Appendix 5.1.2.6B
Fish and Aquatic Resources
2013 Baseline Report

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Blackwater Gold Project



December 2013 / AMEC VE52277

amec

Blackwater Gold Project

Fish and Aquatic Resources
2013 Baseline Report

Part 1
Introduction, Scope and Objectives, Study Area, and Methods

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ACRONYMS

Abbreviations and Units of Measure	Definition
AFS	Atomic Fluorescence Spectrometry
ALS	ALS Environmental Services
AMEC	AMEC Environment & Infrastructure
ANOVA	Analysis of variance
Avison	Avison Management Services Ltd.
BB	Burbot
BMI	Benthic macroinvertebrate
Bio-Limno	Bio-Limno Laboratories Inc.
B-C	Bray-Curtis Similarity Index
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MOE	British Columbia Ministry of Environment
BC MOF	British Columbia Ministry of Forests
BMI	Benthic Macroinvertebrate
CABIN	Canadian Aquatic Biomonitoring Network
Cbf	Dominant cobbles, subdominant boulders and fines
Cbg	Dominant cobbles, subdominant boulders and gravel
CCG	Slimy sculpin
CCME	Canadian Council of Ministers of the Environment
cells/cm^2	Cells per centimetres squared
CL	Confidence limit
cm	Centimetre
cm^2	Centimetres squared
Cordillera	Cordillera Consulting
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch-per-unit-effort
CSU	Largescale sucker
CVAFS	Cold Vapour Atomic Fluorescence Spectrometry
°C	Degrees Celsius
D	Simpson's Diversity Index
dB	Decibel
$D_{1,2}$	Dominance Identity Index
D_L	Shoreline development
D_S	Secchi depth

Abbreviations and Units of Measure	Definition
DFO	Fisheries and Oceans Canada
DO	Dissolved oxygen
EC	Environment Canada
EF	Electrofishing
EPT	Ephemeroptera, Plecoptera, and Trichoptera
Fg	Dominant fines, subdominant gravels
FHAP	Fish Habitat Assessment Procedures
FI	Food Ingestion rate
FISS	Fisheries Information Summary System
FoD	Frequency of detection
FSR	Forest Service Road
FWA	Freshwater Watershed Atlas
g	Gram
Gbf	Dominant gravels, subdominant boulders and fines
Gf	Dominant gravels, subdominant fines
GIS	Geographic Information System
GN	Gillnet
GC	Gas Chromatography
GCAFS	Gas Chromatography Atomic Fluorescence Spectrometry
GPS	Global Positioning System
GSI	Gonadosomatic index
H'	Shannon's diversity index
ha	Hectare
HBI	Hilsenhoff biotic index
HR-ICP-MS	High Resolution-Inductively Coupled Plasma-Mass Spectroscopy
HSI	Hepatosomatic index
ICP-MS	Inductively Coupled Plasma-Mass Spectroscopy
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrophotometry
ID	Identification
ITIS	Integrated Taxonomic Information System
J	Pielou's Evenness index
k	Light extinction coefficient
K	Von Bertalanffy growth rate
kg	Kilogram
km	Kilometre
km^2	Kilometres squared

Abbreviations and Units of Measure	Definition
Knight Piésold	Knight Piésold Ltd.
KO	Kokanee
kV	kilovolt
L	Liver
LiDAR	Light Detection and Ranging
ln	Natural logarithm
LSA	Local Study Area
LWD	Large woody debris
L_{∞}	Asymptotic length
m	Metre
m^2	Metres squared
m^3	Metres cubed
M	Muscle
max	Maximum
masl	Metres above sea level
MDL	Method detection limit
MeHg	Methyl mercury
µg	Microgram
$\mu g/cm^2$	Micrograms per centimetres squared
$\mu g/m^3$	Micrograms per cubic metre
µm	Micrometre
µS/cm	MicroSiemens per centimetre
mg	Milligram
mg/kg wwt	Milligrams per kilogram wet weight
mg/L	Milligrams per litre
min	Minimum
mL	Millilitre
mm	Millimetre
MMER	*Metal Mining Effluent Regulations*
m/s	Metre per second
MT	Minnow trapping
MW	Mountain whitefish
n	Number of samples
n/a	Not applicable / available
NAD	North American datum
NCD	Non-continuous drainage

Abbreviations and Units of Measure	Definition
ND	Not detected
NFC	No fish captured
NIST	National Institute of Standards and Technology
North / South	North / South Consultants Inc.
NRC	National Research Council
NVC	No visible channel
NSC	Northern pikeminnow
OBBN	Ontario benthos biomonitoring network
PCA	Principal component analysis
%	Percent
Proponent (the)	New Gold Inc.
Project (the)	Proposed Blackwater Gold Project
QA/QC	Quality Assurance / Quality Control
r^2	Coefficient of determination
RB	Rainbow trout
RISC	Resource Inventory Standards Committee
RPD	Relative percent difference
RSA	Regional Study Area
RTK	Real Time Kinetic
S	Taxa richness
S_{Eff}	Sorting efficiency
SE	Standard error
Shuksan	Shuksan Fisheries Consulting
SWD	Small woody debris
T_0	Age at zero length
TDI	Tolerable Daily Intake
TIN	Triangular Irregular Network
TK	Traditional Knowledge
TLU	Traditional Land Use
TRG	Tissue Residue Guideline
TS	Target strength
UHF	Ultra High Frequency
US	United States
US DOI	United States Department of the Interior
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator

Abbreviations and Units of Measure	Definition
W	Weight
WF	Whole Fish
WSU	White sucker
wwt	Wet weight
YOY	Young-of-the-year
$Z_{1\%}$	Euphotic depth
Z_{mean}	Mean depth
Z_{max}	Maximum depth
Z_r	Relative depth

EXECUTIVE SUMMARY

This report describes the results of baseline surveys of fish and fish habitat conducted by AMEC Environment and Infrastructure (AMEC) for New Gold Inc. (the Proponent) in 2013 in streams and lakes near the proposed Blackwater Gold Project (the Project).

Overwintering Habitat

From 17 to 19 March 2013, 20 stream sites and 3 lake sites were assessed for overwintering habitat quality in four watersheds of the Blackwater Local Study Area (LSA). This was the second year of overwintering habitat surveys; the first survey was from 6 to 9 March 2012. The purpose of these surveys was to determine the abundance and quality of available overwintering habitat and to determine if overwintering habitat is limiting fish production. Sites were identified by helicopter reconnaissance. Holes were drilled through the ice and measurements of dissolved oxygen (DO), temperature, and conductivity were taken from the water below the ice. Overwintering habitat quality was assessed from the mean DO concentration and water depth.

Four of the stream sites (or 20% of the total) were classified as good quality habitat, 9 (45%) as fair quality habitat, 4 (20%) as poor quality habitat and 3 (15%) as no habitat.

Eight of the 20 sites were visited in both March 2012 and March 2013. There was no change in overwintering habitat quality for two of the eight sites, but habitat quality decreased from March 2012 to March 2013 for three sites and increased for three sites.

In all three lakes, habitat quality decreased with depth because DO concentrations decreased with depth. Similar profiles of DO with depth (and overwintering habitat quality with depth) were observed in two of the lakes in March 2012. This pattern is typical for late winter conditions in temperate zone lakes.

These results show that there is a range of overwintering habitat quality in streams and lakes of the Blackwater LSA, but that it varies between years. Hence, the quantity of overwintering habitat of sufficient quality to support fish (i.e., fair and good) may limit fish production in the LSA, but its effect varies between years.

Stream Temperatures

The purpose of the stream temperature monitoring in 2013 was to assess the suitability of stream temperature regimes to support fish during various life stages. This was the third consecutive year of stream temperature monitoring. In 2013, stream water temperatures were measured at seven sites in the LSA.

Mean daily temperatures showed three patterns. The first was the expected dome-shaped variation with season. Mean daily temperatures rose from near 0°C in early May to a maximum of between 11.2°C and 20.8°C in mid-July and early August and then fell to near 0°C in late October. The same pattern was also observed in 2011 and 2012. The second pattern was a gradient of decreasing temperature with increasing elevation. The third pattern was warmer summer temperatures in 2013 than in 2011, but similar summer temperatures between 2013 and 2012.

In general, stream temperatures in the LSA fall below the British Columbia Ministry of Environment (BC MOE) optimal temperature ranges for rainbow trout and kokanee. Hence, low temperatures rather than high temperatures limit aquatic biological processes in the LSA and RSA.

Electrofishing Survey of Lower Davidson Creek

The lower three reaches of Davidson Creek were electrofished from 9 to 11 July 2013 because attempts to electrofish those reaches in late July 2011 and 2012 were halted by the presence of spawning kokanee.

A total electrofishing effort of 6,580 seconds (s) captured 19 rainbow trout and 1 mountain whitefish. Thirteen of those 20 fish were caught in Reach 2. Electrofishing catch-per-unit-effort (CPUE) for the combined three reaches was 0.30 fish/100 s, and fish density was 1.03 fish/100 m^2.

Almost all of the fish were juveniles less than 100 mm long. The majority of rainbow trout (13 out of 17) were less than 1 year of age, 3 were older juveniles (1 and 2 years old), and 1 was a 3 year old male who was most likely a spawner who had not yet returned to Tatelkuz Lake.

Fish and Fish Habitat of Lower Chedakuz Creek

Reach 15 of lower Chedakuz Creek, the outlet of Tatelkuz Lake, was surveyed for fish and fish habitat on 25 July 2013. This was required for purposes of effects assessment because Tatelkuz Lake will be the primary source of water for the mine site.

Reach 15 consists of glide habitat (62%), followed by pools (15%), riffles (8%), and “Other” (15%; wetland complexes).

A total of 468.5 hours of minnow trapping caught five fish: three slimy sculpin (*Cottus cognatus*) and two longnose suckers (*Catostomus catostomus*). A visual survey from the sides of a boat counted an additional 396 rainbow trout and 11 suckers (not identified to species). The majority of rainbow trout were observed in glide habitat, while the majority of suckers were observed in pool habitat.

Fish and Fish Habitat of Creek 705

Fish and fish habitat in Reaches 1 to 6 of Creek 705 were surveyed from 13 to 16 August 2013 to provide baseline information for the purpose of effects assessment. As part of the Blackwater fish habitat mitigation and offset plan, Creek 705 will receive additional flows once Lake 01682LNRS, currently the headwater lake of Davidson Creek, is redirected into Lake 01538UEUT, one of the two headwater lakes of Creek 705.

Reaches 8 to 12 of Creek 705 were surveyed from 12 to 13 September 2013 because this stream, which is currently the inlet stream to Lake 01538UEUT, may be redirected to Lake 01682LNRS as part of the fish habitat mitigation and offset plan.

Habitat in Reaches 1 to 6 was predominantly alternating riffles and pools with cobble substrate. The exception was Reach 3, which consisted of alternating pools and glides. Gradients ranged from 0.4% to 2.2%, mean bankfull width ranged from 1.4 m to 7.6 m, and mean bankfull depth ranged from 0.2 m to 1.1 m.

Reach 7 is Lake 01538UEUT

Habitat in Reach 8 was also mainly alternating riffles and pools. Reach 9 is a single pool with a width of 37.9 m and a mean depth of 0.64 m. Habitat in Reach 10 was alternating riffles and glides. Reaches 11 and 12 were steep with gradients of 7.3% and 9.8%, respectively. No channel was visible in Reach 12. Gradients in Reaches 8 and 10 ranged from 1.0% to 5.5%, mean bankfull width ranged from 1.3 m to 2.0 m, and mean bankfull depth ranged from 0.25 m to 0.46 m.

A total of 8,605 seconds of electrofishing effort was exerted in Reaches 1 to 8 and in Reaches 10 and 11, and 443 rainbow trout were caught. Three burbot were captured in Reach 1. A total of 75.72 hours of minnow trap effort was exerted in the pond of Reach 9 and 925 longnose suckers were caught. No fish were captured in Reaches 10 and 11.

Electrofishing CPUE for rainbow trout ranged from 0.54 fish/100 s in Reach 3 to 13.6 fish/100 s in Reach 1, and densities ranged from 1.6 fish/100 m^2 in Reach 3 to 67.9/100 m^2 in Reach 1.

The majority of fish caught in Creek 705 were juvenile rainbow trout less than 100 mm long. The three burbot caught in Reach 1 ranged in length from 125 to 193 mm. The majority of longnose suckers were between 51 and 100 mm long, indicating that the pond is used mostly for rearing. Schools of fish shorter than 50 mm were seen, but they were too small to be caught in minnow traps.

In summary, Reaches 1 and 2 had good habitat for spawning and rearing rainbow trout. This likely explains why they had the highest densities of juvenile rainbow trout compared to upstream reaches. Reach 3 had extensive network of beaver dams which may have reduced the ability to catch fish and likely explains the low CPUE and density of fish caught.

Reach 8 had low water levels during the survey, which may be why so few fish were caught. Reach 9 had good rearing habitat for juvenile rainbow trout but only longnose suckers were caught. The lack of fish in Reaches 10 and 11 could be due to earlier outmigration of juvenile fish to Lake 01538UEUT. Alternatively, the pond may be a barrier to upstream migration of rainbow trout.

Fish Habitat of Creek 505659

Creek 505659, a second-order tributary to Creek 661, was surveyed for fish habitat on 15 August 2013. Surveys of the fish community of Creek 505659 were completed in 2011 and 2012.

Creek 505659 has three reaches. Habitat in Reaches 1 and 3 consists of alternating riffles and glides with gravel substrate, while habitat in Reach 2 contains alternating glides and pools produced by beaver dams, also with gravel substrate. Mean gradient of habitat units ranges from <1% to 1.5%, mean bankfull width ranges from 2.9 m to 8.2 m, and mean depth ranges from 0.09 m to 0.98 m.

Fish and Fish Habitat at Stream Crossings of the Water Pipeline

Stream crossings along the proposed fresh water pipeline from Tatelkuz Lake to the mine site were surveyed from 17 to 22 August 2013 for purposes of effects assessment.

Of the nine stream crossings, eight were classified as fish-bearing streams of classes S2, S3 and S4 with widths of >5-20 m, 1.5-5 m, and <1.5 m, respectively. The remaining stream crossing was classified as a non-visible channel (NVC). Six of the sites cross pre-existing logging roads. Two sites are decommissioned logging roads and four sites have culverts that are already installed. Of the eight fish-bearing sites, seven had riffle-pool morphology and one had cascade-pool morphology. The dominant substrate material was either cobble or fines.

Only six of the nine stream crossings could be electrofished because three did not hold water. Two rainbow trout were caught—one at each of two sites. Fish length ranged from 149 to 156 mm.

Fish and Fish Habitat at Stream Crossings of the Transmission Line, Mine Access Road, and Airstrip Access Road

From June to August 2013, Avison Management Services Ltd. (Avison) conducted fish and fish habitat surveys at stream crossings of the transmission line, the mine access road, and the airstrip access road. This was the second consecutive year of stream crossing surveys. In the summer and autumn of 2012, Avison had conducted a survey of stream crossings of the mine access road and earlier alignments of the transmission line.

The focus of the 2013 survey was stream crossings of versions 6 to 9 of the transmission line. That included two potential re-routes of the transmission line: the Stellako River re-route and the Mills Ranch re-route. Surveys were also conducted of several new stream crossings of the mine access road, and of stream crossings of the airstrip access road.

Avison's report on the stream crossing survey first summarized the results of the survey conducted from June to August 2013. It then summarized the results of the surveys for stream crossings of the preferred alignments for the transmission line (i.e., version 9), the mine access road, and the airstrip access road. The preferred alignments included some stream crossings that had been surveyed in 2012 and some that had been surveyed in 2013.

The preferred alignment for the transmission line crosses 161 streams: 143 for the transmission line proper, plus 9 for the Stellako re-route, and 9 for the Mills Ranch re-route. Of those 161 stream crossings, 101 (or 62.7%) were classified as NCD (i.e., non-classified drainage). An NCD cannot support fish. Another 3 stream crossings (or 2%) were classified as S6 or "non-fish-bearing, <3 m wide". The remaining 57 stream crossings (or 35%) were classified as fish-bearing. Of those 57 crossings, 24 (or 15% of the total number) were classified as S4 (<1.5 m wide), 23 (or 11%) were classified as S3 (1.5 to 5.0 m wide), 7 (or 4%) were classified as S2 (>5 to 20 m wide), and 3 (or 2%) were classified as S1 (>20 m wide).

The preferred alignment of the mine access road crosses 109 streams: 100 crossings for the original alignment that was surveyed in 2012 plus an additional 9 crossings that were surveyed in 2013 due to a 1.5 km-long change in alignment. The distribution of stream crossings by stream class was similar to the distribution for the preferred transmission line: 64% NCD, 4% S6, 17% S4, 11% S3, and 5% S2.

The preferred alignment of the airstrip access road crosses 3 streams: 2 NCD and 1 S4.

The S1 stream crossings of the transmission line were different sites within the same reach of the Stellako River, representing two crossing options. They were too deep for fish habitat measurement, and so they are assumed to provide good habitat quality for all life stages of salmonid fish.

Fish habitat was generally assessed as "good" at all S2 streams, most of the S3 streams, and more than half of the S4 streams. Five of the 19 S4 streams did not receive a rating of "good" for any life history stage because these drainages contained little or no spawning gravels. Instead, they contain fine sediment that is a result of the glacial-fluvial and glacial-lacustrine deposition typical for the region. A few were downstream of an NCD reach. Flows were shallow or intermittent and drainage hydrology may have been impacted by upstream or adjacent forest harvesting and/or cattle grazing.

Rainbow trout was the most common fish species observed or captured during the surveys. A few brassy minnow (*Hybognathus hankinsoni*) and lake chub (*Couesius plumbeus*) were observed or captured in some ponds near stream crossings.

Bathymetry of Tatelkuz Lake

AMEC developed a new bathymetric map of Tatelkuz Lake, based on over 36,000 depth soundings and edge-of-water observations made from 23 to 25 May and 7 to 9 June 2013. It replaces a map created in 1977 by the BC MOE. The bathymetric map shows a long, narrow, steep-sided lake with no islands. Four deep basins are distributed equidistantly along the length of the lake. The littoral zone is narrow along most of the shoreline with the exception of four shallow beaches located at the north and south ends of the lake, on the north-east shore, and along the south-west shore. The contours of the bathymetric map for Tatelkuz Lake were estimated to be accurate to ±0.07 m, which for practical purposes was rounded up to ±0.1 m. This was ten times more accurate than the 1977 Tatelkuz bathymetric map.

The bathymetric map was prepared using a mean water surface elevation of 927.6 metres above sea level (masl). Surface area at that elevation is 9,100,000 m^2 or 910 hectares (ha). The littoral zone (<6 m deep) makes up 11.1% of total area or 1,010,000 m^2 (101 ha), and profundal area (>6 m deep) makes up the remaining 88.9%. Lake volume is 195,000,000 m^3, perimeter is 25,000 m, and maximum depth is 33.7 m. Therefore, mean depth is 21.4 m, relative depth is 1.0%, and the index of shoreline development is 2.3.

Littoral Zone Habitat of Tatelkuz Lake

The objective of the Tatelkuz Lake fish habitat study was to map the different types of littoral habitat. These data were required to assess the potential effects to littoral habitat that may result from pumping lake water to the mine site. Water from Tatelkuz Lake will be used as make-up water in the process mill during mine operations and it will augment flows in Davidson Creek during operations, closure, and post-closure.

Littoral habitat was mapped in three steps:

- A helicopter survey was conducted on 14 July 2013. Natural breaks between distinctly different littoral habitats were identified and marked on small scale maps. Photographs were taken of the shoreline. The presence and spatial extent of fish cover types were marked on maps, including submergent and emergent vegetation, woody debris, and overhanging vegetation.
- A shoreline boat cruise was used to ground-truth the maps made during the aerial survey.
- Depth and substrate were measured along transects were established in randomly selected littoral habitat polygons for each littoral habitat type.

Results showed that the littoral zone of Tatelkuz Lake along the eastern and western shorelines is narrow (<25 m) and steep (>10%) and comprised of large substrates (i.e., cobble and boulders). Sand/silt/gravel beaches are located at the northwest and southeast ends where the littoral zone is wide (>150 m) and has lower gradients (<3%).

Low-gradient, sand/silt/gravel beach areas at the northwest and southeast ends of the lake comprise approximately 36% of the total area <4 m deep despite comprising only 23% of the total shoreline length. In comparison, steeper, rockier areas along the east and west shorelines comprise 67% of the total shoreline length, but only 48% of the total littoral area.

In general, substrates in Tatelkuz Lake change from coarse to fine with increasing depth and distance from shore. This is particularly true along the longer and steeper east and west shorelines. This is due to the combined effects of ice scour and frost-heaving in winter and wave action in summer and fall. This phenomenon is not nearly as prominent in the northwest and southeast ends of the lake. Substrate in those two areas is relatively homogenous gravel/silt/sand beaches that generally extend from the high water mark out to at least the 3 m depth contour.

Three habitat classes make up 81% of the littoral area <4 m deep. In order of relative abundance, these are: fines-gravel substrates with no vegetation (36% of total littoral area <4 m deep), cobble-gravel substrates with no vegetation (31%) and gravel-fines with no vegetation (14%).

Beds of submergent *Elodea* sp. (i.e., water-weed) are present in the northwest end of the lake, primarily around the entrance to Chedakuz Creek. Beds of emergent vegetation in the southeastern end of the lake are smaller, do not extend as deep, and are more isolated than in the northwestern end of the lake. A unique bed of *Elodea* sp. is also present in the southeast end of the lake, growing within the finer sediments of a cobble-boulder dominated bay. There were no aquatic plants along the steeper, rockier east and west shorelines of Tatelkuz Lake.

A unique, but regularly occurring, feature of the Tatelkuz Lake littoral zone is the presence of gravel-fines substrates on the small peninsulas that frequently extend out into the lake along the east and west shorelines. These peninsulas are typically steep (>20%) and exposed to north and south winds. Gravel-fine substrates dominates these peninsulas from the water's edge down to the 4 m depth contour and are one of the possible spawning locations for lake-spawning salmonids (e.g., mountain whitefish and kokanee).

Limnology of Tatelkuz Lake

Limnology of Tatelkuz Lake was studied because the lake will be the primary source of water for the Blackwater Project. The specific objectives of the 2013 limnology study were to collect vertical profiles of temperature, DO, and conductivity, measure water transparency (i.e., Secchi depth), and characterize the abundance, biomass, and taxonomic composition of the phytoplankton, zooplankton, and benthic macroinvertebrate (BMI) communities. The study was conducted in mid-August 2013 because that was the time of year at which the plant and animal populations of the lake were expected to be at their maximum biomass and species diversity.

These data were compared among sampling sites within Tatelkuz Lake and among Tatelkuz Lake and three headwater lakes in the LSA – 01682LNRS, 01538UEUT and 01428UEUT – that were surveyed in 2012. The headwater lakes are smaller and shallower than Tatelkuz Lake, they are at higher elevations, and as headwater lakes receive lower concentrations of particulate and dissolved material than does a valley bottom lake such as Tatelkuz Lake. Hence, comparison of the four lakes provided insight into the environmental factors that control the limnology of Tatelkuz Lake.

Physical Limnology

Physical limnology is the vertical structure of the water column and the degree of light penetration. Vertical profiles of temperature, DO, and conductivity were taken in Tatelkuz Lake in 1977 and in 2011 and 2012.

Seven vertical profiles of temperature, DO and conductivity were taken in Tatelkuz Lake: one in January, three in July, two in August and one in October. Secchi depth was measured at the same sites as the vertical profile. Secchi depth was used to calculate the 1% euphotic depth ($Z_{1\%}$), the depth to which 1% of surface light irradiance extends into the water column. That is the maximum depth at which photosynthesis and net carbon fixation occurs.

Vertical profiles showed that the lake was fully mixed as of 28 January 2013, but had developed thermal stratification by 8 July 2013 and maintained it to at least 7 October 2013. By 15 August 2013, thermal stratification reached its greatest extent with a distinct epilimnion in the upper 3 m, a thermocline from 3 to 13 m deep, and a hypolimnion below 13 m. Vertical profiles taken at northern and southern sites in both July and August showed few differences, indicating strong horizontal mixing.

Secchi depths ranged from 3.70 to 3.75 m in July and August 2013, showing little differences between the northern and southern halves of the lake. $Z_{1\%}$ ranged from 10.0 to 10.1 m. Since mean depth of the lake is 21.4 m, photosynthesis only occurred in the upper half of the lake.

The physical limnology of Tatelkuz Lake differs from that of the three headwater lakes due to differences in lake size, shape, elevation, volume of inflows, and position within the hydrological system

Tatelkuz Lake is much bigger and deeper than the three headwater lakes. It is deep enough to stratify in summer, but only Lake 01682LNRS is deep enough to stratify. The other two headwater lakes are well mixed throughout summer.

Tatelkuz Lake is a narrow, elliptical, steep-sided lake, but the three headwater lakes are shallow, lens-shaped lakes. The surface-volume ratio of Tatelkuz Lake (0.04 m^{-1}) is one-third that of lakes 01682LNRS and 01538UEUT (0.18 m^{-1}) and one-sixth that of Lake 01428UEUT (0.32 m^{-1}). All other factors were equal, this would suggest that DO concentrations in Tatelkuz Lake, particularly those below the thermocline, would be lower

than those in the three headwater lakes due to reduced rate of oxygen diffusion across the air-water interface. However, the opposite is true – DO concentrations in Tatelkuz Lake never fall below 4 mg/L, but those in Lake 01682LNRS fall to zero during summer. The reason is that the inflow of water from the 14 tributaries, particularly middle Chedakuz Creek, replenishes DO fast enough to compensate for the lower rate of oxygen diffusion from the atmosphere.

The greater inflow per unit volume into Tatelkuz Lake compared to the headwater lakes, and the position of Tatelkuz Lake as a valley bottom lake, has produced one of the most striking differences between Tatelkuz Lake and the three headwater lakes – the much higher conductivity in Tatelkuz Lake. In 2013, conductivity ranged from 93 to 212 µS/cm in Tatelkuz Lake, which was three to five times higher than the ranges measured in the headwater lakes in August and September 2012.

Higher conductivity typically implies higher rates of biological production. This was partially confirmed by Secchi depth, which was slightly deeper in Tatelkuz Lake (3.7 m) than in Lake 01428UEUT (3.0 m), but it was exceeded by both lakes 01538UEUT (5.7 m) and 01682LNRS (5.7 m).

Summer surface temperatures of Tatelkuz Lake were notably warmer than all three headwater lakes. This was due mainly to the lower elevation of Tatelkuz Lake (928 m) compared to the three headwater lakes (1,345 to 1,354 m).

Phytoplankton Community

The phytoplankton community is a group of single-celled plants that live suspended in the water column of lakes. They are the dominant photosynthesizing organisms in lakes, and so form the base of the food chain. For that reason, their density (cells/m^3) and biomass (µg/m^3 chlorophyll *a*) are used as measures of lake productivity.

Phytoplankton communities are dynamic and undergo quick seasonal succession as different taxa bloom into dominance and recede. They have a diversity of species that show variable responses to environmental effects and therefore are useful for tracking changes to the water quality of a lake.

There are no historical data available on the phytoplankton community of Tatelkuz Lake.

Phytoplankton samples were collected concurrently with limnology profiles at both the northern and southern sample sites in Tatelkuz Lake during mid-August 2013. Phytoplankton samples were collected at three depths: the surface (1 m), the bottom (27 m), and just below the thermocline (13 to 15 m). Water samples containing phytoplankton were collected using a Van Dorn water sampler. At each depth, five replicate samples were collected for taxonomy analysis and another five replicates were collected for chlorophyll *a* measurement. Therefore, 30 phytoplankton taxonomy samples and 30 phytoplankton biomass samples were collected from the two sampling stations in Tatelkuz Lake.

Mean phytoplankton density (cells/mL) and biomass (µg/L of chlorophyll a) and density were highest in the epilimnion of Tatelkuz Lake (i.e., at a depth of 1 m) where light intensity was greatest, and decreased with increasing depth. Mean phytoplankton biomasses-at-depth were similar at both sampling sites within Tatelkuz Lake, indicating strong horizontal mixing of phytoplankton within the lake.

A total of 114 phytoplankton taxa were present. Green algae (Chlorophyceae) was the most diverse group (51 taxa), followed by blue-green algae (Cyanophyceae; 25 taxa) and the diatoms (21 taxa).

Chrysophytes (i.e., golden algae and diatoms) were the predominant major taxa throughout the water column at both sample sites. *Cyclotella bodanica* was typically the most abundant species of algae within all samples below the thermocline at both sample sites. *Rhodomonas minuta* was the most abundant species within the epilimnion.

Chlorophyta (i.e., green algae) is a preferred food for zooplankton, but only represented up to 19.2% of total community density. Grazing by zooplankton may have contributed to its relatively low abundance. Cyanobacteria were abundant at both sites. Dinoflagellates and Euglenoids were uncommon to absent.

Mean genus richness (S) of phytoplankton was highest in the epilimnion and decreased with increasing depth at both sampling sites. Diversity (H') followed the same trend with depth. Phytoplankton evenness (J) showed the opposite pattern with depth.

Clustering analysis of taxonomic data indicated that Tatelkuz Lake phytoplankton communities at all depths show significant divergence from those of the three headwater lakes. In general, surface waters of Tatelkuz Lake were numerically dominated by blue-green algae and Cryptophyte flagellates, while the headwater lakes were dominated by green algae.

In addition, Tatelkuz Lake had significantly higher density (a five-fold difference) and biomass (eight times greater) in surface waters compared to the headwater lakes. Surface chlorophyll *a* levels indicated a mesotrophic status for Tatelkuz Lake versus an oligotrophic state for the headwater lakes.

These differences among lakes were largely due to differences in nutrient concentrations, and secondarily due to differences in vertical structure caused by the strength of thermal stratification.

Phytoplankton communities in the two headwater lakes that were not stratified were similar throughout the waterbody, indicating no barriers to mixing. In contrast, the two stratified lakes (Tatelkuz Lake and Lake 01682LNRS) showed differences in community structure through the water column, with mid-water samples being most similar to bottom samples. The decline in density and biomass with depth was greater in Tatelkuz Lake than in Lake

01682LNRS because Tatelkuz Lake had reduced light penetration in the hypolimnion due to deeper depth and reduced water clarity.

Zooplankton Community

The zooplankton community is a group of invertebrates that live suspended in the water column of lakes. They feed on phytoplankton and each other and, in turn, are prey for many fish species, including rainbow trout and kokanee. Zooplankters are widespread, relatively easy to identify, and respond to environmental stressors such as nutrient enrichment, acidification, and changes to fish composition. Therefore, they are useful for establishing baseline conditions and for tracking environmental change. Their density (organisms/m^3), biomass (i.e., mg/m^3), and taxonomic composition are used as measures of lake productivity and ecosystem health.

There are no historical data available on the zooplankton community of Tatelkuz Lake.

Zooplankton in Tatelkuz Lake were sampled concurrently with phytoplankton. Five replicate samples of zooplankton were collected at each of the two sampling sites using a 0.5 m-diameter plankton net with an 80 µm mesh size. The net was lowered to 1 m above the lake bottom and then raised to the surface at a constant speed of approximately 0.5 m/s. The contents of the cod end were transferred to clean, pre-labelled 250 mL plastic jars and preserved with 10% formalin. Depth was recorded for each tow and the volume of water filtered (m^3) calculated by multiplying the area of the net opening by the total depth of the haul. Taxonomic composition was determined as density (organisms/m^3), as was biomass (mg/m^3).

Mean zooplankton density and biomass were similar between the northern and southern sampling sites of Tatelkuz Lake, indicating strong horizontal mixing within the lake.

Copepods were the predominant zooplankton taxon by density within Tatelkuz Lake. Cyclopoid nauplii were the dominant copepod at both sampling sites. Rotifers were the second most common taxon. The dominant rotifer species at both sample sites was *Kellicotia longispina*. Ciliophors and cladocerans were not highly represented within the Tatelkuz Lake zooplankton population.

Zooplankton species richness (S) was similar at both sampling sites within Tatelkuz Lake, ranging between 16 and 19 taxa. Both diversity (H') and evenness (J) were slightly higher at site TL2 than at site TL1.

Cluster analysis showed that zooplankton communities strong differentiate by lake. Unlike phytoplankton and BMI, the most prominent differences in zooplankton density were observed between Lake 01428UEUT and the remaining lakes (Tatelkuz Lake and lakes 01538UEUT and 01682LNRS). Lakes within the latter group were all distinct but Tatelkuz Lake communities were different from those in Lakes 01538UEUT and 01682LNRS. No significant structuring of zooplankton communities occurred within lakes, except for Lake 01538UEUT.

At higher taxonomic levels, Lake 01428UEUT and Lake 01538UEUT were characterized by a very high proportion of rotifers (88% and 74% respectively) and very low proportions of cladocerans and copepods. In contrast, taxa were much more evenly distributed across samples from Tatelkuz Lake and Lake 01682LNRS.

Zooplankton density in Tatelkuz Lake was on average higher than the headwater lakes, but was not significantly different. In fact, Lake 01428UEUT had the highest mean densities of zooplankton. While zooplankton biomass was highest in Tatelkuz Lake, its difference was only double that of the mean headwater lake, and was small compared to that observed for phytoplankton communities. Part of this discrepancy can be attributed to the relatively small size of the dominant taxa in Lake 01428UEUT (i.e., rotifers) and the integrated nature of zooplankton sampling (i.e., abundance in stratified lakes is moderated by inclusion of low productivity hypolimnetic waters).

Interestingly, measures of taxonomic richness and diversity were significantly elevated in the zooplankton community of Tatelkuz Lake. These results are inconsistent with nutrient enriched lakes, but perhaps reflect the habitat diversity of Tatelkuz Lake, which provides habitat (e.g., temperature, productivity etc.) for taxa of different environmental tolerances. Lake 01682LNRS's relatively high richness and diversity, despite its low biomass and abundance, supports this suggestion.

Conductivity (and its correlates – chlorophyll *a*, surface temperature and water depth) was highly correlated with variation in the density and biomass of zooplankton communities and suggests that the higher nutrient concentrations of Tatelkuz Lake have affected its zooplankton communities but to a lesser degree than other ecosystem components such as BMIs and phytoplankton. Furthermore, differences in some univariate metrics such as richness and diversity were not consistent with expectations from the literature for nutrient enriched waters.

Such differences indicate that other factors besides nutrients (e.g., predation from fish assemblages, lake morphology, etc.) are influencing zooplankton density. For example, the numerical prevalence of small-bodied rotifers in Lake 01428UEUT could be a consequence of a higher proportion of optimal habitat (e.g., absence of low productivity hypolimnetic habitat) or differential predation pressure on large-bodied zooplankton.

Benthic Macroinvertebrate Community

BMI are a diverse group of animals living on or in the substrates of streams, wetlands and lakes. They include protozoans, flatworms, nematodes, aquatic worms, crustaceans (i.e., ostracods, isopods, and amphipods), molluscs (i.e., snails and clams), and larvae of aquatic insects (i.e., mayflies, dragonflies, and blackflies). Many BMI feed on periphyton and so provide a link between primary production and fish. Fish species in the LSA do not feed directly on algae but instead feed on the larger, more energy-rich BMIs (and other fish).

BMIs are not only prey for fish, but also serve as indicators of changes in water quality because of their sessile nature, high taxonomic diversity, and relatively long lifespan (1 to 3 years).

There are no historical data available on the BMI communities of Tatelkuz Lake.

Samples of BMI were collected from both littoral and profundal habitats of Tatelkuz Lake. Twenty samples of BMI were collected with a pole-mounted kick net from cobble-gravel substrates along the littoral zone: five each from the east, west, north, and south shorelines. Habitat data for each site in the littoral zone were collected, including: site coordinates; pH, water temperature, conductivity, and DO concentration; dominant substrate class; percent organic matter; and dominant canopy type. Five replicate samples of profundal BMI were collected with an Ekman dredge at the same two sampling sites as phytoplankton and zooplankton, for 10 samples of profundal BMI.

Mean littoral BMI abundance in Tatelkuz Lake was an order of magnitude higher than in the headwater lakes, while the abundance of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa, which are sensitive to nutrients, were significantly lower. Furthermore, the mean values of the Hilsenhoff Biotic Index (HBI) were “fair” in Tatelkuz Lake compared to the average condition of “excellent” in the headwater lakes. These results generally indicate a nutrient-enriched system.

Some metrics however did not correspond to expectations of nutrient enrichment. The proportion of chironomids (considered pollution tolerant taxa) was of marginally lower abundance in Tatelkuz Lake, while taxonomic richness was significantly elevated in Tatelkuz Lake. No differences in Shannon-Weiner diversity (H’) were observed between the two groups of lakes.

Examinations of BMI abundance and taxa richness across substrate classes in Tatelkuz Lake showed a richer and more abundant BMI community in the fine habitats (Fine/Gravel, Fine and Fine/Organic) than in the coarse habitats (Cobble/Gravel, Gravel/Cobble and Gravel/Fine). Abundance of BMI on fine substrates was 4.3 times greater while richness was 1.4 times greater.

Despite the influence of substrate type on abundance and richness, coarse substrates in Tatelkuz Lake still had levels that exceeded mean levels of the three headwater lakes.

The profundal BMI community of Tatelkuz Lake was significantly different than those collected from the headwater lakes. However, unlike littoral communities, profundal samples showed no additional structure within Tatelkuz Lake.

Variation in profundal BMI communities across lakes was strongly correlated to patterns in environmental conditions. The best correlation for a single environmental variable was with DO concentration followed by conductivity.

In summary, the BMI communities of Tatelkuz Lake are distinct from those sampled in the headwater lakes. These differences likely arise from a combination of the nutrient-enriched condition and the unique morphology and habitat heterogeneity of Tatelkuz Lake relative to the smaller lakes.

Fish Community of Tatelkuz Lake

A survey of the fish community of Tatelkuz Lake was conducted between 15 and 20 July 2013. The primary objective was to collect data on fish species composition, relative abundance, spatial distribution, habitat choice, and biological characteristics such as length, weight, condition, age, sex, sexual maturation, energy storage, and diet. Gillnet CPUE was provided to a hydroacoustic specialist (Shuksan Fisheries Consulting) who used it to assign fish species to hydroacoustic signal data from Tatelkuz Lake.

Gillnets and minnow traps were used to sample the Tatelkuz Lake fish community. Gillnet sampling effort was stratified by horizontal location, habitat type (nearshore or offshore), depth, and time of day (day or night). A total of 78 gillnet sets were made for a total of 479.0 hours of gillnetting. A total of 126 minnow traps were set at 25 different sites for 3,289.6 trap-hours of minnow trap effort.

Effort, Catch and CPUE

A total of 1,254 fish were captured: 1,140 (or 91.1% of the total) in gillnets and 114 (or 8.9%) in minnow traps. Ten fish species were captured (**Table ES 1**). Rainbow trout was the most common species (49.9%), followed by kokanee (17.7%), mountain whitefish (12.8%), northern pikeminnow (6.9%), slimy sculpin (4.8%), longnose sucker (4.2%), brassy minnow (2.5%), largescale sucker (0.9%), white sucker (0.2%), and burbot (0.1%).

Table ES 1: Fish Species Captured in Tatelkuz Lake, July 2013

Common Name	Scientific Name	BC Fish Species Code
Kokanee	*Oncorhynchus nerka*	KO
Rainbow trout	*Oncorhynchus mykiss*	RB
Mountain whitefish	*Prosopium williamsoni*	MW
Burbot	*Lota lota*	BB
Brassy minnow	*Hybognathus hankinsoni*	BMC
Northern pikeminnow	*Ptycheilus oregonensis*	NSC
Slimy sculpin	*Cottus cognatus*	CCG
Largescale sucker	*Catostomus macrocheilus*	CSU
Longnose sucker	*Catostomus catostomus*	LSU
White sucker	*Catostomus commersonii*	WSU

Only brassy minnow is classified as sensitive or vulnerable according to the BC Conservation Data Centre. Brassy minnow is a Blue-listed species because its distribution in

BC is disjunct, with isolated populations in the lower Fraser Valley and in the Nechako Lowlands near Vanderhoof and Prince George. This is believed to make them vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened.

Mean gillnet CPUE showed the following trends:

- No clear trend along the length of Tatelkuz Lake;
- An order of magnitude greater in nearshore habitat (101.8 fish/100 m^2/day) than in offshore habitat (14.5 fish/100 m^2/day);
- Twice as high in day sets (56.1 fish/100 m^2/day) than night sets (23.3 fish/100 m^2/day);
- Highest in the 0 to 5 m depth stratum of Tatelkuz Lake (122.9 fish/100 m^2/day);
- Similar among the five deepest depth strata (i.e., 10 to 15, 15 to 20, 20 to 25, 25 to 30, and 30 to 35 m).
- Highest for rainbow trout (32.6 fish/100 m^2/day), followed by mountain whitefish (6.3 fish/100 m^2/day), kokanee (5.8 fish/100 m^2/day), northern pikeminnow (1.8 fish/100 m^2/day), and longnose sucker (1.5 fish/100 m^2/day); and
- Less than 1.0 fish/100 m^2/day for the other four species.

In general, mean gillnet CPUE showed that rainbow trout, kokanee, and mountain whitefish were the most abundant species in both nearshore and offshore habitat during both day and night. During the day, rainbow trout were especially abundant in the nearshore zone and near the lake surface (0 to 5 m) in both habitats. At night, their nearshore abundance decreased and offshore they moved deeper in the water column. Kokanee were more abundant offshore than nearshore in both day and night. In offshore habitat they were most abundant in the 0 to 5 m depth layer during the day and shifted slightly deeper, mainly to the 5 to 10 m layer, at night. Mountain whitefish were more numerous near shore than offshore both day and night. Near shore they were more abundant 0-5 m during the day and 5 to 10 m at night. Offshore they occurred almost entirely below 10 m during both periods.

Minnow traps caught 112 fish, including 58 slimy sculpin, 29 northern pikeminnow, 18 brassy minnow, 6 longnose suckers, and 1 kokanee. Mean minnow trap CPUE showed the following trends:

- No clear trend along the length of Tatelkuz Lake;
- Lowest in the 0 to 0.5 m depth strata (0.7 fish/100 trap-hours);
- Similar among the other five depth strata (2.5 to 3.7 fish/100 trap-hours); and
- Highest for slimy sculpin (1.4 fish/100 trap-hours) and lowest for kokanee (0.03 fish/100 trap-hours).

Size, Age, and Sex

The majority of biological information was collected on kokanee, rainbow trout, and mountain whitefish – the three most common fish species captured or observed in Tatelkuz Lake in July 2013.

Mean length of the ten fish species ranged from 57 to 370 mm. Slimy sculpin (57 mm) and brassy minnow (68 mm) were the two smallest species, and white sucker (370 mm) and largescale sucker (364 mm) were the longest and heaviest species.

Mean age of fish species ranged from 5 to 11 years. Northern pikeminnow had the oldest mean age (11 years), but mountain whitefish and northern pikeminnow both had maximum recorded ages for an individual of 14 years. Kokanee and rainbow trout both had the lowest mean ages (3 years) of the six species for which ages were determined. However, very few (i.e., n<5) burbot, northern pikeminnow or longnose sucker were aged. Age data was not available for four of the ten species: brassy minnow, largescale sucker, slimy sculpin, and white sucker.

von Bertalanffy growth models were successfully fit to length-age data for rainbow trout, kokanee, and mountain whitefish. They explained 76% of the variance in length-at-age for mountain whitefish, but only 41% for kokanee and 32% for rainbow trout.

Sex ratios were calculated for four of the ten species (kokanee, rainbow trout, mountain whitefish, and northern pikeminnow) because no brassy minnow, largescale sucker, slimy sculpin, or white sucker were autopsied, and too few burbot or longnose sucker were sexed to allow calculation of a sex ratio. Sex ratios ranged from 0.4 for kokanee to 2.5 for rainbow trout.

Lengths at 50% maturity for kokanee, mountain whitefish, and rainbow trout were approximately 180, 250, and 290 mm, respectively. No fish were mature at lengths below 150 mm. Kokanee has an approximate mean length at 95% maturity of 240 mm.

Gonad weights were measured only for kokanee, rainbow trout, and mountain whitefish. No ripe fish were identified, and only one spent male rainbow trout was identified. Of the 84 kokanee autopsied, 80 (or 95%) were classified as mature and four (or 5%) were classified as immature. None were classified as spent. This is the pattern expected of a species preparing to spawn later in the summer, which they did from late July to September 2013.

Of the 38 rainbow trout autopsied, 21 (or 55%) were classified as immature, 15 (or 39%) were classified as maturing (none were classified as mature), and one (or 3%) was classified as spent. This is the pattern expected of a species that has just completed spawning, as they did in May and June 2013. The maturing fish were sub-adults that would likely have spawned for the first time in the spring of 2014.

Of the 49 mountain whitefish autopsied, seven (or 14%) were classified as immature, and 42 (or 86%) were classified as mature. There were no spent fish. This is the pattern expected of a species preparing to spawn in autumn 2013.

Diet

Of the 12 kokanee stomachs sampled from Tatelkuz Lake in July 2013, seven contained prey items and five were empty. Amphipods were the most abundant prey, followed by Diptera (true flies, Trichoptera (caddisflies), and Ephemoptera (mayflies) larva. While amphipods were the most abundant of all prey items found in kokanee stomachs, they were only found in the stomach of a single individual.

All of the 12 rainbow trout stomachs sampled from Tatelkuz Lake in July 2013 contained prey items. The most abundant prey were chironomid larva, followed by beetles (Coleoptera), and amphipods.

All of the 13 mountain whitefish stomachs contained prey items. Dipterans comprised the majority of identifiable prey items, almost exclusively chironomid larvae. These were followed by caddisflies and beetles.

In summary, there was a clear separation of diet among the three fish species: mountain whitefish consumed benthic macroinvertebrates, mainly chironomid larvae; kokanee consumed pelagic prey, mainly amphipods; and rainbow trout consumed a mixture of benthic and pelagic prey.

Tissue Metals Concentrations of Rainbow Trout and Mountain Whitefish of Tatelkuz Lake

Rainbow trout and mountain whitefish were collected from catches of 14 gillnet sets in Tatelkuz Lake made from 17 to 19 July 2013. A total of 79 tissue samples were collected and submitted for laboratory analysis: 20 whole fish (abbreviated as WF) for rainbow trout and 19 WF for mountain whitefish; 10 muscle (M), and 10 liver (L) for rainbow trout; and 10 M and 10 L for mountain whitefish.

Each sample was analyzed for percent moisture, concentrations of 41 total metals, and percent lipid content. Sub-sets of whole fish, liver, and muscle samples were also analyzed for methyl-mercury (MeHg). The metals analyzed and their method detection limits (MDL) were consistent with the requirements of the BC MOE.

Principal Component Analysis

Because there were two species, three tissue types, and a large number of analytical variables, Principle Component Analysis (PCA) was used to identify major trends in the fish tissue metals data set. The first step in the PCA was to combine tissue metal concentrations from fish collected in the LSA in 2011, 2012 and 2013 into a single data matrix.

The first three principle components extracted by PCA explained a cumulative total of 66.2% of the total variance of the data matrix. The first component, PC1, explained 35.8% of the total variance and was significantly (P<0.001) positively correlated with 22 metals including heavy metals such as zinc, iron, manganese, cobalt, uranium, molybdenum, vanadium, cadmium, copper, arsenic, barium, and lead. PC1 was significantly (P<0.001) negatively correlated with potassium. PC1 was interpreted as representing the concentration of heavy metals.

The second component, PC2, explained 21.9% of the total variance and was significantly (P<0.001) positively correlated with strontium, calcium, barium, aluminum, yttrium, and manganese and significantly (P<0.001) negatively correlated with mercury, copper, silver, selenium, thallium, and molybdenum. Calcium is a structural metal because it is found in high concentrations in bones. Strontium is a calcium surrogate. Heavy metals such as mercury do not bind to bones and so they were negatively correlated with PC2. PC2 was interpreted as the concentration of structural metals.

