

Aquatic Studies at Kensington Gold Mine, 2017

By

Johnny Zutz



February 2018

Alaska Department of Fish and Game

Division of Habitat



Symbols and Abbreviations

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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mid-eye-to-fork	MEF
gram	g	all commonly accepted		mid-eye-to-tail fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs., AM, PM, etc.	standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.	Mathematics, statistics	
meter	m			<i>all standard mathematical</i>	
milliliter	mL	at	@	<i>signs, symbols and</i>	
millimeter	mm	compass directions:		<i>abbreviations</i>	
		east	E	alternate hypothesis	H _A
		north	N	base of natural logarithm	e
		south	S	catch per unit effort	CPUE
		west	W	coefficient of variation	CV
		copyright	©	common test statistics	(F, t, χ^2 , etc.)
		corporate suffixes:		confidence interval	CI
		Company	Co.	correlation coefficient	
		Corporation	Corp.	(multiple)	R
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(simple)	r
		District of Columbia	D.C.	covariance	cov
		et alii (and others)	et al.	degree (angular)	°
		et cetera (and so forth)	etc.	degrees of freedom	df
		exempli gratia		expected value	E
		(for example)	e.g.	greater than	>
		Federal Information		greater than or equal to	≥
		Code	FIC	harvest per unit effort	HPUE
		idest (that is)	i.e.	less than	<
		latitude or longitude	lat. or long.	less than or equal to	≤
		monetary symbols		logarithm (natural)	ln
		(U.S.)	\$, ¢	logarithm (base 10)	log
		months (tables and		logarithm (specify base)	log ₂ , etc.
		figures): first three		minute (angular)	'
		letters	Jan,...,Dec	no data	ND
		registered trademark	®	not significant	NS
		trademark	™	null hypothesis	H ₀
		United States		percent	%
		(adjective)	U.S.	probability	P
		United States of		probability of a type I error	
		America (noun)	USA	(rejection of the null	
		U.S.C.	United States	hypothesis when true)	α
			Code	probability of a type II error	
		U.S. state	use two-letter	(acceptance of the null	
			abbreviations	hypothesis when false)	β
			(e.g., AK, WA)	second (angular)	"
				standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var
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	pH				
(negative log of)					
inch of mercury	inHg				
Kilopascal	kPa				
Nephelometric Turbidity Unit	NTU				
parts per million	ppm				
parts per thousand	ppt,				
	‰				
volts	V				
watts	W				

TECHNICAL REPORT NO. 18-02

AQUATIC STUDIES AT KENSINGTON GOLD MINE, 2017

by

Johnny Zutz

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802 3rd Street, Douglas, Alaska, 99824

February 2018

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Cover: Lace River east of Kensington Gold Mine.

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Thank you all for your contribution.

EXECUTIVE SUMMARY

The Alaska Department of Fish and Game (ADF&G) Division of Habitat completes the aquatic resource monitoring the U.S. Forest Service (USFS) and Alaska Department of Environmental Conservation (ADEC) require for Coeur Alaska Inc.'s (Coeur) Kensington Gold Mine. This partnership provides ADF&G the opportunity to gather and review data throughout the year, and help identify, assess, and resolve issues at the mine as they arise.

The National Weather Service reports Juneau received near normal rainfall (158 cm) with total snowfall (169 cm) about 30% below normal during 2017 (K. Vaughan, Observation Program Leader, National Weather Service, Juneau, personal communication).

Since August 2011, Coeur staff sampled surface waters monthly in and around the tailings treatment facility (TTF) for ammonia, chlorophyll *a*, nitrate, nitrite, organic carbon, phosphorus, potassium, and sulfur to investigate the cause of algal blooms in the TTF. Sample sites included the TTF, upstream of the TTF at the outlet of Upper Slate Lake,^a the TTF water treatment plant effluent (Outfall 002), and downstream of Outfall 002 in East Fork Slate Creek^b. During 2017, phosphorus and chlorophyll *a* concentrations in the TTF were similar to concentrations observed since 2013, and lower than observed 2011–2012. In the Outfall 002 effluent, ammonia, nitrate, potassium, and sulfur concentrations continued to be greater than background Upper Slate Lake concentrations. Organic carbon concentrations were typically greatest in Upper Slate Lake and nitrite was not detected in any of the samples, as in previous years.

The July 2017 mean chlorophyll *a* density among periphyton samples collected at each site was similar to mean densities observed since 2011. We also sampled periphyton in Lower Slate Creek and East Fork Slate Creek in April 2017 to continue monitoring for changes that may occur from the TTF, and found a similar mean chlorophyll *a* density compared to previous spring sampling results at each site.^c

The 2017 mean benthic macroinvertebrate density at each site was similar to previous years, except in East Fork Slate Creek and Lower Sherman Creek. At East Fork Slate Creek, we observed the second largest mean density since we began sampling in 2011 due to more Diptera and pea clams present. At both Lower Sherman Creek sample sites, the benthic macroinvertebrate communities included fewer insects and other organisms overall than most previous years, resulting in the lowest mean density observed at each site since 2011.

We observed strong pink salmon *Oncorhynchus gorbuscha* returns in the lower reaches of Slate, Johnson, and Sherman Creeks in 2017, consistent with parent year returns in 2015. In Lower Sherman Creek, we observed the greatest number of returning pink and chum salmon *O. keta* since we began surveying in 2011. We cannot quantify marine survival factors impacting adult salmon returns, so we are unable to attribute changes in adult salmon abundance to construction or operation of the Kensington Gold Mine. We continue to recommend the USFS and Berners Bay working group discontinue the spawning salmon survey requirement.

^a Coeur's water quality monitoring station MLA.

^b Coeur's water quality monitoring station SLA.

^c Not required.

The geometric mean particle size of pink salmon spawning gravel in Lower Slate Creek has increased by several millimeters at both sample sites since we began sampling in 2011, and the 2017 sampling results were within the range of values observed 2011–2016.

Most element concentrations in sediment samples from each site were similar to or less than previous results. Arsenic, copper, and nickel concentrations at most sampling sites remain near or above the guidelines for freshwater sediments (Buchman 2008), including the upstream reference site in Upper Slate Creek. As in previous years, zinc concentration was above the guideline in Lower Slate Creek, zinc and cadmium concentrations were above the guidelines in East Fork Slate Creek, and chromium concentration was above the guideline in Upper Slate Creek. While we find sediment guidelines useful for evaluating the sample data, we also recognize organisms can respond differently in nature.

We did not sample resident fish populations or submit sediment samples to a private laboratory for 10-day chronic toxicity testing as these studies are no longer required by ADEC.

Habitat biologists investigated fish use and fish habitat in the Slate Lakes and Spectacle Lakes drainages in fall 2017 and published the study results in Albrecht (2018).

INTRODUCTION

The Kensington Gold Mine is located near Berners Bay in Southeast Alaska (Figure 1), about 72 km north of Juneau and 56 km south of Haines within the City and Borough of Juneau and the Tongass National Forest (Tetra Tech Inc. et al. 2004a, 2004b). The mine is owned and operated by Coeur Alaska, Inc., a wholly owned subsidiary of Coeur Mining Inc.

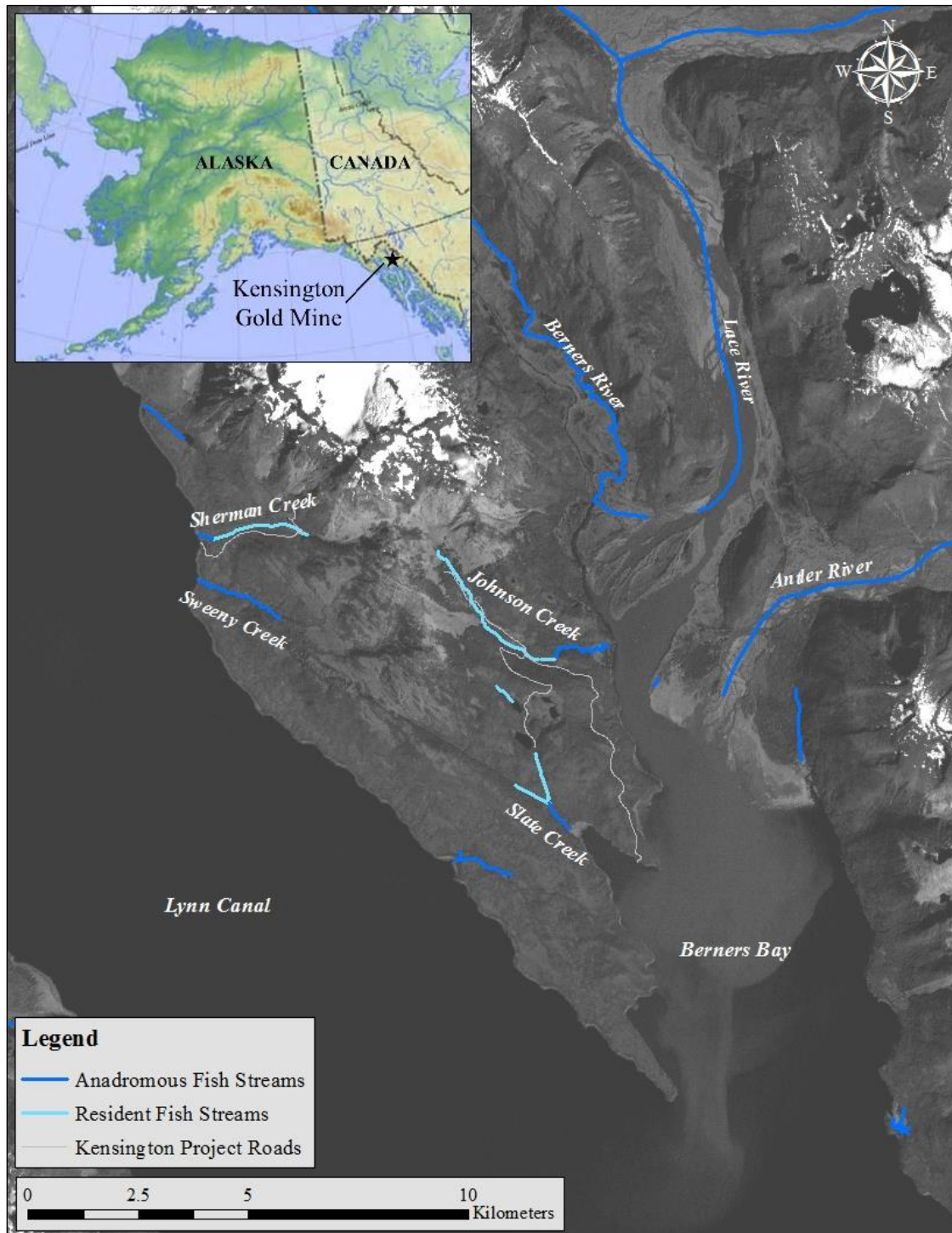


Figure 1.–Kensington Gold Mine project area map.

The underground mine began producing gold concentrate for export on June 24, 2010. Tailings are disposed underground as paste backfill and in the TTF as slurry through a pipeline from the mill. Mine infrastructure is located in three drainages that support resident and anadromous fish: the TTF in the Slate Creek drainage; the waste rock pile, camp and mill facilities in the Johnson Creek drainage; and the waste rock pile and mine water treatment plant in the Sherman Creek drainage.

Contractors gathered aquatic data for the Kensington Gold Mine from the late 1980s through 2005, which provided a basis for Division of Habitat permit decisions, Plan of Operations monitoring requirements (Coeur 2005), the U.S. Environmental Protection Agency (USEPA) National Pollutant Elimination Discharge System Permit No. AK-005057-1, and the ADEC Alaska Pollutant Elimination System (APDES) Permit No. AK0050571. Contractor reports include Aquatic Science Inc. (1998, 1999, 2000, 2001a, 2001b, 2002, 2004), Archipelago Marine Research Ltd. (1991), Dames and Moore (1991), Earthworks Technology, Inc. (2002), EVS Environment Consultants (2000), HDR Alaska, Inc. (2003), Kline (2001, 2003a, 2003b, 2003c, 2003d, 2005), Konopacky Environmental (1992a, 1992b, 1993a, 1993b, 1993c, 1995, 1996a, 1996b, 1996c, 1996d), Pentec Environmental (1990, 1991), and Steffen Robertson and Kirsten Consulting Engineers and Scientists (1997). Monitoring reports include Aquatic Science Inc. (2006, 2007, 2008, 2009a, 2009b, 2009c, 2009d, 2011), Brewster (2016), Kanouse (2015), Kanouse and Zutz (2017), and Timothy and Kanouse (2012, 2013, 2014). Results of the TTF environmental monitoring studies completed during project operation are in Willson-Naranjo and Kanouse (2016), and results of fish and fish habitat investigations in the Slate and Spectacle Lakes drainages are in Albrecht (2018).

The Division of Habitat has completed the aquatic studies required for the Kensington Gold Mine in Slate, Johnson, and Sherman Creeks since 2011. The APDES Permit requires sampling periphyton, benthic macroinvertebrates (BMI), and sediment. We assess stream health using estimates of chlorophyll density and composition, BMI density and community composition, sediment element concentrations, and pink salmon spawning substrate composition. The Division of Habitat also completes the adult salmon counts required in the project Plan of Operations (Coeur 2005).

PURPOSE

This technical report summarizes the 2017 aquatic study data and documents the condition of biological communities and sediments in Slate, Johnson, and Sherman Creeks near mine development and operations. This report satisfies the aquatic study requirements in the project Plan of Operations (Coeur 2005) and APDES Permit AK0050571.

AQUATIC STUDIES

We completed the Kensington Gold Mine aquatic studies required in the project Plan of Operations (Coeur 2005) and APDES Permit AK0050571 (Table 1).

Table 1.–2017 aquatic studies required by the Plan of Operations and APDES permit.

Location	Description	Aquatic Study	Frequency
Lower Slate Creek	1 km reach between the stream mouth in Slate Cove and a 25 m waterfall.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Adult salmon counts	Seasonally
		Spawning substrate composition	1/year
		Sediment composition and element concentrations	1/year
West Fork Slate Creek	A tributary to Lower Slate Creek, upstream of a waterfall and mine influence.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
East Fork Slate Creek	A tributary to Lower Slate Creek, 1 km reach between the TTF plunge pool and waterfall at Lower Slate Creek.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Sediment composition and element concentrations	1/year
Upper Slate Creek	A tributary to Upper Slate Lake and upstream of mine influence.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Sediment composition and element concentrations	1/year
Lower Johnson Creek	1.5 km reach between the stream mouth in Berners Bay and a 30 m waterfall.	Adult salmon counts	Seasonally
		Sediment composition and element concentrations	1/year
Upper Johnson Creek	Upstream of Bridge #2 to the headwaters, adjacent to the upper camp and mill bench.	Benthic macroinvertebrate density and composition	1/year
Lower Sherman Creek	360 m reach between the stream mouth in Lynn Canal and a 15 m waterfall.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Adult salmon counts	Seasonally
		Sediment composition and element concentrations	1/year

STUDY AREA

Slate Creek Drainage

Slate Creek drains a 10.5 km² watershed into Slate Cove on the northwest side of Berners Bay (Coeur 2005; Figure 2). Two waterfalls about 1 km upstream of the mouth of Lower Slate Creek prevent upstream fish migration to the East and West Forks. West Fork Slate Creek is on river right^d. East Fork Slate Creek is on river left and flows between the TTF dam plunge pool and the waterfall at Lower Slate Creek. Coeur operates the TTF in Lower Slate Lake and discharges TTF water treatment plant effluent (Outfall 002) to East Fork Slate Creek. Upstream of the TTF, a concrete dam diverts water from Upper Slate Lake through a diversion pipeline and into East Fork Slate Creek at the TTF dam plunge pool, bypassing the TTF. Upper Slate Creek is the inlet to Upper Slate Lake.

^d The terms “river right” and “river left” reference looking downstream.

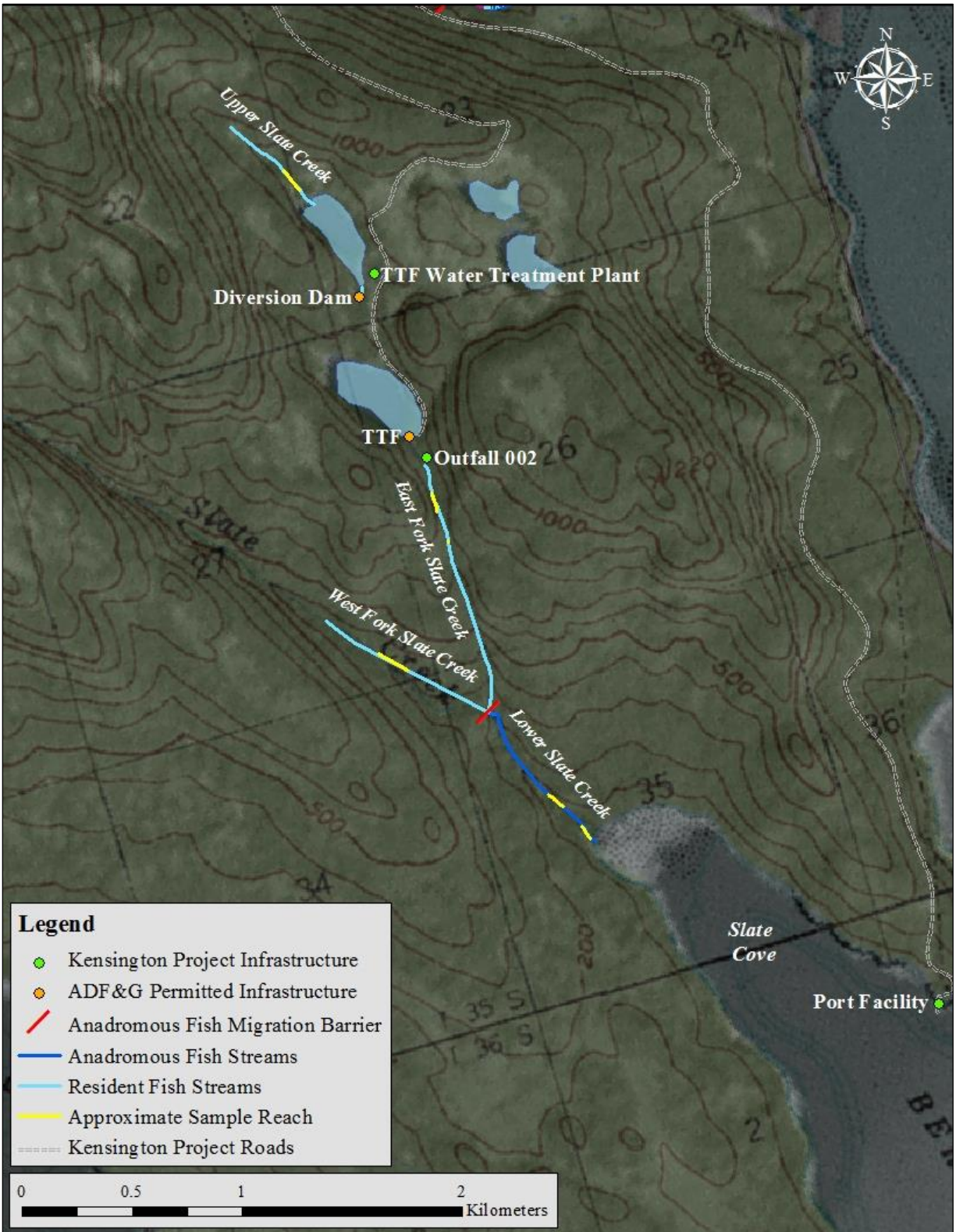


Figure 2.—Slate Creek map.

Lower Slate Creek

Lower Slate Creek provides spawning habitat for chum, coho *O. kisutch*, and pink salmon, and eulachon *Thaleichthys pacificus*, and rearing habitat for coho salmon (Stream No. 115-20-10030; Johnson and Blossom 2017). We have also documented juvenile Dolly Varden char *Salvelinus malma* and adult cutthroat trout *O. clarkii* in the system (Timothy and Kanouse 2012).

Lower Slate Creek is a mixture of waters from the East and West Forks, Outfall 002, and Upper Slate Lake. We sample periphyton, BMIs, pink salmon spawning substrate, and sediment at Sample Point 1 (SP1; Figure 3), pink salmon spawning substrate at Sample Point 2 (SP2), and count adult salmon throughout Lower Slate Creek.

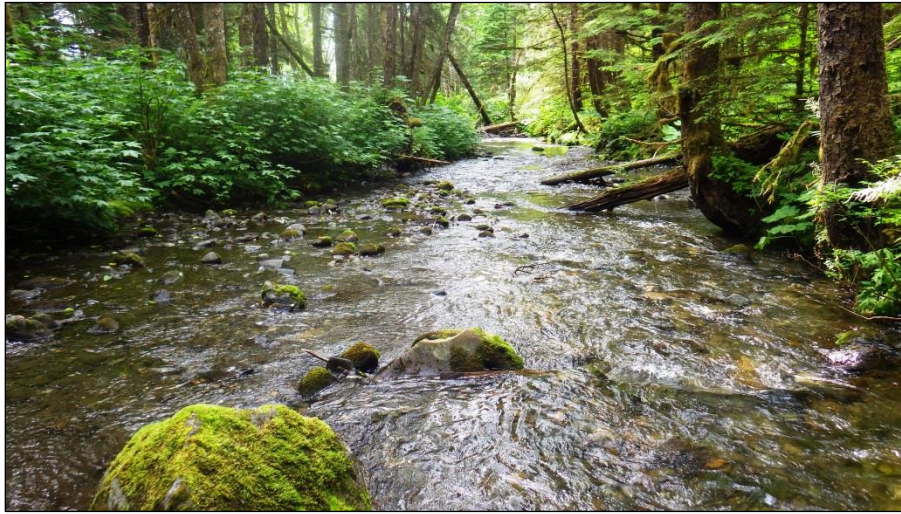


Figure 3.–Lower Slate Creek SP1.

West Fork Slate Creek

West Fork Slate Creek (Figure 4) provides habitat for Dolly Varden char (Timothy and Kanouse 2014) and is not influenced by the mine. We sample periphyton and BMIs about 600 m upstream of the waterfall at Lower Slate Creek.

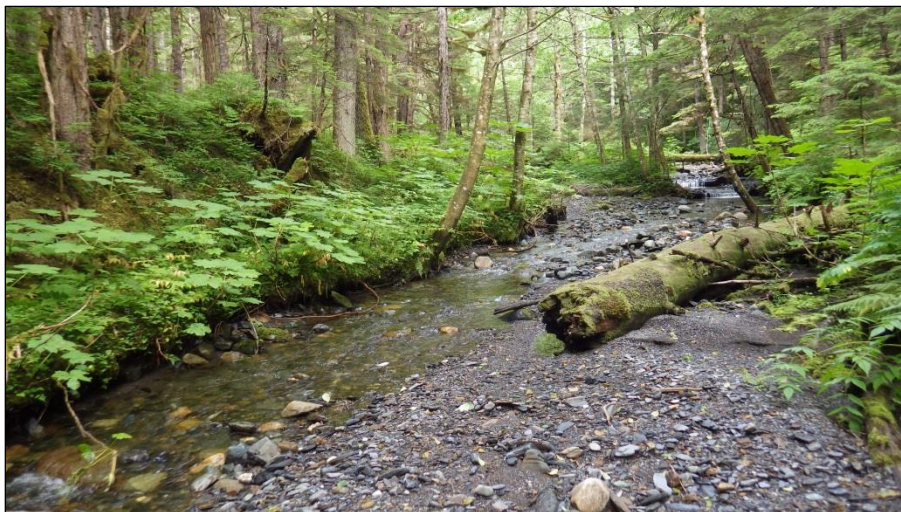


Figure 4.–West Fork Slate Creek.

East Fork Slate Creek

East Fork Slate Creek (Figure 5) provides a corridor for Dolly Varden char and threespine stickleback *Gasterosteus aculeatus* (Kanouse and Zutz 2017) emigrating from Upper Slate Lake, currently via the diversion pipeline and formerly via Lower Slate Lake. East Fork Slate Creek is a mixture of waters from Outfall 002 and Upper Slate Lake. We sample periphyton, BMIs, and sediments in East Fork Slate Creek within 200 m downstream of the TTF.



Figure 5.—East Fork Slate Creek.

Upper Slate Creek

Upper Slate Creek (Figure 6) provides habitat for Dolly Varden char (Kanouse and Zutz 2017) and is not influenced by the mine. We sample periphyton, BMIs, and sediments in Upper Slate Creek within 100 m of Upper Slate Lake.



Figure 6.—Upper Slate Creek.

Johnson Creek Drainage

Johnson Creek drains a 14.6 km² watershed to the Lace River on the northwest shore of Berners Bay (Coeur 2005; Figure 7). A waterfall about 1.5 km upstream of the Lower Johnson Creek mouth prevents upstream fish migration. Middle Johnson Creek is the 2.5 km reach between the waterfall and Jualin Road Bridge #2. Upper Johnson Creek is the reach upstream of Jualin Road Bridge #2 to the headwaters.

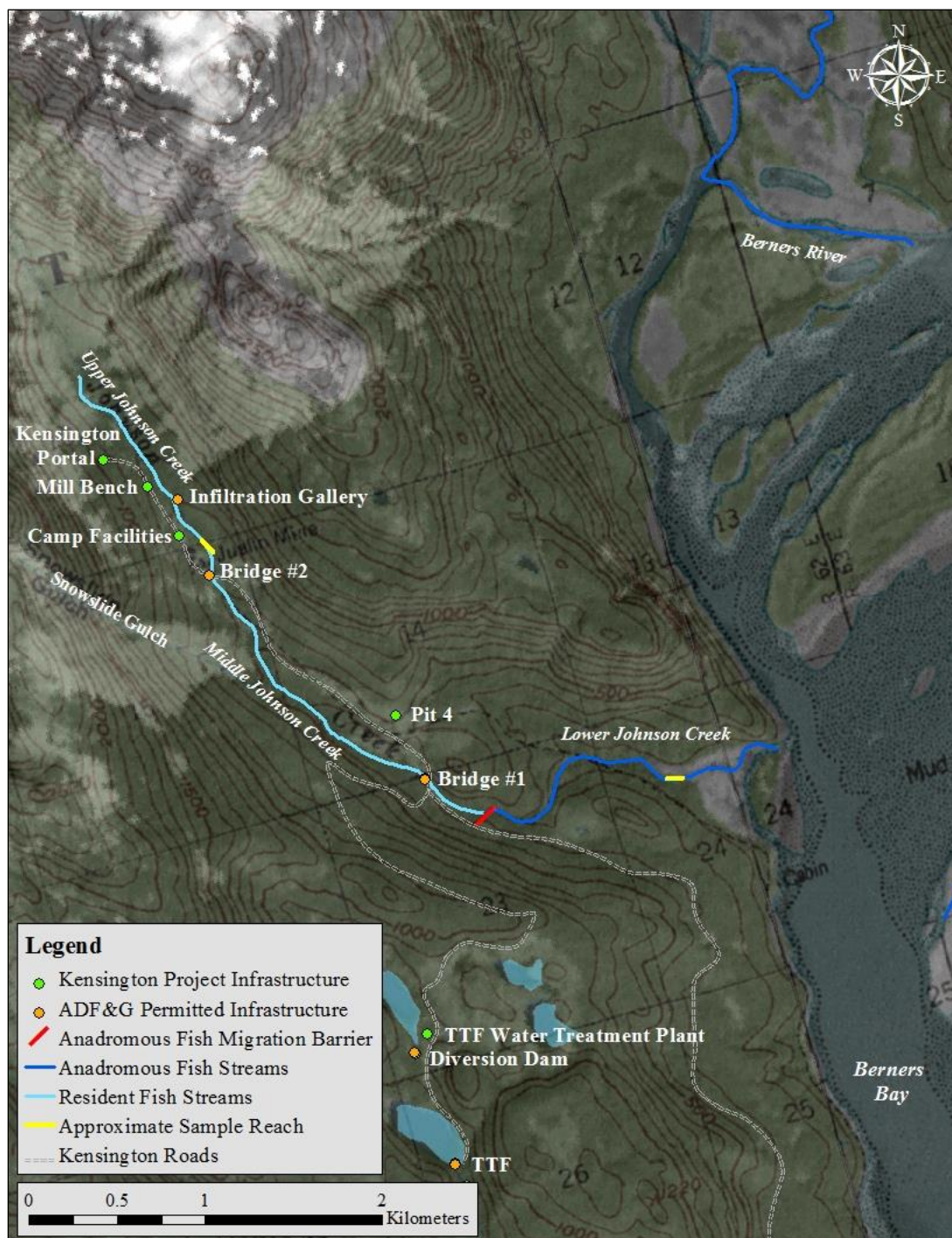


Figure 7.–Johnson Creek map.

