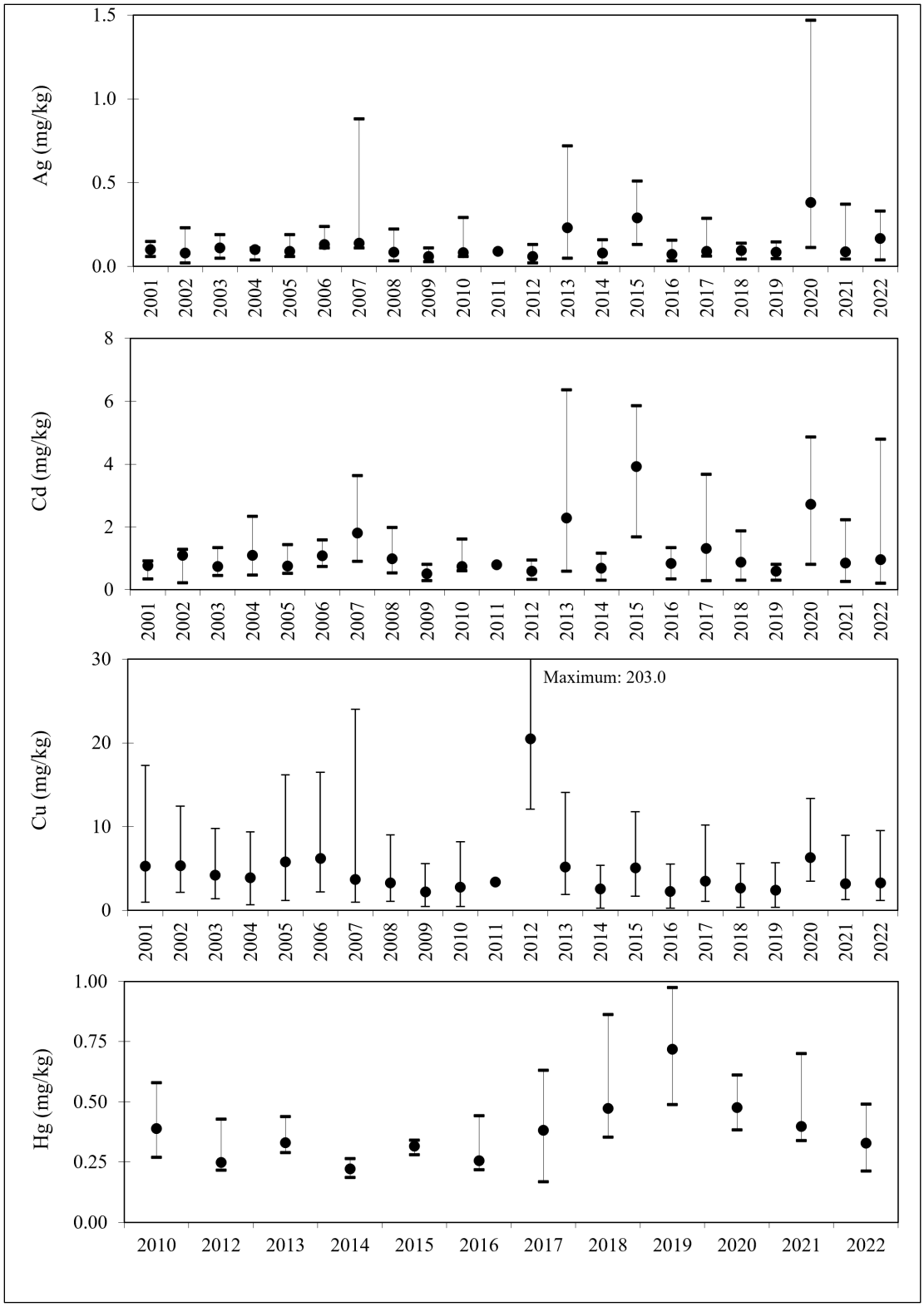

Figure 29.–Tributary Creek Site 9 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2022, and Hg concentrations, 2010, 2012–2022.

Note: Minimum, median, and maximum concentrations presented.

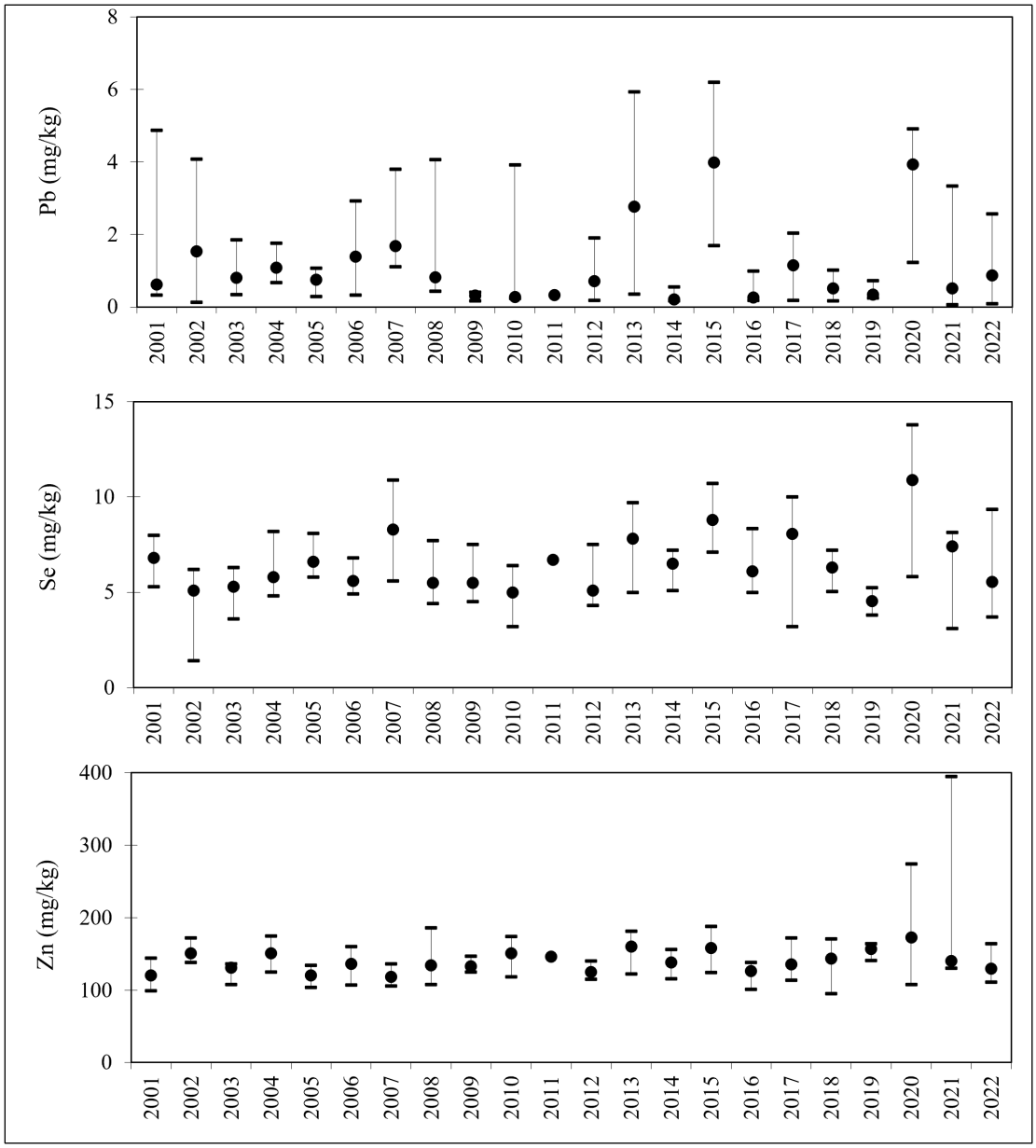

Figure 30.–Tributary Creek Site 9 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2022.

Note: Minimum, median, and maximum concentrations presented.

COMPARISONS AMONG GREENS CREEK SITES

Periphyton: Chlorophyll Density and Composition

In 2022, the mean Chl-*a* density at Site 63 (7.60 mg/m^2) was similar to Site 54 (7.73 mg/m^2). Mean Chl-*a* densities at Sites 48 and 63 and Site 54 generally followed a similar trend 2001–2022 (Figure 31). Periphyton samples collected at all Greens Creek sites generally contained about 90% Chl-*a,* nearly 0% Chl-*b,* and 10% Chl-*c* each year.

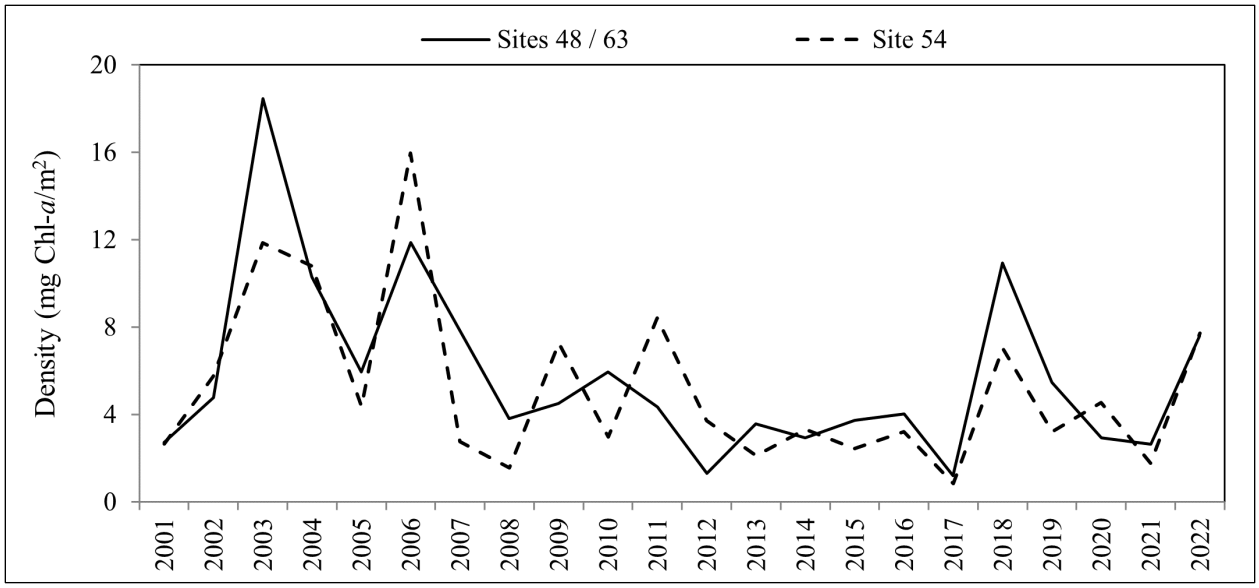

Figure 31.–Greens Creek mean chlorophyll *a* densities, 2001–2022.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2022.

Benthic Macroinvertebrate Density and Community Composition

From 2001 through 2022, 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 samples at each site.

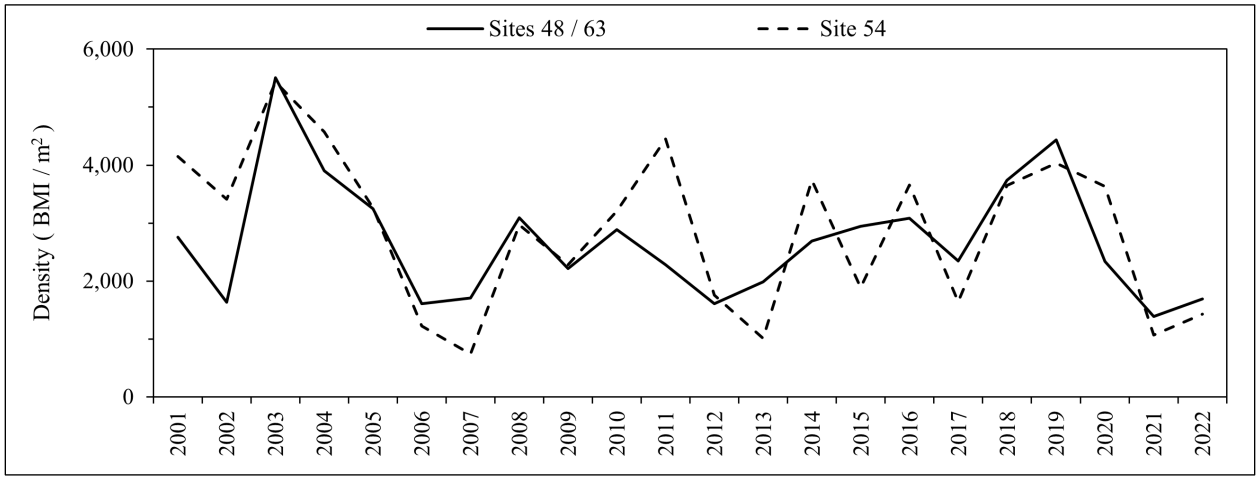

Figure 32.–Greens Creek mean benthic macroinvertebrate densities, 2001–2022.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2022.

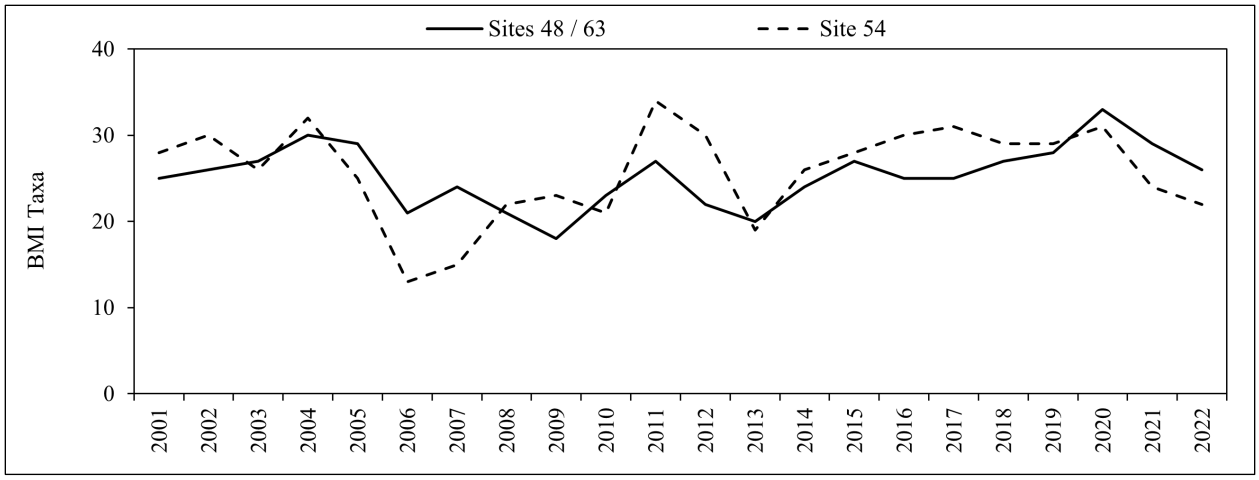

Figure 33.–Greens Creek benthic macroinvertebrate taxa richness, 2001–2022.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2022.

Juvenile Fish Abundance and Condition

In 2022, we captured fewer Dolly Varden at Site 63 than at Site 54, as occasionally observed previously, and few fish overall; high streamflow during sampling limited sites for using minnow traps and influenced our capture results, and preceding high streamflow may have influenced fish distribution. Generally, the number of Dolly Varden captured during a single trapping event has been similar among Greens Creek sample sites since sampling began in 2001 (Figure 34). We captured several age classes of Dolly Varden at all sites most years, and mean fish condition was similar among sites each year, about 1.0. We captured 12 juvenile coho salmon at Site 54 in 2022, within the range observed since HGCMC repaired the Greens Creek fish pass in 2016.

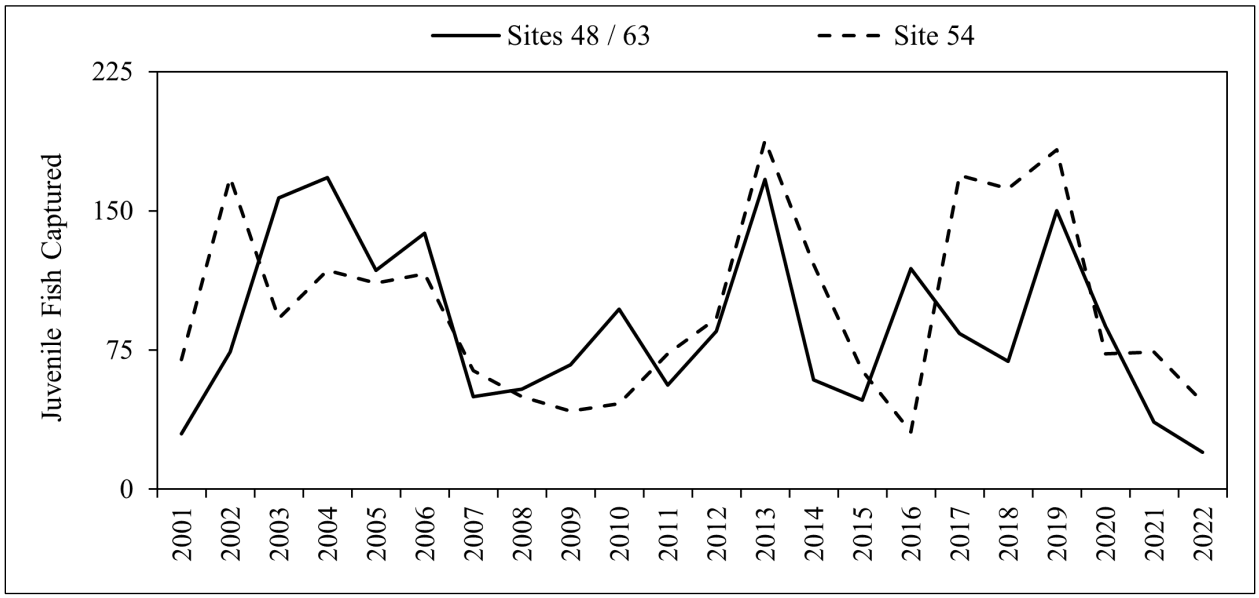

Figure 34.–Greens Creek Dolly Varden captured, 2001–2022.
Note: Site 54 2001–2010 data extrapolated to 50 m sample reach for comparison. Site 48 data collected 2001–2017, and Site 63 data collected 2018–2022.

COMPARISONS AMONG SITES

Juvenile Fish Element Concentrations

In 2022, samples collected at Tributary Creek contained greater median concentrations of Ag and Hg than the Greens Creek samples, and lower median concentrations of Pb, Cd, Cu, Se and Zn (Figure 35). Usually, samples collected at Tributary Creek contain greater concentrations and variability than the Greens Creek samples, except Cu and Zn which were generally greater at Greens Creek sites (Figures 36, 37).

Among 2022 samples, most median element concentrations were within the range of values reported for sample sites with mining-related influence elsewhere in Alaska; however, as observed in previous years, median concentrations of Ag and Hg at Tributary Creek and Pb and Zn at Greens Creek Site 54 were greater than median values for reference and exploration sites (Legere and Timothy 2016).

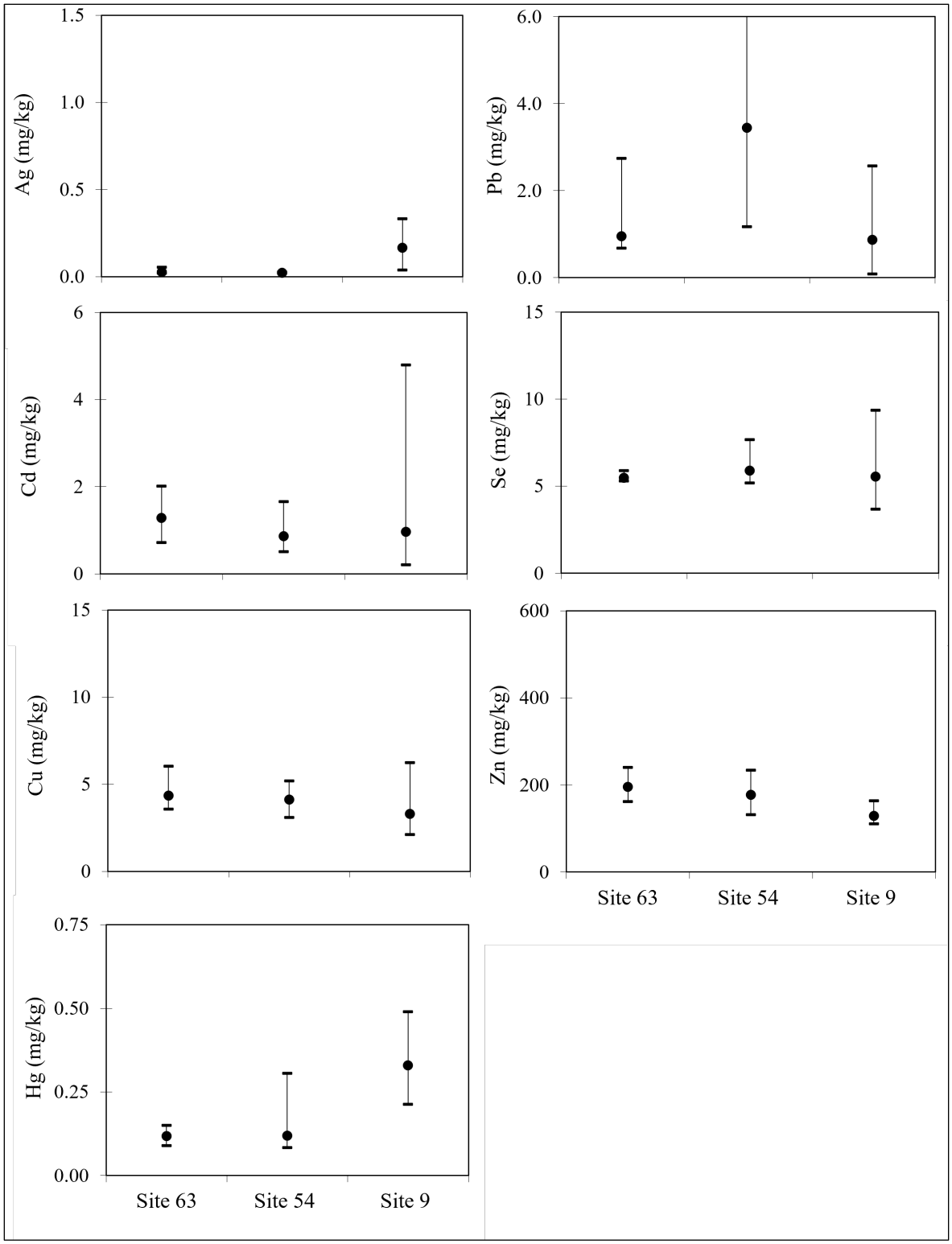

Figure 35.–Greens Creek and Tributary Creek whole body Dolly Varden element concentrations, 2022.
Note: Minimum, median, and maximum whole-body concentrations presented.

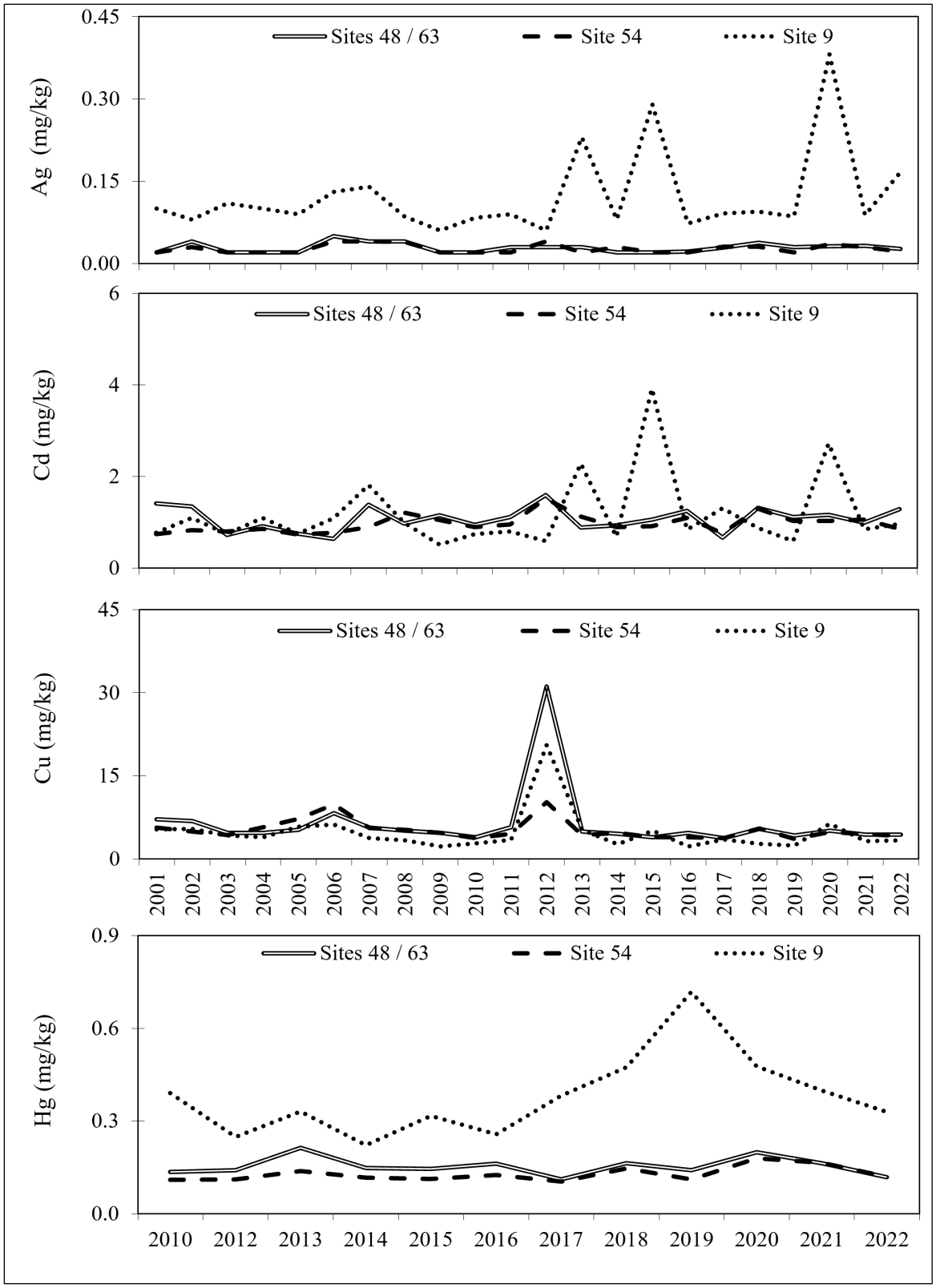

Figure 36.–Greens Creek and Tributary Creek whole body Dolly Varden median Ag, Cd, and Cu concentrations, 2001–2022, and median Hg concentrations, 2010, 2012–2022.

Note: Solid line 2001–2017 is Site 48; 2018–2022 is Site 63.

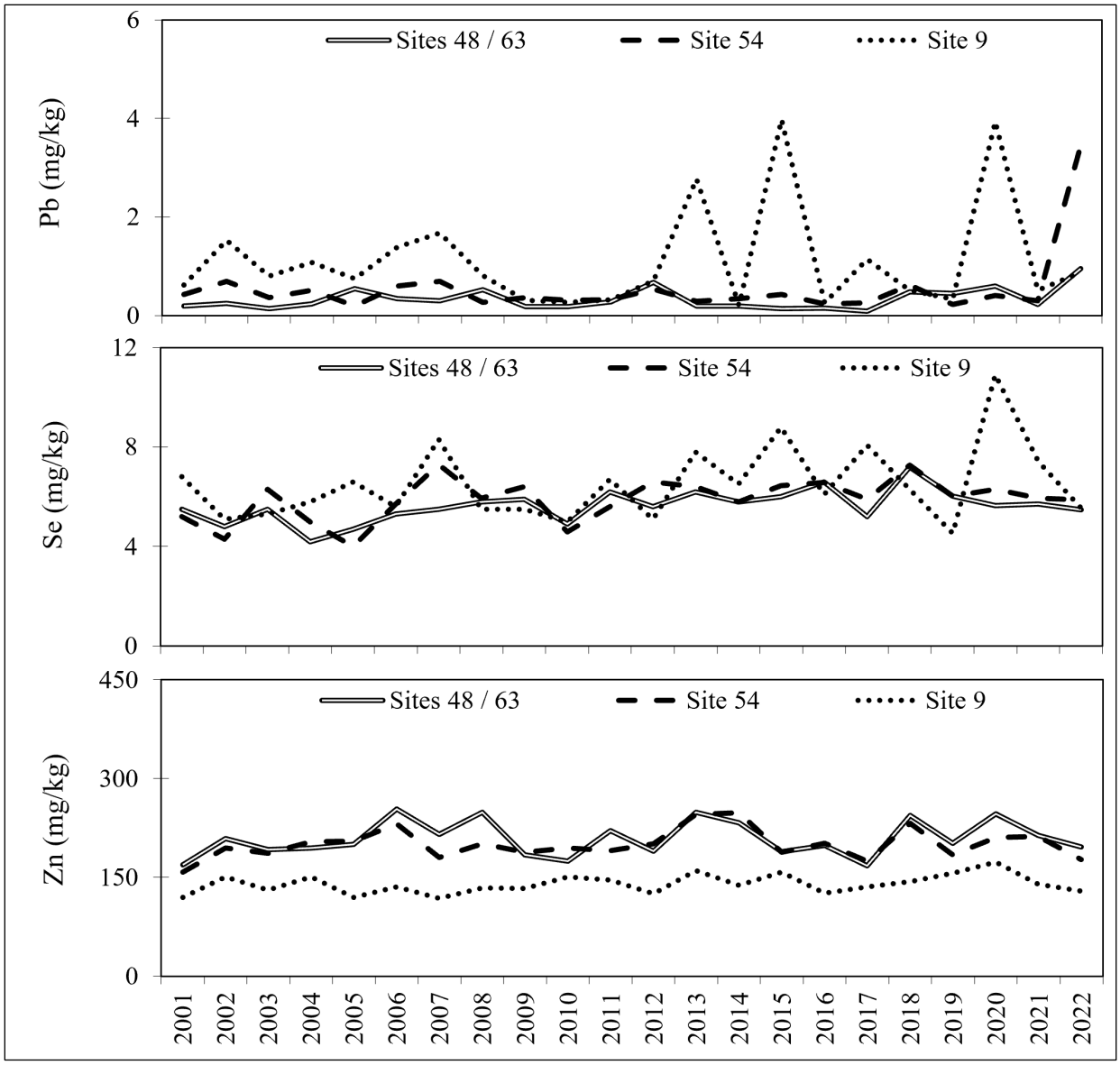

Figure 37.–Greens Creek and Tributary Creek whole body Dolly Varden median Pb, Se, and Zn concentrations, 2001–2022.

Note: Solid line 2001–2017 is Site 48; 2018–2022 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.

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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*
	2.03	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, 2018–2022.