The third component, PC3, explained 8.4% of the total variance and was significantly (P<0.001) positively correlated with caesium and rubidium – two metals that have similar chemical and physical properties. These two metals are rare compared with other metals and may indicate the type of bedrock present in some locations in the Blackwater RSA. Therefore, PC3 was interpreted as representing a geological signature of part of the study area, i.e., location.

Plots of PC2 scores on PC1 scores for mountain whitefish and rainbow trout separated the three types of tissues without any overlap. Whole fish samples had high concentrations of heavy metals and structural metals, liver samples had high concentrations of heavy metals but low concentrations of structural metals, and muscle samples had low concentrations of heavy metals and intermediate concentrations of structural metals. A similar separation was observed in a plot of PC2 scores on PC1 scores for rainbow trout.

Mercury

Total mercury (Hg) was given a focused statistical analysis because it is one of the few metals that have no known biological function, and is highly toxic to plants and animals. All tissue samples collected from mountain whitefish and rainbow trout in Tatelkuz Lake in July 2013 were analyzed for total mercury concentrations, and all concentrations were above the method detection limit (MDL).

Mean total mercury concentrations for both mountain whitefish and rainbow trout were highest in liver tissue and lowest in whole fish.

None of the mountain whitefish and rainbow trout tissue samples collected from Tatelkuz Lake in July 2013 exceeded the Health Canada total mercury guideline for human consumption of fish of 0.5 mg/kg wwt mercury.

Methyl-mercury

Methyl-mercury (MeHg) concentrations were measured from 19 fish tissue samples collected from Tatelkuz Lake in July 2013: 9 rainbow trout and 10 mountain whitefish. All 19 methyl-mercury concentrations were above the MDL. These were combined with methyl-mercury concentrations (and total mercury concentrations) measured from 13 rainbow trout tissue samples collected from streams and lakes of the LSA. Therefore, methyl-mercury concentrations and total mercury concentrations were available for a total of 22 rainbow trout and 10 mountain whitefish.

A linear regression of methyl-mercury concentration on total mercury concentration was highly significant ($P<0.001$) and explained 80% of the variation in methyl-mercury concentration. The intercept of the regression was not significantly ($P>0.05$) different from zero, and the slope of the regression was 0.32, indicating that, on average, methyl-mercury concentration was 32% of total mercury concentration.

BC MOE and the Canadian Council of Ministers of the Environment (CCME) established a methyl-mercury Tissue Residue Guideline (TRG) of 0.033 mg/kg wwt for protection of piscivorous wildlife. For the fish samples collected from Tatelkuz Lake in July 2013, 2 of the 13 measurements of methyl-mercury for mountain whitefish (both livers) exceeded that TRG. However, only one mountain whitefish sample exceeded the Blackwater site-specific methyl-mercury TRG of 0.062 mg/kg wwt – a liver from a 347 mm-long fish.

A linear regression of methyl-mercury concentration on total mercury concentration for rainbow trout was highly significant ($P<0.001$) and explained 75% of the variation in methyl-mercury concentration. The intercept of the regression was not significantly different from zero, and the slope of the regression was 0.51, indicating that, on average, rainbow trout methyl-mercury concentration was 51% of total mercury concentration.

Two of the nine measurements of methyl-mercury for rainbow trout (one liver and one whole fish) exceeded that the TRG established by BC MOE. One liver tissue sample from a 277 mm-long rainbow trout from Tatelkuz Lake exceeded that site-specific TRG. For the rainbow trout sampled from streams and lakes of the LSA in 2012, one sample exceeded the site-specific methyl-mercury TRG. That trout was captured from Lake 01682LNRS, the headwater lake of the Davidson Creek Watershed, on 19 September 2012. It had a methyl-mercury concentration of 0.1360 mg/kg wwt for the muscle sample, and 0.1330 mg/kg wwt for the liver sample.

Selenium

Selenium (Se) was also the subject of focused analysis because it is an essential micronutrient for all animals, but it is toxic in high concentrations. Its primary toxic effect on fish is on egg and larval mortality. Adults transfer (or depurate) selenium from their muscles and organs to developing eggs and sperm. Elevated concentrations may cause deformities in embryos and larvae that lead to death.

For both rainbow trout and mountain whitefish sampled from Tatelkuz Lake in July 2013, mean total selenium concentration was highest for liver tissue and lowest for muscle tissue, with whole fish having an intermediate concentration.

None of the rainbow trout and mountain whitefish tissue samples collected from Tatelkuz Lake in July 2013 exceeded the lowest of the three selenium guidelines issued by the BC MOE and the BC Ministry of Health (i.e., 1.8 mg/kg wwt for 7 servings/week).

BC MOE established a draft total selenium whole fish guideline for protection of aquatic life of 1 mg/kg wwt. That guideline was exceeded by all of the rainbow trout liver samples collected from Tatelkuz Lake, but none of the muscle or whole fish samples. The guideline was also exceeded by all 59 of the liver samples collected from lakes and streams in 2011 and 2012, but by none of the muscle samples. Eight whole rainbow trout collected from streams in 2011 and 2012 exceeded the guideline.

Hydroacoustic Assessment of Fish Numbers in Tatelkuz Lake

In July 2013, coordinated surveys using mobile acoustics (scientific echo sounding) and gillnetting were used to estimate fish abundance and distribution patterns in Tatelkuz Lake. Acoustic sampling was used to estimate absolute numbers of fish in the lake and to describe day and night spatial patterns of the total fish assemblage. The acoustic estimate was restricted to non-benthic species, and acoustic sampling was limited to areas offshore of the 2 m depth contour, with sample volumes very restricted shoreward of the 5 m depth contour. Gillnetting, which sampled benthic and pelagic fish over the whole depth range in all habitats, was used to describe day and night spatial patterns of individual fish species and to determine species composition of the fish population for apportionment of the acoustic estimate. Acoustic and gillnet sampling designs were stratified by nearshore and offshore sampling zones, bounded by the 10 m depth contour. Acoustic sampling took place from 9 to 12 July during day and night periods. Gillnetting was conducted from 15 to 20 July, also during both periods.

Fish densities and distribution patterns were distinctly different on day and night acoustic surveys. During the day, fish were sparsely scattered over the 0 to 20 m depth range, whereas many more fish were seen with acoustics at night, mainly in a layer between 5 and 10 m that often touched the edges of the lake basin. Areal fish density (fish/ha) was much higher throughout the lake at night than during the day. These observations showed that many of the fish in Tatelkuz Lake were unavailable to acoustics during the day (in nearshore areas or close to the lake surface or bottom), and that night was the better period to estimate fish abundance.

The night time total fish abundance estimate and 95% confidence limits for all species combined were 775,286 ±134,418 fish (±17% of the total), for an overall fish density of 864 fish/ha. Fish numbers were much higher in the offshore zone (749,986 fish) than in the nearshore zone (25,300 fish). In the nearshore zone, abundance was close to equal in the 0

to 5 m and 5 to 10 m depth layers. In the offshore zone, 98% of the fish were in the upper 15 m of the water column, with 76% in the 5 to 10 m layer alone, and no fish below 30 m.

Acoustic data apportioned by gillnet catches indicated that kokanee were the most abundant fish in Tatelkuz Lake, numbering 606,375 fish, or 78.2% of the total fish community for large and small fish size groups combined. Numbers of other species were: 117,431 rainbow trout (15.1% of total), 26,237 mountain whitefish (3.4%), 13,763 longnose sucker (1.8%), and 11,498 northern pikeminnow (1.5%). Based on a lake surface area of 897 ha, individual species densities were: 676 kokanee/ha, 131 rainbow trout/ha, 29 mountain whitefish/ha, 15 longnose sucker/ha, and 13 northern pikeminnow/ha. The high abundance of kokanee was not surprising considering their predominance in the large volume of the offshore pelagic zone, the most abundant habitat in the lake. Likewise, the abundance of littoral and semi-pelagic species was limited by the lesser amount of littoral and slope zone habitat available in Tatelkuz Lake. Benthic species that were undetectable with acoustics were not included in the population estimate.

Abundance estimates for individual species of large fish (≥100 mm long) appear reliable because they were well sampled by gill nets for the most part (adequate sample size and spatial and temporal coverage). However, minimal gill net coverage of the 5 to 10 m offshore cell, where the abundance estimate from acoustics was high, reduced the certainty of the individual species abundance estimates. Even so, the conclusion that most large fish in this cell and in the lake were kokanee was supported by other data, such as species composition in adjacent spatial cells and known habitat and temperature preferences of the species present. Abundance estimates for individual species of fish <100 mm long are less certain due to extremely low catches of small fish in gillnets (insufficient sample size despite adequate spatial and temporal coverage). Due to inadequate species composition information for small fish, it was assumed for individual species abundance estimates that all small fish in the offshore zone were kokanee and that all small fish in the nearshore zone were rainbow trout. Based on several considerations, the former assumption seems well founded, while the latter one is more doubtful but only affected a small fraction (2.5%) of the total abundance estimate for all species combined.

Kokanee Spawner Survey

The specific objectives of the 2013 kokanee spawner survey were to:

- Identify locations and timing of kokanee spawning in each stream surveyed in 2013;
- Estimate the number of kokanee spawners in each stream and in the LSA as a whole in 2013;
- Compare the results of the 2013 survey with the results of kokanee spawner surveys in 2011 and 2012; and
- Summarize spawn timing, number of spawners, spawner-redd relationships, and total number of spawners among the three survey years.

Four streams were surveyed for kokanee spawners from 8 August to 12 September 2013: Davidson Creek, Creek 661, lower Chedakuz Creek, and middle Chedakuz Creek. Reaches in each stream were selected for survey based on known kokanee spawning locations, as observed in 2011 and 2012.

Survey timing in 2013 was initially based on observed timing of kokanee spawner migrations in 2011 and 2012. Survey timing was modified as the 2013 spawning season progressed in order to survey as close as possible to the peak of the spawning period in each stream.

For each of the four streams a two-person team counted the number of kokanee and kokanee redds (i.e., egg nests) while hiking upstream along 500 m-long sections of selected reaches. Kokanee were counted into two broad classes: live and dead. Live fish were further classified as migrating, holding, spawning, or spent, depending on their behaviour.

Spawn Timing

Using observations made in 2011, 2012, and 2013, it was concluded that kokanee spawners are present in streams of the Blackwater LSA from mid-July to the end of September – a 10 week long period. The major differences among streams are that:

- Kokanee first enter Davidson Creek in mid-July, which is at least 2 weeks earlier than any of the other four streams, and have the longest spawning period – 6 weeks. Peak spawning is between 8 and 12 August;
- Kokanee enter Creek 661 and middle Chedakuz Creek in early August and leave in early September. Peak spawning is in the second and third week of August; and
- Kokanee enter lower Chedakuz Creek in early September – 6 weeks later than Davidson Creek – and peak spawning is in mid-September.

These differences in spawn timing among stream are largely due to differences in water temperature. According to the BC MOE, optimal water temperatures for kokanee spawning range from 10.6 to 12.8ºC. Comparison of those optima with water temperatures measured in streams of the LSA during the kokanee spawning periods show that kokanee were observed to spawn within these temperature optima in two of the three years (2012 and 2013). This means the earliest spawning occurs in the coldest stream (lower Davidson Creek) and the latest spawning occurs in the warmest stream (lower Chedakuz Creek).

Percent Mortality

Percent mortality of kokanee spawners was highest in lower Chedakuz Creek (37.0%), followed by Davidson Creek (5.2%), middle Chedakuz Creek (0.5%), and Creek 661 (0.4%). Since percent mortality is expected to rise with time during a spawning period, this pattern suggests that spawning was more further advanced in lower Chedakuz Creek than in Davidson Creek in 2013, and that spawning in Davidson Creek was more further advanced than spawning in Creek 661 and middle Chedakuz Creek in 2013.

This pattern agrees with the timing of spawning for lower Chedakuz Creek, but not for the other three streams. A more likely explanation is that counts of dead spawners are underestimates of the true number of dead spawners because dying and dead fish are washed out of the spawning streams before they can be counted. The spatial distribution of percent mortality supports this alternate explanation.

For all four streams, percent mortality was highest in the downstream reach and decreased with upstream distance. This pattern was observed in lower Chedakuz Creek even though the spawners had to migrate from Tatelkuz Lake through the "upstream" Reaches 15 and 14 to arrive at the downstream Reach 13. The most likely explanation for this spatial pattern is that dying and dead spawners drift downstream and collect in the furthest downstream reach in each stream. It is also reasonable to assume that dead and dying fish would continue to be washed further downstream out of Davidson Creek and Creek 661 and into lower and middle Chedakuz Creek, respectively, where they would not be counted.

A second reason why counts of dead spawners may underestimate the true number of dead spawners is that scavengers such as eagles may remove carcasses from a stream before they can be counted. This idea is supported by the differences in water depth between lower Chedakuz Creek and Davidson Creek, Creek 661, and middle Chedakuz Creek. Relatively deep water in lower Chedakuz Creek may reduce the ability of scavenging birds to remove dead spawners from that stream, resulting in apparently higher percent mortality for that stream.

If dead counts are not reliable estimates of the true number of dead fish due to downstream dispersion and scavenging of carcasses, then only live counts are reliable estimators of spawner density.

Kokanee Spawner Number

More kokanee spawners are estimated to have spawned in the Blackwater LSA in 2013 (19,584 fish) than in 2012 (15,805 fish) or 2011 (12,745 fish). These differences reflect differences in the spatial extent of the spawner survey. In 2011, only Davidson Creek and Creek 661 were surveyed. In 2012, all four streams were surveyed, but only one reach was surveyed in each of lower Chedakuz Creek and middle Chedakuz Creek. In 2013, all four streams were surveyed again, but three reaches were surveyed in lower Chedakuz Creek and four reaches in middle Chedakuz Creek.

The most accurate estimate of the number of kokanee that spawn in the Blackwater LSA each year was calculated by combining all data from the three survey years. A total of 24,988 kokanee spawners was calculated, of which middle Chedakuz Creek contributed 9.805 (or 39.2% or the total), followed by Creek 661 (5,893 or 23.6%), lower Chedakuz Creek (5,343 or 21.4%), and Davidson Creek (3,947 or 15.8%).

Spawner Number and Redd Number

A linear regression of spawner number on redd number for the combined data of 2011 to 2013 was highly significantly ($P<0.001$) and explained 78% of the variance in spawner number. The intercept was significantly ($P<0.001$) different from zero, indicating that spawners were counted in sections where no redds were observed. The regression slope has a value of 5.0, indicating that the production of each kokanee redd requires an average of five spawners.

There are several reasons why the number of spawners is not identical to the number of redds (i.e., a regression slope of 1.0). The first is that not all spawning kokanee that arrive on the spawning grounds survive to mate and dig redds because they die from parasites and disease during in-stream migration, or are eaten by wildlife such as eagles and bears soon after they arrive on the spawning grounds. The second reason is that competition among spawners for limited spawning habitat may result in sub-dominant female spawners being forced by dominant females into marginal habitat (Burgner, 1991). It is probably more difficult to successfully mate and dig redds in marginal habitat than high-quality habitat. The third reason is redd superpositioning – the digging up of older redds by more recent arrivals on the spawning grounds. All of these mechanisms operate to varying degrees in salmonid populations.

Habitat Type and Water Depth of Redds

Habitat type (glide, riffle and pool) was assigned to each of the 2,093 redds counted in the three survey years. In each of the four streams, redds were found predominantly in glides, followed by riffles and pools. Pooled over all four streams, 66.5% were found in glide habitat, 26.4% in riffle habitat and 7.1% in pool habitat.

Redd depth was measured only in the 2011 and 2012 surveys. In each of the four streams, the majority of redds were found in 0.21 to 0.40 m depth range. Pooled over all four streams, 58.2% of the 2,451 redds for which depth was measured were at a depth of 0.21 to 0.40 m, followed by 30.2% at a depth of 0.00 to 0.19 m, and 7.0% at a depth of 0.41 to 0.60 m. Nineteen redds or 0.8% of the total were reported to be at depths greater than 1.0 m.

1.0 INTRODUCTION

This report describes the results of baseline surveys of fish and fish habitat conducted by AMEC Environment and Infrastructure (AMEC) for New Gold Inc. (the Proponent) in 2013 in streams and lakes near the proposed Blackwater Gold Project (the Project).

The proposed Project is located on the Nechako Plateau of central British Columbia (BC), approximately 110 kilometres (km) southwest of Vanderhoof (straight-line distance) and 160 km southwest of the city of Prince George (**Figure 1-1** and **Figure 1-2**).

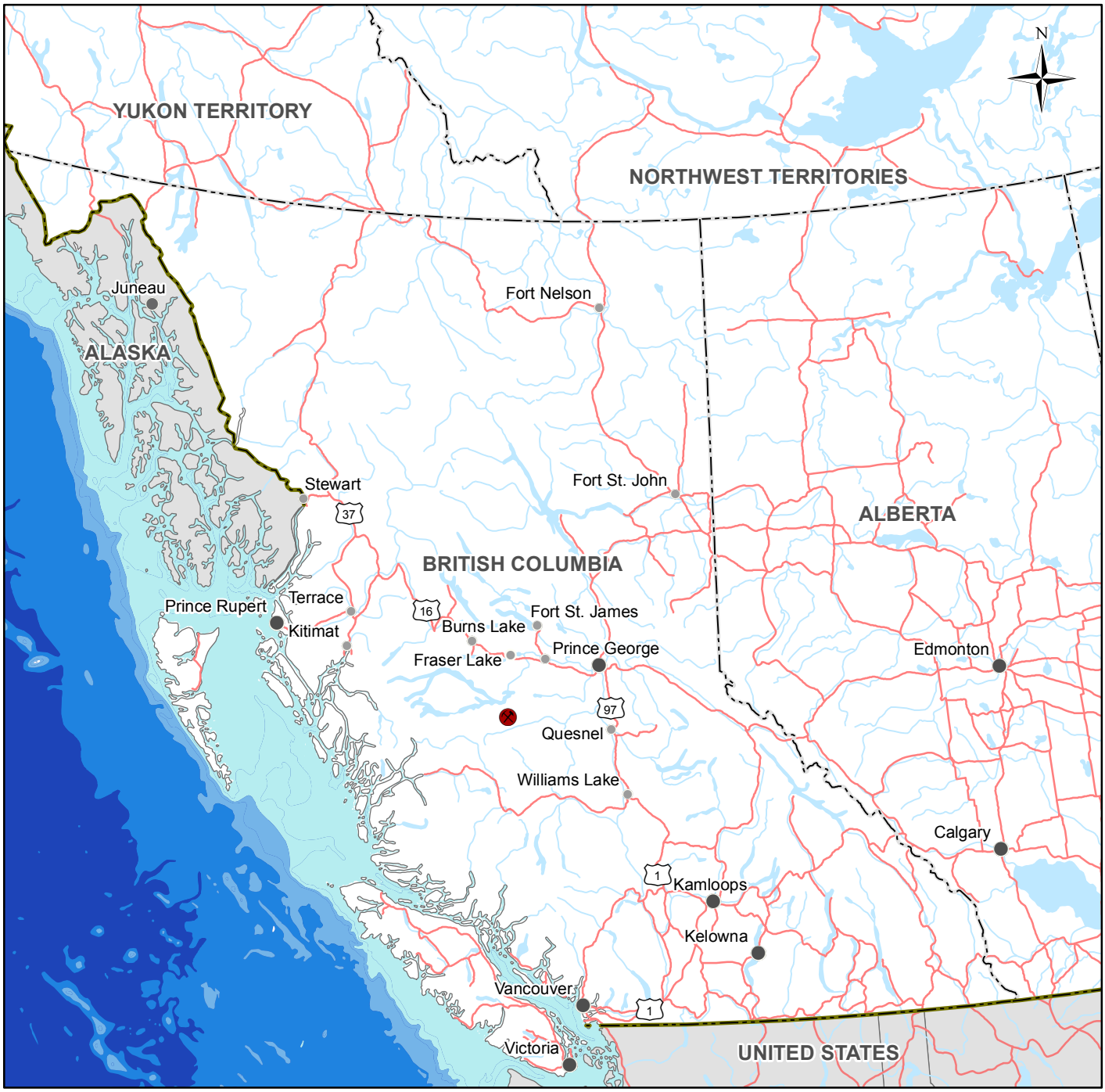
This is the second baseline report on fish and fish habitat of the Project. The *Blackwater Gold Project: Fish and Aquatic Resources 2011-2012 Baseline Report* (AMEC, 2013b) described baseline surveys conducted in 2011 and 2012.

The overall objectives of the baseline studies were to:

- Characterize fish communities and aquatic resources in streams and lakes that may be affected by the Project so to identify potential interactions and opportunities for mitigation, and to support an application for a Certificate of Environmental Assessment;
- Provide baseline data that will support future environmental effects monitoring programs; and
- Quantify fish habitat (and its quality and productive capacity) potentially affected by the Project so that a fish habitat mitigation and offset plan can be developed to meet the criteria laid out in Fisheries and Oceans Canada's (DFO) *Fisheries Protection Policy Statement* (DFO, 2013a) and *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting* (DFO, 2013b).

Studies in 2013 included the following:

- A survey of overwintering habitat quality at 20 stream sites and three lakes in March 2013;
- A third consecutive year of monitoring stream water temperatures;
- An electrofishing survey of the fish community of Reaches 1, 2 and 3 of Davidson Creek;
- A survey of fish and fish habitat in lower Chedakuz Creek;
- A survey of fish and fish habitat of Creek 705;
- A survey of fish habitat of Creek 505659 (a tributary of Creek 661);
- A survey of fish and fish habitat at stream crossings of the water pipeline from Tatelkuz Lake to the mine site;
- A survey of fish and fish habitat at stream crossings of the Project's transmission line, mine access road, and airstrip access road;



Legend

- Blackwater Gold Project
- City
- Town
- Road
- Stream
- Waterbody
- Provincial Boundary
- International Boundary

Reference
Atlas of Canada scale 1:7,500,000

Scale: 1:9,000,000

0 50 100 200 300 400 500
Kilometres

CLIENT: newgold

PROJECT: Blackwater Gold Project

Location of Blackwater Project in British Columbia

DATE:	ANALYST:	Figure 1-1
April, 2013	AA	
JOB No: VE52095	QA/QC: IM	PDF FILE: Other-100-005_v7_project_location.pdf
GIS FILE: Other-100-005_v7.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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320000 360000 400000 440000

5960000 5920000 5880000

François Lake
Cheslatta Carrier
Danskin
CHESLATTA 1
Skin Tyee
Uncha Mountains Red Hills Park
Francois Lake Park
Uncha Lake
Takysie Creek
Binta Lake
BINTA LAKE 2
Cheslatta
KNAPP LAKE 6
BAPTISTE LOUIS 8
Cheslatta River
Cheslatta Lake
Knapp Creek
TARGE CREEK 15
ALEXIS THOMAS 1A
Cheslatta
HOLY CROSS LAKE 3
MURRAY LAKE 4
Bird Creek
Nechako Canyon Protected Area
Lucas Lake
Lucas Creek
Knewstubb Lake
Big Bend Creek
LEON 14
Natalkuz Lake (Nechako Reservoir)
Tetachuck River
Entiako River
Entiako Park
Entiako Lake
Tweedsmuir Park
Johnny Lake
Laidman Lake
Fawnie Creek
Moose Lake
ULKATCHO 6
TSETZI LAKE 11
TSACHLA LAKE 8
Tsacha Lake
Kushya
KUSHYA CREEK 12
KUSHYA CREEK 7
Blackwater River
Kluskus
CHIEF MORRIS 13
BISHOP BLUFFS 5
BISHOP BLUFFS 6
BISHOP BLUFFS 10
KLUSKUS 14
SUNDAYMAN'S MEADOW 3
KLOYADINGLI 2
KLUSKUS 1
UPPER KLUSKUS LAKE 9
YALADELASSLA 4
Kuyakuz Lake
Chedakuz Creek
Top Lake
Tatelkuz Lake
TATELKUS LAKE 28
Kluskus-Ootsa FSR
Proposed Mine Access Road
Proposed Fresh Water Pipeline
Exploration Road
Kluskus-Blue FSR
Kluskus FSR
Mills Ranch Reroute
Chedakuz Creek
Taluk Creek
Batnuni Lake
Euchiniko River
Nataniko Creek
Euchiniko Lakes
Alexander Mackenzie Heritage Trail
Kluskoil Lake Park
EUCHINICO CREEK 19
TROUT LAKE JONNY 15
Nazko
EUCHINICO CREEK 17
EUCHINICO CREEK 18
TROUT LAKE ALEC 16
Euchiniko
Baezaeko
REDWATER CREEK 30
Nazko
Meridian Road (Vanderhoof) Ecological Reserve
Finger Lake
Tatuk Lake
TATUK LAKE 7
Finger Tatuk Park
Chilako River Ecological Reserve
Chilako River
Endako
Stellako
Fraser Lake
FRASER LAKE 2
Nadleh Whuten
YENSISCHUCK 3
Fort Fraser
NAUTLEY 1
STELLAQUO 1
SEASPUNKUT 4
Stellako Reroute
Stellako WMA
Stellako
Fraser Lake
Engen
Nechako River
NOONLA 6
Vanderhoof
Stuart River Park
Stuart River
Weneez
Sinkut River
STONY CREEK 1
Tachick Lake
Saik'uz
CLUSTALACH 5
SINKUT LAKE 8
OLD COUNTRY MEADOW 4
Nulki
Nulki Lake
LAKETOWN 3
SACKANITECLA 2
Mapes
CORKSCREW CREEK 10
CORKSCREW CREEK 9
Corkscrew
Sinkut River
Cluculz Lake
Cluculz Creek
Khai
Smith Creek
Nithi River
Tahultzu Lake
Hallett Lake
Greer Creek
Targe Creek
Nechako River
16
27

N

Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Railway
- Existing Transmission Line
- Alexander Mackenzie Heritage Trail
- Stream
- Waterbody
- Parks and Protected Areas
- Indian Reserve

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Transmission Line Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip Extent
- Proposed Mine Site

KEY MAP



Scale: 1:500,000

0 5 10 20
Kilometres

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Location of Proposed Mine Site, Mine Access Road, Transmission Line, and Water Supply Pipeline

DATE: April, 2014	ANALYST: WR	**Figure** 1-2
JOB No: VE52277	QA/QC: AP	PDF FILE: Other-100-028_v14_Overview.pdf
GIS FILE: Other-100-028_v14_Overview.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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- A survey of the aquatic ecosystem of Tatelkuz Lake, including bathymetry, littoral zone fish habitat, physical and biological limnology, and relative abundance and biological characteristics of the fish community;
- An analysis of tissue metal concentrations in rainbow trout (*Oncorhynchus mykiss*) and mountain whitefish (*Prosopium williamsoni*) from Tatelkuz Lake;
- A hydroacoustic assessment of fish numbers in Tatelkuz Lake; and
- A third consecutive year of surveying of kokanee (*Oncorhynchus nerka*) spawner abundance and spatial distribution in streams.

This report focuses on fish, fish habitat, and aquatic resources in the Project study area. "Fish" includes fish species diversity, absolute and relative abundances, locations and timing of seasonal migrations, and biological characteristics such as length, weight, age, growth, sex, sex ratio, length at 50% sexual maturation, diet, and tissue metal concentrations. "Fish habitat" includes the location, quantity, and quality of stream and lake habitat that supports all life stages of fish: migration, spawning, rearing, and overwintering. "Aquatic resources" include all components of aquatic ecosystems that support fish and fish habitat, including water temperatures and the biomass, density and taxonomic composition of phytoplankton, zooplankton, and benthic macroinvertebrates (BMI).

The report does not describe "fisheries", which are harvests of fish populations, because fisheries were not studied in 2013. This report does not describe Traditional Knowledge (TK) or Traditional Land Use (TLU) of fish and aquatic resources in the Project study area. AMEC has gathered TK/TLU information as part of Project consultation activities.

This report does not describe stream flows, water quality, or sediment quality. Hydrology is described in the *Blackwater Gold Project: 2013 Hydrometeorology Report* (Knight Piésold, 2013), and water quality and sediment quality are described in the *Blackwater Gold Project: Water and Sediment Quality* (AMEC, 2013a).

Section 2.0 of this report briefly describes the study area. This was necessary to understand the scope and objectives of the studies described in **Section 3.0**. **Section 4.0** describes methods and **Section 5.0** describes results.

2.0 STUDY AREA

The Project is located on the Nechako Plateau of central BC (**Figure 1-2**). This region is located within the Omineca Region of the BC Ministry of Environment (BC MOE) and the Pacific Region of DFO. The region is characterized by gently undulating highlands that are dissected by meltwater channels and glacial features. The proposed mine site is situated along the northern flanks of Mount Davidson at an elevation of 1,700 m above sea level (masl). Valleys around the Project have elevations between 940 and 1,010 masl.

The proposed mine site occupies a surface area of approximately 3,300 ha. Its centre is at 53° 11'22.872"N and 124° 52'0.437"W (or 58930000 Northing and 375400 Easting), and is located in National Topographic System sheet 93F/02 (**Figure 2.1-1**).

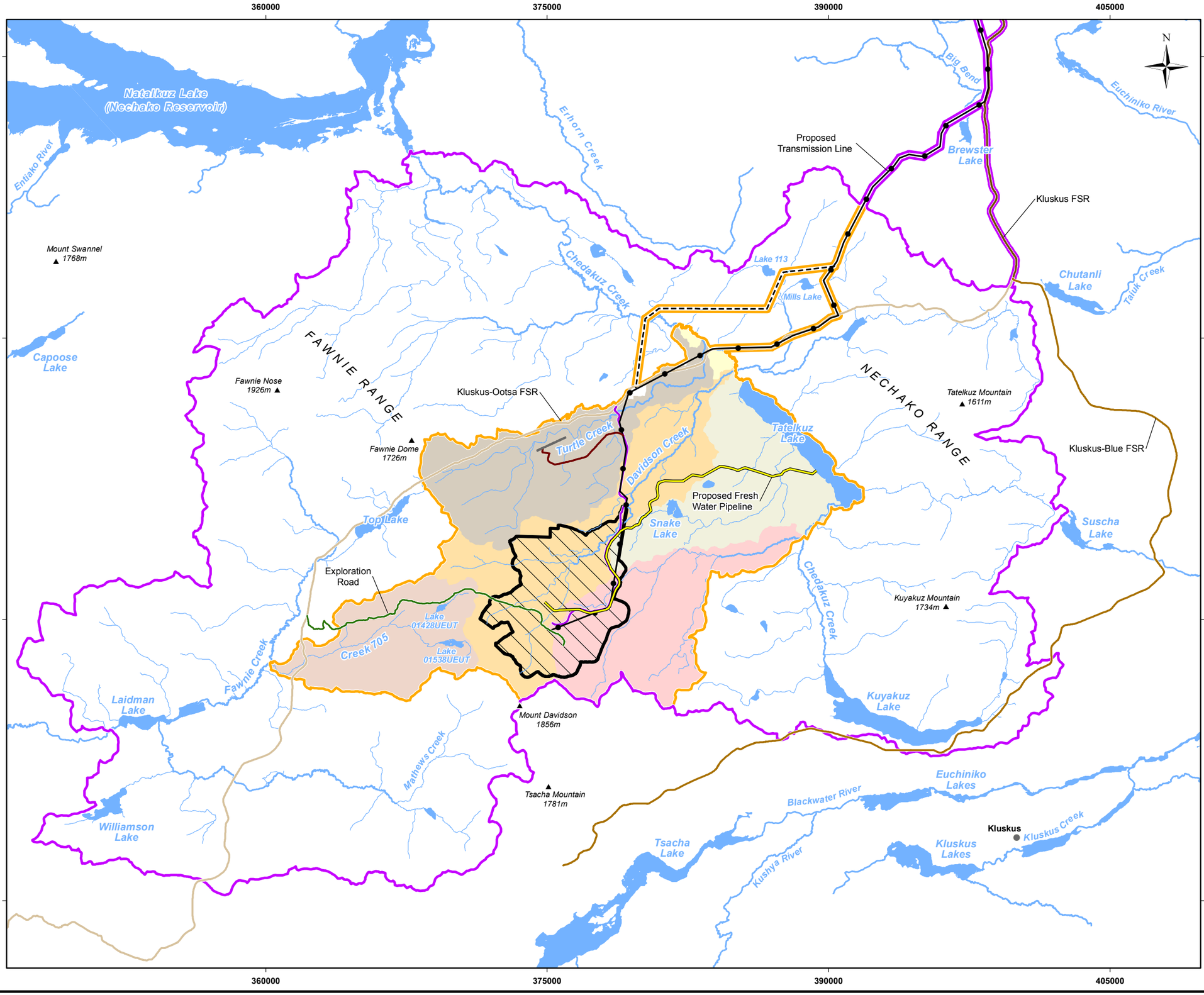
The mine site is largely contained within the Davidson Creek Watershed, a tributary sub-watershed within the Chedakuz Creek Watershed. Davidson Creek flows from the outlet of headwater Lake 01682LNRS near the summit of Mount Davidson northeast to Chedakuz Creek immediately downstream of the exit of Chedakuz Creek from Tatelkuz Lake.

Chedakuz Creek flows to the Nechako Reservoir, which was created in 1952 by construction of Kenney Dam across the Nechako River. The Nechako Reservoir contains multiple basins, including Natalkuz Lake and Knewstubb Lake, both of which are shown in **Figure 1-2**. (Natalkuz Lake is also shown in **Figure 2.1-1**). Hence, the Chedakuz Creek Watershed is now part of the Lower Nechako Reservoir Basin.

2.1 Local Study Area

Early in 2011, AMEC defined a Local Study Area (LSA) for the three aquatic disciplines of the Project: hydrology, water quality, and fish and aquatic resources. The LSA is the region in close proximity to a Project where direct effects of mine activities are anticipated. Direct effects include mortality of fish and loss of fish habitat, whereas indirect effects are those mediated by other disciplines such as water quality or hydrology.

AMEC based the boundaries of the aquatics LSA on a review of the location and size of the Project footprint and associated infrastructure, and on consultation with hydrologists, water quality specialists, and aquatic biologists (**Figure 2.1-1**). They based their selection on an understanding of the potential direct effects of the Project on fish, and on a review of the life histories of fish known to be present in the area.



Legend

- Populated Place
- Spotheights
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Mine Access Road
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Watersheds

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Fish and Aquatic Resources

- Local Study Area
- Regional Study Area

Scale:1:200,000

0 2.5 5 10

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish and Aquatic Resources Study Areas

DATE: December, 2013	ANALYST: WR	**Figure** 2.1-1
JOB No: VE52095	QA/QC: BM	PDF FILE: 10-100-002_v12_aquatic_EA.pdf
GIS FILE: 10-100-002_v12_aquatic_EA.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-002_v12_aquatic_EA.mxd

The Aquatics LSA includes the following streams and lakes, running in a counter clockwise direction from Tatelkuz Lake (**Figure 2.1-1** and **Table 2.1-1**):

- Tatelkuz Lake. The LSA boundary runs along the southern and eastern shores of that lake.
- The portion of lower Chedakuz Creek (which flows from Tatelkuz Lake to the Nechako Reservoir) between Tatelkuz Lake and the confluence with Turtle Creek. The LSA boundary runs along the eastern bank of lower Chedakuz Creek.
- Two small catchments called Chedakuz Creek Local Watersheds, located on the western bank of lower Chedakuz Creek. These are not true watersheds because they contain no streams, but they were created by defining the boundary of the LSA as the eastern bank of lower Chedakuz Creek.
- Turtle Creek, which flows northeast into lower Chedakuz Creek. The main tributary of Turtle Creek is Creek 700, which drains to the west from the Project mine site. The LSA boundary runs along the northwestern and western boundaries of that watershed.
- Davidson Creek, which also flows northeast into lower Chedakuz Creek upstream of the Turtle Creek confluence. The LSA boundary runs along the western and southern boundaries of that watershed.
- Creek 705, which drains the southwest slope of Mount Davidson into Fawnie Creek, a tributary to the Entiako River. The Entiako River drains to the Nechako Reservoir (**Figure 1-2**). The LSA boundary runs along the northwestern and southern boundaries of that watershed.
- Creek 661, which drains the northeast side of Mount Davidson from the Project mine site towards middle Chedakuz Creek upstream of Tatelkuz Lake. Middle Chedakuz Creek flows from Kuyakuz Lake to Tatelkuz Lake. The LSA boundary runs along the southern and eastern boundaries of that watershed.
- The northern portion of middle Chedakuz Creek from the confluence with Creek 661 downstream to Tatelkuz Lake.
- Streams in the Tatelkuz Lake Tributaries Watershed that drain northeast into the west side of Tatelkuz Lake. This is not technically a complete watershed because it does not include the rest of the catchment that drains into the eastern shore of Tatelkuz Lake.

Table 2.1-1: Main Drainages of the Aquatics LSA

Gazetted Name	Local Name	BC Freshwater Atlas Code	Tributary of
n/a	Turtle Creek	100-567134-610692-480511	Chedakuz Creek
n/a	Creek 700	100-567134-610692-480511-645840	Turtle Creek
Davidson Creek	Davidson Creek	100-567134-610692-522527	Chedakuz Creek
n/a	Tatelkuz Lake Tributaries	100-567134-610692-579340	Tatelkuz Lake
n/a	Creek 661	100-567134-610692-671007	Chedakuz Creek
n/a	Creek 705	100-567134-641477-543682-598692	Fawnie Creek

Note: n/a = not applicable

Tatelkuz Lake is the largest lake in the LSA (**Plate 2.1-1** and **Plate 2.1-2**). It is located along the north-eastern boundary of the LSA (**Figure 2.1-1**). It is a long (~9 km), narrow (<1 km wide), steep-sided lake typical of valley lakes found in the BC interior plateau. It is a large lake with a surface area of 910 ha, a mean depth of 21.4 m, and a volume of 195 million m^3. It has no islands. The lake has 14 inlets and one outlet. The major inlet is middle Chedakuz Creek, which enters the lake along its southwest shore (**Plate 2.1-3**). The outlet is lower Chedakuz Creek, which flows out of the northern end of Tatelkuz Lake (**Plate 2.1-1**).



Plate 2.1-1: Tatelkuz Lake Facing Southeast, 19 June 2011, Showing Lower Chedakuz Creek Flowing Towards the Viewer



Plate 2.1-2: Tatelkuz Lake Facing Northwest, 14 July 2013



Plate 2.1-3: Middle Chedakuz Creek Entering Tatelkuz Lake, 14 July 2013

2.2 Regional Study Area

The Regional Study Area (RSA) is the area surrounding the LSA in which both direct and indirect effects may occur. AMEC defined the Aquatics RSA as encompassing the whole of the Chedakuz Creek drainage and part of the Fawnie Creek drainage (**Figure 2.1-1**). It includes the following streams and lakes:

- Kuyakuz Lake and all its tributaries;
- Middle Chedakuz Creek between Kuyakuz Lake and Tatelkuz Lake, and all its tributaries;
- Lower Chedakuz Creek between the confluence of Turtle Creek and the Nechako Reservoir, and all tributaries flowing into that stretch of the creek from the north-east and north-west;
- Tributaries to Chedakuz Creek between the outlet of Tatelkuz Lake and the confluence with Turtle Creek, including Davidson and Turtle creeks and those streams that drain Lake 113 and Mills Lake; and
- Upper Fawnie Creek Watershed from Laidman Lake upstream to Top Lake, and upstream of the headwaters of Creek 705 and Matthews Creek.

AMEC (2013b) provides a detailed summary of historical information on fish and fish habitat in lakes and streams of the RSA.

2.3 Transmission Line and Access Road Corridors

The Project will require connection to the BC Hydro electricity grid through construction of a 230 kV transmission line. The preferred route is a 133 km corridor that will connect with BC Hydro's 230 kV system at the Glenannon Substation near Fraser Lake (New Gold, 2012). The route will run east from the substation for approximately 19 km and then south for another 114 km to the mine site (**Figure 1-2**).

Where possible, the route will follow existing logging roads and other disturbances (e.g., existing BC Hydro transmission line corridors) to avoid creating new disturbances. The corridor will be cleared to a width of 40 m, and will have 40 m-wide management zones on either side of the cleared strip to screen for danger trees that may fall on the line.

The proposed mine site is already accessed by vehicle from a network of forest service roads originating at the community of Engen, approximately 20 km west of Vanderhoof (**Figure 1-2**). Total distance from Engen to the mine site is approximately 194 km.

Both the transmission line and the access road will cross numerous streams. Culverts already exist at some crossings, and culverts will have to be installed at other crossings.

3.0 SCOPE AND OBJECTIVES

This section briefly describes the scope and objectives of each of the baseline studies conducted in 2013.

3.1 Survey of Overwintering Habitat

AMEC conducted a survey of overwintering habitat in streams and lakes of the LSA from 12 to 17 March 2013. The objective of the survey was to measure the physical and chemical characteristics of overwintering habitat available to fish in the study area in winter 2013. This was the second year of overwintering habitat surveys; the first survey was from 6 to 9 March 2012 (AMEC, 2013c). The ultimate purpose of these surveys was to determine the abundance and quality of available overwintering habitat and to assess whether overwintering habitat is limiting fish production.

AMEC conducted the survey in March because dissolved oxygen (DO) concentrations under the ice are at their lowest in late winter. Hence, the survey describes the quality of overwintering habitat at the time of greatest stress for fish.

3.2 Stream Water Temperatures

Temperature is a crucial determinant of biological processes in streams. It influences survival and growth of periphyton, benthic macroinvertebrates (BMI), and fish. Freezing of streams during the winter restricts available overwintering habitat and affects the distribution and abundance of fish populations. During the open water season, low water temperatures can impede growth and survival; high temperatures can similarly impede growth or, if too high, can be fatal.

The objective of stream water temperature monitoring in 2013 was to assess the suitability of stream temperature regimes to support fish during various life stages. This was the third year of stream temperature monitoring. AMEC reported the results of monitoring in 2011 and 2012 in (AMEC, 2013b).

3.3 Electrofishing Survey of Lower Davidson Creek

The lower three reaches of Davidson Creek were electrofished from 9 to 11 July 2013 because attempts to electrofish those reaches in late July 2011 and 2012 were halted by the presence of spawning kokanee[1] (AMEC, 2013b). Therefore, electrofishing of Davidson Creek was conducted in early July 2013 to avoid disturbing kokanee spawners. Electrofishing in early July also avoided disturbing rainbow trout spawners, which migrate into Davidson Creek from Tatelkuz Lake from May to June.

[1]Kokanee spawn earlier in Davidson Creek than other streams in the LSA due to Davidson Creek's low water temperature.

3.4 Fish and Fish Habitat of Lower Chedakuz Creek

Lower Chedakuz Creek, the outlet of Tatelkuz Lake, was surveyed for fish and fish habitat on 24 July 2013. This was required for purposes of effects assessment because Tatelkuz Lake will be the primary source of water for the mine site.

3.5 Fish and Fish Habitat of Creek 705

Fish and fish habitat in Reaches 1 to 6 of Creek 705 were surveyed from 13 to 16 August 2013 to provide baseline information for the purpose of effects assessment. As part of the Blackwater fish habitat mitigation and offset plan, Creek 705 will receive additional flows once Lake 01682LNRS, currently the headwater lake of Davidson Creek, is redirected into Lake 01538UEUT, one of the two headwater lakes of Creek 705.

Reaches 8 to 12 of Creek 705 were surveyed from 12 to 13 September 2013 because this stream, which is currently the inlet stream to Lake 01538UEUT, may be redirected to Lake 01682LNRS as part of the fish habitat mitigation and offset plan.

3.6 Fish Habitat of Creek 505659

Creek 505659, a tributary to Creek 661, was surveyed for fish habitat on 15 August 2013 to support the assessment of potential effects downstream of the mine site facility. Fish surveys of Creek 505659 were completed in 2011 and 2012 (AMEC, 2013b).

3.7 Fish and Fish Habitat of Water Pipeline Stream Crossings

Fish and fish habitat surveys of stream crossings along the proposed fresh water pipeline from Tatelkuz Lake to the mine site were conducted from 17 to 22 August 2013 for purposes of effects assessment.

3.8 Fish and Fish Habitat of Stream Crossings of the Transmission Line, Mine Access Road, and Airstrip Access Road

In the summer of 2013, Avison Management Services Ltd. (Avison) conducted fish and fish habitat surveys at stream crossings of the transmission line, the mine access road, and the airstrip access road. This was the second year of stream crossing surveys. In the summer and autumn of 2012, Avison had conducted a survey of stream crossings of the access road and earlier alignments of the transmission line (Avison, 2013a).

The focus of the 2013 survey was stream crossings of versions 6 to 9 of the transmission line (Avison, 2013b). That included two potential re-routes of the transmission line: the Stellako River re-route and the Mills Ranch re-route. Surveys were also conducted on several new stream crossings of the mine access road, and on stream crossings of the airstrip access road.

The purpose of the 2012 and 2013 surveys was to provide a complete inventory of fish and fish habitat at stream crossings of the final, preferred transmission line and access road alignments by combining information collected from selected crossings in both years.

3.9 Bathymetry of Tatelkuz Lake

The objective of the May and June 2013 bathymetric mapping of Tatelkuz Lake was to create a more accurate and detailed map that would allow calculation of lake surface area, littoral area, volume, perimeter, and maximum depth for specific water surface elevations.

Walsh and Hale (1977) previously surveyed the bathymetry of Tatelkuz Lake from 16 to 18 July 1977. They made 220 depth measurements along 22 transects. The map created from those data has a scale of 1 centimetre (cm) for each 100 metres (m) with depth contours at 6 m intervals. That map was useful in identifying the deeper and shallower areas within the lake. However, it was not accurate and detailed enough for the purposes of the Project because the depth measurements and lake surface elevation at the time of survey were estimated only to the nearest 1 m. Also, the water surface elevation relative to sea level was not reported.

3.10 Littoral Fish Habitat of Tatelkuz Lake

The objective of the Tatelkuz Lake fish habitat study was to identify, quantify, and map the different types of littoral habitat (i.e., shallow, nearshore habitat) available to fish in the lake. These data were required to assess the potential effects to littoral habitat that may result from pumping lake water to the mine site. Tatelkuz Lake will be the primary water source for the Blackwater Gold Mine. Tatelkuz Lake water will be used as make-up water in the process mill during mine operations and it will be used to augment flows in Davidson Creek during operations, closure and post-closure.

3.11 Physical and Biological Limnology of Tatelkuz Lake

Limnology of Tatelkuz Lake was studied because the lake will be the primary source of water for the Blackwater Gold Mine.

Physical limnology is defined as the vertical structure of the water column and the degree of light penetration. Historical data on physical limnology of Tatelkuz Lake is limited. In July 1977, two vertical profiles of temperature and DO were collected by Walsh and Hale (1977) for the BC MOE. Over the last three years (2011 to 2013), water quality samples have been collected every 3 months from a site named WQ21 in the northern third of Tatelkuz Lake in order to generate a baseline data set on water quality (AMEC, 2013b). Most of those water samples were accompanied by the collection of vertical profiles of temperature and DO. On 17 and 23 July 2013, two additional vertical profiles of temperature, DO, and conductivity, as well as Secchi depth measurements, were taken at two sites named E2 and B2 in the lake as part of a study of the lake fish community.

There is no historical information available on the phytoplankton, zooplankton, and BMI communities of Tatelkuz Lake.

The phytoplankton community is a group of single-celled plants that live suspended in the water column of lakes. They are the dominant photosynthesizing organisms in lakes, and so form the base of the food chain. For that reason, their density (cells/m^3) and biomass (µg/m^3 chlorophyll *a*) are used as measures of lake productivity (Willen, 2000).

Phytoplankton communities are dynamic and undergo quick seasonal succession as different taxa bloom into dominance and recede. They have a diversity of species that show variable responses to environmental effects and therefore are useful for tracking changes to the water quality of a lake (Willen, 2000).

