Teck

Teck Coal
Environment Office
Bag Service 2000, 421 Pine Avenue
Sparwood, B.C. Canada V0B 2G0

+1 250 425 3352 Tel
www.teck.com

Technical Report Overview

Report: Koocanusa Reservoir Monitoring Program Annual Data Summary Report - 2020

Overview: This annual report provides an overview of the environmental monitoring activities that were conducted in 2020 in the Canadian portion of Koocanusa Reservoir and a summary of the associated results. This report is required under Permit 107517.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
- Email **feedbackteckcoal@teck.com**

Future studies will be made available at **teck.com/elkvalley**

minnow environmental inc.
A Trinity Consultants Company

Koocanusa Reservoir Monitoring Program Annual Data Summary Report - 2020

Prepared for:
Teck Coal Limited
Sparwood, British Columbia

Prepared by:
Minnow Environmental Inc.
Georgetown, Ontario

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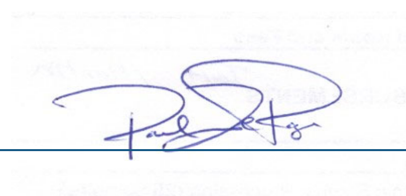
Koocanusa Reservoir Monitoring Program Annual Summary Report – 2020

Heidi Currier, Ph.D., R.P.Bio.
Project Manager

Paul LePage, M.Sc.
Senior Project Advisor



EXECUTIVE SUMMARY

The Koocanusa Reservoir Monitoring Program was conducted in 2020 to assess spatial differences in physico-chemical and biological conditions in Koocanusa Reservoir. In accordance with this monitoring program and conditions of British Colombia Ministry of Environment and Climate Change Strategy (ENV) Permit 107517 (Section 10.8), this annual report provides an overview of the environmental monitoring activities conducted in Koocanusa Reservoir, together with a summary of the associated results. The principal findings from the Koocanusa Reservoir Monitoring Program in 2020 are summarized below.

Water Quality

The Order constituents (dissolved cadmium, nitrate, selenium, and sulphate), as well as the non-order constituents selected for assessment, had monthly average concentrations below or equal to applicable BC water quality guidelines and applicable site performance objectives (SPOs) throughout 2020 at all of the permitted water quality stations. Productivity assessment indicated annual median N:P ratios were consistently 15 or more throughout the water column at all permitted water quality stations in 2020, and thus indicative of phosphorous limitation. Trophic status classification suggest Koocanusa Reservoir was primarily oligotrophic most of the year based on assessment using total phosphorous and chlorophyll-a concentrations, whereas assessment using Secchi depth indicated eutrophic conditions in spring and early summer, followed by mesotrophic conditions. Assessment based on total nitrogen concentrations suggested the reservoir was mesotrophic for the entire year except at RG_ELKMOUTH, which was classified as eutrophic. The seasonal variability in the trophic status of the reservoir in 2020 was consistent with annual patterns shown in previous years, and may be reflective of the rapid changes in reservoir water levels that take place from April to June during freshet.

Monthly loadings of nitrate and selenium from the Elk River to the reservoir were highest from May to July, with the peak coinciding with freshet in June. In the Kootenay River, May to July also showed the highest loadings for nitrate and selenium to the reservoir, with the peak nitrate loadings occurring in May and the peak selenium loadings occurring in June. Loadings of both nitrate and selenium to Koocanusa Reservoir were higher from the Elk River than from the Kootenay River on both a monthly and annual timescale.

Elk River mixing assessment indicated that during April and June under low- and mid-pool conditions, respectively, flow from the Elk River remained largely confined to the eastern half of the reservoir. Under full-pool conditions in August, flow from the Elk River occurs along the bottom of the water column in the reservoir arm that receives flow from the river, but then largely remains within the eastern half of the reservoir suspended approximately mid-water column in the main basin of the reservoir extending as far downstream as the border with Montana. Overall, the results of the 2020 mixing assessment were similar to conditions previously observed in 2018 and 2019.

Sediment Quality

Sediment both downstream and upstream of the Elk River was primarily composed of silt-sized material and lesser amounts of clay-sized material. A significantly higher proportion of clay was indicated in sediment downstream of the Elk River compared to upstream, however no differences in proportions of sand-sized, silt-size, or total organic content material were indicated between areas. Arsenic, iron, manganese, and nickel concentrations in sediment were elevated above the lower working sediment quality guidelines (WSQG) at three or more stations downstream of the Elk River, but because concentrations of these metals were also above WSQG at the upstream area suggests there is a high background concentration. Several metals and polycyclic aromatic hydrocarbons (PAHs) occurred at significantly higher concentrations in sediment downstream of the Elk River compared to upstream in 2020. Concentrations of metals, and PAHs in sediment at the downstream and upstream areas in 2020 were within ranges shown at each respective study area in previous years suggesting no significant changes in concentrations over time at either study area.

Concentrations of selenium in suspended sediment monitored at RG_DSELK was highest in September of 2020 compared to June and July. The September selenium concentration in suspended sediment was within the range of values previously observed at RG_DSELK but were higher than those observed downstream in the Montana portion of the reservoir in 2020.

Zooplankton Community and Tissue Chemistry

In June 2020, higher density, biomass, richness, density of the major groups (Rotifera, Copepoda, and Cladocera), relative abundance of Rotifera, and biomass (both actual and relative) of Copepoda and Rotifera were observed downstream of the Elk River compared to upstream. Conversely, relative abundance of Copepoda and relative biomass of Cladocera were lower downstream. In August 2020, higher total biomass, and actual and relative Copepoda density and biomass, but lower relative abundance and biomass of Rotifera and relative biomass of Cladocera, were observed downstream compared to upstream. Qualitative comparisons of changes over time (based on August data) suggested that density, richness, Rotifera abundance (both actual and relative), and relative Rotifera biomass may have decreased over time at both the downstream and upstream areas. No clear directional change in overall biomass was observed at either area. These differences over time, however, need to take into consideration that sampling methods changed in 2018 to evaluate community over the entire water column as opposed to the top 10 m measured previously from 2014 to 2016.

Zooplankton tissue selenium concentrations were elevated above the BC chronic interim guideline both downstream and upstream of the Elk River in June, but not in August, of 2020. There were no differences in selenium concentrations in zooplankton observed between areas downstream and upstream in either June or August, but concentrations were higher in June than in August for both areas. Temporally, zooplankton tissue selenium concentrations in June of 2020 were higher than observed in 2018 and 2019, whereas concentrations in August of 2020 were comparable to those reported previously at both the downstream and upstream areas from the Elk River.

Benthic Invertebrate Tissue

The benthic invertebrate tissue selenium concentration in the sample collected downstream of the Elk River was elevated above the Elk Valley Water Quality Plan (EVWQP) Level 1 Invertebrate benchmark, and the concentration in the sample collected upstream of the Elk River was elevated relative to the BC guideline, based on sampling conducted in April 2020. In August 2020, the selenium concentration in benthic invertebrate tissue collected downstream of Elk River was elevated above the EVWQP Level 1 benchmark for dietary effects to juvenile fish. Selenium concentrations in benthic invertebrate tissue were higher downstream compared to upstream of the Elk River in 2020, and were higher downstream in both spring and summer than previously observed during the same time period in previous years. Benthic invertebrate tissues collected from the Montana portion of the reservoir (Rexford) had lower selenium concentrations than observed downstream of the Elk River in the Canadian portion of the reservoir in 2020.

Fish Tissue Chemistry

Mean selenium concentrations in muscle tissue of all forage fish (peamouth chub [PCC] and redside shiner [RSC]) and all sport fish were below the applicable BC fish muscle tissue guideline or United States Environmental Protection Agency (US EPA) criterion at all Canadian and Montana study areas in 2020. Peamouth chub and redside shiner captured downstream showed significantly higher muscle selenium concentrations than upstream in 2020, but all concentrations were lower than guidelines and therefore the differences are not expected to be ecologically significant.

Gonadosomatic indices of PCC and RSC sampled in 2020 were well below values indicative of spawning condition (>10%), and thus elevated concentrations of selenium in their ovaries was unlikely to reflect an impairment to the reproduction of either of these species as intended by the guidelines. Ovary selenium concentrations in PCC and RSC were elevated relative to guidelines and benchmarks, however, results were ultimately interpreted with caution.

Redside Shiner Recruitment

All RSC captured at areas located downstream and upstream of the Elk River in the Canadian portion of the reservoir in 2020 were young-of-year (YOY), indicating successful recruitment had occurred at all study areas. The catch-per-unit-effort (CPUE) of RSC was higher at both downstream areas compared to the upstream area in 2020, which contrasted with lower CPUE at the downstream areas relative to the upstream area in 2018 and 2019. The RSC YOY captured at Elk River and Gold Creek study areas had significantly lower and higher condition, respectively, than those sampled upstream at Sand Creek, but the magnitudes of these difference were within the critical effect size of ±10% for condition suggesting these differences are unlikely to be ecologically meaningful. Inconsistent differences and/or direction of differences in RSC YOY condition were indicated at the downstream areas compared to the upstream area over time, suggesting that no effects to RSC YOY condition were associated with exposure to Elk River waters.

Conclusion

This annual summary report provides an overview of environmental monitoring activities conducted in the Canadian and US portions of Koocanusa Reservoir, along with the associated results, from 2020. The next anticipated annual summary report will cover data from 2021 will be due to ENV in June 2022. Data collected from 2020 to 2022 will be used to address key questions related to changes over time, and will be presented in the three-year interpretive report due to ENV in December 2023.

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ACRONYMS AND ABBREVIATIONS

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

ANCOVA – Analysis of Covariance

BAL – Brooks Analytical Laboratory

BC – British Columbia

BCMOE – British Columbia Ministry of Environment

BCWQG – British Columbia Water Quality Guidelines

BT – Bull Trout

CES – Critical Effect Size

CPUE – Catch-Per-Unit-Effort

CRM – Certified Reference Material

DELT - Deformities, Erosions, Lesions, and Tumors

DO – Dissolved Oxygen

DS – Downstream

DSS – Digital Sampling Sensor

dw – Dry Weight

EEM – Environmental Effects Monitoring

EMC – Environmental Monitoring Committee

ENV – British Columbia Ministry of Environment and Climate Change Strategy (formerly BCMOE)

EVWQP – Elk Valley Water Quality Plan

EWT – Early Warning Trigger

GEI – GEI Consultants

GPS – Global Positioning System

GSI – Gonadosomatic Index

HR-ICP-MS – High Resolution Inductively Coupled Plasma Mass Spectrometry

HSD – Honestly Significant Difference

ICP-MS - Inductively Coupled Plasma Mass Spectrometry

Ind/L – Individuals per Litre

IS – Independent Scientist

K-M – Kaplan-Meier

KNC – Ktunaxa Nation Council

KO - Kokanee

KS – Kolmogorov-Smirnov

LA-ICPMS - Laser Ablation Inductively Coupled Plasma Mass Spectrometry

LEL – Lowest Effect Level

LPL – Lowest Practical Level

LRL – Laboratory Reporting Limit

LSS – Largescale Sucker

MAD – Median Absolute Deviation

MCT – Measure of Central Tendency

MFWP - Montana Fish, Wildlife, and Parks

MOD – Magnitude of Difference

MT DEQ – Montana Department of Environmental Quality

MU – Management Unit

MWF – Mountain Whitefish

NMDS – Non-metric Multi-dimensional Scaling

N:P – Nitrogen to Phosphorous Ratio

NSC – Northern Pikeminnow

PAH – Polycyclic Aromatic Hydrocarbon

PCC – Peamouth Chub

PEL – Probable Effect Level

QAPP – Quality Assurance Project Plan

QA/QC – Quality Assurance / Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

RBT – Rainbow Trout

RSC – Redside Shiner

SD – Standard Deviation

SEL – Severe Effect Level

SPO – Site Performance Objective

SRC – Saskatchewan Research Council

TDS – Total Dissolved Solids

TEL – Threshold Effect Level

TOC – Total Organic Carbon

Trich – TrichAnalystics Inc.

TSI – Trophic Status Index

TSS – Total Suspended Solids

US ACE – United States Army Corps of Engineers

US EPA – United States Environmental Protection Agency

UTM – Universal Transverse Mercator

WCT – Westslope Cutthroat Trout

WSC – Water Survey of Canada

WSQG – Working Sediment Quality Guidelines

ww – Wet Weight

YOY – Young-of-the-year

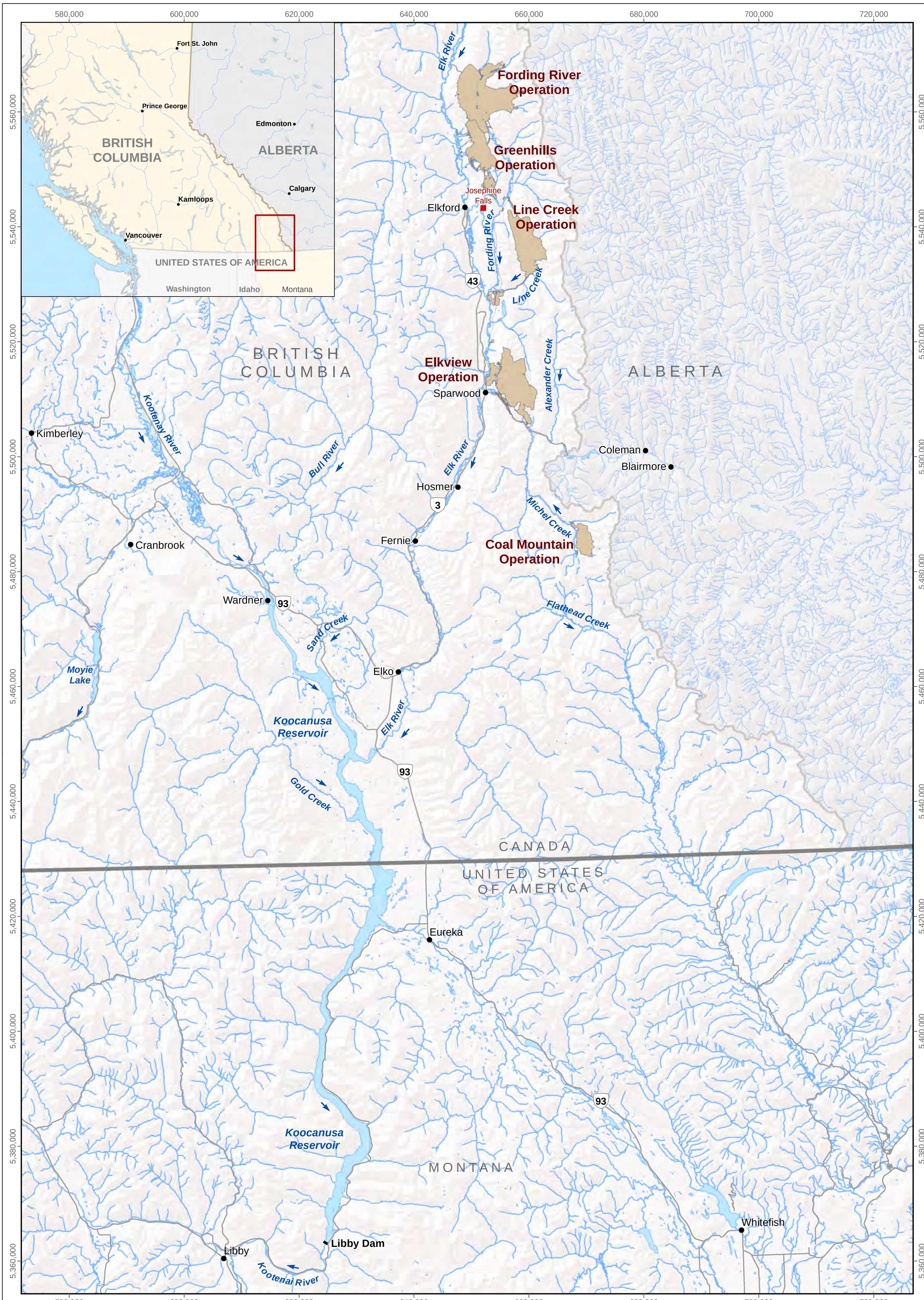
YP – Yellow Perch

1 INTRODUCTION

1.1 Background

Teck Coal Limited (Teck) owns and operates five steelmaking coal mines within the Elk River watershed of southeastern British Columbia (BC; Figure 1.1). From its headwaters near Elk Lakes, the Elk River flows southwesterly into Koocanusa Reservoir approximately 20 kilometres (km; 12 miles) upstream from the border between Canada and the United States (US). Koocanusa Reservoir was created by the construction of Libby Dam in Montana and is operated by the United States Army Corps of Engineers (US ACE) to provide flood protection, hydroelectric power, and recreational benefits. At full pool, the reservoir is 155 km (96 miles) in length, approximately 68 km (42 miles) of which occurs within Canada and the remaining 87 km (54 miles) within the United States (Figure 1.1). In addition to the Elk River, the Kootenay (Kootenai) and Bull rivers supply the majority of inflow to the reservoir (26%, 62%, and 11%, respectively, of mean annual inflow; Woods 1982; Hamilton et al. 1990). Water levels within Koocanusa Reservoir are generally lowest in late winter/early spring (March through May) and highest in summer/early fall (August and September). The normal annual pool fluctuation of the reservoir is about 25 metres (m). At maximum drawdown, a reduction in reservoir total length up to 53%, volume up to 85%, mean depth up to 51%, and total surface area up to 69% generally occurs, with the largest relative changes occurring in the Canadian portion of the reservoir (Hamilton et al. 1990). This results in riverine conditions during low-pool for the section of the reservoir that extends to just below Gold Creek.

In 2014, the Elk Valley Water Quality Plan (EVWQP) was developed and served as the basis for the issuance of Permit 107517 ('the Permit') from the British Columbia Ministry of Environment and Climate Change Strategy (ENV). The Permit specifies water quality limits and site performance objectives (SPOs) for monitoring stations located downstream from the mines and the requirement to implement a Regional Aquatic Effects Monitoring Program (RAEMP). Overarching objectives of the RAEMP are to monitor, assess, and interpret indicators of aquatic ecosystem condition related to mine operations, and to inform adaptive management relative to expectations established in approved plans for mine development and the Permit at each of six management units (MUs). These objectives are consistent with the Koocanusa Reservoir (MU6) Monitoring Program and are used to inform adaptive management relative to expectations established in approved plans for mine development and in the Permit. In accordance with the Permit and the RAEMP, annual monitoring programs were designed, approved by ENV, and implemented for Koocanusa Reservoir beginning in 2013, which was followed by the development of a comprehensive three-year monitoring program referred to as the Koocanusa Reservoir Monitoring Program and implemented each year from 2015 to 2017 (Minnow 2014, 2015a, 2016).



LEGEND

- Libby Dam
- Teck Coal Mine Operation

Location of Teck Coal Mine Operations Relative to Koocanusa Reservoir

0 10 20 40
km

N W E S

Projection: North American Datum 1983 UTM Zone 11
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2021
Project 207202.0012

minnow environmental inc.

Figure 1.1

Document Path: C:\Users\chada\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\June Map Updates\20-12 Figure 1.1 Teck Coal Limited Operation USA.mxd

The second cycle of the three-year monitoring program was implemented from 2018 to 2020 (Minnow 2018a,b, 2019). Together, these programs are used to assess whether physico-chemical and biological conditions in Koocanusa Reservoir differ downstream compared to upstream of the Elk River confluence within the Canadian portion of the reservoir, and whether these conditions are changing over time. Questions specific to the evaluation of potential mine-related effects in the Canadian portion of the reservoir developed for the monitoring program include:

- Are concentrations of mine-related water quality constituents different downstream of the Elk River compared to upstream?
- Are concentrations of key mine-related water quality constituents (i.e., nitrate, selenium, sulphate, and cadmium) changing over time, are the changes consistent with projections, and are concentrations below respective guidelines and SPOs?
- Is productivity (based on nutrient concentrations in water) different downstream of the Elk River compared to upstream and is productivity changing over time?
- Are concentrations of mine-related constituents in sediment that benthic invertebrates are exposed to different downstream of the Elk River compared to upstream and are concentrations changing over time?
- Do phytoplankton, zooplankton, and/or benthic invertebrate community structure differ downstream of the Elk River compared to upstream, and are the differences changing over time?
- Are selenium concentrations in zooplankton different downstream of the Elk River compared to upstream, and are the differences changing over time?
- Are selenium concentrations in benthic invertebrates greater than guidelines or effect thresholds, do they differ downstream of the Elk River compared to upstream, and are the differences changing over time?
- Is fish health different downstream of the Elk River compared to upstream, and are differences in fish health endpoints changing over time?
- Are there differences in fish recruitment downstream of the Elk River compared to upstream?
- Are selenium concentrations in fish tissue greater than guidelines or effect thresholds, do they differ downstream of the Elk River compared to upstream, and are the differences changing over time?

The Koocanusa Reservoir Monitoring Program was designed with technical advice and input from an Environmental Monitoring Committee (EMC)[1], whose role includes review of submissions and provision of technical advice and input to Teck and the ENV Director as a condition under the Permit. In the most recently amended version of the Permit (April 4, 2019; Section 10.8), requirements outlined for the Koocanusa Reservoir Monitoring Program were expanded to include:

> *"The Permittee must prepare on an annual basis a report summarizing activities and monitoring results. The report must be submitted to the Lake Koocanusa Monitoring and Research Working Group (Lake Koocanusa Working Group) and the EMC by June 30 of each year."*

Accordingly, this report provides an overview of environmental monitoring activities conducted in the Canadian and US portions of Koocanusa Reservoir, along with the associated results, from 2020. For cases in which US data were excluded from the analyses, a technical rationale is provided. In this annual data report, results from 2020 are presented and spatially compared between areas located downstream and upstream of the Elk River confluence. Questions related to assessment of changes occurring over time are addressed in the three-year interpretive reports (e.g., Minnow 2016, 2020). Based on the final Koocanusa Reservoir Study Design acceptance letter (ENV 2018), additional data collection and analyses conducted in 2020 included a summary of selenium and nitrate loadings to the reservoir, turbidity measurements with all *in situ* profiles, selenium concentration assessment in suspended sediment at Order station RG_DSELK, and collection of additional zooplankton samples in June to assess seasonal changes.

1.2 Linkages to Teck's Adaptive Management Plan

As required in the Permit's Section 11, Teck has developed an Adaptive Management Plan (AMP) to support implementation of the EVWQP in achieving water quality and calcite targets, protect human health and the environment, and facilitate continuous improvement of water quality in the Elk Valley (Teck 2018a). Following an adaptive management framework, the AMP identifies six Management Questions that are re-evaluated with each AMP update. The AMP also identifies key uncertainties that need to be reduced to fill gaps in current understanding and support achievement of the EVWQP objectives. No adaptive management response was required in 2020 based on the results discussed herein.

[1] The EMC consists of representatives from Teck, ENV, the Ministry of Energy and Mines, the Ktunaxa Nation Council (KNC), Interior Health Authority, and an Independent Scientist (IS).

2 METHODS

2.1 General Overview

The Koocanusa Reservoir Monitoring Program was designed for the Canadian portion of the reservoir to evaluate changes in water quality, sediment quality, and/or biota in the reservoir downstream relative to upstream of the Elk River confluence, and whether any identified changes can be attributed to influences from mining activities within the Elk River watershed. To address the study questions described in Section 1.1, the 2020 Koocanusa Reservoir Monitoring Program included evaluation of the following components:

- Water quality (physical and chemical);
- Elk River mixing assessment;
- Sediment quality (physical and chemical);
- Zooplankton (community and tissue);
- Benthic invertebrate tissue; and
- Fish recruitment assessment and tissue.

The objectives of this annual monitoring report were to provide an overview of environmental monitoring activities conducted in 2020 in the Canadian portion of Koocanusa Reservoir (Table 2.1), and where applicable, supplement these results with data from the Montana portion of the reservoir. Data analyses included statistical evaluations to identify potential differences in key endpoints between areas located downstream and upstream of the Elk River confluence, and qualitative comparisons to results from previous years of monitoring. Field sampling was conducted during two spring sampling events and one late summer sampling event (Table 2.2). During the initial spring sampling event conducted April 20th to 25th, water quality, sediment quality, benthic invertebrate tissue, fish health, fish tissue sampling, and specific conductance and turbidity vertical profiling (i.e., Elk River mixing assessment) were completed. The second spring sampling event, conducted June 15th to 19th, included water quality, Elk River mixing assessment, large volume suspended sediment, zooplankton tissue and community, and fish tissue sampling. The late summer sampling event, conducted August 18th to 23rd, included water quality, Elk River mixing assessment, sediment quality, zooplankton community and tissue, benthic invertebrate tissue, and fish tissue and recruitment sampling. In addition, one large volume suspended sediment sampling event was conducted on September 28th.

To the extent possible, sampling locations used in 2020 were in the same vicinity as those used in previous monitoring programs (2014 to 2016; Minnow 2018a,b; Minnow 2019; Minnow 2020)

Table 2.1: Summary of Receptors, Assessment Endpoints, Measurement Endpoints, and Evaluation Criteria for the Koocanusa Reservoir Monitoring Program, 2018 to 2020

Receptor Group	Focal Species (if Relevant)	Assessment Endpoint	Measurement Endpoint	Evaluation Criteria	Indicator Type
All	Not specific	Not specific	Sediment chemistry	Comparison of results relative to guidelines, between downstream and upstream of the Elk River, and to past observations	Indirect
			Water chemistry	Comparison of concentrations of mine-related constituents relative to SPOs and guidelines, nutrients relative to trophic classifications, between downstream and upstream of the Elk River, and to past observations	Indirect
Phytoplankton and Zooplankton	Not applicable	Abundance and assemblage	Density Richness Biomass Major community group	Comparison of results between downstream and upstream of the Elk River and to past observations	Direct
			Tissue selenium concentrations	Comparison of results relative to guidelines and effect benchmarks, between downstream and upstream of the Elk River, and to past observations	Indirect
Benthic Invertebrates	Not applicable	Abundance and assemblage	Density Richness Major community group	Comparison of results between downstream and upstream of the Elk River and to past observations	Direct
			Tissue selenium concentrations	Comparison of results relative to guidelines and effect benchmarks, between downstream and upstream of the Elk River, and to past observations	Indirect
Fish	Peamouth chub and redside shiner	Population health assessment	Survival (age) Growth (body weight against age) Reproduction (gonad weight against body weight) Energy storage (condition - body weight against length and liver weight against body weight)	Comparison of results between downstream and upstream of the Elk River and to past observations	Direct
			Tissue selenium concentrations	Comparison of results relative to guidelines and effect benchmarks, between downstream and upstream of the Elk River, and to past observations	Indirect
	Redside shiner	Recruitment (non-lethal assessment)	Survival (length frequency distribution) Growth (whole body weight and length) Reproduction (relative abundance / % composition of young-of-the-year) Energy storage (condition - body weight against length)	Comparison of results between downstream and upstream of the Elk River and to past observations	Direct
	Northern pikeminnow and sport fish	Fish health, and human health risk from fish consumption	Tissue chemistry	Comparison of results relative to guidelines and effect benchmarks, between downstream and upstream of the Elk River, to past observations, and to human health effect benchmarks (evaluated outside of the monitoring program)	Indirect

Table 2.2: Overview of the 2020 Koocanusa Reservoir Monitoring Program Study Design

Study Area	Biological Area Code	Biological Area Description	UTMs		Spring 2020 [a,b,c]											Summer 2020										
					Water [a,b]			Sediment	Benthic Invertebrates [a]	Plankton [b]			Fish			Water			Sediment		Plankton			Benthic Invertebrates	Fish	
			Easting	Northing	Mixing Study	Chemistry	*In Situ* Water Quality	Large-Volume Particulate [b,c]	Tissue Chemistry	Zooplankton Tissue Chemistry	Zooplankton Community	Surface Invertebrate Tissue Chemistry	Tissue Chemistry: Peamouth Chub [a]	Tissue Chemistry: Redside Shiner [a]	Tissue Chemistry: Sport Fish [a,b,d]	Mixing Study	Chemistry	*In Situ* Water Quality	Quality (Chemistry and Composition)	Large-Volume Particulate	Zooplankton Tissue Chemistry	Zooplankton Community	Surface Invertebrate Tissue Chemistry	Tissue Chemistry	Sport Fish Tissue Chemistry [d]	Redside Shiner Recruitment
Upstream of the Elk River	RG_SC	near the mouth of Sand Creek	625624	5457296	1	1	1	-	-	-	-	-	10	10	up to 8	1	1	1	-	-	-	-	-	-	up to 8	100
	RG_TN	near the RG_KERRRD permitted water quality station	627112	5453380		1	1	-	1	0[e]	5	-	-	-	-		1	5	5	-	10	5	-	1	-	-
MFWP Canadian Sampling (upstream and downstream of Elk River Confluence)	Kikomun[f]	area encompassing Kikomun Park to below confluence with Elk River	625641	5459945		-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	up to 8	-
Elk River	RG_ER	near the mouth of Elk River	627959	5447572		1	1	-	-	-	-	-	10	10	up to 8		1	1	-	-	-	-	-	-	up to 8	100
Downstream of the Elk River	RG_DSELK	Order station downstream of the mouth of the Elk River	627017	5445677		-	-	1	-	-	-	-	-	-	-		-	-	-	1	-	-	-	-	-	-
	RG_T4	near the RG_GRASMERE permitted water quality station	629235	5441654		1	1	-	1	5	5	-	-	-	-		1	5	5	-	10	5	-	1	-	-
	RG_GC	near the mouth of Gold Creek	630926	5436344		1	1	-	-	-	-	-	10	10	up to 8		1	1	-	-	-	-	-	-	up to 8	100
	Rexford[g]	near Rexford Montana	632993	5418872	-	-	-	2	8	-	-	1	up to 8	up to 8	up to 8		-	-	-	2	-	-	1	8	up to 8	-
	Tenmile[h]	near Tenmile Creek Montana	628092	5377582		-	-	2	8	-	-	1	-	-	-		-	-	-	2	-	-	-	-	-	-

Note: "-" indicates that no sampling was conducted for a specific monitoring component during that time period. "number" indicates number of samples collected.

[a] Sampling completed in April.

[b] Sampling completed in June.

[c] Sampling completed in July.

[d] Up to 8 individuals of each sport fish species (bull trout, Kokanee, mountain whitefish, rainbow trout, westslope cutthroat trout, yellow perch) were captured over the course of the sampling year. Sport fish collected by Montana Fish, Wildlife, and Parks (MFWP) were lethally sampled and provided to Minnow for sample collection.

[e] Zooplankton could not be sampled at RG_TN in June in sufficient mass for tissue analysis.

[f] Fish Tissue samples collected by MFWP and provided to Minnow on up to 15 female northern pikeminnow and 8 females from all other fish species captured.

[g] Fish Tissue samples collected by MFWP and provided to Minnow on up to 15 female northern pikeminnow and 8 females from all other fish species captured. Study area encompasses a large portion of the reservoir downstream of the international border. One epilimnion and one hypolimnion (two total) bulk water samples were collected at International Border (LIBBOR) station by US Army Corps of Engineers during May, July, and September 2020.

[h] No fish sampling was conducted at Tenmile Area by MFWP in 2020. Study area encompasses a large portion of the reservoir downstream of RG_Rexford down to near the vicinity of Libby Dam. One epilimnion and one hypolimnion (two total) bulk water samples were collected at Forebay (LIBFB) station by US Army Corps of Engineers during May, July, and September 2020.

and consistent with the locations indicated in the approved 2018 to 2020 study design. Sampling (profundal sediment quality, zooplankton community and tissue, and benthic invertebrate tissue) was completed at one transect downstream of the Elk River (RG_T4) and one transect upstream of the Elk River (RG_TN), with each transect including five sampling stations (Figure 2.1). Fish sampling (fish tissue and redside shiner recruitment) were conducted at two areas downstream of the mouth of the Elk River (Elk River [RG_ER] and Gold Creek [RG_GC]), and one upstream area (Sand Creek [RG_SC][2]; Figure 2.1). Routine water quality monitoring data that were collected by Teck at permitted downstream water quality monitoring stations (RG_DSELK, RG_GRASMERE, RG_USGOLD, and RG_BORDER, of which RG_DSELK is an Order station) and an upstream water quality monitoring station (RG_KERRRD; Figure 2.1; Teck 2019) in 2020 were summarized in this annual report. In addition, data collected in Montana in 2020[3], including large volume suspended sediment chemistry (International Border and Forebay), benthic invertebrate tissue data (Rexford and Tenmile), and fish tissue data (Rexford and Kikomun; Figure 2.1), were summarized in this report and included in data evaluations where appropriate.

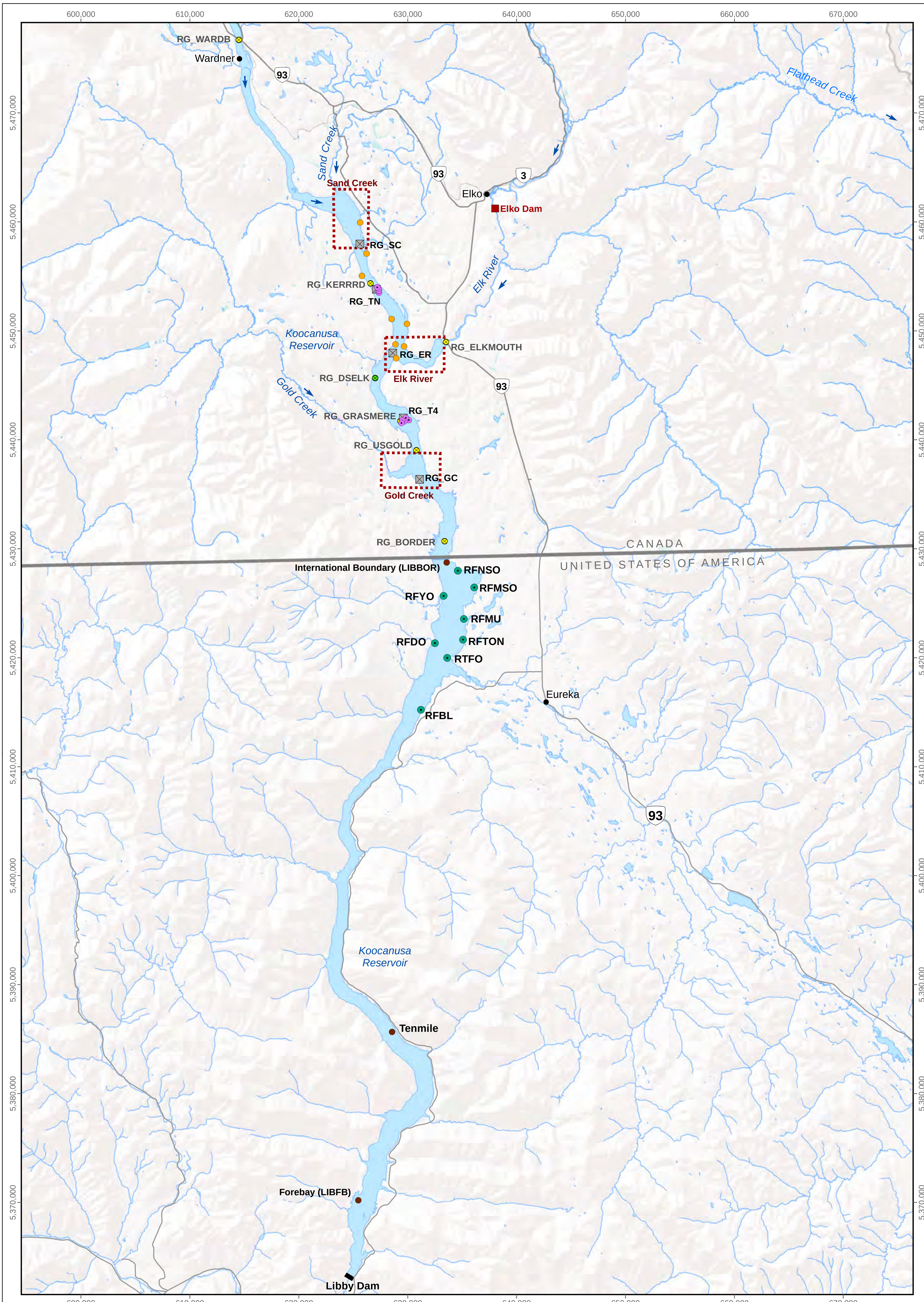
2.2 Water Quality

2.2.1 Overview

In 2020, water quality was assessed through the collection of water chemistry samples and *in situ* field measures. Water chemistry data was collected for Teck's permitted water quality monitoring program (i.e., Stations RG_KERRRD, RG_DSELK, RG_GRASMERE, RG_USGOLD, and RG_BORDER; see Figure 2.1), and reported herein. Four of these stations are referred to as receiving water sampling sites (RG_KERRRD, RG_GRASMERE, RG_USGOLD, RG_BORDER), while the fifth station (RG_DSELK; EMS E300230) is an Order station for which SPOs have been established. Water samples were also collected concurrently with biological sampling (RG_SC, RG_TN, RG_ER, RG_T4, and RG_GC) in April, June, and August 2020. Water chemistry data collected during Teck's routine water quality monitoring program were also used to evaluate productivity. In addition, as per the ENV (2018) study design approval letter, monthly nitrate and selenium loadings to the Koocanusa reservoir were calculated and summarized in this report. Routine water quality monitoring data collected by United States Army Corps of Engineers (US ACE) from the Montana portion of the reservoir

[2] These areas may be adjusted based on seasonal reservoir elevations, access restrictions, and the ability to deploy traps and nets.

[3] Sampling for large volume suspended sediment was completed by United States Army Corps of Engineers, sampling for benthic invertebrate tissue was completed by Minnow, and fish were collected by Montana Fish, Wildlife, & Parks, which were processed for tissue samples by Minnow.



LEGEND

- Permitted Water Quality Station
- Order Water Quality Station and Large-volume Suspended Sediment Location
- Profundal Sediment, Plankton (Community and Tissue Chemistry), and Benthic Invertebrate (Community and Tissue Chemistry) Sampling Location
- Montana Fish Sampling Location
- US ACE, Large-volume Suspended Sediment and Water Quality Monitoring Station
- Montana Benthic Invertebrate (Tissue Chemistry) and Fish Sampling Location
- Water Chemistry and In Situ Monitoring Station
- Approximate Fish (recruitment and fish tissue) Sampling Area

Sampling Locations in Koocanusa Reservoir, 2021

0 5 10 20
km

N W E S

Projection: North American Datum 1983 UTM Zone 11
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2021
Project 207202.0012

minnow environmental inc.

Figure 2.1

Document Path: C:\Users\chada\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\June Map Updates\20-12 Figure 2.1 Sampling Locations.mxd

(Stations International Boundary, Tenmile, and Forebay; Figure 2.1) were not provided, and thus could not be included in evaluations for this annual report. Consistent with monitoring completed previously at the Canadian portion of the reservoir, *in situ* water quality (field parameters) data were collected at each biological monitoring study area/station upstream and downstream of the Elk River confluence in April, June, and August 2020 (Table 2.2). An assessment of mixing of the Elk River within the Canadian portion of the Koocanusa Reservoir (based on specific conductance, water temperature, and turbidity measurements) was completed during three separate events in 2020 to capture low, intermediate, and full-pool conditions (i.e., April, June, and August sampling, respectively; Figure 2.2).

2.2.2 Water Chemistry

2.2.2.1 Sampling and Laboratory Analysis

The Permit requires the collection of water samples at five permitted stations located within the Canadian portion of the reservoir ('Permitted Water Quality Station' on Figure 2.1). Water chemistry samples were collected weekly from April 1st to July 15th, and monthly outside of this period (Table 2.3). When ice conditions restrict access, through-ice samples were collected when ice thickness and safety considerations allowed. Water chemistry samples were collected at transects established at RG_DSELK, RG_USGOLD, and RG_BORDER monthly throughout the year when conditions allowed to identify whether or not mixing was uniform across the reservoir at each transect. Additional weekly transects were done from April to May at RG_DSELK to better assess mixing and its effect on water quality conditions during low-pool conditions. The justification for developing transects is that systematic and grid sampling is used to infer means, percentiles, or other parameters, and is useful for estimating spatial patterns or trends over time. Such a design provides a practical and easy method to ensure uniform coverage. One of the principal reasons for using a stratified design is to ensure a more representative sample by distributing the sample throughout the spatial and/or temporal dimensions. The probability that any body of water such as a reservoir is relatively homogeneous with regard to any water-quality characteristic is low. As a result, a single sampling point generally is not adequate to describe the physical and chemical properties of the water body, or the distribution and abundance of the inhabiting biological community.[4].

Water chemistry samples were also collected at each study area (RG_SC, RG_ER, and RG_GC) and transect (RG_TN, RG_T4) sampled for biota (see 'Water Quality Stations' on Figure 2.1)

[4] Ultimately, these transect data were omitted from the calculation of the monthly means in the analysis of the water quality data. Although useful for examining mixing across the reservoir at the Order station RG_DSELK, and select permitted stations, these data are not used to assess compliance, nor intended for comparison against BC WQGs. Data for these transect stations are provided in Appendix B.

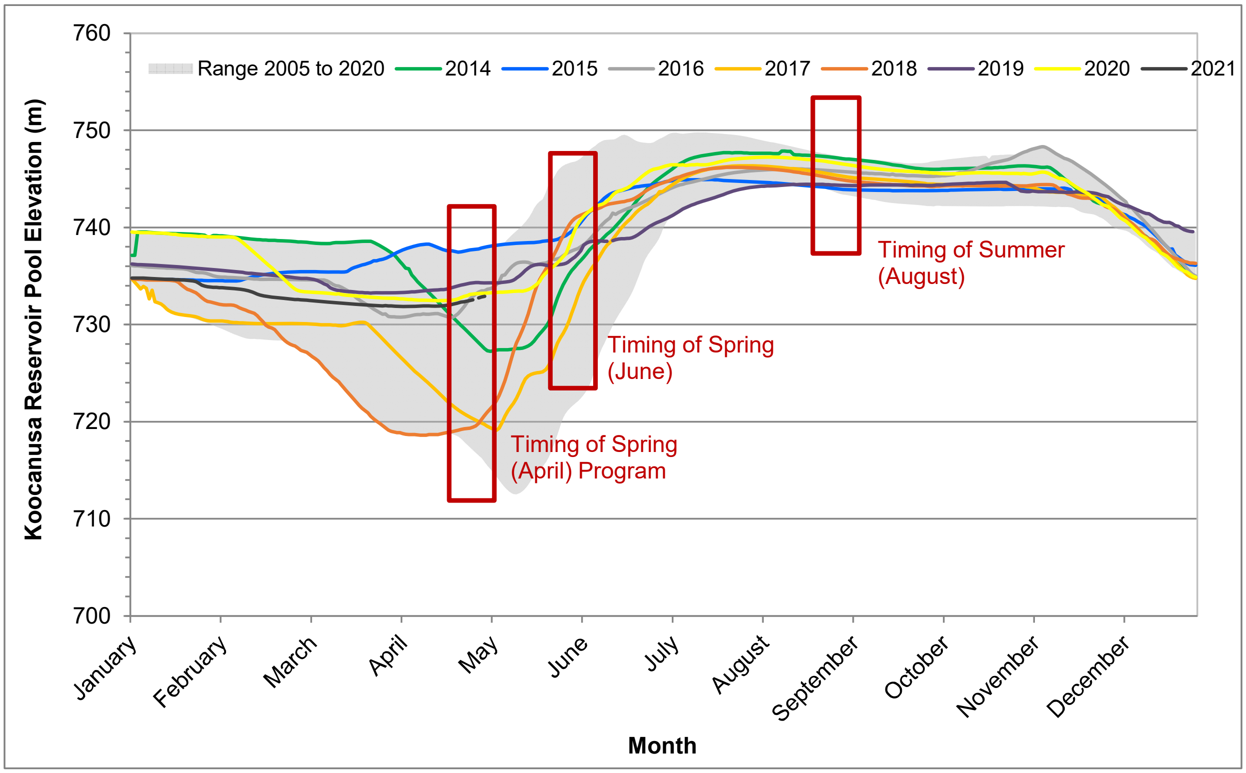


Figure 2.2: Koocanusa Reservoir Water Surface (Pool) Elevation, 2014 to 2021

Notes: Shaded area is the historical daily range of water levels from 2005 to 2020. Data from United States Army Corps of Engineers (USACE 2020).

Table 2.3: Summary of Koocanusa Reservoir Routine Water Quality Monitoring Program

Permitted Station		ENV EMS Number	Sampling Parameter and Associated Monitoring Frequency							
			Field Parameters [a]	Conventional Parameters [b]	Major Ions [c]	Nutrients [d]	Total and Dissolved Metals Scan [e]	Secchi Depth and Chlorophyll-a	Selenium Speciation Sampling [f]	Transect Sampling [g]
Order	RG_DSELK	E300230	W/M	W/M/EH	W/M/EH	W/M/EH	W/M/EH	W/M	Q	M/EH
Receiving	RG_KERRRD	E300095	W/M	W/M/EH	W/M/EH	W/M/EH	W/M/EH	W/M	-	-
	RG_GRASMERE	E300092	W/M	W/M/EH	W/M/EH	W/M/EH	W/M/EH	W/M	-	-
	RG_USGOLD	E300093	W/M	W/M/EH	W/M/EH	W/M/EH	W/M/EH	W/M	-	M/EH
	RG_BORDER	E300094	W/M	W/M/EH	W/M/EH	W/M/EH	W/M/EH	W/M	-	M/EH

Notes: M = Monthly frequency. M/EH = Monthly frequency, unstratified column samples consist of three grabs (3m from surface, 3m from bottom, mid-column). Stratified samples consist of one epilimnetic composite of water sampled from three depths (e.g., 1 m, 5 m, 10 m) and another hypolimnetic composite of water sampled from three depths (e.g., 20 m, 32 m, 45 m). Q = Quarterly frequency. "-" indicates no sampling requirements. W = Weekly frequency from April 1 to July 15, monthly during the rest of the year.

[a] Field parameters include specific conductance, dissolved oxygen, temperature, pH, turbidity, and vertical profiles of dissolved oxygen and temperature.

[b] Conventional Parameters include specific conductance, total dissolved solids, total suspended solids, hardness, alkalinity, dissolved organic carbon, total organic carbon, turbidity.

[c] Major Ions include bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, sulphate.

[d] Nutrients include ammonia, nitrate, nitrite, TKN, orthophosphate, total phosphorous.

[e] Metals (dissolved and total) include aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.

[f] Additional selenium speciation sampling in support of EVWQP baseline information and to fulfill the requirements of the West Line Creek Active Water Treatment Facility Bypass Approval (February 26, 2018).

[g] Additional monthly transect samples collected perpendicular to the five permitted sample locations. Transects include 4 additional sampling locations for water quality (using the same sampling process used at the permitted stations), standard field parameters, and an *in situ* water profile of the station at 1 m increments.

during each of three biological sampling events in 2020 (Table 2.2). Methods used for the collection of all water chemistry samples were consistent with those outlined in Teck's Koocanusa Reservoir Water Quality Monitoring Plan (Teck 2020). Because thermal stratification was not observed during any of the sampling events in 2020, up to three water chemistry samples were collected at each station (depending on total depth), which could include one sample collected 3 m below the water surface, one sample collected 3 m above the substrate, and one sample collected at the mid-point, of the water column. Sampling at biological stations followed the same sampling protocols.

Water samples from the five permitted stations were analyzed for conventional parameters, major ions, nutrients, total and dissolved metals, and chlorophyll-a concentrations (Table 2.3). In addition to these analytes, water chemistry samples associated with the biological monitoring components were also analyzed for polycyclic aromatic hydrocarbons (PAHs; Table 2.4). All water chemistry samples were analyzed by ALS Environmental (ALS) at either their Burnaby, British Columbia (BC) or Calgary, Alberta (AB) locations. The analyses were completed in accordance with procedures described in the most recent edition of the "British Columbia Laboratory Methods Manual for the Analysis of Water, Wastewater, Sediment, Biological Materials, and Discrete Ambient Air" (Province of BC 2020) as per the Permit requirements. Quality Assurance/Quality Control (QA/QC) applied to the laboratory analyses included assessment of the ability to achieve minimum laboratory reporting limits (LRLs; Table 2.4), show undetectable parameter concentrations in blank samples, and evaluation of matrix spikes, certified reference materials (CRMs), and laboratory duplicates, the latter of which was used to assess accuracy and precision of the laboratory data (Appendix A).

2.2.2.2 Data Analysis

The Koocanusa Reservoir Monitoring Program (Minnow 2018b) was designed to address the following questions specific to water quality:

- Are concentrations of mine-related water quality constituents different downstream of the Elk River compared to upstream?
- Are concentrations of key mine-related water quality constituents (i.e., nitrate, selenium, sulphate, and cadmium) changing over time, are the changes consistent with projections, and are concentrations below respective guidelines and SPOs?
- Is productivity (based on nutrient concentrations in water) different downstream of the Elk River compared to upstream and is productivity changing over time?

Assessment of water chemistry data included comparison to applicable provincial guidelines and EVWQP benchmarks, spatial comparisons between downstream and upstream stations, and

Table 2.4: Laboratory Reporting Limits (LRLs) for Water and Sediment Samples

Analyte	Water [a]		Sediment	
	Units	LRL	Units	LRL
Moisture	-	-	%	0.25
pH	-	-	pH	0.10
% Gravel	-	-	%	1.0
% Sand	-	-	%	1.0
% Silt	-	-	%	1.0
% Clay	-	-	%	1.0
Total Organic Carbon (TOC)	mg/L	0.50	%	0.050
Dissolved Organic Carbon (DOC)	mg/L	0.50	-	-
Hardness (as CaCO3)	mg/L	0.50	-	-
Turbidity	NTU	0.10		
Alkalinity	mg/L	1.0	-	-
Total Dissolved Solids (TDS)	mg/L	10	-	-
Total Suspended Solids (TSS)	mg/L	1.0	-	-
Ammonia, Total (as N)	mg/L	0.0050	-	-
Bromide (Br)	mg/L	0.050	-	-
Chloride (Cl)	mg/L	0.50	-	-
Fluoride (F)	mg/L	0.020	-	-
Nitrate (as N)	mg/L	0.0050	-	-
Nitrite (as N)	mg/L	0.001	-	-
Total Kjeldahl Nitrogen	mg/L	0.050	-	-
Phosphorous (P)-Total	mg/L	0.0020	-	-
Orthophosphate	mg/L	0.0010	-	-
Sulphate (SO4)	mg/L	0.30	-	-
Aluminum (Al)	mg/L	0.0030	mg/kg dw	50
Antimony (Sb)	mg/L	0.00010	mg/kg dw	0.10
Arsenic (As)	mg/L	0.00010	mg/kg dw	0.10
Barium (Ba)	mg/L	0.000050	mg/kg dw	0.50
Beryllium (Be)	mg/L	0.000020	mg/kg dw	0.10
Bismuth (Bi)	mg/L	0.000050	mg/kg dw	0.20
Boron (B)	mg/L	0.010	mg/kg dw	5.0
Cadmium (Cd)	mg/L	0.0000050	mg/kg dw	0.020
Calcium (Ca)	mg/L	0.050	mg/kg dw	50
Chromium (Cr)	mg/L	0.00010	mg/kg dw	0.50
Cobalt (Co)	mg/L	0.00010	mg/kg dw	0.10
Copper (Cu)	mg/L	0.00050	mg/kg dw	0.50
Iron (Fe)	mg/L	0.010	mg/kg dw	50
Lead (Pb)	mg/L	0.000050	mg/kg dw	0.50
Lithium (Li)	mg/L	0.0010	mg/kg dw	2.0
Magnesium (Mg)	mg/L	0.0050	mg/kg dw	20
Manganese (Mn)	mg/L	0.00010	mg/kg dw	1.0
Mercury (Hg)	mg/L	0.0000050	mg/kg dw	0.0050
Molybdenum (Mo)	mg/L	0.000050	mg/kg dw	0.10
Nickel (Ni)	mg/L	0.00050	mg/kg dw	0.50
Phosphorous (P)	-	-	mg/kg dw	50
Potassium (K)	mg/L	0.050	mg/kg dw	100
Selenium (Se)	mg/L	0.000050	mg/kg dw	0.20
Silver (Ag)	mg/L	0.000010	mg/kg dw	0.10
Sodium (Na)	mg/L	0.050	mg/kg dw	50
Strontium (Sr)	mg/L	0.00020	mg/kg dw	0.50
Sulphur (S)	-	-	mg/kg dw	100
Thallium (Tl)	mg/L	0.000010	mg/kg dw	0.050
Tin (Sn)	mg/L	0.00010	mg/kg dw	2.0
Titanium (Ti)	mg/L	0.010	mg/kg dw	1.0
Uranium (U)	mg/L	0.000010	mg/kg dw	0.050
Vanadium (V)	mg/L	0.00050	mg/kg dw	0.20
Zinc (Zn)	mg/L	0.0030	mg/kg dw	2.0
Acenaphthylene	-	-	mg/kg dw	0.0050
Anthracene	-	-	mg/kg dw	0.0040
Benz(a)anthracene	-	-	mg/kg dw	0.010
Benzo(a)pyrene	-	-	mg/kg dw	0.010
Benzo(b)fluoranthene	-	-	mg/kg dw	0.010
Benzo(b+j+k)fluoranthene	-	-	mg/kg dw	0.010
Benzo(g,h,i)perylene	-	-	mg/kg dw	0.010
Benzo(k)fluoranthene	-	-	mg/kg dw	0.010
Chrysene	-	-	mg/kg dw	0.010
Dibenz(a,h)anthracene	-	-	mg/kg dw	0.0050
Fluoranthene	-	-	mg/kg dw	0.010
Fluorene	-	-	mg/kg dw	0.010
Indeno(1,2,3-c,d)pyrene	-	-	mg/kg dw	0.010
2-Methylnaphthalene	-	-	mg/kg dw	0.010
Naphthalene	-	-	mg/kg dw	0.010
Phenanthrene	-	-	mg/kg dw	0.010
Pyrene	-	-	mg/kg dw	0.010

Note: "-" indicates no data available.

[a] Total and dissolved metals analyzed in water. Laboratory reporting limits are the same.

qualitative comparisons to data collected during previous monitoring. The constituents selected for the water chemistry assessment included the four order constituents (total selenium, nitrate, sulphate, and dissolved cadmium) and twelve non-order mining-related constituents (i.e., total antimony, total barium, total boron, dissolved cobalt, total lithium, total manganese, total molybdenum, total nickel, nitrite, total dissolved solids, total uranium, and total zinc).[5] The data used in this assessment included samples collected at the five permitted stations: RG_KERRRD, RG_DSELK, RG_GRASMERE, RG_USGOLD, and RG_BORDER . Samples collected from the biological monitoring stations during the three biological sampling events in 2020 (RG_SC, RG_TN, RG_ER, RG_T4, and RG_GC) were excluded from the water quality screening assessment due to limited sample sizes[6]. The permitted surface water quality stations in Koocanusa provide more frequent results at a representative spatial scale for the biological monitoring program.

Monthly mean concentrations for each parameter were estimated using the Kaplan-Meier (K-M) method. This method involves transforming the left censored (i.e., < value) dataset to a right censored (i.e., > value) dataset, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculation was conducted using the survfit() function in the survival package (Therneau 2017) in R (R Core Team 2021), and involves calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs. The method of estimating the mean is equivalent to using the distribution of detectable values below the LRL to represent values that are less than the LRL. If there was only one LRL and no detected values below the LRL, then the K-M estimate of the mean was equivalent to replacing the value below the LRL with the LRL (i.e., the best estimate for the values less than the LRL is the LRL). The constituents selected for this assessment were screened against British Columbia Water Quality Guidelines (BCWQG; BCMOE 2019, 2021) and site performance objectives (SPOs) where applicable (i.e., RG_DSELK). Plots of monthly average concentrations of these constituents at each station, together with applicable BCWQGs and SPOs, were prepared as the basis for qualitative comparisons among stations.

Although 2020 data from Montana were not provided in time for reporting, data collected prior to 2020 are represented in the plots. These data were also compared to United States Environmental Protection Agency (US EPA) criteria for dissolved cadmium and selenium, and total zinc. Water chemistry data from major inflows into Koocanusa Reservoir, namely the

[5] These twelve non-order constituents were selected based on the work done for the development of the surface water early warning triggers (EWT; Azimuth 2018).

[6] Data collected concurrently with biological monitoring samples are provided in Appendix B, but excluded from further analysis.

Kootenay River (Station RG_WARDB) and the Elk River (Station RG_ELKMOUTH), which are monitored on a regular basis, were also included in the monthly plots with the permitted station data. Data for RG_USELK were included for historical reference only[7].

Constituent data were compared statistically between upstream (RG_KERRRD) and downstream (RG_DSELK, RG_GRASMERE, RG_USGOLD, and RG_BORDER) permit stations to evaluate potential mine-related influences on water quality of Koocanusa Reservoir. Statistical comparisons were conducted on the mathematical differences in monthly mean concentrations between stations (i.e., mean concentration downstream of the Elk River less the mean concentration upstream of the Elk River) to remove the potential influence associated with differing sampling season.

Data from upstream and downstream stations were tested for whether differences in monthly mean parameter concentrations were different from zero using a one-sample t-test (or Wilcoxon signed rank test for data that were not normally distributed) by testing the hypothesis:

H_{01}: $\mu_d = 0$

The magnitude of difference (MOD) in parameter concentrations between stations was calculated if a significant difference was detected between stations as (using RG_USGOLD as an example):

$$\text{MOD} = \frac{(MCT_{RG\_USGOLD} - MCT_{RG\_KERRRD})}{MCT_{RG\_KERRRD}} \times 100\%$$

where MCT_{RG_USGOLD} and MCT_{RG_KERRRD} were the measure of central tendency (MCT) for the downstream and upstream stations, respectively (i.e., mean or median depending on whether the statistical comparison was conducted using a parametric or non-parametric method, respectively). The statistical analyses were conducted using R statistical software (R Core Team 2019).

Monthly mean total phosphorus, total nitrogen, and chlorophyll-a concentrations, together with Secchi depth measurements, were used to categorize trophic status at permitted water sampling stations in the Canadian portion of Koocanusa Reservoir based on Nordin (1985) classifications for BC freshwaters (Table 2.5). In addition to qualitative comparison of trophic status (i.e., oligo-, meso-, or eutrophic), comparisons of plotted total phosphorus, total nitrogen, chlorophyll-a, Secchi depth, and nitrogen-to-phosphorus ratio[8] data were conducted to

[7] RG_USELK was the upstream station prior to 2015, but due to its proximity to the Elk River, this monitoring station was relocated farther upstream, renamed RG_KERRRD, and sampled as the upstream station thereafter.

[8] The examination of nitrogen to phosphorus ratios among Koocanusa Reservoir study areas/stations was initially included in the analysis of the 2018 data based on recommendation by the EMC (Minnow 2019).

Table 2.5: Available Criteria for Trophic Status Classification

Variable	Source	Ultra-Oligotrophic	Oligotrophic	Mesotrophic	Meso-Eutrophic	Eutrophic	Hyper-Eutrophic
Total Phosphorus (µg/L)	OECD[a,h]	<4	<10	10 - 35	-	35 -1 00	>100
	Environment Canada[b]	<4	4 - 10	10 - 20	20 - 35	35 - 100	>100
	Quebec[a]	-	4 - 10	10 - 30	-	30 - 100	-
	Sweden[a]	-	<15	15 - 25	-	25 - 100	>100
	Carlson TSI[c,d]	<6	6 - 12	12 - 24	-	24 - 96	>96
	Nordin (BC Criteria)[e]	-	1 - 10	10 - 30	-	>30	-
	Nürnberg[a,f]	-	<10	10 - 30	-	31 - 100	<100
	Vollenweider and Karekes[g]	-	3 - 18	11 - 96	-	16 - 390	-
Chlorophyll-a (µg/L)	OECD	<1	<2.5	2.5 - 8	-	8 - 25	>25
	Environment Canada	<1	<2.5	2.5 - 8	-	8 - 25	>25
	Quebec	-	1 - 3	3 - 8	-	8 - 25	-
	Sweden	-	>3	3 - 7	-	7 - 40	>40
	Carlson TSI	<0.95	0.95 - 2.6	2.6 - 7.3	-	7.3 - 56	>56
	Nordin (BC Criteria)	-	0 - 2	2 - 7	-	>7	-
	Nürnberg	-	<3.5	3.5 - 9	-	9.1 - 25	>25
	Vollenweider and Karekes	-	0.3 - 4.5	3 - 11	-	2.7 - 78	-
Secchi Depth (m)	OECD	>12	>6	3 - 6	-	1.5 - 3	<1.5
	Environment Canada	>12	>6	3 - 6	-	1.5 - 3	<1.5
	Quebec	-	5 - 12	2.5 - 5	-	1 - 2.5	-
	Sweden	-	>3.96	2.43 - 3.96	-	0.91-2.43	<0.91
	Carlson TSI	>8	4 - 8	2 - 4	-	0.5 - 2	<0.25
	Nordin (BC Criteria)	-	>6	3 - 6	-	<3	-
	Nürnberg	-	-	-	-	-	-
	Vollenweider and Karekes	-	5.4 - 28	1.5 - 8.1	-	0.8 - 7	-
Total Nitrogen (µg/L)	OECD	-	-	-	-	-	-
	Environment Canada	-	-	-	-	-	-
	Quebec	-	-	-	-	-	-
	Sweden	-	<400	400 - 600	-	600 - 1,500	>1,500
	Carlson TSI	-	-	-	-	-	-
	Nordin (BC Criteria)	-	<100	100 - 500	-	500 - 1,000	-
	Nürnberg	-	<350	350 - 650	-	651 - 1,200	>1,200
	Vollenweider and Karekes	-	310 - 1,600	360 - 1,400	-	390 - 6,100	-

Note: "-" indicates no data available.
[a] Summarized in Galvez-Cloutier and Sanchez 2007.
[b] Environment Canada 2004.
[c] Carlson 1977.
[d] Values converted from Trophic Status Index (TSI) for comparison to other classifications.
[e] Nordin 1985, Criteria used in British Columbia.
[f] Nürnberg 2001.
[g] Vollenweider and Kerekes 1980.
[h] Organisation for Economic Co-operation and Development.

evaluate whether trophic status differed downstream compared to upstream of the Elk River confluence in Koocanusa Reservoir.

Nitrate and selenium loadings to the Koocanusa Reservoir were calculated using methods outlined in "Permit 107517 2017 Report of Monitoring Results in the Koocanusa Reservoir" (Teck 2018b). Briefly, monthly average concentrations of selenium and nitrate measured at RG_ELKMOUTH and flow data prorated from applicable Water Survey of Canada (WSC) gauging stations on the Elk River were used to estimate loadings into the reservoir. A scaling method derived by Golder Associates Ltd. used WSC hydrometric gauging stations located on the Elk River at Fernie (Station 08NK002; recent data) and at Phillips Bridge (Station 08NK005; historical data) to prorate monthly flow at the mouth of the Elk River as follows: RG_ELKMOUTH = RG_FERNIE x 1.53. The scaling factor was developed by Golder Associates Ltd. from prorated flow based on a relationship between monthly flows as presented in the 2017 Permit Summary Report for Koocanusa Reservoir (Teck 2018b). Similar scaling methods were used to calculate nitrate and selenium loadings to the reservoir from the Kootenay River at Station RG_WARDB using the WSC Kootenay River hydrometric gauging station located at Fort Steele (Station 08NG065) to prorate monthly flow based on the following relationship: RG_WARDB = 08NG065 x 1.18. Estimated loads of nitrate and selenium (in kg/month) were calculated by multiplying the calculated daily load by the number of days in each month to provide a monthly loading rate using the following formula:

$$\text{Flow } (m^3/s) * \text{concentration } (mg/L) * 86.4 = kg/day * \text{number of days in each month}$$

2.2.3 Field Parameters and Mixing Assessment

2.2.3.1 Sampling

In situ water quality data were collected from each of the five zooplankton and benthic invertebrate sampling stations located upstream (Transect Stations RG_TN-1 through RG_TN-5) and downstream of the Elk River (Transect Stations RG_T4-1 through RG_T4 5), as well as at fish sampling areas (Sand Creek, Elk River, and Gold Creek; Figures 2.1). *In situ* measurements of water temperature, dissolved oxygen (DO), pH, specific conductance (i.e., temperature-standardized measurement of conductivity), and turbidity[9] were collected as vertical profiles conducted at 0.5 to 1 m intervals (0.5 m intervals for stations less than 5 m depth, and 1 m intervals for stations greater than 5 m) during biological monitoring conducted in the Canadian portion of the reservoir in April, June, and August 2020 (Table 2.2). The *in situ* water quality measurements were taken using a calibrated YSI ProDSS (digital sampling system)

[9] Turbidity was not included as a field parameter in the 2018 to 2020 monitoring study design; however, based on the study design approval letter (ENV 2018), turbidity measurements were collected with *in situ* profiles beginning in 2018.

handheld multi-parameter meter equipped with four DSS sensors (YSI Inc., Yellow Springs, OH), or an InSitu Aquatroll meter. Additional water quality information collected to support interpretation of biological data at each station/area included Secchi depth and observations of water colour and clarity.

To address the concern that the Elk River may be influencing water quality at the upstream Permitted Station RG_KERRRD and to determine whether the Elk River is fully mixed within the reservoir at the downstream Order Station RG_DSELK, a mixing assessment was conducted in Canadian portion of the reservoir under three pool conditions (low [April], intermediate [June], and full [August]) in 2020. Specific conductance of the Elk River (RG_ELKMOUTH) has consistently been greater than that of the Kootenay River (RG_WARDB), and therefore specific conductance measurements served as the primary means to evaluate Elk River mixing within the reservoir. Because temperature driven differences in water density can also influence mixing features, water temperature data were also considered for the mixing assessment. An InSitu Aquatroll meter was used to collect profile data across transects under the low, intermediate, and full reservoir levels in 2020. The InSitu Aquatroll meter was used to continuously measure and log specific conductance, temperature, turbidity, and depth data upon being lowered through the water column. Transects were grouped closely together (approximately 250 m apart) near the Elk River confluence, and then at interval distances of approximately 1,000 m for four transects upstream of the Elk River confluence, and for transects located downstream of the Elk River confluence that extended to RG_BORDER. To relate mixing status at each of the permitted stations, transects were established so as to intersect each of the Permitted water quality stations. Five to six evenly spaced profile stations were established at each transect during each sampling event.

2.2.3.2 Data Analysis

Vertical *in situ* water quality profiles, completed at the time of biological sampling in August, were plotted to determine if thermal stratification or gradients in DO, pH, specific conductance, and/or turbidity occurred at the sampling areas under representative full pool reservoir conditions. The profile data were compared between downstream (RG_T4) and upstream (RG_TN) transects, and to profile data collected in previous years.

The evaluation of Elk River mixing in the reservoir included the generation of specific conductance, water temperature, and turbidity profile plots for the Koocanusa Reservoir for each of the April, June, and August sampling events. Geographic coordinates (Northing ~ Easting) were used to create a linear model that projected the data along a straight transect. Coordinates along the shorelines were not collected in the field, and therefore shoreline locations were estimated by extending the trend line by the mean distance between transect stations in both directions. Once the x- and y-axes coordinates were estimated from the linear model, a depth profile was derived for each transect using a minimum convex polygon around the x- and y-axis locations and the maximum depth at each point, and then extrapolating the values for each parameter (specific conductance, temperature, and turbidity) horizontally between each station across the entire polygon. The parameter values were estimated using a spatial kriging model with a polynomial degree function of 1 and a range parameter (θ) set to the mean Euclidean distance between the points. The kriging spatial model takes into account the observed data and the correlation between data points under an assumed covariance function (exponential decline with distance between points) and was fit with generalized cross validation. The model was derived and extrapolated in R using the Krig and interpolate functions in the fields and raster packages. Visualization of the generated profiles was conducted by placing the interpolated values in ten bins equally spaced between the maximum and minimum values for each month, which were then assigned a unique colour ramp for each parameter. The extent of Elk River mixing was then assessed visually.

2.3 Sediment Quality

2.3.1 Overview

Sediment quality was assessed as part of the 2020 monitoring program for the Canadian portion of the reservoir to characterize substrate chemistry and support interpretation of biological data. Sediment quality sampling was conducted in August at two profundal[10] areas (RG_T4 and RG_TN). Large volume suspended sediment samples were also collected in 2020 to assess total selenium concentrations in suspended sediment at the Order station RG_DSELK.

2.3.2 Sample Collection

Sediment samples for physical and chemical characterization were collected in August using a stainless-steel petite Ponar (0.023 m^2 sampling area). At each of five stations located along transects downstream (RG_T4-1 to 5) and upstream of the Elk River (RG_TN-1 to 5), three grabs were collected to create a composite sediment sample consisting of the top three centimetres (cm) of sediment (i.e., the sediment fraction in which most benthic fauna generally reside [Kirchner 1975]). If the grab was not complete to each edge of the sampler, or lacked an intact sediment-water surface layer, it was discarded, and a new grab was collected. If the grab was acceptable, the top three centimetres of sediment was removed and placed into a separate plastic tub. This procedure was repeated until three acceptable grabs were obtained, after which the sample was homogenized using a stainless-steel spoon. The homogenized

[10] Referring to the sediment collected from a deep basin of a lake/reservoir.

sediment was then transferred to a glass jar (for analysis of polycyclic aromatic hydrocarbons [PAHs]) and a labelled polyethylene sealable bag (for analyses of other parameters, as described below). Sampling locations were recorded for each station using a handheld global positioning system (GPS) unit in Universal Transverse Mercator (UTM) coordinates. Following collection of each sediment sample, the sample was placed in a cooler containing ice and later transferred to a refrigerator for storage prior to shipment to an accredited analytical laboratory at the completion of the field study.

Large volume suspended sediment samples were collected from the Canadian portion of the reservoir concurrent with samples collected in Montana by the US ACE. Samples for the large volume suspended sediment analysis were collected from the Order station RG_DSELK in June, July, and September 2020 according to methods outlined in the Montana Department of Environmental Quality (MT DEQ) Quality Assurance Project Plan (QAPP; MT DEQ 2018). Briefly, samples were collected from a depth of 3 m below the surface using a pre-acid rinsed beta bottle sampler. Grabs were retrieved until there was enough sample to fill two 20 L carboys. In addition, water quality samples for the analysis of total and dissolved selenium were collected at a depth of 3 m from the surface, and 3 m from the bottom, at each station. Accompanying *in situ* and Secchi depth measurements were collected concurrently with the large volume suspended sediment samples. All samples were stored on ice until shipment to the designated laboratory.

2.3.3 Laboratory Analysis

Sediment samples (whole sample not field-sieved) were sent to ALS (Calgary, AB) for analysis of moisture content, particle size, total organic carbon (TOC), metals/metalloids (hereafter collectively referred to as metals), and PAHs using analytical methods consistent with ENV laboratory guidance manual (Province of BC 2013, 2020) as specified in the Permit. Sediment sampling quality assurance/quality control (QA/QC) included the collection and analysis of field duplicate samples (on a minimum of 10% of the total number of samples collected), as well as an assessment of the accuracy and precision of laboratory data (Province of BC 2020). Data quality was judged based on the ability to achieve minimum LRLs (Table 2.4), and review of the results from laboratory duplicate, spike recovery sample, blank sample, and CRM analyses (see Appendix A).

Large volume suspended sediment samples were submitted to Georgia State University (Georgia, USA) for de-watering prior to being submitted to Brooks Analytical Laboratory (BAL; Washington, USA) for analysis of total selenium. Water samples collected concurrently with the large volume samples were sent directly to BAL for the analysis of total and dissolved selenium.

2.3.4 Data Analysis

Sediment quality data from the 2020 Koocanusa Reservoir Monitoring Program were used to address the following question with regards to sediment quality:

- Are concentrations of mine-related constituents in sediment that benthic invertebrates are exposed to different downstream of the Elk River compared to upstream and are concentrations changing over time?

The assessment of sediment data included comparison to applicable guidelines, spatial comparisons between downstream and upstream areas, and qualitative comparisons to data from 2014 to 2016, 2018, and 2019[11]. Sediment particle size distribution data were presented for each sampling event (August and April) using a stacked bar graph with concentrations of TOC plotted on the secondary axis. Sediment chemistry data were compared to applicable BC Working Sediment Quality Guidelines (WSQGs). The lower WSQGs (i.e., lowest effect level/threshold effect level [LEL/TEL]) represent concentrations below which adverse biological effects would not be expected to occur (BCMOE 2021). In contrast, the highest sediment quality guidelines (i.e., probable effect level/severe effect level [PEL/SEL]) represent concentrations above which effects to sediment dwelling biota may be observed (BCMOE 2021). All parameters with mean concentrations that exceeded the lower WSQG were plotted. Selenium was plotted for all stations, even if concentrations were below the WSQG.

A pairwise t-test was used to evaluate differences in mean sediment chemistry between downstream and upstream areas (RG_T4 and RG_TN, respectively) for data collected in August. Data for both analyses were $\log_{10}$-transformed as required to meet test assumptions. If test assumptions were not met for the pairwise t-test, a rank transformation for a non-parametric test was used. A more conservative α of 0.5 was used for testing the assumptions to limit the use of the rank transformation in those instances where assumptions were violated. A suite of transformations was applied to each endpoint and then tested to determine the transformation that maximized normality, including: $\log_{10}$ (or $\log_{10}[x+1]$ for counts that contain 0), square-root, and fourth-root. The transformation with the highest resulting p-value from a Shapiro-Wilk test was applied to the respective endpoint and carried forward for subsequent tests. In instances where normality could not be achieved through data transformation, the non-parametric Mann-Whitney test was conducted using untransformed data. In instances where the assumption of homogeneity of variances was not met (Levene's test; $\alpha = 0.05$) but data were

[11] Statistical comparisons over time are completed only for the three-year report, and were not conducted as part of the 2020 annual report.

normally distributed, a two-sample t-test assuming unequal variances was conducted using transformed data (Ruxton 2006).

An observed effect size was calculated for each statistical comparison analyzed using a two-sample t-test as:

$$\text{Observed Effect Size} = (\bar{X}_{Downstream} - \bar{X}_{Upstream})/SD$$

where $\bar{X}_{Downstream}$ and $\bar{X}_{Upstream}$ were the downstream and upstream area community endpoint means and the SD is an estimate of the upstream area standard deviation. The estimate of the upstream area standard deviation was either the pooled standard deviation from the two-sample t-test for equal variances, or the upstream area sample standard deviation when the two-sample t-test for unequal variances was applied. The effect size calculations were conducted on the transformed scale when the data were transformed for analysis. When the Mann-Whitney test was used, the observed effect size was estimated using median values instead of means, and the Pooled Median Absolute Deviations (MAD) instead of SD as follows:

$$\text{MAD} = median(|x_{Area}^{i} - median(x_{Area})|)$$

where x_{Area}^{i} was each observation in the dataset, $median(x_{Area})$ was the median of the area to which x_{Area}^{i} belongs (i.e. downstream or upstream) and $|f(x)|$ was the absolute value of $f(x)$.

A MOD in parameter concentrations was calculated as a percentage difference in the measure of central tendency between the downstream area(s) and the upstream area as:

$$\text{MOD} = \frac{(MCT_{RG\_T4} - MCT_{RG\_TN})}{MCT_{RG\_TN}} \times 100\%$$

where MCT_{RG_T4} and MCT_{RG_TN} were the measures of central tendency for the downstream and upstream areas. Measures of central tendency were reported in the original data units as:

- means when no transformation was used;
- geometric means when a $\log_{10}$-transformation was used; and
- medians when a rank transformation was used.

Parameters with concentrations above the WSQG LEL guidelines in 2020 were qualitatively compared to values from 2013 to 2019 to identify potential changes in sediment chemistry over time.

Selenium concentrations from the large volume suspended sediment sample data collected in the Canadian portion of the reservoir in 2020 were compared to applicable BC guidelines, to data collected from reservoir stations located in Montana, and to data collected in 2018 and 2019 using qualitative analysis.

2.4 Zooplankton

2.4.1 Overview

Zooplankton community and tissue samples were collected from the Canadian portion of the reservoir in June and August 2020 to assess differences in community endpoints and tissue selenium concentrations between downstream (RG_T4) and upstream (RG_TN) of the Elk River, as well as seasonally (June and August; ENV 2018; Figure 2.1, Table 2.2).

2.4.2 Sample Collection

Zooplankton community samples were collected using a 19 cm diameter, fine mesh (i.e., 60 micrometre [µm]) plankton net, that was hauled vertically through the entire water column at each sampling station based on methods described by Province of BC (2013)[12]. A composite sample, consisting of three vertical hauls of the plankton net lowered through the water column until approximately 1.5 m above the sediment-water interface (to avoid disturbing the sediment and potentially resulting in addition of benthic organisms into the sample), was collected at RG_TN (RG_TN-1 to RG_TN-5) and RG_T4 (RG_T4-1 to RG_T4-5). Upon retrieval of each vertical haul, the sample material was transferred into a pre-labelled plastic sampling jar and, following retrieval of the third vertical haul, preserved to a level of 10% buffered formalin in ambient water. Zooplankton community samples were collected along with supporting measures that included an *in situ* water quality profile and Secchi depth (see Section 2.2.3.1.). The preserved zooplankton community samples were stored at ambient temperature until shipment to the laboratory.

Zooplankton tissue samples were collected using an 80 µm mesh plankton net (30 cm diameter aperture) designed to target zooplankton and avoid collection of phytoplankton (i.e., the mesh size excluded phytoplankton from zooplankton tissue samples). One sample representing a composite of ten vertical hauls through the entire water column (beginning 1.5 m above the sediment-water interface to avoid disturbance of sediment) was collected at each RG_TN and RG_T4 transect station. Upon retrieval of each haul, as much water as possible was removed from the collected material before transferring the sample to a labelled sterile cryovial. Following transfer of material from the tenth haul, the sample was placed in a cooler on ice and, at the completion of daily field sampling, frozen.

[12] Study design requirements to collect samples from 10 m below the surface were removed in 2019 based on recommendations from the EMC.

2.4.3 Laboratory Analysis

Zooplankton community samples were sent to Salki Consultants Inc. (Winnipeg, MB), where after being allowed to stand undisturbed for 72 hours, were decanted (60 µm filter on vacuum hose, back flushed) to 45 mL glass vials to standardize volume (40 mL) for analyses and long-term storage. Samples were analyzed for species composition, abundance, and biomass of crustaceans and rotifers. Each sample underwent the following three levels of analysis:

- 1/10, 1/20, 1/40, or 1/80 (depending on zooplankton abundance in sample) of each sample was examined under a compound microscope at 63× to 160× magnification, and a minimum of 200 organisms were identified to species (crustaceans) or lowest practical level (LPL; rotifers), and assigned to instar size categories. Additionally, lengths (± 15 µm) of female and male adult specimens (n=20) of dominant species were measured in representative samples for biomass determinations;
- a sub-sample, representing 10 to 20% of the sample volume, was examined under a stereoscope at 12× magnification to identify and enumerate mature and gravid individuals of larger-sized species and rare (i.e., less abundant) species, and to assign these individuals to size classes; and
- the entire sample was examined under a stereoscope at 1/10 magnification to improve abundance/biomass estimates for any large-sized, less abundant, species in the sample.

Under a compound microscope, Cyclopoida and Calanoida specimens (mature and immature) were identified to the species level with the exception of nauplii (N1-N6), which were classified as either Calanoida (small or large) or Cyclopoida (small or large). Cladocera were identified to the species level, while rotifers were identified to genus. Taxonomic identifications were conducted primarily using Brooks (1957), Wilson (1959), and Yeatman (1959) taxonomic keys. Digital microscopic images of selected specimens were provided with the analytical data.

Zooplankton abundance was reported as individuals per litre (ind/L) based on volumes calculated from net mouth area, sample haul depth, and replication. Biomass estimates for each species were determined from:

- abundances of adults multiplied by mean adult wet weights developed from measured lengths (n=20 per adults of dominant species in representative samples), and length-weight relationships presented in Malley et al. (1989); and,
- abundances of various immature instar categories multiplied by weights of respective size categories determined from length-weight regressions (as per Malley et al. 1989).

Additional size measurements made on less common specimens were factored into the biomass calculations. Zooplankton biomass was reported in micrograms (wet weight) per litre (µg/L) of filtered water. Sub-sampling accuracy was assessed by performing replicate counts on 10% of samples. Replicate samples were chosen at random and processed at different times from the original sample to reduce bias.

Zooplankton tissue samples were shipped to TrichAnalytics Inc. (Trich; Saanichton, BC),[13] for analysis of metals (including mercury) and selenium using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) consistent with ENV laboratory guidance as specified in Permit 107517 (Province of BC 2020). At the laboratory, the samples were freeze dried prior to analysis, and thus concentrations were reported on a dry weight basis. Accuracy and precision of data was judged based on ability to achieve minimum LRLs (Table 2.6), review of the results from laboratory duplicate analysis, as well as a comparison to CRMs (Appendix A).

2.4.4 Data Analysis

Data from the zooplankton community and tissue sampling were used to address the following questions:

- Do zooplankton community structure differ downstream of the Elk River compared to upstream and were the differences changing over time?[14]
- Are selenium concentrations in zooplankton different downstream of the Elk River compared to upstream, and were the differences changing over time?

Zooplankton community data were compared between downstream and upstream study areas, and qualitatively to data from the previous monitoring periods (2014 to 2016, 2018, and 2019) using primary metrics of mean taxonomic richness [as identified to lowest practical level (LPL)], mean organism density (average number of organisms per litre), and mean biomass (mass of organisms per litre). Relative density and relative biomass of dominant taxonomic groups were calculated as the density or biomass of each respective group relative to the total number of organisms or biomass in the sample, respectively. Dominant taxa were defined as taxa representing at least 5% of the total organism density at one or more stations. Community endpoints were summarized by reporting the minimum, maximum, mean, median, standard deviation (SD), and sample size for each sampling area. Zooplankton community data

[13] In previous Koocanusa Reservoir Monitoring studies, Saskatchewan Research Council (SRC) laboratory in Saskatoon, SK was utilized for evaluating benthic invertebrate tissue concentrations. In 2020, an Interlaboratory Tissue Analysis Validation Study (Golder 2020) was conducted which led to the laboratory for analysis being changed to TrichAnalytics Inc.

[14] Statistical comparisons over time are only completed as part of the analysis for the three-year report.

Table 2.6: Minimum Laboratory Reporting Limits (LRLs) for Tissue Samples

Analyte	Units	Plankton, Benthic Invertebrate, and Fish Tissue LRL [a]
Moisture	%	-
Aluminum (Al)	µg/g dw	2
Antimony (Sb)	µg/g dw	0.1
Arsenic (As)	µg/g dw	0.05
Barium (Ba)	µg/g dw	0.05
Beryllium (Be)	µg/g dw	0.01
Boron (B)	µg/g dw	1
Cadmium (Cd)	µg/g dw	0.01
Chromium (Cr)	µg/g dw	0.5
Cobalt (Co)	µg/g dw	0.01
Copper (Cu)	µg/g dw	0.05
Iron (Fe)	µg/g dw	2
Lead (Pb)	µg/g dw	0.01
Manganese (Mn)	µg/g dw	0.1
Mercury (Hg)	µg/g dw	0.005
Molybdenum (Mo)	µg/g dw	0.1
Nickel (Ni)	µg/g dw	0.05
Selenium (Se)	µg/g dw	0.05
Silver (Ag)	µg/g dw	0.01
Strontium (Sr)	µg/g dw	0.1
Thallium (Tl)	µg/g dw	0.05
Tin (Sn)	µg/g dw	0.05
Titanium (Ti)	µg/g dw	0.05
Uranium (U)	µg/g dw	0.005
Vanadium (V)	µg/g dw	0.1
Zinc (Zn)	µg/g dw	0.5

Note: "-" indicates no data available.
[a] Laboratory reporting limits provided by SRC in Saskatoon, Saskatchewan.

were compared between downstream (RG_T4) and upstream areas (RG_TN), and between spring and late summer, the latter to determine if there were community differences when the reservoir was at half pool compared to full pool (June and August; as per ENV requirement on June 8, 2018).

Zooplankton community data were compared statistically between the downstream and upstream study areas using a two-way analysis of variance (ANOVA). This allowed for a comparison between downstream (RG_T4) and upstream (RG_TN) areas, but also for a seasonal comparison between June and August data. Data were $\log_{10}$ transformed (or $\log_{10}[x+1]$ for counts that contain 0) as necessary to meet assumptions of normality and homoscedasticity or rank transformed when these assumptions could not be met. When the *Area* and *Season* terms (or their interaction) were significant, post-hoc contrasts were conducted to quantify significant changes in upstream and downstream stations overtime. If the *Area* and/or *Season* terms were not significant, post-hoc contrasts were adjusted accordingly. When the *Season* term was significant, the temporal magnitude of difference (MOD) was calculated as a magnitude of difference between June and August:

$$\text{MOD} = \frac{(MCT_{August} - MCT_{June})}{MCT\,June} \times 100\%$$

where MCTs are measures of central tendency for each season. Measures of central tendency are means, geometric means or medians for untransformed, log10-transformed and rank-transformed analyses, respectively. When the rank transformation was used, the observed effect size was estimated using the Pooled Median Absolute Deviations (MAD) instead of pooled SD. When the *Area* term was significant a MOD between reference and exposed areas was calculated as:

$$\text{MOD} = \frac{(MCT_{Downstream} - MCT_{Upstream})}{MCT\,Upstream}$$

where $MCT_{Downstream}$ and $MCT_{Upstream}$ were the measures of central tendency for the downstream and upstream areas for each year when *Season* was significant, or over both seasons when not significant. When the interaction between *Area* and *Season* was significant post-hoc contrast were also conducted to determine if differences between upstream and downstream differed overtime. All post-hoc contrasts were corrected for the number of tests using an $\alpha = 0.1$ and Tukey's Honestly Significant Difference (HSD) correction. The statistical analyses were conducted using R statistical software (R Core Team 2021).

The assessment of zooplankton tissue data included comparison to the closest representative guidelines and benchmarks, and spatial comparisons between downstream and upstream areas of the reservoir. Concentrations of selenium in zooplankton tissues were compared to the interim chronic dietary BC guideline for invertebrate tissue (4 µg/g dry weight [dw]) and EVWQP Level 1 benchmarks for effects to benthic invertebrates (13 µg/g dw) and dietary effects to juvenile fish (11 µg/g dw). Zooplankton tissue data were compared between downstream (RG_T4) and upstream areas (RG_TN) within both the June and August sampling periods, and compared between spring and late-summer to determine if there were temporal differences in selenium concentrations when the reservoir was at half pool compared to full pool within each area (June and August sampling events) using a pairwise t-test (see Section 2.3.4). The 2020 data were also plotted and compared qualitatively to data from previous monitoring (2014 to 2019).

2.5 Benthic Invertebrate Tissue

2.5.1 Overview

Benthic invertebrate tissue samples were collected from the Canadian portion of the reservoir at profundal areas downstream (RG_T4) and upstream (RG_TN) of the Elk River in April and August 2020 (Table 2.2; Figure 2.1). Additionally, benthic invertebrate tissue samples were collected from eight stations within the Rexford area in the Montana portion of the reservoir in May and September 2020 along with accompanying surface invertebrate tow samples within the vicinity of each benthic station (Figure 2.1).

2.5.2 Sample Collection

A single composite benthic invertebrate tissue sample consisting of 20 petite Ponar grabs (i.e., a composite of four grabs from each of the five sampling stations [RG_T4-1 to RG_T4-5 and RG_TN-1 to RG_TN-5] in each study area) was collected in each of April and August 2020. Due to the low density of benthic invertebrates in the Koocanusa Reservoir, a composite sample collected across a transect provided a spatially representative sample for each of the downstream and upstream areas. Different methods were employed at the Montana stations where a total of eight samples were collected by Montana Fish, Wildlife, and Parks (MFWP). Montana samples consisted of as many grabs as necessary at each of the eight station locations to attain the target tissue volume required by the laboratory (Brooks Analytical Laboratory), which required a larger tissue volume than Canadian samples (analyzed by Trich). For sampling completed at both the Canadian and Montana portions of the reservoir, each grab was placed into and sieved through a 500 µm mesh bag. The remaining material was transferred to a white enamel tray for removal of benthic organisms using tweezers. Visible organisms were removed from the debris/sediment and rinsed clean using ambient water. Similar to sampling conducted previously, chironomids were targeted for tissue collection, but if chironomids were not present in sufficient numbers, other benthic invertebrates were included in the sample (and noted on field sheets) to achieve sufficient sample weight for analysis (approximately 0.5 grams [g]). The benthic invertebrate tissue samples were transferred to sterile cryovials and frozen. Supporting measures for each sample included *in situ* water quality measurements and Secchi depth measurements.

Surface invertebrate tows were also completed at Rexford (REX-ST) in May and September 2020 using methods and gear consistent with that outlined in the QAPP (MT DEQ and FWP 2018a). In brief, a single composite sample (composed of surface tow grabs from the eight representative benthic stations in the Rexford area) was collected using a tow net (1.0 m wide by 0.3 m high opening tapered to a 100 mm diameter collar to which a plastic receptacle [cod piece] outfitted with 80 µm mesh was placed) pulled at the surface for a distance of 1,000 m. Sampled contents were removed from the plastic receptacle and placed in 125 mL sample bottles on ice. Samples were field sorted on a white tray to remove invertebrates until a 5 to 10 g sample was achieved, which was placed in a labelled vial and frozen on the day of collection upon returning from the field.

2.5.3 Laboratory Analysis

Benthic invertebrate tissue samples collected from the Canadian portion of the reservoir were shipped to Trich (Saanichton, BC) for analysis of metals (including mercury) and selenium using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) consistent with ENV laboratory guidance as specified in Permit 107517 (Province of BC 2020). At the laboratory, the samples were freeze dried prior to analysis, and thus concentrations were reported on a dry weight basis. Accuracy and precision of data was judged based on ability to achieve minimum LRLs (Table 2.6), review of the results from laboratory duplicate analysis, as well as a comparison to CRMs (Appendix A). Samples collected from the Montana portion of the reservoir were analyzed by Brooks Applied Laboratory (BAL) for metals (including mercury) and selenium. The BAL results were provided in wet weight based on BAL analytical capabilities for the sample volumes/biomasses provided. As a result, selenium concentrations for tissue collected in Montana were converted to a dry weight based on an average moisture content reported from samples collected at the Canadian portion of the reservoir. As such, results for samples from Montana should be interpreted with caution as the averaged moisture content used to convert these samples to dry weight may not be an accurate representation of the actual moisture content in the samples assessed.

2.5.4 Data Analysis

Data from the benthic invertebrate tissue sampling were used to address the following question:

- Are selenium concentrations in benthic invertebrates greater than guidelines or effect thresholds, do they differ downstream of the Elk River compared to upstream, and are the differences changing over time?[15]

Selenium concentrations in benthic invertebrates were plotted and compared to the British Columbia Ministry of Environment (BCMOE 2019) interim guideline of 4 µg/g dw and to Level 1 dietary effects to juvenile birds, effects on benthic invertebrate reproduction, and for dietary effects to juvenile fish, respectively). Benthic invertebrate selenium concentrations were also compared qualitatively to data from 2014 to 2016, 2018, and 2019.

2.6 Fish

2.6.1 Overview

Collection of fish is an integral component of the Canadian Koocanusa Reservoir Monitoring Program (Table 2.2). Peamouth chub (PCC; *Mylochelius caurinus*) and redside shiner (RSC; *Richardsonius balteatus*), which represent key food sources for piscivorous fish (Lotic 2017), were collected near the mouths of Sand Creek, Elk River, and Gold Creek (RG_SC, RG_ER, and RG_GC respectively; Figure 2.1) using lethal methods in spring (April) 2020, prior to fish spawning, for the fish tissue chemistry assessment. Sport fish (e.g., bull trout [BT; *Salvelinus confluentus*]) reflect the highest trophic level in the reservoir and are an important resource for human consumption (Lotic 2017, Ramboll Environ 2016), and for the latter reason sport fish muscle tissue samples were collected using non-lethal methods (i.e., muscle plug) in April and August 2020 for tissue chemistry analyses. Data collected in the Canadian portion of the reservoir were supplemented with fish tissue samples collected during the fishing programs conducted by the MFWP in May (Rexford) and September (Rexford and Kikomun; Figure 2.1). Redside shiner, which had the highest mean selenium concentrations in ovaries for the 2014 to 2016 monitoring program (Minnow 2018a) were used as the focal species for an assessment of recruitment at the request of the EMC. Recruitment was assessed in August 2020 at three fishing areas (RG_SC, RG_ER, and RG_GC) to confirm the presence of young-of-the-year (YOY) RSC, and evaluate fish health endpoints (Table 2.1).

2.6.2 Fish Tissue Sample Collection

The targeted species, the number of samples collected, and the timing of collection for the fish tissue assessment were as follows:

[15] Statistical comparisons over time were completed for the three-year report only.

- peamouth chub and redside shiner ovary and muscle tissues collected from up to 10 females per species at three fish study areas (RG_SC, RG_ER, and RG_GC) in April 2020; and,
- sport fish muscle tissue (non-lethal collected of muscle tissue plugs) collected from up to eight individuals per species at three fishing areas (RG_SC, RG_ER, and RG_GC) in April and August 2020 (Figure 2.1).

Peamouth chub and redside shiner were collected using very short-set gill nets starting with a maximum set time of 15 minutes. Gill nets with mesh size specific for targeting peamouth chub (2”) and redside shiners (1”) were set on the bottom. The geographic coordinates of each net set (UTM units), as well as the time of net deployment and retrieval, were recorded on field sheets. Captured peamouth chub and redside shiner were sacrificed and transported to a dedicated field laboratory for processing as soon as possible following capture (i.e., within hours). At the field laboratory, peamouth chub and redside shiner were subject to measurement of fork and total lengths to the nearest millimeter using a standard measuring board. Fish weights were measured using appropriately sized spring scales (e.g., 50 g, 100 g, and 300 g) or a digital balance (± 0.001 g). The body cavity of each fish was opened and the sex and/or sexual maturity recorded. Whole gonads and livers were removed from female fish only and weighed to the nearest milligram using an analytical balance with a surrounding draft shield. Photo documentation of each ovary was collected in case later verification of ovary development was required. Whole ovaries and a skinless, boneless muscle fillet sample were collected from sexually mature females and placed in separately labelled, polyethylene (Whirl-Pak®) bags. Following these measurements and tissue collections, age structures (i.e., otoliths) were removed from each fish. Each age structure was wrapped separately in waxed paper and placed inside a labelled envelope. Internal and external anomalies (i.e., deformities, erosion of fin or gill, lesions, or tumors; Sanders et al. 1999) and occurrence of any parasites that were observed on each individual during processing were recorded on laboratory bench sheets. Samples (i.e., ovaries, muscle, and age structures) were stored frozen prior to shipment to the respective laboratory for analysis.

Sport fish targeted for tissue collection included species previously sampled at Koocanusa Reservoir (i.e., bull trout [BT; *Salvelinus confluentus*], Kokanee [KO; *Oncorhynchus nerka*], mountain whitefish [MWF; *Prosopium williamsoni*], rainbow trout [RBT; *Oncorhynchus mykiss*], and westslope cutthroat trout [WCT; *Oncorhynchus clarki lewisi*]; Minnow 2018a). Burbot (*Lota lota*) were not a target species for muscle tissue sampling based on concerns regarding low abundance[16] and the cultural importance of this fish species to the KNC. If burbot were caught, they were immediately released. In addition, previous analysis of burbot tissue confirmed that selenium concentrations were below the BC guideline and EVWQP Level 1 benchmarks, and thus selenium is not expected to cause adverse effects in burbot within Koocanusa Reservoir (Minnow 2015b).

Sport fish were collected using multiple methods. Very short-set gill nets (starting with a maximum set time of 15 minutes) were used to minimize the chance of adversely harming fish. Three foot-diameter hoop nets attached to leads extending to the shoreline, were set on the bottom for overnight durations (i.e., approximately 24 hours; Minnow 2018a). Angling, although not effective in April as a result of flowing water conditions and high turbidity, was used to target sport fish as it is the least invasive fishing method. Angling was conducted from a boat using a single hook baited with salted salmon roe or earthworms, or using fishing lures. The geographic coordinates (UTMs) of each net set or angling site, as well as the time of deployment and the time of retrieval, were recorded on field sheets. Sport fish were lightly anaesthetized in a dilute clove oil solution prior to processing. Each fish was then weighed using appropriately sized spring scales, near the top of the scale's range so that measurements achieved a resolution of approximately one percent or less. Total length and fork length were determined using a standard measuring board (± 1 mm). External anomalies were assessed for each sport fish (Sanders et al. 1999) and recorded on field sheets. A muscle sample was then collected using a biopsy punch (4 mm acu-punch). Following extraction of the biopsy sample, skin was removed from the sample using a scalpel and the remaining muscle placed into a sterile cryovial. Once each fish recovered from the anesthetic in a recovery bin, it was released back into the reservoir near its capture location. The muscle tissue samples were stored frozen until shipment to an accredited laboratory.

Fishing efforts and permitting for sampling conducted as part of the Montana monitoring program was completed by MFWP in alignment with the 2018 Fish Tissue QAPP (Montana DEQ and FWP 2018b). Unlike BC permit requirements, gillnets were set for approximately 24 hrs at Rexford in the spring and fall (mid-May and mid-September 2020) and at Kikomun in the fall (mid-September 2020; Figure 2.1). Fish collected by MFWP were provided to GEI Consultants (GEI) for onshore processing and tissue sample collection. Up to eight individuals for each species captured were sampled from both Rexford and Kikomun (except for northern pikeminnow [NSC] where 15 individuals were targeted in May) with a preference for sampling mature females.

[16] In recent years, lower Kootenay burbot populations were designated as critically imperiled and red-listed, meaning potentially extirpated, endangered, or threatened (BCMOE 2015).

Fish tissue sample preparation was completed using similar processing methods described above, with the exception that sport fish were permitted to be sampled lethally.

2.6.3 Laboratory Analysis

Fish tissue samples collected from the Canadian portion of the reservoir were shipped to Trich for analysis of metals (including mercury) and selenium using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) consistent with ENV laboratory guidance as specified in Permit 107517 (Province of BC 2020). At the laboratory, the samples were freeze dried prior to analysis, and thus concentrations were reported on a dry weight basis. Accuracy and precision of data was judged based on ability to achieve minimum LRLs (Table 2.6), review of the results from laboratory duplicate analysis, replicate analysis of a minimum of 10% of samples, as well as a comparison to CRMs (Appendix A).

Fish tissue samples collected from the Montana portion of the reservoir were submitted to BAL (Bothell, WA), consistent with the 2018 and 2019 studies (MT DEQ and FWP 2018b), for analyses that conformed to EPA820-F-16-007 methods. Analyses were conducted for moisture content (ASTM D2974A modified dry 60 to 65 ºC) and, following digestion (US EPA method 3050), for metals (including arsenic, cadmium, copper, lead, and selenium) by inductively coupled plasma mass spectrometry (ICP-MS, method WS6020) with results reported in dry weight. The target detection limit for determination of selenium concentrations was 0.5 µg/g dry weight or lower.

Fish structures collected for age analysis were submitted to AAE Technical Services (Winnipeg, MB). Otoliths were prepared and then read under a compound microscope using transmitted light. For each structure, the age and edge condition were recorded along with a confidence rating for the age determination. For the purpose of QA/QC, greater than 40% of samples were reassessed by a second individual at the laboratory (Appendix A).

2.6.4 Fish Recruitment

A non-lethal sampling design was used to investigate whether redside shiner recruitment was occurring, and to evaluate condition (among other non-lethal Environmental Effects Monitoring [EEM] endpoints) of YOY shiners at areas downstream of the Elk River (Elk River and Gold Creek) relative to upstream (Sand Creek) in August 2020. Seining was used in littoral areas to collect YOY redside shiner in each of the three study areas (Figure 2.1). Upon retrieval of the net, captured fish were identified, enumerated, and inspected for external anomalies. Non-target fish were released alive at the capture location. Captured redside shiner were placed in buckets containing aerated water and retained for processing (described below). Fish sampling targeted a minimum of 100 YOY redside shiner from each fishing area. The recruitment assessment focused on YOY versus non-YOY (mostly expected to be 1+ age category based on previous sampling; Minnow 2018a). A sufficient number of the non-YOY age class were not captured (e.g., greater than 100), and so endpoints related to fish health were not conducted on non-YOY redside shiner. Recorded supporting information for the sampling included duration of sampling effort, sampling depth, area/distance sampled, UTM coordinates, and habitat descriptions.

Fish were lightly anaesthetized in a dilute clove oil solution prior to processing. Lengths (fork and total) were measured to the nearest hundredth of a millimetre using digital calipers, fresh body weight was measured to the nearest milligram using an analytical balance with a repeatability (standard deviation) of ± 0.003 g, and external deformities, erosions, lesions, and tumors (DELT) were recorded on field sheets for each individual. Ten redside shiners of varying sizes were sacrificed at each study area for collection of otoliths according to methods described in Section 2.6.2. With the exception of fish sacrificed for aging, fish were placed into a recovery bucket following processing and released near the point of capture following completion of sampling.

2.6.5 Data Analysis

Data from the tissue sampling and recruitment survey were used to address the following questions:

- Are selenium concentrations in fish tissue greater than guidelines or effect thresholds, do they differ downstream of the Elk River compared to upstream, and are the differences changing over time?
- Are there differences in redside shiner recruitment downstream of the Elk River compared to upstream?

Selenium concentrations in fish tissues collected in 2020 from downstream areas (RG_ER and RG_GC) were compared statistically to those from the upstream area (RG_SC) for PCC and RSC. Selenium concentrations in all fish tissues (for samples collected at both the Canadian and Montana portions of the reservoir) were plotted and compared to the BC (2019) guidelines (for muscle [4 µg/g dw] and ovary [11 µg/g dw] tissues) and US EPA (2016) criteria (for muscle [11.3 µg/g dw] and ovary [15.1 µg/g dw] tissues), and the EVWQP Level 1 benchmark for reproduction (18 µg/g dw). Selenium concentrations in westslope cutthroat trout tissue samples were also compared to a species specific EVWQP Level 1 benchmark for reproduction (25 µg/g dw). Tissue selenium concentrations for PCC, RSC, and NSC[17] were compared among areas (RG_SC, RG_ER, RG_GC, and Rexford) using ANOVA tests, with the data inspected for

[17] These were the only species sampled in sufficient numbers to allow for statistical comparisons between downstream and upstream.

normality and homogeneity of variance before applying parametric statistical procedures. In cases where data did not meet the assumptions of ANOVA, the Mann-Whitney test was used to test for differences between areas. Data collected in September by MFWP from Kikomun (Canadian portion of the reservoir) were incorporated into the appropriate dataset based on whether fish were caught in nets upstream or downstream of the Elk River. The samples collected in May and September by MFWP from Rexford were also included in the statistical analyses where sufficient sample sizes of species were available.

Mercury concentrations in fish muscle relative to fish length were compared among study areas (RG_SC, RG_ER, RG_GC, and Rexford) using Analysis of Covariance (ANCOVA) to account for potential differences in fish body size/age. Mercury concentrations in fish tissues were also compared to the BC tissue residue guideline for the protection of wildlife (0.033 µg/g ww; BCMOE 2019). The guideline was converted to a dry weight basis using the average moisture content in muscle of all fish collected from Koocanusa Reservoir in 2020.

Data analysis for the RSC recruitment survey included comparisons of fish health endpoints of fork length, fresh body weight, and Fulton's condition factor (body weight / fork length^3 x 10^5) between areas located downstream and upstream of the Elk River. These endpoints were summarized by separately reporting mean, median, minimum, maximum, standard deviation, standard error and sample size for each fishing area. These endpoints were used as the basis for evaluating four response categories (survival, growth, reproduction, and energy storage; Table 2.1) according to the procedures outlined for a non-lethal, small-bodied fish assessment in EEM (Gray et al. 2002; Environment Canada 2012). The proportion of YOY fish captured at each area were compared qualitatively. Mean length and body weight for YOY were compared among the three fishing areas (RG_SC, RG_ER, and RG_GC) using ANOVA, with the data inspected for normality and homogeneity of variance before applying parametric statistical procedures. In cases where data did not meet the assumptions of ANOVA, the Mann-Whitney test was used to test for differences between areas. Body weight at fork length (condition) was compared using ANCOVA. The magnitude of observed differences and the minimum detectable effect sizes were calculated, and together with critical effect size (CES), compared.

3 WATER QUALITY, PRODUCTIVITY, AND MIXING

3.1 Overview

Water quality was monitored weekly from March 15th to July 15th, and monthly outside of this time period (except when prevented by safety concerns) in 2020 by Teck at five stations: one location upstream from the Elk River (RG_KERRRD) and four downstream from the Elk River (RG_DSELK, RG_GRASMERE, RG_USGOLD, RG_BORDER; Figure 2.1). Water chemistry samples and *in situ* measurements were collected at each station. These data were provided in an annual water quality monitoring report produced by Teck (2021) and are summarized in this report along with water quality information collected concurrently with biological sampling conducted at downstream (RG_T4) and upstream (RG_TN) transects, as well as fishing areas downstream (RG_ER and RG_GC) and upstream (RG_SC) of the Elk River in the Canadian portion of the reservoir (Figure 2.1). Water quality data from the U.S. portion of the reservoir collected at three stations in 2020, International Boundary, Tenmile, and Forebay, were not made available and are not included in the analyses. A summary of monthly nitrate and selenium loadings to Koocanusa Reservoir is provided herein. Water quality monitoring conducted in the Canadian portion of the reservoir in 2020 also included specific conductance, temperature, and turbidity profiling to evaluate Elk River mixing characteristics in the reservoir under low (late April), intermediate (early June), and full (late August) pool conditions.

3.2 Water Quality

3.2.1 Water Chemistry

In 2020, monthly average concentrations of total selenium, nitrate, sulphate, and dissolved cadmium (i.e., the order constituents) at RG_KERRRD, RG_GRASMERE, RG_USGOLD, and RG_BORDER were equal to or below respective BC water quality guidelines (Appendix Figures B.4, B.10, and B.13). At RG_DSELK, monthly average concentrations of order constituents did not exceed the SPOs for that location (Appendix Table B.9). Concentrations of selenium approached the BC water quality guideline at RG_GRASMERE and RG_USGOLD, and the SPO at RG_DSELK in months where reservoir levels were low (Appendix Figure B.12; Appendix Table B.7)[18]. The twelve non-order constituents (i.e., total antimony, total barium, total boron, dissolved cobalt, total lithium, total manganese, total molybdenum, total nickel, nitrite, total dissolved solids, total uranium, and total zinc) occurred at concentrations below applicable BC water quality guidelines throughout 2020 at all the permitted water quality stations (Appendix Table B.7; Appendix Figures B.1 to B.16). Concentrations of constituents in water

[18] Results were rounded to match the number of significant digits specified for a provincial guideline or SPO.

samples taken during biological monitoring downstream (RG_ER, RG_T4, and RG_GC) and upstream (RG_SC and RG_TN) of the Elk River confluence were below applicable BC water quality guidelines, except for selenium which was above the BCWQG at RG_ER, RG_T4, and RG_GC in samples collected during the April field program (Appendix Table B.6). When a result is above a BCWQG it does not imply that unacceptable risk exists, but rather that the potential for adverse effects may be increased and additional investigation may be required (BCMOE 2019).

Monthly mean concentrations of barium, dissolved cadmium, lithium, molybdenum, nitrate, and selenium were significantly higher downstream of the Elk River compared to upstream at RG_KERRRD (Table 3.1). Conversely, significantly lower monthly mean concentrations of boron, manganese, and uranium were indicated downstream of the Elk River, and no differences in monthly mean concentrations of nickel, sulphate, total dissolved solids (TDS), or zinc were found between areas (Table 3.1). Concentrations of all constituents were typically highest in the winter and spring months at all stations in 2020, and generally followed the same seasonal pattern observed in previous years (Appendix Figures B.1 to B.16). This is likely reflective of the reservoir drawdown and lower water levels in the winter months. Concentrations of constituents with early warning triggers (EWTs) observed in 2020 at all permitted water quality stations both downstream and upstream of the Elk River were within the respective seasonal ranges observed in years from 2014 to 2016, 2018, and 2019.

3.2.2 Productivity

Productivity comparisons among the five permitted water quality monitoring stations (RG_KERRRD, RG_DSELK, RG_GRASMERE, RG_USGOLD, and RG_BORDER) were based on evaluation of total nitrogen to total phosphorus concentration (N:P) ratios. Ratios of N:P greater than 15 indicate that phosphorus is limiting, whereas ratios less than 7 indicate that nitrogen is limiting, based on categories defined by McDowell et al. (2009) using mass concentrations. At all permitted water quality stations, annual median N:P ratios were consistently 15 or more throughout the water column in 2020 both downstream and upstream of the Elk River indicating phosphorus limitation (Figure 3.1). Productivity for RG_WARDB and RG_ELKMOUTH were also indicative of phosphorus limitation, with the highest N:P ratio for all stations observed at RG_ELKMOUTH (Figure 3.1). Trophic status classification using Nordin (1985) categories for BC freshwaters suggested that Koocanusa Reservoir was primarily oligotrophic most of the year based on assessment using total phosphorus and chlorophyll-a concentrations, whereas assessment using Secchi depth indicated eutrophic conditions in spring and early summer, followed by mesotrophic conditions (Table 3.2). Assessment based on total nitrogen concentrations suggested the reservoir was mesotrophic for the entire year (Table 3.2). The seasonal variability in the trophic status of the reservoir is consistent from year-to-year and

Table 3.1: Comparison of Differences in Parameter Concentrations between Upstream (RG_KERRRD) and Downstream Water Quality Stations, Koocanusa Reservoir Monitoring Program, 2020

Parameter	Station	ANOVA[a]	Q1. Is there a difference in concentrations downstream compared to RG_KERRRD?[b] Magnitude of Difference (%)
Total Boron (mg/L)	RG_DSELK	0.556	-17
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Total Barium (mg/L)	RG_DSELK	0.887	21
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Dissolved Cadmium (mg/L)	RG_DSELK	0.262	8.8
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Total Lithium (mg/L)	RG_DSELK	0.658	24
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Total Manganese (mg/L)	RG_DSELK	0.012	-2.7
	RG_GRASMERE		-20
	RG_USGOLD		-31
	RG_BORDER		-43
Total Molybdenum (mg/L)	RG_DSELK	0.891	6.0
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Nickel (mg/L)	RG_DSELK	0.811	ns
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Nitrate (NO_3 mg/L)	RG_DSELK	0.997	132
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Nitrite (NO_2 mg/L)	RG_DSELK	0.682	40
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Total Selenium (mg/L)	RG_DSELK	0.993	320
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Sulphate (mg/L)	RG_DSELK	0.641	ns
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Total Dissolved Solids (mg/L)	RG_DSELK	0.804	ns
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Uranium (mg/L)	RG_DSELK	0.106	-3.7
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		
Zinc (mg/L)	RG_DSELK	0.453	ns
	RG_GRASMERE		
	RG_USGOLD		
	RG_BORDER		

Station difference P-value < 0.05. (grey)
Downstream value higher than upstream. (blue)
Downstream value lower than upstream. (green)

Notes: "ns" indicates not significant difference (p-value > 0.05) between upstream and downstream. Insufficient sample size (<3) for values above detection limits to complete analyses for total antimony and dissolved cobalt.

[a] ANOVA Conducted on the difference in $\log_{10}$ concentrations Upstream (RG_KERRRD) and Downstream to test for differences among stations (RG_DSELK, RG_GRASMERE, RG_USGOLD, RG_BORDER) of the Elk River ($\log_{10}$[DS]-$\log_{10}$[US]. If significant, each station was compared to Upstream separately.

[b] Post-hoc contrasts testing the difference in $\log_{10}$(DS)-$\log_{10}$(US) against zero with the magnitude of difference (MOD) calculated as (DS-US)/US*100% and application of geometric means for concentrations. Post-hoc tests were adjusted from the number of comparisons using Tukey's Honestly Significant Difference (HSD) tests.

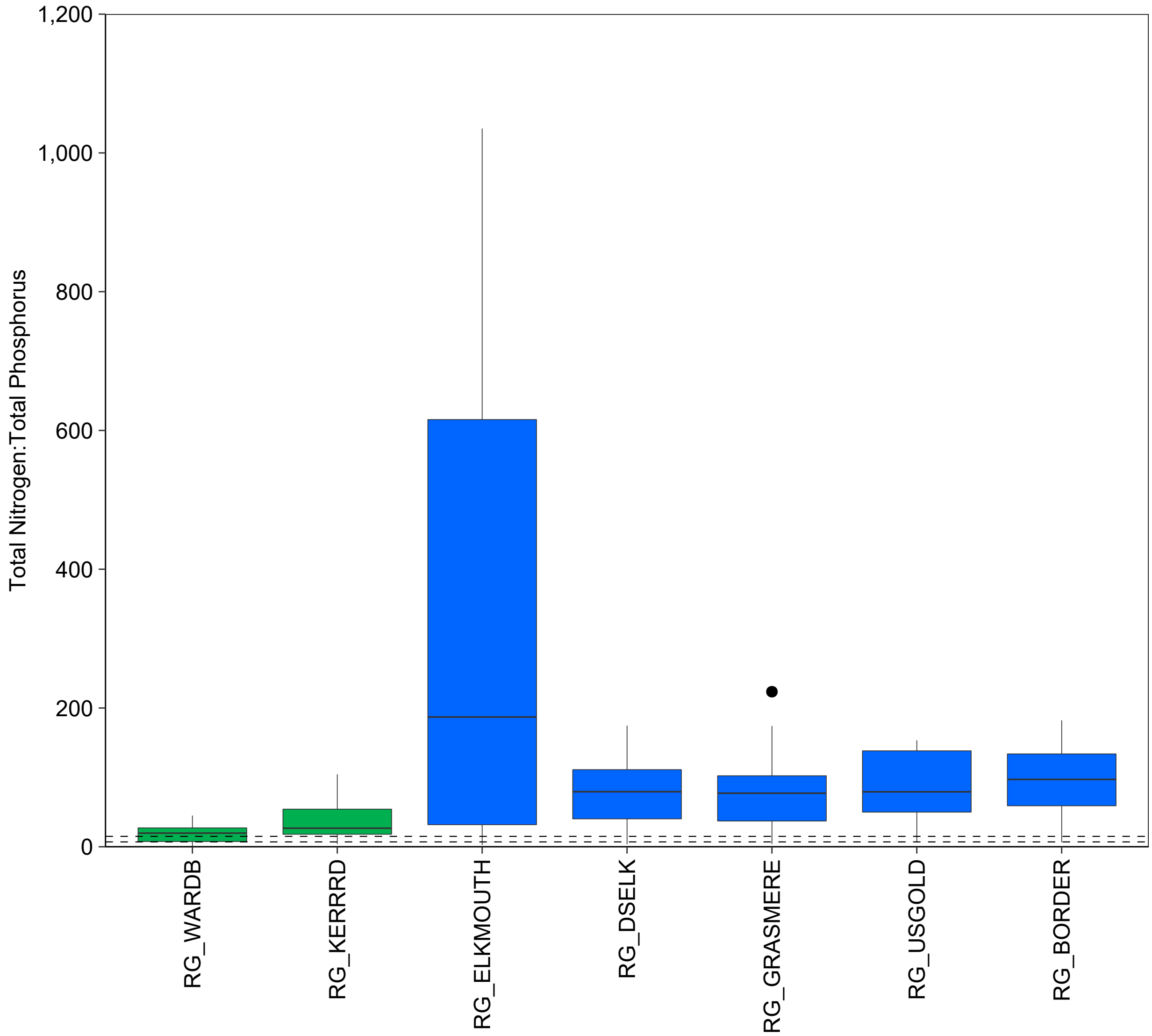


Figure 3.1: Ratio of Total Nitrogen to Total Phosphorus at Upstream (Green) and Downstream (Blue) Stations, Koocanusa Reservoir Monitoring Program, 2020

Notes: Concentrations are averaged across depths when data for multiple depths are available. Total N:P ratios > 15 (hatched line) are indicative of phosphorus limited systems. Total N:P ratios < 7 (hatched line) are indicative of nitrogen limited systems. Total N:P ratios in between 7 and 15 indicate co-limitation.

Table 3.2: Trophic Level Classification Using Monthly Means for Several Analytes Collected at Stations in the Koocanusa Reservoir Study Area, 2020

Unit	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Phosphorus (mg/L)	RG_WARDB	0.0078	0.012	0.016	0.013	0.017	0.25	0.023	0.012	0.0043	0.0060	0.0045	0.0036
	RG_KERRRD	0.0033	0.0053	0.0092	0.011	0.0087	0.054	0.0066	0.0027	0.0026	0.0025	0.0021	0.0038
	RG_ELKMOUTH	0.0027	0.0040	0.0058	0.028	0.027	0.33	0.011	0.0025	<0.002	<0.002	<0.002	<0.002
	RG_DSELK	0.0039	0.0058	0.012	0.011	0.0097	0.048	0.0071	0.0028	0.0022	0.0022	0.0027	0.0030
	RG_GRASMERE	-	0.0044	0.0075	0.0059	0.011	0.041	0.0061	0.0036	0.0036	0.0020	0.0030	0.0029
	RG_USGOLD	0.0047	-	0.0078	0.0075	0.0079	0.026	0.0051	0.0028	0.0023	<0.002	<0.002	0.0021
	RG_BORDER	0.0057	0.0033	0.0041	0.0044	0.0073	0.022	0.0061	0.0036	0.0025	0.0021	0.0024	0.0020
Chlorophyll-a (mg/L)	RG_WARDB	-	-	-	-	-	-	-	-	-	-	-	-
	RG_KERRRD	0.0010	0.00092	0.00059	0.00086	0.0011	0.00030	0.00089	0.0023	0.0020	0.0020	0.0012	0.0015
	RG_ELKMOUTH	-	-	-	-	-	-	-	-	-	-	-	-
	RG_DSELK	0.0017	0.00075	0.0016	0.0020	0.0012	0.00059	0.0011	0.0028	0.0018	0.0024	0.0020	0.0021
	RG_GRASMERE	-	0.0012	0.0025	0.0033	0.0012	0.0011	0.0013	0.0029	0.0020	0.0031	0.0020	0.0027
	RG_USGOLD	0.0043	-	0.0035	0.0035	0.0013	0.0014	0.0015	0.0021	0.0016	0.0024	0.0016	0.0027
	RG_BORDER	0.0048	0.0023	0.0016	0.0029	0.0013	0.0017	0.0016	0.0016	0.0013	0.0021	0.0018	0.0017
Secchi Depth (m)	RG_WARDB	-	-	-	-	-	-	-	-	-	-	-	-
	RG_KERRRD	-	-	0.60	0.66	0.43	0.22	1.8	2.1	3.5	4	4.5	3.3
	RG_ELKMOUTH	-	-	-	-	-	-	-	-	-	-	-	-
	RG_DSELK	-	-	1.6	0.68	0.50	0.57	2.3	2.8	4.5	4.6	4.3	4
	RG_GRASMERE	-	-	1.2	1.3	0.63	0.77	2.5	3	4	4.4	3.5	3.9
	RG_USGOLD	2.5	-	2.1	1.9	0.95	0.99	2.3	2.3	4.6	4.4	4.1	3.8
	RG_BORDER	2.5	3.5	3.0	2.5	1.1	1.4	2.6	2.8	3.9	5.4	4	4.1
Total Nitrogen (mg/L)	RG_WARDB	0.22	0.28	0.30	0.27	0.34	0.56	0.15	0.11	0.13	0.11	0.11	0.16
	RG_KERRRD	0.27	0.28	0.19	0.22	0.32	0.32	0.17	0.27	0.25	0.15	0.22	0.19
	RG_ELKMOUTH	1.5	1.5	1.9	1.7	1.1	1.4	1.1	1.2	1.6	1.5	1.6	1.3
	RG_DSELK	0.40	0.68	0.72	0.68	0.55	0.45	0.32	0.44	0.38	0.25	0.31	0.40
	RG_GRASMERE	-	0.42	0.59	0.66	0.57	0.42	0.27	0.38	0.35	0.35	0.27	0.31
	RG_USGOLD	0.46	-	0.52	0.62	0.55	0.46	0.31	0.43	0.33	0.30	0.30	0.28
	RG_BORDER	0.32	0.48	0.47	0.48	0.56	0.45	0.36	0.30	0.44	0.29	0.34	0.31

(green) Indicates oligotrophic status based on Nordin (1985) classification for the indicated parameter value.

(blue) Indicates mesotrophic status based on Nordin (1985) classification for the indicated parameter value.

(red) Indicates eutrophic status based on Nordin (1985) classification for the indicated parameter value.

Notes: Nordin 1985 criteria used in British Columbia for trophic level classification.

may be reflective of the rapid changes in water levels that take place from April to June during freshet.

3.2.3 Loadings

Monthly nitrate and selenium loadings were estimated based on total monthly flow and monthly average nitrate and selenium concentrations at stations RG_ELKMOUTH (Elk River) and RG_WARDB (Kootenay River). In the Elk River, the highest average monthly loadings occurred from May to July, with the peak occurring in June for both nitrate and selenium (Table 3.3). In the Kootenay River, the same months corresponded with the highest loadings for nitrate and selenium within the year, but with peak nitrate loadings occurring in May and peak selenium loadings occurring in June (Table 3.3). Loadings of both nitrate and selenium to Koocanusa Reservoir were higher from the Elk River than from the Kootenay River on both a monthly and annual timescale in 2020. Qualitative comparisons indicated that loadings of both parameters in 2020 were higher than previously observed from 2015 to 2019 for both rivers (Table 3.3).

3.3 *In Situ* Water Quality Profiles

In situ water quality profiles conducted in August 2020 under full-pool conditions indicated similar temperature changes through the water column at both the downstream and upstream transect, which identified the thermocline to be established between 8 to 10 m depth as had been observed in previous years of monitoring (Figure 3.2). Dissolved oxygen concentration profiles were also similar downstream and upstream of the Elk River and identified a well-oxygenated conditions throughout the entire water column (Figure 3.2). The pH in the profiles was highest near the surface at both transects, and profiles at both transects showed decreasing pH at greater depths below the epilimnion (Figure 3.2). Specific conductance profiles and measurements were also similar between the downstream and upstream transects in 2020 (Figure 3.2). The dissolved oxygen, pH, and specific conductance profiles in 2020 at each transect each showed similar patterns and measurements within the respective ranges observed historically (Figure 3.2).