	7/11/2018			7/9/2019			7/16/2020			7/12/2021		
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*
	ND	ND	ND	4.17	0.00	0.33	3.10	0.00	0.38	1.82	0.00	0.25
	5.45	0.00	0.79	4.59	0.00	0.29	**0.25**	ND	ND	3.84	0.00	0.59
	9.29	0.00	1.77	2.89	0.00	0.30	2.06	0.00	0.25	6.62	0.00	1.00
	7.37	0.00	0.87	4.73	0.00	0.35	3.44	0.00	0.32	1.60	0.00	0.17
	ND	ND	ND	2.78	0.00	0.13	3.74	0.00	0.58	1.39	0.00	0.12
	23.07	0.00	4.01	5.34	0.00	0.48	0.32	0.00	0.08	3.63	0.00	0.55
	8.22	0.00	0.96	2.88	0.00	0.21	5.66	0.00	0.71	1.60	0.00	0.26
	4.38	0.00	0.64	13.03	0.00	1.09	6.94	0.00	0.52	1.17	0.00	0.13
	15.06	0.00	2.28	5.98	0.00	0.75	1.88	0.00	0.21	1.71	0.00	0.31
	14.63	0.00	2.28	8.33	0.00	0.47	2.02	0.00	0.28	3.10	0.00	0.48
mean	10.93	0.00	1.70	5.47	0.00	0.44	2.94	0.00	0.37	2.65	0.00	0.39
minimum	4.38	0.00	0.64	2.78	0.00	0.13	0.25	0.00	0.08	1.17	0.00	0.12
maximum	23.07	0.00	4.01	13.03	0.00	1.09	6.94	0.00	0.71	6.62	0.00	1.00

	7/12/2022		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*
	2.94	0.00	0.29
	12.02	0.00	1.56
	8.01	0.00	1.04
	7.52	0.00	1.12
	4.49	0.00	0.44
	6.09	0.00	0.98
	9.61	0.00	1.23
	13.24	0.00	1.90
	6.73	0.00	0.68
	5.34	0.00	1.08
mean	7.60	0.00	1.03
minimum	2.94	0.00	0.29
maximum	13.24	0.00	1.90

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, 2001–2022.

	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

	7/12/2021			7/12/2022		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	0.85	0.00	0.03	2.88	0.00	0.33
	0.56	0.00	0.06	14.74	0.00	1.77
	0.97	0.00	0.13	2.88	0.00	0.67
	2.65	0.00	0.43	14.20	0.00	2.12
	1.07	0.00	0.04	9.40	0.00	1.48
	1.39	0.00	0.13	12.07	0.00	1.68
	1.50	0.00	0.20	6.94	0.00	1.85
	0.75	0.00	0.05	5.98	0.00	0.66
	1.51	0.00	0.22	5.23	0.00	1.04
	6.62	0.00	0.99	2.99	0.00	0.55
mean	1.79	0.00	0.23	7.73	0.00	1.22
minimum	0.56	0.00	0.03	2.88	0.00	0.33
maximum	6.62	0.00	0.99	14.74	0.00	2.12

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, 2001–2022.

	7/23/2001			7/23/2002			7/23/2003			7/21/2004		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	6.62	0.00	0.79	8.91	0.00	0.52	9.61	0.00	1.26	9.40	0.22	0.80
	11.15	0.00	1.20	16.43	0.95	1.28	17.19	0.00	0.79	5.77	0.00	0.42
	15.05	0.00	1.47	12.65	0.17	0.00	7.69	0.00	0.29	5.45	0.00	0.48
	16.58	0.23	1.51	5.44	0.45	0.07	8.76	0.00	1.11	6.09	0.03	0.38
	3.15	0.00	0.33	23.72	1.21	0.84	10.47	0.00	1.92	14.52	0.02	1.40
	2.59	0.06	0.28	12.75	0.40	0.22	10.79	0.00	1.88	6.51	0.17	0.40
	1.61	0.00	0.01	32.53	0.00	1.89	22.64	0.00	3.98	10.36	0.13	0.80
	6.66	0.00	0.43	4.40	1.50	0.00	12.39	0.00	2.43	6.84	0.04	0.36
	15.21	0.81	1.44	2.94	0.30	0.17	8.54	0.00	1.69	26.17	0.51	2.61
	11.55	0.00	1.51	8.01	1.47	0.27	13.03	0.00	3.86	8.44	0.22	0.53
mean	9.02	0.11	0.90	12.78	0.65	0.53	12.11	0.00	1.92	9.96	0.13	0.82
minimum	1.61	0.00	0.01	2.94	0.00	0.00	7.69	0.00	0.29	5.45	0.00	0.36
maximum	16.58	0.81	1.51	32.53	1.50	1.89	22.64	0.00	3.98	26.17	0.51	2.61

	7/23/2005			7/21/2006			7/20/2007			7/23/2008		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	6.09	0.00	0.25	3.42	0.25	0.19	ND	ND	ND	2.35	0.00	0.12
	8.01	1.28	0.18	4.08	0.40	0.20	5.45	0.08	0.23	6.94	0.00	0.27
	1.82	0.13	0.07	6.94	0.00	0.40	7.26	0.00	0.54	6.30	0.24	0.34
	9.08	0.06	0.29	4.11	0.01	0.32	ND	ND	ND	6.41	0.00	0.25
	4.70	0.00	0.10	4.17	0.00	0.39	ND	ND	ND	2.46	0.12	0.19
	4.70	0.00	0.12	4.78	0.00	0.29	0.85	0.16	0.11	6.19	0.05	0.39
	7.80	0.00	0.20	14.16	0.00	0.57	6.41	0.06	0.24	4.06	0.00	0.13
	14.85	0.00	0.46	4.34	0.01	0.21	7.05	0.24	0.65	4.59	0.00	0.37
	36.10	0.10	1.12	5.23	0.00	0.56	5.02	0.00	0.26	1.60	0.00	0.00
	8.97	0.00	0.26	3.66	0.37	0.26	3.20	0.00	0.23	3.74	0.00	0.28
mean	10.21	0.16	0.31	5.49	0.10	0.34	5.03	0.08	0.32	4.46	0.04	0.23
minimum	1.82	0.00	0.07	3.42	0.00	0.19	0.85	0.00	0.11	1.60	0.00	0.00
maximum	36.10	1.28	1.12	14.16	0.40	0.57	7.26	0.24	0.65	6.94	0.24	0.39

	7/22/2009			7/20/2010			7/20/2011			7/26/2012		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	2.03	0.10	0.16	12.82	0.00	0.39	4.81	0.47	0.08	3.63	0.00	0.25
	5.45	0.17	0.38	6.62	0.00	0.39	3.84	0.00	0.12	8.97	0.00	0.33
	4.38	0.24	0.30	7.69	0.00	0.43	4.91	0.00	0.34	10.68	0.00	0.48
	7.05	0.58	0.33	5.66	0.12	0.32	10.47	0.03	0.50	3.74	0.00	0.25
	9.08	0.36	0.49	9.72	0.88	0.40	5.13	0.00	0.37	1.28	0.00	0.04
	8.76	0.41	0.62	5.98	0.00	0.20	1.71	0.00	0.01	1.71	0.00	0.12
	2.14	0.08	0.09	5.55	0.00	0.40	6.30	0.00	0.44	5.66	0.00	0.29
	18.37	0.66	0.78	10.57	0.28	0.34	9.61	0.00	0.35	6.09	0.00	0.26
	2.35	0.18	0.16	4.06	0.05	0.16	12.50	0.00	0.87	2.14	0.00	0.21
	3.20	0.20	0.33	5.77	0.00	0.32	6.30	0.00	0.17	7.37	0.00	0.40
mean	6.28	0.30	0.36	7.44	0.13	0.34	6.56	0.05	0.33	5.13	0.00	0.26
minimum	2.03	0.08	0.09	4.06	0.00	0.16	1.71	0.00	0.01	1.28	0.00	0.04
maximum	18.37	0.66	0.78	12.82	0.88	0.43	12.50	0.47	0.87	10.68	0.00	0.48

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	7/23/2013			7/23/2014			7/14/2015			7/11/2016		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	11.00	0.00	0.64	ND	ND	ND	5.13	0.00	0.33	5.66	0.00	0.35
	2.88	0.00	0.19	11.21	0.00	0.63	15.06	0.00	0.94	2.24	0.00	0.13
	5.45	0.00	0.40	1.60	0.00	0.17	2.67	0.00	0.14	1.88	0.00	0.21
	5.02	0.00	0.40	5.87	0.00	0.37	3.63	0.00	0.09	1.82	0.00	0.22
	2.24	0.00	0.15	5.98	0.00	0.60	5.55	0.00	0.47	7.80	0.00	0.90
	2.99	0.00	0.17	0.75	0.00	0.06	2.56	0.00	0.11	1.92	0.00	0.26
	9.51	0.00	0.66	1.71	0.00	0.15	2.88	0.21	0.10	1.33	0.00	0.08
	0.32	0.05	0.15	**0.05**	ND	ND	9.29	0.00	0.87	1.55	0.03	0.16
	3.52	0.00	0.19	0.11	0.00	0.00	6.62	0.00	0.52	3.10	0.00	0.21
	2.78	0.00	0.17	3.20	0.00	0.23	4.06	0.00	0.30	4.91	0.00	0.46
mean	4.57	0.01	0.31	3.39	0.00	0.28	5.75	0.02	0.39	3.22	0.00	0.30
minimum	0.32	0.00	0.15	0.05	0.00	0.00	2.56	0.00	0.09	1.33	0.00	0.08
maximum	11.00	0.05	0.66	11.21	0.00	0.63	15.06	0.21	0.94	7.80	0.03	0.90

	7/11/2017			7/12/2018			7/11/2019			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

	7/13/2021			7/11/2022		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*	Chl-*a*	Chl-*b*	Chl-*c*
	14.31	0.00	0.73	4.91	0.00	0.41
	2.46	0.30	0.40	4.06	0.00	0.37
	11.96	0.00	0.73	17.84	0.00	1.04
	2.99	0.00	0.18	7.69	0.00	0.55
	3.74	0.00	0.21	6.41	0.00	0.60
	5.55	0.00	0.20	4.81	0.00	0.27
	3.20	0.00	0.16	11.32	0.00	0.76
	2.78	0.00	0.14	13.24	0.00	1.12
	5.23	0.00	0.23	17.94	0.00	1.03
	7.69	0.00	0.38	6.84	0.00	0.37
mean	5.99	0.03	0.34	9.51	0.00	0.65
minimum	2.46	0.00	0.14	4.06	0.00	0.27
maximum	14.31	0.30	0.73	17.94	0.00	1.12

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, 2018–2022.

	7/12/2018			**7/11/2019**			**7/15/2020**			**7/13/2021**		
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*
	16.98	0.00	3.10	3.95	0.00	0.40	15.38	1.55	1.02	16.34	0.00	0.74
	9.29	0.00	1.66	2.78	0.00	0.25	5.23	0.00	0.26	8.04	0.00	0.36
	6.09	0.00	0.70	0.75	0.00	0.05	12.50	0.00	1.28	27.55	0.00	1.40
	3.63	0.00	0.28	4.70	0.00	0.52	2.46	0.51	0.13	6.51	0.00	0.47
	12.82	0.00	2.14	5.77	0.00	0.58	8.12	0.00	0.54	1.07	0.04	0.17
	3.63	0.02	0.57	4.49	0.00	0.43	6.41	0.00	0.30	6.11	0.00	0.46
	2.24	0.00	0.33	1.92	0.00	0.09	8.44	0.00	0.61	1.13	0.16	0.05
	ND	ND	ND	4.17	0.00	0.32	6.41	0.00	0.52	15.17	0.00	0.87
	8.01	0.00	0.66	ND	ND	ND	1.71	0.00	0.11	1.92	0.00	0.08
	10.68	0.00	1.29	ND	ND	ND	10.89	0.00	0.58	11.32	0.00	0.55
mean	8.15	0.00	1.19	3.57	0.00	0.33	7.76	0.21	0.54	9.52	0.02	0.52
minimum	2.24	0.00	0.28	0.75	0.00	0.05	1.71	0.00	0.11	1.07	0.00	0.05
maximum	16.98	0.02	3.10	5.77	0.00	0.58	15.38	1.55	1.28	27.55	0.16	1.40

	7/13/2022		
mg/m^2	Chl-*a*	Chl-*b*	Chl-*c*
	34.07	0.00	4.74
	23.39	0.00	1.83
	6.51	0.00	1.01
	15.59	0.00	1.21
	29.48	0.00	3.20
	34.50	0.00	2.97
	2.46	0.00	0.25
	11.43	0.00	1.00
	37.70	0.00	4.14
	4.27	0.00	0.29
mean	19.94	0.00	2.06
minimum	2.46	0.00	0.25
maximum	37.70	0.00	4.74

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

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	1%	1%	1%	2%	2%	1%	2%	2%	0%	0%	1%	1%	1%	1%	3%	1%	1%
% Aquatic Diptera	3%	6%	9%	12%	9%	6%	6%	8%	2%	6%	20%	11%	10%	16%	14%	17%	9%
% Other	0%	2%	2%	2%	1%	1%	2%	1%	0%	1%	7%	1%	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, 2018–2022.

	2018	2019	2020	2021	2022
Total BMI Taxa	27	28	33	29	26
Mean BMI Taxa / Sample	14	16	14	16	13
Total Ephemeroptera Taxa	8	8	9	8	9
Total Plecoptera Taxa	7	6	8	6	7
Total Trichoptera Taxa	2	5	3	3	4
Total Counts					
Ephemeroptera	2,271	2,715	1,237	663	993
Plecoptera	110	65	80	61	43
Trichoptera	20	30	29	16	20
Aquatic Diptera	144	220	234	105	83
Other	26	21	31	112	24
% Ephemeroptera	88%	89%	77%	69%	85%
% Plecoptera	4%	2%	5%	6%	4%
% Trichoptera	1%	1%	2%	2%	2%
% Aquatic Diptera	6%	7%	15%	11%	7%
% Other	1%	1%	2%	12%	2%
% EPT	93%	92%	84%	77%	91%
% Chironomidae	5%	7%	12%	6%	5%
% Dominant Taxon	39%	38%	39%	32%	43%
Total BMI	2,571	3,051	1,611	957	1,163
Total Terrestrial Invertebrates	4	6	10	0	2
Total Invertebrates	2,575	3,057	1,621	957	1,165
% Sample BMI	100%	100%	99%	100%	99.8%
% Sample Terrestrial	0%	0%	1%	0%	0.2%
Total Sample Area (m^2)	0.69	0.69	0.69	0.69	0.688
Mean Invertebrates / m^2	3,743	4,443	2,356	1,391	1,693
Mean BMI / m^2	3,737	4,435	2,342	1,391	1,690
± 1 SD	1,240	1,708	1,899	768	808

Appendix B.3.–Greens Creek Site 54 BMI data summary, 2001–2022.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total BMI Taxa	28	30	26	32	25	13	15	22	23	21	34	30	19	26	28	30	31	29	29	31	24	22
Mean BMI Taxa / Sample	15	14	16	19	15	9	8	14	13	13	18	14	9	11	14	15	14	14	15	15	12	11
Total Ephemeroptera Taxa	7	6	7	6	8	5	6	8	7	6	8	7	5	7	7	8	8	8	9	8	7	7
Total Plecoptera Taxa	7	7	7	10	7	3	4	4	7	5	7	10	6	7	6	6	8	7	7	9	4	6
Total Trichoptera Taxa	2	2	1	3	3	2	0	2	2	2	5	4	1	3	2	3	4	3	3	2	1	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	568	839
Plecoptera	80	54	82	117	37	30	22	65	43	53	96	49	54	109	99	204	72	105	129	91	39	56
Trichoptera	7	6	12	19	31	4	0	9	4	8	32	9	3	15	24	18	22	11	17	29	4	5
Aquatic Diptera	53	39	173	184	65	13	10	85	32	61	203	81	52	177	182	201	111	134	282	399	98	65
Other	15	15	57	46	4	1	1	13	5	8	46	24	19	24	52	22	14	10	18	22	26	17
% Ephemeroptera	91%	92%	86%	81%	90%	91%	90%	87%	91%	91%	80%	78%	71%	80%	72%	82%	81%	90%	84%	78%	77%	85%
% Plecoptera	4%	4%	4%	6%	3%	6%	7%	5%	4%	4%	5%	6%	12%	7%	8%	8%	6%	4%	5%	4%	5%	6%
% Trichoptera	0%	0%	1%	1%	2%	1%	0%	1%	0%	1%	2%	1%	1%	1%	2%	1%	2%	0%	1%	1%	1%	1%
% Aquatic Diptera	3%	3%	7%	9%	5%	2%	3%	7%	3%	4%	11%	11%	12%	11%	14%	8%	10%	5%	10%	16%	13%	7%
% Other	1%	1%	2%	2%	0%	0%	0%	1%	1%	1%	2%	4%	4%	1%	4%	1%	1%	0%	1%	1%	4%	2%
% EPT	96%	96%	90%	88%	95%	97%	97%	92%	96%	95%	87%	86%	84%	87%	82%	91%	89%	94%	89%	83%	83%	92%
% Chironomidae	2%	2%	6%	8%	4%	2%	2%	5%	2%	3%	9%	9%	10%	10%	11%	6%	8%	5%	9%	15%	4%	4%
% Dominant Taxon	52%	43%	40%	38%	40%	31%	34%	53%	40%	35%	43%	30%	30%	35%	32%	25%	23%	37%	43%	39%	45%	53%
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	735	982
Total Terrestrial Invertebrates	0	4	7	1	3	1	6	1	8	9	14	5	8	12	6	3	24	4	1	3	0	2
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	735	984
% Sample BMI	100%	99%	99%	99%	99%	99%	98%	100%	99%	99%	99%	99%	98%	99%	99%	99%	98%	100%	100%	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%	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	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	1,068	1,430
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	1,068	1,427
± 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	553	1,029

Appendix B.4.–Tributary Creek Site 9 BMI data summary, 2001–2022.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total BMI Taxa	21	24	36	26	30	23	21	20	26	22	26	27	20	22	23	29	29	25	28	32	28	26
Mean BMI Taxa / Sample	14	15	21	14	14	11	10	14	13	10	12	15	11	12	11	18	16	14	15	14	15	16
Total Ephemeroptera Taxa	6	7	8	5	9	7	5	7	8	7	6	5	7	6	6	7	7	8	7	8	7	6
Total Plecoptera Taxa	5	5	5	6	5	2	3	4	5	5	6	6	4	3	6	4	5	3	4	3	3	4
Total Trichoptera Taxa	0	2	3	3	4	1	2	1	0	0	2	3	1	3	0	5	3	2	3	4	4	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	283	494
Plecoptera	68	69	593	166	95	35	37	50	97	17	138	69	130	166	160	359	365	128	119	261	342	252
Trichoptera	0	2	7	5	4	2	4	1	0	0	13	10	2	8	0	22	7	4	22	6	7	16
Aquatic Diptera	86	66	256	66	60	42	21	206	141	52	196	179	135	181	73	1449	727	427	314	683	634	716
Other	150	175	679	233	35	102	52	55	38	40	232	106	36	146	145	896	255	153	140	313	319	125
% Ephemeroptera	40%	58%	39%	54%	63%	71%	48%	59%	42%	45%	32%	40%	71%	53%	27%	29%	25%	17%	34%	18%	18%	31%
% Plecoptera	13%	9%	24%	16%	18%	6%	17%	7%	20%	9%	16%	11%	13%	16%	31%	9%	20%	15%	13%	17%	22%	16%
% Trichoptera	0%	0%	0%	0%	1%	0%	2%	0%	0%	0%	2%	2%	0%	1%	0%	1%	0%	0%	2%	0%	0%	1%
% Aquatic Diptera	17%	9%	10%	6%	11%	7%	10%	27%	29%	26%	23%	29%	13%	17%	14%	38%	40%	50%	35%	44%	40%	45%
% Other	30%	23%	27%	23%	7%	16%	24%	7%	8%	20%	27%	17%	3%	14%	28%	23%	14%	18%	15%	20%	20%	8%
% EPT	54%	68%	63%	71%	82%	77%	67%	65%	63%	54%	50%	53%	83%	69%	58%	39%	46%	32%	50%	35%	40%	48%
% Chironomidae	7%	5%	5%	5%	8%	4%	1%	1%	22%	23%	21%	26%	11%	14%	11%	29%	24%	35%	15%	40%	36%	16%
% Dominant Taxon	26%	29%	26%	44%	37%	40%	26%	33%	32%	32%	24%	30%	38%	30%	28%	29%	24%	45%	31%	43%	37%	35%
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	1,542	1,585	1,603
Total Terrestrial Invertebrates	0	5	15	3	12	33	1	5	50	22	2	9	13	13	6	18	3	8	2	4	2	0
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	1,546	1,587	1,603
% Sample BMI	100%	99%	99%	99%	98%	95%	99%	99%	91%	90%	99%	99%	99%	99%	99%	99%	99%	99%	100%	100%	100%	100%
% Sample Terrestrial	0%	1%	1%	1%	2%	5%	1%	1%	10%	11%	1%	1%	1%	1%	1%	1%	1%	1%	0%	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	0.69	0.69
Total 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	2,307	2,330
Total 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	2,304	2,330
± 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	879	1296

Appendix B.5.–Tributary Creek Site 1847 BMI data summary, 2018–2022.

	2018	2019	2020	2021	2022
Total BMI Taxa	29	28	29	25	26
Mean BMI Taxa / Sample	18	18	16	15	17
Total Ephemeroptera Taxa	7	7	8	5	8
Total Plecoptera Taxa	4	3	4	3	4
Total Trichoptera Taxa	4	3	3	5	3
Total Counts					
Ephemeroptera	631	1,382	492	985	1,406
Plecoptera	134	291	210	294	217
Trichoptera	34	12	30	50	26
Aquatic Diptera	512	493	496	372	740
Other	197	268	504	267	124
% Ephemeroptera	42%	57%	28%	50%	56%
% Plecoptera	9%	12%	12%	15%	9%
% Trichoptera	2%	0%	2%	3%	1%
% Aquatic Diptera	34%	20%	29%	19%	29%
% Other	13%	11%	29%	14%	5%
% EPT	53%	69%	42%	68%	66%
% Chironomidae	29%	14%	25%	16%	23%
% Dominant Taxon	38%	35%	36%	37%	34%
Total BMI	1,508	2,446	1,732	1,968	2,513
Total Terrestrial Invertebrates	5	1	2	5	3
Total Invertebrates	1,513	2,447	1,734	1,973	2,516
% Sample BMI	100%	100%	100%	100%	100%
% Sample Terrestrial	0%	0%	0%	0%	0%
Total Sample Area (m^2)	0.69	0.69	0.69	0.69	0.69
Total Invertebrates / m^2	2,199	3,557	2,520	2,868	3,657
Total BMI / m^2	2,192	3,555	2,517	2,860	3,653
± 1 SD	1,248	2,417	762	1,209	1,581

APPENDIX C: JUVENILE FISH DATA

Appendix C.1.–Greens Creek Site 48 Dolly Varden 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	54–153	157	ND
2004	DV	58–156	168	ND
2005	DV	53–149	118	ND
2006	DV	49–150	138	ND
2007	DV	60–154	50	ND
2008	DV	80–137	54	ND
2009	DV	54–142	67	ND
2010	DV	62–163	97	ND
2011	DV	57–155	56	ND
2012	DV	68–156	85	1.0
2013	DV	38–149	167	1.0
2014	DV	52–146	59	1.1
2015	DV	58–146	48	1.0
2016	DV	50–148	119	1.2
2017	DV	52–156	84	1.1

Appendix C.2.–Greens Creek Site 63 Dolly Varden capture data, 2018–2022.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2018	DV	59–144	69	1.0
2019	DV	63–176	150	1.0
2020	DV	59–149	88	0.9
2021	DV	70–136	36	1.0
2022	DV	52–124	20	1.1

Appendix C.3.–Greens Creek Site 54 resident fish capture data, 2001–2022.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	27–138	70	ND
2002	DV	43–160	168	ND
2003	DV	54–184	92	ND
2004	DV	55–161	118	ND
2005	DV	56–134	111	ND
2006	DV	50–138	116	ND
2007	DV	58–125	64	ND
	CT	102–104	2	ND
2008	DV	45–131	50	ND
	CT	101–106	2	ND
2009	DV	48–141	42	ND
2010	DV	60–151	46	ND
2011	DV	57–150	73	ND
2012	DV	53–143	92	1.0
2013	DV	50–150	188	1.1
2014	DV	58–158	121	1.0
2015	DV	54–150	64	1.0
2016	DV	59–140	31	1.1
2017	DV	48–150	169	1.1
2018	DV	52–133	162	1.0
2019	DV	61–154	183	1.0
2020	DV	63–158	73	1.0
	RT	135	1	1.0
2021	DV	47–169	74	1.0
2022	DV	58–150	47	1.0

Appendix C.4.–Greens Creek Site 54 coho salmon capture data, 2001–2022.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	44–95	2	ND
2002	CO	59–85	14	ND
2003	CO	44–51	5	ND
2004	CO	74–95	9	ND
2005	CO	68–91	33	ND
2006	CO	66–88	6	ND
2007	CO	ND	0	ND
2008	CO	53–69	4	ND
2009	CO	67–71	2	ND
2010	CO	77	1	ND
2011	CO	ND	0	ND
2012	CO	ND	0	ND
2013	CO	ND	0	ND
2014	CO	70–85	10	1.2
2015	CO	45–100	15	1.1
2016	CO	69–88	14	1.2
2017	CO	ND	0	ND
2018	CO	38–90	17	1.2
2019	CO	44–95	54	1.2
2020	CO	64–94	18	1.1
2021	CO	63	1	1.5
2022	CO	61–86	12	1.2

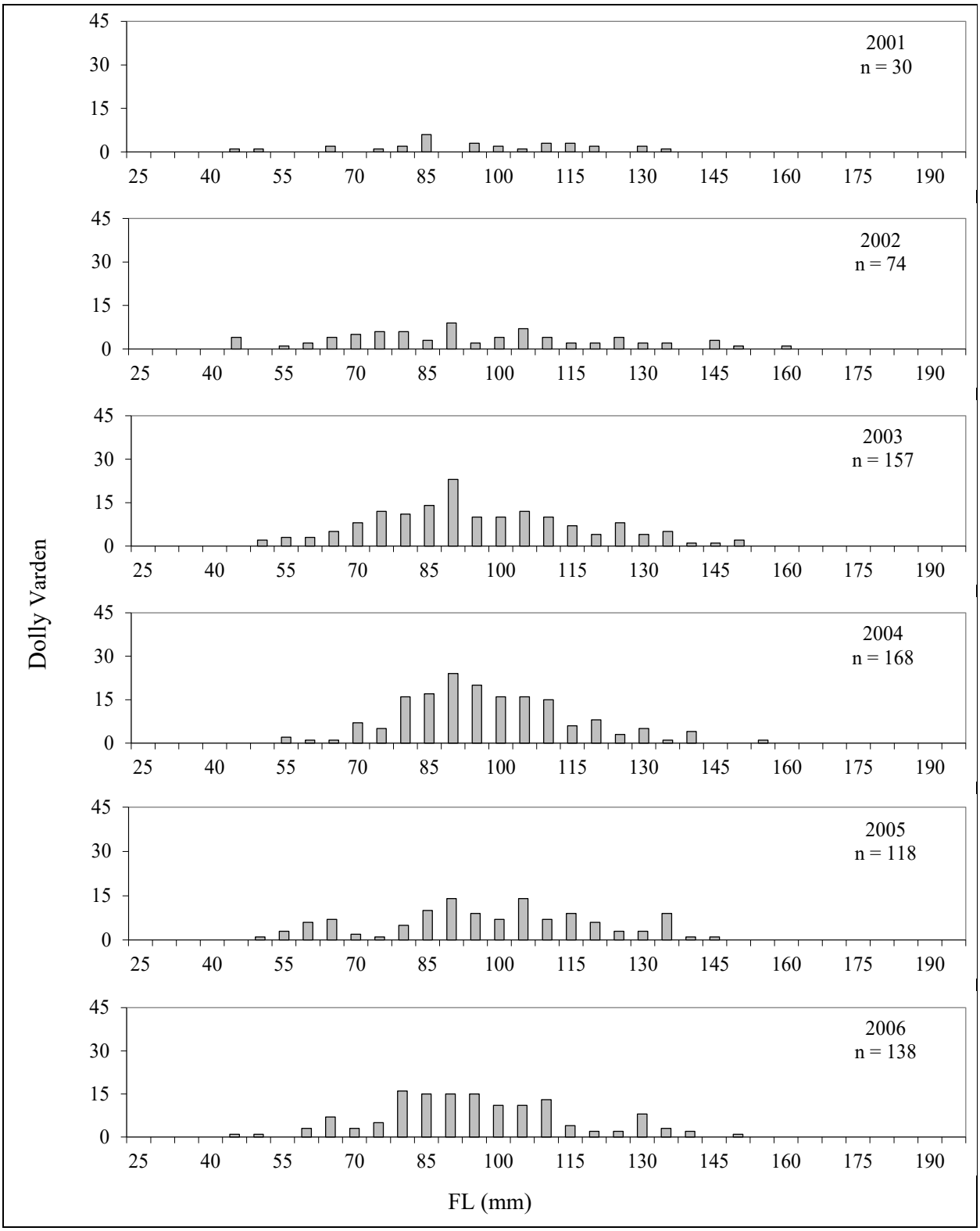
Appendix C.5.–Tributary Creek Site 9 resident fish capture data, 2001–2022.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	61–110	70	ND
	CT	124	1	ND
2002	DV	70–147	29	ND
2003	DV	68–114	13	ND
	CT	122	1	ND
2004	DV	68–109	21	ND
	CT	122	1	ND
	RT	86–106	3	ND
2005	DV	59–131	21	ND
	CT	103	1	ND
2006	DV	85–117	7	ND
2007	DV	81–158	7	ND
2008	DV	60–92	15	ND
	CT	109	1	ND
2009	DV	48–91	24	ND
	CT	97	1	ND
2010	DV	58–108	21	ND
	CT	64–89	4	ND
2011	DV	50–115	15	ND
	CT	115	1	ND
2012	DV	74–122	17	1.0
	CT	63–93	4	1.0
2013	DV	52–92	9	1.2
2014	DV	105	1	1.1
	RT	110	1	0.4
2015	DV	55–80	10	1.2
2016	DV	76–114	15	1.0
2017	DV	55–117	31	1.2
2018	DV	58–106	20	1.0
2019	DV	59–102	8	1.1
2020	DV	112	1	1.0
2021	DV	64–77	5	1.1
2022	DV	ND	0	ND

Appendix C.6.–Tributary Creek Site 9 coho salmon capture data, 2001–2022.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	40–101	89	ND
2002	CO	34–85	29	ND
2003	CO	46–88	37	ND
2004	CO	42–94	23	ND
2005	CO	39–98	82	ND
2006	CO	82–92	5	ND
2007	CO	39–107	50	ND
2008	CO	48–100	72	ND
2009	CO	38–116	42	ND
2010	CO	41–85	77	ND
2011	CO	42–95	18	ND
2012	CO	46–105	39	1.1
2013	CO	50–90	9	1.4
2014	CO	39–91	86	1.2
2015	CO	38–90	36	1.3
2016	CO	45–95	75	1.3
2017	CO	35–94	67	1.3
2018	CO	39–92	32	1.1
2019	CO	45–85	46	1.2
2020	CO	51–83	7	1.3
2021	CO	40–94	70	1.2
2022	CO	41–95	26	1.2