Lower Johnson Creek

Lower Johnson Creek provides spawning and rearing habitat for chum, coho, and pink salmon (Stream No. 115-20-10030; Johnson and Blossom 2017). We have also documented juvenile Dolly Varden char and cutthroat trout in the system (Timothy and Kanouse 2012). Lower Johnson Creek is a mixture of drainages near and from mine infrastructure in Middle^e and Upper Johnson Creeks. We sample sediment about 600 m upstream from the mouth and count adult salmon throughout Lower Johnson Creek (Figure 8).



Figure 8.–Lower Johnson Creek.

Upper Johnson Creek

Upper Johnson Creek provides habitat for Dolly Varden char (Timothy and Kanouse 2012) and flows adjacent to the camp facilities, mill bench, Kensington and Jualin adits, and the waste rock pile. An infiltration gallery collects water from Upper Johnson Creek near the mill bench to support the camp. We sample BMIs about 50 m upstream of Bridge #2 (Figure 9).



Figure 9.–Upper Johnson Creek.

^e Mine facilities include the domestic wastewater treatment plant, warehouse, reclamation material and acid-generating rock storage piles, bridges, and Pit 4; drainages include Snowslide Gulch, the domestic wastewater outfall, and storm water discharges; aquatic studies are not required in Middle Johnson Creek.

Sherman Creek Drainage

Sherman Creek drains a 10.84 km² watershed to the east shore of Lynn Canal (Coeur 2005; Figure 10). A waterfall about 360 m upstream from the Lower Sherman Creek mouth prevents upstream fish migration. Middle Sherman Creek is the 2 km reach between the waterfall and the Comet Beach road bridge. Upper Sherman Creek is the reach upstream of the bridge to the headwaters.

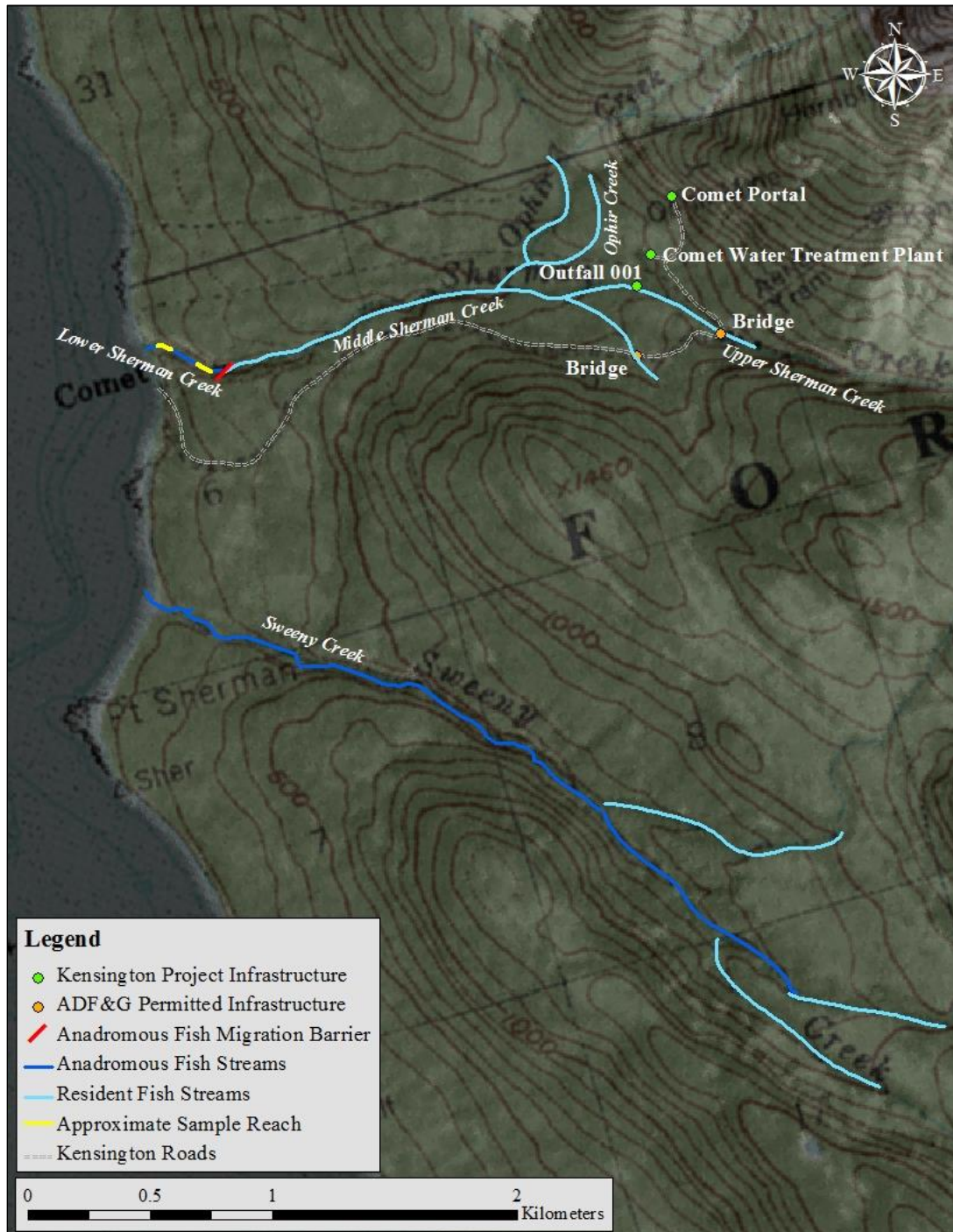


Figure 10.—Sherman Creek map.

Lower Sherman Creek

Lower Sherman Creek provides spawning habitat for chum and pink salmon (Stream No.115-31-10330; Johnson and Blossom 2017). We have also documented juvenile Dolly Varden char in the system (Timothy and Kanouse 2012). Lower Sherman Creek is a mixture of drainages near and from mine infrastructure in Middle Sherman Creek^f and its tributaries. We sample periphyton and BMIs at Sample Points 1 and 2 (SP1, SP2), sediment at SP1, and count adult salmon throughout Lower Sherman Creek (Figures 11, 12).

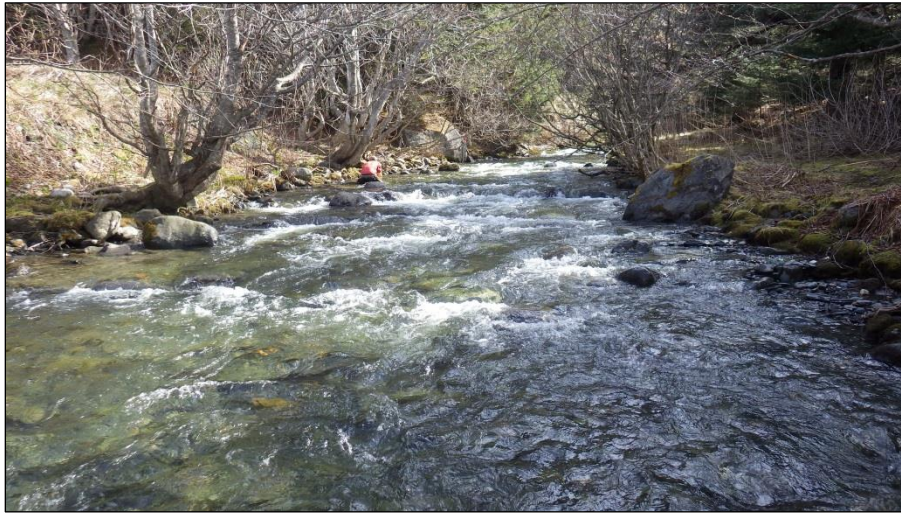


Figure 11.–Lower Sherman Creek SP1.



Figure 12.–Lower Sherman Creek SP2.

^f Mine facilities include the Comet water treatment plant, waste rock pile, bridges and culverts; drainages include Ivanhoe Creek, Ophir Creek, South Fork Sherman Creek, and Comet water treatment plant Outfall 001; aquatic studies are not required in Middle or Upper Sherman Creeks.

SAMPLING LOCATIONS

Table 2 presents the coordinates for each sample site, and Tables 3–5 present the coordinates for adult salmon count reach markers in Lower Slate Creek, Lower Johnson Creek, and Lower Sherman Creek.

Table 2.—2017 aquatic study sample sites.

Location	Sample Site	Latitude	Longitude
Lower Slate Creek	Periphyton and benthic macroinvertebrates	58.7905	-135.0345
	Adult salmon counts	Table 3	
	Spawning substrate		
	Sample Point 1	58.7905	-135.0345
	Sample Point 2	58.7920	-135.0360
	Sediment composition and element concentrations	58.7905	-135.0345
West Fork Slate Creek	Periphyton and benthic macroinvertebrates	58.7993	-135.0457
East Fork Slate Creek	Periphyton	58.8045	-135.0381
	Sediment composition and element concentrations	58.8053	-135.0383
Upper Slate Creek	Periphyton and benthic macroinvertebrates	58.8189	-135.0415
	Sediment composition and element concentrations	58.8189	-135.0416
Lower Johnson Creek	Adult salmon counts	Table 4	
	Sediment composition and element concentrations	58.8235	-135.0024
Upper Johnson Creek	Benthic macroinvertebrates	58.8407	-135.0450
Lower Sherman Creek	Periphyton and benthic macroinvertebrates		
	Sample Point 1	58.8687	-135.1415
	Sample Point 2	58.8674	-135.1381
	Adult salmon counts	Table 5	
	Sediment composition and element concentrations	58.8687	-135.1413

Note: Coordinates in WGS84 datum.

Table 3.—Lower Slate Creek adult salmon count reach markers.

Location	Latitude	Longitude
100 m	58.7884	-135.0324
200 m	58.7893	-135.0337
300 m	58.7905	-135.0349
400 m	58.7915	-135.0359
500 m	58.7922	-135.0361
600 m	58.7930	-135.0368
700 m	58.7936	-135.0379
800 m	58.7944	-135.0384
900 m	58.7953	-135.0385
Falls	58.7964	-135.0389

Table 4.–Lower Johnson Creek adult salmon count reach markers.

Location	Latitude	Longitude
Lace	58.8215	-135.0010
Mouth	58.8236	-134.9987
Trap	58.8235	-135.0007
#4	58.8236	-135.0039
#7	58.8243	-135.0072
#10	58.8254	-135.0109
Power House	58.8259	-135.0148
Log Falls	58.8258	-135.0168
#15	58.8252	-135.0190
Falls	58.8243	-135.0201

Table 5.–Lower Sherman Creek adult salmon count reach markers.

Location	Latitude	Longitude
50 m	58.8687	-135.1416
100 m	58.8687	-134.1408
150 m	58.8684	-135.1401
200 m	58.8682	-135.1394
250 m	58.8679	-135.1388
300 m	58.8675	-135.1383
350 m	58.8673	-135.1374
Falls	58.8671	-135.1367

SAMPLING SCHEDULE

Table 6 presents the dates we collected data in 2017 by site.

Table 6.–2017 aquatic studies sampling schedule.

Aquatic Study	Lower Slate	West Fork Slate	East Fork Slate	Upper Slate	Lower Johnson	Upper Johnson	Lower Sherma
Periphyton	4/25 7/24	---	4/27 7/25	---	---	---	---
Benthic macroinvertebrates	4/25	4/25	4/27	4/27	---	4/26	4/26
Adult salmon counts	7/18– 10/26	---	---	---	7/18– 11/2	---	7/18– 9/21
Spawning substrate	7/6	---	---	---	---	---	---
Sediment element concentrations	7/7	---	7/7	7/7	7/6	---	7/6

Note: Periphyton sampling in April is not required by the Plan of Operations or APDES permit.

METHODS

We annually review data sets to ensure accuracy and consistency with methods modifications, and report corrections and updates in the document and appendices. The most recent technical report presents the current data sets and should be used to analyze data from previous years. In this report, we

- rounded down fish counts by reach for the 2011 adult salmon count data consistent with calculations used in other years; and
- identified incomplete adult salmon surveys in each data set.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Requirement APDES 1.5.3.5.2

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

The APDES permit requires monitoring periphyton chlorophyll density and composition in Lower Slate Creek, East Fork Slate Creek, and Lower Sherman Creek annually between late-June and early-August and not within three weeks following peak discharge to detect changes over time. The APDES permit also requires monitoring at reference sites in West Fork Slate Creek and Upper Slate Creek at the same time to detect variations due to natural factors, such as mineral seeps, climate, and stream flow.

Sample Collection and Analysis

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

We placed a 47mm Type A/E 1 µm glass fiber filter into a Nalgene® filter holder attached to a vacuum pump with a gauge, removed the foam square, and scrubbed the sample area using a rinsed toothbrush into the filter holder. We used stream water in a wash bottle to rinse the loosened periphyton from the rock, the toothbrush, and the inside of the filter holder onto the filter. We repeated the scrub and rinse cycle a second time. We pumped most of the water through the filter, maintaining pressure less than 34 kPa, and added a few drops^g of saturated magnesium carbonate solution^h to the filter before pumping the sample dry. We removed the

^g This measurement is not exact as the amount of water and magnesium carbonate used to create a saturated solution varies. We used supernatant solution to avoid magnesium carbonate solids.

^h To prevent acidification and conversion of chlorophyll to phaeophytin.

glass fiber filter, folded it in half with the sample on the inside, and wrapped it in a white coffee filter to absorb additional water. We placed the samples in a sealed, labeled plastic bag with desiccant and stored the samples in a light-proof cooler containing frozen icepacks during transport, in a camp freezer while onsite, and in an ADF&G Douglas laboratory -20°C freezer until processing.

We followed USEPA (1997) protocol for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.ⁱ We removed the samples from the freezer, cut them into small pieces, and placed the filter pieces for each sample into individual 15 mL screw cap centrifuge tubes containing 10 mL of 90% acetone. We capped the centrifuge tubes and shook each sample vigorously^j before placing them in a rack, covering them with aluminum foil, and storing them in a refrigerator overnight to extract the chlorophyll.^k The following day, we centrifuged the samples for 20 min at 1,600 rpm, individually decanted the supernatant into a cuvette, and measured each sample absorbance at wavelengths 664 nm, 647 nm, 630 nm, and 750 nm using a Shimadzu UV-1800 spectrophotometer. Prior to measuring samples, we inserted two cuvettes with 90% acetone to zero the machine and correct for the absorbance of the solvent. We treated each sample with 80 μL of 0.1 N hydrochloric acid^l, waited 90 s, and measured absorbance at wavelengths 665 nm and 750 nm.

We entered absorbance values into trichromatic equations to estimate chlorophylls *a*, *b*, and *c* density (mg/m^2), and corrected for turbidity using the 750 nm absorbance value (APHA 2012, USEPA 1997). We corrected chlorophyll *a* concentrations when phaeophytin was detected. If chlorophyll *a* was not detected in a sample, we report the concentration at the estimated detection limit and did not report values for chlorophylls *b* or *c*; the 2017 estimated detection limit for chlorophyll *a* concentration was $0.08 \text{ mg}/\text{m}^2$. We round all values to two decimal places.

Data Presentation

For each site and by year, we present a table of mean chlorophylls *a*, *b*, and *c* density, illustrate mean chlorophyll *a* density and mean proportion of chlorophylls *a*, *b*, and *c* in figures, and provide the 2011–2017 data in Appendix A. Periphyton sampling during April is not required by the APDES permit or Plan of Operations, and we include the data in Appendix A.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Requirement APDES 1.5.3.2

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

The APDES permit requires monitoring BMI density and community composition in Lower Slate Creek, East Fork Slate Creek, Upper Johnson Creek, and Lower Sherman Creek annually

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

^j To ensure all filter pieces are submerged.

^k We allowed samples to steep for at least 12 h and not more than 24 h.

^l To convert the chlorophyll to phaeophytin.

between late-March and late-May after spring breakup and before peak snowmelt to detect changes over time. The APDES permit also requires monitoring at reference sites in West Fork Slate Creek and Upper Slate Creek at the same time to detect variations due to natural factors.

Sample Collection and Analysis

We opportunistically collected 6 BMI samples from each site using a Surber stream bottom sampler in riffles and runs with cobble substrate and different flow velocities—habitat that supports greater BMI densities and taxonomic richness (Barbour et al. 1999). We do not sample other habitat types (e.g. pools) to reduce variability of the data.

The Surber stream bottom sampler has a 0.093 m² sample area and material is captured in a 200 mL cod end, both constructed with 300 µm meshes. After securing the frame on the substrate, we scrubbed rocks within the sample area with a brush and disturbed gravels, sand, and silt to about 10 cm depth to dislodge macroinvertebrates into the net.^m We rinsed the net in the stream to ensure all organisms floated into the cod end of the Surber sampler, transferred each sample from the cod end to labeled 500 mL plastic bottles, and preserved the samples in 95% ethanol at a ratio of three parts ethanol to one part sample. We discarded all samples where sediment overfilled the cod end.

Contractor Matt Kern of Alder Grove Farm used an elutriator system and 0.5 mm and 0.3 mm sieves to sort macroinvertebrates from debris,^{n,o} and identified organisms to the lowest practical taxonomic level^p using Merritt and Cummins (1996) and Stewart and Oswood (2006). Habitat Biologist Greg Albrecht provided quality control by verifying macroinvertebrate identification of 5 samples.

We calculated BMI density (per m²) for each sample by dividing the number of macroinvertebrates by 0.093 m², the Surber sampling area. We estimated mean BMI density for each site by calculating the mean density among the 6 samples. We report taxa richness as the number of taxonomic groups identified to the lowest practical level, and exclude terrestrial^q organisms from all calculations.

Shannon Diversity (*H*) and Evenness (*E*) Indices provide measures of taxonomic diversity and abundance equality. We calculate these indices using the following equations given in Magurran (1988):

^m We spend about the same amount of time collecting each sample (e.g. 5 minutes) and prefer to have the same person collecting all samples at each site for consistency.

ⁿ 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 Division of Habitat, 802 3rd Street, Douglas, AK.

^o Katrina Lee, Administrative Assistant, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate sample enumeration procedures; dated 6/28/2016. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Division of Habitat, 802 3rd Street, Douglas, AK.

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

^q Including adult terrestrial insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera.

$$H = - \sum_{i=1}^S (P_i \log_{10} P_i)$$

and

$$E = \frac{H}{\log_{10} S},$$

where P_i is the number of macroinvertebrates per taxonomic group divided by the total number of macroinvertebrates in the sample, and S is the number of taxonomic groups in the sample.^r A single taxa macroinvertebrate community has an H value of 0, which increases with the number of taxa (richness) and abundance equality (evenness). The Evenness calculation normalizes the H value to a number between 0 and 1, with an E value of 1 indicating all taxa are equally abundant.

Data Presentation

For each site and by year, we present a table summarizing mean BMI density, total taxa, total EPT taxa, percent EPT, and mean Shannon Diversity and Evenness scores, illustrate mean density in a figure, and provide the 2011–2017 data summary in Appendix B.

ADULT SALMON COUNTS

Requirement Plan of Operations

The Plan of Operations (Coeur 2005) requires weekly surveys of adult chum, coho, and pink salmon in Lower Slate Creek, Lower Johnson Creek, and Lower Sherman Creek throughout the spawning season.

Sample Collection

We surveyed Slate Creek, Johnson Creek, and Sherman Creek downstream of fish migration barriers once per week between mid-July and mid-September and counted the number of adult pink salmon, chum salmon, and carcasses. We surveyed Slate and Sherman Creeks by foot and Johnson Creek by helicopter.^s We also surveyed Slate and Johnson Creeks by foot once per week from late-September through October to count the number of adult coho salmon and carcasses. To improve coho salmon observations, we snorkeled and recorded underwater videos with a GoPro in large pools and around large woody debris, habitats where adult coho salmon tend to concentrate.

We began each survey at the stream mouth, moving upstream by section and ending at the fish migration barrier. Slate Creek is sectioned in 100 m reaches, Johnson Creek by landmarks, and Sherman Creek in 50 m reaches. A team of two biologists independently recorded the number of live fish and carcasses by species in each section during the foot and aerial surveys, using polarized glasses as necessary to improve visibility. We also recorded weather and flow conditions during each survey.

^r Assuming all taxonomic groups are represented.

^s We no longer conduct three concurrent foot surveys in Johnson Creek to estimate our annual mean aerial count underestimation, as the surveys are not required.

We used the average of the two biologists' counts to estimate the total number of fish by species for each reach and survey, and rounded down all intermediate numbers to whole numbers in the calculations.

Data Presentation

For each site, we present figures of the weekly adult pink salmon count and by distribution, and provide the 2011–2017 count by species in a table. Incomplete surveys are identified in bold. The 2017 data and pink salmon count by statistical week 2011–2017 are in Appendix C.

SPAWNING SUBSTRATE COMPOSITION

Requirement APDES 1.5.3.5.1

The APDES permit requires annually sampling pink salmon spawning substrate during early-July at Lower Slate Creek SP1 and SP2 to detect change in composition over time. We calculate the geometric mean particle size, an index of substrate textural composition, for each sample and among samples collected at each site each year.

Sample Collection

We collected four sediment samples at two locations in Lower Slate Creek using a McNeil sampler, which has a 15 cm basal core diameter and 25 cm core depth. We selected sample sites with substrate measuring less than 10 cm, the maximum gravel size used by pink salmon (Lotspeich and Everest 1981, Kondolf and Wolman 1993), and where the stream gradient was less than 3% (Valentine, B. E. 2001. Unpublished. Stream substrate quality for salmonids: Guidelines for Sampling, Processing, and Analysis. California Department of Forestry and Fire Protection, Coast Cascade Regional Office, Santa Rosa, CA). We pushed the McNeil sampler into the substrate until the sample core was buried, then transferred the sediments to a bucket. We wet-sieved samples onsite using sieve sizes 101.6, 50.8, 25.4, 12.7, 6.35, 1.68, 0.42, and 0.15 mm and measured the contents of each sieve to the nearest 25 mL by the volume of water displaced in 600 mL and 1 L plastic beakers.[†] We transferred the fines that passed through the 0.15 mm sieve to Imhoff cones, allowed 10 min settling time, and measured the sediment volume to the nearest 1 mL using the Imhoff cone gradations.

For the fines that pass through the 0.15 mm sieve, we converted sediment wet weights to dry weights using standards identified by Zollinger (1981). For all other sediments, we converted wet weights to dry weights using a correction factor derived from Shirazi et al. (1981), assuming a gravel density of 2.6 g/cm³ (Aquatic Science Inc. 2011). We calculated the geometric mean particle size (d_g) using methods developed by Lotspeich and Everest (1981), where the midpoint diameter of particles retained in each sieve (d) are raised to a power equal to the decimal fraction of volume retained by that sieve (w), and multiplied the products of each sieve size to obtain the final product,

$$d_g = d_1^{w1} \times d_2^{w2} \times d_3^{w3} \dots d_n^{wn}$$

Data Presentation

For each site and by year, we present a table of the geometric mean particle sizes (GMPS) and include the 2011–2017 data in Appendix D.

[†] Except we measure the contents of the 0.15 mm sieve to the nearest 1 mL using an Imhoff cone.

SEDIMENT COMPOSITION AND ELEMENT CONCENTRATIONS

Requirement APDES 1.5.2

Sediment metals concentrations are influenced by a variety of factors, such as geochemical composition and weathering within the watershed, sediment grain size, organic content, and development (Tchounwou et al. 2012), and heavy metals in sediments can decrease BMI taxa richness and change the composition of BMI communities (Qu et al. 2010).

The APDES permit requires annually sampling fine sediments in Lower Slate Creek, East Fork Slate Creek, Upper Slate Creek, Lower Johnson Creek, and Lower Sherman Creek for particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of silver (Ag), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn).

Sample Collection and Analysis

Wearing latex gloves, we opportunistically collected sand and silt at each site within actively flowing channels and retained the top 4 cm of sediment in three glass jars provided by the laboratory.^u We stored the samples in a cooler with frozen icepacks during transport and in an ADF&G Douglas laboratory fridge until we shipped them to the ALS Environmental laboratory in Kelso, WA for analyses.

We shipped the samples in a cooler with frozen icepacks via overnight air freight, and maintained written chain of custody documentation. ALS Environmental measured particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of Ag, Al, As, Cd, Cr, Cu, Fe, Hg, Pb, Se, and Zn on a dry-weight basis using the methods listed in Table 7. The laboratory provided Tier II quality assurance and quality control information, including results for matrix spikes, sample blanks, and sample duplicates.

Table 7.—Sediment tests, analytes, and methods.

Test Description	Analyte	Method
Standard test method for particle-size analysis of soils	Particle size determination	ASTM D422
Puget Sound Estuary Program sediment total organic carbon	Total organic carbon	PSEP TOC
Total solids on liquids, modified for solids	Total solids	160.3 Modified
Puget Sound Estuary Program sediment sulfide	Total sulfide	PSEP Sulfide
Total volatile solids, modified for solids	Total volatile solids	160.4 Modified
Mercury in solid or semisolid waste	Hg	7471B
Determination of trace elements in waters and wastes by ICP/MS	Ag, Al, As, Cd, Cr, Cu, Ni, Pb, Se, Zn	200.8

^u In 2015, we discontinued sieving sediments during collection to avoid washing contaminants from the sample.

Data Presentation

We present two figures for each site, the 2017 sample concentrations and results by analyte for the 2011–2017 data.^v We compare the 2011–2017 data in the second figure with the Screening Quick Reference Tables for inorganics in freshwater sediment guidelines compiled by the National Oceanic and Atmospheric Administration (NOAA; Buchman 2008), specifically the threshold effects concentrations (TEC) and the probable effects concentrations (PEC). The guidelines are based on results of controlled laboratory bioassays (MacDonald et al. 2000), wherein element concentrations below the TECs rarely affect aquatic life survival and growth, and element concentrations above the PECs can affect aquatic life survival and growth. We provide the 2011–2017 sediment composition and element concentration data by site and the 2017 laboratory report in Appendix E.

^v When the laboratory provides duplicate sample results, we present the mean value.

RESULTS

SLATE CREEK

Lower Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2017 Lower Slate Creek mean chlorophyll *a* density was 2.30 mg/m², within the range observed 2011–2016 (Table 8; Figure 13). Figure 14 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 8.—Lower Slate Creek mean chlorophylls *a*, *b*, and *c* densities.

	7/29/11	7/25/12	7/31/13	7/30/14	7/28/15	7/26/16	7/24/17
Chl- <i>a</i> (mg/m ²)	5.15	2.31	12.59	3.97	2.16	5.26	2.30
Chl- <i>b</i> (mg/m ²)	0.43	0.05	0.00	0.85	0.10	0.21	0.23
Chl- <i>c</i> (mg/m ²)	0.26	0.18	1.64	0.30	0.21	0.62	0.23

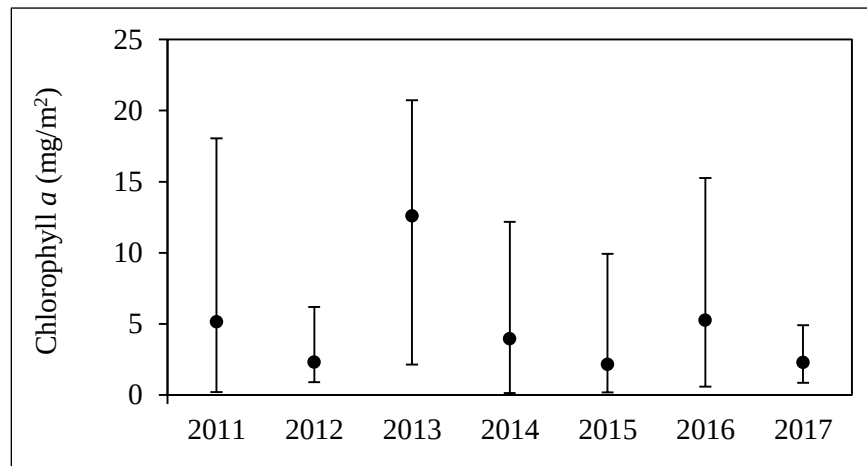


Figure 13.—Lower Slate Creek mean chlorophyll *a* densities.