The zooplankton community is a group of invertebrates that live suspended in the water column of lakes. They feed on phytoplankton and each other and, in turn, are prey for many fish species, including rainbow trout and kokanee. Zooplankters are widespread, relatively easy to identify, and respond to environmental stressors such as nutrient enrichment, acidification, and changes to fish composition (Anas et al., 2013). Therefore, they are useful for establishing baseline conditions and for tracking environmental change. Their density (organisms/m^3), biomass (i.e., mg/m^3), and taxonomic composition are used as measures of lake productivity and ecosystem health.

BMI are a diverse group of animals living on or in the substrates of streams, wetlands and lakes. They include protozoans, flatworms, nematodes, aquatic worms, crustaceans (i.e., ostracods, isopods, and amphipods), molluscs (i.e., snails and clams), and larvae of aquatic insects (i.e., mayflies, dragonflies, and blackflies). Many BMI feed on periphyton and so provide a link between primary production and fish. Fish species in the LSA do not feed directly on algae but instead feed on the larger, more energy-rich BMIs (and other fish).

BMIs are not only prey for fish, but also serve as indicators of changes in water quality because of their sessile nature, high taxonomic diversity, and relatively long lifespan (1 to 3 years) (Resh and Rosenberg, 1984; Metcalfe, 1989; Barbour et al., 1999).

Therefore, the specific objectives of the 2013 limnology study of Tatelkuz Lake were to collect more vertical profiles of temperature, DO and conductivity, measure Secchi depths, and characterize the abundance, biomass, and taxonomic composition of the phytoplankton, zooplankton, and BMI communities. The study was conducted in mid-August 2013 because that was the time of year at which the plant and animal populations of the lake were expected to be at their maximum biomass and species diversity.

These data were compared among sampling sites within Tatelkuz Lake and among Tatelkuz Lake and three headwater lakes in the LSA – 01682LNRS, 01538UEUT and 01428UEUT – that were surveyed in 2012 (AMEC, 2013b). The headwater lakes are much smaller and shallower than Tatelkuz Lake, they are at higher elevations, and as headwater lakes receive lower concentrations of particulate and dissolved material than does a valley bottom lake

such as Tatelkuz Lake. Hence, comparison of the four lakes provided insight into the environmental factors that drive the limnology of Tatelkuz Lake.

3.12 Fish Community of Tatelkuz Lake

A fish community survey of Tatelkuz Lake was conducted between 15 and 20 July 2013. The purpose of the survey was two-fold. First, the survey was intended to inventory the fish community of Tatelkuz Lake by collecting data on fish species composition, relative abundance, spatial distribution, habitat choice, and biological characteristics such as length, weight, condition, age, sex, sexual maturation, energy storage, and diet.

Second, the survey was used to assign fish species and body lengths to hydroacoustic signal data collected by a hydroacoustic survey of Tatelkuz Lake that immediately preceded the fish community survey. The purpose of the hydroacoustic survey was to estimate the number of fish in the lake by species and body length. The results of the hydroacoustic survey are reported in a separate document (Shuksan, 2013) shown in this report as **Annex 5.14-1**. The methods and results of the hydroacoustic survey are summarized in **Sections 4.14** and **5.14**, respectively, of this report.

The hydroacoustic survey and the fish community survey were both conducted in July 2013 because that was the one month of the year during which all members of the fish community were expected to be present in the lake. For example, rainbow trout leave Tatelkuz Lake in April and May to spawn in tributary streams and return to the lake by the end of June (AMEC, 2013b). Also, kokanee leave the lake from the second half of July to the middle of September to spawn in tributary streams and then die. As a result, the Tatelkuz Lake fish community is likely most stable in terms of numbers and species composition in early to mid-July.

Walsh and Hale (1977) surveyed the fish community of Tatelkuz Lake from 16 to 18 July 1977 for the BC MOE. A total of 447 fish from seven species were captured in gillnets, including 195 mountain whitefish (*Prosopium williamsoni*), 127 rainbow trout, 52 kokanee, 33 northern pikeminnow (formerly known as squawfish) (*Ptychocheilus oregonensis*), 25 longnose sucker (*Catostomus catostomus*), 13 large-scale sucker (*Catostomus macrocheilus*), and two burbot (*Lota lota*).

AMEC re-surveyed the fish community in 2013 because Walsh and Hale (1977) based their assessment of the fish community on only three overnight gillnet sets. That was sufficient fishing effort for a reconnaissance survey but not for a baseline biological survey that will be used for ground-truthing the hydroacoustic survey as well as environmental effects assessment. A re-survey was also required because the fish community may have changed over the intervening 36 years.

3.13 Metal Concentrations of Tatelkuz Lake Fish Tissue

Rainbow trout were sampled for tissues from Tatelkuz Lake in 2013 because they had been sampled for tissue metals concentrations in 2011 and 2012 from four streams (Turtle Creek, Davidson Creek, lower Chedakuz Creek, and Creek 661) and three small headwater lakes (Lake 01682LNRS of the Davidson Creek Watershed, and lakes 01428UEUT and 01538UEUT of the Creek 705 Watershed) of the Blackwater LSA (AMEC, 2013b). Hence, the 2013 samples from Tatelkuz Lake – the largest lake in the LSA – completed coverage of the full range of aquatic habitat types in the LSA.

Rainbow trout are the predominant fish species in Tatelkuz Lake (Walsh and Hale, 1977; AMEC, 2013b), and in streams and headwater lakes of the LSA, and a common species in lakes of the RSA (e.g., Kuyakuz Lake) (Burns, 1977). Hence, the loss of rainbow trout collected for tissue sampling from Tatelkuz Lake in 2013 is expected to have a negligible effect on population number. Also, since the population is so large, it will be easier to sample rainbow trout during future aquatic effects monitoring programs.

Rainbow trout are a valued sport fish and are consumed by both humans and piscivorous wildlife, so information on their baseline tissue metal concentrations is useful for assessing environmental health.

Mountain whitefish were sampled from Tatelkuz Lake for tissue metals analysis because they are the third most common fish species in Tatelkuz Lake and a common species in lakes of the RSA (Burns, 1977). In addition, mountain whitefish occupy a different ecological niche than rainbow trout so their metal profiles may differ from those of rainbow trout. Mountain whitefish feed exclusively on benthic macroinvertebrates, mainly chironomid larvae, while rainbow trout feed on a wide range of benthic and pelagic prey, including terrestrial insects that fall on the water surface.

3.14 Hydroacoustic Assessment of Fish Number in Tatelkuz Lake

AMEC contracted Shuksan Fisheries Consulting (Shuksan) to perform an acoustic survey of the lake in July 2013 in conjunction with AMEC's fish community survey. The purpose of both of these surveys was to obtain updated and more detailed information about fish in the lake. Both surveys were scheduled for mid-July when all members of the fish community were expected to be present in the lake.

Specific objectives of the acoustic survey were to:

- Conduct day and night acoustic surveys to describe diel differences in fish distribution patterns and to determine the best period for measuring fish abundance in the lake;
- Construct a total fish abundance estimate (species combined) with 95% confidence limits using data from the most suitable period;

- Construct abundance estimates for individual fish species by apportioning the total acoustic estimate using species composition from gillnetting conducted by AMEC; and
- Estimate the size distribution of fish based on acoustic target strength (TS).

3.15 Survey of Kokanee Spawners

AMEC conducted a third consecutive year of kokanee spawner surveys in streams of the Blackwater LSA from 8 August to 12 September 2013. Kokanee spawner surveys had previously been conducted in 2011 and 2012 (AMEC, 2013b). The specific objectives of the 2013 survey were to:

- Identify locations and timing of kokanee spawning in each stream surveyed in 2013;
- Estimate the number of kokanee spawners in each stream and in the LSA as a whole in 2013;
- Compare the results of the 2013 survey with the results of kokanee spawner surveys in 2011 and 2012; and
- Summarize spawn timing, number of spawners, spawner-redd relationships, and total number of spawners among the three survey years.

4.0 METHODS

This section describes the methods used in the baseline studies of streams and lakes of the LSA and RSA conducted in 2013.

4.1 Overwintering Habitat Survey

AMEC surveyors visited 20 stream sites and 3 lake sites from 12 to 17 March 2013. Stream sites were chosen based on the presence of pools and beaver ponds–features that were deep enough (>0.1 m) to support overwintering juvenile fish. An under-ice cut-off water depth of 0.1 m was based on professional judgement and the results of the March 2012 surveys (AMEC, 2013b).

Those pools and ponds were known from previous summer surveys in 2011 or 2012 or were selected during winter helicopter overflights in 2012 and 2013 based on channel pattern and form (i.e., outside meander bends). Sites were located in Davidson Creek, Turtle Creek, Creek 661, Creek 705, and Chedakuz Creek (**Figure 4.1-1** and **Table 4.1-1**). Headwater lakes included Lake 01682LNRS in the Davidson Creek Watershed and lakes 01428UEUT and 01538UEUT in the Creek 705 Watershed.

Surveyors used a helicopter overflight to take visual observations and photographs from the air (**Table 4.1-2**). This overflight included the entire lengths of Davidson Creek, Creek 661, Creek 705, Turtle Creek, and lower Chedakuz Creek between Tatelkuz Lake and the confluence with Turtle Creek. Data collected from the helicopter included the presence of under ice flow, groundwater seepage, open water, thin ice, and hydraulic connections to upstream, downstream, and/or lateral habitats. Surveyors then visited sampling sites by helicopter, truck, and foot for collection of physical and chemical data.

At each of the 23 sites, surveyors drilled multiple holes through the ice with a gas-powered auger. At each hole, they measured snowpack depths and ice depths with a metre stick. A YSI model 85 multimeter probe with a 25 m-long cable was lowered through the holes to measure pH, temperature, DO concentration, and conductivity of the water (**Plate 4.1-1** and **Plate 4.1-2**). Surveyors calibrated the probe each day before sampling began. In streams, measurements were taken in mid-water. In lakes, measurements were taken at intervals of 0.5 m or 1.0 m during the descent and ascent of the probe through the water column. The length of probe cable required to touch bottom was used to measure water depth below the ice.

364000 371000 378000 385000 392000

5908000 5901000 5894000

N

Lower Nechako Reservoir Regional Watershed

Chedakuz Creek

Fawnie Nose 1926m

Fawnie Dome 1726m

FAWNIE RANGE

NECHAKO RANGE

Proposed Transmission Line

Kluskus-Ootsa FSR

DO-02

DO-03

DO-04

DO-05

DO-06

DO-08

DO-09

DO-13

DO-15

DO-16

DO-17

DO-18

DO-19

DO-20

DO-21

DO-22

DO-23

DO-25

Turtle Creek

Davidson Creek

Tatelkuz Lake

Tatelkuz Lake Tributaries

Proposed Mine Access Road

Proposed Fresh Water Pipeline

Snake Lake

Top Lake

Fawnie Creek

Lake 01428UEUT

Lake 01538UEUT

Lake 01682LNRS

Creek 661

Creek 705

Chedakuz Creek

Kuyakuz Lake

Mount Davidson 1856m

Upper Eutsuk Lake Regional Watershed

Euchiniko Lake Regional Watershed

Mathews Creek

Kluskus-Blue FSR

Legend

- Overwintering Site
- Spotheights
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Stream
- Waterbody
- Regional Watersheds

Watersheds

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Fish and Aquatic Resources

- Local Study Area
- Regional Study Area

Scale:1:105,000

0 1 2 4 6

Kilometres

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Overwintering Sampling Sites

DATE: December, 2013	ANALYST: WR	**Figure** 4.1-1
JOB No: VE52095	QA/QC: MM	PDF FILE: 10-100-169_Overwintering_v2.pdf
GIS FILE: 10-100-169_Overwintering_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Table 4.1-1: Locations of Water Quality Sampling Sites in Streams and Lakes, 12 to 17 March 2013

Watershed	Stream or Lake	Reach	FWA Code	Site Number	Date Sampled	No. of Samples	Habitat Type	UTM Coordinates	
								Easting	Northing
Davidson Creek	Davidson Creek	1	100-567134-610692-522527	DO-09	12-Mar-13	8	Riffle/Pool/Glide	384257	5907757
Davidson Creek	Davidson Creek	3	100-567134-610692-522527	DO-09	16-Mar-13	3	Riffle/Pool/Glide	384257	5907757
Davidson Creek	Davidson Creek	4	100-567134-610692-522527	DO-19	16-Mar-13	6	Riffle/Pool/Glide	380750	5903080
Davidson Creek	Davidson Creek	5	100-567134-610692-522527	DO-19	16-Mar-13	3	Riffle/Pool/Glide	380750	5903080
Davidson Creek	Davidson Creek	6	100-567134-610692-522527	DO-19	16-Mar-13	3	Riffle/Pool/Glide	380750	5903080
Davidson Creek	Davidson Creek	8	100-567134-610692-522527	DO-08	15-Mar-13	5	Pool	377735	5898669
Davidson Creek	Davidson Creek	10	100-567134-610692-522527	DO-06	14-Mar-13	5	Pool	373085	5895698
Davidson Creek	Creek 636713	3	100-567134-610692-522527-636713	DO-22	11-Mar-13	5	Pool	375811	5898396
Davidson Creek	Creek 688328	1	100-567134-610692-522527-688328	DO-23	12-Mar-13	5	Pool	374917	5898043
Davidson Creek	Creek 688328	2	100-567134-610692-522527-688328	DO-04	15-Mar-13	5	Pool	372176	5898107
Davidson Creek	Creek 704454	5	100-567134-610692-522527-704454	DO-21	11-Mar-13	5	Pool	374660	5894728
Turtle Creek	Turtle Creek	3	100-567134-610692-480511	DO-02	11-Mar-13	5	Pool	378532	5905920
Turtle Creek	Turtle Creek	7	100-567134-610692-480511	DO-03	15-Mar-13	5	Pool	373221	5904213
Creek 661	Creek 661	1	100-567134-610692-671007	DO-15	17-Mar-13	6	Riffle/Pool/Glide	384278	5898337
Creek 661	Creek 661	3	100-567134-610692-671007	DO-15	17-Mar-13	6	Riffle/Pool/Glide	384278	5898337
Creek 661	Creek 661	4	100-567134-610692-671007	DO-15	17-Mar-13	5	Riffle/Pool/Glide	384278	5898337
Creek 661	Creek 661	5	100-567134-610692-671007	DO-20	16-Mar-13	5	Pool	381006	5897690
Creek 661	Creek 505659	2	100-567134-610692-671007-505659	DO-13	17-Mar-13	5	Pool	380670	5897562
Creek 705	Creek 705	3	100-567134-641477-543682-698692	DO-16	15-Mar-13	5	Pool	366165	5894568
Chedakuz Creek	Chedakuz Creek	13	100-567134-610692	DO-25	17-Mar-13	5	Pool	383919	5909442
Davidson Creek	Lake 01682LNRS	12	100-567134-610692-522527	DO-05	13-Mar-13	1	Lake	371274	5894054
Creek 705	Lake 01428UEUT	2	100-567134-641477-543682-698692-606013	DO-18	14-Mar-13	1	Lake	369440	5895686
Creek 705	Lake 01538UEUT	6	100-567134-641477-543682-698692	DO-17	14-Mar-13	1	Lake	370201	5893722

Note: FWA = Freshwater Watershed Atlas; UTM = Universal Transverse Mercator, NAD83 Datum, Zone 10U

Table 4.1-2: Habitat Variables Measured During Overwintering Habitat Surveys, March 2013

Physical and Chemical Measurements	Visual Observations from the Air
Snowpack depth (m)	Under ice flow
Ice depth (m)	Hydraulic connection to habitat types
Water depth (m)	Presence of groundwater seeps
Dissolved oxygen (mg/L)	Open water
Temperature (°C)	Thin ice
pH	
Conductivity (µS/cm)	

Note: °C = degrees Celsius; µS/cm = microSiemens per centimetre; m = metre; mg/L = milligrams per litre

Surveyors assigned each stream a rating for overwintering habitat quality based on mean DO concentration and below-ice water depth (**Table 4.1-3**). DO ratings were based on the optimal and lethal DO concentrations for rainbow trout reported by Raleigh et al. (1984) and Ford et al. (1995), and on the BC MOE criteria for buried embryos and alevins (>9 mg/L in the water column; BC MOE, 1997a). Depth ratings were based on professional judgement. To be conservative, the lower of the two ratings was used to rate each site.

Each lake site was rated for overwintering habitat quality based on mean DO concentration.



Plate 4.1-1: Creek 661, DO-13, Augering Sample Holes in the Ice, 17 March 2013



Plate 4.1-2: Recording DO concentrations in Lake 01538UEUT, 13 March 2013

Table 4.1-3: Quality Criteria for Salmonid Overwintering Habitat

Habitat Quality Rating	Dissolved Oxygen Concentration (mg/L)	Water Depth (cm)
None	<3	<10
Poor	3 to 6	10 to 20
Fair	6 to 7	20 to 50
Good	>7	>50

Note: mg/L = milligrams per litre; cm = centimetres

4.2 Stream Water Temperatures

In 2013, stream water temperatures were measured at seven sites in the LSA (**Figure 4.2-1** and **Table 4.2-1**). Temperature data loggers (HOBO Tidbit, Onset Computer Corp.) were installed at sites H4, H6, and ST-03. ("H" refers to a data logger attached to a hydrology station, and "ST" refers to a site with only a data logger.) They were set to measure and record stream water temperatures continuously at 30 min intervals for the entire year. They were downloaded twice each year – once in spring and once in autumn before freeze-up. Avison Management Services Ltd. retrieved data from these stations from 21 to 25 October 2013. Data loggers were then re-set and re-installed.

364000 371000 378000 385000 392000

5908000 5901000 5894000

N

Chedakuz Creek

Lower Nechako Reservoir Regional Watershed

Proposed Transmission Line

ST-03

H4

H6

Kluskus-Ootsa FSR

Turtle Creek

Tatelkuz Lake

NECHAKO RANGE

Fawnie Nose 1926m

Fawnie Dome 1726m

FAWNIE RANGE

Davidson Creek

Tatelkuz Lake Tributaries

Turtle Creek

Proposed Mine Access Road

H9

Proposed Fresh Water Pipeline

Snake Lake

Top Lake

H2

H1

Creek 661

Fawnie Creek

Davidson Creek

H10

Davidson Creek

Chedakuz Creek

Lake 01428UEUT

Lake 01682LNRS

Creek 705

Lake 01538UEUT

Creek 661

Kuyakuz Lake

Mount Davidson 1856m

Upper Eutsuk Lake Regional Watershed

Euchiniko Lake Regional Watershed

Mathews Creek

Kluskus-Blue FSR

364000 371000 378000 385000 392000

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-124_Studyarea_temLog_v3.mxd

Legend

- Stream Temperature Data Logger
- Spotheights
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Stream
- Waterbody
- Regional Watersheds

Watersheds

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Fish and Aquatic Resources

- Local Study Area
- Regional Study Area

Scale:1:105,000

0 1 2 4 6

Kilometres

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Locations of Stream Temperature Data Loggers in the LSA, 2013

DATE: January, 2014	ANALYST: WR	**Figure** 4.2-1
JOB No: VE52095	QA/QC: MM	PDF FILE: 10-100-124_Studyarea_temLog_v3.pdf
GIS FILE: 10-100-124_Studyarea_temLog_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Stream temperature data were also obtained from four data loggers attached to hydrometric sites installed and maintained by Knight Piésold Consulting (H1, H2, H9, and H10; **Figure 4.2-1** and **Table 4.2-1**).

Stream temperatures at the hydrometric sites were recorded at 15 min intervals from late May to early November of each year. These hydrometric stations are removed each fall before they can be damaged by ice, and are re-installed each spring.

Table 4.2-1: Stream Temperature Data Logger Locations, and Dates of Installation and Data Retrieval in 2013

Stream	Baseline Site ID	Location (UTM[1])		Deployment Dates	Data Retrieval Dates	Comments
		Easting	Northing			
Lower Davidson Creek[2]	H4	384162	5907699	20-May-13	21-Oct-13	At ranch road
Middle Davidson Creek	H2	377586	5898645	08-May-13	13-Aug-13	Reach Break 7.1
Upper Davidson Creek[3]	H10, ST-01	373139	5895780	10-Jun-11	21-Oct-13	At Blackwater Camp Road
Creek 428073	H9	378806	5901498	10-May-13	14-Aug-13	Outlet flow from Three Ponds area
Upper Creek 661[2]	H1	381002	5897828	15-May-12	22-Oct-13	Downstream of Creek 505659 confluence
Lower Turtle Creek	ST-03	383309	5908697	10-Jun-11	21-Oct-13	At Ootsa FSR
Middle Turtle Creek[2]	H6	378554	5906018	01-Sep-13	21-Oct-13	At Davidson Main Road

Note: [1] NAD 83, Zone 10
[2] 2013 Temperature data from TIDBIT at this location
[3] No data available from 17 to 31 August 2013
FSR = Forest Service Road; ID = identification; km = kilometre; UTM = Universal Transverse Mercator.

4.3 Electrofishing Survey of Lower Davidson Creek

AMEC conducted the electrofishing survey of Davidson Creek (and all fish surveys conducted in 2013 and described in this report) under Fish Collection Permit No. PG13-86954 issued by the BC MOE and fish sampling licence number XHAB-76-2013 issued by DFO (**Annex 4.3-1**).

4.3.1 Field Methods

Electrofishing was conducted from 9 to 11 July 2013 in Reaches 1 to 3 of lower Davidson Creek (**Figure 4.3-1** and **Table 4.3-1**). Electrofishing was conducted at the same sites surveyed for fish habitat in 2011 and 2012 (AMEC, 2013b). Sampling methods were based on *British Columbia Fish Collection Methods and Standards* published by the Resource Inventory Standards Committee (RISC) (RISC, 1997) and *British Columbia Field Sampling Manual* (Clark, 2003).

380000
382000
384000
386000
5908000
5906000
5904000

Chedakuz Creek
Chedakuz Creek Local Watershed
Tatelkuz Airfield
Kluskus-Ootsa FSR
TATELKUS LAKE RESERVE 28
FS-66
FS-67
FS-68
1
2
3
Turtle Creek
Tatelkuz Lake Ranch Resort
Turtle Creek Watershed
Tatelkuz Lake
Kluskus-Messue FSR
Davidson Creek
Davidson Creek Watershed
1
4
1
1
1
Tatelkuz Lake Tributaries Watershed

N

Legend

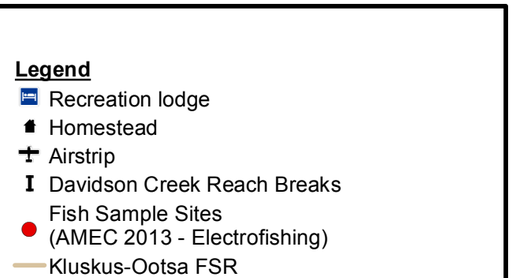
- Recreation lodge
- Homestead
- Airstrip
- Davidson Creek Reach Breaks
- Fish Sample Sites (AMEC 2013 - Electrofishing)
- Kluskus-Ootsa FSR
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody
- Indian Reserve
- Watershed boundaries
- Davidson Creek Watershed

Project Components

- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road

Fish and Aquatic Resources

- Regional Study Area
- Local Study Area



Scale: 1:30,000

0 1 2

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish Sampling Sites Lower Davidson Creek, July 2013

DATE:	ANALYST:	**Figure** 4.3-1
April, 2014	WR	
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-131_fish_sample_2013_DC_v2.pdf
GIS FILE: 10-100-131_fish_sample_2013_DC_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52099_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-131_fish_sample_2013_DC_v2.mxd

Table 4.3-1: Electrofishing Sampling Sites, Lower Davidson Creek, 9 to 11 July 2013

Stream	BC Freshwater Atlas Code	Reach	Baseline Map Site ID	Site (UTM[1])		Date Sampled	Site Length (m)
				Easting	Northing		
Davidson Creek	100-567134-610692-522527	1	FI-66	384170	5907655	9 July	100
		2	FI-67	383988	5907387	11 July	150
		3	FI-68	383491	5907167	10 July	100

Note: [1]NAD 83, Zone 10; UTM = Universal Transverse Mercator, BC = British Columbia, EF = backpack electrofishing; ID = identification; m = metre

Blocking nets were placed at the upstream and downstream ends of electrofishing site. Sampling areas ranged from approximately 100 m to 150 m in length and the entire stream width was sampled. They were electrofished by a two-person crew with a Smith-Root Type 15-D backpack electrofisher from the downstream blocking net to the upstream blocking net, with additional sampling near the downstream blocking net at the end of the survey (**Plate 4.3-1**).



Plate 4.3-1: Electrofishing in Reach 3 of Davidson Creek, 10 July 2013

All fish captured during electrofishing were temporarily stored in a large plastic bucket filled with clean stream water until processing. During processing, all fish were identified to species, fork length was measured to the nearest 1 mm with a measuring board, and weight was measured to the nearest 0.1 g with an Ohous electronic balance scale. Sex and maturity was determined from larger adult fish if milt or eggs was released. If no eggs or milt were released, then fish were classified as immature with unknown sex.

Scales were taken from all rainbow trout for age analysis. Otoliths were extracted for age analysis from all fish that died during capture or handling. All other fish were released live back into the stream.

4.3.2 Laboratory Analysis

Both scales and otoliths were sent to North/South Consultants Inc. (North/South) of Winnipeg, MB, for age reading. At the laboratory, each ageing structure was read by an experienced technician using a compound microscope (otoliths) or a microfiche projector (scales). Otoliths were ground and burnt if necessary to improve differentiation of the annuli. Otoliths were also placed in oil of wintergreen under the microscope for similar reasons.

Each ageing structure was aged blindly (i.e., without looking at fish lengths or previous aging results) three times by the same technician. A fourth reading was conducted if there were less than two readings with the same age or one of the readings was more than one year different than the others. As a final step, a second technician read all of the ageing structures and the two independent ages were compared. Ageing structures were read a fifth time if there was greater than one year discrepancy between the two independent fish ages.

4.3.3 Data Analysis

Plots of ln(weight) on ln(length) for each fish species were examined for the presence of outliers. Outliers were then either corrected by re-examination of field data sheets or, if that did not resolve discrepancies, they were excluded from further analysis. Weight-length relationships were calculated by linear regression of ln-transformed weight on ln-transformed length:

$$\ln(\text{Weight, g}) = a + b*\ln(\text{Length, mm})$$

Where a = the intercept of the regression line and b = slope of the regression line. Ln-transformation normalized the frequency distributions of weight and length and homogenized their variances; the two main pre-requisites of parametric statistics. The main purpose of the regressions, apart from screening for outliers, was to test whether the slopes were close enough to the value of 3.0 for condition factor to be a reliable index of condition.

Condition factor, an index of the relative health of fish, was calculated for each fish using the formula (Ricker, 1975):

$$\text{Condition} = \frac{\text{weight (g)} \times 10^5}{\text{length (mm)}^3}$$

Where weight was multiplied by 10,000 to avoid fractional values.

Age data were screened for outliers by plotting length on age for each fish species. Outliers that could not be corrected were excluded from calculation of mean age and from length-age plots and growth modeling.

4.4 Fish and Fish Habitat of Lower Chedakuz Creek

4.4.1 Fish Habitat

On 24 July 2013, a fish habitat survey was conducted in Reach 15 of lower Chedakuz Creek from the outlet of Tatelkuz Lake to the confluence with Davidson Creek (**Table 4.4-1** and **Figure 4.4-1**). The survey was conducted using the Level 1 Fish Habitat Assessment Procedure (FHAP) (Johnston and Slaney, 1996).

The FHAP collects continuous data over long stretches of habitat. A modified FHAP approach was used to systematically sample each reach using a randomized starting point. This was done because the total length of the stream reach was too great to survey. Reach breaks were identified in 2011 based on *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Reach Information Guide* (RISC, 2000) and *Fish and Fish Habitat Inventory: Standards and Procedures* (RISC, 2001). Reaches are relatively homogenous sections of stream having a sequence of structural characteristics (i.e. channel pattern, confinement, morphology streambed substrates, and bank materials), and similar gradient, processes (e.g., uniformity in discharge), and fish habitat types.

At a minimum, a 250 m-long stream site was selected within the reach to survey. The exception was lower Chedakuz Creek; due to the large width of the creek compared to other streams in the LSA, the 250 m survey section was expanded from the confluence with Davidson Creek upstream to the outlet of Tatelkuz Lake. In addition, mesohabitats (i.e., glides, riffles, and pools) were delineated on a field map while boating from the confluence of Davidson Creek to the reach break located at the bridge of the Kluskus-Ootsa FSR.

Table 4.4-1: FHAP Sites for Stream Reaches Surveyed in 2013

Watercourse	BC Freshwater Atlas Code	Reach	Start UTM		End UTM		Reach Length (m)	Survey Length (m)	Survey Date(s)
			Easting	Northing	Easting	Northing			
Chedakuz Creek	100-567134-610692	15	385024	5908268	385443	5907724	2,760	963	24-Jul-13
Creek 705	100-567134-641477-543682-698692	1	360429	5892557	360508	5892459	590	244	14-Aug-13
Creek 705	100-567134-641477-543682-698692	2	362305	5893078	362482	5893143	6,770	250	15-Aug-13
Creek 705	100-567134-641477-543682-698692	3	366212	5894596	366333	5894644	870	160	16-Aug-13
Creek 705	100-567134-641477-543682-698692	4	368074	5894223	368219	5894115	2,360	251	21-Aug-13
Creek 705	100-567134-641477-543682-698692	5	368633	5893558	368829	5893534	860	258	23-Aug-13
Creek 705	100-567134-641477-543682-698692	6	368858	5893557	369064	5893696	380	265	23-Aug-13
Creek 705	100-567134-641477-543682-698692	8	370551	5893708	370638	5893755	160	131	12-Sep-13
Creek 705	100-567134-641477-543682-698692	10	370774	5893726	370848	5893516	380	258	12-Sep-13
Creek 705	100-567134-641477-543682-698692	11	370912	5893394	370842	5893177	1,840	272	13-Sep-13
Creek 505659	100-567134-610692-671007-505659	1	380955	5897754	380826	5897599	463	262	15-Aug-13
Creek 505659	100-567134-610692-671007-505659	2	380731	5897562	380537	5897517	357	252	15-Aug-13
Creek 505659	100-567134-610692-671007-505659	3	380288	5897480	380096	5897516	636	248	15-Aug-13

Note: All data has been re-organized in a downstream to upstream direction. BC = British Columbia; UTM = Universal Transverse Mercator, North American Datum 83, Zone 10; m = metre

FHAP provided information on the distribution, frequency and surface area of various mesohabitats and described their unique hydraulic parameters. Data was collected for several stream features to characterize habitat conditions, including adult holding pools, spawning gravel quantity and quality, pool area and frequency, cover in pools and riffles, large woody debris (LWD) frequency and distribution, substrate characteristics, and off-channel habitat.

FHAP surveys were completed by walking up the stream and recording the habitat variables listed in **Table 4.4-2** within each habitat unit. Habitat unit types and categories were based on definitions used for FHAP surveys (Johnston and Slaney, 1996). Start and end points for each sampling area were recorded with a handheld GPS unit. Length of each habitat unit was measured with a hip chain and handheld GPS unit. A 30 m-long fibreglass measuring tape, a clinometer, and a metre stick were used to measure widths, gradients, and depths, respectively. Photographs of significant features such as LWD, extensive riffles, and disturbance features were taken within each surveyed habitat unit.

Table 4.4-2: Habitat Variables Measured During FHAP Surveys of 2013

Physical Measurements	Channel Observations	Cover/Habitat
Length (m)	Habitat unit type and category	Dominant substrate type
Bankfull width (m)	Pool type	Sub-dominant substrate type
Wetted width (m)	Presence of barriers	Total cover (%)
Wetted depth (m)		Cover composition (%)
Gradient (%)		Off-channel habitats present
Pool depth (m)		Riparian vegetation type
Residual pool depth (m)		Riparian vegetation structure
		Disturbance indicators
		Functional LWD tally
		Canopy closure (%)

Source: Johnston and Slaney (1996)

Note: LWD = large woody debris; m = metre; % = percent

QA/QC procedures for the FHAP survey were based on review of field data by team leaders every evening during the survey period to look for erroneous or missing data. If data were erroneous it was corrected by the field personnel and, if required, re-measured in the field.

Total survey length, mean bankfull width and mean wetted width were calculated for each habitat unit in all stream reaches where a FHAP survey was conducted. The total area of each habitat unit, by site within each reach, was calculated by multiplying total surveyed length by mean bankfull width. Percent composition of different habitat unit types surveyed was calculated using the habitat unit type and total habitat areas surveyed. Other habitat variables that were calculated or summarized by reach for each habitat unit type found within a site from the FHAP dataset included:

- Mean water depth and residual pool depth;
- Dominant and sub-dominant substrate types and general distribution of spawning gravels;
- Mean total number of functioning LWD;
- Dominant and sub-dominant fish cover types;
- Presence and type of off-channel habitat; and
- Type (e.g., grass, shrubs, conifers, etc.) and structure (e.g., young forest, mature forest, etc.) of riparian vegetation.

4.4.2 Fish

On 24 July 2013, a survey of the fish community in lower Chedakuz Creek was conducted between the outlet of Tatelkuz Lake and approximately 200 m downstream of the confluence with Davidson Creek. Minnow traps (MT) and visual counts from a boat were used because electrofishing was not possible because of deep water and blocking nets could not be placed properly due to the large width of the creek.

Twelve minnow traps (44 cm long x 23 cm wide with 0.6 cm mesh) were baited with dry cat food and left to soak for two days (**Table 4.4-3** and **Plate 4.1-1**). Seven traps were set upstream of the confluence of Davidson Creek and five were set downstream of the confluence. Captured fish from minnow traps were processed according to the protocol described in **Section 4.3.1**, with the exception that only lengths were measured and no ageing structures were collected because ageing structures had been collected from rainbow trout in lower Chedakuz Creek in 2012.

Table 4.4-3: Minnow Trap Sampling Sites, Reach 15 of Lower Chedakuz Creek, 24 July 2013

Stream	BC Freshwater Atlas Code	Location Relation to Davidson Creek	Trap No.	Habitat Type	Site (UTM[1])	
					Easting	Northing
Chedakuz Creek	100-567134-610692	Upstream	MT - 12	Pool	385376	5907838
		Upstream	MT – 11	Pool	385376	5907838
		Upstream	MT – 10	Glide	385353	5907799
		Upstream	MT – 9	Glide	385198	5907836
		Upstream	MT – 8	Glide	385110	5907915
		Upstream	MT – 7	Riffle	385056	5907962
		Upstream	MT – 6	Glide	385029	5908230
		Downstream	MT – 5	Glide	385047	5908329
		Downstream	MT – 4	Riffle	385065	5908404
		Downstream	MT – 3	Pool	385026	5908418
		Downstream	MT – 2	Riffle	385025	5908488
		Downstream	MT - 1	Riffle	385015	5908502

Note: [1] NAD 83, Zone 10
BC = British Columbia; MT = minnow trap; No. = number; ID = identification;
UTM = Universal Transverse Mercator



Plate 4.4-1: Minnow Trap in Reach 15 of Lower Chedakuz Creek, 25 July 2013

Visual counts of fish were conducted by two crew members that sat side-by-side at the bow of the boat, each focusing on one half of the stream. As the boat floated downstream the number of fish by species was counted, discussed between crew members so as not to

double count, and then added together for each habitat unit. A visual survey was also conducted upstream, but the results were excluded because of windy conditions that reduced visibility and made observations and counting unreliable. Young-of-the-year (YOY) were not included in the counts because they could not be counted reliably due to their small size. Fish length was estimated so as to distinguish adults from juveniles.

4.5 Fish and Fish Habitat of Creek 705

From 13 to 15 August 2013 a fish and fish habitat survey was conducted in a 250 m-long section within each of the six lower reaches of Creek 705 (i.e., from its confluence with Fawnie Creek upstream to the outlet of Lake 01538UEUT). In 12 and 13 September 2013, fish and fish habitat surveys were conducted along Reaches 8 to 12 (i.e., the inlet creek to Lake 01538UEUT).

4.5.1 Fish Habitat

AMEC conducted the fish habitat surveys in accordance with guidelines shown in *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures* (RISC, 2001) and with the FHAP (Johnson and Slaney, 1996). **Figure 4.5-1** shows the survey sites for both types of habitat survey, **Table 4.5-1** shows locations of the reconnaissance 1:20,000 sites, and **Table 4.4-1** shows the FHAP sites in Creek 705.

362500 365000 367500 370000 372500

5897500 5895000 5892500 5890000

Davidson Creek Watershed

Kluskus-Ootsa FSR

Fawnie Creek

Creek 705

Creek 705 Watershed

Lake 01428UEUT

Lake 01682LNRS

Lake 01538UEUT

Davidson Creek

FAWNIE RANGE

1666m

1611m

1767m

FI-114

FI-115

FI-116

FI-117

FI-118

FI-119

FI-120

FI-121

FI-122

FI-123

FI-45

N

Legend

- Reach Break
- 1:20,000 Fish and Fish Habitat Inventory (AMEC 2013)
- FHAP Study Segment 2013
- Kluskus-Ootsa FSR
- Existing Road
- Contour (20 m)
- Stream
- Waterbody
- Watershed
- Creek 705 Watershed

Project Components

- Exploration Road
- Proposed Mine Site
- Proposed Mine Site Facilities

Fish and Aquatic Resources

- Regional Study Area
- Local Study Area

KEY MAP

Scale:1:40,000

0 1 2

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold		
PROJECT: Blackwater Gold Project		
Fish Habitat Survey Sites, Creek 705 Watershed, 2013		
DATE: April, 2014	ANALYST: WR	**Figure** 4.5-1
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-049_v3_stream_habitat_705_v2.pdf
GIS FILE: 10-100-049_v3_stream_habitat_705_v2.mxd		amec
PROJECTION: UTM Zone 10	DATUM: NAD83	

Y:\GIS\Projects\VE\VE52099_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-049_v3_stream_habitat_705_v2.mxd

Meters 0 30 60 120

Table 4.5-1: Reconnaissance (1:20,000) Stream Habitat Sampling Sites in 2013

Watershed Name	Stream	Freshwater Atlas Code	Reach Number[1]	Baseline Site Map ID	Site (UTM[2])		Date Sampled
					Easting	Northing	
Creek 705	Creek 705	100-567134-641477-543682-698692	1	FI-115	360429	5892557	14-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	2	FI-114	362296	5893076	13-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	3	FI-116	366212	5894596	16-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	4	FI-117	368074	5894223	21-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	5	FI-118	368713	5893523	22-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	6	FI-119	369043	5893671	23-Aug-13
Creek 705	Creek 705	100-567134-641477-543682-698692	8	FI-120	370531	5893708	12-Sep-13
Creek 705	Creek 705	100-567134-641477-543682-698692	9	FI-121	370638	5893755	12-Sep-13
Creek 705	Creek 705	100-567134-641477-543682-698692	10	FI-45	370774	5893126	12-Sep-13
Creek 705	Creek 705	100-567134-641477-543682-698692	11	FI-122	370912	5893394	12-Sep-13
Creek 705	Creek 705	100-567134-641477-543682-698692	12	FI-123	370807	5893146	13-Sep-13
Tatelkuz Lake Tributaries	Unnamed Tributary to Tatelkuz Lake	100-567134-610692-579340	3	PL-1	387436	5902725	17-Aug-13
Tatelkuz Lake Tributaries	Unnamed Tributary to Tatelkuz Lake	100-567134-610692-579340-140014	2	PL-2	387134	5902659	17-Aug-13
Tatelkuz Lake Tributaries	Unnamed Tributary to Tatelkuz Lake	100-567134-610692-571602	–	PL-3	385822	5903001	17-Aug-13
Tatelkuz Lake Tributaries	Unnamed Tributary to Davidson Creek	100-567134-610692-522527-314089	2	PL-4	381084	5902343	18-Aug-13
Davidson Creek	Creek 704454	100-567134-610692-522527-704454	4	PL-5	375448	5895487	21-Aug-13
Tatelkuz Lake Tributaries	Tributary to Tatelkuz Lake	100-567134-610692-571602-449278	–	PL-6	385241	5902966	18-Aug-13
Creek 661	Creek 505659	100-567134-610692-671007-505659	7	PL-7	376311	5895557	21-Aug-13
Tatelkuz Lake Tributaries	Unnamed Tributary to Davidson Creek	100-567134-610692-522527-226858	5	PL-8	382708	5902801	18-Aug-13
Creek 661	Creek 505659	100-567134-610692-671007-505659	5	PL-9	378845	5897028	21-Aug-13

Note: [1] Based on AMEC reach break analysis; [2]UTM = Universal Transverse Mercator, North American Datum 83, Zone 10
No. = number; ID = identification; FI-fish inventory site; PL = fresh water pipeline site; dash indicates no data

The reconnaissance 1:20,000 method collects habitat information from discrete stream sections by measuring a suite of data over sites that are 100 m long. This method describes how the stream interacts with its upslope valley, the stream's morphology, flow pattern, stream bed and bank characteristics, instream and overhead cover, habitat availability and quality, and documents stream disturbances. Unlike FHAP, the reconnaissance 1:20,000 method produces overall ratings of none, poor, fair, and good for fish habitat quality and habitat suitability for each life history (i.e., spawning, rearing, over-wintering, and migration) of salmonid species. These ratings were based on habitat variables measured during the reconnaissance 1:20,000 survey.

Site cards were filled out as per the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide* (RISC, 1999b). Sampling equipment included a 30 m long fibreglass tape measure, clinometers, and 2 m-long measuring stick. Information on the field cards included the following:

- Stream name;
- Reach number;
- Site number, UTM and length;
- Access;
- Date, time, agency, and crew initials;
- Channel measurements (i.e., bankfull width and wetted width in metres);
- Percent gradient;
- Stage or the amount of water passing through the channel (e.g., low, medium or high);
- Stream cover amount (none, trace, sub-dominant and dominant) of overhanging vegetation, LWD, small woody debris (SWD), boulders, undercut banks, and instream vegetation;
- Percent crown closure;
- Bank characteristics (left bank and right bank shape, texture, riparian vegetation stage);
- Flood signs;
- Channel morphology (riffle-pool, cascade-pool, step-pool, and large channel);
- Dominant and sub-dominant bed material (silt, gravel, cobble, boulder and bedrock);
- Disturbance indicators that result in changes in sediment supply or discharge;
- Channel pattern (e.g., straight, sinuous, irregular wandering, irregular meandering, etc.);
- Presence of islands and bars;
- Coupling, which is the potential of sediment on the hill slopes to enter a stream channel;

- Confinement, which is the ability of the channel to migrate laterally between slopes; and
- Site features that may affect fish or fish habitat (e.g., bridge, waterfalls, fishways).

At each survey site, overall fish habitat quality and habitat suitability for each life history (i.e., spawning, rearing, overwintering, and migration) of salmonid fish species was rated according to known salmonid life history requirements (e.g., presence of spawning gravel, presence of deep pools, presence of abundant cover) (Ford et al., 1995; McPhail, 2007). Salmonid criteria were used because rainbow trout is the predominant fish species in stream habitat in the LSA.

Fish habitat data from all the 1:20,000 fish habitat inventories for the 2013 field season were summarized in tabular form and included;

- BC Freshwater Atlas Code;
- Reach number;
- Stream order;
- Forest Practice Code stream classification according to the BC Ministry of Forests (BC MOF) (BC MOF, 1995);
- Stream morphology/habitat;
- Mean site gradient;
- Mean bankfull and wetted width;
- Mean residual pool depth;
- Mean bankfull depth;
- Stream bed substrate composition;
- Cover composition; and
- Habitat quality ratings for over-wintering, rearing, spawning, and migration habitat for salmonids.

Stream classification was completed using data from the fish habitat inventories for 2013. The stream classification system follows the provincial S1 to S6 scheme that classifies a stream based on fish presence/absence and mean channel width (BC MOF, 1995) (**Table 4.5-2**).

FHAP surveys were conducted as described in **Section 4.4-1** with the exception of Reach 9. FHAP was not conducted in Reach 9 because there is only one habitat type – a pond – and therefore the relevant information was measured and recorded using only reconnaissance methods.

Table 4.5-2: Stream Classification Criteria and Definitions

Stream Class	Fish-Bearing Status	Stream Width (m)
S1	Yes	>20
S2	Yes	>5 - 20
S3	Yes	1.5 - 5
S4	Yes	<1.5
S5	No	>3
S6[1]	No	≤3

Source: Adapted from BC MOF (1995)

Note: [1]S6 designation includes non-continuous drainages (NCDs) and no visible channel (NVC); m = metre

4.5.2 Fish

Fish surveys were conducted at the same sites as the habitat inventory (**Table 4.5-3** and **Figure 4.5-2**).

Table 4.5-3: Fish Sampling Sites, Creek 705, 2013

Stream	BC Freshwater Atlas Code	Reach	Baseline Map Site ID	Site (UTM[1])		Date Sampled	Site Length (m)	Method
				Easting	Northing			
Creek 705	100-567134-641477-543682-698692	1	FI-115	360429	5892557	14-Aug-13	100	EF
		2	FI-114	362296	5893076	13-Aug-13	100	EF
		3	FI-116	366212	5894596	16-Aug-13	100	EF
		4	FI-117	368074	5894223	21-Aug-13	100	EF
		5	FI-118	368713	5893523	22-Aug-13	100	EF
		6	FI-119	369043	5893671	23-Aug-13	100	EF
		8	FI-120	370531	5893708	12-Sep-13	130	EF
		9	FI-121	370638	5893755	12-Sep-13	N/A	MT
		10	FI-45	370774	5893126	12-Sep-13	100	EF
		11	FI-122	370912	5893394	12-Sep-13	100	EF

Note: [1] NAD 83, Zone 10
BC = British Columbia; EF = backpack electrofishing; MT = minnow trapping;
UTM = Universal Transverse Mercator; ID = identification; m = metre; N/A = not applicable

Surveys were conducted with a backpack electrofisher using the methods described in **Section 4.3.1,** with some exceptions. In Reach 9, minnow traps were used rather than electrofishing because the pond was too deep to wade effectively.

Ageing structures were not collected because ageing data had already been collected from stream sampling conducted in 2011 and from sampling of headwater lakes 01428UEUT and 01538UEUT in 2011 and 2012. Due to the high numbers of fish captures, a minimum of 50 fish were measured for length and weight at each site. The remainder were counted.

362500 365000 367500 370000 372500

5897500 5895000 5892500 5890000

Fawnie Creek
Kluskus-Ootsa FSR
Fawnie Creek
Fawnie Creek
Davidson Creek Watershed
Davidson Creek
Creek 705
Creek 705 Watershed
FAWNIE RANGE
1666m
1611m
1767m
Lake 01428UEUT
Lake 01682LNRS
Lake 01538UEUT
FS-114
FS-115
FS-116
FS-117
FS-118
FS-119
FS-120
FS-122
FS-45

Creek 705 Watershed Minnow Trapping Sites

All Minnow Traps: FS-121

MT - 1
MT - 2
MT - 3
MT - 4
MT - 5
MT - 6
MT - 7
MT - 8
MT - 9
MT - 10

Lake 01538UEUT

Meters 0 30 60 120

Legend

Fish Sample Sites (AMEC 2013)
- Electrofishing
- Minnow Trapping
- Reach Break
- Kluskus-Ootsa FSR
- Existing Road
- Contour (20 m)
- Stream
- Waterbody
- Watershed boundaries
- Creek 705 Watershed

Project Components
- Exploration Road
- Proposed Mine Site
- Proposed Mine Site Facilities

Fish and Aquatic Resources
- Regional Study Area
- Local Study Area

KEY MAP

Scale: 1:40,000

0 1 2 Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish Sampling Sites Creek 705 Watershed, 2013

DATE: April, 2014	ANALYST: WR	**Figure** 4.5-2
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-134_FishSample2013_Creek705_v2.pdf
GIS FILE: 10-100-134_FishSample2013_Creek705_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-134_FishSample2013_Creek705_v2.mxd

4.6 Fish Habitat of Creek 505659

On 15 August 2013, an FHAP was completed at sites along the first three reaches of Creek 505659, a tributary to Creek 661 (**Figure 4.6-1**). FHAP methodology was applied as outlined in **Section 4.4.1**.