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



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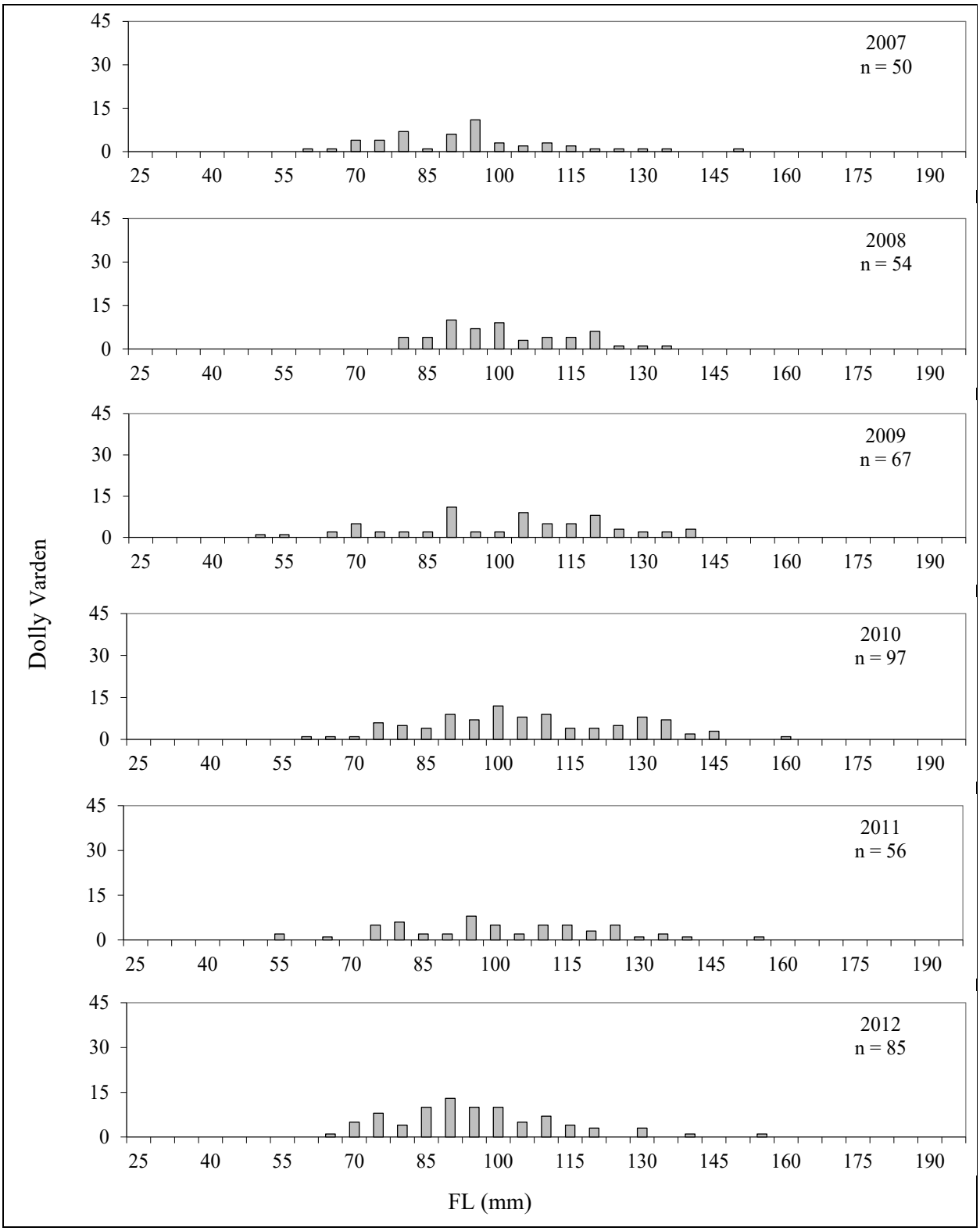
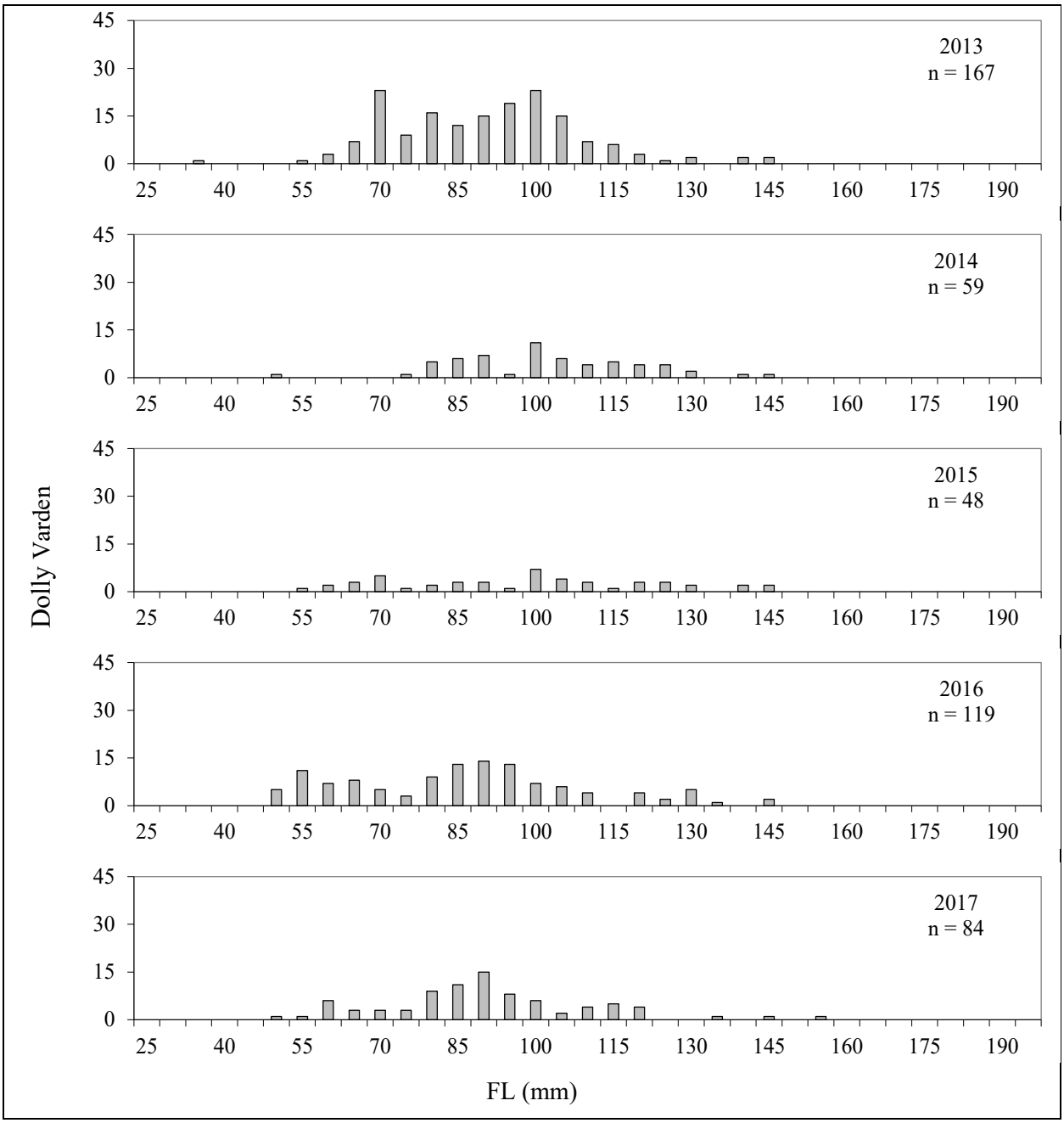
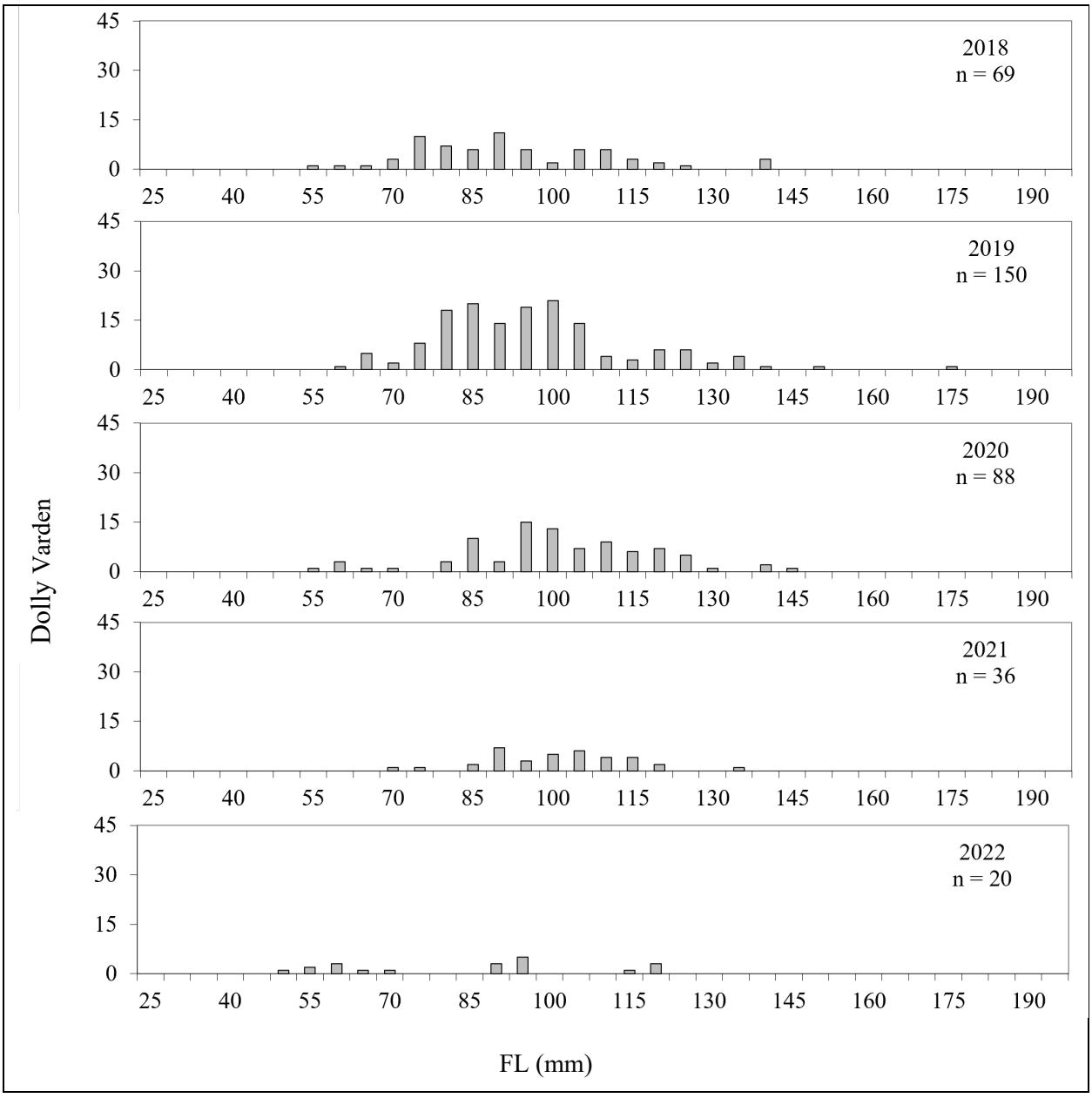

Dolly Varden
2007
n = 50
2008
n = 54
2009
n = 67
2010
n = 97
2011
n = 56
2012
n = 85
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

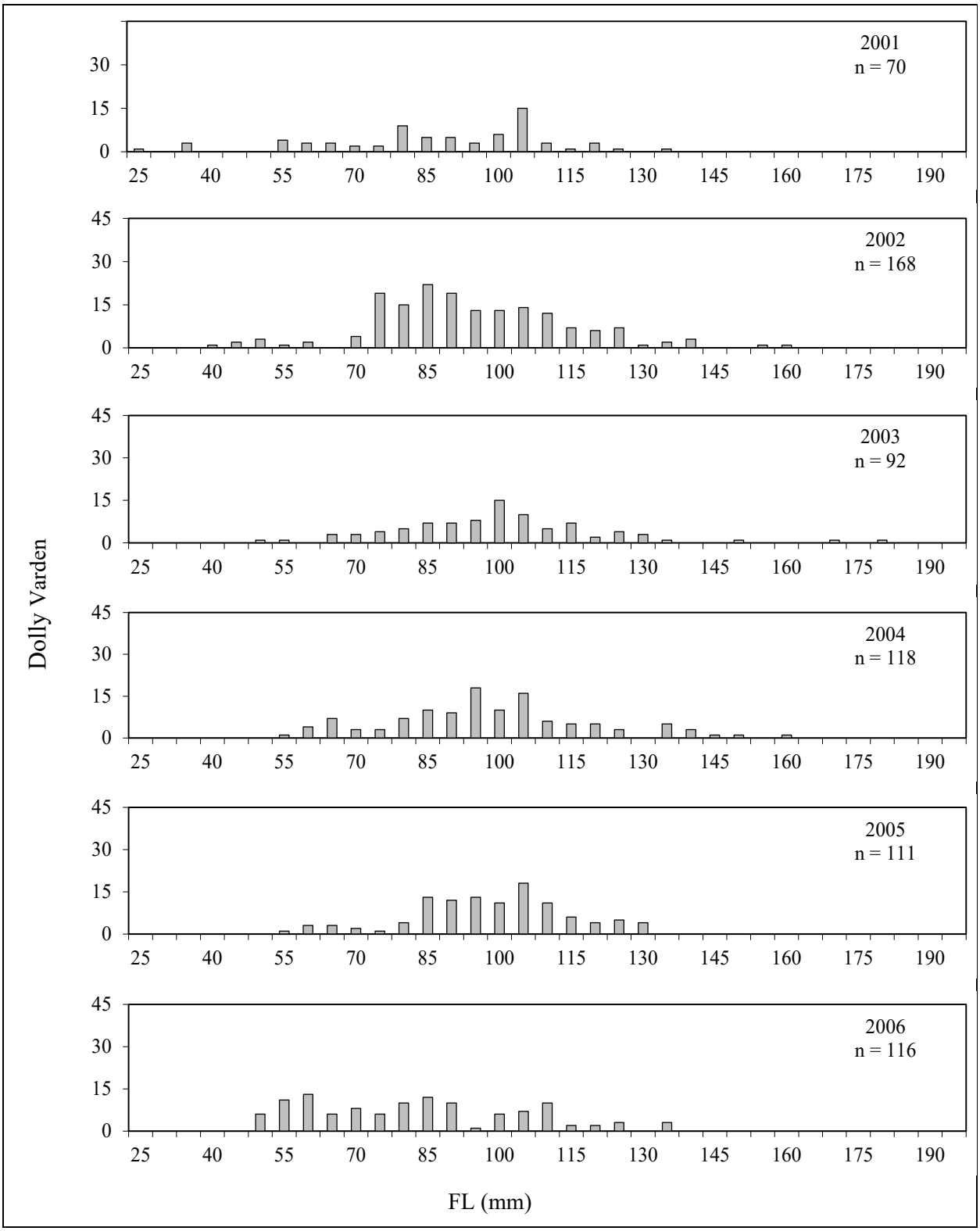
-continued-


Dolly Varden
2013
n = 167
2014
n = 59
2015
n = 48
2016
n = 119
2017
n = 84
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 length frequency distributions, 2018–2022.



Appendix C.9.–Greens Creek Site 54 Dolly Varden length frequency distributions, 2001–2022.



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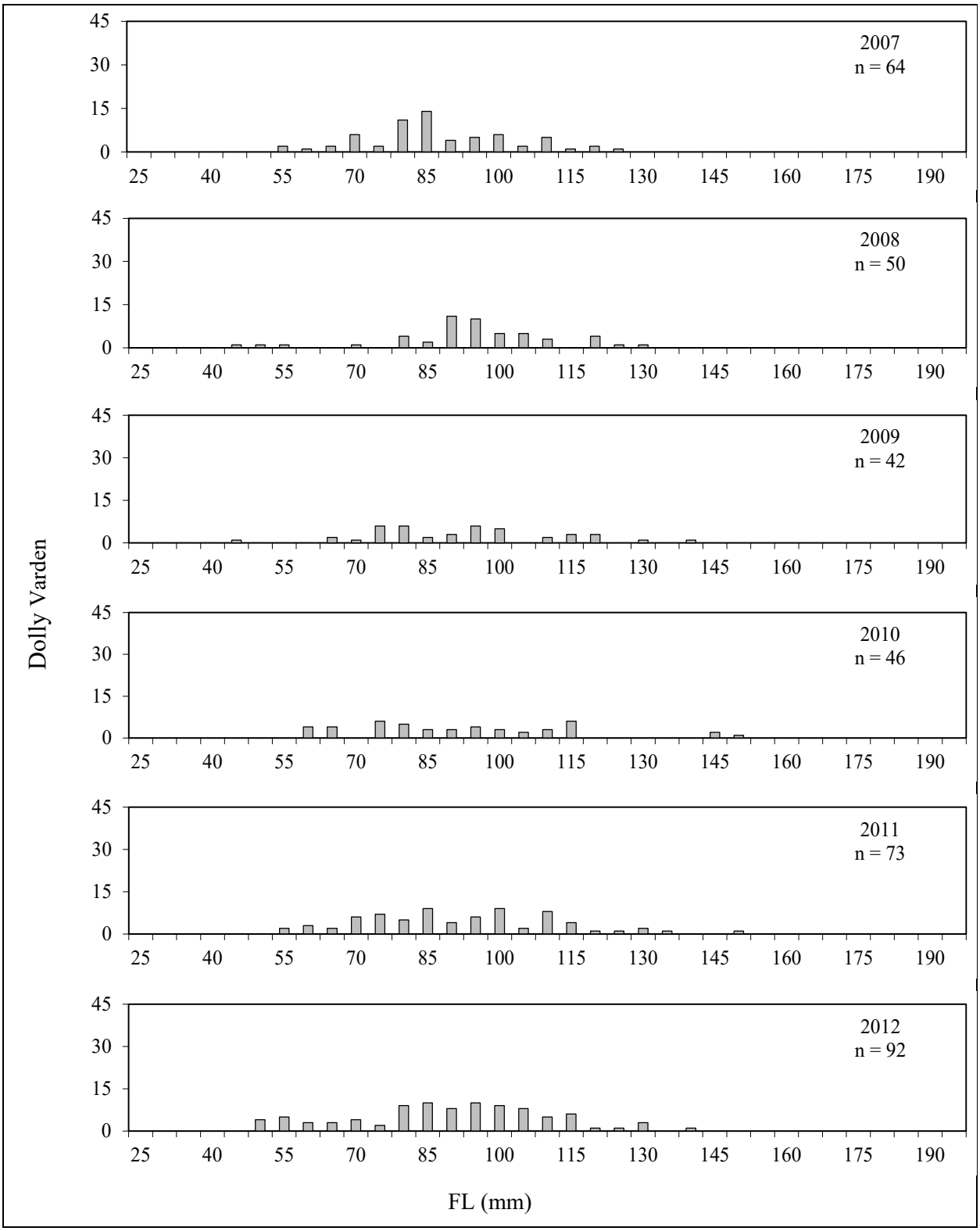
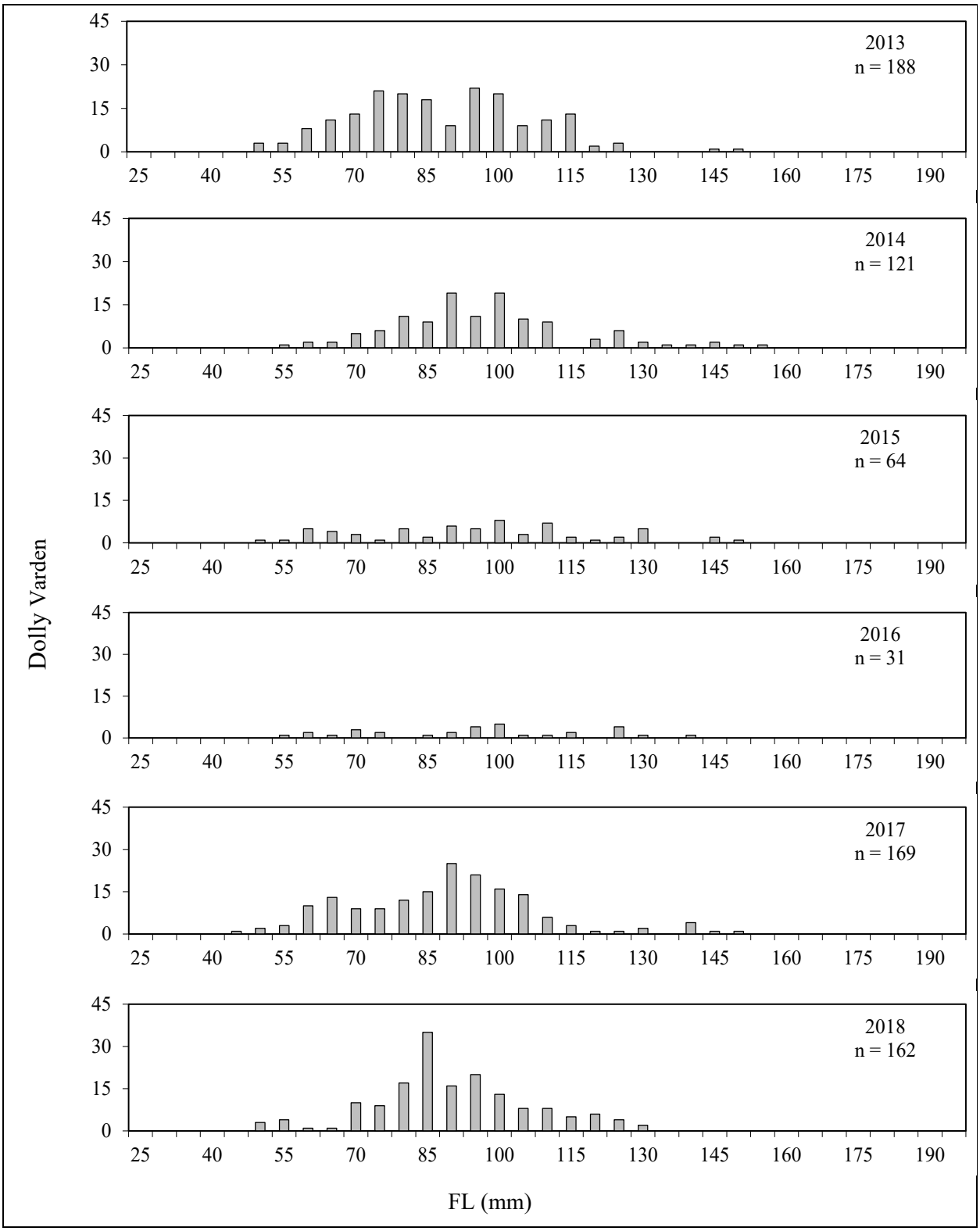
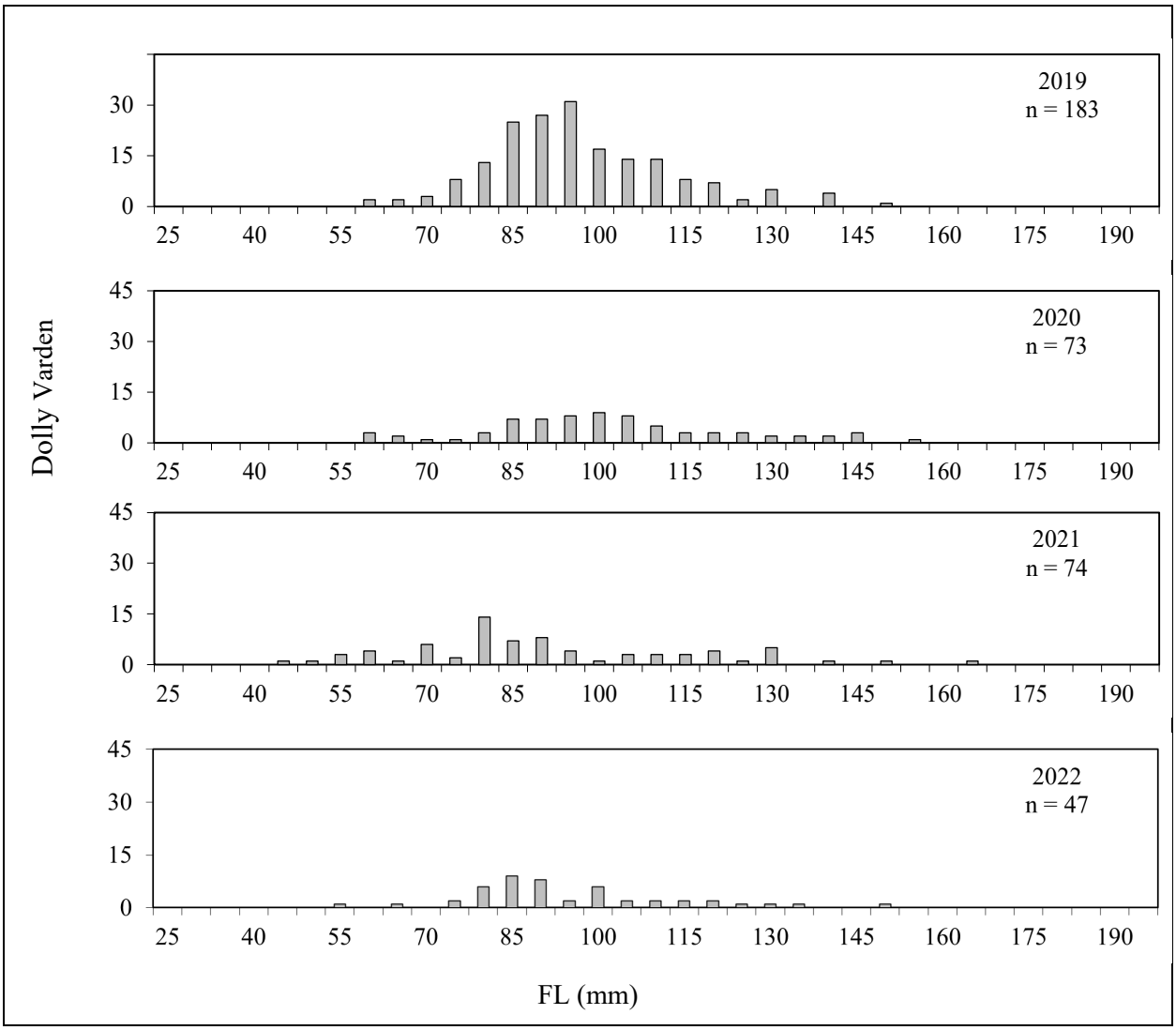

Dolly Varden
2007
n = 64
2008
n = 50
2009
n = 42
2010
n = 46
2011
n = 73
2012
n = 92
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

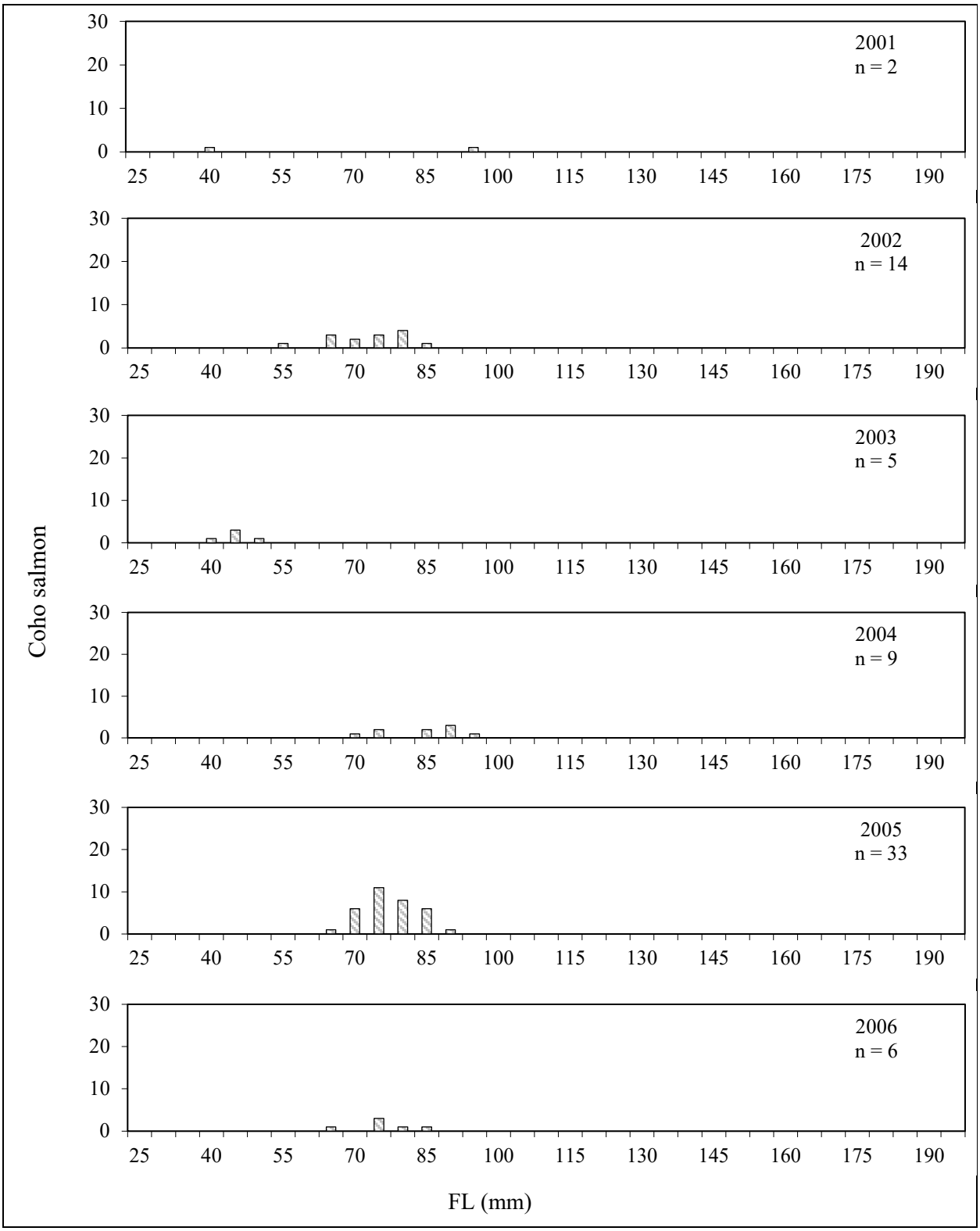
-continued-


Dolly Varden
2013
n = 188
2014
n = 121
2015
n = 64
2016
n = 31
2017
n = 169
2018
n = 162
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Dolly Varden
2019
n = 183
2020
n = 73
2021
n = 74
2022
n = 47
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

Appendix C.10.–Greens Creek Site 54 coho salmon length frequency distributions, 2001–2022.