3.4 Mixing Assessment

Mixing assessments conducted in 2020 represented the third year of the survey. Reservoir levels in April 2020 were similar to those observed in 2019, which were both higher than observed in 2018 (Figure 2.2). In April, specific conductance profiles identified influences from both the Kootenay and Elk rivers in the upper portion of the reservoir (Figure 3.3). Downstream of the Elk River, this influence was more strongly observed along the eastern bank of the reservoir downstream to RG_USGOLD where it appeared to sink down to the bottom of the reservoir bed near RG_BORDER (Figure 3.3). Temperature profiles tended to show a similar pattern and

Table 3.3: Average Monthly Nitrate and Selenium Loadings to the Koocanusa Reservoir, 2014 to 2020

Source	Month	Nitrate Loadings (kg/day)							Selenium Loadings (kg/day)						
		2014	2015	2016	2017	2018	2019	2020	2014	2015	2016	2017	2018	2019	2020
Elk River (RG_ELKMOUTH)	January	2,714	3,017	1,745	3,090	10,410	1,256	2,286	12	14	8	12	55	7	12.3
	February	2,115	4,828	2,250	1,817	11,164	1,073	2,226	10	22	10	8	59	6	12.1
	March	3,274	3,250	2,598	2,530	4,138	2,048	2,532	15	17	12	12	22	11	13
	April	6,164	5,969	7,794	3,988	3,271	2,949	4,558	29	33	33	21	18	18	23
	May	19,592	10,189	10,211	15,710	18,175	5,821	11,803	89	50	44	73	90	32	59
	June	20,975	12,671	8,009	16,016	10,749	10,700	20,277	91	55	35	72	58	51	101
	July	12,810	6,894	7,526	8,265	7,932	9,590	11,136	58	33	32	41	45	46	56
	August	5,542	5,436	6,704	4,883	4,452	6,009	5,977	28	26	30	24	25	30	31
	September	5,485	5,393	4,648	3,349	3,230	4,029	4,224	27	24	19	16	17	20	20
	October	4,380	5,230	4,568	2,760	3,024	3,613	2,918	21	23	20	15	17	19	15
	November	4,000	3,959	3,359	2,426	2,312	2,559	2,970	20	16	15	14	12	14	16
	December	1,944	2,817	3,286	2,984	2,009	2,073	2,773	9	12	15	16	11	12	16
Kootenay River (RG_WARDB)	January	448	567	550	-	591	470	462	0.43	0.50	0.48	-	0.48	0.46	0.64
	February	469	839	541	696	480	284	546	0.39	0.73	0.41	0.86	0.41	0.27	0.51
	March	467	448	411	753	460	612	424	0.35	0.44	0.50	0.62	0.50	0.47	0.56
	April	543	1,252	4,636	821	415	1,191	905	0.7	1.2	2.4	1.2	0.62	0.97	0.80
	May	8,788	4,999	5,434	8,868	11,602	6,262	8,712	5.6	2.8	3.5	5.2	8.2	2.7	3.6
	June	7,247	4,406	3,208	6,616	4,215	5,448	8,200	7.2	4.5	3.0	6.5	4.9	4.0	12.8
	July	4,544	1,582	1,580	2,925	2,417	4,223	3,801	6.6	1.6	2.2	3.9	3.3	3.4	4.0
	August	1,013	351	1,152	681	587	1,093	1,322	1.7	1.3	1.8	1.2	1.3	2.0	2.2
	September	618	658	470	343	199	991	525	1.21	1.01	0.84	0.74	0.71	1.15	1.1
	October	310	574	1,964	279	523	751	449	0.8	0.9	1.9	0.5	0.81	1.07	0.9
	November	868	752	1,788	295	508	765	330	0.95	0.82	1.12	0.43	0.60	0.78	0.85
	December	685	582	1,077	560	576	638	547	0.48	0.52	1.17	0.70	0.59	0.60	0.57

Note: "-" indicates no available data. Values below LRL were subbed in at the detection limit.

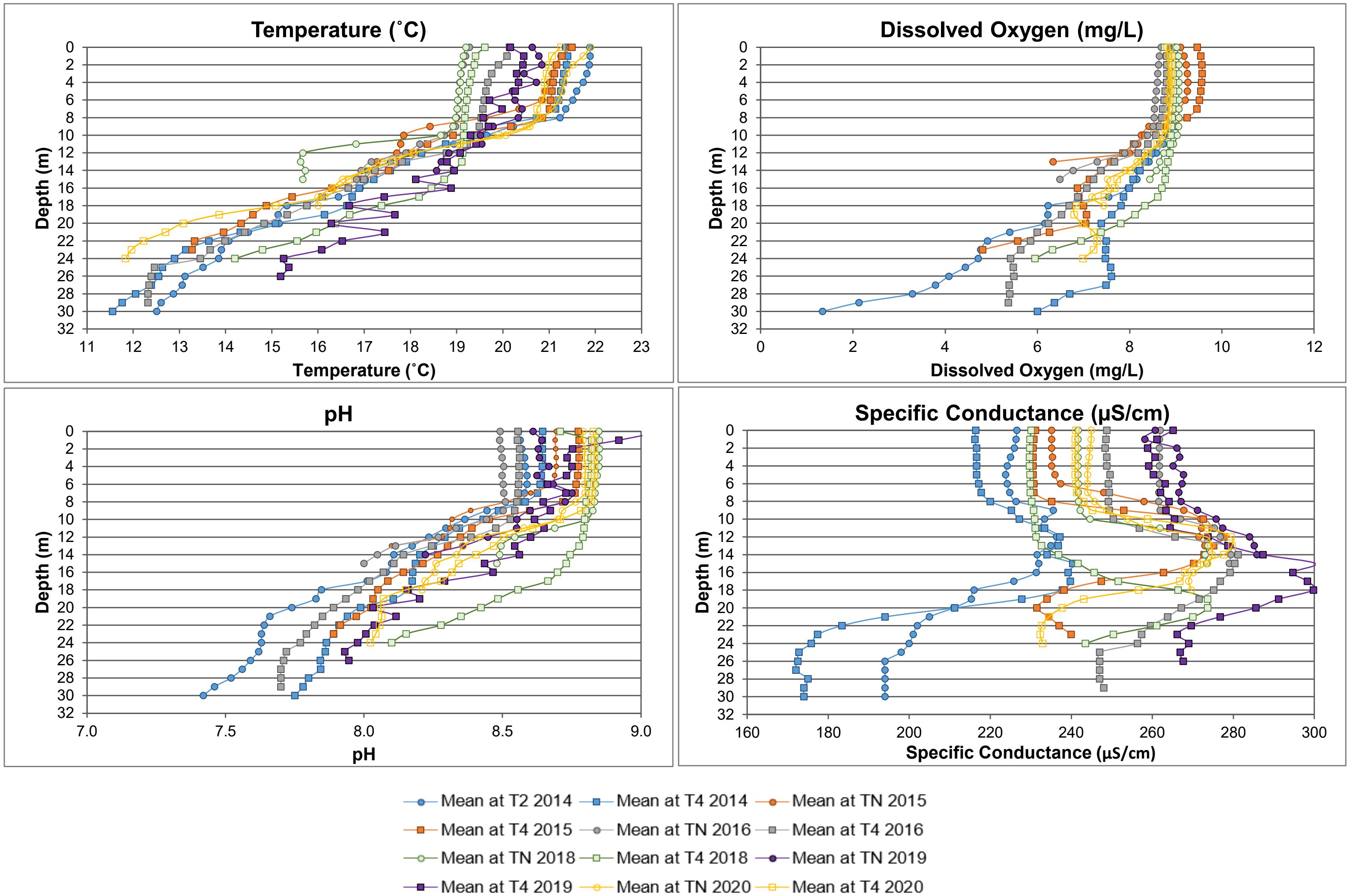
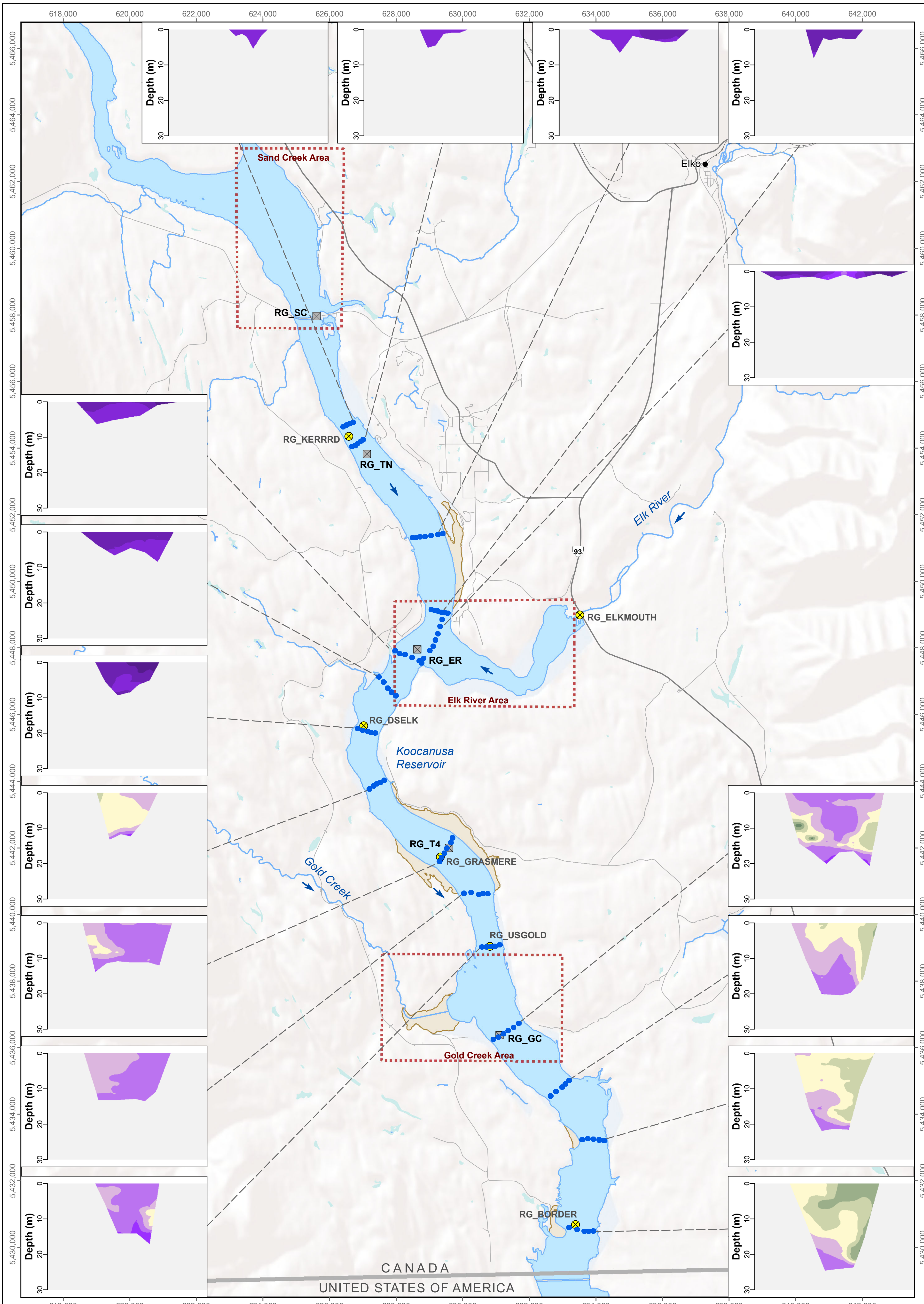


Figure 3.2: Mean Across-Transect (n=5 Stations per Transect) *In Situ* Water Quality Profiles Downstream (RG_T4) and Upstream (T2/RG_TN) of the Elk River in Koocanusa Reservoir Measured Annually in August from 2014 to 2020 (except 2017)

Note: Dissolved oxygen data for 2019 unavailable. Data in 2017 was not collected for these stations. In 2017, only routine water chemistry was measured at Teck's permitted water quality stations.



LEGEND

Specific Conductance (µS/cm)

- 190 - 199
- 199 - 209
- 209 - 218
- 218 - 227
- 227 - 237
- 237 - 246
- 246 -256
- 256 - 265
- 265 - 274
- 274 - 284

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for specific conductance.

Specific Conductance Profiles Conducted at Koocanusa Reservoir, April 2020

0 1.75 3.5 7
km

N E S W

Projection: North American Datum 1983 UTM Zone 11

Date: April 2021
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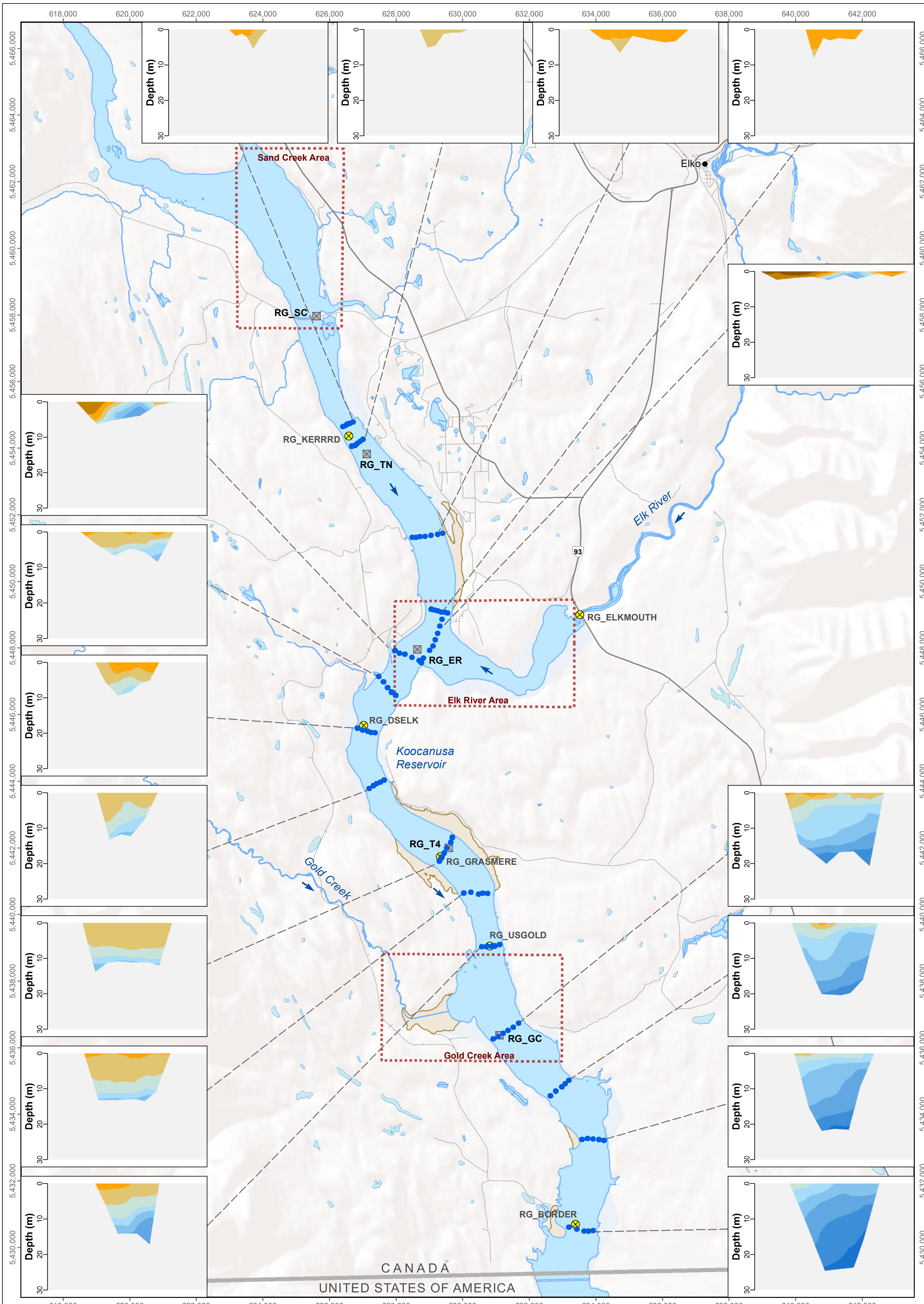
Figure 3.3

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 1 Koocanusa April Plume.mxd identified the Elk River as much colder compared to the Kootenay River, which was confined to the eastern bank of the reservoir until downstream of RG_DSELK where the temperature gradient was more consistent across the width of the basin near RG_BORDER (Figure 3.4). Turbidity profiles consistently indicated higher water clarity near the surface than near the bottom of the water column to as far downstream as RG_GRASMERE (Figure 3.5). Like specific conductance and temperature, turbidity identified a strong influence from the Elk River, but it was masked by a strong influence from the Kootenay River as well (Figures 3.3 to 3.5). Turbidity would have been related to spring freshet conditions at the time of sampling and decreased further downstream in the reservoir (Figure 3.5).

The June 2020 specific conductance profiles suggested that influences from Elk River flow were largely evident along the bottom of the eastern portion of the reservoir to downstream of RG_DSELK, then becoming more evident across the entire width of the reservoir but at slightly higher concentrations along the eastern portion of the reservoir to as far downstream as RG_BORDER (Figure 3.6). No patterns of Elk River mixing were evident in Koocanusa Reservoir based on profiles of either temperature or turbidity in June (Figures 3.7 and 3.8, respectively). Similar to turbidity profiles conducted in April, turbidity profiles in June indicated higher turbidity near the bottom of the water column at all areas, as well as higher turbidity in the upper compared to lower portion of the reservoir (Figure 3.8).

Specific conductance profiles conducted in August indicated flow from the Elk River remained near the bottom of the water column of the reservoir in the arm leading to the mouth of the Elk River (Figure 3.9). Downstream of this arm, the specific conductance profiles suggested that the Elk River flow was largely confined to within the eastern portion of the reservoir but at mid-water column depths to as far downstream as RG_GC (Figure 3.9), likely due to incomplete vertical mixing associated with cooler, higher density, waters at greater depth (compare Figure 3.9 and 3.10). At RG_BORDER, flow from the Elk River appears to occur in the central portion of the reservoir in both lateral and vertical directions based on the specific conductance profiles (Figure 3.9). No patterns of Elk River mixing were evident in Koocanusa Reservoir based on profiles of either temperature or turbidity in August (Figures 3.10 and 3.11, respectively).



LEGEND

Temperature (°C)

- 6.0 - 6.86
- 6.86 - 7.57
- 7.57 - 8.28
- 8.28 - 8.98
- 8.98 - 9.69
- 9.69 - 10.39
- 10.39 - 11.10
- 11.10 - 11.81
- 11.81 - 12.51
- 12.51 - 13.22

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for temperature.

Water Temperature Profiles Conducted at Koocanusa Reservoir, April 2020

0 2 4 8 km

Projection: North American Datum 1983 UTM Zone 11U

Date: April 2021
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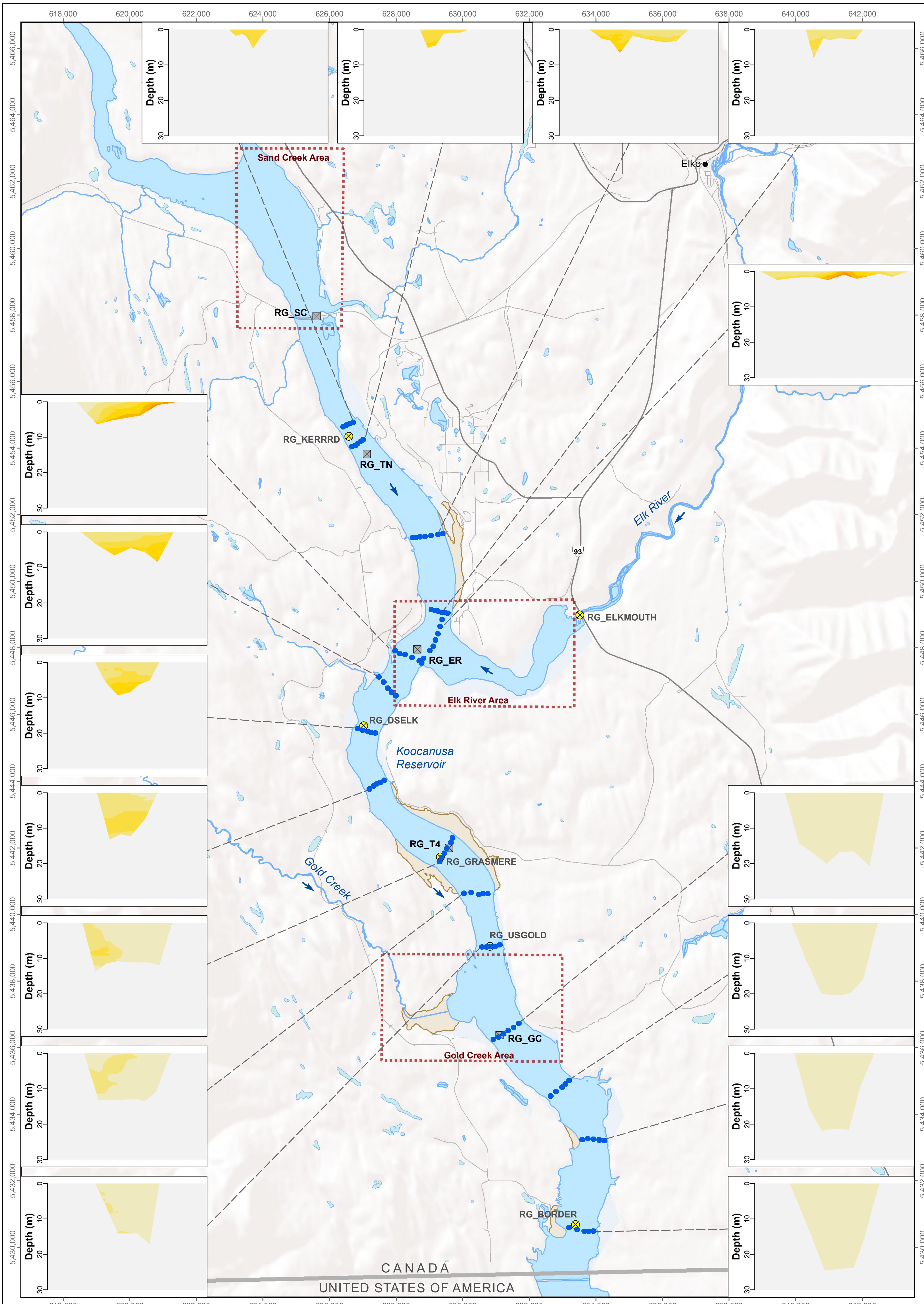
Figure 3.4

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 2 Koocanusa April Temperature.mxd



LEGEND

Turbidity (NTU)

- 0 - 11
- 11 - 23
- 23 - 34
- 34 - 46
- 46 - 57
- 57 - 69
- 69 - 80
- 80 - 91
- 91 - 103
- 103 - 114

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for turbidity.

Turbidity Profiles Conducted at Koocanusa Reservoir, April 2020

0 1.75 3.5 7
km

N E S W

Projection: North American Datum 1983 UTM Zone 11

Date: April 2021
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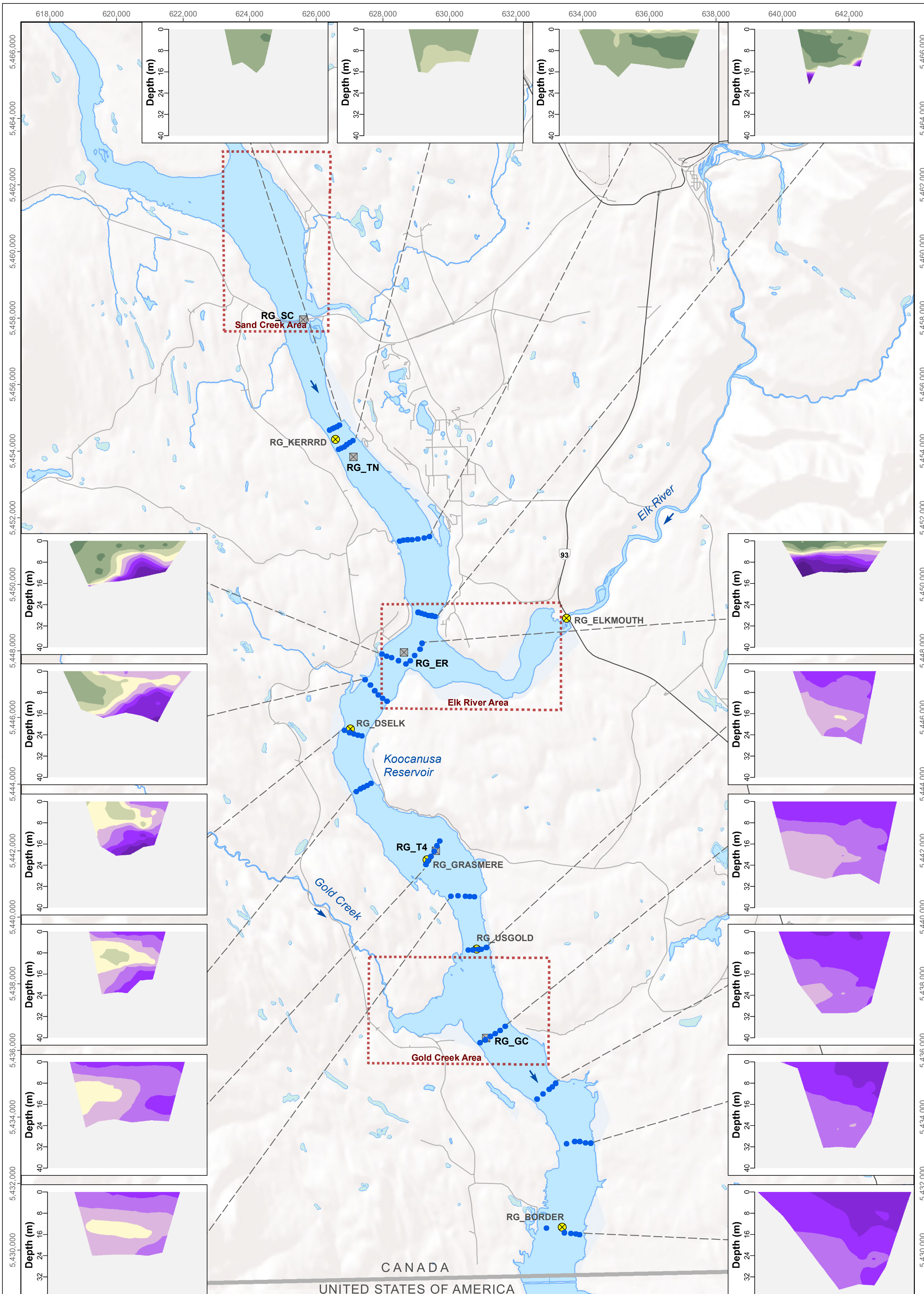
Figure 3.5

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 3 Koocanusa April Turbidity.mxd



LEGEND

Specific Conductance (µS/cm)

- 190 - 199
- 199 - 209
- 209 - 218
- 218 - 227
- 227 - 237
- 237 - 246
- 246 - 256
- 256 - 265
- 265 - 274
- 274 - 284

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for specific conductance.

Specific Conductance Profiles Conducted at Koocanusa Reservoir, June 2020

0 1.75 3.5 7
km

N E S W

Projection: North American Datum 1983 UTM Zone 11

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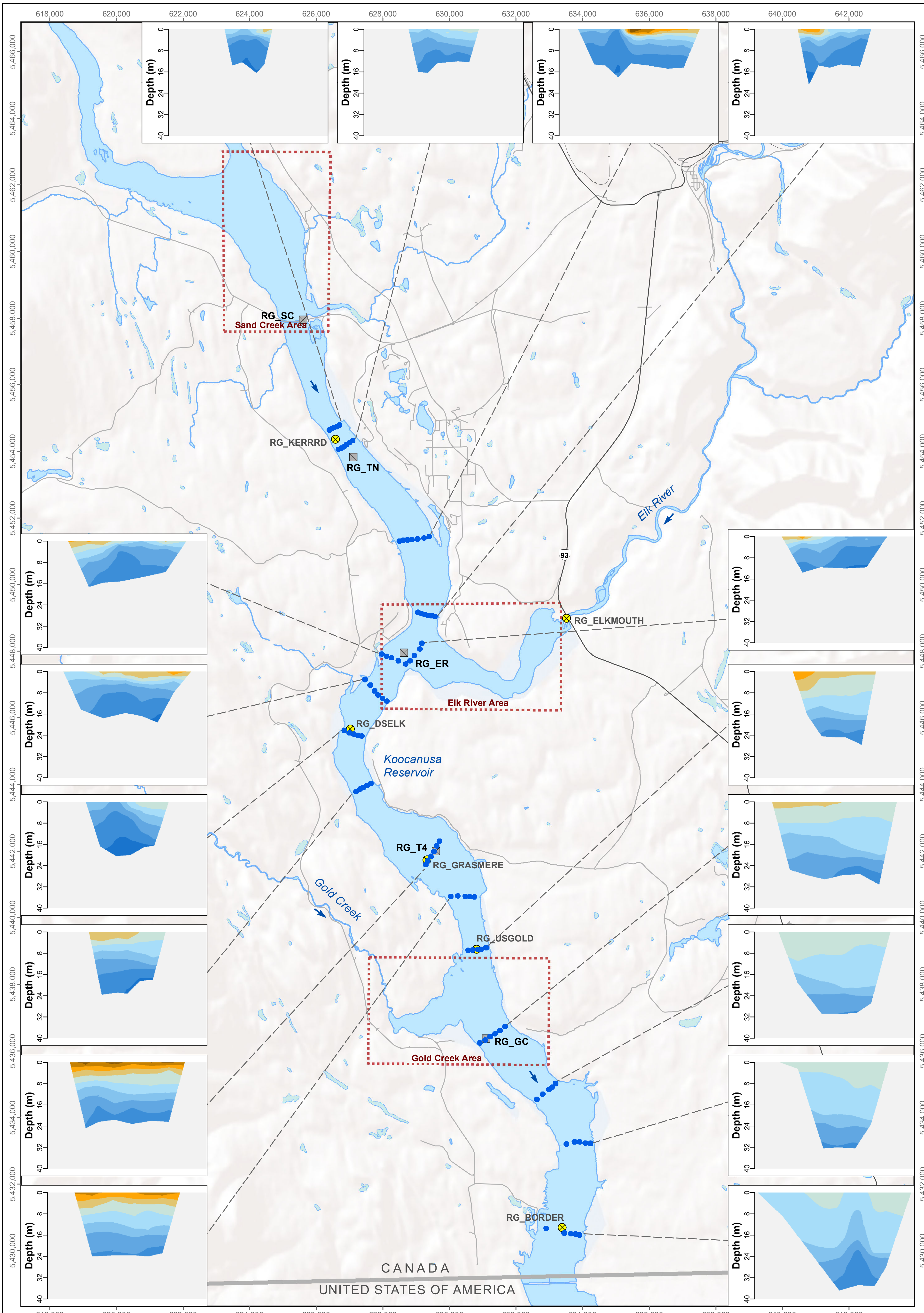
Figure 3.6

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 4 Koocanusa June Plume.mxd



LEGEND

Temperature (°C)

- 9.0 - 9.79
- 9.79 - 10.51
- 10.51 - 11.23
- 11.23 - 11.94
- 11.94 - 12.66
- 12.66 - 13.38
- 13.38 - 14.10
- 14.10 - 14.82
- 14.82 - 15.54
- 15.54 - 16.26

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for temperature.

Water Temperature Profiles Conducted at Koocanusa Reservoir, June 2020

0 1.75 3.5 7
km

N E S W

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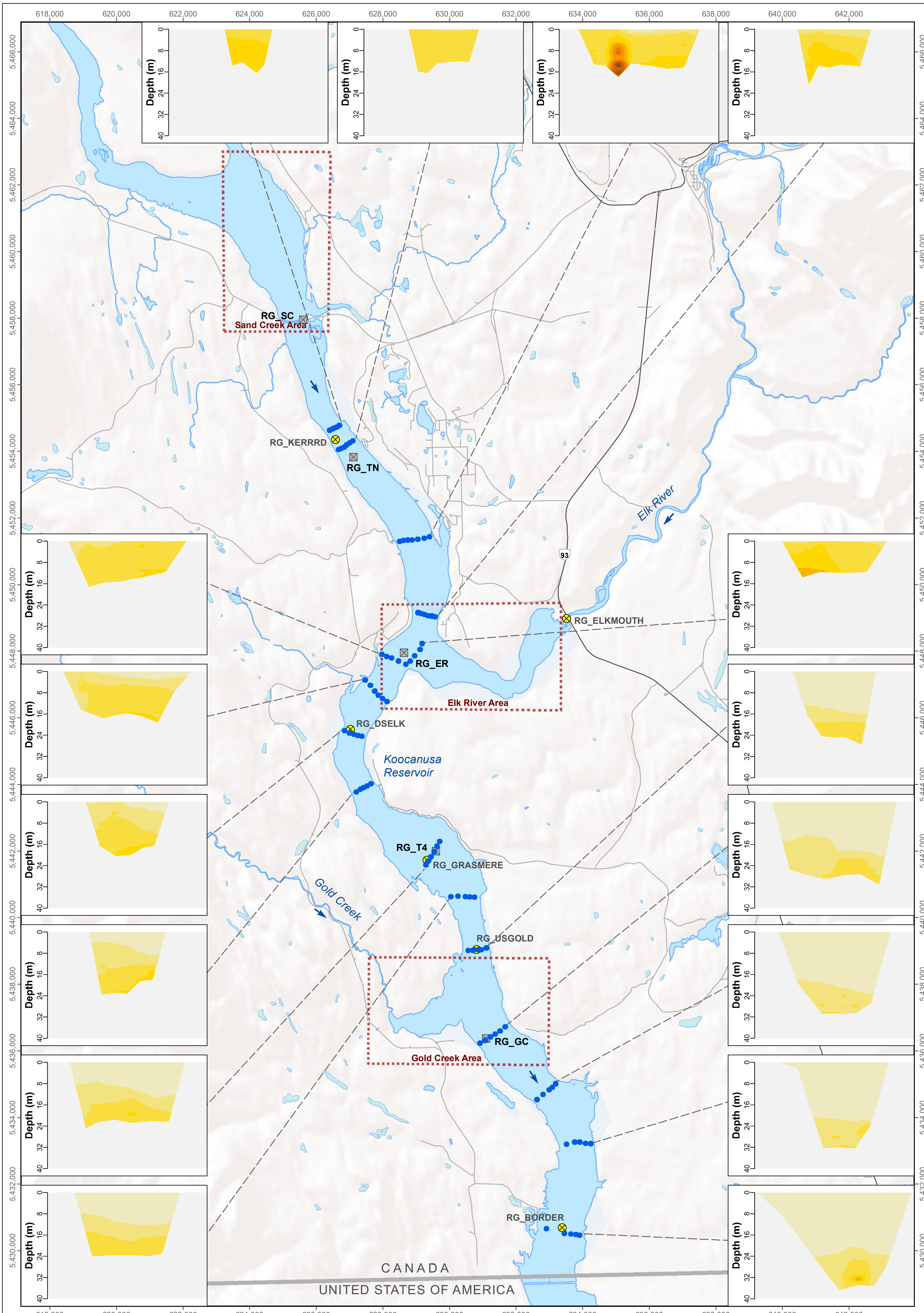
Figure 3.7

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 5 Koocanusa June Temperature.mxd



LEGEND

Turbidity (NTU)

- 0 - 41
- 41 - 81
- 81 - 122
- 122 - 163
- 163 - 203
- 203 - 244
- 244 - 284
- 284 - 325
- 325 - 366
- 366 - 406

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for turbidity.

Turbidity Profiles Conducted at Koocanusa Reservoir, June 2020

0 1.75 3.5 7
km

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Figure 3.8

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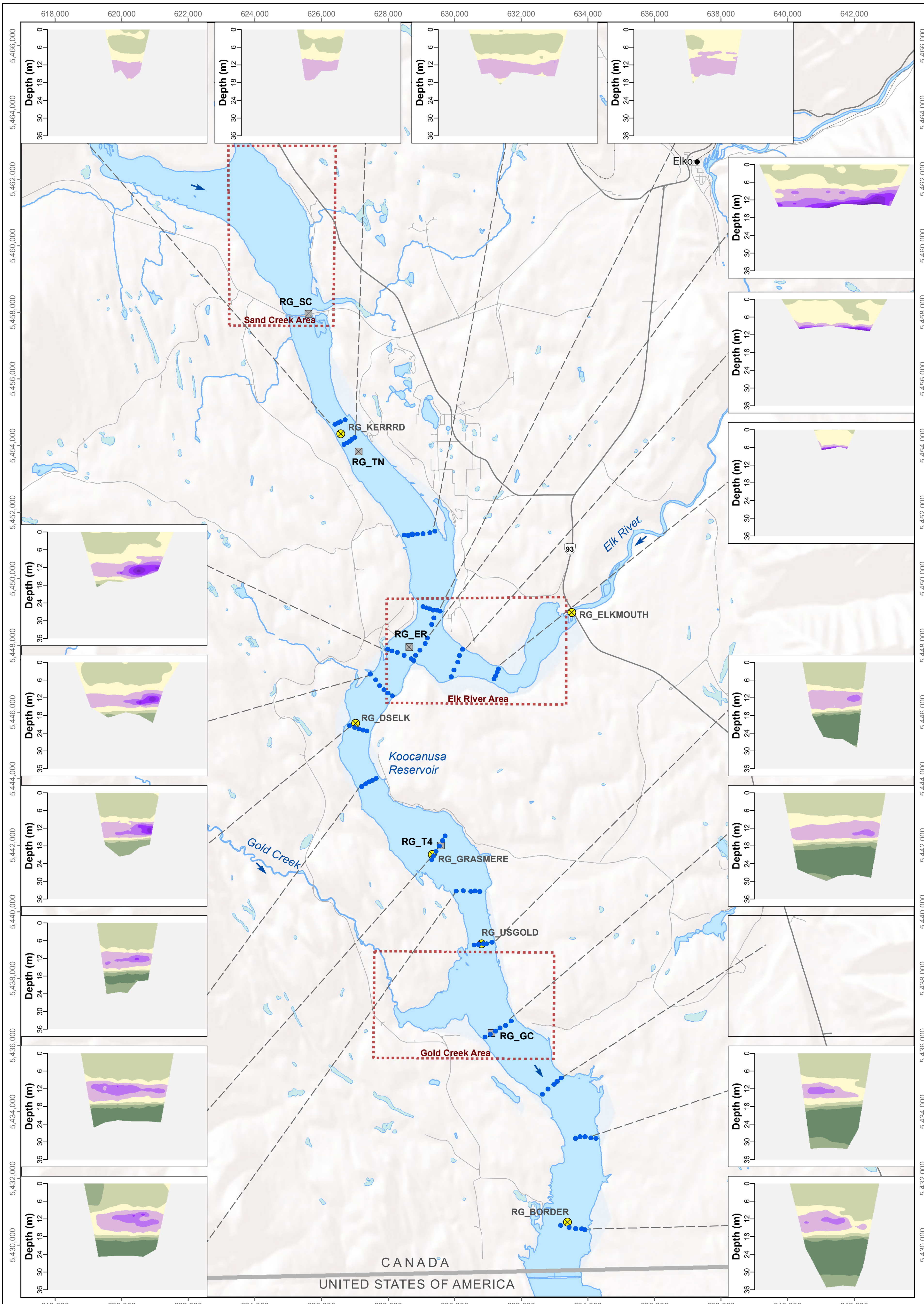

LEGEND

Specific Conductance (µS/cm)

- 223 - 236
- 236 - 250
- 250 - 263
- 263 - 276
- 276 - 289
- 289 - 302
- 302 - 315
- 315 - 329
- 329 - 342
- 342 - 355

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for specific conductance.

Specific Conductance Profiles Conducted at Koocanusa Reservoir, August 2020

0 1.75 3.5 7
km

N E S W

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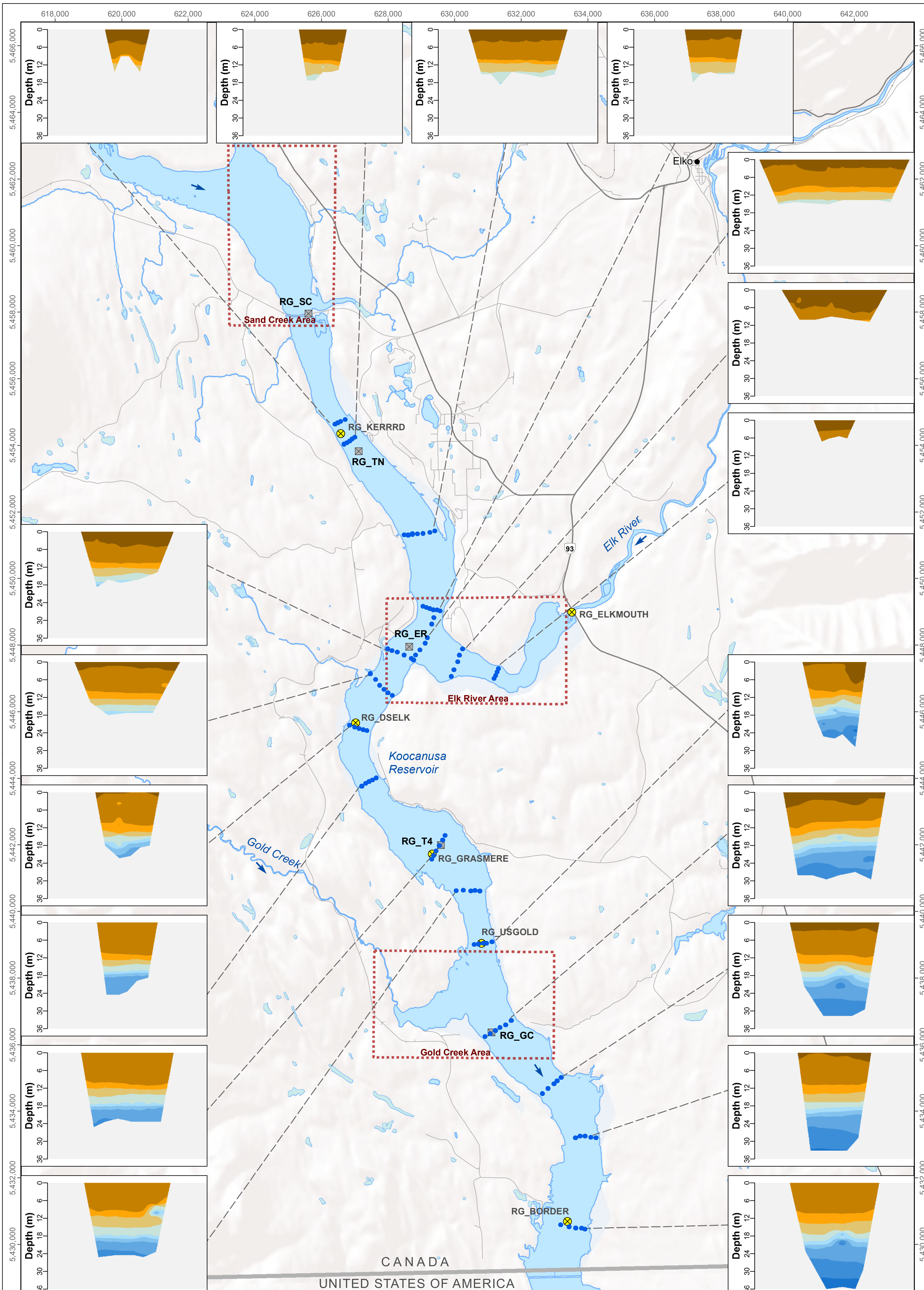
Figure 3.9

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 7 Koocanusa August Plume.mxd



LEGEND

Temperature (°C)

- 9.0 - 10.39
- 10.39 - 11.78
- 11.78 - 13.17
- 13.17 - 14.56
- 14.56 - 15.95
- 15.95 - 17.34
- 17.34 - 18.73
- 18.73 - 20.12
- 20.12 - 21.51
- 21.51 - 22.90

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for temperature.

Water Temperature Profiles Conducted at Koocanusa Reservoir, August 2020

0 1.75 3.5 7
km

N E S W

Projection: North American Datum 1983 UTM Zone 11U

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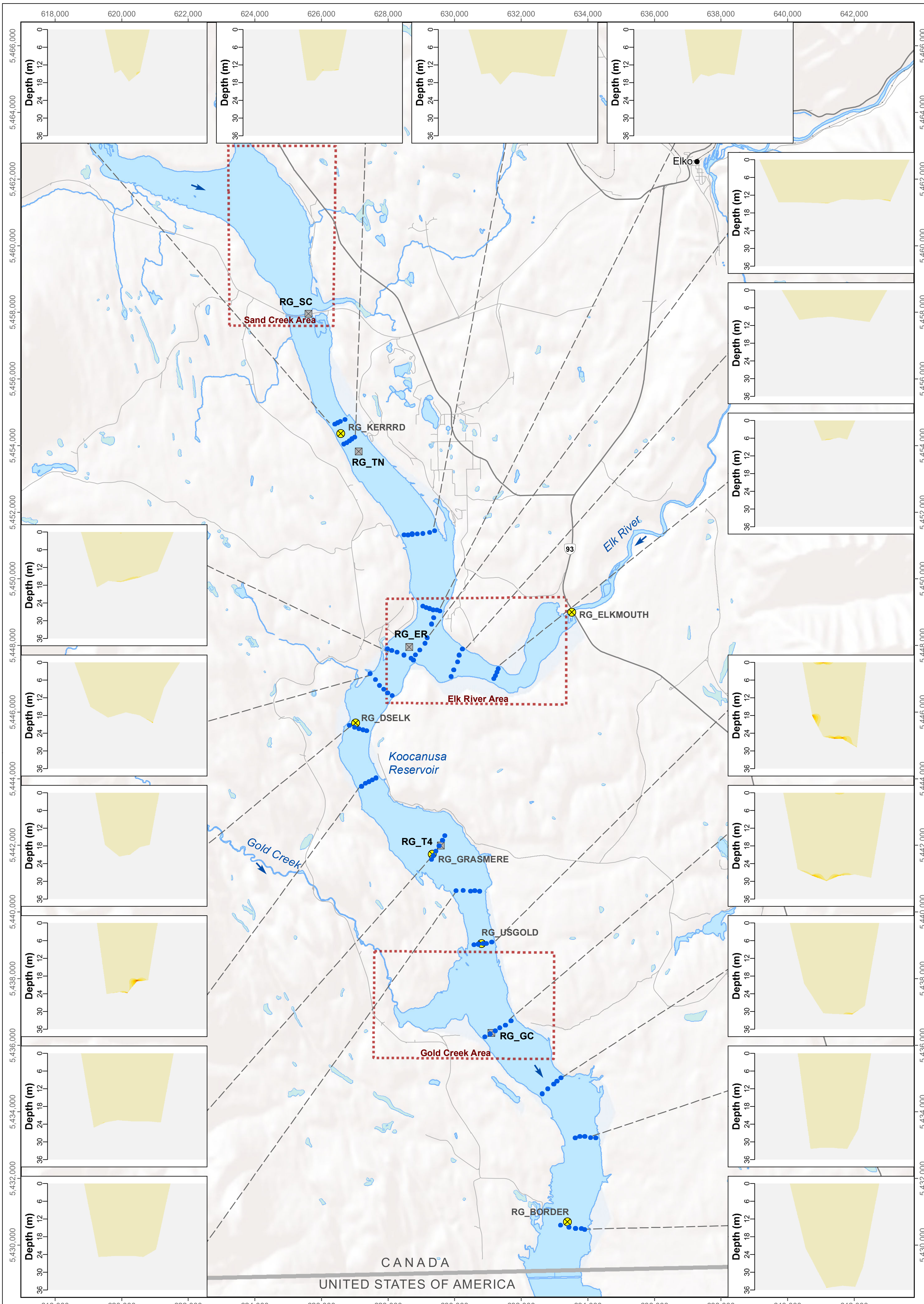
Figure 3.10

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 8 Koocanusa August Temperature.mxd



LEGEND

Turbidity (NTU)
- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- 250 - 300
- 300 - 350
- 350 - 400
- 400 - 450
- 450 - 500

- Transect Location
- Water Chemistry and In Situ Monitoring Station
- Permitted Water Quality Station
- Fish (fish health, recruitment, and fish tissue) Sampling Area

Note: Color scheme set as 10% of the total range for turbidity.

Turbidity Profiles Conducted at Koocanusa Reservoir, August 2020

0 1.75 3.5 7 km

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Figure 3.11

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0012 - Koocanusa\4 - GIS\1 - Report\20-12 Figure 9 Koocanusa August Turbidity.mxd

4 SEDIMENT QUALITY

4.1 Overview

Sediment samples were collected from profundal habitat along transects located downstream (RG_T4) and upstream (RG_TN) of the Elk River confluence with Koocanusa Reservoir in August 2020 consistent with the approved monitoring program study design (Minnow 2018b). Large volume suspended sediment samples were also collected from RG_DSELK in June, July, and September 2020 for the analysis of selenium concentrations in material suspended in the epilimnion.

4.2 Sediment Particle Size and Chemistry

Sediment both downstream and upstream of the Elk River was primarily composed of silt-sized material and lesser proportions of clay-sized material in August 2020 (Figure 4.1). Significantly higher proportions of clay-sized material were measured in sediment downstream of the Elk River compared to upstream (45% difference between areas), but no significant differences in the proportion sand-sized material, silt-sized material, or TOC were indicated between these study areas (Table 4.1).

Metals elevated above the lower working sediment quality guidelines (WSQG) at three or more stations both downstream and upstream of the Elk River included arsenic, iron, manganese, and nickel, but the elevation in concentrations of these parameters was not mine-related based on similar concentrations at both transects (Appendix Table C.1). Concentrations of the PAHs 2-methylnaphthalene and phenanthrene were also elevated above the lower WSQG (Appendix Table C.1). Several metals (including arsenic and selenium) and PAHs (including 2-methylnaphthalene and phenanthrene) occurred at significantly higher concentrations in sediment downstream of the Elk River compared to upstream suggesting an Elk River source for these parameters (Table 4.1). Concentrations of arsenic, iron, manganese, nickel, and selenium metals, and 2-methynaphthalene and phenanthrene PAHs, in sediment at the downstream and upstream areas of Koocanusa Reservoir in 2020 were within respective ranges shown at each study area from 2013 to 2019 (Figure 4.2). This suggested no substantial changes in concentrations of metals and PAHs in sediment at either the downstream or upstream study areas of Koocanusa Reservoir since 2013.

4.3 Suspended Sediment Selenium Concentrations

Large volume suspended sediment samples collected from RG_DSELK in June, July, and September 2020 indicated higher concentrations of selenium in suspended sediment with progression from early to late summer (Figure 4.3). In September 2020, the concentrations of

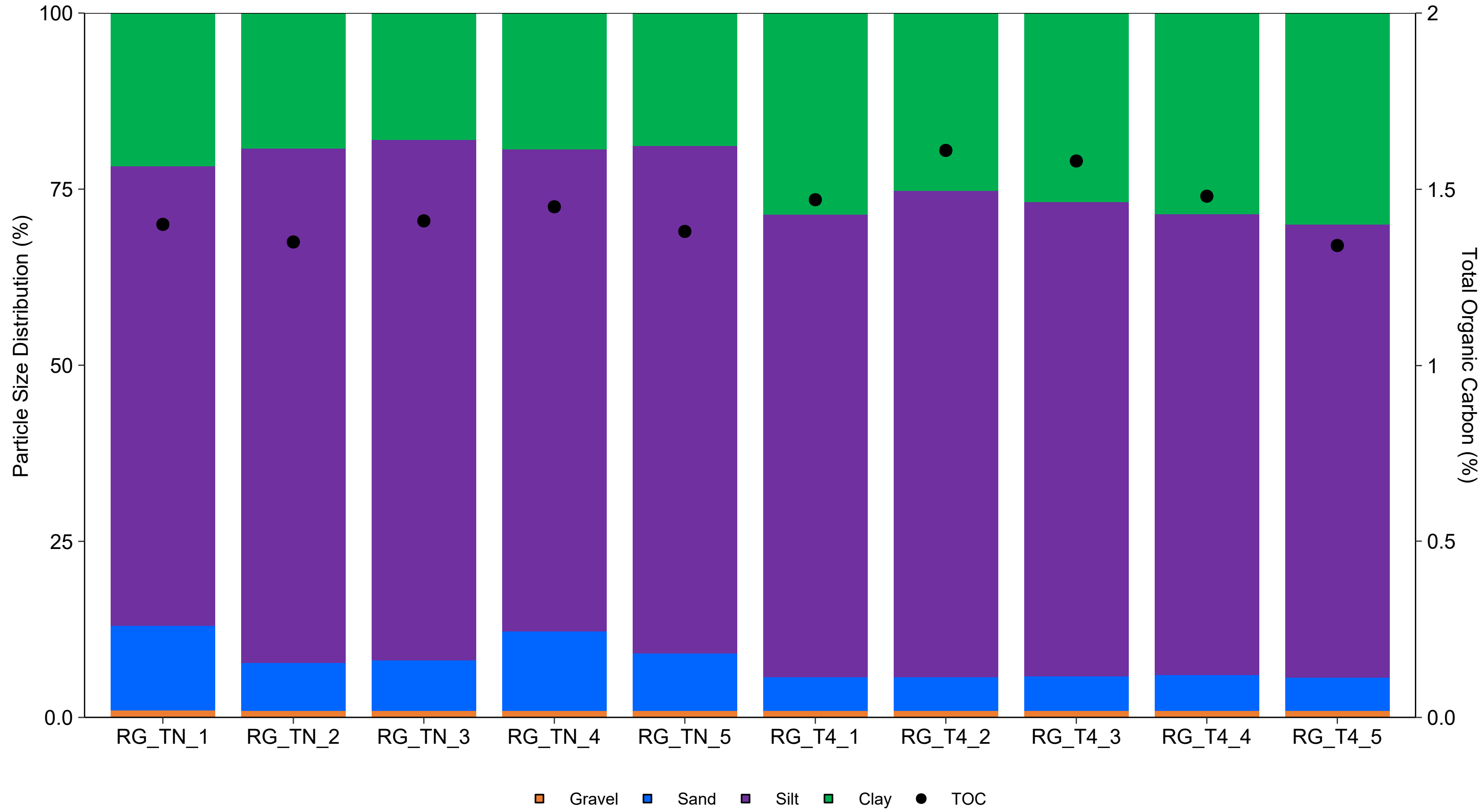


Figure 4.1: Sediment Particle Size Distribution and Total Organic Carbon (TOC) Content at Koocanusa Reservoir Transect Stations, 2020

Table 4.1: Statistical Comparisons of Concentrations of Metals and PAHs in Sediment Between Areas Downstream (RG_T4) and Upstream (RG_TN) of the Elk River, August 2020

Parameter	Units	Test [a]	Summary Statistics	Test P-value	asure of Central Tende		Magnitude of Difference [b]
					RG_TN	RG_T4	
% Sand	%	M-W	Median	0.067	3.50	1.00	ns
% Silt	%	tequal	Mean	0.139	73.4	69.8	ns
% Clay	%	tequal	Mean	0.001	20.2	29.3	45
Total Organic Carbon	%	tequal	Mean	0.088	1.40	1.50	ns
Aluminum	mg/kg	tequal	Mean	0.958	12,720	12,700	ns
Antimony	mg/kg	tequal	Mean	0.001	0.320	0.448	40
Arsenic	mg/kg	tequal	Mean	0.003	5.81	7.12	22
Barium	mg/kg	tequal	Mean	0.001	88.9	158	78
Beryllium	mg/kg	tequal	Mean	0.001	0.430	0.590	37
Bismuth	mg/kg	M-W	Median	0.154	0.210	0.220	ns
Boron	mg/kg	M-W	Median	0.180	5.00	5.00	ns
Cadmium	mg/kg	tunequal	Mean	0.001	0.194	0.502	159
Calcium	mg/kg	tequal	Mean	0.003	114,600	97,040	-15
Chromium	mg/kg	tequal	Mean	0.892	19.2	19.3	ns
Cobalt	mg/kg	tequal	Mean	0.721	9.58	9.42	ns
Copper	mg/kg	tequal	Mean	0.183	15.8	17.1	ns
Iron	mg/kg	tequal	Mean	0.427	23,560	22,660	ns
Lead	mg/kg	tequal	Mean	0.522	15.4	15.0	ns
Lithium	mg/kg	tequal	Mean	0.031	27.5	24.8	-9.7
Magnesium	mg/kg	tequal	Mean	0.105	22,680	20,580	ns
Manganese	mg/kg	tequal	Mean	0.001	464	567	22
Mercury	mg/kg	tequal	Mean	0.001	0.0230	0.0400	74
Molybdenum	mg/kg	tequal	Mean	0.001	0.658	0.952	45
Nickel	mg/kg	tequal	Mean	0.332	22.0	23.1	ns
Phosphorous	mg/kg	tequal	Mean	0.003	489	649	33
Potassium	mg/kg	tequal	Mean	0.001	988	1,564	58
Selenium	mg/kg	M-W	Median	0.007	0.200	0.720	260
Silver	mg/kg	M-W	Median	0.180	0.100	0.100	ns
Sodium	mg/kg	tequal	Mean	0.030	102	113	11
Strontium	mg/kg	tequal	Mean	0.001	282	202	-28
Thallium	mg/kg	tequal	Mean	0.001	0.0902	0.162	79
Tin	mg/kg	tequal	Mean	0.009	77.2	45.2	-41
Titanium	mg/kg	tequal	Mean	0.096	0.683	0.759	ns
Tungsten	mg/kg	tequal	Mean	0.001	14.3	20.3	42
Uranium	mg/kg	tequal	Mean	0.021	70.6	82.7	17
Vanadium	mg/kg	M-W	Median	0.456	1.60	1.50	ns
Benzo(b&j)fluoranthene	mg/kg	M-W	Median	0.007	0.0100	0.0150	50
Benzo(e)pyrene	mg/kg	M-W	Median	0.072	0.0100	0.0110	ns
Benzo(b,j,k)fluoranthene	mg/kg	M-W	Median	0.180	0.0150	0.0150	ns
Fluoranthene	mg/kg	M-W	Median	0.025	0.0100	0.0140	40
2-Methylnaphthalene	mg/kg	M-W	Median	0.007	0.0100	0.0410	310
Naphthalene	mg/kg	M-W	Median	0.007	0.0100	0.0180	80
Perylene	mg/kg	M-W	Median	0.071	0.0100	0.0140	ns
Phenanthrene	mg/kg	M-W	Median	0.007	0.0100	0.0480	380
Pyrene	mg/kg	M-W	Median	0.025	0.0100	0.0120	20
d10-Acenaphthene	mg/kg	tequal	Mean	0.004	100	92.6	-7.7
d12-Chrysene	mg/kg	tequal	Mean	0.761	102	103	ns
d8-Naphthalene	mg/kg	tequal	Mean	0.002	98.5	90.6	-8.1
d10-Phenanthrene	mg/kg	tequal	Mean	0.074	102	97.9	ns
IACR (CCME)	mg/kg	M-W	Median	0.025	0.150	0.180	20

(grey) Indicates significant difference between study areas at a P-value < 0.05.
(blue) Comparison to Upstream (RG_SC) is significant (α = 0.05) and magnitude of difference is positive.
(green) Comparison to Upstream (RG_SC) is significant (α = 0.05) and magnitude of difference is negative.

Notes: nt = not tested; ns = not significant; M-W = Mann-Whitney, tequal = t-test equal variance; tunequal = t-test unequal variance. "-" indicates no data available.

[a] Some parameters were not tested because more than 80% of the values were below the laboratory detection limit. These

[b] Magnitude of difference calculated as $(MCT_{Mine\text{-}exposed} - MCT_{Reference})/(MCT_{Reference})\times100\%$, where MCT is the measure of central tendency = mean (ANOVA, tunequal, and tequal), geometric mean ($ANOVA_{log}$), median (Mann–Whitney or KW tests).

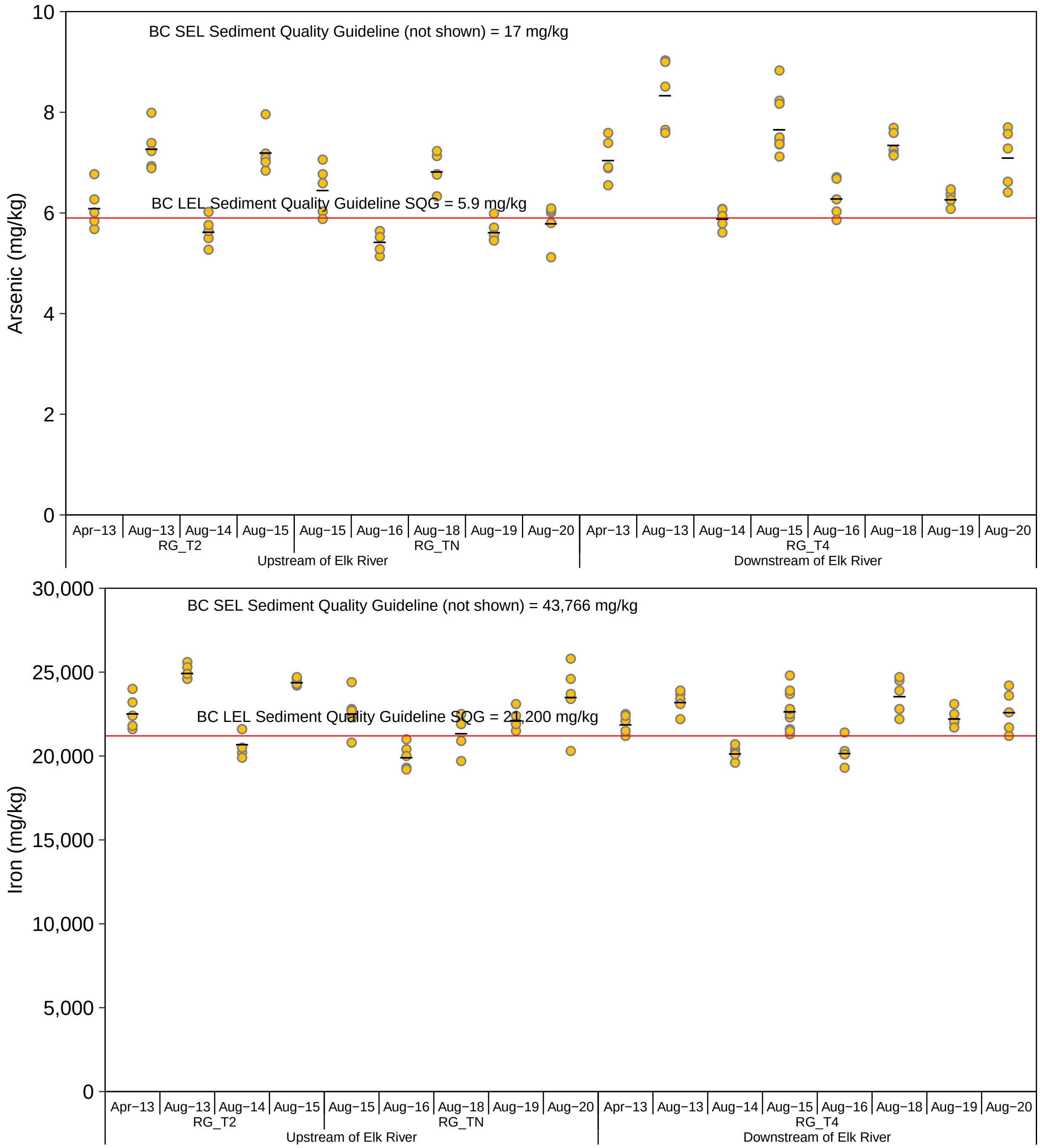


Figure 4.2: Key Sediment Parameter Concentrations for those Parameters that were Elevated Relative to Sediment Quality Guideline Lowest Effects Level (LEL), Koocanusa Reservoir Monitoring Program, 2013 to 2020

Notes: Individual values are plotted. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. The upstream area was sampled at T2 until April 2015 and this area was relocated further upstream from the mouth of the Elk River (TN) beginning in August 2015.

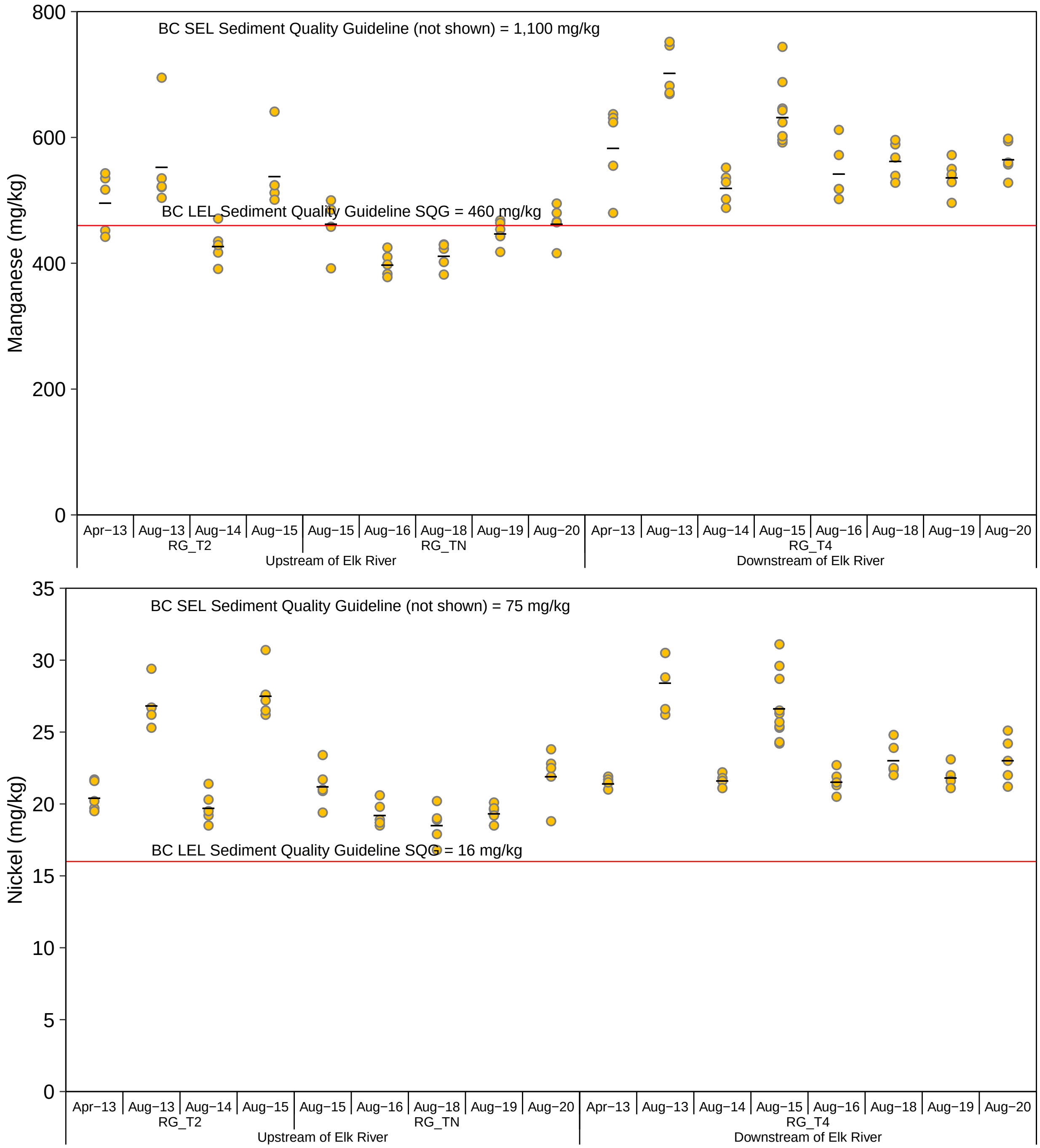


Figure 4.2: Key Sediment Parameter Concentrations for those Parameters that were Elevated Relative to Sediment Quality Guideline Lowest Effects Level (LEL), Koocanusa Reservoir Monitoring Program, 2013 to 2020

Notes: Individual values are plotted. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. The upstream area was sampled at T2 until April 2015 and this area was relocated further upstream from the mouth of the Elk River (TN) beginning in August 2015.

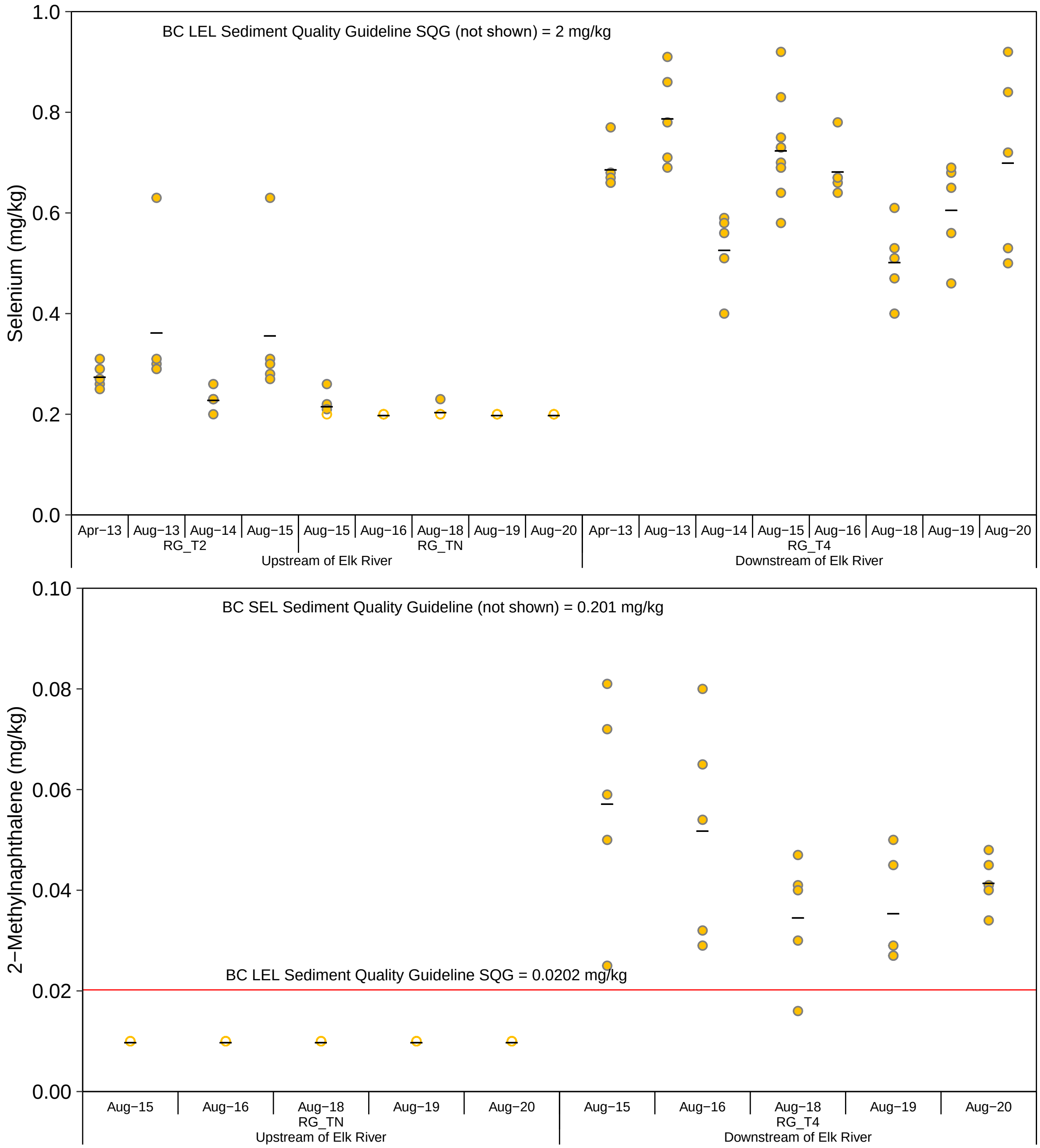


Figure 4.2: Key Sediment Parameter Concentrations for those Parameters that were Elevated Relative to Sediment Quality Guideline Lowest Effects Level (LEL), Koocanusa Reservoir Monitoring Program, 2013 to 2020

Notes: Individual values are plotted. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. The upstream area was sampled at T2 until April 2015 and this area was relocated further upstream from the mouth of the Elk River (TN) beginning in August 2015.

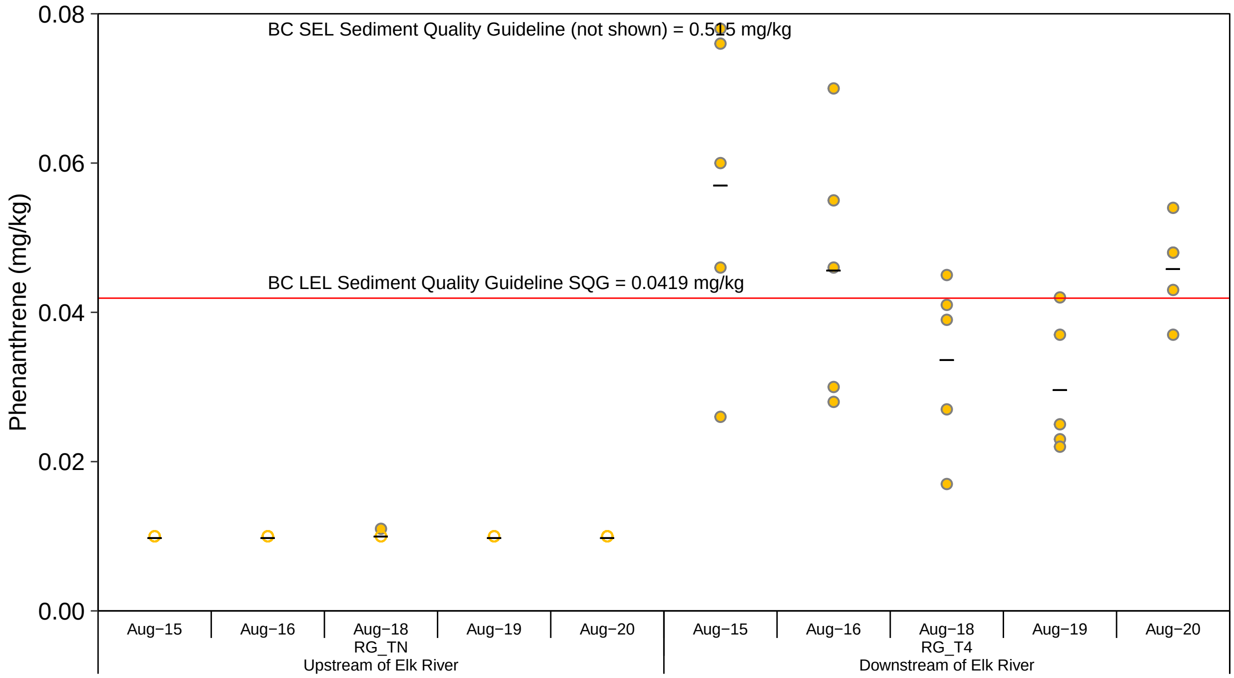
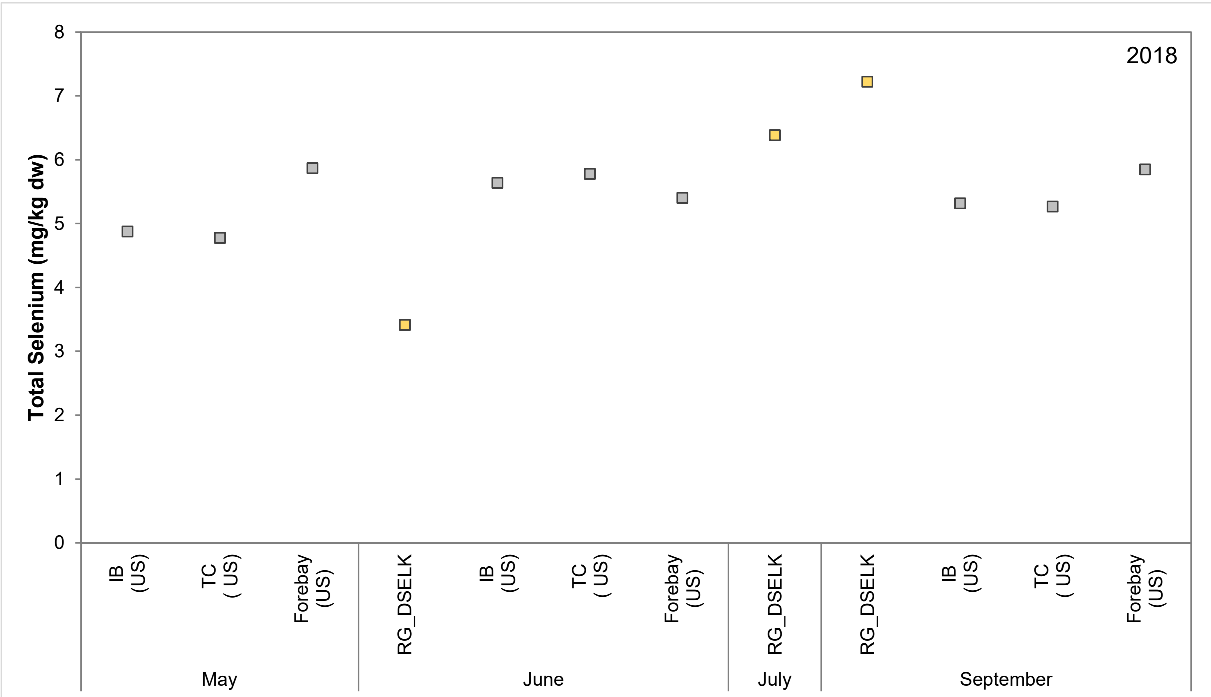


Figure 4.2: Key Sediment Parameter Concentrations for those Parameters that were Elevated Relative to Sediment Quality Guideline Lowest Effects Level (LEL), Koocanusa Reservoir Monitoring Program, 2013 to 2020

Notes: Individual values are plotted. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. The upstream area was sampled at T2 until April 2015 and this area was relocated further upstream from the mouth of the Elk River (TN) beginning in August 2015.



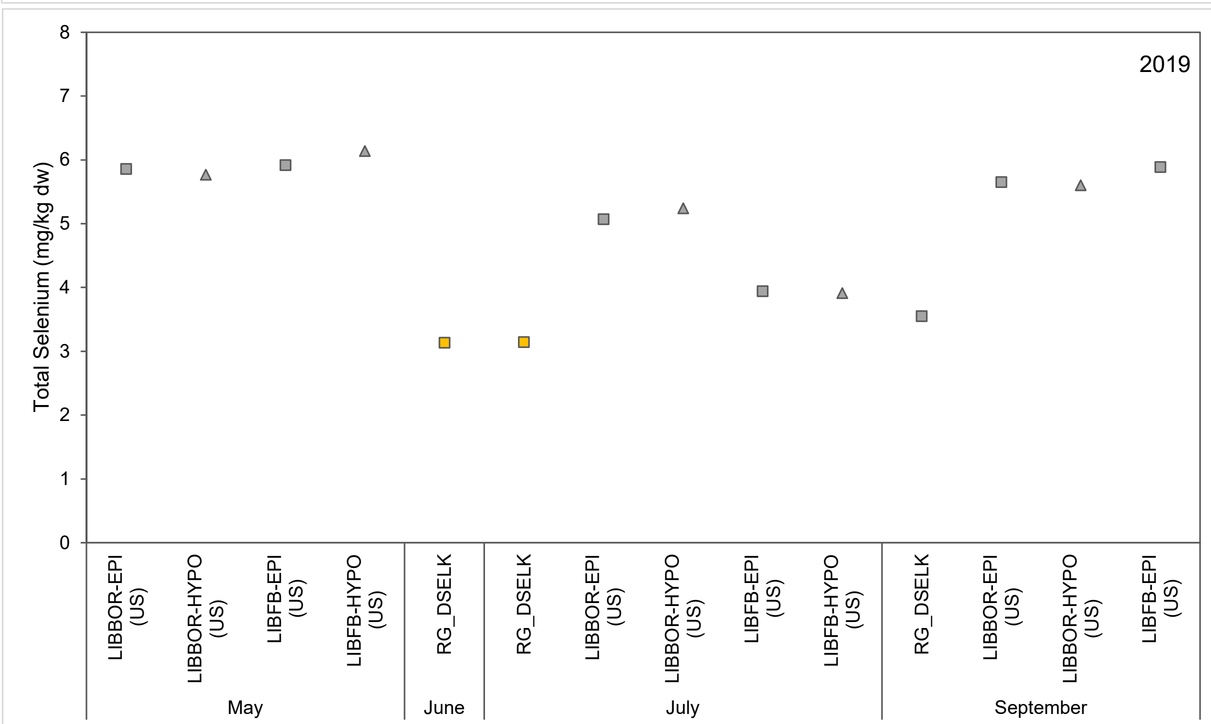


Figure 4.3: Particulate Selenium Concentrations of Large-Volume Suspended Sediment Samples Collected from the Epilimnion of Canadian (RG_DSELK) and Montana (International Boundary [LIBBOR] and Forebay [LIBFB]) Portions of Koocanusa Reservoir, 2018 to 2020

Notes: Concentrations presented as averages where applicable duplicates were collected. Koocanusa Reservoir station in Canada (RG_DSELK) is represented by a yellow symbol, and those for Montana stations are represented by grey symbols. Epilimnion samples represented by a square symbol, hypolimnion samples represented by a triangle symbol. September sample for RG_DSELK was misplaced by the laboratory, and although later found, was not processed in time to be included in this report. No hypolimnion sample was collected for LIBFB in September 2019. No Montana samples were collected in May or July in 2020.

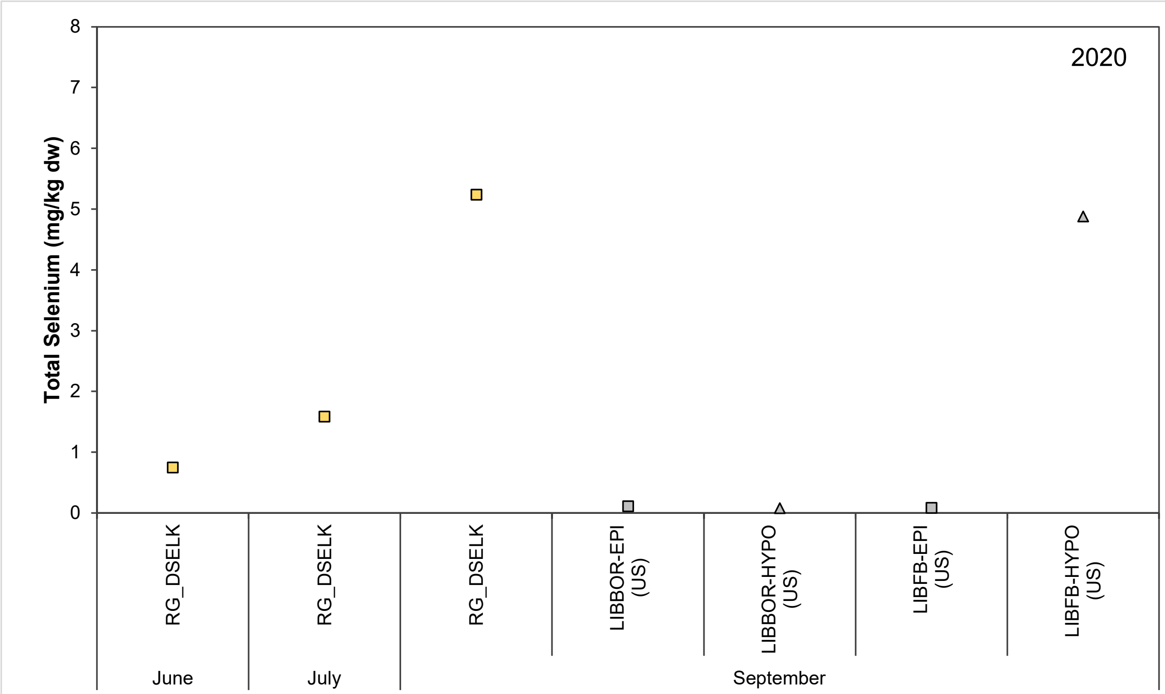


Figure 4.3: Particulate Selenium Concentrations of Large-Volume Suspended Sediment Samples Collected from the Epilimnion of Canadian (RG_DSELK) and Montana (International Boundary [LIBBOR] and Forebay [LIBFB]) Portions of Koocanusa Reservoir, 2018 to 2020

Notes: Concentrations presented as averages where applicable duplicates were collected. Koocanusa Reservoir station in Canada (RG_DSELK) is represented by a yellow symbol, and those for Montana stations are represented by grey symbols. Epilimnion samples represented by a square symbol, hypolimnion samples represented by a triangle symbol. September sample for RG_DSELK was misplaced by the laboratory, and although later found, was not processed in time to be included in this report. No hypolimnion sample was collected for LIBFB in September 2019. No Montana samples were collected in May or July in 2020.

selenium measured in suspended sediment in 2020 were lower than concentrations reported in like-months in 2018 and 2019 at Station RG_DSELK located within the Canadian portion of the reservoir (Figure 4.3). Selenium concentrations in suspended sediment were higher at RG_DSELK than in the epilimnion of both stations located in Montana but were comparable to those of the LIBBYFB hypolimnion (Figure 4.3). Water samples collected concurrently with the suspended sediment samples in 2020 had higher concentrations of total and dissolved selenium in samples collected 3 m from the bottom of the water column in June and September, but not in July (Table 4.2). No consistent monthly pattern in concentrations of selenium in water at the surface versus the bottom were shown from 2018 to 2020 (Table 4.2)

Table 4.2: Large-Volume Suspended Sediment and Water Samples Collected at RG_DSELK, Koocanusa Reservoir, 2018 to 2020

Matrix	Analyte		BC Sediment Quality Guideline[a]	BC Long-term Guideline[b]	2018			2019			2020		
					June[c]	July[d]	September[e]	June[f]	July[g]	September[h]	June[i]	July[j]	September[k]
Sediment	Selenium (mg/kg dw)		2.0	-	3.42	6.39	7.23	3.14	3.15	3.55	0.75	1.59	5.24
Water[l]	3 m from Surface	Selenium (µg/L)	-	2.0	-	-	-	0.61	0.80	0.91	0.41	1.09	1.09
		Dissolved Selenium (µg/L)	-	-	0.41	0.81	1.04	0.64	0.59	0.89	0.29	1.00	0.99
	3 m from Bottom	Selenium (µg/L)	-	2.0	-	-	-	0.54	2.02	1.97	2.50	0.63	1.62
		Dissolved Selenium (µg/L)	-	-	0.74	0.86	1.06	0.59	2.00	1.90	2.35	0.60	1.66

Note: Shaded values were above the respective guideline. ND = No data, September samples still outstanding. "-" indicates no available guidelines.

[a] Working sediment quality guideline (BC MOE 2015).

[b] British Columbia Accepted (BCMOE 2017) Water Quality Guidelines for the Protection of Aquatic Life.

[c] Average concentration presented, values for sample and duplicate were 3.50 and 3.33 mg/kg dw respectively.

[d] Average concentration presented, values for sample and duplicate were 6.31 and 6.46 mg/kg dw respectively.

[e] Average concentration presented, values for sample and duplicate were 6.96 and 7.49 mg/kg dw respectively.

[f] Average concentration presented, values for sample and duplicate were 3.58 and 2.69 mg/kg dw respectively.

[g] Average concentration presented, values for sample and duplicate were 3.47 and 2.82 mg/kd dw respectively.

[h] Average concentration presented, values for sample and duplicate were 3.85 and 3.26 mg/kd dw respectively. Sample was not analyzed until October, 2020 due to misplacement by the laboratory.

[i] Average concentration presented, values for sample and duplicate were 1.39 and 0.11 mg/kd dw respectively.

[j] Average concentration presented, values for sample and duplicate were 3.04 and 0.142 mg/kd dw respectively.

[k] Average concentration presented, values for sample and duplicate were 5.44 and 5.04 mg/kd dw respectively.

[l] Total fraction of selenium not measured in 2018. Dissolved selenium measured in 2018 is presented as an average of two samples.

5 ZOOPLANKTON

5.1 Overview

Zooplankton community structure and zooplankton tissue selenium concentrations were assessed downstream and upstream of the Elk River at RG_T4 and RG_TN, respectively, in June and August 2020. The zooplankton community and tissue chemistry samples were collected as a composite sample through the entire water column depth at five stations along each transect.

5.2 Zooplankton Community

In June 2020, the zooplankton community downstream of the Elk River was primarily dominated by Rotifera, while the community upstream of the Elk River was co-dominated by both Rotifera and Copepoda (Figure 5.1). Spatially, significantly higher density, biomass, richness, density of the major groups (Rotifera, Copepoda, and Cladocera), relative abundance of Rotifera, and biomass (both actual and relative) of Copepoda and Rotifera were observed downstream of the Elk River compared to upstream (Figure 5.2; Appendix Table D.14). Conversely, relative abundance of Copepoda and relative biomass of Cladocera were significantly lower downstream compared to upstream (Figure 5.2; Appendix Table D.14). Except for biomass, and density (actual) and biomass (both actual and relative) of Copepoda, all differences observed had an MOD outside of ±2 SD suggesting they were significantly different between areas (Appendix Table D.14).

In August 2020, when the reservoir was at full-pool, Copepoda dominated the zooplankton community downstream of the Elk River, whereas Rotifera dominated the community upstream of the Elk River (Figure 5.1). Significantly higher biomass and Copepoda density and biomass (both actual and relative) were indicated downstream compared to upstream of the Elk River Figure 5.2; Appendix Table D.14). Conversely, significantly lower relative abundance and biomass of Rotifera, and relative biomass of Cladocera were observed downstream compared to upstream in August 2020 (Figure 5.2; Appendix Table D.14). Of the differences indicated above, only the significantly higher and lower relative densities of Copepoda and Rotifera, respectively at the downstream compared to upstream area were at magnitudes (outside of ±2 SD) that were ecologically meaningful (Figure 5.2; Appendix Table D.14). These results highlighted that the communities both downstream and upstream of the Elk River were more similar to each other in August than they were in June (Figure 5.3). Among individual taxa, *Cyclops bicuspidatus* (Copepoda) was the most abundant zooplankton species at both study areas (Figure 5.3). Notably, *Bosmina longirostris* (Cladocera) were no longer a dominant taxon downstream of the Elk River in August as this species had been in June (Figure 5.3).

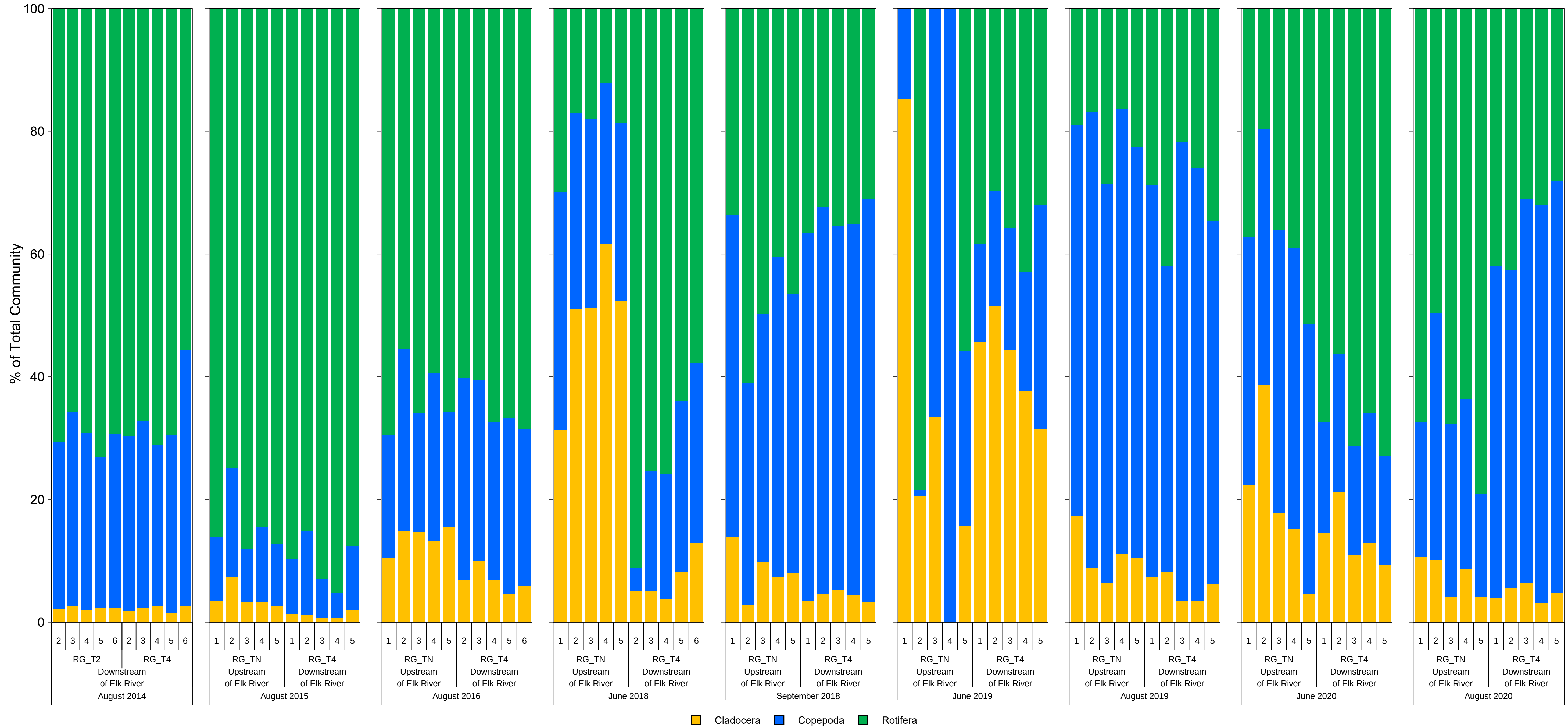


Figure 5.1: Relative Density of Major Zooplankton Groups in Koocanusa Reservoir, 2014 to 2020

Note: The upstream location RG_T2 was relocated further upstream from the mouth of the Elk River in August 2015 to RG_TN.

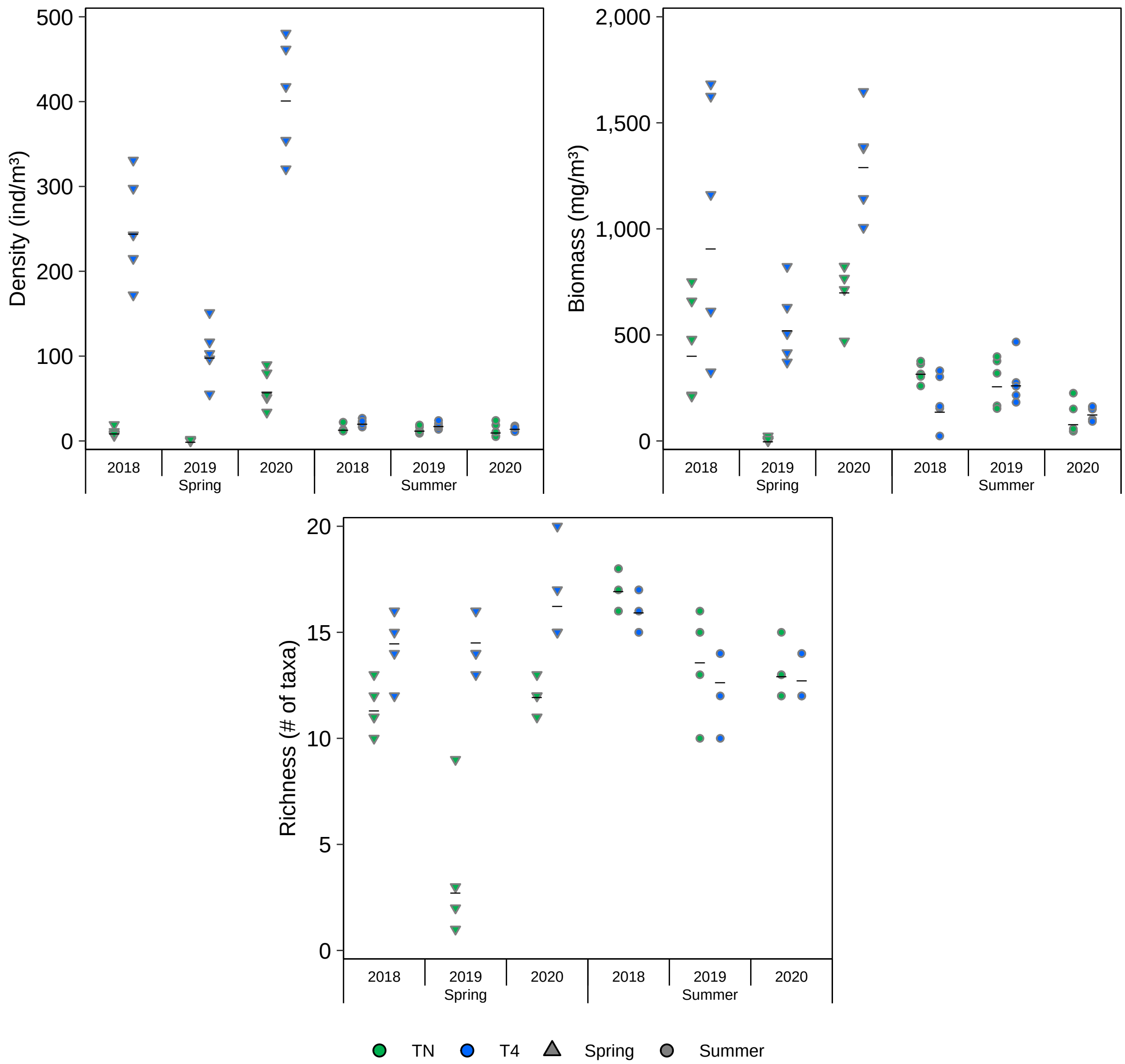


Figure 5.2: Zooplankton Community Endpoints Upstream (RG_TN) and Downstream (RG_T4) of the Elk River on Koocanusa Reservoir in Spring and Summer, 2018 to 2020

Note: Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

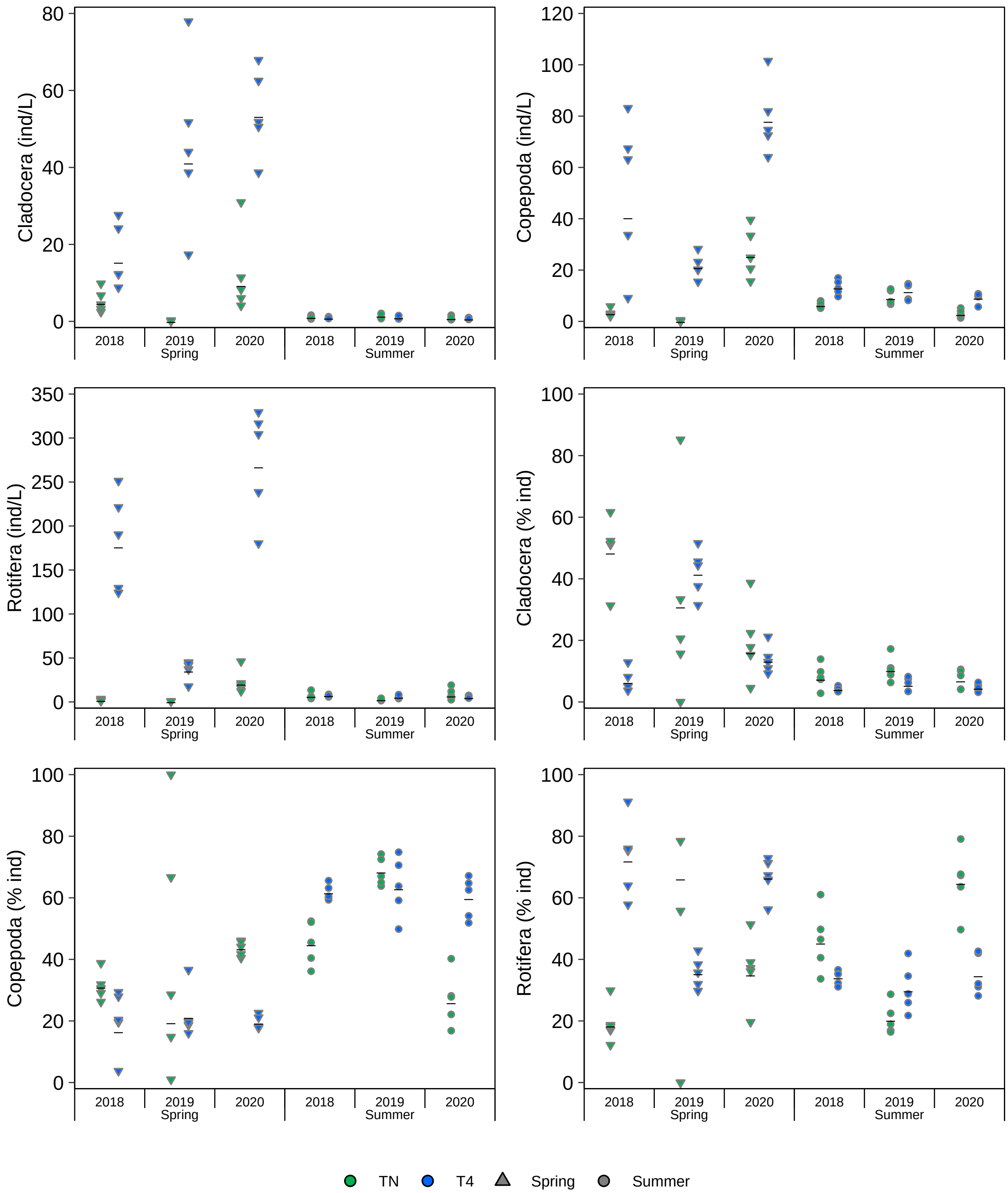


Figure 5.2: Zooplankton Community Endpoints Upstream (RG_TN) and Downstream (RG_T4) of the Elk River on Koocanusa Reservoir in Spring and Summer, 2018 to 2020

Note: Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

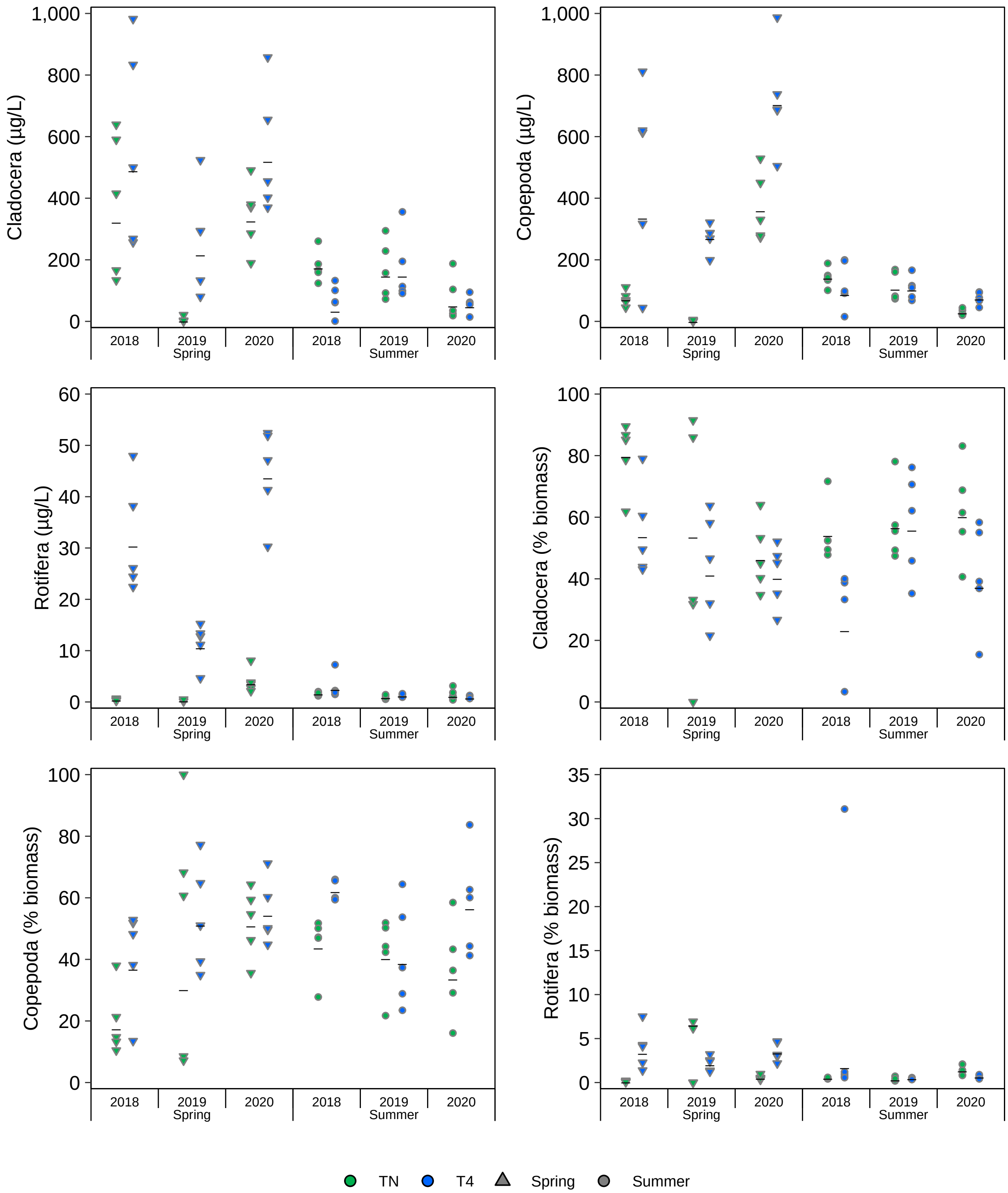


Figure 5.2: Zooplankton Community Endpoints Upstream (RG_TN) and Downstream (RG_T4) of the Elk River on Koocanusa Reservoir in Spring and Summer, 2018 to 2020

Note: Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

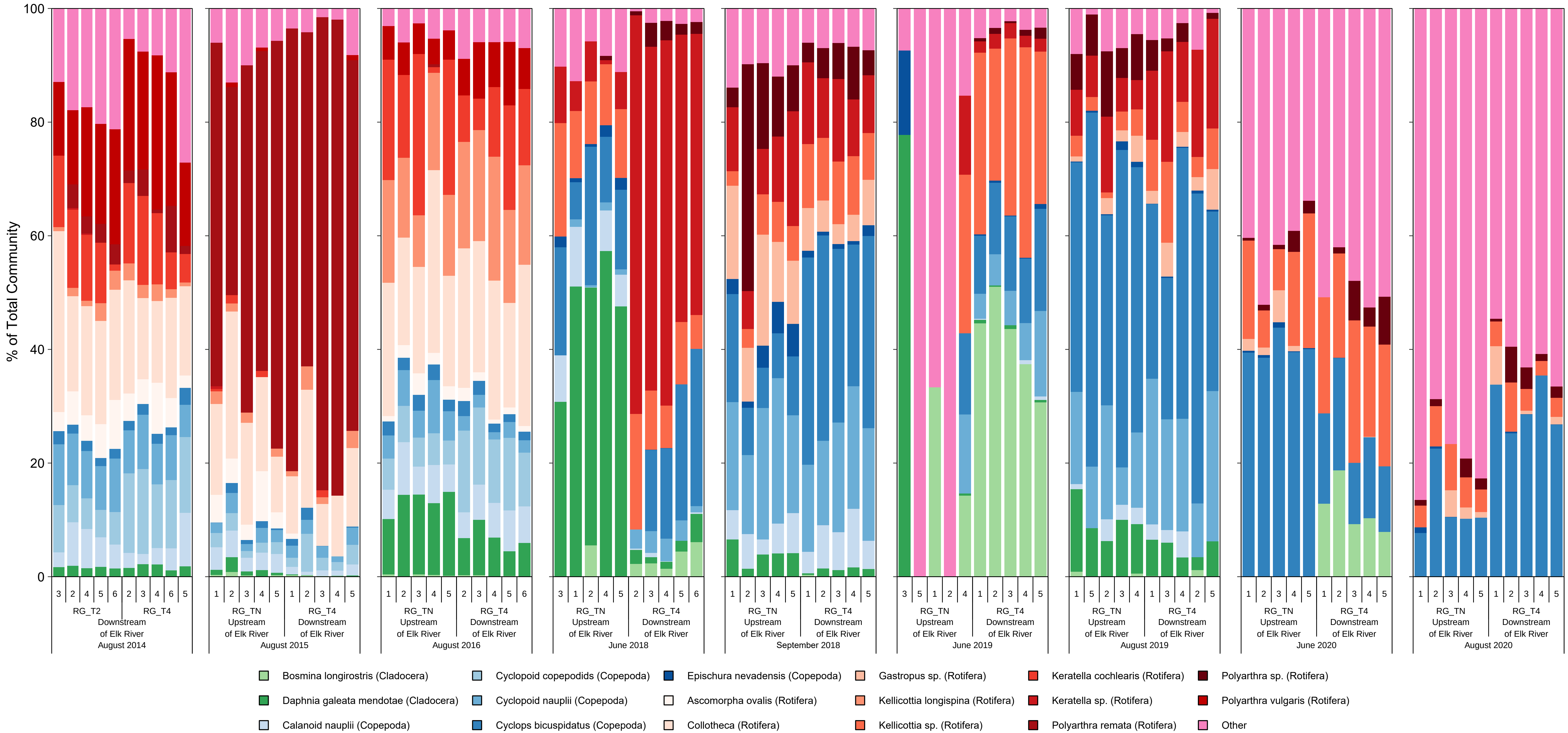


Figure 5.3: Relative Density of Major Zooplankton Taxa in Koocanusa Reservoir, 2014 to 2020

Note: The upstream location RG_T2 was relocated further upstream from the mouth of the Elk River in August 2015 to RG_TN.

Temporal differences in zooplankton community features between June and August downstream of the Elk River (RG_T4) indicated that, except for the relative abundance of Copepoda (which was significantly lower in June), and the relative biomass of Copepoda and Cladocera (which did not differ significantly), all other endpoints were significantly higher in June compared to August. Except for relative abundance of Cladocera, all endpoints that differed significantly between months were outside the range of ±2 SD, indicating the differences were ecologically meaningful (Figure 5.2; Appendix Table D.14). Similarly, most of the endpoints were significantly lower in August compared to June for the upstream area with the exception of richness, and relative abundance and biomass of Rotifera (significantly higher), and relative biomass of Cladocera and Copepoda (non-significant; Figure 5.2; Appendix Table D.14). Again, except for relative abundance of Cladocera, all endpoints that differed significantly between months were outside the range of ±2 SD at RG_TN, indicating the differences were ecologically meaningful (Figure 5.2; Appendix Table D.14). Qualitative comparisons of changes over time (based on August data) suggested that density, richness, Rotifera abundance (both actual and relative), and relative Rotifera biomass may have decreased over time at both the downstream and upstream areas, suggesting a reservoir-wide phenomenon (Figure 5.4). No clear directional change in overall biomass was observed at either area. These differences over time, however, need to take into consideration that methods used from 2018 to 2020 sampled the community through the entire water column as opposed to the top 10 m sampled in studies conducted from 2014 to 2016. This method change may also be related to higher, more variable total biomass, Copepoda density, and Cladocera biomass, and lower Rotifera density and biomass, from 2018 to 2020 compared to years from 2014 to 2016 (Figure 5.4).

5.3 Zooplankton Tissue

In June 2020, zooplankton tissue mean selenium concentrations both downstream and upstream of the Elk River were elevated above the BC chronic interim guideline (4 µg/g), but below the EVWQP Level 1 benchmarks for dietary effects to fish (11 µg/g dw), and the EVWQP Level 1 benchmark for potential effects to invertebrate reproduction (13 µg/g dw; Figure 5.5). In August 2020, zooplankton tissue mean selenium concentrations were below all guidelines and benchmarks both downstream and upstream of the Elk River (Figure 5.5). Spatially, there were no significant differences in zooplankton tissue selenium concentrations between areas downstream and upstream of the Elk River in Koocanusa Reservoir in either June or August 2020, but selenium concentrations in zooplankton tissue at both areas were significantly higher in June than in August (Table 5.1).

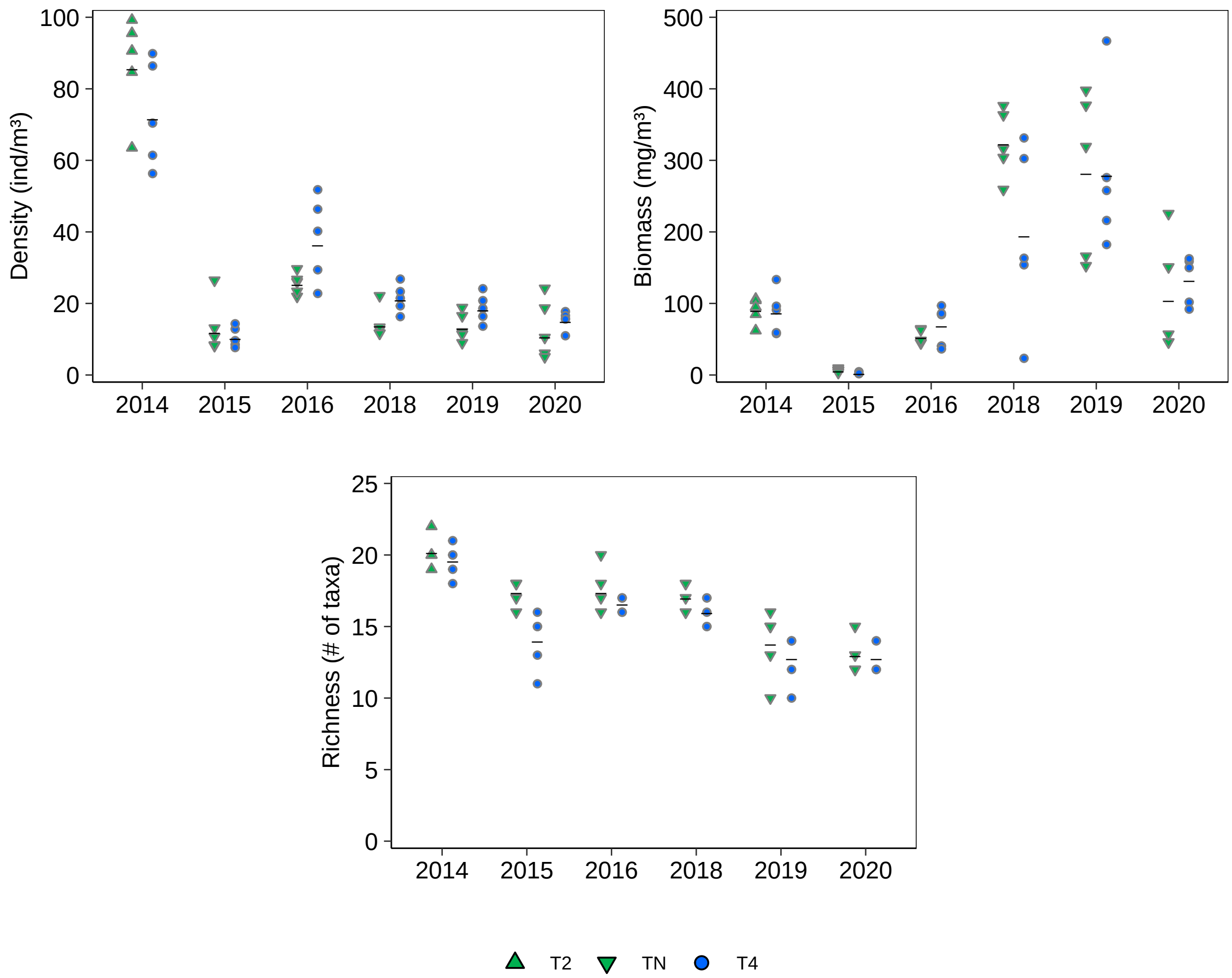


Figure 5.4: Zooplankton Community Endpoints from Upstream (T2 and TN) and Downstream (T4) of the Elk River on Koocanusa Reservoir Collected in the Summer, 2014 to 2020

Note: The upstream location was relocated further upstream of the mouth of the Elk River in 2015 to TN. Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

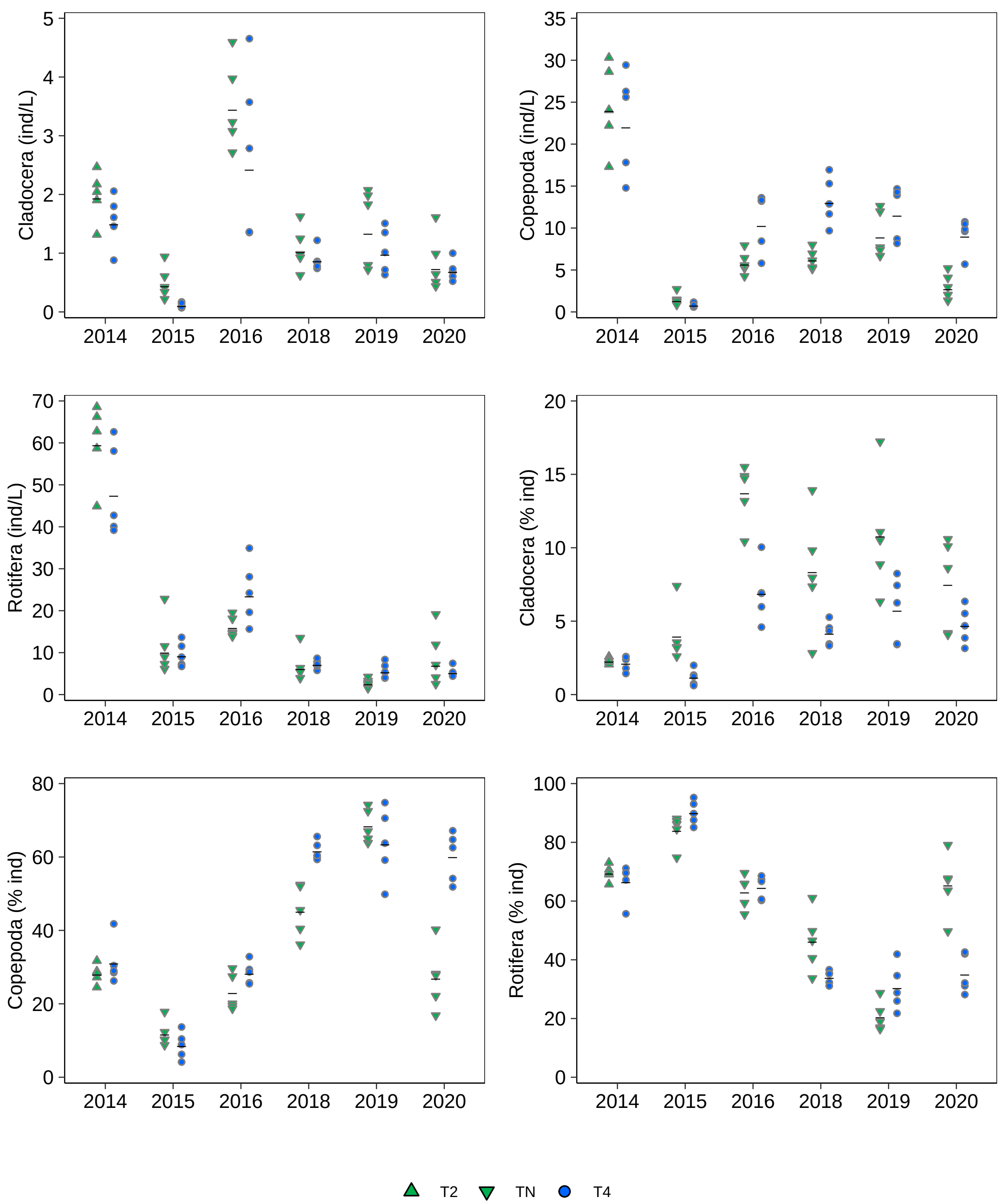


Figure 5.4: Zooplankton Community Endpoints from Upstream (T2 and TN) and Downstream (T4) of the Elk River on Koocanusa Reservoir Collected in the Summer, 2014 to 2020

Note: The upstream location was relocated further upstream of the mouth of the Elk River in 2015 to TN. Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

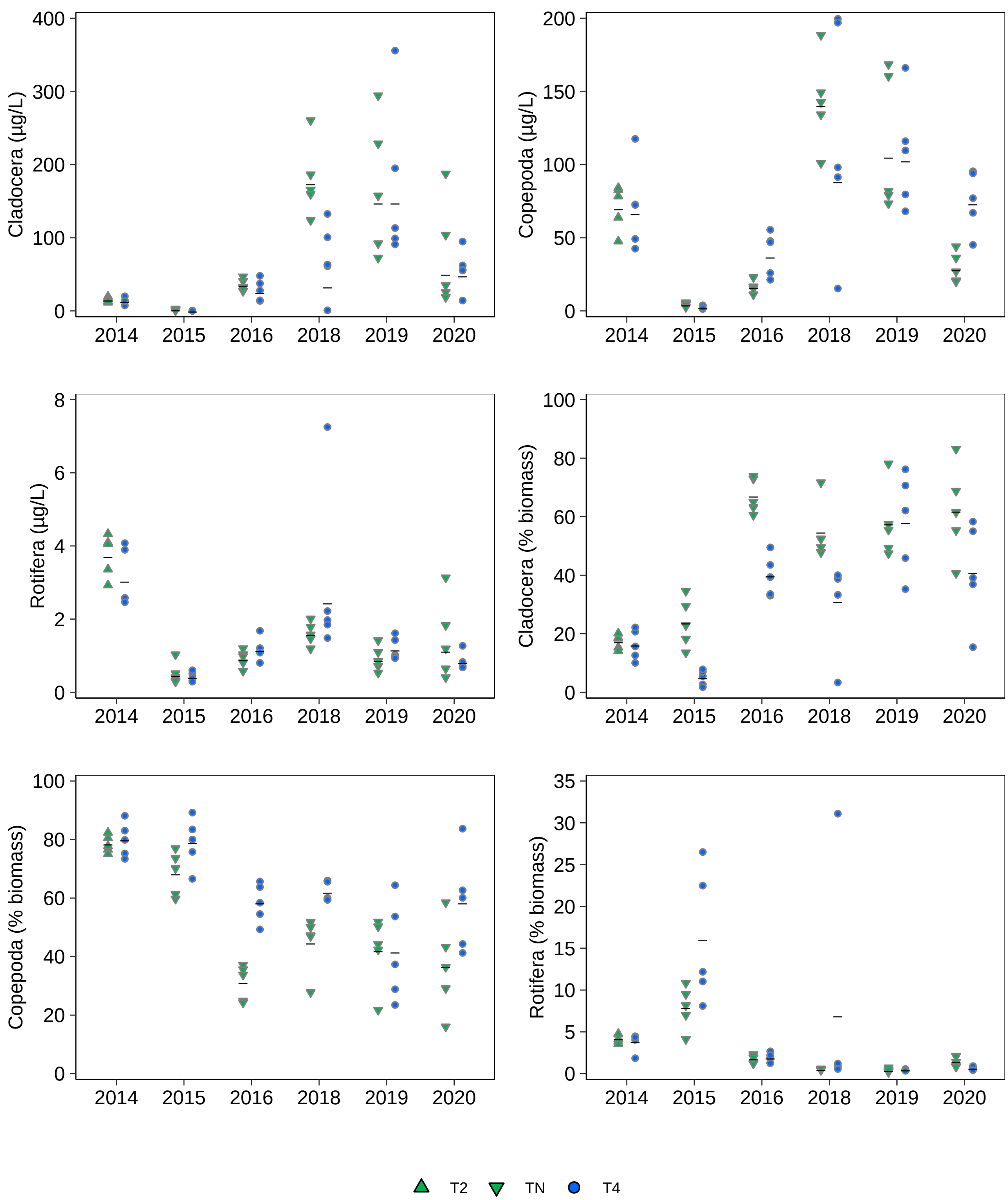


Figure 5.4: Zooplankton Community Endpoints from Upstream (T2 and TN) and Downstream (T4) of the Elk River on Koocanusa Reservoir Collected in the Summer, 2014 to 2020

Note: The upstream location was relocated further upstream of the mouth of the Elk River in 2015 to TN. Measures of Central Tendency (geometric mean for biomass and density, otherwise mean) are plotted as horizontal lines.