Note: Minimum, mean, and maximum values presented.

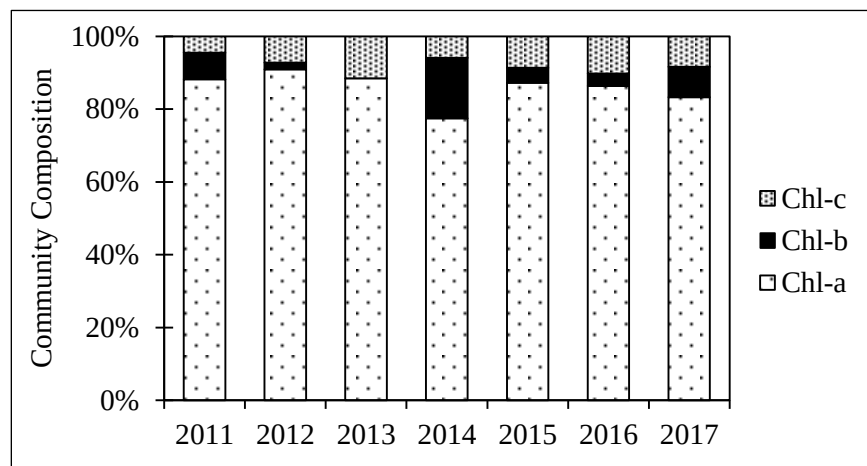


Figure 14.—Lower Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*.

Benthic Macroinvertebrate Density and Community Composition

Among the 2017 Lower Slate Creek BMI samples, we identified 27 taxa and estimate mean density at 1,308 BMI/m², of which 50% were EPT insects, the lowest BMI density observed since 2011 due to fewer Diptera insects and other organisms present (Table 9; Figure 15). The Shannon Diversity and Evenness scores were greater than previous years, and the dominant taxa were Diptera: Chironomidae and Plecoptera: *Suwallia*, representing 36% and 17% of the samples, unlike previous years when samples usually contained more than 50% Chironomidae.

Table 9.–Lower Slate Creek BMI data summaries.

	5/4/11	5/2/12	4/30/13	4/30/14	4/27/15	4/26/16	4/25/17
Mean BMI density (per m ²)	2,057	3,154	2,581	4,136	3,407	3,394	1,308
Total BMI taxa	29	32	27	32	26	24	27
Number of EPT taxa	13	17	16	17	13	11	13
% EPT	14%	38%	51%	19%	24%	15%	50%
Shannon Diversity score	0.51	0.69	0.85	0.64	0.70	0.65	0.81
Evenness score	0.48	0.58	0.70	0.52	0.58	0.57	0.73

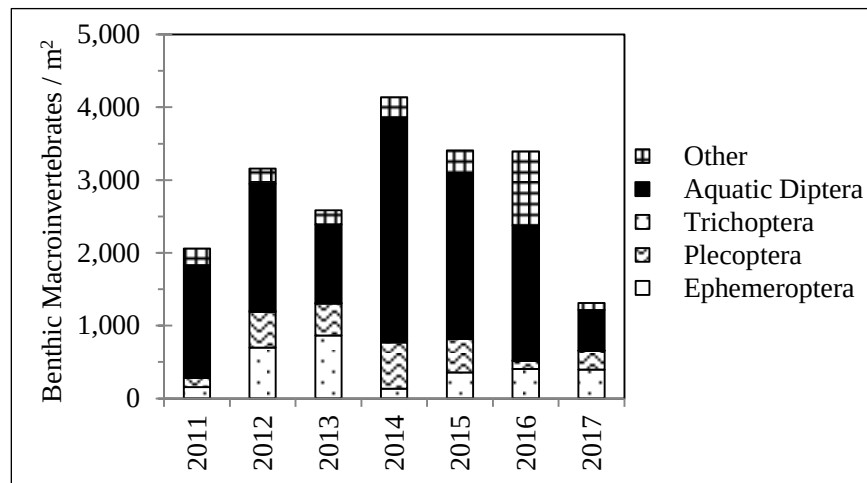


Figure 15.–Lower Slate Creek mean BMI densities and community compositions.

Adult Salmon Counts

We counted 7,416 pink salmon, 1 chum salmon, and 5 coho salmon in Lower Slate Creek during the 2017 spawning season (Table 10).^w Figure 16 shows pink salmon counts for each survey and Figure 17 displays pink salmon distribution by reach.

Table 10.—Lower Slate Creek adult salmon counts.

	2011	2012	2013	2014	2015	2016	2017
Pink salmon	6,254	7,272	3,337	41	7,580	79	7,416
Chum salmon	59	1	1	0	13	45	1
Coho salmon	0	0	26	5	0	2	5

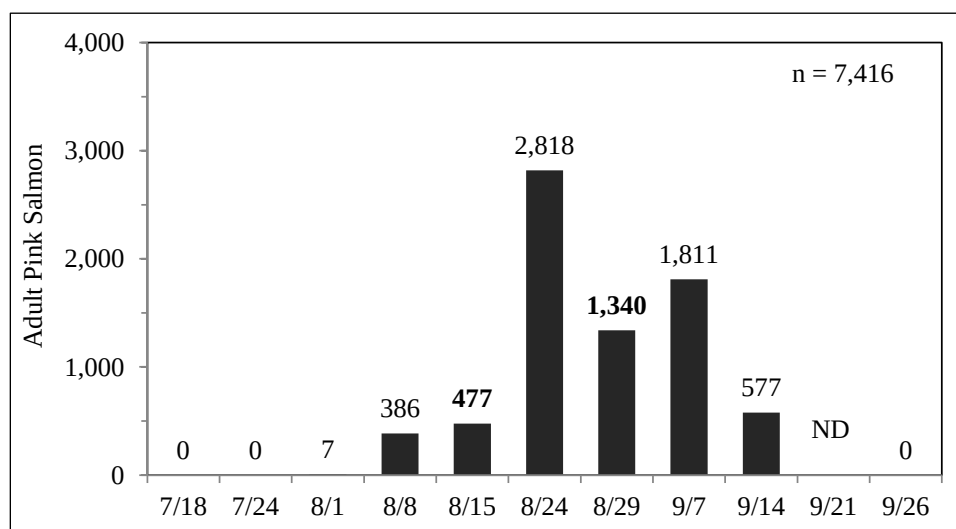


Figure 16.—2017 Lower Slate Creek weekly pink salmon count.

Note: Bold numbers indicate incomplete surveys.

^w We ended the 8/15/17 and 8/29/17 foot surveys early due to bear activity.

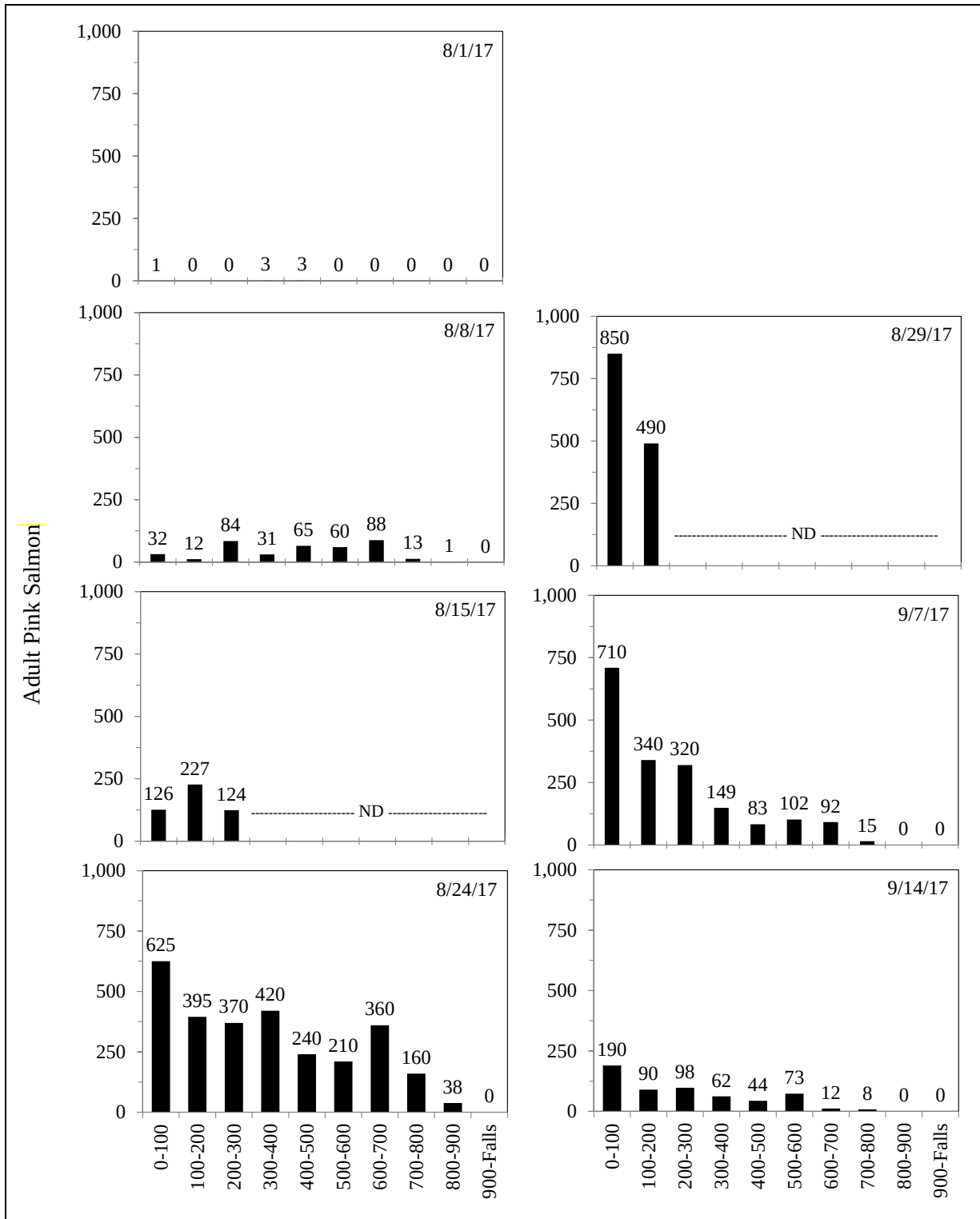


Figure 17.—2017 Lower Slate Creek weekly pink salmon distribution.

Spawning Substrate Composition

Sample Points 1 and 2

The GMPS among pink salmon spawning substrate samples collected at each Lower Slate Creek site was 14.7 mm at SP1, and 13.0 mm at SP2. The SP1 GMPS was the greatest value observed since 2011, and the SP2 GMPS was within the range of sizes previously observed (Table 11).

Table 11.—Lower Slate Creek spawning substrate geometric mean particle sizes (mm).

	2011	2012	2013	2014	2015	2016	2017
Sample Point 1	10.3	10.8	14.2	12.9	13.3	13.6	14.7
Sample Point 2	11.1	11.2	13.2	16.5	17.5	11.6	13.0

Sediment Element Concentrations

The 2017 Lower Slate Creek sediment sample contained a lower Cr concentration than previous years and other element concentrations were within the ranges observed 2011–2016, except Hg and Se concentrations were below the method reporting limits. The As, Cu, Ni, and Zn concentrations remain above NOAA’s freshwater sediment guidelines (Buchman 2008). Figure 18 presents the 2017 results and Figure 19 presents the 2011–2017 data.

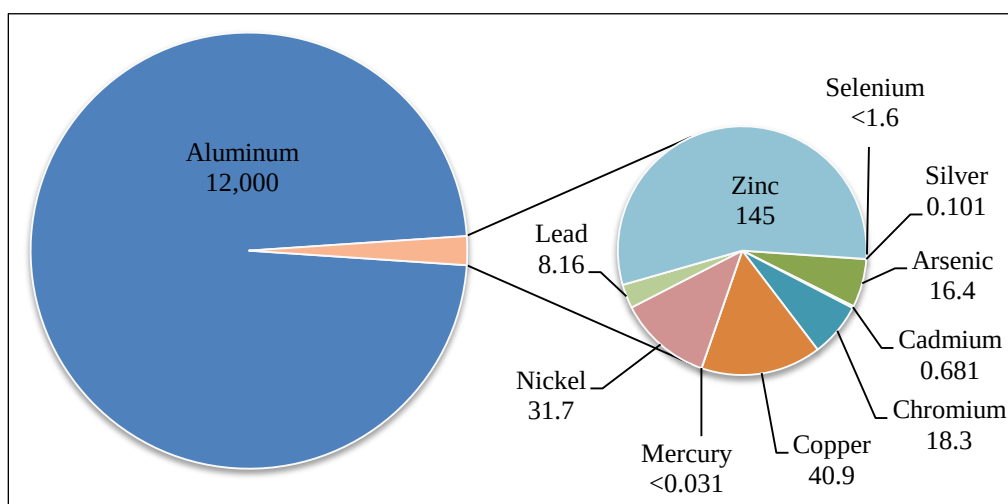


Figure 18.—2017 Lower Slate Creek sediment element concentrations (mg/kg).

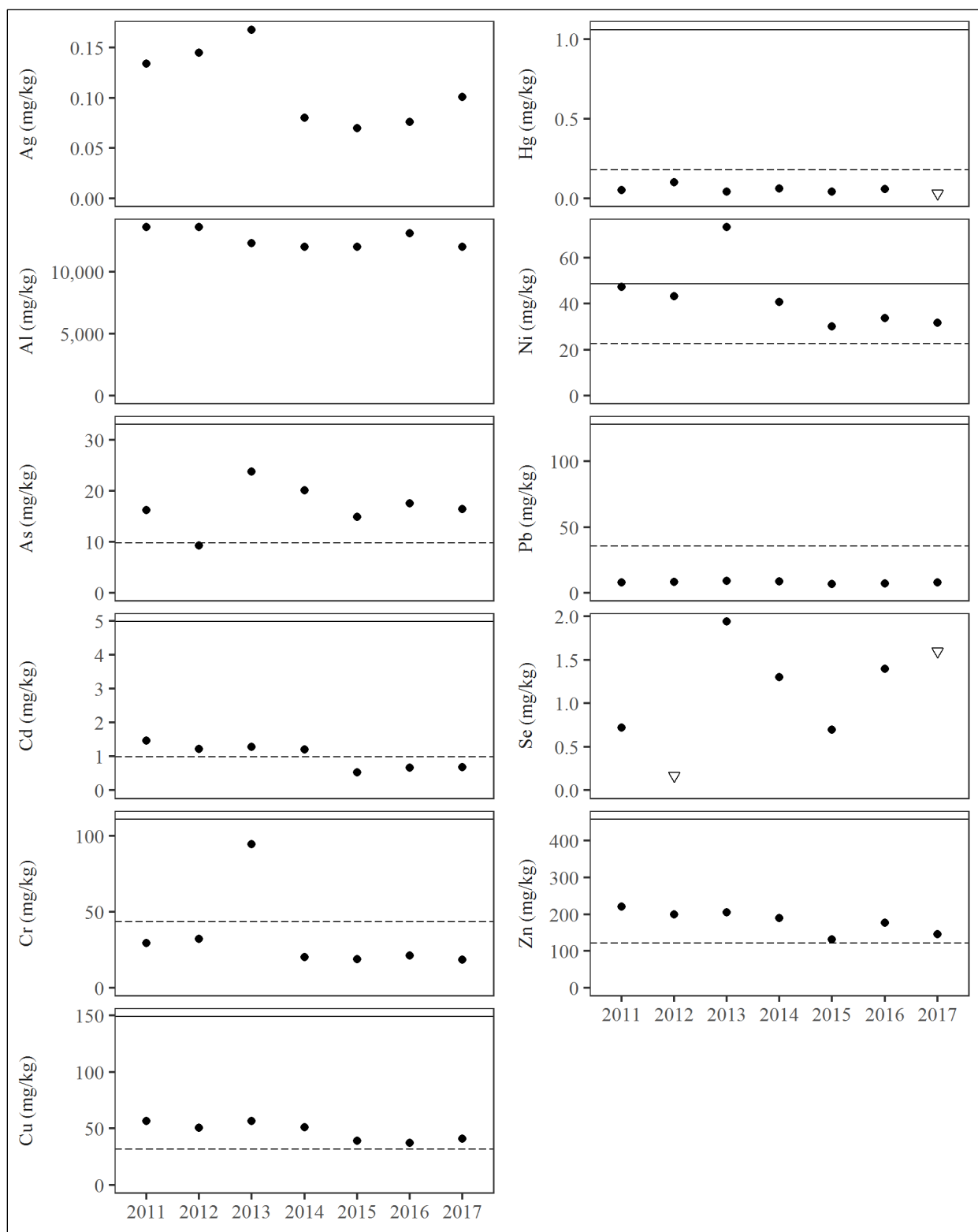


Figure 19.—Lower Slate Creek sediment element concentrations.

Note: Elements undetected (▽) are presented at the analyte method reporting limit. The dashed line represents the TEC and solid line represents the PEC for freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, or Se.

West Fork Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2017 West Fork Slate Creek mean chlorophyll *a* density was 4.96 mg/m², the greatest observed since 2011 and similar to the 2016 density (Table 12; Figure 20). Figure 21 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 12.–West Fork Slate Creek mean chlorophylls *a*, *b*, and *c* densities.

	7/29/11	7/25/12	7/31/13	7/30/14	7/28/15	7/26/16	7/24/17
Chl- <i>a</i> (mg/m ²)	3.92	1.01	4.22	0.77	0.92	4.93	4.96
Chl- <i>b</i> (mg/m ²)	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Chl- <i>c</i> (mg/m ²)	0.27	0.10	0.61	0.06	0.06	0.66	0.85

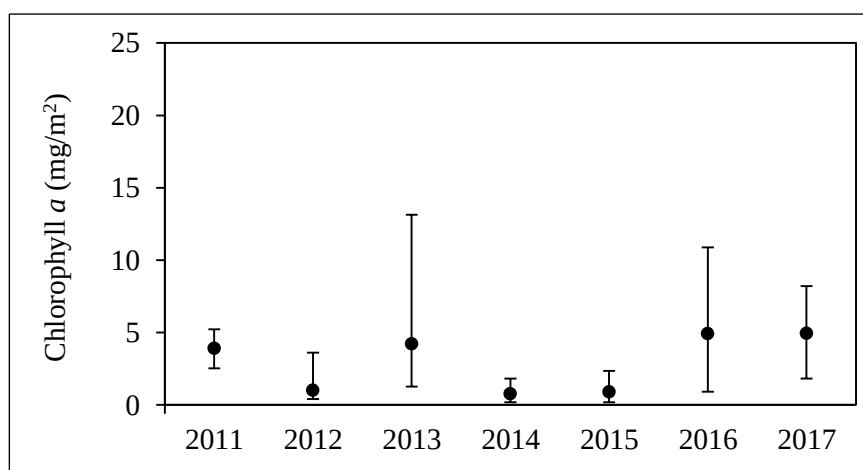


Figure 20.–West Fork Slate Creek mean chlorophyll *a* densities.
Note: Minimum, mean, and maximum values presented.

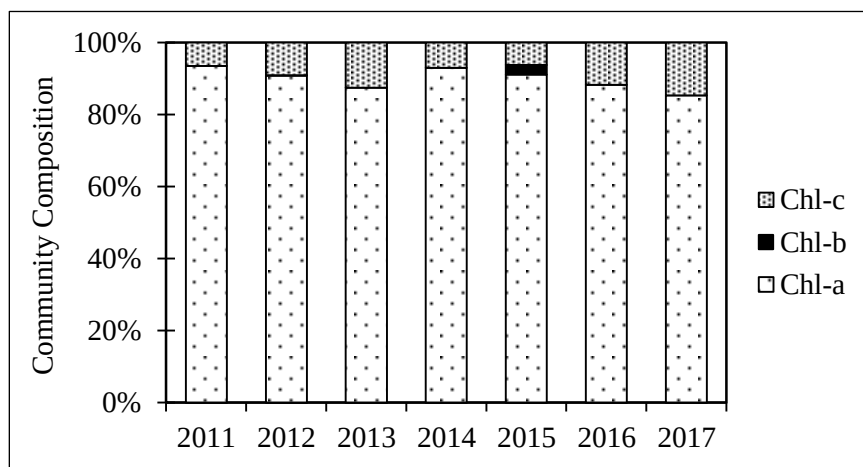


Figure 21.–West Fork Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*.

Benthic Macroinvertebrate Density and Community Composition

Among the 2017 West Fork Slate Creek BMI samples, we identified 21 taxa and estimate mean density at 885 BMI/m², of which 82% were EPT insects, all within ranges observed 2011–2016 (Table 13; Figure 22). The Shannon Diversity and Evenness scores were also similar to previous years, and the dominant taxa were Ephemeroptera: *Baetis* and *Cinygmula*, each representing 26% of the samples.

Table 13.–West Fork Slate Creek BMI data summaries.

	5/4/11	5/2/12	4/30/13	4/30/14	4/27/15	4/26/16	4/25/17
Mean BMI density (per m ²)	502	1,819	2,446	973	2,634	1,470	885
Total BMI taxa	21	31	28	29	28	25	21
Number of EPT taxa	11	21	18	17	16	15	13
% EPT	80%	80%	90%	71%	82%	77%	82%
Shannon Diversity score	0.63	0.84	0.73	0.91	0.82	0.72	0.78
Evenness score	0.78	0.71	0.61	0.79	0.71	0.69	0.78

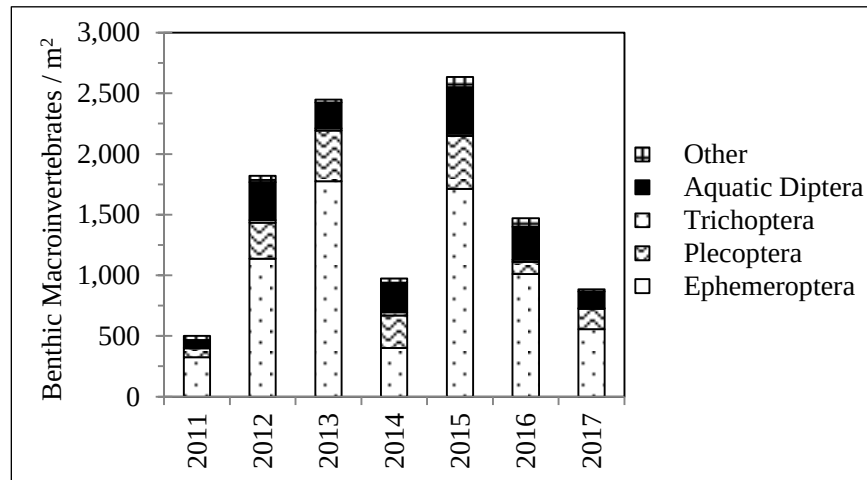


Figure 22.–West Fork Slate Creek mean BMI densities and community compositions.

East Fork Slate Creek

East Fork Slate Creek discharge is dependent on Upper Slate Lake discharge, routed through the diversion pipeline bypassing the TTF, and Outfall 002 effluent discharge^x from the TTF water treatment plant. The July 2017 mean daily discharge^y records for East Fork Slate Creek show the greatest flows occurred during the first few days of the month and peaked at 8.7 ft³/s on July 3 (Figure 23). Median discharge three weeks prior to sampling periphyton was 3.6 ft³/s (Figure 24).

^x Outfall 002 began discharging to East Fork Slate Creek in December 2010.

^y Calculated by combining the diversion pipeline Parshall flume and TTF water treatment plant Outfall 002 mean daily discharge data (unpublished data obtained from K. Eppers, Environmental Superintendent, Coeur Alaska, Inc., Juneau).

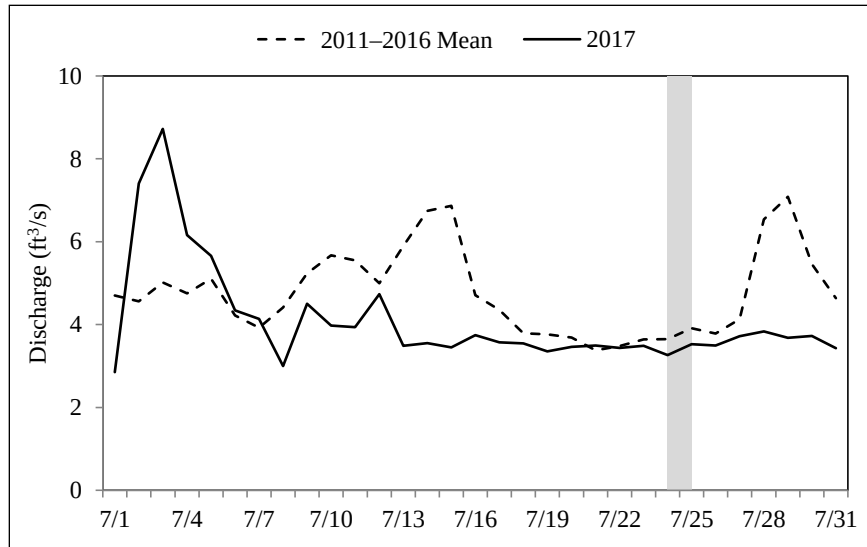


Figure 23.—July 2017 East Fork Slate Creek mean daily discharges.

Note: 2017 periphyton sampling days highlighted in gray.

Source: Unpublished data, Coeur Alaska, Inc., Juneau, AK.

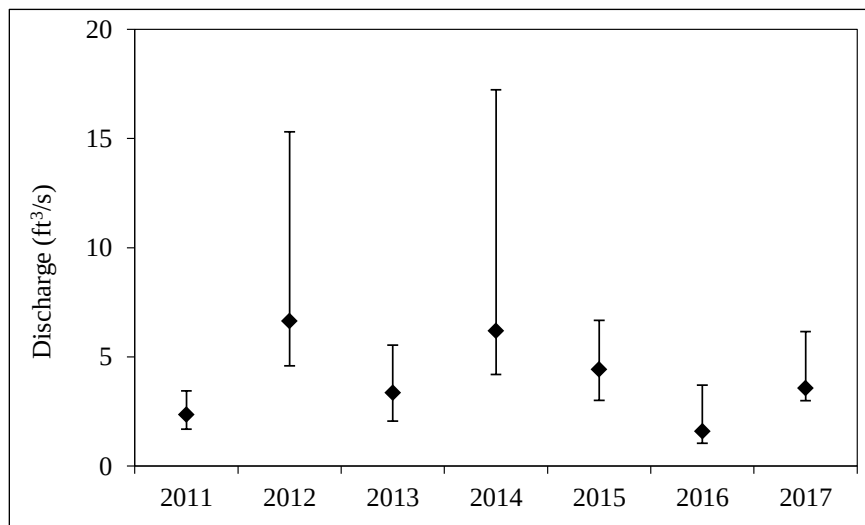


Figure 24.—East Fork Slate Creek mean daily discharges three weeks prior to sampling periphyton in July.

Note: Minimum, median, and maximum mean daily discharges.

Source: Unpublished data, Coeur Alaska, Inc., Juneau, AK.

Periphyton: Chlorophyll Density and Composition

The 2017 East Fork Slate Creek mean chlorophyll *a* density was 0.64 mg/m², the second lowest observed since 2011 (Table 14; Figure 25). Figure 26 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 14.—East Fork Slate Creek mean chlorophylls *a*, *b*, and *c* densities.