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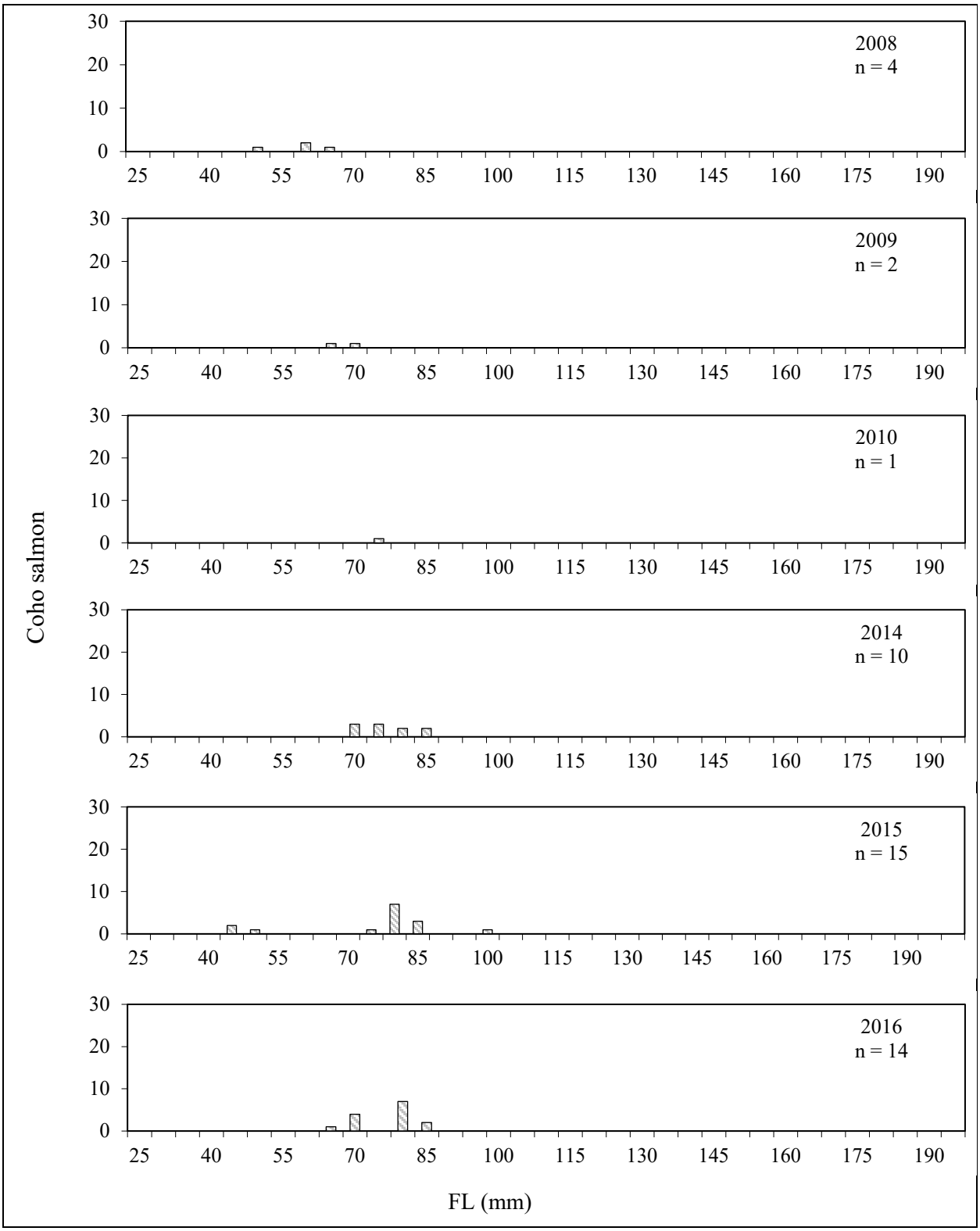
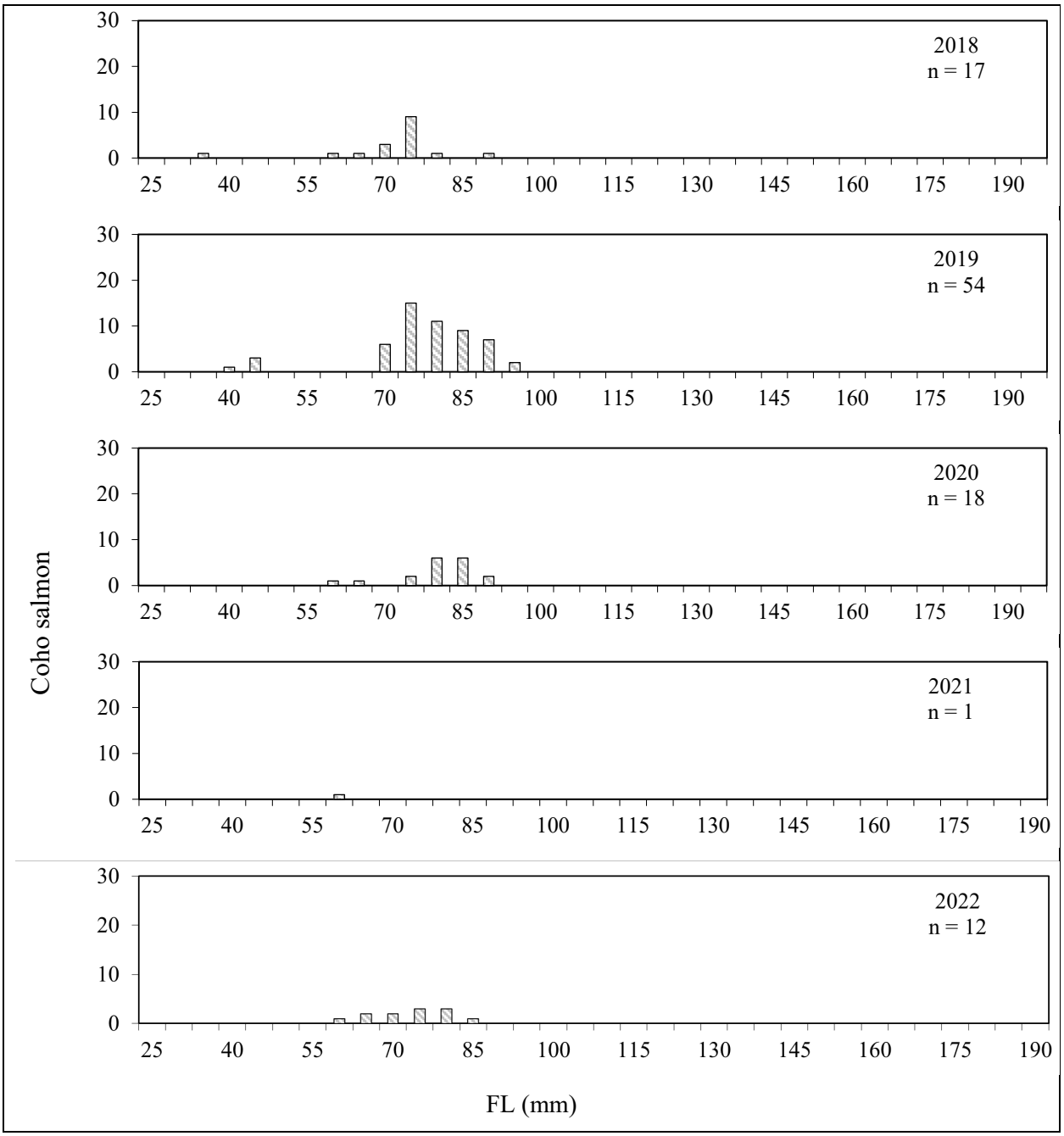
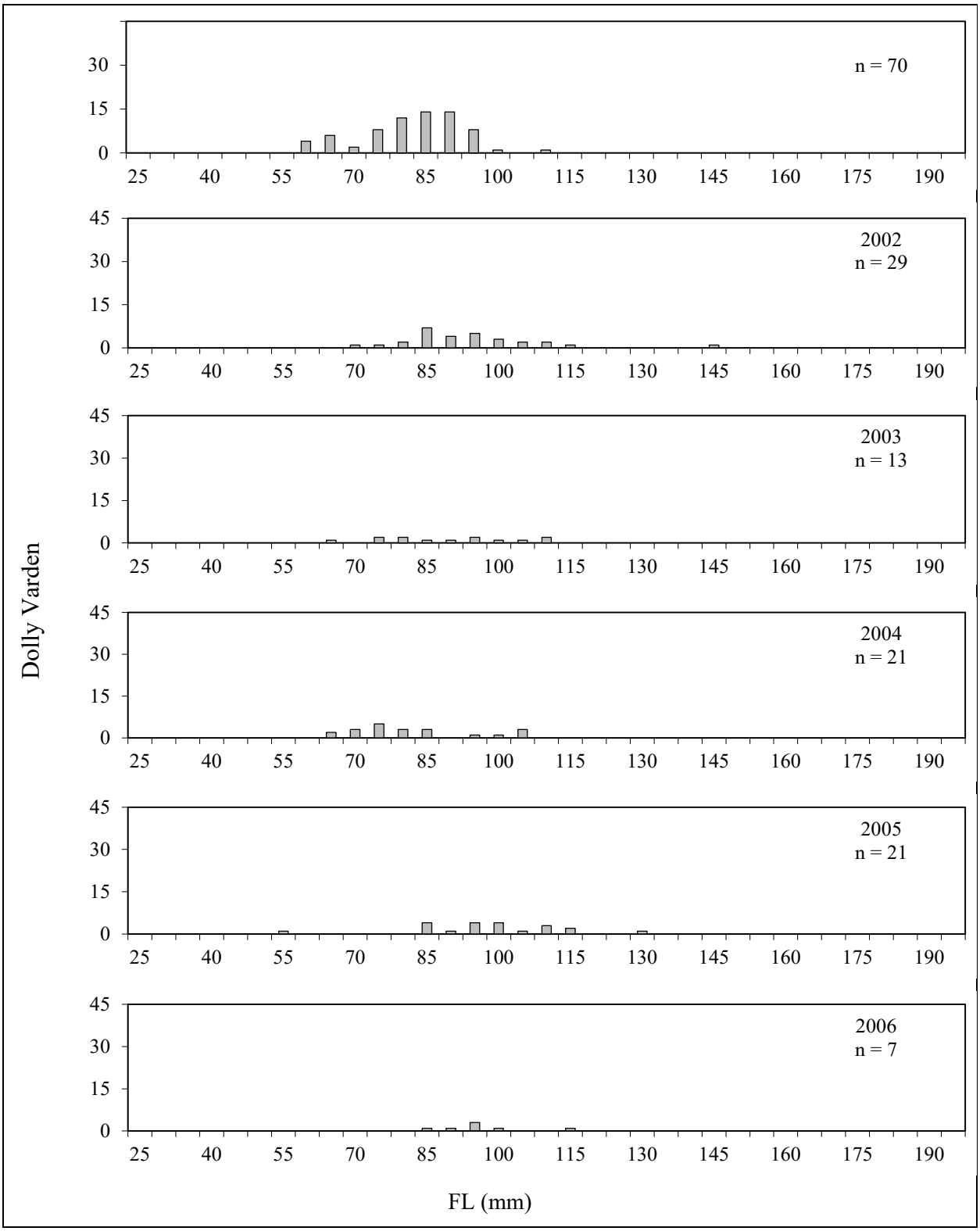

Coho salmon
2008
n = 4
2009
n = 2
2010
n = 1
2014
n = 10
2015
n = 15
2016
n = 14
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2018
n = 17
2019
n = 54
2020
n = 18
2021
n = 1
2022
n = 12
0
10
20
30
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

Appendix C.11.–Tributary Creek Site 9 Dolly Varden length frequency distributions, 2001–2022.



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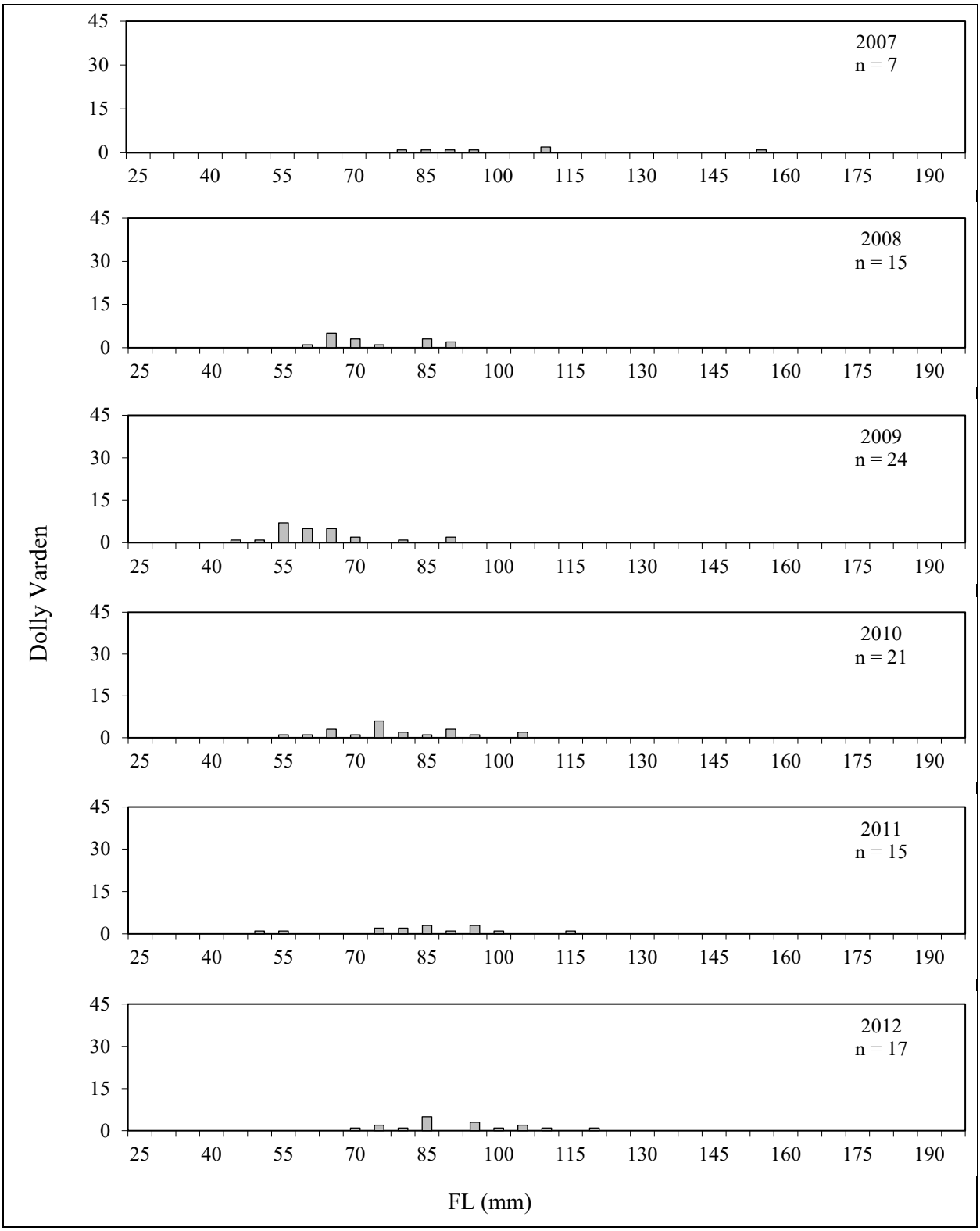
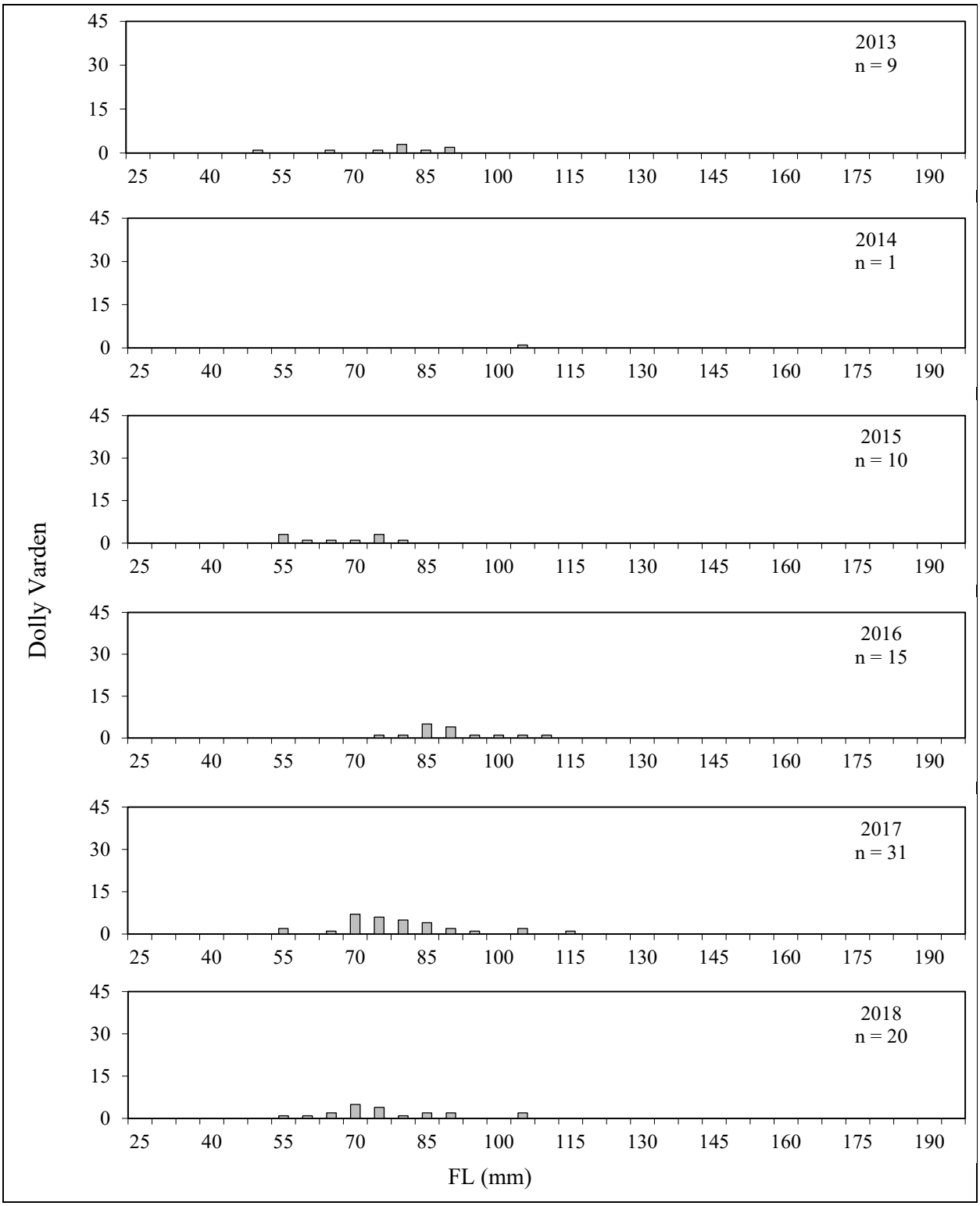
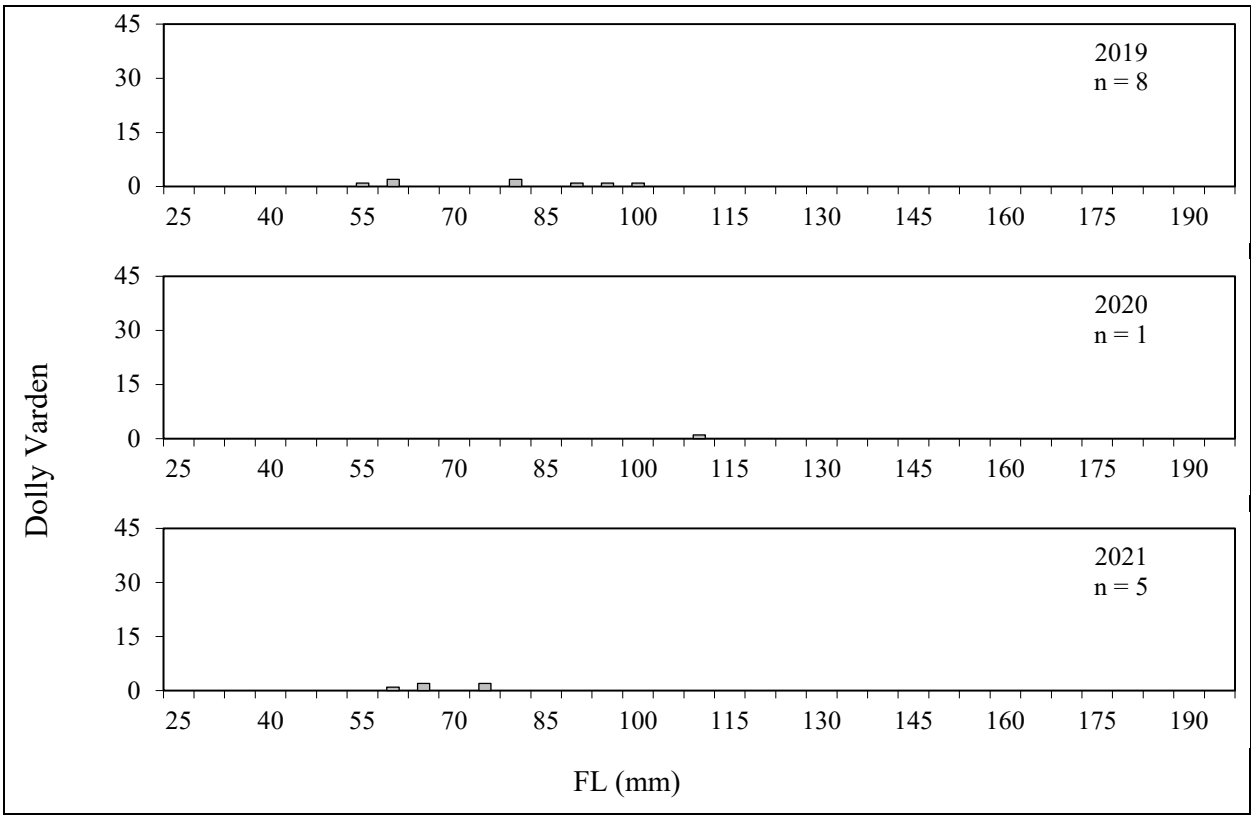

Dolly Varden
2007
n = 7
2008
n = 15
2009
n = 24
2010
n = 21
2011
n = 15
2012
n = 17
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

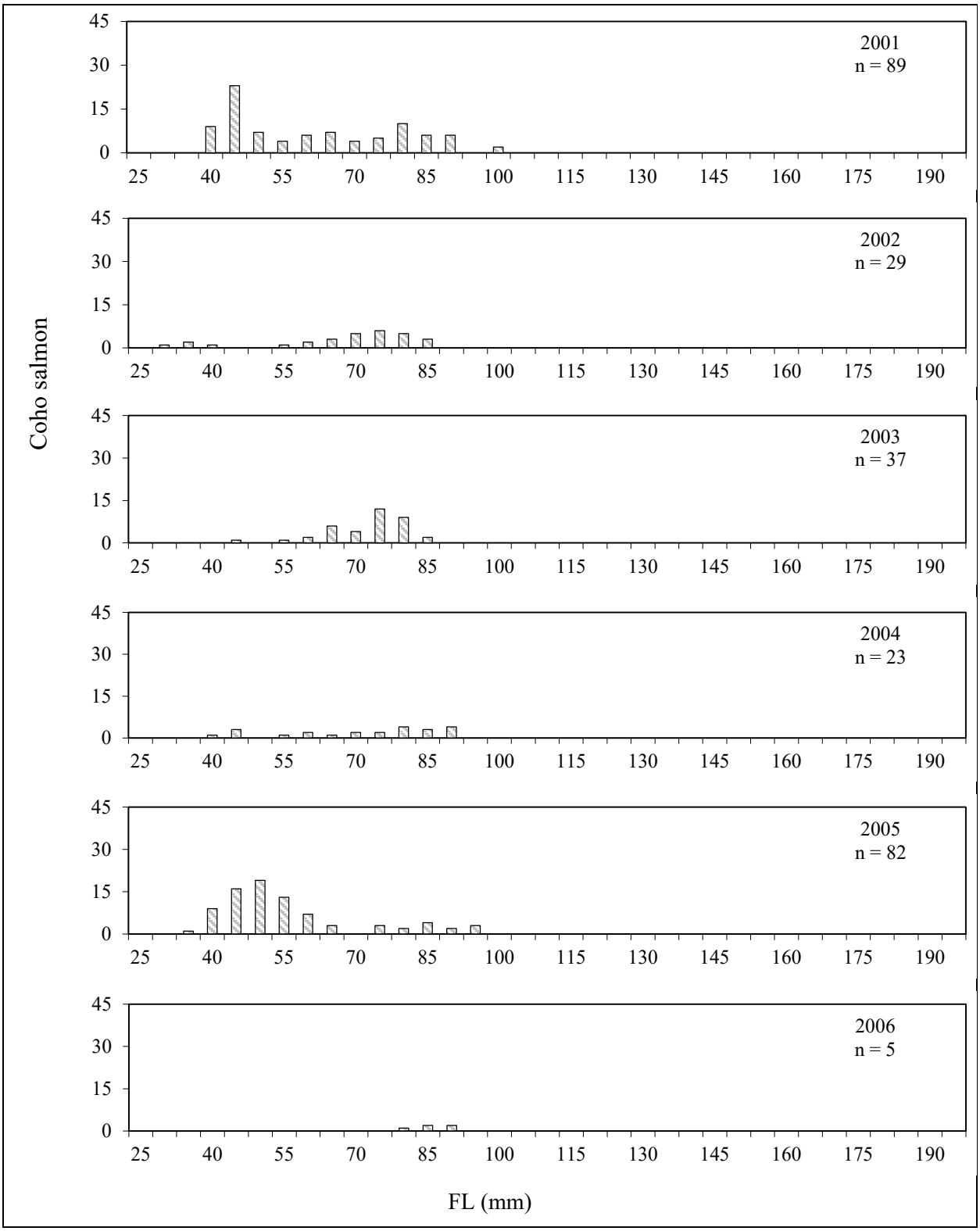

Dolly Varden
2013
n = 9
2014
n = 1
2015
n = 10
2016
n = 15
2017
n = 31
2018
n = 20
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Dolly Varden
2019
n = 8
2020
n = 1
2021
n = 5
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-

Appendix C.12.–Tributary Creek Site 9 coho salmon length frequency distributions, 2001–2022.



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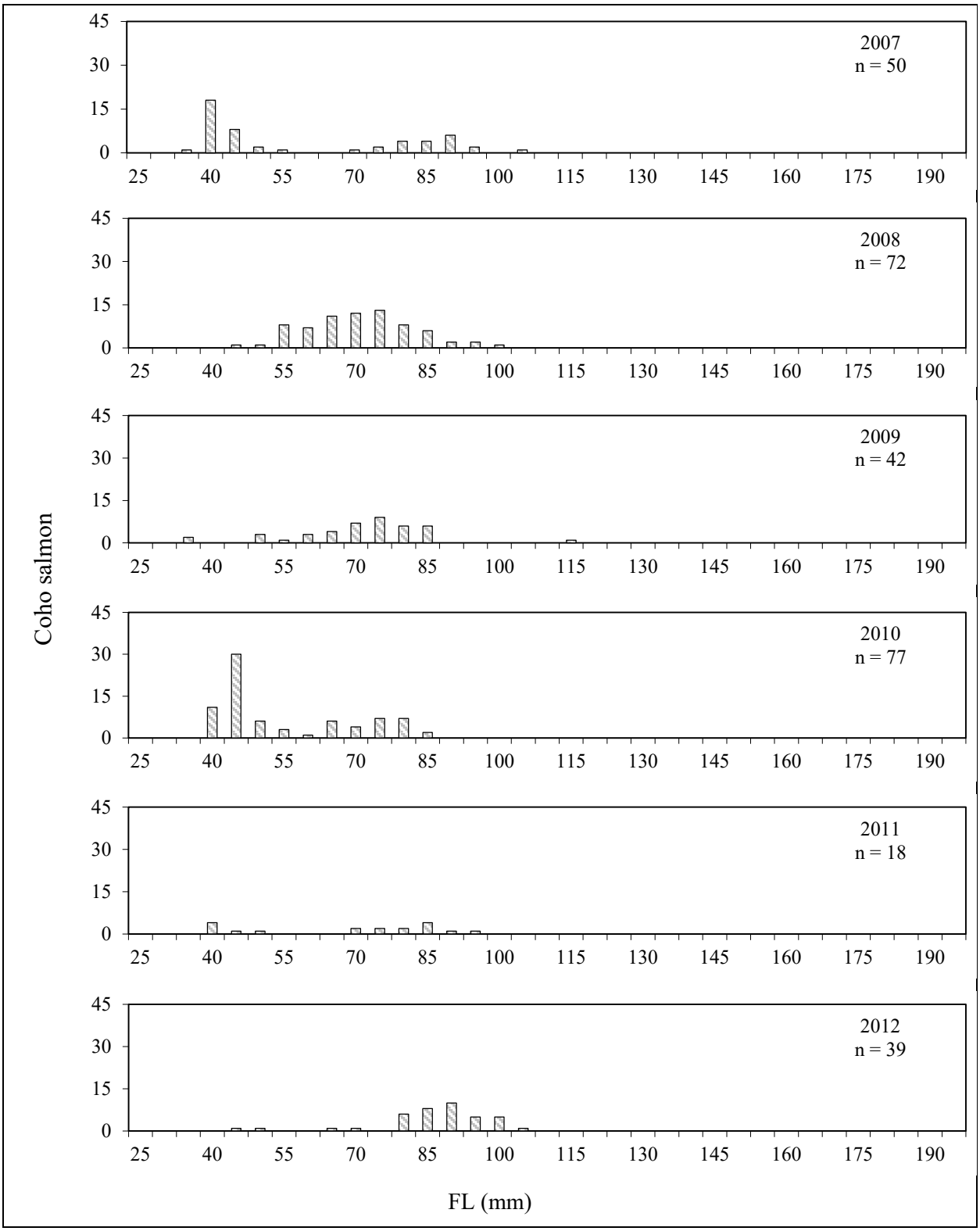
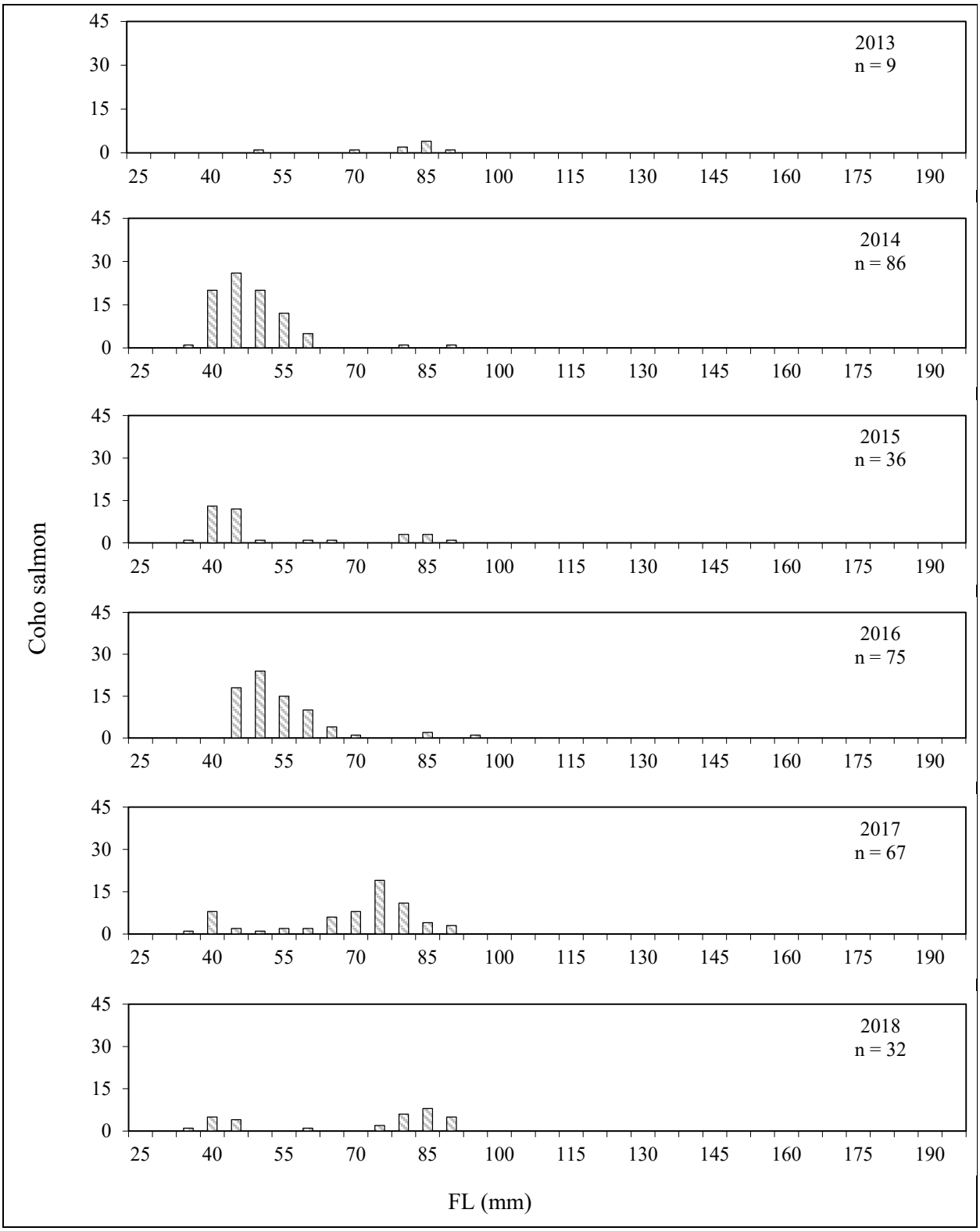
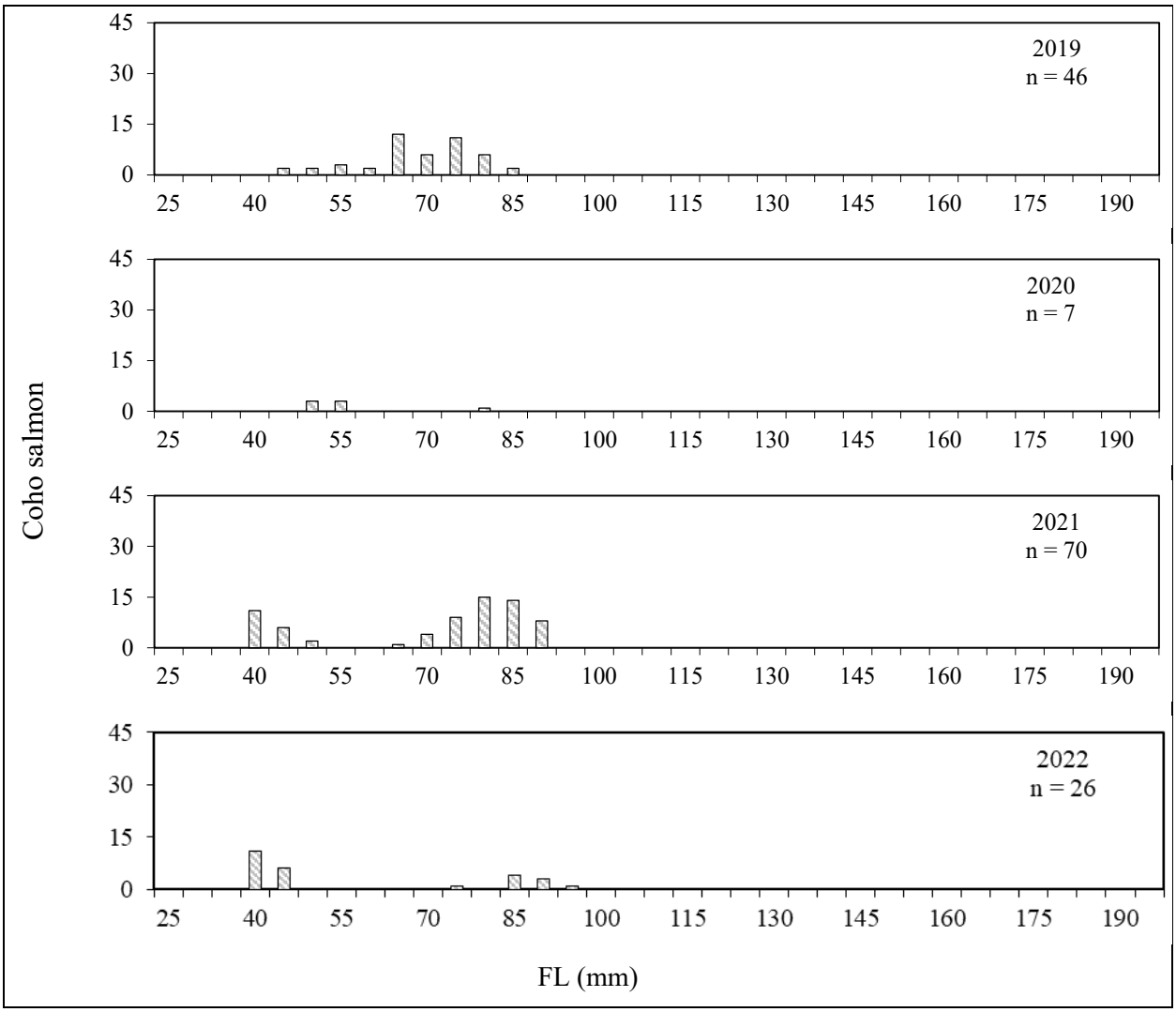