375000 377500 380000 382500 385000 387500

5900000 5897500 5895000 5892500

Turtle Creek Watershed

Snake Lake

Tatelkuz Lake Tributaries

Kluskus-Messue FSR

Davidson Creek Watershed

Site D Main Dam Pond

Davidson Creek

Creek661

Creek543585

Creek505659

Creek 661 Watershed

Site C Dam

Construction Camp

Operation Camp

Plant Site

Creek146920

Low-Grade Stockpile

East Dump

West Dump

Open Pit

Creek 661

FAWNIE RANGE

N

Legend

- Reach Break
- FHAP Study Segment 2013
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody
- Catchment boundaries
- Creek 661 Watershed

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Proposed Mine Site
- Proposed Mine Site Facilities

Fish and Aquatic Resources

- Regional Study Area
- Local Study Area

KEY MAP

Scale:1:45,000

0 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish Habitat Survey Sites, Creek 505659, Creek 661 Watershed, 2013

DATE: December, 2013	ANALYST: WR	**Figure** 4.6-1
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-036_v5_stream_habitat_661.pdf
GIS FILE: 10-100-036_v5_stream_habitat_661.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-036_v5_stream_habitat_661.mxd

4.7 Fish and Fish Habitat of Water Pipeline Stream Crossings

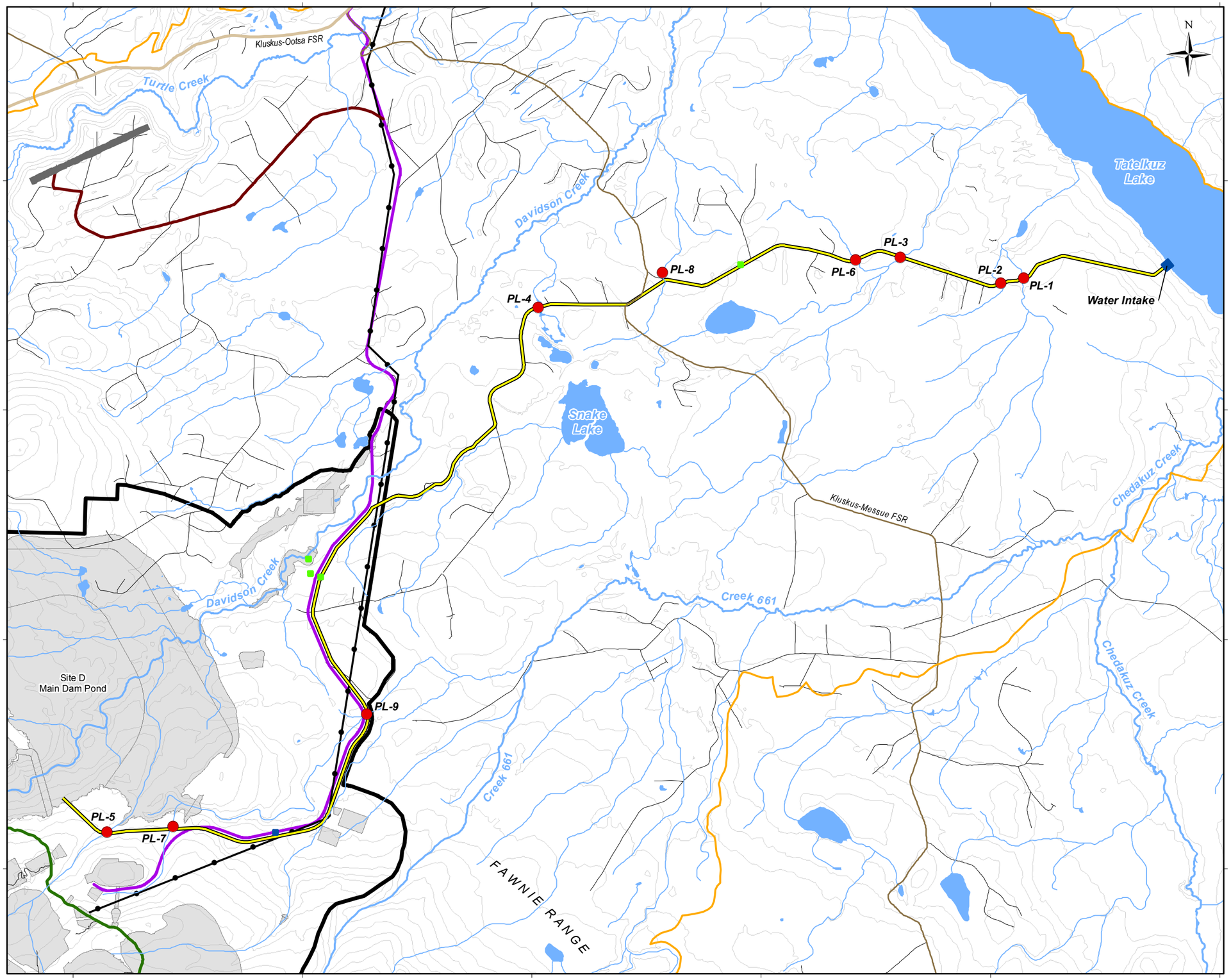
4.7.1 Fish Habitat

A reconnaissance 1:20,000 survey of stream crossings along the water pipeline route from Tatelkuz Lake to the mine site was conducted from 17 to 22 August 2013 (**Figure 4.7-1** and **Table 4.7-1**). Each stream crossing site was visually assessed to determine, first, whether it met the requirements for a stream as per the Forest Practices Code *Fish Stream Identification Guidebook* (BC MOF, 1998), and, second, whether it contained enough open water to support fish and was accessible to fish from downstream receiving waters. The reconnaissance 1:20,000 survey was conducted as described in **Section 4.5.1**.

A 100 m reach description was completed in accordance with the provincial site card requirements with the exception of survey length at sites that were also planned for navigable waters data collection. At those selected sites, the survey length was 200 m rather than 100 m to facilitate additional data collection requirements.

4.7.2 Fish

Fish presence/absence was assessed using single-pass, backpack electrofishing of a 100 m-long section of stream, 50 m upstream and 50 m downstream from the centre of the stream crossing (**Figure 4.7-1** and **Table 4.7-1**). Electrofishing methods and fish processing were done as described in **Section 4.3.1**, except that at Site PL-3 electrofishing was conducted 100 m downstream of the site due to the presence of a large beaver dam upstream from the crossing. Also, no ageing structures were taken from captured fish from streams where ageing data had already been obtained in 201 and 2012.



Legend

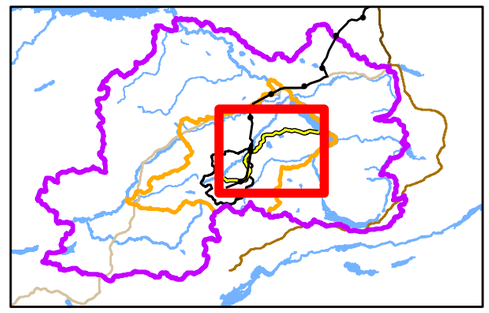
- Fish and Fish Habitat Inventory (1:20,000 / AMEC 2013 - Electrofishing)
- Kluskus-Ootsa FSR
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Pipeline Intake
- Proposed Pump Stations
- Proposed Mine Site
- Proposed Mine Site Facilities

Fish and Aquatic Resources

- Regional Study Area
- Local Study Area



Scale:1:50,000

0 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish and Fish Habitat Survey Sites at Water Pipeline Crossings, 2013

DATE: April, 2014	ANALYST: WR	**Figure** 4.7-1
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-174_fish_sample_2013_pipeline_v2.pdf
GIS FILE: 10-100-174_fish_sample_2013_pipeline_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-174_fish_sample_2013_pipeline_v2.mxd

Table 4.7-1: Electrofishing Sites, Stream Crossings of the Water Pipeline, 2013

Stream	BC Freshwater Atlas Code	Reach	Baseline Site Map ID	Site (UTM[1])		Date Sampled
				Easting	Northing	
Unnamed Tributary to Tatelkuz Lake	100-567134-610692-579340	3	PL-1	387436	5902725	17-Aug-13
Unnamed Tributary to Tatelkuz Lake	100-567134-610692-579340-140014	2	PL-2	387134	5902659	17-Aug-13
Unnamed Tributary to Tatelkuz Lake	100-567134-610692-571602	–	PL-3	385822	5903001	17-Aug-13
Unnamed Tributary to Davidson Creek	100-567134-610692-522527-314089	2	PL-4	381084	5902343	18-Aug-13
Creek 704454	100-567134-610692-522527-704454	4	PL-5	375448	5895487	21-Aug-13
Tributary Tatelkuz Lake	100-567134-610692-571602-449278	–	PL-6	385241	5902966	18-Aug-13
Creek 505659	100-567134-610692-671007-505659	7	PL-7	376311	5895557	21-Aug-13
Unnamed Tributary to Davidson Creek	100-567134-610692-522527-226858	5	PL-8	382708	5902801	18-Aug-13
Creek 505659	100-567134-610692-671007-505659	5	PL-9	378845	5897028	21-Aug-13

Note: [1] NAD 83, Zone 10
All sites were 100 m long
BC = British Columbia; UTM = Universal Transverse Mercator; ID = identification; m = metre; dash indicates no data

4.8 Fish and Fish Habitat at Stream Crossings of Transmission Line and Access Roads

In 2013, as in 2012, the surveys of fish and fish habitat at stream crossings of the transmission line, the mine access road, and the airstrip access road (**Figure 1-2**) involved three steps:

- Identifying the number and locations of potential stream crossings for each version of the three alignments;
- Selecting sampling sites; and
- Surveying fish and fish habitat at selected sites for which there was no historical data.

4.8.1 Identification of Stream Crossings

For each version of the transmission line alignment, AMEC provided to Avison a GIS map showing the location of each potential stream crossing. The crossings were assigned 1:20,000 and 1:50,000 watershed codes and UTM coordinates, and the streams were assigned gazetted names, if they exist.

AMEC also provided to Avison GIS maps showing the location of each potential stream crossing for changes to the alignment of the mine access road, and for the airstrip access road.

4.8.2 Selection of Sample Sites

In 2013, as in 2012, Avison reviewed the list of potential stream crossings for the transmission line, the mine access road, and the airstrip access road. The purpose was to identify crossings that had already been surveyed and crossings that were known to be non-fish-bearing and remove them from the list of crossings that had to be surveyed.

Forestry companies between the years 2002 and 2006 had already surveyed many of the streams that will be crossed by the Blackwater transmission line. To avoid re-surveying those sites, Avison superimposed each version of the transmission line alignment on GIS shapefiles containing historical data on fish and fish habitat taken from the Fisheries Information Summary System (FISS) of BC MOE. Sites that had already been surveyed with sufficient effort to characterize fish community and fish habitat were dropped from the list of sampling sites.

Avison also removed sites that were first-order streams with a short reach upstream of the crossing that had been previously classified as NVC or NCD and had no obvious lentic point of origin, such as a lake or wetland.

In cases in which new versions of the transmission line or the mine access road crossed the same streams, but at different places, the new sites were not surveyed if they were within 200 m of an older surveyed site. They were included, however, if there was a change in

stream order or a significant change in riparian vegetation based on comparison of aerial photography between the old and new site.

In 2013, Avison surveyed 105 stream crossings: 92 crossings of versions 6 to 9 of the transmission line, 9 crossings by the mine access road, and 3 crossings by the airstrip access road.

4.8.3 Fish and Fish Habitat Sampling

Field surveys began on 25 June 2013 and ended on 17 August 2013. Survey methods followed *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory* (RISC, 2001), as described in **Section 4.5.1**. All fish captured by electrofishing were identified, measured for length, and released live back into the stream from which they were captured.

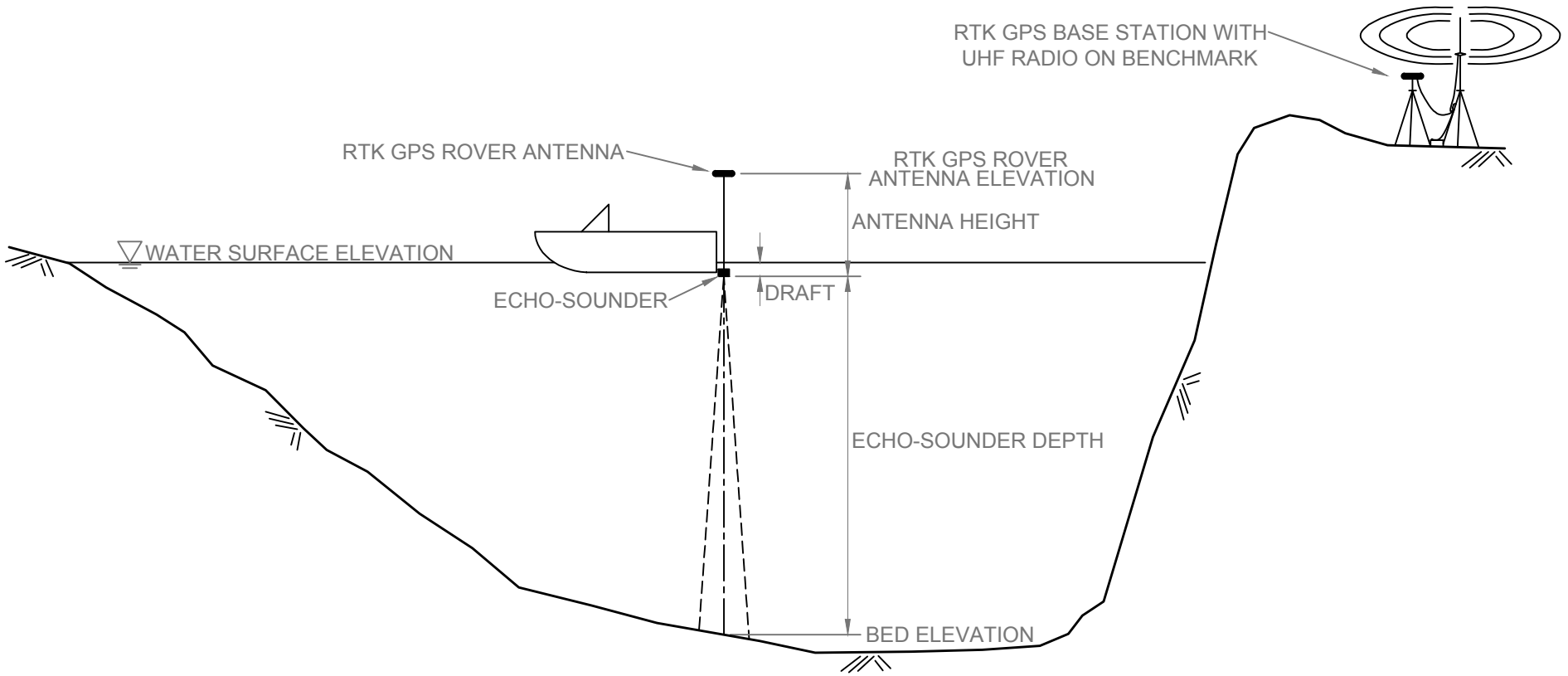
4.9 Bathymetry of Tatelkuz Lake

Field survey methods followed methods described by *Bathymetric Standards for Lake Inventories* (RISC, 2009). This included establishing location coordinate benchmarks on the shore of Tatelkuz Lake, spacing transects close enough to ensure spatial accuracy of the bathymetric map, conducting a shoreline cruise to determine lake perimeter, and recording high water marks.

The northern half of Tatelkuz Lake was surveyed from 23 to 25 May 2013 and the southern half was surveyed from 7 to 9 June 2013. A Trimble R8 Real-Time Kinematic (RTK) Global Navigation Satellite System receiver was established on the shoreline of the lake (the base station), and an Ohmex SonarMite single-beam echosounder was mounted on a boat (the rover) (**Figure 4.9-1**). A Trimble TSC2 data collector was attached to the echosounder to collect and store data.

Surveyors used a 21 foot-long jet boat. One person drove the boat and a second person monitored the echosounder. The boat was piloted in a pattern of diagonal transects. The perimeter of the lake was also surveyed at varying distance intervals depending on the curvature and shape of the shoreline. In some instances, bed elevation was surveyed directly by wading. This was done where more detailed geometry was needed in shallow zones and where bed slope was critical for the assessment of littoral habitat.

The base station monitored several satellites simultaneously to fix its position. By collecting data over a minimum period of 6 hours, it was able to fix its vertical and horizontal coordinates more accurately and precisely than could the rover. The base station used an Ultra High Frequency (UHF) radio to send continuous position corrections to the rover, thereby ensuring equivalent accuracy and precision of the rover's echosounding data. This configuration functioned best when a free line of sight existed between the base station and the rover. Since the perimeter of Tatelkuz Lake includes points and inlets, radio-shadows existed which make it difficult to maintain radio communication from a single control point. Therefore, surveyors relocated the base station as needed to maintain the radio link.



NOTES: COORDINATE CORRECTIONS TRANSMITTED FROM BASE TO ROVER VIA RADIO TO ACHIEVE CENTIMETER LEVEL PRECISION
BED ELEVATION CALCULATED AS: RTK GPS ROVER ANTENNA ELEVATION - ANTENNA HEIGHT - ECHO-SOUNDER DEPTH

CLIENT: NEW GOLD	DWN BY: KM CHK'D BY: N/A DATUM: N/A PROJECTION: N/A SCALE: N.T.S.	PROJECT: TATELKUZ LAKE BATHYMETRY	DATE: JUNE 2013 PROJECT No.: KX52277
AMEC Environment & Infrastructure 5681-70 STREET, EDMONTON, ALBERTA, T6B 3P6 PHONE 780-436-2152, FAX 780-435-8425		TITLE: BATHYMETRY SURVEY EQUIPMENT CONFIGURATION WITH REAL TIME KINETIC GPS	REV. No.: A FIGURE No.: FIGURE 4.9-1

Surveyors established control points by enabling the RTK+logging mode for the base station during the survey. The base station stored a record of the satellite observations, and those records were later post-processed and the control point coordinates determined to a high level of precision using a technique called Precise Point Positioning. Newly established control points were confirmed by checking existing control points for quality assurance purposes. The control point benchmark for Tatelkuz Lake was "Control Point 2" (**Table 4.9-1**).

Table 4.9-1: Tatelkuz Lake Control Point Locations

Name	Date	Northing	Easting	Elevation (masl)
Control Point 2	24 August 2012	5909388.392	383919.029	926.295
BM1	23 May 2013	5905798.734	388114.843	928.633
BMKHF	24 May 2013	5905439.688	388208.917	928.467
BMNF1	9 June 2013	5901279.276	391372.228	929.470
BMNF2	10 June 2013	5902759.582	390350.995	928.381

Note: masl = metres above sea level

Throughout the survey, the rover antenna was mounted directly above the depth sounder at a known height. Corrected position (northing and easting), elevation, echosounder-reported depth, and antenna height were recorded simultaneously. Bed surface elevation was determined for each survey point by subtracting echosounder depth and antenna height from antenna elevation.

Data collected from the echosounder was exported using the Trimble's ASCII file generator. The exported data files contained point name, code, coordinate information, depth, and other parameters for quality assurance. ASCII data files were imported into GlobalMapper1 (Blue Marble Geographics, 2013) where individual points were filtered and scrutinized for quality assurance.

Surveyors searched the data for any apparent inconsistencies between intersecting transect lines and adjacent points. They were expected to have similar bed elevations, and were corrected if they did not. Breakline features were added and a Triangular Irregular Network (TIN) elevation surface was created. From the TIN surface, elevation contours were generated at 1 m intervals. Contours were then smoothed and manually adjusted where necessary to best represent the bathymetry.

The topography of the shore areas was derived from available LiDAR coverage.

The bathymetric map was used to calculate total surface area, littoral area (i.e., area <6 m deep), profundal area (i.e., area >6 m deep), lake volume, perimeter, and maximum depth (Z_{max}). Volume, area, and perimeter estimates were used to calculate mean depth (Z_{mean}), relative depth (Z_r), and the index of shoreline development (D_L) for each lake using the following formulae (Wetzel, 2001):

$$Z_{mean} = \frac{\text{Lake Volume}}{\text{Total Surface Area}}$$

$$Z_r = \frac{50 \times Z_{max}\sqrt[x]{\pi}}{\sqrt{\text{Total Surface Area}}}$$

$$D_L = \frac{\text{Shoreline length (m)}}{2\sqrt{\pi \times \text{Total Surface Area}}}$$

Z_r (m) is the ratio of the maximum depth (Z_{max}) to the mean diameter of the lake at the surface expressed as a percentage. Most lakes have a Z_r of less than 2% while deep lakes with small surface areas typically have a Z_r greater than 4%.

D_L is the ratio of the perimeter to the circumference of a circle of area equal to that of the lake. It reflects the potential for development of littoral biological communities, which are usually of high productivity. Circular lakes have D_L close to 1.0. In many elliptical lakes D_L typically has a value of approximately 2.0. In lakes of flooded river valleys, D_L is greater than 2.0.

4.10 Littoral Fish Habitat of Tatelkuz Lake

The following methods were based on the "*Standard methods guide for the classification/quantification of lacustrine habitat in Newfoundland and Labrador*" (Bradbury et al., 2001). These methods were used instead of the *BC Reconnaissance (1:20,000) Lake Inventory Standards and Procedures* (RISC, 2001) because they allowed collection of data (i.e., substrate, depth, and cover) such that it could be directly compared to habitat suitability indices developed for the different life stages of the different BC fish species present in the lake (Roberge et al., 2001).

4.10.1 Field Surveys

Littoral habitat[2] in Tatelkuz Lake was assessed in three steps. First, an aerial survey was conducted by helicopter on 14 July 2013. This survey was conducted by slowly flying around the lake perimeter at a height between 200 m and 400 m in a clock-wise direction. This was done to: 1) provide enough height to maximize the amount of habitat that could be seen in the water without losing ability to differentiate between different habitat types; 2) allow differentiation between steep and shallow gradient shorelines and; 3) keep the shoreline in constant view of the left-hand side of the helicopter where two AMEC biologists were seated.

Natural breaks between distinctly different littoral habitats were identified and marked on small scale (1:4,500 m) maps by the person seated in the front of the helicopter. At the same time, the person in the back of the helicopter took photographs of the shoreline. The location of these photographs was recorded on separate maps during the flight.

[2] The shallow, near shore region of a lake where adequate light can penetrate to the bottom allowing growth of rooted aquatic plants (Bradbury et al., 2001)

Photographs were later geo-referenced by matching the time and date stamp in the digital file with the time and date data in the GPS track using RoboGEO™ (Pretek, Inc.) software.

Littoral habitat types were delineated from the air by substrate composition and shoreline gradient. These two variables were selected because the substrates are the most important determinant of littoral habitat use by lacustrine fish (Bradbury et al., 1999), while shoreline gradient has a direct effect on the vertical distribution of nearshore substrates. Substrate classes were based on dominant and sub-dominant size classes. Shoreline gradient classes included shallow (i.e., <10%) and steep (i.e., >10%) shorelines. Identification of the appropriate gradient class from the air was aided during the aerial surveys by having the 1 m bathymetry contours printed on the small scale maps.

A total of 17 substrate/gradient classes were identified in Tatelkuz Lake (**Table 4.10-1**).

Table 4.10-1: Littoral Habitat Classes Identified in Tatelkuz Lake

Littoral Habitat Code	Dominant Substrate Class	Sub-dominant Substrate Class	Shoreline Gradient Class[1]
Gf-Sh	Gravel	Fines	Shallow
Gf-St	Gravel	Fines	Steep
Gc-Sh	Gravel	Cobble	Shallow
Gc-St	Gravel	Cobble	Steep
Gb-St	Gravel	Boulder	Steep
Cf-Sh	Cobble	Fines	Shallow
Cf-St	Cobble	Fines	Steep
Cg-Sh	Cobble	Gravel	Shallow
Cg-St	Cobble	Gravel	Steep
Cb-Sh	Cobble	Boulder	Shallow
Cb-St	Cobble	Boulder	Steep
Bc-Sh	Boulder	Cobble	Shallow
Bc-St	Boulder	Cobble	Steep
Fg-Sh	Fines	Gravel	Shallow
Fg-St	Fines	Gravel	Steep
Fc-Sh	Fines	Cobble	Shallow
Fc-St	Fines	Cobble	Steep

Note: [1]shallow =<10%; steep =>10%

The presence and spatial extent of fish cover types in the littoral zone were also marked on maps. These included submergent and emergent vegetation, woody debris and overhanging vegetation.

The second step involved ground-truthing the maps made during the aerial surveys. This involved a shoreline boat cruise (**Plate 4.10-1**) to verify that the substrate and gradient classifications made on the small-scale maps in the helicopter were correct and that the breaks between adjacent littoral habitat types were in the proper locations. Any errors in the habitat typing or in the location of habitat breaks on the maps were corrected before

proceeding to the next step. In Tatelkuz Lake, this shoreline cruise was conducted on 21 and 22 July. Only four of the 54 habitat polygons identified from the air in Tatelkuz Lake required adjustment after completing the shoreline cruise.



Plate 4.10-1: Shoreline of Tatelkuz Lake during Boat Cruise, 22 July 2013

The final step of the field surveys was conducting detailed depth and substrate transects (**Plate 4.10-2**) in randomly selected littoral habitat polygons for each littoral habitat type. The number of transects allocated to each littoral habitat class was proportionally distributed according to the frequency of occurrence of each habitat class (**Table 4.10-2**). At least one transect was surveyed in each littoral habitat class identified. A total of 21 transects were conducted in Tatelkuz Lake (**Figure 4.10-1**). Transect sites were selected in the field by selecting the most representative site within each randomly selected polygon.



Plate 4.10-2: Conducting Transect Surveys on Tatelkuz Lake, July 2013

Table 4.10-2: Distribution of Transect Surveys across Littoral Habitat Classes in Tatelkuz Lake, 2013

Littoral habitat code	Frequency of Occurrence	Number of Transects
Gf-Sh	6[a]	3
Gf-St	8[d]	3
Gc-Sh	4[a]	2
Gc-St	5[d]	1
Cg-Sh	6[b]	2
Cg-St	8	2
Cb-Sh	3[b]	1
Cb-St	6	3
Bc-Sh	3	1
Bc-St	1	1
Fg-Sh	4[c]	2
Total	**54**	**21**

Note: [a] one polygon identified as Gc-Sh from the air was re-classified as Gf-Sh after the shoreline boat cruise
[b] one polygon identified as Cb-Sh from the air was re-classified as Cg-Sh after the shoreline boat cruise
[c] one polygon identified as organic-fine-shallow gradient from the air was re-grouped with Fg-Sh after the shoreline boat cruise
[d] one polygon identified as Gf-St from the air was re-classified as Gc-St after the shoreline boat cruise

At each site, a 50 m-long tape was strung perpendicular to shore between a pin hammered into the soil above the high water mark and a buoy anchored at the 3 m depth contour. The 3 m depth contour was the extent to which substrates could be observed by diving to the bottom or by probing the bottom with an avalanche probe from a boat.

Along the tape, elevations (relative to established benchmarks) and distances (relative to the pin) were measured at the top of bank, toe of bank, and water's edge with a transit, level and surveyor's rod. At 1 m intervals offshore and at notable elevation changes, water depths were measured and substrate composition and percent cover provided by submergent or emergent vegetation were visually estimated. Water depth was measured with a metered avalanche probe. Percent substrate composition was estimated visually within a 0.5 m x 0.5 m quadrant using standardized substrate size classes[3] (RISC, 2001, 2008). At stations >2 m deep, substrate composition was estimated either by diving to the bottom with a mask or by probing the bottom with the avalanche probe from a boat.

Water surface elevation of Tatelkuz Lake was determined each day of the survey by measuring the difference between the water level elevation and at least one of the four permanent benchmarks established around the lake (**Table 4.9-1**, **Plate 4.10-3**, and **Figure 4.10-1**). This was done with a transit, level, and surveyor's rod.



Plate 4.10-3: Surveying a Benchmark on Tatelkuz Lake, 23 July 2013

[3] Fines (<2 mm); gravels (2-64 mm); cobbles (64-256 mm); boulders (>256 mm); bedrock (>4000 mm)

388000 5908000 390000 5906000 392000 5904000 394000

N

1977 BM
BMKN
BMKH3
BMNF2
BMNF1

Chedakuz Creek
Tatelkuz Lake

1 GfSh
2 CgSt
3 CbSt
4 GfSt
5 GcSh
6 CbSt
7 GfSh
8 FgSh
9 CgSh
10 CbSh
11 CgSt
12 GfSt
13 GcSt
14 BcSh
15 CgSh
16 GfSh
17 BcSt
18 GfSt
19 CgSt
20 CgSt
21 GcSh
22 GfSh

BcSh CbSt FgSh GfSh
BcSt CgSh GcSh GfSt
CbSh CgSt GcSt OfSh

Code System

dominant substrate — **GfSt** — gradient
sub dominant substrate

B/b - Boulder
C/c - Cobble
G/g - Gravel
F/f - Fines

Sh - Shallow Gradient
St - Steep Gradient

Scale: 1:25,000
0 0.5 1 2
Kilometres

384000 5904000 386000 5902000 388000 5900000 390000

384000 5908000 386000 5906000 388000 5904000 390000 5902000 392000 5900000 394000

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Legend

- Benchmark Station
- Transect Location
- Waterbody
- Stream
- Contour (20 m)

Source: Shoreline Habitat Classification conducted by AMEC July 2013
BC Government GeoBC Data Distribution

CLIENT: newgold

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4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
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amec

ANALYST:	KA
QA:	MY
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:25,000

PROJECT: Blackwater Gold Project

TITLE: Shoreline Habitat Types and Location of Transect Surveys in Tatelkuz Lake, 2013

REV. NO:	A
DATE:	April, 2014
PROJECT NO:	VE52277
FIGURE NO:	4.10-1

4.10.2 Data Analysis

Breaks between adjacent littoral habitat types along the shoreline, the offshore extent of visible littoral habitat from the air, and polygons of emergent and submergent vegetation were digitized into the ArcInfo (ESRI®) Geographic Information System (GIS) from the small-scale field maps.

Transect data was used to: 1) confirm shoreline gradients; 2) determine the offshore extent of littoral habitat classes identified from the air; and 3) determine the depth strata at which dominant substrate classes identified from the air changed with increasing depth. Depth strata were delineated as follows:

- 0 m to 0.5 m;
- 0.5 m to 1.0 m;
- 1.0 m to 2.0 m; and
- 2.0 m to 4.0 m.

The 0.5 m depth contour was the greatest accuracy that could be achieved from the collected bathymetry data at depths less than 1 m. Depth classes greater than 1 m were based on differentiation of lacustrine habitat suitability information (Roberge et al., 2001).

Depths at which changes in dominant substrate classes occurred along a transect were calibrated to reflect the water depth at maximum lake elevation (927.6 masl) and not the water depth during the surveys (927.3 m). Data from transects conducted in the randomly selected polygons were then used to interpolate the off-shore spatial extent of different substrate types in unsampled polygons of the same littoral habitat classification.

Data from both lakes were incorporated into the GIS and littoral habitat maps were created and the spatial area of each littoral habitat class, by depth class, was calculated. Only substrates and the presence/absence of submergent and aquatic vegetation were used at this stage of analysis. This was done because substrates and aquatic vegetation are the two most important variables differentiating littoral habitat quality for most of the lacustrine fish species in both lakes (Roberge et al., 2001). Gradient classes (i.e., shallow and steep) were ignored at this stage of the analysis because gradients were accounted for by the location of depth contours on the bathymetry maps. Woody debris and overhanging riparian vegetation were not used in the delineation of littoral habitat classes because of their relative paucity around Tatelkuz Lake and their lower value to lake fishes compared to substrates and aquatic vegetation.

4.11 Limnology of Tatelkuz Lake

A 21 foot-long jet boat was used to collect vertical profiles in July and to collect physical data and biological samples in August. A 14 foot-long inflatable Zodiak was used for water quality sampling and vertical profiling in other months.

4.11.1 Physical Limnology

4.11.1.1 Field Sampling

In 2013, seven vertical profiles of temperature, DO and conductivity were taken in Tatelkuz Lake (**Table 4.11-1** and **Figure 4.11-1**). Three profiles were taken at site WQ21 on January 28, July 8, and October 7 as part of the Blackwater Project water quality sampling program. Two profiles were taken on 17 and 23 July at sites E2 and B2 as part of the Tatelkuz Lake fish community study. Two profiles were taken at sites TL1 and TL2 on 15 and 16 August as part of the limnology study.

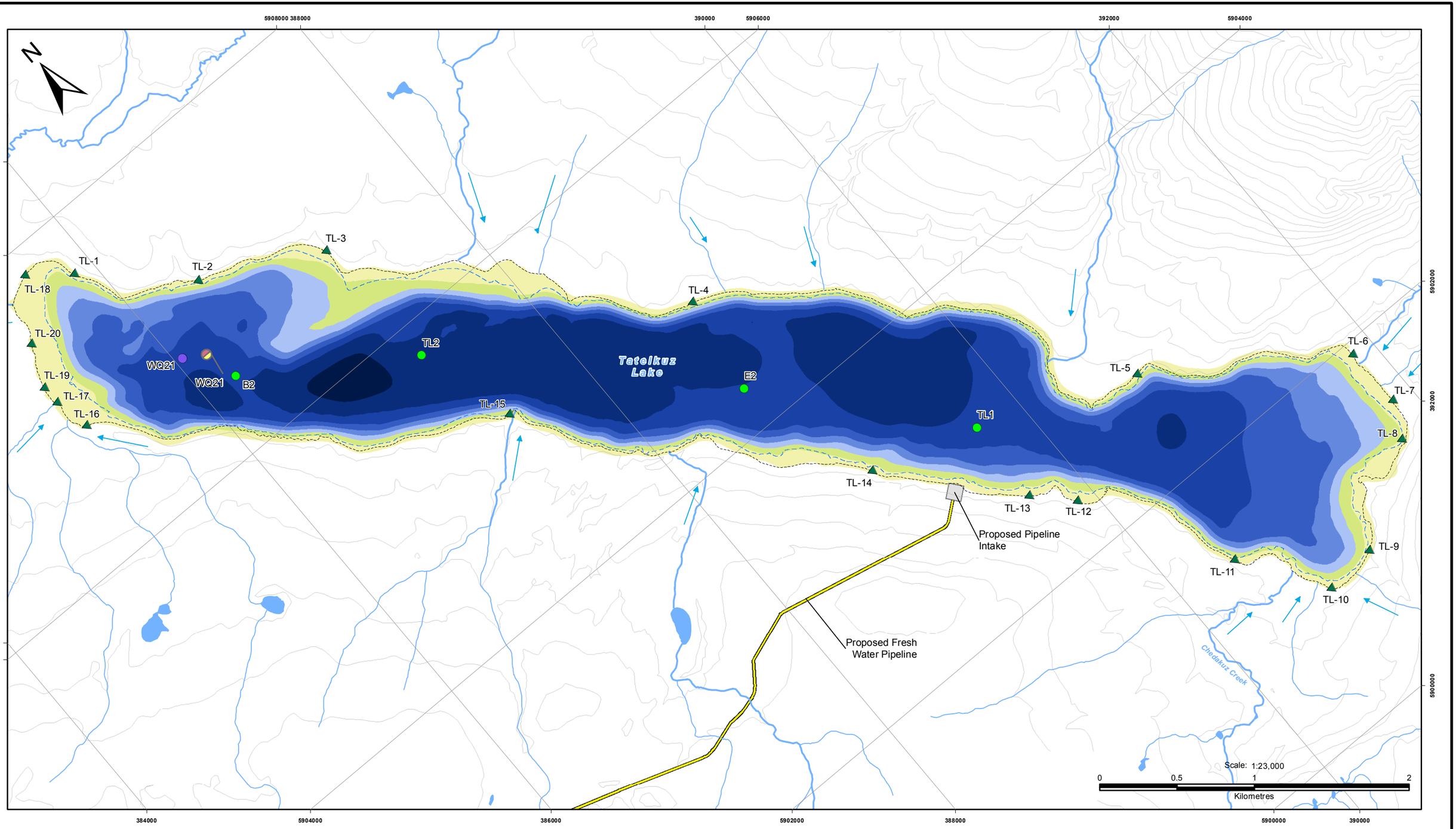
Table 4.11-1: Dates and Sites of Vertical Profiles of Temperature and Dissolved Oxygen, in Tatelkuz Lake, 2013

Site ID	Date	Location (UTM)[1]	
		Easting	Northing
WQ21	28 January	386184	5906523
WQ21	8 July	386184	5906523
E2	17 July	388704	5904283
B2	23 July	386242	5906456
TL1	15 August	389694	5903124
TL2	16 August	387247	5905786
WQ21	7 October	386050	5906764

Note: UTM = Universal Transverse Mercator; [1] = North American Datum 83, Zone 10.

Profiles were taken with a YSI Model 85 multimeter. Temperatures, DO concentrations, and conductivity were measured at intervals of 1.0 m from the surface to the water-substrate interface. For the two August profiles, measurements were recorded at intervals of 0.5 m from the water surface to the bottom of the thermocline and then every 1.0 m to the water-substrate interface. The profiles reported here were the means of the downwards and upwards recordings.

Secchi depth (D_s) was measured in July and August at the same sites as the vertical profiles using methods described in the *British Columbia Field Sampling Manual* (Clark, 2003). Secchi depths were collected by lowering a Secchi disc over the shaded side of a boat with a cable marked in 0.5 m intervals and recording the depth at which the disc disappeared from sight and the depth at which it reappeared after raising the cable. The mean depth of disappearance and reappearance was the Secchi depth.



Limnology Site
Littoral BMI 2013
Sample Period
January
February
July
October
Proposed Fresh Water Pipeline
Stream Direction
Stream
Contour (20 m)

Water Depth (m)
0 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40

Source: Shoreline Habitat Classification conducted July 2013.
Maximum lake elevation (927.6masl)
Bathymetry contour - 4.0m (923.5masl)

CLIENT: newgold

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Tel. 604-294-3811 Fax 604-294-4664

ANALYST: WR
QA: MY
DATUM: NAD83
PROJECTION: UTM Zone 10
SCALE: 1:23,000

PROJECT: Blackwater Gold Project

TITLE: Tatelkuz Lake Littoral BMI and Limnology Sites, 2013

REV. NO: A
DATE: April, 2014
PROJECT NO: VE52277
FIGURE NO: 4.11-1

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4.11.1.2 Data Analysis

Water temperature and DO concentrations were plotted on depth to show the location of the thermocline (the layer of greatest change in temperature), the hypolimnion (the layer below the thermocline), and the epilimnion (the layer above the thermocline).

Secchi depth, D_S, was used to calculate the light extinction coefficient (k) for non-turbid water and 1% euphotic depth ($Z_{1\%}$) using the formula (Parsons et al., 1984):

$$k = \frac{1.7}{D_s}$$

$Z_{1\%}$, the depth to which 1% of surface light irradiance extends into the water column, is the point where gross photosynthetic production in the water column is equal to gross respiration and, therefore, is the maximum depth at which photosynthesis and net carbon fixation occurs. $Z_{1\%}$ was calculated according to the formula (Parsons et al., 1984):

$$Z_{1\%} = \frac{4.6}{k}$$

4.11.2 Phytoplankton

4.11.2.1 Field Sampling

Phytoplankton samples were collected concurrently with limnology profiles at both the northern and southern sample sites in Tatelkuz Lake during mid-August 2013 (**Figure 4.11-1** and **Table 4.11-2**).

Table 4.11-2: Phytoplankton and Zooplankton Sites, Tatelkuz Lake, August 2013

Lake	Field Site ID	Sampling Date	Shallow Sample Depth (m)	Thermocline Sample Depth (m)	Deep Sample Depth (m)	Location (UTM[1])	
						Easting	Northing
Tatelkuz	TL1	15 August	1	13	27	389694	5903124
	TL2	16 August	1	15	27	387247	5905786

Note: UTM = Universal Transverse Mercator; m = metre; [1] = North American Datum 83, Zone 10

Phytoplankton samples were collected at the surface and bottom of both sample locations. Additional samples were collected just below the thermocline to determine if lake stratification had an effect on phytoplankton abundance by either limiting or concentrating nutrients in the water below the thermocline.

Phytoplankton was sampled following standard methods (Clark, 2003; RISC, 2008). Water samples were collected by lowering a Van Dorn water sampler to the selected depth and then closed by a messenger. Upon retrieval, the water samples were transferred into 1 L plastic bottles (**Plate 4.11-1**). At each sampling depth, five replicate samples were collected for taxonomy analysis and another five replicates were collected for chlorophyll *a*

measurement. Therefore, 30 phytoplankton taxonomy samples and 30 phytoplankton biomass samples were collected from the two sampling stations in Tatelkuz Lake.

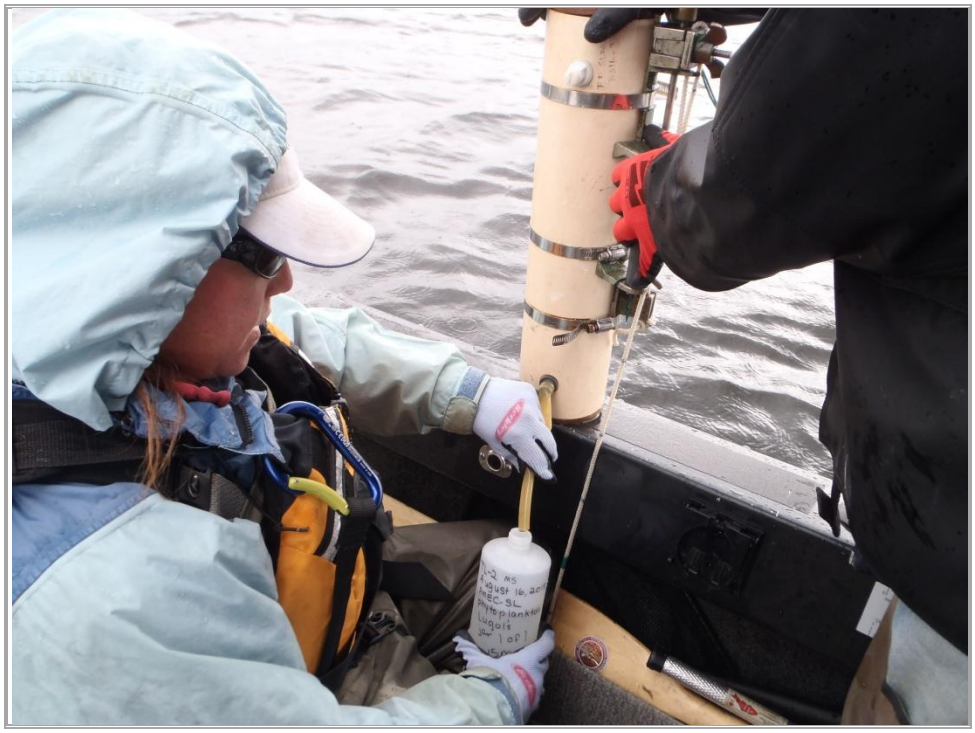


Plate 4.11-1: Transfer of Water Sample from Van Dorn Bottle to Sample Jar, Tatelkuz Lake, 16 August 2013

Samples for taxonomic analysis were preserved in 5% Lugol's iodine solution on site and were sent to Bio-Limno Laboratories Inc. (Bio-Limno) in Halifax, NS, for analysis.

Samples for biomass measurement (i.e., chlorophyll *a* concentration) were kept dark and cool (in a cooler) until they could be processed in a temporary laboratory at camp. In the laboratory, samples were filtered through a 0.45 micrometre (µm) membrane filter paper using an electrical vacuum pump and filter apparatus. The filters containing the filtrate were carefully folded with the filtrate to the inside and placed in separate labelled opaque vials. The bottles were then frozen for later transport to ALS Environment (ALS) in Burnaby, BC.

4.11.2.2 Laboratory Analysis

Bio-Limno allowed aliquots of the preserved samples to settle overnight in sedimentation chambers following the procedure of Lund et al. (1958). Algal units were counted from randomly selected transects on a Zeiss Axiovert 40 CFL (inverted) microscope. Counting units were individual cells, filaments, or colonies depending on the organization of the algae. A minimum of 400 units were counted for each sample. The bulk of the counts were made at 500X magnification. Large and rare organisms (such as *Ceratium*) were scanned for at 250X magnification. All calculations of cell concentration were performed with Hamilton's (1990) computer program.

Taxonomic identifications were based primarily on Geitler (1932 and 1949), Findlay and Kling (1976), Ettl (1978), Rieth (1980), Anton and Duthie (1981), Prescott (1982), Huber-Pestalozzi (1961, 1972, 1982, 1983), Whitford and Schumacher (1984), Starmach (1985), Tikkanen (1986), Krammer and Lange-Bertalot (1986, 1988, 1991a, 1991b), Wehr and Sheath (2003), Komarek and Anagnostidis (1998, 2005), Kristiansen and Preisig (2007), and Popovský and Pfiester (2008).

Bio-Limno recounted 3 of the 30 phytoplankton samples for QA purposes. The Bray-Curtis similarity index (B-C) was calculated for each re-counted sample to determine the similarity of the two counts (Bray and Curtis, 1957). The index was calculated as:

$$B - C = \frac{\sum_{i=1}^{n} |y_{i1} - y_{i2}|}{\sum_{i=1}^{n} (y_{i1} + y_{i2})} - 1$$

Where y_{i1} = number of individuals of the *ith* species i at site 1, y_{i2} = number of individuals of the *ith* species i in the replicate sample, and n = total number of species present between the two samples. The B-C index is a statistic that ranges from 0 to 1, where scores of zero represent communities with no species in common and scores of 1 represent communities with all taxa occurring in both samples at the same abundance. This statistic was calculated for every combination of samples on data that were square-root transformed to add weight to less dominant elements of the BMI community and improve potential future detection of biological effects (Clarke and Green, 1988).

A Dominance Identity index ($D_{1,2}$) was also used to determine how similar the periphyton communities were between counts and re-counts (Kelly, 2001). That index was calculated as:

$$D_{1,2} = \sum q_i$$

Where $D_{1,2}$ = similarity between samples 1 and 2, and q_i = the smaller relative abundance of the *ith* species between the two samples. $D_{1,2}$ ranges from 0% (no similarity) to 100% (identical). Similarity between the two samples is typically considered adequate when $D_{1,2}$ is greater than 60% (Kelly, 2001).

Both the mean Bray-Curtis index and the mean Dominance Identity index were above the threshold values of 0.6 and 60%, respectively (**Table 4.11-3**).

Table 4.11-3: QA/QC Indices for Phytoplankton, 2013

Index	n	Mean	SE	Min.	Max.
Bray-Curtis Similarity (B-C)	3	0.78	0.05	0.70	0.86
Dominance Identity ($D_{1,2}$)	3	77.2	6.95	65.0	89.1

Note: n = number of samples; SE = standard error; Min. = minimum; Max. = maximum

At ALS, a laboratory accredited by the Canadian Association of Laboratory Accreditation, samples of phytoplankton were analysed for chlorophyll *a* concentration using procedures adapted from United States Environmental Protection Agency (US EPA) Method 445.0 (Arar

and Collins, 1997). Pigments were extracted from the filter with 90% aqueous acetone and the concentration of the extract was read with a fluorometer.

ALS used method blanks as part of the measurement of chlorophyll *a* concentrations in periphyton, and the results of method blank analysis were considered by ALS to be within acceptable limits. Detection limits for sample analysis ranged from 0.01 to 0.1 µg.

4.11.2.3 Data Analysis

Phytoplankton composition within Tatelkuz Lake was characterized using mean density (cells/L) and biomass (µg/L). A variety of diversity indices and multivariate statistics were also used to describe the phytoplankton community.