	7/28/11	7/24/12	7/30/13	7/30/14	7/27/15	7/25/16	7/25/17
Chl- <i>a</i> (mg/m ²)	8.84	5.08	2.28	0.27	1.56	1.21	0.64
Chl- <i>b</i> (mg/m ²)	1.56	0.57	0.06	0.02	0.00	0.00	0.00
Chl- <i>c</i> (mg/m ²)	0.24	0.18	0.20	0.03	0.15	0.15	0.06

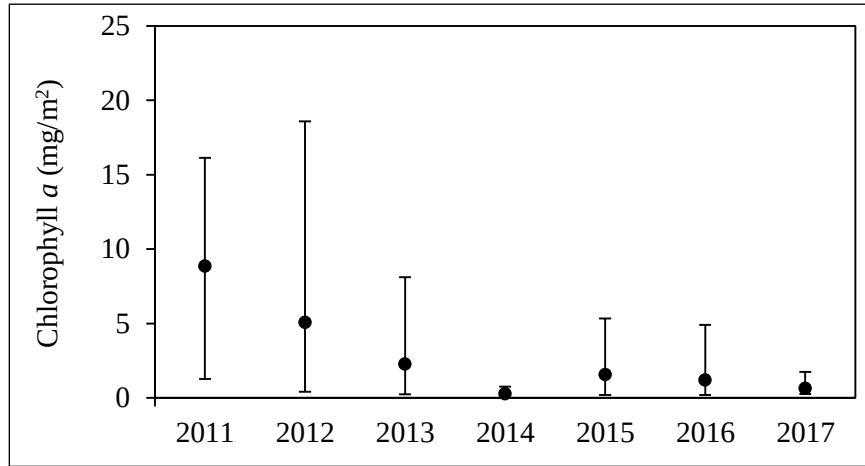


Figure 25.—East Fork Slate Creek mean chlorophyll *a* densities.

Note: Minimum, mean, and maximum values presented.

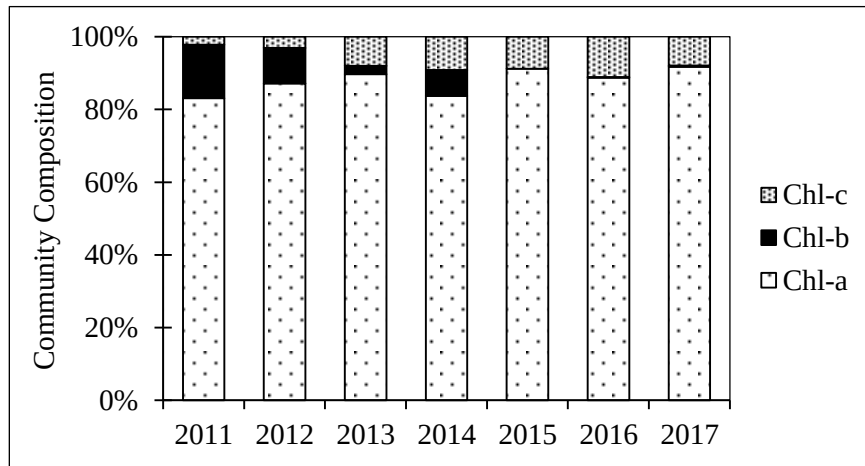


Figure 26.—East Fork Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*.

Benthic Macroinvertebrate Density and Community Composition

Among the 2017 East Fork Slate Creek BMI samples, we identified 27 taxa and estimate mean density at 6,783 BMI/m², of which 11% were EPT insects, the second largest mean density observed since 2011 due to more Diptera and pea clams present (Table 15; Figure 27). The Shannon Diversity and Evenness scores were also within ranges previously observed and the dominant taxon was Bivalvia: *Pisidium*, representing 53% of the samples.

Table 15.–East Fork Slate Creek BMI data summaries.

	5/12/11	4/27/12	4/29/13	4/30/14	4/29/15	4/25/16	4/27/17
Mean BMI density (per m ²)	4,688	4,633	9,407	2,048	3,854	2,002	6,783
Total BMI taxa	27	33	33	24	28	21	27
Number of EPT taxa	15	17	17	9	16	11	13
% EPT	19%	23%	2.5%	2.0%	18%	28%	11%
Shannon Diversity score	0.64	0.78	0.57	0.70	0.92	0.92	0.62
Evenness score	0.54	0.61	0.47	0.63	0.72	0.78	0.51

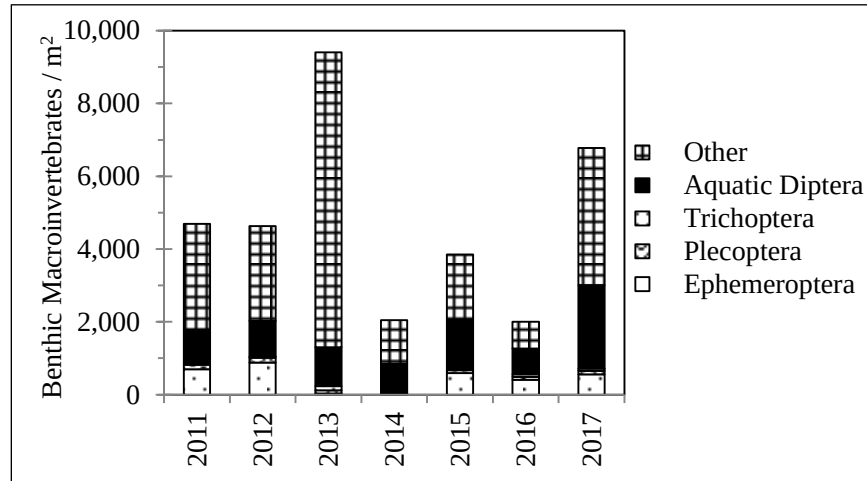


Figure 27.–East Fork Slate Creek mean BMI densities and community compositions.

Sediment Element Concentrations

Element concentrations in the 2017 East Fork Slate Creek sediment sample were within the ranges observed 2011–2016, except Se concentration which was below the method reporting limit. The As, Cd, Cu, Ni, and Zn concentrations remain above NOAA’s freshwater sediment guidelines (Buchman 2008). Figure 28 presents the 2017 results and Figure 29 presents the 2011–2017 data.

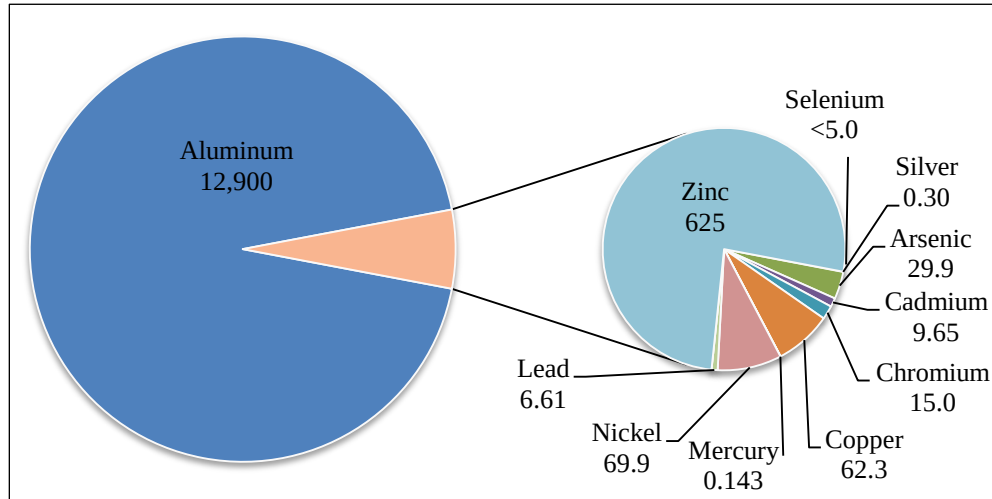


Figure 28.–2017 East Fork Slate Creek sediment element concentrations (mg/kg).

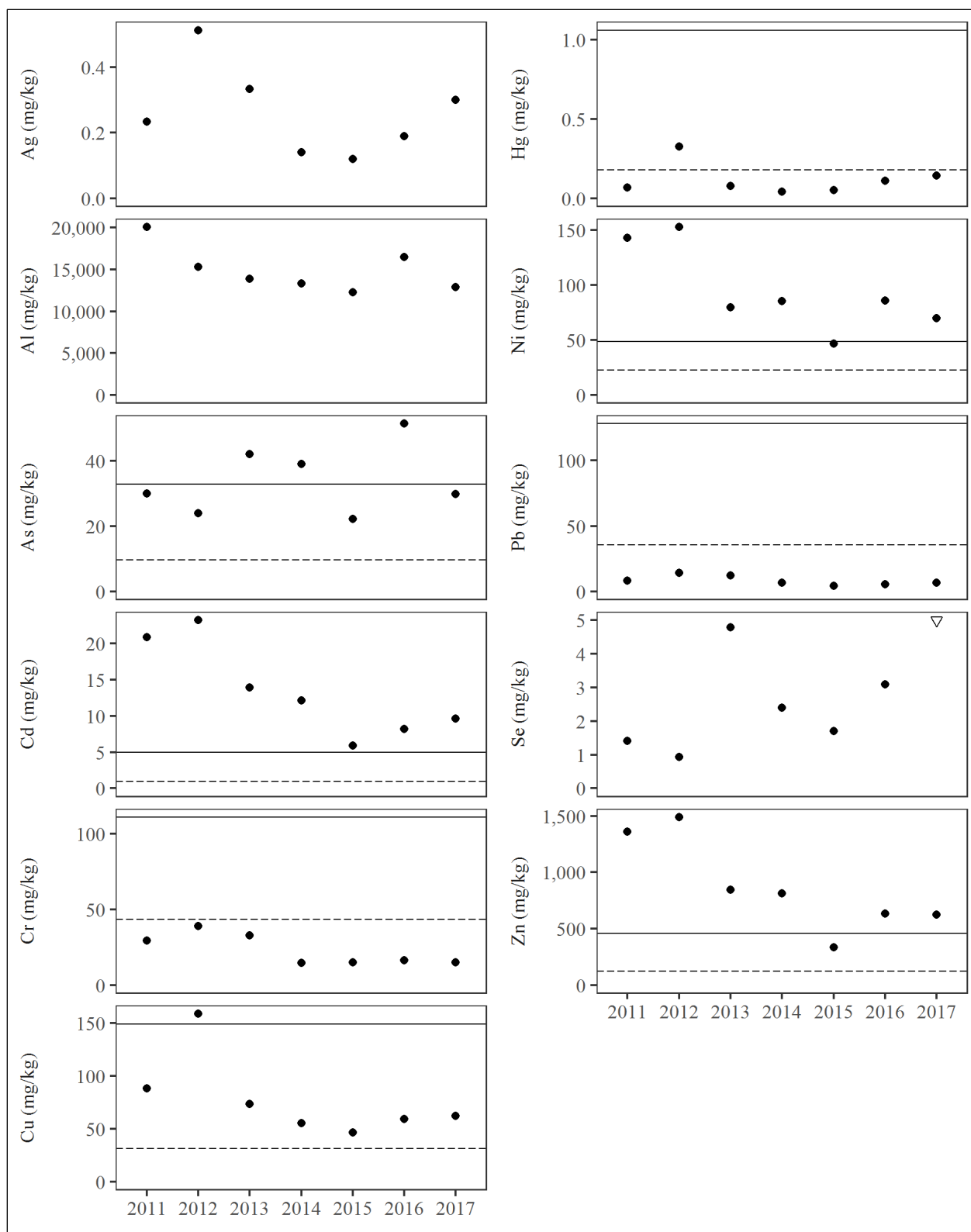


Figure 29.—East Fork Slate Creek sediment element concentrations.

Note: Elements undetected (∇) are presented at the analyte method reporting limit. The dashed line represents the TEC and solid line represents the PEC for freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, or Se.

Upper Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2017 Upper Slate Creek mean chlorophyll *a* density was 0.83 mg/m², within the range observed since 2011 (Table 16; Figure 30). Figure 31 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 16.—Upper Slate Creek mean chlorophylls *a*, *b*, and *c* densities.

	7/29/11	7/24/12	7/30/13	7/30/14	7/27/15	7/25/16	7/24/17
Chl- <i>a</i> (mg/m ²)	0.76	1.26	2.13	1.09	0.63	3.86	0.83
Chl- <i>b</i> (mg/m ²)	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Chl- <i>c</i> (mg/m ²)	0.05	0.07	0.13	0.06	0.09	0.42	0.04

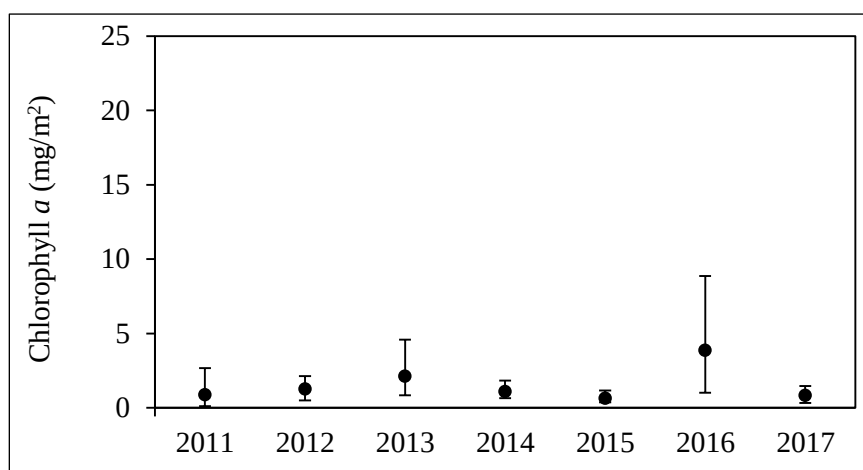


Figure 30.—Upper Slate Creek mean chlorophyll *a* densities.
Note: Minimum, mean, and maximum values presented.

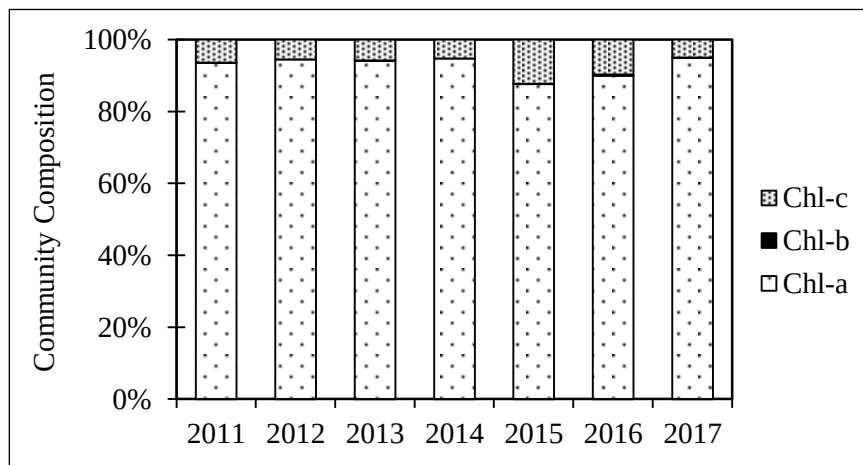


Figure 31.—Upper Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*.

Benthic Macroinvertebrate Density and Community Composition

Among the 2017 Upper Slate Creek BMI samples, we identified 30 taxa and estimate mean density at 2,029 BMI/m², of which 61% were EPT insects, the lowest BMI density and %EPT observed since 2011 (Table 17; Figure 32). The Shannon Diversity and Evenness scores were also lower than previous years. The dominant taxa were Diptera: Chironomidae and Ephemeroptera: *Baetis*, representing 34% and 20% of the samples.

Table 17.–Upper Slate Creek BMI data summaries.

	5/12/11	4/27/12	4/29/13	4/28/14	4/29/15	4/25/16	4/27/17
Mean BMI density (per m ²)	2,523	2,256	2,880	3,125	3,776	2,398	2,029
Total BMI taxa	33	39	34	36	31	28	30
Number of EPT taxa	18	21	20	20	19	15	19
% EPT	63%	68%	72%	63%	68%	68%	61%
Shannon Diversity score	0.97	1.04	1.02	1.03	0.98	1.06	0.96
Evenness score	0.76	0.79	0.78	0.76	0.74	0.82	0.73

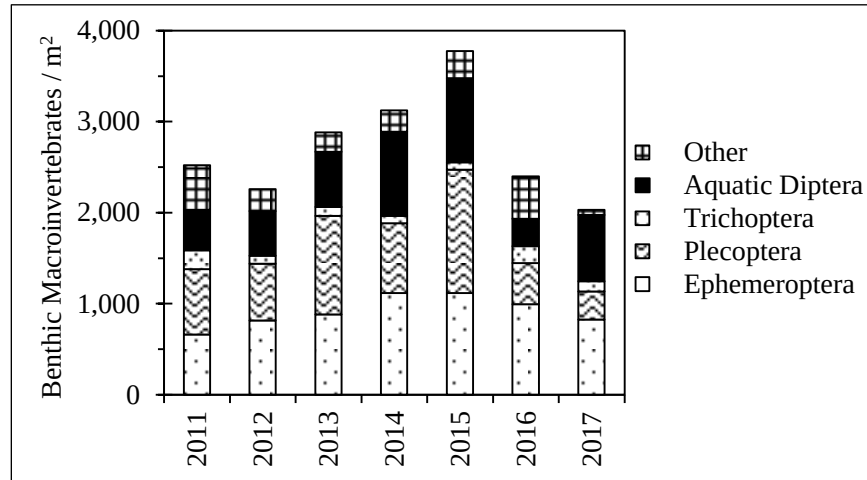


Figure 32.–Upper Slate Creek mean BMI densities and community compositions.

Sediment Element Concentrations

The 2017 Upper Slate Creek sediment sample contained lower concentrations of Cd, Cr, Hg, Ni and Zn than previous years and concentrations of other elements were within the ranges observed 2011–2016. The As, Cr, Cu, and Ni concentrations remain above NOAA’s freshwater sediment guidelines (Buchman 2008). Figure 33 presents the 2017 results and Figure 34 presents the 2011–2017 data.

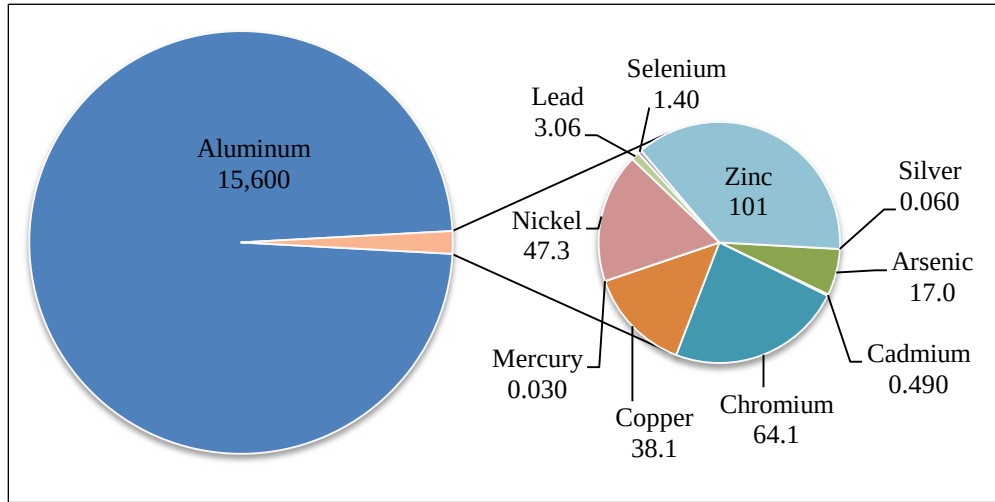


Figure 33.–2017 Upper Slate Creek sediment element concentrations (mg/kg).

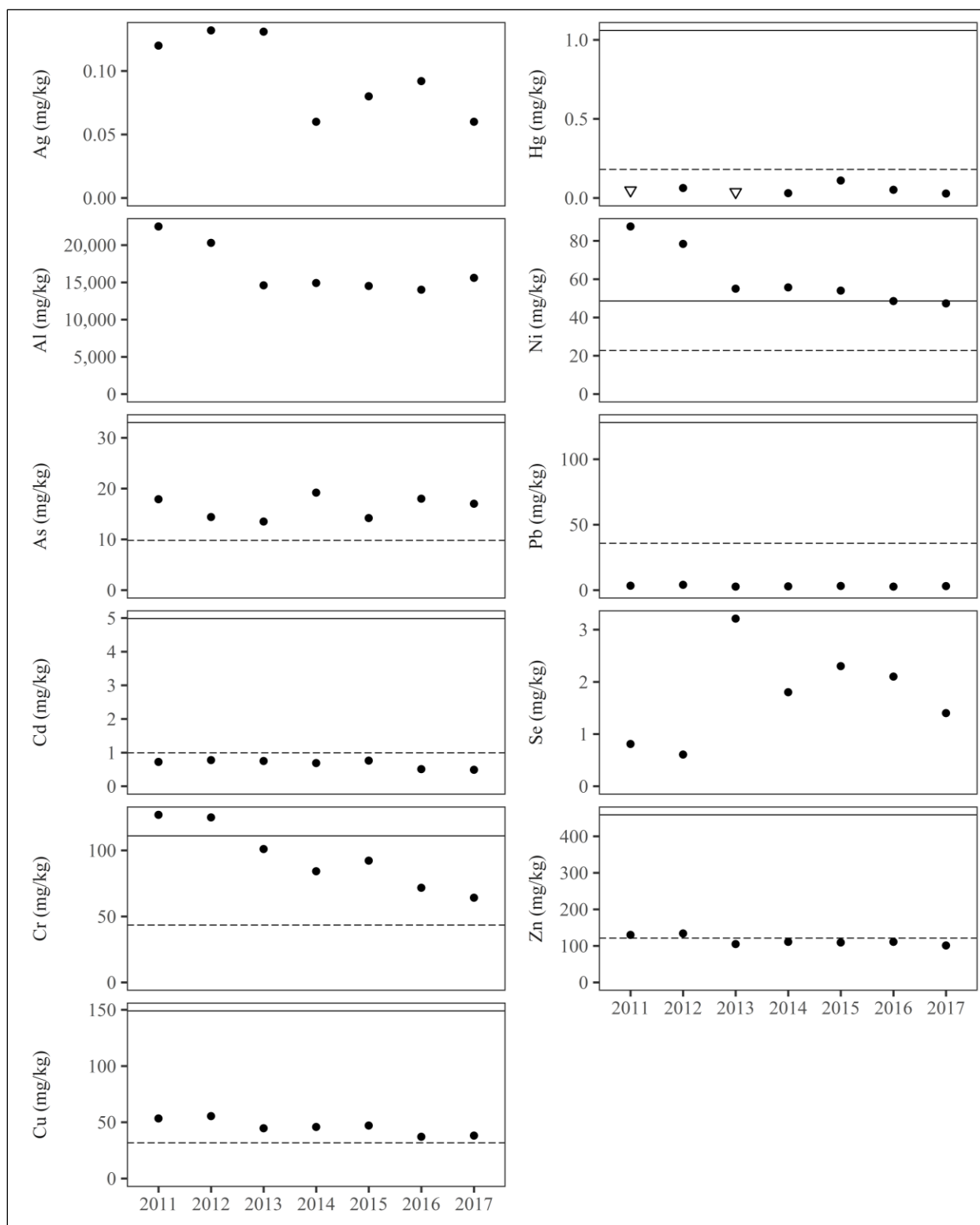


Figure 34.—Upper Slate Creek sediment element concentrations.

Note: Elements undetected (▽) are presented at the analyte method reporting limit. The dashed line represents the TEC and solid line represents the PEC for freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, or Se.

JOHNSON CREEK

Lower Johnson Creek

Adult Salmon Counts

We counted 23,239 pink salmon^z and 83 coho salmon in Lower Johnson Creek during the 2017 spawning season (Table 18). Figure 35 shows pink salmon counts for each survey and Figure 36 displays pink salmon distribution by reach.

Table 18.—Lower Johnson Creek adult salmon counts.

	2011	2012	2013	2014	2015	2016	2017
Pink salmon	17,499	5,016	8,186	189	51,325	428	23,239
Chum salmon	21	99	17	3	0	39	0
Coho salmon	33	90	64	107	88	24	83

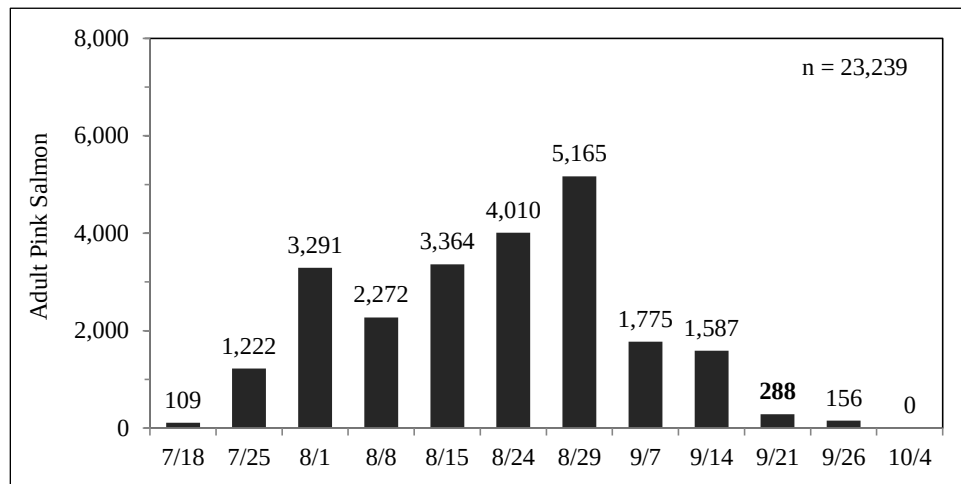


Figure 35.—2017 Lower Johnson Creek weekly pink salmon count.

Note: Bold numbers indicate incomplete surveys.

^z Our last aerial survey was on 9/21/17, though we also observed pink salmon on 9/26/17 and 10/4/17 during coho salmon foot surveys. On 9/21/17, fog prevented counting fish between Marker #7 and Marker #10.