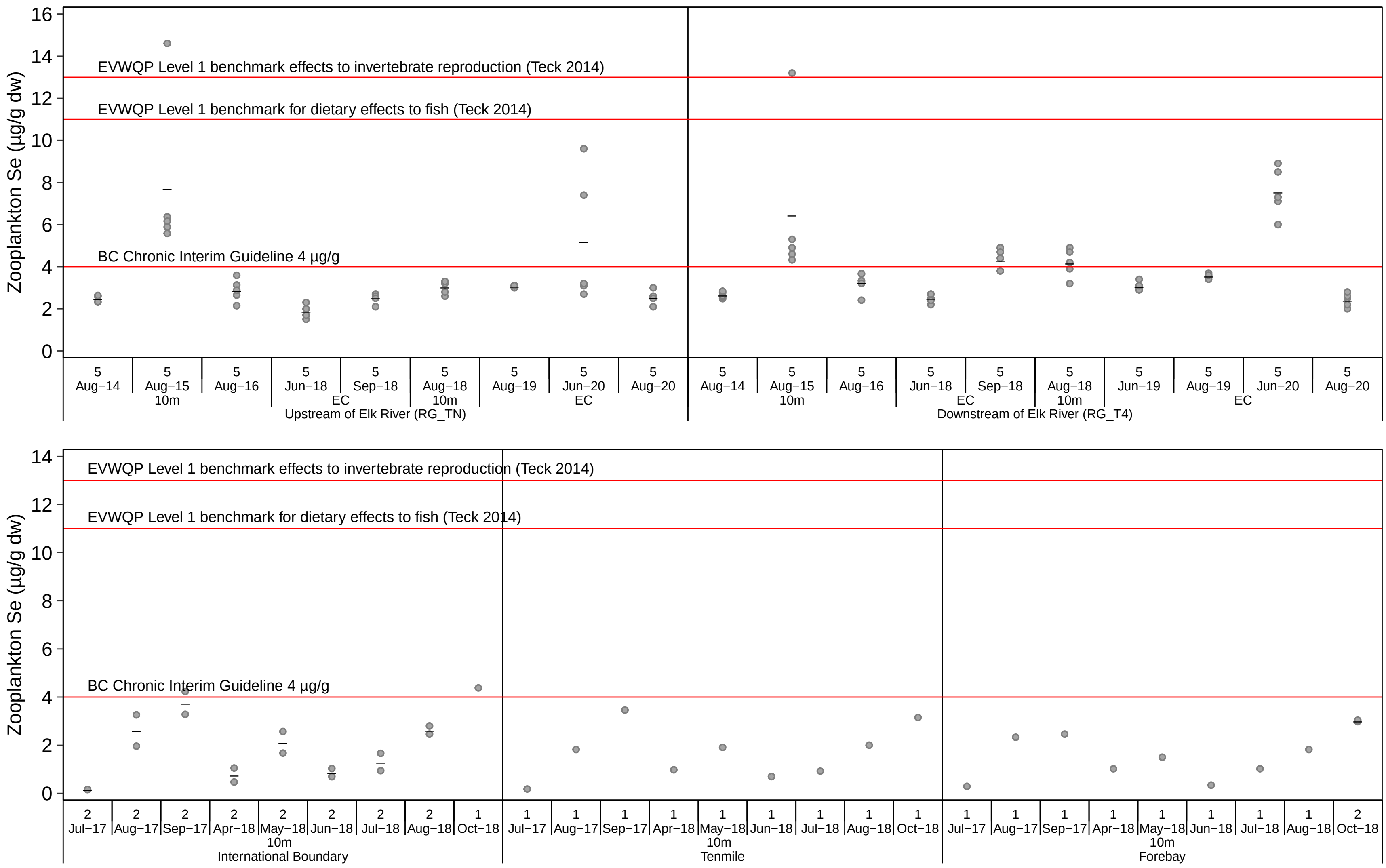


Figure 5.5: Concentration of Selenium (µg/g dw) in Zooplankton in Koocanusa Reservoir, 2014 to 2020

Note: Individual values are plotted. Means are plotted as horizontal lines. EC refers to sampling the entire water column, 10 m refers to the top 10 meters of the water column. Data from Montana stations for 2016 were reported on a wet weight basis (moisture content not available to convert to dry weight), and therefore excluded from this plot. Montana stations include International Boundary, Tenmile, and Forebay. Sufficient sample sizes could not be collected from upstream of Elk River in June 2019.

Table 5.1: Spatial and Temporal Zooplankton Community Tissue Selenium Concentration Comparisons, June and August 2020

ANOVA Model[a]				Measure of Central Tendency [b]				Temporal Post-hoc[c]: Difference between June vs August	Spatial Post-hoc[d]: Difference between TN vs T4
				June		August			
Transformation	Station	Month	Station x Month	RG_TN	RG_T4	RG_TN	RG_T4		
log10	0.125	<0.001	0.067	0.72	0.81	0.34	0.44	-58	ns

(grey) P-value < 0.05.

(blue) P-value for post-hoc paired-wise comparison < .05 and MOD > 0 (T4 or August significantly higher)

(green) P-value for post-hoc paired-wise comparison < .05 and MOD < 0 (T4 or August significantly lower)

[a] P-values from Analysis of Variance (ANOVA) including the terms Station, Month and Station x Month

[b] MCT = black transformed for estimated marginal means when log10 and none transformed and median when rank transformed from the full ANOVA model.

[c] Magnitude of Difference (MOD) = (MCT_{August} - MCT_{June}/MCT_{June})*100%. MCT stands for measure of central tendency.

[d] Magnitude of Difference (MOD) = ($MCT_{downstream}$ - $MCT_{upstream}$/$MCT_{upstream}$)*100%. MCT stands for measure of central tendency.

6 BENTHIC INVERTEBRATE TISSUE

6.1 Overview

Composite taxa benthic invertebrate tissue samples were collected downstream (RG_T4) and upstream (RG_TN) of the Elk River in April and August 2020 for analysis of total metals including selenium. Additionally, benthic invertebrate tissue samples and a composite surface invertebrate tissue sample were collected from the Rexford area in the Montana portion of the reservoir in May and September 2020 (Figure 2.1).

6.2 Tissue Selenium Concentrations

The benthic invertebrate tissue selenium concentration in the composite sample collected downstream of the Elk River in April 2020 was elevated above the EVWQP Level 1 Invertebrate Benchmark (13 µg/g dw) and higher than concentrations previously observed in April in the Canadian portion of the reservoir (Figure 6.1). The selenium concentration in the benthic invertebrate tissue sample collected upstream of the Elk River in April 2020 was also elevated relative to the BC guideline (4 µg/g dw), but below the EVWQP level 1 benchmarks and similar to concentrations reported previously.

Selenium concentrations in benthic invertebrate tissue collected downstream of the Elk River in August 2020 were elevated above the EVWQP Level 1 fish benchmark (11 µg/g dw), and higher than concentrations previously observed in August in the Canadian portion of the reservoir (Figure 6.1). The selenium concentration in the benthic invertebrate tissue sample collected upstream of the Elk River in August 2020 was elevated relative to the BC guideline (4 µg/g dw), but was similar to concentrations shown previously. Selenium concentrations in benthic invertebrate tissues were higher downstream compared to upstream in 2020 and were higher downstream in both spring and summer than previously observed during the sample time period in previous years. Benthic invertebrate tissue selenium concentrations in samples collected from RG_TN in 2020 were within the 95% prediction limits of the regional bioaccumulation model, but selenium concentrations in benthic tissue samples from RG_T4 were outside the 95% prediction limits of the regional bioaccumulation model, and thus were considered unexpected (Figure 6.2).

Within the Montana portion of the reservoir at Rexford, selenium concentrations in benthic invertebrate tissues were above the BC benthic invertebrate tissue selenium guideline in five of nine samples collected in May 2020, and four of nine samples collected in September 2020 (Figure 6.1). Surface tow benthic invertebrate samples (REX-ST) in both May and September were well below the BCMOE guideline (Figure 6.1). Overall, benthic invertebrate tissues collected from the Rexford area of the reservoir had lower selenium concentrations than observed downstream of the Elk River in the Canadian portion of the reservoir (i.e., RG_T4) in May and September of 2020 (Figure 6.1).

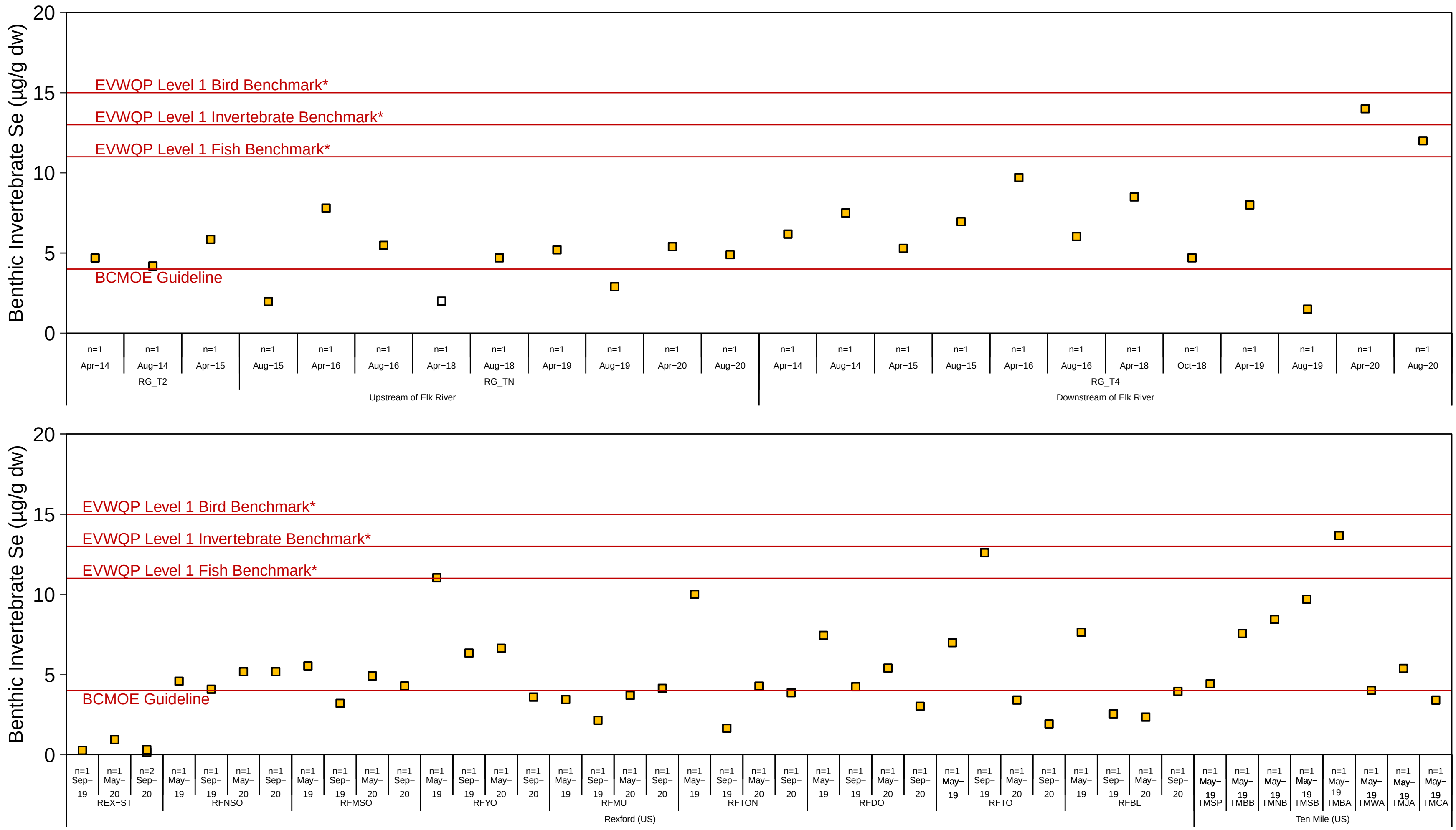


Figure 6.1: Selenium Concentration in Composite Benthic Invertebrate Tissue Samples in Koocanusa Reservoir, 2014 to 2020

Notes: Means of individual values are plotted as horizontal lines when n > 1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. The upstream area was sampled at T2 until April 2015, and subsequently relocated further upstream from the mouth of the Elk River (RG_TN) beginning in August 2015. * 15 µg/g Level 1 Benchmark for dietary effects to juvenile birds; 13 µg/g Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates; 11 µg/g Level 1 Benchmark for dietary effects to juvenile fish (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014); 4 µg/g BC Chronic Interim Guideline for dietary effects to benthic invertebrates (BCMOE 2006). US data converted to dw using a moisture of 73.8% in 2019 and 77.4% in 2020 (average from Canadian samples). REX-ST are the surface benthic tow samples.

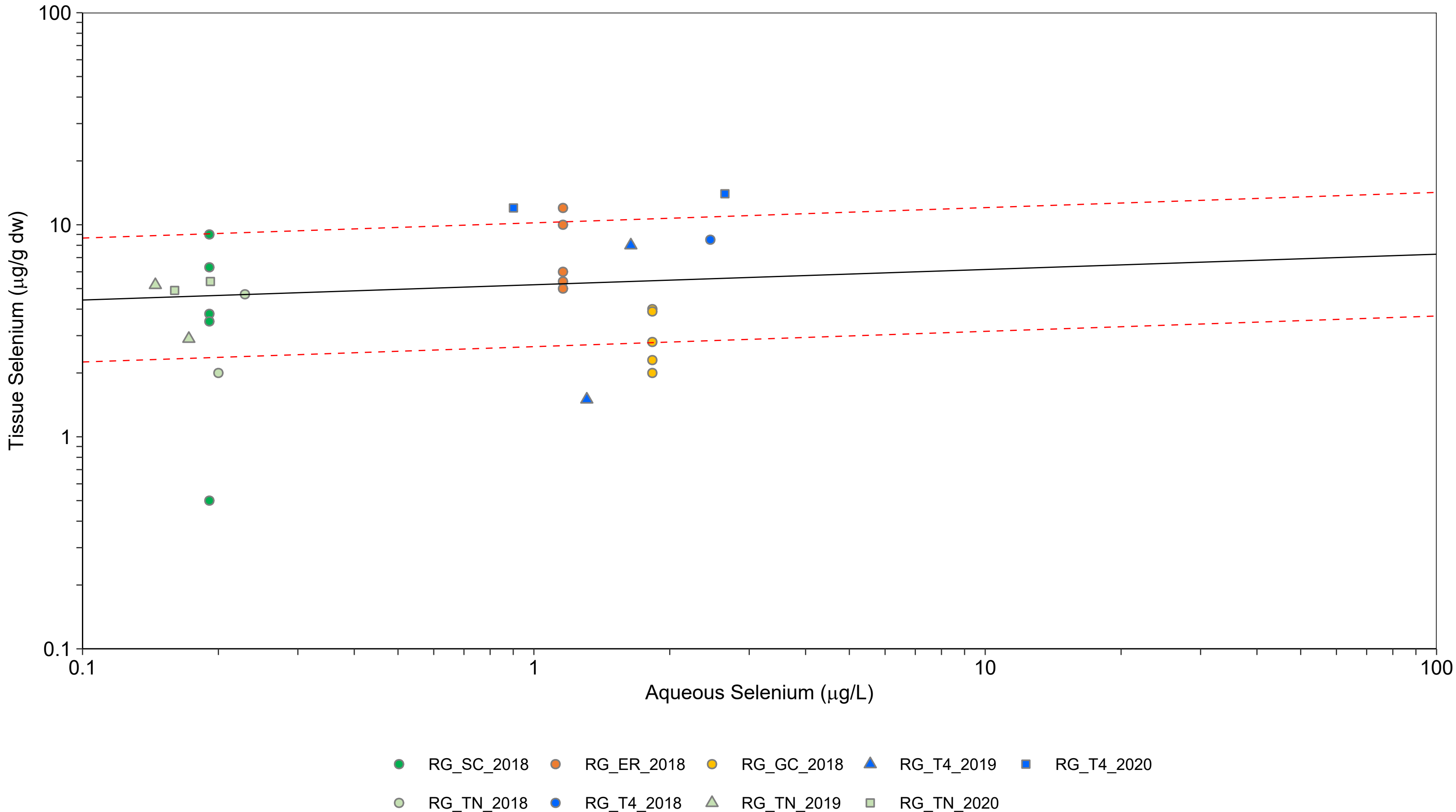


Figure 6.2 Observed and Modelled Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Total Aqueous Selenium Concentrations

Notes: Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: log10[Se]benthic invertebrate=0.717+0.072 x log10[Se]aq (Golder 2020). The 95% prediction limits for a single value from the one-step water to benthic invertebrate selenium accumulation model are plotted as dashed red lines. Reference areas are shown in green.

7 FISH

7.1 Overview

Fish muscle and ovary tissue samples were collected from 10 female PCC and 10 female RSC from each of the three fishing areas (Sand Creek [RG_SC], Elk River [RG_ER], and Gold Creek [RG_GC]; Figure 2.1) in April 2020. In addition, muscle plug tissue samples were collected non-lethally from sport fish in April, June, and August 2020 within the Canadian portion of the reservoir. Fish tissue chemistry data collected with the support of MFWP at Rexford (Montana) and Kikomun (Canada) areas in May and September 2020 were summarized and included within the analysis of the 2020 data.

Redside shiner recruitment was evaluated in the Canadian portion of the Koocanusa Reservoir at each of the three fishing areas indicated above in August 2020 (Figure 2.1). Recruitment was assessed by confirming the presence of young-of-the-year (YOY) RSC, and evaluating YOY endpoints of body size and condition as applicable.

7.2 Tissue Selenium Concentrations

7.2.1 Muscle

Mean values of all fish species sampled (PCC and RSC, and bull trout [BT], Kokanee [KO], mountain whitefish [MWF], rainbow trout [RBT], northern pikeminnow [NSC], westslope cutthroat trout [WCT], largescale sucker [LSS], and yellow perch [YP])in 2020 were below the BC guideline (4 µg/g dw) and the US EPA criterion (11.3 µg/g dw) for selenium (Figure 7.1; Appendix Tables F.3 to F.6). Sample sizes in 2020 were sufficient to allow for some downstream to upstream comparisons of muscle selenium concentrations in PCC, RSC, and NSC. Peamouth chub sampled downstream at RG_GC and Rexford had significantly higher muscle selenium concentrations than PCC sampled upstream at RG_SC (Table 7.1). Redside shiner sampled downstream at RG_ER and RG_GC also had significantly higher muscle selenium concentrations compared to those sampled from RG_SC (Table 7.1). However, since all mean selenium concentrations in muscle were below guidelines, this result is not ecologically significant. No significant differences in NSC muscle selenium concentrations were indicated between areas located downstream and upstream of the Elk River in 2020 (Table 7.1).

7.2.2 Ovary

Mean selenium concentrations in the ovaries of PCC were greater than the BC ovary tissue guideline (11 µg/g dw) at RG_SC (April) and RG_ER (September), greater than the US EPA criterion (15.1 µg/g dw) at RG_SC (September), and greater than the EVWQP Level 1 benchmark for reproductive effects to fish (18 µg/g dw) at Rexford (September; Figure 7.2;

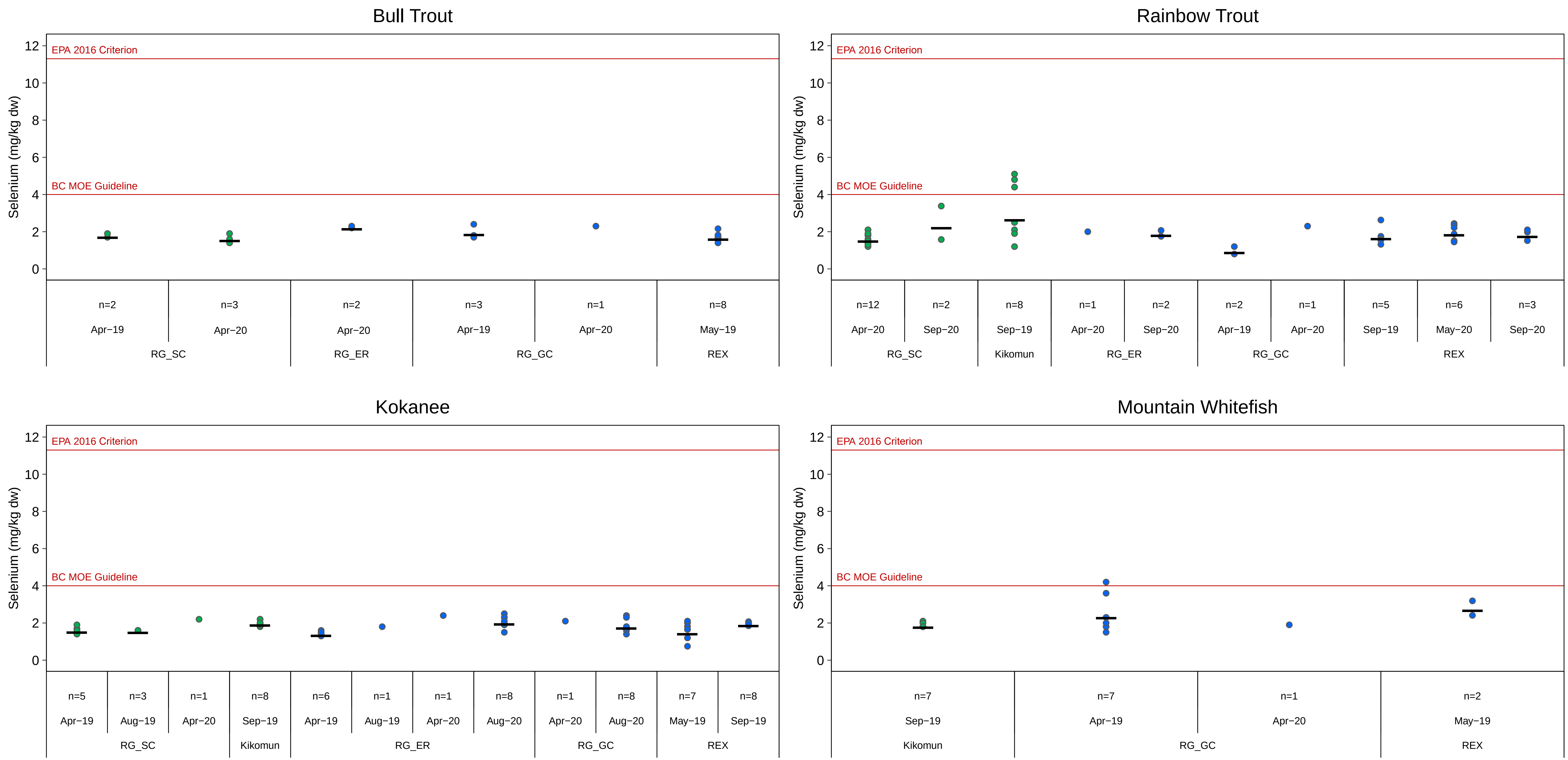


Figure 7.1: Concentrations of Selenium (mg/kg dw) in Fish Muscle Tissue, Koocanusa Reservoir Monitoring Program, 2019 to 2020

Notes: Individual values from muscle or filet are plotted. Reference areas are shown in green exposed in blue. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. Sand Creek study area is upstream of the Elk River confluence, while the Elk River and Gold Creek study areas are downstream of the Elk River. Sand Creek, Elk River, and Gold Creek samples were collected by Teck, with the exception of some samples for Sand Creek that were collected by MFWP. All other sampling areas in the Koocanusa Reservoir are in the United States and samples were collected by MFWP.

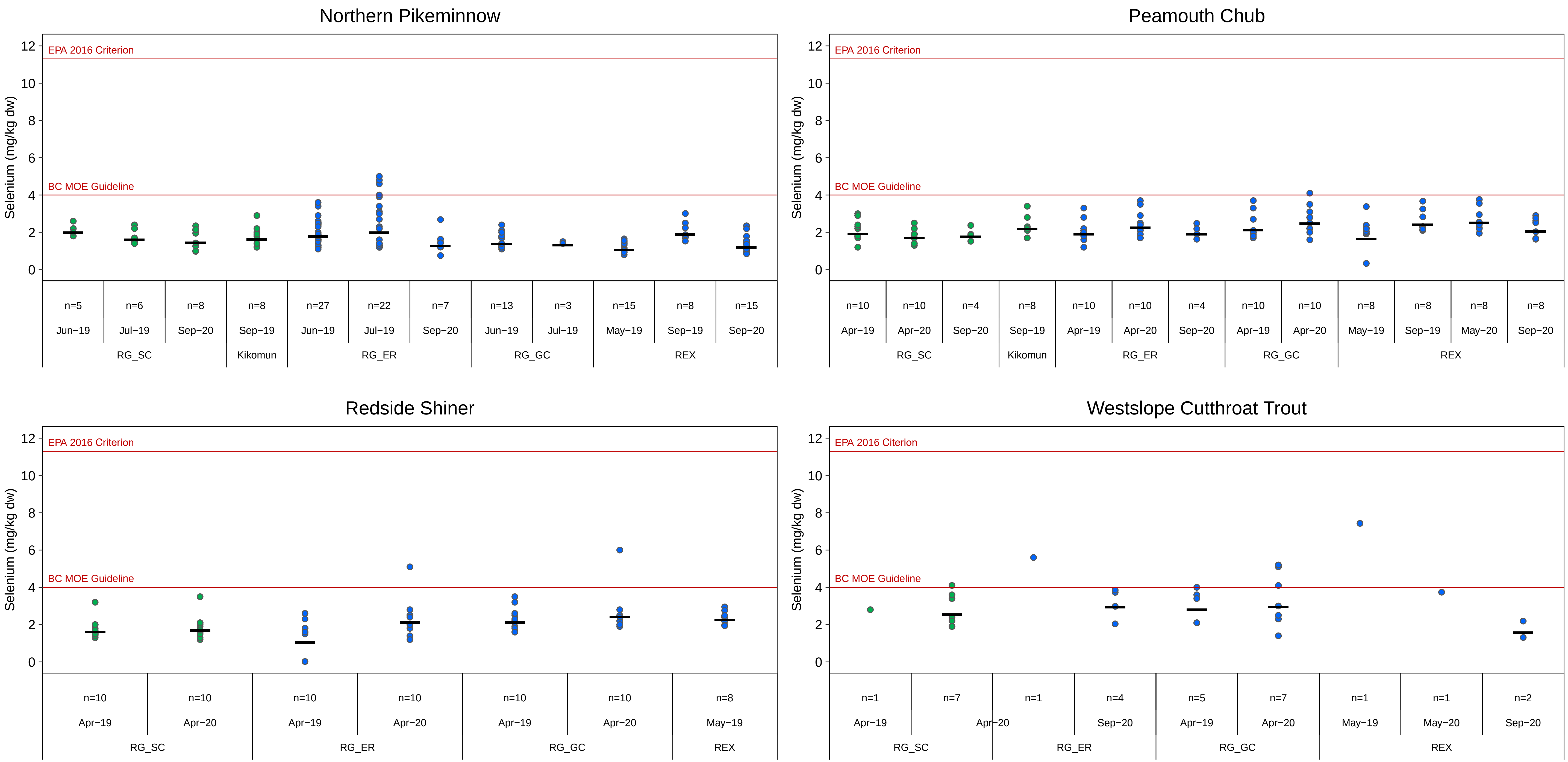


Figure 7.1: Concentrations of Selenium (mg/kg dw) in Fish Muscle Tissue, Koocanusa Reservoir Monitoring Program, 2019 to 2020

Notes: Individual values from muscle or filet are plotted. Reference areas are shown in green exposed in blue. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. Sand Creek study area is upstream of the Elk River confluence, while the Elk River and Gold Creek study areas are downstream of the Elk River. Sand Creek, Elk River, and Gold Creek samples were collected by Teck, with the exception of some samples for Sand Creek that were collected by MFWP. All other sampling areas in the Koocanusa Reservoir are in the United States and samples were collected by MFWP.

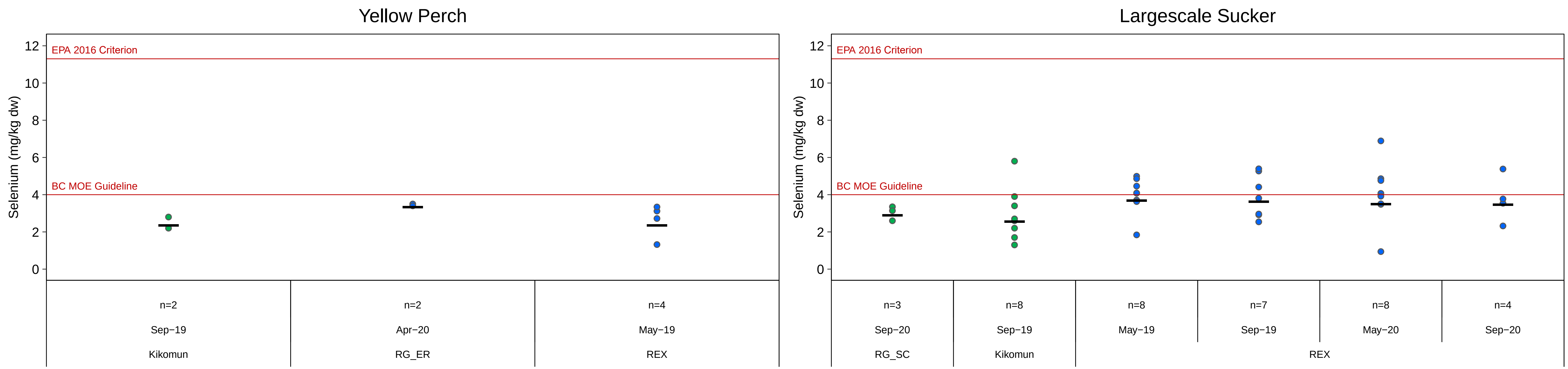


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Table 7.1: Statistical Summary of Spatial Differences in Fish Tissue Selenium Concentrations Downstream (Elk River, Gold Creek and Rexford) Compared to the Upstream (Sand Creek) of the Elk River, Koocanusa Reservoir Monitoring Program, 2020

Fish Species [c]	Tissue Type	Test	Sample Size				Measure of Central Tendency [a]				P-Value	Contrasts				Sand Creek vs Elk River		Sand Creek vs Gold Creek		Sand Creek vs Rexford	
			Sand Creek	Elk River	Gold Creek	Rexford	Sand Creek	Elk River	Gold Creek	Rexford		Sand Creek	Elk River	Gold Creek	Rexford	P-Value	MOD[b]	P-Value	MOD[b]	P-Value	MOD[b]
Peamouth Chub	Muscle	ANOVA	10	10	10	8	1.84	2.46	2.68	2.70	0.017	B	AB	A	A	0.147	34	0.027	46	0.034	47
	Ovary	ANOVA	10	10	10	8	12.6	10.6	9.38	9.67	0.219	A	A	A	A	ns	ns	ns	ns	ns	ns
Redside Shiner	Muscle	K-W	10	10	10	0	1.80	2.45	2.40	-	0.050	B	A	A	-	0.074	36	0.019	33	-	-
	Ovary	ANOVA	10	10	10	0	24.5	25.0	24.4	-	0.991	A	A	A	-	ns	ns	ns	ns	-	-
Northern Pikeminnow	Muscle	ANOVA	8	7	0	15	1.65	1.48	-	1.38	0.477	A	A	-	A	ns	ns	-	-	ns	ns
	Ovary	ANOVA	8	7	0	15	5.66	3.00	-	3.61	0.141	A	A	-	A	ns	ns	-	-	ns	ns

[grey] Indicates significant difference between study areas at a P-value < 0.1.

[blue] Comparison to upstream (RG_SC) is significant, and magnitude of difference (MOD) is positive.

[green] Comparison to upstream (RG_SC) is significant, and MOD is negative.

Notes: "-" indicates no data were collected for this species in the given year. "ns" indicates non-significant value across stations. K-W = Kruskal-Wallis test.

[a] The measure of central tendency (MCT) reported is based on the applied data-transformation, as follows: mean for no transformation; geometric mean for $\log_{10}$-transformation; and, median for rank-transformation.

[b] Magnitude of difference = $(MCT_{downstream} - MCT_{upstream})/MCT_{upstream} * 100$.

[c] Peamouth chub and redside shiner samples collected in April, northern pikeminnow samples collected in September by MFWP.

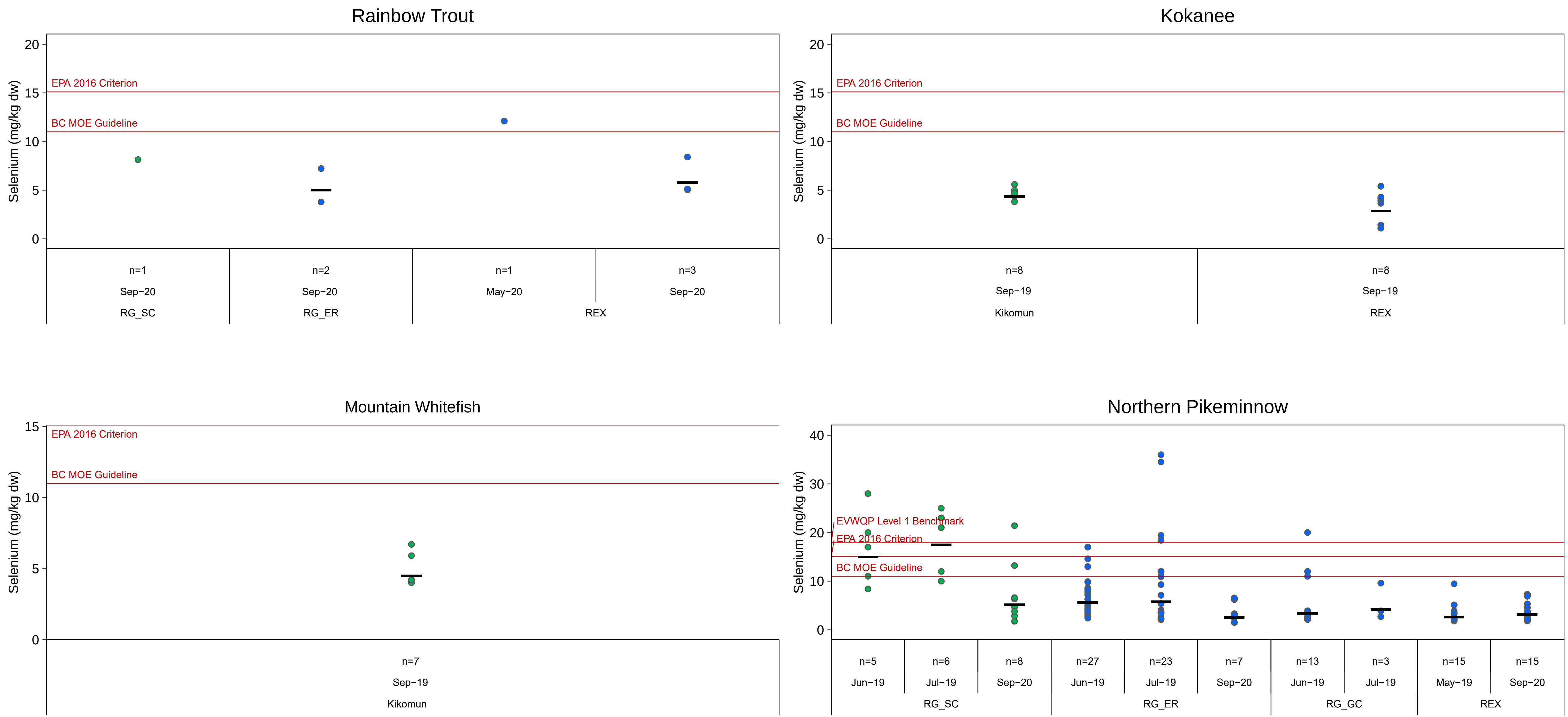
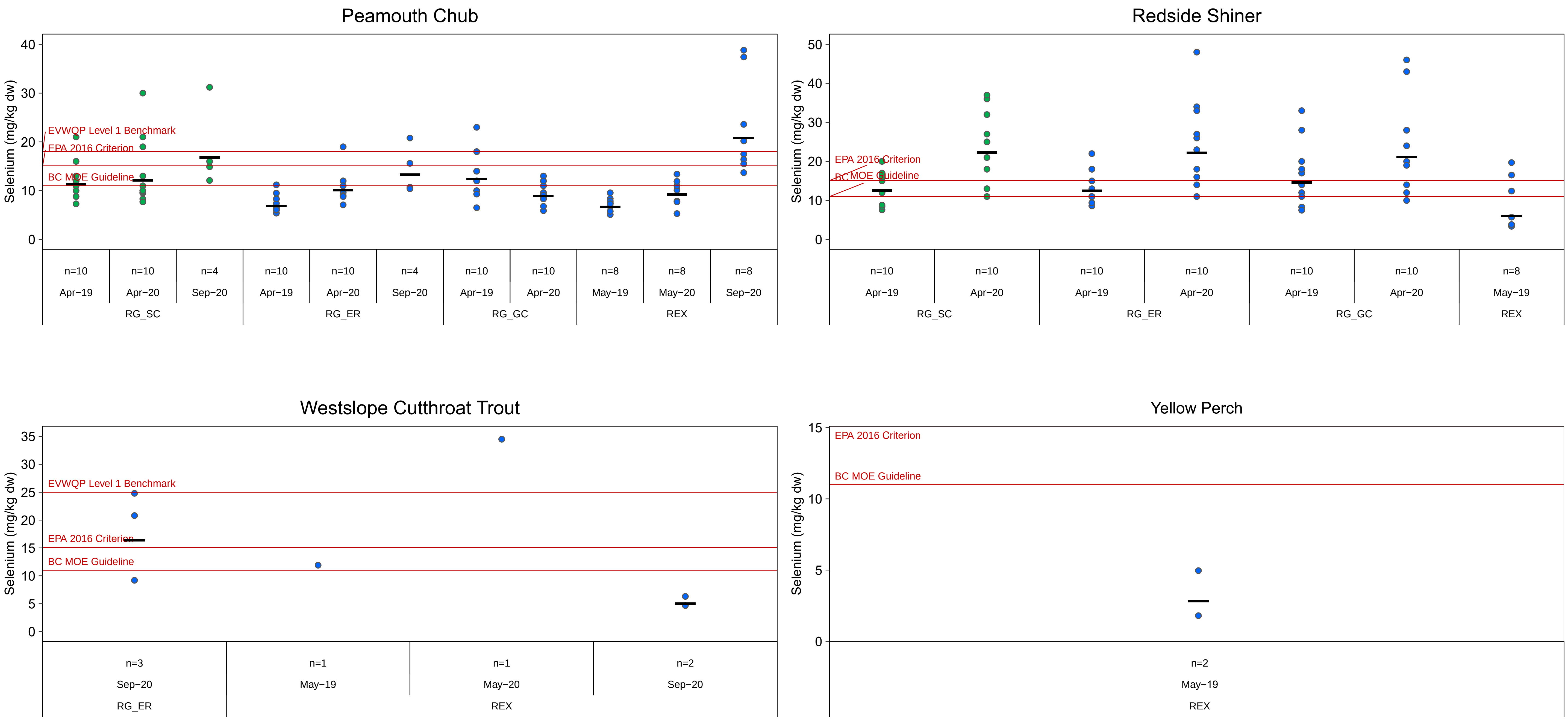


Figure 7.2: Concentrations of Selenium (mg/kg dw) in Fish Ovary Tissue, Koocanusa Reservoir Monitoring Program, 2019 and 2020

Notes: Individual values from ovaries are plotted. Reference areas are shown in green exposed in blue. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal lines when n > 1. Sand Creek study area is upstream of the Elk River confluence, while the Elk River and Gold Creek study areas are downstream of the Elk River. Sand Creek, Elk River, and Gold Creek samples were collected by Teck, with the exception of some samples for Sand Creek that were collected by MWFP. All other sampling areas in the Koocanusa Reservoir are in the United States and samples were collected by MWFP.



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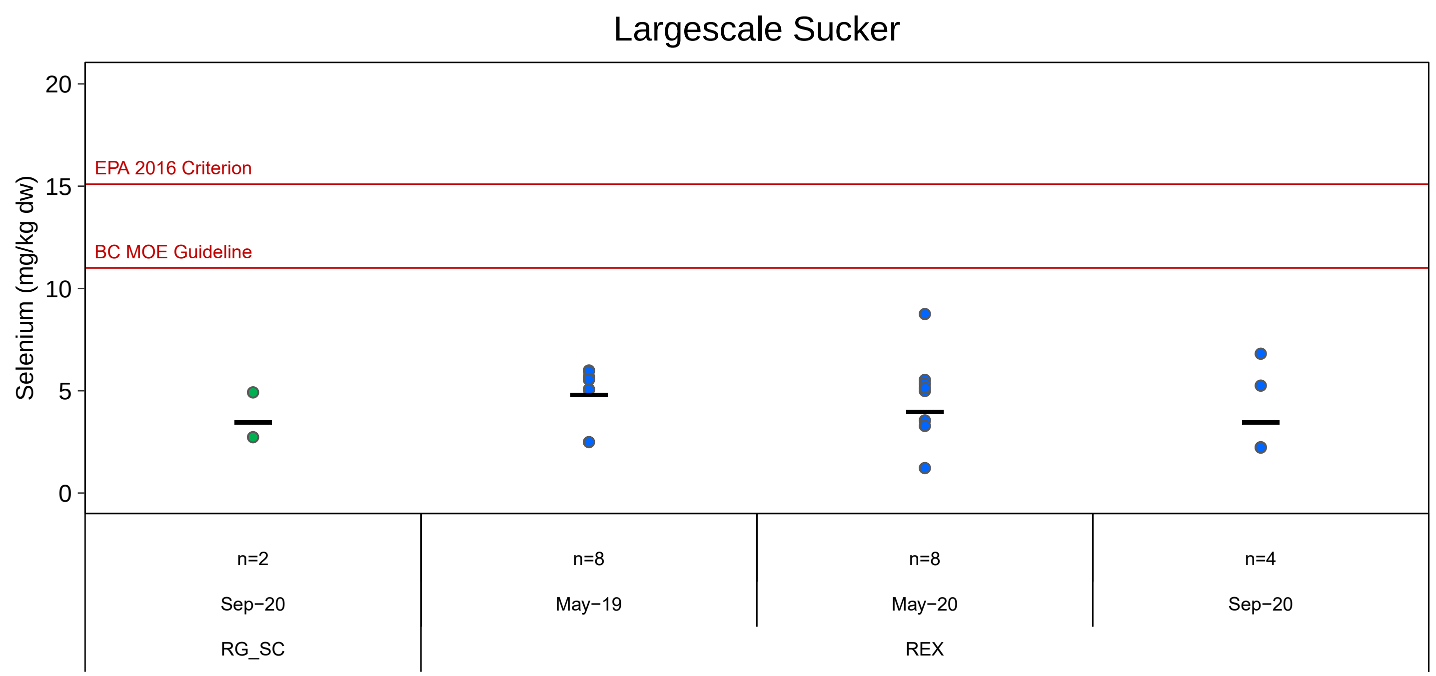

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Appendix Tables F.3 to F.6). Mean selenium concentrations in the ovaries of RSC were elevated above the US EPA criterion at all areas sampled in 2020 (Figure 7.2). However, selenium concentrations in well-developed (i.e., ripe) ovary tissue provide the most direct predictor for potential reproductive effects in fish (Janz et al. 2010, DeForest and Adams 2011) and are also the basis for the development of the guidelines for chronic effects related to selenium. Thus, the determination of potential effects associated with selenium concentrations in ovary tissue should be conducted near the time of fish spawning, when ovaries are fully developed. Ovaries are considered to be ripe based on a gonadosomatic index (GSI) between 13 and 15% for PCC (Gray and Dauble 2001), and a GSI greater than14% for PCC (Golder 2020) near the time of spawning. The mean GSI for PCC and RSC collected at Koocanusa Reservoir study areas in 2020 ranged from 6.4 to 7.1% and 4.0 to 4.5%, respectively, which were below the target GSI indicative of ripeness for these species. Northern pikeminnow ovaries sampled in September by MWFP contained selenium concentrations below the BC guideline at all sampled areas (Figure 7.2). However, similar to PCC and RSC, the GSI for NSC at all study areas was low (i.e., around 1%) and indicative of unripe ovaries. Therefore, due to the early developmental stage of NSC ovaries (pre-spawning), comparison to guideline values is unlikely to be relevant for estimating effects. Moving forward, effort will be focused on collecting PCC and RSC when ovaries are ripe, closer to the time of spawning.

Sample sizes of RBT and WCT sport fish ovary samples collected with support from MWFP in 2020 were small (i.e., <8) and thus no comparisons to respective guidelines and/or benchmarks were conducted (Figure 7.2; Appendix Tables F.5 and F.6).

7.3 Tissue Mercury Concentrations

Sample sizes were sufficient to allow for statistical comparison of mercury concentrations in tissues of PCC, RSC, and NSC between study areas located downstream and upstream of the Elk River in 2020. No significant differences in relative mercury concentrations in muscle tissue (i.e., muscle mercury concentration-at-length relationship) of PCC or NSC were indicated between downstream and upstream areas of the Elk River in 2020 (Appendix Table F.7). Redside shiner did however have significantly higher muscle mercury concentrations at Gold Creek compared to Sand Creek (Appendix Table F.7). With the exception of a few WCT and RBT samples, mercury concentrations in muscle of all fish from all areas downstream and upstream of the Elk River were above the BC guideline for the protection of wildlife (0.165 µg/g dw[19]) in 2020 (Appendix Figure F.1).

[19] The BC guideline for the protection of wildlife (0.033 µg/g ww) was converted to a dry weight basis using the average moisture content in fish muscle in Koocanusa Reservoir of approximately 80%.

7.4 Redside Shiner Recruitment

A total of 270, 350, and 400 RSC were captured from the Sand Creek, Elk River, and Gold Creek study areas, respectively, all of which were classified as YOY (Appendix Table E.7). Unlike previous years (2018 and 2019), the catch-per-unit-effort (CPUE) of RSC was higher at Elk River and Gold Creek downstream areas compared to the Sand Creek upstream area (CPUE of 0.4, 0.5, and 0.3, respectively)[20] in 2020. The YOY sampled for the recruitment survey were all captured in one or two seine hauls at each area, indicating that RSC were plentiful at each of the three study areas (Appendix Table E.7). All RSC captured in each of the three areas were YOY indicating successful recruitment both downstream and upstream of the Elk River.

In 2020, RSC YOY captured at the Elk River and Gold Creek study areas had significantly lower and higher condition, respectively, than those sampled upstream at Sand Creek, but the magnitudes of these difference were within the critical effect size of ±10% for condition (Table 7.2; Figures 7.3 and 7.4). These results differed from those in 2019, which indicated a significantly higher condition in RSC YOY captured downstream at Elk River area compared to upstream at Sand Creek. The inconsistent differences and/or direction of difference in YOY condition between downstream and upstream study areas among years suggested no mine-related influences on RSC recruitment within Koocanusa Reservoir over time.

[20] Confidence intervals of the CPUEs were not practical due to low sampling effort. Only one to three seine net hauls were required per area to catch the required number of fish for the study (see Appendix Table E.7).

Table 7.2: Statistical Comparisons of Juvenile Redside Shiner Health Endpoints at Elk River and Gold Creek (Downstream) Areas Compared to the Sand Creek (Upstream) Area, Koocanusa Reservoir Monitoring Program, 2020

Indicator	Endpoint	Variables		Sample Size			Test	ANCOVA Model Statistics			Summary Statistics[b]				Overall Test P-value (Area)	Pairwise Comparisons[c]			
								Interaction Model	Parallel Slope Model	Covariate Value for Comparisons[a]						Elk River vs. Sand Creek		Gold Creek vs. Sand Creek	
		Response	Covariate	Sand Creek	Elk River	Gold Creek		Interaction P-value	Covariate P-value		Statistic	Sand Creek	Elk River	Gold Creek		P-value	MOD (%)[d]	P-value	MOD (%)[d]
Body Size	Fork Length	log$_{10}$[Fork Length (mm)]	-	100	100	100	K-W	-	-	-	Median	3.35	3.40	3.40	0.731	0.430	1.5	0.655	1.5
	Body Weight	log$_{10}$[Body Weight (g)]	-	100	100	100	K-W	-	-	-	Median	0.365	0.370	0.374	0.427	0.712	1.2	0.205	2.5
Energy Storage	Condition	log$_{10}$[Body Weight (g)]	log$_{10}$[Fork Length (mm)]	100	100	100	ANCOVA	0.559	<0.001	3.29	Adjusted Mean	0.339	0.330	0.354	<0.001	0.264	-2.6	0.029	4.5
				100	99[e]	99[f]	ANCOVA	0.193	<0.001	3.29	Adjusted Mean	0.340	0.329	0.353	<0.001	0.116	-3.1	0.049	3.9

Grey: Indicates area P-value < 0.1 or Interaction P-value < 0.05.

Blue: Indicates Magnitude of Difference > 10% for Condition (EEM effect endpoint).

Yellow: Indicates covariate P-value > 0.05.

Note: "-" indicates no data available.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for log $_{10}$-transformed variables), and adjusted mean are reported for Kruskal-Wallis, ANOVA and ANCOVA, respectively. The predicted means of the regression line equations are reported for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVA when a significant interaction is observed.

[c] Pairwise comparisons conducted using Tukey's honestly significant differences method (ANOVA and ANCOVA) or Dunn's test with Bonferroni adjustment (Kruskal-Wallis test).

[d] Magnitude of Difference (MOD) calculated as the difference in measure of central tendency (MCT) between areas (downstream area minus upstream area), expressed as a percentage of the upstream area MCT (except for the K-S test).

[e] One outlier (Fish ID: RG.ER.RSC.85 Stdnt resid: 4.18) was removed from the analysis.

[f] One outlier (Fish ID: RG.GC.RSC.28 Stdnt resid: 4.839) was removed from the analysis.

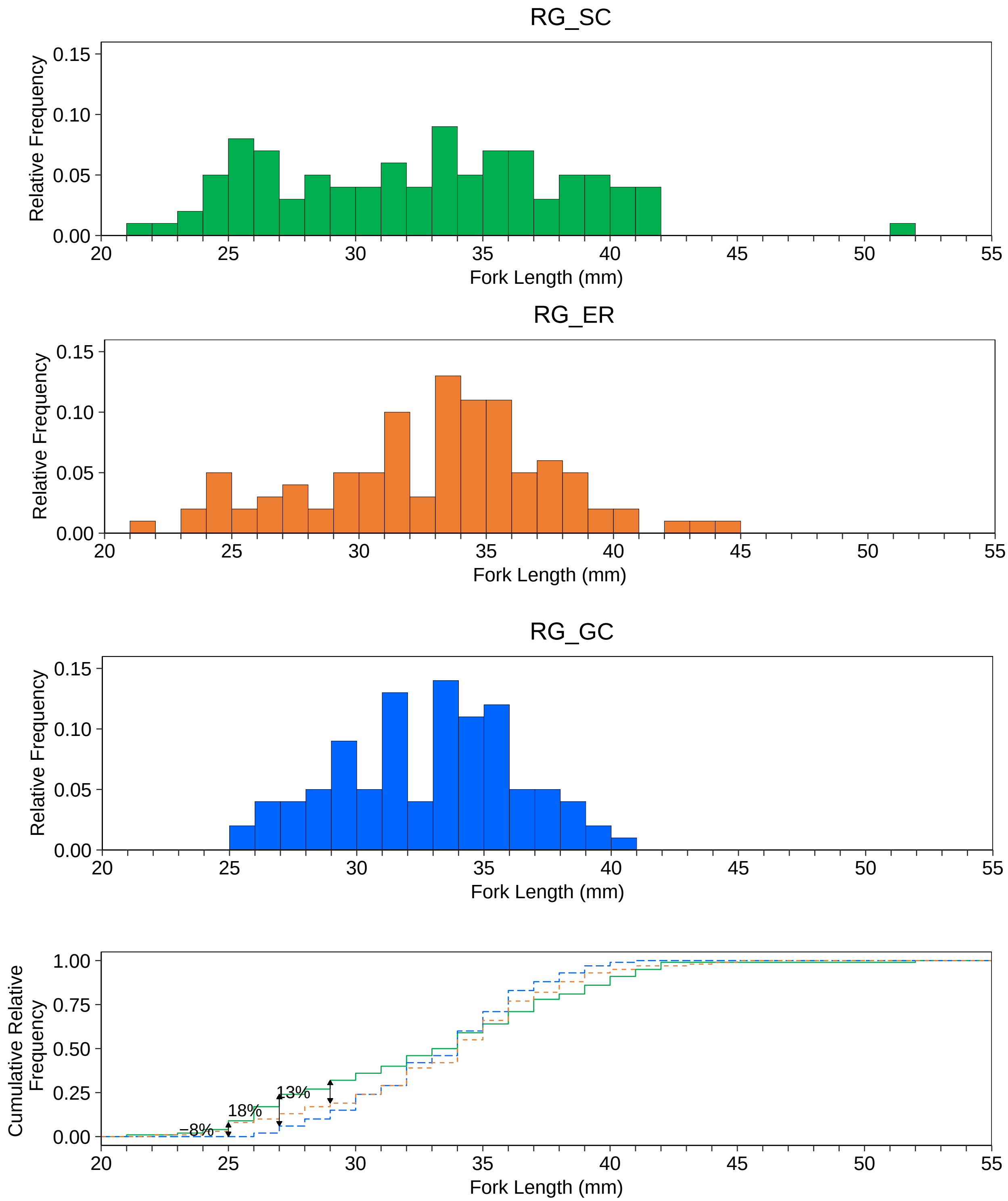

Figure 7.3: Length−Frequency Distributions Supporting Statistical Comparisons for Juvenile Redside Shiner Health Endpoints Koocanusa Reservoir Monitoring Program, 2020

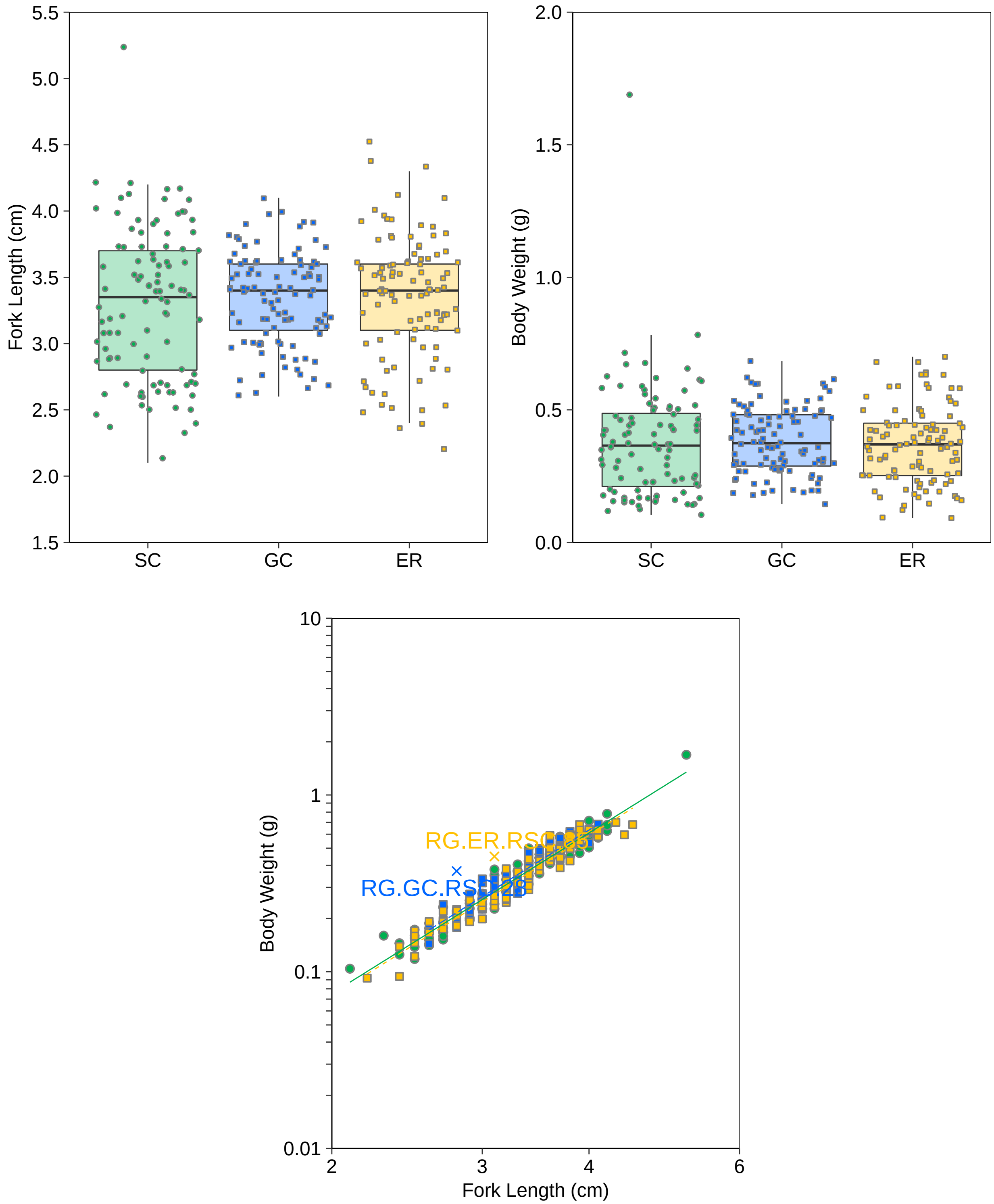

Figure 7.4: Fish Meristics Supporting Statistical Comparisons for Juvenile Redside Shiner Health Endpoints, Kookanusa, 2020

8 SUMMARY

The Koocanusa Reservoir Monitoring Program was conducted in 2020 to assess spatial differences in physico-chemical and biological conditions in Koocanusa Reservoir. In accordance with this monitoring program and conditions of ENV Permit 107517 (Section 10.8), this annual report provides an overview of the environmental monitoring activities conducted in Koocanusa Reservoir, together with a summary of the associated results. The principal findings from the Koocanusa Reservoir Monitoring Program in 2020 are summarized below.

Water Quality

The Order constituents (dissolved cadmium, nitrate, selenium, and sulphate), as well as the non-order constituents selected for assessment, had monthly average concentrations below or equal to applicable BC water quality guidelines and applicable SPOs throughout 2020 at all of the permitted water quality stations. Productivity assessment indicated annual median N:P ratios were consistently 15 or more throughout the water column at all permitted water quality stations in 2020, and thus indicative of phosphorous limitation. Trophic status classification suggest Koocanusa Reservoir was primarily oligotrophic most of the year based on assessment using total phosphorous and chlorophyll-a concentrations, whereas assessment using Secchi depth indicated eutrophic conditions in spring and early summer, followed by mesotrophic conditions. Assessment based on total nitrogen concentrations suggested the reservoir was mesotrophic for the entire year except at RG_ELKMOUTH, which was classified as eutrophic. The seasonal variability in the trophic status of the reservoir in 2020 was consistent with annual patterns shown in previous years, and may be reflective of the rapid changes in reservoir water levels that take place from April to June during freshet.

Monthly loadings of nitrate and selenium from the Elk River to the reservoir were highest from May to July, with the peak coinciding with freshet in June. In the Kootenay River, May to July also showed the highest loadings for nitrate and selenium to the reservoir, with the peak nitrate loadings occurring in May and the peak selenium loadings occurring in June. Loadings of both nitrate and selenium to Koocanusa Reservoir were higher from the Elk River than from the Kootenay River on both a monthly and annual timescale.

Elk River mixing assessment indicated that during April and June under low- and mid-pool conditions, respectively, flow from the Elk River remained largely confined to the eastern half of the reservoir. Under full-pool conditions in August, flow from the Elk River occurs along the bottom of the water column in the reservoir arm that receives flow from the river, but then largely remains within the eastern half of the reservoir suspended approximately mid-water column in the main basin of the reservoir extending as far downstream as the border with Montana. Overall, the results of the 2020 mixing assessment were similar to conditions previously observed in 2018 and 2019.

Sediment Quality

Sediment both downstream and upstream of the Elk River was primarily composed of silt-sized material and lesser amounts of clay-sized material. A significantly higher proportion of clay was indicated in sediment downstream of the Elk River compared to upstream, however no differences in proportions of sand-sized, silt-size, or total organic content material were indicated between areas. Arsenic, iron, manganese, and nickel concentrations in sediment were elevated above the lower WSQG at three or more stations downstream of the Elk River, but because concentrations of these metals were also above WSQG at the upstream area suggests there is a high background concentration. Several metals and PAHs occurred at significantly higher concentrations in sediment downstream of the Elk River compared to upstream in 2020. Concentrations of metals, and PAHs in sediment at the downstream and upstream areas in 2020 were within ranges shown at each respective study area in previous years suggesting no significant changes in concentrations over time at either study area.

Concentrations of selenium in suspended sediment monitored at RG_DSELK was highest in September of 2020 compared to June and July. The September selenium concentration in suspended sediment was within the range of values previously observed at RG_DSELK but were higher than those observed downstream in the Montana portion of the reservoir in 2020.

Zooplankton Community and Tissue Chemistry

In June 2020, higher density, biomass, richness, density of the major groups (Rotifera, Copepoda, and Cladocera), relative abundance of Rotifera, and biomass (both actual and relative) of Copepoda and Rotifera were observed downstream of the Elk River compared to upstream. Conversely, relative abundance of Copepoda and relative biomass of Cladocera were lower downstream. In August 2020, higher total biomass, and actual and relative Copepoda density and biomass, but lower relative abundance and biomass of Rotifera and relative biomass of Cladocera, were observed downstream compared to upstream. Qualitative comparisons of changes over time (based on August data) suggested that density, richness, Rotifera abundance (both actual and relative), and relative Rotifera biomass may have decreased over time at both the downstream and upstream areas. No clear directional change in overall biomass was observed at either area. These differences over time, however, need to take into consideration that sampling methods changed in 2018 to evaluate community over the entire water column as opposed to the top 10 m measured previously from 2014 to 2016.

Zooplankton tissue selenium concentrations were elevated above the BC chronic interim guideline both downstream and upstream of the Elk River in June, but not in August, of 2020. There were no differences in selenium concentrations in zooplankton observed between areas downstream and upstream in either June or August, but concentrations were higher in June than in August for both areas. Temporally, zooplankton tissue selenium concentrations in June of 2020 were higher than observed in 2018 and 2019, whereas concentrations in August of 2020 were comparable to those reported previously at both the downstream and upstream areas from the Elk River.

Benthic Invertebrate Tissue

The benthic invertebrate tissue selenium concentration in the sample collected downstream of the Elk River was elevated above the EVWQP Level 1 Invertebrate benchmark, and the concentration in the sample collected upstream of the Elk River was elevated relative to the BC guideline, based on sampling conducted in April 2020. In August 2020, the selenium concentration in benthic invertebrate tissue collected downstream of Elk River was elevated above the EVWQP Level 1 benchmark for dietary effects to juvenile fish. Selenium concentrations in benthic invertebrate tissue were higher downstream compared to upstream of the Elk River in 2020, and were higher downstream in both spring and summer than previously observed during the same time period in previous years. Benthic invertebrate tissues collected from the Montana portion of the reservoir (Rexford) had lower selenium concentrations than observed downstream of the Elk River in the Canadian portion of the reservoir in 2020.

Fish Tissue Chemistry

Mean selenium concentrations in muscle tissue of all forage fish (PCC and RSC) and all sport fish were below the applicable BC fish muscle tissue guideline or US EPA criterion at all Canadian and Montana study areas in 2020. Peamouth chub and RSC captured downstream showed significantly higher muscle selenium concentrations than upstream in 2020, but all concentrations were lower than guidelines and therefore the differences are not expected to be ecologically significant.

Gonadosomatic indices of PCC and RSC sampled in 2020 were well below values indicative of spawning condition (>10%), and thus elevated concentrations of selenium in their ovaries was unlikely to reflect an impairment to the reproduction of either of these species as intended by the guidelines. Ovary selenium concentrations in PCC and RSC were elevated relative to guidelines and benchmarks, however, results were ultimately interpreted with caution.

Redside Shiner Recruitment

All RSC captured at areas located downstream and upstream of the Elk River in the Canadian portion of the reservoir in 2020 were YOY, indicating successful recruitment had occurred at all study areas. The CPUE of RSC was higher at both downstream areas compared to the upstream area in 2020, which contrasted with lower CPUE at the downstream areas relative to the upstream area in 2018 and 2019. The RSC YOY captured at Elk River and Gold Creek study areas had significantly lower and higher condition, respectively, than those sampled upstream at Sand Creek, but the magnitudes of these difference were within the critical effect size of ±10% for condition suggesting these differences are unlikely to be ecologically meaningful. Inconsistent differences and/or direction of differences in RSC YOY condition were indicated at the downstream areas compared to the upstream area over time, suggesting that no effects to RSC YOY condition were associated with exposure to Elk River waters.

Conclusion

This annual summary report provides an overview of environmental monitoring activities conducted in the Canadian and US portions of Koocanusa Reservoir, along with the associated results, from 2020. The next anticipated annual summary report will cover data from 2021 will be due to ENV in June 2022. Data collected from 2020 to 2022 will be used to address key questions related to changes over time, and will be presented in the three-year interpretive report due to ENV in December 2023.

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APPENDIX A

DATA WATER QUALITY REPORT

APPENDIX A DATA QUALITY REVIEW

A1 INTRODUCTION

A1.1 Background

A variety of factors can influence the chemical and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Inconsistencies in sampling or laboratory methods, use of instruments that are inadequately calibrated or which cannot measure to the desired level of accuracy or precision, and contamination of samples in the field or laboratory are just some of the potential factors that can lead to the reporting of data that do not accurately reflect actual environmental conditions. Depending on their magnitude, inaccuracy or imprecision have the potential to affect the reliability of conclusions made from the data. Therefore, it is important to ensure that monitoring programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and/or temporal variability in the environment).

Data quality, as a concept, is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. A Data Quality Review (DQR) involves comparison of field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRLs), blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials).

As specified in the Koocanusa Reservoir Monitoring Program study design (Minnow 2021), chemistry analyses were completed by laboratories accredited by the Canadian Association for Laboratory Accreditation (CALA), and DQOs were established at the outset of the field program to reflect reasonable and achievable performance expectations (Appendix Table A.1).[1] Programs involving many samples and analytes usually have some results that exceed the DQOs. This is particularly so for multi-element scans (e.g., ICP scans for metals) because the analytical conditions are not necessarily optimal for every element included in the scan.

A DQR was conducted on all laboratory data reported in 2020 in support of the 2021 Koocanusa Reservoir Monitoring Program Report. The objective of the DQR is to define the overall quality of the data presented in the report, and, by extension, the confidence with which

[1] Data Quality Objectives (DQOs) set by the analytical laboratories were applied to samples collected in support of the 2019 Koocanusa Reservoir Monitoring Program.

Table A.1: Data Quality Objectives for Aquatic Ecological Samples in the Koocanusa Reservoir Monitoring Program, 2017 to 2019

Quality Control Measure	Quality Control Sample Type/Check	Study Component				
		Water Chemistry	Sediment Chemistry	Tissue Chemistry	Benthic Invertebrate Community	Zooplankton Community
		ALS	ALS	SRC	ZEAS	Salki
Analytical Laboratory Reporting Limits (LRL)	Comparison actual LRL versus target LRL	LRL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	LRL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	LRL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	n/a	n/a
Blank Analysis	Field or Laboratory Blank	Concentrations measured in blank samples should be <LRL [b]	Concentrations measured in blank samples should be <LRL [b]	n/a	n/a	n/a
Laboratory Precision	Laboratory Duplicates	10% RPD (conductivity) 15% RPD (turbidity) 20% RPD (all remaining analytes)	5% RPD (sand, silt, clay) 20% RPD (moisture) 25% RPD (gravel) 30% RPD (Sb, As, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Fe, Li, Mg, Mn, Ni, P, Se, S, Tl, W, U, V, Zn, Zr) 40% RPD (Al, Ba, Pb, Hg, Mo, K, Ag, Na, Sr, Sn, Ti) 50% RPD (PAHs) Within 2X LRL (pH)	Dependent on the element and the applicable DL. DQOs include 1-4xDL, 4-10xDL, 10-20xDL, 20-100xDL and >100xDL, and are flagged by the laboratory QC protocols.	n/a	n/a
	Organism Sub-Sampling Precision	n/a	n/a	n/a	≤20% difference between sub-samples; minimum of 5% of each sample must be analyzed	≤20% difference between sub-samples; minimum of 5% of each sample must be analyzed
Accuracy	Recovery of Blank Spike	60 to 140% (total silicon) 75 to 125% (TKN) 80 to 120% (orthophosphate, phosphorus, DOC, TOC, total and dissolved metals) 85 to 115% (TSS, TDS, turbidity, alkalinity, ammonia, Br) 90 to 110% (Cl, F, nitrate, nitrite, sulfate)	50 to 130% (naphthalene) 50 to 150% (acridine, 1-methylnaphthalene, perylene, quinoline) 60 to 130% (all PAHs) 80 to 120% (inorganic carbon, total metals) 90 to 110% (moisture, TOC)	n/a	n/a	n/a
	Recovery Matrix Spike	70 to 130% (TKN, orthophosphate, phosphorus, DOC, TOC, total and dissolved metals) 75 to 125% (ammonia, Br, Cl, F, nitrate, nitrite, sulfate)	50 to 150% (PAHs)	n/a	n/a	n/a
	Recovery of Certified Reference Material, QC Standards	80 to 120% (orthophosphate, phosphorus) 85 to 115% (turbidity, alkalinity)	70 to 130% (total metals)[c]	80 to 120%	n/a	n/a
	Organism Recovery	n/a	n/a	n/a	minimum 90% recovery	n/a
	Organism Sub-Sampling Accuracy	n/a	n/a	n/a	80-120%	n/a
	Instrument Accuracy	n/a	n/a	n/a	n/a	n/a

Notes: ALS = ALS Environmental; SRC = Saskatchewan Research Council Environmental Analytical Laboratory; Zeas = Zaranko Environmental Assessment Services Incorporated; AAE = AAE Tech Services Incorporated; n/a = not applicable; RPD = Relative Percent Difference; PAHs = polycyclic aromatic hydrocarbons; 2X = two times; DL = detection limit; TKN = Total Kjeldahl Nitrogen; TOC = total organic carbon; DOC = dissolved organic carbon; Br = bromide; Cl = chloride; F = fluoride; TSS = total suspended solids; TDS = total dissolved solids; QC = quality control.

[a] If no guideline or benchmark exists for a substance, the LRL should be less than predictions.

[b] Only applies to QC samples at concentrations <LRL or greater than 5X the LRL.

[c] The following metals had specific µg/g dw limits: B (0 to 8.2); Se (0.11 to 0.15); Ag (0.13 to 0.33); Tl (0.077 to 0.18); Sn (0 to 3.1); W (0 to 0.66); Zr (0 to 1.8).

the data can be used to derive conclusions. The intent of the DQR is not to reject measurements that did not meet a DQO, but to ensure that questionable data received more scrutiny to determine what effect, if any, were had on interpretation of results within the context of the project.

A1.2 Laboratory Reporting Limits

An LRL is the lowest concentration of an analyte that can be reported with a reasonable degree of accuracy and precision and is ideally synonymous with the lower limit of quantitation (LLOQ). The LLOQ is the lowest concentration of an analyte that can be reliably measured within specific limits of precision and accuracy during routine operating conditions, as opposed to being detected which, in most cases, is the lowest concentration on the calibration curve. The LRL is typically three to ten times the method detection limit (MDL); however, some guidelines are so low the LRL is equal to the MDL to report the guideline. Achieving satisfactory LRLs is important when comparing concentrations to guidelines for that medium. If the LRL is above the guideline, the data cannot be accurately interpreted. Consistency is also important for LRLs when taking consecutive samples. Changes in LRLs between laboratory reports can affect summary calculations and also introduce confounding factors when assessing trends. For the 2019 Koocanusa Reservoir Monitoring Program Interpretive Report, LRLs were screened against guidelines, Elk Valley Water Quality Plan (EVWQP) benchmarks, and site-specific screening values, as appropriate.

A1.3 Quality Control Samples

Typically, a DQR involves the examination of analytical results associated with several types of Quality Control (QC) samples were assessed based on samples collected (or prepared) in the field and laboratory. These samples, and a description of each, include the following:

- **Blanks** are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed the same way as regular samples. These samples will reflect contamination of samples occurring in the field (in the case of field or trip blanks) or the laboratory (in the case of laboratory or method blanks). Concentrations of analytes should not be below the LRL.
- **Field Duplicates** are samples collected from a randomly selected field station that are homogenized to the extent possible, split, and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory. These samples reflect variability introduced during the handling of field samples (e.g., during homogenization), both in the field and laboratory, and therefore provide a measure of field sampling and laboratory precision.

- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.
- **Spike Recovery Samples** are created in the laboratory by adding a known amount/concentration of a given analyte (or mixture of analytes) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in spiked sample minus amount in original sample) relative to the known spike amount (as a percentage). Two types of spike recovery samples are commonly analyzed. Spiked blanks are created using laboratory control materials, whereas matrix spikes are created using field-collected samples. The analysis of spiked samples provides an indication of the accuracy of analytical results.
- **Certified Reference Materials** are commercially prepared (or commercially-homogenized) samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known amount that was recovered in the analysis.

Two additional types of QC, specific to benthic invertebrate and zooplankton community samples, included:

- **Organism Recovery Checks** for benthic invertebrate and zooplankton community samples involve the re-processing of previously sorted material from a randomly selected sample to determine the number of invertebrates and plankton that were not recovered during the original sample processing. The reprocessing is conducted by an analyst not involved during the original processing to reduce any bias. This check allows the determination of accuracy through assessment of recovery efficiency.
- **Sub-Sampling Error** is assessed for studies in which benthic invertebrate and plankton community samples require sub-sampling (due to excessive sample volume and/or invertebrate density). By comparing the numbers of benthic invertebrates or plankton recovered between at least two sub-samples, this measure provides an evaluation of how effective the sub-sampling method was in evenly dividing the original sample. Therefore, sub-sampling error provides a measure of analytical

accuracy and precision. The processing of entire benthic invertebrate community samples in representative sample fractions also allows an evaluation of sub-sampling accuracy.

One additional QC type, specific to fish aging samples, included:

- **Fish aging checks** involve the re-processing of randomly-selected fish aging structures (e.g., otoliths, fin rays, or scales) by a second analyst to determine the precision of fish age estimates. The re-processing is completed by an analyst not involved during the original processing to reduce bias. The original analyst and second analyst both assign a confidence index (e.g., G = good; pattern is clear and age is easily identified) to each age estimate and check.

A2 WATER SAMPLES

A2.1 Laboratory Reporting Limits

The analytical reports from ALS Environmental (ALS) for 2020 (Appendix A) were examined to provide an inventory of analytes for which the sample results were equal to or below the target LRL. The LRLs for these analytes were also assessed relative to the working (BCMOE 2020) and approved (BCMOECCS 2019) British Columbia water quality guidelines (BC WQG) for the protection of freshwater aquatic life, EVWQP Level 1 Benchmarks for water quality (Teck 2014), and relevant site-specific benchmarks (Appendix Table A.2).

Several parameters were consistently (i.e., 100% of samples) reported at concentrations less than the LRL; these included: bromide, total antimony, bismuth and tin, dissolved antimony, beryllium, bismuth, mercury, nickel, silver, thallium, tin, titanium, and vanadium (Appendix Table A.2).

Selenium concentrations were detectable in all samples. The LRLs achieved for water samples the BC WQG and EVWQP Level 1 benchmarks for all analytes (Appendix Table A.2). Overall, the achieved LRLs were appropriate for this study.

A2.2 Field and Laboratory Blanks

A total of three field blanks and four trip blank samples were used to assess field sampling contamination (Appendix Table A.3). The DQO used for laboratory blanks were applied to the trip and field blanks (Appendix Table A.1). of the 448 results that were reported for trip and field blanks, four were greater than the LRL:

- Ammonia in three samples; and
- Total Kjeldahl Nitrogen (TKN) in one sample.

However, detectable concentrations measured in blank samples are only considered reliable if they are greater than five-times the LRL (Appendix Table A.1). None of the detectable concentrations were greater than five-times the LLR, therefore, these results are expected to have negligible impact on data interpretability for this particular study.

A total of 119 method blanks samples were analyzed by ALS (Appendix A). Of the 472 reported method blank results, only total alkalinity in one sample (laboratory report L2463561; Appendix A) had a reportable concentration greater than the LRL. However, the detectable concentration was less than five-times the LRL. In addition, there was no detectable concentrations for selenium, sulphate, cadmium, and nitrate in either the field or laboratory

Table A.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2020

	Analyte	Units	BCWQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs[c,d]	No. LRLs > Guideline[c,d]	No. Sample Results < LRL[d]
			30-d Chronic	Maximum				
Non-metals	Hardness (as $CaCO_3$)	mg/L	-	-	-	0.50	-	0
	Total Suspended Solids	mg/L	-	-	-	1.0	-	12 (27%)
	Total Dissolved Solids	mg/L	-	-	1,000	20	0	0
	Turbidity	NTU	-	-	-	0.10	-	0
	Alkalinity	mg/L	>20	-	-	1.0	0	0
	Ammonia (as N)[e]	mg/L	0.241	1.25	-	0.0050	0	6 (14%)
	Bromide (Br)	mg/L	-	-	-	0.050	-	44 (100%)
	Chloride (Cl)	mg/L	150	600	-	0.50	0	0
	Fluoride (F)[f]	mg/L	1.3	-	-	0.020	0	0
	Nitrate (as N)	mg/L	3.0	32.8	3.0	0.0050	0	0
	Nitrite (as N)[g]	mg/L	0.020	0.060	-	0.0010	0	18 (41%)
	Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	-	0
	Orthophosphate	mg/L	-	-	-	0.0010	-	37 (84%)
	Phosphorus (P)-Total	mg/L	-	-	-	0.0020	-	10 (23%)
	Sulfate (SO_4)[f]	mg/L	309	-	429	0.30	0	0
	Dissolved Organic Carbon	mg/L	-	-	-	0.50	-	1 (2.3%)
	Total Organic Carbon	mg/L	-	-	-	0.50 - 2.5	-	5 (11%)
Total Metals	Aluminum (Al)	mg/L	-	-	-	0.0030	-	0
	Antimony (Sb)	mg/L	0.0090	-	-	0.00010	0	44 (100%)
	Arsenic (As)	mg/L	-	0.0050	-	0.00010	0	0
	Barium (Ba)	mg/L	1.0	-	-	0.00010	0	0
	Beryllium (Be)	µg/L	0.13	-	-	0.020	0	26 (59%)
	Bismuth (Bi)	mg/L	-	-	-	0.000050	-	44 (100%)
	Boron (B)	mg/L	-	1.2	-	0.010	0	31 (70%)
	Cadmium (Cd)	µg/L	-	-	-	0.0050	-	16 (36%)
	Calcium (Ca)	mg/L	-	-	-	0.050	-	0
	Chromium (Cr)[h]	mg/L	0.0010	-	-	0.00010	0	10 (23%)
	Cobalt (Co)	µg/L	4.0	110	-	0.10	0	20 (45%)
	Copper (Cu)	mg/L	0.0020	0.0032	-	0.00050	0	24 (54%)
	Iron (Fe)	mg/L	-	1.0	-	0.010	0	4 (9.1%)
	Lead (Pb)[f]	mg/L	0.053	0.0064	-	0.000050	0	7 (16%)
	Lithium (Li)	mg/L	-	-	-	0.0010	-	0
	Magnesium (Mg)	mg/L	-	-	-	0.10	-	0
	Manganese (Mn)[f]	mg/L	1.03	1.61	-	0.00010	0	0
	Mercury (Hg)[i]	µg/L	0.00125	-	-	0.00050	0	18 (41%)
	Molybdenum (Mo)	mg/L	1.0	2.0	-	0.000050	0	0
	Nickel (Ni)[f]	mg/L	0.110	-	0.123	0.00050	0	26 (59%)
	Potassium (K)	mg/L	-	-	-	0.050	-	0
	Selenium (Se)	µg/L	2.0	-	19	0.050	0	0
	Silicon (Si)	mg/L	-	-	-	0.10	-	0
	Silver (Ag)[f]	mg/L	0.000050	0.00010	-	0.000010	0	43 (98%)
	Sodium (Na)	mg/L	-	-	-	0.050	-	0
	Strontium (Sr)	mg/L	-	-	-	0.00020	-	0
	Thallium (Tl)	mg/L	0.00080	-	-	0.000010	0	34 (77%)
	Tin (Sn)	mg/L	-	-	-	0.00010	-	44 (100%)
	Titanium (Ti)	mg/L	-	-	-	0.010 to 0.11	-	36 (82%)
	Uranium (U)	mg/L	0.0085	-	-	0.000010	0	0
	Vanadium (V)	mg/L	-	-	-	0.00050	-	24 (54%)
	Zinc (Zn)[f]	mg/L	0.0125	0.0380	-	0.0030	0	30 (68%)
Dissolved Metals	Aluminum (Al)	mg/L	0.050	0.10	-	0.0030	0	8 (18%)
	Antimony (Sb)	mg/L	-	-	-	0.00010	-	44 (100%)
	Arsenic (As)	mg/L	-	-	-	0.00010	-	0
	Barium (Ba)	mg/L	-	-	-	0.00010	-	0
	Beryllium (Be)	µg/L	-	-	-	0.020	-	44 (100%)
	Bismuth (Bi)	mg/L	-	-	-	0.000050	-	44 (100%)
	Boron (B)	mg/L		-	-	0.010	-	32 (73%)
	Cadmium (Cd)[f]	µg/L	0.206	0.568	0.0923	0.0050	0	40 (91%)
	Calcium (Ca)	mg/L	-	-	-	0.050	-	0
	Chromium (Cr)	mg/L	-	-	-	0.00010	-	37 (84%)
	Cobalt (Co)	µg/L	-	-	-	0.10	-	43 (98%)
	Copper (Cu)	mg/L	-	-	-	0.00020	-	3 (6.8%)
	Iron (Fe)	mg/L	-	0.35	-	0.010	0	26 (59%)
	Lead (Pb)	mg/L	-	-	-	0.000050	-	41 (93%)
	Lithium (Li)	mg/L	-	-	-	0.0010	-	8 (18%)
	Magnesium (Mg)	mg/L	-	-	-	0.10	-	0
	Manganese (Mn)	mg/L	-	-	-	0.00010	-	0
	Mercury (Hg)	mg/L	-	-	-	0.0000050	-	44 (100%)
	Molybdenum (Mo)	mg/L	-	-	-	0.000050	-	0
	Nickel (Ni)	mg/L	-	-	-	0.00050	-	44 (100%)

Table A.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2020

	Analyte	Units	BCWQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs[c,d]	No. LRLs > Guideline[c,d]	No. Sample Results < LRL[d]
			30-d Chronic	Maximum				
Dissolved Metals	Potassium (K)	mg/L	-	-	-	0.050	-	0
	Selenium (Se)	µg/L	-	-	-	0.050	-	0
	Silicon (Si)	mg/L	-	-	-	0.050	-	0
	Silver (Ag)	mg/L	-	-	-	0.000010	-	44 (100%)
	Sodium (Na)	mg/L	-	-	-	0.050	-	0
	Strontium (Sr)	mg/L	-	-	-	0.00020	-	0
	Thallium (Tl)	mg/L	-	-	-	0.000010	-	44 (100%)
	Tin (Sn)	mg/L	-	-	-	0.00010	-	44 (100%)
	Titanium (Ti)	mg/L	-	-	-	0.010	-	44 (100%)
	Uranium (U)	mg/L	-	-	-	0.000010	-	0
	Vanadium (V)	mg/L	-	-	-	0.00050	-	44 (100%)
	Zinc (Zn)	mg/L	-	-	-	0.0010	-	22 (50%)

Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.

Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOE 2020; BCMOECCS 2019).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre.

[a] Working (BCMOE 2020) or Accepted (BCMOECCS 2019) BC WQG for the Protection of Aquatic Life.

[b] Where more than one EVWQP Level 1 benchmark was applicable, the most conservative (lowest) value was used (Teck 2014).

[c] The LRLs for all analytes were consistently less than the applicable BCWQG (BCMOE 2020; BCMOECCS 2019) and EVWQP Level 1 Benchmarks (Teck 2014).

[d] The total number of samples in 2020 was n = 44 (n = 41 water samples and n = 31 duplicate samples). Data for field and trip blanks are summarized in Table A.3.

[e] Based on most conservative guideline using highest temperature (14) and pH (8.72).

[f] Hardness-based guidelines calculated using the minimum hardness observed for all samples (96.7 mg/L).

[g] Minimum water quality guidelines for Nitrite (as N) reported in BCMOECCS (2019) for chloride concentrations < 2 mg/L.

[h] Guideline for Chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[i] The most conservative guideline (0.00125 µg/L) was applied.

Table A.3: Field Blank and Trip Blank Results for Water Chemistry Analyses, 2020

	Analyte	Units	BCWQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs[c,d]	No. Sample Results < LRL[d]
			30-d Chronic	Maximum			
Non-metals	Hardness (as $CaCO_3$)	mg/L	-	-	-	0.50	4 (100%)
	Total Suspended Solids	mg/L	-	-	-	1.0	7 (100%)
	Total Dissolved Solids	mg/L	-	-	1,000	10	7 (100%)
	Turbidity	NTU	-	-	-	0.10	7 (100%)
	Alkalinity	mg/L	>20	-	-	1.0	7 (100%)
	Ammonia (as N)[e]	mg/L	0.241	1.25	-	0.0050	4 (57%)
	Bromide (Br)	mg/L	-	-	-	0.050	7 (100%)
	Chloride (Cl)	mg/L	150	600	-	0.50	7 (100%)
	Fluoride (F)[f]	mg/L	1.3	-	-	0.020	7 (100%)
	Nitrate (as N)	mg/L	3.0	32.8	3.0	0.0050	7 (100%)
	Nitrite (as N)[g]	mg/L	0.020	0.060	-	0.0010	7 (100%)
	Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	6 (86%)
	Orthophosphate	mg/L	-	-	-	0.0010	7 (100%)
	Phosphorus (P)-Total	mg/L	-	-	-	0.0020	7 (100%)
	Sulfate (SO_4)[f]	mg/L	309	-	429	0.30	7 (100%)
	Dissolved Organic Carbon	mg/L	-	-	-	0.50	3 (100%)
	Total Organic Carbon	mg/L	-	-	-	0.50	7 (100%)
Total Metals	Aluminum (Al)	mg/L	-	-	-	0.0030	7 (100%)
	Antimony (Sb)	mg/L	0.0090	-	-	0.00010	7 (100%)
	Arsenic (As)	mg/L	-	0.0050	-	0.00010	7 (100%)
	Barium (Ba)	mg/L	1.0	-	-	0.00010	7 (100%)
	Beryllium (Be)	µg/L	0.13	-	-	0.020	7 (100%)
	Bismuth (Bi)	mg/L	-	-	-	0.000050	7 (100%)
	Boron (B)	mg/L	-	1.2	-	0.010	7 (100%)
	Cadmium (Cd)	µg/L	-	-	-	0.0050	7 (100%)
	Calcium (Ca)	mg/L	-	-	-	0.050	7 (100%)
	Chromium (Cr)[h]	mg/L	0.0010	-	-	0.00010	7 (100%)
	Cobalt (Co)	µg/L	4.0	110	-	0.10	7 (100%)
	Copper (Cu)	mg/L	0.0020	0.0032	-	0.00050	7 (100%)
	Iron (Fe)	mg/L	-	1.0	-	0.010	7 (100%)
	Lead (Pb)[f]	mg/L	0.053	0.0064	-	0.000050	7 (100%)
	Lithium (Li)	mg/L	-	-	-	0.0010	7 (100%)
	Magnesium (Mg)	mg/L	-	-	-	0.10	7 (100%)
	Manganese (Mn)[f]	mg/L	1.03	1.61	-	0.00010	7 (100%)
	Mercury (Hg)[i]	µg/L	0.00125	-	-	0.00050	7 (100%)
	Molybdenum (Mo)	mg/L	1.0	2.0	-	0.000050	7 (100%)
	Nickel (Ni)[f]	mg/L	0.110	-	0.123	0.00050	7 (100%)
	Potassium (K)	mg/L	-	-	-	0.050	7 (100%)
	Selenium (Se)	µg/L	2.0	-	19	0.050	7 (100%)
	Silicon (Si)	mg/L	-	-	-	0.10	7 (100%)
	Silver (Ag)[f]	mg/L	0.000050	0.00010	-	0.000010	7 (100%)
	Sodium (Na)	mg/L	-	-	-	0.050	7 (100%)
	Strontium (Sr)	mg/L	-	-	-	0.00020	7 (100%)
	Thallium (Tl)	mg/L	0.00080	-	-	0.000010	7 (100%)
	Tin (Sn)	mg/L	-	-	-	0.00010	7 (100%)
	Titanium (Ti)	mg/L	-	-	-	0.010	7 (100%)
	Uranium (U)	mg/L	0.0085	-	-	0.000010	7 (100%)
	Vanadium (V)	mg/L	-	-	-	0.00050	7 (100%)
	Zinc (Zn)[f]	mg/L	0.0125	0.0380	-	0.0030	7 (100%)
Dissolved Metals	Aluminum (Al)	mg/L	0.050	0.10	-	0.0030	3 (100%)
	Antimony (Sb)	mg/L	-	-	-	0.00010	3 (100%)
	Arsenic (As)	mg/L	-	-	-	0.00010	3 (100%)
	Barium (Ba)	mg/L	-	-	-	0.00010	3 (100%)
	Beryllium (Be)	µg/L	-	-	-	0.020	3 (100%)
	Bismuth (Bi)	mg/L	-	-	-	0.000050	3 (100%)
	Boron (B)	mg/L		-	-	0.010	3 (100%)
	Cadmium (Cd)[f]	µg/L	0.206	0.568	0.0923	0.0050	3 (100%)
	Calcium (Ca)	mg/L	-	-	-	0.050	7 (100%)
	Chromium (Cr)	mg/L	-	-	-	0.00010	3 (100%)
	Cobalt (Co)	µg/L	-	-	-	0.10	3 (100%)
	Copper (Cu)	mg/L	-	-	-	0.00020	3 (100%)
	Iron (Fe)	mg/L	-	0.35	-	0.010	3 (100%)
	Lead (Pb)	mg/L	-	-	-	0.000050	3 (100%)
	Lithium (Li)	mg/L	-	-	-	0.0010	3 (100%)
	Magnesium (Mg)	mg/L	-	-	-	0.0050 - 0.10	7 (100%)
	Manganese (Mn)	mg/L	-	-	-	0.00010	3 (100%)
	Mercury (Hg)	mg/L	-	-	-	0.0000050	3 (100%)
	Molybdenum (Mo)	mg/L	-	-	-	0.000050	3 (100%)
	Nickel (Ni)	mg/L	-	-	-	0.00050	3 (100%)

Table A.3: Field Blank and Trip Blank Results for Water Chemistry Analyses, 2020

Analyte		Units	BCWQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs[c,d]	No. Sample Results < LRL[d]
			30-d Chronic	Maximum			
Dissolved Metals	Potassium (K)	mg/L	-	-	-	0.050	7 (100%)
	Selenium (Se)	μg/L	-	-	-	0.050	3 (100%)
	Silicon (Si)	mg/L	-	-	-	0.050	3 (100%)
	Silver (Ag)	mg/L	-	-	-	0.000010	3 (100%)
	Sodium (Na)	mg/L	-	-	-	0.050	7 (100%)
	Strontium (Sr)	mg/L	-	-	-	0.00020	3 (100%)
	Thallium (Tl)	mg/L	-	-	-	0.000010	3 (100%)
	Tin (Sn)	mg/L	-	-	-	0.00010	3 (100%)
	Titanium (Ti)	mg/L	-	-	-	0.010	3 (100%)
	Uranium (U)	mg/L	-	-	-	0.000010	3 (100%)
	Vanadium (V)	mg/L	-	-	-	0.00050	3 (100%)
	Zinc (Zn)	mg/L	-	-	-	0.0010	3 (100%)

Shading indicates blank concentrations greater than the LRL.
Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.
Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOE 2020; BCMOECCS 2019).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; NTU = Nephelometric Turbidity Units; μg/L = micrograms per litre.

[a] Working (BCMOE 2020) or Accepted (BCMOECCS 2019) BC WQG for the Protection of Aquatic Life.

[b] Where more than one EVWQP Level 1 benchmark was applicable, the most conservative (lowest) value was used (Teck 2014).

[c] The LRLs for all analytes were consistently less than the applicable BCWQG (BCMOE 2020; BCMOECCS 2019) and EVWQP Level 1 Benchmarks (Teck

[d] Total n = 7 (n = 4 trip blanks and n = 3 field blanks) for 2020. Additionally, some parameters were not consistently analyzed and reported for the blank samples; differences in sample numbers are reflected in the table.

[e] Based on most conservative guideline using highest temperature (14) and pH (8.72).

[f] Hardness-based guidelines calculated using the minimum hardness observed for all samples (96.7 mg/L).

[g] Minimum water quality guidelines for Nitrite (as N) reported in BCMOECCS (2019) for chloride concentrations < 2 mg/L.

[h] Guideline for Chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[i] The most conservative guideline (0.00125 μg/L) was applied.

blanks, which have long-term water as part of the EVWQP (Teck 2014). Therefore, the results are expected to have a negligible impact on data interpretability.

A2.3 Data Precision

A2.3.1 Field Duplicate Samples

A total of three duplicate samples were collected to assess field sampling precision (Appendix Table A.4). However, sampling techniques varied; samples were collected as split samples or side-by-side duplicates, the latter of which would be expected to result in greater variability among sample results. Additionally, for split samples, the sample aliquots in the larger "general" bottles would not be considered true splits (i.e., the smaller sample bottles would have been filled from these containers, and then these containers would have been filled directly from the sampling area).

Of the analytes with long-term targets under the EVWQP (i.e., selenium, nitrate, sulphate, and total cadmium; Teck 2014), nitrate and sulphate had the best field sampling precision (Appendix Table A.4). For nitrate and sulphate, RPDs between paired results were ≤23% and 16%, respectively. For cadmium, RPDs between paired results were 19% and 76%. The higher RPD was based on concentrations that were less than and/or near the LRL (i.e., within five-times the LRL).[2] For selenium, RPDs between paired results were ≤15%, and/or concentrations were near the LRL, with the exception of one pair with an RPD of 49% (both pairs were greater than the five-times the LRL).

Field sampling precision was also good for total dissolved solids (TDS) and nickel, both of which have site-specific screening values (Appendix Table A.2). For TDS, RPDs between paired result were consistently less than 4.9% (Appendix Table A.4). For nickel, RPDs between all paired results were below the LRL (Appendix Table A.4).

For the remaining analytes, the mean and median RPDs for paired concentrations were less than 62%, with the exception of total suspended solids (TSS). For TTS, the mean RPD was 90%, with one pair of results with an RPD of 148%. The higher RPD was based on one result being less than five-times the LRL, and the other greater than five-times the LRL (Appendix Table A.4). The higher mean and median RPDs of ≤62% for the remaining analytes was the result of one of the three duplicate pairs (i.e., RG_GC_U1) having several RPDs between paired results greater than 100%:

[2] Greater RPDs between paired results for water chemistry are considered more acceptable when concentrations are close to the LRL (e.g., within five-times the LRL; BCMOE 2013).

Table A.4: Field Duplicate Results for Water Chemistry Samples, 2020

Analyte		Units	L2440156			L2463561			L2495155		
			RG_TN_U1_WS_2020-4-22			RG_GC_U1 _WS_2020-06-18_0950			RG_ER_U2_WS_2020-08-26-1110		
			RG_TN_U1	RG_RIVER	RPD (%)	RG_GC_U1	RG_RIVER	RPD (%)	RG_ER_U2	RG_RIVER	RPD (%)
Non-metals	Hardness (as $CaCO_3$)	mg/L	173	166	4.1	117	113	3.5	133	128	3.8
	Total Suspended Solids	mg/L	18.2	13.1	33	1.9	12.6	148	<1.0	<1.0	-
	Total Dissolved Solids	mg/L	183	183	0	145	138	4.9	163	161	1.2
	Turbidity	NTU	14.7	11.5	24	5.42	20.3	116	1.63	1.44	12
	Alkalinity	mg/L	130	131	0.77	104	96.2	7.8	108	109	0.92
	Ammonia (as N)[a]	mg/L	0.0370	0.0502	30	<0.0050	0.0117	80	< 0.02	0.0377	55
	Bromide (Br)	mg/L	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050	-
	Chloride (Cl)	mg/L	5.90	5.90	0	1.66	1.37	19	2.54	2.51	1.2
	Fluoride (F)[b]	mg/L	0.088	0.089	1.1	0.050	0.047	6.2	0.087	0.085	2.3
	Nitrate (as N)	mg/L	0.0664	0.0641	3.5	0.279	0.221	23	0.107	0.108	0.93
	Nitrite (as N)[c]	mg/L	<0.0010	0.0012	18	<0.0016	<0.0010	-	0.0011	0.0014	24
	Total Kjeldahl Nitrogen	mg/L	0.155	0.176	13	0.176	0.188	6.6	0.139	0.212	42
	Orthophosphate	mg/L	0.0024	0.0018	29	<0.0010	<0.0010	-	<0.0010	<0.0010	-
	Phosphorus (P)-Total	mg/L	0.0126	0.0124	1.6	<0.0020	0.0084	123	<0.0020	0.0021	4.9
	Sulfate (SO_4)[b]	mg/L	44.7	44.8	0.22	19.3	16.4	16	25.2	25.1	0.40
	Dissolved Organic Carbon	mg/L	2.10	1.86	12	2.08	1.50	32	1.23	1.63	28
	Total Organic Carbon	mg/L	1.86	1.57	17	2.46	1.49	49	1.07	1.51	34
Total Metals	Aluminum (Al)	mg/L	0.165	0.100	49	0.0886	0.278	103	0.0178	0.0165	7.6
	Antimony (Sb)	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
	Arsenic (As)	mg/L	0.00070	0.00063	11	0.00033	0.00039	17	0.00036	0.00037	2.7
	Barium (Ba)	mg/L	0.0486	0.0461	5.3	0.0406	0.0335	19	0.0401	0.0400	0.25
	Beryllium (Be)	µg/L	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
	Bismuth (Bi)	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
	Boron (B)	mg/L	0.014	0.014	0	<0.010	<0.010	-	<0.010	<0.010	-
	Cadmium (Cd)	µg/L	0.0104	0.0086	19	<0.0050	0.0111	76	<0.0050	<0.0050	-
	Calcium (Ca)	mg/L	45.4	43.6	4.0	32.4	33.5	3.3	34.4	32.3	6.3
	Chromium (Cr)[d]	mg/L	0.00023	0.0002	14	0.00015	0.00040	91	<0.00010	<0.00010	-
	Cobalt (Co)	µg/L	0.21	0.15	33	<0.10	0.20	67	<0.10	<0.10	-
	Copper (Cu)	mg/L	<0.00050	<0.00050	-	<0.00050	0.00065	26	<0.00050	<0.00050	-
	Iron (Fe)	mg/L	0.302	0.191	45	0.059	0.306	135	0.019	0.018	5.4
	Lead (Pb)[b]	mg/L	0.00044	0.000355	21	0.000096	0.000302	104	<0.000050	<0.000050	-
	Lithium (Li)	mg/L	0.0025	0.0024	4.1	0.0017	0.0018	5.7	0.0019	0.0018	5.4
	Magnesium (Mg)	mg/L	14.3	13.2	8.0	8.74	8.16	6.9	10.3	10.5	1.9
	Manganese (Mn)[b]	mg/L	0.0265	0.0215	21	0.00361	0.0114	104	0.00255	0.0023	10
	Mercury (Hg)[e]	µg/L	0.00069	0.00070	1.4	0.00078	0.00118	41	<0.00050	<0.00050	-
	Molybdenum (Mo)	mg/L	0.000628	0.000614	2.3	0.000496	0.000518	4.3	0.000672	0.000635	5.7
	Nickel (Ni)[b]	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
	Potassium (K)	mg/L	0.789	0.741	6.3	0.518	0.497	4.1	0.533	0.521	2.3
	Selenium (Se)	µg/L	0.192	0.165	15	0.948	0.577	49	0.817	0.719	13
	Silicon (Si)	mg/L	2.58	2.42	6.4	2.56	2.71	5.7	1.55	1.45	6.7
	Silver (Ag)[b]	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
	Sodium (Na)	mg/L	7.49	7.03	6.3	2.15	1.95	10	3.35	3.29	1.8
	Strontium (Sr)	mg/L	0.183	0.183	0	0.109	0.118	7.9	0.140	0.137	2.2
	Thallium (Tl)	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
	Tin (Sn)	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
	Titanium (Ti)	mg/L	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
	Uranium (U)	mg/L	0.000856	0.000841	1.8	0.000555	0.000611	10	0.000676	0.000665	1.6
	Vanadium (V)	mg/L	0.00053	<0.00050	5.8	<0.00050	0.00061	20	<0.00050	<0.00050	-
	Zinc (Zn)[b]	mg/L	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-
Dissolved Metals	Aluminum (Al)	mg/L	0.0044	0.0046	4.4	0.0079	0.0130	49	0.0044	0.0032	32
	Antimony (Sb)	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
	Arsenic (As)	mg/L	0.00058	0.00058	0	0.00030	0.00030	0	0.00034	0.00037	8.5
	Barium (Ba)	mg/L	0.0458	0.046	0.44	0.0390	0.0326	18	0.0412	0.0426	3.3
	Beryllium (Be)	µg/L	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
	Bismuth (Bi)	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
	Boron (B)	mg/L	0.014	0.014	0	<0.010	<0.010	-	<0.010	<0.010	-
	Cadmium (Cd)[b]	µg/L	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-
	Calcium (Ca)	mg/L	46.2	43.8	5.3	30.8	30.0	2.6	36.7	35.4	3.6
	Chromium (Cr)	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
	Cobalt (Co)	µg/L	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
	Copper (Cu)	mg/L	0.00024	0.0003	22	0.00037	0.00034	8.5	0.00022	0.00024	8.7
	Iron (Fe)	mg/L	0.013	0.016	21	<0.010	<0.010	-	<0.010	<0.010	-
	Lead (Pb)	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
	Lithium (Li)	mg/L	0.0024	0.0	4.3	0.0017	0.0014	19	0.0017	0.0017	0
	Magnesium (Mg)	mg/L	13.9	13.9	0	9.85	9.29	5.9	9.95	9.69	2.6
	Manganese (Mn)	mg/L	0.0138	0.0142	2.9	0.00063	0.0022	111	0.00035	0.00032	9.0
	Mercury (Hg)	mg/L	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
	Molybdenum (Mo)	mg/L	0.000669	0.000659	1.5	0.000485	0.00049	1.0	0.000654	0.000699	6.7
	Nickel (Ni)	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
	Potassium (K)	mg/L	0.748	0.749	0.13	0.508	0.455	11	0.543	0.554	2.0
	Selenium (Se)	µg/L	0.218	0.177	21	0.96	0.604	45	0.838	0.921	9.4
	Silicon (Si)	mg/L	2.26	2.25	0.44	2.22	2.20	0.90	1.35	1.37	1.5
	Silver (Ag)	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
	Sodium (Na)	mg/L	7.71	7.58	1.7	2.47	1.99	22	3.29	3.26	0.92
	Strontium (Sr)	mg/L	0.18	0.18	0	0.109	0.109	0	0.132	0.135	2.2
	Thallium (Tl)	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
	Tin (Sn)	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
	Titanium (Ti)	mg/L	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
	Uranium (U)	mg/L	0.00089	0.000887	0.34	0.000596	0.000596	0	0.000674	0.000685	1.6
	Vanadium (V)	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
	Zinc (Zn)	mg/L	0.0010	<0.0010	0	<0.0010	<0.0010	-	0.0034	0.0019	57

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; µS/cm = microSiemens per centimetre; CaCO3 = calcium carbonate; mg/L = milligrams per litre; < = less than; NTU = Nephelometric Turbidity Units; - = no data/not calculated; µg/L = micrograms per litre; LRL = Laboratory Reporting Limit;≤ = less than or equal to.

[a] Based on most conservative guideline using highest temperature (14) and pH (8.72).

[b] Hardness-based guidelines calculated using the minimum hardness observed for all samples (96.7 mg/L).

[c] Minimum water quality guidelines for Nitrite (as N) reported in BCMOECCS (2019) for chloride concentrations < 2 mg/L.

[d] Guideline for Chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[e] The most conservative guideline (0.00125 µg/L) was applied.

- phosphorus with an RPD of 123% (one result was below the LRL, the other was within the five-times the LRL);
- TTS with an RPD of 148% (one result was within five-times the LRL, the other was greater than five-times the LRL);
- turbidity with an RPD of 116% (both results were greater than five-times the LRL);
- total aluminum with an RPD of 103% (both results were greater than five-times the LRL);
- total iron with an RPD of 135% (both results were greater than five-times the LRL);
- total lead with an RPD of 104% (one result was within five-times the LRL, the other was greater than five-times the LRL);
- total manganese with an RPD of 104% (both results were greater than five-times the LRL); and
- dissolved manganese with an RPD of 111% (both results were greater than five-times the LRL).

Field precision and reproducibility were considered good with long-term targets under the EVQWP (i.e., selenium, nitrate, sulphate, cadmium, TDS, and total nickel; Teck 2014), and fair to good and the remaining analytes, except selenium and the listed analytes from the duplicate pair RG_GC_U1. These results should be interpreted with caution, as several samples had large RPDs and concentrations that were well above the LRL. Overall, the field sampling precision is considered acceptable for the purpose of this study.

A2.3.2 Laboratory Duplicate Samples

A total of 24 laboratory duplicate samples were used to evaluate analytical precision (Appendix A). For all paired samples, comparisons were within the laboratory DQO set by the analytical laboratory (Appendix Table A.1). The laboratory analytical precision can therefore be considered excellent.

A2.4 Data Accuracy

Data accuracy was evaluated based on results for Certified Reference Materials (CRM), Laboratory Control Samples (LCS), and Matrix Spike (MS) samples. Specifically, seven CRM samples, 119 LCS samples, and 16 MS samples were analyzed to produce seven, 477, and 87 individual results, respectively (see Appendix A). All CRM and LCS results met the laboratory DQO. For 11 MS results (i.e., 13% of the total MS results), analyte concentrations were high in the background samples (i.e., the field sample used as the base for the MS sample) and the analytical laboratory was unable to accurately calculate the recovery of the spiked material. Affected analytes in MS samples include the following: total aluminum, barium, calcium, magnesium, manganese, sodium, and strontium (one sample each) and dissolved barium, calcium, magnesium, and strontium (one sample each). None of the long-term water quality targets under the EVWQP (Teck 2014) had DQO exceedances, and few of the remaining analytes exceeded the DQO overall, the accuracy of the laboratory is considered good.

A3 SEDIMENT SAMPLES

A3.1 Laboratory Reporting Limits

The analytical reports from ALS for sediment samples collected (Appendix A) were examined to provide an inventory of analytes for which sample results were less than the LRL (Appendix Table A.5). The LRLs for these analytes were assessed relative to existing British Columbia Working Sediment Quality Guidelines (BC WSQG; BCMOE 2017) and the alert concentration for selenium (BCMOECCS 2019).

Few metals were consistently (i.e., 100% of samples) reported at concentrations less than the LRL; these included: sulphur, tin, and tungsten (Appendix Table A.5). Additionally, several of the polycyclic aromatic hydrocarbons (PAHs) were consistently less than the LRL i.e., no detectable concentrations); these included: acenaphthene, acenaphthylene, acridine, anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-c,d)pyrene, 1-methylnaphthalene, quinoline, and b(a)p total potency equivalent (Appendix Table A.5).

The LRLs for metal and PAHs measured in sediment samples were less than applicable BC WSQG as well as the alert concentration for selenium (Appendix Table A.5). Overall, the achieved LRLs were appropriate for this study.

A3.2 Laboratory Blanks

A total of nine laboratory method samples were analyzed by ALS (see Appendix A). All 93 reported method blank results were below the laboratory DQO (Appendix Table A.1). Thus, the method blank results for this study indicated no inadvertent contamination of samples within the laboratory during analysis.

A3.3 Data Precision

A3.3.1 Laboratory Duplicate Samples

A total of three laboratory duplicate samples were used to evaluate laboratory precision (see Appendix A). The RPD between all 45 laboratory duplicate measurements were within the laboratory DQO (Appendix Table A.1; Appendix A), indicating that laboratory analytical precision was excellent.

A3.4 Data Accuracy

Data accuracy was evaluated based on the analysis of CRM, LCS, and internal reference material (IRM). Specifically, one CRM, ten LCS, and eight IRM were used to

Table A.5: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, 2020

	Analyte	Units	BC WSQGs[a]		Range of LRLs	No. LRLs > ISQG	No. LRLs > PEL	No. Sample Results < LRL[c]
			ISQG	PEL				
Non-metal	Moisture	%	-	-	0.25	-	-	0
	pH	pH units	-	-	0.10	-	-	0
	Total Organic Carbon	%	-	-	0.93 - 0.98	-	-	0
Particle Size	% Gravel (>2mm)	%	-	-	1.0	-	-	10 (100%)
	% Sand (2.00mm - 1.00mm)	%	-	-	1.0	-	-	10 (100%)
	% Sand (1.00mm - 0.50mm)	%	-	-	1.0	-	-	10 (100%)
	% Sand (0.50mm - 0.25mm)	%	-	-	1.0	-	-	9 (90%)
	% Sand (0.25mm - 0.125mm)	%	-	-	1.0	-	-	9 (90%)
	% Sand (0.125mm - 0.063mm)	%	-	-	1.0	-	-	4 (40%)
	% Silt (0.063mm - 0.0312mm)	%	-	-	1.0	-	-	0
	% Silt (0.0312mm - 0.004mm)	%	-	-	1.0	-	-	0
	% Clay (<4μm)	%	-	-	1.0	-	-	0
Metals	Aluminum (Al)	mg/kg	-	-	50	-	-	0
	Antimony (Sb)	mg/kg	-	-	0.10	-	-	0
	Arsenic (As)	mg/kg	5.9	17	0.10	0	0	0
	Barium (Ba)	mg/kg	-	-	0.50	-	-	0
	Beryllium (Be)	mg/kg	-	-	0.10	-	-	0
	Bismuth (Bi)	mg/kg	-	-	0.20	-	-	2 (20%)
	Boron	mg/kg	-	-	5.0	-	-	8 (80%)
	Cadmium (Cd)	mg/kg	0.60	3.5	0.020	0	0	0
	Calcium (Ca)	mg/kg	-	-	50	-	-	0
	Chromium (Cr)	mg/kg	37.3	90.0	0.50	0	0	0
	Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
	Copper (Cu)	mg/kg	35.7	197	0.50	0	0	0
	Iron (Fe)	mg/kg	21,200	43,766	50	0	0	0
	Lead (Pb)	mg/kg	35.0	91.3	0.50	0	0	0
	Lithium (Li)	mg/kg	-	-	2.0	-	-	0
	Magnesium (Mg)	mg/kg	-	-	20	-	-	0
	Manganese (Mn)	mg/kg	460	1,100	1.0	0	0	0
	Mercury (Hg)	mg/kg	0.170	0.486	0.0050	0	0	0
	Molybdenum (Mo)	mg/kg	-	-	0.10	-	-	0
	Nickel (Ni)	mg/kg	16.0	75.0	0.50	0	0	0
	Phosphorus (P)	mg/kg	-	-	50	-	-	0
	Potassium (K)	mg/kg	-	-	100	-	-	0
	Selenium (Se)	mg/kg	2.0[b]		0.20	0	0	5 (50%)
	Silver (Ag)	mg/kg	0.50	-	0.10	0	-	7 (70%)
	Sodium (Na)	mg/kg	-	-	50	-	-	0
	Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
	Sulphur (S)	mg/kg	-	-	1,000	-	-	10 (100%)
	Thallium (Tl)	mg/kg	-	-	0.050	-	-	0
	Tin (Sn)	mg/kg	-	-	2.0	-	-	10 (100%)
	Titanium (Ti)	mg/kg	-	-	1.0	-	-	0
	Tungsten (W)	mg/kg	-	-	0.50	-	-	10 (100%)
	Uranium (U)	mg/kg	-	-	0.050	-	-	0
	Vanadium (V)	mg/kg	-	-	0.20	-	-	0
	Zinc (Zn)	mg/kg	123	315	2.0	0	0	0
	Zirconium (Zr)	mg/kg	-	-	1.0	-	-	0
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.0050	0	0	10 (100%)
	Acenaphthylene	mg/kg	0.00587	0.128	0.0050	0	0	10 (100%)
	Acridine	mg/kg	-	-	0.010	-	-	10 (100%)
	Anthracene	mg/kg	0.0469	0.245	0.0040	0	0	10 (100%)
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.010 - 0.020	0	0	9 (90%)
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.010	0	0	10 (100%)
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.010	-	-	5 (50%)
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.015	-	-	7 (70%)
	Benzo(e)pyrene	mg/kg	-	-	0.010	-	-	6 (60%)
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.010	0	0	10 (100%)
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.010	0	0	10 (100%)
	Chrysene	mg/kg	0.0571	0.862	0.010 - 0.030	0	0	10 (100%)
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.0050	0	0	10 (100%)
	Fluoranthene	mg/kg	0.111	2.36	0.010	0	0	5 (50%)
	Fluorene	mg/kg	0.0212	0.144	0.010	0	0	10 (100%)
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.010	0	0	10 (100%)
	1-Methylnaphthalene	mg/kg	-	-	0.050	-	-	10 (100%)
	2-Methylnaphthalene	mg/kg	0.0202	0.201	0.010	0	0	5 (50%)
Polycyclic Aromatic Hydrocarbons	Naphthalene	mg/kg	0.0346	0.391	0.010	0	0	5 (50%)
	Perylene	mg/kg	-	-	0.010	-	-	5 (50%)
	Phenanthrene	mg/kg	0.0419	0.515	0.010	0	0	5 (50%)
	Pyrene	mg/kg	0.0530	0.875	0.010	0	0	6 (60%)
	Quinoline	mg/kg	-	-	0.050	-	-	10 (100%)
	B(a)P Total Potency Equivalent	mg/kg	-	-	0.020	-	-	10 (100%)
	IACR (CCME)	mg/kg	-	-	0.15	-	-	6 (60%)

Shading indicates an LRL greater than the lowest BC WSQG (i.e., the ISQG).

Shading indicates an LRL greater than the both the upper BC WSQG (i.e., the PEL) and the BC WSQG (ISQG).

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; LRL = Laboratory Reporting Limit; ISQG = Interim Sediment Quality Guideline; PEL = Probable Effects Level; > = greater than; mm = millimetres; < = less than; μm = micrometres; - = no data/not applicable; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOE 2017).

[b] The 2 mg/kg alert concentrations from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

[c] The total number of samples in 2020 was n = 10.

produce 34, 85, and 56 results, respectively (Appendix A). All CRM, LCS, and IRM results met the laboratory DQO, indicating the accuracy achieved by the laboratory in this study can be considered excellent.

A4 BENTHIC INVERTEBRATES TISSUE CHEMISTRY

A4.1 Laboratory Reporting Limits

The analytical reports from TrichAnalytics Inc. (Trich; Appendix A) were examined to provide an inventory of analytes for which the sample results were less than the LRL. Additionally, LRLs for selenium selenium were assessed relative to the 4 µg/g dw BCMOECCS (2019) guideline and the most conservative (i.e., lowest) EVWQP (i.e., the 11 µg/g dw benchmark for dietary effects to juvenile fish; Golder 2014).

All metals concentrations were detectable in all samples (Appendix Table A.6). In addition, achieved LRLs for selenium were below the below the BCMOECCS guideline and the lowest EVWQP Level 1 Benchmark (Appendix Table A.6). Therefore, the achieved LRLs were considered appropriate for the study.

A4.2 Data Precision

A total of 20 laboratory duplicate samples were analyzed to evaluate laboratory precision within the benthic invertebrate tissue chemistry reports (Appendix A). Concentrations of analytes in paired samples were compared based on the RPD between duplicate results. If the RPD was ≤40% for concentrations greater than 10-times the LRL, the results met the DQO set by the analytical laboratory. Concentrations for duplicate sample results that did not meet the DQO of ≤40% were compared to the LRL, because paired samples with concentrations less than 10-times the LRL are generally accepted to have larger RPDs (Appendix Table A.1).

Of the 600 duplicate pair results, only one lead sample RPDs exceeded the laboratory DQO of ≤40% (Appendix Table A.1; Appendix A). Because only one samples exceeded the laboratory DQO, the laboratory precision and reproducibility were considered acceptable for the study.

A4.3 Data Accuracy

Data accuracy was evaluated based on the quantification of concentrations in CRM (i.e., DORM-4 and NIST-1566b). The DQO were met when concentrations measured in CRM samples were within 70 to 130% of the target value; this DQO only applied to concentrations greater than 20-times the LRL. Recoveries of each analyte were consistently within the DQO; however, results for cadmium, lead, uranium, and nickel were at the upper boundary (130%) of the acceptable range.

Table A.6: Laboratory Reporting Limit (LRL) Evaluation for Benthic Invertebrate Tissue Chemistry Analyses, 2020

Analyte	Units	Range of LRLs [a]	No. Sample Results < LRL [b]
Aluminum	ppm	0.046 - 0.231	0
Antimony	ppm	0.003 - 0.011	0
Arsenic	ppm	0.393 - 0.430	0
Barium	ppm	0.001	0
Boron	ppm	0.108 - 0.121	0
Cadmium	ppm	0.036	0
Calcium	ppm	14 - 56	0
Chromium	ppm	0.188 - 0.379	0
Cobalt	ppm	0.002	0
Copper	ppm	0.009 - 0.014	0
Iron	ppm	1.6 - 3.8	0
Lead	ppm	0.003 - 0.005	0
Lithium	ppm	0.005 - 0.006	0
Magnesium	ppm	0.031 - 0.040	0
Manganese	ppm	0.009 - 0.012	0
Mercury	ppm	0.032 - 0.036	0
Molybdenum	ppm	0.001 - 0.042	0
Nickel	ppm	0.014 - 0.035	0
Phosphorus	ppm	37 - 73	0
Potassium	ppm	1.9 - 12	0
Selenium	ppm	0.260 - 0.271	0
Silver	ppm	0.001	0
Sodium	ppm	1.8 - 4.8	0
Strontium	ppm	0.001	0
Thallium	ppm	0.001 - 0.007	0
Tin	ppm	0.012 - 0.030	0
Titanium	ppm	0.172 - 0.264	0
Uranium	ppm	0.001	0
Vanadium	ppm	0.012 - 0.017	0
Zinc	ppm	0.384 - 1.0	0

Shading indicates an LRL greater than the lowest applicable Level 1 Benchmark from the EVWQP (i.e., 11 µg/g dw Se for dietary effects to juvenile fish; Golder 2014).

Shading indicates an LRL greater than the BCMOECCS interim selenium guideline for invertebrate tissue (4 µg/g dw; BCMOECCS 2019).

Notes: LRL = Laboratory Reporting Limit; µg/g dw = microgram per gram dry weight; EVWQP = Elk Valley Water Quality Plan; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The LRLs for selenium were compared to the BCMOECCS interim guideline and EVWQP Level 1 Benchmark for dietary effects to juvenile fish; LRLs were consistently below guidelines/ benchmarks. No other analytes had guidelines or EVWQP benchmarks for concentrations in benthic invertebrate tissues.

[b] The total number of samples in 2020 was n = 4 samples.

A5 PLANKTON COMMUNITY AND TISSUE CHEMISTRY

A5.1 Laboratory Reporting Limits

The analytical reports from Trich (Appendix A) were examined to provide an inventory of analytes for which the sample results were less than the LRL. All metals concentrations were detectable in all zooplankton tissue chemistry samples (Appendix Table A.7). Therefore, the achieved LRLs were considered excellent for the study.