Relationships between August limnological data and plankton communities was examined within Tatelkuz Lake and were compared to data collected in the three headwater lakes (lakes 01428UEUT, 01538UEUT, and 01682LNRS) (AMEC, 2013b). Sampling methods were consistent in both years.

Mean phytoplankton density (cells/L) and biomass (µg/L) were calculated for each sampling depth and lake and compared graphically. Mean density of major taxa and indices of diversity and evenness were calculated for each sampling depth of each lake and compared using tables.

Taxon richness (*S*) is the number of taxa observed in a community and is typically positively correlated with environmental quality, as defined by habitat diversity, suitability, and water quality (Barbour et al., 1999). “Quality” in this regard means how different a sample is from pristine, undisturbed conditions. Genus richness may be a more robust indicator of biological integrity. Therefore, in this study genus richness was used for analysis.

Shannon’s Diversity Index (*H*’) was calculated as:

$$H' = \sum \frac{n_i}{n} \ln\left(\frac{n_i}{n}\right)$$

Where n_i = number of individuals for species i, and n = total number of individuals in all species. *H’* provides a single representation of species richness and evenness at a site (Krebs, 1989; Wetzel, 2001). It does so by measuring the average degree of uncertainty in predicting to what taxon an individual, chosen at random from a community, described by its species diversity (*S*) and species abundance (*N*) will belong. This uncertainty increases as the number of taxa increases and as the distribution of individuals among the taxa becomes more even. If *H*’ = 0 there is only one taxon in the sample whereas *H*’ is maximized when each taxon in the sample is represented by the same number of individuals (i.e., individuals are distributed evenly among sampled taxa).

Equitability was evaluated by Pielou's Evenness Index (*J*). *J* was calculated because, unlike *H'*, it accounts for the number of each taxon observed as a fraction of the community to determine evenness. *J* was calculated as:

$$J = \frac{H'}{ln(S)}$$

Where *S* = the total number of taxa. *J* can fall between 0 and 1, where *J* = 1 represents equal distribution of individuals between all taxa present (i.e., a stable community). *J* tends to decrease with increasing environmental perturbation.

Phytoplankton community structure (i.e., abundance and proportional representation of taxa) in all habitats were compared within a multivariate framework using the Bray-Curtis Index. This statistic was calculated for every combination of samples on data that were square-root transformed to add weight to less dominant elements of the phytoplankton community and improve potential future detection of biological effects.

Similarity scores were used as inputs for two analytical approaches. First, they were the basis for aggregating phytoplankton samples into statistically defined groups (CLUSTER algorithm with SIMPROF tests; PRIMER 6; Clarke and Warwick, 2001) and second, they were used in ordinations to visually represent the relationships of phytoplankton communities across habitats and across lakes.

Taxa that most characterized the differences among and within lakes were identified using a SIMPER algorithm (PRIMER 6; Clarke and Warwick, 2001), a method that evaluates the contribution of each taxa to Bray-Curtis dissimilarity values (equivalent to one minus the Bray-Curtis similarity) for pairs of sites within and among groups.

Environmental variables were examined for subsets that best reflected the community structure observed in the lake phytoplankton data using the BEST algorithm (PRIMER 6; Clarke and Warwick, 2001). Specifically, the ranked relationships among pairs of sites were compared for each possible subset of environmental variables in terms of their relationship (measured with Spearman rank correlation coefficients) with the phytoplankton community structure (i.e., pattern matching). Unlike the phytoplankton data, which used Bray-Curtis similarities, environmental patterns among sites were assessed using normalized Euclidean distances (Clarke and Warwick, 2001). The environmental variables used in the BEST analysis included subsets of the following four variables: sample depth, water temperature, DO, conductivity, and Secchi depth. Environmental variables were screened to ensure variables were not heavily correlated ($r>0.90$).

Simple metrics were used to add context to the ordination analyses described above. These values were calculated for each sample replicate and included total density and biomass, taxa richness, and the Shannon-Weiner Index of diversity. An additional metric, chlorophyll *a*, was also included to assess the trophic state of the study lakes.

Planned contrasts (Crawley, 2007) of all metrics within a habitat class (i.e., above or below the thermocline) were used within an Analysis of Variance (ANOVA) framework to identify potential differences in Tatelkuz Lake phytoplankton communities relative to the other three headwater lakes. Analyses of all univariate data were conducted in R v. 2.15.1 (R Core Team, 2012).

4.11.3 Zooplankton

4.11.3.1 Field Sampling

Zooplankton communities in Tatelkuz Lake were sampled concurrently with phytoplankton communities (**Figure 4.11-1** and **Table 4.11-2**). Samples of zooplankton were collected using the protocols described in the *British Columbia Field Sampling Manual* (Clark, 2003). Five replicate samples were collected at each of the two sites using a 0.5 m-diameter plankton net with an 80 µm mesh size (**Plate 4.11-2**). Zooplankton samples were collected by lowering the net to 1 m above the lake bottom and then raising the net to the surface at a constant speed of approximately 0.5 m/s. The contents of the cod end were transferred to clean, pre-labelled 250 mL plastic jars and preserved with 10% formalin. Preserved samples were sent to Bio-Limno for taxonomic analysis. Depth was recorded for each tow and the volume of water filtered (m^3) calculated by multiplying the area of the net opening by the total depth of the haul.

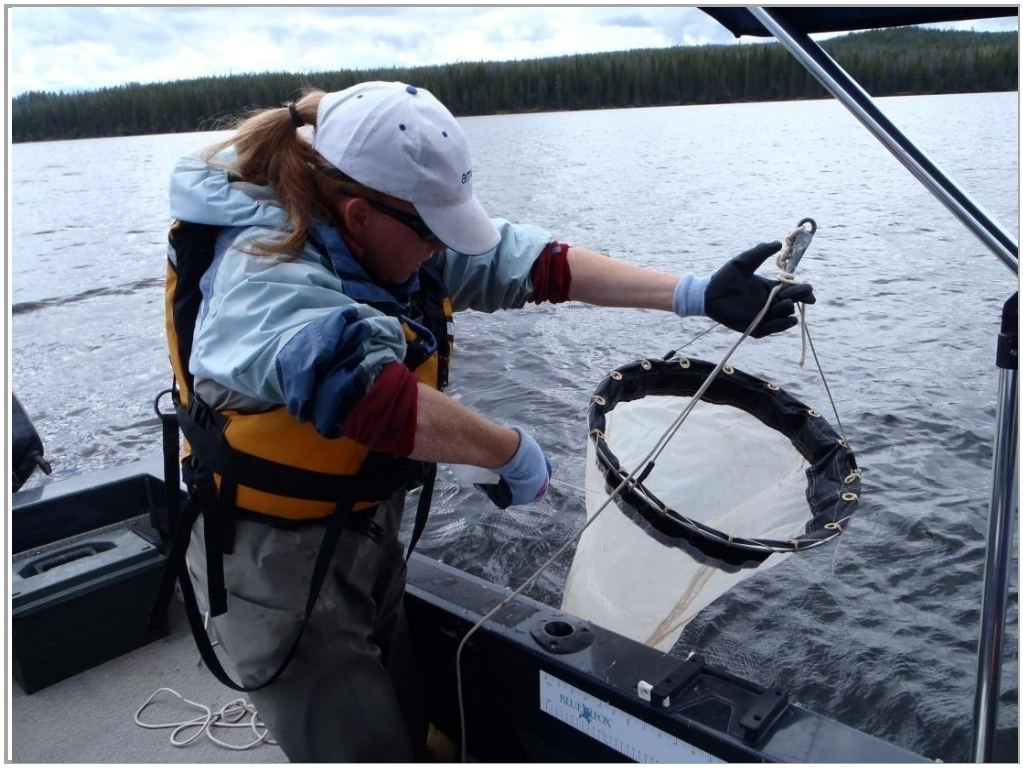


Plate 4.11-2: Zooplankton Sampling with Plankton Net, Tatelkuz Lake, 16 August 2013

4.11.3.2 Laboratory Analysis

At Bio-Limno, each sample was rinsed through a 64 µm Nitex sieve to remove preservative. For each sample, the number of zooplankters in each of three 1 to 5 mL sub-samples were counted using a dissecting microscope at magnifications of 12 to 50X for macro-zooplankton, and using an inverted microscope at magnifications of 200 to 400X for rotifers and copepod nauplii. Sub-samples for rotifers and nauplii were allowed to settle for 24 h prior to counting. The sub-sample volumes used was dependent primarily on the amount of particulate materials in the sample.

Identification used keys including Brooks (1957), Edmondson (1966), Chengalath et al. (1971), Grothe and Grothe (1977), Pennak (1978), Stemberger (1979), Clifford (1991), Thorp and Covich (1991), and Green (2012).

Zooplankter lengths were determined directly on a microscope fitted with a micrometer in the ocular. Generally, lengths were measured for a minimum of 40 to 50 individuals of each species or genus encountered from representative samples (where several samples from the lake are involved). For rare taxa or those that occurred in low numbers, measurements were taken as they were encountered.

Zooplankton biomass was calculated for each sample by summing biomass of each taxon (i.e., species or developmental stage) in each sample. Total biomass for each group was calculated as the product of its density and estimated mean individual weight. Weights were calculated from published length-weight regressions cited in Bottrell et al. (1976), Downing and Rigler (1984), and Stemberger and Gilbert (1987).

In 2013, Bio-Limno re-counted 2 of the 10 zooplankton taxonomy samples for QA/QC purposes (**Table 4.11-4**). Both the mean Bray-Curtis similarity and mean Dominance Identity indices were above the QA thresholds of 0.6 and 60%, respectively.

Table 4.11-4: QA/QC Indices for Zooplankton, 2013

Index	n	Mean	SE	Min	Max
Bray-Curtis (B-C)	2	0.87	0.11	0.76	0.97
Dominance Identity ($D_{1,2}$)	2	87.6	0.70	86.9	88.3

Note: n = number of samples; SE = standard error; Min = minimum; Max = maximum

4.11.3.3 Data Analysis

Mean zooplankton density and biomass were calculated for the two sample sites in Tatelkuz Lake and compared graphically. Mean density of major taxa and indices of diversity (S and H') and evenness (J) were calculated for each lake and compared using tables.

Relationships between August limnological data and zooplankton communities were examined in Tatelkuz Lake and for context were compared to data collected in the three headwater lakes sampled in 2012 (AMEC, 2013b). Sampling methods were consistent

among years enabling direct comparisons. Univariate and multivariate methods were used to characterize zooplankton community structure in Tatelkuz Lake. Differences according to habitat and to three headwater lakes previously sampled in the Project area were also explored. Biomass was considered in parallel with density to enhance understanding of zooplankton dynamics in Tatelkuz Lake.

Zooplankton community structure (i.e. abundance and proportional representation of taxa) in all habitats were compared within a multivariate framework using the Bray-Curtis Index in a similar manner as phytoplankton community structure (**Section 4.11.2.3**). All environmental variables were considered for the BEST analysis, but only conductivity (correlated with surface temperature, chlorophyll *a* and depth), Secchi depth, and bottom DO (correlated with surface DO and bottom temperature) remained after screening was conducted to ensure variables were not heavily correlated (r>0.90).

4.11.4 Benthic Macroinvertebrates

4.11.4.1 Field Sampling

Field collection of BMI samples were conducted in both littoral and profundal habitats of Tatelkuz Lake (**Figure 4.11-1**).

Littoral BMI

Samples of BMI were collected from the littoral zone of Tatelkuz Lake between 12 and 25 August 2013. Sample timing was consistent with the Ontario Benthic Biomonitoring Network (OBBN) protocol (Jones et al., 2004). OBBN was the same protocol used for sampling BMI in headwater lakes in 2012 (AMEC, 2013b).

Littoral sites were located within the representative (most common) lake littoral habitat, defined by substrate type identified during shoreline habitat surveys. Five replicate samples were collected from cobble-gravel substrates along the east and west shores as well as fine-gravel substrates along the north and south shores in Tatelkuz Lake. A total of 20 samples from Tatelkuz Lake were collected (**Figure 4.11-1** and **Table 4.11-5**).

Table 4.11-5: Littoral BMI Sampling Sites in Tatelkuz Lake, August 2013

Site ID	Date	Location (UTM)[1]	
		Easting	Northing
TL-1	12 August	385856	5907635
TL-2		386462	5907070
TL-3		387208	5906669
TL-4		388824	5904917
TL-5		390721	5902721
TL-6	13 August	391850	5901940
TL-7		391858	5901550

Site ID	Date	Location (UTM)[1]	
TL-8		391760	5901281
TL-9		391088	5900873
TL-10		390766	5900866
TL-11	14 August	390414	5901383
TL-12		389870	5902356
TL-13		389674	5902558
TL-14		388980	5903362
TL-15		387455	5905132
TL-16		385297	5906826
TL-17		385241	5907056
TL-18	16 August	385620	5907832
TL-19	25 August	385234	5907180
TL-20		385348	5907449

Note: UTM = Universal Transverse Mercator
[1] North American Datum 83, Zone 10

Samples were collected with a pole-mounted kick net. The net is triangular in shape with a 400-µm mesh and a plastic detachable cod end for sample concentration and removal. Each kick was conducted by a crew member working in a zig-zag pattern along the shoreline for 10 minutes. Transects were established perpendicular from the lakeshore towards the middle of the lake to a maximum of 0.75 m depth. Substrates were disturbed by vigorously kicking to a depth of 5 cm while sweeping the net through the water (**Plate 4.11-3** and **Plate 4.11-4**).

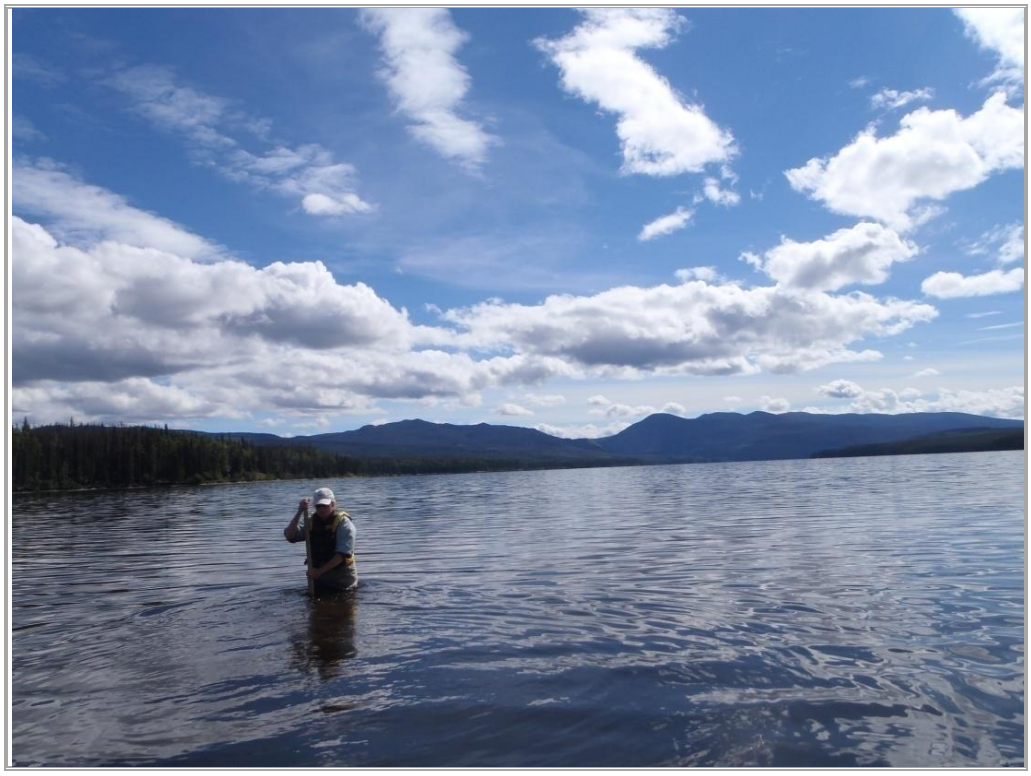


Plate 4.11-3: Sampling BMI with a Kick Net, Tatelkuz Lake, 25 August 2013



Plate 4.11-4: Transferring BMI Sample into Sample Jar, Tatelkuz Lake, 12 August 2013

Samples were washed from the cod end of the net into 500 mL wide-mouth jars. Care was taken to avoid loss of organisms by working over a clean tray and visually inspecting of the net. Each jar was labelled externally and internally before fixing the sample with 37% phosphate-buffered formalin at a ratio of 3:1 to 10:1, depending on the organic content of the sample. More formalin was added to samples with higher organic content.

To protect the integrity of the organisms, large non-organic debris was removed from the sample, cleaned and the rinsate returned to the sample jar. All samples were sent to Cordillera Consulting (Cordillera) of Summerland, BC, for taxonomic identification and enumeration.

Habitat data for each site in the littoral zone were collected following the OBBN protocol for lakes (Jones et al., 2004), and included supporting explanatory variables for metal mining environmental effects monitoring (EC, 2011). These data included:

- Site location measured with a handheld GPS;
- pH, water temperature, conductivity, and DO concentration measured with a YSI 665 multimeter (prior to BMI sampling);
- Dominant substrate class estimated by visual means;
- Percent organic matter and percent areal coverage estimated by visual means; and
- Dominant canopy type estimated by visual means.

Profundal BMI

Samples of BMI in the profundal zone were collected at the same locations as the phytoplankton and zooplankton samples and limnological profiling (**Figure 4.11-1** and **Table 4.11-6**).

Table 4.11-6: Profundal BMI Sample Sites, Tatelkuz Lake, August 2013

Site ID	Sampling Date	Water Depth (m)	Sample Depth (cm)	Location (UTM[1])	
				Easting	Northing
TL1-1	15 August	29.0	12	389616	5903266
TL1-2		28.0	13	389220	5903681
TL1-3		28.5	12	388767	5904054
TL1-4		28.5	14	387787	5905035
TL1-5		28.0	14	386908	5905735
TL2-1	16 August	28.1	15	387269	5905750
TL2-2		27.1	13	389957	5903431
TL2-3		28.0	13	389356	5904197
TL2-4		27.8	14	388919	5904724
TL2-5		28.5	14	388129	5905359

Note: UTM = Universal Transverse Mercator; 1: North American Datum 83, Zone 10; m = metre; cm = centimetre

The location of each sample site was measured with a handheld GPS and depth was measured with a weighted rope. BMI samples were collected using an Ekman dredge with dimensions of 15 x 15 x 15 cm (**Plate 4.11-5**). Five replicate samples were collected at each site from five different points of the boat. The sample volume for each grab sample was approximately 3,000 cm^3 of sediment taken from an area of 225 cm^2 of lake bed to a depth of 9 to 15 cm. Samples were sieved through a 500 µm mesh net prior to transfer into a 500 mL jar (**Plate 4.11-6**). The sample was fixed in 10% buffered formalin. All samples were sent to Cordillera Consulting for taxonomic identification and enumeration.

Field QA/QC procedures were based on standardized protocols (Clark, 2003; McDermott et al., 2010; EC, 2011, 2012) and included the following:

- Equipment was maintained, calibrated and operated consistent with applicable standards and manufacturers' guidelines;
- Standardized field forms were used to collect habitat data which were reviewed for completeness at the conclusion of sampling before leaving the site;
- Samples were stored securely and shipped with a chain of custody from the field to the lab;
- Sites, data, samples, and physical habitat features were documented photographically;

- Data and photographs were stored in a pre-determined file structure in triplicate (hard copy, lap-top, and external memory); and
- Samples were labelled on the outside of the jars with a permanent marker and inside of jars using “Rite-in-the-Rain” paper with pencil.



Plate 4.11-5: Preparing the Ekman Grab Sampler for Profundal BMI sample, Tatelkuz Lake, 15 August 2013

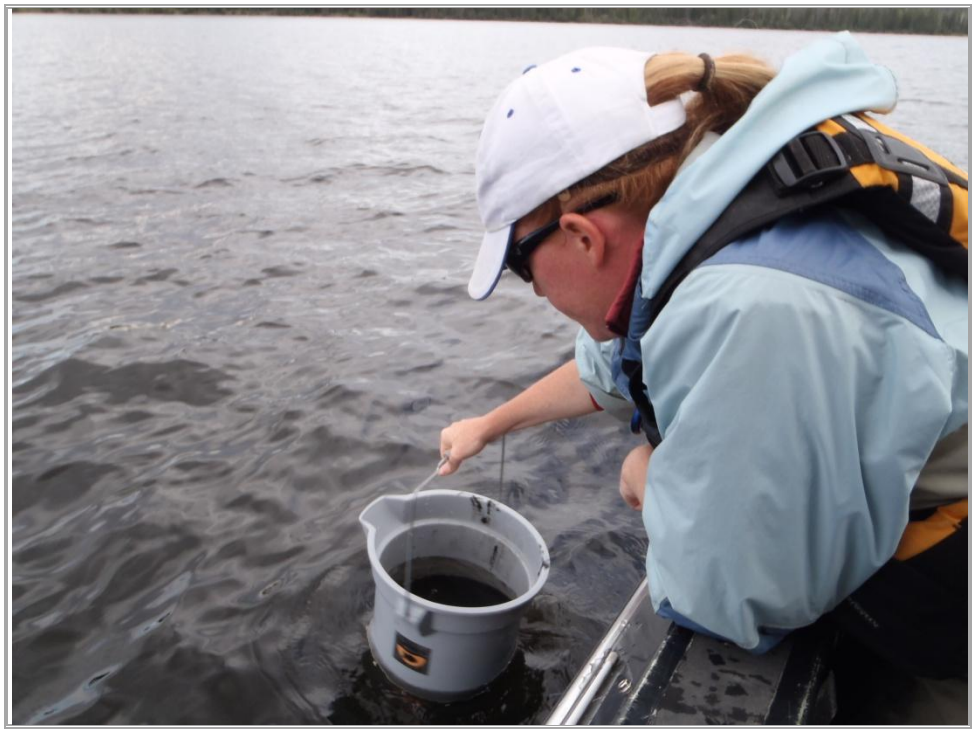


Plate 4.11-6: Field Processing of Profundal Sediments in Sieve Bucket for BMI, Tatelkuz Lake, 16 August 2013

4.11.4.2 Laboratory Analysis

At Cordillera the formalin in all BMI samples was removed by draining the sample in a sieve with a 250 µm mesh. Eighty percent ethanol was then added for long-term preservation. Inorganic material was then removed from the sample by elutriation. This involved swirling the sample in a circular manner to separate light from heavy objects and then filtering the top layer through a fine-mesh filter. Elutriate was examined under low-power magnification to ensure the removal of molluscs and trichopteran cases.

Each sample was examined to estimate total invertebrate numbers. If the total number of organisms was greater than 500 (or up to 3 jars used for the sample), then it was sub-sampled. The sub-samples were sieved through 4 mm, 2 mm, and 400 µm sieves before counting. Where the sample had 4 to 12 jars, a minimum number of 1,500 individuals were identified. Samples with greater than 12 jars were sub-sampled to 3,000 organisms. Following the Canadian Aquatic Biomonitoring Network (CABIN) laboratory manual (McDermott et al., 2010), a Marchant box was used for sub-sampling. A minimum number of invertebrates for sub-sampling was set at 300 individuals. When more than 50% of the sample had to be used to obtain 300 individuals, the entire sample was identified and enumerated. Any cladocera, copepod, porifera, or taxa other than insects were excluded from these counts because they are either non-benthic or they are colonial and cannot be identified as individuals.

Individual BMI were identified with a dissecting microscope with at least 10 to 80X magnification or a compound microscope with 60X to 1,500X magnification for slide-mounted organisms. Taxonomic identification was conducted to at least family level following current published taxonomic references (Brook and Kelton, 1967; Brown and White, 1978; Morihara and McCafferty, 1979; Oliver and Roussel, 1983; Weiderholm, 1983; Stonedahl and Lattin, 1986; Clifford, 1991; Thorpe and Covich, 1991; Needham, 1996; Westfall and May, 1996; Wiggins, 1998; Kathman and Brinkhurst, 1999; Needham et al., 2000; Epler, 2001, no date; Stewart and Stark, 2002; Jacobus and McCafferty, 2003, 2004; Prescott et al., 2004; Jacobus and Randolph, 2005; Larson et al., 2005; Tinerella and Gunderson, 2005; Stewart and Oswood, 2006; Merritt et al., 2007; Rogers and Hill, 2008; Proctor, no date). Organisms were identified to genus or species for specimens that were undamaged and in later stages of maturation. Nomenclature followed the Integrated Taxonomic Information System (ITIS) (ITIS, 2013).

Laboratory QA/QC procedures focused on the two areas for potential error: sorting and sub-sampling; and error in taxonomic classification. These two types of errors were minimized by:

- Use of certified taxonomists (Sue Salter and Nicole Hunziker-Basler) who have achieved Groups 1, 2 and 3 (West) certification by the North American Benthological Society's Taxonomic Certification Program;
- Use of the ITIS to ensure valid classifications and meet revisions and additions to species lists; and
- Estimating sorting efficiency (S_{Eff}) by a certified taxonomist through re-sorting at least 10% (or 8) of samples. The criterion for an acceptable sort was that a mean S_{Eff} ≥95%.

S_{Eff} was calculated for each re-sorted sample as follows (McDermott et al., 2010):

$$S_{Eff} = 1 - \frac{\text{Number of Organisms Missed}}{\text{Total Organisms Found in Audit}} \times 100$$

Eight samples were randomly selected and resorted. Sorting efficiency ranged from 98% to 100% with a mean of 99%, meeting the QC criteria.

4.11.4.3 Data Analysis

Analysis of Tatelkuz Lake BMI communities was done in hierarchal fashion within multivariate (community structure and habitat analysis) and univariate frameworks. First, to place Tatelkuz communities in the local context, comparisons of Tatelkuz Lake were made with data from the three headwater lakes that were sampled in 2012 (AMEC, 2013b). Since differing sample methods were used in profundal and littoral habitats, comparisons of all habitats from all lakes were limited to taxonomic presence information. However, common methods were used across lakes within similar habitats. This permitted separate second stage analyses of abundance data that were done across lakes for each habitat type

(profundal and littoral). Finally, a third stage of analysis was done to describe within-Tatelkuz Lake BMI communities with respect to within-lake habitat conditions. Again, since collection methods were habitat-specific, comparisons were restricted within habitat zones of Tatelkuz Lake.

While all invertebrates were identified, only taxa used in CABIN protocols were used in subsequent data analysis. Excluded taxa (terrestrial taxa, Turbellaria, Copepods, Cladocerans, Nemata, Porifera, Platyhelminthes and Ostracods) were not considered BMI, were poorly sampled with the mesh size used, or are known to create spurious results (McDermott et al., 2010).

Community structure (i.e., abundance and proportional representation of taxa) of BMIs in all habitats were compared within a multivariate framework using the Bray-Curtis Index.

Similarity scores were used as inputs for three analytical approaches. First, they were the basis for assessing differences across lakes and across groups of stations within lakes using a permutation-based multivariate analog of ANOVA (ANOSIM, 9999 permutations, Clarke and Warwick, 2001). Second, they were used to aggregate BMI samples into statistically defined groups (CLUSTER algorithm; PRIMER 6; Clarke and Warwick, 2001) and finally they were used in ordinations to visually represent the relationships of BMI communities across habitats and across lakes.

Taxa that most characterized the differences among and within lakes were identified using a SIMPER algorithm (PRIMER 6; Clarke and Warwick, 2001), for pairs of sites within and among groups.

Environmental variables were examined for subsets that best reflected the community structure observed in the Project area lake BMI data using the BEST algorithm (PRIMER 6; Clarke and Warwick, 2001). Specifically, the ranked relationships among pairs of sites were compared for each possible subset of environmental variables in terms of their relationship (measured with Spearman rank correlation coefficients) with the BMI data (i.e., pattern matching). Unlike the BMI data, which used Bray-Curtis similarities, environmental patterns among sites were assessed using normalized Euclidean distances (Clark and Warwick, 2001). The continuous environmental variables used in the BEST analysis varied according to data availability (**Table 4.11-7**), but included subsets of the following: sample depth, DO, conductivity, Secchi depth, algal cover, and aquatic vegetation cover. Environmental variables were screened to ensure variables were not heavily correlated ($r>0.90$). An additional categorical variable, dominant substrate, was examined using ANOSIM and SIMPER to explain differences within Tatelkuz Lake littoral BMI communities.

Table 4.11-7: Environmental Variables Available for Comparative BMI Analyses within Tatelkuz Lake and across Lakes, 2012 and 2013

Variable	Variable Type	All Lakes[a]		Tatelkuz Lake	
		Profundal	Littoral	Profundal	Littoral
Depth	Continuous	X	-	X	-
Dissolved Oxygen	Continuous	X	X	X	X
Conductivity	Continuous	X	X	X	X
Secchi Depth	Continuous	X	-	X	-
Algae Cover	Continuous	-	-	-	X
Aquatic Vegetation Cover	Continuous	-	-	-	X
Substrate	Categorical	-	-	-	X

Note: [a] = Tatelkuz Lake and lakes 01428UEUT, 01538UEUT and 01682LNRS; X = available environmental variable for comparison; - = data not available.

Community metrics were used to add context to the ordination analyses described above. Several metrics were calculated for each sample replicate including total abundance, taxa richness, the Shannon-Weiner Index, the Hilsenhoff Biotic Index (HBI), the proportion of EPT taxa (i.e., Ephemeroptera, Plecoptera, and Trichoptera) (for littoral zones only), and the proportion of chironomids.

The HBI scores taxa according to their pollution tolerance and averages the scores of all individuals across a sample (Hilsenhoff, 1987). Tolerance values were from the Southwestern Association of Freshwater Taxonomists. It was largely built as an indicator of organic pollution, where high values indicate nutrient enriched systems and low values correspond to intact BMI communities (**Table 4.11-8**).

EPT taxa are typically most sensitive to habitat disturbance and changes in water quality. An even distribution and high numbers of EPTs are indicative of good water quality. As with taxonomic richness, moderate organic enrichment may result in an increase in the number of EPTs present in samples.

Table 4.11-8: Evaluating Water Quality with the Hilsenhoff Biotic Index

Biotic Index	Water Quality	Degree of Organic Pollution
0-3.5	Excellent	No apparent organic pollution
3.6-4.5	Very Good	Possible slight organic pollution
4.6-5.5	Good	Some organic pollution
5.6-6.5	Fair	Fairly significant organic pollution
6.6-7.5	Fairly Poor	Significant organic pollution
7.6-8.5	Poor	Very significant organic pollution
8.6-10	Very Poor	Severe organic pollution

Proportion Chironomidae is a measure of the numerical dominance of chironomidae taxa, which are known to be highly tolerant of pollution relative to EPT taxa and many other insects. A sample containing high numbers of Chironomidae may suggest eutrophic conditions (Armitage et al., 1995) or presence of heavy metals (Hayford and Ferrington, 2005).

Each index has an expected response to various anthropogenic impacts (Barbour et al., 1999). For example, heavily enriched lakes would be expected to have high total abundance and HBI scores and low EPT proportions and Shannon-Weiner Diversity scores because nutrients would eliminate pollution sensitive EPT species and enhance abundance/ dominance of tolerant species such as chironomids.

4.12 Fish Community of Tatelkuz Lake

4.12.1 Sampling Design

Brock Stables of Shuksan Fisheries Consulting conducted the hydroacoustic survey of Tatelkuz Lake from 9 to 12 July 2013 after the end of the rainbow trout spawning migration. Fish biologists from AMEC and Avison conducted the fish community survey soon afterwards – from 15 to 20 July. The two surveys could not have been conducted together because gillnets and bubble trails from outboard engines (which can last up to 0.5 hour) interfere with hydroacoustic signals.

Gillnets (abbreviated as GN) and minnow traps (abbreviated as MT) were used to sample the Tatelkuz Lake fish community. These gears provide the most effective and unbiased sampling in the profundal and pelagic zones and littoral zones, respectively. They are also the methods designed for supporting acoustic surveys of lake fish populations (Beauchamp et al., 2009).

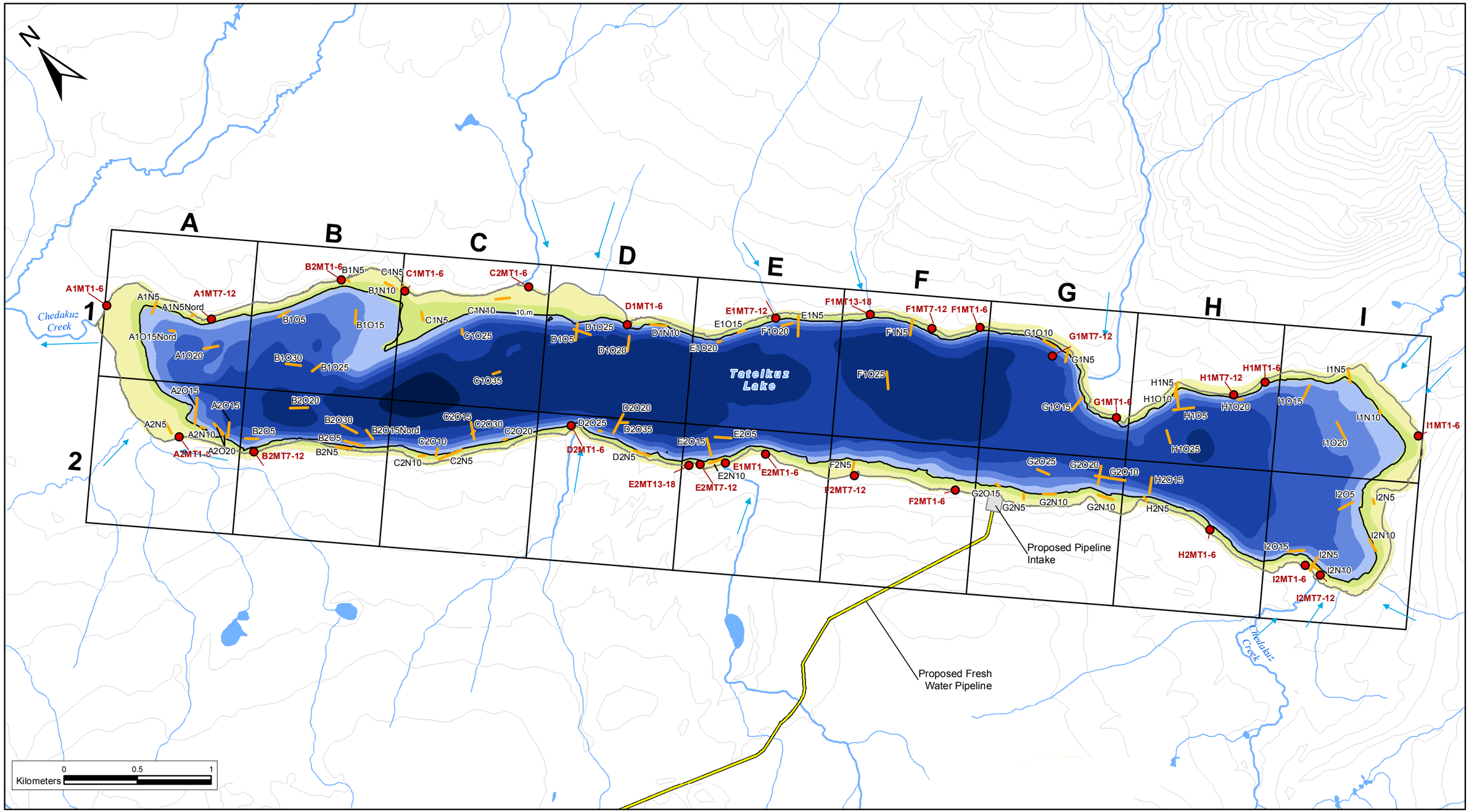
Sampling effort was stratified by horizontal location, habitat type (nearshore or offshore), depth, and time of day (day or night) (**Figure 4.12-1** and **Table 4.12-1**).

To ensure that sampling effort included all areas of the lake, a grid of 18 cells—two rows of nine cells—was laid over a map of the lake (**Figure 4.12-1**). Each cell was a square with a side length of 1 km; hence each cell had an area of approximately 1 km^2. The horizontal rows were labelled “1” and “2” and the nine columns were labelled “A” to “I.” Therefore, each of the 18 cells had a two-digit address (e.g., A1, B2, etc.). Gillnet sets were distributed over the 18 cells with more effort in the northern and southern thirds of the lake than in the central third to reflect the spatial distribution of hydroacoustic signals (B. Stables, Shuksan Fisheries, personal communication).

Within each cell were two habitats: nearshore and offshore. Nearshore habitat was defined as the area along the shoreline that was less than 10 m deep. It had two depth strata: 1 to 5 m and 5 to 10 m. The 1 to 5 m stratum corresponds to the littoral zone, which is conventionally defined in BC as the wetted area less than 6 m deep, but can also be defined by the Secchi disc depth (approximately 4 m in Tatelkuz Lake). That stratum is typically

above the thermocline of Tatelkuz Lake during summer (Walsh and Hale, 1977; AMEC, 2013b). The 5 to 10 m stratum usually straddles the thermocline during summer (Walsh and Hale, 1977; AMEC, 2013b). Offshore habitat was defined as all area with maximum depths deeper than 10 m. These areas had up to seven depth strata within the water column: 1 to 5, 5 to 10, 10 to 15, 15 to 20, 20 to 25, 25 to 30, and 30 to 35 m.

Nearshore and offshore habitats are very different from each other in depth, light penetration, and benthic macroinvertebrate composition, so they were expected to support different fish communities. More gillnet effort was allocated to offshore habitat to reflect the spatial distribution of hydroacoustic signals (B. Stables, Shuksan Fisheries, personal communication). The 36 cell-habitat combinations were labelled according to sampling cell and habitat. For example, the nearshore area (or N) of cell A1 was called “A1N” and the offshore area (or O) was called “A1O” (**Figure 4.12-1**).



REFERENCE:
BC Government GeoBC Data Distribution

Legend

Fish Sample Sites (AMEC 2013)
- Minnow Trapping
- Gillnets
- Depth Contour - 10 m
- Stream and Rivers
- Stream Direction
- Contour (20 m)

Water Depth (m)
- 0 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40

CLIENT: newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
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amec

ANALYST:	KA
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:25,000

PROJECT: Blackwater Gold Project

TITLE: Fish Sample Sites Tatelkuz Lake, 2013

REV. NO:	A
DATE:	April, 2014
PROJECT NO:	VE52277
FIGURE NO:	4.12-1

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Table 4.12-1: Tatelkuz Lake Fish Sampling Sites, Methods, Depths, Dates, and Soak Times, July 2013

Gear Type	Set ID	Total Net Area (m^2) or Total Trap Numbers	UTM 1		UTM 2		Depth (m)	Installation Date	Removal Date	Soak Time[1]
			Easting	Northing	Easting	Northing				
Nordic	A1N5Nord	55	0385973	5907378	0385955	5907380	0-5	15-Jul-13	15-Jul-13	1.6
Nordic	A1O15Nord	113	0385779	5907400	0385804	5907376	10-15	15-Jul-13	15-Jul-13	1.6
Nordic	B2O15Nord	55	0386362	5905949	0386367	5906024	10-15	16-Jul-13	16-Jul-13	3.1
Nordic	G1O10	113	0390315	5903441	0390283	5903532	5-10	17-Jul-13	17-Jul-13	4.0
Nordic	G2O15	113	0389407	5902992	0389414	5902964	10-15	17-Jul-13	17-Jul-13	3.5
Nordic	H1O20	55	0391061	5902356	0391040	5902368	15-20	17-Jul-13	17-Jul-13	3.6
Nordic	H2N5	55	0390114	5902247	0390124	5902274	0-5	17-Jul-13	17-Jul-13	1.6
Nordic	I1N10	55	0391720	5901679	0391725	5901697	5-10	17-Jul-13	17-Jul-13	3.3
Nordic	I2N5	113	0391290	5901234	0391305	5901263	0-5	17-Jul-13	17-Jul-13	3.0
Nordic	A2N10	113	0385534	5906739	0385519	5906762	5-10	18-Jul-13	18-Jul-13	7.2
Nordic	A2O20	113	0385594	5906640	0385607	5906596	15-20	18-Jul-13	18-Jul-13	6.3
Nordic	C1N5	55	0387169	5906609	0387194	5906606	0-5	18-Jul-13	18-Jul-13	2.9
Nordic	C1O35	113	0387271	5905762	0387317	5905743	30-35	18-Jul-13	18-Jul-13	6.2
Nordic	C2O20	113	0387039	5905373	0387058	5905364	15-20	18-Jul-13	19-Jul-13	14.7
Nordic	D2O25	113	0387575	5905003	0387586	5904987	20-25	18-Jul-13	18-Jul-13	5.5
Nordic	E1O15	55	0388729	5904905	0388770	5904888	10-15	18-Jul-13	19-Jul-13	16.1
Nordic	E1O20	55	0388579	5904945	0388599	5904935	15-20	18-Jul-13	18-Jul-13	5.8
Nordic	B1N5	55	0386923	5906894	0386925	5906871	0-5	19-Jul-13	19-Jul-13	3.8
Nordic	C1O25	113	0387307	5906130	0387284	5906101	20-25	19-Jul-13	19-Jul-13	3.1
Nordic	C2N10	55	0386529	5905656	0386562	5905633	5-10	19-Jul-13	19-Jul-13	4.3
Nordic	C2O10	113	0386614	5905582	0386660	5905616	5-10	19-Jul-13	19-Jul-13	4.0
Nordic	C2O30	55	0386897	5905543	0386928	5905544	25-30	19-Jul-13	19-Jul-13	4.4
Nordic	C1N5	55	0387169	5906398	0387143	5906347	0-5	19-Jul-13	20-Jul-13	16.4

Table continues…

Gear Type	Set ID	Total Net Area (m^2) or Total Trap Numbers	UTM 1		UTM 2		Depth (m)	Installation Date	Removal Date	Soak Time[1]
RISC Floating	A1N5	219	0385761	5907566	0385848	5907614	0-5	15-Jul-13	15-Jul-13	1.9
RISC Floating	B1O5	219	0386486	5906982	0386405	5906996	0-5	16-Jul-13	16-Jul-13	3.9
RISC Floating	B2O5	219	0386281	5905953	0386206	5906063	0-5	16-Jul-13	16-Jul-13	3.8
RISC Floating	G2N5	219	0309511	5902819	0389485	5902790	0-5	16-Jul-13	16-Jul-13	2.7
RISC Floating	H1N5	219	0390720	5902667	0390795	5902726	0-5	16-Jul-13	16-Jul-13	2.3
RISC Floating	I1N5	219	0391694	5901971	0391738	5902047	0-5	16-Jul-13	16-Jul-13	2.1
RISC Floating	I2N5	219	0390666	5901169	0390762	5901205	0-5	16-Jul-13	16-Jul-13	1.8
RISC Floating	F2N5	219	0388765	5903724	0388691	5903664	0-5	17-Jul-13	17-Jul-13	2.3
RISC Floating	G1N5	219	0390304	5903323	0390376	5903376	0-5	17-Jul-13	17-Jul-13	3.4
RISC Floating	H1O5	219	0390753	5902687	0390691	5902590	0-5	17-Jul-13	17-Jul-13	5.3
RISC Floating	I2O5	219	0391188	5901336	0391082	5901357	0-5	17-Jul-13	17-Jul-13	5.4
RISC Floating	B2O5	219	0385700	5906510	0385763	5906452	0-5	18-Jul-13	19-Jul-13	2.6
RISC Floating	D1O5	219	0387933	5905658	0387847	5905574	0-5	18-Jul-13	18-Jul-13	5.7
RISC Floating	E1N5	219	0389025	5904625	0389114	5904729	0-5	18-Jul-13	18-Jul-13	3.6
RISC Floating	E2O5	219	0388149	5904463	0388231	5904385	0-5	18-Jul-13	18-Jul-13	5.7
RISC Floating	C2N5	219	0386616	5905553	0386778	5905505	0-5	19-Jul-13	19-Jul-13	4.2
RISC Floating	D2N5	219	0387672	5904746	0387727	5904652	0-5	19-Jul-13	19-Jul-13	5.6
RISC Floating	B2N5	219	0386211	5905989	0386136	5906086	0-5	19-Jul-13	20-Jul-13	17.3
RISC Floating	F1N5	219	0389694	5904211	0389613	5904140	0-5	19-Jul-13	20-Jul-13	17.1
RISC Sinking	A1O20	219	0385963	5907107	0385875	5907158	15-20	15-Jul-13	16-Jul-13	14.5
RISC Sinking	A2N5	219	0385340	5906857	0385359	5906956	0-5	15-Jul-13	15-Jul-13	2.1
RISC Sinking	A2O15	219	0385627	5906930	0385500	5906804	10-15	15-Jul-13	15-Jul-13	1.9
RISC Sinking	A2O15	219	0385618	5906594	0385686	5906661	10-15	16-Jul-13	17-Jul-13	13.0
RISC Sinking	B1O15	219	0386838	5906691	0386770	5906624	10-15	16-Jul-13	17-Jul-13	12.5
RISC Sinking	B1O25	219	0386426	5906563	0386342	5906565	20-25	16-Jul-13	16-Jul-13	4.1
RISC Sinking	B1O30	219	0386307	5906645	0386238	5906719	25-30	16-Jul-13	16-Jul-13	4.7

Table continues…

Gear Type	Set ID	Total Net Area (m^2) or Total Trap Numbers	UTM 1		UTM 2		Depth (m)	Installation Date	Removal Date	Soak Time[1]
RISC Sinking	B2O20	219	0386161	5906396	0386067	5906470	15-20	16-Jul-13	16-Jul-13	3.8
RISC Sinking	B2O30	219	0386305	5906049	0386259	5906157	25-30	16-Jul-13	16-Jul-13	3.9
RISC Sinking	C2O15	219	0386886	5905502	0386946	5905607	10-15	16-Jul-13	17-Jul-13	12.0
RISC Sinking	G1O15	219	0390234	5903065	0390117	5903041	10-15	17-Jul-13	17-Jul-13	4.3
RISC Sinking	G2O20	219	0389938	5902544	0390033	5902623	15-20	17-Jul-13	18-Jul-13	17.9
RISC Sinking	G2O25	219	0389687	5902885	0389726	5902810	20-25	17-Jul-13	17-Jul-13	5.3
RISC Sinking	H1O25	219	0390531	5902522	0390494	5902441	20-25	17-Jul-13	18-Jul-13	17.8
RISC Sinking	H2O15	219	0390164	5902271	0390248	5902346	10-15	17-Jul-13	17-Jul-13	4.2
RISC Sinking	I1O15	219	0391471	5902135	0391372	5902091	10-15	17-Jul-13	17-Jul-13	2.2
RISC Sinking	I2N10	219	0391092	5900980	0391108	5901069	5-10	17-Jul-13	17-Jul-13	3.3
RISC Sinking	I2O15	219	0390723	5901300	0390634	5901362	10-15	17-Jul-13	18-Jul-13	18.3
RISC Sinking	A2O20	219	0385606	5906634	0385602	5906722	15-20	18-Jul-13	19-Jul-13	14.2
RISC Sinking	B1N10	219	0387109	5906708	0387141	5906626	5-10	18-Jul-13	18-Jul-13	2.5
RISC Sinking	C1N10	219	0387689	5906084	0387612	5906137	5-10	18-Jul-13	18-Jul-13	4.7
RISC Sinking	D1O20	219	0388146	5905361	0388070	5905293	15-20	18-Jul-13	18-Jul-13	5.4
RISC Sinking	D1O25	219	0387887	5905640	0387952	5905539	20-25	18-Jul-13	19-Jul-13	16.4
RISC Sinking	D2O20	219	0387641	5904929	0387772	5904982	15-20	18-Jul-13	19-Jul-13	16.7
RISC Sinking	D2O35	219	0387724	5904951	0387761	5904917	30-35	18-Jul-13	18-Jul-13	5.9
RISC Sinking	E2O15	219	0388049	5904382	0388102	5904490	10-15	18-Jul-13	18-Jul-13	5.6
RISC Sinking	F1O25	219	0389262	5903958	0389329	5904052	20-25	18-Jul-13	18-Jul-13	5.7
RISC Sinking	G2N10	219	0389677	5902676	0389612	5902731	5-10	18-Jul-13	18-Jul-13	2.7
RISC Sinking	D1N10	219	0388309	5905331	0388383	5905255	5-10	19-Jul-13	19-Jul-13	3.1
RISC Sinking	E2N10	219	0388006	5904350	0388098	5904317	5-10	19-Jul-13	19-Jul-13	5.5
RISC Sinking	G2N10	219	0389891	5902488	0389948	5902399	5-10	19-Jul-13	19-Jul-13	6.0
RISC Sinking	H1O10	219	0390652	5902601	0390771	5902522	5-10	19-Jul-13	19-Jul-13	4.9
RISC Sinking	I1O20	219	0391452	5901823	0391422	5901694	15-20	19-Jul-13	19-Jul-13	5.4

Table continues…

Gear Type	Set ID	Total Net Area (m^2) or Total Trap Numbers	UTM 1		UTM 2		Depth (m)	Installation Date	Removal Date	Soak Time[1]
RISC Sinking	F1O20	219	0388983	5904749	0389056	5904716	15-20	19-Jul-13	20-Jul-13	17.1
RISC Sinking	G2O10	219	0389960	5902598	390096	5902445	5-10	19-Jul-13	20-Jul-13	16.2
RISC Sinking	I2N10	219	0390693	5901193	0390723	5901098	5-10	19-Jul-13	20-Jul-13	17.3
Minnow Trap	A2MT1-6	6	0385364	5906803	–	–	0.75	16-Jul-13	17-Jul-13	161.0
Minnow Trap	B2MT1-6	6	0386894	5906912	–	–	0.45	16-Jul-13	17-Jul-13	152.0
Minnow Trap	C2MT1-6	6	0387839	5906057	–	–	0.45	16-Jul-13	17-Jul-13	149.0
Minnow Trap	D2MT1-6	6	0387453	5905149	–	–	0.45	16-Jul-13	17-Jul-13	147.0
Minnow Trap	F1MT1-6	6	0390010	5903873	–	–	0.80	16-Jul-13	17-Jul-13	152.5
Minnow Trap	G1MT1-6	6	0390326	5902807	–	–	0.50	16-Jul-13	17-Jul-13	124.9
Minnow Trap	I1MT1-6	6	0391816	5901392	–	–	1.0	16-Jul-13	17-Jul-13	145.5
Minnow Trap	I2MT1-6	6	0390662	5901214	–	–	1.0	16-Jul-13	17-Jul-13	156.0
Minnow Trap	A1MT1-6	6	0385560	5907803	–	–	0.55	17-Jul-13	18-Jul-13	157.5
Minnow Trap	B2MT7-12	6	0385688	5906398	–	–	0.50	17-Jul-13	18-Jul-13	152.0
Minnow Trap	D1MT1-6	6	0388186	5905430	–	–	0.45	17-Jul-13	18-Jul-13	152.5
Minnow Trap	E2MT1-6	6	0388338	5904151	–	–	0.75	17-Jul-13	18-Jul-13	159.0
Minnow Trap	F2MT1-6	6	0389170	5903135	–	–	0.80	17-Jul-13	18-Jul-13	126.2
Minnow Trap	H1MT1-6	6	0391254	5902343	–	–	0.50	17-Jul-13	18-Jul-13	143.9
Minnow Trap	H2MT1-6	6	0390322	5901814	–	–	0.70	17-Jul-13	18-Jul-13	150.9
Minnow Trap	I2MT7-12	6	0390696	5901097	–	–	0.50	17-Jul-13	18-Jul-13	143.3
Minnow Trap	A1MT7-12	6	0386045	5907275	–	–	0.45	18-Jul-13	19-Jul-13	128.5
Minnow Trap	E1MT1-6	6	0388093	5904280	–	–	0.70	18-Jul-13	19-Jul-13	170.4
Minnow Trap	E1MT7-12	6	0388987	5904815	–	–	0.50	18-Jul-13	19-Jul-13	161.5
Minnow Trap	E2MT7-12	6	0387955	5904382	–	–	0.25	18-Jul-13	19-Jul-13	146.7
Minnow Trap	F1MT7-12	6	0389756	5904078	–	–	0.60	18-Jul-13	19-Jul-13	162.5
Minnow Trap	F1MT13-18	6	0389495	5904421	–	–	0.50	18-Jul-13	19-Jul-13	141.5
Minnow Trap	F2MT7-12	6	0388708	5903651	–	–	0.25	18-Jul-13	19-Jul-13	134.5

Table continues…

Gear Type	Set ID	Total Net Area (m^2) or Total Trap Numbers	UTM 1		UTM 2		Depth (m)	Installation Date	Removal Date	Soak Time[1]
Minnow Trap	H1MT7-12	6	0391035	5902412	–	–	0.70	18-Jul-13	19-Jul-13	161.5
Minnow Trap	C1MT1-6	6	0387175	5906574	–	–	0.38	19-Jul-13	20-Jul-13	156.0
Minnow Trap	E2MT13-18	6	0387893	5904427	–	–	0.43	19-Jul-13	20-Jul-13	146.5
Minnow Trap	G1MT7-12	6	0390261	5903409	–	–	0.48	19-Jul-13	20-Jul-13	155.5

Note: [1]Soak time for gillnets is in hours and for minnow traps in trap-hours
ID = identification; m = metres; m^2 = metres squared; No. = number; MT = minnow trap, GN = gillnet

Gillnet sampling effort was distributed over the two depth strata in the nearshore and the seven depth strata in the offshore according to preliminary results of the hydroacoustic survey. For example, effort was focused on the 5 to 10 m and 15 to 20 m strata of the offshore zone at night in order to catch kokanee. There were 36 cell-habitat-depth combinations in nearshore habitat (i.e., 18 cells x 2 depth strata), and a maximum of 126 cell-habitat-depth combinations in offshore habitat (i.e., 18 cells x 7 depth strata), for a maximum of 162 possible cell-habitat-depth combinations. (The actual number of combinations that contained water was 139.) Each gillnet set was labelled according to cell, habitat zone, and depth. For example, a gillnet set in the 5 to 10 m depth stratum of the nearshore zone of cell A2 was labelled A2N10.