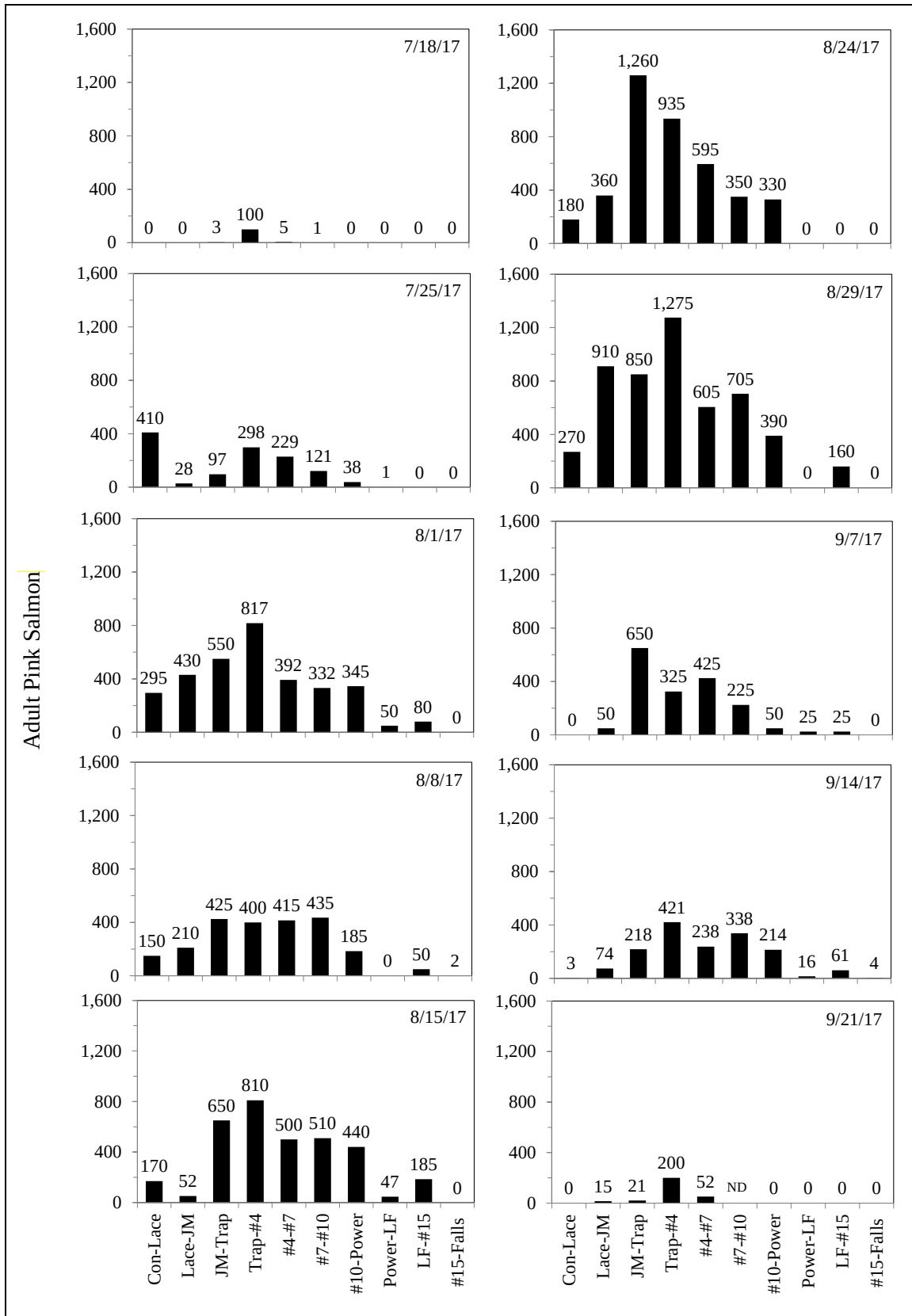


Figure 36.–2017 Lower Johnson Creek weekly pink salmon distribution.

Sediment Element Concentrations

The 2017 Lower Johnson Creek sediment sample contained Ag and Hg concentrations within the ranges observed 2011–2016, and concentrations of all other elements were lower than previous years. Se concentration was not detected at the method reporting limit for the seventh year in a row. As and Cu concentrations remain above NOAA's freshwater sediment guidelines (Buchman 2008). Figure 37 presents the 2017 results and Figure 38 presents the 2011–2017 data.

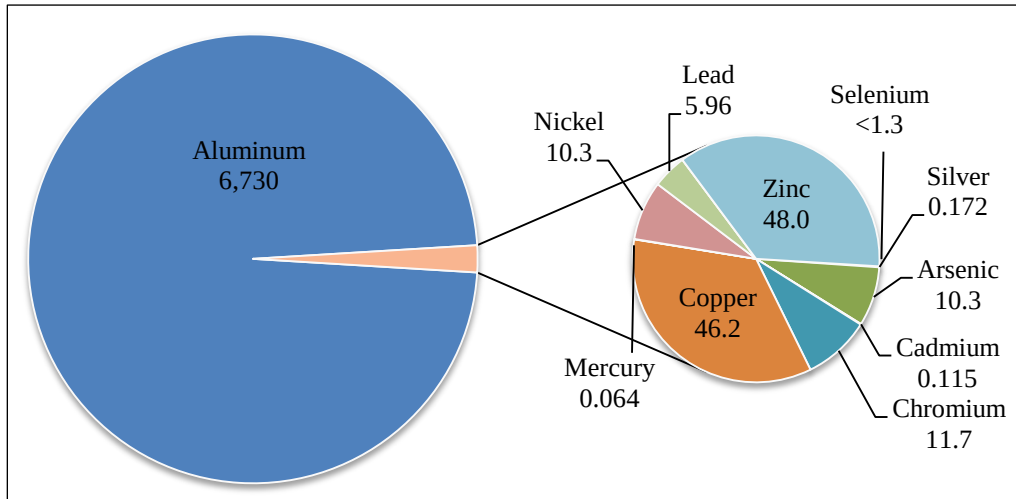


Figure 37.—2017 Lower Johnson Creek sediment element concentrations (mg/kg).

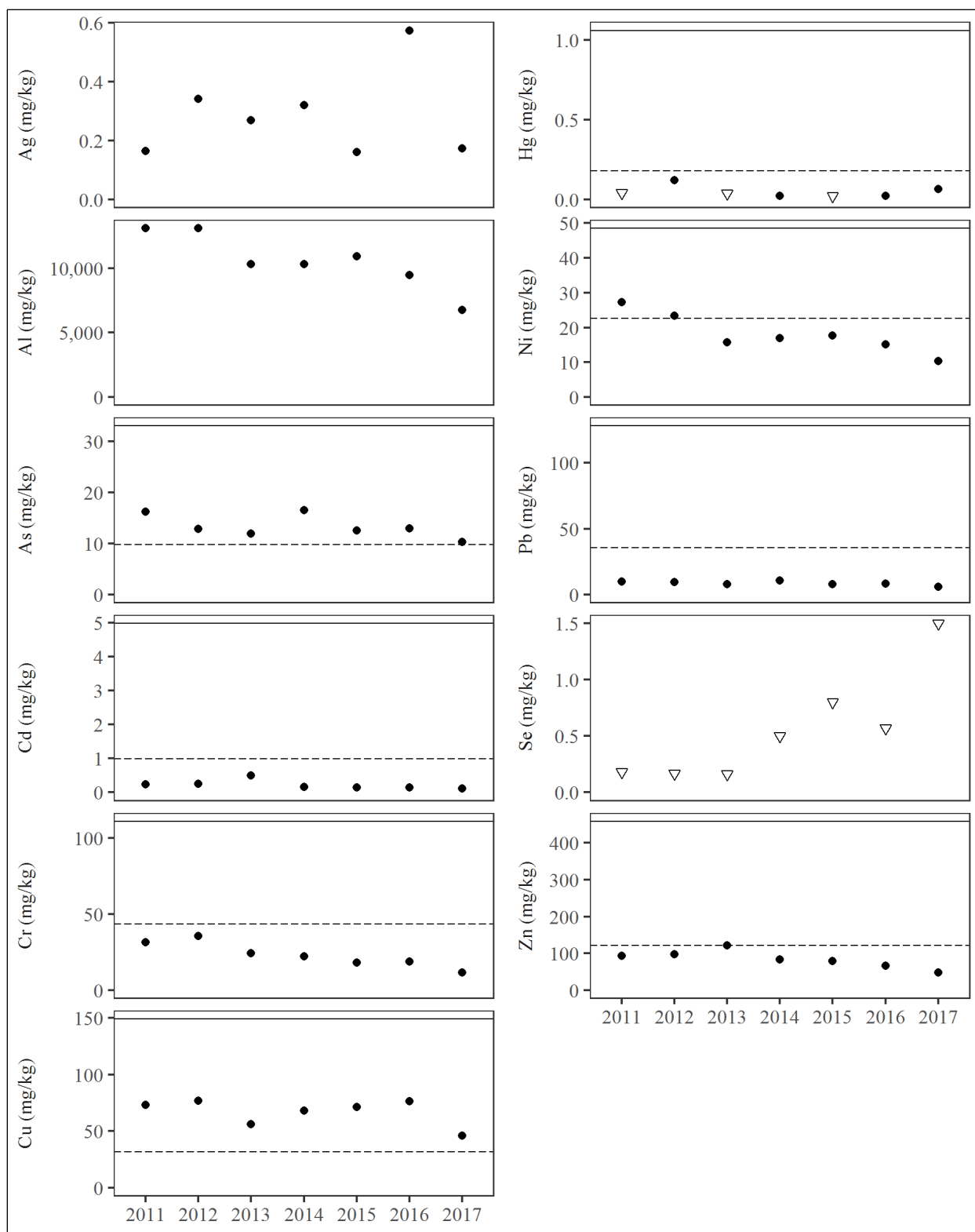


Figure 38.–Lower Johnson Creek sediment element concentrations.

Note: Elements undetected (▽) are presented at the analyte method reporting limit. The dashed line represents the TEC and solid line represents the PEC for freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, or Se.

Upper Johnson Creek

Benthic Macroinvertebrate Density and Community Composition

Among the 2017 Upper Johnson Creek BMI samples, we identified 33 taxa and estimate mean density at 2,901 BMI/m², of which 51% were EPT insects, the lowest %EPT observed since 2011 due to fewer EPT and more Diptera insects present (Table 19; Figure 39). The Shannon Diversity and Evenness scores were also the lowest observed, and the dominant taxon was Diptera: Chironomidae, representing 46% of the samples.

Table 19.–Upper Johnson Creek BMI data summaries.

	5/3/11	4/26/12	4/29/13	4/29/14	4/28/15	4/27/16	4/26/17
Mean BMI density (per m ²)	3,735	3,968	5,265	2,658	2,789	3,681	2,901
Total BMI taxa	24	28	34	32	28	32	33
Number of EPT taxa	14	14	24	21	17	21	19
% EPT	55%	64%	65%	69%	71%	71%	51%
Shannon Diversity score	0.76	0.81	0.74	0.74	0.87	0.88	0.68
Evenness score	0.66	0.68	0.59	0.59	0.71	0.70	0.55

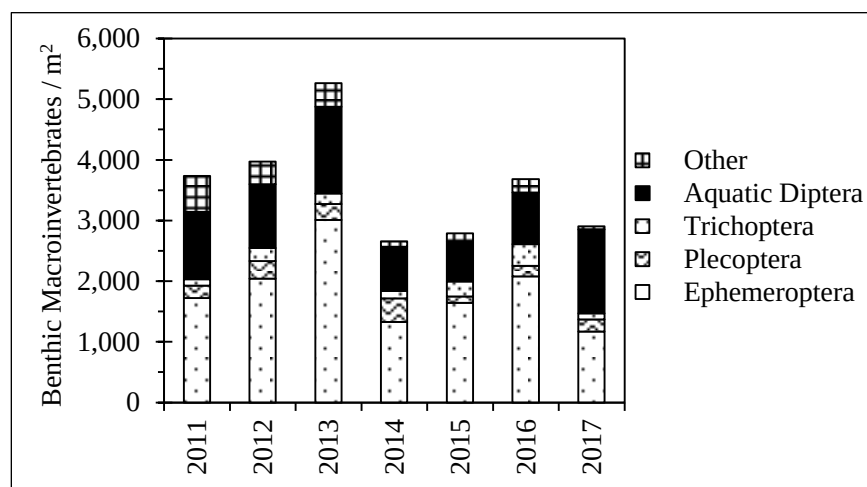


Figure 39.–Upper Johnson Creek mean BMI densities and community compositions.

SHERMAN CREEK

Lower Sherman Creek

Periphyton: Chlorophyll Density and Composition

Sample Point 1

The 2017 Lower Sherman Creek SP1 mean chlorophyll *a* density was 3.86 mg/m², within the range observed since 2011 (Table 20; Figure 40). Figure 41 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 20.–Lower Sherman Creek SP1 mean chlorophylls *a*, *b*, and *c* densities.

	7/28/11	7/26/12	7/29/13	7/28/14	7/27/15	7/25/16	7/25/17
Chl- <i>a</i> (mg/m ²)	7.60	2.54	3.69	1.34	1.36	3.70	3.86
Chl- <i>b</i> (mg/m ²)	0.69	0.93	0.00	0.00	0.00	0.74	0.00
Chl- <i>c</i> (mg/m ²)	0.49	0.08	0.51	0.18	0.17	0.33	0.56

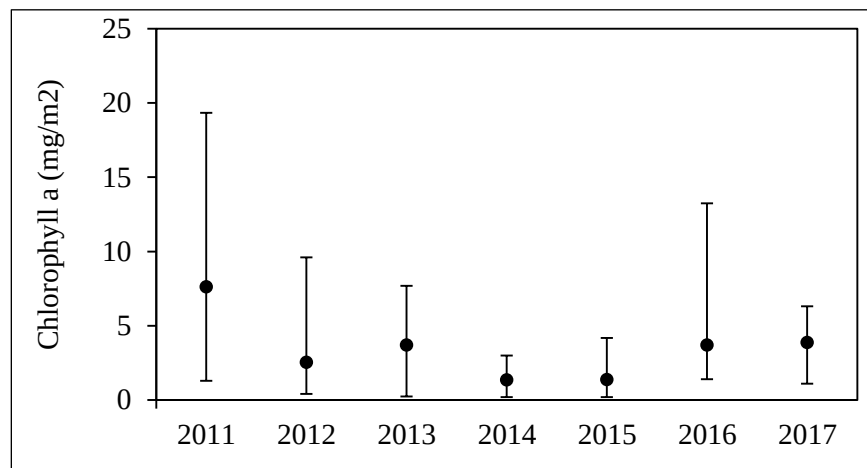


Figure 40.–Lower Sherman SP1 mean chlorophyll *a* densities.

Note: Minimum, mean, and maximum values presented.

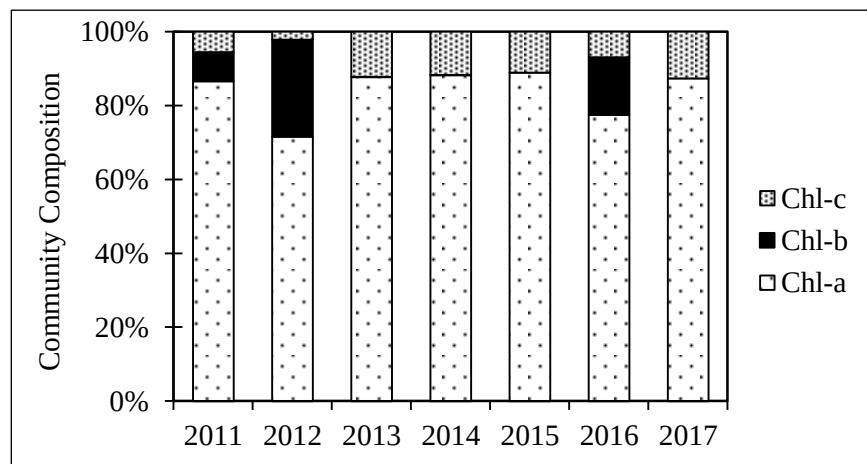


Figure 41.–Lower Sherman SP1 mean proportions of chlorophylls *a*, *b*, and *c*.

Sample Point 2

The 2017 Lower Sherman Creek SP2 mean chlorophyll *a* density was 1.15 mg/m², the second lowest observed and similar to densities observed since 2014 (Table 21; Figure 42). Figure 43 presents the mean proportion of chlorophylls *a*, *b*, and *c* each year.

Table 21.—Lower Sherman Creek SP2 mean chlorophylls *a*, *b*, and *c* densities.

	7/28/11	7/26/12	7/29/13	7/28/14	7/27/15	7/25/16	7/25/17
Chl- <i>a</i> (mg/m ²)	5.61	0.67	2.87	1.32	1.62	1.42	1.15
Chl- <i>b</i> (mg/m ²)	0.02	0.01	0.00	0.00	0.15	0.04	0.00
Chl- <i>c</i> (mg/m ²)	0.32	0.09	0.32	0.12	0.27	0.19	0.12

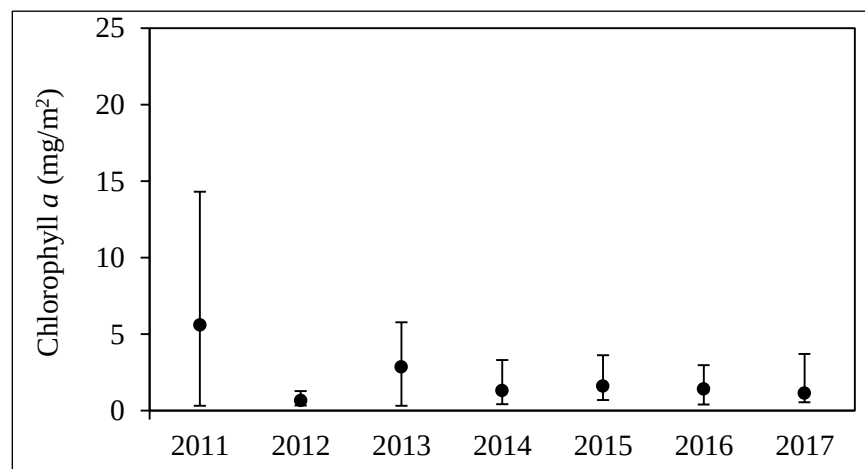


Figure 42.—Lower Sherman SP2 mean chlorophyll *a* densities.

Note: Minimum, mean, and maximum values presented.

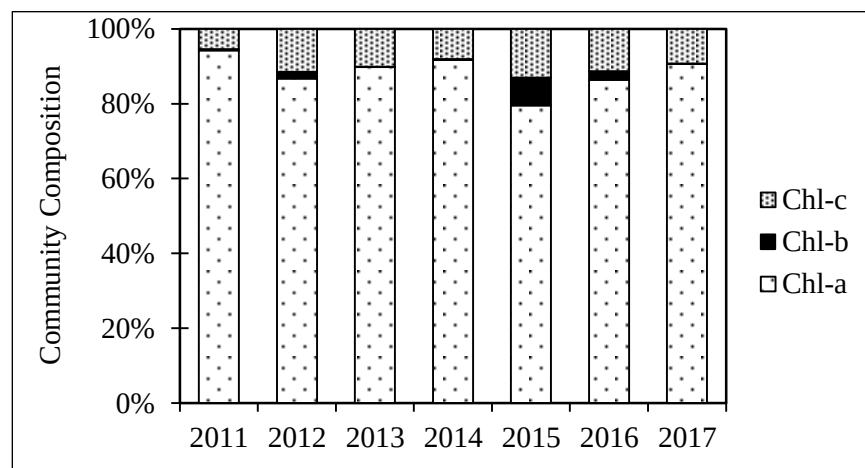


Figure 43.—Lower Sherman SP2 mean proportions of chlorophylls *a*, *b*, and *c*.

Benthic Macroinvertebrate Density and Community Composition

Sample Point 1

Among the 2017 Lower Sherman Creek SP1 BMI samples, we identified 25 taxa and estimate mean density at 1,009 BMI/m², of which 31% were EPT insects, similar to the 2011 sample results and the lowest density observed since 2011 (Table 22; Figure 44). The Shannon Diversity and Evenness scores were within ranges previously observed and the dominant taxon was Annelida: Oligochaeta, representing 43% of the samples.

Table 22.–Lower Sherman Creek SP1 BMI data summaries.

	5/4/11	4/30/12	5/1/13	4/29/14	4/28/15	4/27/16	4/26/17
Mean BMI density (per m ²)	1,118	2,733	1,796	3,023	1,651	6,839	1,009
Total BMI taxa	26	31	28	30	26	26	25
Number of EPT taxa	15	18	16	13	13	13	13
% EPT	32%	66%	64%	14%	27%	4%	31%
Shannon Diversity score	0.76	0.74	0.85	0.71	0.84	0.32	0.81
Evenness score	0.71	0.62	0.71	0.57	0.70	0.27	0.69

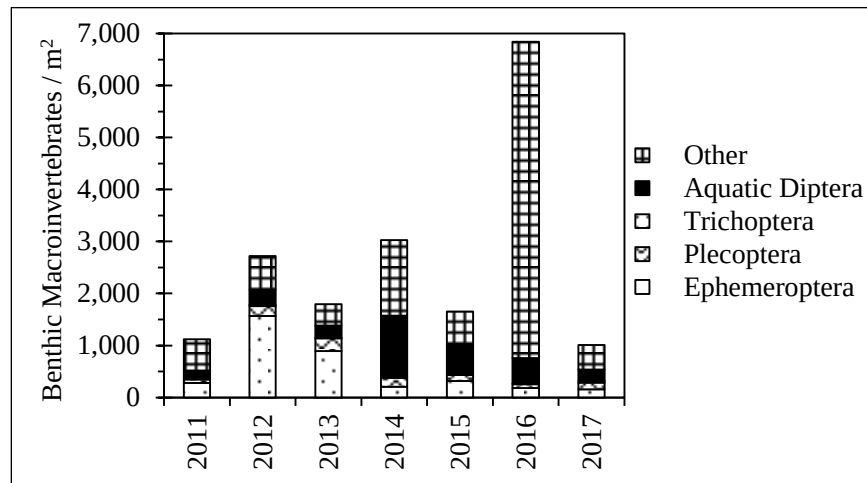


Figure 44.–Lower Sherman Creek SP1 mean BMI densities and community compositions.

Sample Point 2

Among 2017 Lower Sherman Creek SP2 BMI samples, we identified 26 taxa and estimate mean density at 428 BMI/m², of which 28% were EPT insects, the lowest BMI density observed since 2011 (Table 23; Figure 45). The Shannon Diversity score was within the range previously observed, the Evenness score was the greatest observed, and the dominant taxa were Annelida: Oligochaeta and Diptera: Chironomidae, representing 27% and 24% of the samples.

Table 23.–Lower Sherman Creek SP2 BMI data summaries.

	5/3/11	4/30/12	4/30/13	4/29/14	4/28/15	4/27/16	4/26/17
Mean BMI density (per m ²)	1,651	2,823	3,385	1,185	1,609	1,873	428
Total BMI taxa	30	37	39	28	23	23	26
Number of EPT taxa	17	26	25	16	13	13	14
% EPT	76%	79%	72%	12%	25%	12%	28%
Shannon Diversity score	0.93	0.70	0.84	0.70	0.77	0.53	0.84
Evenness score	0.76	0.57	0.65	0.62	0.66	0.49	0.80

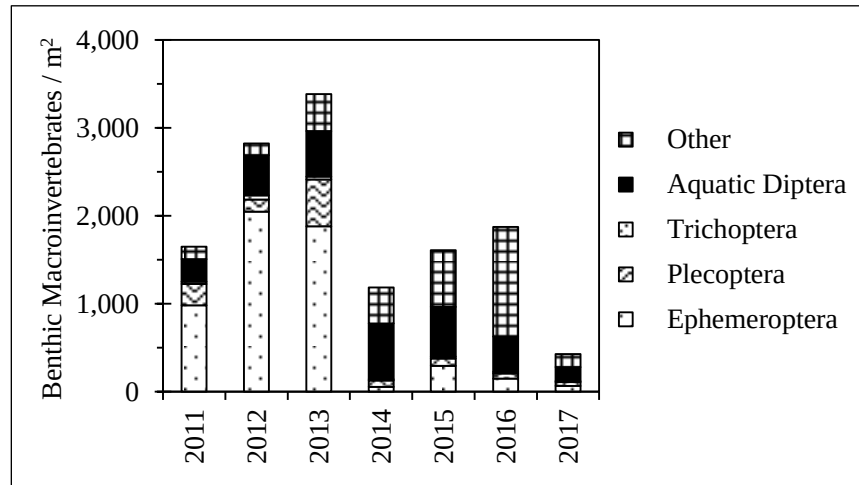


Figure 45.–Lower Sherman Creek SP2 mean BMI densities and community compositions.

Adult Salmon Counts

We counted 5,690 pink salmon and 122 chum salmon in Lower Sherman Creek during the 2017 spawning season (Table 24). Figure 46 shows pink salmon counts for each survey and Figure 47 displays pink salmon distribution by reach.

Table 24.–Lower Sherman Creek adult salmon counts.

	2011	2012	2013	2014	2015	2016	2017
Pink salmon	4,605	1,608	4,981	70	2,798	26	5,690
Chum salmon	0	0	12	0	1	5	122

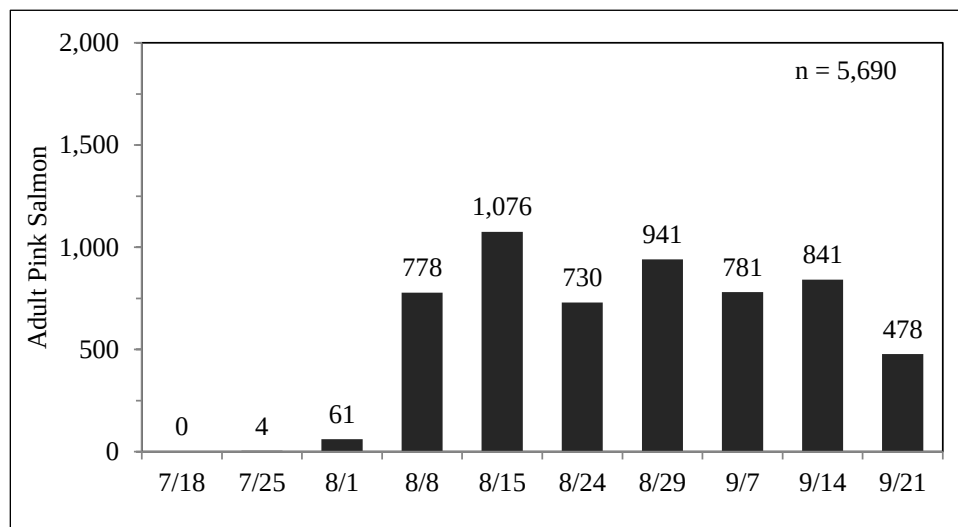


Figure 46.–2017 Lower Sherman Creek weekly pink salmon count.

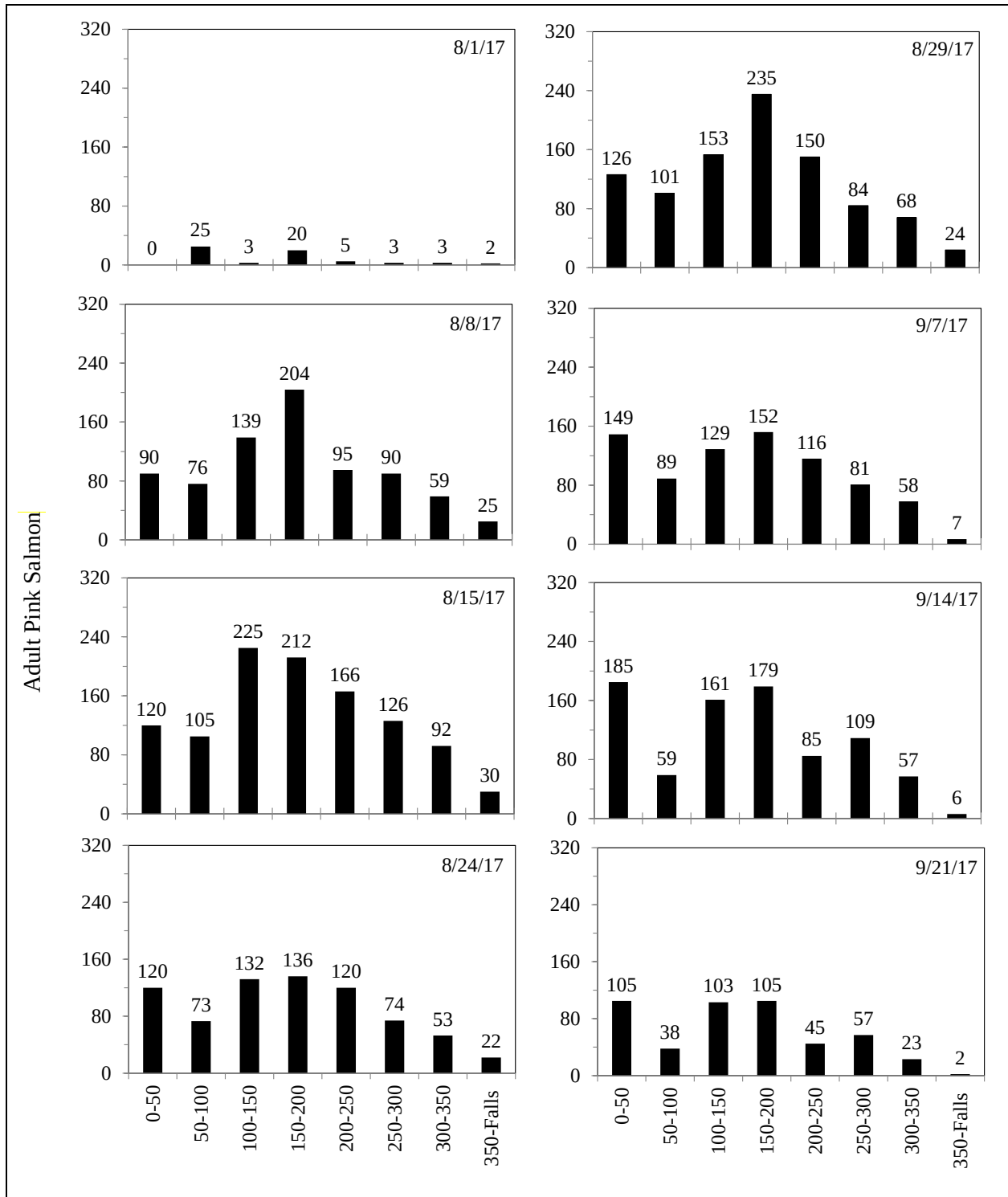


Figure 47.—2017 Lower Sherman Creek weekly pink salmon distribution.