A5.2 Data Precision

A total of five laboratory duplicate samples were analyzed to evaluate laboratory precision within the zooplankton tissue chemistry reports (Appendix A). All 150 duplicate pair results met the laboratory DQO of ≤40% (Appendix Table A.1), therefore the laboratory precision and reproducibility were considered excellent for the study.

A5.3 Data Accuracy

Data accuracy was evaluated based on the results of five CRM (Appendix A). Of the 150 CRM results, only two antimony samples exceeded the laboratory DQO. However, the two CRM results were accepted by the laboratory as the results did not impact the overall reportable results (see laboratory report 2020-137 in Appendix A). Since there was only two exceedances of the DQO, both of which were accepted by Trich, the accuracy achieved by the laboratory in this study can be considered excellent.

Table A.7: Laboratory Reporting Limit (LRL) Evaluation for Zooplankton Tissue Chemistry Analyses, 2020

Analyte	Units	Range of LRLs	No. Sample Results < LRL[a]
Aluminum	ppm	0.046	0
Antimony	ppm	0.011	0
Arsenic	ppm	0.430	0
Barium	ppm	0.001	0
Boron	ppm	0.108	0
Cadmium	ppm	0.036	0
Calcium	ppm	14	0
Chromium	ppm	0.379	0
Cobalt	ppm	0.002	0
Copper	ppm	0.009	0
Iron	ppm	3.8	0
Lead	ppm	0.005	0
Lithium	ppm	0.005	0
Magnesium	ppm	0.040	0
Manganese	ppm	0.012	0
Mercury	ppm	0.032	0
Molybdenum	ppm	0.001	0
Nickel	ppm	0.014	0
Phosphorus	ppm	73	0
Potassium	ppm	12	0
Selenium	ppm	0.271	0
Silver	ppm	0.001	0
Sodium	ppm	1.8	0
Strontium	ppm	0.001	0
Thallium	ppm	0.001	0
Tin	ppm	0.030	0
Titanium	ppm	0.264	0
Uranium	ppm	0.001	0
Vanadium	ppm	0.012	0
Zinc	ppm	1.0	0

Notes: LRL = Laboratory Reporting Limit; µg/g dw = microgram per gram dry weight; EVWQP = Elk Valley Water Quality Plan; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The total number of samples in 2020 was n = 21 samples.

A6 FISH TISSUE CHEMISTRY

A6.1 Laboratory Reporting Limits

The analytical laboratory reports from Trich and ALS (Appendix A) were examined to provide an inventory of analytes for which the samples were less than the LRL (Appendix Table A.8 and A.9). The LRLs for these analytes were assessed relative to appropriate guidelines for small-bodied fish (e.g., redside shiner [*Richardsonius balteatus*] and peamouth chub [*Mylocheilus caurinus]*) and large-bodied fish (e.g., bull trout [*Salvelinus confluentus*], west cutthroat trout [*Oncorhynchus clarkia*], and rainbow trout [*Oncorhynchus mykiss*]). Specifically, the Canadian Food Inspection Agency (CFIA) for chemical contaminants and toxins in fish and fish products (for arsenic, lead, mercury, and selenium; CFIA 2015) and the 4 µg/g dw interim selenium guideline for fish muscle (BCMOECCS 2019).

Few metals were consistently (i.e., 100% of samples) reported at concentrations less than the LRL in the ALS report; these included: beryllium, boron, lithium, and tellurium (Appendix Table A.9). All analytes had one or more detectable concentrations for all samples analyzed by Trich (Appendix Table A.8). Selenium concentrations were detectable in all samples and were below the applicable BCMOECCS (2019) guideline for fish tissues (Appendix Table A.8 and A.9). Arsenic was detectable in all, but one sample analyzed by ALS (Appendix Table A.9), however, 99% of the samples analyzed by Trich were below the LRL (Appendix Table A.8). All arsenic LRLs reported by ALS and Trich were below the applicable CFIA (2015) guideline (Appendix Table A.8 and A.9). Lead and mercury had few samples below the LRL, and all reported LRLs were below applicable CFIA (2015) guidelines (Appendix Table A.8 and A.9). Overall, the LRLs achieved by Trich and ALS were considered appropriate for the study.

A6.2 Laboratory Blanks

A total of eight method blank samples were analyzed by ALS (see Appendix A). All 140 reported method blank results were below the laboratory DQO, except for one arsenic sample (0.0043 mg/kg; LRL = 0.0040 mg/kg). The LRLs for samples in laboratory report L2460094 was adjusted in response to the detectable concentrations in the laboratory blank. Overall, only one method blank result had a detectable concentration, therefore the results are expected to have a negligible impact on data interpretability.

A6.3 Data Precision

A total of 20 laboratory duplicate samples were used to evaluate laboratory precision within the fish tissue chemistry reports from Trich (Appendix A). Of the 600 duplicate pair results,

Table A.8: **TrichAnalytics Inc. Laboratory Reporting Limit (LRL) Evaluation for Fish Tissue Chemistry Analyses, 2020**

Analyte	Units	Human Health Guidelines[a]	Range of LRLs[b]	No. LRLs > Guideline/ Benchmark[b]	No. Sample Results < LRL[b]
Aluminum	ppm	-	0.46 - 0.231	-	1 (0.56%)
Antimony	ppm	-	0.003 - 0.011	-	95 (53%)
Arsenic	ppm	3.5	0.393 - 0.430	0	177 (99%)
Barium	ppm	-	0.001	-	0
Boron	ppm	-	0.108 - 0.121	-	100 (56%)
Cadmium	ppm	-	0.036	-	94 (52%)
Calcium	ppm	-	14 - 56	-	0
Chromium	ppm	-	0.188 - 0.379	-	0
Cobalt	ppm	-	0.002	-	0
Copper	ppm	-	0.009 - 0.014	-	0
Iron	ppm	-	1.6 - 3.8	-	0
Lead	ppm	0.50	0.003 - 0.005	0	0
Lithium	ppm	-	0.005 - 0.006	-	31 (17%)
Magnesium	ppm	-	0.031 - 0.040	-	0
Manganese	ppm	-	0.009 - 0.012	-	0
Mercury	ppm	0.50	0.032 - 0.036	0	7 (3.9%)
Molybdenum	ppm	-	0.001 - 0.042	-	96 (54%)
Nickel	ppm	-	0.014 - 0.035	-	3 (1.7%)
Phosphorus	ppm	-	37 - 73	-	0
Potassium	ppm	-	1.9 - 12	-	0
Selenium	ppm	4.0	0.260 - 0.271	0	0
Silver	ppm	-	0.001	-	45 (25%)
Sodium	ppm	-	1.8 - 4.8	-	0
Strontium	ppm	-	0.001	-	0
Thallium	ppm	-	0.001 - 0.007	-	14 (7.8%)
Tin	ppm	-	0.012 - 0.030	-	1 (0.56%)
Titanium	ppm	-	0.172 - 0.264	-	0
Uranium	ppm	-	0.001	-	104 (58%)
Vanadium	ppm	-	0.012 - 0.017	-	82 (46%)
Zinc	ppm	-	0.384 - 1.0	-	0

Shading indicates an LRL greater than the Health Canada human health concentration for muscle tissue in fish (BCMOECCS 2019; CFIA 2015).

Note: "-" indicates no data available.

[a] Health Canada human health guidelines from the CFIA (2015) are reported on a wet weight basis; moisture

[b] The total number of samples in 2020 was n = 179 samples (117 muscle, 62 ovaries).

Table A.9: ALS Environmental Laboratory Reporting Limit (LRL) Evaluation for Fish Tissue Chemistry Analyses, 2020

Analyte	Units	Human Health Guidelines[a]	Range of LRLs[b]	No. LRLs > Guideline/ Benchmark[b]	No. Sample Results < LRL[b]
Aluminum (Al)	mg/kg wwt	-	0.40 - 0.80	-	5 (8.1%)
Antimony (Sb)	mg/kg wwt	-	0.0020 - 0.0040	-	61 (98%)
Arsenic (As)	mg/kg wwt	3.5	0.0040 - 0.020	0	1 (1.6%)
Barium (Ba)	mg/kg wwt	-	0.010 - 0.020	-	0
Beryllium (Be)	mg/kg wwt	-	0.0020 - 0.0040	-	62 (100%)
Bismuth (Bi)	mg/kg wwt	-	0.0020 - 0.0040	-	55 (89%)
Boron (B)	mg/kg wwt	-	0.20 - 0.40	-	62 (100%)
Cadmium (Cd)	mg/kg wwt	-	0.0010 - 0.0020	-	18 (29%)
Calcium (Ca)	mg/kg wwt	-	4.0 - 8.0	-	0
Cesium (Cs)	mg/kg wwt	-	0.0010 - 0.0020	-	0
Chromium (Cr)	mg/kg wwt	-	0.010 - 0.020	-	7 (11%)
Cobalt (Co)	mg/kg wwt	-	0.0040 - 0.0080	-	16 (26%)
Copper (Cu)	mg/kg wwt	-	0.020 - 0.040	-	0
Iron (Fe)	mg/kg wwt	-	0.60 - 1.2	-	0
Lead (Pb)	mg/kg wwt	0.50	0.0040 - 0.0080	0	23 (37%)
Lithium (Li)	mg/kg wwt	-	0.10 - 0.20	-	62 (100%)
Magnesium (Mg)	mg/kg wwt	-	0.40 - 0.80	-	0
Manganese (Mn)	mg/kg wwt	-	0.010 - 0.020	-	0
Mercury (Hg)	mg/kg wwt	0.50	0.0010 - 0.0020	0	0
Molybdenum (Mo)	mg/kg wwt	-	0.0040 - 0.0080	-	25 (40%)
Nickel (Ni)	mg/kg wwt	-	0.040 - 0.080	-	57 (92%)
Phosphorus (P)	mg/kg wwt	-	2.0 - 4.0	-	0
Potassium (K)	mg/kg wwt	-	4.0 - 8.0	-	0
Rubidium (Rb)	mg/kg wwt	-	0.010 - 0.020	-	0
Selenium (Se)	mg/kg wwt	4.0	0.010 - 0.020	0	0
Sodium (Na)	mg/kg wwt	-	4.0 - 8.0	-	0
Strontium (Sr)	mg/kg wwt	-	0.010 - 0.020	-	0
Tellurium (Te)	mg/kg wwt	-	0.0040 - 0.0080	-	62 (100%)
Thallium (Tl)	mg/kg wwt	-	0.00040 - 0.00080	-	1 (1.6%)
Tin (Sn)	mg/kg wwt	-	0.020 - 0.040	-	5 (8.1%)
Uranium (U)	mg/kg wwt	-	0.00040 - 0.00080	-	27 (44%)
Vanadium (V)	mg/kg wwt	-	0.020 - 0.040	-	59 (95%)
Zinc (Zn)	mg/kg wwt	-	0.10 - 0.20	-	0
Zirconium (Zr)	mg/kg wwt	-	0.040 - 0.080	-	60 (97%)

Shading indicates an LRL greater than the Health Canada human health concentration for muscle tissue in fish (BCMOECCS 2019; CFIA 2015).

Notes: mg/kg wwt = milligram per kilogram wet weight; "-" indicates no data available.

[a] Health Canada human health guidelines from the CFIA (2015) are reported on a wet weight basis; moisture data for individual samples were used to calculate dry weight guidelines for screening purposes.

[b] The total number of samples in 2020 was n = 62 samples (31 muscle, 31 ovaries).

only one lead sample RPDs exceeded the laboratory DQO of ≤40% (Appendix Table A.1; Appendix A). Because only one duplicate result had an RPD that did not meet the laboratory DQO, the laboratory precision and reproducibility were considered acceptable for the study.

Eight pairs of laboratory duplicate samples were used to evaluate precision within the laboratory report from ALS (Appendix A). For all paired samples, comparisons were within the laboratory DQO set by the analytical laboratory (Appendix Table A.1). The laboratory analytical precision can therefore be considered excellent.

A6.4 Data Accuracy

Data accuracy was evaluated based on the CRM within the Trich analytical reports (Appendix A). Five of the 600 CRM results exceeded the laboratory DQO: one cadmium, two lead, one uranium, and one nickel. Because a low number (i.e., 0.8% of the total results) of CRM results were at the upper boundary (130%) off the acceptable range (Appendix A), the accuracy achieved by Trich was considered acceptable for this study.

In the laboratory report from ALS (Appendix A), data accuracy was evaluated based on the analysis of CRM and LCS. Specifically, four CRM, and eight LCS were used to produce 124 and 140 results, respectively (Appendix A). All CRM and LCS results met the laboratory DQO, indicating the accuracy achieved by the laboratory in this study can be considered excellent.

Table A.10: Field Duplicate Results for TrichAnalytic Inc. Fish Tissue Chemistry Samples, 2020

Analyte	Units	Muscle			Ovary		
		RG_GC_PCC-R-M-01_2020-04-22			RG_GC_PCC-R-O-01_2020-04-22		
		RG_GC	RG_RIVER	RPD (%)	RG_GC	RG_RIVER	RPD (%)
Aluminum	ppm	4.2	2.2	63	0.526	0.652	21
Antimony	ppm	0.005	<0.003	50	<0.003	<0.003	-
Arsenic	ppm	<0.393	<0.393	-	<0.393	<0.393	-
Barium	ppm	0.619	1.0	47	0.842	0.892	5.8
Boron	ppm	0.187	<0.121	43	<0.121	<0.121	-
Cadmium	ppm	<0.036	<0.036	-	0.042	0.066	44
Calcium	ppm	1,296	1,097	17	508	539	5.9
Chromium	ppm	1.7	1.6	6.1	1.3	1.4	7.4
Cobalt	ppm	0.033	0.02	49	0.075	0.069	8.3
Copper	ppm	1.6	1.1	37	4.6	4.7	2.2
Iron	ppm	23	15	42	59	58	1.7
Lead	ppm	0.038	0.008	130	0.008	0.011	32
Lithium	ppm	0.014	<0.006	80	<0.006	0.008	28
Magnesium	ppm	1,469	1,508	2.6	918	926	0.87
Manganese	ppm	0.572	0.571	0.17	5.9	5.7	3.4
Mercury	ppm	1.10	0.972	12	0.053	0.078	38
Molybdenum	ppm	<0.042	<0.042	-	0.129	0.136	5.3
Nickel	ppm	0.502	0.399	23	0.054	0.102	62
Phosphorus	ppm	13,388	11,313	17	11,656	13,257	13
Potassium	ppm	28,571	22,067	26	8,238	9,624	16
Selenium	ppm	2.8	2.5	11	9.6	8.7	9.8
Silver	ppm	0.001	<0.001	0	0.025	0.026	3.9
Sodium	ppm	1,586	860	59	1,382	1,426	3.1
Strontium	ppm	1.0	0.688	37	0.340	0.395	15
Thallium	ppm	0.014	0.014	0	0.013	0.012	8.0
Tin	ppm	0.028	0.074	90	0.020	0.022	10
Titanium	ppm	1.2	1.0	18	0.718	0.660	8.4
Uranium	ppm	<0.001	<0.001	-	0.002	0.002	0
Vanadium	ppm	0.028	<0.017	49	0.020	0.022	10
Zinc	ppm	28	27	3.6	98	104	5.9

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; - = no data/not calculated. LRL = Laboratory Reporting Limit.

A7 FISH AGING

A7.1 Data Precision

Otoliths were used for the aging of redside shiner and peamouth chub during the 2020 Koocanusa Reservoir Monitoring Program.

To determine the precision of fish age estimates, a total of 60 aging structures that were analyzed by AAE Technical Service were re-processed by a second analyst (Appendix Table A.10). The original and second analyst assigned a confidence index to each age estimate and check, respectively. A final age estimate for each fish was assigned based on the outcomes of the original analysis and the re-assessment. For the 60 aging structures analyzed, original analysis and the re-assessment were in agreement for 58 samples. The age estimates for one sample was within one year of each other, however the second sample (sample ID GC_PCC-09) differed by two years (Appendix Table A.10). Overall, the fish age data can be interpreted with a high level of confidence.

A8 DATA QUALITY STATEMENT

Overall the quality of the data collected for this project was considered acceptable for serving the derivation of conclusions associated with the objectives of the 2020 Koocanusa Reservoir Monitoring Program Report.

A9 REFERENCES

BCMOE (British Columbia Ministry of Environment). 2015. B.C. Environmental Laboratory Manual [online]. Available from https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-environmental-laboratory-manual [accessed 25 September 2020].

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Golder (Golder Associates Ltd.). 2014. Benchmark Derivation Report for Selenium. Annex E of the Elk Valley Water Quality Plan. Prepared for Teck Coal Limited. July.

Minnow Environmental Inc. (Minnow). 2021. Koocanusa Reservoir Monitoring Program Study Design, 2021 to 2023. Prepared for Teck Coal Limited, February 2021. Project #2072020.0012

Teck (Teck Coal Ltd.). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Minister of Environment for approval on July 22, 2014.

APPENDIX B

WATER QUALITY

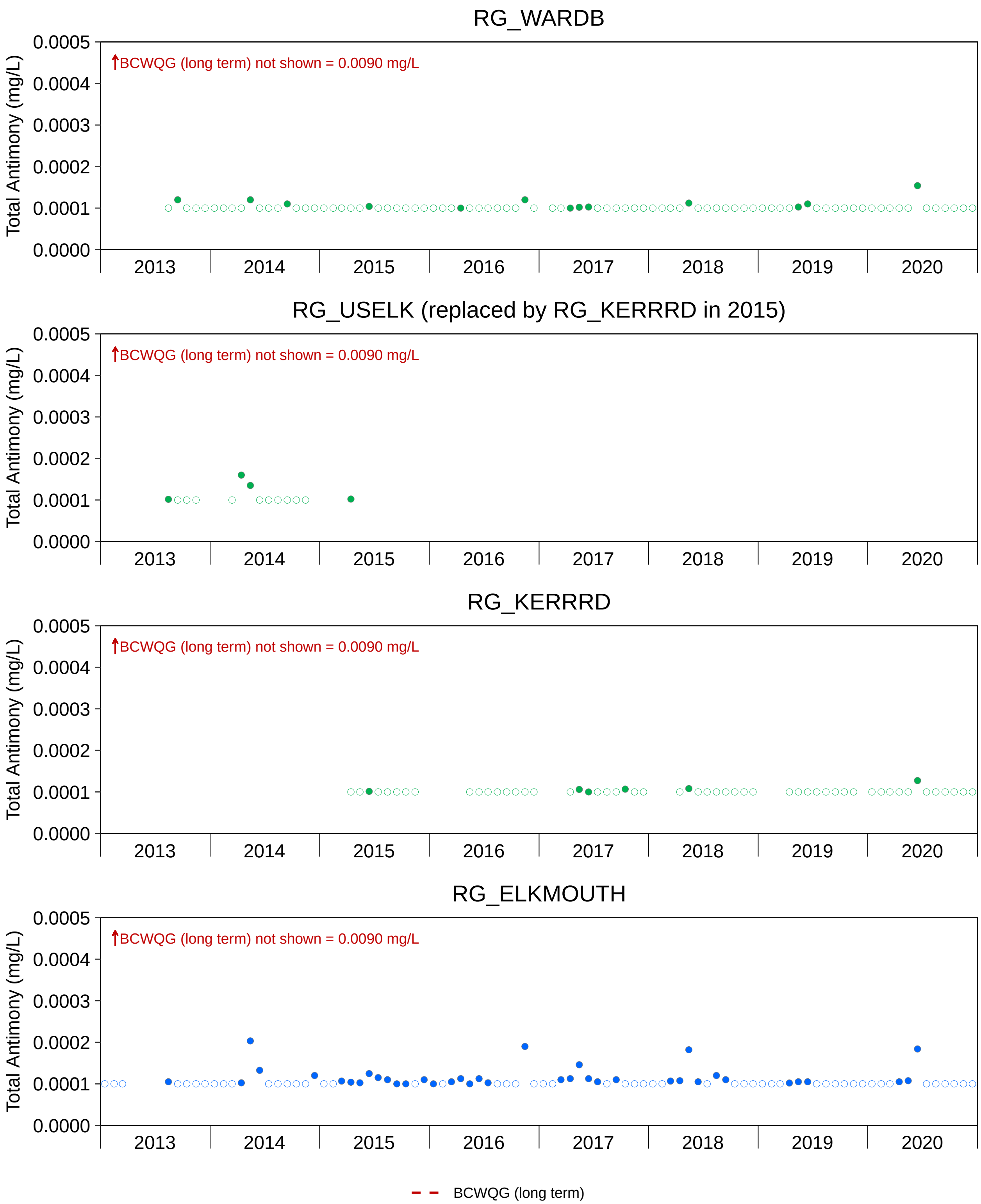

Figure B.1: Monthly Average Concentrations of Total Antimony in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

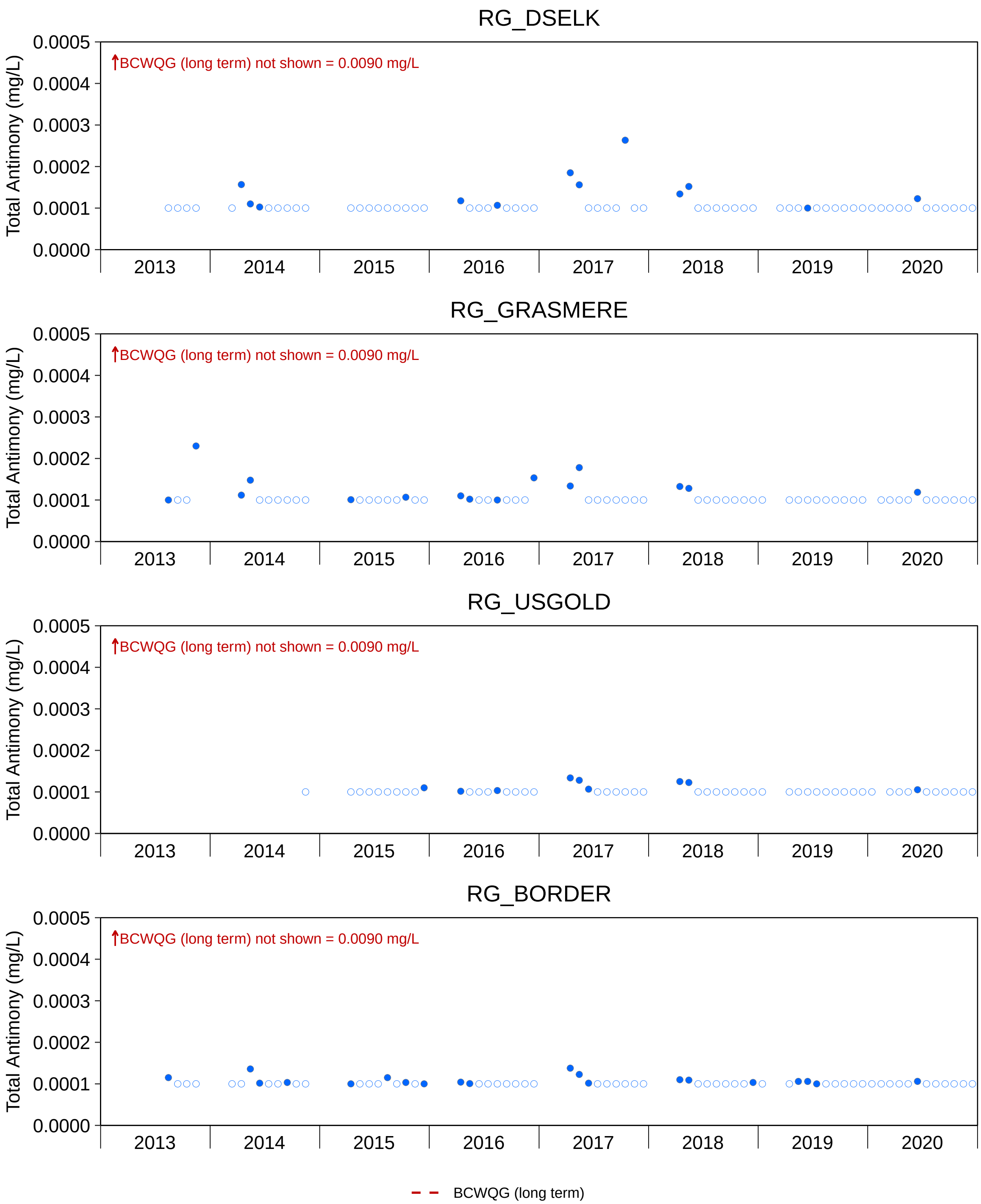

Figure B.1: Monthly Average Concentrations of Total Antimony in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

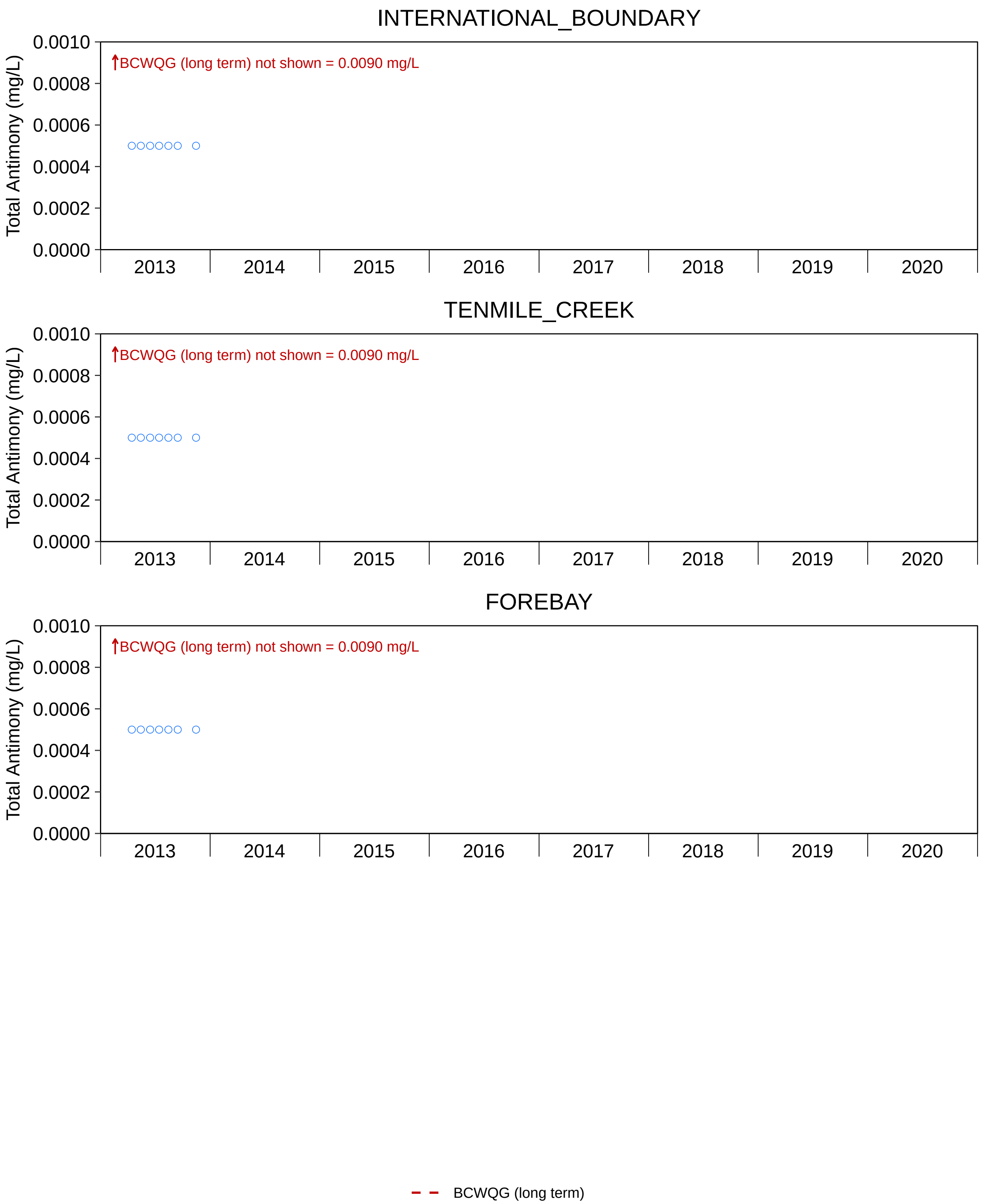

Figure B.1: Monthly Average Concentrations of Total Antimony in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

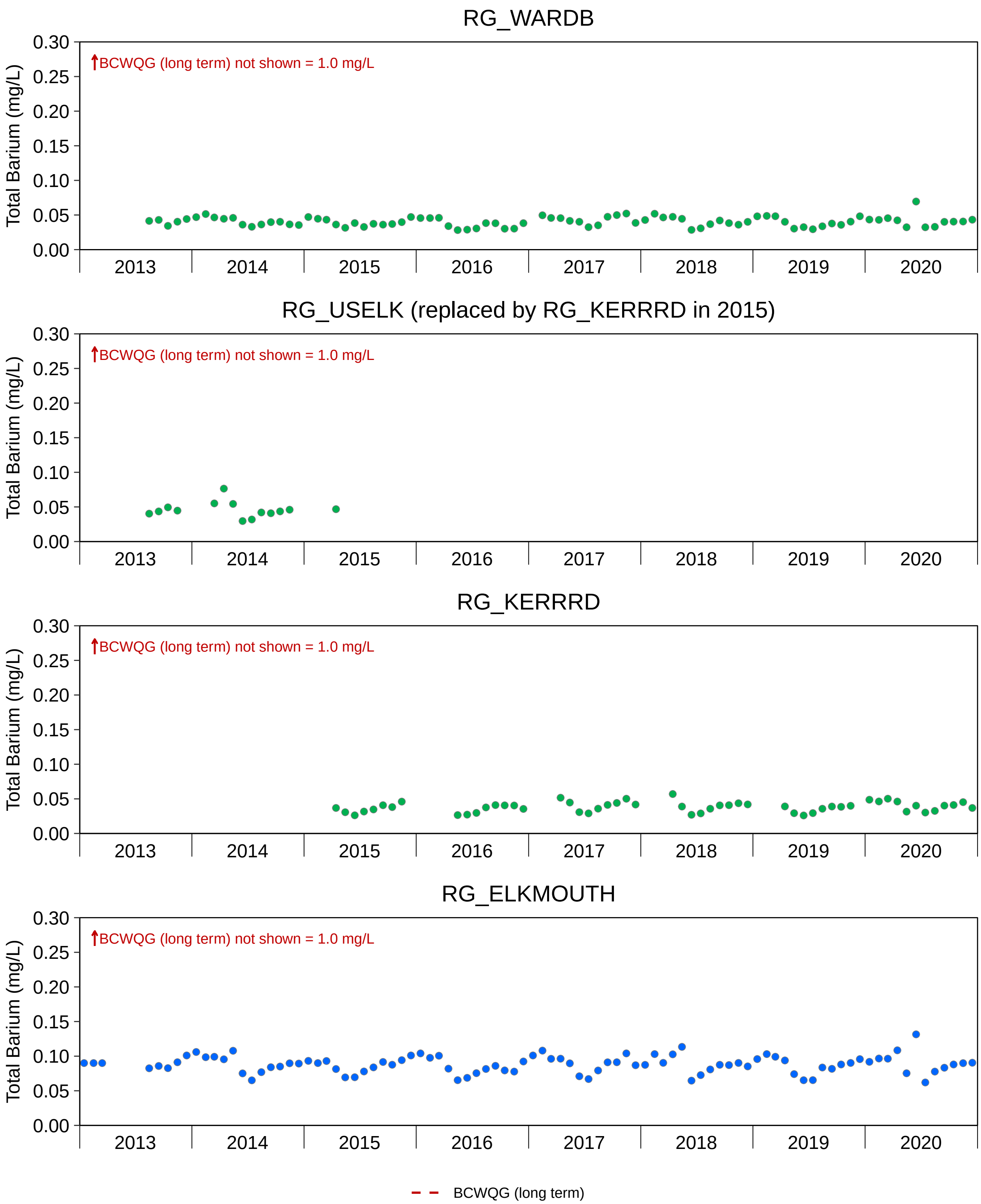

Figure B.2: Monthly Average Concentrations of Total Barium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

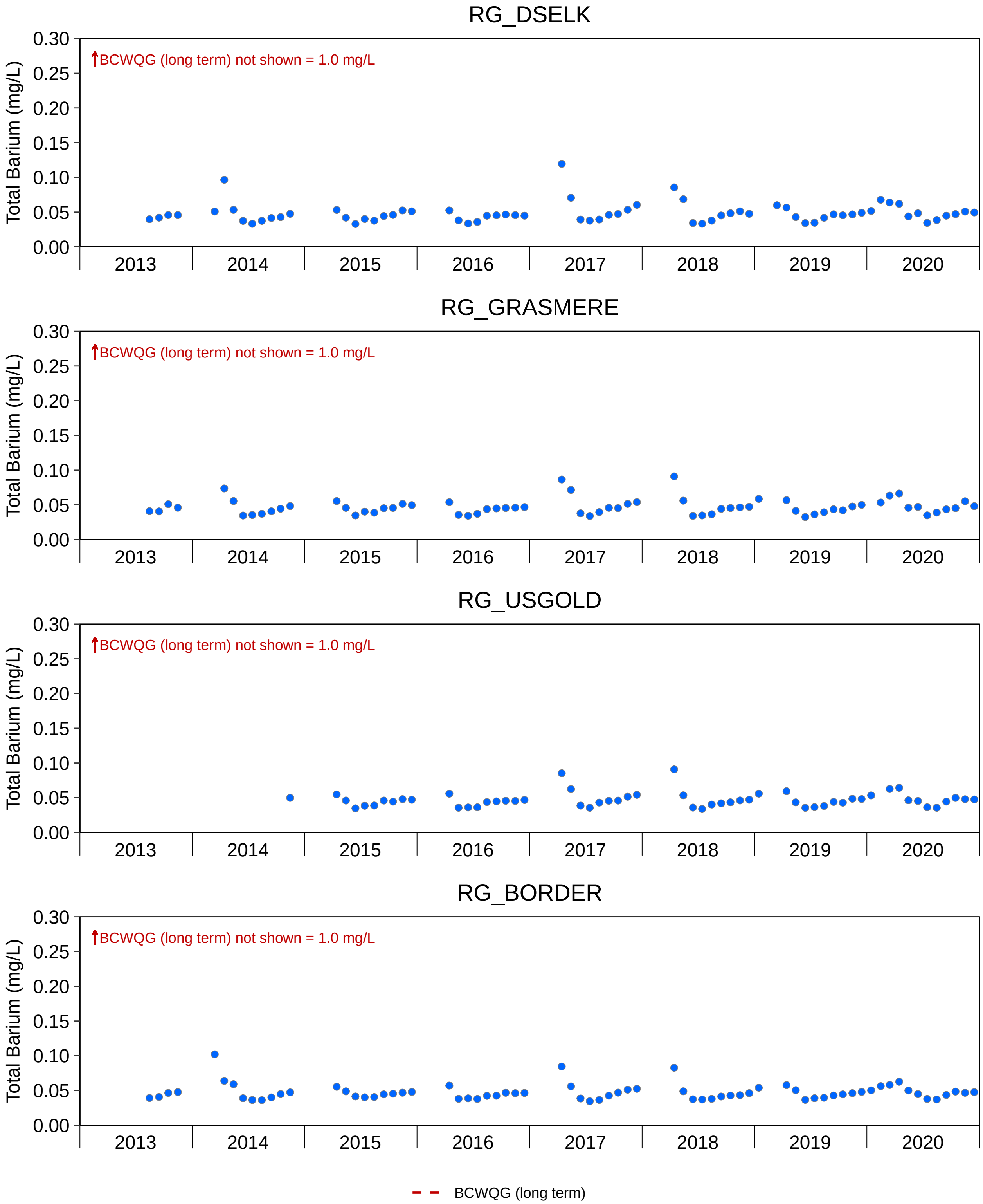

Figure B.2: Monthly Average Concentrations of Total Barium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

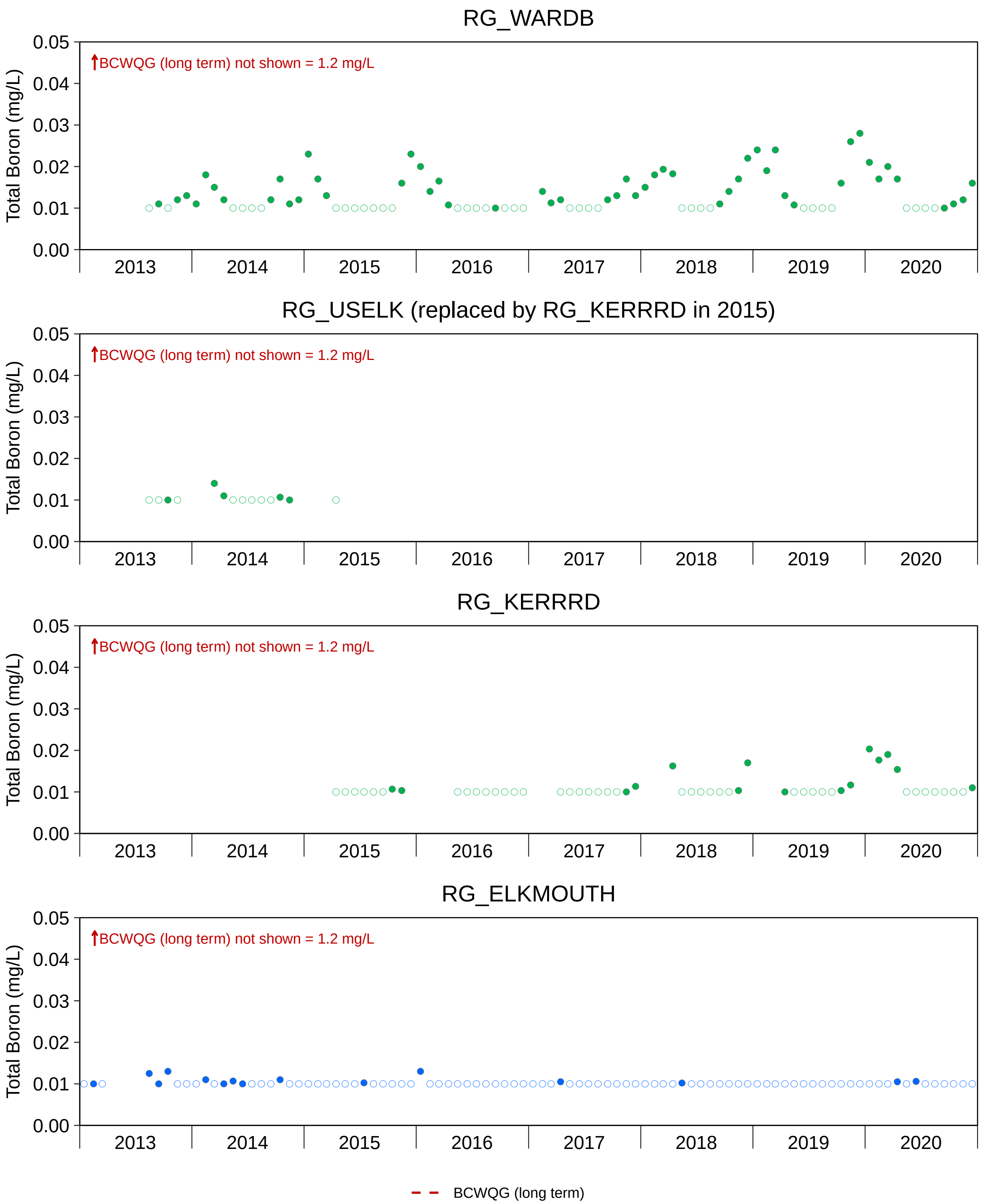

Figure B.3: Monthly Average Concentrations of Total Boron in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

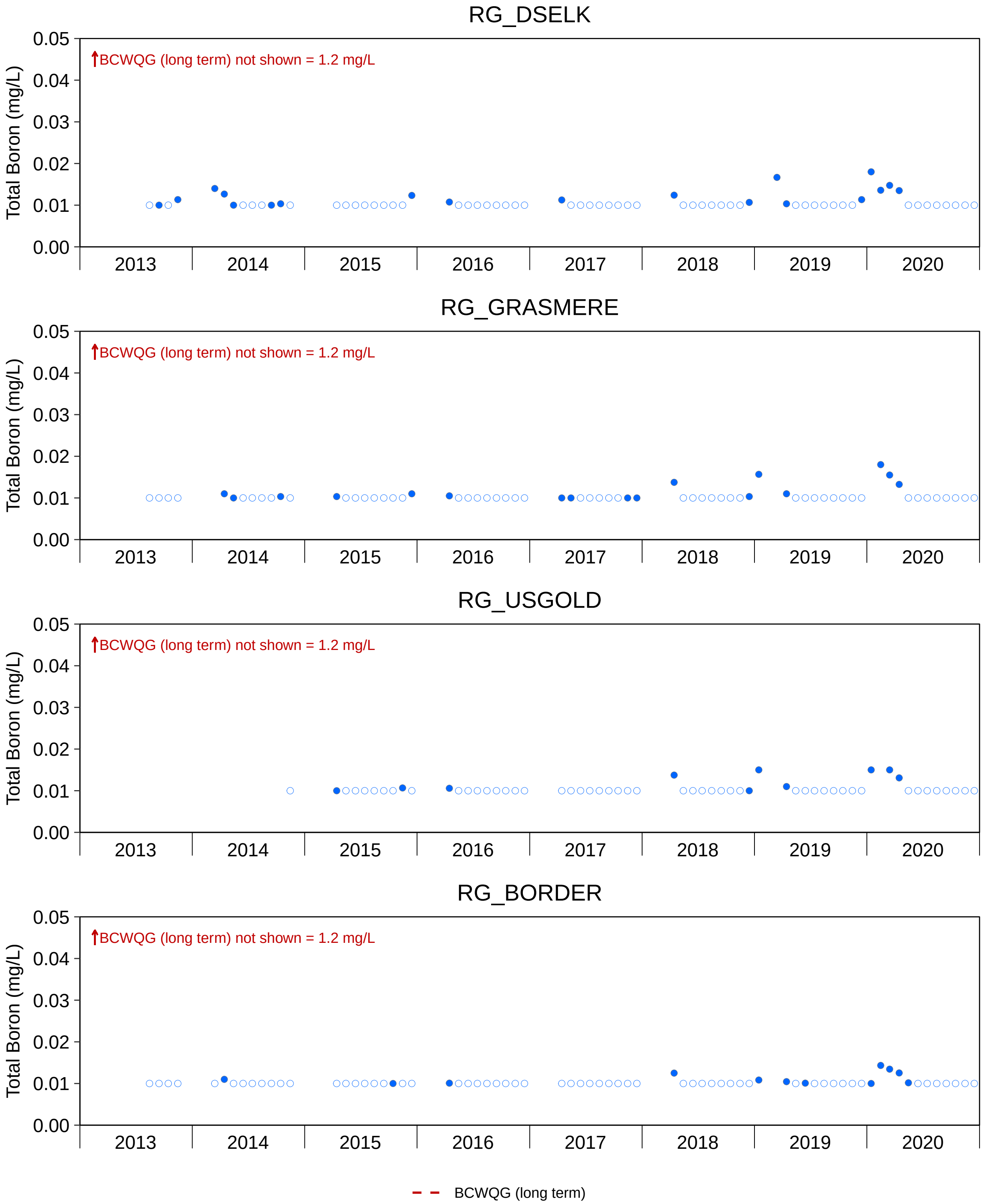

Figure B.3: Monthly Average Concentrations of Total Boron in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

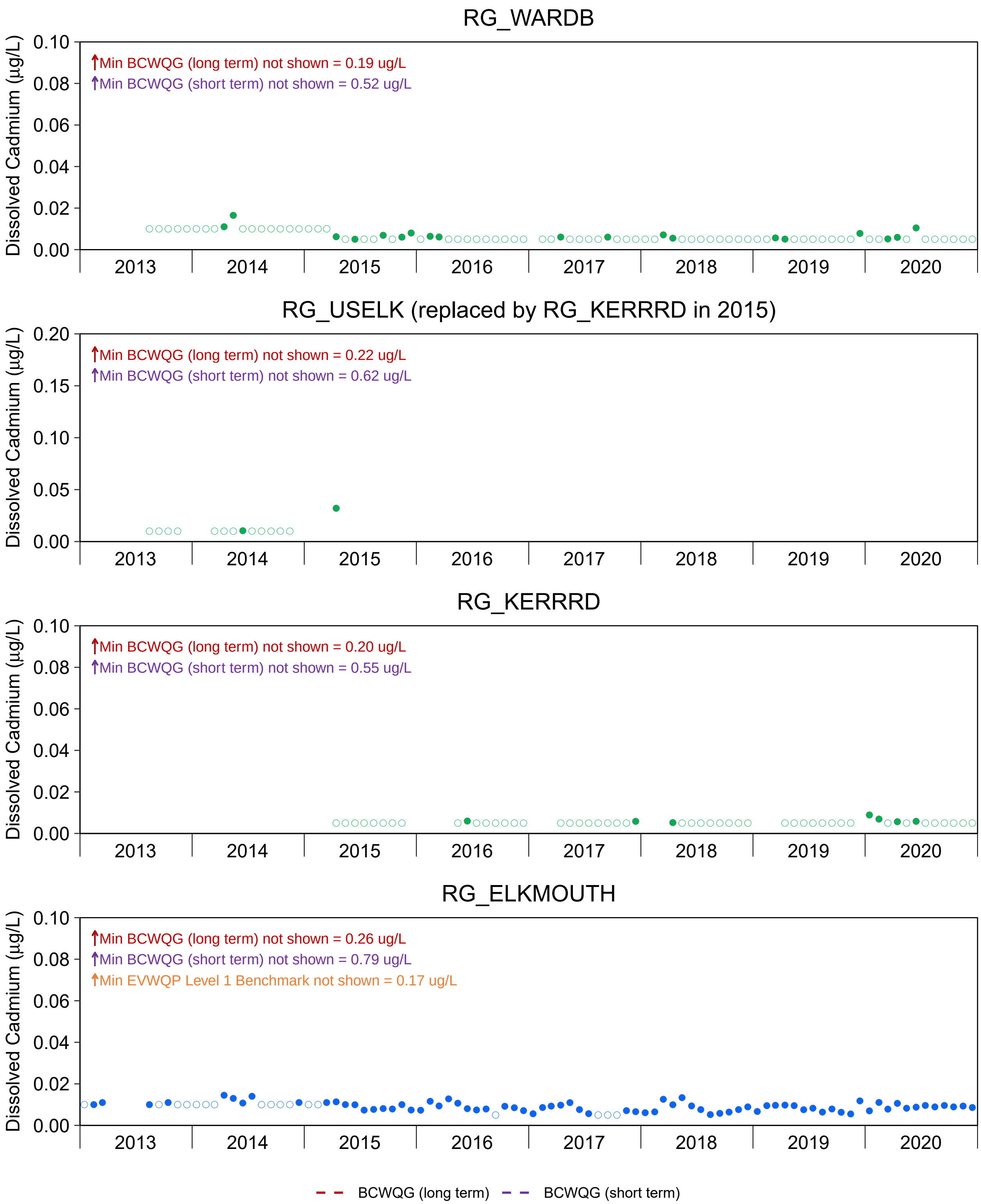

Figure B.4: Monthly Average Concentrations of Dissolved Cadmium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

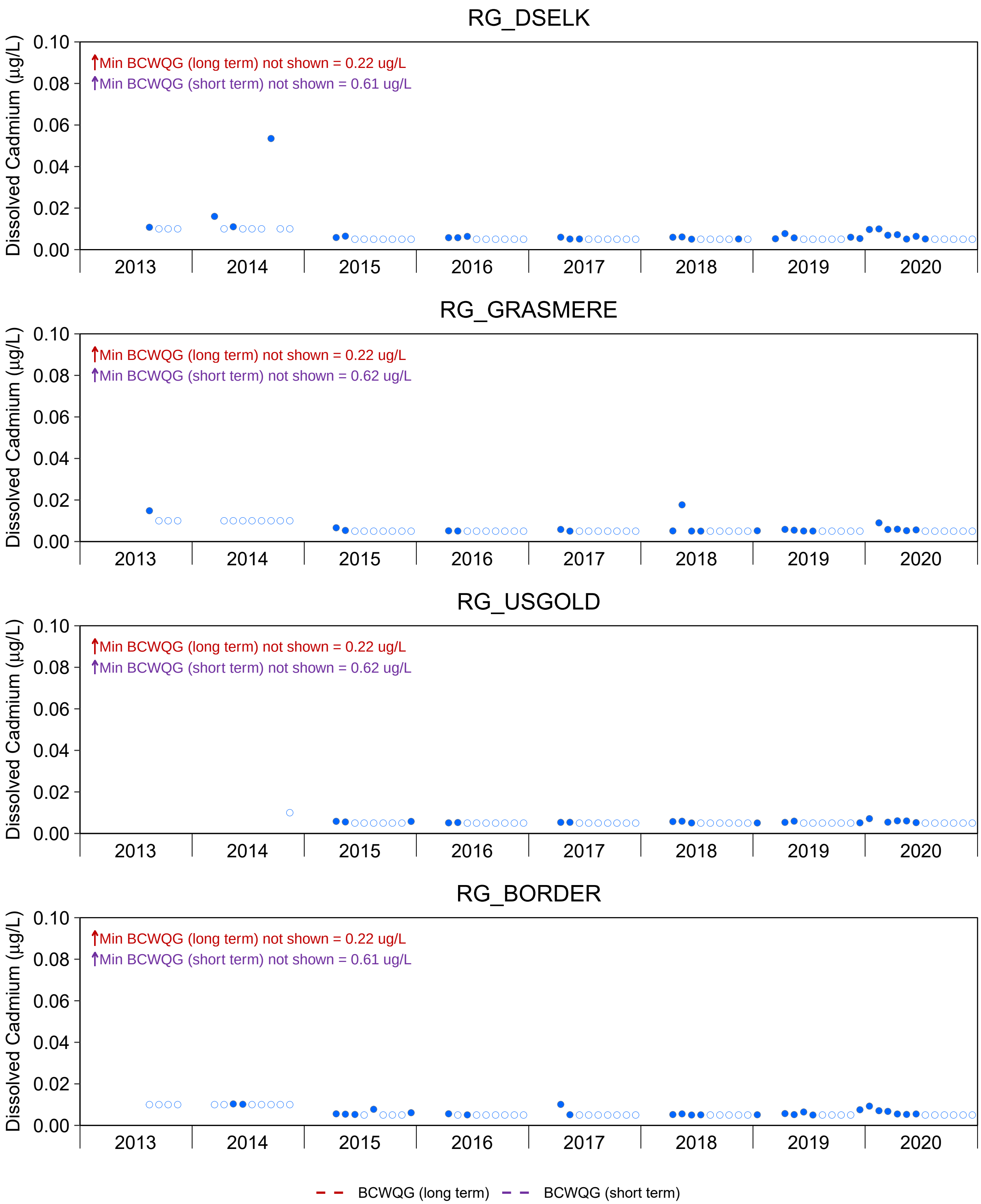

Figure B.4: Monthly Average Concentrations of Dissolved Cadmium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

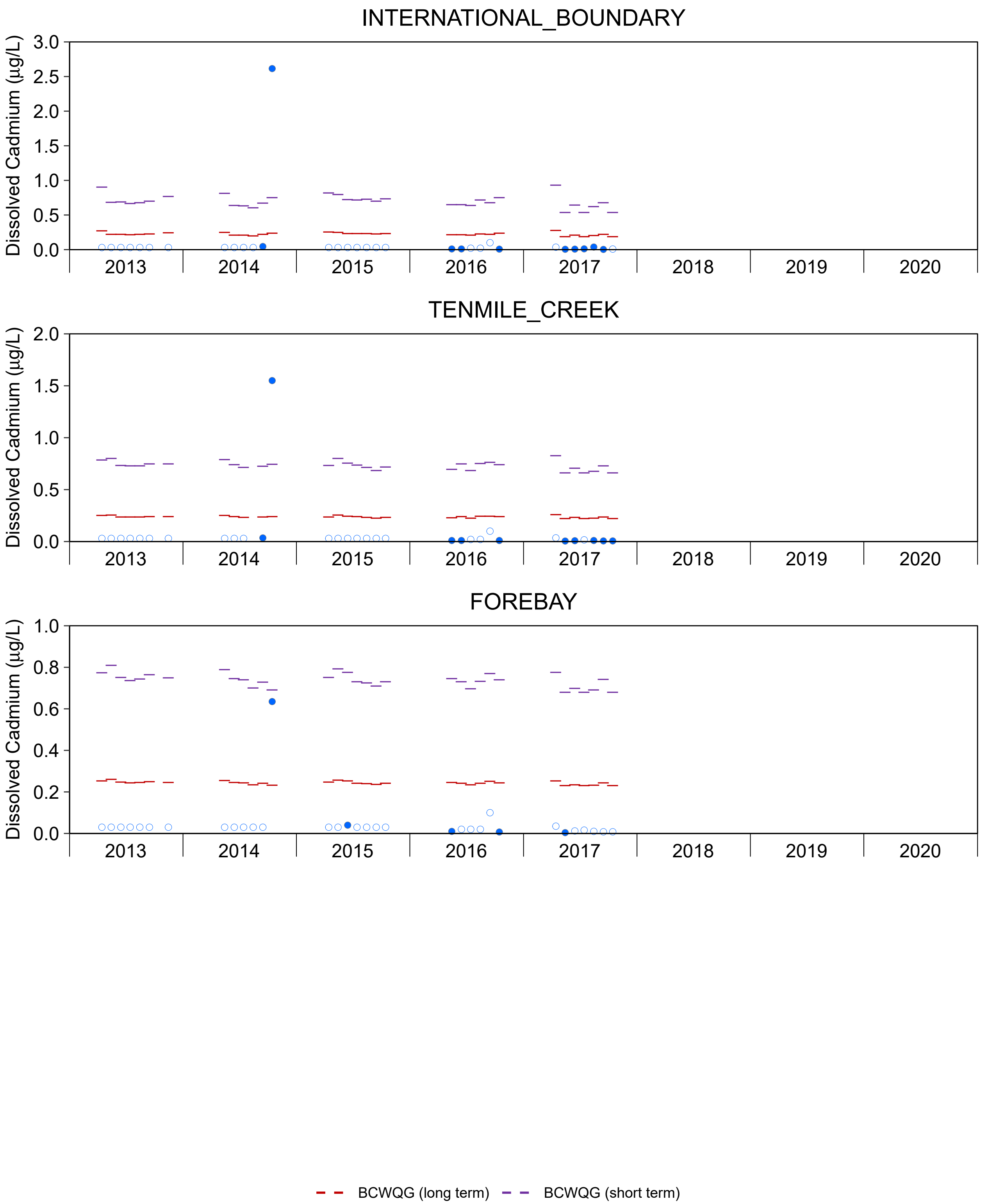

Figure B.4: Monthly Average Concentrations of Dissolved Cadmium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

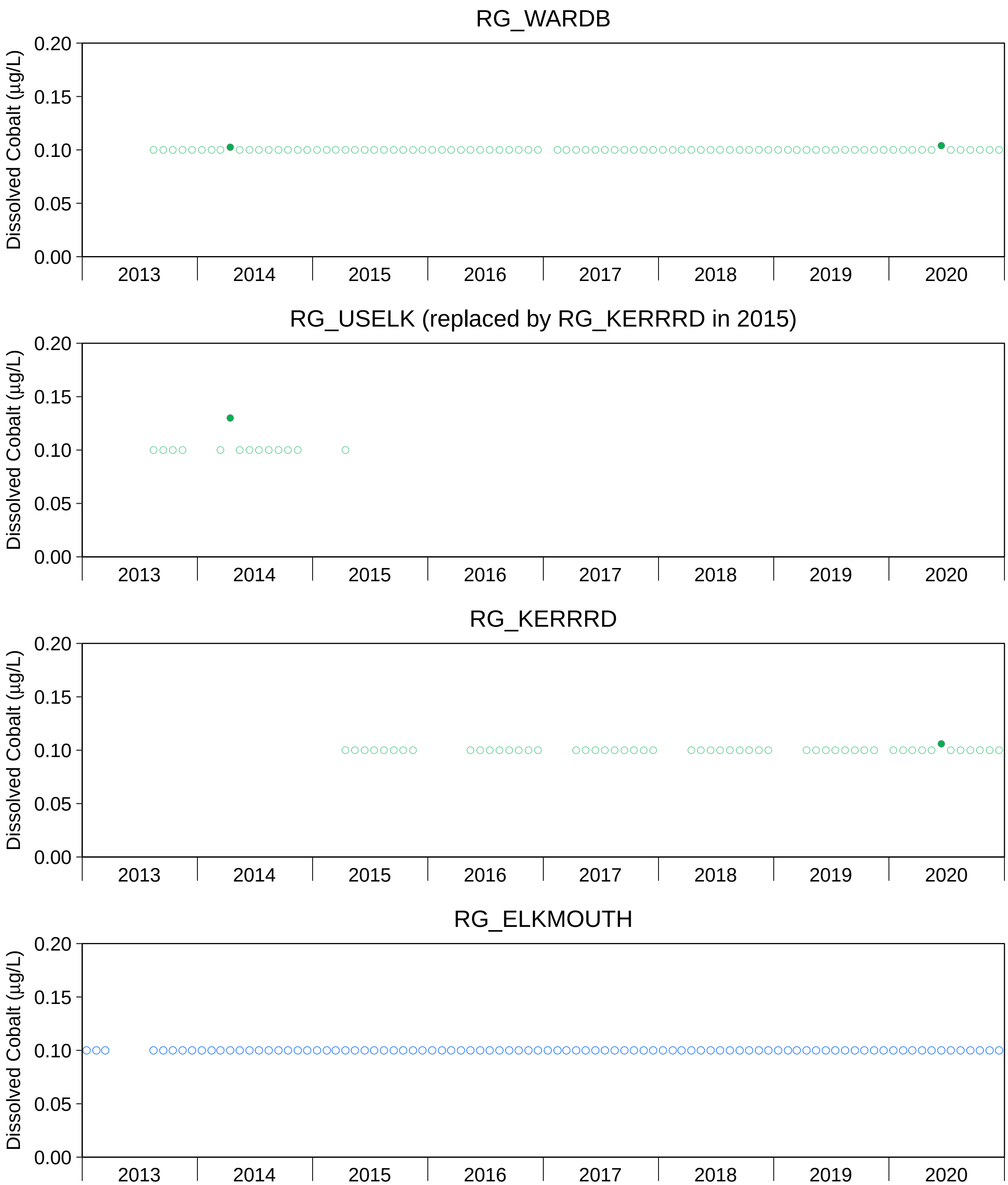

Figure B.5: Monthly Average Concentrations of Dissolved Cobalt in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

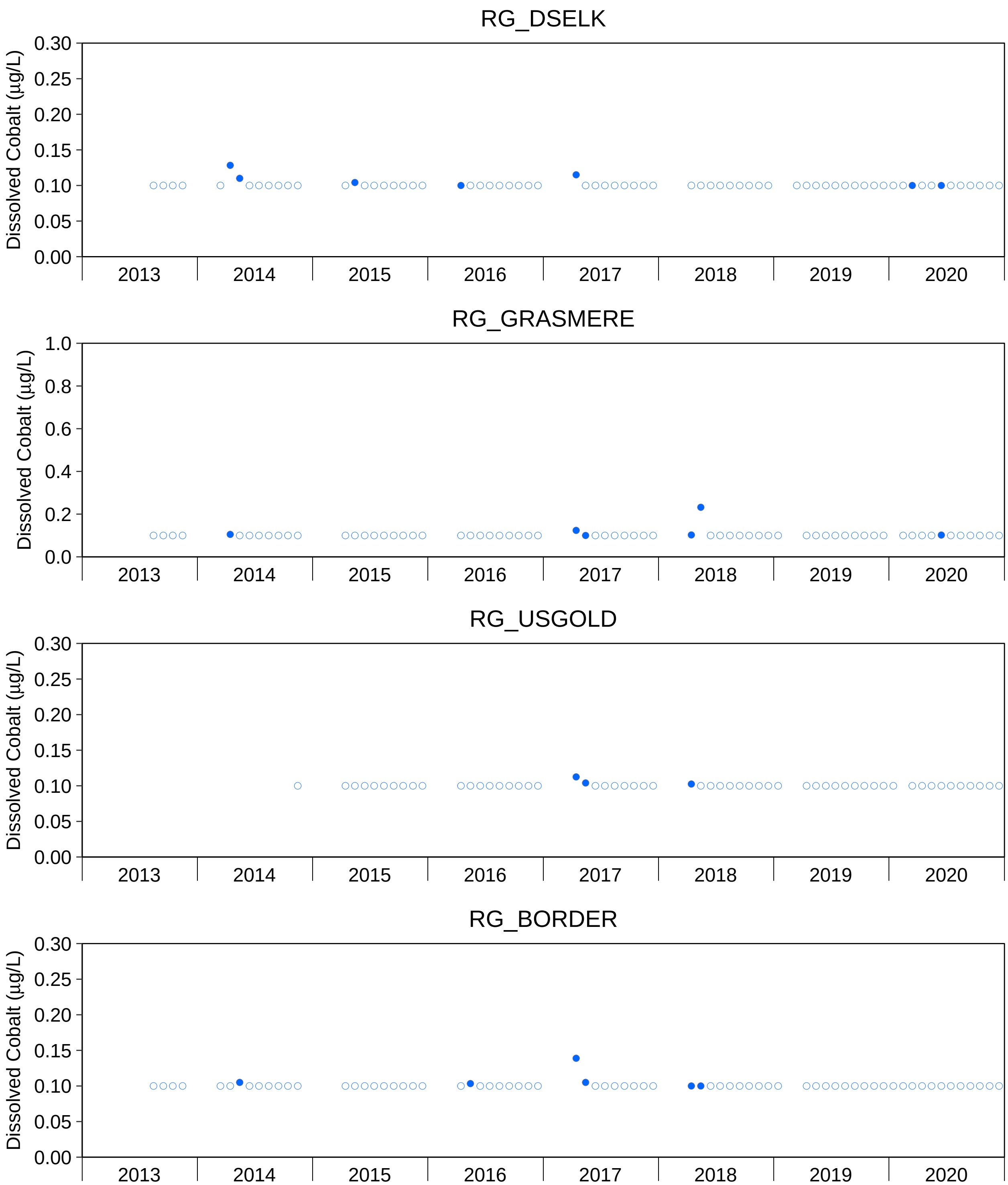

Figure B.5: Monthly Average Concentrations of Dissolved Cobalt in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

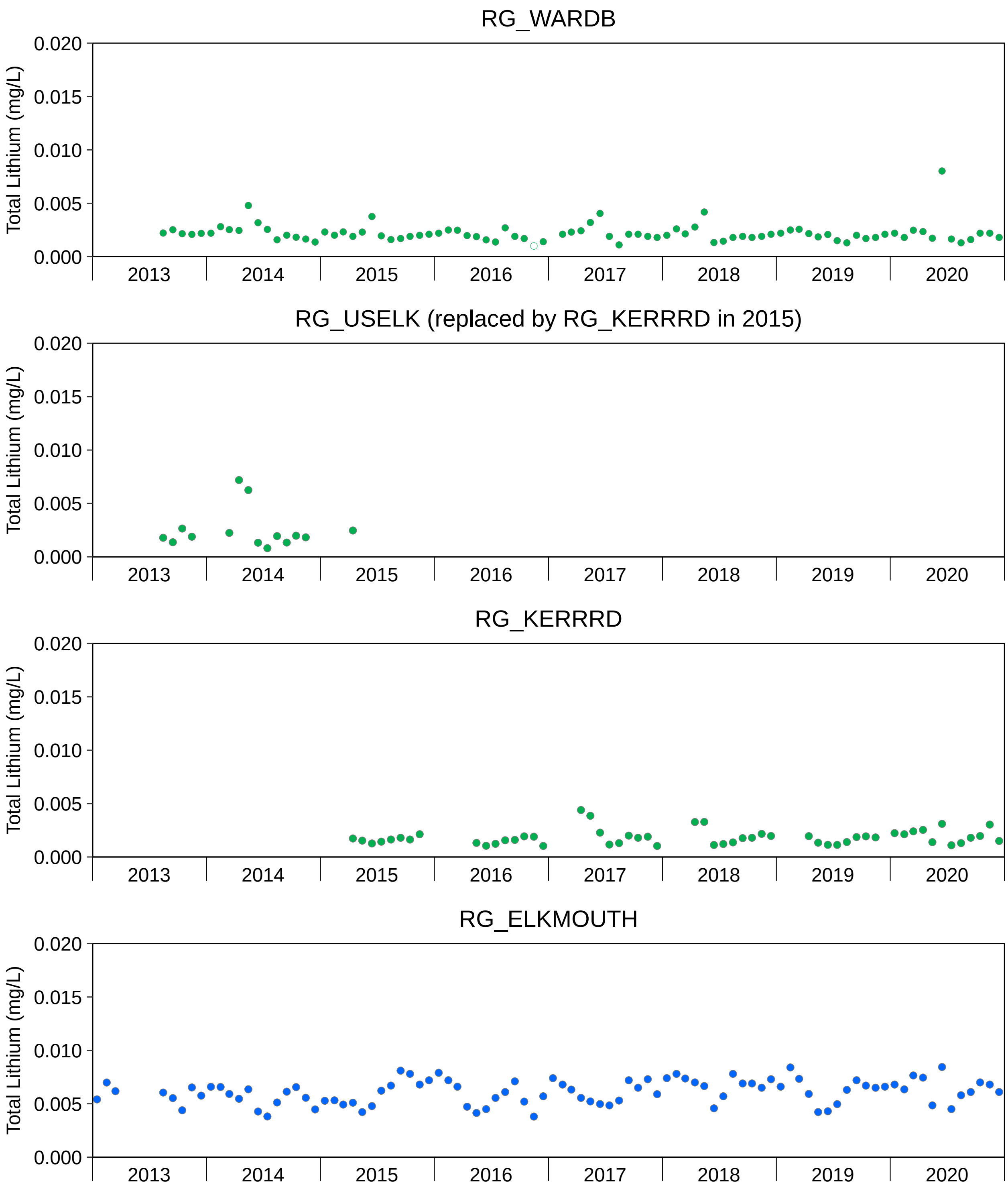

Figure B.6: Monthly Average Concentrations of Total Lithium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

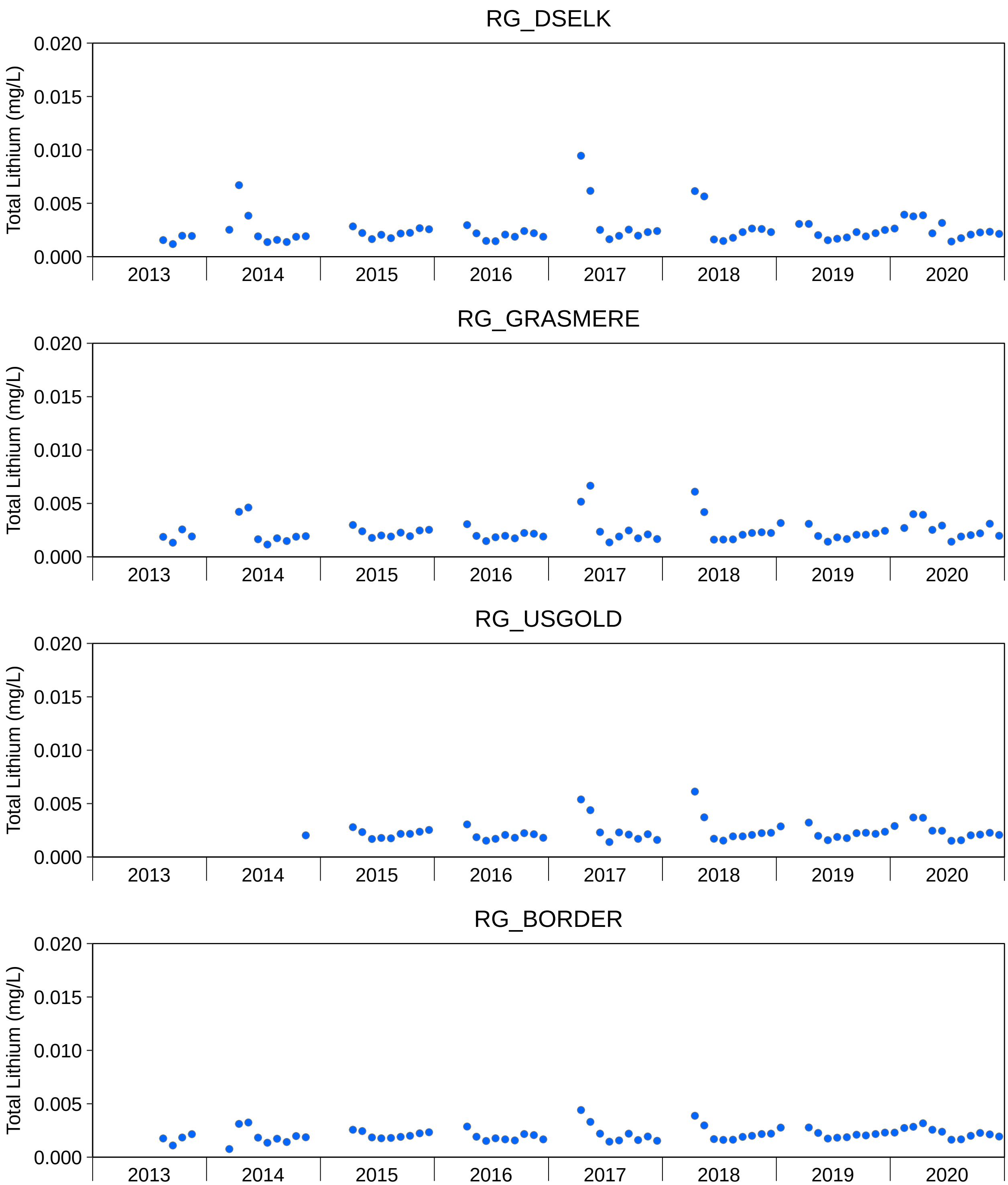

Figure B.6: Monthly Average Concentrations of Total Lithium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

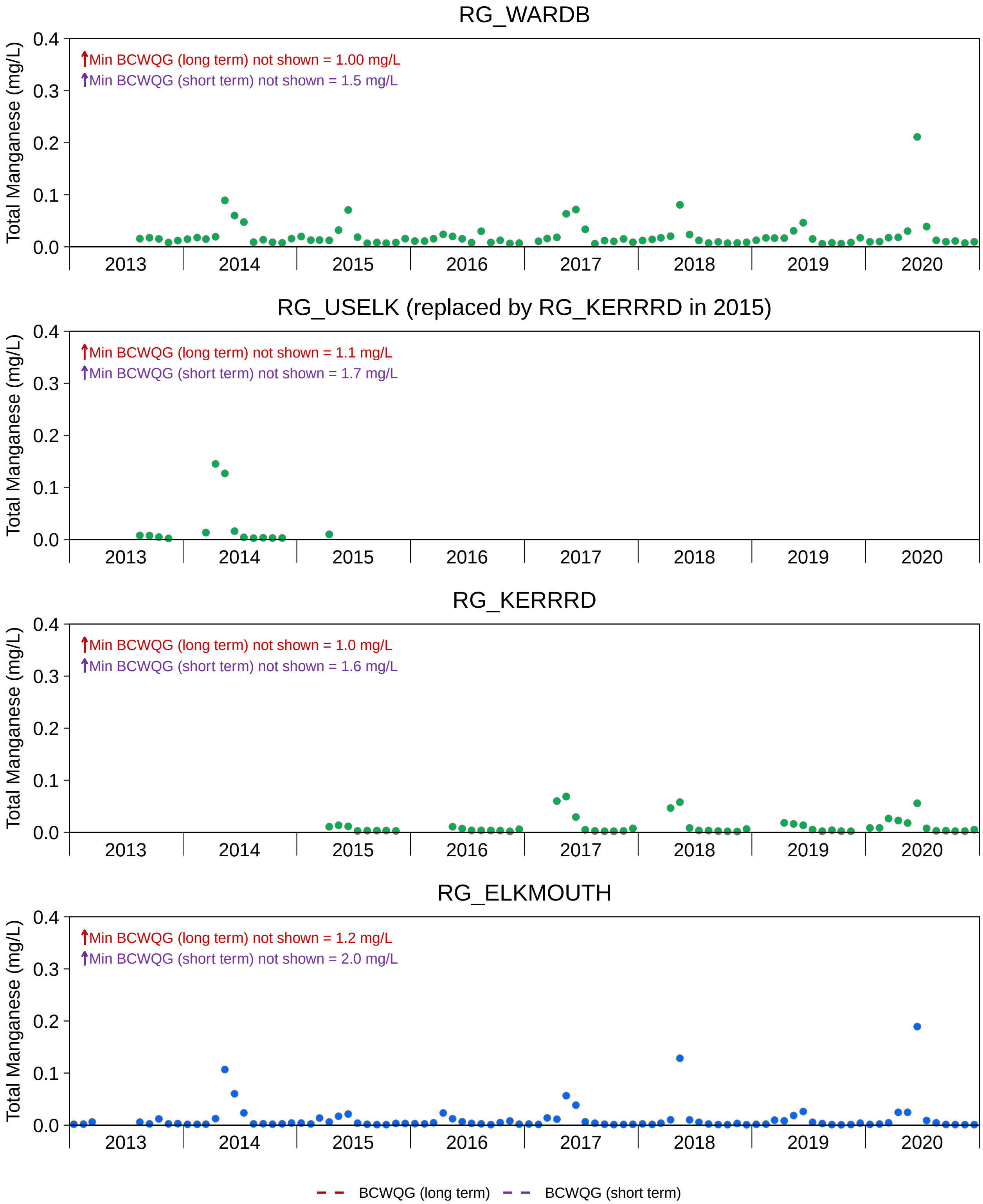

Figure B.7: Monthly Average Concentrations of Total Manganese in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

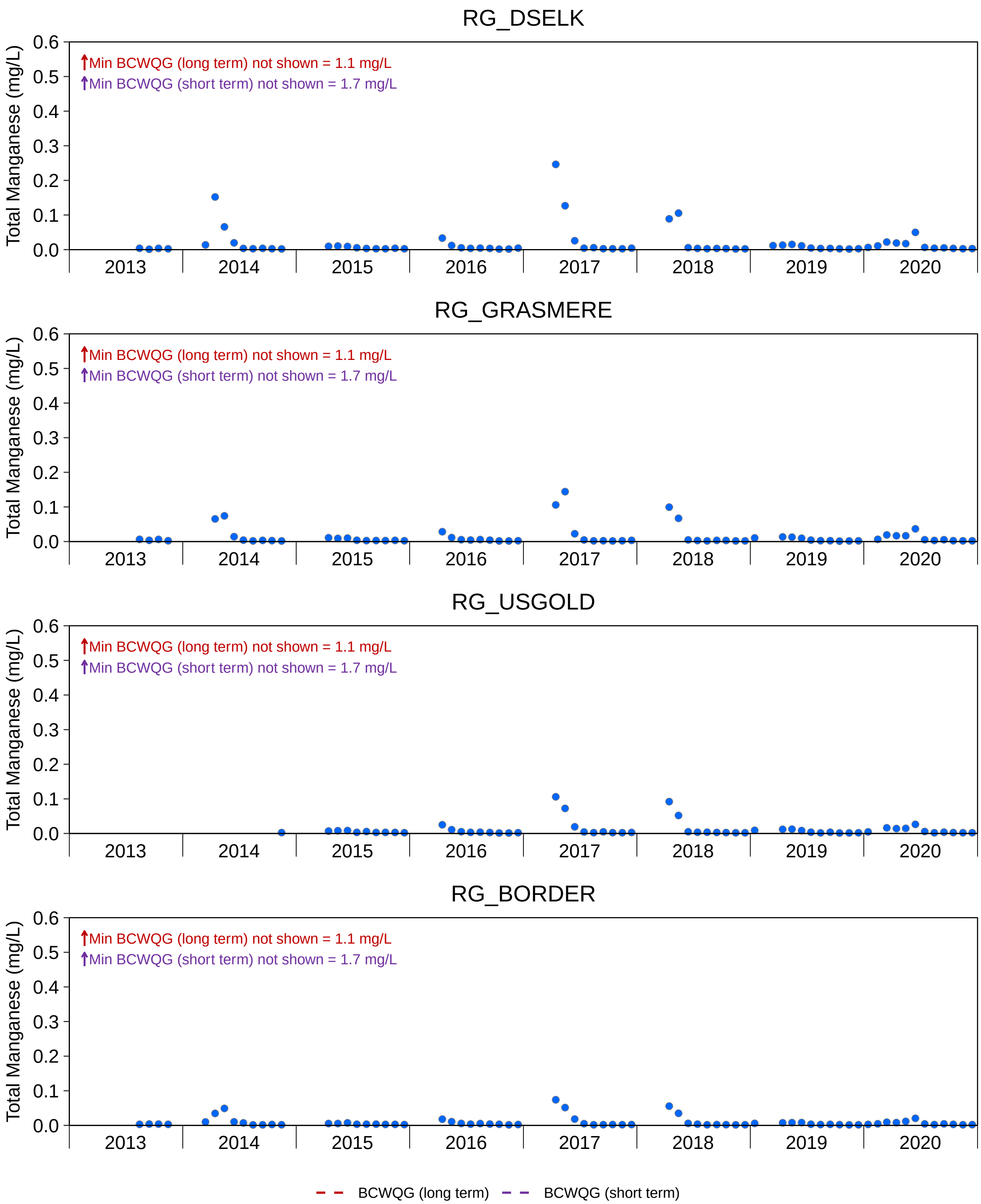

Figure B.7: Monthly Average Concentrations of Total Manganese in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

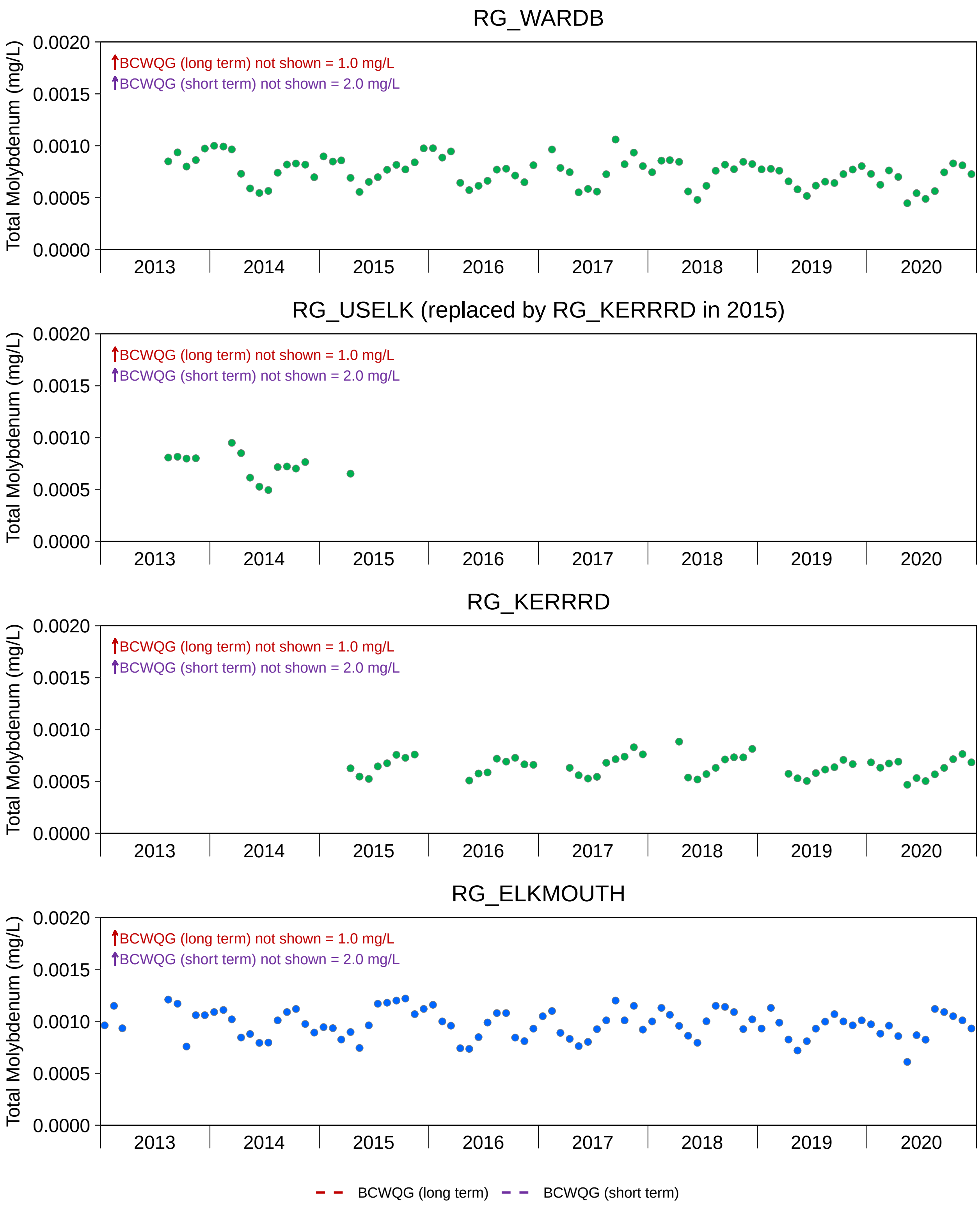

Figure B.8: Monthly Average Concentrations of Total Molybdenum in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

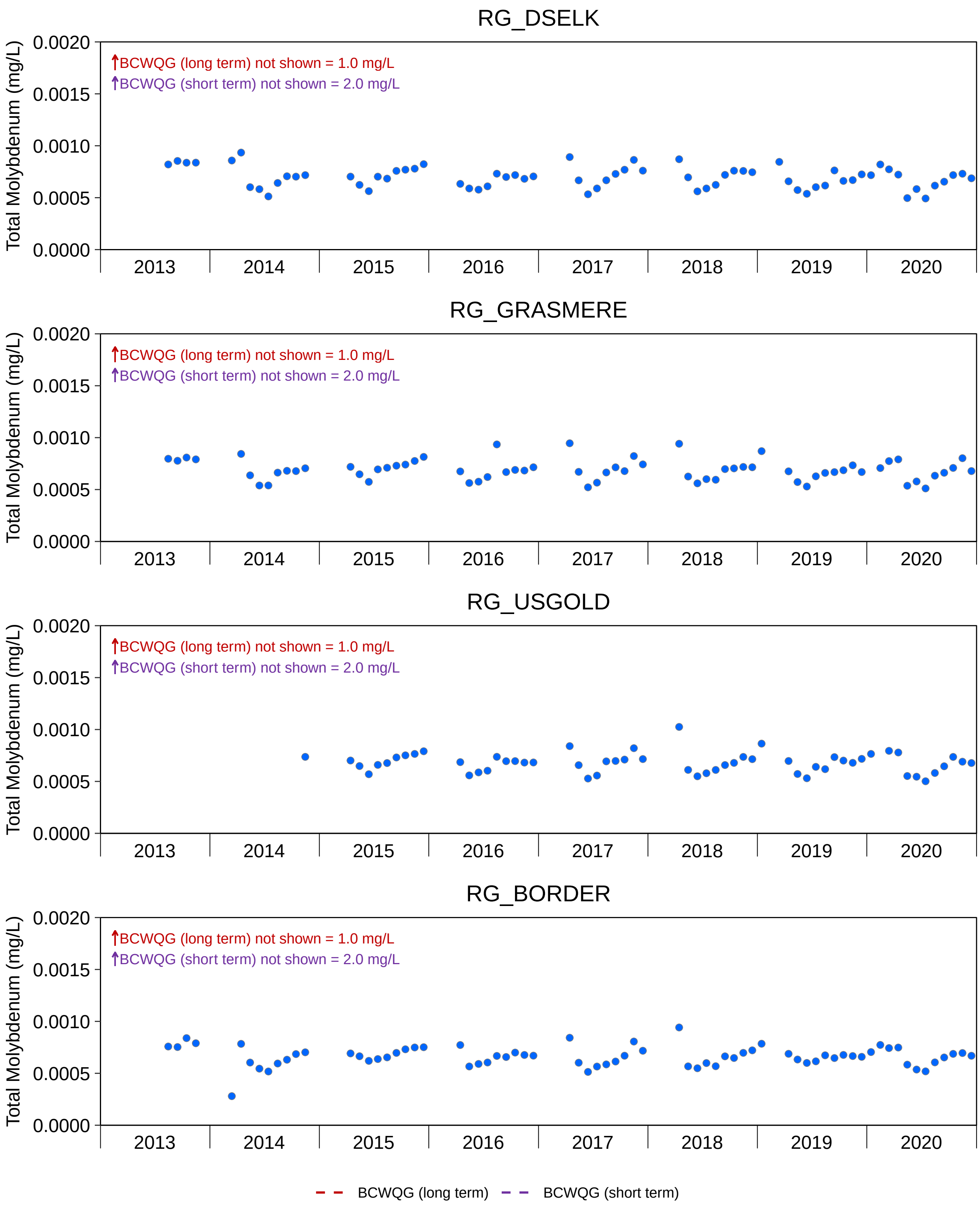

Figure B.8: Monthly Average Concentrations of Total Molybdenum in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

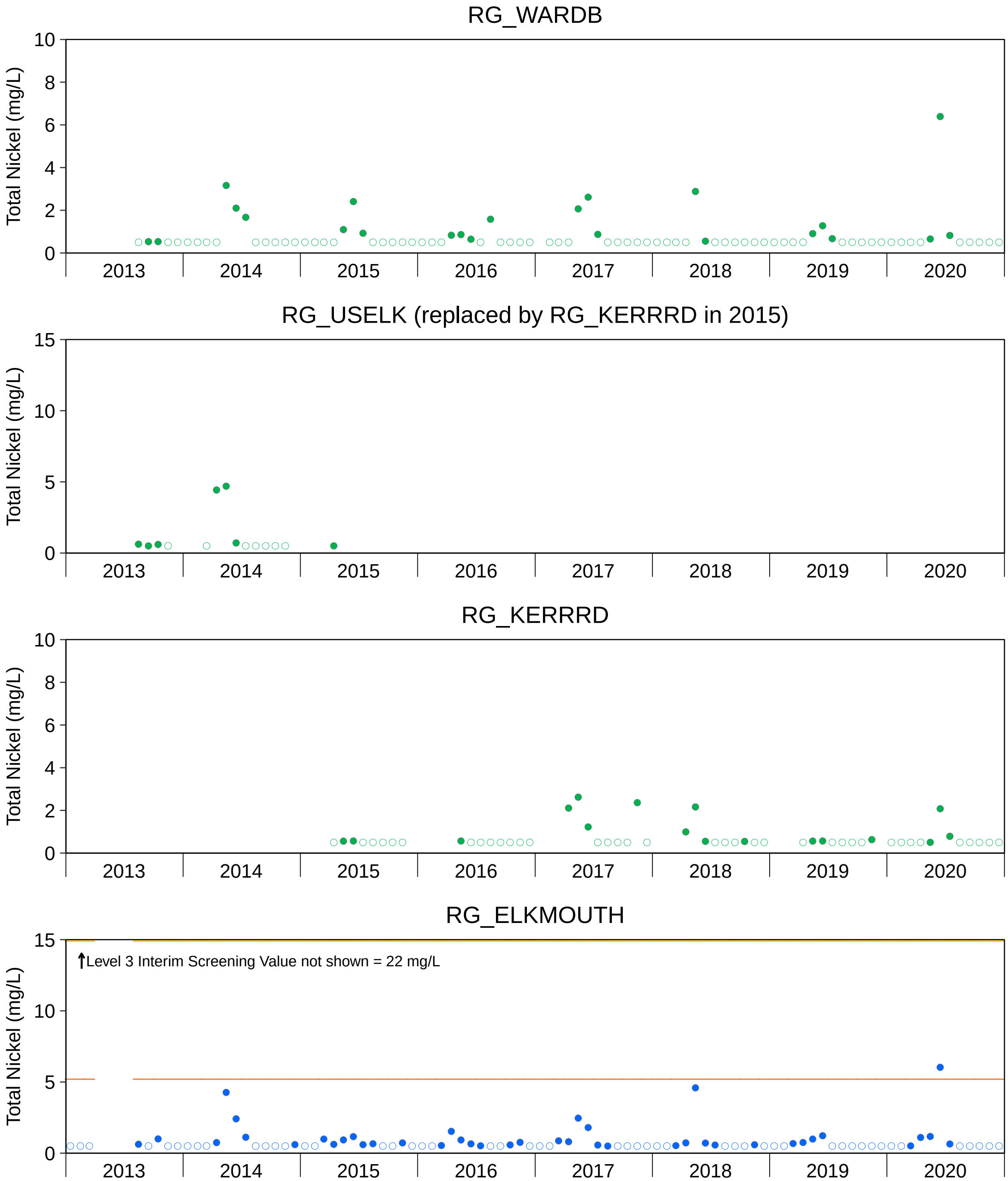

Figure B.9: Monthly Average Concentrations of Total Nickel in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

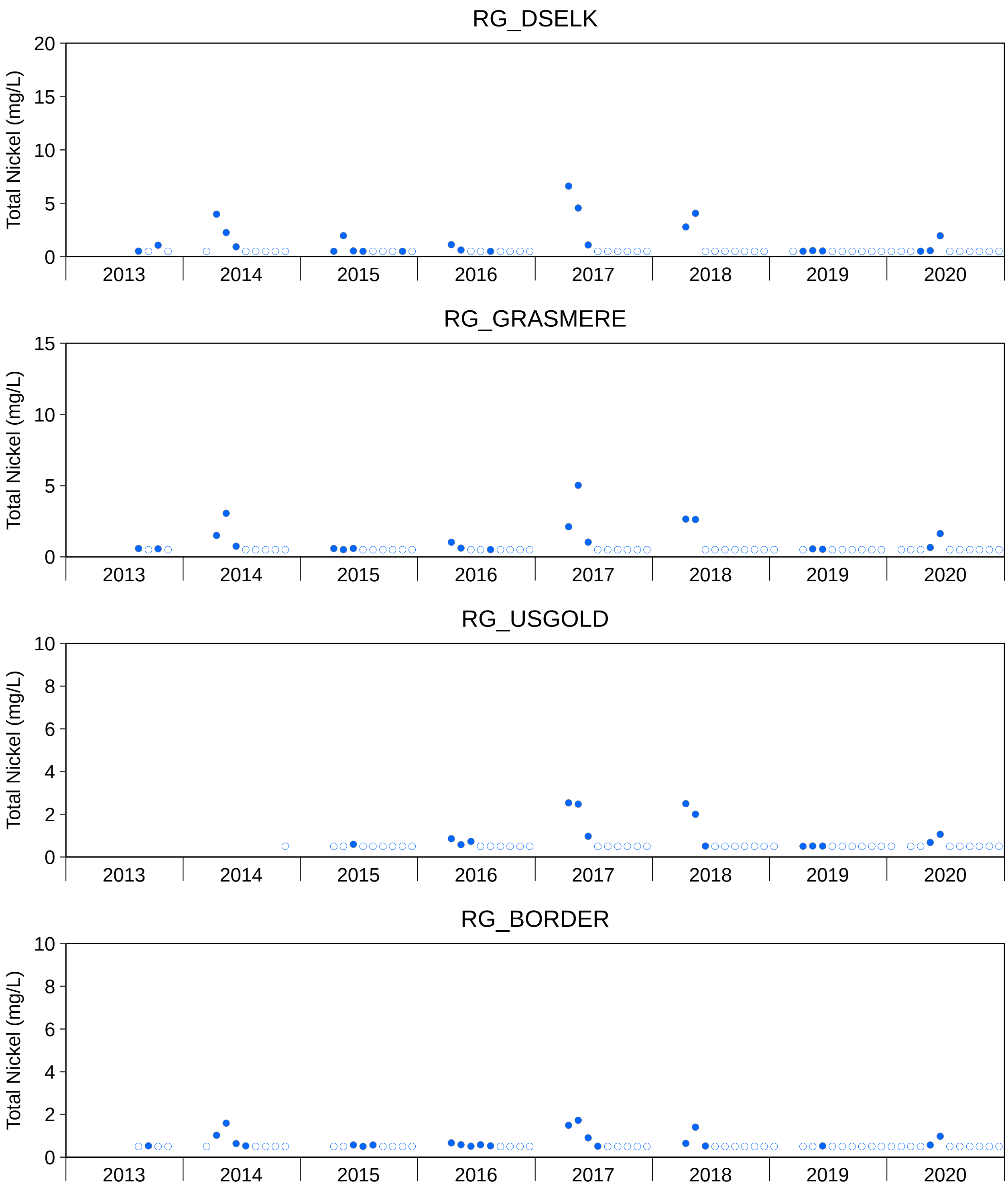

Figure B.9: Monthly Average Concentrations of Total Nickel in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

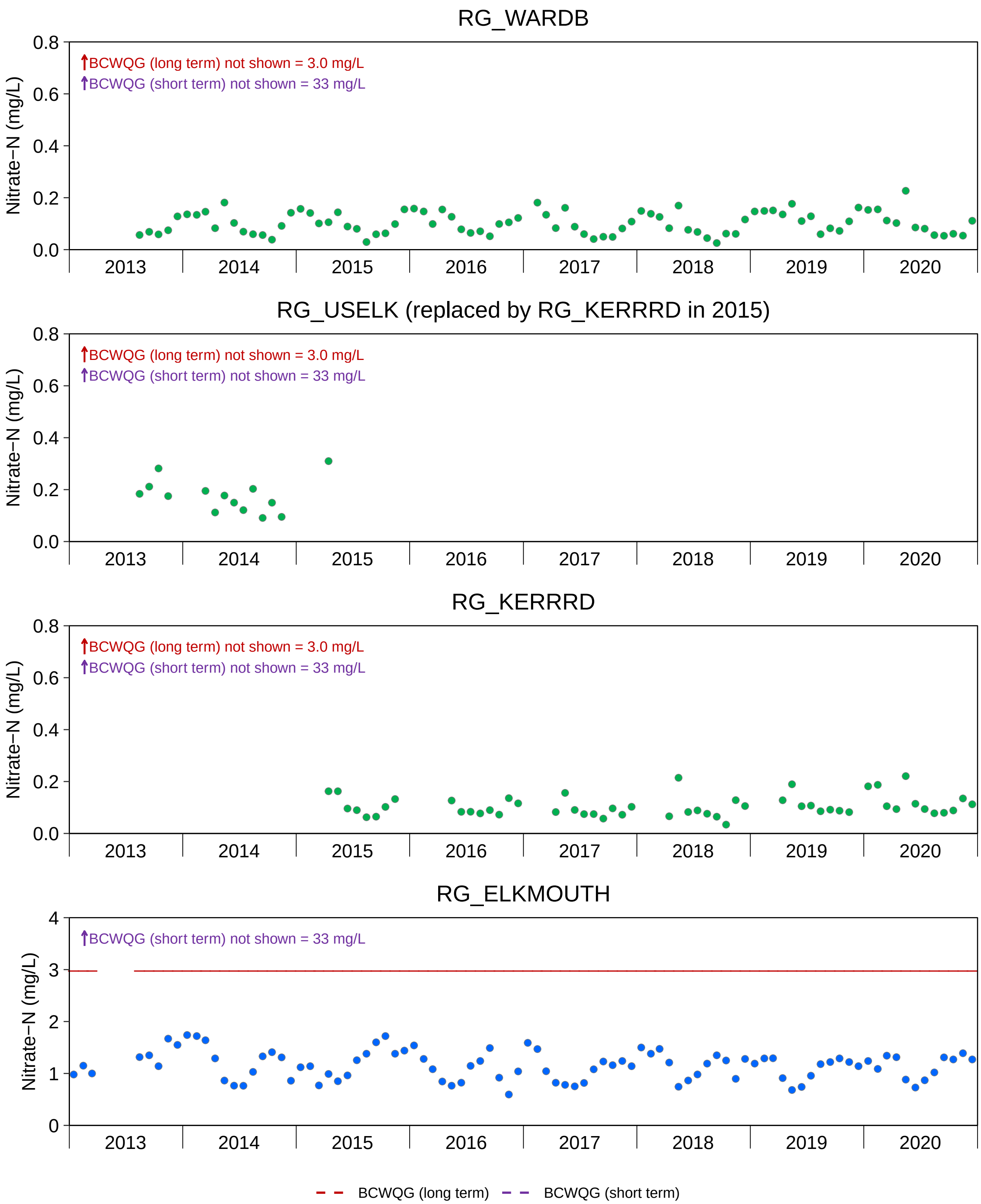

Figure B.10: Monthly Average Concentrations of Nitrate−N in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

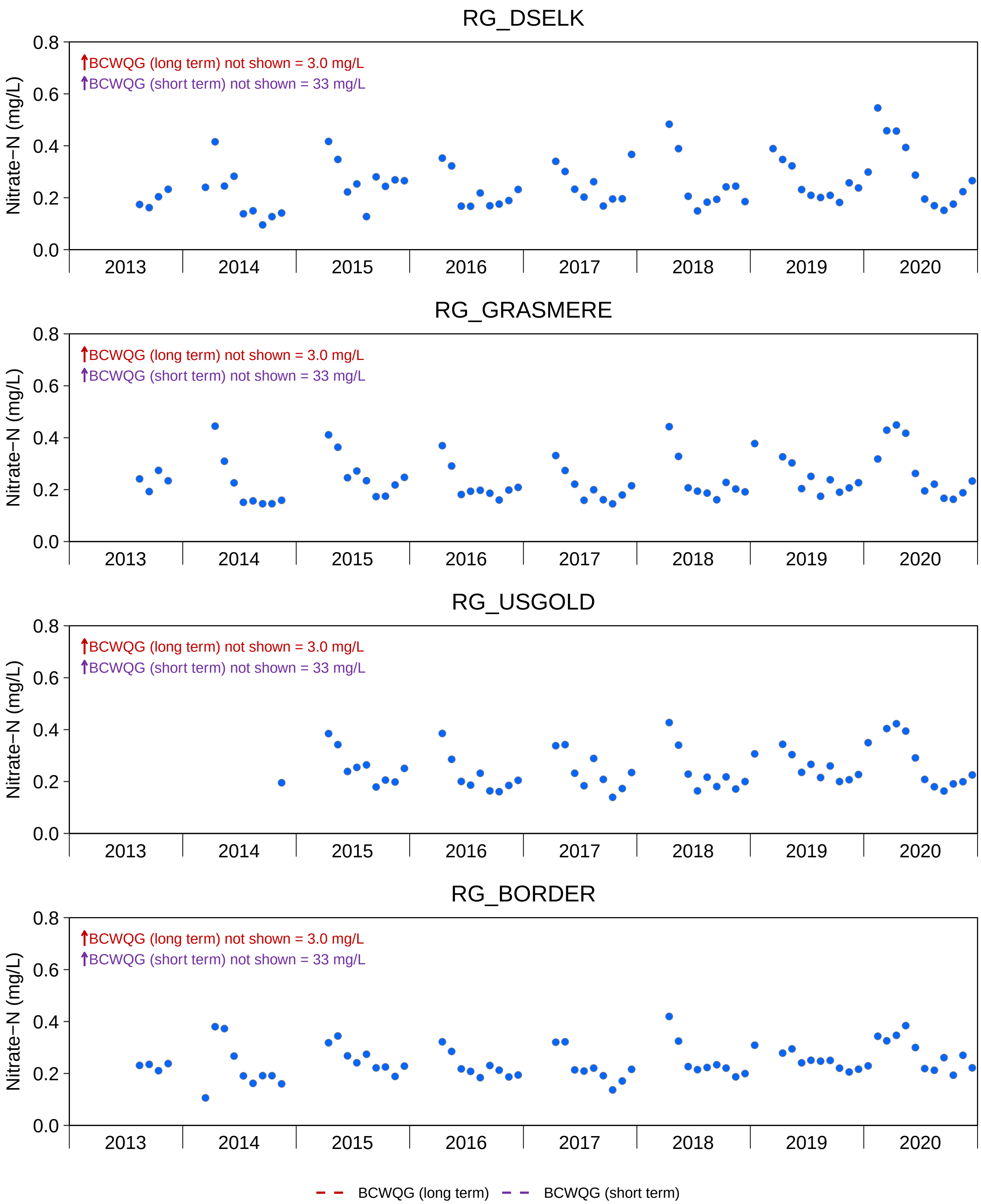

Figure B.10: Monthly Average Concentrations of Nitrate−N in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

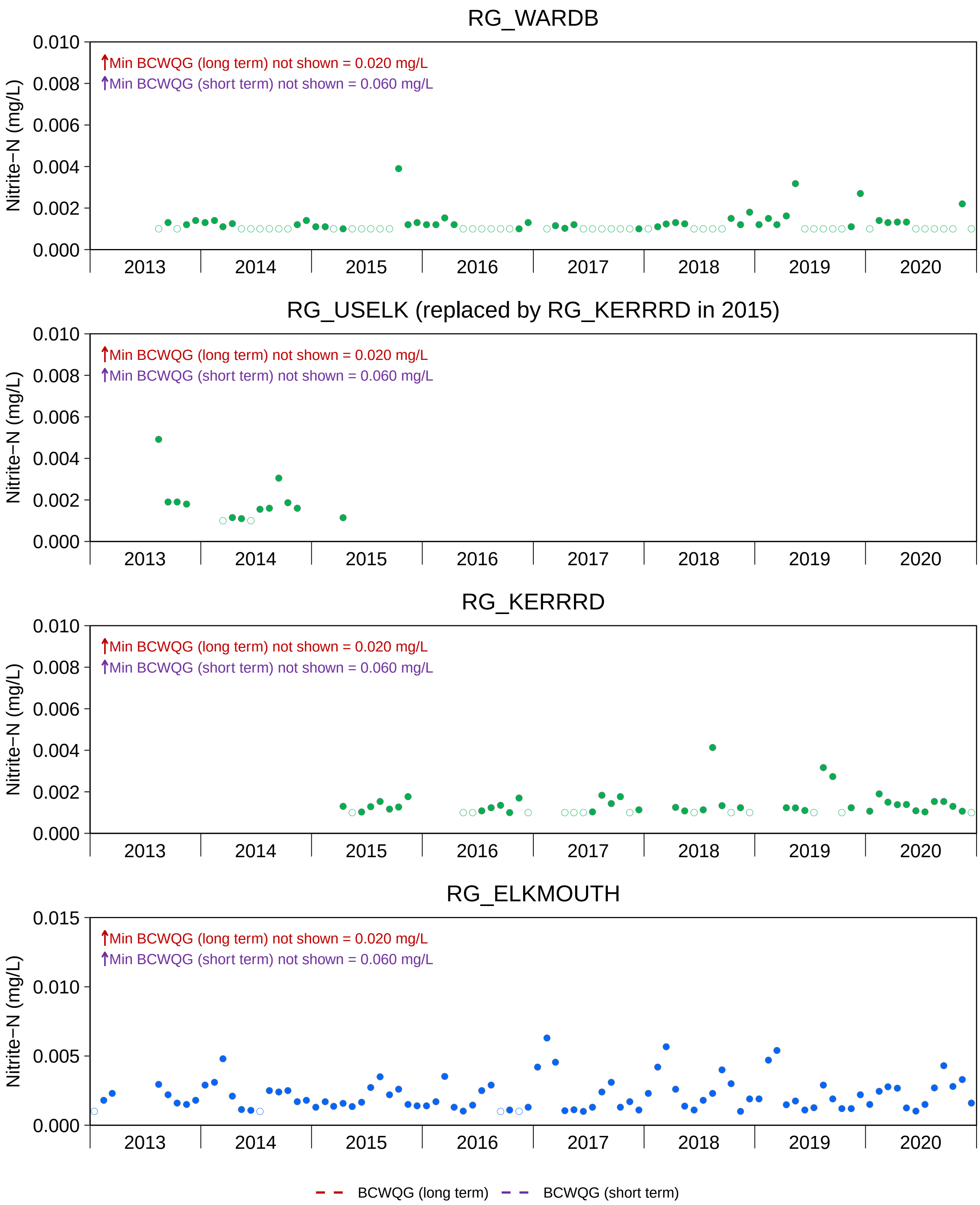

Figure B.11: Monthly Average Concentrations of Nitrite−N in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concenrations.

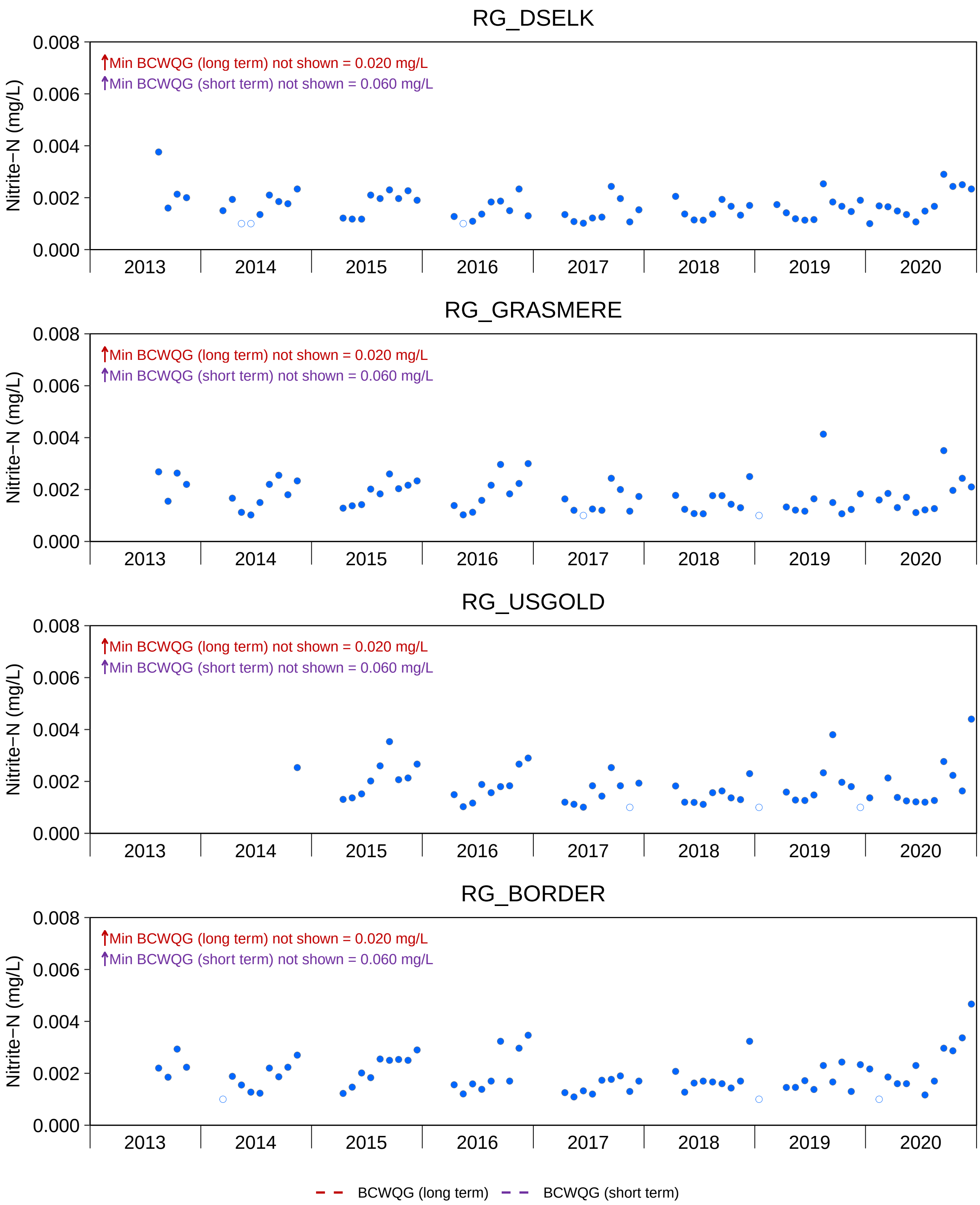

Figure B.11: Monthly Average Concentrations of Nitrite−N in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concenrations.