Spatial distribution and species composition of the fish community was expected to differ between day and night in both nearshore and offshore habitats. Hence, gillnet effort was distributed approximately equally between day and night sets.

Minnow trap sites were established in nearshore habitat of all cells, focusing effort on the northern and southern thirds, similar to the distribution of gillnetting effort. Within cells, minnow traps were set in different littoral habits in approximate proportion to the abundance of those habitat types around the lake.

Six minnow traps were installed at each minnow trap sampling site. All minnow trap sites were labelled by cell location and the number of minnow traps installed at that site. For example, site A1MT7-12 refers to cell A1 and trap numbers 7 to 12. At each minnow trap site, three pairs of traps were installed at depths of 0 to 1 m, 1 to 2 m, and 2 to 4 m, although not all of those three depth strata existed at each site. All minnow trap sets were 24 hours long; hence, there was no distinct day-night timing for minnow trap catches.

4.12.2 Sampling Methods

Two types of gillnets were used: long, multi-panel, larger-mesh standardized RISC nets, and shorter, single-panel, smaller-mesh Nordic nets. RISC nets were used to catch larger juvenile and adult fish while Nordic nets were designed to catch smaller juvenile fish and small-bodied adult fish.

Each RISC gillnet was 90 m long and consisted of six 15.2 m-long, 2.4 m-deep panels containing stretched meshes that ranged from 25 to 89 mm. All RISC gillnet gangs had a total area of 219 m^2. Gillnet specifications were consistent with *Fish Collection Methods and Standards* (BC MOE, 1997b) and *Fish and Fish Habitat Inventory: Standards and Procedures* (RISC, 2001).

Nearshore Nordic nets were 30.5 m long and 1.8 m deep with three panels of 6 mm, 8 mm, and 10 mm mesh. Total area of each nearshore Nordic net was 54 m^2. Pelagic Nordic nets (used in offshore habitat) were 30.5 m long and 3.7 m deep with three panels of 6 mm, 8 mm, and 10 mm mesh. Total area of each pelagic Nordic net was 113 m^2.

Gillnets were deployed from three 21 foot-long jet boats. GPS coordinates were taken from each end of a net. Then, the net was lowered to the desired depth (or allowed to remain floating at the surface) using a combination of weights and buoys. Lake depth and net depth were confirmed by taking depth readings of each end of the net with a depth sounder mounted on the jet boat. Sampling depths ranged from 0.5 to 32 m. Nets installed in nearshore habitat were oriented perpendicular to the shoreline to capture fish migrating along the nearshore. Nets installed in offshore habitat were oriented in random directions.

To minimize mortality of fish, gillnets were set for an initial 2 hour soak and were then lifted to the surface and checked for fish (**Plate 4.12-1, Plate 4.12-2**, and **Plate 4.12-3**). If no fish or only small numbers of fish were captured, then nets were re-set and allowed to soak for up to 4 hours during the day. This was the maximum soak time for gillnets set in nearshore habitat because catches were generally high. For gillnets set in offshore habitat, however, catches sometimes remained low after 4 hours. In those cases, gillnets were set overnight and checked the following day.

Paired minnow traps were placed in nearshore habitats in each of the 18 cells at depths ranging from 0.25 to 4.0 m (**Plate 4.12-4** and **Plate 4.12-5**). Minnow traps were 44 cm long x 23 cm wide with ¼" metal mesh. An attempt was made to set traps in each of the different gross littoral habitat types (i.e., rocky, sandy, weedy, exposed, protected) observed in the lake during the hydroacoustic survey. At each site, pairs of traps were set in the 0 to 0.5 m depth strata, the 1 to 2 m depth strata and the 2 to 4 m depth strata for a total of six traps per site. Traps were baited with either salmon roe or dry cat food. GPS coordinates were taken for each minnow trap site.



Plate 4.12-1: Fish Captured in a RISC Net, Tatelkuz Lake, 18 July 2013



Plate 4.12-2: Checking a Gillnet for Captured Fish, Tatelkuz Lake, 18 July 2013



Plate 4.12-3: Sinking RISC Gillnet, Cell C2, Nearshore Zone, 0-5 m Depth Stratum, Perpendicular to Shore, 18 July 2013



Plate 4.12-4: Two Minnow Traps Set in the Nearshore Zone of Cell B2, 17 July 2013



Plate 4.12-5: Paired Baited Minnow Traps Set in the Nearshore Zone of Cell C1, 19 July 2013

4.12.3 Field Sample Processing

All fish captured in minnow traps were alive and in good condition. Therefore, they were stored temporarily in large plastic pails filled with clean lake water. Pails were taken to the lakeshore soon after emptying the traps for processing the catch. There, all fish were identified to species, measured for fork length to the nearest 1 mm with a measuring board, and measured for weight to the nearest 0.1 g with an electronic balance. Large fish were lightly anaesthetized with clove oil to reduce struggling while they were measured. Photographs of representative members of fish species were taken. Minnow-trapped fish were then released live back to Tatelkuz Lake at the shoreline near their point of capture, except those that were sacrificed for biological information.

In contrast, most fish captured in gillnets were dead upon net retrieval. Those that were still alive and showed some chance of survival were quickly identified to species, measured for length and weight, and then returned to the lake directly from the side of the boat. Dead fish were stored in large plastic pails filled with lake water, and the pails were taken ashore for processing. There, all fish were identified to species and measured for length and weight.

Ageing structures (i.e., scales or otoliths) were collected from rainbow trout, mountain whitefish, and kokanee, the three most abundant species. Where sufficient numbers existed, a maximum of 10 ageing structures from 25 cm length classes, ranging from 75 to 400 mm in length, were collected from each of these three species. These included scales and otoliths from incidental mortalities (i.e., those that died during capture or handling) and fish sacrificed for tissue metal concentrations analysis. A total of 285 otoliths and 23 scales were collected; all were sent to North/South for age reading (**Table 4.12-2**).

Table 4.12-2: Number of Fish Age Structures, Tatelkuz Lake, July 2013

Species	Otoliths	Scales	Total
Rainbow trout	140	13	153
Kokanee	52	6	58
Mountain whitefish	93	4	97
Total	**285**	**23**	**308**

Some dead fish underwent autopsies to gain more biological information. Autopsies were conducted mainly on the four most abundant species (rainbow trout, kokanee, mountain whitefish, and northern pikeminnow). Autopsy effort was limited by time and resource availability during sampling. Effort was therefore concentrated on these four species to maximize sample sizes for the most abundant species. None of the small-bodied fish such as brassy minnow and slimy sculpin were autopsied, and only a few suckers were autopsied. After the autopsies, and following the instructions of the fish sampling permits for this survey (**Annex 4.3-1**), dead fish were disposed of in the lake.

Sex, sexual maturity, and gonad and liver weights were recorded from all autopsied fish. Sex was determined by examining the size, colour, and texture of gonads. Fish were

classified into one of five maturity classes: immature, maturing/mature, ripe, spent, and unknown. If length of a fish was less than 150 mm, and if no eggs or milt were released when the gonads were squeezed, then they were classified as immature with unknown sex. Fish were classified as maturing if small eggs or a small amount of milt was released, but the belly was not flaccid (a sign of a spent fish). Mature fish were either ripe or spent. Ripe gonads were full of large eggs or large amounts of sperm. Spent gonads had only residual numbers of eggs or volumes of sperm, and the belly was flaccid indicating recent expulsion of eggs or sperm.

Gonads and livers were removed and weighed to the nearest 0.1 g with an electronic balance.

Stomachs were removed from 37 fish captured from Tatelkuz Lake for diet analyses. These included 12 kokanee, 13 mountain whitefish, and 12 rainbow trout. Stomach contents were squeezed into plastic jars filled with 10% buffered formalin. No estimates of percent stomach fullness were made. Stomach contents were sent to Cordillera for taxonomic analysis.

4.12.4 Laboratory Analysis

At North/South, each ageing structure was read by experienced technicians using a compound microscope (otoliths) or a microfiche projector (scales) using techniques described in **Section 4.3.2**.

Confidence in each final age estimate was recorded as poor, fair, or good. Of the 308 age estimates, 24 (or 7.8%) were classified as poor, 281 (or 91.2%) were classified as fair, and 3 (1.0%) were classified as good (**Figure 4.12-2**). Comparison of the frequency distributions of confidence estimates among the three fish species showed few differences. The percent classified as fair confidence ranged from 90% for kokanee and rainbow trout to 95% for mountain whitefish.

At Cordillera, stomach contents of rainbow trout were emptied into a glass dish. The material was sorted under a dissecting microscope (minimum magnification = 10X). Invertebrates were separated from debris and stored in 70% ethanol. Recognizable prey items were identified to family or the lowest taxonomic level possible (worms to class level), and enumerated.

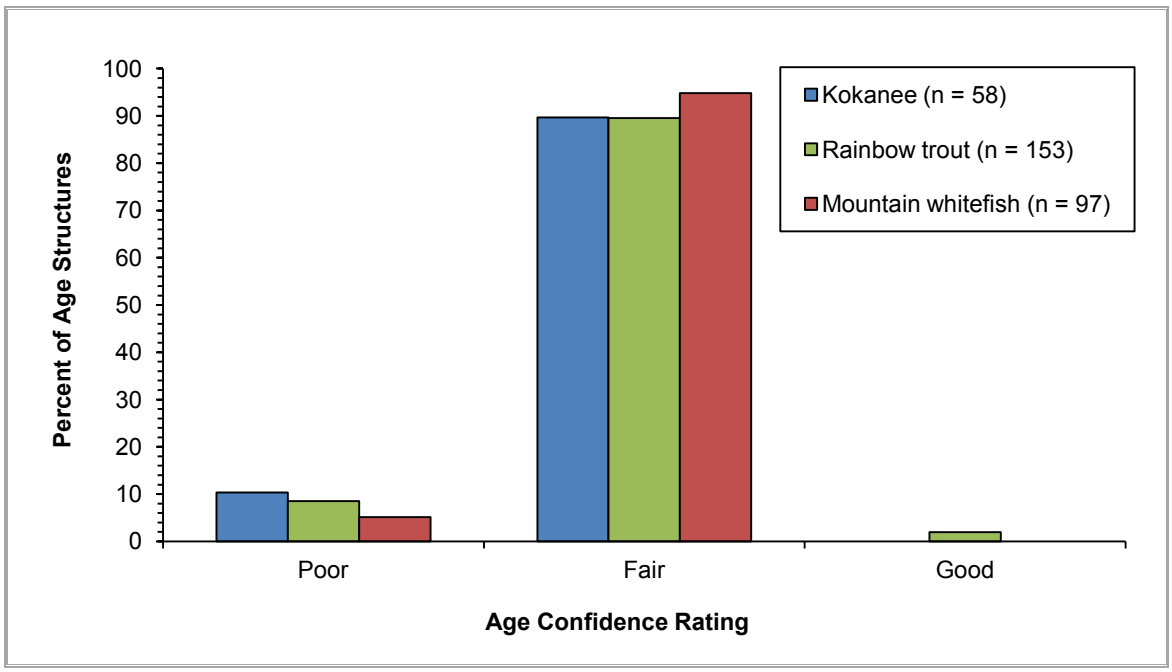


Figure 4.12-2: Frequency Distributions of Confidence Ratings for Age Estimates of Rainbow Trout, Kokanee and Mountain Whitefish, Tatelkuz Lake, July 2013

4.12.5 Data Analysis

Gillnetting Catch-Per-Unit-Effort (CPUE) was calculated as the number of fish captured per 100 m^2 of net per day. Effort took into account the soak time of the nets (i.e., the duration of time the nets were in the water and fishing) and the variation in net area among the three types of gillnet. It was defined as:

$$\text{Effort} = [\text{net area } (m^2)/100]*[\text{soak time (h)}/24].$$

Where "net area" was 219 m^2 for RISC nets, 54 m^2 for nearshore Nordic nets, and 113 m^2 for pelagic Nordic nets. Therefore, gillnet CPUE was defined as:

$$\text{CPUE} = \text{Catch/Effort} = \text{Catch}/\{[\text{net area } (m^2)/100]*[\text{soak time (h)}/24]\}.$$

CPUE has units of number of fish per 100 m^2 of net per 24 hours of soak time.

CPUE of minnow trapping was calculated as the number of fish captured per 100 trap-hours:

$$\text{CPUE} = \frac{\sum_i^n \text{number of fish captured in trap i}}{\frac{\sum_i^n \text{soak time (hours) of trap i}}{100}}$$

Where n = total number of minnow traps set at a site, and i = individual traps.

Plots of ln(weight) on ln(length) for each fish species were examined for the presence of outliers that may have been caused by recording error or transcription error. A few outliers were found that were either corrected by re-examination of field data sheets (in the case of a transcription error) or excluded from further analysis (in the event of a recording error). Weight-length relationships were calculated for all species by linear regression of ln-transformed weight on ln-transformed length.

Age data were screened for outliers by plotting length on age for each fish species. Outliers that could not be corrected by re-examining age data sheets were excluded from all subsequent analyses.

Mean length, weight, condition, and age were calculated for each fish species, and length frequency distributions and age frequency distributions were constructed for each species.

Plots of mean length on age for kokanee, rainbow trout, and mountain whitefish were fit with the von Bertalanffy growth model:

$$L_t = L_\infty(1 - \exp(-K(t - t_0)))$$

Where L_t = length (mm) at age t (year), L_∞ = asymptotic length (mm) (or length at infinite age), K = growth rate ($year^{-1}$), and t_0 = age (year) at which L = 0 mm (Ricker, 1975). The model was fit to length-age data using a non-linear regression module in JMP (SAS, 2013).

Sex ratios for each species were calculated as the ratio of the number of females to the number of males. Immatures were excluded from calculation of sex ratio.

Lengths at 50% and 95% sexual maturation were calculated for each population by plotting the percent of kokanee, rainbow trout, and mountain whitefish that were sexually mature in 50 mm-wide length bins and identifying the lengths at which percent maturity crossed the 50% and 95% values.

Gonadosomatic indices (GSI) and hepatosomatic indices (HSI) were calculated for kokanee, rainbow trout, and mountain whitefish that were either sacrificed for tissue metal analysis and stomach contents or that died during capture and handling. GSI is an index of the state of sexual maturation, and the HSI is an index of energy storage (because glycogen is stored in the liver). GSI's and HSIs were calculated separately for female and male fish. GSI and HSI were calculated using the formula:

$$\text{GSI or HSI} = 100\times\frac{\text{gonad or liver weight (g)}}{\text{total body weight (g)}}$$

The first step in analyzing the diet of rainbow trout, mountain whitefish, and kokanee was to calculate the total number of prey items, relative abundance (i.e., percent of total number), and frequency of occurrence of each major taxon of prey in each fish of each species, using pooled samples collected in 2013. These calculations were shown in tables. The second

step was to calculate relative abundance of major taxa for all fish of one species. Pie charts were used to show these percentages.

4.13 Metal Concentrations of Tatelkuz Lake Fish Tissues

4.13.1 Field Sampling and Sample Processing

Rainbow trout and mountain whitefish were collected from catches of 14 gillnet sets in Tatelkuz Lake made from 17 to 19 July 2013 (**Table 4.13-1** and **Figure 4.13-1**). A total of 79 tissue samples were collected and submitted for laboratory analysis: 39 whole fish (abbreviated as WF), 20 muscle (M), and 20 liver (L).

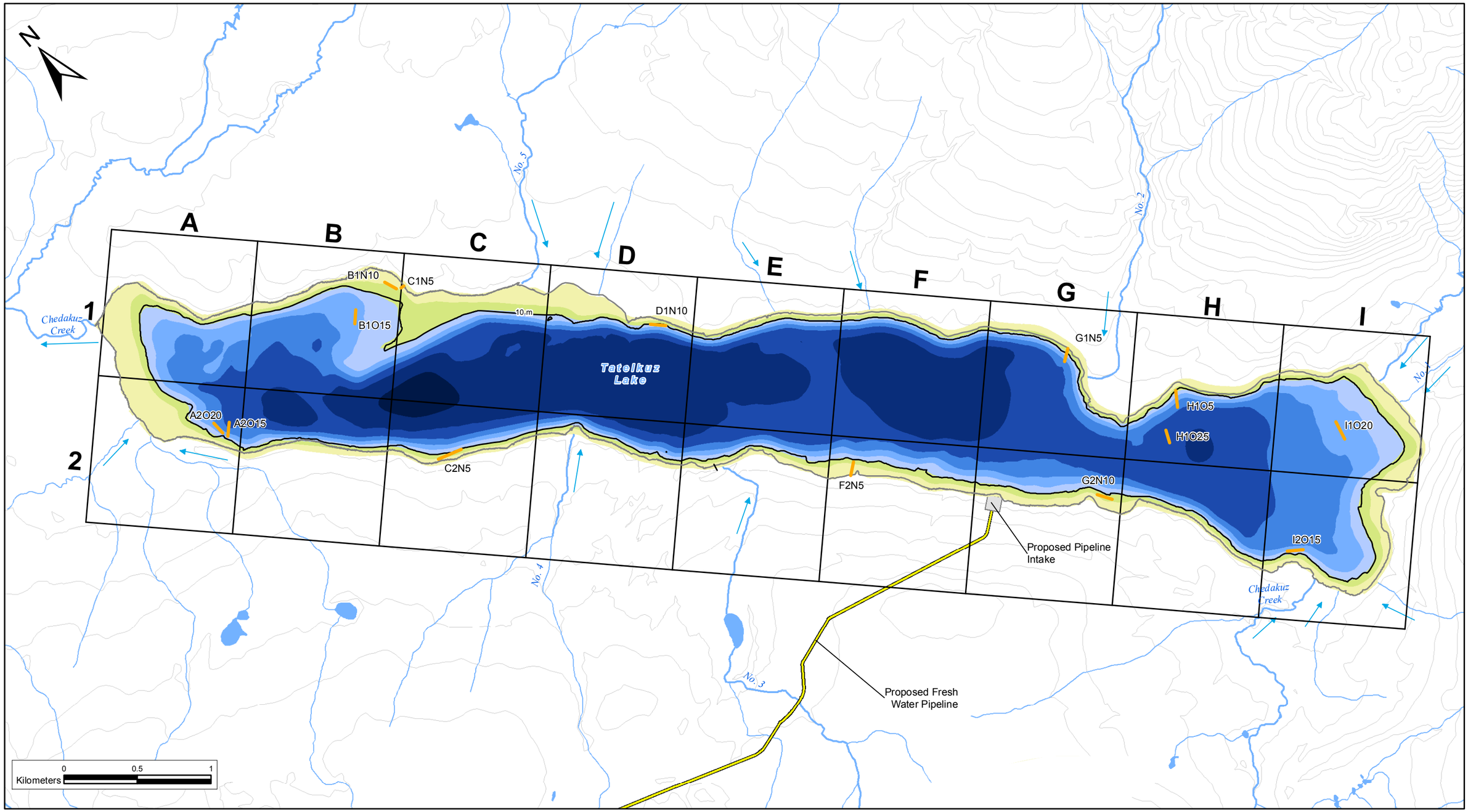
Table 4.13-1: Dates, Locations, Time of Day, and Numbers of Samples for Metals Analysis, Tatelkuz Lake, 17 to 19 July 2013

Date	Sampling Cell	Location	Gillnet ID	Day or Night	Depth (m)	Rainbow Trout			Mountain Whitefish			
						WF	M	L	WF	M	L	Total
17 July	A2	Offshore	A2O15	Night	10-15	1	0	0	0	0	0	1
17 July	B1	Offshore	B1O15	Night	10-15	0	0	0	5	0	0	5
17 July	F2	Nearshore	F2N5	Day	0-5	3	5	5	0	0	0	13
17 July	G1	Nearshore	G1N5	Day	0-5	9	3	3	0	0	0	15
17 July	H1	Offshore	H1O5	Day	0-5	4	1	1	0	0	0	6
18 July	B1	Nearshore	B1N10	Day	5-10	0	0	0	0	4	4	8
18 July	C1	Nearshore	C1N5	Day	0-5	1	0	0	0	2	2	5
18 July	H1	Offshore	H1O25	Night	20-25	0	0	0	1	0	0	1
18 July	I2	Offshore	I2O15	Night	10-15	0	0	0	5	2	2	9
19 July	A2	Offshore	A2O20	Night	15-20	0	0	0	4	2	2	8
19 July	C2	Nearshore	C2N5	Day	0-5	2	1	1	0	0	0	4
19 July	D1	Nearshore	D1N10	Day	5-10	0	0	0	2	0	0	2
19 July	G2	Nearshore	G2N10	Day	5-10	0	0	0	1	0	0	1
19 July	I1	Offshore	I1O20	Day	15-20	0	0	0	1	0	0	1
Total						20	10	10	19	10	10	79

Note: WF = whole fish, M = muscle, L = liver

Metal concentrations were required to be measured from different parts of fish: muscle (also known as fillet by environmental health specialists), liver, and whole body. Besides needing these data to establish baseline conditions, metal concentrations from these tissue types will support human health and ecological risk assessments. Humans eat fish liver and fillet, while piscivorous wildlife eat the whole fish, not just muscle or liver.

Each fish was weighed to the nearest 0.1 g with an electronic balance, measured for length to the nearest 1 mm, and then placed in a labelled plastic bag and stored on ice until the evening where it could be further processed in a field laboratory set up at the mine camp.



REFERENCE:
BC Government GeoBC Data Distribution

Legend

- Gillnet Location
- Depth Contour - 10 m
- Stream
- Stream Direction
- Contour (20 m)

Water Depth

0 - 5	21 - 25
6 - 10	26 - 30
11 - 15	31 - 35
16 - 20	36 - 40

CLIENT: newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
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amec

ANALYST:	KA
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:25,000

PROJECT: Blackwater Gold Project

TITLE: Fish Tissue Sampling Locations Tatelkuz Lake, July 2013

REV. NO:	A
DATE:	April, 2014
PROJECT NO:	VE52277
FIGURE NO:	4.13-1

Y:\GIS\Projects\VE\VE52095_Richfield_BackwaterMapping\10_fisheries-aquatics\Baseline\10-100-179_TissueSample_TL.mxd

In the field laboratory, whole fish samples were assigned a sample number, identified as "whole fish" samples, stored in plastic bags, frozen, and shipped to ALS for analysis.

For muscle and liver tissue samples, each fish was dissected using a ceramic knife that was decontaminated between samples to avoid cross-contamination (BC MOE, 2012). First, the liver was removed, weighed, rinsed with deionised water, and placed in a plastic bag labelled with the sample number and a designation as a "liver" sample.

Next, remaining viscera were removed and discarded. The resulting carcass was then rinsed with deionised water and placed in a plastic bag labelled with the sample number and a designation as a "muscle" sample. Liver and muscle samples were then frozen and shipped to ALS. ALS also removed both filets of muscle tissue from the carcass. ALS then analyzed the liver samples and the fillets.

4.13.2 Laboratory Analysis

ALS conducted all tests within their own recommended hold times. Each sample was analyzed for percent moisture, concentrations of 41 metals, and percent lipid content (**Table 4.13-2**). Sub-sets of whole fish, liver, and muscle samples were also analyzed for methyl-mercury (MeHg). The metals analyzed and their method detection limits (MDL) were consistent with BC MOE requirements (BC MOE, 2012).

Table 4.13-2: Variables, Laboratory Methods, and Detection Limits Used in Analysis of Tissue Metals Concentrations

Variables	Method	Method Detection Limit (mg/kg wwt)
% moisture	Gravimetric	0.10%
Lipids	Gravimetric	NA
Total Aluminum	HR-ICP-MS	0.4
Total Antimony	HR-ICP-MS	0.002
Total Arsenic	HR-ICP-MS	0.004
Total Barium	HR-ICP-MS	0.01
Total Beryllium	HR-ICP-MS	0.002
Total Bismuth	HR-ICP-MS	0.002
Total Boron	HR-ICP-MS	0.2
Total Cadmium	HR-ICP-MS	0.002
Total Calcium	ICP-OES	0.5
Total Cesium	HR-ICP-MS	0.001
Total Chromium	HR-ICP-MS	0.01
Total Cobalt	HR-ICP-MS	0.004
Total Copper	HR-ICP-MS	0.01
Total Gallium	HR-ICP-MS	0.004
Total Iron	HR-ICP-MS	0.2
Total Lead	HR-ICP-MS	0.004

Table continues…

Variables	Method	Method Detection Limit (mg/kg wwt)
Total Lithium	HR-ICP-MS	0.02
Total Magnesium	ICP-OES	1
Total Manganese	HR-ICP-MS	0.004
Total Mercury	CVAFS	0.001
Methyl-mercury	GCAFS	0.001
Total Molybdenum	HR-ICP-MS	0.004
Total Nickel	HR-ICP-MS	0.01
Total Phosphorus	HR-ICP-MS	5
Total Potassium	ICP-OES	20
Total Rhenium	HR-ICP-MS	0.002
Total Rubidium	HR-ICP-MS	0.01
Total Selenium	HR-ICP-MS	0.02
Total Silver	HR-ICP-MS	0.001
Total Sodium	ICP-OES	20
Total Strontium	HR-ICP-MS	0.01
Total Tellurium	HR-ICP-MS	0.004
Total Thallium	HR-ICP-MS	0.0004
Total Thorium	HR-ICP-MS	0.002
Total Tin	HR-ICP-MS	0.004
Total Titanium	HR-ICP-MS	0.01
Total Uranium	HR-ICP-MS	0.0004
Total Vanadium	HR-ICP-MS	0.004
Total Yttrium	HR-ICP-MS	0.002
Total Zinc	HR-ICP-MS	0.1
Total Zirconium	HR-ICP-MS	0.04

Note: CVAFS = Cold Vapour Atomic Fluorescence Spectrometry; HR-ICP-MS = High Resolution-Inductively Coupled Plasma-Mass Spectrometry; ICP-OES = Inductively Coupled Plasma-Optical Emission Spectrophotometry; mg/kg wwt = milligrams per kilogram wet weight; % = percent; NA = Not Applicable.

Moisture content was determined gravimetrically by drying the sample at 105°C for a minimum of 6 hours.

Dried samples were prepared for total metal analysis by homogenization followed by acid digestion. Most metal concentrations were measured by High Resolution-Inductively Coupled Plasma-Mass Spectroscopy (HR-ICP-MS). Cold Vapour Atomic Fluorescence Spectrometry (CVAFS) was used for mercury and Inductively Coupled Plasma-Optical Emission Spectrophotometry (ICP-OES) was used to measure calcium, magnesium, potassium, and sodium concentrations. Results were reported as total metal concentrations per wet weight (milligrams per kilogram wet weight or mg/kg wwt).

Concentrations of MeHg were measured by digesting tissue samples with methanol and potassium hydroxide. A portion of the digestate was analyzed by aqueous phase ethylation and purge and trap, followed by capillary gas chromatography. Highly selective and

sensitive detection was achieved by Atomic Fluorescence Spectrometry (AFS) after pyrolytic decomposition of the gas chromatography (GC) eluent (GCAFS). Results were reported as MeHg concentrations per wet weight (mg/kg wwt).

Lipid content was measured by extracting a portion of the homogenized sample with dichloromethane. The extract was evaporated to dryness and the lipid content determined gravimetrically. Results were reported as percent wet weight (% wwt).

4.13.3 QA/QC

ALS followed standard QA/QC procedures required by the Canadian Association for Laboratory Accreditation. These procedures included analysis of method blanks, analysis of certified reference material, and comparison of replicates.

Method blanks are samples of de-ionized water that are inserted in the analysis stream to test for contamination by and during processing. A total of 38 method blanks were run for the full suite of 41 metals giving a total of 1,558 individual metal measurements. A total of 19 of those measurements exceeded ALS's Data Quality Objectives, giving an error rate of 1.2%, which was considered acceptable by ALS.

A total of 1,216 metal concentrations were produced from tests of reference material VA-NRC-TORT3 (lobster hepatopancreas tissue provided by the National Research Council, VA-NRC-DORM4 (fish protein provided by the National Research Council), and VA-NIST-1566B (oyster tissue provided by the US National Institute of Standards and Technology). All test results fell within ALS's acceptable measurement ranges.

Seven of the 79 tissue samples were split and analyzed separately, providing 574 individual comparisons between replicate metal concentrations. Differences between replicate metal concentrations were calculated using the Relative Percent Difference (RPD) statistic:

$$RPD = (X1 – X2)*100/[(X1 + X2)/2]$$

Where X1 = concentration of a metal in replicate 1 and X2 = concentration of that same metal in the other replicate. A total of 23 RPD (or 4.0% of the total) exceeded the 30% limit. The mean RPD was 57% (range: 30% to 99%). These results were considered acceptable by ALS.

Finally, ln-transformed (i.e., natural log transformed) concentrations of mercury and selenium were plotted on fish length to look for outliers. This showed one whole fish mountain whitefish sample had anomalously low concentrations of those two metals and of all other metals. Re-analysis of that sample provided metal concentrations that fell within the range of other whole fish mountain whitefish samples.

4.13.4 Data Analysis

4.13.4.1 Fish Biological Characteristics

Sex ratio was defined as the ratio of the number of females to the number of males. Immature fish were excluded from calculation of sex ratio because they could not be assigned a sex.

Percent maturity was defined as:

% maturity = (number of males + number of females)*100/(number of males + number of females + number of immature).

4.13.4.2 Metal Concentrations

The first step in analysis was to prepare a statistical annex that showed the Frequency of Detection (FoD), (arithmetic) mean concentration, SE of that mean, and the minimum and maximum detected concentrations for each metal by tissue type and species. FoD refers to the number of tissues for which the concentration is above the MDL. For example, the FoD for a group of nine tissues for which eight have concentrations above the MDL is 8/9. Mean concentration was calculated only for those concentrations above the MDL, so if the FoD was 0/9, then the mean is the MDL and the SE, minimum and maximum are each shown as Not Detected or ND.

Summary statistics (mean, SE, minimum, and maximum) were also calculated using ½ the MDL for parameters reported as non-detects.

Principle Component Analysis (PCA) was used to identify major trends in the fish tissue metals data set. PCA is a statistical method which transforms a large number of possibly correlated variables into a smaller number of variables (called principal components). The method is based on the idea that the variance of a small number of principal components (or factors) can often provide reasonable characterization of the dataset as a whole. In large data sets, the underlying relationship may be quite simple in spite of the large number of variables that were measured. PCA identifies this underlying relationship by reducing the number of variables in the dataset to those that contain the most information. (For that reason, PCA is also called data reduction). PCA was used to visually illustrate trends/relationships between chemical constituents, tissue types, and sample locations.

The first step in the PCA was to combine tissue metal concentrations from fish collected in the LSA into a single data matrix. These records included metals concentrations from:

- Rainbow trout captured in streams and headwater lakes in 2011 and 2012 (AMEC, 2013b);
- Rainbow trout from Tatelkuz Lake in July 2013; and

- Mountain whitefish collected from Tatelkuz Lake in July 2013.

The columns of the matrix were metals and the rows were records of each tissue sample.

Metals with a detection frequency of 10% or less were removed from the matrix because they were not expected to be strongly influential. For the remaining metals, all concentrations below the MDL were replaced by one-half the MDL. Fish length was added as a variable because some heavy metals such as mercury bind permanently to protein, hence producing a positive correlation of metal concentrations with fish body size. Metal concentrations and length were then ln-transformed to normalize their frequency distributions. This matrix was entered into the PCA module of JMP10 software (SAS, 2013), and principle components were extracted.

The number of principal components that explained a meaningful amount of variance was assessed in three ways. The first was to identify the principal components that explained the most variance; typically, principal components that explain less than 5-10% of the explained variance do not represent meaningful trends in the data. The second was to examine the loading table, which is a table of correlation coefficients between each principal component and the original variables. Each principal component that explains a relatively high percent of variance should be highly correlated (i.e., heavily “loaded”) with a different subset of metals. Principal components that are not heavily loaded with any metals do not represent meaningful trends in the data. Finally, a scree plot – a plot of percent variance on rank order of principal components – was examined.

PC2 scores were plotted on PC1 scores to search for patterns in metal concentrations between species, among lake and stream sites, and among tissue types. Mean PC1, PC2, and PC3 scores were also plotted for each species, site, and tissue type.

4.14 Hydroacoustic Assessment of Fish Number in Tatelkuz Lake

In July 2013, coordinated mobile acoustic surveys (i.e., scientific echo sounding) and gillnetting were used to estimate fish abundance and distribution patterns in Tatelkuz Lake. Acoustics was used to estimate absolute abundance of fish and to describe spatial and temporal (day/night) patterns of the total fish assemblage. Results of the mid-July gillnetting program were used to describe spatial and temporal patterns of individual fish species, and to apportion the acoustic estimate among species. Gillnetting was also used to sample fish at the lake surface and shoreward of the 5 m depth contour where the detection of fish with acoustics is greatly limited by acoustic beam geometry and interference from water column boundaries.

4.14.1 Acoustics Sampling

Acoustic survey methods generally followed protocols described in standard fisheries acoustics texts (Thorne, 1983; Brandt, 1996; Simmonds and MacLennan, 2005), with special measures to ensure thorough coverage of the upper water column (Johnston, 1981; Yule, 2000; Beauchamp et al., 2009).

Acoustic sampling took place from 9 to 12 July during day and night periods. Day was defined as sunrise to sunset and night was defined as one hour after sundown to one hour before sunrise. No sampling took place during crepuscular hours. One survey of the whole lake was conducted during each period. A survey consisted of sampling 16 primary shore-to-shore cross-lake transects spaced at 550 m intervals, plus additional shoreline segments on each side of the lake (**Figure 2** in **Annex 5.14-1**).

Cross-lake transects were sampled shoreward as close as safety allowed, typically to about the 2 m depth contour. Shoreline transects were run in a loose zigzag pattern approximately between the 5 and 15 m depth contours, roughly following the shore of the lake with the side-looking transducer aimed toward the lake edge. Shoreline segments were mainly sampled when traveling between the ends of cross-lake transects, except that the entire south shore of the lake was covered in a continuous transect during the night survey. Due to changeable weather conditions, the daytime survey was performed over the course of 2 days. For the night survey, all cross-lake and north shore transects were sampled during a single night, while the south shoreline was sampled the following night.

Acoustic sampling was performed from a 6 m aluminum jet boat at transecting speeds of 1.3 to 1.6 m/s (**Figure 3** in **Annex 5.14-1**). A dual transducer echo sounding system was used to obtain thorough coverage of the entire water column. A downward facing transducer sampled from 2 m beneath the water surface to the lake bottom (down-looking mode), while the second transducer was aimed sideways from the boat, nearly horizontally (down 5°) to cover the upper 5 m of the water column (side-looking mode). The collection of side-looking data was deemed necessary because trout are often surface oriented (Johnston, 1981; Stables and Thomas, 1992; Yule, 2000). The two transducers were sampled simultaneously at rate of 6 to 7 pings per second per transducer.

The echo sounding system consisted of a 200 kHz BioSonics DTX echo sounder and two split-beam transducers paired with a Garmin GPSmap 546 differential GPS. Beam dimensions (full angle) were 6.7° (circular) for both transducers. The echo sounder was operated by a computer, which also served as a data logger and allowed monitoring of data quality on echograms during collection. Latitude and longitude from the GPS were added to acoustic data files as they were logged. Data collection thresholds were -100 decibels (dB) for downlooking and -80 dB for side-looking. Additional equipment specifications and data collection settings are shown in **Table 1** of **Annex 5.14-1**.

4.14.2 Acoustic Data Processing and Analysis

Fish were counted on electronic echograms according to standard echo-trace counting methods (Thorne, 1983; Simmonds and MacLennan, 2005). Computer files were processed using Echoview software (Echoview, 2013) to automatically recognize and extract fish traces, to measure target strength (TS, the acoustic size of fish), and to determine sampling volumes. Down-looking data were used to compute fish density at depths greater than 5 m, while sidelooking data were used to represent the uppermost 5 m of the water column. Fish traces with mean TS greater than -30 dB were visually examined on echograms to validate them.

Echoes smaller than -65 dB (down-looking) and -55 dB (side-looking) were excluded from processing to remove noise and non-fish targets from echograms. This approach allowed detection of fish as small as kokanee fry from down-looking data and age-1 trout (i.e., >100 mm) from side-looking data. Occasional windy periods during the surveys required the higher threshold for sidelooking data, which is very sensitive to noise from rough conditions (Yule, 2000). Additional fish processing settings are listed in **Table 1** of **Annex 5.14-1**.

TS was determined by the split-beam method (Simmonds and MacLennan, 2005). Accuracy of acoustic measurements was assured by field calibration tests. In-situ TS measurements of a -39.5 dB standard sphere indicated a calibration correction of 1.0 dB for the down-looking transducer (slight) and no correction for the side-looking transducer. The calibration correction was applied during data processing in Echoview. Lengths of individual fish detected with acoustics were estimated from down-looking TS using Love's (1977) equation for fish insonified within ±45 degrees of dorsal aspect:

$$\text{length (mm)} = 10 * 10((\text{TS} + 1.6 \log (\text{kHz}) + 61.6) / 18.4)$$

Because TS is affected by factors other than fish size (Simmonds and MacLennan, 2005) and Love's (1977) equation is a generalization from many fish species and sizes, this equation provides an estimate of fish length that is useful, but less precise than a hands-on physical measurement. The relationship between side-looking TS and fish length is highly variable (Love, 1977; Kubecka and Duncan, 1998; Yule, 2000), so fish length was not estimated from sidelooking TS data.

TS data was used to subdivide fish detected with acoustics into small fish (<100 mm long) and large fish (≥100 mm long) to facilitate apportionment among species. Per Love's (1977) ±45 degree model, fish with mean TS less than -46.9 dB were considered to be less than 100 mm long. Corresponding size groups from acoustic and gill net data were matched for apportionment of the acoustic estimate among species.

Depth intervals for data analysis were 0-5 m, 5-10 m, and so forth to 30-35 m, the deepest interval in Tatelkuz Lake. Horizontal sampling strata were the nearshore and offshore sampling zones (shoreward and offshore of the 10 m depth contour, respectively). Fish densities were summarized as fish/m^3 within sampling zones and depth intervals for the population estimate, and as fish/ha in 25 m long segments of transects for maps of fish density (fish/ha along transects). For each spatial cell of interest, fish/m^3 was calculated as the total number of fish counted divided by the volume sampled. The volume sampled in each spatial cell was calculated by Echoview using the acoustic beam angle, distance transected, and a correction for bottom intrusion. The wedge model for sampling volume (Keiser and Mulligan, 1984) was used for all depth intervals. The effective beam angle for each depth interval was modeled considering the nominal beam angle, boat speed, ping rate, and hits required per fish trace, and the sampling volume was adjusted accordingly at ranges where the effective beam angle was less than the nominal beam angle. Under the conditions of the surveys, the effective beam angle was 5.3° for the 0-5 m range and greater

than 6.2° for all other range intervals. A complete list of data analysis settings appears in **Table 1** of **Annex 5.14-1**.

Total fish abundance for the whole lake was computed from night-time data using just the 16 cross-lake transects, which constituted a stratified systematic sampling design (Cochran, 1977). Each transect provided one replicate of each depth interval in each sampling zone. Mean fish density of each depth interval was expanded in proportion to interval volume, and the resulting abundance estimates were summed to obtain the total population estimate. Depth interval volumes were adjusted to the lake surface elevation at the time of the acoustic survey (927.4 m). Variance and 95% confidence intervals were calculated for a stratified systematic sample with horizontal and vertical stratification (sampling zones and depth intervals). Shoreline transects were used for mapping fish density but not for the abundance estimate because they did not meet the criteria of a systematic sampling design.

4.14.3 Species Composition from Gillnet Data

Gillnet CPUE of individual fish species was used to represent their relative abundance in the fish population. A mean CPUE was calculated for each size group (small<100 mm, large ≥100 mm) and species in each combination of sampling strata (diel period x sampling zone x depth layer), matching the stratification of the acoustic estimate. For the offshore strata at night, the degree to which each species was associated with the lake bottom was examined by summarizing their CPUE in each type of gill net set made in that sampling zone (set types: surface, midwater not touching bottom, midwater touching bottom, and bottom).

Although not ideal, small-mesh gillnet and RISC gillnet catches were pooled for these analyses because small-mesh nets caught both large and small fish, and small-mesh nets provided a significant amount of the effort (number of sets) in the offshore area.

4.15 Survey of Kokanee Spawners

4.15.1 Survey Sites

Four streams were surveyed for kokanee spawners from 8 August to 12 September 2013 (**Figure 4.15-1** and **Table 4.15-1**);

- Davidson Creek (Reaches 1 to 4);
- Creek 661 (Reaches 1 to 3);
- Lower Chedakuz Creek (Reaches 13 to 15); and
- Middle Chedakuz Creek from the outlet of Kuyakuz Lake to the inlet of Tatelkuz Lake (Reaches 19 to 26).

Reaches were selected for each stream based on known kokanee spawning locations, as observed in 2011 and 2012 (AMEC, 2013b).