Sediment Element Concentrations

The 2017 Lower Sherman Creek sediment sample contained lower concentrations of Cd, Cu, Ni, Pb and Zn than previous years and other element concentrations were within the ranges observed 2011–2016. Se concentration was below the method reporting limit. The As, Cu, and Ni concentrations remain above NOAA’s freshwater sediment guidelines (Buchman 2008). Figure 48 presents the 2017 results and Figure 49 presents the 2011–2017 data.

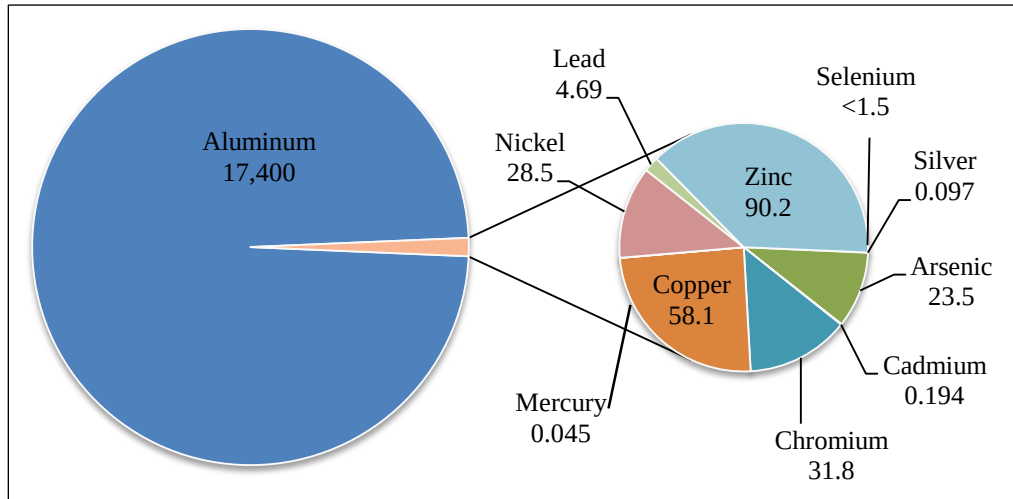


Figure 48.–2017 Lower Sherman Creek sediment element concentrations (mg/kg).

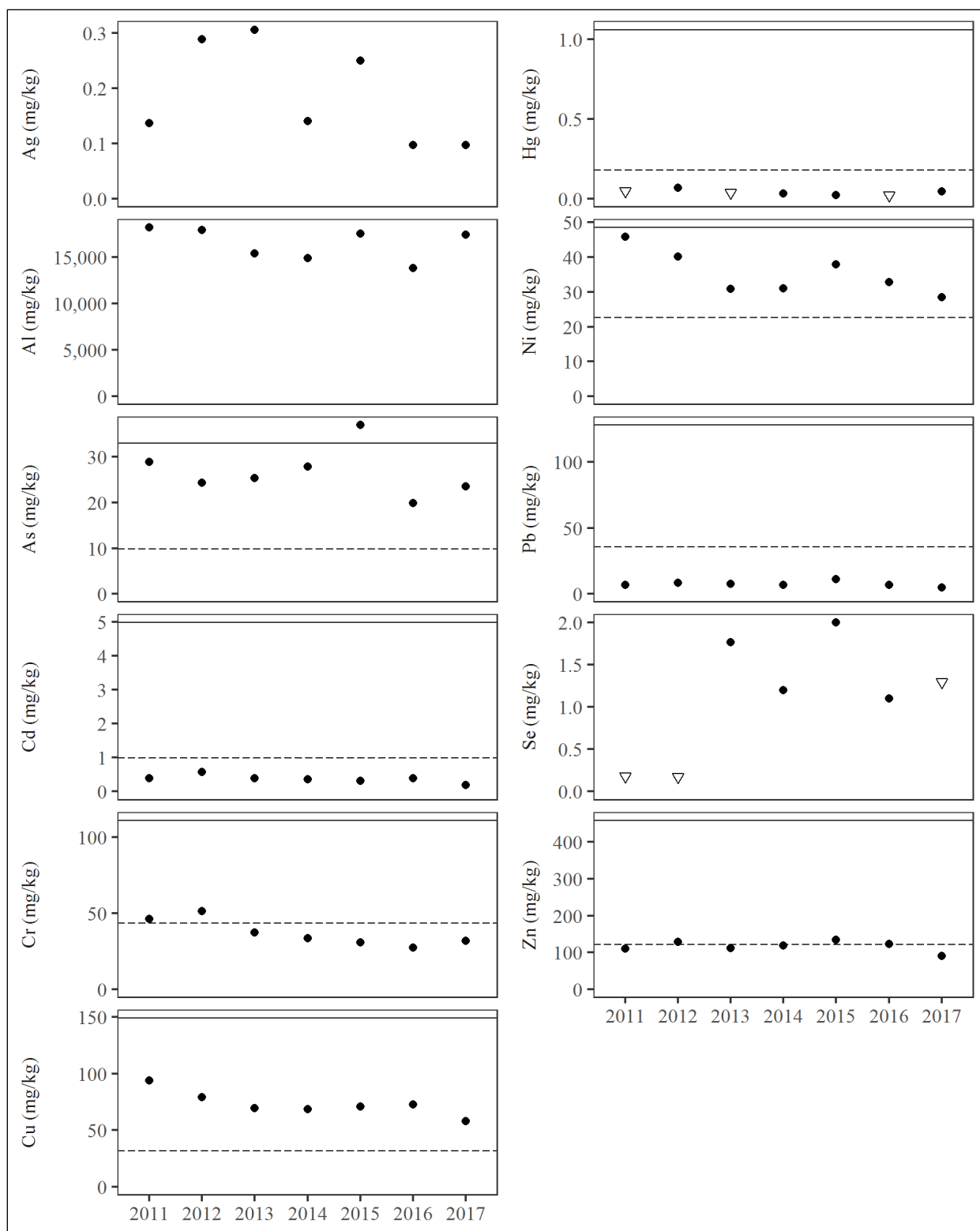


Figure 49.—Lower Sherman Creek sediment element concentrations.

Note: Elements undetected (▽) are presented at the analyte method reporting limit. The dashed line represents the TEC and solid line represents the PEC for freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, or Se.

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^{aa} This publication is actually the resident fish survey report.

^{bb} This publication is actually the invertebrate tissue analysis.

^{cc} Actually published February 2010.

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APPENDIX A: PERIPHYTON DATA

Appendix A.1.–Lower Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.21	0.05	0.00	1.60	0.13	0.07	14.10	0.00	1.56	0.00	0.00	0.00
	1.28	0.02	0.11	4.06	0.00	0.39	20.72	0.00	3.11	9.29	3.22	0.48
	0.85	0.01	0.07	2.03	0.00	0.18	10.89	0.00	1.01	1.45	0.00	0.23
	3.31	0.08	0.25	0.96	0.00	0.04	17.84	0.00	2.66	12.18	5.27	0.38
	11.85	3.11	0.30	2.56	0.04	0.22	2.14	0.00	0.24	0.75	0.00	0.05
	18.05	0.42	0.91	0.92	0.00	0.01	6.09	0.00	0.95	4.70	0.00	0.67
	0.72	0.13	0.00	1.49	0.13	0.13	15.49	0.00	1.99	2.88	0.00	0.49
	0.43	0.05	0.00	2.35	0.12	0.19	12.71	0.00	1.58	1.82	0.00	0.15
	8.54	0.39	0.58	6.19	0.05	0.54	11.32	0.00	1.87	0.73	0.00	0.07
	6.30	0.03	0.38	0.96	0.00	0.06	14.63	0.00	1.46	5.87	0.00	0.51
mean	5.15	0.43	0.26	2.31	0.05	0.18	12.59	0.00	1.64	3.97	0.85	0.30
max	18.05	3.11	0.91	6.19	0.13	0.54	20.72	0.00	3.11	12.18	5.27	0.67
min	0.21	0.01	0.00	0.92	0.00	0.01	2.14	0.00	0.24	0.00	0.00	0.00

mg/m ²	July 2015			July 2016			April 2017			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.45	0.10	0.01	0.60	0.00	0.12	3.63	0.00	0.30	3.84	0.33	0.19
	3.06	0.00	0.28	15.27	0.00	2.14	4.59	0.10	0.56	1.71	0.00	0.27
	0.95	0.09	0.04	6.41	0.00	0.97	1.17	0.06	0.32	1.60	0.00	0.26
	0.85	0.00	0.06	2.35	0.00	0.22	4.38	0.11	0.52	2.14	0.00	0.41
	0.72	0.13	0.00	9.51	0.76	0.88	8.86	0.00	1.29	2.14	0.06	0.09
	2.24	0.44	0.12	2.88	0.66	0.20	1.71	0.00	0.31	4.91	1.86	0.16
	9.93	0.00	1.13	3.52	0.00	0.40	2.99	0.00	0.44	0.87	0.00	0.14
	0.19	ND	ND	2.03	0.00	0.28	1.71	0.00	0.16	2.14	0.00	0.36
	2.88	0.14	0.28	5.34	0.67	0.36	3.63	0.00	0.53	1.60	0.05	0.11
	0.32	0.01	0.00	4.70	0.00	0.65	ND	ND	ND	2.01	0.00	0.32
mean	2.16	0.10	0.21	5.26	0.21	0.62	3.63	0.03	0.49	2.30	0.23	0.23
max	9.93	0.44	1.13	15.27	0.76	2.14	8.86	0.11	1.29	4.91	1.86	0.41
min	0.19	0.00	0.00	0.60	0.00	0.12	1.17	0.00	0.16	0.87	0.00	0.09

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

Appendix A.2.–West Fork Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	2.52	0.00	0.19	1.15	0.00	0.04	4.70	0.00	0.74	0.32	0.00	0.01
	4.70	0.00	0.43	0.41	0.00	0.08	1.39	0.00	0.16	0.19	0.00	0.00
	2.78	0.00	0.26	0.53	0.00	0.02	13.14	0.00	2.19	0.75	0.00	0.05
	3.35	0.00	0.04	0.64	0.00	0.16	4.38	0.00	0.47	0.88	0.00	0.00
	4.27	0.00	0.25	3.62	0.00	0.24	1.28	0.00	0.11	1.60	0.00	0.19
	4.91	0.00	0.42	0.85	0.00	0.14	3.10	0.00	0.50	0.23	0.00	0.03
	3.95	0.00	0.27	0.96	0.01	0.07	3.74	0.00	0.53	0.41	0.00	0.00
	3.10	0.00	0.25	0.41	0.00	0.08	2.03	0.00	0.33	0.33	0.00	0.02
	4.38	0.00	0.39	0.60	0.00	0.12	5.02	0.00	0.67	1.18	0.00	0.13
	5.23	0.00	0.20	0.96	0.00	0.06	3.40	0.00	0.36	1.82	0.00	0.15
mean	3.92	0.00	0.27	1.01	0.00	0.10	4.22	0.00	0.61	0.77	0.00	0.06
max	5.23	0.00	0.43	3.62	0.01	0.24	13.14	0.00	2.19	1.82	0.00	0.19
min	2.52	0.00	0.04	0.41	0.00	0.02	1.28	0.00	0.11	0.19	0.00	0.00

mg/m ²	July 2015			July 2016			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	1.34	0.00	0.21	7.48	0.00	1.16	5.13	0.00	0.60
	0.92	0.00	0.01	4.70	0.00	0.71	5.13	0.00	0.96
	0.77	0.02	0.03	3.22	0.00	0.25	1.82	0.00	0.19
	0.54	0.05	0.00	5.34	0.00	0.61	3.95	0.00	0.83
	0.19	ND	ND	2.67	0.00	0.34	5.87	0.00	1.22
	1.64	0.00	0.04	3.31	0.00	0.45	8.22	0.00	1.38
	2.35	0.00	0.21	4.27	0.00	0.44	8.22	0.00	1.58
	0.53	0.12	0.00	0.92	0.00	0.01	3.74	0.00	0.53
	0.56	0.00	0.06	10.89	0.00	1.64	2.78	0.00	0.33
	0.32	0.05	0.00	6.51	0.00	0.95	4.70	0.00	0.92
mean	0.92	0.03	0.06	4.93	0.00	0.66	4.96	0.00	0.85
max	2.35	0.12	0.21	10.89	0.00	1.64	8.22	0.00	1.58
min	0.19	0.00	0.00	0.92	0.00	0.01	1.82	0.00	0.19

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

Appendix A.3.–East Fork Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	9.51	2.16	0.24	11.53	3.24	0.28	8.12	0.00	0.67	0.14	0.00	0.00
	9.18	0.02	0.20	0.41	0.04	0.04	0.24	ND	ND	0.64	0.00	0.07
	1.28	0.03	0.00	0.88	0.00	0.05	1.07	0.03	0.07	0.05	ND	ND
	5.13	1.15	0.11	0.50	0.00	0.03	0.32	0.07	0.00	0.75	0.14	0.10
	16.02	0.18	0.44	3.42	0.00	0.11	0.64	0.10	0.00	0.05	ND	ND
	8.86	1.94	0.70	0.64	0.08	0.05	5.02	0.16	0.35	0.37	0.00	0.00
	4.70	0.70	0.13	18.58	0.00	0.66	0.43	0.00	0.03	0.05	ND	ND
	16.13	5.35	0.28	13.67	2.32	0.57	6.41	0.11	0.50	0.11	0.00	0.00
	4.91	0.49	0.12	0.69	0.00	0.00	0.32	0.00	0.00	0.53	0.00	0.01
	12.71	3.59	0.15	0.43	0.00	0.00	0.24	ND	ND	0.05	ND	ND
mean	8.84	1.56	0.24	5.08	0.57	0.18	2.28	0.06	0.20	0.27	0.02	0.03
max	16.13	5.35	0.70	18.58	3.24	0.66	8.12	0.16	0.67	0.75	0.14	0.10
min	1.28	0.02	0.00	0.41	0.00	0.00	0.24	0.00	0.00	0.05	0.00	0.00

mg/m ²	July 2015			July 2016			April 2017			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.85	0.00	0.12	0.23	0.00	0.03	0.19	ND	ND	0.56	0.00	0.00
	0.19	ND	ND	4.91	0.00	0.69	0.64	0.00	0.07	0.51	0.00	0.00
	1.92	0.00	0.09	0.75	0.00	0.05	0.21	0.08	0.06	0.27	0.03	0.00
	0.96	0.00	0.09	1.42	0.00	0.14	0.28	0.00	0.03	0.41	0.00	0.08
	1.60	0.00	0.22	0.85	0.02	0.17	0.21	0.16	0.23	0.96	0.00	0.00
	5.34	0.00	0.55	1.56	0.00	0.12	0.32	0.00	0.09	0.85	0.00	0.15
	2.14	0.00	0.09	0.64	0.00	0.08	0.19	ND	ND	0.32	0.00	0.08
	0.37	0.00	0.00	0.19	ND	ND	0.87	0.00	0.14	1.74	0.00	0.16
	0.92	0.00	0.11	0.87	0.00	0.02	0.43	0.00	0.12	0.32	0.00	0.08
	1.28	0.00	0.08	0.64	0.00	0.06	3.42	0.00	0.49	0.46	0.00	0.00
mean	1.56	0.00	0.15	1.21	0.00	0.15	0.68	0.03	0.15	0.64	0.00	0.06
max	5.34	0.00	0.55	4.91	0.02	0.69	3.42	0.16	0.49	1.74	0.03	0.16
min	0.19	0.00	0.00	0.19	0.00	0.02	0.19	0.00	0.03	0.27	0.00	0.00

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

Appendix A.4.–Upper Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.41	0.00	0.00	2.03	0.00	0.14	1.82	0.00	0.27	0.92	0.00	0.11
	0.32	0.00	0.04	0.96	0.00	0.09	0.85	0.01	0.07	1.20	0.00	0.07
	0.96	0.01	0.07	0.75	0.00	0.00	2.94	0.00	0.13	1.52	0.00	0.06
	0.11	0.00	0.00	0.50	0.00	0.03	1.39	0.00	0.12	1.82	0.00	0.15
	2.67	0.00	0.26	2.03	0.00	0.14	2.99	0.00	0.11	0.85	0.00	0.00
	0.28	0.00	0.00	1.07	0.00	0.14	4.59	0.00	0.20	0.64	0.00	0.01
	0.60	0.00	0.12	0.55	0.00	0.02	0.85	0.00	0.01	1.18	0.00	0.07
	1.14	0.00	0.01	1.71	0.00	0.06	2.03	0.00	0.20	0.96	0.00	0.00
	0.53	0.00	0.00	2.14	0.00	0.12	0.85	0.00	0.00	0.64	0.00	0.01
	0.60	0.00	0.02	0.83	0.00	0.00	2.94	0.00	0.20	1.17	0.00	0.12
mean	0.76	0.00	0.05	1.26	0.00	0.07	2.13	0.00	0.13	1.09	0.00	0.06
max	2.67	0.01	0.26	2.14	0.00	0.14	4.59	0.01	0.27	1.82	0.00	0.15
min	0.11	0.00	0.00	0.50	0.00	0.00	0.85	0.00	0.00	0.64	0.00	0.00

mg/m ²	July 2015			July 2016			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.37	0.00	0.08	1.15	0.00	0.07	0.43	0.00	0.00
	0.64	0.00	0.08	8.86	0.00	1.12	1.06	0.00	0.00
	0.64	0.00	0.07	1.52	0.00	0.06	0.64	0.00	0.00
	0.51	0.00	0.06	5.34	0.00	0.93	0.50	0.00	0.03
	0.43	0.00	0.08	2.85	0.00	0.14	0.96	0.00	0.00
	0.55	0.00	0.28	1.01	0.00	0.09	1.17	0.00	0.03
	0.64	0.00	0.02	4.81	0.00	0.40	1.07	0.00	0.14
	0.64	0.00	0.08	2.40	0.16	0.21	0.64	0.00	0.00
	0.69	0.00	0.00	4.49	0.00	0.36	0.32	0.01	0.00
	1.17	0.00	0.13	6.19	0.00	0.79	1.47	0.00	0.23
mean	0.63	0.00	0.09	3.86	0.02	0.42	0.83	0.00	0.04
max	1.17	0.00	0.28	8.86	0.16	1.12	1.47	0.01	0.23
min	0.37	0.00	0.00	1.01	0.00	0.06	0.32	0.00	0.00

Appendix A.5.–Lower Sherman Creek SP1 chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	1.28	0.00	0.05	1.07	0.00	0.14	4.06	0.00	0.38	2.46	0.00	0.30
	5.34	0.00	0.36	2.88	0.87	0.16	5.55	0.00	0.73	0.74	0.00	0.10
	5.98	0.00	0.54	0.41	0.04	0.04	0.24	ND	ND	0.19	0.00	0.00
	3.84	0.10	0.48	2.67	1.27	0.00	4.67	0.00	0.55	0.92	0.00	0.14
	15.59	3.98	0.17	0.60	0.00	0.12	7.69	0.00	0.89	0.83	0.00	0.15
	11.11	2.64	0.28	1.07	0.00	0.11	7.37	0.00	0.62	2.99	0.00	0.47
	19.33	0.00	1.65	3.63	1.56	0.03	0.24	ND	ND	1.39	0.00	0.17
	7.26	0.00	0.74	9.61	4.12	0.08	2.67	0.00	0.35	2.46	0.00	0.25
	1.92	0.04	0.19	2.99	1.43	0.02	0.75	0.03	0.08	0.45	0.01	0.04
	4.38	0.17	0.44	0.43	0.00	0.06	ND	ND	ND	0.96	0.00	0.16
mean	7.60	0.69	0.49	2.54	0.93	0.08	3.69	0.00	0.51	1.34	0.00	0.18
max	19.33	3.98	1.65	9.61	4.12	0.16	7.69	0.03	0.89	2.99	0.01	0.47
min	1.28	0.00	0.05	0.41	0.00	0.00	0.24	0.00	0.08	0.19	0.00	0.00

mg/m ²	July 2015			July 2016			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.28	0.00	0.03	3.31	0.52	0.31	5.02	0.00	0.68
	0.19	ND	ND	4.27	0.00	0.76	5.13	0.00	0.93
	0.92	0.00	0.11	1.39	0.00	0.16	2.35	0.00	0.28
	0.64	0.00	0.01	2.14	0.00	0.37	2.99	0.00	0.40
	2.67	0.00	0.31	2.28	0.00	0.32	4.49	0.00	0.64
	0.79	0.00	0.00	13.24	6.47	0.31	3.84	0.00	0.55
	2.78	0.00	0.32	2.78	0.13	0.23	6.30	0.00	1.05
	0.19	ND	ND	2.24	0.00	0.31	4.06	0.00	0.63
	4.17	0.00	0.49	3.31	0.12	0.35	1.10	0.00	0.05
	1.01	0.00	0.09	2.03	0.20	0.17	3.31	0.00	0.39
mean	1.36	0.00	0.17	3.70	0.74	0.33	3.86	0.00	0.56
max	4.17	0.00	0.49	13.24	6.47	0.76	6.30	0.00	1.05
min	0.19	0.00	0.00	1.39	0.00	0.16	1.10	0.00	0.05

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

Appendix A.6.–Lower Sherman Creek SP2 chlorophylls *a*, *b*, and *c* densities, 2011–2017.

mg/m ²	July 2011			July 2012			July 2013			July 2014		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	3.10	0.00	0.26	1.05	0.04	0.12	1.07	0.00	0.14	0.74	0.00	0.10
	6.30	0.19	0.62	0.64	0.00	0.11	3.84	0.00	0.34	1.38	0.00	0.18
	4.59	0.00	0.38	0.73	0.00	0.07	0.96	0.00	0.15	2.83	0.00	0.15
	0.32	0.00	0.00	0.50	0.07	0.10	4.81	0.00	0.49	3.31	0.00	0.31
	13.88	0.00	0.54	0.34	ND	ND	5.77	0.00	0.78	0.75	0.00	0.06
	7.37	0.00	0.46	0.51	0.00	0.06	0.32	0.02	0.10	0.85	0.03	0.08
	1.50	0.00	0.09	0.96	0.00	0.16	4.70	0.00	0.44	0.85	0.00	0.01
	14.31	0.00	0.59	0.37	0.00	0.00	3.52	0.00	0.35	1.39	0.00	0.16
	0.85	0.00	0.01	1.28	0.00	0.09	0.53	0.00	0.02	0.43	0.01	0.04
	3.84	0.00	0.25	0.34	ND	ND	3.20	0.00	0.43	0.69	0.00	0.07
mean	5.61	0.02	0.32	0.67	0.01	0.09	2.87	0.00	0.32	1.32	0.00	0.12
max	14.31	0.19	0.62	1.28	0.07	0.16	5.77	0.02	0.78	3.31	0.03	0.31
min	0.32	0.00	0.00	0.34	0.00	0.00	0.32	0.00	0.02	0.43	0.00	0.01

mg/m ²	July 2015			July 2016			July 2017		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.69	0.00	0.00	1.50	0.00	0.17	0.75	0.00	0.05
	0.96	0.00	0.00	2.03	0.00	0.30	0.85	0.01	0.07
	0.85	0.00	0.11	0.43	0.00	0.13	0.88	0.00	0.05
	1.28	0.00	0.16	2.98	0.00	0.38	0.69	0.00	0.07
	2.14	0.00	0.24	0.96	0.00	0.09	3.70	0.00	0.46
	3.63	0.65	0.43	1.28	0.04	0.26	0.69	0.00	0.07
	0.96	0.07	0.03	1.71	0.00	0.22	0.64	0.00	0.07
	2.14	0.78	1.30	1.92	0.35	0.16	1.82	0.00	0.20
	1.07	0.00	0.14	0.41	0.00	0.08	0.92	0.00	0.11
	2.46	0.00	0.24	0.96	0.00	0.06	0.55	0.00	0.02
mean	1.62	0.15	0.27	1.42	0.04	0.19	1.15	0.00	0.12
max	3.63	0.78	1.30	2.98	0.35	0.38	3.70	0.01	0.46
min	0.69	0.00	0.00	0.41	0.00	0.06	0.55	0.00	0.02

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

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Lower Slate Creek BMI data summary, 2011–2017.

	5/4/11	5/2/12	4/30/13	4/30/14	4/27/15	4/26/16	4/25/17
Total BMI Taxa	29	32	27	32	26	24	27
Total EPT Taxa	13	17	16	17	13	11	13
Total BMI Counted	1,148	1,760	1,200	2,308	1,901	1,894	730
Ephemeroptera	85	387	400	73	196	225	219
Plecoptera	70	274	203	352	258	61	145
Trichoptera	2	8	6	17	6	3	3
Aquatic Diptera	862	975	503	1,711	1,268	1038	308
Other	129	116	88	155	173	567	55
% Ephemeroptera	7%	22%	33%	3%	10%	12%	30%
% Plecoptera	6%	16%	17%	15%	14%	3%	20%
% Trichoptera	0.2%	0.5%	0.5%	0.7%	0.3%	0.2%	0.4%
% Aquatic Diptera	75%	55%	42%	74%	67%	55%	42%
% Other	11%	7%	7%	7%	9%	30%	8%
% EPT	14%	38%	51%	19%	24%	15%	50%
% Chironomidae	72%	53%	35%	68%	64%	51%	36%
Shannon Diversity Score (H)	0.51	0.69	0.85	0.64	0.70	0.65	0.81
Evenness Score (E)	0.48	0.58	0.70	0.52	0.58	0.57	0.73
Total Sample Area (m ²)	0.558	0.558	0.465	0.558	0.558	0.558	0.558
Mean BMI/m ²	2,057	3,154	2,581	4,136	3,407	3,394	1,308
±1 SD	1,046	1,849	551	3,592	2,458	1,667	436
Terrestrial Invertebrates	0	4	0	1	3	88	1
Juvenile Fish	1	0	0	1	0	0	0

Appendix B.2.—West Fork Slate Creek BMI data summary, 2011–2017.

	5/4/11	5/2/12	4/30/13	4/30/14	4/27/15	4/26/16	4/25/17
Total BMI Taxa	21	31	28	29	28	25	21
Total EPT Taxa	11	21	18	17	16	15	13
Total BMI Counted	280	1,015	1,365	543	1,470	820	494
Ephemeroptera	181	634	991	223	956	564	311
Plecoptera	41	166	233	150	243	55	94
Trichoptera	3	11	10	15	10	10	2
Aquatic Diptera	35	175	118	136	215	151	77
Other	20	29	13	19	46	40	10
% Ephemeroptera	65%	63%	73%	41%	65%	69%	63%
% Plecoptera	15%	16%	17%	28%	17%	7%	19%
% Trichoptera	1%	1%	0.7%	3%	0.7%	1%	0.4%
% Aquatic Diptera	13%	17%	9%	25%	15%	18%	16%
% Other	7%	3%	1%	3%	3%	5%	2%
% EPT	80%	80%	90%	71%	82%	77%	82%
% Chironomidae	10%	15%	7%	22%	12%	18%	14%
Shannon Diversity Score (H)	0.63	0.84	0.73	0.91	0.82	0.72	0.78
Evenness Score (E)	0.78	0.71	0.61	0.79	0.71	0.69	0.78
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	502	1,819	2,446	973	2,634	1,470	885
±1 SD	410	1,009	777	482	1,400	703	592
Terrestrial Invertebrates	2	0	0	0	1	7	0
Juvenile Fish	0	0	0	0	0	0	0

Appendix B.3.—East Fork Slate Creek BMI data summary, 2011–2017.