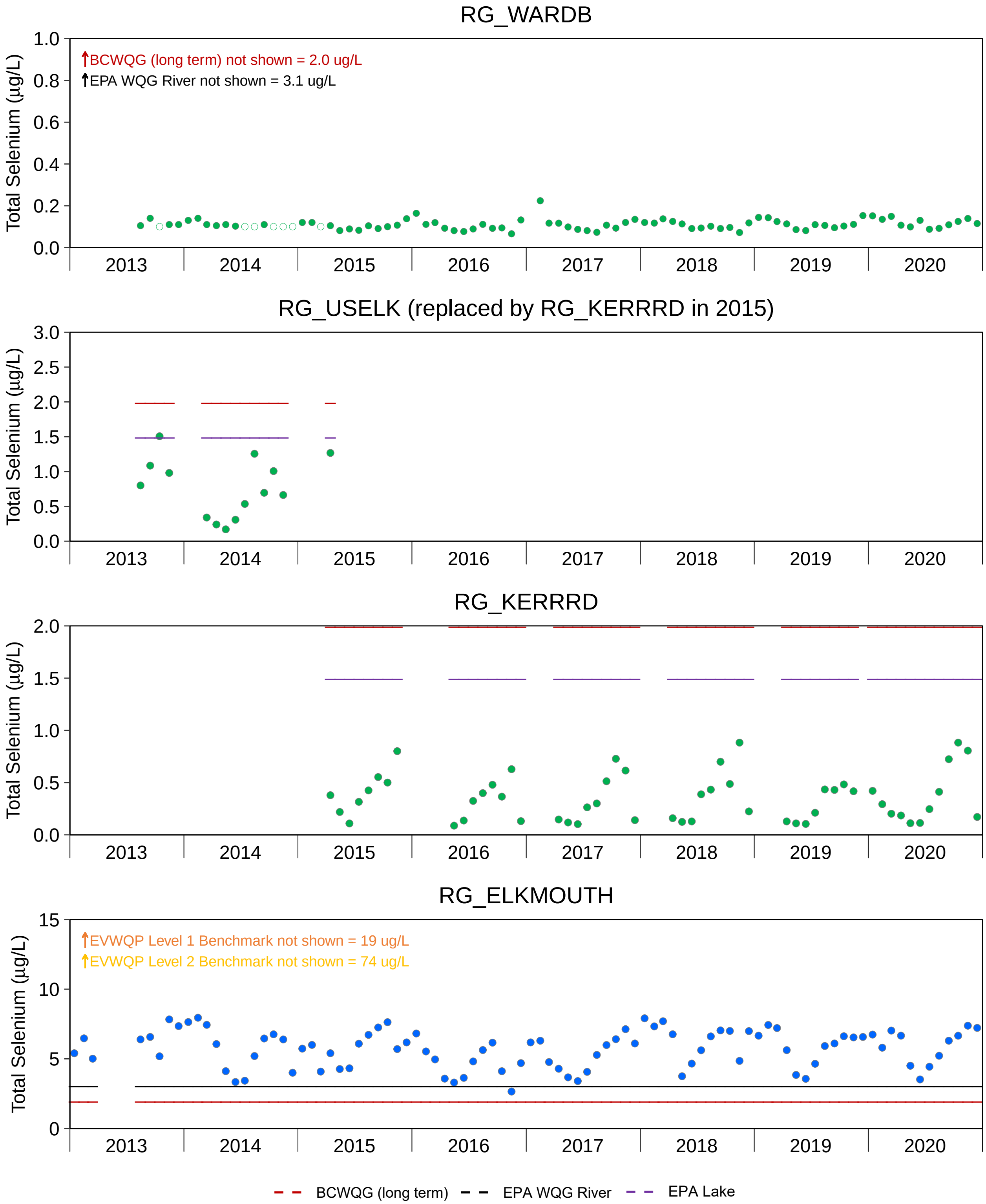

Figure B.12: Monthly Average Concentrations of Total Selenium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

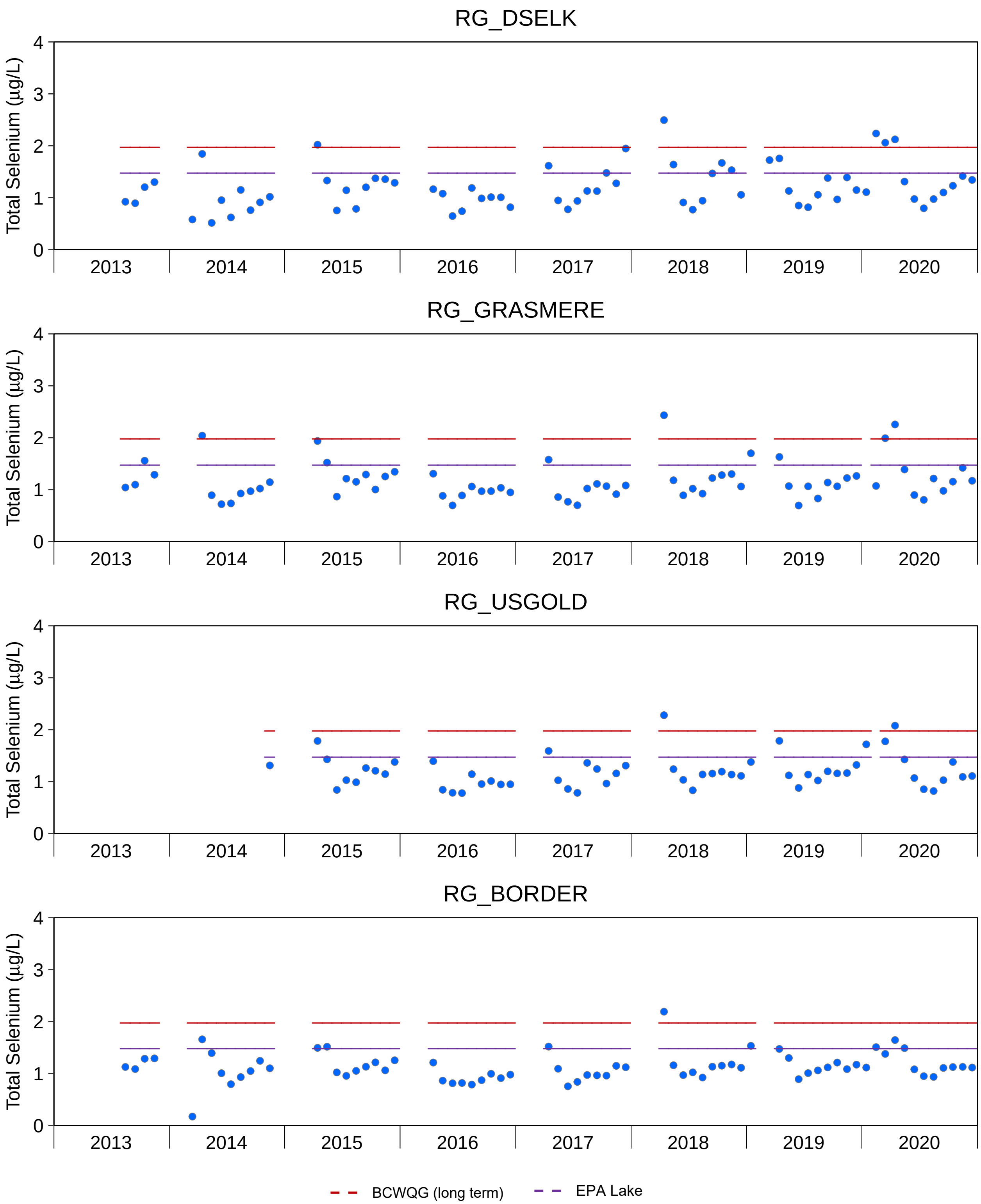

Figure B.12: Monthly Average Concentrations of Total Selenium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

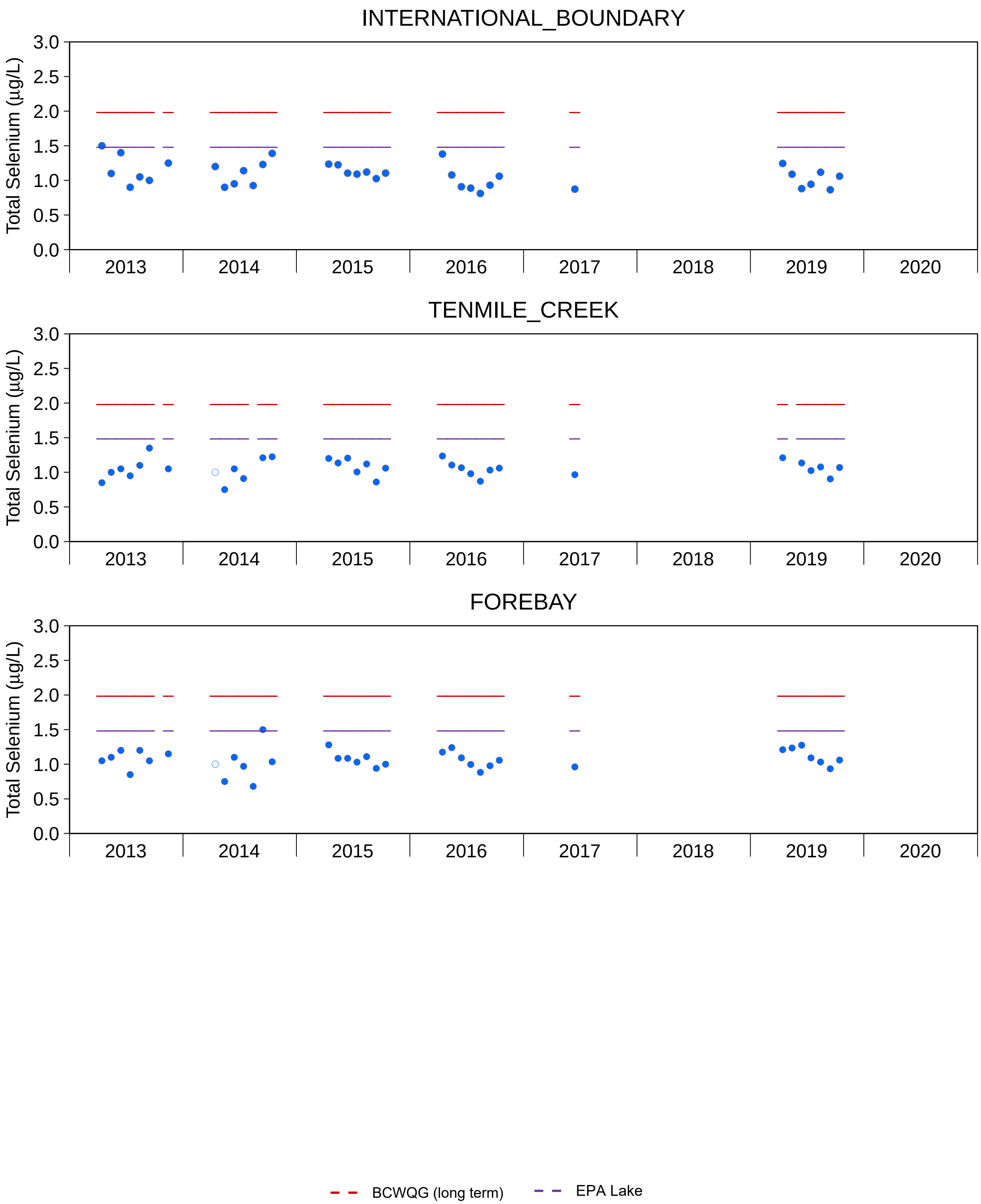

Figure B.12: Monthly Average Concentrations of Total Selenium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

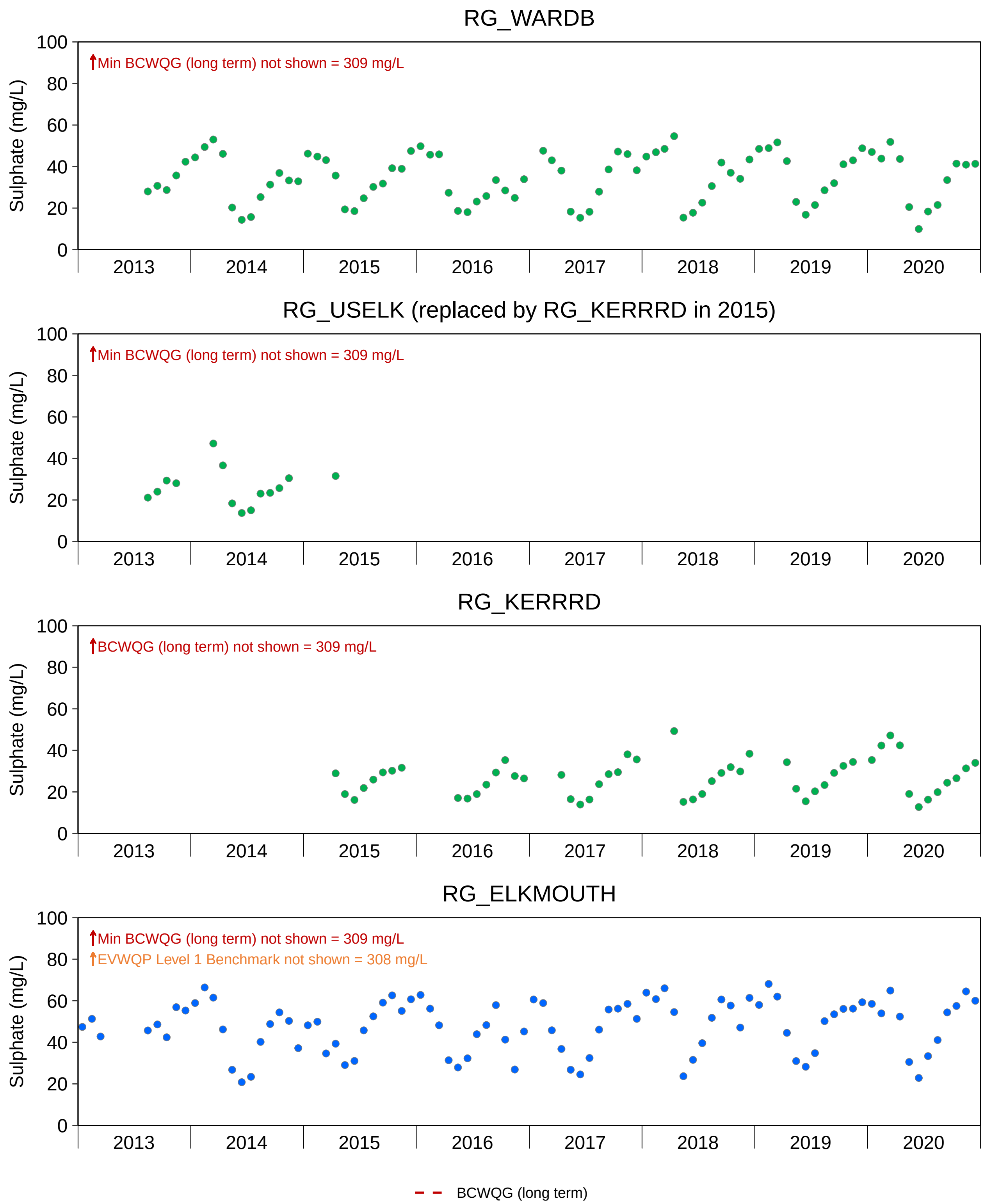

Figure B.13: Monthly Average Concentrations of Sulphate in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

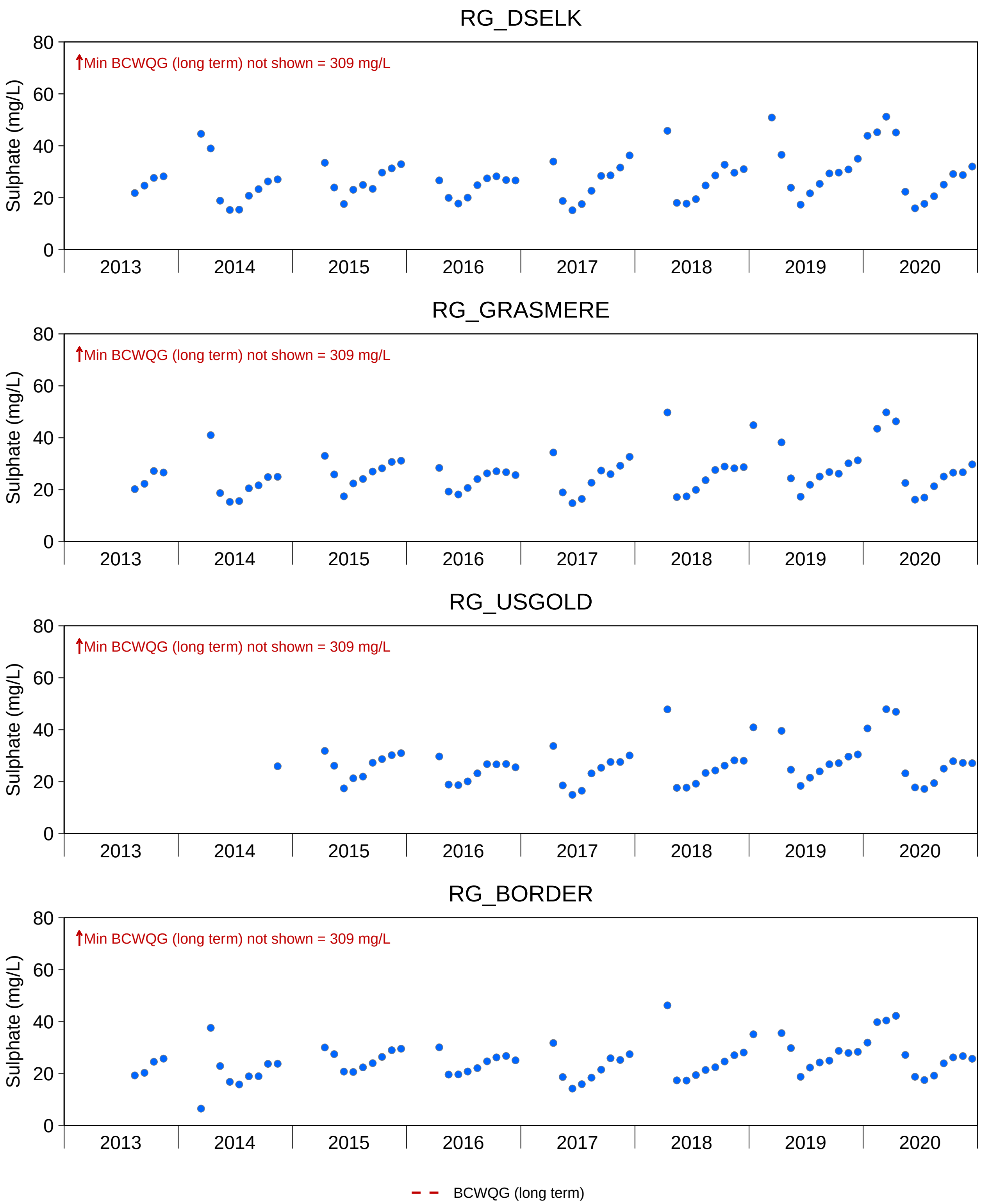

Figure B.13: Monthly Average Concentrations of Sulphate in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

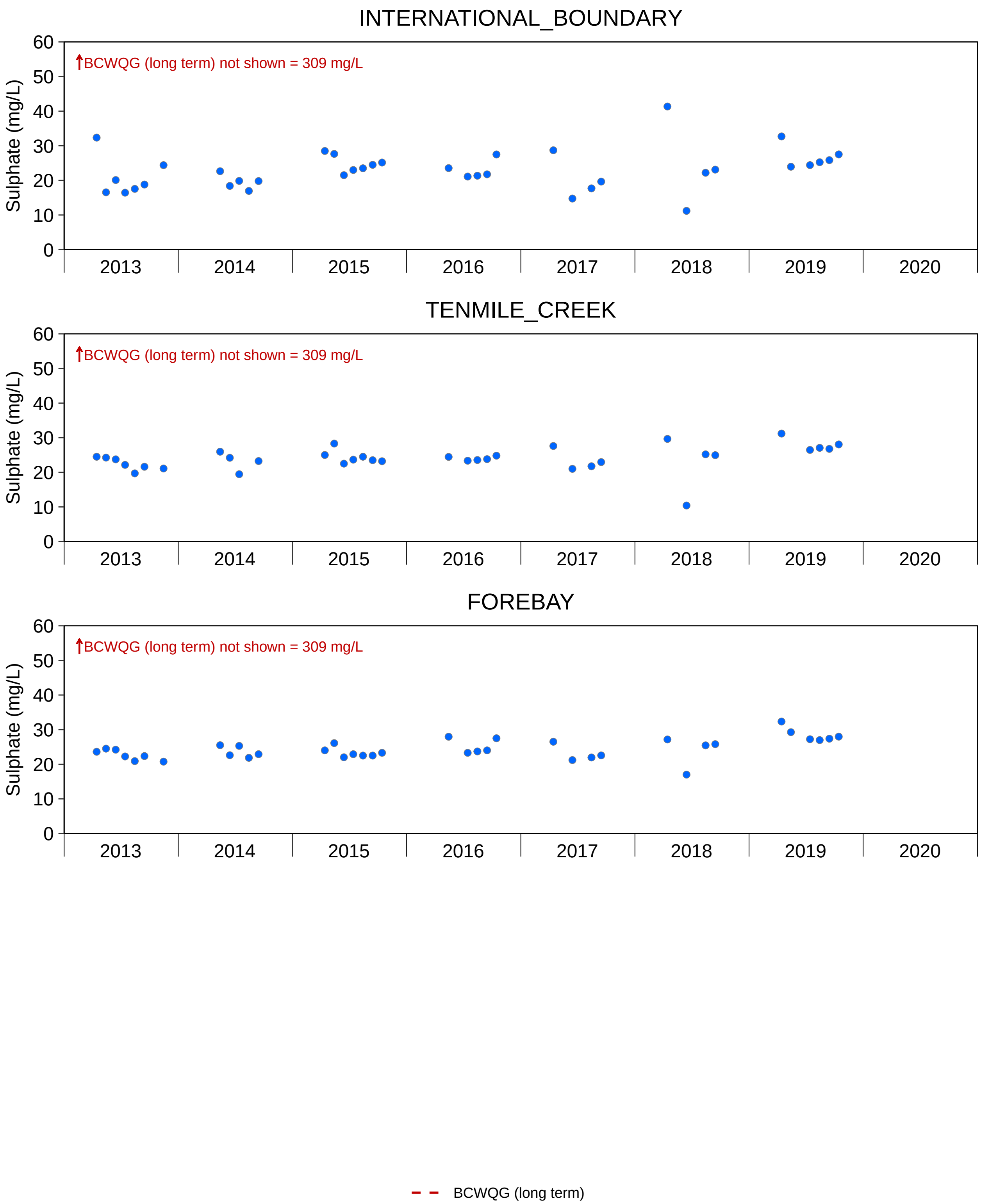

Figure B.13: Monthly Average Concentrations of Sulphate in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

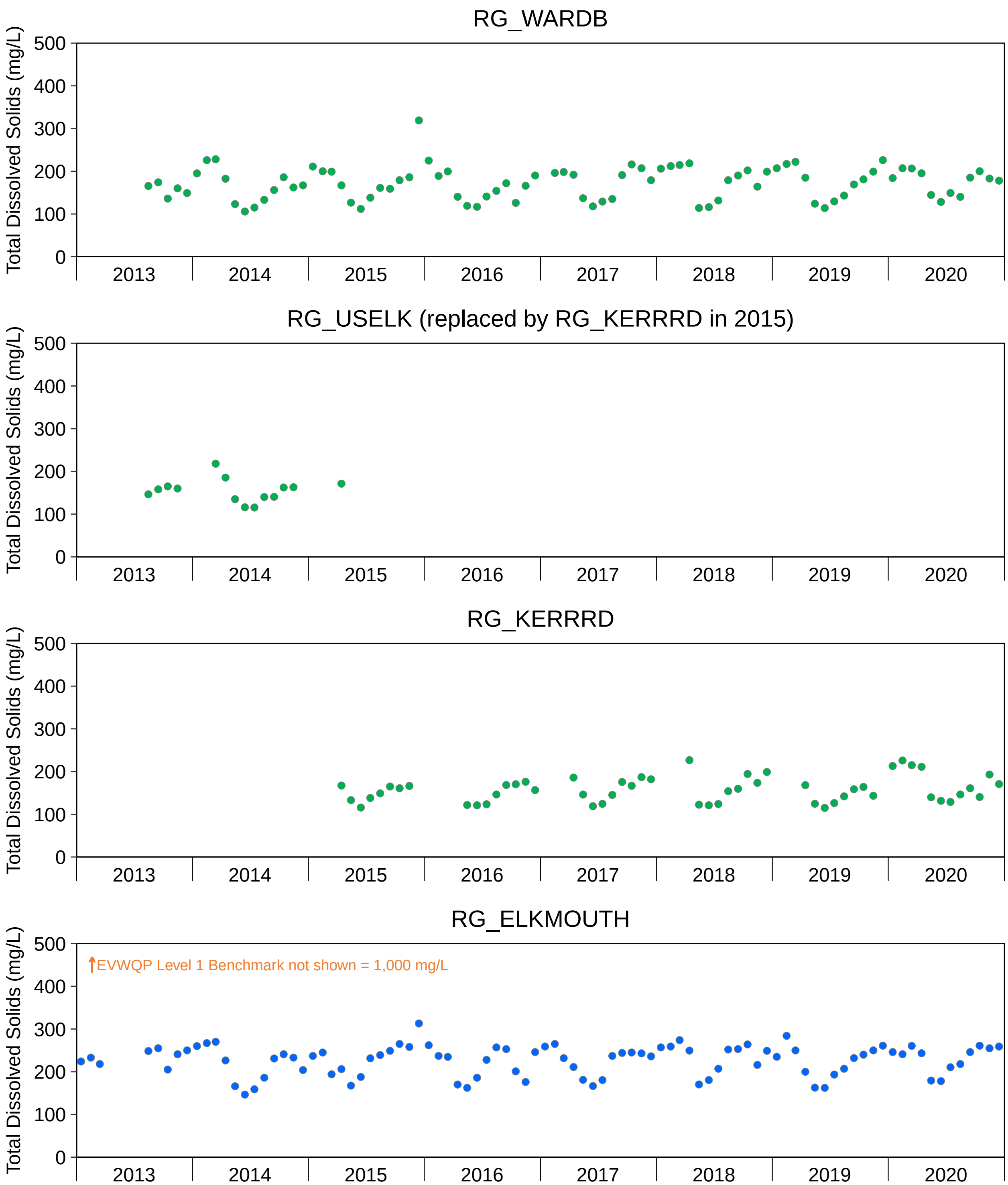

Figure B.14: Monthly Average Concentrations of Total Dissolved Solids in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

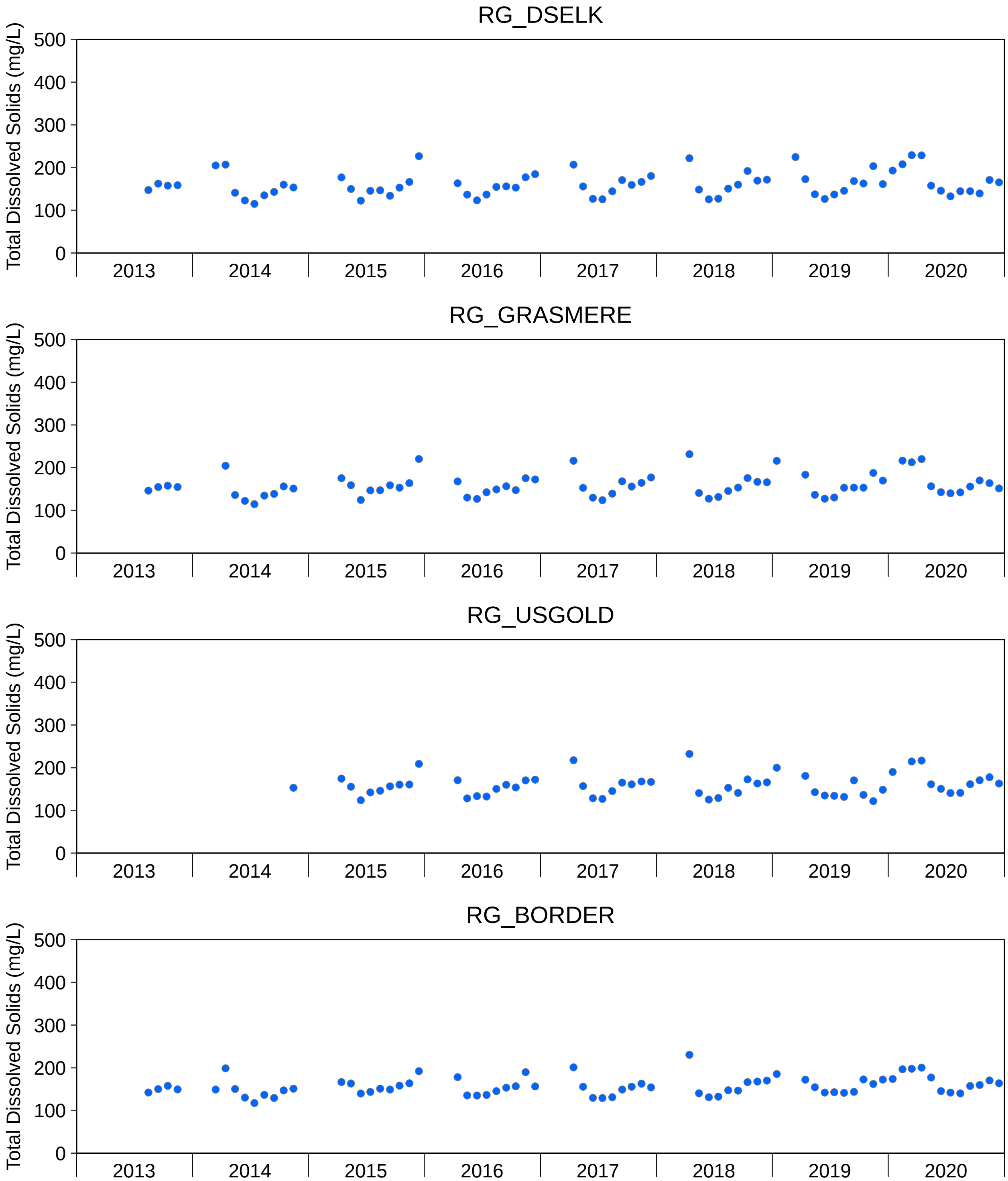

Figure B.14: Monthly Average Concentrations of Total Dissolved Solids in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

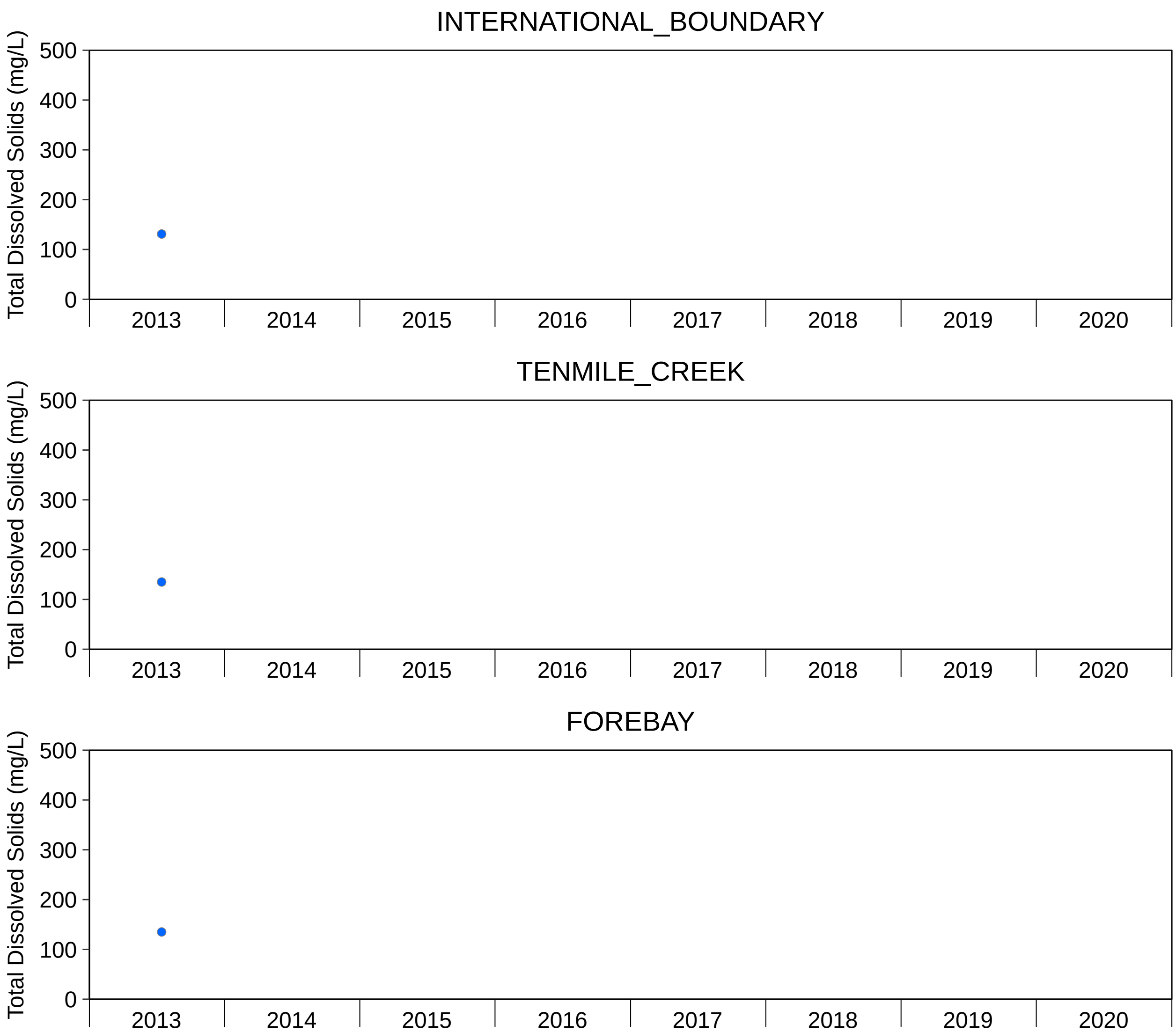

Figure B.14: Monthly Average Concentrations of Total Dissolved Solids in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

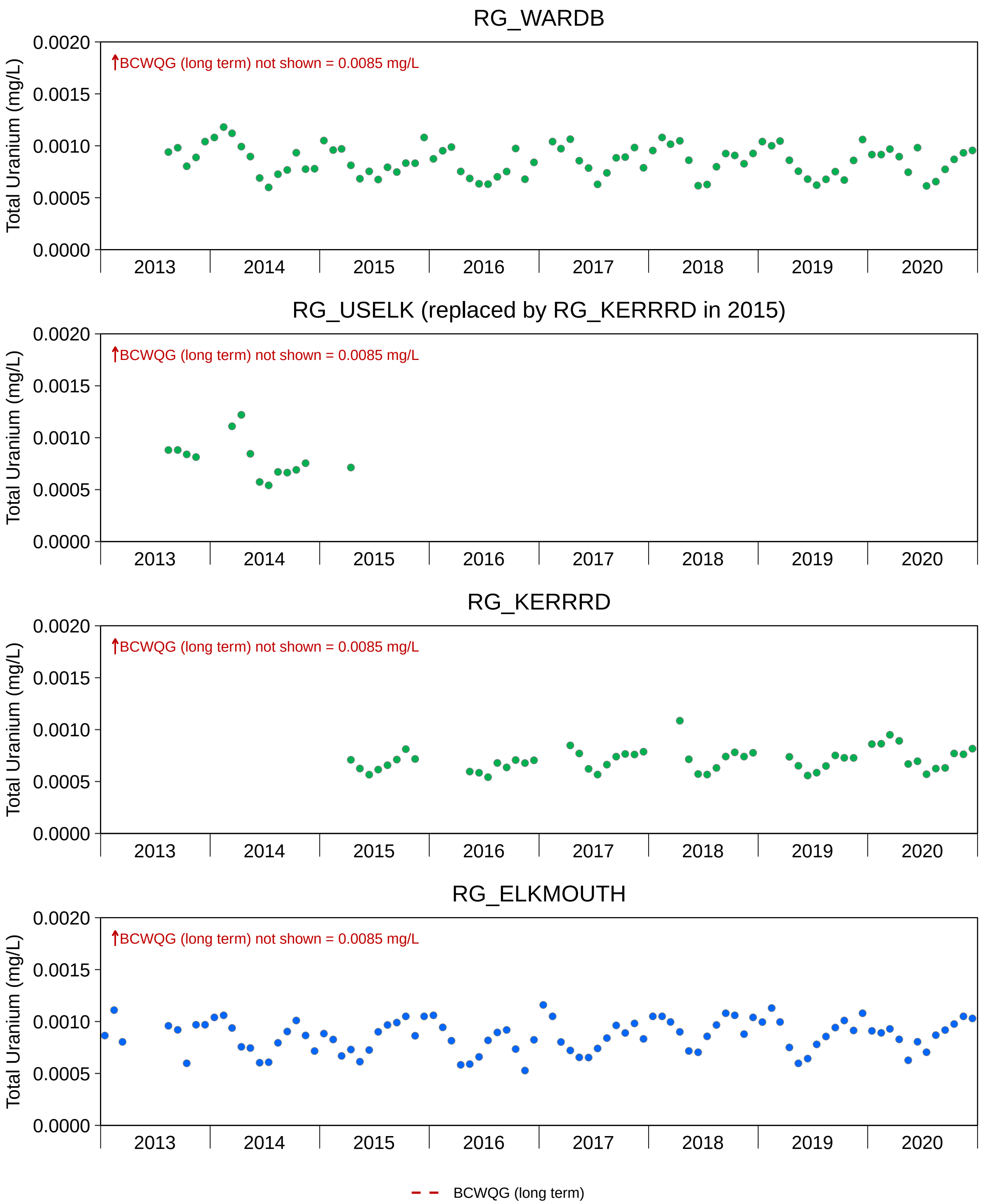

Figure B.15: Monthly Average Concentrations of Total Uranium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

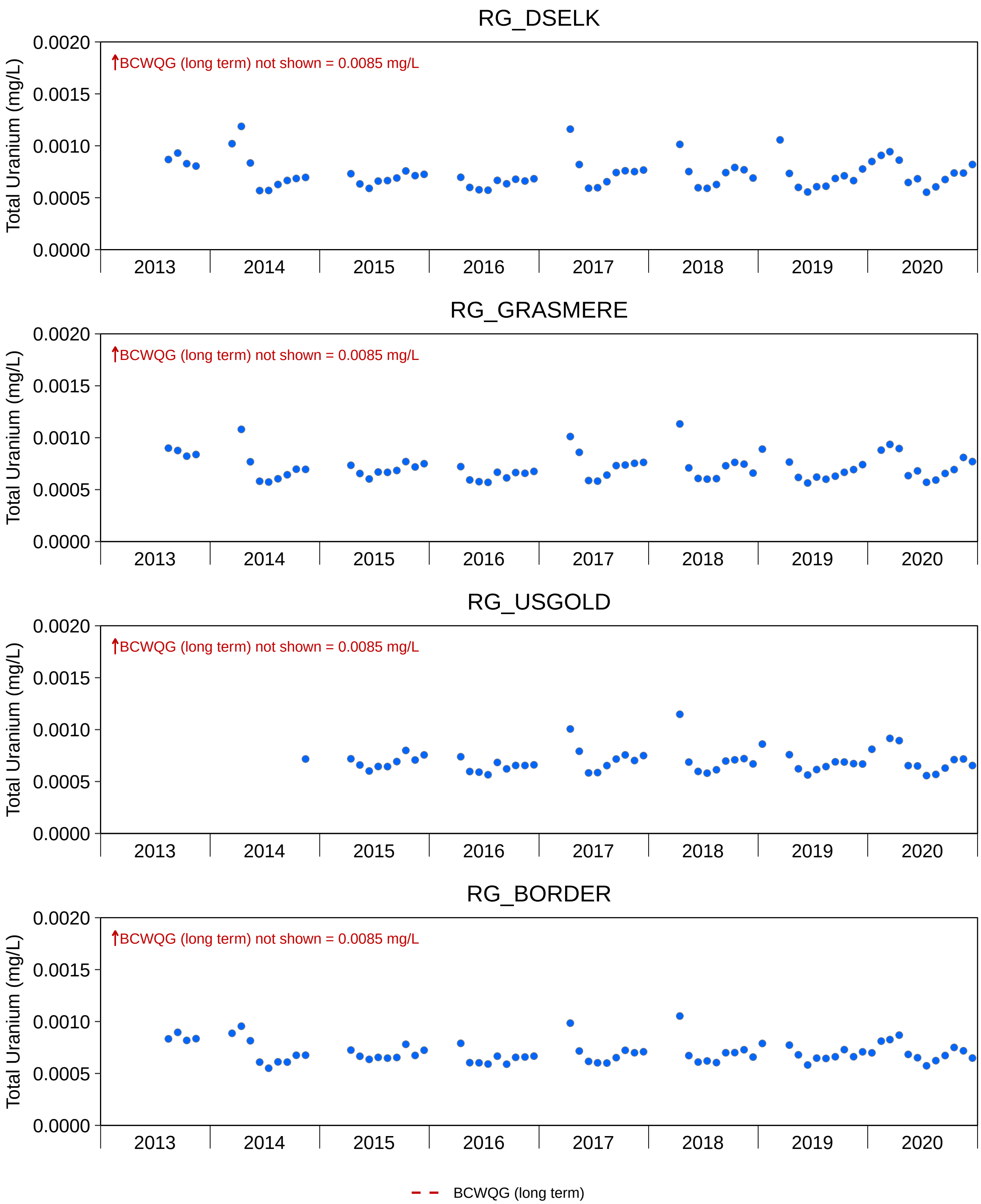

Figure B.15: Monthly Average Concentrations of Total Uranium in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

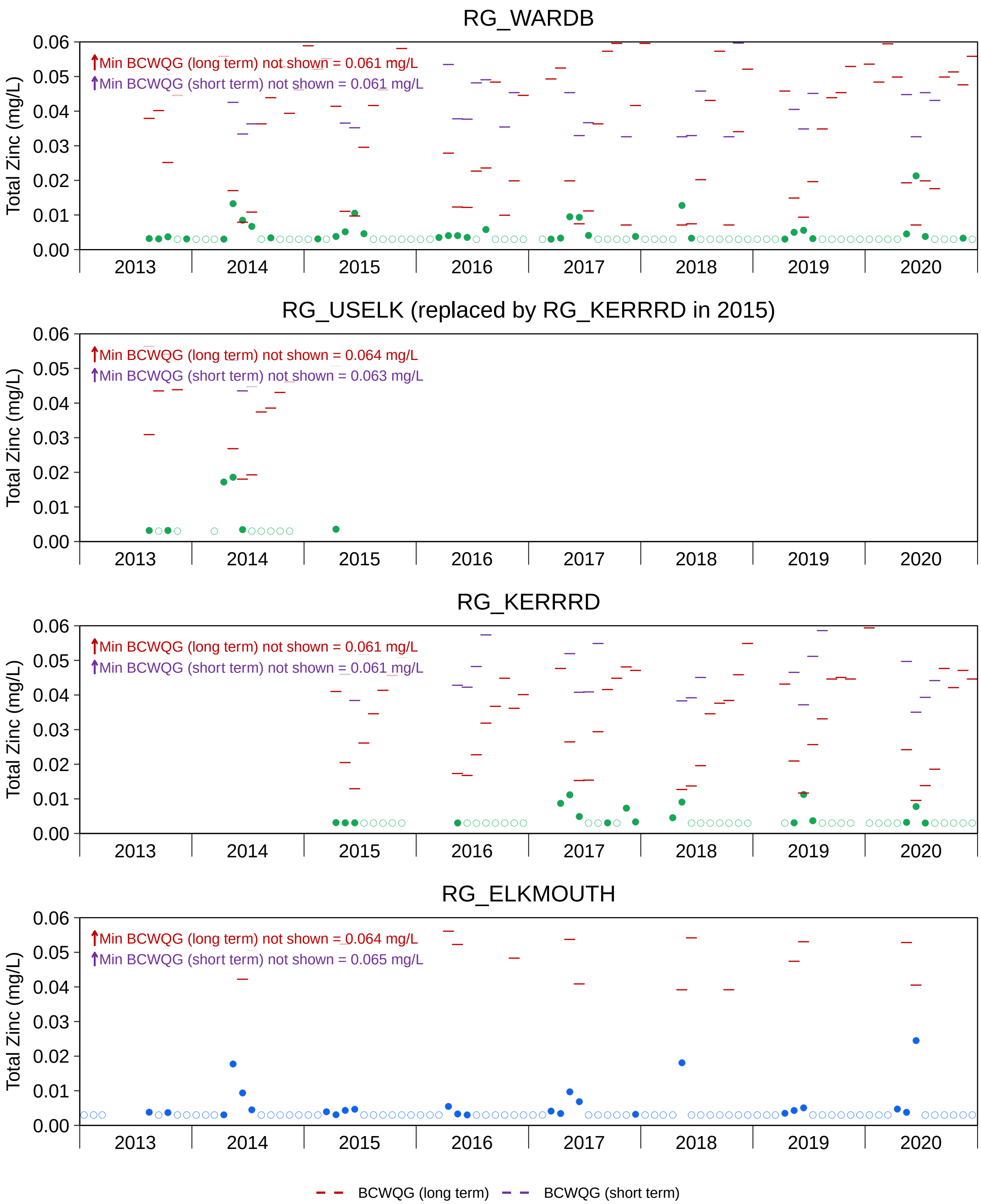

Figure B.16: Monthly Average Concentrations of Total Zinc in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.
Guidelines are dependent on water hardness.

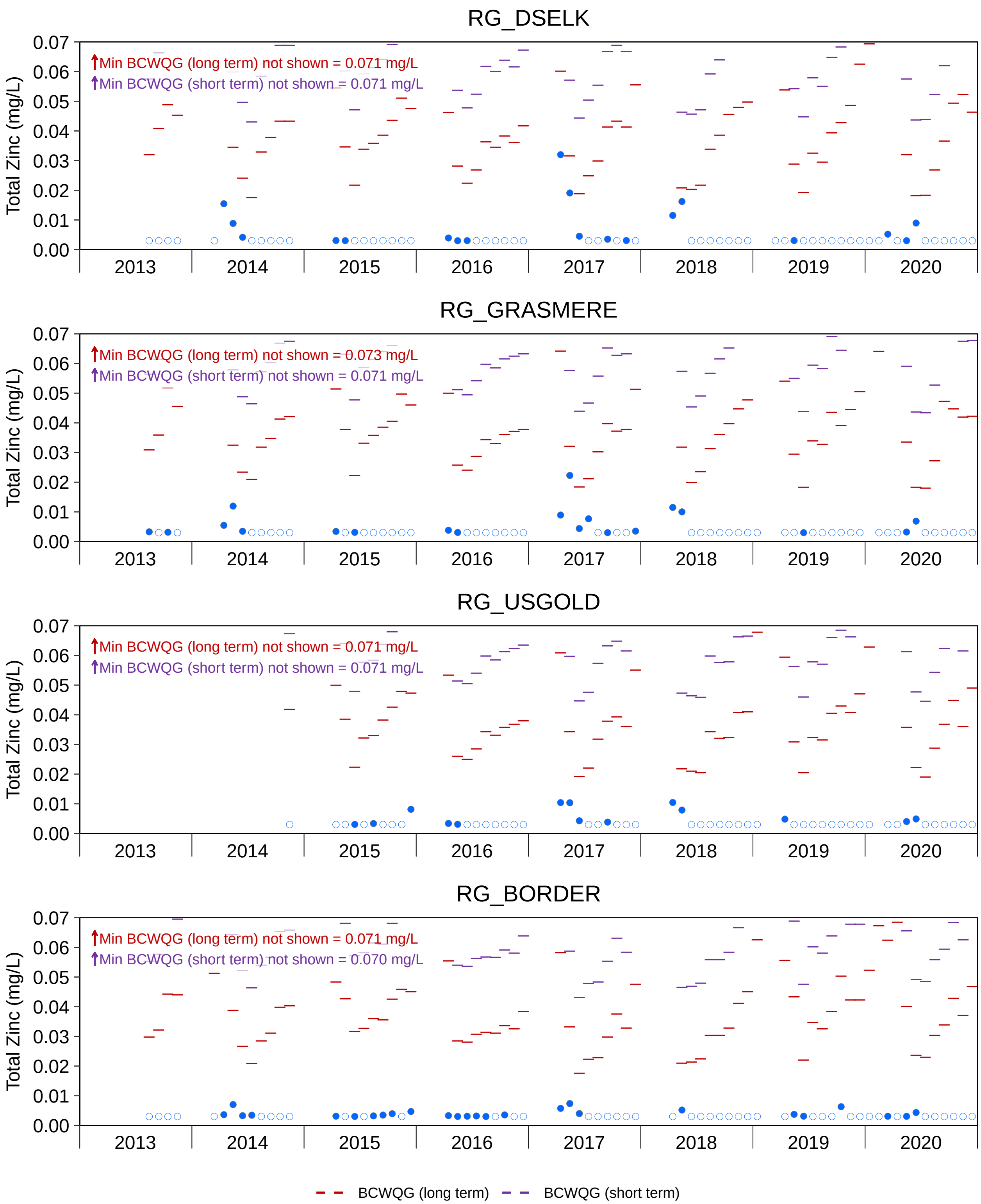

Figure B.16: Monthly Average Concentrations of Total Zinc in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

Figure B.16: Monthly Average Concentrations of Total Zinc in the Koocanusa Reservoir Water Quality Sampling Areas, 2013 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

Table B.1: In Situ Water Quality Profiles for Station RG_SC, Koocanusa Reservoir Monitoring Program, 2020

Month	Depth	Temperature	pH	Dissolved Oxygen		Specific Conductivity	Conductivity	ORP	Turbidity
	(m)	(˚C)	(pH	(mg/L)	(%)	(µS/cm)	(µS/cm)	(Mv)	(NTU)
June	1	11.4	8.13	10.33	102.7	204.2	151.0	283.7	142.0
	2	11.2	8.13	10.26	101.8	203.4	149.8	283.7	121.4
	3	10.7	8.15	10.26	100.5	201.9	146.6	284.8	139.5
	4	10.5	8.15	10.26	100.0	202.2	146.2	285.8	120.8
	5	10.2	8.11	10.37	100.5	204.0	146.3	290.0	137.1
	6	10.2	8.10	10.35	100.2	204.3	146.5	291.2	131.6
	7	10.0	8.08	10.34	99.8	205.8	147.0	293.3	166.0
	8	9.8	8.07	10.37	99.5	206.2	146.4	295.0	135.6
	9	9.8	8.05	10.41	99.8	206.8	146.6	296.5	129.8
	10	9.6	8.02	10.42	99.6	206.9	146.2	300.0	135.4
	11	9.6	8.02	10.43	99.7	206.9	146.2	300.4	124.2
	12	9.6	8.00	10.43	99.7	207.0	146.2	301.7	135.6
	13	9.6	7.99	10.43	99.6	206.9	146.1	302.5	128.6
	14	9.6	7.97	10.43	99.6	206.5	145.8	304.8	144.5
	15	9.6	7.97	10.44	99.7	206.3	145.5	305.7	144.4
August	1	21.6	8.41	7.50	107.6	262.7	283.9	249.0	6.1
	2	21.5	8.41	7.50	107.5	262.6	283.8	249.0	6.1
	3	21.5	8.42	7.50	107.4	262.3	283.2	249.2	6.0
	4	20.6	8.42	7.52	107.5	262.1	282.5	249.6	6.0
	5	21.3	8.42	7.52	107.5	262.2	282.3	249.8	6.1
	6	21.2	8.42	7.52	107.4	262.3	282.2	250.3	6.0
	7	21.2	8.43	7.53	107.5	262.2	281.9	250.0	6.0
	8	21.2	8.42	7.45	106.3	263.3	282.8	250.8	6.4
	9	21.2	8.37	7.47	106.1	266.5	285.3	253.2	6.2
	10	20.7	8.35	7.44	105.4	267.8	285.8	254.2	6.0
	11	20.3	8.23	7.29	101.6	276.3	289.8	259.6	6.4
	12	18.8	8.22	7.25	100.4	278.1	290.2	261.3	6.3
	13	18.2	8.20	7.24	99.6	280.5	290.7	262.6	6.5
	14	18.0	8.15	7.19	98.4	282.3	290.7	265.4	6.8
	15	17.5	8.14	7.17	97.4	284.2	290.7	266.9	7.7
	16	17.3	8.14	7.16	97.1	284.6	290.7	267.6	7.1
	17	17.3	8.12	7.14	96.7	285.0	290.8	268.9	6.9
	18	17.3	8.10	7.13	96.3	286.0	290.9	271.3	7.1

Note: Too shallow in April to collect vertical profile.

Table B.2: In Situ Water Quality Profiles for Station RG_TN, Koocanusa Reservoir Monitoring Program, 2020

Month	Depth	Temperature	pH	Dissolved Oxygen		Specific Conductivity	Conductivity	ORP	Turbidity
	(m)	(˚C)	(pH units)	(mg/L)	(%)	(µS/cm)	(µS/cm)	(Mv)	(NTU)
April	0	11.0	8.29	10.15	100.9	402.7	295.3	274.1	21.9
	1	11.0	8.28	10.13	100.6	402.4	295.1	274.3	22.5
	2	11.0	8.28	10.10	100.1	400.8	293.3	274.3	23.3
	3	10.8	8.29	10.10	99.8	401.6	292.3	274.5	29.3
	4	10.7	8.29	10.11	99.7	401.8	292.2	274.7	37.9
June	0	12.4	8.14	10.04	105.0	198.0	152.0	277.4	102.3
	1	12.2	8.14	10.38	103.3	198.9	149.9	277.3	112.2
	2	11.8	8.16	10.11	100.1	197.6	148.6	277.5	97.9
	3	10.8	8.18	10.01	99.3	197.2	145.3	279.2	129.7
	4	10.5	8.18	10.19	99.6	199.3	144.4	281.6	121.8
	5	10.2	8.16	10.32	100.0	201.4	144.5	284.6	127.6
	6	10.1	8.16	10.34	99.9	201.6	144.3	286.0	133.8
	7	10.1	8.14	10.34	99.8	202.0	144.6	287.5	151.0
	8	9.9	8.13	10.33	99.5	202.4	144.4	289.2	133.9
	9	9.8	8.12	10.38	99.5	202.9	144.1	290.7	144.9
	10	9.8	8.10	10.38	99.5	203.1	144.1	292.9	131.0
	11	9.7	8.08	10.40	99.6	202.8	143.7	294.8	154.6
	12	9.7	8.06	10.41	99.6	202.9	143.6	296.5	131.5
	13	9.6	8.05	10.42	99.6	202.7	143.3	298.1	152.7
	14	9.6	8.04	10.41	99.6	202.4	143.2	299.1	148.3
	15	9.6	8.02	10.41	99.5	202.3	143.1	300.6	132.1
August	1	21.5	8.45	7.58	108.3	262.3	282.5	248.5	6.0
	2	21.5	8.44	7.58	108.2	262.0	282.0	249.6	6.0
	3	21.3	8.46	7.59	108.3	261.8	281.5	248.7	5.9
	4	21.2	8.44	7.59	108.2	261.8	281.4	249.9	5.9
	5	21.2	8.45	7.59	108.1	261.7	281.2	249.7	5.9
	6	21.2	8.44	7.58	107.9	262.1	281.4	250.7	6.0
	7	21.2	8.45	7.56	107.7	262.0	281.3	250.5	6.0
	8	21.2	8.44	7.55	107.4	262.1	281.2	251.1	6.1
	9	21.2	8.40	7.45	105.9	266.6	285.8	251.5	6.6
	10	20.8	8.44	7.49	106.6	262.1	281.1	251.2	10.2
	11	20.3	8.25	7.22	101.1	276.4	291.9	259.6	6.0
	12	19.2	8.15	7.22	99.9	280.9	292.9	263.8	6.4
	13	18.2	8.16	7.19	98.7	282.7	292.5	266.0	6.3
	14	18	8.13	7.12	97.0	284.8	292.4	268.4	6.6
	15	17.8	8.12	7.06	95.9	285.1	291.8	269.2	7.0
	16	17.6	8.10	6.98	94.7	285.3	291.5	270.4	6.8
	17	17.6	8.06	6.72	90.8	283.7	288.9	271.9	7.4
	18	17.3	8.01	6.47	87.1	278.4	282.4	274.1	7.5
	19	16.6	8.00	6.43	86.5	277.7	281.4	274.4	7.6

Table B.3: In Situ Water Quality Profiles for Station RG_ER, Koocanusa Reservoir Monitoring Program, 2020

Month	Depth	Temperature	pH	Dissolved Oxygen		Specific Conductivity	Conductivity	ORP	Turbidity
	(m)	(˚C)	(pH units)	(mg/L)	(%)	(µS/cm)	(µS/cm)	(Mv)	(NTU)
April	1	10.8	8.34	10.56264	104.4738	416.4525	303.6534	281.1224	28.22041
	2	10.4	8.34	10.5002	102.8678	417.1838	300.9096	281.0441	42.79009
	3	9.9	8.32	10.35887	100.2709	419.9078	298.8423	282.3734	47.43288
	4	9.6	8.32	10.37	99.7	422.0	297.9	281.9	50.7
	5	9.4	8.31	10.37	99.3	422.8	296.8	282.5	54.5
	6	9.3	8.30	10.41	99.4	423.6	296.6	282.9	68.7
June	1	13.5	8.20	10.14	105.9	221.3	172.8	277.5	36.7
	2	13.3	8.20	10.19	105.9	221.2	171.7	278.4	37.6
	3	13.1	8.21	10.21	105.5	220.0	169.8	279.3	37.9
	4	12.5	8.18	10.00	102.1	208.2	158.6	282.5	66.9
	5	11.3	8.19	9.97	99.0	199.5	147.4	283.4	95.5
	6	10.5	8.18	10.10	98.5	198.2	143.4	286.7	114.4
	7	10.0	8.18	10.28	99.0	199.5	142.4	289.7	108.4
	8	9.9	8.18	10.31	99.1	199.7	142.2	291.2	125.0
	9	9.8	8.15	10.33	99.1	200.3	142.3	294.0	115.1
	10	9.8	8.13	10.37	99.3	201.1	142.6	296.0	110.2
	11	9.7	8.11	10.38	99.3	201.1	142.4	297.8	112.0
	12	9.7	8.10	10.38	99.2	202.7	143.3	299.4	113.9
	13	9.7	8.08	10.38	99.2	203.5	143.9	300.5	126.0
	14	9.6	8.07	10.40	99.3	203.2	143.5	301.8	114.5
	15	9.6	8.04	10.41	99.3	205.2	144.7	304.4	121.1
	16	9.6	8.03	10.42	99.3	204.8	144.4	305.5	159.3
	17	9.5	8.02	10.44	99.4	205.1	144.5	306.8	125.9
August	1	21.2	8.46	7.62	108.1	263.6	282.4	252.5	6.1
	2	21.2	8.46	7.61	108.0	263.4	282.2	252.2	5.9
	3	21.2	8.46	7.61	108.0	263.3	282.0	252.4	5.9
	4	21.2	8.45	7.61	108.0	263.1	281.7	253.1	5.9
	5	21.2	8.44	7.62	108.1	263.0	281.5	253.7	5.9
	6	21.2	8.45	7.62	108.1	262.9	281.5	253.5	6.0
	7	21.2	8.45	7.62	108.1	262.9	281.5	254.1	5.9
	8	21.2	8.45	7.61	108.0	262.9	281.4	253.9	5.9
	9	21.2	8.44	7.57	107.4	264.0	282.6	254.3	5.9
	10	20.7	8.36	7.30	103.2	274.6	292.8	257.1	6.2
	11	19.2	8.23	7.18	100.3	280.7	295.7	262.9	6.1
	12	18.8	8.17	7.16	98.8	282.3	294.0	266.6	6.1
	13	18.3	8.14	7.15	98.3	283.9	294.0	268.9	6.1
	14	18.1	8.14	7.12	97.3	285.7	294.5	269.9	6.1
	15	18	8.13	7.10	96.8	287.8	295.6	271.0	6.6
	16	17.9	8.13	7.09	96.4	290.1	297.5	271.7	6.4
	17	17.9	8.12	6.95	94.0	302.7	308.7	273.2	7.7
	18	17.6	8.08	6.62	89.0	296.8	300.8	274.1	10.1
	19	17.2	7.96	5.84	77.9	277.6	279.0	279.9	13.6
	20	15.7	7.76	4.69	61.1	255.6	250.5	290.7	10.1

Table B.4: In Situ Water Quality Profiles for Station RG_T4, Koocanusa Reservoir Monitoring Program, 2020

Month	Depth	Temperature	pH	Dissolved Oxygen		Specific Conductivity	Conductivity	ORP	Turbidity
	(m)	(˚C)	(pH units)	(mg/L)	(%)	(µS/cm)	(µS/cm)	(Mv)	(NTU)
April	0	10.9	8.39	11.04	109.6	433.1	316.8	287.3	9.3
	1	10.8	8.40	11.06	109.5	433.7	316.3	286.5	9.2
	2	10.6	8.39	10.93	107.3	428.6	310.6	286.6	10.2
	3	10.1	8.38	10.87	105.7	431.4	308.3	286.9	11.3
	4	9.7	8.36	10.78	103.9	433.6	306.9	287.6	11.3
	5	9.4	8.36	10.78	103.1	432.2	303.2	288.0	13.3
	6	9.2	8.34	10.75	102.4	435.3	304.3	288.7	13.4
	7	9.0	8.33	10.76	102.0	440.3	306.0	289.3	12.3
	8	8.8	8.33	10.68	100.7	441.9	305.1	290.0	8.6
	9	8.5	8.31	10.71	100.4	443.6	304.2	290.5	9.7
	10	8.4	8.30	10.70	99.9	444.3	303.4	291.2	9.2
	11	8.4	8.28	10.66	99.4	444.8	303.4	291.7	7.4
	12	8.1	8.24	10.50	97.5	449.0	304.4	293.3	6.5
	13	7.8	8.19	10.35	95.2	450.4	302.3	294.7	9.5
June	0	14.6	8.29	10.31	110.1	246.3	197.2	295.1	5.0
	1	14.6	8.29	10.25	109.6	246.2	197.3	295.0	4.8
	2	14.5	8.29	10.25	109.3	245.1	196.0	295.0	5.5
	3	14.2	8.27	10.03	106.3	242.4	192.5	297.1	6.3
	4	13.5	8.20	9.92	103.4	240.7	187.7	303.1	8.0
	5	12.9	8.16	9.81	100.9	234.0	179.9	307.6	16.1
	6	12.7	8.15	9.84	100.9	233.2	178.6	308.5	17.5
	7	12.6	8.14	9.86	100.6	231.1	176.2	309.8	22.1
	8	12.4	8.14	9.92	100.9	224.9	170.6	309.9	29.8
	9	11.9	8.12	9.95	100.1	218.8	164.2	309.8	51.2
	10	11.6	8.12	10.08	100.6	218.4	162.4	309.0	52.1
	11	11.4	8.11	10.13	100.7	218.2	161.5	308.6	55.1
	12	11.1	8.10	10.17	100.4	215.4	158.2	308.6	76.3
	13	10.7	8.08	10.20	99.7	217.0	157.6	308.8	74.0
	14	10.4	8.07	10.25	99.6	220.1	158.8	309.1	76.8
	15	10.4	8.06	10.26	99.6	220.5	158.9	309.5	73.5
	16	10.2	8.03	10.31	99.6	222.4	159.5	311.1	80.7
	17	10.0	8.01	10.35	99.7	223.8	159.8	312.3	81.0
	18	10.0	7.99	10.37	99.7	224.9	160.3	313.0	78.3
	19	9.9	7.97	10.39	99.7	225.8	160.6	313.9	95.7
	20	9.9	7.95	10.40	99.7	227.2	161.5	314.9	94.4
	21	9.8	7.92	10.41	99.7	228.3	161.9	316.0	88.6
	22	9.8	7.90	10.43	99.8	228.4	161.9	316.5	89.0
	23	9.7	7.89	10.43	99.8	228.7	162.1	317.3	89.9
	24	9.7	7.88	10.42	99.7	228.9	162.2	317.5	90.5
August	1	20.7	8.48	7.70	108.7	258.7	275.4	267.3	5.8
	2	21.0	8.48	7.70	108.7	258.6	275.4	267.7	5.7
	3	21.0	8.48	7.70	108.7	258.6	275.4	267.7	5.8
	4	21.0	8.48	7.69	108.6	258.6	275.4	267.5	5.8
	5	21.0	8.47	7.69	108.5	258.6	275.4	268.0	5.8
	6	20.8	8.47	7.69	108.5	258.6	275.4	267.8	5.8
	7	20.8	8.47	7.69	108.5	258.7	275.4	267.5	5.8
	8	20.8	8.47	7.67	108.3	258.8	275.6	267.7	5.8
	9	20.8	8.45	7.63	107.5	259.9	276.5	268.2	5.9
	10	20.7	8.41	7.59	106.9	263.4	279.9	270.2	5.9
	11	20.6	8.37	7.54	105.9	272.0	288.2	271.5	6.0
	12	20.2	8.28	7.41	103.3	281.9	295.8	275.7	5.8
	13	19.3	8.23	7.22	99.9	290.7	304.0	277.7	5.8
	14	18.6	8.20	7.10	97.6	288.9	299.3	280.5	6.3
	15	17.8	8.12	6.91	94.2	285.1	293.4	282.2	6.3
	16	17.3	8.09	6.76	91.3	283.7	289.1	285.8	6.5
	17	17.1	8.05	6.66	89.5	278.5	282.2	288.2	6.9
	18	16.8	8.03	6.53	87.5	276.7	279.4	289.5	7.0
	19	16.6	7.98	6.23	82.9	265.2	266.1	292.5	6.4
	20	15.1	7.85	5.68	74.5	246.7	244.6	296.9	6.7
	21	14.2	7.80	5.40	70.0	238.7	233.5	300.0	5.8
	22	13.5	7.80	5.34	68.6	231.2	223.7	301.8	5.9
	23	12.8	7.80	5.74	72.8	230.3	219.6	303.0	5.6
	24	12.6	7.78	5.75	72.5	232.3	220.3	305.1	5.8
	25	12.2	7.75	5.70	71.4	232.0	218.6	307.2	6.0
	26	12.0	7.71	5.59	69.4	234.1	219.7	309.3	7.3
	27	12.0	7.65	5.35	66.7	236.1	221.2	312.4	7.1

Table B.5: In Situ Water Quality Profiles for Station RG_GC, Koocanusa Reservoir Monitoring Program, 2020

Month	Depth	Temperature	pH	Dissolved Oxygen		Specific Conductivity	Conductivity	ORP	Turbidity
	(m)	(˚C)	(pH units)	(mg/L)	(%)	(µS/cm)	(µS/cm)	(Mv)	(NTU)
April	1	8.6	8.16	11.63	108.9	413.0	-	282.8	-
	2	8.4	8.15	11.67	108.9	414.4	-	283.5	-
	3	8.3	8.14	11.64	108.3	416.4	-	284.2	-
	4	8.2	8.13	11.64	108.1	417.7	-	284.9	-
	5	8.1	8.12	11.64	107.9	419.3	-	285.4	-
	6	8.0	8.10	11.55	106.8	426.9	-	286.8	-
	7	7.9	8.08	11.52	106.1	429.2	-	287.7	-
	8	7.8	8.07	11.52	106.0	428.9	-	288.5	-
	9	7.8	8.06	11.55	106.0	429.7	-	289.5	-
	10	7.7	8.03	11.53	105.8	432.5	-	290.6	-
	11	7.7	8.00	11.49	105.3	436.2	-	292.3	-
	12	7.5	7.97	11.45	104.4	439.4	-	294.2	-
	13	7.4	7.94	11.38	103.6	442.8	-	295.2	-
	14	7.3	7.94	11.34	102.9	436.6	-	295.9	-
	15	7.2	7.92	11.35	102.6	433.1	-	296.4	-
June	1	14.2	8.10	10.09	106.6	249.1	198.4	304.2	4.6
	2	14.0	8.10	10.09	106.3	247.8	196.1	304.2	5.3
	3	13.7	8.07	10.02	104.8	243.5	190.8	308.1	6.1
	4	13.3	8.05	10.00	103.8	243.2	189.0	310.5	6.6
	5	13.3	8.03	9.95	103.1	243.9	189.2	313.2	6.9
	6	12.9	7.97	9.84	101.2	238.1	183.0	319.2	9.1
	7	12.6	7.95	9.81	100.0	230.7	176.1	322.1	19.0
	8	12.3	7.93	9.83	99.5	225.6	170.6	323.5	29.4
	9	12.0	7.91	9.90	99.7	226.3	170.1	324.0	35.2
	10	12.0	7.92	9.91	99.7	226.1	169.8	324.0	33.8
	11	11.9	7.90	9.95	99.9	226.4	169.6	324.3	34.3
	12	11.8	7.89	9.96	99.8	224.9	168.0	324.8	39.9
	13	11.7	7.87	10.00	100.0	225.0	167.8	325.7	42.7
	14	11.6	7.85	10.00	99.8	224.5	167.0	326.7	44.7
	15	11.5	7.82	10.04	99.9	225.3	167.1	327.8	43.3
	16	11.3	7.79	10.09	100.0	225.7	166.8	328.9	57.6
	17	11.3	7.77	10.10	100.0	225.7	166.5	330.3	48.3
	18	10.9	7.74	10.12	99.4	224.3	163.9	331.1	64.2
	19	10.9	7.74	10.11	99.3	224.5	164.1	331.4	65.6
	20	10.8	7.72	10.11	99.1	225.8	164.5	332.4	64.7
	21	10.6	7.72	10.13	98.9	227.1	164.8	333.3	62.0
	22	10.6	7.70	10.15	98.8	227.4	164.8	333.7	64.1
	23	10.5	7.69	10.14	98.7	227.5	164.5	334.8	88.9
	24	10.4	7.68	10.19	98.9	228.1	164.4	335.3	67.2
	25	10.3	7.67	10.23	99.2	228.3	164.3	335.8	78.8
	26	10.2	7.66	10.22	98.8	229.0	164.4	335.8	88.6
August	1	20.7	8.47	7.62	107.7	257.3	274.6	253.9	5.9
	2	20.7	8.46	7.62	107.8	257.4	274.7	253.4	6.0
	3	20.7	8.45	7.62	107.8	257.7	275.0	254.2	5.9
	4	20.7	8.45	7.62	107.8	257.3	274.6	254.8	5.8
	5	20.7	8.45	7.62	107.7	257.4	274.6	254.8	5.9
	6	20.7	8.45	7.62	107.7	257.3	274.5	254.8	6.0
	7	20.7	8.45	7.62	107.7	257.4	274.5	255.0	6.1
	8	20.7	8.44	7.61	107.6	257.2	274.3	255.8	5.9
	9	20.7	8.45	7.61	107.5	257.1	274.0	255.8	5.8
	10	20.6	8.45	7.58	107.0	257.0	273.8	256.1	5.9
	11	20.6	8.30	7.42	103.6	273.7	288.8	262.7	5.9
	12	19.9	8.29	7.35	102.4	271.2	284.7	263.8	5.9
	13	19.6	8.27	7.28	101.3	272.5	285.9	264.8	5.8
	14	19.3	8.22	7.17	99.2	282.2	293.6	267.4	5.8
	15	18.8	8.20	7.15	98.6	282.8	294.4	268.4	5.9
	16	18.3	8.17	7.09	97.4	282.8	293.3	270.2	5.9
	17	17.9	8.13	7.00	95.5	283.8	292.1	272.3	5.9
	18	17.6	8.08	6.84	92.7	280.0	286.3	275.3	6.0
	19	17.3	8.05	6.69	90.4	277.5	282.7	276.6	6.6
	20	16.8	7.93	6.20	83.0	253.0	255.7	281.7	7.4
	21	14.3	7.84	5.72	74.7	234.6	232.0	287.4	7.0
	22	13.2	7.79	5.62	72.0	228.6	220.7	290.7	6.6
	23	12.6	7.80	5.74	72.9	225.5	215.6	291.3	6.3
	24	12.1	7.82	5.92	74.7	224.3	212.9	291.7	6.2
	25	12.0	7.81	6.17	77.4	225.0	212.3	293.0	6.1
	26	12.0	7.76	6.31	78.7	226.3	212.3	296.2	5.9
	27	11.9	7.72	6.28	77.9	228.9	213.3	299.0	6.2
	28	11.7	7.70	6.20	76.9	230.1	214.4	301.0	8.8
	29	11.7	7.63	5.84	72.0	233.0	216.1	304.3	10.1

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_SC_U1	RG_SC_U2	RG_SC_U3	RG_SC_U1	RG_SC_U2
					21-Apr-20	21-Apr-20	21-Apr-20	18-Jun-20	18-Jun-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	149	159	167	97.5	99.5
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.52	8.69	8.72	8.08	8.08
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.24	8.24	8.24	8.03	8.05
	Total Sus. Solids, Lab	mg/L	-	-	38.7	46.3	44.2	62.0	63.9
	Total Dissolved Solids	mg/L	-	-	186	211	214	129	129
	Dissolved Oxygen-Field	mg/L	< 8	< 5	14.5	14.4	14.0	10.3	10.3
	Dissolved Oxygen-Field	%	-	-	124	126	123	100	99.8
	Temperature-Field	C	-	-	9.30	9.00	8.90	10.7	10.0
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.0499	0.0535	0.0651	0.0204	0.00860
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	4.45	5.96	6.11	1.15	1.15
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0890	0.0950	0.0950	0.0370	0.0370
	Nitrate (as N)	mg/L	3	32.8	0.0748	0.0596	0.0568	0.113	0.112
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	<0.00100	0.00110	<0.00100	<0.00100	<0.00100
	Phosphorus (P)-Total	mg/L	-	-	0.0186	0.0259	0.0248	0.0208	0.0176
	Sulphate (SO_4)	mg/L	309 - 429	-	33.6	44.6	45.9	12.6	12.7
Total Metals	Aluminum (Al)	mg/L	-	-	0.402	0.316	0.508	2.52	2.29
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000730	0.000800	0.000870	0.000610	0.000600
	Barium (Ba)	mg/L	1	-	0.0458	0.0479	0.0490	0.0454	0.0428
	Beryllium (Be)	mg/L	0.00013	-	0.0000250	0.0000220	0.0000240	0.0000800	0.0000890
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	0.0120	0.0160	0.0160	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	-	-	0.0000131	0.0000167	0.0000165	0.0000130	0.0000129
	Calcium (Ca)	mg/L	-	-	51.4	53.7	53.6	37.4	37.3
	Chromium (Cr)	mg/L	0.001	-	0.000660	0.000460	0.000750	0.00311	0.00264
	Cobalt (Co)	mg/L	0.004	0.11	0.000380	0.000360	0.000420	0.000720	0.000700
	Copper (Cu)	mg/L	-	-	0.00101	0.000840	0.00112	0.00166	0.00151
	Iron (Fe)	mg/L	-	1	0.721	0.649	0.896	1.47	1.47
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000682	0.000854	0.000825	0.00101	0.00100
	Lithium (Li)	mg/L	-	-	0.00260	0.00280	0.00320	0.00290	0.00280
	Magnesium (Mg)	mg/L	-	-	13.8	15.6	15.5	8.01	8.03
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0344	0.0371	0.0348	0.0310	0.0314
	Mercury (Hg)	µg/L	0.00125	-	0.00123	0.00107	0.00107	0.00173	0.00167
	Molybdenum (Mo)	mg/L	1	2	0.000543	0.000665	0.000797	0.000478	0.000544
	Nickel (Ni)	mg/L	0.025	-	0.000760	0.000660	0.000940	0.00175	0.00164
	Potassium (K)	mg/L	-	-	0.744	0.841	0.881	1.19	1.11
	Selenium (Se)	mg/L	0.002	-	0.000115	0.000159	0.000108	0.000112	0.000103
	Silicon (Si)-Total	mg/L	-	-	2.74	2.60	2.85	7.57	6.55
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	0.0000140
	Sodium (Na)	mg/L	-	-	6.40	8.46	8.57	1.67	1.63
	Strontium (Sr)	mg/L	-	-	0.172	0.231	0.230	0.131	0.129
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	<0.0000100	<0.0000100	0.0000210	0.0000190
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	0.110	0.0800
	Uranium (U)	mg/L	0.0085	-	0.000694	0.000897	0.000908	0.000619	0.000596
	Vanadium (V)	mg/L	-	-	0.000700	0.000610	0.000790	0.00286	0.00271
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	0.00490	0.00480	0.00620	0.00500	0.00450
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	<0.00300	0.00500	<0.00300	0.0276	0.0267
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000460	0.000540	0.000560	0.000270	0.000270
	Barium (Ba)	mg/L	-	-	0.0422	0.0419	0.0436	0.0224	0.0230
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	0.0100	0.0150	0.0160	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	39.7	41.2	43.5	26.4	26.8
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	0.000120	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	<0.000200	0.000290	0.000230	0.000350	0.000370
	Iron (Fe)	mg/L	-	0.35	0.0140	0.0390	0.0200	0.0130	0.0130
	Lead (Pb)	mg/L	-	-	<0.0000500	0.0000540	0.0000630	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00190	0.00230	0.00240	<0.00100	<0.00100
	Magnesium (Mg)	mg/L	-	-	12.1	13.8	14.3	7.70	7.90
	Manganese (Mn)	mg/L	-	-	0.0134	0.0121	0.0117	0.00272	0.00269
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000589	0.000692	0.000720	0.000420	0.000428
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.647	0.738	0.773	0.390	0.404
	Selenium (Se)	mg/L	-	-	0.000106	0.000146	0.000127	0.0000860	0.0000870
	Silicon (Si)	mg/L	-	-	2.06	2.03	1.86	2.00	1.97
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	5.55	7.49	7.95	1.55	1.61
	Strontium (Sr)	mg/L	-	-	0.140	0.172	0.183	0.103	0.106
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000696	0.000817	0.000911	0.000543	0.000556
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	0.00200	0.00150	0.00140	<0.00100	<0.00100

Exceeds CCME Long Term Guideline.

Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_SC_U3	RG_SC_U1	RG_SC_U2	RG_SC_U3	RG_TN_U1
					18-Jun-20	26-Aug-20	26-Aug-20	26-Aug-20	22-Apr-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	99.0	125	125	138	173
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.00	8.42	8.37	8.14	8.28
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.06	8.23	8.21	8.19	8.36
	Total Sus. Solids, Lab	mg/L	-	-	64.7	<1.00	<1.00	1.60	18.2
	Total Dissolved Solids	mg/L	-	-	123	153	158	166	183
	Dissolved Oxygen-Field	mg/L	< 8	< 5	10.4	7.50	7.47	7.17	10.1
	Dissolved Oxygen-Field	%	-	-	99.7	107	106	97.4	100
	Temperature-Field	C	-	-	9.60	21.5	21.2	17.5	11.0
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.00580	0.0305	0.0521	0.0138	0.0370
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	1.15	2.89	2.42	3.63	5.90
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0370	0.103	0.0830	0.0870	0.0880
	Nitrate (as N)	mg/L	3	32.8	0.119	0.118	0.0677	0.0544	0.0664
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	<0.00100	0.00170	0.00130	<0.00100	<0.00100
	Phosphorus (P)-Total	mg/L	-	-	0.0180	<0.00200	0.00210	0.00380	0.0126
	Sulphate (SO_4)	mg/L	309 - 429	-	12.6	22.2	23.8	28.3	44.7
Total Metals	Aluminum (Al)	mg/L	-	-	2.11	0.00920	0.0111	0.0322	0.165
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000670	0.000360	0.000350	0.000390	0.000700
	Barium (Ba)	mg/L	1	-	0.0403	0.0397	0.0373	0.0370	0.0486
	Beryllium (Be)	mg/L	0.00013	-	0.0000530	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100	<0.0100	<0.0100	<0.0100	0.0140
	Cadmium (Cd)	mg/L	-	-	0.0000118	<0.00000500	<0.00000500	<0.00000500	0.0000104
	Calcium (Ca)	mg/L	-	-	36.9	31.6	31.7	34.2	45.4
	Chromium (Cr)	mg/L	0.001	-	0.00248	<0.000100	<0.000100	0.000100	0.000230
	Cobalt (Co)	mg/L	0.004	0.11	0.000700	<0.000100	<0.000100	<0.000100	0.000210
	Copper (Cu)	mg/L	-	-	0.00151	<0.000500	<0.000500	<0.000500	<0.000500
	Iron (Fe)	mg/L	-	1	1.42	<0.0100	0.0110	0.0420	0.302
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000988	0.0000520	<0.0000500	0.0000860	0.000440
	Lithium (Li)	mg/L	-	-	0.00280	0.00180	0.00160	0.00150	0.00250
	Magnesium (Mg)	mg/L	-	-	7.94	9.50	9.97	10.7	14.3
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0302	0.00112	0.00141	0.00502	0.0265
	Mercury (Hg)	µg/L	0.00125	-	0.00124	<0.000500	<0.000500	<0.000500	0.000690
	Molybdenum (Mo)	mg/L	1	2	0.000507	0.000596	0.000611	0.000697	0.000628
	Nickel (Ni)	mg/L	0.025	-	0.00154	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	1.00	0.495	0.512	0.574	0.789
	Selenium (Se)	mg/L	0.002	-	0.0000880	0.00101	0.000719	0.000208	0.000192
	Silicon (Si)-Total	mg/L	-	-	7.25	0.960	1.29	2.12	2.58
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	0.0000160	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.59	2.54	3.01	4.39	7.49
	Strontium (Sr)	mg/L	-	-	0.126	0.126	0.134	0.163	0.183
	Thallium (Tl)	mg/L	0.0008	-	0.0000180	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	0.0680	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000613	0.000613	0.000636	0.000708	0.000856
	Vanadium (V)	mg/L	-	-	0.00234	<0.000500	<0.000500	<0.000500	0.000530
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	0.00460	<0.00300	<0.00300	<0.00300	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.0312	0.00350	0.00360	0.00380	0.00440
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000260	0.000340	0.000340	0.000400	0.000580
	Barium (Ba)	mg/L	-	-	0.0232	0.0418	0.0396	0.0394	0.0458
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	0.0140
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	26.4	34.0	33.0	38.2	46.2
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000350	0.000260	0.000210	<0.000200	0.000240
	Iron (Fe)	mg/L	-	0.35	0.0160	<0.0100	<0.0100	<0.0100	0.0130
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	<0.00100	0.00170	0.00170	0.00140	0.00240
	Magnesium (Mg)	mg/L	-	-	8.06	9.64	10.4	10.3	13.9
	Manganese (Mn)	mg/L	-	-	0.00316	0.000260	0.000260	0.000520	0.0138
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000413	0.000615	0.000635	0.000728	0.000669
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.408	0.523	0.520	0.565	0.748
	Selenium (Se)	mg/L	-	-	0.0000860	0.000896	0.000780	0.000225	0.000218
	Silicon (Si)	mg/L	-	-	1.99	0.835	1.18	1.85	2.26
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.59	2.64	3.10	4.31	7.71
	Strontium (Sr)	mg/L	-	-	0.103	0.126	0.131	0.153	0.180
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000557	0.000660	0.000638	0.000723	0.000890
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	<0.00100	0.00100	0.00180	0.00200	0.00100

Exceeds CCME Long Term Guideline. (grey)

Exceeds CCME Short Term Guideline. (blue)

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_TN_U1	RG_TN_U2	RG_TN_U3	RG_TN_U1	RG_TN_U2
					18-Jun-20	18-Jun-20	18-Jun-20	26-Aug-20	26-Aug-20
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	101	98.1	99.7	128	129
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.18	8.14	8.06	8.46	8.40
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.07	8.06	8.08	8.30	8.26
	Total Sus. Solids, Lab	mg/L	-	-	57.1	62.2	66.9	<1.00	<1.00
	Total Dissolved Solids	mg/L	-	-	121	128	130	155	157
	Dissolved Oxygen-Field	mg/L	< 8	< 5	10.0	10.3	10.4	7.59	7.45
	Dissolved Oxygen-Field	%	-	-	99.3	99.8	99.6	108	106
	Temperature-Field	C	-	-	10.8	10.1	9.70	21.3	21.2
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	<0.00500	0.0219	0.0128	0.0872	0.0330
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	1.12	1.13	1.11	1.81	2.25
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0370	0.0360	0.0360	0.0830	0.0830
	Nitrate (as N)	mg/L	3	32.8	0.112	0.110	0.112	0.106	0.0776
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	<0.00100	<0.00100	<0.00100	0.00200	0.00150
	Phosphorus (P)-Total	mg/L	-	-	0.0159	0.0157	0.0216	0.00210	<0.00200
	Sulphate (SO_4)	mg/L	309 - 429	-	12.3	12.3	12.3	21.8	23.2
Total Metals	Aluminum (Al)	mg/L	-	-	0.424	0.854	0.742	0.00980	0.0157
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000420	0.000590	0.000500	0.000330	0.000380
	Barium (Ba)	mg/L	1	-	0.0309	0.0323	0.0327	0.0400	0.0388
	Beryllium (Be)	mg/L	0.00013	-	0.0000260	0.0000420	0.0000420	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	-	-	0.0000110	0.0000130	0.0000129	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	37.2	36.5	37.2	31.2	30.9
	Chromium (Cr)	mg/L	0.001	-	0.000500	0.00105	0.000950	<0.000100	<0.000100
	Cobalt (Co)	mg/L	0.004	0.11	0.000400	0.000560	0.000500	<0.000100	<0.000100
	Copper (Cu)	mg/L	-	-	0.000880	0.00131	0.00105	<0.000500	<0.000500
	Iron (Fe)	mg/L	-	1	0.443	1.16	0.712	<0.0100	0.0160
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000742	0.000897	0.000834	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00130	0.00290	0.00200	0.00180	0.00170
	Magnesium (Mg)	mg/L	-	-	7.40	8.01	7.80	9.55	10.0
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0249	0.0279	0.0288	0.00117	0.00162
	Mercury (Hg)	µg/L	0.00125	-	0.00161	0.00185	0.00182	<0.000500	<0.000500
	Molybdenum (Mo)	mg/L	1	2	0.000403	0.000523	0.000415	0.000621	0.000656
	Nickel (Ni)	mg/L	0.025	-	0.000600	0.00119	0.000820	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.498	0.583	0.606	0.500	0.517
	Selenium (Se)	mg/L	0.002	-	0.0000930	0.000117	0.0000970	0.00107	0.000757
	Silicon (Si)-Total	mg/L	-	-	2.73	3.37	3.43	0.980	1.23
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.61	1.68	1.66	2.46	3.02
	Strontium (Sr)	mg/L	-	-	0.128	0.131	0.125	0.127	0.138
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	0.0140	<0.0180	<0.0100	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000602	0.000573	0.000577	0.000635	0.000642
	Vanadium (V)	mg/L	-	-	0.000640	0.00105	0.00111	<0.000500	<0.000500
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300	0.00420	0.00310	<0.00300	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.0273	0.0301	0.0304	0.00360	0.00680
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000260	0.000260	0.000270	0.000310	0.000370
	Barium (Ba)	mg/L	-	-	0.0239	0.0230	0.0229	0.0419	0.0409
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	27.3	26.6	27.2	35.8	35.7
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000360	0.000370	0.000350	0.000270	0.000340
	Iron (Fe)	mg/L	-	0.35	0.0140	0.0150	0.0180	<0.0100	<0.0100
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	<0.00100	<0.00100	<0.00100	0.00180	0.00170
	Magnesium (Mg)	mg/L	-	-	7.95	7.72	7.72	9.37	9.67
	Manganese (Mn)	mg/L	-	-	0.00287	0.00295	0.00298	0.000310	0.000360
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000444	0.000437	0.000423	0.000632	0.000631
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.402	0.398	0.399	0.497	0.561
	Selenium (Se)	mg/L	-	-	0.0000780	0.000104	0.0000810	0.00120	0.000831
	Silicon (Si)	mg/L	-	-	2.04	1.98	1.97	0.852	1.11
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.58	1.56	1.54	2.53	2.96
	Strontium (Sr)	mg/L	-	-	0.107	0.104	0.104	0.124	0.128
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000562	0.000549	0.000545	0.000643	0.000648
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	<0.00100	<0.00100	<0.00100	<0.00100	0.00470

Exceeds CCME Long Term Guideline. (grey)
Exceeds CCME Short Term Guideline. (blue)

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_TN_U3	RG_ER_U1	RG_ER_U2	RG_ER_U1	RG_ER_U2
					26-Aug-20	22-Apr-20	22-Apr-20	18-Jun-20	18-Jun-20
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	138	184	185	107	96.7
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.12	8.34	8.32	8.21	8.15
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.19	8.36	8.37	8.06	8.03
	Total Sus. Solids, Lab	mg/L	-	-	1.20	19.8	26.6	15.5	58.4
	Total Dissolved Solids	mg/L	-	-	169	198	212	127	136
	Dissolved Oxygen-Field	mg/L	< 8	< 5	7.06	10.5	10.4	10.2	10.3
	Dissolved Oxygen-Field	%	-	-	95.9	103	99.7	106	99.1
	Temperature-Field	C	-	-	17.8	10.4	9.60	13.1	9.80
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.0526	0.0690	0.0304	<0.00500	<0.00500
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	3.53	4.34	3.78	1.33	1.09
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0840	0.122	0.107	0.0430	0.0380
	Nitrate (as N)	mg/L	3	32.8	0.0508	0.713	0.846	0.181	0.125
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	0.00100	0.00310	0.00130	0.00100	<0.00100
	Phosphorus (P)-Total	mg/L	-	-	0.00230	0.00810	0.0309	0.0118	0.0177
	Sulphate (SO_4)	mg/L	309 - 429	-	28.1	46.3	45.9	15.4	12.3
Total Metals	Aluminum (Al)	mg/L	-	-	0.0265	0.427	0.614	0.937	1.65
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000410	0.000600	0.000620	0.000460	0.000560
	Barium (Ba)	mg/L	1	-	0.0383	0.0856	0.0917	0.0367	0.0386
	Beryllium (Be)	mg/L	0.00013	-	<0.0000200	0.0000290	0.0000420	0.0000330	0.0000560
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100	0.0110	0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	-	-	<0.00000500	0.0000240	0.0000334	0.00000990	0.0000126
	Calcium (Ca)	mg/L	-	-	33.0	49.6	49.0	31.3	33.8
	Chromium (Cr)	mg/L	0.001	-	0.000160	0.000610	0.000780	0.00106	0.00183
	Cobalt (Co)	mg/L	0.004	0.11	<0.000100	0.000260	0.000320	0.000260	0.000600
	Copper (Cu)	mg/L	-	-	<0.000500	0.000760	0.000990	0.000770	0.00134
	Iron (Fe)	mg/L	-	1	0.0350	0.475	0.692	0.482	1.13
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.0000750	0.000441	0.000583	0.000399	0.000892
	Lithium (Li)	mg/L	-	-	0.00150	0.00530	0.00610	0.00190	0.00230
	Magnesium (Mg)	mg/L	-	-	11.1	15.3	14.8	7.74	7.62
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.00511	0.0261	0.0304	0.0126	0.0289
	Mercury (Hg)	µg/L	0.00125	-	<0.000500	0.00172	0.00236	0.00107	0.000930
	Molybdenum (Mo)	mg/L	1	2	0.000689	0.000764	0.000779	0.000511	0.000474
	Nickel (Ni)	mg/L	0.025	-	<0.000500	0.000870	0.00110	0.000630	0.00121
	Potassium (K)	mg/L	-	-	0.576	0.854	0.897	0.696	0.877
	Selenium (Se)	mg/L	0.002	-	0.000160	0.00372	0.00426	0.000485	0.000121
	Silicon (Si)-Total	mg/L	-	-	2.10	2.96	3.20	4.66	5.82
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	4.31	5.01	4.14	1.85	1.54
	Strontium (Sr)	mg/L	-	-	0.152	0.178	0.175	0.111	0.117
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	0.0000120	0.0000180	<0.0000100	0.0000150
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	0.0350	0.0650
	Uranium (U)	mg/L	0.0085	-	0.000714	0.000797	0.000788	0.000570	0.000574
	Vanadium (V)	mg/L	-	-	<0.000500	0.00108	0.00143	0.00127	0.00210
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300	0.00320	0.00350	<0.00300	0.00410
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.00350	0.00490	0.00600	0.0233	0.0253
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000390	0.000380	0.000360	0.000290	0.000280
	Barium (Ba)	mg/L	-	-	0.0409	0.0747	0.0831	0.0288	0.0233
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100	0.0100	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	0.00000600	0.00000830	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	37.6	48.9	49.3	28.7	26.5
	Chromium (Cr)	mg/L	-	-	<0.000100	0.000110	0.000110	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000210	0.000400	0.000530	0.000370	0.000370
	Iron (Fe)	mg/L	-	0.35	<0.0100	<0.0100	0.0110	0.0110	0.0120
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	0.0000880
	Lithium (Li)	mg/L	-	-	0.00150	0.00490	0.00550	0.00120	<0.00100
	Magnesium (Mg)	mg/L	-	-	10.6	14.9	15.0	8.53	7.40
	Manganese (Mn)	mg/L	-	-	0.000410	0.0110	0.0115	0.00220	0.00247
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000721	0.000799	0.000810	0.000475	0.000460
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.592	0.691	0.697	0.453	0.401
	Selenium (Se)	mg/L	-	-	0.000237	0.00387	0.00483	0.000472	0.000128
	Silicon (Si)	mg/L	-	-	1.83	2.18	2.19	2.07	1.92
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	4.37	5.04	4.42	1.86	1.52
	Strontium (Sr)	mg/L	-	-	0.154	0.180	0.178	0.105	0.103
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000728	0.000840	0.000787	0.000580	0.000564
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	0.00110	0.00110	<0.00100	<0.00100	<0.00100

Exceeds CCME Long Term Guideline. (grey)

Exceeds CCME Short Term Guideline. (blue)

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_ER_U3	RG_ER_U1	RG_ER_U2	RG_ER_U3	RG_T4_U1
					18-Jun-20	26-Aug-20	26-Aug-20	26-Aug-20	22-Apr-20
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	99.8	127	133	140	186
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.07	8.46	8.36	8.12	8.38
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.04	8.27	8.25	8.21	8.40
	Total Sus. Solids, Lab	mg/L	-	-	60.6	<1.00	<1.00	<1.00	7.90
	Total Dissolved Solids	mg/L	-	-	134	152	163	173	207
	Dissolved Oxygen-Field	mg/L	< 8	< 5	10.4	7.61	7.30	6.95	10.9
	Dissolved Oxygen-Field	%	-	-	99.3	108	103	94.0	106
	Temperature-Field	C	-	-	9.60	21.2	20.7	17.9	10.1
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	<0.00500	0.0854	0.0214	0.0660	0.0400
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	1.06	2.94	2.54	4.14	5.75
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0390	0.108	0.0870	0.109	0.104
	Nitrate (as N)	mg/L	3	32.8	0.136	0.158	0.107	0.159	0.523
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	<0.00100	0.00190	0.00110	0.00130	0.00120
	Phosphorus (P)-Total	mg/L	-	-	0.0173	<0.00200	<0.00200	<0.00200	0.00890
	Sulphate (SO_4)	mg/L	309 - 429	-	12.5	22.2	25.2	29.2	49.1
Total Metals	Aluminum (Al)	mg/L	-	-	1.13	0.00980	0.0178	0.0258	0.110
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000580	0.000290	0.000360	0.000390	0.000550
	Barium (Ba)	mg/L	1	-	0.0348	0.0408	0.0401	0.0413	0.0686
	Beryllium (Be)	mg/L	0.00013	-	0.0000620	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100	<0.0100	<0.0100	<0.0100	0.0130
	Cadmium (Cd)	mg/L	-	-	0.0000131	<0.00000500	<0.00000500	<0.00000500	0.0000109
	Calcium (Ca)	mg/L	-	-	34.7	31.1	34.4	34.1	49.0
	Chromium (Cr)	mg/L	0.001	-	0.00143	<0.000100	<0.000100	<0.000100	0.000220
	Cobalt (Co)	mg/L	0.004	0.11	0.000600	<0.000100	<0.000100	<0.000100	0.000120
	Copper (Cu)	mg/L	-	-	0.00140	<0.000500	<0.000500	<0.000500	<0.000500
	Iron (Fe)	mg/L	-	1	1.19	<0.0100	0.0190	0.0300	0.147
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000903	<0.0000500	<0.0000500	0.0000680	0.000250
	Lithium (Li)	mg/L	-	-	0.00220	0.00180	0.00190	0.00180	0.00430
	Magnesium (Mg)	mg/L	-	-	7.59	9.57	10.3	11.0	15.2
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0285	0.00106	0.00255	0.00449	0.0193
	Mercury (Hg)	µg/L	0.00125	-	0.000900	<0.000500	<0.000500	<0.000500	0.000710
	Molybdenum (Mo)	mg/L	1	2	0.000488	0.000624	0.000672	0.000720	0.000764
	Nickel (Ni)	mg/L	0.025	-	0.00124	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.649	0.489	0.533	0.571	0.796
	Selenium (Se)	mg/L	0.002	-	0.000203	0.00112	0.000817	0.000695	0.00266
	Silicon (Si)-Total	mg/L	-	-	4.19	1.06	1.55	2.11	2.43
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.44	2.46	3.35	4.05	6.64
	Strontium (Sr)	mg/L	-	-	0.119	0.127	0.140	0.152	0.196
	Thallium (Tl)	mg/L	0.0008	-	0.0000120	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	0.0230	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000557	0.000623	0.000676	0.000692	0.000935
	Vanadium (V)	mg/L	-	-	0.00135	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	0.00430	<0.00300	<0.00300	<0.00300	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.0315	0.00410	0.00440	0.00390	<0.00300
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000260	0.000310	0.000340	0.000420	0.000420
	Barium (Ba)	mg/L	-	-	0.0242	0.0428	0.0412	0.0437	0.0678
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	0.0130
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	0.00000850
	Calcium (Ca)	mg/L	-	-	27.1	35.1	36.7	38.1	48.9
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000360	0.000270	0.000220	<0.000200	0.000330
	Iron (Fe)	mg/L	-	0.35	0.0170	<0.0100	<0.0100	<0.0100	<0.0100
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	<0.00100	0.00180	0.00170	0.00180	0.00440
	Magnesium (Mg)	mg/L	-	-	7.84	9.48	9.95	10.8	15.6
	Manganese (Mn)	mg/L	-	-	0.00280	0.000490	0.000350	0.000550	0.00620
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000455	0.000624	0.000654	0.000741	0.000780
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.410	0.507	0.543	0.596	0.737
	Selenium (Se)	mg/L	-	-	0.000177	0.00108	0.000838	0.000627	0.00297
	Silicon (Si)	mg/L	-	-	1.97	0.960	1.35	1.81	2.16
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	1.53	2.53	3.29	4.06	6.69
	Strontium (Sr)	mg/L	-	-	0.103	0.124	0.132	0.149	0.189
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000577	0.000630	0.000674	0.000732	0.000929
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	<0.00100	0.00260	0.00340	0.00130	0.00110

(grey) Exceeds CCME Long Term Guideline.

(blue) Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

Analyte		Units	Long Term Guidelines	Short Term Guidelines	RG_T4_U2	RG_T4_U3	RG_T4_U1	RG_T4_U2	RG_T4_U3
					22-Apr-20	22-Apr-20	18-Jun-20	18-Jun-20	18-Jun-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	192	187	117	106	108
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.33	8.28	8.27	8.10	7.92
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.40	8.40	8.13	8.09	8.10
	Total Sus. Solids, Lab	mg/L	-	-	7.70	6.90	2.30	22.9	37.9
	Total Dissolved Solids	mg/L	-	-	212	222	141	137	140
	Dissolved Oxygen-Field	mg/L	< 8	< 5	10.8	10.7	10.0	10.2	10.4
	Dissolved Oxygen-Field	%	-	-	102	99.4	106	100	99.7
	Temperature-Field	C	-	-	9.00	8.40	14.2	11.1	9.80
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.00740	0.0358	0.00880	0.0304	0.0123
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	5.77	5.81	1.61	1.24	1.07
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.102	0.104	0.0490	0.0440	0.0510
	Nitrate (as N)	mg/L	3	32.8	0.530	0.527	0.264	0.206	0.308
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	0.00200	0.00130	0.00150	<0.00100	<0.00100
	Phosphorus (P)-Total	mg/L	-	-	0.00710	0.00710	0.00560	0.0126	0.0161
	Sulphate (SO_4)	mg/L	309 - 429	-	49.5	50.2	19.0	15.0	16.3
Total Metals	Aluminum (Al)	mg/L	-	-	0.0972	0.0613	0.0557	0.435	0.885
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000530	0.000530	0.000360	0.000440	0.000610
	Barium (Ba)	mg/L	1	-	0.0701	0.0748	0.0377	0.0347	0.0413
	Beryllium (Be)	mg/L	0.00013	-	<0.0000200	<0.0000200	<0.0000200	0.0000240	0.0000410
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	0.0130	0.0140	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	-	-	0.0000137	0.00000860	0.00000770	0.0000141	0.0000295
	Calcium (Ca)	mg/L	-	-	48.6	50.6	34.0	37.4	38.2
	Chromium (Cr)	mg/L	0.001	-	0.000220	0.000160	0.000120	0.000630	0.00113
	Cobalt (Co)	mg/L	0.004	0.11	0.000100	0.000100	<0.000100	0.000240	0.000410
	Copper (Cu)	mg/L	-	-	<0.000500	<0.000500	<0.000500	0.000800	0.00104
	Iron (Fe)	mg/L	-	1	0.132	0.0960	0.0460	0.346	0.843
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000236	0.000202	0.000250	0.000433	0.000657
	Lithium (Li)	mg/L	-	-	0.00430	0.00420	0.00190	0.00190	0.00280
	Magnesium (Mg)	mg/L	-	-	15.2	16.2	8.89	8.32	8.92
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0177	0.0177	0.00360	0.0165	0.0265
	Mercury (Hg)	µg/L	0.00125	-	0.000650	0.000580	0.000780	0.00142	0.00196
	Molybdenum (Mo)	mg/L	1	2	0.000762	0.000748	0.000522	0.000468	0.000565
	Nickel (Ni)	mg/L	0.025	-	<0.000500	<0.000500	<0.000500	0.000550	0.00110
	Potassium (K)	mg/L	-	-	0.777	0.808	0.503	0.541	0.678
	Selenium (Se)	mg/L	0.002	-	0.00283	0.00265	0.000939	0.000515	0.000959
	Silicon (Si)-Total	mg/L	-	-	2.38	2.37	2.38	3.29	3.55
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	6.62	7.08	2.36	1.83	1.71
	Strontium (Sr)	mg/L	-	-	0.186	0.196	0.115	0.119	0.125
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	0.0000150
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	0.0120	<0.0160
	Uranium (U)	mg/L	0.0085	-	0.000926	0.000915	0.000591	0.000590	0.000683
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	0.000850	0.00175
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300	<0.00300	<0.00300	<0.00300	0.00400
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	<0.00300	<0.00300	0.0180	0.0186	0.0258
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000420	0.000410	0.000300	0.000290	0.000260
	Barium (Ba)	mg/L	-	-	0.0682	0.0692	0.0378	0.0293	0.0325
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	0.0130	0.0130	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	0.00000790	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	50.6	48.7	30.7	28.6	28.4
	Chromium (Cr)	mg/L	-	-	0.000110	<0.000100	<0.000100	<0.000100	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000450	0.000280	0.000370	0.000330	0.000330
	Iron (Fe)	mg/L	-	0.35	<0.0100	<0.0100	<0.0100	<0.0100	0.0120
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00440	0.00430	0.00160	0.00120	0.00160
	Magnesium (Mg)	mg/L	-	-	15.9	16.0	9.87	8.49	8.89
	Manganese (Mn)	mg/L	-	-	0.00581	0.00361	0.000930	0.00249	0.00312
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000783	0.000771	0.000487	0.000514	0.000523
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.757	0.749	0.489	0.426	0.412
	Selenium (Se)	mg/L	-	-	0.00294	0.00292	0.000890	0.000523	0.00108
	Silicon (Si)	mg/L	-	-	2.18	2.23	2.23	2.12	2.05
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	6.82	7.20	2.39	1.73	1.53
	Strontium (Sr)	mg/L	-	-	0.192	0.192	0.110	0.106	0.102
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000930	0.000956	0.000611	0.000595	0.000587
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	0.00120	<0.00100	<0.00100	<0.00100	<0.00100

Exceeds CCME Long Term Guideline.

Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_T4_U1	RG_T4_U2	RG_T4_U3	RG_GC_U1	RG_GC_U2
					26-Aug-20	26-Aug-20	26-Aug-20	21-Apr-20	21-Apr-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	123	139	118	170	181
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	8.48	8.23	7.78	8.14	8.07
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.29	8.23	8.14	8.27	8.30
	Total Sus. Solids, Lab	mg/L	-	-	<1.00	<1.00	<1.00	2.50	2.90
	Total Dissolved Solids	mg/L	-	-	155	178	155	212	224
	Dissolved Oxygen-Field	mg/L	< 8	< 5	7.70	7.22	5.75	11.6	11.5
	Dissolved Oxygen-Field	%	-	-	109	99.9	72.5	108	106
	Temperature-Field	C	-	-	21.0	19.3	12.6	8.30	7.80
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.0348	0.0731	0.0150	0.00920	0.00720
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	1.75	2.89	1.59	5.17	5.46
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0800	0.0950	0.0790	0.106	0.111
	Nitrate (as N)	mg/L	3	32.8	0.114	0.199	0.278	0.346	0.378
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	0.00160	0.00190	<0.00100	0.00190	0.00190
	Phosphorus (P)-Total	mg/L	-	-	<0.00200	<0.00200	<0.00200	0.00550	0.00680
	Sulphate (SO_4)	mg/L	309 - 429	-	21.1	29.1	19.8	44.1	46.2
Total Metals	Aluminum (Al)	mg/L	-	-	0.0113	0.0190	0.0223	0.0115	0.0171
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000300	0.000410	0.000310	0.000440	0.000400
	Barium (Ba)	mg/L	1	-	0.0402	0.0446	0.0355	0.0666	0.0690
	Beryllium (Be)	mg/L	0.00013	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100	<0.0100	<0.0100	0.0130	0.0130
	Cadmium (Cd)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	0.00000530	<0.00000500
	Calcium (Ca)	mg/L	-	-	31.9	34.6	30.3	49.7	50.7
	Chromium (Cr)	mg/L	0.001	-	<0.000100	0.000110	0.000100	0.000130	0.000140
	Cobalt (Co)	mg/L	0.004	0.11	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	-	-	0.00105	<0.000500	<0.000500	<0.000500	<0.000500
	Iron (Fe)	mg/L	-	1	<0.0100	0.0260	0.0240	0.0270	0.0380
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000131	0.0000610	<0.0000500	0.0000650	0.0000840
	Lithium (Li)	mg/L	-	-	0.00180	0.00210	0.00160	0.00340	0.00360
	Magnesium (Mg)	mg/L	-	-	9.77	11.7	8.98	16.3	16.2
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.00147	0.00450	0.00281	0.00841	0.0101
	Mercury (Hg)	µg/L	0.00125	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Molybdenum (Mo)	mg/L	1	2	0.000596	0.000730	0.000616	0.000789	0.000779
	Nickel (Ni)	mg/L	0.025	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.495	0.556	0.450	0.773	0.791
	Selenium (Se)	mg/L	0.002	-	0.00108	0.00103	0.000901	0.00179	0.00200
	Silicon (Si)-Total	mg/L	-	-	1.12	2.00	2.45	2.31	2.41
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	2.43	3.60	2.18	7.14	7.38
	Strontium (Sr)	mg/L	-	-	0.122	0.154	0.120	0.209	0.219
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000618	0.000703	0.000616	0.000867	0.000904
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.00510	0.00410	0.00580	<0.00300	<0.00300
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000310	0.000360	0.000270	0.000360	0.000400
	Barium (Ba)	mg/L	-	-	0.0432	0.0467	0.0386	0.0672	0.0637
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100	<0.0100	<0.0100	0.0120	0.0140
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	33.4	37.2	33.0	44.3	46.7
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	<0.000100	0.000130	0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000310	0.000220	0.000260	0.000220	0.000270
	Iron (Fe)	mg/L	-	0.35	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00170	0.00210	0.00160	0.00320	0.00380
	Magnesium (Mg)	mg/L	-	-	9.70	11.2	8.70	14.4	15.7
	Manganese (Mn)	mg/L	-	-	0.000430	0.000420	0.000420	0.000690	0.00132
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000616	0.000771	0.000602	0.000767	0.000781
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.505	0.564	0.463	0.772	0.759
	Selenium (Se)	mg/L	-	-	0.00116	0.00112	0.00106	0.00163	0.00195
	Silicon (Si)	mg/L	-	-	1.06	1.86	2.20	2.15	2.07
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	2.48	3.65	2.18	6.38	6.75
	Strontium (Sr)	mg/L	-	-	0.121	0.147	0.118	0.176	0.178
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000664	0.000714	0.000619	0.000896	0.000886
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	0.00110	0.00140	0.00110	<0.00100	0.00110

Exceeds CCME Long Term Guideline.

Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_GC_U3	RG_GC_U1	RG_GC_U2	RG_GC_U3	RG_GC_U1
					21-Apr-20	18-Jun-20	18-Jun-20	18-Jun-20	18-Jun-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	188	117	109	110	129
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	7.40	8.07	7.87	7.69	8.29
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.30	8.11	8.07	8.09	8.24
	Total Sus. Solids, Lab	mg/L	-	-	3.90	1.90	13.6	29.8	<1.00
	Total Dissolved Solids	mg/L	-	-	225	145	140	142	164
	Dissolved Oxygen-Field	mg/L	< 8	< 5	11.4	10.0	10.0	10.1	7.35
	Dissolved Oxygen-Field	%	-	-	104	105	100	98.7	102
	Temperature-Field	C	-	-	7.40	13.7	11.7	10.5	19.9
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.00990	<0.00500	<0.00500	0.0231	0.0330
	Bromide (Br)	mg/L	-	-	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
	Chloride (Cl)	mg/L	150	600	5.65	1.66	1.37	1.22	2.22
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.112	0.0500	0.0460	0.0480	0.0870
	Nitrate (as N)	mg/L	3	32.8	0.406	0.279	0.223	0.261	0.156
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	0.00160	0.00160	0.00100	<0.00100	0.00170
	Phosphorus (P)-Total	mg/L	-	-	0.00590	<0.00200	0.0123	0.0153	<0.00200
	Sulphate (SO_4)	mg/L	309 - 429	-	48.0	19.3	16.3	16.2	24.3
Total Metals	Aluminum (Al)	mg/L	-	-	0.0319	0.0886	0.463	1.12	0.0131
	Antimony (Sb)	mg/L	0.009	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000440	0.000330	0.000410	0.000530	0.000370
	Barium (Ba)	mg/L	1	-	0.0677	0.0406	0.0369	0.0420	0.0420
	Beryllium (Be)	mg/L	0.00013	-	<0.0000200	<0.0000200	0.0000220	0.0000500	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	1.2	-	0.0140	<0.0100	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	-	-	0.00000710	<0.00000500	0.0000147	0.0000267	<0.00000500
	Calcium (Ca)	mg/L	-	-	51.1	32.4	33.1	35.1	31.9
	Chromium (Cr)	mg/L	0.001	-	0.000160	0.000150	0.000570	0.00141	<0.000100
	Cobalt (Co)	mg/L	0.004	0.11	<0.000100	<0.000100	0.000200	0.000360	<0.000100
	Copper (Cu)	mg/L	-	-	<0.000500	<0.000500	0.000640	0.00101	<0.000500
	Iron (Fe)	mg/L	-	1	0.0560	0.0590	0.322	0.770	0.0130
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000102	0.0000960	0.000321	0.000572	0.000127
	Lithium (Li)	mg/L	-	-	0.00380	0.00170	0.00180	0.00230	0.00190
	Magnesium (Mg)	mg/L	-	-	16.8	8.74	8.27	8.48	10.3
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.0114	0.00361	0.0128	0.0235	0.00220
	Mercury (Hg)	μg/L	0.00125	-	<0.000500	0.000780	0.00116	0.00202	<0.000500
	Molybdenum (Mo)	mg/L	1	2	0.000800	0.000496	0.000513	0.000546	0.000656
	Nickel (Ni)	mg/L	0.025	-	<0.000500	<0.000500	0.000530	0.00103	<0.000500
	Potassium (K)	mg/L	-	-	0.798	0.518	0.587	0.785	0.522
	Selenium (Se)	mg/L	0.002	-	0.00211	0.000948	0.000689	0.000814	0.000988
	Silicon (Si)-Total	mg/L	-	-	2.39	2.56	3.35	4.80	1.63
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	7.69	2.15	1.86	1.69	2.89
	Strontium (Sr)	mg/L	-	-	0.209	0.109	0.113	0.114	0.132
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100	<0.0000100	<0.0000100	0.0000160	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0150	<0.0340	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000929	0.000555	0.000576	0.000605	0.000647
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	0.000860	0.00191	<0.000500
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300	<0.00300	<0.00300	0.00360	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	<0.00300	0.00790	0.0245	0.0278	0.00370
	Antimony (Sb)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Arsenic (As)	mg/L	-	-	0.000430	0.000300	0.000290	0.000290	0.000360
	Barium (Ba)	mg/L	-	-	0.0651	0.0390	0.0322	0.0319	0.0418
	Beryllium (Be)	mg/L	-	-	<0.0000200	<0.0000200	<0.0000200	<0.0000200	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Boron (B)	mg/L	-	-	0.0150	<0.0100	<0.0100	<0.0100	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Calcium (Ca)	mg/L	-	-	49.2	30.8	28.6	29.5	34.8
	Chromium (Cr)	mg/L	-	-	<0.000100	<0.000100	0.000120	0.000130	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000230	0.000370	0.000350	0.000330	0.000320
	Iron (Fe)	mg/L	-	0.35	<0.0100	<0.0100	0.0130	0.0140	<0.0100
	Lead (Pb)	mg/L	-	-	<0.0000500	<0.0000500	<0.0000500	<0.0000500	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00410	0.00170	0.00130	0.00150	0.00190
	Magnesium (Mg)	mg/L	-	-	15.8	9.85	9.09	8.96	10.2
	Manganese (Mn)	mg/L	-	-	0.000420	0.000630	0.00225	0.00301	0.000750
	Mercury (Hg)	mg/L	-	-	<0.00000500	<0.00000500	<0.00000500	<0.00000500	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000821	0.000485	0.000470	0.000534	0.000664
	Nickel (Ni)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Potassium (K)	mg/L	-	-	0.774	0.508	0.462	0.437	0.560
	Selenium (Se)	mg/L	-	-	0.00219	0.000955	0.000571	0.000820	0.00112
	Silicon (Si)	mg/L	-	-	2.08	2.22	2.15	2.12	1.44
	Silver (Ag)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Sodium (Na)	mg/L	-	-	6.97	2.47	1.94	1.74	3.03
	Strontium (Sr)	mg/L	-	-	0.191	0.109	0.104	0.107	0.132
	Thallium (Tl)	mg/L	-	-	<0.0000100	<0.0000100	<0.0000100	<0.0000100	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
	Uranium (U)	mg/L	-	-	0.000940	0.000596	0.000579	0.000583	0.000664
	Vanadium (V)	mg/L	-	-	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
	Zinc (Zn)	mg/L	-	-	<0.00100	<0.00100	<0.00100	<0.00100	0.00180

Exceeds CCME Long Term Guideline.

Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.6: Water Quality Collected from Biological Sampling Stations, Koocanusa Reservoir Monitoring Program, 2020

	Analyte	Units	Long Term Guidelines	Short Term Guidelines	RG_GC_U2
					18-Jun-20
Physical Characteristics	Hardness (as CaCO3)	mg/L	-	-	114
	pH, Field	pH	6.5 - 9.0	6.5 - 9.0	7.76
	pH, Lab	pH	6.5 - 9.0	6.5 - 9.0	8.13
	Total Sus. Solids, Lab	mg/L	-	-	1.20
	Total Dissolved Solids	mg/L	-	-	146
	Dissolved Oxygen-Field	mg/L	< 8	< 5	6.31
	Dissolved Oxygen-Field	%	-	-	78.7
	Temperature-Field	C	-	-	12.0
Anions and Nutrients	Ammonia as N	mg/L	0.196 - 1.9	1.02 - 14.8	0.0256
	Bromide (Br)	mg/L	-	-	<0.0500
	Chloride (Cl)	mg/L	150	600	1.50
	Fluoride (F)	mg/L	-	1.32 - 1.6	0.0790
	Nitrate (as N)	mg/L	3	32.8	0.282
	Nitrite (as N)	mg/L	0.02 - 0.08	0.06 - 0.24	<0.00100
	Phosphorus (P)-Total	mg/L	-	-	0.00310
	Sulphate (SO_4)	mg/L	309 - 429	-	19.3
Total Metals	Aluminum (Al)	mg/L	-	-	0.0346
	Antimony (Sb)	mg/L	0.009	-	<0.000100
	Arsenic (As)	mg/L	-	0.005	0.000290
	Barium (Ba)	mg/L	1	-	0.0357
	Beryllium (Be)	mg/L	0.00013	-	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500
	Boron (B)	mg/L	1.2	-	<0.0100
	Cadmium (Cd)	mg/L	-	-	0.00000630
	Calcium (Ca)	mg/L	-	-	29.5
	Chromium (Cr)	mg/L	0.001	-	0.000140
	Cobalt (Co)	mg/L	0.004	0.11	<0.000100
	Copper (Cu)	mg/L	-	-	<0.000500
	Iron (Fe)	mg/L	-	1	0.0340
	Lead (Pb)	mg/L	0.00636 - 0.0106	0.0782 - 0.187	0.000439
	Lithium (Li)	mg/L	-	-	0.00160
	Magnesium (Mg)	mg/L	-	-	9.18
	Manganese (Mn)	mg/L	1.03 - 1.45	1.61 - 2.66	0.00380
	Mercury (Hg)	µg/L	0.00125	-	<0.000500
	Molybdenum (Mo)	mg/L	1	2	0.000584
	Nickel (Ni)	mg/L	0.025	-	<0.000500
	Potassium (K)	mg/L	-	-	0.454
	Selenium (Se)	mg/L	0.002	-	0.000826
	Silicon (Si)-Total	mg/L	-	-	2.48
	Silver (Ag)	mg/L	0.00005 - 0.0015	0.0001 - 0.003	<0.0000100
	Sodium (Na)	mg/L	-	-	2.18
	Strontium (Sr)	mg/L	-	-	0.120
	Thallium (Tl)	mg/L	0.0008	-	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100
	Uranium (U)	mg/L	0.0085	-	0.000600
	Vanadium (V)	mg/L	-	-	<0.000500
	Zinc (Zn)	mg/L	0.0125 - 0.084	0.038 - 0.11	<0.00300
Dissolved Metals	Aluminum (Al)	mg/L	0.05	0.1	0.00590
	Antimony (Sb)	mg/L	-	-	<0.000100
	Arsenic (As)	mg/L	-	-	0.000280
	Barium (Ba)	mg/L	-	-	0.0372
	Beryllium (Be)	mg/L	-	-	<0.0000200
	Bismuth (Bi)	mg/L	-	-	<0.0000500
	Boron (B)	mg/L	-	-	<0.0100
	Cadmium (Cd)	mg/L	0.000206 - 0.000342	0.000568 - 0.00115	<0.00000500
	Calcium (Ca)	mg/L	-	-	31.2
	Chromium (Cr)	mg/L	-	-	<0.000100
	Cobalt (Co)	mg/L	-	-	<0.000100
	Copper (Cu)	mg/L	0.0004 - 0.0023	0.0023 - 0.0132	0.000320
	Iron (Fe)	mg/L	-	0.35	<0.0100
	Lead (Pb)	mg/L	-	-	<0.0000500
	Lithium (Li)	mg/L	-	-	0.00160
	Magnesium (Mg)	mg/L	-	-	8.79
	Manganese (Mn)	mg/L	-	-	0.000810
	Mercury (Hg)	mg/L	-	-	<0.00000500
	Molybdenum (Mo)	mg/L	-	-	0.000601
	Nickel (Ni)	mg/L	-	-	<0.000500
	Potassium (K)	mg/L	-	-	0.455
	Selenium (Se)	mg/L	-	-	0.00101
	Silicon (Si)	mg/L	-	-	2.16
	Silver (Ag)	mg/L	-	-	<0.0000100
	Sodium (Na)	mg/L	-	-	2.08
	Strontium (Sr)	mg/L	-	-	0.112
	Thallium (Tl)	mg/L	-	-	<0.0000100
	Tin (Sn)	mg/L	-	-	<0.000100
	Titanium (Ti)	mg/L	-	-	<0.0100
	Uranium (U)	mg/L	-	-	0.000597
	Vanadium (V)	mg/L	-	-	<0.000500
	Zinc (Zn)	mg/L	-	-	0.00210

Exceeds CCME Long Term Guideline.

Exceeds CCME Short Term Guideline.

Notes: "-" indicates no data.

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Total Hardness (CaCO3 mg/L)	Temperature (Degrees C)	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Dissolved Organic Carbon (mg/L)	Alkalinity (CaCO3 mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	Total Kjeldahl (mg/L)	Orthophosphate (mg/L)	Phosphorus (mg/L)	Sulphate (mg/L)
RG_WARDB	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	89.4	0	128	8.14	7.73	7.59	<0.5	90.9	0.0534	<0.001	<0.005	<0.05	<0.001	0.00360	9.93
	Annual Maximum	160	17.8	207	8.39	8.30	14.3	3.62	126	0.226	0.00220	0.0494	0.474	0.00710	0.246	51.8
	Annual Mean	134	7.37	175	8.25	7.89	11.0	1.46	111	0.104	0.00121	0.0190	0.123	0.00280	0.0304	34.5
	Annual Median	146	8.09	184	8.24	7.87	11.0	1.26	116	0.0938	<0.001	0.0134	0.0725	0.00215	0.0118	41.1
	% < LRL	0%	0%	0%	0%	0%	0%	8%	0%	0%	58%	17%	33%	25%	0%	0%
	% > BCWQG[a]	-	-	-	0%	0%	8%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA River Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_KERRRD	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	93.2	1.36	129	8.11	7.77	8.25	<0.5	88.9	0.0778	<0.001	0.00690	0.0520	<0.001	<0.002	12.7
	Annual Maximum	174	20.6	226	8.37	8.34	12.3	2.28	137	0.221	0.00190	0.0361	0.203	0.00340	0.0541	47.2
	Annual Mean	136	9.66	173	8.24	8.08	10.4	1.46	115	0.124	0.00132	0.0174	0.110	0.00165	0.00922	29.3
	Annual Median	142	8.57	166	8.25	8.06	10.5	1.48	114	0.108	0.00139	0.0151	0.0910	0.00117	0.00455	29.0
	% < LRL	0%	0%	0%	0%	0%	0.0%	8%	0%	0%	42%	0%	0%	42%	8%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_ELKMOUTH	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	135	0.600	178	8.28	7.93	9.41	<0.5	118	0.729	0.00102	<0.005	<0.05	<0.001	<0.002	22.8
	Annual Maximum	224	15.0	261	8.48	8.47	14.0	2.78	164	1.39	0.00430	0.0246	0.672	0.00594	0.327	64.9
	Annual Mean	196	6.36	233	8.37	8.13	12.0	1.28	149	1.14	0.00232	0.0138	0.312	0.00185	0.0346	49.5
	Annual Median	211	5.71	245	8.36	8.12	12.1	1.08	154	1.25	0.00256	0.0140	0.275	0.00119	0.00332	54.2
	% < LRL	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	8%	8%	42%	33%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA River Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 1 Benchmark	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	0%
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	105	0.920	132	8.14	8.03	8.00	0.520	97.4	0.151	<0.001	0.00750	0.0670	<0.001	<0.002	15.9
	Annual Maximum	190	21.2	229	8.34	8.37	12.7	2.47	146	0.546	0.00290	0.0487	0.270	0.00292	0.0479	51.2
	Annual Mean	145	9.85	172	8.22	8.19	10.5	1.49	120	0.302	0.00177	0.0168	0.160	0.00150	0.00905	31.4
	Annual Median	144	9.21	162	8.21	8.18	10.5	1.48	118	0.276	0.00168	0.0130	0.145	0.00120	0.00485	28.9
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	0%	8%	0%	0%	50%	17%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_GRASMERE	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	105	1.30	140	7.94	7.97	8.13	<0.5	98.4	0.163	<0.001	<0.005	0.0700	<0.001	<0.002	16.1
	Annual Maximum	182	20.1	220	8.33	8.39	12.3	3.23	142	0.449	0.00350	0.0245	0.207	0.00200	0.0415	49.8
	Annual Mean	140	10.8	170	8.21	8.19	10.2	1.61	117	0.277	0.00178	0.0113	0.140	0.00128	0.00821	29.5
	Annual Median	137	9.87	156	8.24	8.15	10.1	1.57	115	0.233	0.00168	0.00780	0.155	0.00100	0.00440	26.5
	% < LRL	0%	0%	0%	0%	0%	0.0%	9%	0%	0%	9%	9%	0%	45%	9%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_USGOLD	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	106	2.35	140	7.77	8.07	8.01	1.11	99.2	0.163	<0.001	0.00740	<0.05	<0.001	<0.002	17.2
	Annual Maximum	177	19.6	216	8.33	8.69	12.1	2.30	144	0.422	0.00440	0.0701	0.253	0.00160	0.0257	47.9
	Annual Mean	139	10.8	172	8.19	8.25	10.1	1.61	119	0.275	0.00184	0.0159	0.136	0.00114	0.00634	29.1
	Annual Median	130	9.86	163	8.21	8.22	10.1	1.48	116	0.225	0.00140	0.00968	0.116	<0.001	0.00500	27.1
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	0%	9%	0%	9%	64%	36%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Total Hardness (CaCO3 mg/L)	Temperature (Degrees C)	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Dissolved Organic Carbon (mg/L)	Alkalinity (CaCO3 mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	Total Kjeldahl (mg/L)	Orthophosphate (mg/L)	Phosphorus (mg/L)	Sulphate (mg/L)
RG_BORDER	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	111	2.33	140	8.13	7.84	7.52	0.940	99.7	0.193	<0.001	<0.005	0.0650	<0.001	<0.002	17.4
	Annual Maximum	172	18.4	200	8.34	8.95	12.1	2.43	137	0.384	0.00470	0.0766	0.180	0.00220	0.0223	42.2
	Annual Mean	139	9.49	169	8.25	8.15	10.1	1.50	116	0.275	0.00223	0.0171	0.118	0.00121	0.00542	28.3
	Annual Median	136	9.75	167	8.24	8.03	10.3	1.43	115	0.266	0.00202	0.0128	0.131	0.00100	0.00383	26.4
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	0%	8%	8%	0%	50%	17%	0%
	% > BCWQG[a]	-	-	-	0%	0%	25%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] Benchmarks for Nickel are Interim screening values

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Dissolved Chloride (mg/L)	Dissolve Fluoride (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Manganese (mg/L)	Mercury (mg/L)
RG_WARDB	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	1.03	0.0402	<0.0001	0.000450	0.0323	<0.00002	<0.01	0.000130	<0.0001	<0.0005	0.0480	0.0000510	0.00130	0.00716	<0.0000005
	Annual Maximum	8.16	0.105	0.000154	0.00265	0.0695	0.000174	0.0210	0.00517	0.00361	0.00746	6.96	0.00683	0.00802	0.211	0.00000812
	Annual Mean	4.98	0.0765	0.000104	0.000694	0.0421	0.0000333	0.0137	0.000658	0.000458	0.00118	0.771	0.000835	0.00244	0.0321	0.00000138
	Annual Median	5.51	0.0820	<0.0001	0.000510	0.0415	<0.00002	0.0115	0.000190	0.000104	<0.0005	0.126	0.000165	0.00200	0.0118	0.000000630
	% < LRL	0%	0%	92%	0%	0%	75%	33%	0%	50%	67%	0%	0%	0%	0%	25%
	% > BCWQG[a]	0%	-	0%	-	0%	8%	0%	8%	0%	8%	-	8%	-	0%	25%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	8%	0%	-	0%	-
	EPA River Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_KERRRD	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	1.21	0.0532	<0.0001	0.000340	0.0302	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0180	<0.00005	0.00105	0.00233	<0.0000005
	Annual Maximum	6.88	0.0980	0.000128	0.00101	0.0502	0.0000682	0.0200	0.00175	0.00114	0.00238	2.04	0.00200	0.00310	0.0559	0.00000356
	Annual Mean	3.72	0.0729	0.000102	0.000501	0.0408	0.0000240	0.0128	0.000358	0.000206	0.000671	0.258	0.000307	0.00203	0.0137	0.000000860
	Annual Median	3.17	0.0700	<0.0001	0.000425	0.0406	<0.00002	<0.01	0.000145	<0.0001	<0.0005	0.0475	0.0000750	0.00205	0.00809	0.000000535
	% < LRL	0%	0%	92%	0%	0%	92%	58%	25%	58%	75%	0%	17%	0%	0%	50%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	8%	0%	0%	-	0%	-	0%	8%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	8%	0%	-	0%	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_ELKMOUTH	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.754	0.104	<0.0001	0.000210	0.0620	<0.00002	<0.01	0.000180	<0.0001	<0.0005	0.0100	<0.00005	0.00450	0.000970	<0.0000005
	Annual Maximum	4.78	0.171	0.000184	0.00211	0.132	0.000219	0.0106	0.00398	0.00200	0.00498	4.30	0.00375	0.00844	0.189	0.0000154
	Annual Mean	2.47	0.138	0.000108	0.000432	0.0910	0.0000389	0.0101	0.000635	0.000291	0.000944	0.467	0.000436	0.00649	0.0220	0.00000216
	Annual Median	2.45	0.143	<0.0001	0.000260	0.0902	<0.00002	<0.01	0.000251	<0.0001	<0.0005	0.0408	0.0000510	0.00657	0.00332	0.000000566
	% < LRL	0%	0%	75%	0%	0%	75%	83%	0%	67%	67%	0%	42%	0%	0%	50%
	% > BCWQG[a]	0%	-	0%	-	0%	8%	0%	8%	0%	0%	-	0%	-	0%	25%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	8%	0%	-	0%	-
	EPA River Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	1.22	0.0600	<0.0001	0.000330	0.0344	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0170	<0.00005	0.00140	0.00244	<0.0000005
	Annual Maximum	6.50	0.103	0.000122	0.000988	0.0678	0.0000666	0.0180	0.00152	0.000784	0.00202	1.65	0.00143	0.00395	0.0499	0.00000326
	Annual Mean	3.31	0.0814	0.000102	0.000458	0.0502	0.0000239	0.0117	0.000293	0.000169	0.000674	0.212	0.000227	0.00260	0.0124	0.000000871
	Annual Median	2.82	0.0820	<0.0001	0.000395	0.0489	<0.00002	<0.01	0.000178	<0.0001	<0.0005	0.0475	0.0000570	0.00225	0.00624	0.000000540
	% < LRL	0%	0%	92%	0%	0%	92%	67%	17%	58%	67%	0%	17%	0%	0%	42%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	8%	0%	0%	-	0%	-	0%	17%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	8%	0%	-	0%	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_GRASMERE	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	1.24	0.0580	<0.0001	0.000310	0.0349	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0120	<0.00005	0.00140	0.00201	<0.0000005
	Annual Maximum	6.72	0.109	0.000118	0.000816	0.0664	0.0000554	0.0180	0.00133	0.000696	0.00173	1.41	0.00118	0.00400	0.0368	0.00000316
	Annual Mean	3.12	0.0785	0.000102	0.000454	0.0493	0.0000235	0.0116	0.000280	0.000166	0.000628	0.202	0.000210	0.00261	0.0105	0.000000886
	Annual Median	2.45	0.0770	<0.0001	0.000440	0.0471	<0.00002	<0.01	0.000145	<0.0001	<0.0005	0.0590	<0.00005	0.00255	0.00519	0.000000570
	% < LRL	0%	0%	91%	0%	0%	82%	73%	27%	73%	82%	0%	55%	0%	0%	45%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	9%	0%	0%	-	0%	-	0%	18%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	9%	0%	-	0%	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG_USGOLD	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	1.32	0.0605	<0.0001	0.000310	0.0354	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0120	<0.00005	0.00155	0.00206	<0.0000005
	Annual Maximum	6.49	0.110	0.000102	0.000596	0.0642	0.0000406	0.0150	0.000810	0.000458	0.00110	0.743	0.000786	0.00370	0.0263	0.00000214
	Annual Mean	2.94	0.0824	0.000100	0.000413	0.0484	0.0000221	0.0112	0.000243	0.000143	0.000568	0.132	0.000196	0.00244	0.00855	0.000000780
	Annual Median	2.29	0.0760	<0.0001	0.000390	0.0474	<0.00002	<0.01	0.000140	<0.0001	<0.0005	0.0440	0.0000880	0.00230	0.00455	<0.0000005
	% < LRL	0%	0%	91%	0%	0%	82%	73%	27%	73%	82%	0%	45%	0%	0%	64%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	0%	0%	0%	-	0%	-	0%	18%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	0%	0%	-	0%	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Dissolved Chloride (mg/L)	Dissolve Fluoride (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Manganese (mg/L)	Mercury (mg/L)
RG_BORDER	**n**	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	1.36	0.0620	<0.0001	0.000330	0.0370	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0160	<0.00005	0.00165	0.00187	<0.0000005
	Annual Maximum	5.14	0.103	0.000102	0.000566	0.0625	0.0000348	0.0140	0.000700	0.000358	0.000992	0.635	0.000631	0.00314	0.0204	0.00000171
	Annual Mean	2.82	0.0807	0.000100	0.000390	0.0485	0.0000213	0.0109	0.000193	0.000125	0.000546	0.0961	0.000118	0.00230	0.00622	0.000000677
	Annual Median	2.34	0.0810	<0.0001	0.000370	0.0479	<0.00002	<0.01	0.000138	<0.0001	<0.0005	0.0290	0.0000500	0.00230	0.00433	<0.0000005
	% < LRL	0%	0%	92%	0%	0%	83%	75%	25%	83%	75%	0%	50%	0%	0%	67%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	0%	0%	0%	-	0%	-	0%	8%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	0%	0%	-	0%	-
	EPA Lake Guideline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] Benchmarks for Nickel are Interim screening values

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Molybdenum (mg/L)	Nickel (mg/L)[c]	Selenium (mg/L)	Silver (mg/L)	Thallium (mg/L)	Uranium (mg/L)	Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
RG_WARDB	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000447	<0.0005	0.0000875	<0.00001	<0.00001	0.000614	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000830	0.00639	0.000152	0.0000246	0.0000440	0.000982	0.0213	0.0358	0.0000105	0.000104	0.000380	0.0274
	Annual Mean	0.000664	0.00103	0.000120	0.0000112	0.0000128	0.000851	0.00474	0.00751	0.00000554	0.000100	0.000236	0.0139
	Annual Median	0.000713	<0.0005	0.000120	<0.00001	<0.00001	0.000905	<0.003	0.00358	<0.000005	<0.0001	0.000200	0.0120
	% < LRL	0%	75%	0%	92%	92%	0%	67%	42%	75%	92%	50%	33%
	% > BCWQG[a]	0%	-	0%	0%	0%	0%	8%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	-	0%	0%	-	0%	0%
	EPA River Guideline	-	-	0%	-	-	-	0%	-	-	-	-	-
RG_KERRRD	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000468	<0.0005	0.000112	<0.00001	<0.00001	0.000570	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000764	0.00206	0.000883	0.0000122	0.0000194	0.000950	0.00766	0.0325	0.00000890	0.000106	0.000548	0.0242
	Annual Mean	0.000629	0.000647	0.000381	0.0000102	0.0000108	0.000759	0.00340	0.00706	0.00000545	0.000100	0.000302	0.0117
	Annual Median	0.000652	<0.0005	0.000270	<0.00001	<0.00001	0.000766	<0.003	0.00345	<0.000005	<0.0001	0.000283	<0.01
	% < LRL	0%	83%	0%	92%	92%	0%	83%	42%	67%	92%	17%	58%
	% > BCWQG[a]	0%	-	0%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	0%	0%	-	-	0%	0%	0%	-	0%	0%
	EPA Lake Guideline	-	-	0%	-	-	-	0%	-	-	-	-	-
RG_ELKMOUTH	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000610	<0.0005	0.00352	<0.00001	<0.00001	0.000627	<0.003	<0.003	0.00000700	<0.0001	<0.0002	<0.01
	Annual Maximum	0.00112	0.00603	0.00738	0.0000512	0.0000910	0.00105	0.0245	0.0412	0.0000110	<0.0001	0.000308	0.0286
	Annual Mean	0.000931	0.00108	0.00596	0.0000137	0.0000184	0.000878	0.00500	0.00800	0.00000903	<0.0001	0.000227	0.0119
	Annual Median	0.000945	<0.0005	0.00648	<0.00001	<0.00001	0.000900	<0.003	0.00351	0.00000890	<0.0001	0.000200	<0.01
	% < LRL	0%	58%	0%	75%	75%	0%	75%	42%	0%	100%	50%	75%
	% > BCWQG[a]	0%	-	100%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%	0%	-	0%	0%
	EPA River Guideline	-	-	100%	-	-	-	0%	-	-	-	-	-
	% > Level 1 Benchmark	-	8%	0%	-	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	0%	-	0%	-	-	-
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000492	<0.0005	0.000764	<0.00001	<0.00001	0.000552	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000820	0.00192	0.00224	0.0000152	0.0000250	0.000943	0.00886	0.0320	0.00000970	<0.0001	0.000645	0.0345
	Annual Mean	0.000667	0.000624	0.00139	0.0000104	0.0000112	0.000751	0.00364	0.00846	0.00000613	<0.0001	0.000318	0.0133
	Annual Median	0.000702	<0.0005	0.00127	<0.00001	<0.00001	0.000738	<0.003	0.00438	0.00000500	<0.0001	0.000315	<0.01
	% < LRL	0%	75%	0%	92%	92%	0%	83%	25%	50%	100%	25%	67%
	% > BCWQG[a]	0%	-	25%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%	0%	-	0%	0%
	EPA Lake Guideline	-	-	25%	-	-	-	0%	-	-	-	-	-
RG_GRASMERE	n	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	0.000510	<0.0005	0.000802	<0.00001	<0.00001	0.000570	<0.003	<0.003	<0.000005	<0.0001	0.000230	<0.01
	Annual Maximum	0.000802	0.00160	0.00226	0.0000132	0.0000216	0.000936	0.00674	0.0275	0.00000900	<0.0001	0.000496	0.0166
	Annual Mean	0.000671	0.000613	0.00130	0.0000103	0.0000111	0.000738	0.00335	0.00710	0.00000559	<0.0001	0.000309	0.0106
	Annual Median	0.000678	<0.0005	0.00117	<0.00001	<0.00001	0.000693	<0.003	0.00400	<0.000005	<0.0001	0.000280	<0.01
	% < LRL	0%	82%	0%	91%	91%	0%	82%	36%	55%	100%	0%	91%
	% > BCWQG[a]	0%	-	9%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%	0%	-	0%	0%
	EPA Lake Guideline	-	-	18%	-	-	-	0%	-	-	-	-	-
RG_USGOLD	n	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	0.000502	<0.0005	0.000817	<0.00001	<0.00001	0.000557	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000795	0.000990	0.00208	0.0000100	0.0000142	0.000916	0.00464	0.0219	0.00000700	<0.0001	0.000830	0.0120
	Annual Mean	0.000661	0.000559	0.00130	0.0000100	0.0000104	0.000706	0.00321	0.00646	0.00000530	<0.0001	0.000354	0.0102
	Annual Median	0.000677	<0.0005	0.00111	<0.00001	<0.00001	0.000654	<0.003	<0.003	<0.000005	<0.0001	0.000270	<0.01
	% < LRL	0%	82%	0%	91%	91%	0%	82%	55%	64%	100%	9%	91%
	% > BCWQG[a]	0%	-	9%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%	0%	-	0%	0%
	EPA Lake Guideline	-	-	27%	-	-	-	0%	-	-	-	-	-

Table B.7: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Monitoring Stations, 2020

Station	Summary Statistic	Molybdenum (mg/L)	Nickel (mg/L)[c]	Selenium (mg/L)	Silver (mg/L)	Thallium (mg/L)	Uranium (mg/L)	Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
RG_BORDER	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000518	<0.0005	0.000934	<0.00001	<0.00001	0.000574	<0.003	<0.003	<0.000005	<0.0001	0.000210	<0.01
	Annual Maximum	0.000773	0.000894	0.00164	0.0000104	0.0000138	0.000869	0.00404	0.0195	0.00000930	<0.0001	0.000540	0.0114
	Annual Mean	0.000660	0.000537	0.00121	0.0000100	0.0000103	0.000710	0.00309	0.00589	0.00000564	<0.0001	0.000322	0.0101
	Annual Median	0.000678	<0.0005	0.00112	<0.00001	<0.00001	0.000691	<0.003	<0.003	<0.000005	<0.0001	0.000290	<0.01
	% < LRL	0%	83%	0%	92%	92%	0%	92%	58%	58%	100%	0%	92%
	% > BCWQG[a]	0%	-	0%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%	0%	-	0%	0%
	EPA Lake Guideline	-	-	17%	-	-	-	0%	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] Benchmarks for Nickel are Interim screening values

Table B.8: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Transect Monitoring Stations, 2020

Station	Summary Statistic	Total Hardness (CaCO3 mg/L)	Temperature (Degrees C)	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Dissolved Organic Carbon (mg/L)	Alkalinity (CaCO3 mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	Total Kjeldahl (mg/L)	Orthophosphate (mg/L)	Phosphorus (mg/L)	Sulphate (mg/L)
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	99.3	1.14	126	8.07	7.92	8.54	0.785	96.5	0.122	0.00105	0.00602	0.0612	<0.001	<0.002	12.4
	Annual Maximum	183	21.5	224	8.35	8.41	12.4	4.50	144	0.423	0.00230	0.0679	0.406	0.00435	0.201	48.4
	Annual Mean	143	9.54	174	8.25	8.20	10.6	1.68	119	0.267	0.00155	0.0184	0.174	0.00150	0.0214	30.6
	Annual Median	141	8.75	163	8.24	8.23	10.8	1.40	116	0.270	0.00142	0.0148	0.144	0.00101	0.00498	27.2
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	0%	0%	0%	0%	50%	8%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	8%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
RG_USGOLD	n	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Annual Minimum	105	1.72	140	8.11	8.09	8.19	<0.5	99.2	0.156	0.00108	0.00648	<0.05	<0.001	<0.002	15.4
	Annual Maximum	177	20.0	239	8.36	8.54	12.3	2.98	144	0.412	0.00420	0.0467	0.588	0.00140	0.0716	46.5
	Annual Mean	136	11.3	168	8.24	8.27	10.1	1.39	115	0.259	0.00181	0.0137	0.196	0.00108	0.0111	27.1
	Annual Median	136	10.6	161	8.23	8.29	10.0	1.12	115	0.222	0.00144	0.0102	0.124	<0.001	0.00425	26.8
	% < LRL	0%	0%	0%	0%	0%	0.0%	10%	0%	0%	0%	0%	10%	60%	20%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-
RG_BORDER	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	113	1.82	140	8.15	8.12	8.14	0.685	99.9	0.184	0.00110	0.00525	0.0675	<0.001	<0.002	17.1
	Annual Maximum	169	20.6	208	8.36	8.57	12.3	2.70	137	0.374	0.00495	0.0618	0.199	0.00110	0.0268	38.4
	Annual Mean	139	9.91	170	8.28	8.23	10.3	1.42	116	0.258	0.00236	0.0161	0.124	0.00103	0.00567	27.8
	Annual Median	138	10.1	164	8.28	8.18	10.5	1.15	113	0.238	0.00206	0.0111	0.131	<0.001	0.00315	26.2
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	0%	0%	0%	0%	67%	17%	0%
	% > BCWQG[a]	-	-	-	0%	0%	0%	-	0%	0%	0%	0%	0%	-	-	0%
	% > BCWQG[b]	-	-	-	-	-	0%	-	-	0%	0%	0%	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

Table B.8: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Transect Monitoring Stations, 2020

Station	Summary Statistic	Dissolved Chloride (mg/L)	Dissolve Fluoride (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Manganese (mg/L)	Mercury (mg/L)
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.798	0.0568	<0.0001	0.000322	0.0312	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0122	<0.00005	0.00128	0.00169	<0.0000005
	Annual Maximum	6.20	0.105	0.000202	0.00275	0.0912	0.000234	0.0180	0.00501	0.00311	0.00678	6.14	0.00554	0.00822	0.169	0.0000104
	Annual Mean	3.28	0.0826	0.000109	0.000598	0.0517	0.0000379	0.0120	0.000592	0.000361	0.00104	0.581	0.000565	0.00287	0.0217	0.00000146
	Annual Median	2.66	0.0808	<0.0001	0.000379	0.0492	<0.00002	<0.01	0.000170	<0.0001	<0.0005	0.0457	0.0000592	0.00234	0.00682	0.000000530
	% < LRL	0%	0%	92%	0%	0%	83%	67%	17%	67%	75%	0%	25%	0%	0%	42%
	% > BCWQG[a]	0%	-	0%	-	0%	8%	0%	8%	0%	8%	-	0%	-	0%	17%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	8%	0%	-	0%	-
RG_USGOLD	n	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Annual Minimum	1.15	0.0518	<0.0001	0.000315	0.0340	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0132	<0.00005	0.00150	0.00218	<0.0000005
	Annual Maximum	5.97	0.112	0.000112	0.00134	0.0641	0.000100	0.0152	0.00239	0.00135	0.00316	2.61	0.00227	0.00472	0.0654	0.00000532
	Annual Mean	2.65	0.0797	0.000101	0.000481	0.0490	0.0000280	0.0108	0.000371	0.000228	0.000766	0.306	0.000303	0.00250	0.0115	0.00000108
	Annual Median	2.30	0.0762	<0.0001	0.000381	0.0487	<0.00002	<0.01	0.000151	<0.0001	<0.0005	0.0344	0.0000521	0.00217	0.00384	<0.0000005
	% < LRL	0%	0%	90%	0%	0%	90%	80%	20%	70%	90%	0%	40%	0%	0%	70%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	10%	0%	0%	-	0%	-	0%	10%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	10%	0%	-	0%	-
RG_BORDER	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	1.33	0.0552	<0.0001	0.000325	0.0376	<0.00002	<0.01	<0.0001	<0.0001	<0.0005	0.0107	<0.00005	0.00170	0.00144	<0.0000005
	Annual Maximum	4.72	0.102	0.000102	0.000695	0.0591	0.0000548	0.0135	0.00129	0.000425	0.00124	0.815	0.000731	0.00302	0.0211	0.00000280
	Annual Mean	2.74	0.0788	0.000100	0.000396	0.0495	0.0000229	0.0107	0.000221	0.000127	0.000567	0.0985	0.000122	0.00231	0.00524	0.000000753
	Annual Median	2.29	0.0776	<0.0001	0.000370	0.0483	<0.00002	<0.01	0.000120	<0.0001	<0.0005	0.0246	0.0000510	0.00219	0.00359	<0.0000005
	% < LRL	0%	0%	92%	0%	0%	92%	67%	33%	92%	83%	0%	42%	0%	0%	75%
	% > BCWQG[a]	0%	-	0%	-	0%	0%	0%	8%	0%	0%	-	0%	-	0%	8%
	% > BCWQG[b]	0%	0%	-	0%	-	-	-	-	0%	0%	0%	0%	-	0%	-

> 5% of samples exceed the guideline or benchmark.