Coho salmon
2007
n = 50
2008
n = 72
2009
n = 42
2010
n = 77
2011
n = 18
2012
n = 39
0
15
30
45
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2013
n = 9
2014
n = 86
2015
n = 36
2016
n = 75
2017
n = 67
2018
n = 32
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

-continued-


Coho salmon
2019
n = 46
2020
n = 7
2021
n = 70
2022
n = 26
45
30
15
0
25
40
55
70
85
100
115
130
145
160
175
190
FL (mm)

APPENDIX D: JUVENILE FISH ELEMENT CONCENTRATIONS DATA AND LAB REPORT

Appendix D.1.–Greens Creek Site 48 Dolly Varden 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)
07/23/01	131	26.0	0.02	1.76	8.3	ND	0.20	6.1	180
07/23/01	137	28.8	0.03	0.89	7.2	ND	0.17	4.6	146
07/23/01	119	18.8	0.02	2.27	5.7	ND	0.20	6.2	189
07/23/01	121	21.1	0.02	1.56	6.9	ND	0.17	5.2	182
07/23/01	111	13.7	0.03	0.89	4.7	ND	0.23	5.4	138
07/23/01	121	21.1	<0.02	1.26	7.4	ND	0.10	5.6	157
07/24/02	133	23.2	0.03	1.64	6.8	ND	0.72	4.8	239
07/24/02	120	15.0	0.07	0.85	7.0	ND	0.28	4.1	210
07/24/02	122	17.5	0.03	0.74	4.3	ND	0.17	4.9	162
07/24/02	127	20.8	0.04	1.40	6.1	ND	0.16	4.7	185
07/24/02	134	24.8	0.05	1.30	7.9	ND	0.46	4.3	208
07/24/02	128	21.7	0.04	1.56	6.8	ND	0.22	5.7	343
07/22/03	90	8.9	<0.02	0.65	4.2	ND	0.14	5.6	191
07/22/03	98	9.9	<0.02	0.90	5.1	ND	0.22	5.5	180
07/22/03	103	12.1	<0.02	0.82	5.6	ND	0.16	5.4	241
07/22/03	112	12.5	<0.02	0.78	6.1	ND	0.11	6.1	192
07/22/03	108	11.9	<0.02	0.63	3.9	ND	0.14	5.2	174
07/22/03	100	10.5	<0.02	0.58	3.7	ND	0.08	5.5	218
07/22/04	96	8.6	<0.02	0.63	4.7	ND	0.15	4.3	206
07/22/04	88	6.8	<0.02	0.83	5.6	ND	0.26	4.0	175
07/22/04	101	11.5	<0.02	1.54	4.6	ND	0.21	4.1	183
07/22/04	98	9.3	<0.02	0.80	5.2	ND	0.28	3.7	168
07/22/04	93	7.6	<0.02	1.25	4.4	ND	0.14	6.4	220
07/22/04	91	7.5	0.03	1.01	4.5	ND	0.29	5.6	323
07/22/05	103	19.7	0.02	0.66	4.4	ND	0.44	4.2	183
07/22/05	96	13.1	<0.02	0.84	14.5	ND	0.98	4.8	220
07/22/05	119	15.6	0.02	0.89	4.4	ND	0.66	4.8	226
07/22/05	114	17.1	0.02	0.59	6.0	ND	0.32	4.8	178
07/22/05	111	15.3	0.03	1.10	18.8	ND	0.79	4.6	217
07/22/05	125	16.9	0.03	0.47	3.6	ND	0.36	3.8	161
07/20/06	110	15.8	0.04	0.56	8.5	ND	0.37	5.4	244
07/20/06	110	15.4	0.05	1.20	8.3	ND	0.31	6.0	217
07/20/06	113	16.1	0.04	0.65	6.3	ND	0.24	5.4	264
07/20/06	132	25.0	0.06	0.63	8.1	ND	0.66	5.2	232
07/20/06	104	12.8	0.08	0.96	8.5	ND	0.37	5.1	283
07/20/06	114	16.7	0.03	0.63	5.3	ND	0.20	5.1	270

-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)
07/21/07	122	17.9	0.03	1.16	5.5	ND	0.17	5.5	221
07/21/07	95	10.4	0.02	1.42	3.9	ND	0.29	5.8	165
07/21/07	135	22.8	0.09	1.35	14.1	ND	1.37	5.3	166
07/21/07	98	9.9	0.03	0.96	5.7	ND	0.27	5.2	269
07/21/07	105	13.2	0.11	1.79	11.4	ND	1.62	5.4	323
07/21/07	99	10.0	0.04	1.43	5.2	ND	0.31	5.7	208
07/22/08	112	16.4	0.069	1.23	5.2	ND	0.95	5.72	289.0
07/22/08	123	21.3	0.039	0.79	3.9	ND	0.57	4.56	194.0
07/22/08	105	14.0	0.079	0.82	4.6	ND	0.52	5.88	199.5
07/22/08	124	20.6	0.041	0.87	4.9	ND	0.42	6.31	244.0
07/22/08	115	16.9	0.030	1.36	5.3	ND	0.51	5.36	254.0
07/22/08	122	19.8	0.037	1.07	5.6	ND	0.38	6.11	260.0
07/21/09	120	20.1	<0.02	1.05	5.2	ND	0.22	5.9	186
07/21/09	121	20.7	<0.02	1.40	5.3	ND	0.44	5.7	173
07/21/09	119	17.9	0.02	1.10	4.5	ND	0.13	5.9	182
07/21/09	108	13.6	<0.02	1.20	4.1	ND	0.15	5.7	162
07/21/09	109	14.6	<0.02	1.50	4.9	ND	0.17	5.9	186
07/21/09	110	15.2	<0.02	0.84	3.8	ND	0.18	6.1	202
07/21/10	103	11.9	0.020	1.56	4.8	0.09	0.16	5.0	226
07/21/10	109	16.1	<0.019	0.51	3.0	0.15	0.20	5.6	168
07/21/10	108	13.9	0.040	0.91	4.2	0.17	0.30	5.0	180
07/21/10	105	13.8	<0.020	0.98	3.4	0.13	0.09	4.6	163
07/21/10	98	10.8	0.062	0.90	4.8	0.14	0.46	4.8	213
07/21/10	93	9.1	<0.020	0.96	3.6	0.10	0.09	4.0	156
07/22/11	88-112	ND	0.03	1.12	5.7	ND	0.28	6.2	221
07/24/12	109	11.3	0.03	2.26	27.0	0.134	0.16	5.5	186
07/24/12	123	18.3	0.03	1.37	4.9	0.122	0.10	5.7	184
07/24/12	110	9.8	0.03	1.83	25.6	0.159	2.59	5.6	275
07/24/12	103	10.6	0.03	0.99	76.8	0.175	0.30	5.1	189
07/24/12	104	10.7	0.03	2.66	84.8	0.122	1.05	6.3	242
07/24/12	116	15.8	0.04	0.73	35.1	0.148	1.03	4.7	190
07/25/13	145	20.6	<0.02	0.68	3.7	0.214	0.17	5.3	237
07/25/13	115	17.9	0.07	0.97	6.1	0.238	0.24	5.8	239
07/25/13	115	14.3	<0.02	0.81	4.0	0.180	0.08	6.7	258
07/25/13	105	11.4	<0.02	0.68	3.2	0.213	0.14	6.4	213
07/25/13	109	13.0	0.04	2.01	6.6	0.113	0.36	6.2	271
07/25/13	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)
07/25/14	110	13.0	0.04	0.55	4.5	0.146	0.11	5.3	234
07/25/14	100	10.5	<0.02	0.93	4.2	0.148	0.19	6.9	213
07/25/14	106	10.7	<0.02	1.22	4.8	0.199	0.38	5.7	232
07/25/14	105	11.3	<0.02	1.45	4.2	0.122	0.44	6.1	193
07/25/14	100	10.4	<0.02	0.92	4.5	0.134	0.06	4.9	237
07/25/14	120	14.8	0.04	0.75	5.5	0.260	0.18	5.9	305
07/16/15	105	12.4	<0.02	0.60	2.5	0.114	0.13	6.2	159
07/16/15	104	11.7	0.04	1.11	10.7	0.100	1.30	5.8	205
07/16/15	100	11.7	0.03	1.05	3.8	0.152	0.14	6.1	187
07/16/15	105	11.3	0.03	1.39	4.2	0.154	0.36	6.1	198
07/16/15	105	12.7	<0.02	1.06	4.0	0.128	0.12	5.7	169
07/16/15	100	10.4	0.02	1.49	3.9	0.165	0.37	5.4	191
07/16/15	104	9.6	<0.02	0.85	3.1	0.091	0.09	5.2	175
07/16/15	85	8.6	0.03	0.90	3.6	0.139	0.27	5.9	172
07/16/15	102	10.3	<0.02	1.51	3.7	0.180	0.15	7.2	192
07/16/15	120	16.3	<0.02	0.86	4.0	0.150	0.14	6.4	223
07/14/16	84	7.3	<0.020	1.28	4.72	0.180	0.157	7.63	252
07/14/16	82	6.1	0.023	0.921	4.82	0.160	0.147	5.83	222
07/14/16	98	10.1	0.021	1.09	3.99	0.108	0.150	6.30	189
07/14/16	93	7.9	<0.020	1.44	4.49	0.163	0.205	6.77	197
07/14/16	88	6.9	0.035	1.50	4.65	0.243	0.493	7.63	185
07/14/16	84	7.3	0.023	0.681	4.12	0.150	0.088	6.42	200
07/14/16	94	8.8	0.065	1.21	4.69	0.172	0.143	7.19	194
07/14/16	86	7.6	0.022	1.89	4.96	0.210	0.295	7.27	251
07/14/16	93	9.4	<0.020	1.23	4.85	0.127	0.193	5.8	205
07/14/16	101	9.8	<0.020	1.32	4.72	0.114	0.134	6.28	178
07/13/17	95	8.7	0.054	0.649	3.74	0.115	0.189	5.79	172
07/13/17	91	8.0	0.097	1.51	3.86	0.118	0.417	5.98	169
07/13/17	102	10.0	0.024	0.746	3.92	0.0919	0.089	5.37	168
07/13/17	105	13.1	0.022	1.00	4.98	0.143	0.237	6.78	194
07/13/17	94	8.6	<0.020	0.456	2.81	0.106	0.064	4.5	166
07/13/17	99	9.9	0.023	1.03	3.93	0.111	0.087	5.39	200
07/13/17	98	10.8	0.022	0.462	2.68	0.101	0.064	4.4	168
07/13/17	124	18.8	0.034	0.655	3.77	0.123	0.087	5.02	154
07/13/17	99	10.7	<0.020	0.673	3.48	0.0893	0.067	4.69	165
07/13/17	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 element concentrations, 2018–2022.

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
07/12/21	119	12.6	0.027	0.783	4.41	0.163	0.291	6.30	212
07/12/21	94	7.5	0.048	1.45	6.35	0.116	0.264	5.20	188
07/12/21	93	7.6	0.025	1.44	5.07	0.163	0.207	6.04	228
07/12/21	114	12.7	0.034	0.827	4.12	0.193	0.341	5.79	215
07/12/21	113	9.9	0.022	0.848	3.91	0.114	0.093	5.05	148
07/12/21	95	7.3	0.038	1.14	4.10	0.192	0.150	6.16	222
07/12/21	105	12.1	0.040	0.764	6.99	0.109	0.376	5.28	180
07/12/21	102	8.2	0.030	1.85	4.86	0.220	0.226	5.47	278
07/12/21	113	13.8	0.035	0.812	4.04	0.179	0.210	5.97	194
07/12/21	92	6.5	0.025	1.79	4.28	0.146	0.229	5.62	228

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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)
07/12/22	94	13	0.035	0.78	4.37	0.115	1.330	5.35	209
07/12/22	94	9	0.034	1.72	4.41	0.117	1.060	5.44	223
07/12/22	93	9.3	0.028	1.13	4.35	0.144	1.030	5.57	193
07/12/22	117	15.9	0.036	1.65	6.03	0.150	0.736	5.61	240
07/12/22	97	9.7	0.020	1.44	4.95	0.099	1.140	5.44	199
07/12/22	98	10	0.020	0.92	3.57	0.089	0.868	5.89	162
07/12/22	99	10	0.054	1.76	5.13	0.143	2.740	5.43	235
07/12/22	98	8.4	0.025	0.76	4.21	0.121	0.682	5.30	163
07/12/22	95	8.9	0.024	0.72	3.93	0.094	0.781	5.51	168
07/12/22	124	22.1	0.025	2.01	4.01	0.118	0.882	5.53	180

Appendix D.3.–Greens Creek Site 54 Dolly Varden element concentrations, 2001–2022.

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)
07/23/01	121	21.5	0.03	0.46	4.3	ND	0.33	5.7	126
07/23/01	119	19.3	0.02	0.21	3.2	ND	0.22	3.6	82
07/23/01	107	15.7	0.03	0.73	6.3	ND	0.59	4.7	144
07/23/01	109	13.6	0.02	0.82	5.4	ND	0.86	4.9	172
07/23/01	105	13.5	<0.02	0.79	6.5	ND	0.45	5.8	203
07/23/01	138	27.5	<0.02	0.74	5.8	ND	0.40	5.4	171
07/24/02	118	18.0	0.03	0.50	4.4	ND	0.94	3.4	363
07/24/02	128	22.3	0.03	0.52	4.5	ND	0.35	4.7	150
07/24/02	115	17.7	0.05	0.95	6.0	ND	0.66	4.4	161
07/24/02	115	18.9	0.03	1.03	5.2	ND	0.66	4.2	216
07/24/02	124	21.1	0.05	1.32	5.2	ND	0.74	3.9	194
07/24/02	123	20.9	0.02	0.70	3.9	ND	0.78	4.4	195
07/22/03	123	21.1	0.03	0.85	6.4	ND	1.40	6.1	188
07/22/03	101	10.6	<0.02	0.67	4.2	ND	0.32	6.4	174
07/22/03	88	9.2	<0.02	0.75	4.3	ND	0.35	6.5	186
07/22/03	109	14.8	<0.02	1.11	5.8	ND	0.38	5.7	188
07/22/03	95	10.6	<0.02	0.59	3.5	ND	0.29	5.7	174
07/22/03	92	9.7	<0.02	0.91	4.1	ND	0.43	6.5	263
07/21/04	103	9.9	0.02	0.79	11.0	ND	0.57	4.6	232
07/21/04	104	10.0	<0.02	0.88	5.5	ND	0.54	5.0	206
07/21/04	86	6.6	<0.02	1.26	5.1	ND	0.36	5.3	164
07/21/04	96	9.3	0.03	0.79	5.9	ND	0.28	5.4	191
07/21/04	93	9.9	<0.02	0.83	5.0	ND	0.48	3.9	202
07/21/04	104	12.9	0.08	1.12	7.0	ND	0.93	4.9	217
07/22/05	120	12.3	0.03	0.72	5.0	ND	0.27	4.0	160
07/22/05	106	12.1	0.02	0.63	4.5	ND	0.13	3.9	200
07/22/05	113	20.8	<0.02	0.73	8.8	ND	0.17	4.7	223
07/22/05	114	17.9	<0.02	0.82	9.7	ND	0.17	3.9	222
07/22/05	112	16.1	0.03	1.06	8.8	ND	0.22	4.4	209
07/22/05	118	22.3	0.02	0.55	5.5	ND	0.39	3.9	185
07/20/06	137	27.3	0.06	0.42	4.8	ND	0.51	5.7	208
07/20/06	112	14.9	0.04	0.75	16.0	ND	0.95	7.2	223
07/20/06	102	12.0	0.02	0.93	22.2	ND	0.52	6.3	239
07/20/06	114	19.6	0.04	1.03	7.6	ND	0.85	5.3	252
07/20/06	98	12.3	0.08	0.54	10.9	ND	0.48	5.4	223
07/20/06	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)
07/20/07	102	11.8	0.04	0.88	5.3	ND	0.54	5.6	157
07/20/07	125	21.1	0.03	0.97	5.2	ND	0.83	7.5	234
07/20/07	97	10.7	0.06	0.81	5.7	ND	0.89	8.6	185
07/20/07	123	19.7	0.02	0.75	4.4	ND	0.50	7.1	175
07/20/07	104	12.5	0.03	0.92	5.6	ND	0.57	7.8	174
07/20/07	110	15.1	0.04	1.38	6.2	ND	0.82	5.4	191
07/22/08	123	21.9	0.039	0.66	5.3	ND	0.26	5.53	185.0
07/22/08	94	10.8	0.039	1.04	5.1	ND	0.28	6.07	203.0
07/22/08	123	21.5	0.028	1.53	4.9	ND	3.46	6.29	261.0
07/22/08	97	11.2	0.029	1.34	5.0	ND	0.17	5.90	198.5
07/22/08	108	16.0	0.045	1.98	6.3	ND	0.23	5.97	220.0
07/22/08	108	14.2	0.059	1.07	8.4	ND	1.31	5.03	195.0
07/21/09	132	26.9	0.04	1.10	4.8	ND	0.33	5.4	213
07/21/09	141	32.3	0.02	0.71	4.5	ND	0.45	7.9	143
07/21/09	116	17.9	<0.02	0.99	4.2	ND	0.40	6.3	153
07/21/09	117	17.7	0.03	1.00	5.9	ND	0.39	6.8	200
07/21/09	119	22.1	<0.02	1.20	4.0	ND	0.28	6.5	176
07/21/09	103	13.0	0.02	2.20	5.3	ND	0.35	5.9	226
07/20/10	115	16.0	<0.019	0.80	3.4	0.08	0.37	4.6	159
07/20/10	112	12.8	0.022	0.67	3.1	0.09	0.34	3.7	154
07/20/10	118	12.6	<0.020	0.98	3.6	0.12	0.25	5.2	190
07/20/10	108	10.6	<0.019	1.31	3.8	0.10	0.16	4.1	212
07/20/10	115	12.3	<0.020	1.73	5.0	0.12	0.36	4.4	222
07/20/10	94	9.0	0.025	0.77	4.0	0.14	0.31	4.8	199
07/21/11	95-117	ND	<0.02	0.95	4.5	ND	0.32	5.6	191
07/23/12	132	24.2	0.02	0.85	7.7	0.0768	0.41	9.2	144
07/23/12	118	17.3	0.04	1.03	7.7	0.109	0.57	6.3	199
07/23/12	109	13.1	0.06	2.04	19.2	0.112	1.32	7.4	215
07/23/12	97	9.1	0.03	2.04	65.6	0.126	0.50	6.2	227
07/23/12	115	15.4	0.04	1.22	12.6	0.123	1.10	6.9	202
07/23/12	119	18.3	0.03	1.81	5.3	0.0798	0.27	5.1	191
07/24/13	117	16.9	<0.02	1.39	4.2	0.131	0.30	5.6	247
07/24/13	117	17.6	0.02	0.74	3.9	0.183	0.39	7.0	297
07/24/13	94	11.3	<0.02	1.27	4.3	0.172	0.28	6.6	262
07/24/13	118	18.9	<0.02	0.89	3.9	0.145	0.33	6.0	211
07/24/13	105	10.3	0.02	1.18	5.3	0.108	0.27	6.4	245
07/24/13	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)
07/24/14	125	21.2	0.08	0.93	12.7	0.121	1.55	5.7	212
07/25/14	104	10.8	0.04	1.15	4.5	0.111	0.37	4.8	247
07/25/14	110	11.5	0.21	0.85	4.3	0.119	0.30	6.2	291
07/25/14	110	14.9	<0.02	0.69	4.8	0.113	0.25	5.9	248
07/25/14	104	10.5	<0.02	1.03	5.0	0.106	0.28	5.7	250
07/25/14	135	24.1	0.02	0.86	4.4	0.160	0.49	6.6	243
07/15/15	110	11.3	0.02	0.92	4.7	0.121	0.59	6.3	236
07/15/15	105	11.5	<0.02	0.52	2.5	0.116	0.36	7.0	117
07/15/15	110	11.7	<0.02	0.67	3.0	0.106	0.36	6.4	171
07/15/15	105	12.0	0.03	1.16	3.8	0.109	1.62	7.3	221
07/15/15	100	10.7	<0.02	2.06	4.9	0.106	0.37	6.6	198
07/15/15	95	8.4	<0.02	0.91	3.4	0.096	0.38	5.5	176
07/15/15	100	8.2	<0.02	0.60	3.6	0.119	0.49	5.8	219
07/15/15	92	9.9	0.02	0.84	4.7	0.072	0.47	6.5	153
07/15/15	90	7.1	0.03	1.32	3.9	0.159	1.08	7.2	204
07/15/15	88	6.2	0.02	1.13	4.0	0.119	0.39	6.4	179
07/12/16	127	21.5	<0.020	0.913	3.24	0.0958	0.194	4.29	122
07/12/16	113	16.2	0.024	1.01	3.49	0.130	0.295	6.23	154
07/12/16	117	15.8	<0.020	1.44	4.22	0.146	0.232	7.03	210
07/12/16	104	12.1	<0.019	0.626	3.39	0.153	0.220	6.18	173
07/12/16	101	9.0	<0.020	1.49	4.57	0.129	0.305	6.66	257
07/12/16	95	8.7	<0.020	0.558	3.26	0.101	0.226	6.01	194
07/12/16	99	11.1	0.029	1.89	5.98	0.110	0.820	7.47	210
07/12/16	86	8.8	0.022	1.52	5.21	0.101	0.359	6.48	226
07/12/16	107	10.0	<0.020	0.983	3.60	0.127	0.239	7.10	182
07/12/16	97	8.9	<0.019	1.18	4.60	0.124	0.215	6.93	244
07/12/17	103	11.5	0.028	0.745	3.39	0.0996	0.189	6.36	173
07/12/17	96	8.8	0.030	0.771	3.69	0.103	0.327	5.9	160
07/12/17	93	8.1	0.039	0.487	3.25	0.116	0.468	5.1	133
07/12/17	96	10.4	0.020	0.674	3.30	0.107	0.173	5.7	177
07/12/17	84	6.5	0.028	0.724	3.72	0.110	0.403	5.18	192
07/12/17	109	14.1	0.033	0.454	3.29	0.0882	0.212	5.05	150
07/12/17	90	9.0	0.035	1.30	5.34	0.0929	0.281	7.16	227
07/12/17	97	9.9	0.029	0.893	3.79	0.0901	0.246	6.3	178
07/12/17	101	10.6	0.031	0.869	4.27	0.104	0.222	6.4	167
07/12/17	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 5.

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
07/12/21	88	7.5	0.042	1.26	5.96	0.184	0.418	5.91	227
07/12/21	93	9.9	0.025	1.08	4.28	0.150	0.291	7.01	183
07/12/21	83	5.3	0.035	1.04	4.00	0.161	0.797	5.75	222
07/12/21	105	11.6	0.038	1.43	4.96	0.182	0.334	6.12	230
07/12/21	90	6.8	0.027	0.789	3.43	0.205	0.272	5.60	157
07/12/21	99	8.0	0.020	0.808	3.44	0.175	0.203	5.78	189
07/12/21	92	7.9	0.028	2.11	7.63	0.163	0.265	7.16	282
07/12/21	96	8.2	0.020	0.855	3.10	0.161	0.304	5.57	151
07/12/21	91	6.8	0.031	0.927	4.57	0.165	0.409	5.99	203
07/12/21	92	7.2	0.035	1.74	4.89	0.161	0.128	6.92	261

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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)
07/12/22	100	10.0	0.021	1.66	5.19	0.306	2.01	6.07	234
07/12/22	110	14.6	0.023	1.14	4.28	0.084	3.57	7.67	184
07/12/22	118	19.4	0.020	0.651	3.22	0.188	1.55	5.33	171
07/12/22	124	24.2	0.024	0.747	4.56	0.106	1.17	5.70	132
07/12/22	108	11.6	0.028	0.508	4.35	0.120	3.32	5.18	151
07/12/22	103	10.9	0.021	0.838	3.67	0.140	6.76	5.48	139
07/12/22	116	17.9	0.025	0.892	3.71	0.119	3.87	6.19	182
07/12/22	113	14.5	0.020	0.823	3.96	0.121	1.65	6.15	173
07/12/22	101	11.6	0.027	1.03	4.82	0.104	9.95	6.31	186
07/12/22	93	8.8	0.020	0.884	3.09	0.110	6.29	5.40	185

Appendix D.4.–Tributary Creek Site 9 Dolly Varden element concentrations, 2001–2022.