	5/12/11	4/27/12	4/29/13	4/30/14	4/29/15	4/25/16	4/27/17
Total BMI Taxa	27	33	33	24	28	21	27
Total EPT Taxa	15	17	17	9	16	11	13
Total BMI Counted	2,616	2,585	5,249	1,143	1,792	1,117	3,785
Ephemeroptera	387	490	19	9	274	227	310
Plecoptera	70	73	45	10	36	42	58
Trichoptera	28	23	66	3	14	40	33
Aquatic Diptera	507	547	598	454	633	398	1,281
Other	1,624	1,451	4,521	667	835	410	2,103
% Ephemeroptera	15%	19%	0.4%	0.8%	15%	20%	8%
% Plecoptera	3%	3%	0.9%	0.9%	2%	4%	2%
% Trichoptera	1%	0.9%	1%	0.3%	0.8%	4%	1%
% Aquatic Diptera	19%	21%	11%	40%	35%	36%	34%
% Other	62%	56%	86%	58%	47%	37%	56%
% EPT	19%	23%	2%	2%	18%	28%	11%
% Chironomidae	17%	15%	10%	35%	28%	26%	21%
Shannon Diversity Score (H)	0.64	0.78	0.57	0.70	0.92	0.92	0.62
Evenness Score (E)	0.54	0.61	0.47	0.63	0.72	0.78	0.51
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.465	0.558	0.558
Mean BMI/m ²	4,688	4,633	9,407	2,048	3,854	2,002	6,783
±1 SD	1,081	1,325	3,830	952	837	469	2,365
Terrestrial Invertebrates	3	1	0	0	5	11	0
Juvenile Fish	0	0	0	0	0	0	0

Appendix B.4.–Upper Slate Creek BMI data summary, 2011–2017.

	5/12/11	4/27/12	4/29/13	4/28/14	4/29/15	4/25/16	4/27/17
Total BMI Taxa	33	39	34	36	31	28	30
Total EPT Taxa	18	21	20	20	19	15	19
Total BMI Counted	1,408	1,259	1,607	1,744	2,107	1,338	1,132
Ephemeroptera	368	454	492	622	622	554	460
Plecoptera	401	349	604	429	758	252	172
Trichoptera	116	48	55	44	44	104	62
Aquatic Diptera	248	273	338	518	517	169	406
Other	275	135	118	131	166	259	32
% Ephemeroptera	26%	36%	31%	36%	30%	41%	41%
% Plecoptera	29%	28%	38%	25%	36%	19%	15%
% Trichoptera	8.2%	4%	3%	3%	2%	8%	5%
% Aquatic Diptera	18%	22%	21%	30%	25%	13%	36%
% Other	20%	11%	7%	8%	8%	19%	3%
% EPT	63%	68%	72%	63%	68%	68%	61%
% Chironomidae	15%	20%	19%	28%	22%	11%	34%
Shannon Diversity Score (H)	0.97	1.04	1.02	1.03	0.98	1.06	0.96
Evenness Score (E)	0.76	0.79	0.78	0.76	0.74	0.82	0.73
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	2,523	2,256	2,880	3,125	3,776	2,398	2,029
±1 SD	1,173	1,321	1,049	660	1,174	520	1,143
Terrestrial Invertebrates	1	0	0	1	3	6	3
Juvenile Fish	0	0	0	0	0	0	0

Appendix B.5.—Upper Johnson Creek BMI data summary, 2011–2017.

	5/3/11	4/26/12	4/29/13	4/29/14	4/28/15	4/27/16	4/26/17
Total BMI Taxa	24	28	34	32	28	32	33
Total EPT Taxa	14	14	24	21	17	21	19
Total BMI Counted	2,084	2,214	2,938	1,483	1,556	2,054	1,619
Ephemeroptera	962	1,139	1,680	740	917	1160	651
Plecoptera	114	163	147	217	58	97	113
Trichoptera	59	118	95	68	137	198	54
Aquatic Diptera	619	586	799	407	366	476	773
Other	330	208	217	51	78	123	28
% Ephemeroptera	46%	51%	57%	50%	59%	56%	40%
% Plecoptera	6%	7%	5%	15%	4%	5%	7%
% Trichoptera	3%	5%	3%	5%	9%	10%	3%
% Aquatic Diptera	30%	27%	27%	27%	24%	23%	48%
% Other	16%	9%	7%	3%	5%	6%	2%
% EPT	55%	64%	65%	69%	71%	71%	51%
% Chironomidae	29%	26%	27%	26%	22%	22%	46%
Shannon Diversity Score (H)	0.76	0.81	0.74	0.74	0.87	0.88	0.68
Evenness Score (E)	0.66	0.68	0.59	0.59	0.71	0.70	0.55
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	3,735	3,968	5,265	2,658	2,789	3,681	2,901
±1 SD	1,918	2,305	2,512	2,017	858	1,025	1,056
Terrestrial Invertebrates	1	1	1	4	1	2	6
Juvenile Fish	0	0	0	0	0	0	0

Appendix B.6.–Lower Sherman Creek SP1 BMI data summary, 2011–2017.

	5/4/11	4/30/12	5/1/13	4/29/14	4/28/15	4/27/16	4/26/17
Total BMI Taxa	26	31	28	30	26	26	25
Total EPT Taxa	15	18	16	13	13	13	13
Total BMI Counted	624	1,525	1,002	1,687	921	3,816	563
Ephemeroptera	157	876	499	114	175	101	88
Plecoptera	36	103	135	97	67	41	72
Trichoptera	7.0	14	6	18	6	9	16
Aquatic Diptera	89	160	131	648	326	273	123
Other	335	372	231	810	347	3,392	264
% Ephemeroptera	25%	58%	50%	7%	19%	3%	16%
% Plecoptera	6%	7%	13%	6%	7%	1%	13%
% Trichoptera	1%	0.9%	0.6%	1%	1%	0.2%	3%
% Aquatic Diptera	14%	11%	13%	38%	35%	7%	22%
% Other	54%	24%	23%	48%	38%	89%	47%
% EPT	32%	66%	64%	14%	27%	4%	31%
% Chironomidae	6%	8%	12%	33%	33%	7%	13%
Shannon Diversity Score (H)	0.76	0.74	0.85	0.71	0.84	0.32	0.81
Evenness Score (E)	0.71	0.62	0.71	0.57	0.70	0.27	0.69
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	1,118	2,733	1,796	3,023	1,651	6,839	1,009
±1 SD	1,000	1,410	247	936	718	1,398	168
Terrestrial Invertebrates	1	0	14	1	14	21	1
Juvenile Fish	10	12	0	8	0	77	0

Appendix B.7.–Lower Sherman Creek SP2 BMI data summary, 2011–2017.

	5/3/11	4/30/12	4/30/13	4/29/14	4/28/15	4/27/16	4/26/17
Total BMI Taxa	30	36	39	28	23	23	26
Total EPT Taxa	17	26	25	16	13	13	14
Total BMI Counted	921	1,573	1,889	661	898	1,045	239
Ephemeroptera	548	1,143	1,049	31	163	84	37
Plecoptera	137	77	299	40	47	32	25
Trichoptera	14	26	18	7	13	10	5
Aquatic Diptera	143	254	289	354	315	224	88
Other	79	75	234	229	360	695	84
% Ephemeroptera	60%	73%	56%	5%	18%	8%	15%
% Plecoptera	15%	5%	16%	6%	5%	3%	10%
% Trichoptera	2%	2%	1%	1%	1%	1%	2%
% Aquatic Diptera	16%	16%	15%	54%	35%	21%	37%
% Other	8.6%	4.8%	12%	35%	40%	67%	35%
% EPT	76%	79%	72%	12%	25%	12%	28%
% Chironomidae	11%	15%	14%	48%	33%	20%	24%
Shannon Diversity Score (H)	0.93	0.70	0.84	0.70	0.77	0.53	0.84
Evenness Score (E)	0.76	0.57	0.65	0.62	0.66	0.49	0.80
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	1,651	2,823	3,385	1,185	1,609	1,873	428
±1 SD	927	1,174	1,471	769	748	982	219
Terrestrial Invertebrates	1	2	18	1	10	4	2
Juvenile Fish	0	0	14	0	0	6	0

APPENDIX C: ADULT SALMON DATA

Appendix C.1.–2017 Lower Slate Creek weekly adult pink salmon count by reach.

Stream Reach	7/18/2017		7/24/2017		8/1/2017		8/8/2017		8/15/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-100 m	0	0	0	1	1	1	32	2	126	15
100-200 m	0	0	0	0	0	2	12	0	227	14
200-300 m	0	0	0	1	0	1	84	1	124	8
300-400 m	0	0	0	0	3	0	31	0	ND	ND
400-500 m	0	0	0	0	3	2	65	5	ND	ND
500-600 m	0	0	0	0	0	0	60	4	ND	ND
600-700 m	0	0	0	0	0	0	88	1	ND	ND
700-800 m	0	0	0	0	0	0	13	0	ND	ND
800-900 m	0	0	0	0	0	0	1	0	ND	ND
900-Falls	0	0	0	0	0	0	0	0	ND	ND
Total	0	0	0	2	7	6	386	13	477	37

Stream Reach	8/24/2017		8/29/2017		9/7/2017		9/14/2017		9/26/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-100 m	625	42	850	83	710	102	190	114	0	0
100-200 m	395	34	490	79	340	27	90	67	0	0
200-300 m	370	41	ND	ND	320	44	98	67	0	0
300-400 m	420	40	ND	ND	149	16	62	50	0	0
400-500 m	240	23	ND	ND	83	19	44	17	0	0
500-600 m	210	23	ND	ND	102	21	73	33	0	0
600-700 m	360	21	ND	ND	92	8	12	9	0	0
700-800 m	160	2	ND	ND	15	1	8	2	0	0
800-900 m	38	0	ND	ND	0	0	0	0	0	0
900-Falls	0	0	ND	ND	0	0	0	0	0	0
Total	2,818	226	1,340	162	1,811	238	577	359	0	0

Note : Bold numbers indicate incomplete surveys.

Appendix C.2.–2017 Lower Slate Creek weekly adult chum salmon count by reach.

Stream Reach	7/18/2017		7/24/2017		8/1/2017		8/8/2017		8/15/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-100 m	0	0	0	0	0	0	0	0	0	0
100-200 m	0	0	0	0	0	0	0	0	0	0
200-300 m	0	0	0	0	0	0	0	0	0	0
300-400 m	0	0	0	0	1	0	0	0	ND	ND
400-500 m	0	0	0	0	0	0	0	0	ND	ND
500-600 m	0	0	0	0	0	0	0	0	ND	ND
600-700 m	0	0	0	0	0	0	0	0	ND	ND
700-800 m	0	0	0	0	0	0	0	0	ND	ND
800-900 m	0	0	0	0	0	0	0	0	ND	ND
900-Falls	0	0	0	0	0	0	0	0	ND	ND
Total	0	0	0	0	1	0	0	0	0	0

Stream Reach	8/24/2017		8/29/2017		9/7/2017		9/14/2017		9/26/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-100 m	0	0	0	0	0	0	0	0	0	0
100-200 m	0	0	0	0	0	0	0	0	0	0
200-300 m	0	0	ND	ND	0	0	0	0	0	0
300-400 m	0	0	ND	ND	0	0	0	0	0	0
400-500 m	0	0	ND	ND	0	0	0	0	0	0
500-600 m	0	0	ND	ND	0	0	0	0	0	0
600-700 m	0	0	ND	ND	0	0	0	0	0	0
700-800 m	0	0	ND	ND	0	0	0	0	0	0
800-900 m	0	0	ND	ND	0	0	0	0	0	0
900-Falls	0	0	ND	ND	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0

Note : Bold numbers indicate incomplete surveys.

Appendix C.3.–2017 Lower Slate Creek weekly adult coho salmon count by reach.

Stream Reach	9/26/2017		10/4/2017		10/11/2017		10/20/2017		10/26/2016	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-100 m	0	0	0	0	0	0	0	0	0	0
100-200 m	0	0	0	0	1	0	0	0	0	0
200-300 m	0	0	0	0	0	0	0	0	0	0
300-400 m	0	0	0	0	0	0	0	0	0	0
400-500 m	0	0	0	0	0	0	0	0	1	0
500-600 m	0	0	0	0	0	0	0	0	1	0
600-700 m	0	0	0	1	0	0	1	0	0	0
700-800 m	0	0	1	0	0	0	0	0	0	0
800-900 m	0	0	0	0	0	0	0	0	0	0
900-Falls	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	1	1	0	1	0	2	0

Appendix C.4.–2017 Lower Johnson Creek weekly adult pink salmon count by reach.

Stream Reach	7/18/2017		7/25/2017		8/1/2017		8/8/2017		8/15/2017		8/24/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	0	0	410	0	295	0	150	0	170	10	180	50
Lace-JM	0	0	28	3	430	3	210	0	52	9	360	40
JM-Trap Site	3	0	97	3	550	0	425	0	650	18	1,260	12
Trap-Site #4	100	0	298	2	817	0	400	10	810	55	935	30
Site #4-Site #7	5	0	229	3	392	5	415	10	500	16	595	18
Site #7-Site #10	1	1	121	7	332	10	435	10	510	73	350	20
Site #10-PH	0	0	38	2	345	2	185	25	440	78	330	12
PH-LF	0	0	1	3	50	0	0	6	47	20	0	0
LF-Site #15	0	0	0	3	80	7	50	5	185	45	0	0
Site #15-Falls	0	0	0	0	0	0	2	0	0	0	0	0
Total	109	1	1,222	26	3,291	27	2,272	66	3,364	324	4,010	182

Stream Reach	8/29/2017		9/7/2017		9/14/2017		9/21/2017		9/26/2017		10/4/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	270	0	0	0	3	58	0	49	ND	ND	ND	ND
Lace-JM	910	100	50	12	74	48	15	390	ND	ND	ND	ND
JM-Trap Site	850	50	650	30	218	42	21	170	42	0	0	0
Trap-Site #4	1,275	30	325	32	421	24	200	145	16	0	0	0
Site #4-Site #7	605	30	425	30	238	36	52	65	29	0	0	0
Site #7-Site #10	705	75	225	13	338	20	ND	42	60	0	0	0
Site #10-PH	390	25	50	0	214	21	0	200	9	0	0	0
PH-LF	0	10	25	0	16	12	0	5	0	0	0	0
LF-Site #15	160	5	25	0	61	27	0	4	0	0	0	0
Site #15-Falls	0	0	0	0	4	0	0	2	ND	ND	ND	ND
Total	5,165	325	1,775	117	1,587	288	288	1,072	156	0	0	0

Note : Bold numbers indicate incomplete surveys.

Appendix C.5.–2017 Lower Johnson Creek weekly adult coho salmon count by reach.

Stream Reach	9/26/2017		10/4/2017		10/11/2017		10/20/2017		10/26/2017		11/2/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lace-JM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
JM-Trap Site	0	0	1	0	33	0	0	0	13	0	1	0
Trap-Site #4	0	0	3	0	8	0	0	0	1	0	27	0
Site #4-Site #7	0	0	0	0	4	0	1	0	1	0	4	0
Site #7-Site #10	0	0	0	0	0	0	2	0	1	0	1	0
Site #10-PH	0	0	0	0	7	0	2	0	2	0	4	0
PH-LF	0	0	0	0	0	0	0	0	ND	ND	0	0
LF-Site #15	0	0	0	0	4	0	0	0	ND	ND	1	0
Site #15-Falls	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	0	0	4	0	56	0	5	0	18	0	38	0

Note : Bold numbers indicate incomplete surveys.

Appendix C.6.–2017 Lower Sherman Creek weekly adult pink salmon count by reach.

Stream Reach	7/18/2017		7/25/2017		8/1/2017		8/8/2017		8/15/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	0	0	0	0	0	0	90	16	120	16
50-100 m	0	0	1	0	25	1	76	3	105	27
100-150 m	0	0	0	0	3	3	139	6	225	20
150-200 m	0	0	2	0	20	4	204	16	212	31
200-250 m	0	0	1	0	5	1	95	2	166	11
250-300 m	0	0	0	0	3	0	90	12	126	11
300-350 m	0	0	0	0	3	0	59	3	92	24
350-Falls	0	0	0	0	2	0	25	0	30	0
Total	0	0	4	0	61	9	778	58	1076	140

Stream Reach	8/24/2017		8/29/2017		9/7/2017		9/14/2017		9/21/2017	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	120	21	126	21	149	4	185	26	105	50
50-100 m	73	11	101	29	89	11	59	30	38	52
100-150 m	132	15	153	10	129	11	161	21	103	64
150-200 m	136	20	235	32	152	29	179	36	105	44
200-250 m	120	13	150	23	116	26	85	21	45	37
250-300 m	74	10	84	18	81	51	109	45	57	18
300-350 m	53	5	68	5	58	11	57	8	23	6
350-Falls	22	0	24	0	7	0	6	0	2	0
Total	730	95	941	138	781	143	841	187	478	271

	7/18/2017		7/25/2017		8/1/2017		8/8/2017		8/15/2017	
Stream Reach	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	0	0	0	0	0	0	2	0	4	0
50-100 m	0	0	2	0	0	0	2	0	7	0
100-150 m	0	0	0	0	0	0	10	0	13	0
150-200 m	0	0	0	0	3	0	9	0	19	0
200-250 m	0	0	0	0	1	0	5	0	7	0
250-300 m	0	0	0	0	0	0	3	0	5	0
300-350 m	0	0	0	0	0	0	11	0	7	0
350-Falls	0	0	0	0	1	0	5	0	0	0
Total	0	0	2	0	5	0	47	0	62	0

[illegible]

Appendix C.8.–Lower Slate Creek adult pink salmon count by statistical week, 2011–2017.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017
29	ND	0	0	0	ND	ND	0
30	0	0	7	0	12	0	0
31	0	364	66	2	487	0	7
32	369	1,106	604	14	1,769	1	386
33	763	3,152	864	13	1,783	0	477
34	1,394	2,331	1,199	12	1,543	64	2,818
35	1,646	318	472	0	850	12	1,340
36	1,807	1	97	ND	527	2	1,811
37	229	0	27	ND	575	ND	577
38	46	ND	1	ND	32	ND	ND
39	0	ND	ND	ND	2	ND	0
40	ND	ND	ND	ND	ND	ND	ND

Note : Bold numbers indicate incomplete surveys.

Appendix C.9.–Lower Johnson Creek adult pink salmon count by statistical week, 2011–2017.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017
29	ND	0	59	ND	ND	ND	109
30	1	73	200	44	4,512	0	1,222
31	180	411	2,250	48	568	6	3,291
32	1,891	753	1,456	84	17,517	154	2,272
33	3,850	1,698	1,873	2	19,028	125	3,364
34	5,264	1,816	1,557	11	5,444	15	4,010
35	1,350	198	545	0	2,057	95	5,165
36	3,712	60	149	ND	1,238	33	1,775
37	670	7	97	ND	702	ND	1,587
38	436	0	ND	ND	249	ND	288
39	145	ND	ND	ND	10	ND	155
40	ND	ND	ND	ND	ND	ND	0

Note : Bold numbers indicate incomplete surveys.

Appendix C.10.–Lower Sherman Creek adult pink salmon count by statistical week, 2011–2017.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017
29	ND	0	2	ND	ND	ND	0
30	1	2	164	0	120	0	4
31	298	9	860	6	38	0	61
32	773	97	979	40	348	0	778
33	1,049	285	765	10	723	0	1,076
34	397	521	549	4	334	0	730
35	157	521	785	10	ND	24	941
36	870	145	624	0	413	2	781
37	416	25	232	ND	648	ND	841
38	609	3	21	ND	159	ND	478
39	35	ND	ND	ND	15	ND	ND
40	ND	ND	ND	ND	ND	ND	ND

Note : Bold numbers indicate incomplete surveys.

APPENDIX D: SPAWNING SUBSTRATE DATA

Appendix D.1.–Lower Slate Creek SP1 pink salmon spawning substrate data, 2011–2017.

Sample Date	Sample No.	Volume (mL/L) Retained Each Sieve (mm)								Imhoff	GMPS
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15		
08/17/11	1	0	0	470	260	340	425	225	20	22.0	9.8
08/17/11	2	0	70	460	250	200	280	100	25	8.0	14.0
08/17/11	3	525	280	240	210	290	440	100	70	20.5	12.2
08/17/11	4	0	0	250	340	495	1425	525	55	68.0	5.2
07/09/12	1	1,050	140	140	280	190	395	95	15	24.0	10.6
07/09/12	2	0	0	200	225	140	325	140	15	24.0	8.2
07/09/12	3	0	515	310	225	250	580	240	27	65.0	12.8
07/09/12	4	0	570	510	260	290	750	435	53	54.0	11.8
07/02/13	1	0	400	460	430	320	365	145	25	66.0	15.4
07/02/13	2	0	150	400	250	245	515	225	36	53.0	9.8
07/02/13	3	0	800	325	320	255	445	205	25	60.0	18.0
07/02/13	4	0	275	565	385	245	495	250	19	28.0	13.5
07/01/14	1	600	420	375	225	235	320	165	22	57.0	15.5
07/01/14	2	0	50	350	300	175	225	25	7.5	41.0	14.0
07/01/14	3	0	100	510	465	275	420	250	38	52.0	11.0
07/01/14	4	400	275	260	220	225	375	225	19	51.0	11.2
07/06/15	1	0	75	300	350	325	350	325	70	42.0	8.2
07/06/15	2	0	225	350	400	325	525	300	24	20.5	10.8
07/06/15	3	0	150	475	150	150	200	50	6	6.5	19.6
07/06/15	4	0	275	400	225	275	375	150	16	17.0	14.6
07/05/16	1	0	175	600	300	375	625	100	25	34.0	12.8
07/05/16	2	0	500	375	375	300	700	100	50	26.0	14.6
07/05/16	3	0	275	300	475	725	500	100	25	15.0	12.9
07/05/16	4	0	100	725	250	300	500	125	25	15.0	13.9
07/06/17	1	0	625	400	425	400	600	300	62	47.0	13.7
07/06/17	2	0	550	275	350	250	575	275	44	34.0	13.3
07/06/17	3	0	775	200	325	300	575	175	14	13.0	17.6
07/06/17	4	0	550	325	325	400	525	250	44	25.0	14.0

Appendix D.2.–Lower Slate Creek SP2 pink salmon spawning substrate data, 2011–2017.

Sample Date	Sample No.	Volume (mL/L) Retained Each Sieve (mm)								Imhoff	GMPS
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15		
08/17/11	1	1050	130	305	210	205	350	200	20	11.5	11.0
08/17/11	2	0	120	320	405	335	740	415	85	53.0	7.3
08/17/11	3	0	400	350	295	290	540	200	40	17.5	13.4
08/17/11	4	0	100	450	580	320	390	160	15	25.0	12.8
07/09/12	1	0	250	380	270	260	475	195	23	46.5	11.8
07/09/12	2	600	75	395	295	180	375	135	15	18.5	12.0
07/09/12	3	0	450	340	370	340	590	295	30	18.0	12.8
07/09/12	4	0	0	320	460	285	545	300	28	16.5	8.3
07/02/13	1	0	310	490	440	505	640	410	35	107.5	9.8
07/02/13	2	0	420	270	240	215	560	150	34	42.0	13.1
07/02/13	3	0	550	885	375	290	570	290	45	107.8	15.0
07/02/13	4	0	785	230	340	240	580	330	30	46.5	14.8
07/01/14	1	0	1225	450	495	305	760	300	12	110.0	17.7
07/01/14	2	0	450	250	250	200	300	100	11	65.0	16.5
07/01/14	3	0	850	480	200	175	490	175	30	106.0	18.4
07/01/14	4	0	150	350	200	225	300	120	15	20.0	13.3
07/06/15	1	0	75	175	325	425	475	50	6	5.5	10.7
07/06/15	2	500	825	225	225	175	250	50	11	8.0	28.9
07/06/15	3	300	225	500	200	175	300	50	15	21.5	18.1
07/06/15	4	275	100	200	200	150	225	100	22	9.0	12.2
07/05/16	1	0	300	275	400	350	525	100	25	26.0	13.1
07/05/16	2	0	0	200	600	575	550	150	25	30.0	9.0
07/05/16	3	0	0	100	1150	450	650	100	25	26.0	10.1
07/05/16	4	125	275	575	525	450	475	150	25	39.0	14.3
07/06/17	1	0	0	675	600	550	525	350	82	47.0	9.8
07/06/17	2	0	300	300	650	475	500	375	60	28.0	10.8
07/06/17	3	0	525	450	500	475	400	50	5	3.0	19.7
07/06/17	4	0	375	375	550	475	625	325	58	22.0	11.7

APPENDIX E: SEDIMENT DATA AND LAB REPORTS

Appendix E.1.—Sediment compositions, 2011–2017.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (> 2 mm)				
Lower Slate Creek								
10/03/11	2.0	4.0	94.0	0.4	78.00	3.38	ND	2.04
07/03/12	2.0	0.0	98.0	0.1	79.22	3.37	ND	1.67
07/02/13	2.0	2.0	96.0	0.0	74.57	1.63	ND	1.67
07/28/14	2.3	3.8	91.8	0.9	75.3	3.28	<1.3	0.58
07/06/15	1.8	3.1	72.2	22.8	83.5	ND	<1.2	0.473
07/05/16	0.0	23.1	55.1	21.8	70.3	7.70	<2.5	0.585
07/07/17	1.5	6.9	84.5	7.1	59.6	2.80	<3.2	0.494
East Fork Slate Creek								
10/03/11	10.0	4.0	86.0	1.7	60.17	7.81	ND	11.00
07/10/12	40.0	34.0	26.0	0.0	23.72	28.54	ND	16.70
07/01/13	6.0	12.0	82.0	0.0	43.66	13.30	ND	18.30
07/30/14	3.8	21.1	75.0	0.1	65.5	6.21	<1.5	1.84
07/07/15	2.3	6.9	82.3	8.5	76.2	ND	<1.3	0.792
07/06/16	3.5	24.8	53.7	18.0	21.0	31.40	<6.8	13
07/07/17	34.9	32.2	28.8	4.0	18.9	32.50	<9.0	16.3
Upper Slate Creek								
10/06/11	4.0	2.0	94.0	0.0	72.10	4.12	ND	5.46
07/02/12	2.0	0.0	98.0	0.3	79.58	2.90	ND	3.74
07/01/13	4.0	0.0	96.0	0.2	74.21	2.73	ND	5.50
07/30/14	4.3	8.2	87.5	0.0	72.4	3.88	<1.4	0.87
07/07/15	1.5	0.2	31.9	66.3	76.5	ND	<1.3	1.04
07/06/16	0.0	2.9	73.1	24.0	62.9	5.00	<2.2	2.14
07/07/17	3.0	4.6	89.9	2.5	72.7	3.45	<2.4	0.84
Lower Johnson Creek								
10/03/11	2.0	2.0	96.0	0.0	74.28	2.01	ND	0.89
07/02/12	8.0	0.0	92.0	0.0	77.67	2.55	ND	1.19
07/01/13	2.0	2.0	96.0	0.3	73.21	0.90	ND	1.08
07/30/14	2.9	4.8	91.4	0.2	73.7	1.93	<1.4	0.26
07/06/15	0.4	1.1	41.9	56.6	80.0	ND	<1.3	0.376
08/08/16	5.1	28.1	66.8	0.0	71.9	2.40	<2.5	0.422
07/07/17	4.1	20.8	72.6	2.5	57.6	4.60	<3.3	1.6
Lower Sherman Creek								
10/04/11	2.0	2.0	96.0	0.1	73.15	2.75	ND	0.54
07/03/12	4.0	0.0	96.0	0.1	78.55	3.05	ND	0.82
07/01/13	2.0	2.0	96.0	0.6	75.66	0.75	ND	0.61
07/28/14	3.4	6.5	89.9	0.3	76.7	2.50	<1.3	0.35
07/07/15	1.8	3.0	86.1	9.0	76.2	ND	<1.3	0.399
07/06/16	0.1	0.9	71.2	27.8	80.5	3.10	<2.4	0.322
07/07/17	1.5	5.4	67.04	26.1	76.5	2.00	<2.5	0.288