364000 371000 378000 385000 392000

5908000 5901000 5894000

Lower Nechako Reservoir Regional Watershed

Upper Eutsuk Lake Regional Watershed

Euchiniko Lake Regional Watershed

Chedakuz Creek

Fawnie Nose 1926m

Fawnie Dome 1726m

FAWNIE RANGE

NECHAKO RANGE

Proposed Transmission Line

Kluskus-Ootsa FSR

Turtle Creek

Davidson Creek

Tatelkuz Lake

Tatelkuz Lake Tributaries

Proposed Mine Access Road

Proposed Fresh Water Pipeline

Snake Lake

Top Lake

Fawnie Creek

Creek 661

Creek 705

Lake 01428UEUT

Lake 01538UEUT

Lake 01682LNRS

Mount Davidson 1856m

Mathews Creek

Kuyakuz Lake

Kluskus-Blue FSR

KO- 43 KO- 44 KO- 45 KO- 35 KO- 36 KO- 38 KO- 37 KO- 42 KO- 41 KO- 40 KO- 48 KO- 46 KO- 49 KO- 50 KO- 51

13 14 15 1 2 3 4 19 20 21 22 23 24 25 26

N

Legend

- Spotheights
- Reach Break
- Kokanee Survey Site
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Stream
- Waterbody
- Regional Watersheds

Watersheds

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Fish and Aquatic Resources

- Local Study Area
- Regional Study Area

Scale:1:105,000

0 1 2 4 6

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Kokanee Survey Sites Local Study Area, 2013

DATE:	ANALYST:	**Figure** 4.15-1
December, 2013	WR	
JOB No: VE52095	QA/QC: MM	PDF FILE: 10-100-186_Kokanee_v2.pdf
GIS FILE: 10-100-186_Kokanee_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Table 4.15-1: Kokanee Spawning Survey Sites in Davidson Creek, Creek 661, and Chedakuz Creek, August and September, 2013

Stream	BC Freshwater Atlas Code	Reach	Baseline Site ID	Date Surveyed	Start Location (UTM)		End Location (UTM)		Length Surveyed (m)
					Easting	Northing	Easting	Northing	
Davidson Creek	100-567134-610692-522527	1	KO- 35	8-Aug-13	384600	5908028	384297	5907870	508.2
Davidson Creek	100-567134-610692-522527	2	KO- 36	8-Aug-13	384074	5907548	383899	5907316	502.7
Davidson Creek	100-567134-610692-522527	3	KO- 37	10-Aug-13	383551	5907125	383310	5907138	502.5
Davidson Creek	100-567134-610692-522527	4	KO- 38	10-Aug-13	382995	5906924	382846	5905970	1,332.0
Creek 661	100-567134-610692-671007	1	KO- 40	11-Aug-13	388707	5899424	388418	5899337	505.7
Creek 661	100-567134-610692-671007	2	KO- 41	24-Aug-13	385981	5898498	385691	5898446	507.2
Creek 661	100-567134-610692-671007	3	KO- 42	24-Aug-13	384774	5898410	384362	5898331	500.0
Lower Chedakuz Creek	100-567134-610692	13	KO- 43	11-Sep-13	382766	5910266	382986	5910101	521.0
Lower Chedakuz Creek	100-567134-610692	14	KO- 44	11-Sep-13	383368	5909969	383640	5909594	514.0
Lower Chedakuz Creek	100-567134-610692	15	KO- 45	11-Sep-13	384433	5909321	384006	5909380	500.0
Middle Chedakuz Creek	100-567134-610692	19	KO- 46	11-Aug-13	388785	5899649	388634	5899310	501.0
Middle Chedakuz Creek	100-567134-610692	20	KO- 48	11-Sep-13	388719	5899416	388659	5899066	500.0
Middle Chedakuz Creek	100-567134-610692	22	KO- 49	12-Sep-13	389425	5895639	389585	5895353	342.9
Middle Chedakuz Creek	100-567134-610692	23	KO- 50	12-Sep-13	389585	5895353	389669	5894976	772.5
Middle Chedakuz Creek	100-567134-610692	26	KO- 51	12-Sep-13	389749	5893932	389768	5893387	616.8

Note: ID = identification; UTM = Universal Transverse Mercator, Zone 10U, North American Datum 83; m = metre

4.15.2 Survey Timing

Survey timing in 2013 was initially based on observed timing of kokanee spawner migrations in 2011 and 2012. Survey timing was modified as the 2013 spawning season progressed in order to survey as close as possible to the peak of the spawning period in each stream.

4.15.2.1 Davidson Creek

Based on observations in 2011 and 2012, the kokanee spawning run in Davidson Creek was expected to occur from mid-July to mid-August with a peak in the first week of August. AMEC wildlife biologists first observed kokanee in Davidson Creek on 17 July 2013. Therefore, surveys in Davidson Creek were scheduled to start on 8 August 2013 when the peak of the spawning run was expected. Reaches 1 and 2 were surveyed on 8 August 2013 and Reaches 3 and 4 on 10 August 2013.

4.15.2.2 Creek 661

Based on observations in 2011 and 2012, timing of the kokanee spawning run in Creek 661 in 2013 was expected to be similar to that of Davidson Creek. Therefore, Reach 1 of Creek 661 was surveyed on 11 August 2013, immediately after Davidson Creek had been surveyed. However, no spawners were observed, which was interpreted to mean that the spawning run was later than in the previous 2 years. Therefore, surveys of Reaches 2 and 3 of Creek 661 were postponed to allow the spawners to enter those upstream reaches.

Five days later on 16 August 2013, Reach 3 was surveyed, but less than 30 kokanee spawners were observed in a 500 m section. Therefore, further surveys of Creek 661 were delayed another 8 days.

On 24 August 2013, Reaches 2 and 3 of Creek 661 were surveyed. Kokanee were present in Reach 2, but fewer fish were observed in Reach 3 than during the survey on 16 August. Therefore, it was assumed that the peak of the spawning run was closer to 16 August than to 24 August.

4.15.2.3 Middle Chedakuz Creek

Middle Chedakuz Creek was surveyed on 10 and 11 August 2013 because surveyors were on site for Davidson Creek and Creek 661. Reaches 19, 20, 22, 23, and 26 were surveyed because they were the most accessible to foot surveys. Kokanee were observed in Reach 19 and 20, but no kokanee spawners were observed in upstream Reaches 22, 23 and 26, so the survey was discontinued. One month later, on 12 September 2013, Middle Chedakuz Creek was re-surveyed, but no live or dead kokanee spawners were observed.

4.15.2.4 Lower Chedakuz Creek

Based on observations in 2011 and 2012, surveys in lower Chedakuz Creek were scheduled for mid-September. Reaches 13, 14, and 15 were surveyed on 11 September 2013.

4.15.3 Survey Methods

For each of the four streams a two-person team counted the number of kokanee and kokanee redds (i.e., egg nests) while hiking upstream along 500 m-long sections of selected reaches. By walking upstream, the crew reduced the startle response of fish, which were usually oriented head first into the flowing water. This increased the probability of accurately counting fish.

Kokanee were counted into two broad classes: live and dead. Live fish were further classified as migrating, holding, spawning, or spent, depending on their behaviour. Migrating fish were swimming steadily—usually upstream. Holding fish were not paired and were occupying a station. Spawning fish were paired and engaged in courtship behaviour with one or more mates or were actively digging or guarding a redd. Spent fish were observed in pools and backwaters or were drifting downstream along the stream margins with clear damage to body and fins.

Fish in each of the five classes were counted individually by each crew member and then the two sets of counts were compared at the end of a survey section. The set with the larger numbers was chosen as the best representative of the number of fish in that section. This assumption is commonly made in fish spawning surveys because visual counts are almost always underestimates of true numbers due to the ability of fish to hide under stream banks, woody debris, and boulders (Crawford et al., 2007).

Additional information recorded during the stream walks included date, UTM coordinates at the start and end of each section (measured by GPS). Distance from the start point (measured by hipchain), water temperature (°C) (measured with a handheld thermometer), and habitat type (glide, riffle, or pool). Glides are areas of fast-flowing, non-turbulent water with relatively flat bottoms in cross-section (Johnston and Slaney, 1996). Riffles are shallow areas of turbulent, fast-flowing water. Pools are areas of slower, deeper water with a concave bottom profile, fine sediments, and a water surface gradient near 0%.

All data were recorded in field notebooks, and photographs were taken of selected stream sites.

4.15.4 Survey Efficiency

Survey efficiency is defined as the percent of spawners or redds in a stream section that are actually counted. Survey efficiency for spawners is almost always less than 100% because fish hide under stream banks, woody debris, and boulders (Crawford et al., 2007). When possible, visual counts of spawning salmonids are adjusted upwards by a factor that is

derived by comparing stream counts with absolute counts obtained by a stream fence or a mark-recapture study. A correction factor was not developed for the kokanee spawner surveys of the Blackwater LSA because fences were not installed across any stream, and no mark-recapture studies were conducted because marking or tagging spawners would inflict some mortalities. Therefore, the visual counts of kokanee spawner number in the Blackwater LSA are assumed to be underestimates of true spawner number.

Even if kokanee spawner counts could not be adjusted for survey efficiency, they are still comparable among reaches, streams, and survey years if there were no substantial differences in survey efficiency among surveyors. Different crews conducted the surveys each year, but survey efficiency was assumed to be similar among surveyors because kokanee spawners were easy to identify because of their bright red colour (**Plate 4.15-1**). In addition, water clarity was always high in streams of the Blackwater LSA, and water levels were relatively low in late summer in all three survey years.



Plate 4.15-1: Kokanee Spawners in Reach 1 of Davidson Creek 8 August 2013

Survey efficiency for kokanee redds is also not known, but it was assumed to be higher, on average, than survey efficiency for spawners because redds do not move or hide. There was, however, some difficulty in distinguishing redds from non-redds in some substrates with large cobble. For example, redd survey efficiency was probably lower in Creek 661 than in Davidson Creek because spawning gravel is larger in Creek 661 than in Davidson Creek.

Also, redd counts may underestimate the true number of redds that have been built because later spawners sometimes dig up redds built by early spawners.

One method of confirming that both spawner and redd survey efficiency was similar among crews and survey years is to plot kokanee spawner counts on redd counts for individual sections. A single relationship with no clear outlying streams or years supports the idea of a common survey efficiency among crews and years.

4.15.5 Data Analysis

All data on kokanee spawners collected in 2013 was presented within the context of data on kokanee spawners collected in 2011 and 2012 (AMEC, 2013b). Pooling data from all three years provided a more complete picture of kokanee spawn timing, spatial distribution, density, and total number than was possible if each of the three survey years was treated separately.

To allow comparisons of kokanee spawner abundance among reaches, streams and years, densities of spawning kokanee in each section of each reach were calculated by dividing the number of live spawners by the area or linear distance surveyed in a section. The number of live spawners was used, instead of the sum of live and dead spawners, because the number of dead spawners was not accurately counted in 2011 and 2012. (They were in 2013.) Aerial density was calculated as number of live spawners per 100 m^2 and linear density was calculated as the number of live spawners per metre. Area was calculated by multiplying the length of a surveyed stream section by the mean wetted width of that stream section obtained from 1:20,000 reconnaissance data (AMEC, 2013b). However, reach widths were not available for all stream reaches. For example, wetted stream width was not measured in Reach 13 of lower Chedakuz Creek or in the reaches of middle Chedakuz Creek. Therefore, linear density was used as the principle index of density for analysis.

Redd density (aerial and linear) were calculated in a similar manner.

The total number of kokanee spawners in a reach were calculated by multiplying linear density by the total accessible length of a reach. The number of kokanee spawners in a stream was the sum of estimated numbers in each reach in which spawning was recorded.

In 2011 and 2012, but not in 2013, water depth to the base of redds was measured with a meter stick. Hence, the analyses of redd depth were based only on data collected in 2011 and 2012.

Blackwater Gold Project

Fish and Aquatic Resources
2013 Baseline Report

Part 2
Results

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5.0 RESULTS AND DISCUSSION

This section describes and discusses the results of baseline studies conducted in the Blackwater LSA in 2013.

5.1 Overwintering Habitat Survey

Annex 5.1-1 provides the detailed results of the individual stream and lake site surveys, and this section summarizes those data. Air temperatures at the time of the survey ranged from -4°C to 5°C.

5.1.1 Streams

Mean ice depth at each of the 20 stream sites ranged from 0 cm to 56 cm, mean water depth ranged from 20 cm to 102 cm, and DO concentrations ranged from 11.77 mg/L to 14.56 mg/L (**Table 5.1-1**). Because mean DO concentrations were above 7 mg/L at all 20 stream sites sampled, overwintering habitat quality ratings were assigned based on mean water depth; DO was not limiting at any site, but water depth frequently was.

Table 5.1-1: Characteristics of Overwintering Stream Habitat, 12 to 17 March 2013

Watershed	Stream/ Lake Name	Reach	Site Number	Habitat Type	Mean Ice Depth (cm)	Mean Water Depth (cm)	Mean Dissolved Oxygen (mg/L)	Overwintering Habitat Quality
Davidson Creek	Davidson Creek	1	DO-09	Riffle/Pool/Glide	56	20	12.93	Poor
Davidson Creek	Davidson Creek	3	DO-09	Riffle/Pool/Glide	5	32	14.10	Fair
Davidson Creek	Davidson Creek	4	DO-19	Riffle/Pool/Glide	7	30	14.50	Fair
Davidson Creek	Davidson Creek	5	DO-19	Riffle/Pool/Glide	2	25	14.17	Fair
Davidson Creek	Davidson Creek	6	DO-19	Riffle/Pool/Glide	1	31	14.14	Fair
Davidson Creek	Davidson Creek	8	DO-08	Pool	0	47	13.57	Fair
Davidson Creek	Davidson Creek	10	DO-06	Pool	6	33	12.37	Fair
Davidson Creek	Creek 636713	3	DO-22	Pool	6	0	-	None
Davidson Creek	Creek 688328	1	DO-23	Pool	18	10	12.28	None
Davidson Creek	Creek 688328	2	DO-04	Pool	29	12	12.65	Poor
Davidson Creek	Creek 704454	5	DO-21	Pool	22	18	11.94	Poor
Turtle Creek	Turtle Creek	3	DO-02	Pool	12	82	12.73	Good
Turtle Creek	Turtle Creek	7	DO-03	Pool	5	79	11.77	Good
Creek 661	Creek 661	1	DO-15	Riffle/Pool/Glide	6	29	14.56	Fair
Creek 661	Creek 661	3	DO-15	Riffle/Pool/Glide	1	29	14.34	Fair
Creek 661	Creek 661	4	DO-15	Riffle/Pool/Glide	1	22	14.19	Fair
Creek 661	Creek 661	5	DO-20	Pool	101	0	-	None

Table continues …

Watershed	Stream/ Lake Name	Reach	Site Number	Habitat Type	Mean Ice Depth (cm)	Mean Water Depth (cm)	Mean Dissolved Oxygen (mg/L)	Overwintering Habitat Quality
Creek 661	Creek 505659	2	DO-13	Pool	10	102	10.90	Good
Creek 705	Creek 705	3	DO-16	Pool	16	14	11.00	Poor
Chedakuz Creek	Chedakuz Creek	13	DO-25	Pool	0	114	13.83	Good

Notes: m = metre, mg/L = milligram per litre
Dashes indicate no data available

5.1.1.1 Davidson Creek Watershed

Helicopter overflights in March 2013 showed that Reaches 1 and 2 and Reach 8 and above of Davidson Creek were covered with ice during winter 2013. Reaches 4 to 7 of Davidson Creek had long areas of open water that were probably caused by groundwater inflows.

These observations supported those taken in March 2012 (AMEC, 2013b). In 2012, the lower section (Reach 1) and the upper section (Reaches 10 to 12 plus Lake 01628LNRS) were covered with ice, and tributaries to the upper and middle sections of Davidson Creek were also covered with ice. However, in 2012, the middle section (Reaches 2 to 9) showed long areas of open water.

In March 2013, none of the 11 stream sites visited in the Davidson Creek Watershed were given an overwintering habitat quality rating above fair. This was due solely to the less than optimal under-ice water depths (i.e., <50 cm) at these sites and not because of low DO concentrations. DO concentrations at all sites with water were above 7 mg/L (**Table 5.1-1**). Six of the streams were given an overwintering habitat quality rating of fair because water depths were between 20 cm and 50 cm. Three sites were given an overwintering habitat rating of poor because water depths were <20 cm. Two sites were given an overwintering habitat rating of none: one because water depths were <10 cm and one because there was no water below the ice.

These results differ from those reported from five stream sites in Davidson Creek visited from 6 to 9 March 2012 (AMEC, 2013b) (**Table 5.1-2**). Two of the five sites (DO-09 and DO-08, both visited in March 2013) had an overwintering habitat quality rating of good because water depths exceeded 50 cm and DO concentrations exceeded 9 mg/L. Another two sites (DO-06 and DO-04, both visited in March 2013) were rated as fair because water depths were between 20 and 50 cm and DO concentrations exceeded 9 mg/L. One site, DO-10 in Creek 428073 (not visited in March 2013), was rated as poor because it is located in a pond where minimal winter flows resulted in a thick ice cover, low water depth (15 cm) and a low mean DO concentration (4.4 mg/L).

These results indicate variation in overwintering habitat quality between March 2012 and March 2013. Two sites (DO-09 and D-08) had worse quality in March 2013 than March 2012, another two sites (DO-10 and DO-04) had better quality in March 2013 than March 2012, and one site (DO-06) was unchanged between years.

Table 5.1-2: Quality of Overwintering Habitat in Streams, Blackwater LSA, March 2012 and March 2013

Watershed	Year	Number of Stream Sites				
		Good	Fair	Poor	None	Total
Davidson Creek	2012	2	2	1	0	5
	2013	0	6	3	2	11
Turtle Creek	2012	0	0	1	1	2
	2013	2	0	0	0	2
Creek 661	2012	1	0	0	2	3
	2013	1	3	0	1	5
Creek 705	2012	0	1	0	0	1
	2013	0	0	1	0	1
Tatelkuz Lake Tributaries	2012	0	0	1	1	2
	2013	0	0	0	0	0
Lower Chedakuz Creek	2012	0	0	0	0	0
	2013	1	0	0	0	1
Total	**2012**	**3**	**3**	**3**	**4**	**13**
	2013	**4**	**9**	**4**	**3**	**20**

5.1.1.2 Turtle Creek Watershed

Helicopter overflights in March 2013 showed that the lower section (Reaches 1 and 2) of Turtle Creek was covered with ice. The middle section (Reaches 3 through 6) of Turtle Creek, through the confined valley, contained pockets of open water likely caused by groundwater inflows. The upper section (Reach 7 and above) also contained areas of open water or showed evidence of recent open water and recent re-freezing.

These observations supported those taken in March 2012 (AMEC, 2013b). In 2012, the lower section of Turtle Creek (Reaches 1 and 2) were covered with ice. However, the upper and middle sections contained sections of open water.

In March 2013, overwintering habitat quality was rated as good at both sites surveyed in Turtle Creek (**Table 5.1-1**). Mean water depth ranged from 79 cm to 80 cm, and mean DO concentrations were >11 mg/L, more than sufficient for overwintering salmonids to survive.

Only one site was surveyed in both March 2012 and March 2013 in Turtle Creek: site DO-02. Its habitat quality was rated as none in March 2012 because mean water depth was only 3 cm—too shallow to take a DO measurement (**Table 5.1-2**). However, it was assigned an overwintering habitat quality of good in March 2013 because water depth exceeded 50 cm and DO concentration exceeded 9 mg/L. This finding further supports the idea of between-year variation in overwintering habitat quality in streams of the LSA.

5.1.1.3 Creek 661 Watershed

Helicopter overflights in March 2012 and March 2013 showed that Reaches 1 and 2 of Creek 661 and some of its tributaries were open. However, Reaches 3 and 4 were entirely covered with ice. The open areas were likely caused by groundwater inflows.

In March 2013, only one site in the Creek 661 Watershed had an overwintering habitat quality of good: the pool at site DO-13 in Creek 505659 (**Table 5.1-1**). Water depth and DO concentrations at this site were >100 cm and >10 mg/L, respectively. Mean DO concentrations in the lower reaches of Creek 661 (Reaches 1, 3, and 4) exceeded 14 mg/L. However, water depths were less than 30 cm at all three sites, resulting in overwintering habitat quality ratings of only fair. A pool sampled in the middle reaches of Creek 661 (Site DO-20 in Reach 5) was frozen to bottom and provided no overwintering habitat.

Site DO-13 was also the only site visited in March 2012 – its overwintering habitat quality was also rated as good in that year (**Table 5.1-2**). Two other sites visited in March 2012 (sites DO-07 and DO-14) provided no overwintering habitat because their water depths were less than 10 cm.

5.1.1.4 Creek 705 Watershed

Helicopter overflights in March 2012 and March 2013 showed that all reaches of Creek 705 were covered with ice. The exception was isolated pockets of open water close to the bridge in Reach 2. This suggests Creek 705 has less frequent and lower volume groundwater inflows than Davidson Creek, Turtle Creek, and Creek 661.

In March 2013, the single pool site sampled in Reach 3 of Creek 705 (site DO-16) was given a poor overwintering habitat quality rating due to its shallow depth (14 cm). Mean DO concentration at this site was 11 mg/L.

A “fair” habitat quality rating had been assigned to site DO-16 in March 2012, also due to low water depth (28 cm) (**Table 5.1-2**).

5.1.1.5 Lower Chedakuz Creek

Helicopter overflights showed that all reaches of lower Chedakuz Creek between Tatelkuz Lake outlet and the confluence of Turtle Creek were free of ice cover. Ice was only found along the banks of the creek and never across the entire channel.

The single site in Chedakuz Creek, a pool site located in Reach 13 (**Plate 5.1-1**), was given a good overwintering habitat quality rating due to DO concentrations over 13 mg/L and mean water depths greater than 100 cm at this location.

No sites were visited in lower Chedakuz Creek in March 2012.



Plate 5.1-1: Overwintering Habitat Rated as Good, Lower Chedakuz Creek, DO-25, 17 March 2013

5.1.1.6 Comparison between 2013 and 2012

A total of 33 stream sites were visited in the two years: 13 sites in March 2012 and 20 sites in March 2013. Overwintering habitat quality ranged from none to good in both years, but the frequency distribution varied between years. In March 2013, the highest percentage (45%) was classified as fair and the lowest percentage (15%) was classified as none (**Figure 5.1-1**). In March 2012, the highest percentage was none (31%) and the other three categories were lower (23%).

Eight sites were visited in both years. There was no change in overwintering habitat quality for two of the eight sites (DO-06 and DO-13), but habitat quality decreased from March 2012 to March 2013 for three sites (DO-08, DO-09 and DO-16) and increased for three sites (DO-02, DO-04 and DO-10).

These results show that there is a range of overwintering habitat quality in streams of the Blackwater LSA, but that it varies between years. Hence, the quantity of overwintering habitat of sufficient quality to support fish (i.e., fair and good) may limit fish production in the LSA, but its effect varies between years.

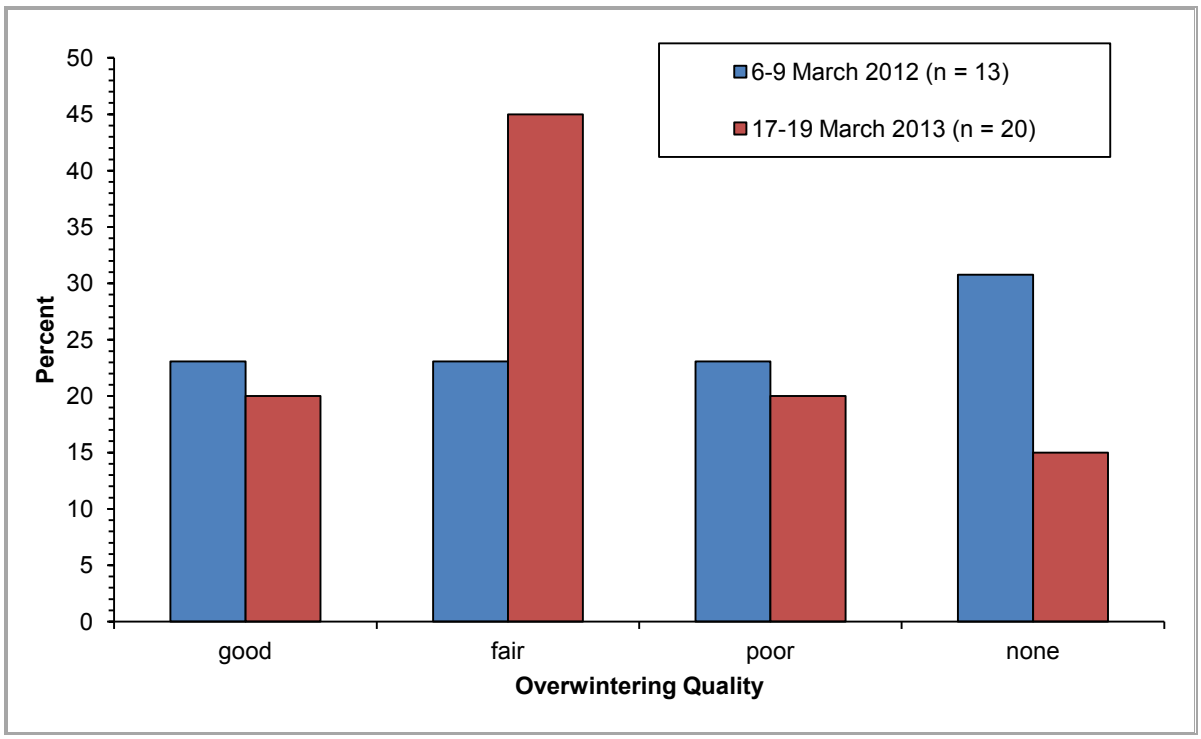


Figure 5.1-1: Frequency Distribution of Overwintering Habitat Quality, Blackwater LSA, March 2012 and March 2013

5.1.2 Headwater Lakes

In March 2013, mean ice depth in the three sampled lakes ranged from 89 cm to 108 cm, mean water depth ranged from 5.0 m to 14.50 m, and mean DO concentrations ranged from 0.36 mg/L to 14.11 mg/L (**Table 5.1-3**).

In all three lakes, habitat quality decreased with depth because DO concentrations decreased with depth. This pattern is typical for late winter conditions in temperate zone lakes. DO concentrations are always lowest near the lake bottom because DO is mainly consumed by microorganisms at the water-sediment interface. As winter progresses, the zone of low DO concentration rises through the water column at a rate controlled by lake depth and morphometry, nutrient concentrations, and plant biomass (Babin and Prepas, 1985; Meding and Jackson, 2003, 2011; Clark et al., 2009). As long as good habitat remains underneath the ice throughout winter, however, a lake can support fish.

Similar profiles of DO with depth (and overwintering habitat quality with depth) were observed in Lake 01682LNRS and Lake 01538UEUT in March 2012.

Table 5.1-3: Characteristics of Overwintering Lake Habitat, March 2013

Watershed	Stream/ Lake Name	Reach	Site Number	Ice Depth (cm)	Water Depth (m)	Depth of Measurement (m)	Dissolved Oxygen (mg/L)	Over-Wintering Habitat Quality
Davidson Creek	Lake 01682LNRS	12	DO-05	103	14.50	1	9.45	Good
						2	7.84	Good
						3	6.97	Fair
						4	6.60	Fair
						5	5.91	Poor
						6	5.01	Poor
						7	4.10	Poor
						8	3.42	Poor
						9	3.31	Poor
						10	3.43	Poor
						11	3.90	Poor
						12	4.41	Poor
						13	4.45	Poor
						14	4.43	Poor
Creek 705	Lake 01428UEUT	2	DO-18	89	5.00	1	7.65	Good
						2	4.51	Poor
						3	3.18	Poor
						4	0.70	None
						5	0.42	None
Creek 705	Lake 01538UEUT	6	DO-17	108	9.00	1	9.45	Good
						2	8.70	Good
						3	8.25	Good
						4	8.13	Good
						5	7.09	Good
						6	5.39	Fair
						7	2.27	None
						8	0.61	None
						9	0.36	None

Notes: m = metre, mg/L = milligram per litre

5.2 Stream Water Temperatures

In 2013, continuous stream temperature measurement data for the ice-free period were available only for two of the seven sites that were monitored: H1 in middle Creek 661 (**Figure 5.2-7**) and H4 in lower Davidson Creek (**Figure 5.2-3**). Data from the other five sites were incomplete due to a variety of technical problems including exposure of the loggers to air during low flow events, damage to loggers by woody debris produced by severe windstorms, and software failures. Partial temperature records were only available from

early May to mid-August in 2013 from three hydrometric stations: H2 in middle Davidson Creek (**Figure 5.2-2**), H9 in Creek 428073 (**Figure 5.2-4**), and H10 in upper Davidson Creek (**Figure 5.2-1**). Temperature records were available only from early September to late October 2013 for sites H6 (middle Turtle Creek; **Figure 5.2-5**) and ST-03 (lower Turtle Creek; **Figure 5.2-6**).

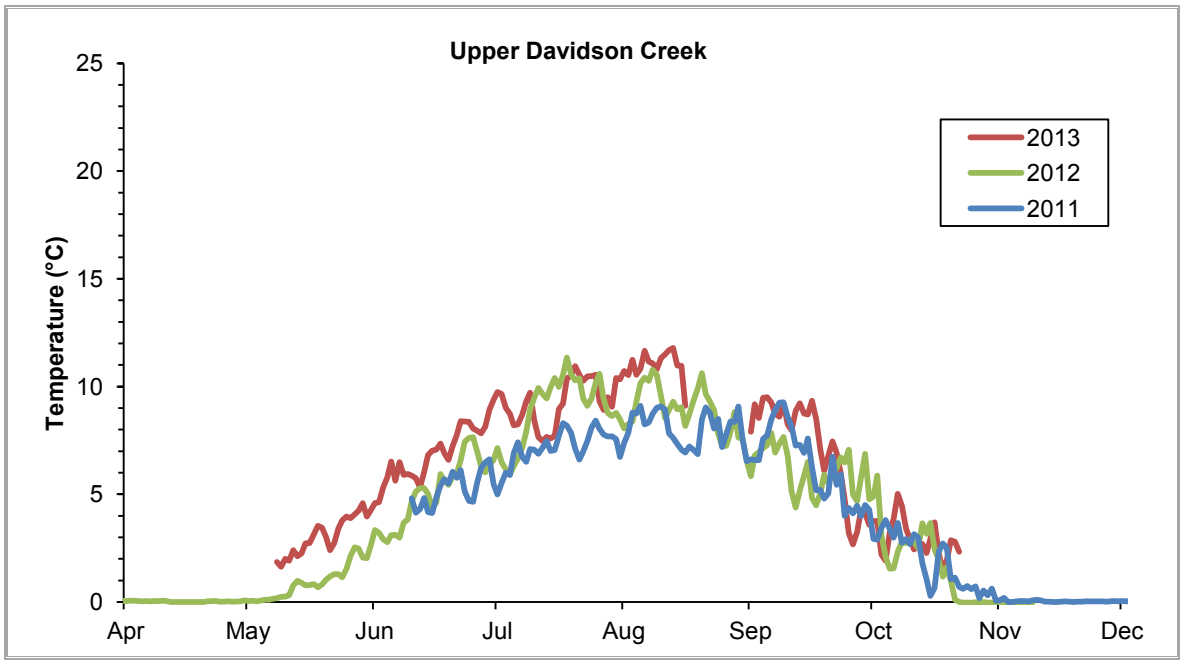


Figure 5.2-1: Mean Daily Stream Temperature in Upper Davidson Creek (H10), 2011 – 2013

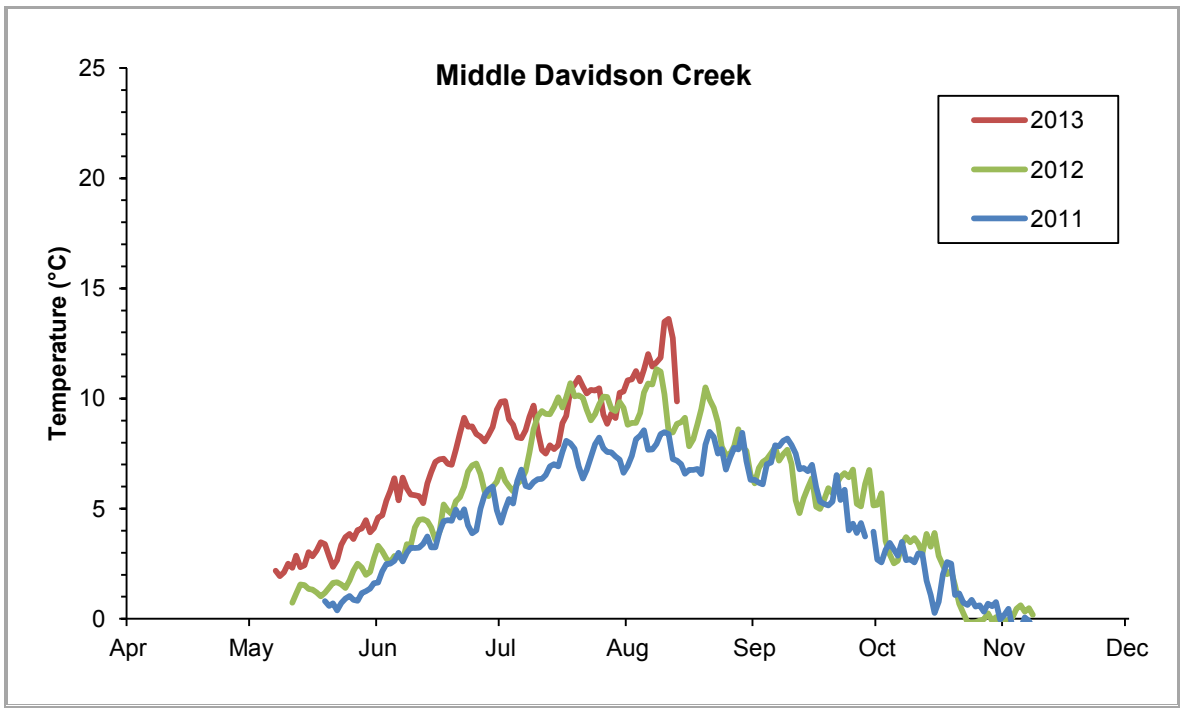


Figure 5.2-2: Mean Daily Stream Temperature in Middle Davidson Creek (H2), 2011 – 2013

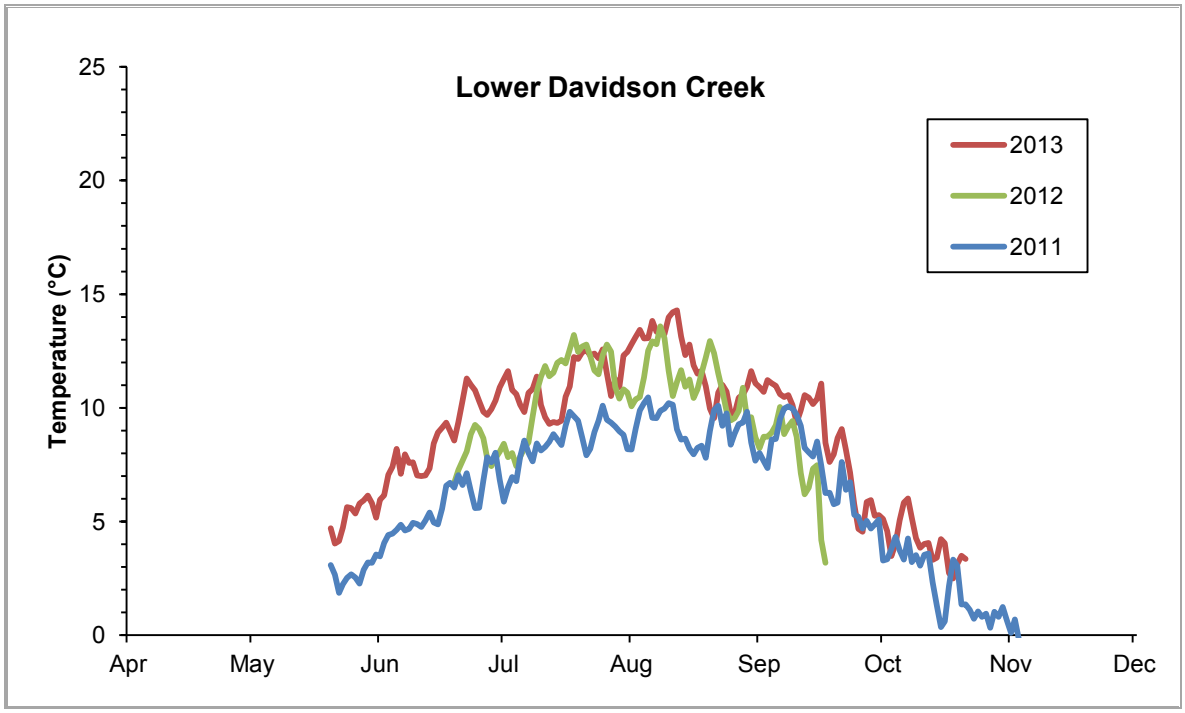


Figure 5.2-3: Mean Daily Stream Temperature in Lower Davidson Creek (H4), 2011 – 2013

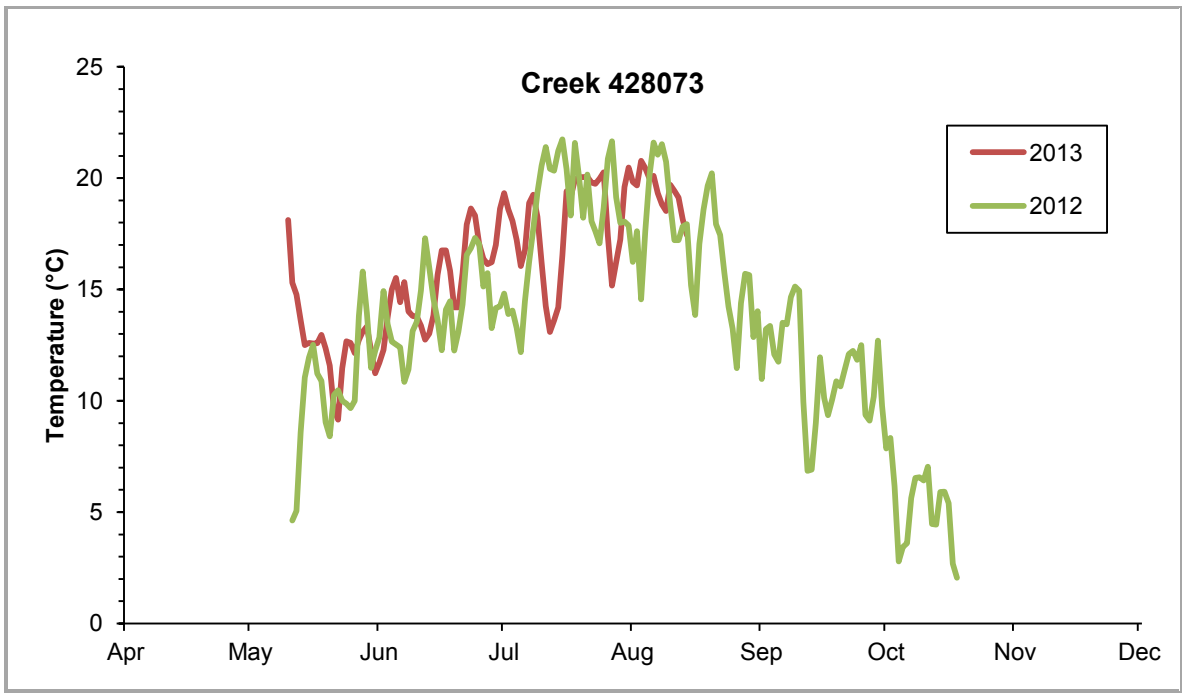


Figure 5.2-4: Mean Daily Stream Temperature in Creek 428073 (H9), 2011 – 2013

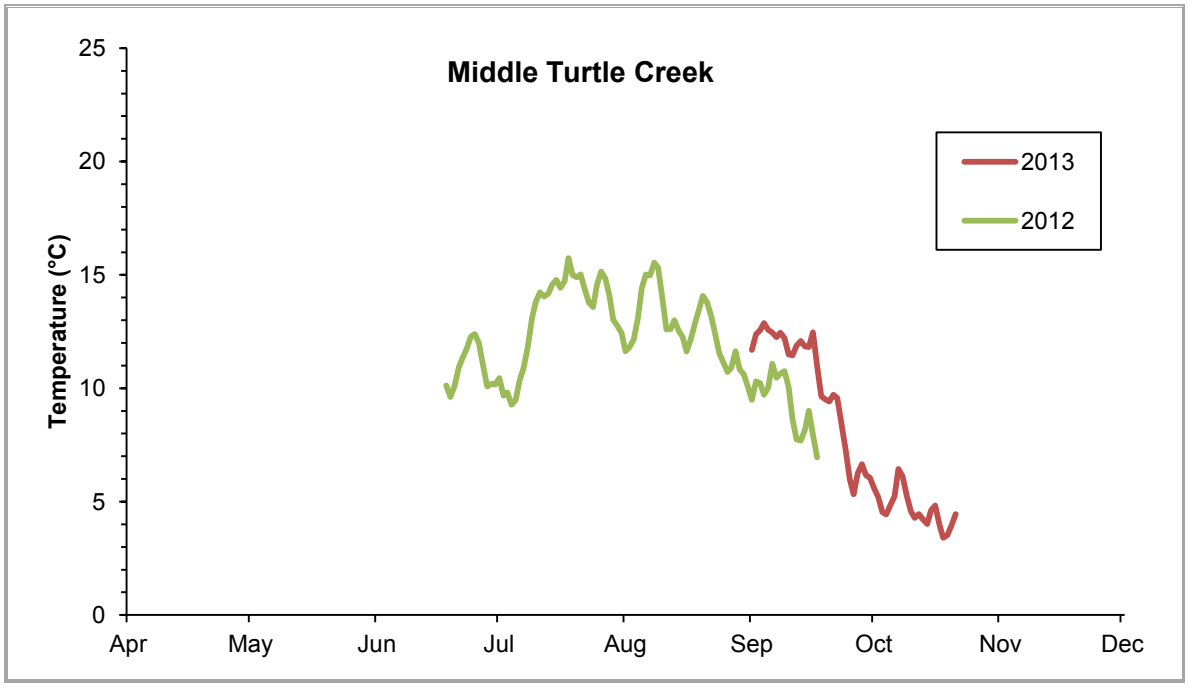


Figure 5.2-5: Mean Daily Stream Temperature in Middle Turtle Creek (H6), 2011 – 2013

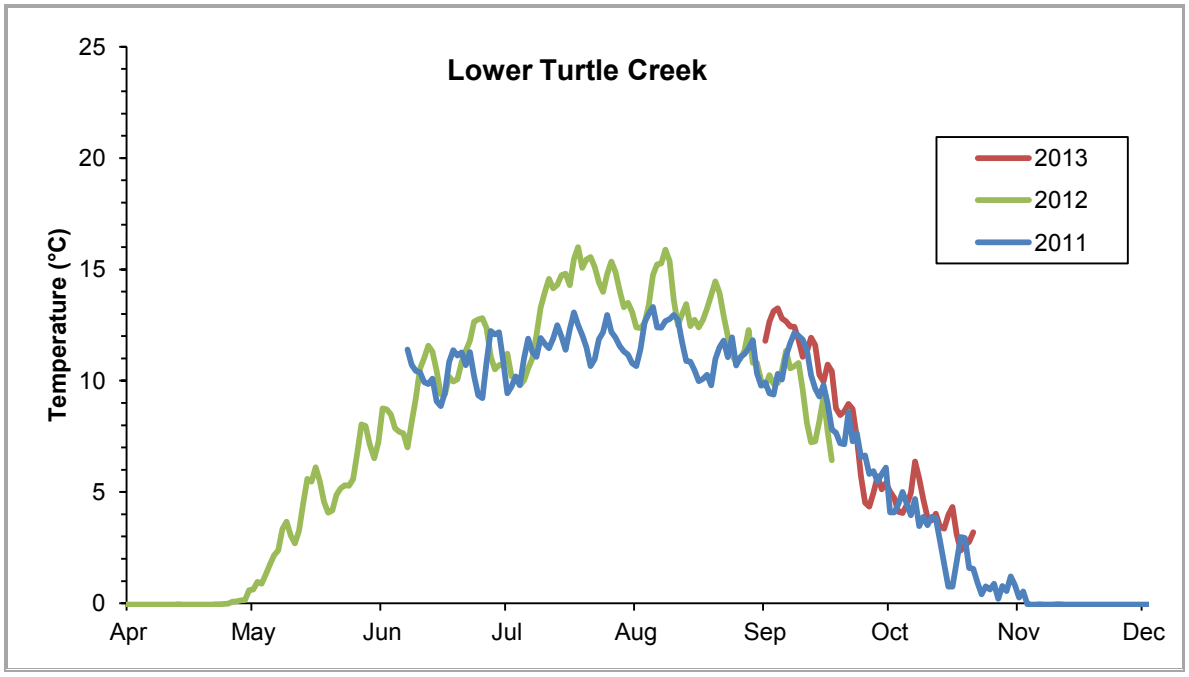


Figure 5.2-6: Mean Daily Stream Temperature in Lower Turtle Creek (ST-03), 2011 – 2013

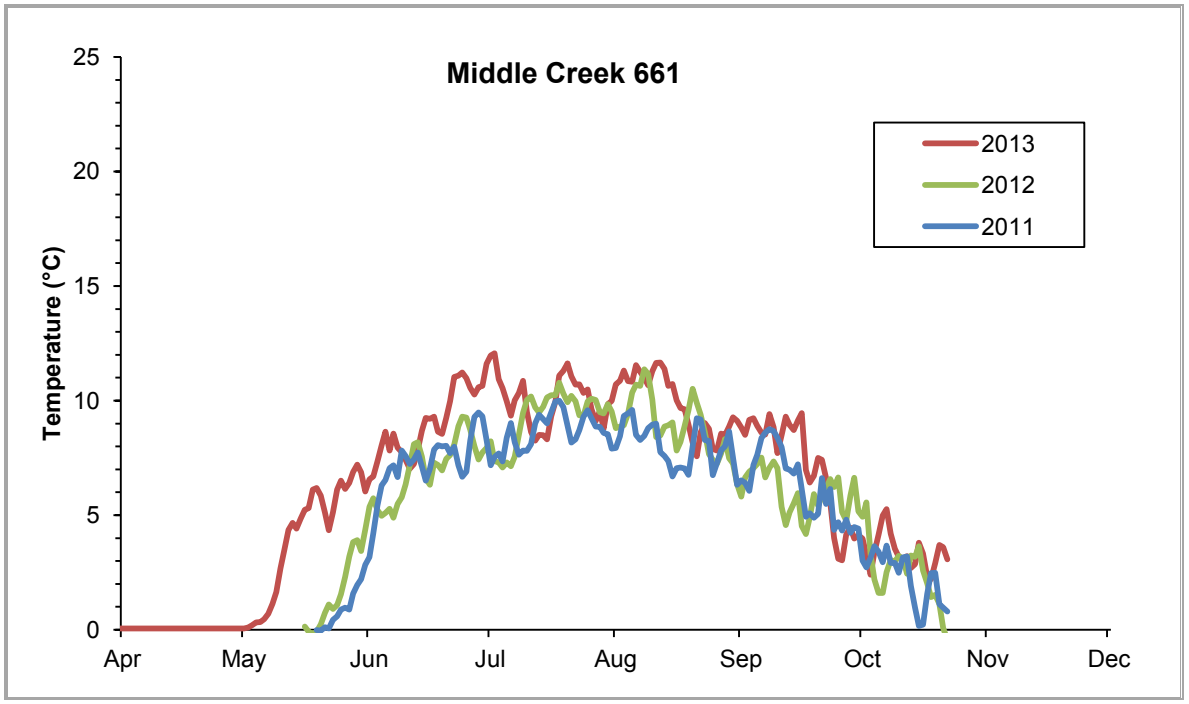


Figure 5.2-7: Mean Daily Stream Temperature in Middle Creek 661 (H1), 2011 – 2013

Mean daily temperatures showed three patterns. The first was the expected dome-shaped variation with season. Mean daily temperatures rose from near 0°C in early May to a

maximum of between 11.2°C and 20.8°C in mid-July and early August and then fell to near 0°C in late October. The same pattern was also observed in 2011 and 2012 (AMEC, 2013c).

The second pattern was a gradient of decreasing temperature with increasing elevation. This is evident when comparing temperatures in lower Davidson Creek (**Figure 5.2-3**) with those in middle Davidson Creek (**Figure 5.2-2**) and upper Davidson Creek (**Figure 5.2-1**). Creek 428073 (site H9), a lower elevation tributary flowing through a series of shallow ponds, exhibited the highest summer temperatures of all sites in 2013 (**Figure 5.2-4**).