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)
07/21/01	97	9.1	0.09	0.35	4.3	ND	0.56	6.8	127
07/21/01	97	9.7	0.10	0.77	5.2	ND	0.67	8.0	118
07/21/01	97	9.5	0.15	0.92	5.4	ND	4.88	5.3	144
07/21/01	98	10.4	0.15	0.86	6.7	ND	2.19	ND	99
07/21/01	86	6.4	0.08	0.76	4.9	ND	0.33	6.2	106
07/21/01	93	7.8	0.06	0.37	12.0	ND	0.38	6.8	122
07/24/02	103	10.8	0.02	0.22	3.7	ND	0.12	1.4	144
07/24/02	97	10.4	0.07	1.20	5.5	ND	1.66	3.3	172
07/24/02	100	11.2	0.13	1.06	6.1	ND	3.40	5.0	138
07/24/02	90	7.9	0.23	1.29	7.1	ND	4.08	5.2	168
07/24/02	90	9.2	0.08	1.15	5.2	ND	1.39	6.2	150
07/24/02	100	9.3	0.04	0.84	3.2	ND	0.33	5.4	152
07/23/03	106	10.7	0.06	0.46	2.8	ND	0.34	6.3	134
07/23/03	89	6.8	0.10	1.01	4.0	ND	0.82	6.0	131
07/23/03	112	17.4	0.16	1.35	4.4	ND	1.85	5.7	108
07/23/03	95	11.6	0.19	0.69	5.6	ND	1.30	3.6	136
07/23/03	91	9.5	0.05	0.72	4.4	ND	0.56	4.9	131
07/23/03	84	8.4	0.12	0.76	3.9	ND	0.78	4.7	125
07/21/04	84	5.5	0.10	0.96	3.2	ND	1.19	5.4	169
07/21/04	96	8.5	0.10	1.24	3.8	ND	0.67	5.9	138
07/21/04	105	14.1	0.10	2.02	4.0	ND	1.76	5.8	125
07/21/04	85	5.8	0.04	0.47	3.7	ND	0.93	4.8	175
07/21/04	81	6.4	0.09	2.34	4.3	ND	1.44	8.2	140
07/21/04	86	10.4	0.11	0.83	5.5	ND	0.97	5.8	161
07/23/05	97	11.1	0.06	0.70	10.4	ND	0.29	6.4	104
07/23/05	113	16.8	0.10	0.63	4.7	ND	0.97	6.1	122
07/23/05	115	18.8	0.07	0.52	6.3	ND	0.53	5.8	109
07/23/05	117	20.5	0.19	0.79	9.9	ND	1.07	6.7	117
07/23/05	101	11.7	0.07	1.44	5.2	ND	1.00	8.1	130
07/23/05	107	13.7	0.10	1.29	4.6	ND	0.46	8.0	134
07/21/06	99	12.9	0.12	0.74	4.0	ND	0.32	6.3	120
07/21/06	96	11.6	0.12	0.76	7.7	ND	1.32	6.8	157
07/21/06	94	10.9	0.18	1.59	10.3	ND	2.48	4.9	160
07/21/06	100	10.9	0.11	1.34	8.5	ND	1.46	5.2	142
07/21/06	97	11.7	0.14	0.88	4.6	ND	0.96	5.2	107
07/21/06	117	20.8	0.24	1.29	4.3	ND	2.92	5.9	130

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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)
07/20/07	98	12.4	0.11	0.91	2.7	ND	1.10	7.8	106
07/20/07	89	8.9	0.12	1.72	3.3	ND	1.80	5.6	136
07/20/07	114	14.1	0.15	2.76	3.4	ND	1.28	8.7	122
07/20/07	81	7.1	0.14	1.90	4.2	ND	2.03	7.0	114
07/20/07	114	14.6	0.88	3.63	3.9	ND	1.56	10.9	131
07/20/07	93	10.6	0.14	1.50	20.3	ND	3.80	9.4	107
07/23/08	103	12.9	0.224	1.99	4.2	ND	3.47	7.66	169.0
07/23/08	108	14.8	0.095	0.96	3.2	ND	0.86	5.82	143.0
07/23/08	88	8.9	0.076	0.93	3.3	ND	0.75	4.41	186.0
07/23/08	86	9.3	0.220	1.91	5.7	ND	4.06	5.71	119.0
07/23/08	92	9.6	0.073	1.01	2.7	ND	0.61	5.20	125.0
07/23/08	90	8.7	0.033	0.54	2.2	ND	0.43	4.80	108.0
07/22/09	83	6.9	0.04	0.29	1.7	ND	0.24	5.4	127
07/22/09	91	8.6	0.06	0.55	2.1	ND	0.16	5.1	137
07/22/09	91	8.5	0.11	0.36	2.0	ND	0.23	7.5	138
07/22/09	98	10.3	0.09	0.81	3.4	ND	0.38	5.8	147
07/22/09	91	8.6	0.03	0.47	2.2	ND	0.40	4.5	125
07/22/09	90	7.8	0.06	0.60	2.2	ND	0.38	5.6	129
07/20/10	87	7.4	0.293	1.61	5.4	0.43	3.92	6.4	151
07/20/10	94	10.9	0.124	0.82	2.5	0.58	0.24	5.7	174
07/20/10	90	8.5	0.084	0.73	2.9	0.35	0.29	5.3	125
07/20/10	90	8.2	0.059	0.60	2.3	0.27	0.33	4.7	151
07/20/10	108	13.5	0.081	0.66	2.6	0.54	0.25	3.2	118
07/20/10	105	11.6	0.076	0.75	3.1	0.27	0.23	3.9	150
07/21/11	85-115	ND	0.090	0.80	3.4	ND	0.32	6.7	146
07/26/12	89	7.3	<0.02	0.33	18.4	0.429	0.18	4.3	123
07/26/12	122	16.5	0.03	0.60	8.4	0.257	0.54	4.8	126
07/26/12	74,75	8.1	0.05	0.76	42.4	0.217	1.65	4.9	140
07/26/12	105	11.7	0.13	0.57	22.6	0.241	0.74	7.5	128
07/26/12	98	9.9	0.07	0.95	203	0.235	1.90	5.5	115
07/26/12	86,112	20.2	0.06	0.53	8.5	0.278	0.67	5.3	116
07/23/13	90	10.1	0.72	6.36	7.5	0.418	5.93	9.7	179
07/23/13	92	10.4	0.27	1.57	3.8	0.329	1.60	6.9	122
07/23/13	85	7.8	0.19	2.41	5.8	0.297	3.90	8.6	153
07/23/13	82,52	8.0	0.05	0.59	3.3	0.439	0.35	5.0	152
07/23/13	82	6.6	0.48	4.67	8.9	0.332	4.87	9.6	181
07/23/13	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)
07/23/14	105	13.1	0.16	0.82	2.7	0.186	0.16	7.1	145
07/23/14	105	11.5	0.02	0.69	2.3	0.188	0.18	5.1	140
07/23/14	104	9.1	0.09	0.69	2.6	0.247	0.22	7.2	116
07/23/14	94	8.4	0.06	1.16	2.4	0.264	0.33	6.7	156
07/23/14	95	8.3	0.12	0.54	2.8	0.215	0.55	6.2	135
07/23/14	105	11.4	0.04	0.30	2.6	0.228	0.19	5.3	117
07/14/15	77,60	12.4	0.22	3.92	3.8	0.285	3.30	7.1	188
07/14/15	77	5.7	0.33	4.40	5.2	0.321	4.93	9.1	157
07/14/15	84	7.2	0.22	2.54	5.3	0.338	2.84	7.9	134
07/14/15	63,69	81.0	0.48	4.73	6.7	0.338	6.20	10.6	173
07/14/15	82	6.9	0.36	3.76	4.6	0.342	4.80	8.5	153
07/14/15	55,75	7.7	0.25	4.03	5.3	0.280	3.42	7.8	165
07/14/15	90	9.3	0.28	1.81	3.4	0.304	1.69	9.2	124
07/14/15	80	6.8	0.30	3.92	5.1	0.312	4.87	9.7	159
07/14/15	75,75	8.9	0.13	1.69	4.2	0.322	1.86	7.2	142
07/14/15	75,75	12.8	0.51	5.86	5.1	0.293	4.54	10.7	175
07/11/16	97	8.1	0.057	0.341	1.99	0.250	0.222	6.34	136
07/11/16	90	6.3	0.068	0.898	2.68	0.219	0.493	5.61	115
07/11/16	105	11.5	0.139	0.438	2.23	0.315	0.333	7.48	124
07/11/16	94	9.4	0.134	1.30	2.76	0.234	0.982	7.12	134
07/11/16	94	10.3	0.078	0.783	2.35	0.334	0.189	6.62	125
07/11/16	114	16.4	0.109	1.03	2.19	0.232	0.285	5.83	131
07/11/16	87	6.5	0.051	0.494	2.09	0.363	0.190	4.99	101
07/11/16	89	6.5	0.034	0.577	2.17	0.249	0.198	5.61	138
07/11/16	102	11.1	0.156	0.892	3.29	0.443	0.368	5.4	127
07/11/16	87	6.1	0.059	1.35	2.27	0.263	0.179	8.34	125
07/11/17	109	12.9	0.080	1.15	2.76	0.269	0.484	10.0	114
07/11/17	78	5.4	0.191	2.78	3.60	0.408	2.04	8.8	145
07/11/17	78	5.7	0.089	2.34	6.71	0.310	1.57	7.89	160
07/11/17	109	12.4	0.094	1.29	2.40	0.631	0.413	6.15	122
07/11/17	84	6.2	0.079	1.16	2.62	0.400	0.412	7.39	121
07/11/17	117	17.8	0.288	3.68	3.21	0.439	1.72	9.25	148
07/11/17	87	7.4	0.191	2.02	4.01	0.261	1.30	8.6	126
07/11/17	94	9.2	0.068	0.292	3.55	0.169	0.183	3.2	163
07/11/17	73	4.1	0.062	0.817	3.85	0.364	0.988	5.5	172
07/11/17	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
07/13/21	104	11.4	0.239	1.01	3.57	0.348	1.09	6.99	138
07/13/21	99	10.2	0.373	2.23	3.70	0.442	0.757	8.09	132
07/13/21	123	13.5	0.056	0.972	4.47	0.358	2.39	3.10	395
07/13/21	110	13.6	0.084	0.264	1.88	0.438	0.079	7.85	132
07/13/21	85	7.1	0.321	1.29	5.80	0.457	3.34	7.83	142
07/20/21	102	10.2	0.059	0.503	2.23	0.340	0.166	6.03	130
07/20/21	115	11.7	0.044	0.276	2.79	0.700	0.054	3.17	192
07/20/21	103	10.2	0.092	0.724	2.75	0.357	0.263	8.14	168
07/12/22	94	8.4	0.039	0.206	2.12	0.213	0.084	3.69	111
07/12/22	97	8.2	0.147	1.300	3.38	0.287	0.749	6.59	154
07/12/22	77	4.8	0.041	0.401	3.23	0.346	0.185	4.02	128
07/12/22	77	4.3	0.218	0.482	2.83	0.364	0.679	3.94	143
08/15/22	98	15.1	0.332	4.790	5.83	0.490	1.340	9.35	164
08/15/22	100	10.6	0.186	2.260	2.69	0.297	1.000	6.21	111
08/15/22	104	13.8	0.103	0.952	3.48	0.325	1.040	5.11	130
08/15/22	104	13.4	0.101	0.522	3.00	0.328	0.428	4.64	123
08/15/22	122	23.3	0.221	0.981	6.24	0.330	2.570	7.45	129
08/15/22	87	9.3	0.260	2.55	3.64	0.452	1.450	5.99	154

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November 09, 2022 **Analytical Report for Service Request No:** K2211543

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

RE: 2022 Greens Creek Biomonitoring

Dear Bill,

Enclosed are the results of the sample(s) submitted to our laboratory September 21, 2022
For your reference, these analyses have been assigned our service request number **K2211543.**

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

Please contact me if you have any questions. My extension is 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

ALS Environmental
ALS Group USA, Corp
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Kelso, WA 98626
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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.
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.
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

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

Client: Alaska Department of Fish and Game
Project: 2022 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2211543
Date Received: 09/21/2022

CASE NARRATIVE

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

Sample Receipt:

Twenty five animal tissue samples were received for analysis at ALS Environmental on 09/21/2022. 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 1631app, 11/02/2022: The matrix spike recoveries of Mercury for sample Tributary Creek Site 27 DV Metals Fish #1 were outside control criteria. Recovery in the Quality Control Sample (QCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

Approved by Noe D. Davis Date 11/09/2022

Chain of Custody

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CHAIN OF CUSTODY

ALS Environmental

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SR# K221543

PAGE 1 OF 3 COC#

PROJECT NAME: 2022 Greens Creek Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: AK Department of Fish & Game
ADDRESS: 802 3rd St
CITY/STATE/ZIP: Douglas, AK 99824
E-MAIL ADDRESS: kate.kanouse@alaska.gov
PHONE #: (907)465-4290 FAX #:
SAMPLER'S SIGNATURE: D. [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, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS, Turb.	(circle) NH3-N, COD, TKN, TOC, DOC, NO2+NO3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity ☐ CO3 ☐ HCO3 ☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ CO2☐ Methane☐ Ethane☐ Ethene☐	Hg - 1631E			REMARKS
See attachments (2) for whole body juvenile fish individual samples.					45								X		60204							X			

REPORT REQUIREMENTS

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

INVOICE INFORMATION

P.O. # Hecla Greens Creek
Bill To: David Landes
dlandes@hecla-mining.com

TURNAROUND REQUIREMENTS

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

Requested Report Date

Circle which metals are to be analyzed:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:

please send report to Kate Kanouse and Erika King (erika.king@alaska.gov)

please send invoice to David Landes at dlandes@hecla-mining.com

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

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time 9/19/22 0930	Signature	Date/Time 9/21/22 1025	Signature	Date/Time	Signature	Date/Time
Printed Name ERIKA KING	Firm ADFG	Printed Name ALS Environmental	Firm	Printed Name	Firm	Printed Name	Firm

Project Name:	2022 Greens Creek Mine Biomonitoring		**Attachment 1 of 2**
Project Manager:	Erika King	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:	erika.king@alaska.gov / 907-465-6979		

K2211543

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body	7/12/2022	Tributary Creek Site 27 DV Metals Fish #1	2022TC27DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	117	17.9
Whole Body	7/12/2022	Tributary Creek Site 27 DV Metals Fish #2	2022TC27DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	112	14.7
Whole Body	7/12/2022	Tributary Creek Site 27 DV Metals Fish #3	2022TC27DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	12.2
Whole Body	7/12/2022	Tributary Creek Site 27 DV Metals Fish #4	2022TC27DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	106	12.2
Whole Body	7/12/2022	Tributary Creek Site 27 DV Metals Fish #5	2022TC27DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	10.8
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #1	2022GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.0
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #2	2022GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	110	14.6
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #3	2022GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	118	19.4
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #4	2022GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	124	24.2
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #5	2022GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	108	11.6
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #6	2022GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	103	10.9
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #7	2022GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	116	17.9
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #8	2022GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	113	14.5
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #9	2022GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	101	11.6
Whole Body	7/12/2022	Greens Creek Site 54 DV Metals Fish #10	2022GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	8.8
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #1	2022GC63DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	13.0
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #2	2022GC63DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	9.0
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #3	2022GC63DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	9.3
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #4	2022GC63DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	117	15.9
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #5	2022GC63DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	9.7
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #6	2022GC63DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	10.0
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #7	2022GC63DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	10.0
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #8	2022GC63DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	8.4
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #9	2022GC63DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	8.9
Whole Body	7/12/2022	Greens Creek Site 63 DV Metals Fish #10	2022GC63DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	124	22.1

PM Mark

Cooler Receipt and Preservation Form

Client 2022 Greens Creek Biomonitoring Service Request K22 11543

Received: ~~9~~ 9/21/22 Opened: ~~9~~ 9/21/22 By: JA Unloaded: 9/21/22 By: JA

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

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
	4.6	IR01				2781 4469 3502	

4. Was a Temperature Blank present in cooler? NA Y (N) If yes, notate the temperature in the appropriate column above:
   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*

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* ~~*Gel Packs*~~ *Wet Ice* *Dry Ice* *Sleeves* _____
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) (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
15. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? (NA) Y N Under filled Overfilled

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: _____

: _____

1/13/22

Page ____ *of* ____

Total Solids

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

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
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 27 DV Metals Fish #1	K2211543-001	**24.0**	-	-	1	10/24/22	
Tributary Creek Site 27 DV Metals Fish #2	K2211543-002	**26.3**	-	-	1	10/24/22	
Tributary Creek Site 27 DV Metals Fish #3	K2211543-003	**24.9**	-	-	1	10/24/22	
Tributary Creek Site 27 DV Metals Fish #4	K2211543-004	**23.8**	-	-	1	10/24/22	
Tributary Creek Site 27 DV Metals Fish #5	K2211543-005	**24.7**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #1	K2211543-006	**22.8**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #2	K2211543-007	**25.2**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #3	K2211543-008	**25.5**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #4	K2211543-009	**26.1**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #5	K2211543-010	**25.2**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #6	K2211543-011	**24.1**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #7	K2211543-012	**23.8**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #8	K2211543-013	**23.9**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #9	K2211543-014	**24.1**	-	-	1	10/24/22	
Greens Creek Site 54 DV Metals Fish #10	K2211543-015	**25.7**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #1	K2211543-016	**19.4**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #2	K2211543-017	**19.6**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #3	K2211543-018	**21.3**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #4	K2211543-019	**23.5**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #5	K2211543-020	**23.8**	-	-	1	10/24/22	
Greens Creek Site 63 DV Metals Fish #6	K2211543-021	**25.0**	-	-	1	10/25/22	
Greens Creek Site 63 DV Metals Fish #7	K2211543-022	**23.2**	-	-	1	10/25/22	
Greens Creek Site 63 DV Metals Fish #8	K2211543-023	**23.3**	-	-	1	10/25/22	
Greens Creek Site 63 DV Metals Fish #9	K2211543-024	**23.7**	-	-	1	10/25/22	
Greens Creek Site 63 DV Metals Fish #10	K2211543-025	**24.0**	-	-	1	10/25/22	

Metals

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ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22

Mercury, Total

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

Units: ng/g
Basis: Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tributary Creek Site 27 DV Metals Fish #1	K2211543-001	9.8	1.96	10	11/02/22	11/04/22	841	
Tributary Creek Site 27 DV Metals Fish #2	K2211543-002	9.9	1.98	10	11/02/22	11/04/22	382	
Tributary Creek Site 27 DV Metals Fish #3	K2211543-003	10.0	1.99	10	11/02/22	11/04/22	615	
Tributary Creek Site 27 DV Metals Fish #4	K2211543-004	9.9	1.97	10	11/02/22	11/04/22	583	
Tributary Creek Site 27 DV Metals Fish #5	K2211543-005	10.0	2.00	10	11/02/22	11/04/22	585	
Greens Creek Site 54 DV Metals Fish #1	K2211543-006	10.0	2.00	10	11/02/22	11/04/22	306	
Greens Creek Site 54 DV Metals Fish #2	K2211543-007	9.8	1.96	10	11/02/22	11/04/22	83.8	
Greens Creek Site 54 DV Metals Fish #3	K2211543-008	9.8	1.96	10	11/02/22	11/04/22	188	
Greens Creek Site 54 DV Metals Fish #4	K2211543-009	10.0	2.00	10	11/02/22	11/04/22	106	
Greens Creek Site 54 DV Metals Fish #5	K2211543-010	9.7	1.95	10	11/02/22	11/04/22	120	
Greens Creek Site 54 DV Metals Fish #6	K2211543-011	9.9	1.98	10	11/02/22	11/04/22	140	
Greens Creek Site 54 DV Metals Fish #7	K2211543-012	10.0	1.99	10	11/02/22	11/04/22	119	
Greens Creek Site 54 DV Metals Fish #8	K2211543-013	9.9	1.99	10	11/02/22	11/04/22	121	
Greens Creek Site 54 DV Metals Fish #9	K2211543-014	10.0	1.99	10	11/02/22	11/04/22	104	
Greens Creek Site 54 DV Metals Fish #10	K2211543-015	9.9	1.99	10	11/02/22	11/04/22	110	
Greens Creek Site 63 DV Metals Fish #1	K2211543-016	9.9	1.98	10	11/02/22	11/04/22	115	
Greens Creek Site 63 DV Metals Fish #2	K2211543-017	9.6	1.93	10	11/02/22	11/04/22	117	
Greens Creek Site 63 DV Metals Fish #3	K2211543-018	10.0	2.00	10	11/2/2022	11/4/2022	144	
Greens Creek Site 63 DV Metals Fish #4	K2211543-019	9.6	1.97	10	11/2/2022	11/4/2022	150	
Greens Creek Site 63 DV Metals Fish #5	K2211543-020	9.8	1.96	10	11/2/2022	11/4/2022	99.1	
Method Blank 1	K2211543-MB1	1.0	0.20	1	11/2/2022	11/4/2022	ND	
Method Blank 2	K2211543-MB2	1.0	0.20	1	11/2/2022	11/4/2022	ND	
Method Blank 3	K2211543-MB3	1.0	0.20	1	11/2/2022	11/4/2022	ND	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22
		Date Extracted:	11/02/22
		Date Analyzed:	11/04/22

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 27 DV Metals Fish #1	Units:	ng/g
Lab Code:	K2211543-001MS, K2211543-001DMS	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	9.9	249	248	841	1290	1310	180	189	70-130	2	N

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22
		Date Extracted:	11/02/22
		Date Analyzed:	11/04/22

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 27 DV Metals Fish #2	Units:	ng/g
Lab Code:	K2211543-002MS, K2211543-002DMS	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	10.0	246	249	382	601	614	89	93	70-130	2	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/04/22

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Initial)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.64	93	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/04/22

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Final)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.90	98	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	11/02/22
		Date Analyzed:	11/04/22

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	258	88	70-130	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22

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 #6	K2211543-021	9.6	1.93	10	11/02/22	11/03/22	89.0	
Greens Creek Site 63 DV Metals Fish #7	K2211543-022	9.9	1.98	10	11/02/22	11/03/22	143	
Greens Creek Site 63 DV Metals Fish #8	K2211543-023	10.0	2.00	10	11/02/22	11/03/22	121	
Greens Creek Site 63 DV Metals Fish #9	K2211543-024	10.0	2.00	10	11/02/22	11/03/22	94.0	
Greens Creek Site 63 DV Metals Fish #10	K2211543-025	9.6	1.91	10	11/02/22	11/03/22	118	
Method Blank 1	K2211543-MB1	1.0	0.20	1	11/02/22	11/03/22	ND	
Method Blank 2	K2211543-MB2	1.0	0.20	1	11/02/22	11/03/22	ND	
Method Blank 3	K2211543-MB3	1.0	0.20	1	11/02/22	11/03/22	ND	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22
		Date Extracted:	11/02/22
		Date Analyzed:	11/03/22

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 63 DV Metals Fish #10	Units:	ng/g
Lab Code:	K2211543-025MS, K2211543-025DMS	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	246	246	118	348	349	93	94	70-130	<1	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/03/22

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	5.29	106	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/03/22

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Final)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.75	95	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	11/02/22
		Date Analyzed:	11/03/22

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	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 27 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2211543-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.245**	mg/Kg	0.020	0.004	5	11/08/22 14:52	11/02/22	
Copper	6020A	**3.02**	mg/Kg	0.099	0.030	5	11/08/22 14:52	11/02/22	
Lead	6020A	**0.893**	mg/Kg	0.020	0.003	5	11/08/22 14:52	11/02/22	
Selenium	6020A	**2.85**	mg/Kg	0.99	0.20	5	11/08/22 14:52	11/02/22	
Silver	6020A	**0.047**	mg/Kg	0.020	0.008	5	11/08/22 14:52	11/02/22	
Zinc	6020A	**146**	mg/Kg	0.50	0.08	5	11/08/22 14:52	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 27 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2211543-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.191**	mg/Kg	0.020	0.004	5	11/08/22 14:59	11/02/22	
Copper	6020A	**2.51**	mg/Kg	0.099	0.030	5	11/08/22 14:59	11/02/22	
Lead	6020A	**0.623**	mg/Kg	0.020	0.003	5	11/08/22 14:59	11/02/22	
Selenium	6020A	**2.57**	mg/Kg	0.99	0.20	5	11/08/22 14:59	11/02/22	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	11/08/22 14:59	11/02/22	
Zinc	6020A	**125**	mg/Kg	0.49	0.08	5	11/08/22 14:59	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 27 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2211543-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.192**	mg/Kg	0.020	0.004	5	11/08/22 15:01	11/02/22	
Copper	6020A	**2.89**	mg/Kg	0.099	0.030	5	11/08/22 15:01	11/02/22	
Lead	6020A	**0.466**	mg/Kg	0.020	0.003	5	11/08/22 15:01	11/02/22	
Selenium	6020A	**2.44**	mg/Kg	0.99	0.20	5	11/08/22 15:01	11/02/22	
Silver	6020A	**0.042**	mg/Kg	0.020	0.008	5	11/08/22 15:01	11/02/22	
Zinc	6020A	**126**	mg/Kg	0.50	0.08	5	11/08/22 15:01	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 27 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2211543-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.149**	mg/Kg	0.020	0.004	5	11/08/22 15:03	11/02/22	
Copper	6020A	**1.89**	mg/Kg	0.099	0.030	5	11/08/22 15:03	11/02/22	
Lead	6020A	**0.267**	mg/Kg	0.020	0.003	5	11/08/22 15:03	11/02/22	
Selenium	6020A	**2.20**	mg/Kg	0.99	0.20	5	11/08/22 15:03	11/02/22	
Silver	6020A	**0.013**	mg/Kg	0.020	0.008	5	11/08/22 15:03	11/02/22	**J**
Zinc	6020A	**112**	mg/Kg	0.49	0.08	5	11/08/22 15:03	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 27 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2211543-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.193**	mg/Kg	0.020	0.004	5	11/08/22 15:06	11/02/22	
Copper	6020A	**2.51**	mg/Kg	0.098	0.029	5	11/08/22 15:06	11/02/22	
Lead	6020A	**0.384**	mg/Kg	0.020	0.003	5	11/08/22 15:06	11/02/22	
Selenium	6020A	**2.62**	mg/Kg	0.98	0.20	5	11/08/22 15:06	11/02/22	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	11/08/22 15:06	11/02/22	
Zinc	6020A	**138**	mg/Kg	0.49	0.08	5	11/08/22 15:06	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2211543-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.66**	mg/Kg	0.020	0.004	5	11/08/22 15:08	11/02/22	
Copper	6020A	**5.19**	mg/Kg	0.10	0.03	5	11/08/22 15:08	11/02/22	
Lead	6020A	**2.01**	mg/Kg	0.020	0.003	5	11/08/22 15:08	11/02/22	
Selenium	6020A	**6.07**	mg/Kg	1.0	0.2	5	11/08/22 15:08	11/02/22	
Silver	6020A	**0.021**	mg/Kg	0.020	0.008	5	11/08/22 15:08	11/02/22	
Zinc	6020A	**234**	mg/Kg	0.50	0.08	5	11/08/22 15:08	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2211543-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.14**	mg/Kg	0.020	0.004	5	11/08/22 15:10	11/02/22	
Copper	6020A	**4.28**	mg/Kg	0.099	0.030	5	11/08/22 15:10	11/02/22	
Lead	6020A	**3.57**	mg/Kg	0.020	0.003	5	11/08/22 15:10	11/02/22	
Selenium	6020A	**7.67**	mg/Kg	0.99	0.20	5	11/08/22 15:10	11/02/22	
Silver	6020A	**0.023**	mg/Kg	0.020	0.008	5	11/08/22 15:10	11/02/22	
Zinc	6020A	**184**	mg/Kg	0.50	0.08	5	11/08/22 15:10	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2211543-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.651**	mg/Kg	0.020	0.004	5	11/08/22 15:13	11/02/22	
Copper	6020A	**3.22**	mg/Kg	0.098	0.030	5	11/08/22 15:13	11/02/22	
Lead	6020A	**1.55**	mg/Kg	0.020	0.003	5	11/08/22 15:13	11/02/22	
Selenium	6020A	**5.33**	mg/Kg	0.98	0.20	5	11/08/22 15:13	11/02/22	
Silver	6020A	**0.015**	mg/Kg	0.020	0.008	5	11/08/22 15:13	11/02/22	**J**
Zinc	6020A	**171**	mg/Kg	0.49	0.08	5	11/08/22 15:13	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2211543-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.747**	mg/Kg	0.020	0.004	5	11/08/22 15:15	11/02/22	
Copper	6020A	**4.56**	mg/Kg	0.10	0.03	5	11/08/22 15:15	11/02/22	
Lead	6020A	**1.17**	mg/Kg	0.020	0.003	5	11/08/22 15:15	11/02/22	
Selenium	6020A	**5.7**	mg/Kg	1.0	0.2	5	11/08/22 15:15	11/02/22	
Silver	6020A	**0.024**	mg/Kg	0.020	0.008	5	11/08/22 15:15	11/02/22	
Zinc	6020A	**132**	mg/Kg	0.50	0.08	5	11/08/22 15:15	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2211543-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.514**	mg/Kg	0.020	0.004	5	11/08/22 14:40	11/02/22	
Copper	6020A	**4.52**	mg/Kg	0.099	0.030	5	11/08/22 14:40	11/02/22	
Lead	6020A	**3.28**	mg/Kg	0.020	0.003	5	11/08/22 14:40	11/02/22	
Selenium	6020A	**5.05**	mg/Kg	0.99	0.20	5	11/08/22 14:40	11/02/22	
Silver	6020A	**0.029**	mg/Kg	0.020	0.008	5	11/08/22 14:40	11/02/22	
Zinc	6020A	**150**	mg/Kg	0.50	0.08	5	11/08/22 14:40	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2211543-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.838**	mg/Kg	0.020	0.004	5	11/08/22 15:17	11/02/22	
Copper	6020A	**3.67**	mg/Kg	0.098	0.030	5	11/08/22 15:17	11/02/22	
Lead	6020A	**6.76**	mg/Kg	0.020	0.003	5	11/08/22 15:17	11/02/22	
Selenium	6020A	**5.48**	mg/Kg	0.98	0.20	5	11/08/22 15:17	11/02/22	
Silver	6020A	**0.021**	mg/Kg	0.020	0.008	5	11/08/22 15:17	11/02/22	
Zinc	6020A	**139**	mg/Kg	0.49	0.08	5	11/08/22 15:17	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2211543-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.892**	mg/Kg	0.020	0.004	5	11/08/22 15:20	11/02/22	
Copper	6020A	**3.71**	mg/Kg	0.099	0.030	5	11/08/22 15:20	11/02/22	
Lead	6020A	**3.87**	mg/Kg	0.020	0.003	5	11/08/22 15:20	11/02/22	
Selenium	6020A	**6.19**	mg/Kg	0.99	0.20	5	11/08/22 15:20	11/02/22	
Silver	6020A	**0.025**	mg/Kg	0.020	0.008	5	11/08/22 15:20	11/02/22	
Zinc	6020A	**182**	mg/Kg	0.50	0.08	5	11/08/22 15:20	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2211543-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.823**	mg/Kg	0.020	0.004	5	11/08/22 15:26	11/02/22	
Copper	6020A	**3.96**	mg/Kg	0.098	0.029	5	11/08/22 15:26	11/02/22	
Lead	6020A	**1.65**	mg/Kg	0.020	0.003	5	11/08/22 15:26	11/02/22	
Selenium	6020A	**6.15**	mg/Kg	0.98	0.20	5	11/08/22 15:26	11/02/22	
Silver	6020A	**0.020**	mg/Kg	0.020	0.008	5	11/08/22 15:26	11/02/22	
Zinc	6020A	**173**	mg/Kg	0.49	0.08	5	11/08/22 15:26	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2211543-014		