> 50% of samples exceed the guideline or benchmark.

> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

Table B.8: Summary of Water Chemistry Data for Key Parameters for the Koocanusa Transect Monitoring Stations, 2020

Station	Summary Statistic	Molybdenum (mg/L)	Nickel (mg/L)	Selenium (mg/L)	Silver (mg/L)	Thallium (mg/L)	Uranium (mg/L)	Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
RG_DSELK	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000486	<0.0005	0.000694	<0.00001	<0.00001	0.000526	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000774	0.00665	0.00209	0.0000332	0.0000780	0.000969	0.0268	0.0642	0.0000123	<0.0001	0.000702	0.0510
	Annual Mean	0.000671	0.00102	0.00121	0.0000119	0.0000157	0.000769	0.00502	0.00999	0.00000662	<0.0001	0.000314	0.0138
	Annual Median	0.000705	<0.0005	0.00117	<0.00001	<0.00001	0.000781	<0.003	0.00382	0.00000509	<0.0001	0.000276	0.0100
	% < LRL	0%	75%	0%	92%	75%	0%	75%	25%	33%	100%	8%	50%
	% > BCWQG[a]	0%	-	8%	0%	0%	0%	8%	8%	0%	-	0%	-
	% > BCWQG[b]	0%	-	8%	0%	-	-	0%	0%	0%	-	0%	0%
RG_USGOLD	n	10	10	10	10	10	10	10	10	10	10	10	10
	Annual Minimum	0.000502	<0.0005	0.000828	<0.00001	<0.00001	0.000553	<0.003	<0.003	<0.000005	<0.0001	0.000218	<0.01
	Annual Maximum	0.000776	0.00297	0.00202	0.0000130	0.0000323	0.000904	0.0118	0.0320	0.0000122	<0.0001	0.000520	0.0193
	Annual Mean	0.000654	0.000747	0.00127	0.0000103	0.0000122	0.000691	0.00392	0.00795	0.00000587	<0.0001	0.000316	0.0109
	Annual Median	0.000656	<0.0005	0.00117	<0.00001	<0.00001	0.000677	<0.003	0.00446	<0.000005	<0.0001	0.000282	<0.01
	% < LRL	0%	90%	0%	90%	90%	0%	80%	40%	60%	100%	0%	90%
	% > BCWQG[a]	0%	-	10%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	30%	0%	-	-	0%	0%	0%	-	0%	0%
RG_BORDER	n	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	0.000516	<0.0005	0.000960	<0.00001	<0.00001	0.000576	<0.003	<0.003	<0.000005	<0.0001	<0.0002	<0.01
	Annual Maximum	0.000752	0.00120	0.00177	0.0000122	0.0000222	0.000821	0.00528	0.0243	0.00000782	<0.0001	0.000438	0.0158
	Annual Mean	0.000650	0.000558	0.00122	0.0000102	0.0000110	0.000708	0.00319	0.00630	0.00000530	<0.0001	0.000290	0.0105
	Annual Median	0.000659	<0.0005	0.00116	<0.00001	<0.00001	0.000712	<0.003	0.00346	<0.000005	<0.0001	0.000254	<0.01
	% < LRL	0%	92%	0%	92%	92%	0%	92%	42%	58%	100%	8%	83%
	% > BCWQG[a]	0%	-	0%	0%	0%	0%	0%	0%	0%	-	0%	-
	% > BCWQG[b]	0%	-	8%	0%	-	-	0%	0%	0%	-	0%	0%

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

APPENDIX C

SEDIMENT QUALITY

Table C.1: Profundal Sediment Quality in Koocanusa Reservoir, August 2020

Analyte		Units	BC Sediment Quality Guidelines		Upstream of Elk River (RG_TN)				
			Lower SQG	Upper SQG	TN-1	TN-2	TN-3	TN-4	TN-5
					27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20
Physical Tests	Moisture	%	-	-	40.1	37.5	39.5	40.3	43.1
	pH(1:2 Soil:Water)	pH	-	-	8.26	8.20	8.23	8.27	8.15
Particle Size	% Gravel (>2 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (2.00 mm - 1.00 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (1.00 mm - 0.50 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.50 mm - 0.25 mm)	%	-	-	8.30	<1	<1	<1	<1
	% Sand (0.25 mm - 0.125 mm)	%	-	-	<1	<1	<1	1.10	<1
	% Sand (0.125 mm - 0.063 mm)	%	-	-	<1	3.10	3.50	7.60	4.50
	% Silt (0.063 mm - 0.0312 mm)	%	-	-	11.1	17.5	19.8	14.8	17.1
	% Silt (0.0312 mm - 0.004 mm)	%	-	-	55.5	59.0	57.7	56.3	58.4
	% Clay (<4 µm)	%	-	-	22.2	20.2	18.9	20.1	19.8
	Texture	-	-	-	Silt loam	Silt	Silt	Silt loam	Silt
Organic Carbon	Total Organic Carbon	%	-	-	1.40	1.35	1.41	1.45	1.38
Metals	Aluminum (Al)	mg/kg	-	-	11,900	12,700	13,700	12,700	12,600
	Antimony (Sb)	mg/kg	-	-	0.280	0.330	0.340	0.330	0.320
	Arsenic (As)	mg/kg	5.9	17	5.12	6.01	6.05	6.09	5.80
	Barium (Ba)	mg/kg	-	-	77.9	92.3	93.8	91.3	89.4
	Beryllium (Be)	mg/kg	-	-	0.380	0.410	0.470	0.440	0.450
	Bismuth (Bi)	mg/kg	-	-	<0.2	0.210	0.210	<0.2	0.210
	Boron (B)	mg/kg	-	-	<5	<5	<5	<5	<5
	Cadmium (Cd)	mg/kg	0.60	3.5	0.176	0.198	0.193	0.197	0.204
	Calcium (Ca)	mg/kg	-	-	106,000	111,000	127,000	115,000	114,000
	Chromium (Cr)	mg/kg	37	90	16.4	19.7	21.0	19.6	19.2
	Cobalt (Co)	mg/kg	-	-	8.31	9.57	10.4	9.90	9.71
	Copper (Cu)	mg/kg	36	197	13.1	16.0	17.0	16.4	16.6
	Iron (Fe)	mg/kg	21,200	43,766	20,300	23,400	25,800	24,600	23,700
	Lead (Pb)	mg/kg	35	91	13.5	15.7	16.6	15.7	15.5
	Lithium (Li)	mg/kg	-	-	24.3	27.8	29.9	27.7	27.8
	Magnesium (Mg)	mg/kg	-	-	19,300	22,200	25,500	23,700	22,700
	Manganese (Mn)	mg/kg	460	1,100	416	466	495	480	465
	Mercury (Hg)	mg/kg	0.17	0.49	0.0220	0.0217	0.0245	0.0228	0.0239
	Molybdenum (Mo)	mg/kg	25	23,000	0.580	0.650	0.670	0.700	0.690
	Nickel (Ni)	mg/kg	16	75	18.8	21.9	23.8	22.8	22.5
	Phosphorus (P)	mg/kg	-	-	473	482	561	462	469
	Potassium (K)	mg/kg	-	-	990	1,050	1,060	920	920
	Selenium (Se)	mg/kg	2.0	-	<0.2	<0.2	<0.2	<0.2	<0.2
	Silver (Ag)	mg/kg	0.50	-	<0.1	<0.1	<0.1	<0.1	<0.1
	Sodium (Na)	mg/kg	-	-	95.0	106	109	102	98.0
	Strontium (Sr)	mg/kg	-	-	257	277	313	283	281
	Sulfur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000
	Thallium (Tl)	mg/kg	-	-	0.0810	0.0940	0.0970	0.0890	0.0900
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	65.5	85.4	105	76.4	53.7
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	0.583	0.685	0.754	0.702	0.690
	Vanadium (V)	mg/kg	-	-	12.5	14.7	15.7	14.6	14.0
	Zinc (Zn)	mg/kg	123	315	60.0	71.1	76.9	72.7	72.4
	Zirconium (Zr)	mg/kg	-	-	1.40	1.60	1.50	1.80	1.80
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.0067	0.089	<0.005	<0.005	<0.005	<0.005	<0.005
	Acenaphthylene	mg/kg	0.0059	0.13	<0.005	<0.005	<0.005	<0.005	<0.005
	Acridine	mg/kg	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
	Anthracene	mg/kg	0.047	0.25	<0.004	<0.004	<0.004	<0.004	<0.004
	Benz(a)anthracene	mg/kg	0.032	0.39	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(a)pyrene	mg/kg	0.032	0.78	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(b,j)fluoranthene	mg/kg	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(b,j,k)fluoranthene	mg/kg	-	-	<0.015	<0.015	<0.015	<0.015	<0.015
	Benzo(e)pyrene	mg/kg	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(g,h,i)perylene	mg/kg	0.17	3.2	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(k)fluoranthene	mg/kg	0.24	13	<0.01	<0.01	<0.01	<0.01	<0.01
	Chrysene	mg/kg	0.057	0.86	<0.01	<0.01	<0.01	<0.01	<0.01
	Dibenz(a,h)anthracene	mg/kg	0.0062	0.14	<0.005	<0.005	<0.005	<0.005	<0.005
	Fluoranthene	mg/kg	0.11	2.4	<0.01	<0.01	<0.01	<0.01	<0.01
	Fluorene	mg/kg	0.021	0.14	<0.01	<0.01	<0.01	<0.01	<0.01
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.20	3.2	<0.01	<0.01	<0.01	<0.01	<0.01
	1-Methylnaphthalene	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
	2-Methylnaphthalene	mg/kg	0.020	0.20	<0.01	<0.01	<0.01	<0.01	<0.01
	Naphthalene	mg/kg	0.035	0.39	<0.01	<0.01	<0.01	<0.01	<0.01
	Perylene	mg/kg	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
	Phenanthrene	mg/kg	0.042	0.52	<0.01	<0.01	<0.01	<0.01	<0.01
	Pyrene	mg/kg	0.053	0.88	<0.01	<0.01	<0.01	<0.01	<0.01
	Quinoline	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
	d10-Acenaphthene	%	-	-	99.9	102	97.9	102	99.5
	d12-Chrysene	%	-	-	101	103	101	102	103
	d8-Naphthalene	%	-	-	97.9	100	97.2	99.6	97.9
	d10-Phenanthrene	%	-	-	99.5	104	99.5	103	102
	B(a)P Total Potency Equivalent	mg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
	IACR (CCME)	mg/kg	-	-	<0.15	<0.15	<0.15	<0.15	<0.15

Note: Shaded values were above Lower Working Sediment Quality Guideline (WSQG) and Canadian Sediment Quality Guideline (CCME). No values exceeded the upper (WSQG and CCME) guidelines.

Table C.1: Profundal Sediment Quality in Koocanusa Reservoir, August 2020

Analyte		Units	BC Sediment Quality Guidelines		Downstream of Elk River (RG_T4)				
			Lower SQG	Upper SQG	T4-1	T4-2	T4-3	T4-4	T4-5
					28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Physical Tests	Moisture	%	-	-	43.5	42.2	42.9	45.4	48.2
	pH(1:2 Soil:Water)	pH	-	-	8.13	8.11	8.13	8.12	8.19
Particle Size	% Gravel (>2 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (2.00 mm - 1.00 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (1.00 mm - 0.50 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.50 mm - 0.25 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.25 mm - 0.125 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.125 mm - 0.063 mm)	%	-	-	<1	<1	1.10	1.30	<1
	% Silt (0.063 mm - 0.0312 mm)	%	-	-	9.80	14.6	11.8	10.0	7.90
	% Silt (0.0312 mm - 0.004 mm)	%	-	-	59.1	58.3	58.8	58.5	60.2
	% Clay (<4 μm)	%	-	-	30.1	26.7	28.2	29.9	31.8
	Texture	-	-	-	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Organic Carbon	Total Organic Carbon	%	-	-	1.47	1.61	1.58	1.48	1.34
Metals	Aluminum (Al)	mg/kg	-	-	11,900	13,200	13,000	12,900	12,500
	Antimony (Sb)	mg/kg	-	-	0.380	0.470	0.490	0.470	0.430
	Arsenic (As)	mg/kg	5.9	17	6.41	7.28	7.70	7.57	6.62
	Barium (Ba)	mg/kg	-	-	135	169	170	169	149
	Beryllium (Be)	mg/kg	-	-	0.490	0.610	0.590	0.640	0.620
	Bismuth (Bi)	mg/kg	-	-	0.200	0.220	0.260	0.220	0.210
	Boron (B)	mg/kg	-	-	<5	6.00	<5	5.40	<5
	Cadmium (Cd)	mg/kg	0.60	3.5	0.390	0.559	0.580	0.523	0.457
	Calcium (Ca)	mg/kg	-	-	95,700	92,100	103,000	101,000	93,400
	Chromium (Cr)	mg/kg	37	90	17.3	19.8	20.1	21.0	18.4
	Cobalt (Co)	mg/kg	-	-	8.94	9.19	10.0	10.0	8.98
	Copper (Cu)	mg/kg	36	197	15.7	17.1	18.8	18.0	16.1
	Iron (Fe)	mg/kg	21,200	43,766	21,200	22,600	24,200	23,600	21,700
	Lead (Pb)	mg/kg	35	91	14.2	15.0	16.1	15.6	13.9
	Lithium (Li)	mg/kg	-	-	23.5	24.9	26.3	25.4	24.0
	Magnesium (Mg)	mg/kg	-	-	19,300	20,400	22,300	21,200	19,700
	Manganese (Mn)	mg/kg	460	1,100	528	557	594	598	560
	Mercury (Hg)	mg/kg	0.17	0.49	0.0356	0.0401	0.0419	0.0422	0.0402
	Molybdenum (Mo)	mg/kg	25	23,000	0.830	0.910	1.05	1.02	0.950
	Nickel (Ni)	mg/kg	16	75	21.2	23.0	25.1	24.2	22.0
	Phosphorus (P)	mg/kg	-	-	543	700	720	685	599
	Potassium (K)	mg/kg	-	-	1,240	1,890	1,520	1,640	1,530
	Selenium (Se)	mg/kg	2.0	-	0.500	0.840	0.920	0.720	0.530
	Silver (Ag)	mg/kg	0.50	-	<0.1	0.100	0.110	0.170	<0.1
	Sodium (Na)	mg/kg	-	-	101	120	118	113	113
	Strontium (Sr)	mg/kg	-	-	208	187	210	204	201
	Sulfur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000
	Thallium (Tl)	mg/kg	-	-	0.129	0.184	0.177	0.167	0.152
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	40.4	53.8	43.8	50.1	38.1
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	0.674	0.802	0.834	0.776	0.710
	Vanadium (V)	mg/kg	-	-	16.4	22.7	21.4	21.9	19.0
	Zinc (Zn)	mg/kg	123	315	73.1	85.1	89.9	87.3	77.9
	Zirconium (Zr)	mg/kg	-	-	1.50	1.30	2.90	1.50	1.40
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.0067	0.089	<0.005	<0.005	<0.005	<0.005	<0.005
	Acenaphthylene	mg/kg	0.0059	0.13	<0.005	<0.005	<0.005	<0.005	<0.005
	Acridine	mg/kg	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
	Anthracene	mg/kg	0.047	0.25	<0.004	<0.004	<0.004	<0.004	<0.004
	Benz(a)anthracene	mg/kg	0.032	0.39	<0.01	<0.02	<0.01	0.0100	<0.01
	Benzo(a)pyrene	mg/kg	0.032	0.78	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(b,j)fluoranthene	mg/kg	-	-	0.0110	0.0190	0.0150	0.0160	0.0140
	Benzo(b,j,k)fluoranthene	mg/kg	-	-	<0.015	0.0190	0.0150	0.0160	<0.015
	Benzo(e)pyrene	mg/kg	-	-	<0.01	0.0140	0.0110	0.0150	0.0100
	Benzo(g,h,i)perylene	mg/kg	0.17	3.2	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo(k)fluoranthene	mg/kg	0.24	13	<0.01	<0.01	<0.01	<0.01	<0.01
	Chrysene	mg/kg	0.057	0.86	<0.01	<0.03	<0.03	<0.03	<0.02
	Dibenz(a,h)anthracene	mg/kg	0.0062	0.14	<0.005	<0.005	<0.005	<0.005	<0.005
	Fluoranthene	mg/kg	0.11	2.4	0.0100	0.0150	0.0140	0.0140	0.0110
	Fluorene	mg/kg	0.021	0.14	<0.01	<0.01	<0.01	<0.01	<0.01
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.20	3.2	<0.01	<0.01	<0.01	<0.01	<0.01
	1-Methylnaphthalene	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
	2-Methylnaphthalene	mg/kg	0.020	0.20	0.0340	0.0450	0.0410	0.0480	0.0400
	Naphthalene	mg/kg	0.035	0.39	0.0160	0.0210	0.0180	0.0210	0.0160
	Perylene	mg/kg	-	-	0.0100	0.0190	0.0140	0.0140	0.0100
	Phenanthrene	mg/kg	0.042	0.52	0.0370	0.0540	0.0480	0.0480	0.0430
	Pyrene	mg/kg	0.053	0.88	<0.01	0.0170	0.0120	0.0130	0.0110
	Quinoline	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
	d10-Acenaphthene	%	-	-	88.7	97.7	95.9	91.3	89.4
	d12-Chrysene	%	-	-	95.2	109	106	101	102
	d8-Naphthalene	%	-	-	86.9	95.8	92.6	88.6	89.0
	d10-Phenanthrene	%	-	-	94.3	102	100	96.3	96.3
	B(a)P Total Potency Equivalent	mg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
	IACR (CCME)	mg/kg	-	-	<0.15	0.220	0.180	0.200	0.170

Note: Shaded values were above Lower Working Sediment Quality Guideline (WSQG) and Canadian Sediment Quality Guideline (CCME). No values exceeded the upper (WSQG and CCME) guidelines.

APPENDIX D

ZOOPLANKTON

Table D.1: 2020 Minnow Zooplankton Abundance Individuals/L

	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L
COPEPODA																						
CALANOIDA																						
Limnocalanus macrurus Sars adults + CV copepodites	**0.01**	**0.27**																				
Epischura nevadensis Lilljeborg																						
E.n. adult female 2.0mm	0.00		0.00	0.01		0.03	0.03	0.11	0.00	0.03			0.00					0.00	0.00	0.00		
E.n. adult male 1.8mm	0.01	0.02		0.01	0.02	0.07	0.10	0.11	0.07	0.10	0.01	0.01	0.00	0.00	0.00	0.00	0.00		0.02	0.00	0.00	0.00
E.n. immature 0.5-1.0 mm					0.02	0.07	0.26	0.11	0.03	0.03		0.00	0.02	0.00			0.00	0.06				
Total E. nevadensis	**0.01**	**0.02**	**0.00**	**0.01**	**0.03**	**0.17**	**0.40**	**0.32**	**0.10**	**0.16**	**0.01**	**0.01**	**0.03**	**0.01**	**0.00**	**0.00**	**0.01**	**0.06**	**0.02**	**0.00**	**0.00**	**0.00**
Diaptomus tyrrelli Poppe																						
D.t. adult female 1.39mm							0.03	0.04	0.03		0.04			0.03		0.05	0.01			0.00	0.02	
D.t. gravid female 1.39 mm									0.50		0.01	0.01	0.01			0.03	0.01	0.00			0.02	
D.t. adult male 1.21mm	0.03		0.02	0.02		0.07	0.03	0.11	0.20	0.03	0.04	0.07	0.07	0.02	0.03	0.03	0.02	0.00	0.00	0.00	0.02	
D.t. immature 1.16mm												0.09		0.10								
D.t. immature 1.0 mm								0.04					0.02	0.10		0.10		0.06				
D.t. immature 0.75 mm	0.52																					
D.t. immature 0.5 mm	1.03	0.53															0.10					
Total D. tyrrelli	**1.58**	**0.53**	**0.02**	**0.02**		**0.07**	**0.07**	**0.18**	**0.73**	**0.03**	**0.10**	**0.16**	**0.10**	**0.25**	**0.03**	**0.21**	**0.14**	**0.07**	**0.00**	**0.00**	**0.05**	
Diaptomus sicilis SA Forbes																						
D.s. adult female 1.39mm																						
D.s. gravid female 1.39 mm	0.00	0.27																				
D.s. adult male 1.21mm		0.27																				
D.s. immature 1.16mm																						
D.s. immature 1.0 mm																						
D.s. immature 0.75 mm		0.27																				
D.s. immature 0.5 mm																						
Total D. sicilis	**0.00**	**0.80**																				

Table D.1: 2020 Minnow Zooplankton Abundance Individuals/L

	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L
Diaptomus pallidus Herrick																						
D.p. adult female 1.25mm		0.27									0.17	0.07		0.10			0.01	0.06		0.00		0.00
D.p. gravid female														0.00		0.03		0.02	0.02	0.00		
D.p. adult male 0.97mm													0.02	0.00	0.03			0.02	0.02		0.02	0.12
D.p. immature 2.0 mm																						
D.p. immature 1.0 mm		0.27												0.10			0.00	0.02	0.06			
D.p. immature 0.75 mm		0.53	0.27								0.09	0.17		0.10				0.06				0.12
D.p. immature 0.5 mm			0.54								0.09						0.10		0.06			
Total D. pallidus		**1.07**	**0.81**								**0.34**	**0.24**	**0.02**	**0.31**	**0.03**	**0.03**	**0.12**	**0.17**	**0.15**	**0.01**	**0.02**	**0.24**
Calanoid nauplius 0.3mm	**1.29**	**0.80**	**4.05**	**0.27**	**0.26**						**0.43**	**0.68**		**0.30**	**0.42**		**0.31**	**0.17**	**0.18**		**0.87**	
Total Calanoida ind/L	**2.90**	**3.48**	**4.88**	**0.30**	**0.30**	**0.24**	**0.47**	**0.50**	**0.83**	**0.20**	**0.87**	**1.09**	**0.15**	**0.86**	**0.48**	**0.24**	**0.57**	**0.47**	**0.35**	**0.02**	**0.93**	**0.24**
CYLOPOIDA																						
Cyclops scutifer Sars																						
C. s.adult female	0.26																					
C. s. gravid female	0.02																					
C. s. male																						
C. s. immature 1.3 mm																						
C. s. immature 0.99 mm		0.27																				
C. s. immature 0.75mm		0.27																				
C. s. immature 0.5 mm	0.26																					
Total C. scutifer	**0.53**	**0.53**																				
C.vernalis (?) immature 0.5 mm					**0.53**						**0.09**		**0.09**						**0.06**	**0.12**	**0.12**	
Cyclops bicuspidatus thomasi S.A.Forbes																						
C. b. t. adult female 0.92mm	2.06	2.40	5.13	3.00	2.36	3.11	4.44	3.53	2.25	4.95	1.11	0.77	0.43	0.90	0.94	0.21	0.52		0.24	0.37	0.25	0.96
C. b. t. gravid female 0.92mm	1.55	1.07	0.27	0.36	0.31	0.14	0.51	0.18	0.23	0.75		0.02	0.09		0.03	0.31	0.05		0.06		0.05	
C. b. t. adult male 0.77mm	3.35	2.13	5.94	6.00	2.63	0.78	1.05	0.54	0.75		0.86	0.26		0.70	0.31	0.31	0.42	0.06	0.24	0.12	0.12	
C. b. t. immature 1.0 mm	1.55	0.53						0.27						0.10								
C. b. t. immature 0.75 mm	16.50	21.04	18.91	17.46	10.50	6.73	12.81	4.89	7.99	18.32	0.86	0.43	0.43	0.80	1.05	0.21	0.73	0.12	0.30	0.12	0.62	0.36
C. b. t. immature 0.5 mm	31.19	36.22	19.45	41.73	32.30	9.32	12.02	5.43	10.24	11.89	3.17	2.40	1.82	2.00	3.55	3.14	3.24	0.29	0.30	0.49	0.87	1.20
Total C. b. thomasi	**56.20**	**63.38**	**49.70**	**68.54**	**48.10**	**20.08**	**30.83**	**14.84**	**21.46**	**35.91**	**5.99**	**3.87**	**2.77**	**4.50**	**5.88**	**4.18**	**4.97**	**0.47**	**1.14**	**1.10**	**1.91**	**2.51**
Cyclopoid nauplius 0.2mm	**4.38**	**5.06**	**27.28**	**32.73**	**25.73**	**0.26**	**2.09**	**0.27**	**2.50**	**3.47**	**2.65**	**4.28**	**2.68**	**4.50**	**4.39**	**6.06**	**5.02**	**0.41**	**0.48**	**1.71**	**2.23**	**1.32**
Total Cyclopoida ind/L	**61.11**	**68.97**	**76.99**	**101.27**	**74.36**	**20.34**	**32.93**	**15.11**	**23.96**	**39.38**	**8.73**	**8.15**	**5.54**	**9.01**	**10.27**	**10.25**	**9.99**	**0.87**	**1.68**	**2.93**	**4.26**	**3.83**

Table D.1: 2020 Minnow Zooplankton Abundance Individuals/L

	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L
CLADOCERA																						
Leptodora kindtii Focke 5.1mm		**0.02**	**0.01**	**0.01**	**0.05**	**0.00**	**0.07**	**0.02**	**0.02**	**0.11**										**0.00**		
Diaphanosoma leuchtenbergianum Fisher 0.8mm									**0.03**		**0.09**	**0.26**	**0.09**	**0.30**	**0.21**	**0.21**		**0.17**	**0.24**	**0.12**	**0.62**	**0.36**
Daphnia schoedleri Sars 1.25mm	**0.00**	**0.27**						**0.02**		**0.50**												
Daphnia galeata mendotae Birge																						
D. g. m. 2.5 mm	0.52																					
D. g. m. 2.0 mm																				0.02		
D. g. m. 1.5 mm	0.26			0.82	0.53	0.26	0.26				0.09	0.09	0.09	0.10		0.21			0.02	0.03	0.37	0.24
D. g. m. 1.0 mm	1.80	1.07	1.35	3.27		1.81	6.27	2.44	2.75	0.99	0.09			0.10		0.10		0.12	0.12	0.03	0.37	0.24
D. g. m. 0.5 mm	2.32	3.20	2.70	4.09	1.31	2.85	0.03	1.63	1.50		0.17		0.09	0.20	0.10		0.10	0.17	0.12			0.12
Total D. g. mendotae	4.90	4.26	4.05	8.18	1.84	4.92	6.57	4.07	4.25	0.99	0.34	0.09	0.17	0.40	0.10	0.31	0.10	0.29	0.25	0.08	0.74	0.60
DaphniaS longiremis Sars																						
D. l. mature 1.0 mm																						
D. l. immature 0.5 mm	1.29				0.79							0.09										
Total D. longiremis	**1.29**				**0.79**							**0.09**										
Daphnia retrocurva Forbes																						
D. r. 1.52 mm	0.00		0.81	1.36	0.53	0.26	1.31			0.50	0.17	0.17	0.17			0.10	0.10	0.12	0.02	0.05	0.25	0.03
D. r. 1.24 mm		0.53	1.08	0.82	0.79	3.63	17.25	0.81	3.75	1.49	0.09	0.17		0.10	0.10					0.06		
D. r. 0.8 mm		2.93	1.89	2.73	1.58	2.59	5.75	1.09	0.25	0.50			0.17	0.10	0.10	0.10		0.06		0.12		
Total D. retrocurva	**0.00**	**3.46**	**3.78**	**4.91**	**2.89**	**6.47**	**24.31**	**1.90**	**4.00**	**2.48**	**0.26**	**0.34**	**0.35**	**0.20**	**0.21**	**0.21**	**0.10**	**0.17**	**0.02**	**0.23**	**0.25**	**0.03**
Bosmina longirostris O.F. Mueller																						
B. l. 0.5 mm	7.48	6.66	4.05	5.18	3.15																	
B. l. 0.25 mm	38.15	53.26	38.63	44.18	29.94							0.09										
Total B. longirostris	**45.63**	**59.92**	**42.68**	**49.37**	**33.09**							**0.09**										
Chydorus sps (?) 0.4mm														**0.10**								
Total Cladocera Ind/L	**51.82**	**67.93**	**50.53**	**62.47**	**38.65**	**11.40**	**30.95**	**6.02**	**8.29**	**4.07**	**0.68**	**0.86**	**0.61**	**1.00**	**0.52**	**0.73**	**0.21**	**0.64**	**0.51**	**0.44**	**1.61**	**0.99**
TOTAL CRUSTACEA ind/L	115.83	140.39	132.40	164.04	113.31	31.97	64.34	21.62	33.08	43.64	10.28	10.09	6.30	10.87	11.27	11.22	10.77	1.98	2.54	3.39	6.80	5.06

Table D.1: 2020 Minnow Zooplankton Abundance Individuals/L

	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L	IND/L
ROTIFERA																						
Kellicottia sps	72.44	58.85	115.62	93.28	89.54	8.81	5.23	2.44	8.99	21.30	0.77	1.71	0.95	0.60	0.42	0.52	0.63	0.23	0.36	0.86	0.99	0.96
Keratella sps	163.96	111.58	175.58	202.65	177.25	8.55	8.63	7.60	9.24	22.29	5.39	4.88	3.03	3.60	4.70	3.35	4.50	3.79	2.09	5.74	9.78	15.19
Polyarthra sps		3.46	31.88	16.09	35.19	0.26	0.78	0.27	2.00	1.98	0.09	0.26	0.69	0.60	0.21	0.31	0.42	0.06	0.06		0.62	0.48
Conochilus sps		0.27							0.50													
Gastropus sps				0.27		1.04	1.05	1.90	0.50		1.20	0.43		0.10		0.21	0.73			0.49	0.37	0.24
Brachionus sps	0.26	2.13	1.89	1.09	1.31					0.50											0.12	
Asplanchna sps	1.80	3.46	3.51	2.73	1.31	0.26																
Unknown rotifer																						2.27
Total Rotifera	**238.46**	**179.76**	**328.48**	**316.11**	**304.61**	**18.91**	**15.68**	**12.21**	**21.23**	**46.06**	**7.44**	**7.27**	**4.68**	**4.90**	**5.33**	**4.39**	**6.27**	**4.08**	**2.51**	**7.09**	**11.89**	**19.14**
Total Calanoida ind/L	2.90	3.48	4.88	0.30	0.30	0.24	0.47	0.50	0.83	0.20	0.87	1.09	0.15	0.86	0.48	0.24	0.57	0.47	0.35	0.02	0.93	0.24
Total Cyclopoida ind/L	61.11	68.97	76.99	101.27	74.36	20.34	32.93	15.11	23.96	39.38	8.73	8.15	5.54	9.01	10.27	10.25	9.99	0.87	1.68	2.93	4.26	3.83
Total Cladocera ind/L	51.82	67.93	50.53	62.47	38.65	11.40	30.95	6.02	8.29	4.07	0.68	0.86	0.61	1.00	0.52	0.73	0.21	0.64	0.51	0.44	1.61	0.99
Total Rotifera ind/L	238.46	179.76	328.48	316.11	304.61	18.91	15.68	12.21	21.23	46.06	7.44	7.27	4.68	4.90	5.33	4.39	6.27	4.08	2.51	7.09	11.89	19.14
TOTAL ZOOPLANKTON ABUNDANCE ind/L	354.30	320.14	460.87	480.15	417.91	50.88	80.02	33.84	54.32	89.70	17.72	17.37	10.98	15.77	16.60	15.61	17.04	6.07	5.05	10.47	18.69	24.20
Specimens counted in sample	1391	1219	1715	1797	1641	211	358	158	248	243	217	221	138	170	162	154	185	117	102	113	163	207

Table D.2: **2020 Minnow Zooplankton Biomass WW ug/L**

										Analytical #	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
										Lake	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
										Station	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
										Year	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
										Month	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
										Day	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
										Time	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
										Depth	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
										Collect	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
								Formula		**Gear**	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	Mean	**Malley et al 1989***					**Calculate**	**Wet**	**Wet**	**Sub-sample Fraction #1**	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	LENGTH	**Regression**				**Calculate**	**DryWt**	**Weight**	**Weight**	**Sub-sample Fraction #2**	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	Lmm	**LnL**	**#**	**Lna**	**b**	**LnW**	**ug**	**ug**	**ug**	**Sub-sample Fraction#3**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
										Net Mouth Area (cm2)	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS											ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
COPEPODA																																
CALANOIDA																																
Limnocalanus macrurus Sars adults + CV copepodites	**2.8**						**54.95****	**785.00**	**785**		**8.85**	**210.36**																				
Epischura nevadensis Lilljeborg																																
E.n. adult female 2.0mm	2	0.693	32	1.1337	2.7882	3.0663	21.463	306.615	306.62		1.48		0.52	2.61		10.42	10.52	32.77	0.96	9.97			1.33					0.89	1.38	0.94		
E.n. adult male 1.8mm	1.8	0.588	32	1.1337	2.7882	2.7726	16	228.57	228.57		2.21	3.99		1.17	3.94	15.54	23.52	24.43	14.99	22.29	1.47	1.47	0.49	0.57	0.60	0.60	0.60		3.59	0.35	0.71	0.68
E.n. immature 0.5-1.0 mm	1.1	0.095	32	1.1337	2.7882	1.3994	4.0529	57.90	57.90						1.00	3.94	15.13	6.19	1.90	1.88		0.12	1.32	0.14			0.15	3.38				
Total E. nevadensis											**3.69**	**3.99**	**0.52**	**3.78**	**4.94**	**29.90**	**49.18**	**63.39**	**17.84**	**34.13**	**1.47**	**1.59**	**3.14**	**0.72**	**0.60**	**0.60**	**0.75**	**4.27**	**4.96**	**1.29**	**0.71**	**0.68**
Diaptomus tyrrelli Poppe																																
D.t. adult female 1.4mm	1.4	0.336	30	0.977	2.538	1.8313	6.242	89.17	89.17								3.06	3.18	2.92		4.00			2.34		4.89	0.70			0.14	1.45	
D.t. gravid female 1.4 mm	1.4	0.336	30	0.977	2.538	1.8313	6.242	89.17	89.17										44.55		0.57	0.57	0.77			2.45	0.70	0.26			1.45	
D.t. adult male 1.2 mm	1.2	0.182	30	0.977	2.538	1.44	4.2207	60.30	60.30		2.04		1.07	1.08		4.10	2.07	6.44	11.86	1.96	2.71	4.06	4.11	1.21	1.65	1.65	0.95	0.26	0.18	0.09	0.98	
D.t. immature 1.16mm	1.18	0.166	30	0.977	2.538	1.3973	4.0444	57.78	57.78													4.94		5.78								
D.t. immature 1.0 mm	0.99	-0.010	30	0.977	2.538	0.9517	2.5901	37.00	37.00									1.32					0.84	3.70		3.87		2.16				
D.t. immature 0.75 mm	0.75	-0.288	30	0.977	2.538	0.2469	1.2801	18.29	18.29		9.43																					
D.t. immature 0.5 mm	0.5	-0.693	30	0.977	2.538	-0.782	0.4574	6.53	6.53		6.74	3.48															0.68					
Total D. tyrrelli											**18.21**	**3.48**	**1.07**	**1.08**		**4.10**	**5.13**	**10.94**	**59.34**	**1.96**	**7.28**	**9.58**	**5.72**	**13.04**	**1.65**	**12.87**	**3.03**	**2.68**	**0.18**	**0.23**	**3.88**	
Diaptomus sicilis SA Forbes																																
D. s. adult female 1.4mm	1.4	0.3365	L124	0.931	3.036	1.9525	7.0465	100.6642	100.66415																							
D. s. gravid female 1.4mm	1.4	0.3365	L124	0.931	3.036	1.9525	7.0465	100.6642	100.66415		0.16	26.81																				
D.s. adult male 1.2mm	1.2	0.1823	L124	0.931	3.036	1.4845	4.4129	63.04119	63.041188			16.79																				
D.s. immature 1.18mm	1.18	0.1655	L124	0.931	3.036	1.4335	4.1934	59.90511	59.905114																							
D.s. immature 1.0	0.99	-0.0101	L124	0.931	3.036	0.9005	2.4608	35.15431	35.15431																							
D.s. immature 0.75	0.75	-0.2877	L124	0.931	3.036	0.0576	1.0593	15.13269	15.132689			4.03																				
D.s. immature 0.5	0.5	-0.6931	L124	0.931	3.036	-1.1734	0.3093	4.418787	4.4187869																							
Total D. sicilis											**0.16**	**47.63**																				
Diaptomus pallidus Herrick																																
D.p. adult female 1.25 mm	1.25	0.223	30	0.9772	2.538	1.5435	4.6811	66.87	66.87			17.81									11.44	4.50		6.69			0.70	4.10		0.20		0.10
D.p. gravid female 1.25 mm	1.25	0.223	30	0.9772	2.538	1.5435	4.6811	66.87	66.87															0.17		1.84		1.02	1.05	0.31		
D.p. adult male 0.97 mm	0.97	-0.030	30	0.9772	2.538	0.8999	2.4593	35.13	35.13														0.80	0.09	0.96			0.54	0.55		0.57	4.20
D.p. immature >1 mm	1.15	0.140	30	0.9772	2.538	1.3319	3.7883	54.12	54.12																							
D.p. immature 1.0 mm	0.99	-0.010	30	0.9772	2.538	0.9517	2.5901	37.00	37.00			9.85												3.70			0.10	0.57	2.21			
D.p. immature 0.75 mm	0.75	-0.288	30	0.9772	2.538	0.2471	1.2803	18.29	18.29			9.74	4.94								1.56	3.13		1.83				1.07				2.19
D.p. immature 0.5 mm	0.5	-0.693	30	0.9772	2.538	-0.782	0.4575	6.54	6.54				3.53								0.56						0.68		0.39			
Total D. pallidus												**37.40**	**8.47**								**13.56**	**7.63**	**0.80**	**12.48**	**0.96**	**1.84**	**1.48**	**7.29**	**4.21**	**0.51**	**0.57**	**6.49**
Calanoid nauplius 0.3mm	**0.293**	**-1.228**	**6**	**0.9926**	**2.0997**	**-1.585**	**0.205**	**2.93**	**2.928**		**3.77**	**2.34**	**11.86**	**0.80**	**0.77**						**1.25**	**2.00**		**0.88**	**1.22**		**0.92**	**0.51**	**0.53**		**2.54**	
Total Calanoida ug/L											**34.68**	**305.20**	**21.92**	**5.66**	**5.71**	**34.00**	**54.30**	**74.33**	**77.18**	**36.09**	**23.57**	**20.80**	**9.66**	**27.12**	**4.44**	**15.30**	**6.17**	**14.76**	**9.87**	**2.02**	**7.69**	**7.17**

Table D.2: 2020 Minnow Zooplankton Biomass WW ug/L

										Analytical #	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
										Lake	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
										Station	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
										Year	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
										Month	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
										Day	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
										Time	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
										Depth	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
										Collect	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
								Formula		Gear	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
	Mean	Malley et al 1989*					Calculate	Wet	Wet	Sub-sample Fraction #1	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
	LENGTH	Regression				Calculate	DryWt	Weight	Weight	Sub-sample Fraction #2	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	Lmm	LnL	#	Lna	b	LnW	ug	ug	ug	Sub-sample Fraction#3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
										Net Mouth Area (cm2)	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS											ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
CYLOPOIDA																																
Cyclops scutifer Sars																																
C. s.adult female	1.400	0.336	94	1.317	2.792	2.255	9.536	136.234	136.234		35.12																					
C. s. gravid female	1.330	0.285	94	1.317	2.792	2.113	8.273	118.190	118.190		1.90																					
C. s. male	1.190	0.174	94	1.317	2.792	1.803	6.065	86.642	86.642																							
C. s. immature 1.3 mm	1.140	0.131	94	1.317	2.792	1.683	5.380	76.857	76.857																							
C. s. immature 0.99 mm	0.990	-0.010	94	1.317	2.792	1.289	3.629	51.837	51.837			13.80																				
C. s. immature 0.75mm	0.750	-0.288	94	1.317	2.792	0.514	1.672	23.880	23.880			6.36																				
C. s. immature 0.5 mm	0.500	-0.693	94	1.317	2.792	-0.618	0.539	7.699	7.699		1.98																					
Total C. scutifer											**39.01**	**20.16**																				
Acanthocyclops vernalis (?) immature 0.5 mm	**0.5**	**-0.693**	**92**	**0.8344**	**2.576**	**-0.951**	**0.3863**	**5.51854**	**5.519**						**2.90**						**0.47**		**0.48**						**0.33**	**0.67**	**0.68**	
Cyclops bicuspidatus thomasi S.A.Forbes																																
C. b. t. adult female 0.92mm	0.920	-0.083	68	0.7606	3.9145	0.4342	1.5437	22.05	22.05		45.48	52.86	113.19	66.16	52.12	68.54	97.99	77.82	49.58	109.22	24.52	16.98	9.55	19.87	20.75	4.61	11.53		5.28	8.08	5.46	21.10
C. b. t. gravid female 0.92mm	0.92	-0.083	68	0.7606	3.9145	0.4342	1.5437	22.05	22.05		34.11	23.49	5.96	7.89	6.84	3.00	11.35	3.93	5.06	16.48		0.50	1.91		0.61	6.92	1.21		1.38		1.08	
C. b. t. adult male 0.77mm	0.77	-0.261	68	0.7606	3.9145	-0.263	0.7691	10.99	10.99		36.82	23.41	65.30	65.93	28.85	8.54	11.49	5.96	8.23		9.40	2.82		7.70	3.45	3.45	4.59	0.64	2.63	1.34	1.36	
C. b. t. immature 1.0 mm	0.99	-0.010	51	0.9032	2.7307	0.876	2.401	34.300	34.300		53.05	18.27						9.31						3.43								
C. b. t. immature 0.75 mm	0.75	-0.288	51	0.9032	2.7307	0.117	1.124	16.055	16.055		264.89	337.77	303.59	280.25	168.64	108.11	205.62	78.44	128.34	294.19	13.73	6.87	6.95	12.86	16.79	3.36	11.75	1.87	4.80	1.96	9.94	5.76
C. b. t. immature 0.5 mm	0.5	-0.693	51	0.9032	2.7307	-0.989	0.372	5.313	5.313		165.72	192.41	103.33	221.69	171.59	49.53	63.88	28.84	54.41	63.14	16.81	12.72	9.66	10.64	18.88	16.66	17.22	1.55	1.59	2.60	4.60	6.35
Total C. b. thomasi											**600.08**	**648.21**	**591.36**	**641.92**	**428.04**	**237.71**	**390.33**	**204.30**	**245.63**	**483.03**	**64.47**	**39.88**	**28.07**	**54.49**	**60.47**	**34.99**	**46.30**	**4.06**	**15.68**	**13.99**	**22.44**	**33.22**
Cyclopoid nauplius 0.2mm	**0.14**	**-1.966**	**49**	**1.6388**	**2.4474**	**-1.649**	**0.192**	**2.747**	**2.747**		**12.04**	**13.90**	**74.96**	**89.92**	**70.70**	**0.71**	**5.74**	**0.75**	**6.86**	**9.52**	**7.29**	**11.75**	**7.37**	**12.38**	**12.06**	**16.66**	**13.79**	**1.12**	**1.31**	**4.70**	**6.12**	**3.61**
Total Cyclopoida ug/L											**651.13**	**682.27**	**666.31**	**731.84**	**501.64**	**238.42**	**396.07**	**205.05**	**252.50**	**492.56**	**72.23**	**51.63**	**35.92**	**66.87**	**72.54**	**51.65**	**60.09**	**5.18**	**17.32**	**19.36**	**29.25**	**36.83**

Table D.2: 2020 Minnow Zooplankton Biomass WW ug/L

INSTAR IDENTIFICATION & SIZE CLASS	Mean LENGTH Lmm	Malley et al 1989* Regression LnL	#	Lna	b	Calculate LnW	Calculate DryWt ug	Formula Wet Weight ug	Wet Weight ug
CLADOCERA									
Leptodora kindtii Focke 5.1mm							**12****	**171.43**	**171.43**
Diaphanosoma leuchtenbergianum Fisher 0.8mm	**0.8**	**-0.223**	**L223**	**1.274**	**3.2454**	**0.5498**	**1.7329**	**24.7561**	**24.7561**
Daphnia schoedleri Sars 1.25mm	**1.250**	**0.223**	**DsL885**	**1.3933**	**3.0114**	**2.0653**	**7.8875**	**112.68**	**112.68**
Daphnia galeata mendotae Birge									
D. g. m. 2.5 mm	2.50	0.916	L223	1.0797	2.7188	3.5709	35.549	507.84	507.84
D. g. m. 2.0 mm	1.95	0.6678	L223	1.0797	2.7188	3.4399	31.182	445.464	445.4635
D. g. m. 1.5 mm	1.5	0.4055	L223	1.0797	2.7188	3.1566	23.49	335.573	335.5734
D. g. m. 1.0 mm	1.01	0.010	L223	1.0797	2.7188	1.108	3.027	43.243	43.243
D. g. m. 0.5 mm	0.38	-0.968	L223	1.0797	2.7188	-1.619	0.198	2.830	2.830
Total D. g. mendotae									
DaphniaS longiremis Sars									
D. l. mature 1.0 mm	0.900	-0.105	L302	1.627	3.337	1.276	3.582	51.167	51.167
D. l. immature 0.5 mm	0.750	-0.288	L302	1.627	3.337	0.667	1.949	27.848	27.848
Total D. longiremis									
Daphnia retrocurva Forbes									
D. r. 1.52 mm	1.52	0.419	L227	0.8637	3.1262	2.1727	8.7817	125.45	125.45
D. r. 1.24 mm	1.24	0.215	L227	0.8637	3.1262	1.5362	4.6468	66.38	66.38
D. r. 0.8 mm	0.8	-0.223	L227	0.8637	3.1262	0.1661	1.1807	16.87	16.87
Total D. retrocurva									
Bosmina longirostris O.F. Mueller									
B. l. 0.5 mm	0.5	-0.693	L223Bl	2.4751	3.3614	0.145	1.156	16.517	16.517
B. l. 0.25 mm	0.250	-1.386	L223Bl	2.4751	3.3614	-2.185	0.113	1.607	1.607
Total B. longirostris									
Chydorus sps (?) 0.4mm							**.741******	**10.5857**	**10.58571**
Total Cladocera ug/L									
TOTAL CRUSTACEA ug/L									
ROTIFERA									
Kellicottia sps	**0.128**	**-2.056**	**L224**				**0.015**	**0.214**	**0.214**
Keratella sps	**0.102**	**-2.283**	**L224**				**0.011**	**0.157**	**0.157**
Polyarthra sps******	**0.126**	**-2.071**	**L227**				**0.041**	**0.586**	**0.586**
Conochilus sps	**0.186**	**-1.682**	**L223**				**0.042**	**0.600**	**0.600**
Gastropus sps	**0.05**	**-2.996**	**L224**				**0.015**	**0.214**	**0.214**
Brachionus sps*********	**0.2**	**-1.609**	**Clay**				**0.044**	**0.629**	**0.629**
Asplanchna sps******	**0.500**		**302**						**1.501**
Unknown rotifer (Gastropus like) ?	**0.05**	**-2.996**	**L224**				**0.015**	**0.214**	**0.214**
Total Rotifera									
Total Calanoida ug/L									
Total Cyclopoida ug/L									
Total Cladocera ug/L									
Total Rotifera ug/L									
TOTAL ZOOPLANKTON BIOMASS ug /L									

Analytical #	1	2	3	4	5	6	7	8	9	10	11	11x	12	13	14	15	15X	16	17	18	19	20
Lake	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Station	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
Year	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
Month	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
Day	19	19	19	19	19	22	22	22	22	22	26	26	26	26	26	26	26	24	24	26	26	26
Time	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
Depth	22	21	21	21	22	11	11	10	11	11	17	17	16	14	14	14	14	24	24	23	23	24
Collect	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Gear	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
Sub-sample Fraction #1	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
Sub-sample Fraction #2	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Sub-sample Fraction#3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Net Mouth Area (cm2)	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
INSTAR IDENTIFICATION & SIZE CLASS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
CLADOCERA																						
Leptodora kindtii Focke 5.1mm		**3.71**	**2.03**	**1.46**	**7.88**	**0.55**	**11.76**	**4.07**	**2.68**	**18.04**										**0.26**		
Diaphanosoma leuchtenbergianum Fisher 0.8mm									**0.81**		**2.12**	**6.35**	**2.14**	**7.43**	**5.18**	**5.18**		**4.33**	**5.92**	**3.03**	**15.33**	**8.88**
Daphnia schoedleri Sars 1.25mm	**0.54**	**30.01**						**2.68**		**55.80**												
Daphnia galeata mendotae Birge																						
D. g. m. 2.5 mm	261.84																					
D. g. m. 2.0 mm																				7.14		
D. g. m. 1.5 mm	86.51			274.57	176.24	86.91	87.71				28.71	28.71	29.06	33.59		70.17			5.27	10.76	124.64	80.28
D. g. m. 1.0 mm	78.04	46.06	58.41	141.53		78.39	271.27	105.64	118.83	42.83	3.70			4.33		4.52		5.04	5.17	1.39	16.06	10.34
D. g. m. 0.5 mm	6.57	9.04	7.64	11.58	3.72	8.06	0.10	4.61	4.24		0.48		0.25	0.57	0.30		0.30	0.50	0.34			0.34
Total D. g. mendotae	**432.95**	**55.11**	**66.05**	**427.68**	**179.95**	**173.36**	**359.07**	**110.25**	**123.07**	**42.83**	**32.89**	**28.71**	**29.30**	**38.49**	**0.30**	**74.69**	**0.30**	**5.54**	**10.78**	**19.30**	**140.70**	**90.96**
DaphniaS longiremis Sars																						
D. l. mature 1.0 mm																						
D. l. immature 0.5 mm	35.90				21.94							2.38										
Total D. longiremis	**35.90**				**21.94**							**2.38**										
Daphnia retrocurva Forbes																						
D. r. 1.52 mm	0.20		101.67	171.08	65.89	32.49	163.95			62.13	21.46	21.46	21.73			13.12	13.12	14.63	1.97	6.04	31.06	3.94
D. r. 1.24 mm		35.36	71.73	54.32	52.29	240.68	1145.16	54.05	248.75	98.63	5.68	11.36		6.65	6.94					4.26		
D. r. 0.8 mm		49.41	31.89	46.00	26.58	43.68	96.99	18.31	4.21	8.35			2.92	1.69	1.76	1.76		0.98		2.06		
Total D. retrocurva	**0.20**	**84.77**	**205.29**	**271.40**	**144.76**	**316.86**	**1406.11**	**72.37**	**252.96**	**169.11**	**27.14**	**32.82**	**24.65**	**8.33**	**8.70**	**14.88**	**13.12**	**15.62**	**1.97**	**12.36**	**31.06**	**3.94**
Bosmina longirostris O.F. Mueller																						
B. l. 0.5 mm	123.49	109.97	66.93	85.59	52.05																	
B. l. 0.25 mm	61.32	85.60	62.08	71.01	48.11							0.14										
Total B. longirostris	**184.80**	**195.57**	**129.01**	**156.61**	**100.16**							**0.14**										
Chydorus sps (?) 0.4mm														**1.06**								
Total Cladocera ug/L	**654.40**	**369.16**	**402.38**	**857.15**	**454.68**	**490.77**	**1776.94**	**189.36**	**379.52**	**285.78**	**62.15**	**70.40**	**56.09**	**55.31**	**14.18**	**94.75**	**13.41**	**25.49**	**18.67**	**34.94**	**187.09**	**103.78**
TOTAL CRUSTACEA ug/L	**1340.21**	**1356.63**	**1090.61**	**1594.65**	**962.03**	**763.19**	**2227.32**	**468.73**	**709.20**	**814.44**	**157.94**	**142.84**	**101.68**	**149.30**	**91.15**	**161.70**	**79.68**	**45.43**	**45.87**	**56.33**	**224.03**	**147.79**
ROTIFERA																						
Kellicottia sps	15.52	12.61	24.77	19.99	19.19	1.89	1.12	0.52	1.93	4.56	0.16	0.37	0.20	0.13	0.09	0.11	0.13	0.05	0.08	0.18	0.21	0.21
Keratella sps	25.76	17.53	27.59	31.84	27.85	1.34	1.36	1.19	1.45	3.50	0.85	0.77	0.48	0.57	0.74	0.53	0.71	0.60	0.33	0.90	1.54	2.39
Polyarthra sps******		2.03	18.68	9.43	20.62	0.15	0.46	0.16	1.17	1.16	0.05	0.15	0.41	0.35	0.12	0.18	0.25	0.03	0.04		0.36	0.28
Conochilus sps		0.16							0.30													
Gastropus sps				0.06		0.22	0.22	0.41	0.11		0.26	0.09		0.02		0.04	0.16			0.10	0.08	0.05
Brachionus sps*********	0.16	1.34	1.19	0.69	0.83					0.31											0.08	
Asplanchna sps******	2.71	5.20	5.27	4.09	1.97	0.39																
Unknown rotifer (Gastropus like) ?																						0.49
Total Rotifera	**44.16**	**38.87**	**77.51**	**66.10**	**70.46**	**3.99**	**3.16**	**2.28**	**4.96**	**9.54**	**1.32**	**1.37**	**1.09**	**1.07**	**0.95**	**0.87**	**1.24**	**0.68**	**0.44**	**1.19**	**2.27**	**3.41**
Total Calanoida ug/L	34.68	305.20	21.92	5.66	5.71	34.00	54.30	74.33	77.18	36.09	23.57	20.80	9.66	27.12	4.44	15.30	6.17	14.76	9.87	2.02	7.69	7.17
Total Cyclopoida ug/L	651.13	682.27	666.31	731.84	501.64	238.42	396.07	205.05	252.50	492.56	72.23	51.63	35.92	66.87	72.54	51.65	60.09	5.18	17.32	19.36	29.25	36.83
Total Cladocera ug/L	654.40	369.16	402.38	857.15	454.68	490.77	1776.94	189.36	379.52	285.78	62.15	70.40	56.09	55.31	14.18	94.75	13.41	25.49	18.67	34.94	187.09	103.78
Total Rotifera ug/L	44.16	38.87	77.51	66.10	70.46	3.99	3.16	2.28	4.96	9.54	1.32	1.37	1.09	1.07	0.95	0.87	1.24	0.68	0.44	1.19	2.27	3.41
TOTAL ZOOPLANKTON BIOMASS ug /L	**1384.36**	**1395.50**	**1168.11**	**1660.75**	**1032.49**	**767.18**	**2230.48**	**471.02**	**714.16**	**823.97**	**159.26**	**144.21**	**102.76**	**150.37**	**92.11**	**162.56**	**80.92**	**46.11**	**46.31**	**57.52**	**226.30**	**151.20**

Table D.2: 2020 Minnow Zooplankton Biomass WW ug/L

INSTAR IDENTIFICATION & SIZE CLASS	Mean LENGTH Lmm	Malley et al 1989* Regression LnL	#	Lna	b	Calculate LnW	Calculate DryWt ug	Formula Wet Weight ug	Wet Weight ug

	1	2	3	4	5	6	7	8	9	10	11
Analytical #	1	2	3	4	5	6	7	8	9	10	11
Lake	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Station	RGT41	RGT42	RGT43	RGT44	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5	RGT41
Year	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
Month	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	JUNE	AUG
Day	19	19	19	19	19	22	22	22	22	22	26
Time	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
Depth	22	21	21	21	22	11	11	10	11	11	17
Collect	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Gear	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
Sub-sample Fraction #1	160.0	160.0	160.0	160.0	160.0	80.0	80.0	80.0	80.0	160.0	40.0
Sub-sample Fraction #2	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Sub-sample Fraction#3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Net Mouth Area (cm2)	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L

	11x	12	13	14	15	15X	16	17	18	19	20
Analytical #	11x	12	13	14	15	15X	16	17	18	19	20
Lake	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Station	RGT41	RGT42	RGT43	RGT44	RGT45	RGT45	RGTN1	RGTN2	RGTN3	RGTN4	RGTN5
Year	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
Month	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG	AUG
Day	26	26	26	26	26	26	24	24	26	26	26
Time	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
Depth	17	16	14	14	14	14	24	24	23	23	24
Collect	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW	MINNOW
Gear	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM	WJ19CM
Sub-sample Fraction #1	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0
Sub-sample Fraction #2	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Sub-sample Fraction#3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Net Mouth Area (cm2)	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4	283.4
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L

*Length/DryWeight Regressions in form Lnw = Lna + bLnL from Malley et al. 1989
R6 LnW= 0.9926-2.0997 LnL
R27 LnW = 1.0542 -2.748 LnL
R30 LnW =0.9772-2.5384 LnL
R32 Ln+A145:E155W = 1.1337 + 2.7882 LnL
R49 LnW= 1.6388 - 2.4474 LnL
R77 LnW= 1.3472+3.0087LnL
R92 LnW= 0.8344-2.5760 LnL
R94 LnW = 1.3169 - 2.7197 LnL
DsL885 LnW = 1.3933 - 3.0114 LnL t
RL302 LnW = 1.6274 - 3.3367 LnL
RL223Hg LnW = 2.1169 + 2.6972 LnL
RL223Bl LnW = 2.4751 - 3.3614 LnL
RL223Cs LnW = 3.1270 -3.3678 LnL
** Table A2 Malley et al. 1989 Lake Ontario
***used formula for Diaphanosoma birgei Table 10 Malley et al 1989.
****Table 11 Malley et al 1989
***** used formula for Keratella cochlearis Clay Lake Table 11 Malley et all 1989
******used formula for Ceriodaphnia lacustris Clay Lake Table 10 Malley et al 1989
*******Table A1 Malley et al 1989

Table D.3: Zooplankton Community Density Data (no. organisms/L), Koocanusa Reservoir Monitoring Program, June and August 2020

Month	Taxa Group	Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
			TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5
June	Cladocera	*Bosmina longirostris*	0	0	0	0	0	45.6	59.9	42.7	49.4	33.1
		Daphnia galeata	4.92	6.57	4.07	4.25	0.99	4.9	4.26	4.05	8.18	1.84
		Daphnia longiremis	0	0	0	0	0	1.29	0	0	0	0.788
		Daphnia retrocurva	6.47	24.3	1.9	4	2.48	0.00161	3.46	3.78	4.91	2.89
		Daphnia schoedleri	0	0	0.0238	0	0.495	0.00483	0.266	0	0	0
		Diaphanosoma leuchtenbergianum	0	0	0	0.0328	0	0	0	0	0	0
		Leptodora kindtii	0.00324	0.0686	0.0238	0.0156	0.105	0	0.0216	0.0118	0.00852	0.046
	Copepoda	*Calanoid nauplius*	0	0	0	0	0	1.29	0.799	4.05	0.273	0.263
		Cyclopoid nauplius	0.259	2.09	0.271	2.5	3.47	4.38	5.06	27.3	32.7	25.7
		Cyclops bicuspidatus	20.1	30.8	14.8	21.5	35.9	56.2	63.4	49.7	68.5	48.1
		Cyclops scutifer	0	0	0	0	0	0.532	0.533	0	0	0
		Cyclops vernalis	0	0	0	0	0	0	0	0	0	0.525
		Diaptomus pallidus	0	0	0	0	0	0	1.07	0.81	0	0
		Diaptomus sicilis	0	0	0	0	0	0.00161	0.799	0	0	0
		Diaptomus tyrrelli	0.068	0.0686	0.178	0.729	0.0325	1.58	0.533	0.0177	0.0179	0
		Epischura nevadensis	0.17	0.399	0.321	0.101	0.163	0.0145	0.0175	0.00169	0.0136	0.0345
		Limnocalanus macrurus	0	0	0	0	0	0.0113	0.268	0	0	0
	Rotifera	*Asplanchna sps*	0.259	0	0	0	0	1.8	3.46	3.51	2.73	1.31
		Brachionus sps	0	0	0	0	0.495	0.258	2.13	1.89	1.09	1.31
		Conochilus sps	0	0	0	0.5	0	0	0.266	0	0	0
		Gastropus sps	1.04	1.05	1.9	0.5	0	0	0	0	0.273	0
		Kellicottia sps	8.81	5.23	2.44	8.99	21.3	72.4	58.9	116	93.3	89.5
		Keratella sps	8.55	8.63	7.6	9.24	22.3	164	112	176	203	177
		Polyarthra sps	0.259	0.784	0.271	2	1.98	0	3.46	31.9	16.1	35.2
		Total Number of Organisms/L:	**50.9**	**80.0**	**33.8**	**54.4**	**89.7**	**354**	**321**	**462**	**480**	**418**
		Total Number of Taxa:	**12**	**11**	**12**	**13**	**12**	**17**	**20**	**15**	**15**	**15**
August	Cladocera	*Daphnia galeata*	0.292	0.255	0.0802	0.743	0.598	0.342	0.173	0.4	0.105	0.314
		Daphnia retrocurva	0.175	0.0157	0.234	0.248	0.0314	0.257	0.346	0.2	0.209	0.209
		Diaphanosoma leuchtenbergianum	0.175	0.239	0.122	0.619	0.359	0.0855	0.0866	0.3	0.209	0.209
		Leptodora kindtii	0	0	0.00153	0	0	0	0	0	0	0
	Copepoda	*Calanoid nauplius*	0.175	0.179	0	0.867	0	0.428	0	0.3	0.418	0
		Cyclopoid nauplius	0.408	0.478	1.71	2.23	1.32	2.65	2.68	4.5	4.39	6.06
		Cyclops bicuspidatus	0.467	1.14	1.1	1.91	2.51	5.99	2.77	4.5	5.88	4.18
		Cyclops vernalis	0	0.0598	0.122	0.124	0	0.0855	0.0866	0	0	0
		Diaptomus pallidus	0.165	0.151	0.00764	0.0163	0.241	0.342	0.0227	0.305	0.0274	0.0274
		Diaptomus tyrrelli	0.0656	0.00299	0.00306	0.0488	0	0.0962	0.0996	0.247	0.0274	0.214
		Epischura nevadensis	0.0612	0.0202	0.00458	0.0031	0.00299	0.00642	0.0292	0.00501	0.00261	0.00261
	Rotifera	*Brachionus sps*	0	0	0	0.124	0	0	0	0	0	0
		Conochilus sps	0	0	0	0	0	0	0	0	0	0
		Gastropus sps	0	0	0.489	0.371	0.239	1.2	0	0.1	0	0.209
		Kellicottia sps	0.233	0.359	0.855	0.99	0.957	0.77	0.953	0.601	0.418	0.523
		Keratella sps	3.79	2.09	5.74	9.78	15.2	5.39	3.03	3.6	4.7	3.35
		Polyarthra sps	0.0583	0.0598	0	0.619	0.478	0.0855	0.693	0.601	0.209	0.314
		Unknown rotifer	0	0	0	0	2.27	0	0	0	0	0
		Total Number of Organisms/L:	**6.07**	**5.05**	**10.5**	**18.7**	**24.2**	**17.7**	**11.0**	**15.7**	**16.6**	**15.6**
		Total Number of Taxa:	**12**	**13**	**13**	**15**	**12**	**14**	**12**	**13**	**12**	**12**

Table D.4: **Zooplankton Density (no. of organisms/L) Organized by Major Groups, Koocanusa Reservoir Monitoring Program, June and August 2020**

Month	Group	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
		TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5
June	Cladocera	11.4	30.9	6.02	8.29	4.07	51.8	67.9	50.5	62.5	38.6
	Copepoda	20.6	33.4	15.6	24.8	39.6	64.0	72.5	81.9	102	74.7
	Rotifera	18.9	15.7	12.2	21.2	46.1	238	180	328	316	305
	Total number of organisms/L	**50.9**	**80.0**	**33.8**	**54.3**	**89.7**	**354**	**320**	**461**	**480**	**418**
	Total number of groups	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
August	Cladocera	0.64	0.51	0.44	1.6	1.0	0.68	0.61	1.0	0.5	0.7
	Copepoda	1.34	2.031	2.948	5.19	4.07	9.60	5.69	9.866	10.749	10.49
	Rotifera	4.08	2.51	7.09	11.89	19.14	7.44	4.68	4.90	5.33	4.39
	Total number of organisms/L	**6.1**	**5.05**	**10.5**	**18.7**	**24.2**	**17.7**	**11.0**	**15.8**	**16.6**	**15.6**
	Total number of groups	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Table D.5: Relative Density (%) of Zooplankton Species, June 2020

Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)					Summary Statistics									
											Minimum		Median		Maximum		Mean		Standard Deviation	
	TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4
Acanthocyclops vernalis	0.509	0	0	0	0	0.508	1.08	0.760	0.568	0.314	0.509	0.314	0.509	0.568	0.509	1.08	0.509	0.646	-	0.290
Bosmina longirostris	0	0	0	0	0	12.9	18.7	9.25	10.3	7.93	0	7.93	NA	10.3	NA	18.7	NA	11.8	NA	4.25
Brachionus sps	0	0	0	0	0.552	0.0728	0.664	0.409	0.227	0.314	0.552	0.0728	0.552	0.314	0.552	0.664	0.552	0.337	-	0.221
Calanoid nauplius	0	0	0	0	0	0.364	0.249	0.877	0.0568	0.0630	NA	0.0568	NA	0.249	NA	0.877	NA	0.322	NA	0.336
Conochilus sps	0	0	0	0.920	0	0	0.0830	0	0	0	0.920	0.0830	0.920	0.0830	0.920	0.0830	0.920	0.0830	-	-
Cyclopoid nauplius	0.509	2.61	0.802	4.60	3.87	1.24	1.58	5.91	6.81	6.15	0.509	1.24	2.61	5.91	4.60	6.81	2.48	4.34	1.81	2.70
Cyclops bicuspidatus thomasi	39.5	38.5	43.8	39.5	40.0	15.9	19.8	10.8	14.3	11.5	38.5	10.8	39.5	14.3	43.8	19.8	40.3	14.4	2.04	3.63
Cyclops scutifer	0	0	0	0	0	0.150	0.166	0	0	0	NA	0.150	NA	0.158	NA	0.166	NA	0.158	NA	0.0114
Cyclops vernalis	0	0	0	0	0	0	0	0	0	0.126	NA	0.126	NA	0.126	NA	0.126	NA	0.126	NA	-
Daphnia galeata mendotae	9.66	8.21	12.0	7.82	1.10	1.38	1.33	0.877	1.70	0.441	1.10	0.441	8.21	1.33	12.0	1.70	7.77	1.15	4.08	0.492
Daphnia longiremis	0	0	0	0	0	0.364	0	0	0	0.189	NA	0.189	NA	0.276	NA	0.364	NA	0.276	NA	0.124
Daphnia retrocurva	12.7	30.4	5.62	7.36	2.76	0.000454	1.08	0.819	1.02	0.692	2.76	0.000454	7.36	0.819	30.4	1.08	11.8	0.722	11.0	0.433
Daphnia schoedleri	0	0	0.0704	0	0.552	0.00136	0.0830	0	0	0	0.0704	0.00136	0.311	0.0422	0.552	0.0830	0.311	0.0422	0.340	0.0577
Diaphanosoma leuchtenbergianum	0	0	0	0.0603	0	0	0	0	0	0	0.0603	NA	0.0603	NA	0.0603	NA	0.0603	NA	-	NA
Diaptomus pallidus	0	0	0	0	0	0	0.334	0.175	0	0	NA	0.175	NA	0.255	NA	0.334	NA	0.255	NA	0.112
Diaptomus sicilis	0	0	0	0	0	0.000454	0.249	0	0	0	NA	0.000454	NA	0.125	NA	0.249	NA	0.125	NA	0.176
Diaptomus tyrrelli	0.134	0.0858	0.527	1.34	0.0362	0.446	0.166	0.00383	0.00373	0	0.0362	0.00373	0.134	0.0850	1.34	0.446	0.425	0.155	0.548	0.209
Epischura nevadensis	0.334	0.499	0.950	0.186	0.182	0.00409	0.00546	0.000366	0.00283	0.00826	0.182	0.000366	0.334	0.00409	0.950	0.00826	0.430	0.00420	0.318	0.00294
Gastropus sps	2.04	1.31	5.62	0.920	0	0	0	0	0.0568	0	0.920	0.0568	1.68	0.0568	5.62	0.0568	2.47	0.0568	2.15	-
Kellicottia sps	17.3	6.54	7.22	16.5	23.7	20.4	18.4	25.1	19.4	21.4	6.54	18.4	16.5	20.4	23.7	25.1	14.3	21.0	7.31	2.59
Keratella sps	16.8	10.8	22.5	17.0	24.9	46.3	34.9	38.1	42.2	42.4	10.8	34.9	17.0	42.2	24.9	46.3	18.4	40.8	5.50	4.37
Leptodora kindtii	0.00636	0.0858	0.0704	0.0287	0.117	0	0.00674	0.00256	0.00177	0.0110	0.00636	0.00177	0.0704	0.00465	0.117	0.0110	0.0617	0.00552	0.0444	0.00426
Limnocalanus macrurus	0	0	0	0	0	0.00319	0.0836	0	0	0	NA	0.00319	NA	0.0434	NA	0.0836	NA	0.0434	NA	0.0569
Polyarthra sps	0.509	0.980	0.802	3.68	2.21	0	1.08	6.91	3.35	8.43	0.509	1.08	0.980	5.13	3.68	8.43	1.64	4.94	1.31	3.34

Table D.6: Relative Density (%) of Zooplankton Species, August 2020

Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)					Summary Statistics									
											Minimum		Median		Maximum		Mean		Standard Deviation	
	TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4
Brachionus sps	0	0	0	66.3	0	0	0	0	0	0	66.3	0	66.3	0	66.3	0	66.3	0	0	0
Calanoid nauplius	289	354	0	464	0	241	0	190	252	0	289	190	354	241	464	252	369	228	88.5	32.9
Cyclopoid nauplius	673	947	1630	1190	545	1490	2440	2860	2640	3880	545	1490	947	2640	1630	3880	998	2660	434	857
Cyclops bicuspidatus thomasi	770	2260	1050	1020	1040	3380	2520	2860	3540	2680	770	2520	1040	2860	2260	3540	1230	3000	587	444
Cyclops vernalis	0	118	117	66.3	0	48.2	78.9	0	0	0	66.3	48.2	117	63.6	118	78.9	100	63.6	29.5	21.7
Daphnia galeata mendotae	481	505	76.6	397	247	193	158	254	63.3	201	76.6	63.3	397	193	505	254	342	174	179	70.7
Daphnia retrocurva	289	31.1	224	133	13	145	315	127	126	134	13	126	133	134	289	315	138	169	119	82
Diaphanosoma leuchtenbergianum	289	473	117	331	148	48.2	78.9	190	126	134	117	48.2	289	126	473	190	272	115	145	54.6
Diaptomus pallidus	272	299	7.3	8.72	99.6	193	20.7	194	16.5	17.6	7.3	16.5	99.6	20.7	299	194	137	88.2	141	95.9
Diaptomus tyrrelli	108	5.92	2.92	26.1	0	54.3	90.8	157	16.5	137	2.92	16.5	16	90.8	108	157	35.8	91.1	49.3	57.8
Epischura nevadensis	101	40	4.37	1.66	1.24	3.62	26.6	3.18	1.57	1.67	1.24	1.57	4.37	3.18	101	26.6	29.6	7.33	43.1	10.8
Gastropus sps	0	0	467	198	98.7	677	0	63.5	0	134	98.7	63.5	198	134	467	677	255	291	191	336
Kellicottia sps	384	711	817	530	395	434	869	381	252	335	384	252	530	381	817	869	567	454	192	241
Keratella sps	6250	4140	5480	5230	6280	3040	2760	2280	2830	2150	4140	2150	5480	2760	6280	3040	5480	2610	879	381
Leptodora kindtii	0	0	1.46	0	0	0	0	0	0	0	1.46	0	1.46	0	1.46	0	1.46	0	0	0
Unknown rotifer	0	0	0	0	938	0	0	0	0	0	938	0	938	0	938	0	938	0	0	0

Table D.7: Zooplankton Community Biomass Data (µg/L dw), Koocanusa Reservoir Monitoring Program, June and August 2020

Month	Taxa Group	Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
			TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5
June	Cladocera	*Bosmina longirostris*	0	0	0	0	0	185	196	129	157	100
		Daphnia galeata mendotae	173	359	110	123	42.8	433	55.1	66.1	428	180
		Daphnia longiremis	0	0	0	0	0	35.9	0	0	0	21.9
		Daphnia retrocurva	317	1406	72.4	253	169	0.202	84.8	205	271	145
		Daphnia schoedleri	0	0	2.68	0	55.8	0.545	30	0	0	0
		Diaphanosoma leuchtenbergianum	0	0	0	0.812	0	0	0	0	0	0
		Leptodora kindtii	0.555	11.8	4.07	2.68	18	0	3.71	2.03	1.46	7.88
	Copepoda	*Acanthocyclops vernalis*	0	0	0	0	0	0	0	0	0	2.9
		Calanoid nauplii	0	0	0	0	0	3.77	2.34	11.9	0.799	0.769
		Cyclopoid nauplii	0.711	5.74	0.746	6.86	9.52	12	13.9	75	89.9	70.7
		Cyclops bicuspidatus	238	390	204	246	483	600	648	591	642	428
		Cyclops scutifer	0	0	0	0	0	39	20.2	0	0	0
		Diaptomus pallidus	0	0	0	0	0	0	37.4	8.47	0	0
		Diaptomus sicilis	0	0	0	0	0	0.162	47.6	0	0	0
		Diaptomus tyrrelli	4.1	5.13	10.9	59.3	1.96	18.2	3.48	1.07	1.08	0
		Epischura nevadensis	29.9	49.2	63.4	17.8	34.1	3.69	3.99	0.518	3.78	4.94
		Limnocalanus macrurus	0	0	0	0	0	8.85	210	0	0	0
	Rotifera	*Asplanchna sps*	0.389	0	0	0	0	2.71	5.2	5.27	4.09	1.97
		Brachionus sps	0	0	0	0	0.312	0.162	1.34	1.19	0.686	0.826
		Conochilus sps	0	0	0	0.3	0	0	0.16	0	0	0
		Gastropus sps	0.222	0.224	0.407	0.107	0	0	0	0	0.0584	0
		Kellicottia sps	1.89	1.12	0.523	1.93	4.56	15.5	12.6	24.8	20	19.2
		Keratella sp.	1.34	1.36	1.19	1.45	3.5	25.8	17.5	27.6	31.8	27.9
		Polyarthra sps	0.152	0.459	0.159	1.17	1.16	0	2.03	18.7	9.43	20.6
		Total Biomass (µg/L dw)	**767.3**	**2,230.0**	**470**	**714**	**824**	**1,384**	**1,395**	**1,168**	**1,661**	**1,033**
		Total Number of Taxa:	**12**	**11**	**12**	**13**	**12**	**16**	**19**	**14**	**14**	**14**
August	Cladocera	*Chydorus sps*	0	0	0	0	0	0	0	1.06	0	0
		Daphnia galeata mendotae	5.54	10.8	19.3	141	91	32.9	29.3	38.5	0.296	74.7
		Daphnia retrocurva	15.6	1.97	12.4	31.1	3.94	27.1	24.6	8.33	8.7	14.9
		Diaphanosoma leuchtenbergianum	4.33	5.92	3.03	15.3	8.88	2.12	2.14	7.43	5.18	5.18
		Leptodora kindtii	0	0	0.262	0	0	0	0	0	0	0
	Copepoda	*Acanthocyclops vernalis*	0	0.33	0.674	0.683	0	0.472	0.478	0	0	0
		Calanoid nauplii	0.512	0.525	0	2.54	0	1.25	0	0.879	1.22	0
		Cyclopoid nauplii	1.12	1.31	4.7	6.12	3.61	7.29	7.37	12.4	12.1	16.7
		Cyclops bicuspidatus	4.06	15.7	14	22.4	33.2	64.5	28.1	54.5	60.5	35
		Diaptomus pallidus	7.29	4.21	0.511	0.571	6.49	13.6	0.799	12.5	0.964	1.84
		Diaptomus tyrrelli	2.68	0.18	0.228	3.88	0	7.28	5.72	13	1.65	12.9
		Epischura nevadensis	4.27	4.96	1.29	0.707	0.683	1.47	3.14	0.717	0.597	0.597
	Rotifera	*Brachionus sps*	0	0	0	0.0779	0	0	0	0	0	0
		Gastropus sps	0	0	0.105	0.0796	0.0513	0.257	0	0.0215	0	0.0448
		Kellicottia sps	0.05	0.0769	0.183	0.212	0.205	0.165	0.204	0.129	0.0896	0.112
		Keratella sp.	0.596	0.329	0.903	1.54	2.39	0.847	0.476	0.566	0.739	0.526
		Polyarthra sps	0.0342	0.035	0	0.363	0.28	0.0501	0.406	0.352	0.123	0.184
		Unknown rotifer	0	0	0	0	0.487	0	0	0	0	0
		Total Biomass (µg/L dw)	**46.1**	**46.3**	**57.6**	**226.6**	**151.2**	**159.3**	**102.7**	**150.4**	**92.2**	**162.7**
		Total Number of Taxa:	**12**	**13**	**13**	**15**	**12**	**14**	**12**	**14**	**12**	**12**

Table D.8: **Zooplankton Community Biomass Data (μg/L dw), August 2019**

Taxa Group	Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
		TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5
Cladocera	*Chydorus sps*	0	0	0	0	0	0	0	1.06	0	0
	Daphnia galeata mendotae	5.54	10.8	19.3	141	91	32.9	29.3	38.5	0.296	74.7
	Daphnia retrocurva	15.6	1.97	12.4	31.1	3.94	27.1	24.6	8.33	8.7	14.9
	Diaphanosoma leuchtenbergianum	4.33	5.92	3.03	15.3	8.88	2.12	2.14	7.43	5.18	5.18
	Leptodora kindtii	0	0	0.262	0	0	0	0	0	0	0
Copepoda	*Acanthocyclops vernalis*	0	0.33	0.674	0.683	0	0.472	0.478	0	0	0
	Calanoid nauplii	0.512	0.525	0	2.54	0	1.25	0	0.879	1.22	0
	Cyclopoid nauplii	1.12	1.31	4.7	6.12	3.61	7.29	7.37	12.4	12.1	16.7
	Cyclops bicuspidatus	4.06	15.7	14	22.4	33.2	64.5	28.1	54.5	60.5	35
	Diaptomus pallidus	7.29	4.21	0.511	0.571	6.49	13.6	0.799	12.5	0.964	1.84
	Diaptomus tyrrelli	2.68	0.18	0.228	3.88	0	7.28	5.72	13	1.65	12.9
	Epischura nevadensis	4.27	4.96	1.29	0.707	0.683	1.47	3.14	0.717	0.597	0.597
Rotifera	*Brachionus sps*	0	0	0	0.0779	0	0	0	0	0	0
	Gastropus sps	0	0	0.105	0.0796	0.0513	0.257	0	0.0215	0	0.0448
	Kellicottia sps	0.05	0.0769	0.183	0.212	0.205	0.165	0.204	0.129	0.0896	0.112
	Keratella sp.	0.596	0.329	0.903	1.54	2.39	0.847	0.476	0.566	0.739	0.526
	Polyarthra sps	0.0342	0.035	0	0.363	0.28	0.0501	0.406	0.352	0.123	0.184
	Unknown rotifer	0	0	0	0	0.487	0	0	0	0	0
	Total Biomass (μg/L dw)	**46.1**	**46.3**	**57.6**	**226.6**	**151.2**	**159.3**	**102.7**	**150.4**	**92.2**	**162.7**
	Total Number of Taxa:	**12**	**13**	**13**	**15**	**12**	**14**	**12**	**14**	**12**	**12**

Table D.9: Biomass (µg/L dw) of Zooplankton by Group, June 2020

Group	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
	TN-1	**TN-2**	**TN-3**	**TN-4**	**TN-5**	**T4-1**	**T4-2**	**T4-3**	**T4-4**	**T4-5**
Cladocera	491	1777	189	380	286	654	369	402	857	455
Copepoda	272	450	279	330	529	686	987	688	737	507
Rotifera	3.99	3.16	2.28	4.96	9.54	44.2	38.9	77.5	66.1	70.5
Total biomass of organisms	**767**	**2,230**	**471**	**714**	**824**	**1,384**	**1,396**	**1,168**	**1,661**	**1,032**
Total number of groups	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Table D.10: Biomass (µg/L dw) of Zooplankton by Group, August 2020

Group	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)				
	TN-1	**TN-2**	**TN-3**	**TN-4**	**TN-5**	**T4-1**	**T4-2**	**T4-3**	**T4-4**	**T4-5**
Cladocera	25.5	18.7	34.9	187	104	62.1	56.1	55.3	14.2	95
Copepoda	19.9	27.2	21.4	36.9	44.0	95.8	45.6	94.0	77.0	67.0
Rotifera	0.680	0.441	1.19	2.269	3.41	1.32	1.09	1.068	0.951	0.87
Total biomass of organisms	**46.1**	**46.3**	**57.5**	**226**	**151**	**159**	**103**	**150**	**92.1**	**163**
Total number of groups	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Table D.11: Relative Biomass (%) of Zooplankton Species, June 2020

Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)					Summary Statistics									
											Minimum		Median		Maximum		Mean		Standard Deviation	
	TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4
Acanthocyclops vernalis	0	0	0	0	0	0	0	0	0	0.281	-	0.281	-	0.281	-	0.281	-	0.281	-	-
Asplanchna sps	0.0507	0	0	0	0	0.196	0.372	0.451	0.247	0.191	0.0507	0.191	0.0507	0.247	0.0507	0.451	0.0507	0.291	-	0.116
Bosmina longirostris	0	0	0	0	0	13.3	14.0	11.0	9.43	9.70	-	9.43	-	11.0	-	14.0	-	11.5	-	2.09
Brachionus sps	0	0	0	0	0.0378	0.0117	0.0960	0.102	0.0413	0.0800	0.0378	0.0117	0.0378	0.0800	0.0378	0.102	0.0378	0.0662	-	0.0385
Calanoid nauplii	0	0	0	0	0	0.273	0.168	1.02	0.0481	0.0745	-	0.0481	-	0.168	-	1.02	-	0.316	-	0.401
Conochilus sps	0	0	0	0.0420	0	0	0.0114	0	0	0	0.0420	0.0114	0.0420	0.0114	0.0420	0.0114	0.0420	0.0114	-	-
Cyclopoid nauplii	0.0927	0.258	0.158	0.961	1.16	0.870	0.996	6.42	5.41	6.85	0.0927	0.870	0.258	5.41	1.16	6.85	0.525	4.11	0.495	2.95
Cyclops bicuspidatus	31.0	17.5	43.4	34.4	58.6	43.4	46.5	50.6	38.6	41.5	17.5	38.6	34.4	43.4	58.6	50.6	37.0	44.1	15.3	4.62
Cyclops scutifer	0	0	0	0	0	2.82	1.44	0	0	0	-	1.44	-	2.13	-	2.82	-	2.13	-	0.971
Daphnia galeata mendotae	22.6	16.1	23.4	17.2	5.20	31.3	3.95	5.65	25.8	17.4	5.20	3.95	17.2	17.4	23.4	31.3	16.9	16.8	7.29	12.0
Daphnia longiremis	0	0	0	0	0	2.59	0	0	0	2.12	-	2.12	-	2.36	-	2.59	-	2.36	-	0.331
Daphnia retrocurva	41.3	63.0	15.4	35.4	20.5	0.0146	6.07	17.6	16.3	14.0	15.4	0.0146	35.4	14.0	63.0	17.6	35.1	10.8	18.9	7.51
Daphnia schoedleri	0	0	0.568	0	6.77	0.0393	2.15	0	0	0	0.568	0.0393	3.67	1.09	6.77	2.15	3.67	1.09	4.39	1.49
Diaphanosoma leuchtenbergianum	0	0	0	0.114	0	0	0	0	0	0	0.114	-	0.114	-	0.114	-	0.114	-	-	-
Diaptomus pallidus	0	0	0	0	0	0	2.68	0.725	0	0	-	0.725	-	1.70	-	2.68	-	1.70	-	1.38
Diaptomus sicilis	0	0	0	0	0	0.0117	3.41	0	0	0	-	0.0117	-	1.71	-	3.41	-	1.71	-	2.40
Diaptomus tyrrelli	0.534	0.230	2.32	8.31	0.238	1.32	0.249	0.0915	0.0650	0	0.230	0.0650	0.534	0.170	8.31	1.32	2.33	0.430	3.46	0.596
Epischura nevadensis	3.90	2.20	13.5	2.50	4.14	0.267	0.286	0.0443	0.228	0.478	2.20	0.0443	3.90	0.267	13.5	0.478	5.24	0.261	4.67	0.155
Gastropus sps	0.0289	0.0100	0.0864	0.0150	0	0	0	0	0.00352	0	0.0100	0.00352	0.0220	0.00352	0.0864	0.00352	0.0351	0.00352	0.0351	-
Kellicottia sps	0.246	0.0502	0.111	0.270	0.554	1.12	0.904	2.12	1.20	1.86	0.0502	0.904	0.246	1.20	0.554	2.12	0.246	1.44	0.195	0.521
Keratella sp.	0.175	0.0608	0.254	0.203	0.425	1.86	1.26	2.36	1.92	2.70	0.0608	1.26	0.203	1.92	0.425	2.70	0.224	2.02	0.133	0.547
Leptodora kindtii	0.0723	0.527	0.864	0.375	2.19	0	0.266	0.173	0.0880	0.763	0.0723	0.0880	0.527	0.220	2.19	0.763	0.806	0.323	0.825	0.302
Limnocalanus macrurus	0	0	0	0	0	0.639	15.1	0	0	0	-	0.639	-	7.86	-	15.1	-	7.86	-	10.2
Polyarthra sps	0.0198	0.0206	0.0338	0.164	0.141	0	0.145	1.60	0.568	2.00	0.0198	0.145	0.0338	1.08	0.164	2.00	0.0758	1.08	0.0706	0.865

Table D.12: Relative Biomass (%) of Zooplankton Species, August 2020

Species	Upstream of Elk River (RG_TN)					Downstream of Elk River (RG_T4)					Summary Statistics									
											Minimum		Median		Maximum		Mean		Standard Deviation	
	TN-1	TN-2	TN-3	TN-4	TN-5	T4-1	T4-2	T4-3	T4-4	T4-5	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4	RG_TN	RG_T4
Acanthocyclops vernalis	0	0.713	1.17	0.302	0	0.296	0.465	0	0	0	0.302	0.296	0.713	0.381	1.17	0.465	0.729	0.381	0.436	0.119
Brachionus sps	0	0	0	0.0344	0	0	0	0	0	0	0.0344	-	0.0344	-	0.0344	-	0.0344	-	-	-
Calanoid copepodids	1.11	1.13	0	1.12	0	0.786	0	0.585	1.33	0	1.11	0.585	1.12	0.786	1.13	1.33	1.12	0.900	0.0117	0.385
Chydorus sps	0	0	0	0	0	0	0	0.705	0	0	-	0.705	-	0.705	-	0.705	-	0.705	-	-
Cyclopoid nauplii	2.43	2.84	8.17	2.71	2.39	4.57	7.18	8.23	13.1	10.2	2.39	4.57	2.71	8.23	8.17	13.1	3.71	8.67	2.50	3.21
Cyclops bicuspidatus	8.81	33.9	24.3	9.92	22.0	40.5	27.3	36.2	65.7	21.5	8.81	21.5	22.0	36.2	33.9	65.7	19.8	38.2	10.5	17.0
Daphnia galeata mendotae	12.0	23.3	33.5	62.2	60.2	20.6	28.5	25.6	0.321	45.9	12.0	0.321	33.5	25.6	62.2	45.9	38.2	24.2	22.3	16.4
Daphnia retrocurva	33.9	4.25	21.5	13.7	2.61	17.0	24.0	5.54	9.45	9.15	2.61	5.54	13.7	9.45	33.9	24.0	15.2	13.0	12.9	7.42
Diaphanosoma leuchtenbergianum	9.39	12.8	5.26	6.77	5.88	1.33	2.09	4.94	5.62	3.18	5.26	1.33	6.77	3.18	12.8	5.62	8.02	3.43	3.10	1.83
Diaptomus pallidus	15.8	9.08	0.888	0.252	4.29	8.52	0.777	8.30	1.05	1.13	0.252	0.777	4.29	1.13	15.8	8.52	6.06	3.95	6.48	4.07
Diaptomus tyrrelli	5.82	0.389	0.397	1.71	0	4.57	5.57	8.67	1.80	7.91	0.389	1.80	1.06	5.57	5.82	8.67	2.08	5.71	2.57	2.75
Epischura nevadensis	9.26	10.7	2.24	0.313	0.452	0.921	3.05	0.477	0.649	0.368	0.313	0.368	2.24	0.649	10.7	3.05	4.60	1.09	5.01	1.12
Gastropus sps	0	0	0.182	0.0352	0.0339	0.161	0	0.0143	0	0.0276	0.0339	0.0143	0.0352	0.0276	0.182	0.161	0.0837	0.0677	0.0852	0.0812
Kellicottia sps	0.108	0.166	0.319	0.0938	0.136	0.104	0.199	0.0856	0.0973	0.0689	0.0938	0.0689	0.136	0.0973	0.319	0.199	0.165	0.111	0.0905	0.0508
Keratella sp.	1.29	0.710	1.57	0.679	1.58	0.532	0.463	0.377	0.803	0.323	0.679	0.323	1.29	0.463	1.58	0.803	1.17	0.500	0.445	0.187
Leptodora kindtii	0	0	0.455	0	0	0	0	0	0	0	0.455	-	0.455	-	0.455	-	0.455	-	-	-
Polyarthra sps	0.0741	0.0757	0	0.160	0.185	0.0315	0.395	0.234	0.133	0.113	0.0741	0.0315	0.118	0.133	0.185	0.395	0.124	0.181	0.0575	0.140
Unknown rotifer	0	0	0	0	0.322	0	0	0	0	0	0.322	-	0.322	-	0.322	-	0.322	-	-	-

Table D.13: Summary Statistics for Seasonal Zooplankton Community Endpoints, Koocanusa, 2018 to 2020

Endpoint	Season	Year	Station	N	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (#/m²)	Spring	2018	TN	5	10.5	5.09	2.28	6.34	8.41	19.1
			T4	5	252	63.6	28.4	172	243	331
		2019	TN	5	0.48	0.72	0.32	0.0118	0.0794	1.69
			T4	5	104	34.7	15.5	55.2	103	151
		2020	TN	5	61.8	22.7	10.2	33.8	54.4	89.7
			T4	5	407	68.5	30.6	321	418	480
	Fall	2018	TN	5	14.3	4.43	1.98	11.6	12.7	22.1
			T4	5	21.4	3.98	1.78	16.3	21.5	26.8
		2019	TN	5	13.5	4.02	1.80	8.98	12.0	18.8
			T4	5	18.7	4.02	1.80	13.6	18.6	24.1
		2020	TN	5	12.9	8.30	3.71	5.05	10.5	24.2
			T4	5	15.3	2.58	1.15	11.0	15.8	17.7
Biomass (mg/m³)	Spring	2018	TN	5	463	248	111	211	479	750
			T4	5	1,081	603	270	325	1,161	1,683
		2019	TN	5	0.48	0.72	0.32	0.01	0.08	1.7
			T4	5	104	35	15.5	55	103	151
		2020	TN	5	720	147	65.6	470	767	824
			T4	5	1,328	242	108	1,030	1,384	1,661
	Fall	2018	TN	5	324	47.3	21.2	259	316	376
			T4	5	195	125	55.8	23.3	163	331
		2019	TN	5	282	116	52.0	153	319	398
			T4	5	280	111	49.5	182	258	467
		2020	TN	5	105	80.6	36.1	46.0	56.9	226
			T4	5	133	33.4	14.9	92.2	150	163
LPL Richness (# taxa)	Spring	2018	TN	5	11.4	1.14	0.51	10.0	11.0	13.0
			T4	5	14.6	1.67	0.75	12.0	15.0	16.0
		2019	TN	5	6.53	9.60	4.29	0.21	1.45	22.72
			T4	5	548.7	181.95	81.37	371.1	505.5	822.1
		2020	TN	5	12.0	0.707	0.316	11.0	12.0	13.0
			T4	5	16.4	2.19	0.980	15.0	15.0	20.0
	Fall	2018	TN	5	17.0	1.00	0.45	16.0	17.0	18.0
			T4	5	16.0	1.00	0.45	15.0	16.0	17.0
		2019	TN	5	13.8	2.39	1.07	10.0	15.0	16.0
			T4	5	12.8	1.79	0.80	10.0	14.0	14.0
		2020	TN	5	13.0	1.22	0.548	12.0	13.0	15.0
			T4	5	12.8	1.10	0.490	12.0	12.0	14.0
Cladocera Density (#/L)	Spring	2018	TN	5	5.33	2.99	1.34	2.44	4.40	9.81
			T4	5	17.0	8.32	3.72	8.78	12.3	27.6
		2019	TN	5	3.6000	3.13	1.4000	1	3.0000	9.00
			T4	5	14.6	1.3	0.60	13.0	14.0	16.0
		2020	TN	5	12.1	10.8	4.85	4.07	8.30	30.9
			T4	5	54.3	11.4	5.09	38.7	51.8	67.9
	Fall	2018	TN	5	1.08	0.38	0.17	0.62	0.98	1.62
			T4	5	0.89	0.19	0.0856	0.74	0.84	1.22
		2019	TN	5	1.48	0.67	0.30	0.72	1.83	2.07
			T4	5	1.05	0.38	0.17	0.63	1.01	1.51
		2020	TN	5	0.838	0.481	0.215	0.438	0.642	1.61
			T4	5	0.709	0.181	0.0810	0.523	0.684	1.00
Copepoda Density (#/L)	Spring	2018	TN	5	3.24	1.52	0.68	2.02	2.87	5.86
			T4	5	51.3	29.6	13.2	9.10	63.1	83.1
		2019	TN	5	0.09	0.11	0.0486	0.00000	0.0676	0.26
			T4	5	45.9	21.97	9.82	17.4	44.0	77.9
		2020	TN	5	26.8	9.68	4.33	15.6	24.8	39.6
			T4	5	78.9	14.2	6.33	64.0	74.6	102
	Fall	2018	TN	5	6.30	1.19	0.53	5.14	6.12	8.00
			T4	5	13.3	2.88	1.29	9.68	12.9	16.9
		2019	TN	5	9.27	2.80	1.25	6.67	7.68	12.6
			T4	5	11.9	3.22	1.44	8.17	13.9	14.7
		2020	TN	5	3.12	1.55	0.693	1.34	2.95	5.20
			T4	5	9.27	2.06	0.920	5.69	9.86	10.8
Rotifera Density (#/L)	Spring	2018	TN	5	1.95	0.96	0.43	1.08	1.57	3.46
			T4	5	183	55.9	25.0	124	190	251
		2019	TN	5	0.10	0.21	0.09	0.005881	0.0117619	0.48
			T4	5	21.4	4.7	2.10	15.5	20.2	28.2
		2020	TN	5	22.8	13.4	6.01	12.2	18.9	46.1
			T4	5	274	62.9	28.1	180	304	329
	Fall	2018	TN	5	6.92	3.78	1.69	3.93	5.41	13.5
			T4	5	7.27	1.09	0.49	5.77	7.25	8.66
		2019	TN	5	2.80	1.02	0.46	1.52	2.71	4.23
			T4	5	5.72	1.89	0.85	3.93	5.40	8.35
		2020	TN	5	8.94	6.73	3.01	2.51	7.08	19.1
			T4	5	5.35	1.22	0.546	4.40	4.90	7.45

Table D.13: **Summary Statistics for Seasonal Zooplankton Community Endpoints, Koocanusa, 2018 to 2020**

Endpoint	Season	Year	Station	N	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
% Cladocera Ind.	Spring	2018	TN	5	49.52	11.08	4.96	31.33	51.28	61.64
			T4	5	6.97	3.67	1.64	3.70	5.11	12.85
		2019	TN	5	30.96	32.58	14.57	0.00	20.59	85.19
			T4	5	42.12	7.76	3.47	31.45	44.38	51.56
		2020	TN	5	19.70	12.50	5.57	4.54	17.80	38.70
			T4	5	13.80	4.60	2.06	9.26	13.00	21.20
	Fall	2018	TN	5	8.38	4.02	1.80	2.82	7.96	13.91
			T4	5	4.19	0.81	0.36	3.34	4.34	5.27
		2019	TN	5	10.80	4.04	1.81	6.33	10.52	17.23
			T4	5	5.76	2.24	1.00	3.41	6.25	8.24
		2020	TN	5	7.51	3.17	1.42	4.08	8.61	10.60
			T4	5	4.71	1.27	0.57	3.15	4.69	6.35
% Copepoda Ind.	Spring	2018	TN	5	31.31	4.69	2.10	26.18	30.65	38.78
			T4	5	20.20	10.18	4.55	3.75	20.37	29.37
		2019	TN	5	30.96	32.58	14.57	0.00	20.59	85.19
			T4	5	42.12	7.76	3.47	31.45	44.38	51.56
		2020	TN	5	43.60	2.46	1.10	40.50	44.10	46.10
			T4	5	19.50	2.24	1.00	17.70	18.10	22.60
	Fall	2018	TN	5	45.32	7.14	3.19	36.15	45.53	52.41
			T4	5	61.69	2.62	1.17	59.33	60.45	65.57
		2019	TN	5	68.51	4.61	2.06	63.82	67.00	74.21
			T4	5	63.63	9.79	4.38	49.84	63.77	74.81
		2020	TN	5	27.00	8.72	3.90	16.80	27.80	40.20
			T4	5	60.10	6.72	3.01	51.90	62.50	67.20
% Rotifera Ind.	Spring	2018	TN	5	19.17	6.52	2.92	12.18	18.07	29.90
			T4	5	72.84	12.83	5.74	57.78	75.32	91.19
		2019	TN	5	26.84	37.61	16.82	0.00	0.00	78.43
			T4	5	35.74	5.19	2.32	29.77	35.72	42.87
		2020	TN	5	36.70	11.30	5.06	19.60	37.20	51.40
			T4	5	66.70	6.53	2.92	56.20	67.30	72.90
	Fall	2018	TN	5	46.30	10.26	4.59	33.68	46.51	61.03
			T4	5	34.12	2.32	1.04	31.09	35.21	36.62
		2019	TN	5	20.69	5.06	2.26	16.44	18.94	28.67
			T4	5	30.61	7.85	3.51	21.78	28.80	41.91
		2020	TN	5	65.50	10.60	4.72	49.70	67.30	79.10
			T4	5	35.20	6.66	2.98	28.20	32.10	42.60
Cladocera Biomass (ug/L)	Spring	2018	TN	5	389	234	105	133	415	639
			T4	5	568	329	147	257	500	982
		2019	TN	5	4.95	8.91	3.99	0	1.25	20.8
			T4	5	265	173	77.5	80.0	293	524
		2020	TN	5	343	113	50.4	189	371	491
			T4	5	548	206	91.9	370	455	857
	Fall	2018	TN	5	179	50.7	22.7	124	165	260
			T4	5	71.6	49.4	22.1	0.78	63.2	133
		2019	TN	5	169	93.0	41.6	72.4	157	294
			T4	5	171	111	49.8	90.9	113	356
		2020	TN	5	74.1	71.9	32.2	18.7	35.0	187
			T4	5	56.5	28.7	12.8	14.2	56.0	94.8
Copepoda Biomass (ug/L)	Spring	2018	TN	5	74	24	11	45	69	111
			T4	5	481	302	135	44	613	811
		2019	TN	5	1.46	2.03	0.91	0.1042133	0.21	4.8
			T4	5	273	45	20.2	199.0	286	321
		2020	TN	5	372	113	50.4	273	330	529
			T4	5	721	173	77.5	504	688	987
	Fall	2018	TN	5	143	31.4	14.1	101	143	188
			T4	5	120.3	78.3	35.0	15.29	98.1	200
		2019	TN	5	113	47.4	21.2	73.3	82	168
			T4	5	108	38	17.1	68.1	110	166
		2020	TN	5	29.6	10.4	4.64	19.9	26.9	44.0
			T4	5	75.7	20.8	9.31	45.1	77.0	95.4
Rotifera Biomass (ug/L)	Spring	2018	TN	5	0.39	0.18	0.08	0.21	0.31	0.66
			T4	5	32	11	5	22	26	48
		2019	TN	5	0.12	0.21	0.10	0	0.00	0.5
			T4	5	11.4	4.1	1.8	4.6	12.8	15.2
		2020	TN	5	4.78	2.83	1.27	2.28	3.99	9.53
			T4	5	59.4	17.0	7.59	38.8	66.1	77.6
	Fall	2018	TN	5	1.60	0.31	0.14	1.19	1.57	2.01
			T4	5	2.96	2.42	1.08	1.48	1.97	7.25
		2019	TN	5	0.92	0.34	0.15	0.53	0.85	1.42
			T4	5	1.20	0.31	0.14	0.93	1.02	1.61
		2020	TN	5	1.60	1.23	0.552	0.441	1.19	3.41
			T4	5	1.06	0.171	0.0765	0.867	1.07	1.32

Table D.13: Summary Statistics for Seasonal Zooplankton Community Endpoints, Koocanusa, 2018 to 2020

Endpoint	Season	Year	Station	N	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
% Cladocera Biomass	Spring	2018	TN	5	80.35	11.10	4.97	61.83	85.16	89.52
			T4	5	55.18	15.01	6.71	43.06	49.52	78.98
		2019	TN	5	48.47	39.09	17.48	0.00	33.16	91.48
			T4	5	44.40	17.61	7.88	21.57	46.58	63.71
		2020	TN	5	47.40	11.50	5.13	34.70	45.00	63.90
			T4	5	40.80	10.20	4.56	26.50	44.20	51.60
	Fall	2018	TN	5	54.75	9.66	4.32	47.79	52.35	71.66
			T4	5	31.00	15.70	7.02	3.34	38.73	39.99
		2019	TN	5	57.55	12.21	5.46	47.42	55.50	78.08
			T4	5	58.00	17.12	7.66	35.24	62.11	76.18
		2020	TN	5	61.80	15.70	7.02	40.60	61.50	83.00
			T4	5	40.90	17.10	7.64	15.40	39.10	58.30
% Copepoda Biomass	Spring	2018	TN	5	19.54	11.04	4.94	10.44	14.75	37.96
			T4	5	40.91	16.38	7.33	13.51	48.21	52.81
		2019	TN	5	48.91	40.29	18.02	7.17	60.66	100.00
			T4	5	53.45	17.60	7.87	34.93	51.01	77.19
		2020	TN	5	52.00	11.30	5.06	35.50	54.60	64.20
			T4	5	54.50	10.50	4.69	44.40	49.50	70.70
	Fall	2018	TN	5	44.75	9.70	4.34	27.78	47.19	51.75
			T4	5	62.09	3.38	1.51	59.38	60.06	65.98
		2019	TN	5	42.07	12.05	5.39	21.73	44.18	51.86
			T4	5	41.55	17.14	7.67	23.47	37.33	64.40
		2020	TN	5	36.60	15.80	7.07	16.00	36.40	58.40
			T4	5	58.30	17.00	7.59	41.20	60.10	83.60
% Rotifera Biomass	Spring	2018	TN	5	0.10	0.06	0.03	0.05	0.09	0.21
			T4	5	3.91	2.36	1.05	1.38	4.13	7.51
		2019	TN	5	2.62	3.60	1.61	0.00	0.00	6.93
			T4	5	2.15	0.84	0.37	1.25	2.42	3.21
		2020	TN	5	0.65	0.31	0.14	0.38	0.52	1.16
			T4	5	4.69	1.93	0.86	2.78	3.98	6.85
	Fall	2018	TN	5	0.50	0.07	0.03	0.42	0.46	0.59
			T4	5	6.91	13.52	6.05	0.56	0.96	31.09
		2019	TN	5	0.38	0.22	0.10	0.19	0.32	0.72
			T4	5	0.45	0.09	0.04	0.35	0.46	0.56
		2020	TN	5	1.56	0.60	0.27	0.96	1.48	2.26
			T4	5	0.83	0.22	0.10	0.53	0.83	1.06

Table D.14: Spatial and Seasonal Differences in Zooplankton Community Endpoints Between Upstream (TN) and Downstream (T4) Areas, Koocanusa, June and August 2020

Endpoint	ANOVA Model[a]				Measure of Central Tendency[b]				Temporal Post-hoc[c]: Difference between June vs August		Spatial Post-hoc[d]: Difference between TN vs T4	
					June		August					
	Transformation	Month	Station	MonthxStation	RG_TN	RG_T4	RG_TN	RG_T4	TN	T4	June	August
Density (ind/m³)	log10	<0.001	<0.001	<0.001	1.8	2.6	1.0	1.2	-4.3	-19	5.0	ns
Biomass (mg/m³)	log10	<0.001	0.013	0.636	2.9	3.1	1.9	2.1	-5.8	-5.8	0.43	0.43
Richness (# of taxa)	rank	0.170	0.005	0.001	5.7	18	9.9	8.7	↑	↓	↑	ns
Cladocera (ind/L)	log10	<0.001	0.002	<0.001	0.97	1.7	-0.13	-0.16	-3.3	-20	2.3	ns
Copepoda (ind/L)	log10	<0.001	<0.001	0.873	1.4	1.9	0.45	0.95	-3.3	-3.3	0.92	0.92
Rotifera (ind/L)	log10	<0.001	<0.001	<0.001	1.3	2.4	0.84	0.72	-2.1	-16	5.1	ns
Cladocera (% ind)	log10	<0.001	0.201	0.634	-0.77	-0.90	-1.2	-1.3	-1.7	-1.7	ns	ns
Copepoda (% ind)	none	<0.001	0.101	<0.001	0.44	0.19	0.27	0.60	-6.7	18	-9.8	3.8
Rotifera (% ind)	none	0.741	0.979	<0.001	0.37	0.67	0.65	0.35	2.5	-4.8	2.7	-2.9
Cladocera (µg/L)	log10	<0.001	0.486	0.399	2.6	2.7	1.6	1.7	-5.1	-5.1	ns	ns
Copepoda (µg/L)	log10	<0.001	<0.001	0.309	2.5	2.9	1.5	1.8	-5.5	-5.5	0.59	0.59
Rotifera (µg/L)	log10	<0.001	<0.001	<0.001	0.63	1.8	0.089	0.020	-2.3	-13	4.8	ns
Cladocera (% biomass)	none	0.261	0.042	0.266	0.51	0.37	0.58	0.44	ns	ns	-0.92	-0.92
Copepoda (% biomass)	log10	0.217	0.062	0.125	-0.34	-0.22	-0.42	-0.30	ns	ns	0.68	0.68
Rotifera (% biomass)	log10	0.034	<0.001	<0.001	-2.2	-1.4	-1.8	-2.1	2.1	-4.1	4.7	-1.5
NMDS 1	none	<0.001	<0.001	0.034	-0.100	-0.36	0.29	0.17	20	39	-13	-0.84

(grey) P-value < 0.1.

(blue) P-value for post-hoc paired-wise comparison < 0.1 and MOD > 0 (T4 or August significantly higher)

(green) P-value for post-hoc paired-wise comparison < 0.1 and MOD < 0 (T4 or August significantly lower)

Note: "ns": non-significant.

[a] P-values from Analysis of Variance (ANOVA) including the terms Station, Month and Station x Month

[b] MCT = black transformed for estimated marginal means when log10 and none transformed and median when rank transformed from the full ANOVA model.

[c] Magnitude of Difference (MOD) = MCT_{August} - MCT_{June}/SD_{June}, where MCT_{June} and MCT_{August} are the measures of central tendency for the June and August, respectively.

[d] Magnitude of Difference (MOD) = $MCT_{downstream}$ - $MCT_{upstream}/SD_{upstream}$, where $MCT_{downstream}$ and $MCT_{upstream}$ are the measures of central tendency for the downstream and upstream sites, respectively.

APPENDIX E

FISH

Table E.1: **Gill Net Records for Fish Caught in Sand Creek, Koocanusa Reservoir Monitoring Program, April 2020**

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Effort (Fishing Hours)	Depth Range (m)		Set		Bull Trout			Mountain Whitefish			Northern Pikeminnow			Peamouth Chub			Rainbow Trout			Redside Shiner			Westslope Cutthroat Trout		
		Easting	Northing								Length (ft)	Mesh (inches)	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Sand Creek	RG_SC-GN-01	623574	5461297	20-Apr-20	20-Apr-20	14:10	14:25	0.25	0.8	1.5	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	8.0	0	0	0
	RG_SC-GN-02	623574	5461297	20-Apr-20	20-Apr-20	14:20	14:40	0.33	0.5	1.5	50	2	1	0	3.0	0	0	0	2	2	6.0	8	6	24	0	0	0	0	0	0	0	0	0
	RG_SC-GN-03	623432	5461358	20-Apr-20	20-Apr-20	15:10	15:25	0.25	0.4	1.5	50	1	0	0	0	1	0	4.0	1	0	4.0	4	4	16	0	0	0	35	13	140	0	0	0
	RG_SC-GN-04	623484	5461333	20-Apr-20	20-Apr-20	16:10	16:30	0.33	0.5	2.0	50	1	0	0	0	0	0	0	0	0	0	17	10	51	5	1	15	0	0	0	1	1	3.0
							Total	**1.2**					**1**	**0**	0.86	**1**	**0**	**0.86**	**3**	**2**	**2.6**	**29**	**20**	**25**	**5**	**1**	**4.3**	**37**	**15**	**32**	**1**	**1**	**0.86**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the gill net sets in one area.