Appendix E.2.—Sediment element concentrations, 2011–2017

Sample Date	Concentration (mg/kg dry weight)										
	Ag	Al	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Lower Slate Creek											
10/03/11	0.134	13,600	16.2	1.46	29.4	56.7	0.0502	47.4	7.79	0.720	220
07/03/12	0.145	13,600	9.31	1.22	32.0	50.7	0.0994	43.2	8.45	<0.170	200
07/02/13	0.168	12,300	23.7	1.29	94.5	56.7	0.0402	73.4	9.14	1.94	205
07/28/14	0.08	12,000	20.1	1.21	20.0	51.1	0.06	40.8	8.78	1.3	189
07/06/15	0.07	12,000	14.9	0.53	18.9	39.1	0.04	30.0	6.86	0.7	131
07/05/16	0.079	12,800	17.0	0.735	20.4	39.8	0.057	35.2	7.16	1.3	173
07/07/17	0.101	12,000	16.4	0.681	18.3	40.9	<0.031	31.7	8.16	<1.6	145
East Fork Slate Creek											
10/03/11	0.233	20,100	30.0	20.9	29.5	88.4	0.0692	143	8.50	1.41	1,360
07/10/12	0.513	15,300	24.0	23.2	38.9	159.0	0.3270	153	14.2	0.934	1,490
07/01/13	0.334	13,900	42.2	13.9	32.7	73.4	0.0774	79.8	12.5	4.79	844
07/30/14	0.14	13,300	39.1	12.1	14.6	55.7	0.04	85.3	6.94	2.4	812
07/07/15	0.12	12,300	22.3	5.87	15.1	46.7	0.05	46.8	4.48	1.7	333
07/06/16	0.190	16,500	51.5	8.20	16.5	59.5	0.109	86.1	5.54	3.1	634
07/07/17	0.30	12,900	29.9	9.65	15.0	62.3	0.143	69.9	6.61	<5.0	625
Upper Slate Creek											
10/06/11	0.120	22,500	17.9	0.722	127	53.4	<0.0489	87.5	3.37	0.809	130
07/02/12	0.132	20,300	14.4	0.776	125	55.4	0.0625	78.4	4.05	0.606	134
07/01/13	0.131	14,600	13.5	0.750	101	44.6	<0.0380	55.0	2.70	3.21	105
07/30/14	0.06	14,900	19.2	0.69	84.2	45.8	0.03	55.7	2.86	1.8	111
07/07/15	0.08	14,500	14.2	0.76	92.2	47.0	0.11	54.0	3.17	2.3	109
07/06/16	0.092	14,000	18.0	0.507	71.7	37.0	0.051	48.5	2.69	2.1	111
07/07/17	0.060	15,600	17.0	0.490	64.1	38.1	0.030	47.3	3.06	1.4	101
Lower Johnson Creek											
10/03/11	0.164	13,100	16.2	0.238	31.5	73.1	<0.0386	27.3	9.76	<0.181	93.3
07/02/12	0.342	13,100	12.8	0.250	35.5	76.8	0.119	23.4	9.45	<0.167	97.3
07/01/13	0.269	10,300	11.9	0.492	24.4	56.1	<0.0354	15.7	8.00	<0.163	121
07/30/14	0.32	10,300	16.5	0.16	22.2	68.2	0.02	16.9	10.9	<0.5	83.4
07/06/15	0.16	10,900	12.5	0.15	18.1	71.1	<0.02	17.7	8.04	<0.8	79.7
08/08/16	0.574	9,470	13.0	0.150	18.9	76.3	0.020	15.1	8.41	<0.57	65.7
07/06/17	0.172	6,730	10.3	0.115	11.7	46.2	0.064	10.3	5.96	<1.5	48.0
Lower Sherman Creek											
10/04/11	0.137	18,200	28.9	0.389	46.2	94.0	<0.0455	45.9	6.70	<0.178	110
07/03/12	0.289	17,900	24.3	0.578	51.4	79.1	0.0681	40.2	8.43	<0.174	128
07/01/13	0.306	15,400	25.4	0.390	37.4	69.4	<0.0384	30.9	7.39	1.77	111
07/28/14	0.14	14,900	27.9	0.360	33.6	68.4	0.03	31.1	6.97	1.2	119
07/07/15	0.25	17,500	37.0	0.32	30.9	70.8	0.02	38.0	11.0	2.0	134
07/06/16	0.097	13,800	19.9	0.388	27.5	72.5	<0.020	32.9	6.6	1.1	123
07/06/17	0.097	17,400	23.5	0.194	31.8	58.1	0.045	28.5	4.69	<1.3	90.2



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August 28, 2017

Analytical Report for Service Request No: K1707282

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

RE: Coeur AK Biomonitoring

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory July 12, 2017
For your reference, these analyses have been assigned our service request number **K1707282**.

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

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

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager



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Acronyms

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Acronyms

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

Inorganic Data Qualifiers

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

Metals Data Qualifiers

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

Organic Data Qualifiers

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

Additional Petroleum Hydrocarbon Specific Qualifiers

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

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

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjllabs.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/bsdwlabservice.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/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
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ALS ENVIRONMENTAL

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request No.: K1707282
Date Received: 07/12/17

Case Narrative

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

Sample Receipt

Five sediment samples were received for analysis at ALS Environmental on 07/12/17. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

Particle Size Determination by ASTM Method D422:

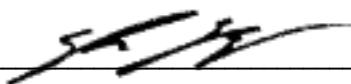
A significant difference exists between the percent passing 75 micron sieve analysis result of 38.73 and the 74 micron hydrometer analysis result of 67.17. Both results should be relatively closer together but the sample contained high concentration of organic matter, wood, which interfered with the hydrometer analysis.

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

Total Metals

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

Approved by _____





Chain of Custody

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PC Shaw

Cooler Receipt and Preservation Form

Client U 7/12/17 Green / Alaska D. of Fish & Wildlife Service Request K17 07282
 Received: 7/12/17 Opened: 7/12/17 By: U Unloaded: 7/12/17 By: U

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

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID	Tracking Number	NA	Filed
<u>1.2</u>	<u>1.1</u>	<u>5.7</u>	<u>5.6</u>	<u>-0.1</u>	<u>364</u>	<u>79923</u>	<u>7871 3344 2665</u>		

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

Sample ID on Bottle	Sample ID on COC	Identified by:

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

Notes, Discrepancies, & Resolutions: _____



Total Solids

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K1707282
Date Collected: 07/06/17 - 07/07/17
Date Received: 07/12/17
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
KGM-USC	K1707282-001	73.1	-	1	07/13/17 09:59	
KGM-EFSC	K1707282-002	18.9	-	1	07/13/17 09:59	
KGM-LSC	K1707282-003	59.6	-	1	07/13/17 09:59	
KGM-LSH	K1707282-004	76.5	-	1	07/13/17 09:59	
KGM-LJC	K1707282-005	57.6	-	1	07/13/17 09:59	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282**Date Collected:** 07/07/17**Date Received:** 07/12/17**Date Analyzed:** 07/13/17**Replicate Sample Summary****Inorganic Parameters****Sample Name:** KGM-USC**Units:** Percent**Lab Code:** K1707282-001**Basis:** As Received

				Duplicate Sample K1707282- 001DUP			
Analyte Name	Analysis Method	MRL	Sample Result	Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	73.1	72.2	72.7	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.



General Chemistry

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K1707282
Date Collected: 07/06/17 - 07/07/17
Date Received: 07/12/17
Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
KGM-USC	K1707282-001	3.30	0.10	1	07/13/17 14:05	
KGM-EFSC	K1707282-002	32.5	0.10	1	07/13/17 14:05	
KGM-LSC	K1707282-003	2.80	0.10	1	07/13/17 14:05	
KGM-LSH	K1707282-004	2.00	0.10	1	07/13/17 14:05	
KGM-LJC	K1707282-005	4.60	0.10	1	07/13/17 14:05	
Method Blank	K1707282-MB	ND U	0.10	1	07/13/17 14:05	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282**Date Collected:** 07/07/17**Date Received:** 07/12/17**Date Analyzed:** 07/13/17**Replicate Sample Summary
General Chemistry Parameters**

Sample Name: KGM-USC
Lab Code: K1707282-001

Units: Percent**Basis:** Dry, per Method

					Duplicate Sample K1707282- 001DUP		
Analyte Name	Analysis Method	MRL	Sample Result	Result	Average	RPD	RPD Limit
Solids, Total Volatile	160.4 Modified	0.10	3.30	3.60	3.45	9	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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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/7/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-USC
Lab Code: K1707282-001

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4" (19.0 mm)	0.0000	99.93
Gravel (9.50 mm)	No.3/8" (9.50 mm)	0.0000	99.93
Gravel, Medium	No.4 (4.75 mm)	0.6444	98.87
Gravel, Fine	No.10 (2.00 mm)	0.8289	97.51
Sand, Very Coarse	No.20 (0.850 mm)	10.6548	79.94
Sand, Coarse	No.40 (0.425 mm)	32.7035	26.01
Sand, Medium	No.60 (0.250 mm)	11.2582	7.44
Sand, Fine	No.140 (0.106 mm)	1.2507	5.38
Sand, Very Fine	No.200 (0.0750 mm)	0.1438	5.14

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	7.60
0.005 mm	2.98
0.001 mm	0.22

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/7/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-EFSC
Lab Code: K1707282-002

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	99.62
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	99.62
Gravel, Medium	No.4 (4.75 mm)	0.1885	98.76
Gravel, Fine	No.10 (2.00 mm)	0.6073	95.99
Sand, Very Coarse	No.20 (0.850 mm)	2.9450	81.97
Sand, Coarse	No.40 (0.425 mm)	1.8157	73.32
Sand, Medium	No.60 (0.250 mm)	1.7592	64.94
Sand, Fine	No.140 (0.106 mm)	4.1075	45.38
Sand, Very Fine	No.200 (0.0750 mm)	1.3948	38.73

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	67.17
0.005 mm	34.93
0.001 mm	15.67

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/7/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-LSC
Lab Code: K1707282-003

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4" (19.0 mm)	0.0000	99.87
Gravel (9.50 mm)	No.3/8" (9.50 mm)	0.0000	99.87
Gravel, Medium	No.4 (4.75 mm)	0.9228	98.20
Gravel, Fine	No.10 (2.00 mm)	2.9257	92.92
Sand, Very Coarse	No.20 (0.850 mm)	12.7776	69.86
Sand, Coarse	No.40 (0.425 mm)	15.0891	42.63
Sand, Medium	No.60 (0.250 mm)	12.6329	19.83
Sand, Fine	No.140 (0.106 mm)	7.7953	5.76
Sand, Very Fine	No.200 (0.0750 mm)	0.6946	4.51

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	8.42
0.005 mm	1.49
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/6/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-LSH
Lab Code: K1707282-004

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4" (19.0 mm)	0.0000	99.22
Gravel (9.50 mm)	No.3/8" (9.50 mm)	0.7809	97.94
Gravel, Medium	No.4 (4.75 mm)	4.3641	90.81
Gravel, Fine	No.10 (2.00 mm)	10.3475	73.89
Sand, Very Coarse	No.20 (0.850 mm)	15.6631	48.54
Sand, Coarse	No.40 (0.425 mm)	12.8319	27.77
Sand, Medium	No.60 (0.250 mm)	7.4910	15.64
Sand, Fine	No.140 (0.106 mm)	6.7232	4.76
Sand, Very Fine	No.200 (0.0750 mm)	0.7955	3.47

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	6.85
0.005 mm	1.46
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/6/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-LJC
Lab Code: K1707282-005

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	99.56
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	99.56
Gravel, Medium	No.4 (4.75 mm)	0.0332	99.49
Gravel, Fine	No.10 (2.00 mm)	1.0291	97.50
Sand, Very Coarse	No.20 (0.850 mm)	3.9245	89.89
Sand, Coarse	No.40 (0.425 mm)	8.9256	72.60
Sand, Medium	No.60 (0.250 mm)	11.2597	50.79
Sand, Fine	No.140 (0.106 mm)	13.8053	24.05
Sand, Very Fine	No.200 (0.0750 mm)	2.5589	19.09

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	24.87
0.005 mm	4.06
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 7/6/2017
Date Received: 7/12/2017
Date Analyzed: 8/22/2017

Particle Size Determination
ASTM D422

Sample Name: KGM-LJC
Lab Code: K1707282-005DUP

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4" (19.0 mm)	0.0000	99.80
Gravel (9.50 mm)	No.3/8" (9.50 mm)	0.0000	99.80
Gravel, Medium	No.4 (4.75 mm)	0.0531	99.67
Gravel, Fine	No.10 (2.00 mm)	0.7049	97.91
Sand, Very Coarse	No.20 (0.850 mm)	2.5402	91.55
Sand, Coarse	No.40 (0.425 mm)	6.6888	74.82
Sand, Medium	No.60 (0.250 mm)	8.6232	53.24
Sand, Fine	No.140 (0.106 mm)	10.8019	26.22
Sand, Very Fine	No.200 (0.0750 mm)	2.1601	20.81

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	35.78
0.005 mm	0.00
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K1707282
Date Collected: 07/06/17 - 07/07/17
Date Received: 07/12/17
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
KGM-USC	K1707282-001	ND U	2.4	1	07/13/17 21:10	7/13/17	
KGM-EFSC	K1707282-002	ND U	9.0	1	07/13/17 21:10	7/13/17	
KGM-LSC	K1707282-003	ND U	3.2	1	07/13/17 21:10	7/13/17	
KGM-LSH	K1707282-004	ND U	2.5	1	07/13/17 21:10	7/13/17	
KGM-LJC	K1707282-005	ND U	3.3	1	07/13/17 21:10	7/13/17	
Method Blank	K1707282-MB	ND U	1.0	1	07/13/17 21:10	7/13/17	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: NA
Date Received: NA
Date Analyzed: 07/13/17

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: Batch QC
Lab Code: K1707052-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	MRL	Sample Result	Duplicate K1707052- 001DUP Result	Triplicate K1707052- 001TRP Result	Average	RSD	RSD Limit
Sulfide, Total	6.4	10.9	13.2	8.7	10.9	20	20

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

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

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

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SuperSet Reference:17-0000429205 rev 00

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: N/A
Date Received: N/A
Date Analyzed: 07/13/17
Date Extracted: 07/13/17

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name: Batch QC
Lab Code: K1707052-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike		Result	Duplicate Matrix Spike		% Rec Limits	RPD	RPD Limit
			Spike Amount	% Rec		Spike Amount	% Rec			
Sulfide, Total	10.9	750	920	80	780	930	82	28-175	3	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Analyzed: 07/13/17
Date Extracted: 07/13/17

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 553505

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1707282-LCS	300	360	85	39-166

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K1707282
Date Collected: 07/06/17 - 07/07/17
Date Received: 07/12/17
Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
KGM-USC	K1707282-001	0.841	0.050	1	07/17/17 13:10	7/17/17	
KGM-EFSC	K1707282-002	16.3	0.050	1	07/17/17 13:10	7/17/17	
KGM-LSC	K1707282-003	0.494	0.050	1	07/17/17 13:10	7/17/17	
KGM-LSH	K1707282-004	0.288	0.050	1	07/17/17 13:10	7/17/17	
KGM-LJC	K1707282-005	1.60	0.050	1	07/17/17 13:10	7/17/17	
Method Blank	K1707282-MB	ND U	0.050	1	07/17/17 13:10	7/17/17	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17
Date Received: 07/12/17
Date Analyzed: 07/17/17

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: KGM-USC
Lab Code: K1707282-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	MRL	Sample Result	Duplicate K1707282- 001DUP Result	Triplicate K1707282- 001TRP Result	Average	RSD	RSD Limit
Carbon, Total Organic (TOC)	0.050	0.841	0.846	0.843	0.843	<1	27

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17
Date Received: 07/12/17
Date Analyzed: 07/17/17
Date Extracted: 07/17/17

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name: KGM-USC
Lab Code: K1707282-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	Sample Result	Matrix Spike K1707282-001MS			Duplicate Matrix Spike K1707282-001DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Carbon, Total Organic (TOC)	0.841	4.16	3.40	98	4.32	3.57	98	69-123	<1	27

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Analyzed: 07/17/17
Date Extracted: 07/17/17

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 553861

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1707282-LCS	0.577	0.603	96	74-118



Metals

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

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17 10:00
Date Received: 07/12/17 10:10

Sample Name: KGM-USC
Lab Code: K1707282-001

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	15700	mg/Kg	2.3	2	07/24/17 16:21	07/13/17	
Arsenic	200.8	17.5	mg/Kg	0.58	5	07/21/17 12:40	07/13/17	
Cadmium	200.8	0.454	mg/Kg	0.023	5	07/21/17 12:40	07/13/17	
Chromium	200.8	61.4	mg/Kg	0.23	5	07/21/17 12:40	07/13/17	
Copper	200.8	36.9	mg/Kg	0.12	5	07/21/17 12:40	07/13/17	
Lead	200.8	3.17	mg/Kg	0.058	5	07/21/17 12:40	07/13/17	
Mercury	7471B	0.028	mg/Kg	0.023	1	07/14/17 09:30	07/13/17	
Nickel	200.8	47.2	mg/Kg	0.23	5	07/21/17 12:40	07/13/17	
Selenium	200.8	1.4	mg/Kg	1.2	5	07/21/17 12:40	07/13/17	
Silver	200.8	0.056	mg/Kg	0.023	5	07/21/17 12:40	07/13/17	
Zinc	200.8	99.7	mg/Kg	0.58	5	07/21/17 12:40	07/13/17	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17 09:00
Date Received: 07/12/17 10:10

Sample Name: KGM-EFSC
Lab Code: K1707282-002

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	12900	mg/Kg	10	2	07/24/17 16:31	07/13/17	
Arsenic	200.8	29.9	mg/Kg	2.5	5	07/21/17 12:50	07/13/17	
Cadmium	200.8	9.65	mg/Kg	0.10	5	07/21/17 12:50	07/13/17	
Chromium	200.8	15.0	mg/Kg	1.0	5	07/21/17 12:50	07/13/17	
Copper	200.8	62.3	mg/Kg	0.50	5	07/21/17 12:50	07/13/17	
Lead	200.8	6.61	mg/Kg	0.25	5	07/21/17 12:50	07/13/17	
Mercury	7471B	0.143	mg/Kg	0.098	1	07/14/17 09:34	07/13/17	
Nickel	200.8	69.9	mg/Kg	1.0	5	07/21/17 12:50	07/13/17	
Selenium	200.8	ND U	mg/Kg	5.0	5	07/21/17 12:50	07/13/17	
Silver	200.8	0.30	mg/Kg	0.10	5	07/21/17 12:50	07/13/17	
Zinc	200.8	625	mg/Kg	2.5	5	07/21/17 12:50	07/13/17	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17 11:00
Date Received: 07/12/17 10:10

Sample Name: KGM-LSC
Lab Code: K1707282-003

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	12000	mg/Kg	3.2	2	07/24/17 16:41	07/13/17	
Arsenic	200.8	16.4	mg/Kg	0.80	5	07/21/17 12:53	07/13/17	
Cadmium	200.8	0.681	mg/Kg	0.032	5	07/21/17 12:53	07/13/17	
Chromium	200.8	18.3	mg/Kg	0.32	5	07/21/17 12:53	07/13/17	
Copper	200.8	40.9	mg/Kg	0.16	5	07/21/17 12:53	07/13/17	
Lead	200.8	8.16	mg/Kg	0.080	5	07/21/17 12:53	07/13/17	
Mercury	7471B	ND U	mg/Kg	0.031	1	07/14/17 09:36	07/13/17	
Nickel	200.8	31.7	mg/Kg	0.32	5	07/21/17 12:53	07/13/17	
Selenium	200.8	ND U	mg/Kg	1.6	5	07/21/17 12:53	07/13/17	
Silver	200.8	0.101	mg/Kg	0.032	5	07/21/17 12:53	07/13/17	
Zinc	200.8	145	mg/Kg	0.80	5	07/21/17 12:53	07/13/17	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Sample Name: KGM-LSH
Lab Code: K1707282-004

Service Request: K1707282
Date Collected: 07/06/17 10:00
Date Received: 07/12/17 10:10

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	17400	mg/Kg	2.6	2	07/24/17 16:43	07/13/17	
Arsenic	200.8	23.5	mg/Kg	0.65	5	07/21/17 12:56	07/13/17	
Cadmium	200.8	0.194	mg/Kg	0.026	5	07/21/17 12:56	07/13/17	
Chromium	200.8	31.8	mg/Kg	0.26	5	07/21/17 12:56	07/13/17	
Copper	200.8	58.1	mg/Kg	0.13	5	07/21/17 12:56	07/13/17	
Lead	200.8	4.69	mg/Kg	0.065	5	07/21/17 12:56	07/13/17	
Mercury	7471B	0.045	mg/Kg	0.025	1	07/14/17 09:38	07/13/17	
Nickel	200.8	28.5	mg/Kg	0.26	5	07/21/17 12:56	07/13/17	
Selenium	200.8	ND U	mg/Kg	1.3	5	07/21/17 12:56	07/13/17	
Silver	200.8	0.097	mg/Kg	0.026	5	07/21/17 12:56	07/13/17	
Zinc	200.8	90.2	mg/Kg	0.65	5	07/21/17 12:56	07/13/17	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/06/17 13:30
Date Received: 07/12/17 10:10

Sample Name: KGM-LJC
Lab Code: K1707282-005

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	6730	mg/Kg	3.1	2	07/24/17 16:46	07/13/17	
Arsenic	200.8	10.3	mg/Kg	0.77	5	07/21/17 13:00	07/13/17	
Cadmium	200.8	0.115	mg/Kg	0.031	5	07/21/17 13:00	07/13/17	
Chromium	200.8	11.7	mg/Kg	0.31	5	07/21/17 13:00	07/13/17	
Copper	200.8	46.2	mg/Kg	0.15	5	07/21/17 13:00	07/13/17	
Lead	200.8	5.96	mg/Kg	0.077	5	07/21/17 13:00	07/13/17	
Mercury	7471B	0.064	mg/Kg	0.033	1	07/14/17 09:42	07/13/17	
Nickel	200.8	10.3	mg/Kg	0.31	5	07/21/17 13:00	07/13/17	
Selenium	200.8	ND U	mg/Kg	1.5	5	07/21/17 13:00	07/13/17	
Silver	200.8	0.172	mg/Kg	0.031	5	07/21/17 13:00	07/13/17	
Zinc	200.8	48.0	mg/Kg	0.77	5	07/21/17 13:00	07/13/17	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Sample Name: Method Blank
Lab Code: KQ1709629-01

Service Request: K1707282
Date Collected: NA
Date Received: NA

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	ND U	mg/Kg	2	2	07/24/17 16:17	07/13/17	
Arsenic	200.8	ND U	mg/Kg	0.5	5	07/21/17 12:33	07/13/17	
Cadmium	200.8	ND U	mg/Kg	0.020	5	07/21/17 12:33	07/13/17	
Chromium	200.8	ND U	mg/Kg	0.20	5	07/21/17 12:33	07/13/17	
Copper	200.8	ND U	mg/Kg	0.10	5	07/21/17 12:33	07/13/17	
Lead	200.8	ND U	mg/Kg	0.05	5	07/21/17 12:33	07/13/17	
Nickel	200.8	ND U	mg/Kg	0.20	5	07/21/17 12:33	07/13/17	
Selenium	200.8	ND U	mg/Kg	1.0	5	07/21/17 12:33	07/13/17	
Silver	200.8	ND U	mg/Kg	0.020	5	07/21/17 12:33	07/13/17	
Zinc	200.8	ND U	mg/Kg	0.5	5	07/21/17 12:33	07/13/17	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Sample Name: Method Blank
Lab Code: KQ1709462-01

Service Request: K1707282
Date Collected: NA
Date Received: NA

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	1	07/14/17 08:25	07/13/17	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17
Date Received: 07/12/17
Date Analyzed: 07/21/17 - 07/24/17

Replicate Sample Summary**Total Metals**

Sample Name: KGM-USC
Lab Code: K1707282-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample KQ1709629-03		Average	RPD	RPD Limit
				Result	Result			
Aluminum	200.7	2.3	15700	15400	15600	15600	2	30
Arsenic	200.8	0.57	17.5	16.5	17.0	17.0	6	30
Cadmium	200.8	0.023	0.454	0.526	0.490	0.490	15	30
Chromium	200.8	0.23	61.4	66.8	64.1	64.1	8	30
Copper	200.8	0.11	36.9	39.2	38.1	38.1	6	30
Lead	200.8	0.057	3.17	2.95	3.06	3.06	7	30
Nickel	200.8	0.23	47.2	47.4	47.3	47.3	<1	30
Selenium	200.8	1.1	1.4	1.4	1.4	1.4	<1	30
Silver	200.8	0.023	0.056	0.063	0.060	0.060	10	30
Zinc	200.8	0.57	99.7	103	101	101	3	30

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282**Date Collected:** 07/07/17**Date Received:** 07/12/17**Date Analyzed:** 07/14/17**Replicate Sample Summary****Total Metals****Sample Name:** KGM-USC**Units:** mg/Kg**Lab Code:** K1707282-001**Basis:** Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
				KQ1709462-13 Result			
Mercury	7471B	0.023	0.028	0.031	0.030	12	20

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17
Date Received: 07/12/17
Date Analyzed: 07/21/17 - 07/24/17

Matrix Spike Summary
Total Metals

Sample Name: KGM-USC
Lab Code: K1707282-001

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1709629-04

Analyte Name	Method	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.7	15700	14800	505	-178 #	70-130
Arsenic	200.8	17.5	136	126	94	70-130
Cadmium	200.8	0.454	13.1	12.6	101	70-130
Chromium	200.8	61.4	115	50.5	106	70-130
Copper	200.8	36.9	104	63.1	107	70-130
Lead	200.8	3.17	128	126	99	70-130
Nickel	200.8	47.2	168	126	96	70-130
Selenium	200.8	1.4	123	126	97	70-130
Silver	200.8	0.056	12.4	12.6	98	70-130
Zinc	200.8	99.7	231	126	104	70-130

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Collected: 07/07/17
Date Received: 07/12/17
Date Analyzed: 07/14/17
Date Extracted: 07/13/17

**Matrix Spike Summary
Total Metals**

Sample Name: KGM-USC
Lab Code: K1707282-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

**Matrix Spike
KQ1709462-14**

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Mercury	0.028	0.599	0.570	100	80-120

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

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

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

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QA/QC Report

Client: Alaska Department of Fish and Game

Project: Coeur AK Biomonitoring

Sample Matrix: Sediment

Service Request: K1707282

Date Analyzed: 07/24/17

Lab Control Sample Summary

Total Metals

Units:mg/Kg

Basis:Dry

Lab Control Sample

KQ1709629-05

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.7	6530	7930	82	39-161

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Analyzed: 07/21/17

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1709629-05

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	200.8	101	98.5	102	69-145
Cadmium	200.8	151	146	104	73-127
Chromium	200.8	181	182	99	71-130
Copper	200.8	104	106	98	75-125
Lead	200.8	135	130	104	72-127
Nickel	200.8	144	149	97	73-127
Selenium	200.8	157	154	102	68-132
Silver	200.8	43.0	40.9	105	66-134
Zinc	200.8	185	191	97	70-130

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1707282
Date Analyzed: 07/14/17

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1709462-05

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	8.22	7.10	116	51-149