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	11/08/22 15:29	11/02/22	
Copper	6020A	**4.82**	mg/Kg	0.099	0.030	5	11/08/22 15:29	11/02/22	
Lead	6020A	**9.95**	mg/Kg	0.020	0.003	5	11/08/22 15:29	11/02/22	
Selenium	6020A	**6.31**	mg/Kg	0.99	0.20	5	11/08/22 15:29	11/02/22	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	11/08/22 15:29	11/02/22	
Zinc	6020A	**186**	mg/Kg	0.50	0.08	5	11/08/22 15:29	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 54 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2211543-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.884**	mg/Kg	0.020	0.004	5	11/08/22 15:31	11/02/22	
Copper	6020A	**3.09**	mg/Kg	0.10	0.03	5	11/08/22 15:31	11/02/22	
Lead	6020A	**6.29**	mg/Kg	0.020	0.003	5	11/08/22 15:31	11/02/22	
Selenium	6020A	**5.4**	mg/Kg	1.0	0.2	5	11/08/22 15:31	11/02/22	
Silver	6020A	**0.013**	mg/Kg	0.020	0.008	5	11/08/22 15:31	11/02/22	**J**
Zinc	6020A	**185**	mg/Kg	0.50	0.08	5	11/08/22 15:31	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2211543-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.779**	mg/Kg	0.020	0.004	5	11/08/22 15:33	11/02/22	
Copper	6020A	**4.37**	mg/Kg	0.10	0.03	5	11/08/22 15:33	11/02/22	
Lead	6020A	**1.33**	mg/Kg	0.020	0.003	5	11/08/22 15:33	11/02/22	
Selenium	6020A	**5.35**	mg/Kg	1.0	0.2	5	11/08/22 15:33	11/02/22	
Silver	6020A	**0.035**	mg/Kg	0.020	0.008	5	11/08/22 15:33	11/02/22	
Zinc	6020A	**209**	mg/Kg	0.50	0.08	5	11/08/22 15:33	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2211543-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.72**	mg/Kg	0.020	0.004	5	11/08/22 15:36	11/02/22	
Copper	6020A	**4.41**	mg/Kg	0.099	0.030	5	11/08/22 15:36	11/02/22	
Lead	6020A	**1.06**	mg/Kg	0.020	0.003	5	11/08/22 15:36	11/02/22	
Selenium	6020A	**5.44**	mg/Kg	0.99	0.20	5	11/08/22 15:36	11/02/22	
Silver	6020A	**0.034**	mg/Kg	0.020	0.008	5	11/08/22 15:36	11/02/22	
Zinc	6020A	**223**	mg/Kg	0.49	0.08	5	11/08/22 15:36	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2211543-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.13**	mg/Kg	0.020	0.004	5	11/08/22 15:38	11/02/22	
Copper	6020A	**4.35**	mg/Kg	0.099	0.030	5	11/08/22 15:38	11/02/22	
Lead	6020A	**1.03**	mg/Kg	0.020	0.003	5	11/08/22 15:38	11/02/22	
Selenium	6020A	**5.57**	mg/Kg	0.99	0.20	5	11/08/22 15:38	11/02/22	
Silver	6020A	**0.028**	mg/Kg	0.020	0.008	5	11/08/22 15:38	11/02/22	
Zinc	6020A	**193**	mg/Kg	0.49	0.08	5	11/08/22 15:38	11/02/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2211543-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.65**	mg/Kg	0.020	0.004	5	11/08/22 15:40	11/02/22	
Copper	6020A	**6.03**	mg/Kg	0.099	0.030	5	11/08/22 15:40	11/02/22	
Lead	6020A	**0.736**	mg/Kg	0.020	0.003	5	11/08/22 15:40	11/02/22	
Selenium	6020A	**5.61**	mg/Kg	0.99	0.20	5	11/08/22 15:40	11/02/22	
Silver	6020A	**0.036**	mg/Kg	0.020	0.008	5	11/08/22 15:40	11/02/22	
Zinc	6020A	**240**	mg/Kg	0.49	0.08	5	11/08/22 15:40	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2211543-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.44**	mg/Kg	0.020	0.004	5	11/08/22 15:43	11/02/22	
Copper	6020A	**4.95**	mg/Kg	0.099	0.030	5	11/08/22 15:43	11/02/22	
Lead	6020A	**1.14**	mg/Kg	0.020	0.003	5	11/08/22 15:43	11/02/22	
Selenium	6020A	**5.44**	mg/Kg	0.99	0.20	5	11/08/22 15:43	11/02/22	
Silver	6020A	**0.016**	mg/Kg	0.020	0.008	5	11/08/22 15:43	11/02/22	**J**
Zinc	6020A	**199**	mg/Kg	0.50	0.08	5	11/08/22 15:43	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2211543-021		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.922**	mg/Kg	0.020	0.004	5	11/08/22 17:22	11/07/22	
Copper	6020A	**3.57**	mg/Kg	0.099	0.030	5	11/08/22 17:22	11/07/22	
Lead	6020A	**0.868**	mg/Kg	0.020	0.003	5	11/08/22 17:22	11/07/22	
Selenium	6020A	**5.89**	mg/Kg	0.99	0.20	5	11/08/22 17:22	11/07/22	
Silver	6020A	**0.014**	mg/Kg	0.020	0.008	5	11/08/22 17:22	11/07/22	**J**
Zinc	6020A	**162**	mg/Kg	0.50	0.08	5	11/08/22 17:22	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2211543-022		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.76**	mg/Kg	0.020	0.004	5	11/08/22 17:29	11/07/22	
Copper	6020A	**5.13**	mg/Kg	0.10	0.03	5	11/08/22 17:29	11/07/22	
Lead	6020A	**2.74**	mg/Kg	0.020	0.003	5	11/08/22 17:29	11/07/22	
Selenium	6020A	**5.43**	mg/Kg	1.0	0.2	5	11/08/22 17:29	11/07/22	
Silver	6020A	**0.054**	mg/Kg	0.020	0.008	5	11/08/22 17:29	11/07/22	
Zinc	6020A	**235**	mg/Kg	0.50	0.08	5	11/08/22 17:29	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2211543-023		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.755**	mg/Kg	0.020	0.004	5	11/08/22 17:32	11/07/22	
Copper	6020A	**4.21**	mg/Kg	0.10	0.03	5	11/08/22 17:32	11/07/22	
Lead	6020A	**0.682**	mg/Kg	0.020	0.003	5	11/08/22 17:32	11/07/22	
Selenium	6020A	**5.30**	mg/Kg	1.0	0.2	5	11/08/22 17:32	11/07/22	
Silver	6020A	**0.025**	mg/Kg	0.020	0.008	5	11/08/22 17:32	11/07/22	
Zinc	6020A	**163**	mg/Kg	0.50	0.08	5	11/08/22 17:32	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2211543-024		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.719**	mg/Kg	0.020	0.004	5	11/08/22 17:34	11/07/22	
Copper	6020A	**3.93**	mg/Kg	0.10	0.03	5	11/08/22 17:34	11/07/22	
Lead	6020A	**0.781**	mg/Kg	0.020	0.003	5	11/08/22 17:34	11/07/22	
Selenium	6020A	**5.51**	mg/Kg	1.0	0.2	5	11/08/22 17:34	11/07/22	
Silver	6020A	**0.024**	mg/Kg	0.020	0.008	5	11/08/22 17:34	11/07/22	
Zinc	6020A	**168**	mg/Kg	0.50	0.08	5	11/08/22 17:34	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Greens Creek Site 63 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2211543-025		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.01**	mg/Kg	0.020	0.004	5	11/08/22 17:36	11/07/22	
Copper	6020A	**4.01**	mg/Kg	0.10	0.03	5	11/08/22 17:36	11/07/22	
Lead	6020A	**0.882**	mg/Kg	0.020	0.003	5	11/08/22 17:36	11/07/22	
Selenium	6020A	**5.53**	mg/Kg	1.0	0.2	5	11/08/22 17:36	11/07/22	
Silver	6020A	**0.025**	mg/Kg	0.020	0.008	5	11/08/22 17:36	11/07/22	
Zinc	6020A	**180**	mg/Kg	0.50	0.08	5	11/08/22 17:36	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2219138-01		

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	11/08/22 14:31	11/02/22	
Copper	6020A	ND	U	mg/Kg	0.10	0.03	5	11/08/22 14:31	11/02/22	
Lead	6020A	ND	U	mg/Kg	0.020	0.003	5	11/08/22 14:31	11/02/22	
Selenium	6020A	ND	U	mg/Kg	1.0	0.2	5	11/08/22 14:31	11/02/22	
Silver	6020A	ND	U	mg/Kg	0.020	0.008	5	11/08/22 14:31	11/02/22	
Zinc	6020A	ND	U	mg/Kg	0.5	0.08	5	11/08/22 14:31	11/02/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2219141-01		

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	11/08/22 16:33	11/07/22	
Copper	6020A	ND	U	mg/Kg	0.10	0.03	5	11/08/22 16:33	11/07/22	
Lead	6020A	ND	U	mg/Kg	0.020	0.003	5	11/08/22 16:33	11/07/22	
Selenium	6020A	ND	U	mg/Kg	1.0	0.2	5	11/08/22 16:33	11/07/22	
Silver	6020A	ND	U	mg/Kg	0.020	0.008	5	11/08/22 16:33	11/07/22	
Zinc	6020A	ND	U	mg/Kg	0.5	0.08	5	11/08/22 16:33	11/07/22	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
		Date Analyzed:	11/08/22

Replicate Sample Summary

Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #5	**Units:**	mg/Kg
Lab Code:	K2211543-010	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2219138-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.004	0.514	0.501	0.508	3	20
Copper	6020A	0.10	0.03	4.52	4.17	4.35	8	20
Lead	6020A	0.020	0.003	3.28	3.36	3.32	2	20
Selenium	6020A	1.0	0.2	5.05	5.31	5.18	5	20
Silver	6020A	0.020	0.008	0.029	0.027	0.028	7	20
Zinc	6020A	0.5	0.08	150	151	151	<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.

Printed 11/9/2022 1:39:15 PM

Superset Reference:

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	07/12/22
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
		Date Analyzed:	11/8/22
		Date Extracted:	11/2/22

Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #5	**Units:**	mg/Kg
Lab Code:	K2211543-010	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2219138-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.514	5.68	4.92	105	75-125
Copper	4.52	28.7	24.6	98	75-125
Lead	3.28	49.7	49.2	94	75-125
Selenium	5.05	22.7	16.4	108	75-125
Silver	0.029	4.98	4.92	101	75-125
Zinc	150	211	49.2	124	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
Project: 2022 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2211543
Date Analyzed: 11/08/22

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2219138-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	5.16	5.00	103	80-120
Copper	6020A	25.1	25.0	101	80-120
Lead	6020A	50.0	50.0	100	80-120
Selenium	6020A	17.0	16.7	102	80-120
Silver	6020A	5.21	5.00	104	80-120
Zinc	6020A	49.6	50.0	99	80-120

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2022 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2211543
Date Analyzed: 11/08/22

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2219141-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	5.26	5.00	105	80-120
Copper	6020A	26.2	25.0	105	80-120
Lead	6020A	51.1	50.0	102	80-120
Selenium	6020A	16.8	16.7	101	80-120
Silver	6020A	5.10	5.00	102	80-120
Zinc	6020A	49.8	50.0	100	80-120

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/2/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219138-03	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	0.318	106	0.225 - 0.380	
Copper	PSEP Tissue	6020A	15.7	15.8	101	12.2 - 19.4	
Lead	PSEP Tissue	6020A	0.40	0.36	89	0.274 - 0.559	
Selenium	PSEP Tissue	6020A	3.45	3.77	109	2.44 - 4.62	
Silver	PSEP Tissue	6020A	0.0252	0.0287	114	0.0162 - 0.0362	
Zinc	PSEP Tissue	6020A	51.6	52.0	101	39.0 - 65.3	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/2/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219138-04	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	40.5	96	32.4-52.9	
Copper	PSEP Tissue	6020A	497	460	93	380-623	
Lead	PSEP Tissue	6020A	0.225	0.189	84	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.3	94	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	129	95	104-170	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/7/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219141-03	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	0.322	108	0.225 - 0.380	
Copper	PSEP Tissue	6020A	15.7	16.3	104	12.2 - 19.4	
Lead	PSEP Tissue	6020A	0.40	0.40	99	0.274 - 0.559	
Selenium	PSEP Tissue	6020A	3.45	3.68	107	2.44 - 4.62	
Silver	PSEP Tissue	6020A	0.0252	0.0270	107	0.0162 - 0.0362	
Zinc	PSEP Tissue	6020A	51.6	51.5	100	39.0 - 65.3	

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211543
Project:	2022 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/7/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219141-04	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	42.7	101	32.4-52.9	
Copper	PSEP Tissue	6020A	497	494	99	380-623	
Lead	PSEP Tissue	6020A	0.225	0.205	91	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.7	98	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	133	98	104-170	

ALS Group USA, Corp.
dba ALS Environmental

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 409194
Analytical Method: 6020A **Extraction Date:** 11/02/22 15:01

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
Tributary Creek Site 27 DV Metals Fish #1	K2211543-001	7/12/22	9/21/22	0.3020 g	30 mL	
Tributary Creek Site 27 DV Metals Fish #2	K2211543-002	7/12/22	9/21/22	0.3040 g	30 mL	
Tributary Creek Site 27 DV Metals Fish #3	K2211543-003	7/12/22	9/21/22	0.3020 g	30 mL	
Tributary Creek Site 27 DV Metals Fish #4	K2211543-004	7/12/22	9/21/22	0.3040 g	30 mL	
Tributary Creek Site 27 DV Metals Fish #5	K2211543-005	7/12/22	9/21/22	0.3060 g	30 mL	
Greens Creek Site 54 DV Metals Fish #1	K2211543-006	7/12/22	9/21/22	0.3010 g	30 mL	
Greens Creek Site 54 DV Metals Fish #2	K2211543-007	7/12/22	9/21/22	0.3030 g	30 mL	
Greens Creek Site 54 DV Metals Fish #3	K2211543-008	7/12/22	9/21/22	0.3050 g	30 mL	
Greens Creek Site 54 DV Metals Fish #4	K2211543-009	7/12/22	9/21/22	0.3000 g	30 mL	
Greens Creek Site 54 DV Metals Fish #5	K2211543-010	7/12/22	9/21/22	0.3020 g	30 mL	
Greens Creek Site 54 DV Metals Fish #6	K2211543-011	7/12/22	9/21/22	0.3050 g	30 mL	
Greens Creek Site 54 DV Metals Fish #7	K2211543-012	7/12/22	9/21/22	0.3020 g	30 mL	
Greens Creek Site 54 DV Metals Fish #8	K2211543-013	7/12/22	9/21/22	0.3060 g	30 mL	
Greens Creek Site 54 DV Metals Fish #9	K2211543-014	7/12/22	9/21/22	0.3020 g	30 mL	
Greens Creek Site 54 DV Metals Fish #10	K2211543-015	7/12/22	9/21/22	0.3000 g	30 mL	
Greens Creek Site 63 DV Metals Fish #1	K2211543-016	7/12/22	9/21/22	0.3010 g	30 mL	
Greens Creek Site 63 DV Metals Fish #2	K2211543-017	7/12/22	9/21/22	0.3040 g	30 mL	
Greens Creek Site 63 DV Metals Fish #3	K2211543-018	7/12/22	9/21/22	0.3040 g	30 mL	
Greens Creek Site 63 DV Metals Fish #4	K2211543-019	7/12/22	9/21/22	0.3040 g	30 mL	
Greens Creek Site 63 DV Metals Fish #5	K2211543-020	7/12/22	9/21/22	0.3030 g	30 mL	
Method Blank	KQ2219138-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ2219138-02LCS	NA	NA	0.3000 g	30 mL	
Standard Reference Material	KQ2219138-03SRM	7/12/22	9/21/22	0.3020 g	30 mL	
Standard Reference Material	KQ2219138-04SRM	7/12/22	9/21/22	0.3050 g	30 mL	
Duplicate	KQ2219138-05DUP	7/12/22	9/21/22	0.3060 g	30 mL	
Matrix Spike	KQ2219138-06MS	7/12/22	9/21/22	0.3050 g	30 mL	

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 409196
Analytical Method: 6020A **Extraction Date:** 11/07/22 14:34

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
Greens Creek Site 63 DV Metals Fish #6	K2211543-021	7/12/22	9/21/22	0.30200 g	30 mL	
Greens Creek Site 63 DV Metals Fish #7	K2211543-022	7/12/22	9/21/22	0.30100 g	30 mL	
Greens Creek Site 63 DV Metals Fish #8	K2211543-023	7/12/22	9/21/22	0.30100 g	30 mL	
Greens Creek Site 63 DV Metals Fish #9	K2211543-024	7/12/22	9/21/22	0.30100 g	30 mL	
Greens Creek Site 63 DV Metals Fish #10	K2211543-025	7/12/22	9/21/22	0.30100 g	30 mL	
Method Blank	KQ2219141-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ2219141-02LCS	NA	NA	0.3000 g	30 mL	
Standard Reference Material	KQ2219141-03SRM	7/12/22	9/21/22	0.30100 g	30 mL	
Standard Reference Material	KQ2219141-04SRM	7/12/22	9/21/22	0.30100 g	30 mL	

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 11/08/22 14:10						
Cadmium	6020A	784436	12.6	12.5	101	90-110
Copper	6020A	784436	12.4	12.5	99	90-110
Lead	6020A	784436	24.3	25.0	97	90-110
Selenium	6020A	784436	24.8	25.0	99	90-110
Silver	6020A	784436	12.2	12.5	97	90-110
Zinc	6020A	784436	25.0	25.0	100	90-110
CCV 11/08/22 14:12						
Cadmium	6020A	784436	24.9	25.0	100	90-110
Copper	6020A	784436	24.7	25.0	99	90-110
Lead	6020A	784436	25.2	25.0	101	90-110
Selenium	6020A	784436	24.9	25.0	100	90-110
Silver	6020A	784436	12.5	12.5	100	90-110
Zinc	6020A	784436	25.3	25.0	101	90-110
CCV 11/08/22 14:54						
Cadmium	6020A	784436	25.3	25.0	101	90-110
Copper	6020A	784436	25.2	25.0	101	90-110
Lead	6020A	784436	25.3	25.0	101	90-110
Selenium	6020A	784436	25.6	25.0	102	90-110
Silver	6020A	784436	12.7	12.5	102	90-110
Zinc	6020A	784436	25.3	25.0	101	90-110
CCV 11/08/22 15:22						
Cadmium	6020A	784436	25.7	25.0	103	90-110
Copper	6020A	784436	25.8	25.0	103	90-110
Lead	6020A	784436	25.4	25.0	102	90-110
Selenium	6020A	784436	25.1	25.0	100	90-110
Silver	6020A	784436	13.1	12.5	104	90-110
Zinc	6020A	784436	26.0	25.0	104	90-110
CCV 11/08/22 15:45						
Cadmium	6020A	784436	25.7	25.0	103	90-110
Copper	6020A	784436	25.6	25.0	102	90-110
Lead	6020A	784436	25.7	25.0	103	90-110
Selenium	6020A	784436	26.0	25.0	104	90-110
Silver	6020A	784436	13.1	12.5	104	90-110
Zinc	6020A	784436	25.6	25.0	102	90-110
ICV 11/08/22 16:13						
Cadmium	6020A	784467	12.5	12.5	100	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 11/08/22 16:13						
Copper	6020A	784467	12.2	12.5	98	90-110
Lead	6020A	784467	24.0	25.0	96	90-110
Selenium	6020A	784467	24.0	25.0	96	90-110
Silver	6020A	784467	12.0	12.5	96	90-110
Zinc	6020A	784467	23.9	25.0	96	90-110
CCV 11/08/22 16:15						
Cadmium	6020A	784467	24.2	25.0	97	90-110
Copper	6020A	784467	24.8	25.0	99	90-110
Lead	6020A	784467	24.1	25.0	96	90-110
Selenium	6020A	784467	24.7	25.0	99	90-110
Silver	6020A	784467	12.1	12.5	97	90-110
Zinc	6020A	784467	23.8	25.0	95	90-110
CCV 11/08/22 16:56						
Cadmium	6020A	784467	25.0	25.0	100	90-110
Copper	6020A	784467	24.7	25.0	99	90-110
Lead	6020A	784467	24.6	25.0	98	90-110
Selenium	6020A	784467	24.3	25.0	97	90-110
Silver	6020A	784467	12.4	12.5	99	90-110
Zinc	6020A	784467	24.4	25.0	98	90-110
CCV 11/08/22 17:25						
Cadmium	6020A	784467	25.1	25.0	100	90-110
Copper	6020A	784467	25.3	25.0	101	90-110
Lead	6020A	784467	24.7	25.0	99	90-110
Selenium	6020A	784467	25.0	25.0	100	90-110
Silver	6020A	784467	12.5	12.5	100	90-110
Zinc	6020A	784467	24.7	25.0	99	90-110
CCV 11/08/22 17:39						
Cadmium	6020A	784467	25.2	25.0	101	90-110
Copper	6020A	784467	25.2	25.0	101	90-110
Lead	6020A	784467	24.9	25.0	99	90-110
Selenium	6020A	784467	25.1	25.0	100	90-110
Silver	6020A	784467	12.5	12.5	100	90-110
Zinc	6020A	784467	24.3	25.0	97	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
ICB 11/08/22 14:15				
Cadmium	6020A	784436	0.008	U
Copper	6020A	784436	0.06	U
Lead	6020A	784436	0.006	U
Selenium	6020A	784436	0.4	U
Silver	6020A	784436	0.016	U
Zinc	6020A	784436	0.2	U
CCB 11/08/22 14:17				
Cadmium	6020A	784436	0.008	U
Copper	6020A	784436	0.06	U
Lead	6020A	784436	0.006	U
Selenium	6020A	784436	0.4	U
Silver	6020A	784436	0.016	U
Zinc	6020A	784436	0.2	U
CCB 11/08/22 14:56				
Cadmium	6020A	784436	0.008	U
Copper	6020A	784436	0.06	U
Lead	6020A	784436	0.007	J
Selenium	6020A	784436	0.4	U
Silver	6020A	784436	0.016	U
Zinc	6020A	784436	0.2	U
CCB 11/08/22 15:24				
Cadmium	6020A	784436	0.008	U
Copper	6020A	784436	0.06	U
Lead	6020A	784436	0.006	U
Selenium	6020A	784436	0.4	U
Silver	6020A	784436	0.016	U
Zinc	6020A	784436	0.2	U
CCB 11/08/22 15:47				
Cadmium	6020A	784436	0.008	U
Copper	6020A	784436	0.06	U
Lead	6020A	784436	0.006	J
Selenium	6020A	784436	0.4	U
Silver	6020A	784436	0.016	U
Zinc	6020A	784436	0.2	U
ICB 11/08/22 16:18				
Cadmium	6020A	784467	0.008	U

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
ICB 11/08/22 16:18				
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 16:20				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 16:59				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 17:27				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 17:41				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

LOW LEVEL INITIAL AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
LLICVT							
Cadmium	6020A	784436	0.044	0.04	110	70-130	11/08/22 14:19
Copper	6020A	784436	0.21	0.2	106	70-130	11/08/22 14:19
Lead	6020A	784436	0.040	0.04	100	70-130	11/08/22 14:19
Selenium	6020A	784436	2.1	2.0	105	70-130	11/08/22 14:19
Silver	6020A	784436	0.041	0.04	104	70-130	11/08/22 14:19
Zinc	6020A	784436	0.88	1.0	88	70-130	11/08/22 14:19
LLCCVT							
Cadmium	6020A	784436	0.035	0.04	89	70-130	11/08/22 15:50
Copper	6020A	784436	0.21	0.2	103	70-130	11/08/22 15:50
Lead	6020A	784436	0.046	0.04	115	70-130	11/08/22 15:50
Selenium	6020A	784436	2.2	2.0	108	70-130	11/08/22 15:50
Silver	6020A	784436	0.037	0.04	93	70-130	11/08/22 15:50
Zinc	6020A	784436	1.0	1.0	105	70-130	11/08/22 15:50
LLICVT							
Cadmium	6020A	784467	0.043	0.04	107	70-130	11/08/22 16:22
Copper	6020A	784467	0.19	0.2	95	70-130	11/08/22 16:22
Lead	6020A	784467	0.040	0.04	100	70-130	11/08/22 16:22
Selenium	6020A	784467	1.9	2.0	97	70-130	11/08/22 16:22
Silver	6020A	784467	0.044	0.04	111	70-130	11/08/22 16:22
Zinc	6020A	784467	1.1	1.0	106	70-130	11/08/22 16:22
LLCCVT							
Cadmium	6020A	784467	0.047	0.04	119	70-130	11/08/22 17:44
Copper	6020A	784467	0.20	0.2	99	70-130	11/08/22 17:44
Lead	6020A	784467	0.039	0.04	97	70-130	11/08/22 17:44
Selenium	6020A	784467	1.9	2.0	95	70-130	11/08/22 17:44
Silver	6020A	784467	0.039	0.04	98	70-130	11/08/22 17:44
Zinc	6020A	784467	1.0	1.0	104	70-130	11/08/22 17:44

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSA **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784436	0.012	-	-	-	11/08/22 14:22
Copper	6020A	784436	0.13	-	-	-	11/08/22 14:22
Lead	6020A	784436	0.113	-	-	-	11/08/22 14:22
Selenium	6020A	784436	0.5	-	-	-	11/08/22 14:22
Silver	6020A	784436	0.006	-	-	-	11/08/22 14:22
Zinc	6020A	784436	0.3	-	-	-	11/08/22 14:22

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSAB **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784436	24.9	25.0	99	80-120	11/08/22 14:24
Copper	6020A	784436	45.2	50.0	90	80-120	11/08/22 14:24
Lead	6020A	784436	0.116	-	-	-	11/08/22 14:24
Selenium	6020A	784436	24.6	25.0	98	80-120	11/08/22 14:24
Silver	6020A	784436	11.6	12.5	93	80-120	11/08/22 14:24
Zinc	6020A	784436	23.3	25.0	93	80-120	11/08/22 14:24

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSA **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784467	0.009	-	-	-	11/08/22 16:25
Copper	6020A	784467	0.12	-	-	-	11/08/22 16:25
Lead	6020A	784467	0.115	-	-	-	11/08/22 16:25
Selenium	6020A	784467	0.5	-	-	-	11/08/22 16:25
Silver	6020A	784467	0.008	-	-	-	11/08/22 16:25
Zinc	6020A	784467	0.3	-	-	-	11/08/22 16:25

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSAB **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784467	24.8	25.0	99	80-120	11/08/22 16:27
Copper	6020A	784467	46.0	50.0	92	80-120	11/08/22 16:27
Lead	6020A	784467	0.115	-	-	-	11/08/22 16:27
Selenium	6020A	784467	24.2	25.0	97	80-120	11/08/22 16:27
Silver	6020A	784467	11.6	12.5	93	80-120	11/08/22 16:27
Zinc	6020A	784467	23.0	25.0	92	80-120	11/08/22 16:27

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

POST SPIKE SAMPLE RECOVERY

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Post Spike Result	True Value	% Rec	% Rec. Limits	Analysis Date
K2211543-010A								
Cadmium	6020A	784436	1.03	52.6	50.0	103	80-120	11/08/22 14:47
Copper	6020A	784436	9.1	58.7	50.0	99	80-120	11/08/22 14:47
Lead	6020A	784436	6.61	54.8	50.0	96	80-120	11/08/22 14:47
Selenium	6020A	784436	10	63	50	105	80-120	11/08/22 14:47
Silver	6020A	784436	0.06	4.93	5.00	97	80-120	11/08/22 14:47
Zinc	6020A	784436	302	352	50.0	101 #	80-120	11/08/22 14:47

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

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring

ICP SERIAL DILUTIONS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Serial Dillution Result	% Diff	% Diff. Limit	Analysis Date
K2211543-010SDL							
Cadmium	6020A	784436	5.2	5.2	1	10	11/08/22 14:45
Copper	6020A	784436	45.5	46.5	2	10	11/08/22 14:45
Lead	6020A	784436	33.1	33.5	1	10	11/08/22 14:45
Selenium	6020A	784436	51	50	1	10	11/08/22 14:45
Silver	6020A	784436	0.3	0.4 U	33	10	11/08/22 14:45
Zinc	6020A	784436	1510	1530	1	10	11/08/22 14:45

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring/

Detection Limits

Instrument: K-ICP-MS-06 **Matrix:** Animal Tissue

Analyte	Mass	Units	MRL	MDL	Method
Cadmium	111	ug/L	0.04	0.008	6020A
Copper	65	ug/L	0.2	0.06	6020A
Lead	208	ug/L	0.04	0.006	6020A
Selenium	78	ug/L	2	0.4	6020A
Silver	107	ug/L	0.04	0.016	6020A
Zinc	66	ug/L	1	0.16	6020A

Client: Alaska Department of Fish and Game **Service Request:** K2211543
Project: 2022 Greens Creek Biomonitoring/

ICP Linear Range (Quarterly)

Instrument: K-ICP-MS-06

Analyte	Concentration (ug/L)	Method
Cadmium 111	9000	6020A
Copper 65	4500	6020A
Lead 208	4500	6020A
Selenium 78	9000	6020A
Silver 107	450	6020A
Zinc 66	9000	6020A

ALS Environmental
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November 09, 2022 **Analytical Report for Service Request No:** K2211547

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 are the results of the sample(s) submitted to our laboratory September 21, 2022
For your reference, these analyses have been assigned our service request number **K2211547.**

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

Please contact me if you have any questions. My extension is 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

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Table of Contents

Acronyms

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

Inorganic Data Qualifiers

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

Organic Data Qualifiers

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

Additional Petroleum Hydrocarbon Specific Qualifiers

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

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

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

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

Service Request: K2211547
Date Received: 09/21/2022

CASE NARRATIVE

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

Sample Receipt:

Twenty animal tissue samples were received for analysis at ALS Environmental on 09/21/2022. 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, 11/08/2022: The Relative Percent Difference (RPD) for the replicate analysis of Lead in sample Tributary Creek Site 9 DV Metals Fish #9 was outside the normal ALS control limits (21% RPD versus a control limit of 21%). The samples were homogenized, freeze dried, then ground prior to digestion, however this was not sufficient to achieve a completely uniform distribution of Lead in the tissue.

Approved by Noe D. Dave Date 11/09/2022

Chain of Custody

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CHAIN OF CUSTODY

ALS Environmental
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SR# IC22115
PAGE 1 OF 3 COC#

PROJECT NAME: 2022 Greens Creek Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: AK Department of Fish & Game
ADDRESS: 802 3rd St
CITY/STATE/ZIP: Douglas, AK 99824
E-MAIL ADDRESS: kate.kanouse@alaska.gov
PHONE #: (907)465-4290 FAX #:
SAMPLER'S SIGNATURE: D. Thurk

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8270LL☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐ BTEX☐	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) 6020A	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO4, PO4, F, NO_3, BOD, TSS, TDS, Turb.	(circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity ☐ CO_3☐ HCO_3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ CO_2☐ Methane☐ Ethane☐ Ethene☐	Hg - 1631E			REMARKS
See attachments (2)		for			45							X									X			
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: David Landes
dlandes@hecla-mining.com

TURNAROUND REQUIREMENTS

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

Requested Report Date

Circle which metals are to be analyzed:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:

please send report to Kate Kanouse and Erika King (erika-king@alaska.gov)

please send invoice to David Landes at dlandes@hecla-mining.com

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

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
ERIKA KING	ADFG	ALS Environmental					
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm
	9/19/22 0930		9/21/22 1025				

Project Name:	2022 Greens Creek Mine Biomonitoring		**Attachment 2 of 2**
Project Manager:	Erika King	Sample Type:	Whole body juvenile Dolly Varden char and Coho Salmon
Company Name:	Alaska Department of Fish and Game	Analysis:	Total metals, dry weight basis, report percent solids
Contact Information:	erika.king@alaska.gov / 907-465-6979		

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body		Tributary Creek Site 9 DV Metals Fish #1	2022TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.4
Whole Body		Tributary Creek Site 9 DV Metals Fish #2	2022TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	97	8.2
Whole Body		Tributary Creek Site 9 DV Metals Fish #3	2022TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	77	4.8
Whole Body		Tributary Creek Site 9 DV Metals Fish #4	2022TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	77	4.3
Whole Body		Tributary Creek Site 9 DV Metals Fish #5	2022TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	15.1
Whole Body		Tributary Creek Site 9 DV Metals Fish #6	2022TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	10.6
Whole Body		Tributary Creek Site 9 DV Metals Fish #7	2022TC9DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	13.8
Whole Body		Tributary Creek Site 9 DV Metals Fish #8	2022TC9DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	13.4
Whole Body		Tributary Creek Site 9 DV Metals Fish #9	2022TC9DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	122	23.3
Whole Body		Tributary Creek Site 9 DV Metals Fish #10	2022TC9DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	9.3
Whole Body		Tributary Creek Site 9 CO Metals Fish #1	2022TC9CO1	Ag, Cd, Cu, Hg, Pb, Se, Zn	81	6.6
Whole Body		Tributary Creek Site 9 CO Metals Fish #2	2022TC9CO2	Ag, Cd, Cu, Hg, Pb, Se, Zn	75	5.8
Whole Body		Tributary Creek Site 9 CO Metals Fish #3	2022TC9CO3	Ag, Cd, Cu, Hg, Pb, Se, Zn	83	7.2
Whole Body		Tributary Creek Site 9 CO Metals Fish #4	2022TC9CO4	Ag, Cd, Cu, Hg, Pb, Se, Zn	82	7.5
Whole Body		Tributary Creek Site 9 CO Metals Fish #5	2022TC9CO5	Ag, Cd, Cu, Hg, Pb, Se, Zn	75	5.9
Whole Body		Tributary Creek Site 9 CO Metals Fish #6	2022TC9CO6	Ag, Cd, Cu, Hg, Pb, Se, Zn	74	6.4
Whole Body		Tributary Creek Site 9 CO Metals Fish #7	2022TC9CO7	Ag, Cd, Cu, Hg, Pb, Se, Zn	82	8.2
Whole Body		Tributary Creek Site 9 CO Metals Fish #8	2022TC9CO8	Ag, Cd, Cu, Hg, Pb, Se, Zn	83	8.1
Whole Body		Tributary Creek Site 9 CO Metals Fish #9	2022TC9CO9	Ag, Cd, Cu, Hg, Pb, Se, Zn	79	7.7
Whole Body		Tributary Creek Site 9 CO Metals Fish #10	2022TC9CO10	Ag, Cd, Cu, Hg, Pb, Se, Zn	83	7.1

PM_____

Cooler Receipt and Preservation Form

Client 2022 Greens Creek Biomonitoring Service Request K22_____

Received: ~~9~~ 9/21/22 Opened: ~~9~~ 9/21/22 By: JA Unloaded: 9/21/22 By: JA

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

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
	4.6	IR01				2781 4469 3502	

4. Was a Temperature Blank present in cooler? NA Y (N) If yes, notate the temperature in the appropriate column above:
   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*

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* ~~*Gel Packs*~~ *Wet Ice* *Dry Ice* *Sleeves* _____
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
15. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? (NA) Y N Under filled Overfilled