Table E.2: Gill Net Records for Fish Caught in Elk River, Koocanusa Reservoir Monitoring Program, April 2020

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Effort (Fishing Hours)	Depth Range (m)		Set		Kokanee			Longnose Sucker			Northern Pikeminnow			Peamouth Chub		
		Easting	Northing								Length (ft)	Mesh (inches)	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Elk River	RG_ER-GN-01	626956	5446783	21-Apr-20	21-Apr-20	14:00	14:20	0.33	1.0	1.5	25	2	0	0	0	0	0	0	4	0	12	3	3	9.0
	RG_ER-GN-02	626944	5446801	21-Apr-20	21-Apr-20	13:50	14:10	0.33	0.3	1.2	50	1	0	0	0	0	0	0	11	0	33	42	0	126
	RG_ER-GN-03	626942	5446798	21-Apr-20	21-Apr-20	16:00	16:15	0.25	0.3	1.2	50	1	0	0	0	0	0	0	1	0	4.0	3	0	12
	RG_ER-GN-04	626956	5446783	21-Apr-20	21-Apr-20	16:10	16:35	0.42	1.0	2.0	50	2	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-05	627009	5446705	22-Apr-20	22-Apr-20	14:00	14:17	0.28	0.8	1.5	75	2	0	0	0	0	0	0	1	0	3.5	8	6	28
	RG_ER-GN-06	626959	5446813	22-Apr-20	22-Apr-20	14:10	14:30	0.33	1.0	2.0	50	2	0	0	0	0	0	0	13	0	39	27	10	81
	RG_ER-GN-07	627017	5446712	22-Apr-20	22-Apr-20	15:00	15:20	0.33	1.5	2.0	75	2	0	0	0	0	0	0	7	0	21	2	0	6.0
	RG_ER-GN-08	626954	5446811	22-Apr-20	22-Apr-20	15:10	15:30	0.33	1.0	2.5	50	2	0	0	0	0	0	0	4	0	12	11	0	33
	RG_ER-GN-09	629303	5447823	24-Apr-20	24-Apr-20	10:00	10:30	0.50	0.8	1.5	75	2	0	0	0	3	0	6.0	9	0	18	41	0	82
	RG_ER-GN-10	629209	5448066	24-Apr-20	24-Apr-20	11:10	11:40	0.50	1.0	2.0	-	2	0	0	0	0	0	0	7	0	14	35	0	70
	RG_ER-GN-11	629449	5448529	24-Apr-20	24-Apr-20	12:30	12:50	0.33	1.5	2.5	75	2	0	0	0	0	0	0	12	0	36	28	0	84
	RG_ER-GN-12	626890	5446644	25-Apr-20	25-Apr-20	12:32	13:25	0.88	1.0	4.0	75	2	0	0	0	0	0	0	12	2	14	9	2	10
	RG_ER-GN-13	627021	5447519	25-Apr-20	25-Apr-20	12:45	13:30	0.75	1.0	5.0	75	2	1	0	1.3	0	0	0	8	1	11	6	0	8.0
	RG_ER-GN-14	626887	5446645	25-Apr-20	25-Apr-20	14:00	14:45	0.75	1.5	4.0	75	2	0	0	0	0	0	0	6	0	8.0	8	0	11
	RG_ER-GN-15	627021	5447519	25-Apr-20	25-Apr-20	14:10	14:50	0.67	1.5	4.0	75	2	0	0	0	0	0	0	6	0	9.0	5	1	7.5
							Total	**7.0**					**1**	**0**	**0.14**	**3**	**0**	**0.43**	**101**	**3**	**14**	**228**	**22**	**33**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the gill net sets in one area

Table E.2: **Gill Net Records for Fish Caught in Elk River, Koocanusa Reservoir Monitoring Program, April 2020**

Area	Station ID	Largescale Sucker			Redside Shiner			Rainbow Trout			Western Cutthroat Trout			Yellow Perch			Mountain Whitefish		
		Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Elk River	RG_ER-GN-01	3	0	9.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-02	0	0	0	14	11	42	0	0	0	0	0	0	0	0	0	6	0	18
	RG_ER-GN-03	0	0	0	7	4	28	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-05	3	0	11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3.5
	RG_ER-GN-06	3	0	9.0	0	0	0	1	0	3.0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-07	4	0	12	0	0	0	0	0	0	0	0	0	1	1	3.0	0	0	0
	RG_ER-GN-08	1	0	3.0	0	0	0	0	0	0	0	0	0	1	1	3.0	0	0	0
	RG_ER-GN-09	8	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-10	11	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-12	2	0	2.3	0	0	0	0	0	0	1	0	1.1	0	0	0	0	0	0
	RG_ER-GN-13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-14	2	0	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-GN-15	1	0	1.5	0	0	0	0	0	0	1	0	1.5	0	0	0	0	0	0
		38	**0**	**5.4**	**21**	**15**	**3.0**	**1**	**0**	**0.14**	**2**	**0**	**0.29**	**2**	**2**	**0.29**	**7**	**0**	**1.0**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the gill net sets in one area

Table E.3: Gill Net Records for Fish Caught in Gold Creek, Koocanusa Reservoir Monitoring Program, April 202

Area	Station ID	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Lift Time	Effort (Fishing Hours)	Depth Range (m)		Set		Bull Trout			Largescale Sucker			Kokanee			Mountain Whitefish			Northern Pikeminnow		
		Easting	Northing								Length (ft)	Mesh (inches)	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Gold Creek	RG_GC-GN-01	629649	5437049	21-Apr-20	21-Apr-20	14:20	14:40	0.33	1.0	2.0	50	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-02	629626	5437081	21-Apr-20	21-Apr-20	14:25	14:56	0.52	1.0	2.0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-03	629662	5436765	21-Apr-20	21-Apr-20	14:45	15:17	0.53	0.5	3.0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-04	629608	5437334	21-Apr-20	21-Apr-20	15:06	15:27	0.35	1.0	3.0	75	1	0	0	0	0	0	0	0	0	0	1	1	2.9	0	0	0
	RG_GC-GN-05	629635	5436940	21-Apr-20	21-Apr-20	15:23	15:50	0.45	2.0	4.0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-06	629737	5436919	21-Apr-20	21-Apr-20	15:54	16:23	0.48	1.0	3.0	75	2	0	0	0	0	0	0	0	0	0	1	0	2.1	0	0	0
	RG_GC-GN-07	629608	5437334	21-Apr-20	21-Apr-20	15:30	15:58	0.47	1.0	3.0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-08	629599	5437347	21-Apr-20	21-Apr-20	16:09	16:20	0.18	1.0	3.0	75	1	0	0	0	0	0	0	0	0	0	1	0	5.5	0	0	0
	RG_GC-GN-09	630337	5436967	22-Apr-20	22-Apr-20	9:06	9:28	0.37	3.0	8.0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-10	630540	5437247	22-Apr-20	22-Apr-20	9:11	9:40	0.48	1.0	6.0	50	1	0	0	0	0	0	0	0	0	0	6	1	12	0	0	0
	RG_GC-GN-11	630094	5437431	22-Apr-20	22-Apr-20	9:17	9:50	0.55	1.0	3.0	50	2	0	0	0	0	0	0	0	0	0	1	0	1.8	0	0	0
	RG_GC-GN-12	630203	5436861	22-Apr-20	22-Apr-20	9:38	10:00	0.37	1.0	6.0	75	2	0	0	0	0	0	0	0	0	0	1	0	2.7	1	0	2.7
	RG_GC-GN-13	630094	5437431	22-Apr-20	22-Apr-20	9:55	10:25	0.50	1.0	3.0	50	2	0	0	0	0	0	0	2	1	0.67	1	0	2.0	0	0	0
	RG_GC-GN-14	630203	5436861	22-Apr-20	22-Apr-20	10:08	10:41	0.55	1.0	6.0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-15	629951	5437395	22-Apr-20	22-Apr-20	9:50	10:17	0.45	0.5	5.0	75	1	0	0	0	0	0	0	0	0	0	1	0	2.2	0	0	0
	RG_GC-GN-16	629865	5437326	22-Apr-20	22-Apr-20	10:20	10:48	0.47	0.5	4.0	75	1	0	0	0	0	0	0	0	0	0	5	0	11	0	0	0
	RG_GC-GN-17	630094	5437431	22-Apr-20	22-Apr-20	10:34	11:00	0.43	0.5	3.0	75	2	0	0	0	0	0	0	0	0	0	3	0	6.9	0	0	0
	RG_GC-GN-18	629767	5437303	22-Apr-20	22-Apr-20	10:47	11:17	0.50	2.5	2.5	75	2	0	0	0	1	0	2.0	0	0	0	1	0	2.0	1	0	2.0
	RG_GC-GN-19	630094	5437431	22-Apr-20	22-Apr-20	11:08	11:58	0.83	0.5	3.0	75	2	0	0	0	0	0	0	0	0	0	1	0	1.2	0	0	0
	RG_GC-GN-20	629767	5437303	22-Apr-20	22-Apr-20	11:30	12:30	1.00	2.5	2.5	75	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1.0
	RG_GC-GN-21	629694	5437344	22-Apr-20	22-Apr-20	10:56	11:26	0.50	1.5	3.0	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-22	629651	5437355	22-Apr-20	22-Apr-20	11:38	12:40	1.03	0.5	2.0	75	1	0	0	0	0	0	0	0	0	0	10	0	9.7	0	0	0
	RG_GC-GN-23	629656	5437005	22-Apr-20	22-Apr-20	12:20	12:45	0.42	1.0	1.5	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-24	629951	5437376	22-Apr-20	22-Apr-20	12:27	13:00	0.55	1.0	3.5	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-25	629575	5437375	22-Apr-20	22-Apr-20	12:48	13:30	0.70	0.5	1.5	50	1	0	0	0	0	0	0	0	0	0	1	0	1.4	0	0	0
	RG_GC-GN-26	630089	5436848	22-Apr-20	22-Apr-20	13:27	13:49	0.37	1.0	3.0	75	1	0	0	0	0	0	0	0	0	0	1	0	2.7	0	0	0
	RG_GC-GN-27	629966	5436870	22-Apr-20	22-Apr-20	13:40	14:20	0.67	1.0	3.0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-28	630230	5436876	22-Apr-20	22-Apr-20	13:55	14:25	0.50	2.0	4.0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-29	629674	5437205	22-Apr-20	22-Apr-20	15:26	15:58	0.53	1.0	1.0	50	1	0	0	0	0	0	0	0	0	0	1	0	1.9	0	0	0
	RG_GC-GN-30	629624	5436937	23-Apr-20	23-Apr-20	12:15	12:55	0.67	0.5	1.5	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-31	629788	5437325	23-Apr-20	23-Apr-20	12:30	13:00	0.50	2.5	2.5	75	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4.0
	RG_GC-GN-32	629695	5437139	23-Apr-20	23-Apr-20	12:30	12:53	0.38	1.0	1.5	50	1	0	0	0	0	0	0	0	0	0	9	0	23	0	0	0
	RG_GC-GN-33	629724	5437315	23-Apr-20	23-Apr-20	12:40	13:20	0.67	2.5	2.5	75	2	0	0	0	4	0	6.0	1	0	0.40	0	0	0	2	0	3.0
	RG_GC-GN-34	629695	5437139	23-Apr-20	23-Apr-20	12:57	13:30	0.55	1.0	1.5	50	1	0	0	0	0	0	0	0	0	0	2	0	3.6	0	0	0
	RG_GC-GN-35	629788	5437250	23-Apr-20	23-Apr-20	13:00	13:50	0.83	1.0	2.0	50	1	0	0	0	0	0	0	0	0	0	2	0	2.4	0	0	1.0
	RG_GC-GN-36	629724	5437315	23-Apr-20	23-Apr-20	13:40	14:00	0.33	2.5	2.5	75	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	9.0
	RG_GC-GN-37	629841	5437336	23-Apr-20	23-Apr-20	14:00	14:45	0.75	2.0	4.0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1.3
	RG_GC-GN-38	629618	5437083	23-Apr-20	23-Apr-20	14:44	15:15	0.52	1.0	1.0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-39	629700	5437153	23-Apr-20	23-Apr-20	14:48	15:18	0.50	1.0	1.5	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-40	629700	5437153	23-Apr-20	23-Apr-20	15:20	15:50	0.50	1.0	1.5	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-41	629907	5437370	24-Apr-20	24-Apr-20	11:24	12:15	0.85	1.0	5.0	75	2	0	0	0	1	0	1.2	0	0	0	0	0	0	1	0	1.2
	RG_GC-GN-42	630078	5437437	24-Apr-20	24-Apr-20	11:30	12:20	0.83	2.0	7.0	75	2	1	0	1.2	0	0	0	0	0	0	0	0	0	2	0	2.4
	RG_GC-GN-43	630508	5437255	24-Apr-20	24-Apr-20	13:00	14:34	1.57	0.5	10	75	2	0	0	0	1	0	0.6	0	0	0	1	0	0.6	3	0	1.9
	RG_GC-GN-44	630356	5437365	24-Apr-20	24-Apr-20	13:50	14:15	0.67	0.5	10	75	2	0	0	0	1	0	3.0	0	0	0	1	0	0.0	2	0	2.0
	RG_GC-GN-45	630356	5437365	24-Apr-20	24-Apr-20	14:20	15:00	0.67	0.5	10	75	2	0	0	0	2	0	3.0	0	0	0	0	0	0	1	0	2.0
							Total	**24.5**					**1**	**0**	**0.041**	**10**	**0**	**0.41**	**3**	**1**	**0.12**	**51**	**2**	**2.1**	**20**	**1**	**0.82**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the gill net sets in one area.

Table E.3: Gill Net Records for Fish Caught in Gold Creek, Koocanusa Reservoir Monitoring Program, April 2020

Area	Station ID	Peamouth Chub			Rainbow Trout			Redside Shiner			Westslope Cutthroat Trout			Yellow Perch		
		Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Gold Creek	RG_GC-GN-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-07	9	0	19	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-08	3	0	16	0	0	0	1	1	5.5	0	0	0	0	0	0
	RG_GC-GN-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-11	1	1	1.8	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-13	1	1	2.0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-14	0	0	0	0	0	0	0	0	0	7	0	13	0	0	0
	RG_GC-GN-15	1	0	2.2	0	0	0	1	1	2.2	0	0	0	0	0	0
	RG_GC-GN-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-17	1	1	2.3	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-18	2	2	4.0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-19	0	0	0	0	0	0	0	0	0	1	0	1.2	0	0	0
	RG_GC-GN-20	5	4	5.0	0	0	0	0	0	0	1	0	1.0	0	0	0
	RG_GC-GN-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-22	2	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-23	0	0	0	0	0	0	1	1	2.4	0	0	0	0	0	0
	RG_GC-GN-24	2	2	3.6	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-25	9	2	13	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-30	0	0	0	0	0	0	2	1	3.0	0	0	0	0	0	0
	RG_GC-GN-37	0	0	0	0	0	0	0	0	0	1	1	2.0	0	0	0
	RG_GC-GN-34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-38	3	2	4.5	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-36	1	0	1.8	0	0	0	3	3	5.5	0	0	0	0	0	0
	RG_GC-GN-35	1	0	1.2	0	0	0	1	1	1.2	0	0	0	0	0	0
	RG_GC-GN-39	1	1	3.0	1	0	3.0	0	0	0	1	1	3.0	0	0	0
	RG_GC-GN-40	2	0	2.7	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-32	2	0	4.0	0	0	0	4	3	8.0	0	0	0	0	0	0
	RG_GC-GN-33	1	0	2.0	0	0	0	4	3	8.0	0	0	0	0	0	0
	RG_GC-GN-41	3	0	3.5	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-42	4	0	4.8	0	0	0	0	0	0	0	0	0	0	0	0
	RG_GC-GN-43	5	0	3.2	0	0	0	0	0	0	0	0	0.0	1	0	1
	RG_GC-GN-44	3	0	4.5	0	0	0	0	0	0	1	0	1.5	0	0	0
	RG_GC-GN-45	5	1	7.5	0	0	0	0	0	0	0	0	0	0	0	0
		67	**17**	**2.7**	**1**	**0**	**0.041**	**17**	**14**	**0.69**	**12**	**2**	**0.49**	**1**	**0**	**0.041**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the gill net sets in one area.

Table E.4: **Hoop Net Records for Fish Caught in Sand Creek, Koocanusa Reservoir, April 2020**

Area	Station ID	Net Size (inches)	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Removal Time	Fishing Hours (hrs)	Depth Range (m)		Set Configuration	Effort (Fishing days)	Largescale Sucker			Rainbow Trout			Northern Pikeminnow			Peamouth Chub			Peamouth Chub			Westslope Cutthroat Trout		
			Easting	Northing										Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Sand Creek	RG_SC-HN-01	2.5	625548	5460412	20-Apr-20	21-Apr-20	12:50	13:10	24.33	0.1	1.5	Central Lead	1.01	2	0	2.0	7	0	6.9	4	0	3.9	6	0	5.9	0	0	0	5	0	4.9
	RG_SC-HN-02	2.5	623402	5461355	20-Apr-20	21-Apr-20	13:40	14:00	24.33	0.1	1.2	Central Lead	1.01	1	0	1.0	0	0	0	4	0	3.9	7	0	6.9	0	0	0	0	0	0
	RG_SC-HN-03	2.5	625548	5460412	21-Apr-20	22-Apr-20	14:20	14:35	24.25	0.5	1.0	Central Lead	1.01	1	0	1.0	0	0	0	0	0	0	1	0	1.0	3	0	3.0	0	0	0
	RG_SC-HN-04	2.5	623402	5461355	21-Apr-20	22-Apr-20	15:10	15:35	24.42	0.5	1.5	Central Lead	1.02	1	0	1.0	0	0	0	2	0	2.0	0	0	0	0	0	0	0	0	0
												Total	**4.06**	**5**	**0**	**1.2**	**7**	**0**	**1.7**	**10**	**0**	**2.5**	**14**	**0**	**3.5**	**3**	**0**	**0.7**	**5**	**0**	**1.2**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the hoop net sets in one area.

Table E.5: **Hoop Net Records for Fish Caught in Elk River, Koocanusa Reservoir, April 2020**

Area	Station ID	Net Size (inches)	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Removal Time	Fishing Hours (hrs)	Depth Range (m)		Set Configuration	Effort (Fishing days)	Largescale Sucker			Northern Pikeminnow			Peamouth Chub			Western Cutthroat Trout		
			Easting	Northing										Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Elk River	RG_ER-HN-01	2.5	627955	5467881	21-Apr-20	22-Apr-20	12:35	14:00	25.4	0.1	1.5	Central Lead	1.06	0	0	0	0	0	0	0	0	0	0	0	0
	RG_ER-HN-02	2.5	627476	5447154	21-Apr-20	23-Apr-20	13:35	12:30	46.9	0.1	1.5	Central Lead	1.95	0	0	0	0	0	0	0	0	0	0	0	0
												Total	**3.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the hoop net sets in one area.

Table E.6: Hoop Net Records for Fish Caught in Gold Creek, Koocanusa Reservoir, April 2020

Area	Station ID	Net Size (Inches)	UTM (NAD83, 11U)		Set Date	Lift Date	Set Time	Removal Time	Fishing Hours (hrs)	Depth Range (m)		Set Configuration	Effort (Fishing days)	Largescale Sucker			Northern Pikeminnow			Westslope Cutthroat Trout		
			Easting	Northing										Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]	Catch	Mortalities/ Sacrificed	CPUE [a]
Gold Creek	RG_GC-HN-01	2.5	629788	5436732	20-Apr-20	21-Apr-20	16:00	12:15	20.3	0	4.0	Central Lead	0.8	0	0	0	0	0	0	0	0	0
	RG_GC-HN-02	2.5	629618	5437083	20-Apr-20	21-Apr-20	16:45	12:00	19.3	0	1.0	Central Lead	0.8	4	0	5.0	1	0	1.2	5	0	6.2
	RG_GC-HN-03	2.5	629618	5437083	21-Apr-20	22-Apr-20	12:30	13:55	25.4	0	3.5	Central Lead	1.1	31	0	29	2	0	1.9	1	0	0.94
												Total	**1.6**	**35**	**0**	**21**	**3**	**0**	**1.8**	**6**	**0**	**3.6**

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the hoop net sets in one area.

Table E.7: Seine Net Records for Fish Caught in Koocanusa Reservoir, August 2020

Area	Station ID	UTM (NAD83, 11U)		Date	Time	Net Length (m)	Haul Distance (m)	# of Hauls	Effort [Area Seined (m^2)]	Depth Range (m)		Set		Redside Shiner			Largescale Sucker			Peamouth Chub			Mountain Whitefish			Northern Pikeminnow			Yellow Perch		
		Easting	Northing									Height (m)	Mesh (mm)	Catch	Mortalities/ Sacrificed	CPUE[a]	Catch	Mortalities/ Sacrificed	CPUE[a]	Catch	Mortalities/ Sacrificed	CPUE[a]	Catch	Mortalities/ Sacrificed	CPUE[a]	Catch	Mortalities/ Sacrificed	CPUE[a]	Catch	Mortalities/ Sacrificed	CPUE[a]
Sand Creek	RG_SC_SN-01	625747	5458955	25-Aug-20	9:20	25	40	1	1,000	0.1	1.0	1.0	5.0	270	35	0.27	450	40	0	350	20	0	0	0	0	300	20	0	0	0	0
Elk River	RG_ER_SN-01	628013	5448368	25-Aug-20	13:21	25	20	1	500	0.1	1.0	1.0	5.0	0	0	0.0	10	0	0.020	200	0	0.40	0	0	0	100	0	0.20	3	0	0.0060
	RG_ER_SN-02	627072	5447111	25-Aug-20	14:28	25	20	1	500	0.1	1.2	1.0	5.0	350	10	0.70	0	0	0	400	20	0.80	20	0	0.040	200	10	0.40	15	0	0.030
								Total	**1,000**					**350**	**10**	**0.35**	**10**	**0**	**0.010**	**600**	**20**	**0.60**	**20**	**0**	**0.020**	**300**	**10**	**0.30**	**18**	**0**	**0.018**
Gold Creek	RG_GC_SN-01	630426	5438232	27-Aug-20	10:30	25	30	1	750	0.1	1.0	1.0	5.0	400	190	0.53	20	2	0.027	600	400	0.80	50	25	0.067	150	50	0.20	0	0	0

[a] Total catch-per-unit-effort (CPUE) calculated as the total catch of a single species over the total effort for all the seine net sets in one area. Confidence intervals not calculated due to small number of sampling attempts.

Table E.8: **Angling Records for Fish Caught in the Koocanusa Reservoir, 2020**

Sampling Month	Area	Station ID	UTM (NAD83, 11U)		Set Date	Removal Date	Start Time	End Time	Angling Hours (hours)	Depth Range (m)		# of Lines	Effort (angling lines*days)	Bull Trout		Northern Pikeminnow		Kokanee	
			Easting	Northing										Catch	Mortalities/ Sacrificed	Catch	Mortalities/ Sacrificed	Catch	Mortalities/ Sacrificed
April	Sand Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Elk River	RG_ER_AG-01	628594	5447372	24-Apr-20	24-Apr-20	12:00	16:30	4.50	3.0	15	2	0.375	2	0	3	0	-	-
		RG_ER_AG-02	626890	5446644	25-Apr-20	25-Apr-20	11:00	12:00	1.00	0	15	2	0.083	0	0	1	0	0	0
		RG_ER_AG-03	627021	5447519	25-Apr-20	25-Apr-20	12:10	14:00	1.83	1.0	5.0	2	0.153	0	0	2	0	0	0
	Gold Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
August	Sand Creek	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
	Elk River	ER_AN_01	627902	5447432	28-Aug-20	28-Aug-20	9:14	12:47	3.55	15	20	2	0.296	0	0	1	0	9	0
	Gold Creek	GC_AN_01	630641	5438276	27-Aug-20	27-Aug-20	12:40	16:45	4.08	15	20	2	0.340	0	0	0	0	8	0

Note: "-" indicates no data available.

Table E.9: Fish Meristics Data for Peamouth Chub, Koocanusa Reservoir, April 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age	Sex	Gonad Weight (g)	Liver Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor(K)	Gonado-somatic Index	Hepato-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Worm Weight (g)	Tissue Collected	Comment
														D	E	L	T			
Sand Creek	20-Apr-20	RG_SC_PCC-01	27.7	25.1	168	8	F	7.779	2.973	157.248	1.06	0.046	0.018	A	A	A	A	6.285	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_PCC-02	25.3	24.7	130	5	F	5.236	1.933	122.831	0.86	0.040	0.015	A	A	A	A	7.140	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_PCC-03	25.5	22.7	138	8	F	12.062	4.458	121.480	1.18	0.087	0.032	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_PCC-04	26.7	24.0	152	7	F	8.496	2.354	141.150	1.10	0.056	0.015	A	A	A	A	10.735	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_PCC-05	28.5	25.7	198	7	F	6.147	2.495	189.358	1.17	0.031	0.013	A	A	A	A	21.793	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_PCC-06	26.6	23.9	136	6	F	10.578	2.611	122.811	1.00	0.078	0.019	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_PCC-07	25.9	23.2	140	5	F	11.730	2.146	126.124	1.12	0.084	0.015	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_PCC-08	26.7	24.0	145	8	F	12.667	2.746	129.587	1.05	0.087	0.019	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_PCC-09	22.8	20.2	95	8	F	5.158	2.333	87.509	1.15	0.054	0.025	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_PCC-10	23.6	21.2	110	5	F	8.461	2.636	98.903	1.15	0.077	0.024	A	A	A	A	-	Muscle, Ovary	-
total sample size			**10**	**10**	**10**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	-	-	-	-	-	-	-
average			**25.9**	**23.5**	**141**	**6.7**	**-**	**8.831**	**2.669**	**129.7**	**1.08**	**0.064**	**0.019**	-	-	-	-	-	-	-
median			**26.3**	**24.0**	**139**	**7**	**-**	**8.479**	**2.553**	**124.5**	**1.11**	**0.066**	**0.018**	-	-	-	-	-	-	-
standard deviation			**1.74**	**1.71**	**28.6**	**1.34**	**-**	**2.82**	**0.696**	**28.6**	**0.0976**	**0.021**	**0.0059**	-	-	-	-	-	-	-
standard error			**0.550**	**0.542**	**9.04**	**0.42**	**-**	**0.892**	**0.220**	**9.04**	**0.0308**	**0.0066**	**0.0019**	-	-	-	-	-	-	-
minimum			**22.8**	**20.2**	**95**	**5**	**-**	**5.158**	**1.933**	**87.509**	**0.863**	**0.031**	**0.013**	-	-	-	-	-	-	-
maximum			**28.5**	**25.7**	**198**	**8**	**-**	**12.667**	**4.458**	**189.358**	**1.18**	**0.087**	**0.032**	-	-	-	-	-	-	-
Elk River	21-Apr-20	RG_ER_PCC-01	24.4	21.7	112	7	F	8.512	2.370	101.118	1.10	0.076	0.021	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_PCC-02	23.6	21.0	102	8	F	7.136	2.495	92.369	1.10	0.070	0.024	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-03	25.9	23.5	148	6	F	10.573	2.703	134.724	1.14	0.071	0.018	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-04	26.5	23.5	160	8	F	12.260	4.305	143.435	1.23	0.077	0.027	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-05	25.4	22.7	130	8	F	9.506	2.427	118.067	1.11	0.073	0.019	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-06	25.7	23.2	146	7	F	1.425	1.992	142.583	1.17	0.010	0.014	A	A	A	A	21.046	Muscle, Ovary	Worms Present
	22-Apr-20	RG_ER_PCC-07	26.8	24.5	148	11	F	9.037	2.909	136.054	1.01	0.061	0.020	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-08	27.3	24.4	155	12	F	12.080	4.267	138.653	1.07	0.078	0.028	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-09	27.0	24.2	154	7	F	15.280	3.975	134.745	1.09	0.099	0.026	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_ER_PCC-10	23.4	21.0	118	5	F	8.450	3.614	105.936	1.27	0.072	0.031	A	A	A	A	-	Muscle, Ovary	-
total sample size			**10**	**10**	**10**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	-	-	-	-	-	-	-
average			**25.6**	**23.0**	**137**	**7.9**	**-**	**9.426**	**3.106**	**124.768**	**1.13**	**0.069**	**0.023**	-	-	-	-	-	-	-
median			**25.8**	**23.4**	**147**	**7.5**	**-**	**9.272**	**2.806**	**134.735**	**1.11**	**0.072**	**0.023**	-	-	-	-	-	-	-
standard deviation			**1.40**	**1.33**	**20.3**	**2.13**	**-**	**3.68**	**0.857**	**18.836**	**0.079**	**0.023**	**0.0052**	-	-	-	-	-	-	-
standard error			**0.441**	**0.421**	**6.43**	**0.67**	**-**	**1.16**	**0.271**	**5.957**	**0.025**	**0.0072**	**0.0017**	-	-	-	-	-	-	-
minimum			**23.4**	**21**	**102**	**5**	**-**	**1.425**	**1.992**	**92.369**	**1.01**	**0.010**	**0.014**	-	-	-	-	-	-	-
maximum			**27.3**	**24.5**	**160**	**12**	**-**	**15.28**	**4.305**	**143.435**	**1.27**	**0.099**	**0.031**	-	-	-	-	-	-	-
Gold Creek	22-Apr-20	RG_GC_PCC-01	26.8	24.0	155	6	F	11.599	2.868	140.533	1.12	0.075	0.019	A	A	A	A	-	Muscle, Ovary	Duplicate Collected
	22-Apr-20	RG_GC_PCC-02	27.3	24.6	165	12	F	11.149	3.803	150.048	1.11	0.068	0.023	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-03	29.2	26.1	194	9	F	17.778	4.824	171.398	1.09	0.092	0.025	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-04	26.9	24.3	150	6	F	7.713	2.530	139.757	1.05	0.051	0.017	A	A	A	A	6.764	Muscle, Ovary	Worms Present
	22-Apr-20	RG_GC_PCC-05	24.2	21.9	117	7	F	9.103	2.580	105.317	1.11	0.078	0.022	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-06	27.6	24.8	155	7	F	12.472	3.066	139.462	1.02	0.080	0.020	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-07	24.9	22.1	120	6	F	9.648	2.075	108.277	1.11	0.080	0.017	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-08	25.4	22.7	124	7	F	4.830	2.037	117.133	1.06	0.039	0.016	A	A	A	A	8.692	Muscle, Ovary	Worms Present
	22-Apr-20	RG_GC_PCC-09	28.7	25.8	204	12	F	18.574	4.743	180.683	1.19	0.091	0.023	A	A	A	A	-	Muscle, Ovary	-
	22-Apr-20	RG_GC_PCC-10	25.8	23.2	128	6	F	7.745	2.306	117.949	1.03	0.061	0.018	A	A	A	A	-	Muscle, Ovary	-
total sample size			**10**	**10**	**10**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	-	-	-	-	-	-	-
average			**26.7**	**24.0**	**151**	**7.8**	**-**	**11.061**	**3.083**	**137.056**	**1.09**	**0.071**	**0.020**	-	-	-	-	-	-	-
median			**26.9**	**24.2**	**153**	**7**	**-**	**10.399**	**2.724**	**139.610**	**1.10**	**0.076**	**0.019**	-	-	-	-	-	-	-
standard deviation			**1.61**	**1.46**	**30.3**	**2.39**	**-**	**4.36**	**1.03**	**25.5**	**0.052**	**0.017**	**0.0031**	-	-	-	-	-	-	-
standard error			**0.511**	**0.460**	**9.58**	**0.76**	**-**	**1.38**	**0.327**	**8.08**	**0.016**	**0.0054**	**0.0010**	-	-	-	-	-	-	-
minimum			**24.2**	**21.9**	**117**	**6**	**-**	**4.830**	**2.037**	**105.317**	**1.02**	**0.039**	**0.016**	-	-	-	-	-	-	-
maximum			**29.2**	**26.1**	**204**	**12**	**-**	**18.574**	**4.824**	**180.683**	**1.19**	**0.092**	**0.025**	-	-	-	-	-	-	-

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scales, oto - otoliths.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

Table E.10: Fish Meristics Data for Redside Shiners, Koocanusa Reservoir, April 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Liver Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	Hepato-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Worm Weight (g)	Tissue Collected	Comment
															D	E	L	T			
Sand Creek	20-Apr-20	RG_SC_RSC-01	10.7	9.0	10.926	oto, sc	3	F	0.484	0.167	10.275	1.50	0.044	0.0153	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-02	11.3	9.9	12.687	oto, sc	3	F	0.412	0.216	12.059	1.31	0.032	0.0170	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-03	11.8	10.6	12.588	oto, sc	4	F	0.562	0.193	11.833	1.06	0.045	0.0153	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-04	11.7	10.5	15.253	oto, sc	3	F	0.699	0.383	14.171	1.32	0.046	0.0251	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-05	9.8	8.5	7.571	oto, sc	2	F	0.250	0.210	7.111	1.23	0.033	0.0277	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-06	11.0	9.5	12.281	oto, sc	3	F	0.389	0.188	11.704	1.43	0.032	0.0153	A	A	A	A	0.345	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_RSC-07	10.0	8.8	8.537	oto, sc	3	F	0.349	0.098	8.090	1.25	0.041	0.0115	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-08	11.3	10.0	13.218	oto, sc	3	F	0.648	0.219	12.351	1.32	0.049	0.0166	A	A	A	A	-	Muscle, Ovary	-
	20-Apr-20	RG_SC_RSC-09	10.4	9.1	9.184	oto, sc	3	F	0.419	0.099	8.666	1.22	0.046	0.0108	A	A	A	A	0.079	Muscle, Ovary	Worms Present
	20-Apr-20	RG_SC_RSC-10	9.8	8.6	7.143	oto, sc	2	F	0.256	0.122	6.765	1.12	0.036	0.0171	A	A	A	A	-	Muscle, Ovary	-
		total sample size	**10**	**10**	**10**	**-**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		average	**10.8**	**9.5**	**10.94**	**-**	**2.9**	**-**	**0.447**	**0.190**	**10.303**	**1.28**	**0.0403**	**0.0172**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		median	**10.9**	**9.3**	**11.60**	**-**	**3**	**-**	**0.416**	**0.191**	**10.990**	**1.28**	**0.0426**	**0.0160**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**0.757**	**0.768**	**2.71**	**-**	**0.57**	**-**	**0.152**	**0.082**	**2.51**	**0.132**	**0.0065**	**0.0054**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard error	**0.239**	**0.243**	**0.856**	**-**	**0.18**	**-**	**0.048**	**0.026**	**0.795**	**0.042**	**0.0021**	**0.0017**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		minimum	**9.8**	**8.5**	**7.143**	**-**	**2**	**-**	**0.250**	**0.098**	**6.765**	**1.06**	**0.0317**	**0.0108**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		maximum	**11.8**	**10.6**	**15.253**	**-**	**4**	**-**	**0.699**	**0.383**	**14.171**	**1.50**	**0.0490**	**0.0277**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Elk River	21-Apr-20	RG_ER_RSC-01	11.3	10.7	11.490	oto, sc	3	F	0.525	0.117	10.848	0.94	0.0457	0.0102	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-02	11.0	10.6	8.218	oto, sc	3	F	0.451	0.156	7.611	0.69	0.0549	0.0190	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-03	11.0	9.4	11.403	oto, sc	3	F	0.507	0.116	10.780	1.37	0.0445	0.0102	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-04	11.1	9.8	12.088	oto, sc	4	F	0.463	0.127	11.498	1.28	0.0383	0.0105	A	A	A	A	0.029	Muscle, Ovary	Worms Present
	21-Apr-20	RG_ER_RSC-05	10.9	9.4	10.191	oto, sc	3	F	0.519	0.095	9.577	1.23	0.0509	0.0093	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-06	10.9	9.7	8.675	oto, sc	3	F	0.326	0.129	8.220	0.95	0.0376	0.0149	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-07	10.1	8.9	8.255	oto, sc	3	F	0.316	0.162	7.777	1.17	0.0383	0.0196	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-08	11.0	9.4	10.428	oto, sc	3	F	0.455	0.160	9.813	1.26	0.0436	0.0153	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-09	10.9	9.6	10.175	oto, sc	3	F	0.401	0.128	9.646	1.15	0.0394	0.0126	A	A	A	A	-	Muscle, Ovary	-
	21-Apr-20	RG_ER_RSC-10	10.5	9.1	8.684	oto, sc	3	F	0.558	0.291	7.835	1.15	0.0643	0.0335	A	A	A	A	-	Muscle, Ovary	-
		total sample size	**10**	**10**	**10**	**-**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		average	**10.9**	**9.7**	**10.0**	**-**	**3.1**	**-**	**0.452**	**0.148**	**9.361**	**1.12**	**0.0457**	**0.0155**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		median	**11.0**	**9.5**	**10.183**	**-**	**3**	**-**	**0.459**	**0.129**	**9.612**	**1.16**	**0.0440**	**0.0137**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**0.337**	**0.585**	**1.43**	**-**	**0.32**	**-**	**0.082**	**0.055**	**1.43**	**0.203**	**0.0087**	**0.0073**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard error	**0.107**	**0.185**	**0.453**	**-**	**0.10**	**-**	**0.026**	**0.017**	**0.451**	**0.064**	**0.0027**	**0.0023**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		minimum	**10.1**	**8.9**	**8.218**	**-**	**3**	**-**	**0.316**	**0.095**	**7.611**	**0.69**	**0.0376**	**0.0093**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		maximum	**11.3**	**10.7**	**12.088**	**-**	**4**	**-**	**0.558**	**0.291**	**11.498**	**1.37**	**0.0643**	**0.0335**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Gold Creek	25-Apr-20	RG_GC_RSC-01	10.7	9.4	9.053	oto	3	F	0.474	0.172	8.407	1.09	0.0524	0.0190	A	A	A	A	-	Muscle, Ovary	-
	25-Apr-20	RG_GC_RSC-02	11.2	10.8	12.151	oto	3	F	0.436	0.107	11.608	0.96	0.0359	0.0088	A	A	A	A	1.047	Muscle, Ovary	Worms Present
	25-Apr-20	RG_GC_RSC-03	11.1	9.6	11.885	oto	3	F	0.417	0.167	11.301	1.34	0.0351	0.0141	A	A	A	A	1.179	Muscle, Ovary	Worms Present
	25-Apr-20	RG_GC_RSC-04	11.5	10.0	10.764	oto	3	F	0.447	0.187	10.130	1.08	0.0415	0.0174	A	A	A	A	-	Muscle, Ovary	-
	25-Apr-20	RG_GC_RSC-05	10.7	9.4	9.016	oto	3	F	0.258	0.072	8.686	1.09	0.0286	0.0080	A	A	A	A	0.162	Muscle, Ovary	Worms Present
	25-Apr-20	RG_GC_RSC-06	9.2	8.1	6.710	oto	2	F	0.205	0.086	6.419	1.26	0.0306	0.0128	A	A	A	A	-	Muscle, Ovary	-
	25-Apr-20	RG_GC_RSC-07	11.6	10.3	11.929	oto	3	F	0.719	0.151	11.059	1.09	0.0603	0.0127	A	A	A	A	-	Muscle, Ovary	-
	25-Apr-20	RG_GC_RSC-08	12.0	10.5	13.366	oto	3	F	0.598	0.108	12.660	1.15	0.0447	0.0081	A	A	A	A	0.075	Muscle, Ovary	Worms Present
	25-Apr-20	RG_GC_RSC-09	10.7	9.5	8.915	oto	3	F	0.401	0.141	8.373	1.04	0.0450	0.0158	A	A	A	A	-	Muscle, Ovary	-
	25-Apr-20	RG_GC_RSC-10	9.7	8.6	7.599	oto	3	F	0.215	0.058	7.326	1.19	0.0283	0.0076	A	A	A	A	0.105	Muscle, Ovary	Worms Present
		total sample size	**10**	**10**	**10**	**-**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		average	**10.8**	**9.6**	**10.139**	**-**	**2.9**	**-**	**0.417**	**0.125**	**9.597**	**1.13**	**0.0402**	**0.0124**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		median	**10.9**	**9.6**	**9.9085**	**-**	**3**	**-**	**0.427**	**0.125**	**9.408**	**1.09**	**0.0387**	**0.0127**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**0.857**	**0.832**	**2.192**	**-**	**0.32**	**-**	**0.163**	**0.045**	**2.05**	**0.111**	**0.0106**	**0.0042**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		standard error	**0.271**	**0.263**	**0.693**	**-**	**0.10**	**-**	**0.052**	**0.014**	**0.648**	**0.035**	**0.0033**	**0.0013**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		minimum	**9.2**	**8.1**	**6.71**	**-**	**2**	**-**	**0.205**	**0.058**	**6.419**	**0.96**	**0.0283**	**0.0076**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		maximum	**12.0**	**10.8**	**13.366**	**-**	**3**	**-**	**0.719**	**0.187**	**12.660**	**1.34**	**0.0603**	**0.0190**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scales, oto - otoliths.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

Table E.11: Sport Fish Meristics Data for the Koocanusa Reservoir, April 2020

Area	Processing Date	Fish Species	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	DELT (Severe[S]/Minor[M]/ Absent[A])				Tissue Collected	Comment
							D	E	L	T		
Sand Creek	20-Apr-20	BT	SC_BT-01	31.1	29.0	320	A	A	A	A	Muscle	-
	20-Apr-20	WCT	SC_WCT-01	27.9	26.0	185	A	A	A	A	Muscle	-
	20-Apr-20	RBT	SC_RBT-01	25.4	23.9	140	A	A	A	A	Muscle	-
	20-Apr-20	RBT	SC_RBT-02	25.6	24.0	130	A	A	A	A	Muscle	-
	20-Apr-20	RBT	SC_RBT-03	49.5	47.3	1,100	A	A	A	A	Muscle	-
	20-Apr-20	RBT	SC_RBT-04	51.7	49.5	1,650	A	A	A	A	Muscle	-
	20-Apr-20	RBT	SC_RBT-05	26.9	25.1	162	A	A	A	A	Muscle	-
	21-Apr-20	WCT	SC_WCT-02	45.6	43.0	850	A	A	A	A	Muscle	-
	21-Apr-20	WCT	SC_WCT-03	32.8	31.2	350	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-06	52.5	49.0	1,350	S	A	A	A	Muscle	Caudal Fin Rot (Spawning)
	21-Apr-20	WCT	SC_WCT-04	26.6	25.4	175	A	A	A	A	Muscle	-
	21-Apr-20	WCT	SC_WCT-05	34.0	32.0	400	A	A	A	A	Muscle	-
	21-Apr-20	WCT	SC_WCT-06	42.8	40.6	650	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-07	43.0	40.0	700	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-08	40.5	38.5	575	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-09	35.0	32.5	375	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-10	39.8	36.7	450	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-11	36.5	34.1	375	A	A	A	A	Muscle	-
	21-Apr-20	RBT	SC_RBT-12	39.8	37.1	525	A	A	A	A	Muscle	-
	23-Apr-20	WCT	SC_WCT-07	34.1	33.2	350	A	A	A	A	Muscle	-
	23-Apr-20	BT	SC_BT-02	30.9	28.8	230	A	A	A	A	Muscle	-
	23-Apr-20	KO	SC_KO-01	26.2	23.6	135	A	A	A	A	Muscle	-
	23-Apr-20	BT	SC_BT-03	36.6	33.4	780	A	A	A	A	Muscle	-
Elk River	22-Apr-20	YP	ER_YP-01	27.2	26.0	230	A	A	A	A	Muscle	-
	22-Apr-20	YP	ER_YP-02	13.2	12.3	21	A	A	A	A	Muscle	-
	22-Apr-20	RBT	ER_RBT-01	31.7	29.2	250	A	A	A	A	Muscle	-
	24-Apr-20	BT	ER_BT-01	58.2	56.2	1,900	A	A	A	A	Muscle	-
	24-Apr-20	BT	ER_BT-02	65.5	62.3	2,450	A	A	A	A	Muscle	
	25-Apr-20	KO	ER_KO-01	25.2	22.9	115	A	A	A	A	Muscle	-
	25-Apr-20	WCT	ER_WCT-01	23.2	21.9	100	A	A	A	A	Muscle	-
Gold Creek	21-Apr-20	WCT	GC_WCT-01	37.4	34.6	410	A	A	A	A	Muscle	-
	21-Apr-20	WCT	GC_WCT-02	40.8	38.3	710	A	A	A	A	Muscle	-
	21-Apr-20	WCT	GC_WCT-03	41.5	39.1	700	A	A	A	A	Muscle	-
	21-Apr-20	WCT	GC_WCT-04	34.9	32.9	420	A	A	A	A	Muscle	-
	21-Apr-20	WCT	GC_WCT-05	38.6	36.3	560	A	A	A	A	Muscle	-
	23-Apr-20	KO	GC_KO-01	29.2	27.5	208	A	A	A	A	Muscle	-
	23-Apr-20	WCT	GC_WCT-06	36.1	34.0	343	A	A	A	A	Muscle	-
	23-Apr-20	WCT	GC_WCT-07	29.9	28.2	242	A	A	A	A	Muscle	-
	23-Apr-20	RBT	GC_RBT-01	30.0	28.8	218	A	A	A	A	Muscle	-
	24-Apr-20	BT	GC_BT-01	33.0	31.0	230	A	A	A	A	Muscle	-
	24-Apr-20	MWF	GC_MWF-01	28.4	25.9	87	A	A	A	A	Muscle	Sample Not Sent
	24-Apr-20	MWF	GC_MWF-02	32.6	30.0	200	A	A	A	A	Muscle	-

Notes: D - deformities, E - erosion, L - lesions, T - tumors, BT = bull trout; WCT = westslope cutthroat trout; RBT = rainbow trout; KO = kokanee; YP = yellow perch; "-" indicates no data.

Table E.12: Redside Shiner Recruitment Data for Sand Creek, Koocanusa Reservoir, August 2020

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
									D	E	L	T	
25-Aug-20	RG_SC_RSC-01	4.3	3.9	0.559	oto	0	U	0.942	A	A	A	A	-
25-Aug-20	RG_SC_RSC-02	3.9	3.5	0.443	oto	0	U	1.033	A	A	A	A	-
25-Aug-20	RG_SC_RSC-03	3.8	3.4	0.406	oto	0	U	1.033	A	A	A	A	-
25-Aug-20	RG_SC_RSC-04	3.9	3.5	0.439	oto	0	U	1.024	A	A	A	A	-
25-Aug-20	RG_SC_RSC-05	3.6	3.3	0.369	oto	0	U	1.027	A	A	A	A	-
25-Aug-20	RG_SC_RSC-06	3.8	3.4	0.424	oto	0	U	1.079	A	A	A	A	-
25-Aug-20	RG_SC_RSC-07	5.7	5.2	1.689	oto	1	U	1.201	M	A	A	A	caudal is ripped
25-Aug-20	RG_SC_RSC-08	3.5	3.2	0.292	oto	0	U	0.891	A	A	A	A	-
25-Aug-20	RG_SC_RSC-09	3.0	2.8	0.214	oto	0	U	0.975	A	A	A	A	-
25-Aug-20	RG_SC_RSC-10	3.9	3.6	0.423	oto	0	U	0.907	A	A	A	A	-
25-Aug-20	RG_SC_RSC-11	4.0	3.6	0.441	-	-	U	0.945	A	A	A	A	-
25-Aug-20	RG_SC_RSC-12	3.2	2.9	0.228	-	-	U	0.935	A	A	A	A	-
25-Aug-20	RG_SC_RSC-13	3.0	2.7	0.232	-	-	U	1.179	A	A	A	A	-
25-Aug-20	RG_SC_RSC-14	4.0	3.7	0.508	-	-	U	1.003	A	A	A	A	-
25-Aug-20	RG_SC_RSC-15	4.0	3.7	0.582	-	-	U	1.149	A	A	A	A	-
25-Aug-20	RG_SC_RSC-16	3.5	3.2	0.307	-	-	U	0.937	A	A	A	A	-
25-Aug-20	RG_SC_RSC-17	3.8	3.5	0.462	-	-	U	1.078	A	A	A	A	-
25-Aug-20	RG_SC_RSC-18	3.7	3.4	0.370	-	-	U	0.941	A	A	A	A	-
25-Aug-20	RG_SC_RSC-19	4.3	3.9	0.614	-	-	U	1.035	A	A	A	A	-
25-Aug-20	RG_SC_RSC-20	4.0	3.7	0.442	-	-	U	0.873	A	A	A	A	-
25-Aug-20	RG_SC_RSC-21	3.7	3.4	0.349	-	-	U	0.888	A	A	A	A	-
25-Aug-20	RG_SC_RSC-22	4.4	4.0	0.524	-	-	U	0.819	A	A	A	A	-
25-Aug-20	RG_SC_RSC-23	4.5	4.2	0.626	-	-	U	0.845	A	A	A	A	-
25-Aug-20	RG_SC_RSC-24	3.9	3.6	0.451	-	-	U	0.967	A	A	A	A	-
25-Aug-20	RG_SC_RSC-25	4.6	4.2	0.677	-	-	U	0.914	A	A	A	A	-
25-Aug-20	RG_SC_RSC-26	3.9	3.6	0.424	-	-	U	0.909	A	A	A	A	-
25-Aug-20	RG_SC_RSC-27	4.1	3.8	0.450	-	-	U	0.820	A	A	A	A	-
25-Aug-20	RG_SC_RSC-28	4.4	4.0	0.715	-	-	U	1.117	A	A	A	A	-
25-Aug-20	RG_SC_RSC-29	4.5	4.1	0.620	-	-	U	0.900	A	A	A	A	-
25-Aug-20	RG_SC_RSC-30	4.3	3.9	0.469	-	-	U	0.791	A	A	A	A	-
25-Aug-20	RG_SC_RSC-31	3.8	3.5	0.359	-	-	U	0.837	A	A	A	A	-
25-Aug-20	RG_SC_RSC-32	3.7	3.4	0.371	-	-	U	0.944	A	A	A	A	-
25-Aug-20	RG_SC_RSC-33	3.5	3.2	0.282	-	-	U	0.861	A	A	A	A	-
25-Aug-20	RG_SC_RSC-34	4.2	3.8	0.543	-	-	U	0.990	A	A	A	A	-
25-Aug-20	RG_SC_RSC-35	4.3	4.0	0.504	-	-	U	0.788	A	A	A	A	-
25-Aug-20	RG_SC_RSC-36	4.5	4.1	0.656	-	-	U	0.952	A	A	A	A	-
25-Aug-20	RG_SC_RSC-37	2.8	2.5	0.160	-	-	U	1.024	A	A	A	A	-
25-Aug-20	RG_SC_RSC-38	3.2	2.9	0.244	-	-	U	1.000	A	A	A	A	-
25-Aug-20	RG_SC_RSC-39	2.9	2.6	0.176	-	-	U	1.001	A	A	A	A	-
25-Aug-20	RG_SC_RSC-40	4.5	4.1	0.573	-	-	U	0.831	A	A	A	A	-
25-Aug-20	RG_SC_RSC-41	4.0	3.6	0.408	-	-	F	0.874	A	A	A	A	-
25-Aug-20	RG_SC_RSC-42	3.1	2.8	0.219	-	-	U	0.998	A	A	A	A	-
25-Aug-20	RG_SC_RSC-43	4.0	3.6	0.426	-	-	U	0.913	A	A	A	A	-
25-Aug-20	RG_SC_RSC-44	3.3	3.0	0.258	-	-	U	0.956	A	A	A	A	-
25-Aug-20	RG_SC_RSC-45	2.7	2.3	0.160	-	-	U	1.315	A	A	A	A	-
25-Aug-20	RG_SC_RSC-46	2.9	2.6	0.169	-	-	U	0.962	A	A	A	A	-
25-Aug-20	RG_SC_RSC-47	2.9	2.6	0.151	-	-	U	0.859	A	A	A	A	-
25-Aug-20	RG_SC_RSC-48	4.0	3.7	0.477	-	-	U	0.942	A	A	A	A	-
25-Aug-20	RG_SC_RSC-49	4.6	4.2	0.783	-	-	U	1.057	A	A	A	A	-
25-Aug-20	RG_SC_RSC-50	3.6	3.3	0.374	-	-	U	1.041	A	A	A	A	-
25-Aug-20	RG_SC_RSC-51	2.7	2.4	0.145	-	-	U	1.049	A	A	A	A	-
25-Aug-20	RG_SC_RSC-52	3.2	2.9	0.253	-	-	U	1.037	A	A	A	A	-
25-Aug-20	RG_SC_RSC-53	3.5	3.2	0.332	-	-	U	1.013	A	A	A	A	-
25-Aug-20	RG_SC_RSC-54	3.5	3.1	0.352	-	-	U	1.182	A	A	A	A	-
25-Aug-20	RG_SC_RSC-55	3.7	3.3	0.405	-	-	U	1.127	A	A	A	A	-
25-Aug-20	RG_SC_RSC-56	3.8	3.4	0.499	-	-	U	1.270	A	A	A	A	-
25-Aug-20	RG_SC_RSC-57	2.8	2.5	0.173	-	-	U	1.107	A	A	A	A	-
25-Aug-20	RG_SC_RSC-58	3.2	2.9	0.201	-	-	U	0.824	A	A	A	A	-
25-Aug-20	RG_SC_RSC-59	4.0	3.6	0.483	-	-	U	1.035	A	A	A	A	-
25-Aug-20	RG_SC_RSC-60	3.6	3.2	0.361	-	-	U	1.102	A	A	A	A	-
25-Aug-20	RG_SC_RSC-61	2.9	2.6	0.166	-	-	U	0.944	A	A	A	A	-
25-Aug-20	RG_SC_RSC-62	3.3	3.0	0.227	-	-	U	0.841	A	A	A	A	-
25-Aug-20	RG_SC_RSC-63	2.8	2.5	0.155	-	-	U	0.992	A	A	A	A	-
25-Aug-20	RG_SC_RSC-64	3.8	3.4	0.422	-	-	U	1.074	A	A	A	A	-
25-Aug-20	RG_SC_RSC-65	2.7	2.4	0.125	-	-	U	0.904	A	A	A	A	-
25-Aug-20	RG_SC_RSC-66	3.0	2.7	0.190	-	-	U	0.965	A	A	A	A	-
25-Aug-20	RG_SC_RSC-67	2.9	2.6	0.154	-	-	U	0.876	A	A	A	A	-
25-Aug-20	RG_SC_RSC-68	3.0	2.7	0.167	-	-	U	0.848	A	A	A	A	-
25-Aug-20	RG_SC_RSC-69	3.4	3.0	0.241	-	-	U	0.893	A	A	A	A	-
25-Aug-20	RG_SC_RSC-70	3.8	3.4	0.313	-	-	U	0.796	A	A	A	A	-
25-Aug-20	RG_SC_RSC-71	4.3	3.9	0.524	-	-	U	0.883	A	A	A	A	-
25-Aug-20	RG_SC_RSC-72	4.1	3.7	0.575	-	-	U	1.135	A	A	A	A	-
25-Aug-20	RG_SC_RSC-73	4.4	4.0	0.589	-	-	U	0.920	A	A	A	A	-
25-Aug-20	RG_SC_RSC-74	4.6	4.2	0.672	-	-	U	0.907	A	A	A	A	-
25-Aug-20	RG_SC_RSC-75	3.7	3.4	0.348	-	-	U	0.885	A	A	A	A	-
25-Aug-20	RG_SC_RSC-76	3.5	3.1	0.379	-	-	U	1.272	A	A	A	A	-
25-Aug-20	RG_SC_RSC-77	3.4	3.1	0.227	-	-	U	0.762	A	A	A	A	-
25-Aug-20	RG_SC_RSC-78	3.8	3.5	0.414	-	-	U	0.966	A	A	A	A	-
25-Aug-20	RG_SC_RSC-79	3.0	2.7	0.177	-	-	U	0.899	A	A	A	A	-

Table E.12: Redside Shiner Recruitment Data for Sand Creek, Koocanusa Reservoir, August 2020

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
									D	E	L	T	
25-Aug-20	RG_SC_RSC-80	3.2	2.9	0.196	-	-	U	0.804	A	A	A	A	-
25-Aug-20	RG_SC_RSC-81	4.1	3.7	0.502	-	-	U	0.991	A	A	A	A	-
25-Aug-20	RG_SC_RSC-82	4.0	3.7	0.464	-	-	U	0.916	A	A	A	A	-
25-Aug-20	RG_SC_RSC-83	3.5	3.2	0.291	-	-	U	0.888	A	A	A	A	-
25-Aug-20	RG_SC_RSC-84	4.2	3.8	0.517	-	-	U	0.942	A	A	A	A	-
25-Aug-20	RG_SC_RSC-85	3.3	3.0	0.277	-	-	U	1.026	A	A	A	A	-
25-Aug-20	RG_SC_RSC-86	2.4	2.1	0.104	-	-	U	1.123	A	A	A	A	-
25-Aug-20	RG_SC_RSC-87	2.8	2.5	0.138	-	-	U	0.883	A	A	A	A	-
25-Aug-20	RG_SC_RSC-88	3.2	2.8	0.221	-	-	U	1.007	A	A	A	A	-
25-Aug-20	RG_SC_RSC-89	2.9	2.6	0.144	-	-	U	0.819	A	A	A	A	-
25-Aug-20	RG_SC_RSC-90	4.5	4.1	0.591	-	-	U	0.858	A	A	A	A	-
25-Aug-20	RG_SC_RSC-91	4.4	4.0	0.609	-	-	U	0.952	A	A	A	A	-
25-Aug-20	RG_SC_RSC-92	4.3	3.9	0.512	-	-	U	0.863	A	A	A	A	-
25-Aug-20	RG_SC_RSC-93	2.9	2.6	0.188	-	-	U	1.070	A	A	A	A	-
25-Aug-20	RG_SC_RSC-94	3.6	3.3	0.320	-	-	U	0.890	A	A	A	A	-
25-Aug-20	RG_SC_RSC-95	2.9	2.6	0.141	-	-	U	0.802	A	A	A	A	-
25-Aug-20	RG_SC_RSC-96	3.4	3.1	0.242	-	-	U	0.812	A	A	A	A	-
25-Aug-20	RG_SC_RSC-97	3.0	2.7	0.168	-	-	U	0.854	A	A	A	A	-
25-Aug-20	RG_SC_RSC-98	3.0	2.7	0.152	-	-	U	0.772	A	A	A	A	-
25-Aug-20	RG_SC_RSC-99	3.0	2.7	0.159	-	-	U	0.808	A	A	A	A	-
25-Aug-20	RG_SC_RSC-100	2.8	2.5	0.118	-	-	U	0.755	A	A	A	A	-
total sample size		**100**	**100**	**100**	**-**	**10**		**100**	**-**	**-**	**-**	**-**	**-**
average		**3.6**	**3.3**	**0.374**	**-**	**0.1**		**0.956**	**-**	**-**	**-**	**-**	**-**
median		**3.7**	**3.4**	**0.365**	**-**	**0**		**0.942**	**-**	**-**	**-**	**-**	**-**
standard deviation		**0.604**	**0.571**	**0.213**	**-**	**0.316**		**0.118**	**-**	**-**	**-**	**-**	**-**
standard error		**0.0604**	**0.0571**	**0.0213**	**-**	**0.100**	**#DIV/0!**	**0.0118**	**-**	**-**	**-**	**-**	**-**
minimum		**2.4**	**2.1**	**0.104**	**-**	**0**		**0.755**	**-**	**-**	**-**	**-**	**-**
maximum		**5.7**	**5.2**	**1.689**	**-**	**1**		**1.315**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformity, E - erosion, L - lesion, T - tumor, "-" indicates no data.
[a] Age structures collected: oto = otolith extracted from whole body (WB).

Table E.13: Redside Shiner Recruitment Data for Elk River, Koocanusa Reservoir, August 2020

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
								D	E	L	T	
25-Aug-20	RG_ER_RSC-01	4.3	3.9	0.550	oto	0	0.927	A	A	A	A	-
25-Aug-20	RG_ER_RSC-02	4.1	3.7	0.503	oto	0	0.993	A	A	A	A	-
25-Aug-20	RG_ER_RSC-03	3.9	3.5	0.411	oto	0	0.959	A	A	A	A	-
25-Aug-20	RG_ER_RSC-04	3.8	3.4	0.291	oto	0	0.740	A	A	A	A	-
25-Aug-20	RG_ER_RSC-05	3.5	3.2	0.286	oto	0	0.873	A	A	A	A	-
25-Aug-20	RG_ER_RSC-06	4.0	3.6	0.452	oto	0	0.969	A	A	A	A	-
25-Aug-20	RG_ER_RSC-07	4.2	3.8	0.498	oto	0	0.908	A	A	A	A	-
25-Aug-20	RG_ER_RSC-08	4.3	3.9	0.581	oto	0	0.979	A	A	A	A	-
25-Aug-20	RG_ER_RSC-09	4.4	4.0	0.641	oto	0	1.002	A	A	A	A	-
25-Aug-20	RG_ER_RSC-10	4.1	3.6	0.589	oto	0	1.262	A	A	A	A	-
25-Aug-20	RG_ER_RSC-11	4.8	4.5	0.680	-	-	0.746	A	A	A	A	-
25-Aug-20	RG_ER_RSC-12	4.7	4.4	0.596	-	-	0.700	A	A	A	A	-
25-Aug-20	RG_ER_RSC-13	4.7	4.3	0.700	-	-	0.880	A	A	A	A	-
25-Aug-20	RG_ER_RSC-14	3.6	3.2	0.382	-	-	1.166	A	A	A	A	-
25-Aug-20	RG_ER_RSC-15	3.5	3.2	0.247	-	-	0.754	A	A	A	A	-
25-Aug-20	RG_ER_RSC-16	4.1	3.8	0.424	-	-	0.773	A	A	A	A	-
25-Aug-20	RG_ER_RSC-17	3.6	3.3	0.367	-	-	1.021	A	A	A	A	-
25-Aug-20	RG_ER_RSC-18	3.7	3.4	0.376	-	-	0.957	A	A	A	A	-
25-Aug-20	RG_ER_RSC-19	3.8	3.5	0.384	-	-	0.896	A	A	A	A	-
25-Aug-20	RG_ER_RSC-20	3.8	3.4	0.347	-	-	0.883	A	A	A	A	-
25-Aug-20	RG_ER_RSC-21	3.3	3.0	0.199	-	-	0.737	A	A	A	A	-
25-Aug-20	RG_ER_RSC-22	2.8	2.5	0.122	-	-	0.781	A	A	A	A	-
25-Aug-20	RG_ER_RSC-23	3.7	3.4	0.380	-	-	0.967	A	A	A	A	-
25-Aug-20	RG_ER_RSC-24	3.5	3.2	0.282	-	-	0.861	A	A	A	A	-
25-Aug-20	RG_ER_RSC-25	3.7	3.4	0.320	-	-	0.814	A	A	A	A	-
25-Aug-20	RG_ER_RSC-26	4.5	4.1	0.582	-	-	0.844	A	A	A	A	-
25-Aug-20	RG_ER_RSC-27	3.8	3.5	0.399	-	-	0.931	A	A	A	A	-
25-Aug-20	RG_ER_RSC-28	3.3	3.0	0.231	-	-	0.856	A	A	A	A	-
25-Aug-20	RG_ER_RSC-29	3.7	3.4	0.307	-	-	0.781	A	A	A	A	-
25-Aug-20	RG_ER_RSC-30	2.8	2.5	0.170	-	-	1.088	A	A	A	A	-
25-Aug-20	RG_ER_RSC-31	4.0	3.6	0.425	-	-	0.911	A	A	A	A	-
25-Aug-20	RG_ER_RSC-32	3.7	3.4	0.338	-	-	0.860	A	A	A	A	-
25-Aug-20	RG_ER_RSC-33	4.1	3.7	0.434	-	-	0.857	A	A	A	A	-
25-Aug-20	RG_ER_RSC-34	3.5	3.2	0.256	-	-	0.781	A	A	A	A	-
25-Aug-20	RG_ER_RSC-35	3.0	2.7	0.175	-	-	0.889	A	A	A	A	-
25-Aug-20	RG_ER_RSC-36	3.7	3.3	0.312	-	-	0.868	A	A	A	A	-
25-Aug-20	RG_ER_RSC-37	3.7	3.4	0.337	-	-	0.857	A	A	A	A	-
25-Aug-20	RG_ER_RSC-38	2.7	2.4	0.094	-	-	0.680	A	A	A	A	-
25-Aug-20	RG_ER_RSC-39	2.8	2.5	0.146	-	-	0.934	A	A	A	A	-
25-Aug-20	RG_ER_RSC-40	4.1	3.7	0.496	-	-	0.979	A	A	A	A	-
25-Aug-20	RG_ER_RSC-41	4.0	3.6	0.458	-	-	0.982	A	A	A	A	-
25-Aug-20	RG_ER_RSC-42	3.9	3.5	0.407	-	-	0.949	A	A	A	A	-
25-Aug-20	RG_ER_RSC-43	3.9	3.5	0.372	-	-	0.868	A	A	A	A	-
25-Aug-20	RG_ER_RSC-44	2.6	2.4	0.139	-	-	1.005	A	A	A	A	-
25-Aug-20	RG_ER_RSC-45	3.0	2.7	0.220	-	-	1.118	A	A	A	A	-
25-Aug-20	RG_ER_RSC-46	4.0	3.6	0.443	-	-	0.950	A	A	A	A	-
25-Aug-20	RG_ER_RSC-47	2.5	2.2	0.092	-	-	0.864	A	A	A	A	-
25-Aug-20	RG_ER_RSC-48	3.9	3.5	0.420	-	-	0.980	A	A	A	A	-
25-Aug-20	RG_ER_RSC-49	4.0	3.6	0.441	-	-	0.945	A	A	A	A	-
25-Aug-20	RG_ER_RSC-50	2.9	2.6	0.192	-	-	1.092	A	A	A	A	-
25-Aug-20	RG_ER_RSC-51	4.3	3.9	0.680	-	-	1.146	A	A	A	A	-
25-Aug-20	RG_ER_RSC-52	3.1	2.8	0.208	-	-	0.948	A	A	A	A	-
25-Aug-20	RG_ER_RSC-53	4.0	3.6	0.421	-	-	0.902	A	A	A	A	-
25-Aug-20	RG_ER_RSC-54	3.7	3.4	0.351	-	-	0.893	A	A	A	A	-
25-Aug-20	RG_ER_RSC-55	2.8	2.5	0.170	-	-	1.088	A	A	A	A	-
25-Aug-20	RG_ER_RSC-56	2.8	2.5	0.159	-	-	1.018	A	A	A	A	-
25-Aug-20	RG_ER_RSC-57	3.5	3.1	0.272	-	-	0.913	A	A	A	A	-
25-Aug-20	RG_ER_RSC-58	3.5	3.2	0.313	-	-	0.955	A	A	A	A	-
25-Aug-20	RG_ER_RSC-59	3.1	2.8	0.225	-	-	1.025	A	A	A	A	-
25-Aug-20	RG_ER_RSC-60	3.8	3.5	0.424	-	-	0.989	A	A	A	A	-
25-Aug-20	RG_ER_RSC-61	4.3	3.9	0.633	-	-	1.067	A	A	A	A	-
25-Aug-20	RG_ER_RSC-62	3.7	3.4	0.359	-	-	0.913	A	A	A	A	-
25-Aug-20	RG_ER_RSC-63	4.1	3.6	0.445	-	-	0.954	A	A	A	A	-
25-Aug-20	RG_ER_RSC-64	3.4	3.1	0.234	-	-	0.785	A	A	A	A	-
25-Aug-20	RG_ER_RSC-65	3.8	3.4	0.433	-	-	1.102	A	A	A	A	-
25-Aug-20	RG_ER_RSC-66	3.5	3.2	0.327	-	-	0.998	A	A	A	A	-
25-Aug-20	RG_ER_RSC-67	4.1	3.8	0.547	-	-	0.997	A	A	A	A	-
25-Aug-20	RG_ER_RSC-68	3.3	3.0	0.232	-	-	0.859	A	A	A	A	-
25-Aug-20	RG_ER_RSC-69	3.5	3.2	0.305	-	-	0.931	A	A	A	A	-
25-Aug-20	RG_ER_RSC-70	4.2	3.8	0.524	-	-	0.955	A	A	A	A	-
25-Aug-20	RG_ER_RSC-71	4.3	3.9	0.583	-	-	0.983	A	A	A	A	-
25-Aug-20	RG_ER_RSC-72	3.8	3.5	0.395	-	-	0.921	A	A	A	A	-
25-Aug-20	RG_ER_RSC-73	3.3	3.0	0.252	-	-	0.933	A	A	A	A	-
25-Aug-20	RG_ER_RSC-74	3.0	2.7	0.192	-	-	0.975	A	A	A	A	-
25-Aug-20	RG_ER_RSC-75	3.7	3.4	0.361	-	-	0.918	A	A	A	A	-
25-Aug-20	RG_ER_RSC-76	3.4	3.1	0.252	-	-	0.846	A	A	A	A	-
25-Aug-20	RG_ER_RSC-77	4.0	3.6	0.476	-	-	1.020	A	A	A	A	-

Table E.13: Redside Shiner Recruitment Data for Elk River, Koocanusa Reservoir, August 2020

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
								D	E	L	T	
25-Aug-20	RG_ER_RSC-78	3.2	2.9	0.192	-	-	0.787	A	A	A	A	-
25-Aug-20	RG_ER_RSC-79	4.5	4.1	0.632	-	-	0.917	A	A	A	A	-
25-Aug-20	RG_ER_RSC-80	4.0	3.7	0.388	-	-	0.766	A	A	A	A	-
25-Aug-20	RG_ER_RSC-81	4.2	3.8	0.533	-	-	0.971	A	A	A	A	-
25-Aug-20	RG_ER_RSC-82	3.6	3.3	0.317	-	-	0.882	A	A	A	A	-
25-Aug-20	RG_ER_RSC-83	3.8	3.5	0.393	-	-	0.917	A	A	A	A	-
25-Aug-20	RG_ER_RSC-84	3.5	3.2	0.270	-	-	0.824	A	A	A	A	-
25-Aug-20	RG_ER_RSC-85	3.4	3.1	0.449	-	-	1.507	S	A	A	A	-
25-Aug-20	RG_ER_RSC-86	4.0	3.7	0.442	-	-	0.873	A	A	A	A	-
25-Aug-20	RG_ER_RSC-87	3.5	3.2	0.260	-	-	0.793	A	A	A	A	-
25-Aug-20	RG_ER_RSC-88	3.2	2.9	0.253	-	-	1.037	A	A	A	A	-
25-Aug-20	RG_ER_RSC-89	3.1	2.8	0.221	-	-	1.007	A	A	A	A	-
25-Aug-20	RG_ER_RSC-90	4.4	4.0	0.633	-	-	0.989	A	A	A	A	-
25-Aug-20	RG_ER_RSC-91	4.2	3.8	0.588	-	-	1.072	A	A	A	A	-
25-Aug-20	RG_ER_RSC-92	3.8	3.5	0.372	-	-	0.868	A	A	A	A	-
25-Aug-20	RG_ER_RSC-93	3.8	3.5	0.396	-	-	0.924	A	A	A	A	-
25-Aug-20	RG_ER_RSC-94	4.0	3.6	0.478	-	-	1.025	A	A	A	A	-
25-Aug-20	RG_ER_RSC-95	4.0	3.6	0.499	-	-	1.070	A	A	A	A	-
25-Aug-20	RG_ER_RSC-96	3.3	3.0	0.246	-	-	0.911	A	A	A	A	-
25-Aug-20	RG_ER_RSC-97	3.7	3.4	0.353	-	-	0.898	A	A	A	A	-
25-Aug-20	RG_ER_RSC-98	3.4	3.1	0.269	-	-	0.903	A	A	A	A	-
25-Aug-20	RG_ER_RSC-99	3.1	2.8	0.182	-	-	0.829	A	A	A	A	-
25-Aug-20	RG_ER_RSC-100	2.8	2.6	0.166	-	-	0.944	A	A	A	A	-
total sample size		**100**	**100**	**100**	**-**	**10**	**100**	**-**	**-**	**-**	**-**	**-**
average		**3.7**	**3.3**	**0.368**	**-**	**0**	**0.932**	**-**	**-**	**-**	**-**	**-**
median		**3.7**	**3.4**	**0.370**	**-**	**0**	**0.925**	**-**	**-**	**-**	**-**	**-**
standard deviation		**0.500**	**0.466**	**0.1471**	**-**	**0.00**	**0.119**	**-**	**-**	**-**	**-**	**-**
standard error		**0.050**	**0.047**	**0.0147**	**-**	**0.00**	**0.012**	**-**	**-**	**-**	**-**	**-**
minimum		**2.5**	**2.2**	**0.092**	**-**	**0**	**0.680**	**-**	**-**	**-**	**-**	**-**
maximum		**4.8**	**4.5**	**0.700**	**-**	**0**	**1.507**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformity, E - erosion, L - lesion, T - tumor, "-" indicates no data.

[a] Age structures collected: oto = otolith extracted from whole body (WB).

Table E.14: Redside Shiner Recruitment Data for Gold Creek, Koocanusa Reservoir, August 2020

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
								D	E	L	T	
27-Aug-20	RG_GC_RSC-01	3.7	3.3	0.359	oto	0	0.999	A	A	A	A	-
27-Aug-20	RG_GC_RSC-02	4.1	3.7	0.500	oto	0	0.987	A	A	A	A	-
27-Aug-20	RG_GC_RSC-03	3.8	3.5	0.423	oto	0	0.987	A	A	A	A	-
27-Aug-20	RG_GC_RSC-04	4.0	3.6	0.521	oto	0	1.117	A	A	A	A	-
27-Aug-20	RG_GC_RSC-05	3.5	3.2	0.304	oto	0	0.928	A	A	A	A	-
27-Aug-20	RG_GC_RSC-06	4.4	4.0	0.534	oto	0	0.834	A	A	A	A	-
27-Aug-20	RG_GC_RSC-07	4.3	3.9	0.603	oto	0	1.017	A	A	A	A	-
27-Aug-20	RG_GC_RSC-08	4.4	4.0	0.615	oto	0	0.961	A	A	A	A	-
27-Aug-20	RG_GC_RSC-09	4.3	3.9	0.531	oto	0	0.895	A	A	A	A	-
27-Aug-20	RG_GC_RSC-10	3.9	3.5	0.423	oto	0	0.987	A	A	A	A	-
27-Aug-20	RG_GC_RSC-11	3.0	2.7	0.196	-	-	0.996	A	A	A	A	-
27-Aug-20	RG_GC_RSC-12	3.9	3.6	0.485	-	-	1.040	A	A	A	A	-
27-Aug-20	RG_GC_RSC-13	4.0	3.6	0.534	-	-	1.145	A	A	A	A	-
27-Aug-20	RG_GC_RSC-14	3.6	3.4	0.355	-	-	0.903	A	A	A	A	-
27-Aug-20	RG_GC_RSC-15	4.1	3.7	0.520	-	-	1.027	A	A	A	A	-
27-Aug-20	RG_GC_RSC-16	3.0	2.7	0.195	-	-	0.991	A	A	A	A	-
27-Aug-20	RG_GC_RSC-17	3.5	3.1	0.310	-	-	1.041	A	A	A	A	-
27-Aug-20	RG_GC_RSC-18	3.5	3.2	0.315	-	-	0.961	A	A	A	A	-
27-Aug-20	RG_GC_RSC-19	3.9	3.5	0.460	-	-	1.073	A	A	A	A	-
27-Aug-20	RG_GC_RSC-20	4.2	3.8	0.599	-	-	1.092	A	A	A	A	-
27-Aug-20	RG_GC_RSC-21	4.0	3.6	0.503	-	-	1.078	A	A	A	A	-
27-Aug-20	RG_GC_RSC-22	3.7	3.4	0.408	-	-	1.038	A	A	A	A	-
27-Aug-20	RG_GC_RSC-23	3.5	3.2	0.270	-	-	0.824	A	A	A	A	-
27-Aug-20	RG_GC_RSC-24	3.9	3.5	0.394	-	-	0.919	A	A	A	A	-
27-Aug-20	RG_GC_RSC-25	3.1	2.8	0.178	-	-	0.811	A	A	A	A	-
27-Aug-20	RG_GC_RSC-26	3.2	2.9	0.198	-	-	0.812	A	A	A	A	-
27-Aug-20	RG_GC_RSC-27	3.6	3.2	0.343	-	-	1.047	A	A	A	A	-
27-Aug-20	RG_GC_RSC-28	3.2	2.8	0.371	-	-	1.690	A	A	A	A	-
27-Aug-20	RG_GC_RSC-29	3.8	3.4	0.406	-	-	1.033	A	A	A	A	-
27-Aug-20	RG_GC_RSC-30	3.3	3.0	0.267	-	-	0.989	A	A	A	A	-
27-Aug-20	RG_GC_RSC-31	3.5	3.2	0.293	-	-	0.894	A	A	A	A	-
27-Aug-20	RG_GC_RSC-32	3.3	3.0	0.236	-	-	0.874	A	A	A	A	-
27-Aug-20	RG_GC_RSC-33	4.1	3.7	0.543	-	-	1.072	A	A	A	A	-
27-Aug-20	RG_GC_RSC-34	3.9	3.5	0.417	-	-	0.973	A	A	A	A	-
27-Aug-20	RG_GC_RSC-35	3.7	3.4	0.377	-	-	0.959	A	A	A	A	-
27-Aug-20	RG_GC_RSC-36	3.8	3.4	0.333	-	-	0.847	A	A	A	A	-
27-Aug-20	RG_GC_RSC-37	3.4	3.1	0.290	-	-	0.973	A	A	A	A	-
27-Aug-20	RG_GC_RSC-38	3.7	3.4	0.378	-	-	0.962	A	A	A	A	-
27-Aug-20	RG_GC_RSC-39	4.0	3.6	0.481	-	-	1.031	A	A	A	A	-
27-Aug-20	RG_GC_RSC-40	4.3	3.9	0.552	-	-	0.931	A	A	A	A	-
27-Aug-20	RG_GC_RSC-41	3.8	3.5	0.422	-	-	0.984	A	A	A	A	-
27-Aug-20	RG_GC_RSC-42	3.3	3.0	0.277	-	-	1.026	A	A	A	A	-
27-Aug-20	RG_GC_RSC-43	3.4	3.1	0.268	-	-	0.900	A	A	A	A	-
27-Aug-20	RG_GC_RSC-44	2.9	2.6	0.186	-	-	1.058	A	A	A	A	-
27-Aug-20	RG_GC_RSC-45	3.3	3.0	0.271	-	-	1.004	A	A	A	A	-
27-Aug-20	RG_GC_RSC-46	3.8	3.4	0.359	-	-	0.913	A	A	A	A	-
27-Aug-20	RG_GC_RSC-47	4.6	4.1	0.684	-	-	0.992	A	A	A	A	-
27-Aug-20	RG_GC_RSC-48	4.0	3.6	0.477	-	-	1.022	A	A	A	A	-
27-Aug-20	RG_GC_RSC-49	3.9	3.5	0.455	-	-	1.061	A	A	A	A	-
27-Aug-20	RG_GC_RSC-50	3.4	3.1	0.303	-	-	1.017	A	A	A	A	-
27-Aug-20	RG_GC_RSC-51	3.2	2.9	0.243	-	-	0.996	A	A	A	A	-
27-Aug-20	RG_GC_RSC-52	3.1	2.8	0.187	-	-	0.852	A	A	A	A	-
27-Aug-20	RG_GC_RSC-53	3.6	3.3	0.347	-	-	0.966	A	A	A	A	-
27-Aug-20	RG_GC_RSC-54	3.5	3.2	0.282	-	-	0.861	A	A	A	A	-
27-Aug-20	RG_GC_RSC-55	3.7	3.4	0.455	-	-	1.158	A	A	A	A	-
27-Aug-20	RG_GC_RSC-56	3.8	3.4	0.434	-	-	1.104	A	A	A	A	-
27-Aug-20	RG_GC_RSC-57	3.6	3.3	0.277	-	-	0.771	A	A	A	A	-
27-Aug-20	RG_GC_RSC-58	4.1	3.7	0.513	-	-	1.013	A	A	A	A	-
27-Aug-20	RG_GC_RSC-59	4.2	3.8	0.622	-	-	1.134	A	A	A	A	-
27-Aug-20	RG_GC_RSC-60	3.9	3.5	0.498	-	-	1.162	A	A	A	A	-
27-Aug-20	RG_GC_RSC-61	4.2	3.8	0.499	-	-	0.909	A	A	A	A	-
27-Aug-20	RG_GC_RSC-62	3.6	3.3	0.292	-	-	0.813	A	A	A	A	-
27-Aug-20	RG_GC_RSC-63	3.3	3.0	0.226	-	-	0.837	A	A	A	A	-
27-Aug-20	RG_GC_RSC-64	3.7	3.4	0.362	-	-	0.921	A	A	A	A	-
27-Aug-20	RG_GC_RSC-65	4.0	3.6	0.478	-	-	1.025	A	A	A	A	-
27-Aug-20	RG_GC_RSC-66	3.2	2.9	0.222	-	-	0.910	A	A	A	A	-
27-Aug-20	RG_GC_RSC-67	3.7	3.4	0.391	-	-	0.995	A	A	A	A	-
27-Aug-20	RG_GC_RSC-68	3.5	3.2	0.298	-	-	0.909	A	A	A	A	-
27-Aug-20	RG_GC_RSC-69	4.0	3.6	0.438	-	-	0.939	A	A	A	A	-
27-Aug-20	RG_GC_RSC-70	4.2	3.8	0.599	-	-	1.092	A	A	A	A	-
27-Aug-20	RG_GC_RSC-71	3.8	3.4	0.474	-	-	1.206	A	A	A	A	-
27-Aug-20	RG_GC_RSC-72	4.0	3.6	0.495	-	-	1.061	A	A	A	A	-
27-Aug-20	RG_GC_RSC-73	3.3	3.0	0.318	-	-	1.178	A	A	A	A	-
27-Aug-20	RG_GC_RSC-74	3.0	2.7	0.240	-	-	1.219	A	A	A	A	-

Table E.14: **Redside Shiner Recruitment Data for Gold Creek, Koocanusa Reservoir, August 2020**

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Fulton's Condition Factor (K)	DELT (Severe[S]/Minor[M]/Absent[A])				Comment
								D	E	L	T	
27-Aug-20	RG_GC_RSC-75	3.3	3.0	0.335	-	-	1.241	A	A	A	A	-
27-Aug-20	RG_GC_RSC-76	4.3	3.9	0.587	-	-	0.990	A	A	A	A	-
27-Aug-20	RG_GC_RSC-77	3.5	3.2	0.297	-	-	0.906	A	A	A	A	-
27-Aug-20	RG_GC_RSC-78	3.3	3.0	0.242	-	-	0.896	A	A	A	A	-
27-Aug-20	RG_GC_RSC-79	3.9	3.5	0.414	-	-	0.966	A	A	A	A	-
27-Aug-20	RG_GC_RSC-80	3.0	2.7	0.195	-	-	0.991	A	A	A	A	-
27-Aug-20	RG_GC_RSC-81	3.3	3.0	0.254	-	-	0.941	A	A	A	A	-
27-Aug-20	RG_GC_RSC-82	3.1	2.8	0.188	-	-	0.856	A	A	A	A	-
27-Aug-20	RG_GC_RSC-83	2.9	2.6	0.144	-	-	0.819	A	A	A	A	-
27-Aug-20	RG_GC_RSC-84	3.5	3.2	0.348	-	-	1.062	A	A	A	A	-
27-Aug-20	RG_GC_RSC-85	3.5	3.2	0.306	-	-	0.934	A	A	A	A	-
27-Aug-20	RG_GC_RSC-86	3.5	3.2	0.297	-	-	0.906	A	A	A	A	-
27-Aug-20	RG_GC_RSC-87	3.4	3.1	0.334	-	-	1.121	A	A	A	A	-
27-Aug-20	RG_GC_RSC-88	3.2	2.9	0.275	-	-	1.128	A	A	A	A	-
27-Aug-20	RG_GC_RSC-89	4.2	3.8	0.597	-	-	1.088	A	A	A	A	-
27-Aug-20	RG_GC_RSC-90	4.0	3.6	0.445	-	-	0.954	A	A	A	A	-
27-Aug-20	RG_GC_RSC-91	3.5	3.2	0.316	-	-	0.964	A	A	A	A	-
27-Aug-20	RG_GC_RSC-92	3.7	3.4	0.378	-	-	0.962	A	A	A	A	-
27-Aug-20	RG_GC_RSC-93	3.5	3.2	0.299	-	-	0.912	A	A	A	A	-
27-Aug-20	RG_GC_RSC-94	4.1	3.7	0.571	-	-	1.127	A	A	A	A	-
27-Aug-20	RG_GC_RSC-95	4.0	3.6	0.470	-	-	1.007	A	A	A	A	-
27-Aug-20	RG_GC_RSC-96	3.2	2.9	0.221	-	-	0.906	A	A	A	A	-
27-Aug-20	RG_GC_RSC-97	4.0	3.6	0.457	-	-	0.980	A	A	A	A	-
27-Aug-20	RG_GC_RSC-98	3.9	3.4	0.471	-	-	1.198	A	A	A	A	-
27-Aug-20	RG_GC_RSC-99	3.8	3.5	0.496	-	-	1.157	A	A	A	A	-
27-Aug-20	RG_GC_RSC-100	3.9	3.5	0.482	-	-	1.124	A	A	A	A	-
total sample size		**100**	**100**	**100**	**-**	**10**	**100**	**-**	**-**	**-**	**-**	**-**
average		**3.7**	**3.3**	**0.383**	**-**	**0.0**	**0.999**	**-**	**-**	**-**	**-**	**-**
median		**3.7**	**3.4**	**0.374**	**-**	**0**	**0.989**	**-**	**-**	**-**	**-**	**-**
standard deviation		**0.388**	**0.348**	**0.126**	**-**	**0.000**	**0.124**	**-**	**-**	**-**	**-**	**-**
standard error		**0.039**	**0.035**	**0.013**	**-**	**0.000**	**0.012**	**-**	**-**	**-**	**-**	**-**
minimum		**2.9**	**2.6**	**0.144**	**-**	**0**	**0.771**	**-**	**-**	**-**	**-**	**-**
maximum		**4.6**	**4.1**	**0.684**	**-**	**0**	**1.690**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformity, E - erosion, L - lesion, T - tumor, "-" indicates no data.

[a] Age structures collected: oto = otolith extracted from whole body (WB).

Table E.15: Sport Fish Meristics Data for the Koocanusa Reservoir, August 2020

Area	Processing Date	Fish Species	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Sex	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected	Comment
								D	E	L	T		
Gold Creek	27-Aug-20	KO	RG_GC_KO-01	18.1	16.4	49	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-02	19.8	17.6	56	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-03	22.6	20.3	84	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-04	21.9	19.7	81	M	A	A	M	A	Muscle	Scars from attempted predation (bull trout)
	27-Aug-20	KO	RG_GC_KO-05	17.9	16.8	43	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-06	17.4	15.8	41	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-07	21.5	19.8	70	M	A	A	A	A	Muscle	-
	27-Aug-20	KO	RG_GC_KO-08	17.3	15.5	40	M	A	A	A	A	Muscle	-
Elk River	28-Aug-20	KO	RG_ER_KO-01	22.1	20.0	77	M	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-02	22.7	20.3	81	F	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-03	22.4	20.3	84	M	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-04	19.6	17.8	61	M	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-05	22.5	20.7	88	F	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-06	21.5	19.6	83	M	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-07	23.9	22.1	99	UK	A	A	A	A	Muscle	-
	28-Aug-20	KO	RG_ER_KO-08	21.9	20.4	74	F	A	A	A	A	Muscle	-

Notes: D - deformity, E - erosion, L - lesion, T - tumor, KO = Kokanee, M = male, F = female = UK = unknown.

Table E.16: Fish Meristics Data for Peamouth Chub, Koocanusa Reservoir USA Portion, May 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor(K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A]) D	E	L	T	Tissue Collected
Rexford	13-May-20	Rexford_PCC-01	26.3	24.0	140	oto	9	F	9.6	14.0	130.4	1.01	0.069	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-02	26.2	23.5	145	oto	7	F	14.3	10.0	130.7	1.12	0.099	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-03	27.5	25.0	156	oto	12	F	11.4	16.0	144.6	1.00	0.073	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-04	26.5	24.0	170	oto	3	F	17.6	9.0	152.4	1.23	0.104	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-05	26.4	23.8	154	oto	6	F	16.3	11.0	137.7	1.14	0.106	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-06	26.9	24.5	170	oto	6	F	20.6	10.0	149.4	1.16	0.121	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-07	26.1	23.5	150	oto	9	F	15.7	15.0	134.3	1.16	0.105	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_PCC-08	26.0	23.7	145	oto	4	F	15.2	13.0	129.8	1.09	0.105	A	A	A	A	Muscle, Ovary
		total sample size	**8**	**8**	**8**	**-**	**8**	**-**	**8**	**8**	**8**	**8**	**8**	**-**	**-**	**-**	**-**	**-**
		average	**26.5**	**24.0**	**154**	**-**	**7**	**-**	**15.1**	**12.3**	**138.7**	**1.11**	**0.098**	**-**	**-**	**-**	**-**	**-**
		median	**26.4**	**23.9**	**152**	**-**	**6.5**	**-**	**15.5**	**12.0**	**136.0**	**1.13**	**0.104**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**0.49**	**0.52**	**11.3**	**-**	**2.93**	**-**	**3.44**	**2.60**	**9.0**	**0.0774**	**0.018**	**-**	**-**	**-**	**-**	**-**
		standard error	**0.175**	**0.183**	**3.99**	**-**	**1.04**	**-**	**1.22**	**0.92**	**3.19**	**0.0274**	**0.0063**	**-**	**-**	**-**	**-**	**-**
		minimum	**26**	**23.5**	**140**	**-**	**3**	**-**	**9.6**	**9**	**129.8**	**0.998**	**0.069**	**-**	**-**	**-**	**-**	**-**
		maximum	**27.5**	**25**	**170**	**-**	**12**	**-**	**20.6**	**16**	**152.4**	**1.23**	**0.121**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformities, E - erosion, L - lesions, T - tumors

[a] Age structures collected: sc - scales, oto - otoliths

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight

Table E.17: Fish Meristics Data for Northern Pikeminnow, Koocanusa Reservoir USA Portion, May 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected
														D	E	L	T	
Rexford	13-May-20	Rexford_NSC-01	52.2	48.0	1,640	oto, sc	15	F	41.5	45	1,599	1.48	0.025	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-02	51.2	46.5	1,260	sc	6	F	23.9	53	1,236	1.25	0.019	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-03	46.5	42.0	1,021	oto	14	F	34.4	56	987	1.38	0.034	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-04	50.9	46.2	1,600	oto, sc	4	F	51.0	72	1,549	1.62	0.032	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-05	50.4	46.0	1,400	sc	5	F	40.0	92	1,360	1.44	0.029	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-06	53.0	48.0	1,660	sc	4	F	53.0	83	1,607	1.50	0.032	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-07	52.0	47.0	1,580	sc	6	F	36.0	76	1,544	1.52	0.023	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-08	52.8	48.5	1,800	sc	7	F	52.0	86	1,748	1.58	0.029	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-09	51.0	47.0	1,340	sc	8	F	33.5	158	1,307	1.29	0.025	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-10	48.5	44.5	1,200	sc	7	F	27.3	72	1,173	1.36	0.023	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-11	50.4	45.5	1,200	sc	8	F	16.8	109	1,183	1.27	0.014	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-12	40.5	36.5	620	sc	6	F	9.1	19	611	1.28	0.015	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-13	36.5	33.5	450	sc	7	F	3.2	48	447	1.20	0.007	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-14	39.8	35.6	540	sc	5	F	10.6	44	529	1.20	0.020	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_NSC-15	37.2	33.5	415	sc	6	F	3.8	42	411	1.10	0.009	A	A	A	A	Muscle, Ovary
total sample size			**15**	**15**	**15**	-	**15**	-	**15**	**15**	**15**	**15**	**15**	-	-	-	-	-
average			**47.5**	**43.2**	**1181.73**	-	**7.2**	-	**29.073**	**70.333**	**1152.660**	**1.36**	**0.0223**	-	-	-	-	-
median			**50.4**	**46.0**	**1260.00**	-	**6**	-	**33.500**	**72.000**	**1236.100**	**1.36**	**0.0228**	-	-	-	-	-
standard deviation			**5.930**	**5.542**	**471.36**	-	**3.21**	-	**17.274**	**33.670**	**455.31**	**0.154**	**0.0083**	-	-	-	-	-
standard error			**1.531**	**1.431**	**121.705**	-	**0.83**	-	**4.460**	**8.694**	**117.561**	**0.040**	**0.0021**	-	-	-	-	-
minimum			**36.5**	**33.5**	**415**	-	**4**	-	**3.200**	**19**	**411.200**	**1.10**	**0.0071**	-	-	-	-	-
maximum			**53**	**48.5**	**1800**	-	**15**	-	**53**	**158**	**1748.000**	**1.62**	**0.0337**	-	-	-	-	-

Notes: D - deformities, E - erosion, L - lesions, T - tumors

[a] Age structures collected: sc - scales, oto - otoliths

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight

Table E.18: Fish Meristics Data for Northern Pikeminnow, Koocanusa Reservoir USA Portion, May 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected
														D	E	L	T	
Rexford	13-May-20	Rexford_LNS-01	41.6	38.0	800	pf	8	F	106.0	65	694	1.46	0.133	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-02	39.9	36.9	640	pf	8	F	47.0	24	593	1.27	0.073	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-03	36.5	34.0	500	pf	7	F	29.0	53	471	1.27	0.058	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-04	36.2	34.0	450	pf	7	F	1.9	20	448	1.14	0.004	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-05	35.8	33.5	430	pf	7	F	7.8	60	422	1.14	0.018	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-06	33.1	31.0	350	pf	6	M	-	21	350	1.17	-	A	A	A	A	Muscle
	13-May-20	Rexford_LNS-07	36.4	34.4	420	pf	7	F	3.4	50	417	1.03	0.008	A	A	A	A	Muscle, Ovary
	13-May-20	Rexford_LNS-08	37.2	34.0	550	pf	7	M	-	27	550	1.40	-	A	A	A	A	Muscle
		total sample size	**8**	**8**	**8**	**-**	**8**	**-**	**6**	**8**	**8**	**8**	**6**	**-**	**-**	**-**	**-**	**-**
		average	**37.1**	**34.5**	**517.50**	**-**	**7.125**	**-**	**32.517**	**40.000**	**493.113**	**1.24**	**0.0491**	**-**	**-**	**-**	**-**	**-**
		median	**36.5**	**34.0**	**475.00**	**-**	**7**	**-**	**18.400**	**38.500**	**459.550**	**1.22**	**0.0381**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**2.604**	**2.139**	**144.40**	**-**	**0.64**	**-**	**40.045**	**18.822**	**111.77**	**0.142**	**0.0496**	**-**	**-**	**-**	**-**	**-**
		standard error	**0.920**	**0.756**	**51.051**	**-**	**0.23**	**-**	**16.348**	**6.655**	**39.517**	**0.050**	**0.0202**	**-**	**-**	**-**	**-**	**-**
		minimum	**33.1**	**31**	**350**	**-**	**6**	**-**	**1.900**	**20**	**350.000**	**1.03**	**0.0042**	**-**	**-**	**-**	**-**	**-**
		maximum	**41.6**	**38**	**800**	**-**	**8**	**-**	**106**	**65**	**694.000**	**1.46**	**0.1325**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformities, E - erosion, L - lesions, T - tumors

[a] Age structures collected: pf - pectoral fin ray

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight

Table E.19: Fish Meristics Data for Largescale Sucker, Koocanusa Reservoir USA Portion, May 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected
														D	E	L	T	
Rexford	13-May-20	Rexford_CSU-01	43.5	41.4	1,116	pf	9	F	82.0	82	1,034	1.57	0.073	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-02	43.9	41.0	960	pf	9	F	47.0	57	913	1.39	0.049	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-03	41.7	38.9	740	pf	10	F	45.0	70	695	1.26	0.061	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-04	45.8	42.5	940	pf	7	F	34.0	49	906	1.22	0.036	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-05	45.6	42.8	920	pf	9	F	7.7	74	912	1.17	0.008	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-06	43.5	41.0	840	pf	6	F	4.7	67	835	1.22	0.006	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-07	43.6	40.5	920	pf	9	F	6.0	88	914	1.38	0.007	A	A	A	A	muscle/ovary
	13-May-20	Rexford_CSU-08	36.7	34.4	570	pf	4	F	1.8	30	570	1.40	0.003	A	A	A	A	muscle/ovary
		total sample size	**8**	**8**	**8**	**-**	**8**	**-**	**8**	**8**	**8**	**8**	**8**	**-**	**-**	**-**	**-**	**-**
		average	**43.0**	**40.3**	**875.8**	**-**	**7.875**	**-**	**28.5**	**64.6**	**847**	**1.33**	**0.030**	**-**	**-**	**-**	**-**	**-**
		median	**43.6**	**41.0**	**920.0**	**-**	**9**	**-**	**20.9**	**68.5**	**909**	**1.32**	**0.022**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**2.870**	**2.675**	**163.03**	**-**	**2.03**	**-**	**28.599**	**18.792**	**147.13**	**0.133**	**0.028**	**-**	**-**	**-**	**-**	**-**
		standard error	**1.015**	**0.946**	**57.640**	**-**	**0.72**	**-**	**10.111**	**6.644**	**52.018**	**0.047**	**0.010**	**-**	**-**	**-**	**-**	**-**
		minimum	**36.7**	**34.4**	**570**	**-**	**4**	**-**	**1.8**	**30**	**570**	**1.17**	**0.003**	**-**	**-**	**-**	**-**	**-**
		maximum	**45.8**	**42.8**	**1,116**	**-**	**10**	**-**	**82**	**88**	**1,034**	**1.57**	**0.073**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformities, E - erosion, L - lesions, T - tumors

[a] Age structures collected: pf - pectoral fin ray

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight

Table E.20: Fish Meristics Data for Sportfish, Koocanusa Reservoir USA Portion, May 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected
														D	E	L	T	
Rexford	13-May-20	Rexford_WCT-01	31.1	29.5	365	sc	3	F	0.4	24	365	1.42	0.001	A	A	A	A	muscle/ovary
	13-May-20	Rexford_RBT-01	43.6	40.8	780	sc	5	M	-	136	780	1.15	-	A	A	A	A	muscle
	13-May-20	Rexford_RBT-02	36.5	33.6	450	sc	3	M	-	42	450	1.19	-	A	A	A	A	muscle
	13-May-20	Rexford_RBT-03	35.0	33.5	315	sc	2	F	1.0	48	314	0.84	0.003	A	A	A	A	muscle/ovary
	13-May-20	Rexford_RBT-04	32.0	29.8	260	sc	3	M	-	22	260	0.98	-	A	A	A	A	muscle
	13-May-20	Rexford_RBT-05	27.4	25.6	161	sc	2	F	-	28	161	0.96	-	A	A	A	A	muscle
	13-May-20	Rexford_RBT-06	25.3	24.4	230	sc	2	F	-	17	230	1.58	-	A	A	A	A	muscle
		total sample size	**7**	**7**	**7**	**-**	**7**	**-**	**2**	**7**	**7**	**7**	**2**	**-**	**-**	**-**	**-**	**-**
		average	**33.0**	**31.0**	**366**	**-**	**2.857**	**-**	**0.70**	**45.286**	**366**	**1.16**	**0.002**	**-**	**-**	**-**	**-**	**-**
		median	**32.0**	**29.8**	**315**	**-**	**3**	**-**	**0.70**	**28.000**	**314**	**1.15**	**0.002**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**6.108**	**5.560**	**205.27**	**-**	**1.07**	**-**	**0.42**	**41.516**	**205.31**	**0.266**	**0.001**	**-**	**-**	**-**	**-**	**-**
		standard error	**2.309**	**2.101**	**77.584**	**-**	**0.40**	**-**	**0.30**	**15.692**	**77.600**	**0.100**	**0.001**	**-**	**-**	**-**	**-**	**-**
		minimum	**25.3**	**24.4**	**161**	**-**	**2**	**-**	**0.4**	**17**	**161**	**0.84**	**0.001**	**-**	**-**	**-**	**-**	**-**
		maximum	**43.6**	**40.8**	**780**	**-**	**5**	**-**	**1**	**136**	**780**	**1.58**	**0.003**	**-**	**-**	**-**	**-**	**-**

Notes: D - deformities, E - erosion, L - lesions, T - tumors

[a] Age structures collected: sc - scale

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight

Table E.21: Fish Meristics Data for Peamouth Chub, Koocanusa Reservoir USA Portion, September 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor(K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected	Comment
														D	E	L	T		
Kikomun	15-Sep-20	Kikomun_PCC-01	29.3	25.8	173	oto	7	F	5.0	25.0	168.0	1.01	0.029	A	A	A	A	Muscle, Ovary	N. of Cabin
	15-Sep-20	Kikomun_PCC-02	25.9	23.1	125	oto	5	F	4.0	26.0	121.0	1.01	0.032	A	A	A	A	Muscle, Ovary	S. of Bridge
	15-Sep-20	Kikomun_PCC-03	28.5	25.7	189	oto	6	F	5.0	29.0	184.0	1.11	0.026	A	A	A	A	Muscle, Ovary	Cabin
	15-Sep-20	Kikomun_PCC-04	27.0	24.0	141	oto	15	F	4.0	10.0	137.0	1.02	0.028	A	A	A	A	Muscle, Ovary	W. of Ramp
	15-Sep-20	Kikomun_PCC-05	27.5	25.3	157	oto	5	F	6.0	23.0	151.0	0.97	0.038	A	A	A	A	Muscle, Ovary	S. Point Elk
	15-Sep-20	Kikomun_PCC-06	27.2	24.9	136	oto	0	F	4.0	13.0	132.0	0.88	0.029	A	A	A	A	Muscle, Ovary	S. Point Elk
	15-Sep-20	Kikomun_PCC-07	28.1	25.3	170	oto	1	F	5.0	14.0	165.0	1.05	0.029	A	A	A	A	Muscle, Ovary	N. Point Elk
	15-Sep-20	Kikomun_PCC-08	29.5	27.2	193	oto	8	F	4.0	25.0	189.0	0.96	0.021	A	A	A	A	Muscle, Ovary	Across CG
Rexford	16-Sep-20	Rexford_PCC-01	25.7	23.4	129	sc	4	F	3.0	11.0	126.0	1.01	0.023	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-02	26.2	24.1	138	sc	5	F	3.0	14.0	135.0	0.99	0.022	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-03	24.8	22.0	120	oto	5	F	3.0	20.0	117.0	1.13	0.025	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-04	27.3	24.0	173	oto	5	F	2.0	19.0	171.0	1.25	0.012	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-05	23.7	21.2	114	sc	5	F	2.0	15.0	112.0	1.20	0.018	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-06	22.6	21.4	82	oto	6	F	1.0	8.0	81.0	0.84	0.012	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-07	25.6	23.0	129	sc	7	F	4.0	15.0	125.0	1.06	0.031	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_PCC-08	26.6	24.0	145	sc	6	F	3.0	12.0	142.0	1.05	0.021	A	A	A	A	Muscle, Ovary	-
total sample size			**16**	**16**	**16**	**-**	**16**	**-**	**16**	**16**	**16**	**16**	**16**	**-**	**-**	**-**	**-**	**-**	**-**
average			**26.6**	**24.0**	**144.6**	**-**	**5.6**	**-**	**3.6**	**17.4**	**141.0**	**1.0**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
median			**26.8**	**24.0**	**139.5**	**-**	**5.0**	**-**	**4.0**	**15.0**	**136.0**	**1.0**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
standard deviation			**1.89**	**1.66**	**29.65**	**-**	**3.22**	**-**	**1.31**	**6.49**	**28.86**	**0.11**	**0.01**	**-**	**-**	**-**	**-**	**-**	**-**
standard error			**0.472**	**0.415**	**7.413**	**-**	**0.806**	**-**	**0.328**	**1.623**	**7.214**	**0.026**	**0.002**	**-**	**-**	**-**	**-**	**-**	**-**
minimum			**22.6**	**21.2**	**82.0**	**-**	**0.0**	**-**	**1.0**	**8.0**	**81.0**	**0.8**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
maximum			**29.5**	**27.2**	**193.0**	**-**	**15.0**	**-**	**6.0**	**29.0**	**189.0**	**1.3**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**

Highlighting denotes weights < 1 .0 g.

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scale.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

Table E.22: Fish Meristics Data for Northern Pikeminnow, Koocanusa Reservoir USA Portion, Sept 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A]) D	E	L	T	Tissue Collected	Comment
Kikomun	15-Sep-20	Kikomun_NSC-01	29.2	26.3	192	sc	4	F	2.0	21	190	1.06	0.010	A	A	A	A	Muscle, Ovary	N. of Cabin
	15-Sep-20	Kikomun_NSC-02	26.1	23.8	129	sc	5	F	1.0	21	128	0.96	0.008	A	A	A	A	Muscle, Ovary	N. of Cabin
	15-Sep-20	Kikomun_NSC-03	45.5	41.2	1,073	oto	7	F	12.0	52	1,061	1.53	0.011	A	A	A	A	Muscle, Ovary	S. of Bridge
	15-Sep-20	Kikomun_NSC-04	44.4	40.7	848	oto	9	F	6.0	47	842	1.26	0.007	A	A	A	A	Muscle, Ovary	S. of Bridge
	15-Sep-20	Kikomun_NSC-05	36.9	33.2	418	oto	7	F	5.0	20	413	1.14	0.012	A	A	A	A	Muscle, Ovary	Cabin
	15-Sep-20	Kikomun_NSC-06	35.1	31.5	317	oto	5	F	2.0	31	315	1.01	0.006	A	A	A	A	Muscle, Ovary	Cabin
	15-Sep-20	Kikomun_NSC-07	34.5	31.0	359	oto	5	F	2.0	37	357	1.21	0.006	A	A	A	A	Muscle, Ovary	W. of Ramp
	15-Sep-20	Kikomun_NSC-08	28.9	26.0	201	oto	8	F	2.0	14	199	1.14	0.010	A	A	A	A	Muscle, Ovary	W. of Ramp
	15-Sep-20	Kikomun_NSC-09	44.0	40.8	1,042	oto	9	F	4.0	58	1,038	1.53	0.004	A	A	A	A	Muscle, Ovary	S. Point Elk
	15-Sep-20	Kikomun_NSC-10	50.5	45.1	1,353	oto	9	F	23.0	127	1,330	1.47	0.017	A	A	A	A	Muscle, Ovary	S. Point Elk
	15-Sep-20	Kikomun_NSC-11	41.3	37.5	773	oto	10	F	7.0	23	766	1.47	0.009	A	A	A	A	Muscle, Ovary	S. Point Elk
	15-Sep-20	Kikomun_NSC-12	45.0	40.3	934	oto	10	F	12.0	31	922	1.43	0.013	A	A	A	A	Muscle, Ovary	N. Point Elk
	15-Sep-20	Kikomun_NSC-13	46.5	41.4	972	oto	12	F	16.0	18	956	1.37	0.016	A	A	A	A	Muscle, Ovary	N. Point Elk
	15-Sep-20	Kikomun_NSC-14	46.5	42.5	1,114	sc	6	F	14.0	47	1,100	1.45	0.013	A	A	A	A	Muscle, Ovary	Across CG
	15-Sep-20	Kikomun_NSC-15	45.0	40.8	960	oto	15	F	10.0	94	950	1.41	0.010	A	A	A	A	Muscle, Ovary	Across CG
Rexford	16-Sep-20	Rexford_NSC-01	55.0	49.5	1,924	oto	14	F	21.0	40	1,903	1.59	0.011	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-02	52.1	47.0	1,304	oto	10	F	29.0	48	1,275	1.26	0.022	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-03	40.0	35.7	509	oto	7	F	1.0	44	508	1.12	0.002	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-04	38.1	34.4	474	oto	10	F	4.0	31	470	1.16	0.008	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-05	41.1	37.5	685	oto	10	F	10.0	25	675	1.30	0.015	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-06	36.8	33.0	498	oto	5	F	4.0	45	494	1.39	0.008	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-07	52.4	47.0	1,427	oto	18	F	30.0	39	1,397	1.37	0.021	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-08	42.0	37.9	685	oto	6	F	2.0	26	683	1.26	0.003	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-09	48.1	43.9	1,307	oto	15	F	28.0	38	1,279	1.54	0.021	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-10	44.1	40.0	865	oto	8	F	7.0	34	858	1.35	0.008	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-11	55.4	50.2	1,532	oto	18	F	28.0	43	1,504	1.21	0.018	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-12	39.9	35.8	576	oto	13	F	6.0	53	570	1.26	0.010	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-13	38.5	34.8	478	oto	8	F	3.0	34	475	1.13	0.006	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-14	42.1	38.3	696	oto	10	F	11.0	35	685	1.24	0.016	A	A	A	A	Muscle, Ovary	-
	16-Sep-20	Rexford_NSC-15	54.4	49.3	1,586	oto	15	F	31.0	57	1,555	1.32	0.020	A	A	A	A	Muscle, Ovary	-
total sample size			**30**	**30**	**30**	**-**	**30**	**-**	**30**	**30**	**30**	**30**	**30**	**-**	**-**	**-**	**-**	**-**	**-**
average			**42.6**	**38.5**	**841.0**	**-**	**9.6**	**-**	**11.1**	**41.1**	**829.9**	**1.3**	**0.011**	**-**	**-**	**-**	**-**	**-**	**-**
median			**43.1**	**39.2**	**810.5**	**-**	**9.0**	**-**	**7.0**	**37.5**	**804.0**	**1.3**	**0.010**	**-**	**-**	**-**	**-**	**-**	**-**
standard deviation			**7.604**	**6.891**	**######**	**-**	**3.883**	**-**	**9.963**	**22.692**	**450.498**	**0.166**	**0.006**	**-**	**-**	**-**	**-**	**-**	**-**
standard error			**1.388**	**1.258**	**83.832**	**-**	**0.709**	**-**	**1.819**	**4.143**	**82.249**	**0.030**	**0.001**	**-**	**-**	**-**	**-**	**-**	**-**
minimum			**26.1**	**23.8**	**129.0**	**-**	**4.0**	**-**	**1.0**	**14.0**	**128.0**	**1.0**	**0.002**	**-**	**-**	**-**	**-**	**-**	**-**
maximum			**55.4**	**50.2**	**1924.0**	**-**	**18.0**	**-**	**31.0**	**127.0**	**1903.0**	**1.6**	**0.022**	**-**	**-**	**-**	**-**	**-**	**-**

Highlighting denotes weights < 1.0 g.

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scale.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

Table E.23: Fish Meristics Data for Largescale Sucker, Koocanusa Reservoir USA Portion, Sept 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A])				Tissue Collected	Comment
														D	E	L	T		
Kikomun	15-Sep-20	Kikomun_CSU-01	16.8	15.5	42	pf	1	M	-	7	42	1.13	-	A	A	A	A	muscle	S. of bridge
	15-Sep-20	Kikomun_CSU-02	33.0	30.6	304	pf	4	F	1.0	23	303	1.06	0.003	A	A	A	A	muscle/ovary	W. of ramp
	15-Sep-20	Kikomun_CSU-03	41.5	39.0	624	pf	6	F	4.0	49	620	1.05	0.006	A	A	A	A	muscle/ovary	Across CG
Rexford	16-Sep-20	Rexford_CSU-01	37.7	35.3	422	pf	7	F	1.0	34	421	0.96	0.002	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_CSU-02	23.7	21.8	119	pf	2	F	1.0	11	118	1.15	0.008	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_CSU-03	17.8	16.5	47	pf	1	F	1.0	10	46	1.05	0.021	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_CSU-04	39.7	36.8	545	pf	6	F	4.0	26	541	1.09	0.007	A	A	A	A	muscle/ovary	-
		total sample size	**7**	**7**	**7**	**-**	**7**	**-**	**6**	**7**	**7**	**7**	**6**	**-**	**-**	**-**	**-**	**-**	**-**
		average	**30.0**	**27.9**	**300.43**	**-**	**3.8571**	**-**	**2.000**	**22.857**	**298.714**	**1.07**	**0.0082**	**-**	**-**	**-**	**-**	**-**	**-**
		median	**33.0**	**30.6**	**304.00**	**-**	**4**	**-**	**1.000**	**23.000**	**303.000**	**1.06**	**0.0069**	**-**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**10.467**	**9.878**	**239.18**	**-**	**2.54**	**-**	**1.549**	**15.137**	**237.81**	**0.062**	**0.0068**	**-**	**-**	**-**	**-**	**-**	**-**
		standard error	**3.956**	**3.733**	**90.400**	**-**	**0.96**	**-**	**0.632**	**5.721**	**89.884**	**0.024**	**0.0028**	**-**	**-**	**-**	**-**	**-**	**-**
		minimum	**16.8**	**15.5**	**42**	**-**	**1**	**-**	**1.000**	**7**	**42.000**	**0.96**	**0.0024**	**-**	**-**	**-**	**-**	**-**	**-**
		maximum	**41.5**	**39**	**624**	**-**	**7**	**-**	**4**	**49**	**620.000**	**1.15**	**0.0213**	**-**	**-**	**-**	**-**	**-**	**-**

Highlighting denotes weights < 1.0 g.

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scale.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

Table E.24: Fish Meristics Data for Sportfish, Koocanusa Reservoir USA Portion, Sept 2020

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected [a]	Age	Sex	Gonad Weight (g)	Fillet Weight (g)	Adjusted Body Weight (g) [b]	Fulton's Condition Factor (K)	Gonado-somatic Index	DELT (Severe[S]/Minor[M]/Absent[A]) D	E	L	T	Tissue Collected	Comment
Kikomun	15-Sep-20	Kikomun_RBT-01	46.2	43.2	757	sc	7	M	-	62	757	0.94	-	A	A	A	A	muscle	S. of Bridge
	15-Sep-20	Kikomun_RBT-02	36.0	33.8	384	sc	3	F	1.0	48	383	0.99	0.003	A	A	A	A	muscle/ovary	S. of Bridge
	15-Sep-20	Kikomun_RBT-03	34.5	32.5	362	sc	3	F	1.0	28	361	1.05	0.003	A	A	A	A	muscle/ovary	S. Point Elk
	15-Sep-20	Kikomun_RBT-04	40.1	37.4	477	sc	4	F	1.0	52	476	0.91	0.002	A	A	A	A	muscle/ovary	N. Point Elk
	15-Sep-20	Kikomun_WCT-01	21.2	19.7	87	sc	2	F	1.0	16	87	1.14	0.011	A	A	A	A	muscle/ovary	S. Point Elk
	15-Sep-20	Kikomun_WCT-02	31.9	30.1	318	sc	2	M	-	37	318	1.17	-	A	A	A	A	muscle	N. Point Elk
	15-Sep-20	Kikomun_WCT-03	27.0	25.8	201	sc	4	F	1.0	26	201	1.17	-	A	A	A	A	muscle/ovary	N. Point Elk
	15-Sep-20	Kikomun_WCT-04	32.6	30.9	328	sc	3	F	6.0	31	328	1.11	-	A	A	A	A	muscle/ovary	N. Point Elk
Rexford	16-Sep-20	Rexford_RBT-01	35.9	33.2	417	sc	2	F	1.0	29	417	1.14	0.002	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_RBT-02	31.0	29.0	287	sc	4	F	1.0	25	287	1.18	0.003	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_RBT-03	18.7	17.5	72	sc	3	F	1.0	10	72	1.34	0.014	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_WCT-01	25.4	24.2	148	sc	3	F	1.0	11	148	1.04	0.007	A	A	A	A	muscle/ovary	-
	16-Sep-20	Rexford_WCT-02	31.9	30.0	-	sc	2	F	4.0	16	-	-	-	A	A	A	A	muscle/ovary	-
		total sample size	**13**	**13**	**12**	**-**	**13**	**-**	**11**	**13**	**12**	**12**	**8**	**-**	**-**	**-**	**-**	**-**	**-**
		average	**31.7**	**29.8**	**319.8**	**-**	**3.2**	**-**	**1.7**	**30.1**	**319.6**	**1.1**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
		median	**31.9**	**30.1**	**323.0**	**-**	**3.0**	**-**	**1.0**	**28.0**	**323.0**	**1.1**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
		standard deviation	**7.456**	**6.921**	**188.68**	**-**	**1.363**	**-**	**1.679**	**16.023**	**188.549**	**0.119**	**0.005**	**-**	**-**	**-**	**-**	**-**	**-**
		standard error	**2.068**	**1.920**	**54.47**	**-**	**0.378**	**-**	**0.506**	**4.444**	**54.429**	**0.034**	**0.002**	**-**	**-**	**-**	**-**	**-**	**-**
		minimum	**18.7**	**17.5**	**72.0**	**-**	**2.0**	**-**	**1.0**	**10.0**	**72.0**	**0.9**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**
		maximum	**46.2**	**43.2**	**757.0**	**-**	**7.0**	**-**	**6.0**	**62.0**	**757.0**	**1.3**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**

Highlighting denotes weights < 1 .0g.

Notes: D - deformities, E - erosion, L - lesions, T - tumors.

[a] Age structures collected: sc - scale.

[b] Adjusted Body Weight = Body Weight - Liver Weight - Gonad Weight.

APPENDIX F

TISSUE

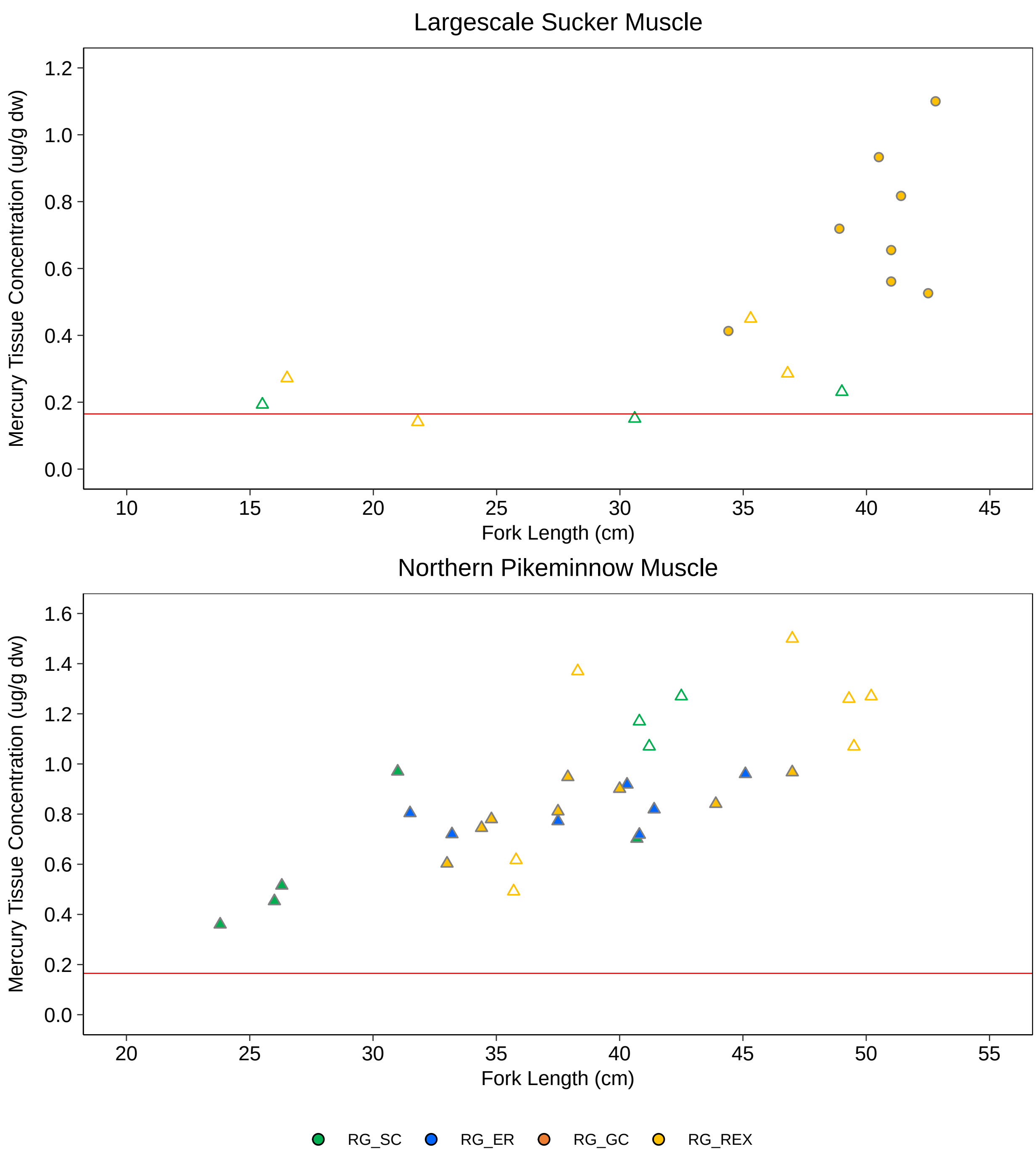

Figure F.1: Mercury Concentrations (µg/g dw) in Fish Tissue Relative to Fork Length (cm) for all Species, Koocanusa Resevoir Monitoring Program, 2020

Notes: Different seasons are plotted with different symbols, and open symbols represent measured values less than the method detection limit. Circle = Spring, Triangle = Fall. Spring and Fall data were analyzed separately. Red line = BC Guideline for the Protection of Wildlife = 0.165.

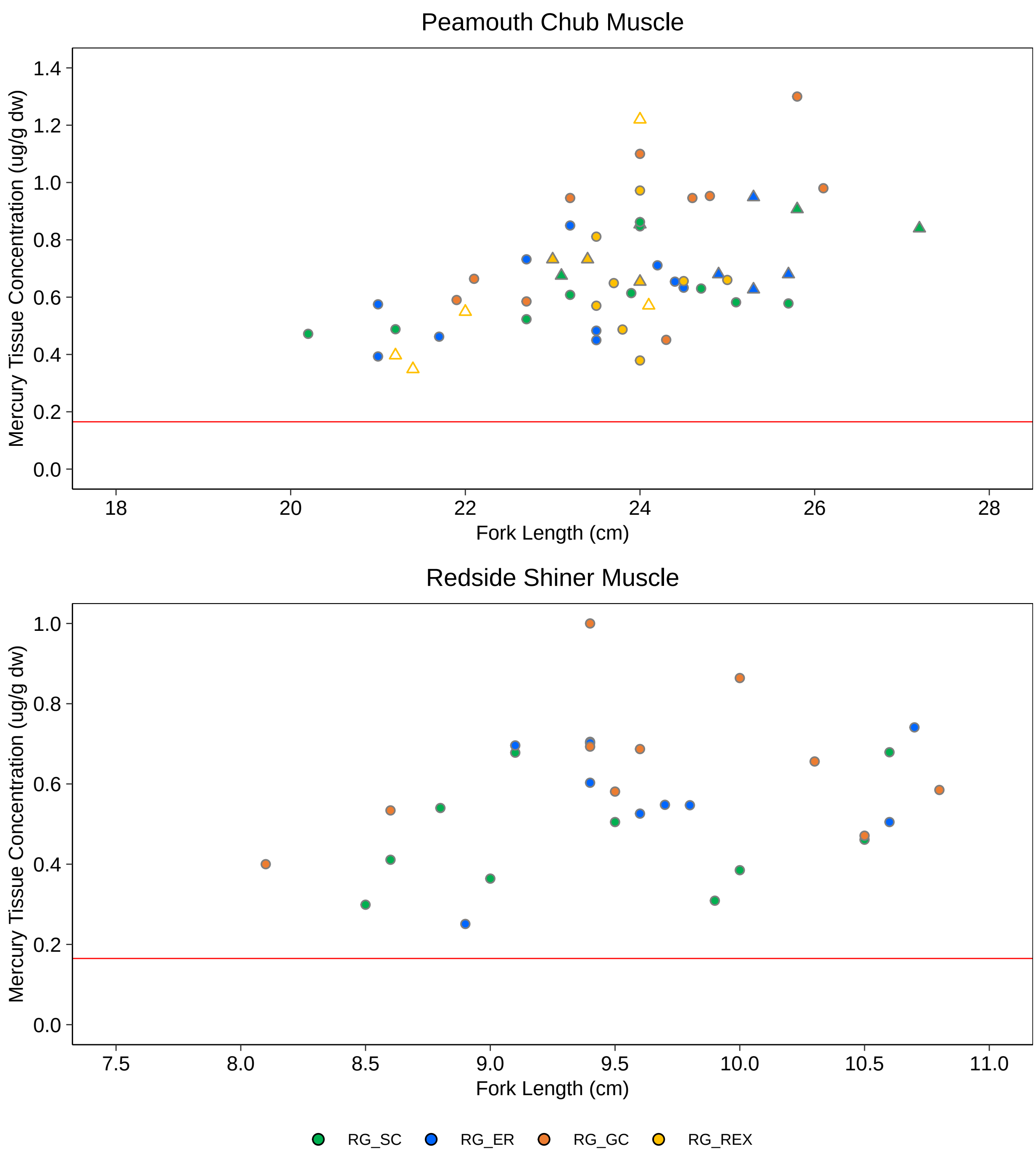

Figure F.1: Mercury Concentrations (µg/g dw) in Fish Tissue Relative to Fork Length (cm) for all Species, Koocanusa Resevoir Monitoring Program, 2020

Notes: Different seasons are plotted with different symbols, and open symbols represent measured values less than the method detection limit. Circle = Spring, Triangle = Fall. Spring and Fall data were analyzed separately. Red line = BC Guideline for the Protection of Wildlife = 0.165.

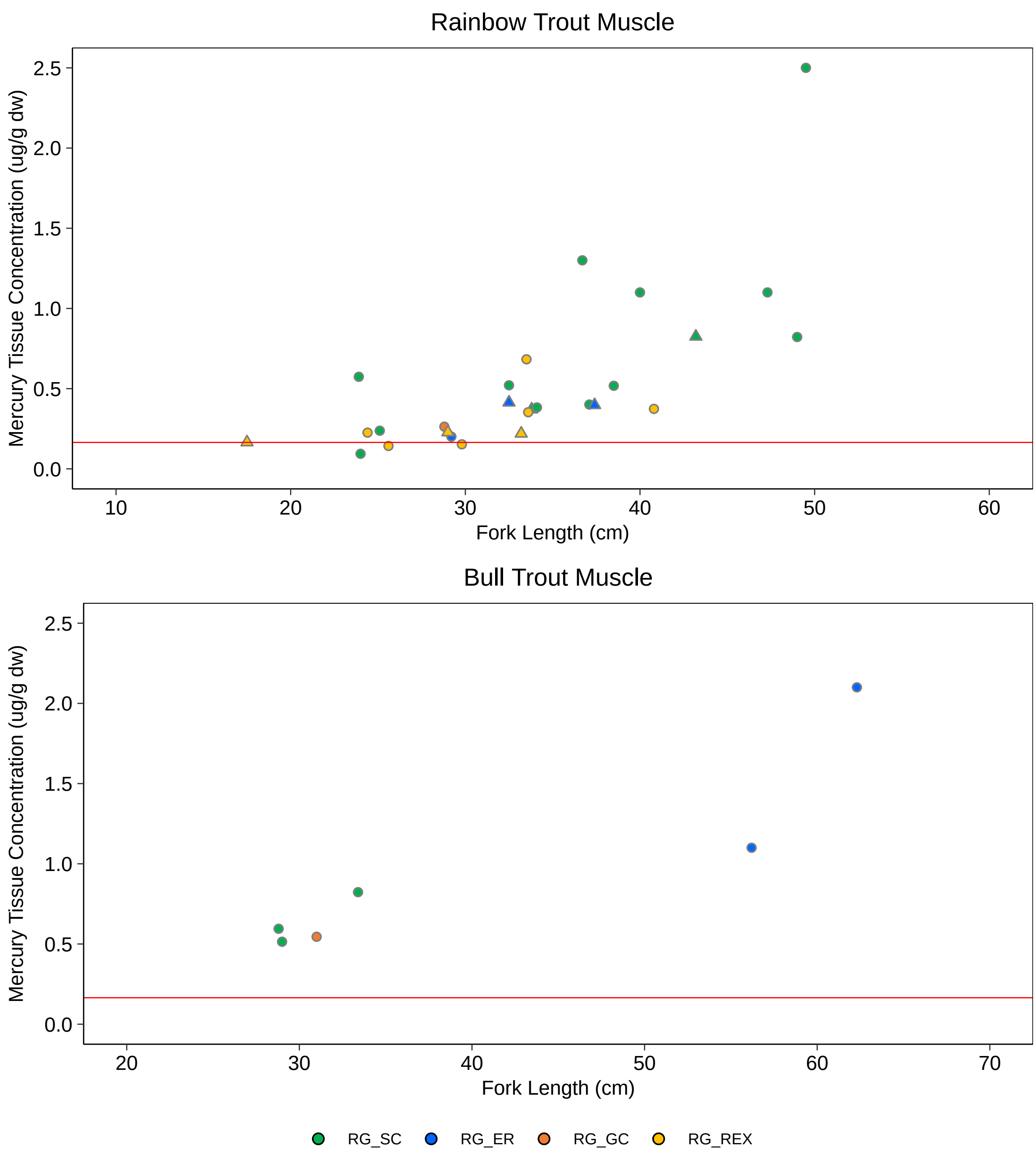

Figure F.1: Mercury Concentrations (µg/g dw) in Fish Tissue Relative to Fork Length (cm) for all Species, Koocanusa Resevoir Monitoring Program, 2020

Notes: Different seasons are plotted with different symbols, and open symbols represent measured values less than the method detection limit. Circle = Spring, Triangle = Fall. Spring and Fall data were analyzed separately. Red line = BC Guideline for the Protection of Wildlife = 0.165.

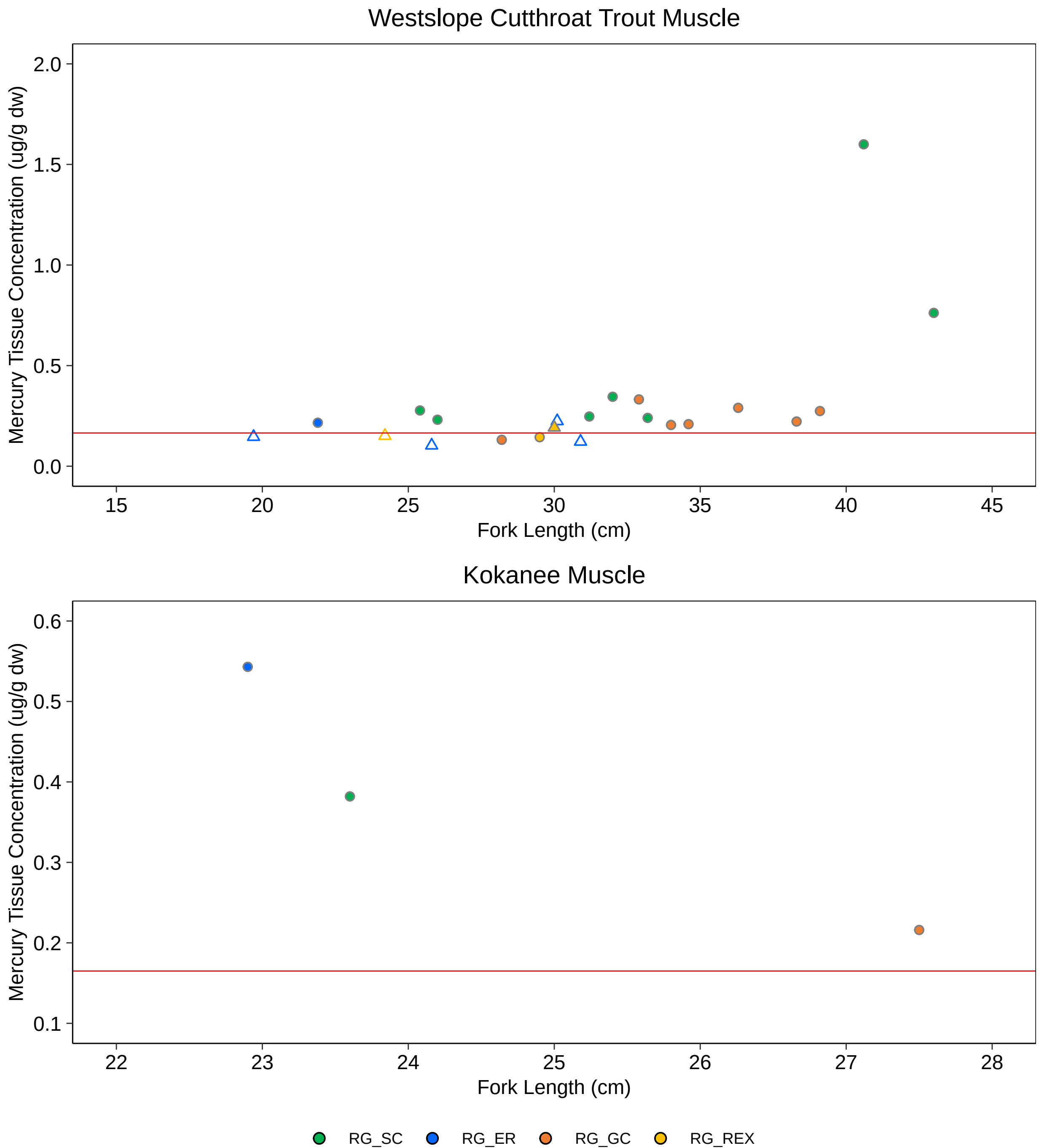

Figure F.1: Mercury Concentrations (µg/g dw) in Fish Tissue Relative to Fork Length (cm) for all Species, Koocanusa Resevoir Monitoring Program, 2020

Notes: Different seasons are plotted with different symbols, and open symbols represent measured values less than the method detection limit. Circle = Spring, Triangle = Fall. Spring and Fall data were analyzed separately. Red line = BC Guideline for the Protection of Wildlife = 0.165.

Table F.1: Benthic Invertebrate Tissue Sampling Locations, Koocanusa Reservoir, April 2020

Station Identification	Comment	UTM (NAD 83, Zone 11U)		Average Station Depth (m)	Average Ponar Fullness (%)	Sample Texture	Macrophytes in Sample	Algae in Sample	Dominant Taxa
		Easting	Northing						
RG_TN-1	Glacial silt mixed with organic material	627394	5453542	1.0	60%	90% sand and finer, 10% organics	NA	NA	-
RG_TN-2		627291	5453642						
RG_TN-3		627343	5456370						
RG_TN-4		627344	5453854						
RG_TN-5		627175	5453986						
RG_T4-1	-	630074	5441765	15.0	75%	100% sand and finer	NA	NA	chironomids
RG_T4-2		629838	5442106						
RG_T4-3		629706	5441670						
RG_T4-4		629512	5441745						
RG_T4-5		629460	5441543						

Note: "-" indicates no data available, "NA" indicates not available, *italics* indicates overall site notes.

Table F.2: Tissue Metals Analysis for Benthic Invertebrates and Zooplankton Samples, Koocanusa Reservoir, 2020

Parameter	Unit	Benthic Invertebrates				Zooplankton																			
		April		August		June										August									
		RG_TN	RG_T4	RG_TN	RG_T4	RG_TN-1	RG_TN-2	RG_TN-3	RG_TN-4	RG_TN-5	RG_T4-1	RG_T4-2	RG_T4-3	RG_T4-4	RG_T4-5	RG_TN-1	RG_TN-2	RG_TN-3	RG_TN-4	RG_TN-5	RG_T4-1	RG_T4-2	RG_T4-3	RG_T4-4	RG_T4-5
Wet Weight	g	0.432	0.444	0.283	0.368	1.704	1.761	1.738	1.724	1.521	1.175	1.886	1.689	1.736	1.742	1.077	1.399	1.403	0.876	0.931	1.003	0.707	0.591	0.774	0.993
Dry Weight	g	0.117	0.110	0.048	0.081	0.046	0.062	0.044	0.068	0.058	0.060	0.113	0.104	0.155	0.180	0.014	0.018	0.022	0.020	0.015	0.014	0.009	0.009	0.011	0.011
Moisture	%	73.0	75.2	83.2	78.1	97.3	96.5	97.4	96.1	96.2	94.9	94.0	93.9	91.1	89.7	98.7	98.7	98.4	97.7	98.4	98.6	98.7	98.6	98.6	98.9
Aluminum	mg/kg	17,845	17,319	10,280	7,841	8,265	8,125	5,816	4,600	5,920	5,777	2,488	6,662	4,193	2,735	21,888	19,475	29,322	11,963	14,016	19,281	11,736	12,411	14,735	12,697
Antimony	mg/kg	0.267	0.309	0.335	0.363	0.186	0.094	0.121	0.053	0.072	0.108	0.045	0.093	0.06	0.048	1.3	0.613	0.717	0.307	0.434	0.453	0.314	0.373	0.391	0.311
Arsenic	mg/kg	10	8.4	24	16	1.3	1.1	6.3	6.2	4.5	1.1	2.2	0.981	0.975	1.4	4.9	4.2	6.1	3.8	3.7	4.2	3.4	3.6	4.5	4.5
Barium	mg/kg	434	400	992	1,030	278	305	192	196	216	150	115	176	146	119	511	464	614	379	484	455	324	345	356	406
Boron	mg/kg	7.7	12	5.7	6.7	5.7	5.6	4.1	3.2	3.7	4.9	1.9	4.9	3.4	2.1	17	13	20	8.8	11	11	12	11	11	9.6
Cadmium	mg/kg	1	4	0.314	1.9	1	1.1	0.941	0.941	0.84	0.899	0.995	0.928	0.821	0.866	1.1	0.765	0.765	0.903	0.746	0.726	0.706	0.638	1	0.922
Calcium	mg/kg	18,391	21,038	10,733	9,706	65,235	89,865	54,717	60,007	59,702	20,439	18,122	25,753	22,098	18,395	33,114	30,924	38,831	30,246	37,473	25,155	23,518	20,678	23,082	26,431
Chromium	mg/kg	75	44	23	13	21	24	28	17	25	10	3.7	5.1	3.7	3.1	279	140	157	60	77	136	189	74	259	173
Cobalt	mg/kg	5.3	4.9	5.3	5.8	2.7	2.8	2.7	2.2	2.4	2.1	1.5	1.7	1.4	1.3	21	12	14	6.1	7.4	13	15	7.8	20	16
Copper	mg/kg	26	42	28	30	17	17	15	13	13	11	11	12	10	10	21	16	16	11	12	14	12	10	13	12
Iron	mg/kg	10,847	11,213	5,279	5,073	2,835	3,077	2,177	1,942	2,470	2,093	965	2,077	1,419	1,040	13,961	11,441	14,979	5,978	6,751	8,176	7,976	6,372	9,701	10,226
Lead	mg/kg	11	9	10	9	7	44,032	3	2	2	4	2	3	2	1	24	13	17	7	10	12	7	9	7	7
Lithium	mg/kg	8.8	9.1	4.4	3.5	4	4	2.6	2.2	2.8	2.9	1.3	3.2	2.1	1.3	11	9	15	5.9	6.5	8.7	5.2	6.1	6.2	6.4
Magnesium	mg/kg	4,901	4,620	2,957	2,874	4,032	4,163	3,286	2,939	3,112	1,696	908	1,666	1,367	909	5,792	4,755	6,477	3,368	4,008	3,418	3,382	3,282	3,711	3,738
Manganese	mg/kg	156	232	77	111	99	93	87	83	92	95	74	103	83	75	235	251	341	168	198	208	148	179	205	182
Mercury	mg/kg	0.078	0.137	0.157	0.184	0.078	0.055	0.038	0.06	0.051	0.081	0.081	0.086	0.078	0.083	0.114	0.08	0.084	0.1	0.107	0.067	0.067	0.074	0.074	0.08
Molybdenum	mg/kg	0.741	0.755	0.782	0.816	0.582	0.544	0.489	0.476	0.462	0.48	0.493	0.438	0.418	0.363	0.673	0.585	0.979	0.53	0.394	0.673	0.34	0.299	0.829	0.884
Nickel	mg/kg	99	67	52	36	36	39	45	30	41	21	5.6	8.8	5.4	3.8	586	303	331	150	171	318	411	168	613	436
Phosphorus	mg/kg	8,516	8,450	11,495	13,386	19,636	20,651	16,226	44,032	17,097	12,841	14,915	13,651	13,175	14,400	6,895	6,743	7,096	8,990	9,727	6,131	6,333	5,050	6,746	7,428
Potassium	mg/kg	13,596	11,707	11,226	12,335	12,273	15,810	12,665	15,187	14,597	12,058	13,163	13,435	11,670	12,784	6,737	5,881	8,756	3,804	4,110	4,686	3,692	3,852	3,819	4,109
Selenium	mg/kg	5.4	14	4.9	12	9.6	7.4	3.1	3.2	2.7	8.9	8.5	7.1	6	7.3	3	2.5	2.1	2.6	2.5	2	2.5	2.2	2.6	2.8
Silver	mg/kg	0.1	0.146	0.148	0.203	0.087	0.044	0.039	0.032	0.034	0.045	0.045	0.052	0.048	0.05	0.131	0.1	0.107	0.055	0.055	0.065	0.062	0.062	0.069	0.052
Sodium	mg/kg	6,464	5,200	3,902	5,862	4,749	5,465	4,441	6,267	5,893	4,198	5,060	4,165	3,649	4,909	1,086	704	1,181	628	653	569	544	518	716	811
Strontium	mg/kg	48	39	35	31	127	165	107	103	104	33	32	47	40	31	82	70	88	71	86	52	60	47	56	63
Thallium	mg/kg	0.133	0.248	0.143	0.125	0.098	0.151	0.086	0.092	0.096	0.071	0.049	0.095	0.056	0.047	0.115	0.101	0.165	0.066	0.073	0.086	0.051	0.074	0.065	0.07
Tin	mg/kg	1.2	1.1	0.955	0.592	3.5	3.6	4.1	3.1	2.4	3.9	2.3	2.3	1.2	1.4	7	6.7	6.8	3.9	5.3	6.4	9.7	6.4	8	8
Titanium	mg/kg	1,569	1,249	804	634	643	494	320	308	370	389	157	463	288	186	1,667	1,466	1,740	830	1,082	1,288	661	921	896	1,039
Uranium	mg/kg	0.505	0.428	0.469	0.365	0.216	0.196	0.141	0.109	0.133	0.166	0.11	0.179	0.122	0.089	1.2	0.871	1.1	0.726	0.899	0.869	0.845	0.85	0.809	0.97
Vanadium	mg/kg	12	16	8.8	8.8	6.1	6.7	4.8	4	4.9	5.1	2	5.1	3.5	2.2	26	22	27	12	14	17	15	16	16	13
Zinc	mg/kg	95	132	141	216	284	122	107	94	90	122	123	117	107	101	260	179	208	173	190	191	175	174	174	176

Notes: RG_TN represents the transect upstream of the Elk River, RG_T4 represents the transect downstream of the Elk River.

Table F.3: Total Metal Analysis for Peamouth Chub and Redside Shiner Muscle and Ovary Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Species	Area	Tissue	Sample ID	Wet Weight	Dry Weight	Moisture	Aluminum	Antimony	Arsenic	Barium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
				g	g	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Peamouth Chub	Sand Creek	Muscle	RG_SC_PCC-M-01_2020-04-20	0.1162	0.0293	74.8	11	0.006	<0.393	0.713	0.177	<0.036	792	1.7	0.036	1.2	33	0.044	0.006
			RG_SC_PCC-M-02_2020-04-20	0.1759	0.0451	74.4	1.2	<0.003	<0.393	0.385	<0.121	<0.036	1,205	1.3	0.019	0.989	14	0.008	<0.006
			RG_SC_PCC-M-03_2020-04-20	0.3847	0.0948	75.4	2.6	<0.003	<0.393	3.6	<0.121	<0.036	870	1.3	0.024	2.3	33	0.022	0.009
			RG_SC_PCC-M-04_2020-04-20	0.1997	0.0515	74.2	0.43	<0.003	<0.393	0.539	<0.121	<0.036	1,180	1.2	0.014	0.945	14	0.005	<0.006
			RG_SC_PCC-M-05_2020-04-20	0.2658	0.0662	75.1	0.992	<0.003	<0.393	1.2	<0.121	0.091	995	1.2	0.017	1.1	22	0.02	0.017
			RG_SC_PCC-M-06_2020-04-20	0.5151	0.1184	77.0	1.5	0.009	<0.393	3	<0.121	<0.036	875	1.5	0.041	2.5	30	0.016	0.047
			RG_SC_PCC-M-07_2020-04-20	0.2749	0.0669	75.7	0.477	<0.003	<0.393	0.616	<0.121	<0.036	780	1.1	0.01	1	11	0.008	<0.006
			RG_SC_PCC-M-08_2020-04-20	0.5189	0.1328	74.4	2.4	0.006	<0.393	2.6	<0.121	<0.036	1,304	1.4	0.032	2.4	36	0.023	0.013
			RG_SC_PCC-M-09_2020-04-20	0.2501	0.062	75.2	1.3	<0.003	<0.393	0.405	<0.121	<0.036	1,265	1.2	0.012	1	12	0.009	<0.006
			RG_SC_PCC-M-10_2020-04-20	0.2423	0.0596	75.4	1.3	<0.003	<0.393	0.819	<0.121	<0.036	1,399	1.6	0.04	1.1	19	0.007	<0.006
		Ovary	RG_SC_PCC-O-01_2020-04-20	0.1866	0.0603	67.7	16	0.004	<0.393	3	<0.121	0.067	859	1.5	0.142	3.9	115	0.056	0.025
			RG_SC_PCC-O-02_2020-04-20	0.2237	0.0734	67.2	1.6	0.004	<0.393	0.818	0.13	0.067	743	1.2	0.077	4.7	101	0.084	0.012
			RG_SC_PCC-O-03_2020-04-20	0.6872	0.2712	60.5	0.37	<0.003	<0.393	1.5	<0.121	<0.036	317	1.3	0.05	3.3	57	0.008	<0.006
			RG_SC_PCC-O-04_2020-04-20	0.2972	0.1265	57.4	1.6	0.004	<0.393	2.8	<0.121	0.105	540	1.6	0.088	4.7	73	0.03	0.01
			RG_SC_PCC-O-05_2020-04-20	0.4671	0.1387	70.3	0.881	<0.003	<0.393	0.379	<0.121	0.073	1,406	1.5	0.078	5	138	0.013	0.019
			RG_SC_PCC-O-06_2020-04-20	0.3825	0.153	60.0	2.2	0.005	<0.393	3.3	<0.121	0.094	513	1.5	0.054	3.3	62	0.038	<0.006
			RG_SC_PCC-O-07_2020-04-20	0.3908	0.1645	57.9	0.483	<0.003	<0.393	1.8	<0.121	<0.036	346	1.2	0.037	2.8	51	0.01	<0.006
			RG_SC_PCC-O-08_2020-04-20	0.4394	0.1724	60.8	1.5	0.004	<0.393	5.1	<0.121	0.052	509	1.6	0.062	4.6	64	0.021	0.009
			RG_SC_PCC-O-09_2020-04-20	0.2984	0.1135	62.0	0.685	0.008	<0.393	1.3	<0.121	0.042	407	1.3	0.055	4.2	69	0.012	<0.006
			RG_SC_PCC-O-10_2020-04-20	0.5932	0.2419	59.2	2.3	<0.003	<0.393	2.5	<0.121	0.042	524	1.5	0.094	4.3	81	0.033	0.007
	Elk River	Muscle	RG_ER_PCC-M-01_2020-04-21	0.3145	0.0742	76.4	0.924	<0.003	<0.393	1.1	<0.121	<0.036	732	1.1	0.009	0.857	9.3	0.007	0.007
			RG_ER_PCC-M-02_2020-04-21	0.4376	0.1002	77.1	1.1	<0.003	<0.393	0.629	<0.121	<0.036	733	1	0.017	0.724	12	0.016	<0.006
			RG_ER_PCC-M-03_2020-04-22	0.3411	0.0856	74.9	0.867	<0.003	<0.393	3.3	<0.121	<0.036	718	1.4	0.033	2.3	34	0.004	0.009
			RG_ER_PCC-M-04_2020-04-22	0.3219	0.0757	76.5	1.4	<0.003	<0.393	0.943	<0.121	<0.036	901	1	0.018	0.768	16	0.014	<0.006
			RG_ER_PCC-M-05_2020-04-22	0.4052	0.0946	76.7	1.3	<0.003	<0.393	2.9	<0.121	<0.036	1,204	1.5	0.022	1.4	26	0.009	0.006
			RG_ER_PCC-M-06_2020-04-22	0.3146	0.0667	78.8	1.9	<0.003	<0.393	0.838	<0.121	<0.036	1,113	2.7	0.062	1.1	38	0.012	0.009
			RG_ER_PCC-M-07_2020-04-22	0.5336	0.1163	78.2	0.48	<0.003	<0.393	0.925	<0.121	0.071	1,082	1.3	0.014	0.872	17	0.003	<0.006
			RG_ER_PCC-M-08_2020-04-22	0.2995	0.0663	77.9	1.7	<0.003	<0.393	1.3	<0.121	<0.036	953	1.3	0.034	1.1	28	0.017	0.015
			RG_ER_PCC-M-09_2020-04-22	0.3441	0.0796	76.9	1.3	<0.003	<0.393	0.645	0.152	<0.036	1,195	1.3	0.018	1	17	0.007	0.006
			RG_ER_PCC-M-10_2020-04-22	0.2654	0.067	74.8	0.78	<0.003	<0.393	2	0.121	<0.036	993	1.4	0.032	1.6	23	0.016	<0.006
		Ovary	RG_ER_PCC-O-01_2020-04-21	0.4764	0.1839	61.4	0.237	<0.003	<0.393	1.6	<0.121	0.043	426	1.2	0.053	4.2	56	0.012	<0.006
			RG_ER_PCC-O-02_2020-04-21	0.5717	0.2204	61.4	0.589	<0.003	<0.393	1.8	<0.121	0.038	600	1.2	0.065	3.6	78	0.023	0.008
			RG_ER_PCC-O-03_2020-04-22	0.4237	0.1657	60.9	0.771	<0.003	<0.393	2.3	<0.121	0.057	578	1.4	0.073	2.4	65	0.018	<0.006
			RG_ER_PCC-O-04_2020-04-22	0.8515	0.3399	60.1	0.448	<0.003	<0.393	5.7	<0.121	0.038	498	1.3	0.076	3.3	70	0.012	<0.006
			RG_ER_PCC-O-05_2020-04-22	0.7854	0.3165	59.7	0.491	<0.003	<0.393	5.4	<0.121	0.057	587	1.3	0.05	4	64	0.004	0.008
			RG_ER_PCC-O-06_2020-04-22	0.2283	0.0552	75.8	7.1	0.004	<0.393	9.3	0.154	0.277	1,335	1.9	0.124	5.9	316	0.06	0.026
			RG_ER_PCC-O-07_2020-04-22	0.6702	0.2203	67.1	1.2	<0.003	<0.393	2.3	<0.121	0.057	703	1.3	0.079	2.6	84	0.023	0.008
			RG_ER_PCC-O-08_2020-04-22	0.8773	0.3419	61.0	0.283	<0.003	<0.393	3	<0.121	0.067	510	1.2	0.11	3.3	67	0.012	<0.006
			RG_ER_PCC-O-09_2020-04-22	0.7425	0.2871	61.3	1.7	<0.003	<0.393	1.9	<0.121	0.048	504	1.4	0.068	3.4	65	0.016	0.01
			RG_ER_PCC-O-10_2020-04-22	0.7404	0.3023	59.2	0.277	<0.003	<0.393	2	<0.121	0.038	526	1.1	0.079	2.5	65	0.014	<0.006
	Gold Creek	Muscle	RG_GC_PCC-M-01_2020-04-22	0.4291	0.1138	73.5	4.2	0.005	<0.393	0.619	0.187	<0.036	1,296	1.7	0.033	1.6	23	0.038	0.014
			RG_GC_PCC-M-02_2020-04-22	0.3641	0.0972	73.3	1.7	<0.003	<0.393	0.913	0.132	<0.036	1,325	1.6	0.022	0.963	20	0.032	0.006
			RG_GC_PCC-M-03_2020-04-22	0.3331	0.0941	71.8	1	<0.003	<0.393	2	<0.121	0.107	885	1.4	0.026	2.4	30	0.01	0.009
			RG_GC_PCC-M-04_2020-04-22	0.176	0.0549	68.8	0.716	<0.003	<0.393	1.7	<0.121	<0.036	1,248	1.2	0.021	1.4	18	0.005	0.009
			RG_GC_PCC-M-05_2020-04-22	0.2049	0.0608	70.3	3.4	<0.003	<0.393	0.56	0.121	<0.036	1,077	1.3	0.022	0.963	17	0.019	0.011
			RG_GC_PCC-M-06_2020-04-22	0.2983	0.0774	74.1	1.4	<0.003	<0.393	1	<0.121	<0.036	1,195	1.3	0.012	0.998	15	0.038	0.009
			RG_GC_PCC-M-07_2020-04-22	0.1217	0.0475	61.0	0.473	<0.003	<0.393	18	<0.121	0.039	433	1.4	0.052	5.6	63	0.005	<0.006
			RG_GC_PCC-M-08_2020-04-22	0.228	0.0644	71.8	1.3	<0.003	<0.393	3	<0.121	<0.036	1,020	1.4	0.024	1.3	18	0.012	0.009
			RG_GC_PCC-M-09_2020-04-22	0.2763	0.0816	70.5	5.1	<0.003	<0.393	1.9	<0.121	<0.036	749	1.5	0.033	1.4	28	0.02	0.011
			RG_GC_PCC-M-10_2020-04-22	0.2531	0.069	72.7	7.2	<0.003	<0.393	1.9	<0.121	<0.036	1,278	2.4	0.076	1.2	40	0.043	0.021
		Ovary	RG_GC_PCC-O-01_2020-04-22	0.29	0.1109	61.8	0.526	<0.003	<0.393	0.842	<0.121	0.042	508	1.3	0.075	4.6	59	0.008	<0.006
			RG_GC_PCC-O-02_2020-04-22	0.2795	0.0907	67.5	5.3	0.005	<0.393	3.1	<0.121	0.073	866	1.4	0.103	4.2	105	0.045	0.014
			RG_GC_PCC-O-03_2020-04-22	0.3954	0.1508	61.9	0.743	<0.003	<0.393	2	<0.121	0.052	545	1.3	0.068	3.4	61	0.013	0.009
			RG_GC_PCC-O-04_2020-04-22	0.1402	0.0735	47.6	8.8	<0.003	<0.393	2.3	<0.121	0.188	676	1.4	0.104	2.6	88	0.025	0.014
			RG_GC_PCC-O-05_2020-04-22	0.3117	0.1256	59.7	0.567	<0.003	<0.393	2.3	<0.121	0.052	563	1.4	0.086	4.1	72	0.017	0.007
			RG_GC_PCC-O-06_2020-04-22	0.3267	0.1463	55.2	1.6	0.008	<0.393	2.4	<0.121	0.047	742	1.2	0.045	3.3	53	0.01	0.007
			RG_GC_PCC-O-07_2020-04-22	0.3948	0.1613	59.1	0.905	<0.003	<0.393	2.3	<0.121	0.042	578	1.2	0.068	3.9	56	0.038	<0.006
			RG_GC_PCC-O-08_2020-04-22	0.1661	0.0597	64.1	4.6	<0.003	<0.393	25	<0.121	0.105	1,048	1.3	0.12	4.5	165	0.025	0.019
			RG_GC_PCC-O-09_2020-04-22	0.3677	0.1628	55.7	0.381	<0.003	<0.393	1.7	<0.121	0.052	469	1.3	0.079	3.9	63	0.011	0.009
			RG_GC_PCC-O-10_2020-04-22	0.3836	0.1479	61.4	5.8	<0.003	<0.393	2.4	<0.121	0.073	819	1.2	0.084	4.3	80	0.028	0.016

Table F.3: Total Metal Analysis for Peamouth Chub and Redside Shiner Muscle and Ovary Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Sample ID				Wet Weight	Dry Weight	Moisture	Aluminum	Antimony	Arsenic	Barium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
				g	g	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-01_2020-04-20	0.4402	0.1114	74.7	1.2	<0.003	<0.393	2.5	<0.121	0.114	1,110	1.3	0.023	2	35	0.02	0.011
			RG_SC_RSC-M-02_2020-04-20	1.8082	0.4453	75.4	0.687	0.005	<0.393	0.45	<0.121	<0.036	1,171	1.1	0.011	1.1	16	0.016	<0.006
			RG_SC_RSC-M-03_2020-04-20	0.8016	0.19	76.3	3.3	<0.003	<0.393	2.4	<0.121	<0.036	1,821	1.4	0.03	2.1	48	0.023	0.013
			RG_SC_RSC-M-04_2020-04-20	0.9602	0.2265	76.4	0.664	<0.003	<0.393	0.488	<0.121	<0.036	1,220	1.1	0.009	1.1	19	0.011	<0.006
			RG_SC_RSC-M-05_2020-04-20	1.1472	0.2855	75.1	0.389	<0.003	<0.393	0.863	<0.121	<0.036	1,102	0.998	0.012	0.987	15	0.01	0.008
			RG_SC_RSC-M-06_2020-04-20	0.527	0.1246	76.4	1.7	<0.003	<0.393	0.769	<0.121	<0.036	1,228	1.3	0.017	1.2	20	0.014	0.01
			RG_SC_RSC-M-07_2020-04-20	0.497	0.1183	76.2	1.4	<0.003	<0.393	0.476	<0.121	<0.036	1,222	1.5	0.014	1.4	22	0.009	<0.006
			RG_SC_RSC-M-08_2020-04-20	2.4507	0.5871	76.0	<0.231	<0.003	<0.393	0.765	<0.121	<0.036	1,146	1.1	0.01	1.4	17	0.004	0.007
			RG_SC_RSC-M-09_2020-04-20	0.6283	0.1475	76.5	1.7	<0.003	<0.393	0.34	<0.121	0.117	1,293	1.2	0.01	1	19	0.01	0.01
			RG_SC_RSC-M-10_2020-04-20	0.5743	0.1428	75.1	1.1	<0.003	<0.393	0.969	<0.121	<0.036	1,205	1.2	0.068	1.3	23	0.009	0.009
		Ovary	RG_SC_RSC-O-01_2020-04-20	0.3392	0.1162	65.7	1.7	<0.003	<0.393	1.6	<0.121	0.079	1,630	1.2	0.074	4.7	139	0.026	<0.006
			RG_SC_RSC-O-02_2020-04-20	0.3034	0.0974	67.9	0.616	<0.003	<0.393	2.7	<0.121	0.121	1,674	1.5	0.079	7.3	153	0.01	0.011
			RG_SC_RSC-O-03_2020-04-20	0.4741	0.1434	69.8	2.3	0.005	<0.393	4.5	<0.121	0.121	1,872	1.4	0.12	6.1	139	0.026	0.016
			RG_SC_RSC-O-04_2020-04-20	0.5786	0.1783	69.2	0.954	<0.003	<0.393	5.1	<0.121	0.107	1,895	1.3	0.067	3.7	120	0.008	0.012
			RG_SC_RSC-O-05_2020-04-20	0.1459	0.0497	65.9	2.4	0.005	<0.393	6.2	<0.121	0.13	1,580	1.4	0.113	5.6	150	0.025	0.019
			RG_SC_RSC-O-06_2020-04-20	0.276	0.0855	69.0	4.4	0.008	<0.393	3.6	0.185	0.177	2,290	1.7	0.121	8.9	206	0.044	0.03
			RG_SC_RSC-O-07_2020-04-20	0.2621	0.0803	69.4	8.8	0.005	<0.393	3.4	<0.121	0.149	1,910	1.6	0.064	8.3	163	0.048	0.02
			RG_SC_RSC-O-08_2020-04-20	0.5358	0.173	67.7	0.26	<0.003	<0.393	2.5	<0.121	0.065	1,696	1.2	0.07	5.8	115	0.005	0.008
			RG_SC_RSC-O-09_2020-04-20	0.3045	0.0984	67.7	1.8	0.004	<0.393	2.8	<0.121	0.251	1,715	1.3	0.096	6.9	133	0.03	0.014
			RG_SC_RSC-O-10_2020-04-20	0.2007	0.0669	66.7	3.1	<0.003	<0.393	4.5	<0.121	0.135	1,844	1.6	0.116	6	165	0.035	0.012
	Elk River	Muscle	RG_ER_RSC-M-01_2020-04-21	0.415	0.1051	74.7	15	0.038	<0.393	2	1.6	0.163	1,509	3	0.188	2.9	100	0.262	0.065
			RG_ER_RSC-M-02_2020-04-21	1.409	0.3208	77.2	3.7	0.01	<0.393	1.8	0.316	0.037	1,075	2.1	0.051	1.9	48	0.052	0.019
			RG_ER_RSC-M-03_2020-04-21	0.5225	0.1274	75.6	12	0.008	<0.393	2.1	0.484	0.057	1,373	2.3	0.092	2.2	58	0.107	0.027
			RG_ER_RSC-M-04_2020-04-21	0.5016	0.1192	76.2	2.3	<0.003	<0.393	2.4	<0.121	<0.036	1,432	2.1	0.057	2.3	44	0.013	0.023
			RG_ER_RSC-M-05_2020-04-21	0.6084	0.14	77.0	0.584	<0.003	<0.393	1.1	0.138	<0.036	1,001	1.3	0.022	1.3	21	0.016	0.012
			RG_ER_RSC-M-06_2020-04-21	2.0494	0.5035	75.4	1.4	0.005	<0.393	1.2	<0.121	<0.036	1,338	1.2	0.022	1.3	23	0.023	0.013
			RG_ER_RSC-M-07_2020-04-21	0.4453	0.1168	73.8	1.8	0.005	<0.393	0.572	0.122	<0.036	1,321	1.3	0.019	1.4	21	0.03	0.018
			RG_ER_RSC-M-08_2020-04-21	0.7992	0.2041	74.5	3.6	0.005	<0.393	1	0.53	0.041	1,277	1.6	0.039	1.6	35	0.037	0.017
			RG_ER_RSC-M-09_2020-04-21	0.4649	0.1166	74.9	3.2	0.005	<0.393	1.4	0.143	<0.036	1,231	1.4	0.018	1.6	22	0.012	0.015
			RG_ER_RSC-M-10_2020-04-21	1.2962	0.3294	74.6	0.913	0.005	<0.393	0.975	<0.121	<0.036	1,115	1.3	0.018	1.4	24	0.015	0.015
		Ovary	RG_ER_RSC-O-01_2020-04-21	0.3885	0.1229	68.4	25	0.017	<0.393	5.9	0.523	0.2	2,547	2.4	0.187	7	261	0.143	0.039
			RG_ER_RSC-O-02_2020-04-21	0.3592	0.1089	69.7	12	0.005	<0.393	6.5	0.347	0.156	1,931	2.4	0.142	8.5	176	0.19	0.021
			RG_ER_RSC-O-03_2020-04-21	0.3571	0.1156	67.6	1.1	<0.003	<0.393	2.4	0.165	0.098	1,948	1.2	0.096	5.2	127	0.016	0.015
			RG_ER_RSC-O-04_2020-04-21	0.3557	0.1127	68.3	2.7	<0.003	<0.393	7.9	<0.121	0.161	2,037	1.4	0.137	5.6	176	0.044	0.021
			RG_ER_RSC-O-05_2020-04-21	0.3437	0.1057	69.2	1.7	<0.003	<0.393	3.1	0.187	0.137	2,788	1.8	0.106	8	223	0.025	0.02
			RG_ER_RSC-O-06_2020-04-21	0.237	0.0727	69.3	1.9	0.005	<0.393	6.1	0.149	0.166	2,240	1.6	0.11	7.1	178	0.053	0.019
			RG_ER_RSC-O-07_2020-04-21	0.2233	0.0763	65.8	0.899	<0.003	<0.393	2.1	<0.121	0.088	1,872	1.3	0.062	7.6	129	0.016	0.017
			RG_ER_RSC-O-08_2020-04-21	0.2674	0.0896	66.5	8.3	0.019	<0.393	6.5	0.962	0.298	2,926	2.3	0.181	6.9	234	0.155	0.066
			RG_ER_RSC-O-09_2020-04-21	0.2738	0.0889	67.5	1.1	<0.003	<0.393	2.8	<0.121	0.13	1,800	1.6	0.11	7.8	182	0.018	0.022
			RG_ER_RSC-O-10_2020-04-21	0.4449	0.1343	69.8	0.954	<0.003	<0.393	6	<0.121	0.237	1,938	1.4	0.109	6.8	198	0.012	0.02
	Gold Creek	Muscle	RG_GC_RSC-M-01_2020-04-21	1.4516	0.3203	77.9	0.483	<0.003	<0.393	0.518	<0.121	<0.036	1,123	1	0.009	1.1	18	0.012	<0.006
			RG_GC_RSC-M-02_2020-04-22	0.5266	0.1192	77.4	0.727	<0.003	<0.393	0.408	<0.121	<0.036	1,361	1.1	0.007	0.962	14	0.005	0.01
			RG_GC_RSC-M-03_2020-04-23	0.3389	0.0847	75.0	1.4	<0.003	<0.393	0.697	<0.121	<0.036	949	1.1	0.009	1.4	18	0.009	0.012
			RG_GC_RSC-M-04_2020-04-23	1.8667	0.4243	77.3	0.638	<0.003	<0.393	1.1	<0.121	<0.036	1,007	1.1	0.011	1.1	14	0.007	<0.006
			RG_GC_RSC-M-05_2020-04-23	0.436	0.1015	76.7	0.809	<0.003	<0.393	0.612	<0.121	<0.036	1,004	1.2	0.009	1.1	17	0.006	0.009
			RG_GC_RSC-M-06_2020-04-23	0.3552	0.0849	76.1	3.5	0.005	<0.393	1.1	0.215	<0.036	1,374	1.4	0.016	1.7	26	0.014	0.011
			RG_GC_RSC-M-07_2020-04-24	0.377	0.0928	75.4	0.513	<0.003	<0.393	1.1	<0.121	<0.036	956	1.1	0.009	1.6	17	0.007	0.008
			RG_GC_RSC-M-08_2020-04-24	0.5685	0.1302	77.1	2.8	<0.003	<0.393	1.2	<0.121	0.095	1,237	1.2	0.013	1.2	20	0.023	0.007
			RG_GC_RSC-M-09_2020-04-24	1.1558	0.275	76.2	1.1	<0.003	<0.393	0.731	<0.121	<0.036	962	1.1	0.013	1.7	17	0.017	<0.006
			RG_GC_RSC-M-10_2020-04-24	0.446	0.1037	76.7	1.5	<0.003	<0.393	0.986	0.147	<0.036	1,140	1.2	0.013	1.2	18	0.014	0.008
		Ovary	RG_GC_RSC-O-01_2020-04-21	0.3675	0.1093	70.3	2	0.005	<0.393	5.8	<0.121	0.149	2,521	1.8	0.104	8.1	183	0.016	0.014
			RG_GC_RSC-O-02_2020-04-22	0.3649	0.1132	69.0	9.6	0.008	<0.393	7.1	0.34	0.168	2,674	2.2	0.152	7	224	0.061	0.037
			RG_GC_RSC-O-03_2020-04-23	0.3259	0.0905	72.2	4.1	0.005	<0.393	3.8	0.168	0.195	2,212	1.6	0.142	6.9	250	0.04	0.016
			RG_GC_RSC-O-04_2020-04-23	0.3741	0.1136	69.6	2.6	0.008	<0.393	8.7	0.141	0.14	2,453	2.1	0.145	7.4	165	0.047	0.02
			RG_GC_RSC-O-05_2020-04-23	0.2013	0.0624	69.0	1.9	<0.003	<0.393	5	<0.121	0.149	1,816	1.4	0.093	7.3	151	0.016	0.02
			RG_GC_RSC-O-06_2020-04-23	0.1327	0.0422	68.2	23	0.018	0.526	9	1.1	0.277	2,669	3.4	0.279	12	292	0.38	0.084
			RG_GC_RSC-O-07_2020-04-24	0.577	0.1662	71.2	8.2	0.009	<0.393	7.8	1.1	0.201	3,769	3.3	0.266	9.4	390	0.117	0.055
			RG_GC_RSC-O-08_2020-04-24	0.4715	0.1726	63.4	3	0.004	<0.393	2.1	0.158	0.32	2,702	1.8	0.139	8.8	171	0.045	0.018
			RG_GC_RSC-O-09_2020-04-24	0.3273	0.0929	71.6	0.43	<0.003	<0.393	3.2	<0.121	0.129	1,984	1.2	0.088	8.4	193	0.016	0.01
			RG_GC_RSC-O-10_2020-04-24	0.1198	0.0399	66.7	2.1	0.003	<0.393	3.7	0.144	0.162	2,598	1.4	0.109	9.2	209	0.027	0.015

Table F.3: Total Metal Analysis for Peamouth Chub and Redside Shiner Muscle and Ovary Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Species	Site	Tissue	Sample ID	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Strontium mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
Peamouth Chub	Sand Creek	Muscle	RG_SC_PCC-M-01_2020-04-20	1,398	0.73	0.582	<0.042	0.816	10,876	22,004	2.2	0.001	1,179	0.449	<0.007	0.313	1.2	<0.001	<0.017	15
			RG_SC_PCC-M-02_2020-04-20	1,435	0.449	0.63	<0.042	0.328	9,615	20,893	1.3	<0.001	1,183	0.558	0.01	0.048	0.929	<0.001	<0.017	16
			RG_SC_PCC-M-03_2020-04-20	1,381	0.627	0.523	<0.042	0.223	11,503	20,553	1.7	<0.001	1,227	0.684	0.022	0.059	0.929	<0.001	<0.017	28
			RG_SC_PCC-M-04_2020-04-20	1,530	0.355	0.847	<0.042	0.157	10,422	20,847	1.9	<0.001	960	0.851	<0.007	0.024	0.743	<0.001	<0.017	13
			RG_SC_PCC-M-05_2020-04-20	1,339	0.525	0.578	<0.042	0.293	9,513	18,933	1.9	<0.001	1,328	0.803	0.008	0.032	0.836	<0.001	<0.017	19
			RG_SC_PCC-M-06_2020-04-20	863	0.33	0.614	<0.042	0.391	9,349	21,436	1.7	<0.001	1,595	0.596	<0.007	0.056	0.836	<0.001	<0.017	40
			RG_SC_PCC-M-07_2020-04-20	1,330	0.518	0.608	<0.042	0.091	12,347	22,797	2.5	<0.001	1,043	0.411	0.012	0.185	0.836	<0.001	<0.017	17
			RG_SC_PCC-M-08_2020-04-20	1,216	0.498	0.862	<0.042	0.363	10,807	19,418	1.9	0.001	1,720	1.1	0.067	0.123	0.929	<0.001	<0.017	48
			RG_SC_PCC-M-09_2020-04-20	1,335	0.251	0.472	<0.042	0.153	10,890	22,486	1.4	0.001	1,157	1.1	<0.007	0.098	0.743	<0.001	<0.017	14
			RG_SC_PCC-M-10_2020-04-20	1,670	0.515	0.488	<0.042	0.565	10,472	22,048	1.9	<0.001	1,264	1.1	0.012	0.071	1	<0.001	<0.017	15
		Ovary	RG_SC_PCC-O-01_2020-04-20	1,198	11	0.045	0.185	0.468	14,046	11,883	21	0.018	4,159	0.887	<0.007	0.201	1.2	0.012	0.055	114
			RG_SC_PCC-O-02_2020-04-20	1,338	10	0.052	0.204	0.114	14,115	12,296	19	0.02	2,686	0.409	0.01	0.139	1.1	0.004	0.027	142
			RG_SC_PCC-O-03_2020-04-20	874	2.6	<0.038	0.099	0.05	15,299	11,191	13	0.011	1,884	0.353	0.012	0.051	0.743	0.005	<0.017	87
			RG_SC_PCC-O-04_2020-04-20	1,243	7.7	0.06	0.135	0.124	13,745	10,215	9.5	0.022	1,517	0.446	0.008	0.041	0.923	0.004	0.03	134
			RG_SC_PCC-O-05_2020-04-20	2,363	21	0.073	0.389	0.077	14,227	14,337	30	0.019	3,353	0.914	0.019	0.06	1.1	0.007	0.032	158
			RG_SC_PCC-O-06_2020-04-20	1,004	2.4	0.043	0.119	0.108	11,852	7,305	11	0.014	1,456	0.357	<0.007	0.031	0.923	0.004	0.029	117
			RG_SC_PCC-O-07_2020-04-20	707	5.5	<0.038	0.092	0.039	13,146	11,112	8.3	0.014	1,845	0.247	0.012	0.047	0.666	0.001	<0.017	87
			RG_SC_PCC-O-08_2020-04-20	1,039	5.4	0.066	0.135	0.139	16,819	10,928	9.7	0.021	2,281	0.444	0.011	0.153	1	0.004	0.036	134
			RG_SC_PCC-O-09_2020-04-20	926	8	<0.038	0.123	<0.035	12,925	9,617	7.7	0.019	1,734	0.341	<0.007	0.038	0.615	0.002	0.02	106
			RG_SC_PCC-O-10_2020-04-20	992	9.1	<0.038	0.132	0.132	13,011	8,835	10	0.017	1,542	0.607	0.014	0.028	0.923	0.003	0.029	108
	Elk River	Muscle	RG_ER_PCC-M-01_2020-04-21	978	0.207	0.462	<0.042	0.067	11,976	25,142	1.7	<0.001	953	0.367	0.011	0.199	0.692	<0.001	<0.017	17
			RG_ER_PCC-M-02_2020-04-21	1,064	0.31	0.393	<0.042	0.2	8,520	18,117	2.2	<0.001	865	0.462	0.011	0.084	0.692	<0.001	<0.017	9.8
			RG_ER_PCC-M-03_2020-04-22	994	0.41	0.483	<0.042	0.385	10,980	22,607	2.9	0.001	1,454	0.549	0.018	0.094	0.653	<0.001	<0.017	37
			RG_ER_PCC-M-04_2020-04-22	1,274	0.401	0.45	<0.042	0.091	9,802	23,300	2.1	<0.001	1,107	0.576	0.019	0.045	0.769	<0.001	<0.017	14
			RG_ER_PCC-M-05_2020-04-22	1,747	0.824	0.732	<0.042	0.258	11,738	24,464	1.9	0.001	1,612	0.91	0.021	0.279	1.2	<0.001	0.018	25
			RG_ER_PCC-M-06_2020-04-22	1,262	0.55	0.85	<0.042	2	12,468	28,609	2.5	<0.001	2,238	0.592	0.013	0.026	0.836	<0.001	0.033	18
			RG_ER_PCC-M-07_2020-04-22	1,321	0.384	0.633	<0.042	0.279	10,366	22,688	1.7	<0.001	1,284	0.781	0.013	0.024	0.836	<0.001	<0.017	14
			RG_ER_PCC-M-08_2020-04-22	862	0.377	0.654	<0.042	0.614	10,718	23,859	3.7	<0.001	1,883	0.648	0.009	0.145	0.743	<0.001	<0.017	15
			RG_ER_PCC-M-09_2020-04-22	1,328	0.298	0.711	<0.042	0.265	12,407	23,139	2.4	<0.001	1,597	1.1	0.019	0.085	0.836	<0.001	<0.017	16
			RG_ER_PCC-M-10_2020-04-22	1,536	0.714	0.575	<0.042	0.453	9,580	19,652	3.5	0.001	1,185	0.644	0.016	0.04	0.836	<0.001	<0.017	31
		Ovary	RG_ER_PCC-O-01_2020-04-21	929	8.5	0.042	0.12	0.064	12,665	8,033	9.7	0.016	1,730	0.359	0.009	0.057	0.699	0.003	0.02	85
			RG_ER_PCC-O-02_2020-04-21	974	7.5	<0.038	0.099	0.057	12,900	9,009	9.6	0.016	1,667	0.466	0.019	0.023	0.786	0.005	0.018	89
			RG_ER_PCC-O-03_2020-04-22	985	7.5	0.062	0.12	0.078	11,488	7,740	11	0.012	1,298	0.44	0.014	0.062	0.786	0.003	0.02	98
			RG_ER_PCC-O-04_2020-04-22	795	11	0.039	0.115	0.05	10,914	6,410	9	0.014	1,147	0.38	0.017	0.014	0.612	0.003	<0.017	84
			RG_ER_PCC-O-05_2020-04-22	1,114	5.3	0.039	0.104	0.071	11,365	7,692	12	0.014	1,389	0.505	0.012	0.02	0.612	0.005	<0.017	124
			RG_ER_PCC-O-06_2020-04-22	1,695	13	0.149	0.287	0.717	19,643	22,131	19	0.023	4,312	0.932	0.044	0.126	1.8	0.004	0.095	273
			RG_ER_PCC-O-07_2020-04-22	1,316	5.6	0.045	0.136	0.092	12,618	9,063	8.8	0.011	2,193	0.45	0.015	0.017	0.874	0.004	0.028	95
			RG_ER_PCC-O-08_2020-04-22	969	12	<0.038	0.131	0.085	12,507	9,229	12	0.026	1,747	0.315	0.011	0.014	0.874	0.004	0.026	83
			RG_ER_PCC-O-09_2020-04-22	810	5.9	0.058	0.11	0.071	11,287	8,142	7.1	0.021	1,484	0.464	0.019	0.051	0.874	0.002	0.028	85
			RG_ER_PCC-O-10_2020-04-22	889	4.2	<0.038	0.073	0.085	11,024	7,494	11	0.025	1,351	0.439	0.009	0.054	0.524	0.003	<0.017	99
	Gold Creek	Muscle	RG_GC_PCC-M-01_2020-04-22	1,469	0.572	1.1	<0.042	0.502	13,388	28,571	2.8	0.001	1,586	1	0.014	0.028	1.2	<0.001	0.028	28
			RG_GC_PCC-M-02_2020-04-22	1,168	0.312	0.946	<0.042	0.344	14,404	26,737	4.1	0.001	1,478	0.965	<0.007	0.085	1.3	<0.001	<0.017	20
			RG_GC_PCC-M-03_2020-04-22	1,304	0.473	0.98	<0.042	0.165	10,721	22,668	2.8	<0.001	1,108	0.673	0.025	0.143	0.838	<0.001	<0.017	22
			RG_GC_PCC-M-04_2020-04-22	1,272	0.341	0.451	<0.042	0.125	10,466	22,314	2.2	0.001	1,205	1.2	0.021	0.217	0.754	<0.001	<0.017	21
			RG_GC_PCC-M-05_2020-04-22	1,142	0.373	0.59	<0.042	0.323	9,063	18,394	2.5	0.001	1,045	0.869	<0.007	0.162	1.1	<0.001	0.028	16
			RG_GC_PCC-M-06_2020-04-22	1,291	0.362	0.953	<0.042	0.075	10,390	22,444	1.6	0.001	1,190	0.867	0.01	0.102	0.838	<0.001	<0.017	22
			RG_GC_PCC-M-07_2020-04-22	955	0.72	0.664	<0.042	0.563	10,412	18,401	2.2	<0.001	1,426	0.273	0.057	0.032	0.796	<0.001	<0.017	79
			RG_GC_PCC-M-08_2020-04-22	1,268	0.614	0.585	<0.042	0.359	10,127	22,617	3.5	<0.001	1,134	0.684	0.014	0.068	1.1	<0.001	0.022	63
			RG_GC_PCC-M-09_2020-04-22	1,284	0.787	1.3	<0.042	0.531	10,449	22,710	2	0.001	1,231	0.485	0.019	0.081	1.2	<0.001	0.019	30
			RG_GC_PCC-M-10_2020-04-22	1,200	0.984	0.946	<0.042	2.3	10,887	23,253	3.1	0.001	1,473	1	0.012	0.109	1.3	<0.001	0.039	27
		Ovary	RG_GC_PCC-O-01_2020-04-22	918	5.9	0.053	0.129	0.054	11,656	8,238	9.6	0.025	1,382	0.34	0.013	0.02	0.718	0.002	0.02	98
			RG_GC_PCC-O-02_2020-04-22	1,331	7	0.053	0.147	0.213	11,358	8,907	12	0.027	3,349	0.595	<0.007	0.303	1	0.003	0.041	151
			RG_GC_PCC-O-03_2020-04-22	956	7.1	0.04	0.08	0.077	10,606	6,650	11	0.016	1,422	0.503	0.016	0.073	0.718	0.002	<0.017	94
			RG_GC_PCC-O-04_2020-04-22	1,208	11	0.043	0.184	0.186	11,899	9,385	8.8	0.008	2,128	0.516	0.019	0.024	1.3	0.005	0.036	106
			RG_GC_PCC-O-05_2020-04-22	1,187	8	0.047	0.123	0.07	12,818	8,040	13	0.019	1,513	0.463	0.008	0.11	1	0.003	0.026	114
			RG_GC_PCC-O-06_2020-04-22	1,000	5.5	0.045	0.123	0.108	8,203	5,028	5.9	0.019	1,036	0.348	0.028	0.037	0.923	0.002	0.06	87
			RG_GC_PCC-O-07_2020-04-22	1,053	7.3	0.057	0.11	0.101	10,326	7,526	9.1	0.019	1,158	0.451	0.008	0.026	0.718	0.002	<0.017	104
			RG_GC_PCC-O-08_2020-04-22	1,862	16	0.06	0.147	0.271	10,987	9,331	12	0.017	2,512	0.839	0.02	0.089	1.1	0.006	0.035	170
			RG_GC_PCC-O-09_2020-04-22	949	5.7	0.043	0.098	0.077	14,386	10,884	6.8	0.023	2,559	0.353	0.016	0.089	0.769	0.002	0.023	95
			RG_GC_PCC-O-10_2020-04-22	1,368	9.4	0.066	0.19	0.139	11,653	10,085	8.3	0.028	2,480	0.54	0.017	<0.012	1.3	0.002	0.04	124

Table F.3: Total Metal Analysis for Peamouth Chub and Redside Shiner Muscle and Ovary Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Species	Location	Tissue	Sample ID	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Strontium mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-01_2020-04-20	949	0.752	0.364	<0.042	0.386	9,252	19,244	1.6	0.001	1,078	0.619	<0.007	0.092	1.2	<0.001	<0.017	73
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-02_2020-04-20	946	0.386	0.309	<0.042	0.135	9,534	19,946	1.9	0.001	1,304	0.532	0.008	0.097	1.1	<0.001	<0.017	36
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-03_2020-04-20	1,290	0.906	0.679	<0.042	0.454	10,906	20,391	1.2	0.001	1,137	1.5	0.014	0.127	1.3	<0.001	0.025	51
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-04_2020-04-20	945	0.467	0.461	<0.042	0.058	7,593	16,845	1.3	<0.001	773	0.913	<0.007	0.037	0.95	<0.001	<0.017	46
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-05_2020-04-20	841	0.307	0.299	<0.042	0.097	6,844	14,281	1.5	0.001	569	0.792	0.013	0.084	0.864	<0.001	<0.017	32
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-06_2020-04-20	1,213	0.499	0.505	<0.042	0.335	9,121	20,552	3.5	0.001	1,190	0.763	0.009	0.336	1.1	<0.001	<0.017	23
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-07_2020-04-20	1,023	0.416	0.54	<0.042	0.467	10,462	22,933	1.7	0.001	1,080	0.662	<0.007	0.163	0.922	<0.001	<0.017	32
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-08_2020-04-20	1,223	0.407	0.385	<0.042	<0.035	10,810	23,934	2	0.001	1,101	0.578	0.007	0.021	0.922	<0.001	<0.017	48
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-09_2020-04-20	928	0.484	0.678	<0.042	0.112	8,148	19,667	2.1	0.001	1,015	0.618	0.011	0.025	0.845	<0.001	<0.017	20
Redside Shiner	Sand Creek	Muscle	RG_SC_RSC-M-10_2020-04-20	924	0.404	0.411	<0.042	0.133	8,236	17,590	2.1	0.001	1,240	0.905	0.012	0.234	0.922	<0.001	<0.017	34
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-01_2020-04-20	1,764	9.7	0.052	0.152	0.059	12,234	12,610	21	0.012	1,948	1	0.013	0.111	0.981	0.002	<0.017	184
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-02_2020-04-20	1,446	11	0.07	0.23	0.039	14,195	15,684	27	0.019	2,530	0.669	0.045	0.093	1.1	<0.001	<0.017	241
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-03_2020-04-20	1,760	9.5	0.095	0.178	0.167	12,667	13,869	18	0.02	2,840	0.977	0.044	0.098	1.1	0.001	<0.017	232
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-04_2020-04-20	1,574	9.6	0.078	0.133	0.085	12,863	10,936	32	0.007	1,883	0.883	0.025	0.07	0.736	<0.001	<0.017	247
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-05_2020-04-20	1,677	6.4	0.076	0.125	0.197	13,116	12,850	13	0.023	2,297	0.927	0.06	0.496	1.1	<0.001	<0.017	261
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-06_2020-04-20	1,896	4.7	0.108	0.212	0.381	14,394	15,122	36	0.054	2,480	1.3	0.095	0.35	1.6	0.003	0.07	268
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-07_2020-04-20	1,436	10	0.079	0.303	0.223	14,791	18,504	37	0.02	2,701	0.94	0.046	0.209	1.6	0.002	0.043	257
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-08_2020-04-20	1,462	6	0.043	0.162	<0.035	12,148	13,976	25	0.013	2,404	0.606	0.013	0.087	0.817	<0.001	<0.017	186
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-09_2020-04-20	1,290	11	0.11	0.146	0.112	12,340	13,728	11	0.025	2,742	0.905	0.065	0.03	1.1	<0.001	<0.017	186
Redside Shiner	Sand Creek	Ovary	RG_SC_RSC-O-10_2020-04-20	1,501	9.5	0.058	0.157	0.361	12,550	17,335	25	0.023	2,172	1.4	0.059	0.374	1.1	<0.001	<0.017	251
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-01_2020-04-21	1,374	2.6	0.741	0.055	3	10,824	22,852	2.5	0.034	1,809	2	0.034	0.143	3	0.044	0.382	49
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-02_2020-04-21	710	1.1	0.505	<0.042	1.3	8,024	17,397	1.8	0.002	1,251	0.743	<0.007	0.171	1.6	0.002	0.074	72
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-03_2020-04-21	1,489	2.1	0.705	0.048	1.5	9,622	19,892	2.8	0.005	1,351	1.3	0.016	0.249	1.9	0.006	0.087	48
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-04_2020-04-21	1,722	0.983	0.547	<0.042	1.5	11,214	20,192	5.1	0.002	1,081	1.2	0.028	0.1	1.2	<0.001	0.037	50
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-05_2020-04-21	1,034	0.42	0.603	<0.042	0.225	6,607	13,771	2.5	0.001	855	0.678	0.011	0.25	0.95	<0.001	<0.017	49
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-06_2020-04-21	1,050	0.57	0.548	<0.042	0.209	9,393	18,442	1.4	0.001	1,101	0.717	0.015	0.059	1.3	<0.001	<0.017	60
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-07_2020-04-21	1,088	0.551	0.251	<0.042	0.373	9,416	18,975	1.2	0.003	1,259	0.852	0.007	0.045	1.2	0.001	0.019	41
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-08_2020-04-21	1,246	0.6	0.702	<0.042	0.528	10,159	22,579	2	0.005	1,152	1	0.018	0.171	1.6	0.002	0.039	39
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-09_2020-04-21	1,228	0.571	0.526	<0.042	0.248	10,741	21,088	2.5	0.003	1,096	0.84	0.016	0.082	1.3	<0.001	<0.017	56
Redside Shiner	Elk River	Muscle	RG_ER_RSC-M-10_2020-04-21	1,101	0.628	0.696	<0.042	0.229	9,916	20,694	2.4	0.001	1,195	0.629	0.016	0.088	1	<0.001	<0.017	46
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-01_2020-04-21	1,805	7.1	0.068	0.232	1.3	15,004	19,247	34	0.032	3,113	1.3	0.027	0.15	2.5	0.005	0.102	292
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-02_2020-04-21	1,846	15	0.056	0.164	1.4	12,939	15,139	26	0.023	2,442	1.2	0.023	0.117	1.6	0.001	0.063	282
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-03_2020-04-21	1,356	8	0.068	0.113	0.147	11,891	15,343	11	0.014	2,086	0.863	0.028	0.045	0.922	<0.001	<0.017	174
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-04_2020-04-21	1,913	5.7	0.068	0.107	0.222	13,096	16,791	48	0.019	2,411	0.849	0.033	0.077	1	<0.001	0.019	281
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-05_2020-04-21	2,285	13	0.068	0.195	0.671	12,994	12,897	23	0.027	2,299	1.3	0.033	0.073	1.2	<0.001	0.031	213
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-06_2020-04-21	1,740	5.2	0.091	0.105	0.319	14,606	17,843	14	0.021	3,084	1.1	0.041	0.197	1.2	<0.001	0.032	297
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-07_2020-04-21	1,498	11	0.054	0.164	0.093	12,149	12,650	16	0.02	2,034	0.827	0.009	0.106	0.922	<0.001	<0.017	212
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-08_2020-04-21	1,713	12	0.092	0.199	0.827	14,278	17,542	18	0.032	3,148	1.5	0.087	0.255	2.4	0.008	0.123	281
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-09_2020-04-21	1,653	11	0.067	0.172	0.246	12,961	20,740	33	0.029	3,282	0.747	0.074	0.089	1.3	<0.001	0.019	223
Redside Shiner	Elk River	Ovary	RG_ER_RSC-O-10_2020-04-21	1,862	10	0.076	0.162	0.098	12,778	16,189	27	0.032	2,624	0.851	0.088	0.016	1.1	<0.001	<0.017	265
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-01_2020-04-21	559	0.282	0.693	<0.042	0.085	8,543	19,240	2.4	<0.001	1,146	0.586	0.008	0.088	0.845	<0.001	<0.017	25
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-02_2020-04-22	906	0.517	0.585	<0.042	0.07	8,998	21,502	2.2	<0.001	1,535	0.989	0.008	0.126	0.692	<0.001	<0.017	16
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-03_2020-04-23	1,146	0.455	0.687	<0.042	0.085	11,041	25,136	2.4	<0.001	959	0.598	0.023	0.094	0.999	<0.001	<0.017	31
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-04_2020-04-23	931	0.328	0.864	<0.042	0.067	10,666	21,387	1.9	0.001	1,380	0.532	0.021	0.14	0.922	<0.001	<0.017	49
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-05_2020-04-23	1,021	0.459	1	<0.042	0.227	8,561	18,970	2.5	0.001	1,115	0.548	0.015	0.262	0.922	<0.001	<0.017	29
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-06_2020-04-23	1,507	0.601	0.4	<0.042	0.242	9,849	20,122	2.8	0.001	977	1.1	0.016	0.564	1.1	<0.001	<0.017	39
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-07_2020-04-24	971	0.317	0.656	<0.042	0.097	9,909	20,342	2.2	0.001	1,168	0.504	0.015	0.351	0.769	<0.001	<0.017	37
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-08_2020-04-24	1,312	0.538	0.471	<0.042	0.139	8,424	18,282	2	<0.001	876	0.946	0.013	0.048	0.999	<0.001	<0.017	26
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-09_2020-04-24	649	0.416	0.581	<0.042	0.067	9,985	23,136	6	<0.001	1,030	0.482	0.014	0.16	0.845	<0.001	<0.017	43
Redside Shiner	Gold Creek	Muscle	RG_GC_RSC-M-10_2020-04-24	1,039	0.488	0.534	<0.042	0.339	9,451	19,745	2.4	0.001	938	0.683	0.02	0.064	0.845	<0.001	<0.017	41
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-01_2020-04-21	1,813	10	0.073	0.185	0.453	12,970	17,116	12	0.027	2,825	0.937	0.059	0.144	1.5	0.001	0.035	243
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-02_2020-04-22	1,837	6.5	0.086	0.23	0.946	13,985	13,977	14	0.031	2,749	1.2	0.068	0.141	1.9	0.002	0.059	270
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-03_2020-04-23	1,711	7.5	0.101	0.225	0.256	17,186	19,457	28	0.029	2,932	0.937	0.113	0.2	1.5	0.001	0.03	315
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-04_2020-04-23	1,681	6.5	0.082	0.165	0.979	13,244	13,659	20	0.024	2,319	0.854	0.074	0.111	1.5	0.001	0.041	236
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-05_2020-04-23	1,387	4.3	0.098	0.11	0.098	14,740	16,203	43	0.021	2,413	0.686	0.101	0.811	1.3	<0.001	<0.017	249
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-06_2020-04-23	2,250	14	0.081	0.379	2.3	21,238	22,059	24	0.069	3,641	1.8	0.068	0.365	3.7	0.02	0.213	400
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-07_2020-04-24	2,278	8.4	0.094	0.209	1.5	19,656	19,812	10	0.037	3,979	1.7	0.057	0.251	3.1	0.015	0.105	337
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-08_2020-04-24	1,729	6	0.075	0.214	0.338	16,354	20,759	19	0.043	3,479	0.961	0.036	0.133	1.5	0.001	0.04	238
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-09_2020-04-24	1,668	14	0.042	0.136	0.131	11,237	13,548	46	0.035	2,359	0.856	0.042	0.099	0.786	<0.001	<0.017	225
Redside Shiner	Gold Creek	Ovary	RG_GC_RSC-O-10_2020-04-24	1,561	8.9	0.078	0.154	0.241	14,953	20,844	28	0.029	2,660	0.96	0.049	0.051	1.3	<0.001	0.021	258

Table F.4: Total Metal Analysis for Sport Fish Muscle Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Sample ID			Wet Weight	Dry Weight	Moisture	Aluminum	Antimony	Arsenic	Barium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
			g	g	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Bull Trout	Sand Creek	RG_SC_BT-M-01_2020-04-20	0.0339	0.0109	67.8	64	0.059	0.438	2.4	1.4	0.121	2277	3	0.25	2.8	131	0.401	0.122
		RG_SC_BT-M-02_2020-04-23	0.0395	0.0145	63.3	3.6	0.003	<0.393	0.178	0.122	<0.036	1133	1.3	0.031	0.996	16	0.023	<0.006
		RG_SC_BT-M-03_2020-04-23	0.0582	0.0178	69.4	29	0.013	<0.393	1	0.334	<0.036	1672	1.5	0.04	1.4	32	0.142	0.016
	Elk River	RG_ER_BT-M-01_2020-04-24	0.0665	0.0283	57.4	0.583	0.003	<0.393	0.133	<0.121	<0.036	658	1.3	0.018	1.3	12	0.012	<0.006
		RG_ER_BT-M-02_2020-04-24	0.0731	0.0253	65.4	0.603	0.003	<0.393	0.155	<0.121	<0.036	346	1.3	0.015	1.3	15	0.016	0.008
	Gold Creek	RG_GC_BT-M-01_2020-04-24	0.0499	0.0175	64.9	0.416	0.003	<0.393	0.133	<0.121	<0.036	687	1.2	0.022	1.2	10	0.035	0.014
Kokanee	Sand Creek	RG_SC_KO-M-01_2020-04-23	0.0413	0.0159	61.5	2.2	0.003	<0.393	0.333	<0.121	<0.036	463	1.4	0.016	0.832	14	0.037	0.01
	Elk River	RG_ER_KO-M-01_2020-04-25	0.0368	0.0128	65.2	51	0.026	<0.393	4.2	0.811	0.046	863	2	0.062	2.5	53	0.416	0.05
		RG_ER_KO-01_M_2020-08-28	0.1081	0.0285	73.6	5.3	0.013	<0.430	3.5	0.939	0.067	15225	1.8	0.129	2	134	0.041	0.118
		RG_ER_KO-02_M_2020-08-28	0.107	0.0259	75.8	2.4	<0.011	<0.430	0.629	0.465	<0.036	2026	1.6	0.038	2	27	0.113	0.072
		RG_ER_KO-03_M_2020-08-28	0.1561	0.0317	79.7	4	0.017	<0.430	0.55	0.673	<0.036	1622	1.8	0.059	3.4	57	0.023	0.069
		RG_ER_KO-04_M_2020-08-28	0.109	0.0335	69.3	2.8	<0.011	<0.430	0.262	0.474	<0.036	1582	1.5	0.033	1.4	22	0.342	0.029
		RG_ER_KO-05_M_2020-08-28	0.0828	0.0231	72.1	0.634	<0.011	<0.430	0.183	0.368	0.053	1457	1.6	0.031	1.1	54	0.027	0.045
		RG_ER_KO-06_M_2020-08-28	0.1047	0.0288	72.5	5.6	<0.011	<0.430	0.419	0.474	<0.036	1496	1.7	0.034	2	28	0.04	0.05
		RG_ER_KO-07_M_2020-08-28	0.0977	0.027	72.4	2.3	<0.011	<0.430	0.183	0.436	<0.036	1151	1.7	0.05	2.4	62	0.014	0.072
		RG_ER_KO-08_M_2020-08-28	0.1005	0.0269	73.2	8.3	0.02	<0.430	0.419	0.126	0.04	1313	1.5	0.078	2.1	43	0.127	0.072
	Gold Creek	RG_GC_KO-M-01_2020-04-23	0.0168	0.011	34.5	1.3	0.003	<0.393	0.399	0.142	<0.036	392	1.4	0.018	1.1	18	0.049	0.01
		RG_GC_KO-01_M_2020-08-27	0.0854	0.0268	68.6	3.8	<0.011	<0.430	0.183	0.153	<0.036	1445	1.9	0.034	1.8	25	0.014	0.026
		RG_GC_KO-02_M_2020-08-27	0.0636	0.0191	70	34	0.014	<0.430	0.548	0.375	<0.036	1037	2.6	0.074	2.3	51	1.6	0.048
		RG_GC_KO-03_M_2020-08-27	0.0716	0.0228	68.2	5.6	0.014	<0.430	0.53	1	0.047	1049	2	0.049	2.1	61	0.372	0.048
		RG_GC_KO-04_M_2020-08-27	0.1046	0.0259	75.2	2.3	<0.011	<0.430	0.438	0.277	<0.036	1356	1.7	0.028	2.4	24	0.15	0.058
		RG_GC_KO-05_M_2020-08-27	0.1114	0.0309	72.3	2.6	<0.011	<0.430	0.219	0.236	<0.036	1482	1.8	0.019	1.3	19	0.039	0.022
		RG_GC_KO-06_M_2020-08-27	0.1005	0.028	72.1	1.1	<0.011	<0.430	0.146	0.264	<0.036	1186	1.7	0.021	1.4	17	0.014	0.029
		RG_GC_KO-07_M_2020-08-27	0.1019	0.0285	72	1.9	<0.011	<0.430	0.219	0.444	0.047	1222	1.7	0.035	2	41	0.025	0.032
		RG_GC_KO-08_M_2020-08-27	0.0807	0.0222	72.5	0.848	<0.011	<0.430	0.183	<0.108	<0.036	1588	1.6	0.021	1.3	20	0.007	0.022
Mountain Whitefish	Gold Creek	RG_GC_MWF-M-02_2020-04-24	0.0521	0.0185	64.5	1.7	<0.003	<0.393	0.106	<0.121	<0.036	304	1.3	0.099	1.3	44	0.023	0.023

Table F.4: Total Metal Analysis for Sport Fish Muscle Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Sample ID			Wet Weight	Dry Weight	Moisture	Aluminum	Antimony	Arsenic	Barium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
			g	g	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Rainbow Trout	Sand Creek	RG_SC_RBT-M-01_2020-04-20	0.0381	0.0169	55.6	15	0.019	<0.393	1.1	1.2	0.106	679	2.4	0.087	2.5	52	0.139	0.063
		RG_SC_RBT-M-02_2020-04-20	0.0406	0.0156	61.6	22	0.017	<0.393	0.743	0.365	<0.036	1664	2.3	0.083	2	51	0.095	0.023
		RG_SC_RBT-M-03_2020-04-20	0.0566	0.0226	60.1	1.1	<0.003	<0.393	0.433	<0.121	<0.036	1779	1.5	0.025	2.6	29	0.009	0.014
		RG_SC_RBT-M-04_2020-04-20	0.0741	0.0245	66.9	30	0.014	<0.393	1.1	0.247	<0.036	1841	1.7	0.034	2.6	48	0.138	0.044
		RG_SC_RBT-M-05_2020-04-20	0.0728	0.0273	62.5	21	0.022	<0.393	0.619	0.148	<0.036	549	2.8	0.111	1.4	57	0.046	0.015
		RG_SC_RBT-M-06_2020-04-21	0.0126	0.0054	57.1	9.5	0.011	<0.393	0.97	0.553	<0.036	1478	1.6	0.025	2.6	29	0.057	0.023
		RG_SC_RBT-M-07_2020-04-21	0.0244	0.0094	61.5	4.6	0.008	<0.393	0.537	0.76	0.04	1276	1.9	0.038	2.7	34	0.043	0.019
		RG_SC_RBT-M-08_2020-04-21	0.1064	0.0284	73.3	85	0.026	<0.393	2.9	0.958	0.04	1431	4.2	0.232	3.1	146	0.325	0.094
		RG_SC_RBT-M-09_2020-04-21	0.0601	0.0152	74.7	9.1	0.014	<0.393	0.516	0.252	0.07	1846	2.2	0.034	2.1	33	0.037	0.027
		RG_SC_RBT-M-10_2020-04-21	0.0448	0.0126	71.9	2.2	0.005	<0.393	0.433	0.128	0.06	1346	1.6	0.051	1.5	28	0.01	0.015
		RG_SC_RBT-M-11_2020-04-21	0.0355	0.0134	62.3	7	0.011	<0.393	0.805	0.128	<0.036	739	1.6	0.03	0.98	22	0.046	0.015
		RG_SC_RBT-M-12_2020-04-21	0.0424	0.0143	66.3	2	0.005	<0.393	0.248	<0.121	0.05	994	1.6	0.035	1.3	22	0.01	0.008
	Elk River	RG_ER_RBT-M-01_2020-04-22	0.0959	0.034	64.5	9.9	0.01	<0.393	0.577	<0.121	<0.036	689	1.5	0.035	1.3	24	0.035	0.016
	Gold Creek	RG_GC_RBT-M-01_2020-04-23	0.0331	0.0092	72.2	7.1	0.007	<0.393	1.4	0.132	<0.036	617	1.4	0.051	1.2	23	0.157	0.018
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-01_2020-04-20	0.0319	0.013	59.2	6.7	0.012	<0.393	0.547	0.464	0.05	1714	2	0.084	2	56	0.053	0.022
		RG_SC_WCT-M-02_2020-04-21	0.0567	0.023	59.4	8	0.021	<0.393	0.578	0.138	<0.036	1589	1.9	0.096	1.6	55	0.026	0.025
		RG_SC_WCT-M-03_2020-04-21	0.0387	0.0122	68.5	4.6	0.008	<0.393	0.64	0.158	<0.036	2132	2	0.11	2.3	42	0.017	0.023
		RG_SC_WCT-M-04_2020-04-21	0.0536	0.0183	65.9	2.6	0.005	<0.393	0.351	0.306	<0.036	1822	1.9	0.069	1.9	31	0.022	0.019
		RG_SC_WCT-M-05_2020-04-21	0.0539	0.0131	75.7	29	0.011	<0.393	0.888	0.197	<0.036	2094	2.2	0.091	2.4	51	0.054	0.037
		RG_SC_WCT-M-06_2020-04-21	0.0885	0.0233	73.7	22	0.011	<0.393	1.2	0.212	0.101	2252	2.4	0.096	2.4	78	0.068	0.048
		RG_SC_WCT-M-07_2020-04-23	0.0448	0.0123	72.5	76	0.012	<0.393	1.9	0.36	<0.036	1566	2.1	0.062	1.5	66	0.49	0.04
	Elk River	RG_ER_WCT-M-01_2020-04-25	0.0354	0.0127	64.1	4.9	0.007	<0.393	0.954	0.334	<0.036	919	1.4	0.031	1.4	21	0.167	0.014
	Gold Creek	RG_GC_WCT-M-01_2020-04-21	0.0062	0.0036	41.9	12	0.01	<0.393	1.9	0.243	<0.036	1118	1.6	0.139	6.9	74	0.039	0.036
		RG_GC_WCT-M-02_2020-04-21	0.0128	0.0088	31.3	21	0.003	<0.393	3.2	0.132	<0.036	908	1.2	0.081	2.1	94	0.125	0.02
		RG_GC_WCT-M-03_2020-04-21	0.0108	0.0066	38.9	2.7	0.003	<0.393	0.533	0.177	<0.036	1175	1.3	0.065	1.9	32	0.036	0.029
		RG_GC_WCT-M-04_2020-04-21	0.0033	0.0027	18.2	1.8	0.01	<0.393	0.422	0.162	<0.036	785	1.6	0.133	12	128	0.029	0.086
		RG_GC_WCT-M-05_2020-04-21	0.0135	0.0073	45.9	12	0.007	<0.393	0.688	0.274	<0.036	1325	1.8	0.097	2.3	39	0.035	0.017
		RG_GC_WCT-M-06_2020-04-23	0.0331	0.0133	59.8	7.5	0.013	<0.393	1.1	0.289	<0.036	1074	1.6	0.087	2.2	37	0.095	0.047
		RG_GC_WCT-M-07_2020-04-23	0.0164	0.0094	42.7	203	0.03	<0.393	5.4	0.405	<0.036	984	1.9	0.133	2.3	156	0.524	0.117
Yellow Perch	Elk River	RG_ER_YP-M-01_2020-04-22	0.0919	0.0247	73.1	2	0.003	<0.393	0.333	0.132	<0.036	1176	1.6	0.043	0.969	25	0.013	0.054
		RG_ER_YP-M-02_2020-04-22	0.0812	0.0243	70.1	3.4	0.003	<0.393	0.333	0.132	<0.036	1348	1.4	0.026	0.795	17	0.015	0.023

Table F.4: Total Metal Analysis for Sport Fish Muscle Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Sample ID			Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Bull Trout	Sand Creek	RG_SC_BT-M-01_2020-04-20	1094	2.2	0.514	0.086	1.3	9871	16000	1.9	0.073	2225	2.2	0.058	0.192	6.3	0.02	0.251	34
		RG_SC_BT-M-02_2020-04-23	1222	0.166	0.595	<0.042	0.064	14000	33944	1.4	<0.001	1144	0.556	0.075	0.118	1.4	<0.001	<0.017	15
		RG_SC_BT-M-03_2020-04-23	1462	0.592	0.823	<0.042	0.287	11758	20126	1.6	0.002	941	1.4	0.059	0.115	2.2	<0.001	0.032	18
	Elk River	RG_ER_BT-M-01_2020-04-24	1281	0.315	1.1	<0.042	0.136	9099	13408	2.2	<0.001	709	0.271	0.087	0.061	0.872	<0.001	<0.017	14
		RG_ER_BT-M-02_2020-04-24	1346	0.311	2.1	<0.042	0.057	14127	28989	2.3	<0.001	1200	0.094	0.098	0.054	0.92	<0.001	<0.017	15
	Gold Creek	RG_GC_BT-M-01_2020-04-24	828	0.334	0.545	<0.042	0.05	10315	17482	2.3	<0.001	1059	0.231	0.081	0.038	0.92	<0.001	<0.017	15
Kokanee	Sand Creek	RG_SC_KO-M-01_2020-04-23	1373	0.415	0.382	<0.042	0.176	11867	21426	2.2	<0.001	614	0.435	0.103	0.077	1.2	<0.001	<0.017	16
	Elk River	RG_ER_KO-M-01_2020-04-25	1359	1.7	0.543	<0.042	0.882	9268	14379	2.4	0.005	939	1.2	0.108	0.277	4.9	0.005	0.097	27
		RG_ER_KO-01_M_2020-08-28	1316	2.7	0.214	0.026	1	18626	17363	1.9	0.004	3194	13	0.055	0.15	1.9	0.002	0.08	133
		RG_ER_KO-02_M_2020-08-28	1350	0.346	0.232	0.018	0.122	13131	23176	2.5	0.002	2008	1.6	0.061	0.195	1.5	<0.001	0.02	52
		RG_ER_KO-03_M_2020-08-28	1217	0.525	0.23	0.026	0.346	11275	18013	2.3	0.006	2049	1.3	0.066	0.235	1.8	0.002	0.032	43
		RG_ER_KO-04_M_2020-08-28	1173	0.339	0.224	0.009	0.314	10756	17856	1.5	<0.001	1629	0.989	0.04	0.2	1.2	<0.001	<0.012	29
		RG_ER_KO-05_M_2020-08-28	1147	0.2	0.315	0.009	0.075	11526	20852	1.9	0.002	2287	0.79	0.04	0.13	1.5	<0.001	0.016	89
		RG_ER_KO-06_M_2020-08-28	1374	0.351	0.256	0.009	0.108	12965	21901	2	0.002	1869	0.887	0.073	0.13	1.7	<0.001	0.021	32
		RG_ER_KO-07_M_2020-08-28	1117	0.35	0.262	0.018	0.094	12733	23669	2.3	0.002	3533	0.617	0.059	0.082	1.5	<0.001	0.016	54
		RG_ER_KO-08_M_2020-08-28	1335	0.916	0.219	0.035	0.29	12068	21157	2.1	0.004	2323	0.871	0.073	0.187	1.9	0.006	0.06	30
	Gold Creek	RG_GC_KO-M-01_2020-04-23	1430	0.61	0.216	<0.042	0.229	13300	24427	2.1	<0.001	983	0.15	0.062	0.013	1.1	<0.001	<0.017	14
		RG_GC_KO-01_M_2020-08-27	1497	0.254	0.232	0.013	0.086	13139	23867	1.8	0.003	1555	0.98	0.073	0.07	2.1	<0.001	0.026	52
		RG_GC_KO-02_M_2020-08-27	1192	0.74	0.258	0.038	2	9746	16112	1.4	0.003	1479	0.791	0.067	0.191	2.9	0.002	0.054	51
		RG_GC_KO-03_M_2020-08-27	1041	0.445	0.308	0.025	0.637	10348	16347	2.4	<0.001	2218	0.725	0.082	0.121	1.9	<0.001	0.031	66
		RG_GC_KO-04_M_2020-08-27	1404	0.316	0.27	0.025	0.115	14028	25692	2.3	<0.001	2002	1.1	0.099	0.196	1.9	0.002	0.034	32
		RG_GC_KO-05_M_2020-08-27	1363	0.225	0.232	0.013	0.1	12574	19877	1.6	<0.001	1210	1	0.066	0.146	1.5	<0.001	0.021	50
		RG_GC_KO-06_M_2020-08-27	1340	0.238	0.197	0.013	0.215	14461	26643	1.7	<0.001	1871	0.773	0.072	0.146	1.4	<0.001	0.018	65
		RG_GC_KO-07_M_2020-08-27	1270	0.269	0.253	0.013	0.1	11403	18054	1.8	<0.001	1726	0.742	0.068	0.116	1.7	<0.001	0.016	102
		RG_GC_KO-08_M_2020-08-27	1362	0.184	0.157	0.013	0.115	12547	21340	1.8	<0.001	1407	0.872	0.043	0.136	1.5	<0.001	0.018	36
Mountain Whitefish	Gold Creek	RG_GC_MWF-M-02_2020-04-24	763	0.71	0.388	<0.042	0.212	8678	19650	1.9	<0.001	1229	0.119	0.008	0.186	0.66	<0.001	<0.017	51

Table F.4: Total Metal Analysis for Sport Fish Muscle Tissue Samples, Koocanusa Reservoir Monitoring Program, 2020

Sample ID			Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Rainbow Trout	Sand Creek	RG_SC_RBT-M-01_2020-04-20	1907	1.3	0.574	<0.042	0.985	15642	30642	1.8	0.026	1318	0.689	0.073	0.154	2.6	0.014	0.126	38
Rainbow Trout	Sand Creek	RG_SC_RBT-M-02_2020-04-20	1520	0.703	0.094	<0.042	1.5	12757	23879	1.4	0.001	1752	1.3	0.019	0.116	2.4	0.003	0.04	30
Rainbow Trout	Sand Creek	RG_SC_RBT-M-03_2020-04-20	1196	0.261	1.1	<0.042	0.109	11601	22611	2.1	<0.001	2203	1.2	0.03	0.057	1.1	<0.001	<0.017	24
Rainbow Trout	Sand Creek	RG_SC_RBT-M-04_2020-04-20	1411	0.547	2.5	<0.042	0.386	11887	22972	2.1	0.003	2392	1.3	0.018	0.16	2.8	0.003	0.06	33
Rainbow Trout	Sand Creek	RG_SC_RBT-M-05_2020-04-20	1444	1	0.238	<0.042	2.8	11046	20193	1.4	<0.001	679	0.372	0.06	0.028	2.3	<0.001	0.062	14
Rainbow Trout	Sand Creek	RG_SC_RBT-M-06_2020-04-21	679	0.555	0.822	<0.042	0.332	4341	4600	1.8	0.001	1271	1.4	0.019	0.117	1.5	0.002	0.018	33
Rainbow Trout	Sand Creek	RG_SC_RBT-M-07_2020-04-21	1543	0.54	1.1	<0.042	0.458	11140	20895	1.4	0.004	1764	1.1	0.027	0.127	1.7	0.003	0.035	33
Rainbow Trout	Sand Creek	RG_SC_RBT-M-08_2020-04-21	1768	3.1	0.518	0.074	5.8	13925	26413	1.9	0.023	2571	1.6	0.038	0.362	7.7	0.016	0.227	69
Rainbow Trout	Sand Creek	RG_SC_RBT-M-09_2020-04-21	1486	0.694	0.521	<0.042	0.137	10516	20805	1.6	0.012	1576	1.4	0.031	0.19	2.3	0.002	0.046	56
Rainbow Trout	Sand Creek	RG_SC_RBT-M-10_2020-04-21	1339	0.316	1.3	<0.042	0.198	11358	22402	1.2	<0.001	1516	1.1	0.043	0.178	1.4	0.001	<0.017	106
Rainbow Trout	Sand Creek	RG_SC_RBT-M-11_2020-04-21	1449	0.799	0.383	<0.042	0.092	12107	29656	1.5	0.001	1311	0.851	0.041	0.354	1.4	0.003	0.018	67
Rainbow Trout	Sand Creek	RG_SC_RBT-M-12_2020-04-21	1303	0.237	0.401	<0.042	0.062	10747	20733	1.3	0.001	1676	0.636	0.04	0.071	1.2	<0.001	<0.017	53
Rainbow Trout	Elk River	RG_ER_RBT-M-01_2020-04-22	1873	0.722	0.201	<0.042	0.172	14614	27985	2	0.002	1677	0.475	0.038	0.11	1.7	<0.001	0.019	23
Rainbow Trout	Gold Creek	RG_GC_RBT-M-01_2020-04-23	1338	1.3	0.263	<0.042	0.337	8382	14313	2.3	<0.001	1077	0.599	0.039	0.211	1.4	0.002	<0.017	21
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-01_2020-04-20	1460	0.708	0.231	0.046	1	12140	24979	1.9	0.007	1842	1.2	0.039	0.226	1.6	0.005	0.096	26
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-02_2020-04-21	819	0.397	0.762	0.052	0.444	10213	18437	3.4	0.005	2538	0.603	0.029	0.373	1.6	0.001	0.062	46
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-03_2020-04-21	1608	0.564	0.247	<0.042	0.957	12745	21092	4.1	0.003	1744	1.5	0.024	0.246	1.6	0.001	0.025	53
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-04_2020-04-21	1412	0.416	0.277	<0.042	0.465	12593	22978	3.6	0.003	1645	1	0.03	0.294	1.6	<0.001	0.025	48
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-05_2020-04-21	1372	0.67	0.345	<0.042	1.1	12626	23987	2.4	0.003	2055	1.6	0.045	0.103	2.1	0.006	0.053	58
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-06_2020-04-21	1467	1.1	1.6	<0.042	1.1	11259	19277	1.9	0.004	2447	1.2	0.022	0.15	3.1	0.003	0.095	175
Westslope Cutthroat Trout	Sand Creek	RG_SC_WCT-M-07_2020-04-23	1447	1	0.24	<0.042	1.2	11383	17300	2.2	0.003	767	1.4	0.008	0.137	6.3	0.007	0.138	20
Westslope Cutthroat Trout	Elk River	RG_ER_WCT-M-01_2020-04-25	1107	0.653	0.216	<0.042	0.229	10473	18479	5.6	0.002	1258	0.557	0.04	0.12	1.3	<0.001	0.017	20
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-01_2020-04-21	864	1.6	0.209	<0.042	0.573	8297	10898	5.1	0.005	2439	0.97	0.041	0.077	1.6	<0.001	0.036	39
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-02_2020-04-21	1239	3.4	0.222	<0.042	0.473	9728	16149	1.4	<0.001	2093	0.925	0.009	0.014	2.3	0.006	0.036	17
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-03_2020-04-21	808	0.664	0.274	<0.042	0.358	10563	26699	4.1	0.002	3052	0.336	0.038	0.029	1.3	<0.001	0.017	18
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-04_2020-04-21	787	1.9	0.332	<0.042	0.451	10573	16694	2.3	0.003	4693	0.39	0.034	0.059	1.2	<0.001	<0.017	37
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-05_2020-04-21	965	0.892	0.29	<0.042	1.3	9010	13592	2.5	0.002	1791	1.2	0.013	0.064	1.7	<0.001	0.024	19
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-06_2020-04-23	1188	0.809	0.205	<0.042	0.444	9684	19385	5.2	0.003	2096	0.625	0.057	0.048	1.5	<0.001	<0.017	42
Westslope Cutthroat Trout	Gold Creek	RG_GC_WCT-M-07_2020-04-23	1306	2.9	0.131	<0.042	1.3	11690	19267	3	0.002	1462	0.923	0.043	0.058	14	0.005	0.152	26
Yellow Perch	Elk River	RG_ER_YP-M-01_2020-04-22	1340	0.612	1.8	<0.042	0.559	13948	28473	3.5	<0.001	2738	0.492	0.047	0.09	1.9	<0.001	0.026	41
Yellow Perch	Elk River	RG_ER_YP-M-02_2020-04-22	1385	0.615	0.193	<0.042	0.33	9962	19037	3.4	<0.001	1184	0.534	0.055	0.035	1.3	<0.001	<0.017	33

Table F.5: **Total Metal Analysis for Fish Muscle Tissue Samples Collected by Montana FWP, Koocanusa Reservoir, May 2020**

Species	Tissue	Sample ID	%TS	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Largescale Sucker	Muscle	RG_Rexford-CSU-01-muscle	22.28	1.78	0.024	0.179	0.643	0.064	4.22	0.009	0.2	0.03	1.71	20.7	0.025
		RG_Rexford-CSU-02-muscle	19.07	5.56	0.029	0.119	0.168	0.075	4.93	0.01	0.234	0.035	1.27	15	0.023
		RG_Rexford-CSU-03-muscle	18.6	6.36	0.028	0.144	0.91	0.073	4.82	0.01	0.228	0.041	1.51	66.2	0.049
		RG_Rexford-CSU-04-muscle	19.1	1.31	0.028	0.139	0.153	0.075	4.91	0.011	0.233	0.04	1.31	20	0.023
		RG_Rexford-CSU-05-muscle	18.54	11.1	0.028	0.113	0.528	0.073	4.78	0.023	0.226	0.042	1.28	34.7	0.065
		RG_Rexford-CSU-06-muscle	17.94	4.62	0.03	0.138	0.58	0.078	5.13	0.011	2.1	0.041	1.1	30.4	0.024
		RG_Rexford-CSU-07-muscle	16.59	21.1	0.03	0.158	0.61	0.08	5.24	0.019	0.248	0.045	1.31	55	0.041
		RG_Rexford-CSU-08-muscle	19.91	7.16	0.026	0.109	1.93	0.069	4.5	0.009	0.213	0.044	1.18	17.3	0.028
	Ovary	RG_Rexford-CSU-01-ovary	37.61	0.55	0.023	0.131	0.233	0.037	2.44	0.005	0.116	0.109	4.59	24.4	0.012
		RG_Rexford-CSU-02--ovary	34.48	0.93	0.018	0.062	0.715	0.039	2.59	0.008	0.123	0.111	5.52	38.2	0.012
		RG_Rexford-CSU-03--ovary	34.66	0.93	0.015	0.086	0.711	0.041	2.66	0.02	0.126	0.122	5.35	38.6	0.013
		RG_Rexford-CSU-04--ovary	31.67	0.91	0.016	0.084	0.502	0.043	2.82	0.032	0.134	0.125	6.28	45.6	0.013
		RG_Rexford-CSU-05--ovary	22.14	4.86	0.013	0.258	0.998	0.016	1.08	0.15	0.051	0.15	23.4	108	0.043
		RG_Rexford-CSU-06--ovary	16.49	33.4	0.023	0.494	0.979	0.03	1.97	0.076	0.093	0.287	35.9	301	0.084
		RG_Rexford-CSU-07--ovary	20.32	26	0.014	0.282	1.49	0.019	1.23	0.194	0.094	0.147	20	291	0.049
		RG_Rexford-CSU-08--ovary	21.27	10.8	0.013	0.27	1.07	0.028	1.81	0.054	0.087	0.284	14.5	114	0.052
Peamouth Chub	Muscle	RG_Rexford-PCC-01-muscle	18.68	4.61	0.029	0.117	1.61	0.076	5	0.015	1.3	0.033	1.56	33.6	0.024
		RG_Rexford-PCC-02-muscle	20.53	9.73	0.027	0.131	1.58	0.068	4.46	0.043	0.26	0.023	1.32	21.8	0.034
		RG_Rexford-PCC-03-muscle	18.68	1.13	0.03	0.153	1.19	0.076	5	0.02	0.237	0.026	1.41	17.5	0.024
		RG_Rexford-PCC-04-muscle	19.51	3.95	0.026	0.128	0.834	0.069	4.49	0.013	0.435	0.025	1.31	29.6	0.046
		RG_Rexford-PCC-05-muscle	20.36	1.68	0.025	0.145	1.61	0.067	4.4	0.009	0.209	0.023	2.1	20.2	0.037
		RG_Rexford-PCC-06-muscle	20.26	0.99	0.026	0.146	1.15	0.067	4.39	0.009	0.208	0.023	1.25	14.4	0.025
		RG_Rexford-PCC-07-muscle	17.97	1.26	0.029	0.202	1.81	0.075	4.92	0.01	0.233	0.03	1.33	20	0.023
		RG_Rexford-PCC-08-muscle	19.17	1.12	0.029	0.116	0.936	0.075	4.94	0.01	0.234	0.026	1.59	18.9	0.023
	Ovary	RG_Rexford-PCC-01-ovary	32.93	1.73	0.009	0.123	2.16	0.017	1.14	0.023	0.054	0.059	3.57	60.4	0.017
		RG_Rexford-PCC-02-ovary	36.42	0.57	0.015	0.105	0.526	0.039	2.53	0.022	0.12	0.048	3.7	44.9	0.012
		RG_Rexford-PCC-03-ovary	32.22	8.41	0.024	0.132	1.89	0.044	2.87	0.077	0.136	0.087	4.98	80.2	0.016
		RG_Rexford-PCC-04-ovary	39.13	0.66	0.016	0.055	0.408	0.036	2.37	0.008	0.112	0.054	2.96	34.7	0.017
		RG_Rexford-PCC-05-ovary	38.23	0.55	0.018	0.193	0.795	0.037	2.43	0.009	0.115	0.052	3.52	49.5	0.011
		RG_Rexford-PCC-06-ovary	38.98	0.51	0.024	0.121	0.462	0.034	2.25	0.01	0.106	0.058	3.6	46.1	0.012
		RG_Rexford-PCC-07-ovary	37.15	0.56	0.017	0.112	1.13	0.084	2.48	0.036	0.117	0.087	3.82	51.2	0.012
		RG_Rexford-PCC-08-ovary	35.86	0.59	0.019	0.112	0.556	0.04	2.6	0.029	0.123	0.055	3.87	65.1	0.015
Rainbow Trout	Muscle	RG_Rexford-RBT-01-muscle	25.43	0.82	0.021	0.122	0.061	0.055	3.62	0.008	0.217	0.025	1.6	19.1	0.017
		RG_Rexford-RBT-02-muscle	21.5	0.95	0.024	0.087	0.114	0.064	4.22	0.009	0.2	0.022	2.12	16.3	0.02
		RG_Rexford-RBT-03-muscle	19.95	1.08	0.028	0.059	0.095	0.073	4.76	0.012	0.228	0.025	1.56	19.2	0.023
		RG_Rexford-RBT-04-muscle	22.9	0.91	0.023	0.054	0.038	0.061	4.01	0.012	0.192	0.022	0.991	14.8	0.019
		RG_Rexford-RBT-05-muscle	21.74	0.91	0.023	0.027	0.062	0.061	4.01	0.008	0.19	0.021	1.21	16	0.019
		RG_Rexford-RBT-06-muscle	19.99	1.07	0.027	0.11	0.086	0.072	4.74	0.028	0.224	0.04	1.39	24	0.022
	Ovary	RG_Rexford-RBT-03-ovary	21.95	4.01	0.017	0.209	0.176	0.038	2.49	0.076	0.144	0.604	22.1	356	0.022
Westslope Cutthroat	Muscle	RG_Rexford-WCT-01-muscle	20.34	0.97	0.025	0.076	0.089	0.065	4.27	0.009	0.658	0.043	1.19	22.1	0.02
	Ovary	RG_Rexford-WCT-01-ovary	34.7	1.96	0.045	0.13	0.299	0.119	7.79	0.095	0.641	0.824	20.4	415	0.041

Table F.5: Total Metal Analysis for Fish Muscle Tissue Samples Collected by Montana FWP, Koocanusa Reservoir, May 2020

Sample ID			Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Selenium mg/kg	Silver mg/kg	Strontium mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
Largescale Sucker	Muscle	RG_Rexford-CSU-01-muscle	2.26	0.817	0.018	0.061	0.942	0.007	2.71	0.016	0.031	0.923	0.001	0.018	23.7
		RG_Rexford-CSU-02-muscle	0.502	0.655	0.021	0.081	4.86	0.008	0.242	0.018	0.036	1.08	0.001	0.021	16.7
		RG_Rexford-CSU-03-muscle	2.46	0.719	0.02	0.114	4.07	0.008	2.18	0.021	0.035	1.05	0.002	0.02	22.3
		RG_Rexford-CSU-04-muscle	0.734	0.526	0.021	0.09	4.76	0.008	0.187	0.018	0.036	1.07	0.0007	0.021	16.9
		RG_Rexford-CSU-05-muscle	1.79	1.1	0.02	0.105	3.92	0.008	0.761	0.018	0.035	1.82	0.002	0.026	19.6
		RG_Rexford-CSU-06-muscle	1.26	0.561	0.022	0.097	6.89	0.008	1.04	0.019	0.038	1.12	0.0005	0.022	18
		RG_Rexford-CSU-07-muscle	1.97	0.933	0.022	0.151	3.48	0.008	0.634	0.019	0.039	1.14	0.001	0.038	21.5
		RG_Rexford-CSU-08-muscle	3.03	0.413	0.019	0.076	3.51	0.007	4.54	0.031	0.033	0.982	0.0008	0.019	21.6
	Ovary	RG_Rexford-CSU-01-ovary	9.53	0.0173	0.053	0.039	1.22	0.04	0.201	0.009	0.018	0.533	0.001	0.011	73.8
		RG_Rexford-CSU-02--ovary	21.9	0.0136	0.106	0.067	5.53	0.028	0.283	0.011	0.019	0.565	0.0009	0.011	101
		RG_Rexford-CSU-03--ovary	15.6	0.0162	0.081	0.076	5.35	0.03	0.309	0.013	0.02	0.582	0.001	0.011	100
		RG_Rexford-CSU-04--ovary	20.9	0.0151	0.125	0.065	4.99	0.027	0.324	0.015	0.021	0.616	0.0007	0.012	97.1
		RG_Rexford-CSU-05--ovary	2.21	0.0594	0.29	0.14	3.55	0.054	0.334	0.021	0.009	0.087	0.002	0.035	481
		RG_Rexford-CSU-06--ovary	4.38	0.0316	0.141	0.263	8.75	0.111	0.464	0.046	0.016	0.766	0.022	0.104	966
		RG_Rexford-CSU-07--ovary	4.3	0.063	0.206	0.153	3.28	0.053	0.672	0.028	0.011	0.446	0.008	0.051	678
		RG_Rexford-CSU-08--ovary	9.88	0.0302	0.096	0.233	5.13	0.044	0.64	0.071	0.013	0.237	0.003	0.029	968
Peamouth Chub	Muscle	RG_Rexford-PCC-01-muscle	0.618	0.972	0.021	0.12	2.25	0.008	0.775	0.018	0.037	1.09	0.0005	0.021	30.3
		RG_Rexford-PCC-02-muscle	1.69	0.57	0.019	0.088	1.95	0.007	4.77	0.019	0.033	0.973	0.0008	0.019	27.1
		RG_Rexford-PCC-03-muscle	0.773	0.66	0.021	0.088	3.76	0.008	1.38	0.02	0.037	1.09	0.0005	0.021	33.6
		RG_Rexford-PCC-04-muscle	1.07	0.379	0.019	0.116	2.95	0.007	2.19	0.017	0.033	0.981	0.001	0.019	24.9
		RG_Rexford-PCC-05-muscle	1.36	0.487	0.019	0.087	2.2	0.007	3.27	0.025	0.032	0.961	0.002	0.019	42.1
		RG_Rexford-PCC-06-muscle	0.962	0.656	0.018	0.058	2.55	0.007	3.47	0.016	0.032	0.959	0.001	0.018	28.7
		RG_Rexford-PCC-07-muscle	0.728	0.811	0.021	0.083	3.55	0.008	2.03	0.025	0.036	1.07	0.001	0.021	37.7
		RG_Rexford-PCC-08-muscle	0.907	0.649	0.021	0.071	2.41	0.008	2.6	0.018	0.036	1.08	0.0009	0.021	27.1
	Ovary	RG_Rexford-PCC-01-ovary	9.86	0.0492	0.097	0.052	13.4	0.026	0.3	0.008	0.009	0.025	0.004	0.027	95.3
		RG_Rexford-PCC-02-ovary	6.99	0.0193	0.101	0.041	10.1	0.02	0.26	0.013	0.019	0.552	0.001	0.011	78.7
		RG_Rexford-PCC-03-ovary	10.7	0.036	0.137	0.128	11	0.033	0.376	0.012	0.021	0.626	0.004	0.035	101
		RG_Rexford-PCC-04-ovary	3.78	0.00921	0.082	0.064	13.4	0.019	0.174	0.009	0.017	0.518	0.004	0.01	75.1
		RG_Rexford-PCC-05-ovary	6.76	0.0198	0.097	0.076	5.3	0.02	0.187	0.009	0.018	0.53	0.001	0.01	86.1
		RG_Rexford-PCC-06-ovary	3.32	0.0191	0.077	0.038	7.88	0.028	0.169	0.008	0.017	0.49	0.001	0.01	66.5
		RG_Rexford-PCC-07-ovary	4.24	0.0275	0.082	0.06	11.9	0.021	0.225	0.015	0.018	0.541	0.003	0.016	87.8
		RG_Rexford-PCC-08-ovary	6.25	0.0229	0.114	0.055	7.7	0.025	0.25	0.01	0.019	0.569	0.003	0.016	67.7
Rainbow Trout	Muscle	RG_Rexford-RBT-01-muscle	0.333	0.374	0.015	0.048	2.44	0.006	0.264	0.136	0.027	0.791	0.0004	0.015	20.9
		RG_Rexford-RBT-02-muscle	0.482	0.353	0.018	0.055	2.36	0.007	0.756	0.151	0.031	0.921	0.0006	0.018	18.1
		RG_Rexford-RBT-03-muscle	0.337	0.683	0.02	0.073	2.22	0.008	0.534	0.055	0.035	1.04	0.0005	0.02	23.3
		RG_Rexford-RBT-04-muscle	0.274	0.153	0.017	0.053	1.51	0.006	0.156	0.057	0.03	0.876	0.0004	0.017	16
		RG_Rexford-RBT-05-muscle	0.32	0.143	0.017	0.055	1.45	0.006	0.287	0.015	0.03	0.877	0.0004	0.017	20.3
		RG_Rexford-RBT-06-muscle	0.582	0.226	0.02	0.077	1.88	0.007	0.46	0.02	0.035	1.03	0.0005	0.02	20.1
	Ovary	RG_Rexford-RBT-03-ovary	9.27	-	0.081	0.072	12.1	0.034	0.676	0.062	0.018	0.078	0.001	0.012	271
Westslope Cutthroat	Muscle	RG_Rexford-WCT-01-muscle	0.397	0.144	0.018	0.06	3.74	0.007	0.425	0.016	0.031	0.934	0.0004	0.018	15.9
	Ovary	RG_Rexford-WCT-01-ovary	20.7	-	0.068	0.253	34.5	0.116	0.583	0.053	0.057	0.446	0.003	0.033	487

Table F.6: Total Metal Analysis for Fish Muscle Tissue Samples Collected by Montana, Koocanusa Reservoir, September 2020

Species	Location	Tissue	Sample ID	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-09-muscle	0.82	0.018	0.129	0.150	0.055	3.62	0.008	0.171	0.019	1.3	16	0.031
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-10-muscle	1.00	0.018	0.135	2.91	0.064	4.17	0.009	0.197	0.022	1.1	10	0.020
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-11-muscle	1.43	0.015	0.171	0.477	0.060	3.96	0.008	0.188	0.021	1.3	14	0.019
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-12-muscle	0.54	0.010	0.053	0.28	0.036	2.38	0.005	0.113	0.013	0.84	10	0.011
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-13-muscle	0.97	0.019	0.087	0.376	0.066	4.30	0.009	0.204	0.023	0.98	9	0.020
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-14-muscle	0.87	0.018	0.042	0.212	0.058	3.83	0.008	0.181	0.020	0.98	10	0.018
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-15-muscle	0.79	0.021	0.208	0.118	0.054	3.51	0.007	0.166	0.018	1.5	19	0.017
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-01-ovary	1.71	0.015	0.049	0.360	0.063	4.14	0.009	0.196	0.059	3.7	112	0.020
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-02-ovary	0.84	0.010	0.044	0.071	0.057	3.71	0.010	0.176	0.070	4.1	132	0.018
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-03-ovary	1.17	0.017	0.277	0.293	0.028	1.86	0.004	0.088	0.020	2.2	53	0.009
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-04-ovary	2.02	0.145	0.219	0.967	0.088	5.78	0.017	0.274	0.030	2.2	78	0.195
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-05-ovary	0.89	0.020	0.120	0.072	0.060	3.95	0.023	0.187	0.050	3.6	119	0.019
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-06-ovary	0.42	0.017	0.099	0.041	0.029	1.87	0.006	0.089	0.030	2.6	130	0.009
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-07-ovary	0.84	0.017	0.246	0.057	0.056	3.69	0.008	0.175	0.048	3.0	84	0.017
Northern Pikeminnow	Montana	Ovary	RG_Rexford-NSC-08-ovary	0.52	0.019	0.233	0.107	0.029	1.89	0.005	0.089	0.028	2.7	83	0.009
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-09-ovary	1.26	0.072	0.125	0.848	0.070	4.57	0.010	0.216	0.024	2.4	114	0.095
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-10-ovary	0.73	0.019	0.215	0.028	0.045	2.92	0.008	0.138	0.036	2.5	94	0.014
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-11-ovary	0.73	0.020	0.116	0.082	0.046	3.01	0.055	0.142	0.016	1.9	51	0.014
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-12-ovary	1.04	0.020	0.125	0.095	0.058	3.78	0.010	0.179	0.053	3.9	276	0.018
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-13-ovary	0.57	0.015	0.328	0.043	0.038	2.52	0.005	0.119	0.017	1.3	96	0.012
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-14-ovary	0.83	0.024	0.093	0.089	0.056	3.65	0.008	0.173	0.052	3.1	164	0.017
Northern Pikeminnow	Canada	Ovary	RG_Canada-NSC-15-ovary	0.89	0.012	0.054	0.098	0.058	3.81	0.008	0.181	0.048	3.7	134	0.018
Rainbow Trout	Montana	Muscle	RG_Rexford-RBT-01-muscle	1.05	0.011	0.052	0.109	0.063	4.13	0.009	0.196	0.022	0.83	18	0.020
Rainbow Trout	Montana	Muscle	RG_Rexford-RBT-02-muscle	0.93	0.011	0.156	0.088	0.063	4.12	0.009	0.195	0.022	0.94	10	0.020
Rainbow Trout	Montana	Muscle	RG_Rexford-RBT-03-muscle	0.96	0.012	0.053	0.210	0.065	4.25	0.016	0.201	0.024	1.8	14	0.020
Rainbow Trout	Montana	Ovary	RG_Rexford-RBT-01-ovary	2.08	0.030	0.120	0.251	0.056	3.65	0.017	0.173	0.183	12	338	0.019
Rainbow Trout	Montana	Ovary	RG_Rexford-RBT-02-ovary	3.30	0.040	0.208	0.165	0.094	6.13	0.018	0.290	0.220	7.5	232	0.029
Rainbow Trout	Montana	Ovary	RG_Rexford-RBT-03-ovary	17.9	0.296	0.375	2.06	1.21	79.2	0.167	3.75	0.417	9.1	239	0.375
Westslope Cutthroat	Montana	Muscle	RG_Rexford-WCT-01-muscle	1.53	0.011	0.271	0.333	0.066	4.29	0.009	0.203	0.028	2.3	17	0.020
Westslope Cutthroat	Montana	Muscle	RG_Rexford-WCT-02-muscle	0.92	0.011	0.119	0.084	0.062	4.06	0.009	0.192	0.021	1.4	15	0.019
Westslope Cutthroat	Montana	Ovary	RG_Rexford-WCT-01-ovary	7.29	0.140	0.287	0.348	0.492	32.2	0.068	1.53	0.283	11	180	0.153
Westslope Cutthroat	Montana	Ovary	RG_Rexford-WCT-02-ovary	0.96	0.017	0.238	0.570	0.029	1.89	0.030	0.090	0.232	28	243	0.009

Table F.6: **Total Metal Analysis for Fish Muscle Tissue Samples Collected by Montana, Koocanusa Reservoir, September 2020**

Sample ID				Manganese mg/kg	Mercury ng/g	Molybdenum mg/kg	Nickel mg/kg	Selenium mg/kg	Silver mg/kg	Strontium mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
Northern Pikeminnow	Montana	Muscle	RG_Rexford-NSC-09-muscle	0.239	841	0.015	0.067	1.1	0.006	0.203	0.013	0.027	0.046	0.0004	0.015	15
			RG_Rexford-NSC-10-muscle	2.6	901	0.018	0.055	0.98	0.007	24	0.022	0.031	0.103	0.003	0.023	54
			RG_Rexford-NSC-11-muscle	0.319	1,270	0.017	0.052	0.97	0.006	1.08	0.015	0.029	0.071	0.001	0.017	16
			RG_Rexford-NSC-12-muscle	0.274	617	0.010	0.031	0.85	0.004	0.473	0.009	0.018	0.026	0.0003	0.010	11
			RG_Rexford-NSC-13-muscle	0.518	780	0.018	0.057	1.6	0.007	0.625	0.016	0.032	0.047	0.001	0.018	19
			RG_Rexford-NSC-14-muscle	0.283	1,370	0.016	0.050	1.4	0.006	0.748	0.014	0.028	0.042	0.0004	0.016	15
			RG_Rexford-NSC-15-muscle	0.146	1,260	0.015	0.046	1.1	0.006	0.279	0.013	0.026	0.039	0.0004	0.015	16
		Ovary	RG_Rexford-NSC-01-ovary	2.0	259	0.129	0.056	4.6	0.007	0.348	0.046	0.031	0.046	0.002	0.045	250
			RG_Rexford-NSC-02-ovary	1.5	190	0.160	0.049	3.5	0.009	0.383	0.042	0.027	0.041	0.002	0.044	159
			RG_Rexford-NSC-03-ovary	0.826	49.5	0.033	0.039	3.8	0.003	0.158	0.037	0.014	0.053	0.001	0.009	272
			RG_Rexford-NSC-04-ovary	0.685	105	0.046	0.076	1.9	0.009	0.177	0.032	0.043	0.085	0.002	0.024	50
			RG_Rexford-NSC-05-ovary	3.6	127	0.125	0.052	7.2	0.006	0.345	0.050	0.029	0.044	0.0004	0.018	210
			RG_Rexford-NSC-06-ovary	1.8	108	0.089	0.032	6.9	0.003	0.241	0.044	0.014	0.024	0.001	0.028	322
			RG_Rexford-NSC-07-ovary	1.6	217	0.109	0.049	1.9	0.006	0.274	0.037	0.027	0.048	0.001	0.025	115
			RG_Rexford-NSC-08-ovary	0.817	77.6	0.041	0.033	2.2	0.003	0.389	0.056	0.014	0.037	0.0003	0.008	278
	Canada		RG_Canada-NSC-09-ovary	0.694	109	0.036	0.074	3.3	0.007	0.346	0.021	0.034	0.069	0.001	0.019	192
			RG_Canada-NSC-10-ovary	0.650	103	0.090	0.038	1.5	0.005	0.221	0.027	0.022	0.032	0.0004	0.026	145
			RG_Canada-NSC-11-ovary	0.544	246	0.032	0.047	2.4	0.005	0.111	0.025	0.022	0.044	0.001	0.018	42
			RG_Canada-NSC-12-ovary	1.8	157	0.107	0.050	3.0	0.006	0.316	0.041	0.028	0.042	0.002	0.041	182
			RG_Canada-NSC-13-ovary	0.522	138	0.041	0.033	1.5	0.004	0.130	0.014	0.019	0.036	0.002	0.011	90
			RG_Canada-NSC-14-ovary	1.8	214	0.111	0.048	4.7	0.006	0.398	0.037	0.027	0.046	0.001	0.046	178
			RG_Canada-NSC-15-ovary	2.1	113	0.116	0.050	3.8	0.006	0.322	0.049	0.028	0.042	0.001	0.016	232
Rainbow Trout	Montana	Muscle	RG_Rexford-RBT-01-muscle	0.607	220	0.017	0.054	2.0	0.007	0.406	0.024	0.030	0.046	0.001	0.017	16
			RG_Rexford-RBT-02-muscle	0.281	228	0.017	0.054	1.5	0.007	0.370	0.015	0.030	0.046	0.0004	0.017	16
			RG_Rexford-RBT-03-muscle	1.4	166	0.018	0.056	2.1	0.007	0.825	0.016	0.031	0.059	0.001	0.018	22
		Ovary	RG_Rexford-RBT-01-ovary	5.0	-	0.063	0.077	8.4	0.014	0.425	0.029	0.027	0.067	0.002	0.015	328
			RG_Rexford-RBT-02-ovary	2.6	-	0.046	0.209	5.0	0.010	0.619	0.023	0.045	0.143	0.002	0.026	296
			RG_Rexford-RBT-03-ovary	13	-	0.789	3.010	5.1	0.125	2.42	0.292	0.583	1.00	0.008	0.333	315
Westslope Cutthroat		Muscle	RG_Rexford-WCT-01-muscle	0.728	151	0.018	0.057	1.3	0.007	0.223	0.016	0.032	0.083	0.001	0.018	20
			RG_Rexford-WCT-02-muscle	0.395	192	0.017	0.053	2.2	0.006	0.340	0.015	0.030	0.045	0.001	0.017	16
		Ovary	RG_Rexford-WCT-01-ovary	11.3	-	0.136	0.424	6.3	0.051	0.983	0.119	0.237	0.407	0.003	0.136	233
			RG_Rexford-WCT-02-ovary	15	50	0.041	0.025	4.7	0.084	1.18	0.010	0.014	0.036	0.002	0.008	257

Table F.7: **Statistical Comparison of Mercury Concentration Between Upstream (RG_SC) and Downstream (RG_ER, RG_GC, RG_REX) Areas, Koocanusa Reservoir Monitoring Program, 2020**

Species	Tissue	Sample Size				ANCOVA Model Statistics			Measure of Central Tendency[b]					Pairwise Comparisons[c]					
						Interaction Model	Parallel Slope Model	Covariate Value for Comparisons[a]						Sand Creek vs. Elk River		Sand Creek vs. Gold Creek		Sand Creek vs. Rexford	
		Sand Creek	Elk River	Gold Creek	Rexford	Interaction P-value	Covariate P-value		Statistic	Sand Creek	Elk River	Gold Creek	Rexford	P-value	MOD (%)[d]	P-value	MOD (%)[d]	P-value	MOD (%)[d]
Peamouth Chub	Muscle	10	10	10	8	0.755	0.006	23.5	Adjusted Mean	0.615	0.610	0.785	0.600	1.000	ns	0.150	ns	0.997	ns
Redside Shiner	Muscle	10	10	10	-	0.900	0.128	-	Mean	0.463	0.582	0.647	-	0.215	ns	0.034	40	-	-
Northern Pikeminnow	Muscle	8	7	-	15	0.569	0.005	38.5	Predicted Mean	0.760	0.811	-	0.740	ns	ns	-	-	ns	ns

Significant P-value (Area P-value < 0.1, Interaction P-value < 0.05, Pairwise P-value < 0.1/n contrasts).

Magnitude of Difference > 25%.

Notes: "-" = no data. na = no post-hoc comparison conducted for interaction between covariate and area. Peamouth Chub Ovary analysis was completed using a censored regression. All other analysis was conducted using an ANCOVA as all data was above the LDL. Peamouth Chub ovary covariate values are the minimum and maximum values where data overlaps.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The geometric mean. The predicted means of the regression line equations are reported for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVA when a significant interaction is observed.

[c] Pairwise comparisons conducted using Tukey's Honestly Significant Differences (differences in means for parallel slope models; differences in slopes for interaction models).

[d] Magnitude of Difference (MOD) calculated as the difference in Measure of Central Tendency (MCT) between areas (downstream minus upstream), expressed as a percentage of the upstream area MCT.