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:_____

:_____

1/13/22

Page ____ *of* ____

Total Solids

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

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
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	K2211547-001	**25.5**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #2	K2211547-002	**24.5**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #3	K2211547-003	**22.6**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #4	K2211547-004	**24.0**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #5	K2211547-005	**25.6**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #6	K2211547-006	**25.3**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #7	K2211547-007	**26.4**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #8	K2211547-008	**26.2**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #9	K2211547-009	**27.1**	-	-	1	10/24/22	
Tributary Creek Site 9 DV Metals Fish #10	K2211547-010	**24.7**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #1	K2211547-011	**27.8**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #2	K2211547-012	**26.2**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #3	K2211547-013	**26.8**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #4	K2211547-014	**25.9**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #5	K2211547-015	**29.0**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #6	K2211547-016	**27.0**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #7	K2211547-017	**26.3**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #8	K2211547-018	**28.1**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #9	K2211547-019	**26.0**	-	-	1	10/24/22	
Tributary Creek Site 9 CO Metals Fish #10	K2211547-020	**27.2**	-	-	1	10/24/22	

Metals

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

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22

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	K2211547-001	9.8	1.96	10	11/02/22	11/03/22	213	
Tributary Creek Site 9 DV Metals Fish #2	K2211547-002	9.8	1.96	10	11/02/22	11/03/22	287	
Tributary Creek Site 9 DV Metals Fish #3	K2211547-003	9.9	1.98	10	11/02/22	11/03/22	346	
Tributary Creek Site 9 DV Metals Fish #4	K2211547-004	10.0	2.00	10	11/02/22	11/03/22	364	
Tributary Creek Site 9 DV Metals Fish #5	K2211547-005	9.7	1.95	10	11/02/22	11/03/22	490	
Tributary Creek Site 9 DV Metals Fish #6	K2211547-006	9.9	1.98	10	11/02/22	11/03/22	297	
Tributary Creek Site 9 DV Metals Fish #7	K2211547-007	9.7	1.95	10	11/02/22	11/03/22	325	
Tributary Creek Site 9 DV Metals Fish #8	K2211547-008	9.9	1.98	10	11/02/22	11/03/22	328	
Tributary Creek Site 9 DV Metals Fish #9	K2211547-009	10.0	2.00	10	11/02/22	11/03/22	330	
Tributary Creek Site 9 DV Metals Fish #10	K2211547-010	9.7	1.95	10	11/02/22	11/03/22	452	
Tributary Creek Site 9 CO Metals Fish #1	K2211547-011	10.0	1.99	10	11/02/22	11/03/22	265	
Tributary Creek Site 9 CO Metals Fish #2	K2211547-012	10.0	2.00	10	11/02/22	11/03/22	348	
Tributary Creek Site 9 CO Metals Fish #3	K2211547-013	10.0	2.00	10	11/02/22	11/03/22	305	
Tributary Creek Site 9 CO Metals Fish #4	K2211547-014	9.8	1.96	10	11/02/22	11/03/22	343	
Tributary Creek Site 9 CO Metals Fish #5	K2211547-015	9.9	1.98	10	11/02/22	11/03/22	217	
Tributary Creek Site 9 CO Metals Fish #6	K2211547-016	10.0	2.00	10	11/02/22	11/03/22	432	
Tributary Creek Site 9 CO Metals Fish #7	K2211547-017	9.9	1.99	10	11/02/22	11/03/22	552	
Tributary Creek Site 9 CO Metals Fish #8	K2211547-018	10.0	2.00	10	11/2/2022	11/3/2022	602	
Tributary Creek Site 9 CO Metals Fish #9	K2211547-019	9.8	1.96	10	11/2/2022	11/3/2022	254	
Tributary Creek Site 9 CO Metals Fish #10	K2211547-020	9.7	1.93	10	11/2/2022	11/3/2022	329	
Method Blank 1	K2211547-MB1	1.0	0.20	1	11/2/2022	11/3/2022	ND	
Method Blank 2	K2211547-MB2	1.0	0.20	1	11/2/2022	11/3/2022	ND	
Method Blank 3	K2211547-MB3	1.0	0.20	1	11/2/2022	11/3/2022	ND	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22
		Date Extracted:	11/02/22
		Date Analyzed:	11/03/22

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #5	Units:	ng/g
Lab Code:	K2211547-005MS, K2211547-005DMS	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	245	490	720	698	94	85	70-130	3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	09/21/22
		Date Extracted:	11/02/22
		Date Analyzed:	11/03/22

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #8	Units:	ng/g
Lab Code:	K2211547-008MS, K2211547-008MS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	Result
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	10.0	248	250	328	562	581	94	101	70-130	3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/03/22

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	5.16	103	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/03/22

Ongoing Precision and Recovery (OPR) Sample Summary

Total Metals

Sample Name: Ongoing Precision and Recovery (Final)

Units: ng/g

Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.97	99	70-130	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	11/02/22
		Date Analyzed:	11/03/22

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	262	90	70-130	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2211547-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.206**	mg/Kg	0.020	0.004	5	11/08/22 18:07	11/07/22	
Copper	6020A	**2.12**	mg/Kg	0.099	0.030	5	11/08/22 18:07	11/07/22	
Lead	6020A	**0.084**	mg/Kg	0.020	0.003	5	11/08/22 18:07	11/07/22	
Selenium	6020A	**3.69**	mg/Kg	0.99	0.20	5	11/08/22 18:07	11/07/22	
Silver	6020A	**0.039**	mg/Kg	0.020	0.008	5	11/08/22 18:07	11/07/22	
Zinc	6020A	**111**	mg/Kg	0.50	0.08	5	11/08/22 18:07	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2211547-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.30**	mg/Kg	0.020	0.004	5	11/08/22 18:14	11/07/22	
Copper	6020A	**3.38**	mg/Kg	0.10	0.03	5	11/08/22 18:14	11/07/22	
Lead	6020A	**0.749**	mg/Kg	0.020	0.003	5	11/08/22 18:14	11/07/22	
Selenium	6020A	**6.59**	mg/Kg	1.0	0.2	5	11/08/22 18:14	11/07/22	
Silver	6020A	**0.147**	mg/Kg	0.020	0.008	5	11/08/22 18:14	11/07/22	
Zinc	6020A	**154**	mg/Kg	0.50	0.08	5	11/08/22 18:14	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2211547-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.401**	mg/Kg	0.020	0.004	5	11/08/22 18:17	11/07/22	
Copper	6020A	**3.23**	mg/Kg	0.099	0.030	5	11/08/22 18:17	11/07/22	
Lead	6020A	**0.185**	mg/Kg	0.020	0.003	5	11/08/22 18:17	11/07/22	
Selenium	6020A	**4.02**	mg/Kg	0.99	0.20	5	11/08/22 18:17	11/07/22	
Silver	6020A	**0.041**	mg/Kg	0.020	0.008	5	11/08/22 18:17	11/07/22	
Zinc	6020A	**128**	mg/Kg	0.50	0.08	5	11/08/22 18:17	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2211547-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.482**	mg/Kg	0.020	0.004	5	11/08/22 18:19	11/07/22	
Copper	6020A	**2.83**	mg/Kg	0.10	0.03	5	11/08/22 18:19	11/07/22	
Lead	6020A	**0.679**	mg/Kg	0.020	0.003	5	11/08/22 18:19	11/07/22	
Selenium	6020A	**3.94**	mg/Kg	1.0	0.2	5	11/08/22 18:19	11/07/22	
Silver	6020A	**0.218**	mg/Kg	0.020	0.008	5	11/08/22 18:19	11/07/22	
Zinc	6020A	**143**	mg/Kg	0.50	0.08	5	11/08/22 18:19	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2211547-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**4.79**	mg/Kg	0.020	0.004	5	11/08/22 18:21	11/07/22	
Copper	6020A	**5.83**	mg/Kg	0.10	0.03	5	11/08/22 18:21	11/07/22	
Lead	6020A	**1.34**	mg/Kg	0.020	0.003	5	11/08/22 18:21	11/07/22	
Selenium	6020A	**9.35**	mg/Kg	1.0	0.2	5	11/08/22 18:21	11/07/22	
Silver	6020A	**0.332**	mg/Kg	0.020	0.008	5	11/08/22 18:21	11/07/22	
Zinc	6020A	**164**	mg/Kg	0.50	0.08	5	11/08/22 18:21	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2211547-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.26**	mg/Kg	0.020	0.004	5	11/08/22 18:24	11/07/22	
Copper	6020A	**2.69**	mg/Kg	0.099	0.030	5	11/08/22 18:24	11/07/22	
Lead	6020A	**1.00**	mg/Kg	0.020	0.003	5	11/08/22 18:24	11/07/22	
Selenium	6020A	**6.21**	mg/Kg	0.99	0.20	5	11/08/22 18:24	11/07/22	
Silver	6020A	**0.186**	mg/Kg	0.020	0.008	5	11/08/22 18:24	11/07/22	
Zinc	6020A	**111**	mg/Kg	0.49	0.08	5	11/08/22 18:24	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2211547-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.952**	mg/Kg	0.020	0.004	5	11/08/22 18:26	11/07/22	
Copper	6020A	**3.48**	mg/Kg	0.098	0.030	5	11/08/22 18:26	11/07/22	
Lead	6020A	**1.04**	mg/Kg	0.020	0.003	5	11/08/22 18:26	11/07/22	
Selenium	6020A	**5.11**	mg/Kg	0.98	0.20	5	11/08/22 18:26	11/07/22	
Silver	6020A	**0.103**	mg/Kg	0.020	0.008	5	11/08/22 18:26	11/07/22	
Zinc	6020A	**130**	mg/Kg	0.49	0.08	5	11/08/22 18:26	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2211547-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.522**	mg/Kg	0.020	0.004	5	11/08/22 18:29	11/07/22	
Copper	6020A	**3.00**	mg/Kg	0.10	0.03	5	11/08/22 18:29	11/07/22	
Lead	6020A	**0.428**	mg/Kg	0.020	0.003	5	11/08/22 18:29	11/07/22	
Selenium	6020A	**4.64**	mg/Kg	1.0	0.2	5	11/08/22 18:29	11/07/22	
Silver	6020A	**0.101**	mg/Kg	0.020	0.008	5	11/08/22 18:29	11/07/22	
Zinc	6020A	**123**	mg/Kg	0.50	0.08	5	11/08/22 18:29	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2211547-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.981**	mg/Kg	0.020	0.004	5	11/08/22 17:55	11/07/22	
Copper	6020A	**6.24**	mg/Kg	0.10	0.03	5	11/08/22 17:55	11/07/22	
Lead	6020A	**2.57**	mg/Kg	0.020	0.003	5	11/08/22 17:55	11/07/22	
Selenium	6020A	**7.45**	mg/Kg	1.0	0.2	5	11/08/22 17:55	11/07/22	
Silver	6020A	**0.221**	mg/Kg	0.020	0.008	5	11/08/22 17:55	11/07/22	
Zinc	6020A	**129**	mg/Kg	0.50	0.08	5	11/08/22 17:55	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2211547-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.55**	mg/Kg	0.020	0.004	5	11/08/22 18:31	11/07/22	
Copper	6020A	**3.64**	mg/Kg	0.099	0.030	5	11/08/22 18:31	11/07/22	
Lead	6020A	**1.45**	mg/Kg	0.020	0.003	5	11/08/22 18:31	11/07/22	
Selenium	6020A	**5.99**	mg/Kg	0.99	0.20	5	11/08/22 18:31	11/07/22	
Silver	6020A	**0.260**	mg/Kg	0.020	0.008	5	11/08/22 18:31	11/07/22	
Zinc	6020A	**154**	mg/Kg	0.50	0.08	5	11/08/22 18:31	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #1	**Basis:**	Dry
Lab Code:	K2211547-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.860**	mg/Kg	0.020	0.004	5	11/08/22 18:33	11/07/22	
Copper	6020A	**3.89**	mg/Kg	0.099	0.030	5	11/08/22 18:33	11/07/22	
Lead	6020A	**1.80**	mg/Kg	0.020	0.003	5	11/08/22 18:33	11/07/22	
Selenium	6020A	**4.51**	mg/Kg	0.99	0.20	5	11/08/22 18:33	11/07/22	
Silver	6020A	**0.226**	mg/Kg	0.020	0.008	5	11/08/22 18:33	11/07/22	
Zinc	6020A	**116**	mg/Kg	0.50	0.08	5	11/08/22 18:33	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #2	**Basis:**	Dry
Lab Code:	K2211547-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.719**	mg/Kg	0.020	0.004	5	11/08/22 18:36	11/07/22	
Copper	6020A	**4.50**	mg/Kg	0.10	0.03	5	11/08/22 18:36	11/07/22	
Lead	6020A	**1.16**	mg/Kg	0.020	0.003	5	11/08/22 18:36	11/07/22	
Selenium	6020A	**6.09**	mg/Kg	1.0	0.2	5	11/08/22 18:36	11/07/22	
Silver	6020A	**0.231**	mg/Kg	0.020	0.008	5	11/08/22 18:36	11/07/22	
Zinc	6020A	**131**	mg/Kg	0.50	0.08	5	11/08/22 18:36	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #3	**Basis:**	Dry
Lab Code:	K2211547-013		

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	11/08/22 18:43	11/07/22	
Copper	6020A	**3.14**	mg/Kg	0.098	0.030	5	11/08/22 18:43	11/07/22	
Lead	6020A	**0.977**	mg/Kg	0.020	0.003	5	11/08/22 18:43	11/07/22	
Selenium	6020A	**5.44**	mg/Kg	0.98	0.20	5	11/08/22 18:43	11/07/22	
Silver	6020A	**0.094**	mg/Kg	0.020	0.008	5	11/08/22 18:43	11/07/22	
Zinc	6020A	**123**	mg/Kg	0.49	0.08	5	11/08/22 18:43	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #4	**Basis:**	Dry
Lab Code:	K2211547-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.633**	mg/Kg	0.020	0.004	5	11/08/22 18:45	11/07/22	
Copper	6020A	**3.86**	mg/Kg	0.099	0.030	5	11/08/22 18:45	11/07/22	
Lead	6020A	**0.856**	mg/Kg	0.020	0.003	5	11/08/22 18:45	11/07/22	
Selenium	6020A	**4.71**	mg/Kg	0.99	0.20	5	11/08/22 18:45	11/07/22	
Silver	6020A	**0.191**	mg/Kg	0.020	0.008	5	11/08/22 18:45	11/07/22	
Zinc	6020A	**145**	mg/Kg	0.50	0.08	5	11/08/22 18:45	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #5	**Basis:**	Dry
Lab Code:	K2211547-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.558**	mg/Kg	0.020	0.004	5	11/08/22 18:47	11/07/22	
Copper	6020A	**4.43**	mg/Kg	0.099	0.030	5	11/08/22 18:47	11/07/22	
Lead	6020A	**1.46**	mg/Kg	0.020	0.003	5	11/08/22 18:47	11/07/22	
Selenium	6020A	**3.55**	mg/Kg	0.99	0.20	5	11/08/22 18:47	11/07/22	
Silver	6020A	**0.205**	mg/Kg	0.020	0.008	5	11/08/22 18:47	11/07/22	
Zinc	6020A	**117**	mg/Kg	0.50	0.08	5	11/08/22 18:47	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #6	**Basis:**	Dry
Lab Code:	K2211547-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.538**	mg/Kg	0.020	0.004	5	11/08/22 18:50	11/07/22	
Copper	6020A	**3.77**	mg/Kg	0.10	0.03	5	11/08/22 18:50	11/07/22	
Lead	6020A	**0.822**	mg/Kg	0.020	0.003	5	11/08/22 18:50	11/07/22	
Selenium	6020A	**5.51**	mg/Kg	1.0	0.2	5	11/08/22 18:50	11/07/22	
Silver	6020A	**0.256**	mg/Kg	0.020	0.008	5	11/08/22 18:50	11/07/22	
Zinc	6020A	**122**	mg/Kg	0.50	0.08	5	11/08/22 18:50	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #7	**Basis:**	Dry
Lab Code:	K2211547-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.718**	mg/Kg	0.020	0.004	5	11/08/22 18:52	11/07/22	
Copper	6020A	**4.04**	mg/Kg	0.10	0.03	5	11/08/22 18:52	11/07/22	
Lead	6020A	**0.974**	mg/Kg	0.020	0.003	5	11/08/22 18:52	11/07/22	
Selenium	6020A	**3.71**	mg/Kg	1.0	0.2	5	11/08/22 18:52	11/07/22	
Silver	6020A	**0.213**	mg/Kg	0.020	0.008	5	11/08/22 18:52	11/07/22	
Zinc	6020A	**132**	mg/Kg	0.50	0.08	5	11/08/22 18:52	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #8	**Basis:**	Dry
Lab Code:	K2211547-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.929**	mg/Kg	0.020	0.004	5	11/08/22 18:55	11/07/22	
Copper	6020A	**4.66**	mg/Kg	0.10	0.03	5	11/08/22 18:55	11/07/22	
Lead	6020A	**2.35**	mg/Kg	0.020	0.003	5	11/08/22 18:55	11/07/22	
Selenium	6020A	**5.38**	mg/Kg	1.0	0.2	5	11/08/22 18:55	11/07/22	
Silver	6020A	**0.617**	mg/Kg	0.020	0.008	5	11/08/22 18:55	11/07/22	
Zinc	6020A	**155**	mg/Kg	0.50	0.08	5	11/08/22 18:55	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #9	**Basis:**	Dry
Lab Code:	K2211547-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.52**	mg/Kg	0.020	0.004	5	11/08/22 18:57	11/07/22	
Copper	6020A	**5.22**	mg/Kg	0.099	0.030	5	11/08/22 18:57	11/07/22	
Lead	6020A	**2.51**	mg/Kg	0.020	0.003	5	11/08/22 18:57	11/07/22	
Selenium	6020A	**5.78**	mg/Kg	0.99	0.20	5	11/08/22 18:57	11/07/22	
Silver	6020A	**0.372**	mg/Kg	0.020	0.008	5	11/08/22 18:57	11/07/22	
Zinc	6020A	**176**	mg/Kg	0.50	0.08	5	11/08/22 18:57	11/07/22	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22 10:25
Sample Name:	Tributary Creek Site 9 CO Metals Fish #10	**Basis:**	Dry
Lab Code:	K2211547-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.32**	mg/Kg	0.020	0.004	5	11/08/22 18:59	11/07/22	
Copper	6020A	**6.93**	mg/Kg	0.099	0.030	5	11/08/22 18:59	11/07/22	
Lead	6020A	**3.82**	mg/Kg	0.020	0.003	5	11/08/22 18:59	11/07/22	
Selenium	6020A	**7.09**	mg/Kg	0.99	0.20	5	11/08/22 18:59	11/07/22	
Silver	6020A	**0.350**	mg/Kg	0.020	0.008	5	11/08/22 18:59	11/07/22	
Zinc	6020A	**160**	mg/Kg	0.50	0.08	5	11/08/22 18:59	11/07/22	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2219140-01		

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	11/08/22 17:46	11/07/22	
Copper	6020A	ND	U	mg/Kg	0.10	0.03	5	11/08/22 17:46	11/07/22	
Lead	6020A	ND	U	mg/Kg	0.020	0.003	5	11/08/22 17:46	11/07/22	
Selenium	6020A	ND	U	mg/Kg	1.0	0.2	5	11/08/22 17:46	11/07/22	
Silver	6020A	ND	U	mg/Kg	0.020	0.008	5	11/08/22 17:46	11/07/22	
Zinc	6020A	ND	U	mg/Kg	0.5	0.08	5	11/08/22 17:46	11/07/22	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
		Date Analyzed:	11/08/22

Replicate Sample Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #9	**Units:**	mg/Kg
Lab Code:	K2211547-009	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2219140-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.004	0.981	1.05	1.02	7	20
Copper	6020A	0.10	0.03	6.24	6.99	6.62	11	20
Lead	6020A	0.020	0.003	2.57	3.17	2.87	21 *	20
Selenium	6020A	1.0	0.2	7.45	7.73	7.59	4	20
Silver	6020A	0.020	0.008	0.221	0.235	0.228	6	20
Zinc	6020A	0.5	0.08	129	131	130	2	20

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

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

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

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	N/A
Sample Matrix:	Animal Tissue	**Date Received:**	09/21/22
		Date Analyzed:	11/8/22
		Date Extracted:	11/7/22

Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #9	**Units:**	mg/Kg
Lab Code:	K2211547-009	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2219140-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.981	6.75	4.98	116	75-125
Copper	6.24	34.3	24.9	113	75-125
Lead	2.57	55.7	49.8	107	75-125
Selenium	7.45	24.8	16.6	104	75-125
Silver	0.221	5.56	4.98	107	75-125
Zinc	129	191	49.8	124	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
Project: 2020 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2211547
Date Analyzed: 11/08/22

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2219140-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	5.37	5.00	107	80-120
Copper	6020A	26.3	25.0	105	80-120
Lead	6020A	50.9	50.0	102	80-120
Selenium	6020A	17.5	16.7	105	80-120
Silver	6020A	5.13	5.00	103	80-120
Zinc	6020A	50.1	50.0	100	80-120

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/7/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219140-03	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	0.323	108	0.225 - 0.380	
Copper	PSEP Tissue	6020A	15.7	16.4	104	12.2 - 19.4	
Lead	PSEP Tissue	6020A	0.40	0.38	94	0.274 - 0.559	
Selenium	PSEP Tissue	6020A	3.45	3.74	108	2.44 - 4.62	
Silver	PSEP Tissue	6020A	0.0252	0.0328	130	0.0162 - 0.0362	
Zinc	PSEP Tissue	6020A	51.6	50.9	99	39.0 - 65.3	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2211547
Project:	2020 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/7/2022
		Date Analyzed:	11/8/2022

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2219140-04	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	43.2	102	32.4-52.9	
Copper	PSEP Tissue	6020A	497	495	100	380-623	
Lead	PSEP Tissue	6020A	0.225	0.203	90	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.9	100	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	135	99	104-170	

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 409195
Analytical Method: 6020A **Extraction Date:** 11/07/22 14:34

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
Tributary Creek Site 9 DV Metals Fish #1	K2211547-001	NA	9/21/22	0.30300 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #2	K2211547-002	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #3	K2211547-003	NA	9/21/22	0.30200 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #4	K2211547-004	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #5	K2211547-005	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #6	K2211547-006	NA	9/21/22	0.30400 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #7	K2211547-007	NA	9/21/22	0.30500 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #8	K2211547-008	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #9	K2211547-009	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #10	K2211547-010	NA	9/21/22	0.30200 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #1	K2211547-011	NA	9/21/22	0.30300 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #2	K2211547-012	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #3	K2211547-013	NA	9/21/22	0.30500 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #4	K2211547-014	NA	9/21/22	0.30200 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #5	K2211547-015	NA	9/21/22	0.30300 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #6	K2211547-016	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #7	K2211547-017	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #8	K2211547-018	NA	9/21/22	0.30100 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #9	K2211547-019	NA	9/21/22	0.30200 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #10	K2211547-020	NA	9/21/22	0.30300 g	30 mL	
Method Blank	KQ2219140-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ2219140-02LCS	NA	NA	0.3000 g	30 mL	
Standard Reference Material	KQ2219140-03SRM	NA	9/21/22	0.30100 g	30 mL	
Standard Reference Material	KQ2219140-04SRM	NA	9/21/22	0.30500 g	30 mL	
Duplicate	KQ2219140-05DUP	NA	9/21/22	0.30100 g	30 mL	
Matrix Spike	KQ2219140-06MS	NA	9/21/22	0.30100 g	30 mL	

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 11/08/22 16:13						
Cadmium	6020A	784467	12.5	12.5	100	90-110
Copper	6020A	784467	12.2	12.5	98	90-110
Lead	6020A	784467	24.0	25.0	96	90-110
Selenium	6020A	784467	24.0	25.0	96	90-110
Silver	6020A	784467	12.0	12.5	96	90-110
Zinc	6020A	784467	23.9	25.0	96	90-110
CCV 11/08/22 16:15						
Cadmium	6020A	784467	24.2	25.0	97	90-110
Copper	6020A	784467	24.8	25.0	99	90-110
Lead	6020A	784467	24.1	25.0	96	90-110
Selenium	6020A	784467	24.7	25.0	99	90-110
Silver	6020A	784467	12.1	12.5	97	90-110
Zinc	6020A	784467	23.8	25.0	95	90-110
CCV 11/08/22 16:56						
Cadmium	6020A	784467	25.0	25.0	100	90-110
Copper	6020A	784467	24.7	25.0	99	90-110
Lead	6020A	784467	24.6	25.0	98	90-110
Selenium	6020A	784467	24.3	25.0	97	90-110
Silver	6020A	784467	12.4	12.5	99	90-110
Zinc	6020A	784467	24.4	25.0	98	90-110
CCV 11/08/22 17:25						
Cadmium	6020A	784467	25.1	25.0	100	90-110
Copper	6020A	784467	25.3	25.0	101	90-110
Lead	6020A	784467	24.7	25.0	99	90-110
Selenium	6020A	784467	25.0	25.0	100	90-110
Silver	6020A	784467	12.5	12.5	100	90-110
Zinc	6020A	784467	24.7	25.0	99	90-110
CCV 11/08/22 17:39						
Cadmium	6020A	784467	25.2	25.0	101	90-110
Copper	6020A	784467	25.2	25.0	101	90-110
Lead	6020A	784467	24.9	25.0	99	90-110
Selenium	6020A	784467	25.1	25.0	100	90-110
Silver	6020A	784467	12.5	12.5	100	90-110
Zinc	6020A	784467	24.3	25.0	97	90-110
CCV 11/08/22 18:10						
Cadmium	6020A	784467	24.8	25.0	99	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
CCV 11/08/22 18:10						
Copper	6020A	784467	25.0	25.0	100	90-110
Lead	6020A	784467	24.6	25.0	98	90-110
Selenium	6020A	784467	24.9	25.0	100	90-110
Silver	6020A	784467	12.4	12.5	100	90-110
Zinc	6020A	784467	24.6	25.0	98	90-110
CCV 11/08/22 18:38						
Cadmium	6020A	784467	25.2	25.0	101	90-110
Copper	6020A	784467	25.4	25.0	102	90-110
Lead	6020A	784467	25.0	25.0	100	90-110
Selenium	6020A	784467	25.3	25.0	101	90-110
Silver	6020A	784467	12.6	12.5	101	90-110
Zinc	6020A	784467	24.4	25.0	98	90-110
CCV 11/08/22 19:02						
Cadmium	6020A	784467	25.0	25.0	100	90-110
Copper	6020A	784467	25.0	25.0	100	90-110
Lead	6020A	784467	24.8	25.0	99	90-110
Selenium	6020A	784467	25.0	25.0	100	90-110
Silver	6020A	784467	12.6	12.5	101	90-110
Zinc	6020A	784467	24.0	25.0	96	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
ICB 11/08/22 16:18				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 16:20				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 16:59				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 17:27				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 17:41				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 18:12				
Cadmium	6020A	784467	0.008	U

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
CCB 11/08/22 18:12				
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 18:40				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U
CCB 11/08/22 19:04				
Cadmium	6020A	784467	0.008	U
Copper	6020A	784467	0.06	U
Lead	6020A	784467	0.006	U
Selenium	6020A	784467	0.4	U
Silver	6020A	784467	0.016	U
Zinc	6020A	784467	0.2	U

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

LOW LEVEL INITIAL AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
LLICVT							
Cadmium	6020A	784467	0.043	0.04	107	70-130	11/08/22 16:22
Copper	6020A	784467	0.19	0.2	95	70-130	11/08/22 16:22
Lead	6020A	784467	0.040	0.04	100	70-130	11/08/22 16:22
Selenium	6020A	784467	1.9	2.0	97	70-130	11/08/22 16:22
Silver	6020A	784467	0.044	0.04	111	70-130	11/08/22 16:22
Zinc	6020A	784467	1.1	1.0	106	70-130	11/08/22 16:22
LLCCVT							
Cadmium	6020A	784467	0.047	0.04	119	70-130	11/08/22 17:44
Copper	6020A	784467	0.20	0.2	99	70-130	11/08/22 17:44
Lead	6020A	784467	0.039	0.04	97	70-130	11/08/22 17:44
Selenium	6020A	784467	1.9	2.0	95	70-130	11/08/22 17:44
Silver	6020A	784467	0.039	0.04	98	70-130	11/08/22 17:44
Zinc	6020A	784467	1.0	1.0	104	70-130	11/08/22 17:44
LLCCVT							
Cadmium	6020A	784467	0.041	0.04	103	70-130	11/08/22 19:06
Copper	6020A	784467	0.20	0.2	101	70-130	11/08/22 19:06
Lead	6020A	784467	0.038	0.04	96	70-130	11/08/22 19:06
Selenium	6020A	784467	2.0	2.0	101	70-130	11/08/22 19:06
Silver	6020A	784467	0.040	0.04	100	70-130	11/08/22 19:06
Zinc	6020A	784467	1.0	1.0	103	70-130	11/08/22 19:06

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSA **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784467	0.009	-	-	-	11/08/22 16:25
Copper	6020A	784467	0.12	-	-	-	11/08/22 16:25
Lead	6020A	784467	0.115	-	-	-	11/08/22 16:25
Selenium	6020A	784467	0.5	-	-	-	11/08/22 16:25
Silver	6020A	784467	0.008	-	-	-	11/08/22 16:25
Zinc	6020A	784467	0.3	-	-	-	11/08/22 16:25

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSAB **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	784467	24.8	25.0	99	80-120	11/08/22 16:27
Copper	6020A	784467	46.0	50.0	92	80-120	11/08/22 16:27
Lead	6020A	784467	0.115	-	-	-	11/08/22 16:27
Selenium	6020A	784467	24.2	25.0	97	80-120	11/08/22 16:27
Silver	6020A	784467	11.6	12.5	93	80-120	11/08/22 16:27
Zinc	6020A	784467	23.0	25.0	92	80-120	11/08/22 16:27

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

POST SPIKE SAMPLE RECOVERY

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Post Spike Result	True Value	% Rec	% Rec. Limits	Analysis Date
K2211547-009A								
Cadmium	6020A	784467	1.97	53.5	50.0	103	80-120	11/08/22 18:02
Copper	6020A	784467	12.5	61.9	50.0	99	80-120	11/08/22 18:02
Lead	6020A	784467	5.15	53.2	50.0	96	80-120	11/08/22 18:02
Selenium	6020A	784467	15	66	50	102	80-120	11/08/22 18:02
Silver	6020A	784467	0.44	5.25	5.00	96	80-120	11/08/22 18:02
Zinc	6020A	784467	258	304	50.0	92 #	80-120	11/08/22 18:02

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

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring

ICP SERIAL DILUTIONS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Serial Dillution Result	% Diff	% Diff. Limit	Analysis Date
K2211547-009SDL							
Cadmium	6020A	784467	9.8	10.0	2	10	11/08/22 18:00
Copper	6020A	784467	62.6	63.0	1	10	11/08/22 18:00
Lead	6020A	784467	25.8	25.5	1	10	11/08/22 18:00
Selenium	6020A	784467	75	75	0	10	11/08/22 18:00
Silver	6020A	784467	2.2	2.0	9	10	11/08/22 18:00
Zinc	6020A	784467	1290	1320	2	10	11/08/22 18:00

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring/

Detection Limits

Instrument: K-ICP-MS-06 **Matrix:** Animal Tissue

Analyte	Mass	Units	MRL	MDL	Method
Cadmium	111	ug/L	0.04	0.008	6020A
Copper	65	ug/L	0.2	0.06	6020A
Lead	208	ug/L	0.04	0.006	6020A
Selenium	78	ug/L	2	0.4	6020A
Silver	107	ug/L	0.04	0.016	6020A
Zinc	66	ug/L	1	0.16	6020A

Client: Alaska Department of Fish and Game **Service Request:** K2211547
Project: 2020 Greens Creek Biomonitoring/

ICP Linear Range (Quarterly)

Instrument: K-ICP-MS-06

Analyte	Concentration (ug/L)	Method
Cadmium 111	9000	6020A
Copper 65	4500	6020A
Lead 208	4500	6020A
Selenium 78	9000	6020A
Silver 107	450	6020A
Zinc 66	9000	6020A