The third pattern was warmer summer temperatures in 2013 than in 2011, but similar summer temperatures between 2013 and 2012.

Mean monthly temperatures were lowest in upper Davidson Creek (site H10) during May, June, July and October and in middle Creek 661 (site H1) during August and September (**Annex 5.2-1**), Creek 428073 (site H9) exhibited the highest mean monthly temperatures from May to August, and middle Turtle Creek (site H6) had the highest mean monthly temperatures during September and October.

In general, stream temperatures in the LSA fall below the BC MOE optimal temperature ranges for rainbow trout and kokanee (BC MOE, 2001) (**Table 5.2-1**). Hence, low temperatures rather than high temperatures limit aquatic biological processes in the LSA and RSA.

Table 5.2-1: BC MOE Optimal Temperature Ranges for Kokanee and Rainbow Trout

Species	Incubation	Rearing	Migration	Spawning
Sockeye salmon	4.0-13.0	10.0-15.0	7.2-15.6	10.6-12.8
Rainbow trout	10.0-12.0	16.0-18.0	-	10.0-15.5

Notes: All temperatures have units of °C. Sockeye salmon ranges are assumed to represent optimal ranges for kokanee, the landlocked morph of sockeye salmon.

Rainbow trout are present in streams throughout the LSA (AMEC, 2013b). During their spawning period in May and June, mean monthly temperatures (i.e., those pooled over 2011, 2012, and 2013) fall within the optimal ranges for migration and spawning only for Creek 428073 during May and June and for Turtle Creek during June **(Annex 5.2-1**). Mean monthly temperatures are below the optimal range for spawning at all other sites.

Turtle Creek and lower Davidson Creek have warmer monthly temperatures than other sites during the summer incubation and rearing period, with mean monthly temperatures approaching or within the optimal ranges. Mean monthly stream temperatures in Creek 428073 during July and August exceed the maximum optimal rearing temperature. Mean monthly stream temperatures in middle and upper Davidson Creek and in Creek 661 are below the optimal ranges for rainbow trout rearing.

Kokanee spawn in lower Davidson Creek, Creek 661, and lower Chedakuz Creek and rear and overwinter in Tatelkuz Lake. Mean pooled stream temperatures in lower Davidson Creek during August, when kokanee spawn, are within the optimal range for that species (**Annex 5.2-1**). Stream temperatures at all monitoring stations in Davidson Creek in 2013 fell within the optimal range for kokanee spawning. Mean monthly temperature in Middle Creek 661 is marginally below the optimal range for spawning.

5.3 Electrofishing Survey of Lower Davidson Creek

A total of 19 rainbow trout (**Plate 5.3-1**) were captured at sites in the lower three reaches of Davidson Creek by backpack electrofishing in July 2013 (**Annex 5.3-1** and **Table 5.3-1**). One mountain whitefish was captured in Reach 3 (**Plate 5.3-2**). A total electrofishing effort of 6,580 seconds was expended on sites in Davidson Creek.

Electrofishing CPUE of rainbow trout was highest at site FI-67 in Reach 2 on 11 July 2013 (1.07 fish/100 s) as was trout density (1.47 fish/100 m²) (**Table 5.3-1**). Rainbow trout CPUE and density at the other two sites were less than 1.0 fish/100 s and 1.0 fish/100 m², respectively.



Plate 5.3-1: Rainbow Trout Captured in Reach 2 of Davidson Creek, 11 July 2013



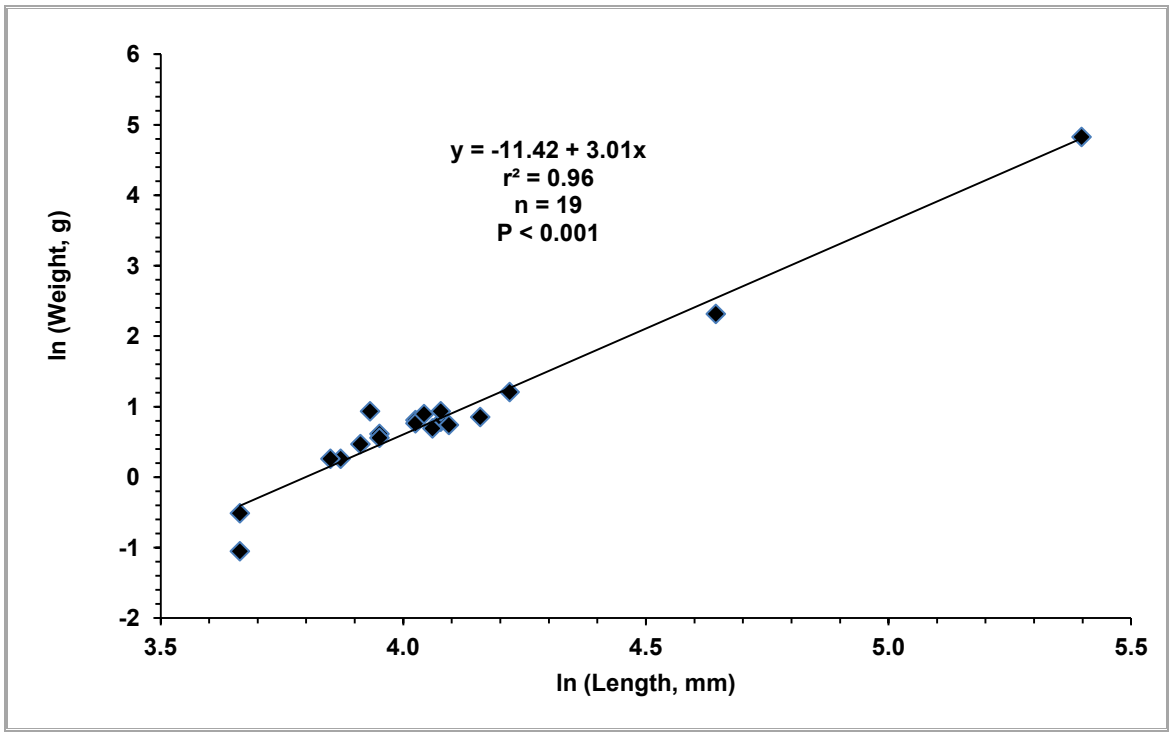
Plate 5.3-2: Mountain Whitefish Captured in Reach 3 of Davidson Creek, 10 July 2013

Table 5.3-1: Electrofishing Effort, Catch, and CPUE of Reaches 1 to 3 of Lower Davidson Creek, July 2013

Stream	Site ID	Reach	Date	Site Length (m)	Site Width (m)	Site Area (m^2)	Effort[1]	Catch (RB)	Catch (MW)	Total Catch	RB CPUE	MW CPUE	Total CPUE	RB Density (No./100 m^2)	MW Density (No./100 m^2)	Total Density (No./100 m^2)
Davidson Creek	FI-66	1	09-Jul-13	100	6.00	600	3,134	2	0	2	0.06	0.00	0.06	0.33	0.00	0.33
Davidson Creek	FI-67	2	11-Jul-13	150	5.90	885	1,212	13	0	13	1.07	0.00	1.07	1.47	0.00	1.47
Davidson Creek	FI-68	3	10-Jul-13	100	4.50	450	2,234	4	1	5	0.18	0.04	0.22	0.89	0.22	1.11
Overall						**1,935**	**6,580**	**19**	**1**	**20**	**0.29**	**0.02**	**0.30**	**0.98**	**0.05**	**1.03**

Note: [1]Electrofishing effort is measured in seconds; [2]CPUE for electrofishing is number of fish/100 EF seconds
RB = rainbow trout; MW = mountain whitefish; Density = number of fish/100 m^2; CPUE = Catch-Per-Unit-Effort; EF = electrofishing; m = metre; m^2 = metres squared.

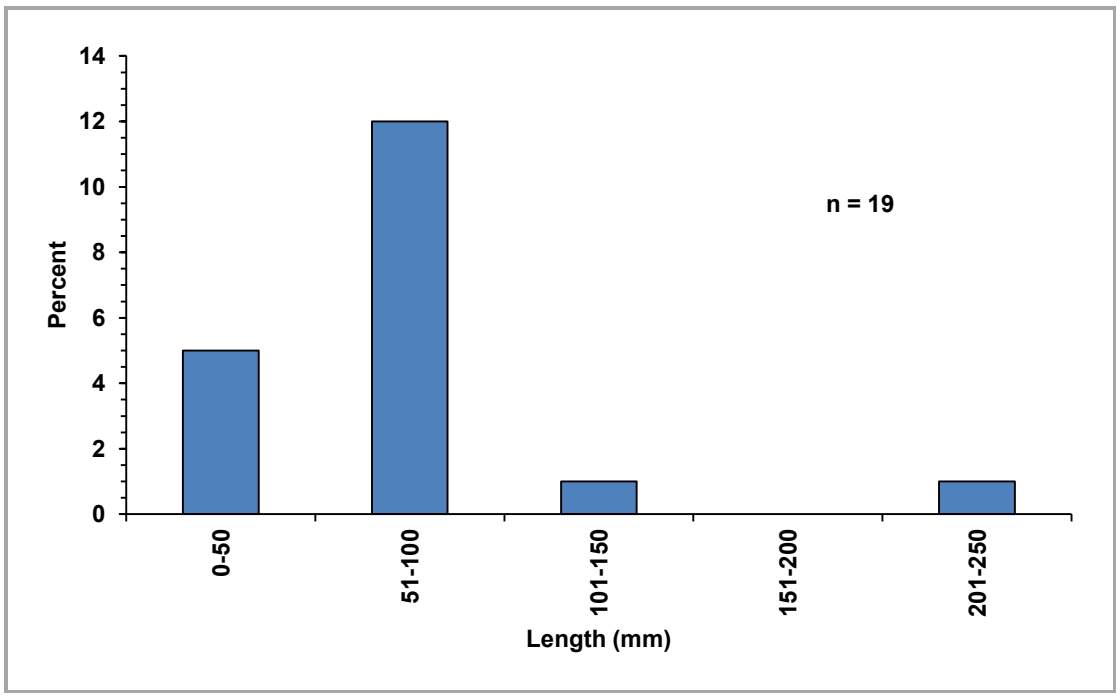
A plot of ln(weight) on ln(length) for rainbow trout of lower Davidson Creek showed no obvious outliers (**Annex 5.3-2** and **Figure 5.3-1**). The linear regression of ln(weight) on ln(length) was highly significant (P<0.001), and explained 96% of the variation in ln(weight). The slope was close to 3.0 assumed by the formula for condition, thereby validating the use of that index.



Note: ln = natural logarithm; g = grams; mm = millimetre; n = sample size

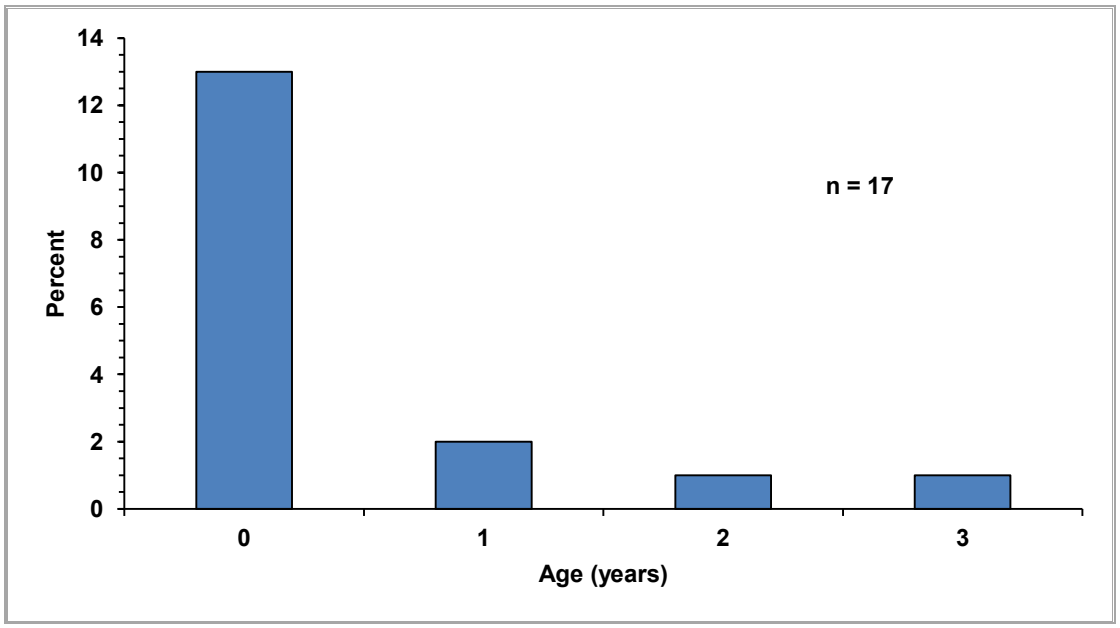
Figure 5.3-1: Linear Regression of Weight on Length for Rainbow Trout, Lower Davidson Creek, 2013

Length frequency plots showed that lower Davidson Creek is dominated by small rainbow trout and mountain whitefish (<100 mm) (**Figure 5.3-2** and **Table 5.3-2**). The majority of rainbow trout (13 out of 17) were less than 1 year old, three were older juveniles (1 and 2 years old), and one was a 3 year old adult male who was most likely a delayed spawner who had not yet returned to Tatelkuz Lake (**Figure 5.3-3**).



Note: mm = millimetre; n = sample size

Figure 5.3-2: Length Frequency Distribution for Rainbow Trout, Lower Davidson Creek, 2013



Notes: n = sample size

Figure 5.3-3: Age Frequency Distribution of Rainbow Trout, Lower Davidson Creek, 2013

Table 5.3-2: Summary of Biological Characteristics of Fish Captured in Reaches 1 to 3 of Lower Davidson Creek, July 2013

Species	Sampling Time 2013	Fork Length (mm)				Weight (g)				Condition Factor				Age			
		n	Mean	SE	Range	n	Mean	SE	Range	n	Mean	SE	Range	n	Mean	SE	Range
Rainbow trout	July	19	65	9	39 - 221	19	8.8	6.5	0.35 - 125.0	19	1.16	0.06	0.59 - 1.92	17	0.41	0.21	0 - 3
Mountain whitefish	July	1	127	–	–	1	19.5	–	–	1	0.95	–	–	1	1	–	–

Note: n = sample size; SE = standard error; mm = millimetres; g = grams

5.4 Fish and Fish Habitat of Lower Chedakuz Creek

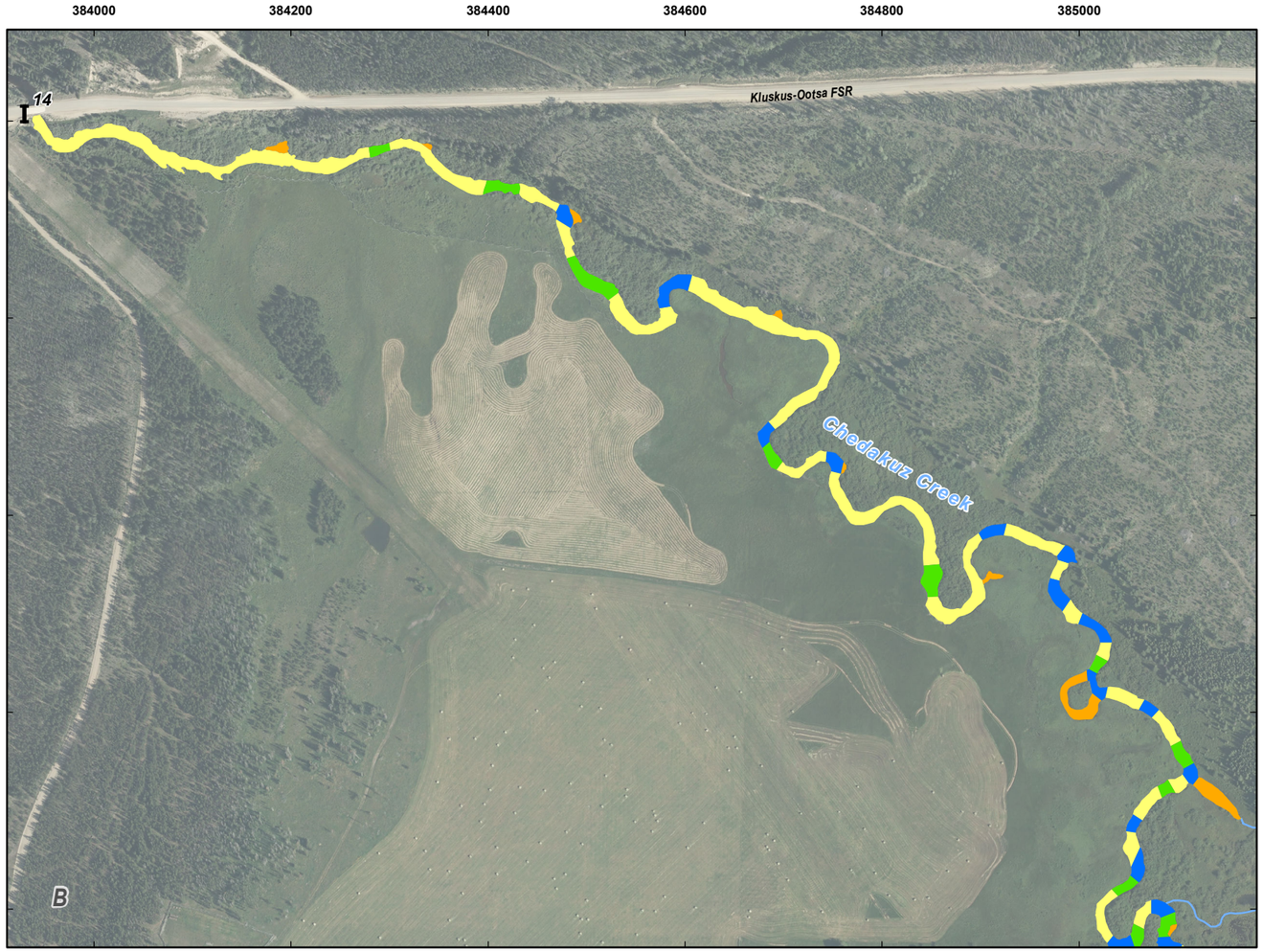
5.4.1 Fish Habitat

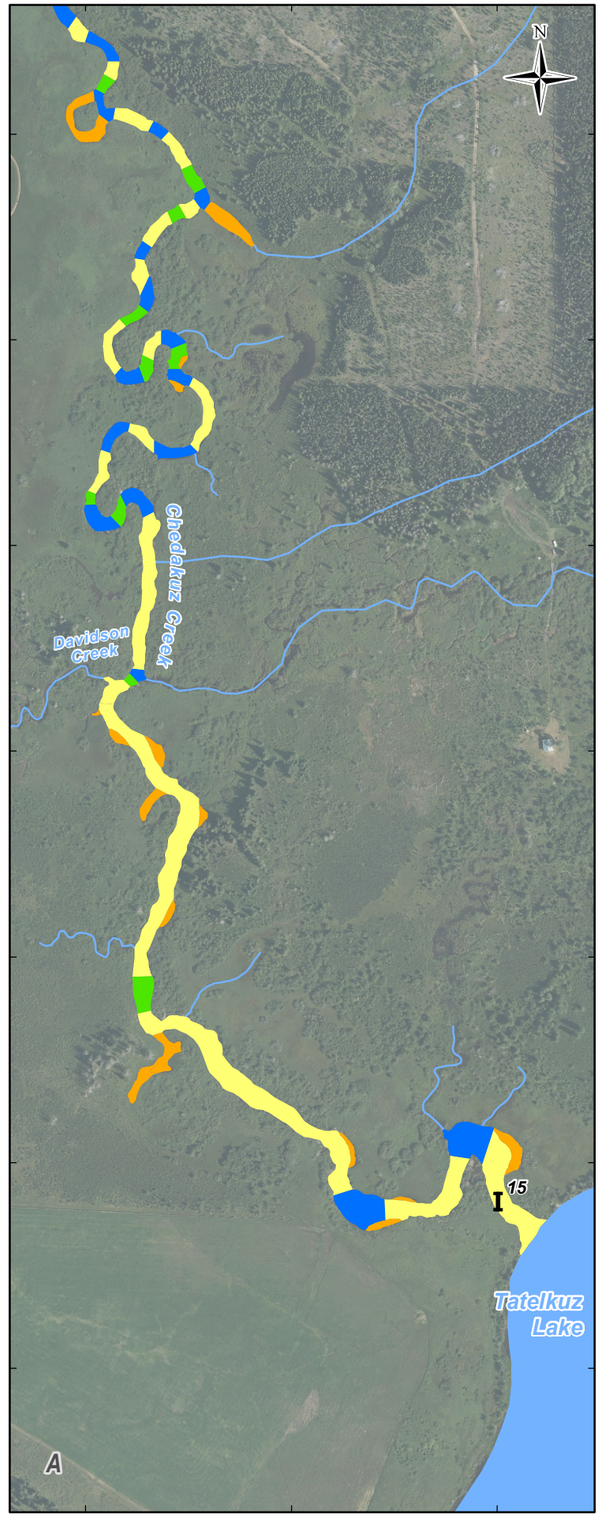
Reach 15 of Lower Chedakuz Creek consists predominantly of glide habitat (62%) (**Plate 5.4-1**, **Figure 5.4-1** and **Table 5.4-1**; **Annex 5.4-1**), followed by pools (15%), riffles (8%), and "Other" (15%). The latter habitat type includes wetland complexes that lack an identifiable primary channel, sloughs, lakes, areas of sub-surface flow or areas where the channel cannot be observed (Johnston and Slaney, 1996).

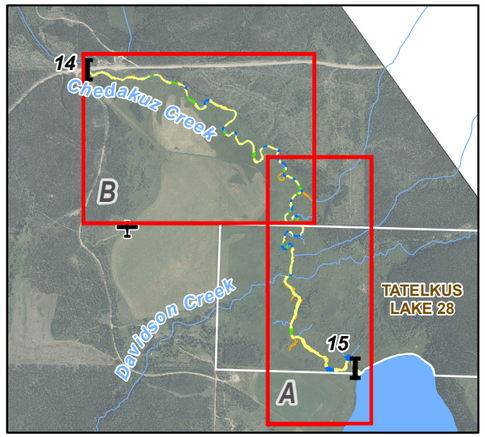


Plate 5.4-1: Glide Habitat in Chedakuz Creek, 24 July 2013

Gravel and fines are the dominant substrates in this reach. There are some sections of suitable silt-free salmonid spawning gravels for rainbow trout and kokanee located in riffles and glides. Instream vegetation provides the majority of cover. Cover is also provided by small woody debris and large woody debris. Deep pools (>1 m) and off-channel habitat are suitable habitat for overwintering. Habitat quality for salmonids is rated as good for migration because there are no obstructions to movement of fish of all life stages upstream or downstream.







Legend

- Stream
- Waterbody

Stream Habitat Classes (Reach 15)

- Glide
- Pool
- Riffle
- Other

Scale: 1:5,800

0 50 100 200 300

Meters

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Stream Habitat of Reach 15 Lower Chedakuz Creek

DATE: December, 2013	ANALYST: WR	**Figure** 5.4-1
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-184_ChedakuzStreamSplit.pdf
GIS FILE: 10-100-184_ChedakuzStreamSplit.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-184_ChedakuzStreamSplit.mxd

Table 5.4-1: Habitat Features of Reach 15 in Chedakuz Creek, July 2013

Reach No.	Habitat Unit Type	Percent Composition (%)	Total Length (m)	Total Area (m^2)	Mean Gradient (%)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Water Depth (m)	Mean Residual Pool Depth (m)	Substrate			Mean Functioning LWD	Cover Type		Off-Channel Habitat	Riparian Vegetation	
										Dominant	Sub-Dominant	Spawning Gravels		Dominant	Sub-Dominant		Type	Structure
15		**100**	**4,485.4**	**23,852.5**														
	Riffle	8	374.0	6,968.9	<1	18.6	17.1	0.37	–	G, S	S, G	H, L	0	SWD	IV	N	SH, G	SHR
	Pool	15	658.0	23,852.5	<1	36.3	33.6	1.26	1.46	S	G, S	N	1	DP, SWD	IV	SL, N	G	SHR
	Glide	62	2,760.0	60,996.0	<1	22.1	18.3	0.57	–	S, G	G, S	L, H	12	SWD, LWD	IV	SL, N	SH, G	SHR
	Other	15	693.4	4,837.0	<1	–	10.1	0.35	–	S	–	N	2	IV	LWD	SL	G	SHR

Note: Substrate: B = boulder; C = cobble; G = gravel; R = bedrock; S = fines
Spawning Gravels: H = high quality; L = low quality; N = none
Cover Type : B = boulders; C = cobbles; DP = deep pools; IV = instream vegetation; LWD = large woody debris; OV = overhanging vegetation
Off-Channel Habitat: SC = side channel; WL = wetland
Riparian Vegetation: C = conifer; M = mixed; MF = mature forest; S = shrub; SHR = shrubs
No. = number; m = metres; % = percent; dash indicates no data

5.4.2 Fish

A total of 468.5 hours of minnow trapping were conducted in lower Chedakuz Creek on 25 July 2013, and five fish were caught (**Table 5.4-2**; **Annex 5.3-1**). Slimy sculpin (*Cottus cognatus*) (**Plate 5.4-2**) were caught in two traps and longnose suckers (*Catostomus catostomus*) in two other traps.

Table 5.4-2: Minnow Trapping Effort, Catch, and CPUE of Reach 15 of Lower Chedakuz Creek, 25 July 2013

Number of Traps	Effort[1]	Species	Catch	CPUE[2]
2	87.7	slimy sculpin	3	3.42
2	85.1	longnose suckers	2	2.35
7	295.6	no fish caught	0	0.00
Overall	**468.5**		**5**	**1.07**

Note: [1] minnow trapping effort is in trap-hours
[2] CPUE is measured in #fish/100 trap-hours
CPUE = Catch-Per-Unit-Effort



Plate 5.4-2: Slimy Sculpin Caught by Minnow Trap, Lower Chedakuz Creek, 25 July 2013

On average, longnose suckers were shorter than slimy sculpin (**Table 5.4-3**; **Annex 5.3-2**).

Table 5.4-3: Summary of Biological Characteristics of Fish Captured in Lower Chedakuz Creek, 25 July 2013

Species	Fork Length (mm)			
	n	Mean	SE	Range
Slimy sculpin	3	82.3	14.2	54 - 99
Longnose sucker	2	71.5	2.5	69 - 74

Note: n = sample size; SE = standard error; mm = millimetres

The visual survey counted a total of 396 rainbow trout and 11 suckers (**Table 5.4-4**). (Suckers could not be identified to species.) The majority of rainbow trout were observed in glide habitat, while the majority of suckers were observed in pool habitat. Unidentified YOY's were not counted because they were too small to be caught in minnow traps or counted reliably. They were typically observed in small schools among instream vegetation cover.

Table 5.4-4: Number of Fish Counted in Lower Chedakuz Creek, 25 July 2013

Survey Direction	Habitat Type	Species	Fish Count
Downstream	Glide	rainbow trout	361
		unknown sucker	1
	Riffle	rainbow trout	1
		unknown sucker	0
	Pool	rainbow trout	34
		unknown sucker	10
	Total	**rainbow trout**	**396**
		unknown sucker	**11**

5.5 Fish and Fish Habitat of Creek 705

5.5.1 Fish Habitat

Habitat in Reach 1 of Creek 705 consists mostly of glides (49%) followed by riffles (36%) and pools (16%) (**Table 5.5-1**, **Table 5.5-2**, and **Plate 5.5-1**; **Annex 5.4-1**). The substrate from highest to lowest percent composition in all three habitat types was cobble, silt, and gravel. There were some sections of clean gravel substrates in glides and riffles that would be suitable for rainbow trout spawning. The dominant cover is provided by undercut banks in riffles and small woody debris in glide habitat. There are also some deep pools (residual pools >0.6 m deep) with large woody debris for juveniles to overwinter. Rainbow trout habitat was classified as good for migrating because there were no obstructions to fish movement. Riparian vegetation changes from shrubs and grasses dominant near the confluence with Fawnie Creek to a coniferous mature forest approximately 250 m upstream.

Table 5.5-1: Summary of Reconnaissance (1:20,000) Stream Habitat Assessments, Creek 705 Watershed, 2013

Freshwater Atlas Code	Reach No.	Baseline Site Map ID	Sampling Date	Stream Order	Stream Classification	Stream Morphology/ Habitat	Mean Gradient (%)	Mean BfW (m)	Mean WW (m)	Mean Res. Pool (m)	Mean BfD (m)	Bed Materials	Stream Cover (%)	Habitat Quality[1]			
														Over-Wintering	Rearing	Spawning	Migration
100-567134-641477-543682-698692	1	FI-115	14/08/2013	3	S2	Riffle-pool with cobble	1.50	7.60	3.80	0.63	0.95	Cobble	<5	G	G	G	G
100-567134-641477-543682-698692	2	FI-114	13/08/2013	3	S2	Riffle-pool with cobble	2.20	7.20	3.50	0.54	0.89	Cobble	5-20	G	G	G	G
100-567134-641477-543682-698692	3	FI-116	16/08/2013	3	S3	Pool - glide	0.40	3.90	6.80	1.20	1.10	Gravel	<5	G	G	P	P
100-567134-641477-543682-698692	4	FI-117	21/08/2013	2	S3	Riffle-pool with cobble	1.10	2.10	2.10	0.08	0.40	Cobble	>20	G	G	P	G
100-567134-641477-543682-698692	5	FI-118	22/08/2013	2	S4	Riffle-pool with cobble	2.90	1.40	1.60	0.19	0.35	Cobble	>20	P	G	P	G
100-567134-641477-543682-698692	6	FI-119	23/08/2013	2	S3	Riffle-pool with cobble	1.50	3.30	3.10	0.32	0.23	Cobble	>20	P	G	P	P
100-567134-641477-543682-698692	8	FI-120	12/09/2013	2	S4	Riffle-pool with cobble	5.50	1.50	1.50	0.09	NS	Cobble	>20	N	P	P	F
100-567134-641477-543682-698692	9	FI-121	12/09/2013	2	S1	Pool	0.75	37.90	38.70	NS	0.64	Fines	5-20	G	G	N	G
100-567134-641477-543682-698692	10	FI-45	12/09/2013	2	S4	Riffle - glide	1.00	2.00	1.70	0.12	0.25	Fines	5-20	P	F	P	F
100-567134-641477-543682-698692	11	FI-122	12/09/2013	2	S3	Cascade-pool with cobble	7.25	1.70	2.00	0.14	NS	Cobble	>20	N	F	P	F
100-567134-641477-543682-698692	12	FI-123	13/09/2013	2	S6	Cascade-pool to NVC	9.75	1.30	1.50	0.05	NS	Cobble	<5	N	N	N	N

Note: [1] Habitat Quality: G = good; F = fair; P = poor; N = none; NS = not specified
No. = Number ; ID = identification; BfW = bankfull width; BfD = bankfull depth; WW = wetted width; NVC = non-visible channel; % = percent; Res. = residual; m = metre

Table 5.5-2: Habitat Features of Creek 705, August and September 2013

Reach No.	Habitat Unit Type	Percent Composition (%)	Total Survey Length (m)	Total Area (m^2)	Mean Gradient (%)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Water Depth (m)	Mean Residual Pool Depth (m)	Substrate			Number of Mean Functioning LWD	Cover Type		Off-Channel Habitat	Riparian Vegetation	
										Dominant	Sub-Dominant	Spawning Gravels		Dominant	Sub-Dominant		Type	Structure
1		**100**	**286.58**	**1,409.1**														
	Riffle	36	101.75	0.0	2.3	6.7	4.2	0.09	–	G	C, S	L, H	5	UC, LWD	OV, LWD, UC	–	SH, C, M	SHR, M, YF
	Pool	16	45.33	383.8	<1	8.5	5.4	0.62	0.75	S,G	G, S	H, L, N	7	LWD, OV, DP	DP, UC, LWD	–	SH, C	SHR, M
	Glide	49	139.5	1,025.3	<1	7.4	2.5	0.27	–	G, S	S,G	L, H	1	SWD	UC	–	SH, C	SHR, M
2		**100**	**249**	**1,840.2**														
	Riffle	52	129	970.7	1.5	7.5	2.9	0.11	–	C	G	L	4	LWD, B, OV	OV, B	SC, none	SH, M, C	SHR, YF, M
	Pool	14	35	269.5	<1	7.7	4.8	0.43	0.58	C	G	L	6	LWD, DP	OV, LWD, B	–	SH	SHR, YF, M
	Glide	28	70	483.0	1.0	6.9	2.9	0.19	–	C	G	L	4	OV	LWD	–	SH	SHR
	Other	6	15	117.0	1.0	7.8	4.6	0.12	–	C	G	L	16	LWD	OV	–	C	M
3		**100**	**120**	**422.4**														
	Pool	100	120	422.4	<0.5	3.5	8.5	0.70	1.20	G	S	N	1	DP	UC, OV	–	G	SHR
4		**100**	**252**	**601.3**														
	Riffle	42	106	219.1	2.0	2.1	1.6	0.08	–	C	G, S	L	3	B, IV	OV	–	C	MF
	Pool	21	54	170.6	0.7	3.2	4.4	0.54	0.50	C, S	G, C	L, N	0	OV, IV	B, IV, OV	none, WL	C, G	MF, SHR
	Glide	37	92	211.6	0.8	2.3	5.0	0.24	–	C	G, S	L, N	0	IV	OV	none, WL	C, G	MF, SHR
5		**100**	**271**	**505.9**														
	Riffle	55	149	285.6	3.5	1.9	2.0	0.07	–	C	G	L	5	IV	OV	none, SC	C	MF
	Pool	17	46	125.4	0.2	2.7	3.0	0.46	0.56	C, G, S	G, C	L, H	2	IV, LWD, OV	OV, DP	none, SC	C, G	MF, SHR
	Glide	28	76	95.0	0.3	1.3	1.3	0.11	–	C, G	G, C	L, H	0	IV	OV	SC	C	MF
6		**100**	**265**	**4,048.2**														
	Riffle	10	27	30.5	2.0	1.1	1.1	0.08	–	C	G	L	2	IV	OV	SC, none	G, C	MF
	Pool	46	121	3,678.4	0.5	30.4	30.4	0.57	0.30	S	C	L, N	4	DP, LWD	C, IV	WL, none	G, C	SHR, MF
	Glide	44	117	339.3	0.5	4.4	4.8	0.38	–	S, C	C, G	L	0	OV, IV	C	WL, none	G, C	SHR, MF
8		**100**	**133.6**	**223.4**														
	Riffle	64	85.4	139.5	5.2	1.6	1.7	0.05	–	C	S	L, N	3	IV	OV	–	C	MF
	Glide	29	39.4	39.0	3.2	1.0	1.2	0.08	–	C, S	C	L, N	4	IV	OV, LWD	–	C	MF
	Other	7	8.8	44.9	4.0	5.1	3.7	0.09	–	S	C	N	10	LWD	IV	–	C	MF
10		**100**	**258**	**323.4**														
	Riffle	24	62	92.2	0.8	1.5	1.5	0.04	–	G	S	H	0	OV, SWD	IV, SWD	–	G, C	SHR, MF, YF
	Pool	3	7	12.2	0.5	1.8	1.8	0.26	0.29	S,G	C, B, S	N, H	0	SWD, B, OV	OV	–	G, C	SHR, YF, PS
	Glide	58	149	181.4	2.3	1.2	1.4	0.12	–	S, G, C	C, S, G	H, L, N	3	OV, LWD, IV	IV, OV	–	C, G	MF, SHR, YF
	Cascade	16	40	37.6	12.0	0.9	1.6	0.07	–	C	B	L	10	B	OV	–	C	MF
11		100	272	542.7														
	Riffle	4	11	14.4	3.5	1.3	0.8	0.08	–	C	G	L	4	IV	OV	SC	C	MF
	Glide	3	7	17.1	0.5	2.4	1.6	0.15	–	C, G	C, G	L, N	1	IV	OV	–	C	MF
	Cascade	93	254	511.1	8.6	2.0	2.1	0.09	–	C, G	C, G, S	N, L	19	IV, LWD	LWD, OV	–	C	MF

Note: Substrate: B = boulder; C = cobble; G = gravel; R = bedrock; S = fines, Spawning Gravels: H = high quality; L = low quality; N = none, Cover Type : B = boulders; C = cobbles; DP = deep pools; IV = instream vegetation; LWD = large woody debris; OV = overhanging vegetation; UC = undercut bank
Off-Channel Habitat: SC = side channel; WL = wetland, Riparian Vegetation: C = conifer; M = mixed; MF = mature forest; SH = shrub; SHR = shrubs; G = grass; YF = young forest
No. = number; m = metre; m^2 = metres squared; dash indicates no data



Plate 5.5-1: Glide Habitat, Reach 1 of Creek 705, 14 August 2013

Reach 2 of Creek 705 has predominantly riffle habitat (52%) followed by glide habitat (28%) and pool habitat (14%) (**Table 5.5-2** and **Plate 5.5-2**). "Other" habitat (6%) consists of a large woody debris jam. The predominant substrate in all habitat types is cobble, and gravel is subdominant. There is less spawning gravel than Reach 1, but they were still rated good for spawning rainbow trout. Cover is provided by large woody debris in riffles and by deep pools. Overwintering habitat for juvenile rainbow trout is provided by boulders, large woody debris, and a few deep pools. The dominant cover in glide habitat is overhanging vegetation. Rainbow trout habitat is classified as good for all life history stages including migration because there are no obstructions for fish movement upstream. The woody debris jam has created a side channel accessible to fish during most flows.



Plate 5.5-2: Upstream Glide with Riffle Section, Reach 2 of Creek 705, 15 August 2013

Reach 3 of Creek 705 has been affected by recent beaver dam activity (**Plate 5.5-3**). This has produced a long pool-glide channel that is slow and deep and makes up 100% of the habitat. Gravels are the predominant substrate with silt among the interstitial spaces resulting in poor suitability for rainbow trout spawning. Cover is mostly provided by the deep pool channel and some undercut banks with overhanging vegetation. The riparian vegetation consists of shrubs and grasses due to the open meadow caused by the flooding of the beaver dams. Rainbow trout habitat is rated good for juvenile overwintering and rearing due the presence of deep water habitat that span the entire channel. Migration is poor due to the beaver dam obstructions over 1 m in height and in some sections 10 m in length across the channel. Migration could be rated as fair should the beaver dam become passable during high flows.



Plate 5.5-3: Deep Pool-Glide Habitat in Reach 3 of Creek 705, 16 August 2013

Reach 4 of Creek 705 returns to riffle-pool-glide morphology, however there is a ~50 m long beaver dam impoundment. Habitat consists of riffle (42%), followed by glide (37%) and then pool (21%) (**Plate 5.5-4**). The predominant substrate type is cobble in the glides and riffles and silt in the pools, especially in the beaver dam impounded flow. Gravel is sub-dominant and patchy resulting in a poor rating for rainbow trout spawning habitat. Cover is provided in all habitat types by instream moss vegetation. Other dominant types of cover are boulders in riffles and overhanging vegetation in pools. Riparian vegetation is mostly mature coniferous forest with some shrubs and grasses. Habitat quality for rainbow trout is rated as good for rearing due to various types of cover. There is good overwintering habitat for juvenile rainbow trout in some pool sections and there are boulders and overhanging vegetation for cover. The only potential obstruction to fish migration is the one beaver dam that is less than 1 m tall and 1.7 m long.



Plate 5.5-4: Glide Habitat, Reach 4 of Creek 705, 21 August 2013

Reach 5 of Creek 705 is dominated by riffle habitat (55%) (**Plate 5.5-5**). Glides account for 28% of total area and pools for 17%. Cobble is the dominant substrate in the majority of habitat types. Gravel is dominant in some pool and glide habitats, but high in silt reducing the quality of spawning gravels. Cover for fish is provided by instream moss vegetation present in all habitat types. Large woody debris and overhanging vegetation also provide cover in pools. Riparian vegetation is a mix of mature coniferous forest with shrubs and grasses. Rainbow trout habitat is rated as poor for overwintering because most sections are shallow with the exception of one pool in a small meadow section. Rearing is rated as good because there is a high cover (>20%) for rainbow trout. Migration is also rated as good because there are no passage issues for fish migration.



Plate 5.5-5: Riffle in Reach 5 of Creek 705, 23 August 2013

Reach 6 of Creek 705 is the outlet of Lake 01538UEUT. Morphology of this reach changes from a glide near the outlet of the lake, to a narrow riffle that opens into a pond (**Plate 5.5-6**) that flows into a glide to the reach break. The majority of habitat is pool (46%) followed by glides (44%) and then riffles (10%). Cobble is the dominant substrate in riffles and in some sections of glides. Silt is predominant in pools and glide habitat resulting in poor spawning habitat. Cover for fish is provided by instream vegetation, large woody debris, and overhanging vegetation in riffles, pools and glides, respectively. In the riffles there is evidence of braiding among the grass vegetation. Riparian vegetation changes from shrub grassland around the pond area to mature coniferous forest around the riffles near the outlet of the lake. The only suitable habitat for overwintering juveniles would be the pond area and glide habitat because the riffles of the stream are too shallow. Rearing is rated as good for rainbow trout because there is high cover (>20%) available to fish.



Plate 5.5-6: Narrow Braided Riffle, Reach 6 of Creek 705, 23 August 2013

Reach 7 of Creek 705 is Lake 01538UEUT. AMEC (2013b) provides a description of the physical and biological characteristics of that lake. Reaches 8 to 12 are the inlet stream to Lake 01538UEUT. Those reaches were surveyed on 12 and 13 September 2013.

Reach 8 is a short section (<250 m) that falls between the lake and a pond that is Reach 9. Riffles are the predominant habitat type in Reach 8 (64%) (**Plate 5.5-7**). Glides (29%) and a log jam or "other" habitat (7%) make up the remaining fish habitat. Substrate composition is predominantly cobble in riffles and fines in glides. Cover for fish is provided by instream vegetation in riffles and glides and large woody debris in the log jam. Riparian habitat is mature coniferous forest for all of Reach 8. Rainbow trout spawning habitat was rated poor due to the lack of spawning gravels. Rearing was considered poor due to low water levels. Low water levels and the lack of deep pools also mean that there is no suitable overwintering habitat for juveniles or adults. Migration is rated fair because there are no obstructions that would prevent migration other than low water levels during the low flow season.



Plate 5.5-7: Riffle in Reach 8 of Creek 705, 12 September 2013

Reach 9 is a large pond (**Plate 5.5-8**) for which FHAP was not conducted because there was only one type of habitat. Rainbow trout habitat was rated as good for overwintering, rearing and migration, based on the presence of large woody debris, cobble-boulder substrate along the shoreline and water depth for cover. There was no rainbow trout spawning habitat due to the absence of spawning gravels. The pond is open on the south side to grassland meadow and mature coniferous forest on the north side.



Plate 5.5-8: Reach 9 of Creek 705, 13 September 2013

Glide habitat (58%) is the predominant habitat in Reach 10 (**Plate 5.5-9**), with smaller amounts of riffle (24%), cascade (16%), and pool (3%). Substrate composition is predominantly gravel in riffles and cobble in cascades. A variety of dominant substrates including silt, gravel and cobble are present in glides. Substrate composition in glides changes from silt to gravel to cobble as the reach moves away from the break with Reach 9. Both silt and gravel are the dominant substrates in pools, silt being dominant in pools closer to the Reach 9 break. Overhanging vegetation and small woody debris provides cover in riffles and pools. In some pool habitat, boulders are the dominant cover. Overhanging vegetation, large woody debris and instream vegetation are the dominant cover types in glides. Cascades have large boulders that provide the majority of cover to fish. Near the mouth of the creek to the pond in Reach 9 the riparian vegetation is herbs and shrubs with a few smaller conifers and then progresses into a mature coniferous forest.

Overwintering is rated as poor for juvenile rainbow trout because there are not very many deep pools present and high content of fine substrates. Rearing is rated fair because there is cover available in all habitat types but is not abundant in all sections. Spawning is considered poor because the gravels available are associated with abundant fines. Migration is rated as fair due to a small land barrier approximately 100 m from the start of the reach that may impede migration upstream; otherwise there is no impediment to fish migration.



Plate 5.5-9: Glide in Reach 10, Creek 705, 12 September 2013

Cascades account for 93% of the habitat in Reach 11 (**Plate 5.5-10**). Riffle habitat accounts for 4% and glide habitat account for only 3%. Cobble is the predominant substrate with some gravel as subdominant in the glide habitat. There are very few patches of suitable spawning gravels. Stream cover is provided by instream vegetation in all the habitat types with the addition of large woody debris in the cascade habitat. Riparian vegetation is mature coniferous forest. Migration for rainbow trout is considered fair because there are no impediments to migration if the gradient is not too steep (mean of 8.6%). There is no overwintering habitat for juvenile rainbow trout because there are no pools and the water level is very low. Rearing is considered fair because there are a variety of cover types in all habitat types.



Plate 5.5-10: Cascade in Reach 11, Creek 705, 13 September 2013

There is no visible channel in the majority of Reach 12. A small channel begins at the reach break to Reach 11, but it was mostly dry during the September survey. The gradient is steep (>9 %) and there is water only during spring freshet. Halfway through the reach there is evidence of a holding pond for water because evidence of a water line along the rocks (**Plate 5.5-11**). There is no suitable fish habitat in this reach.



Plate 5.5-11: Reach 12 of Creek 705

In summary, the six reaches of Creek 705 downstream of Lake 01538UEUT have the majority of good fish habitat compared to Reaches 8 to 12. There is good rearing habitat throughout the lower six reaches and there are patches of good overwintering habitat for juveniles available in all downstream reaches. Rainbow trout spawning habitat predominates in Reaches 1 and 2, but some sections still have patches of good spawning gravel. There are, however, some sections that are affected by beaver damming that may inhibit fish migration and reduce fish habitat quality. Upstream of Lake 01538UEUT in the inlet stream, with the exception of a small pond, the creek narrows and the gradient increases upstream. Available fish habitat is reduced, there is still good rearing habitat, however spawning habitat is limited to Reach 10 and small patches in Reach 11. Overwintering habitat is mostly confined to the pond in Reach 9.

5.5.2 Fish

A total of 8,605 seconds of electrofishing effort was conducted in Creek 705 and 75.72 hours of minnow trap effort in Reach 9 (**Table 5.5-3**). Rainbow trout (**Plate 5.5-12**) was the most common fish species – a total of 443 rainbow trout were caught in 7 of the 10 reaches that were surveyed. Longnose suckers (**Plate 5.5-13**) were the only fish caught in the pond of Reach 9, totalling 925 fish. Three burbot (**Plate 5.5-14**) were found in Reach 1 of Creek 705.



Plate 5.5-12: Rainbow Trout Captured by Electrofishing in Reach 2 of Creek 705, 13 August 2013



Plate 5.5-13: Longnose Sucker Captured by Minnow Trap in Reach 9 of Creek 705, 13 September 2013



Plate 5.5-14: Burbot Captured by Electrofishing in Reach 1 of Creek 705, 14 August 2013

Table 5.5-3: Effort, Catch, and CPUE of Survey of Creek 705, August and September 2013

Site ID	Reach	Gear Type	Date	Temp (ºC)	Site Length (m)	Site Width (m)	Site Area (m^2)	Effort[1]	Species	Fish Catch	CPUE[2]	Density (No./100 m^2)
FS-115	1	EF	14-Aug-13	10.7	100	3.80	380	1,924	RB	258	13.41	67.89
FS-115	1	EF	14-Aug-13	10.7	100	3.80	380	1,924	BB	3	0.16	0.63
FS-114	2	EF	13-Aug-13	12.0	100	3.50	350	1,021	RB	104	10.19	29.71
FS-116	3	EF	16-Aug-13	13.6	100	3.16	316	934	RB	5	0.54	1.58
FS-117	4	EF	21-Aug-13	7.1	100	2.10	210	568	RB	30	5.28	14.29
FS-118	5	EF	23-Aug-13	11.0	100	1.60	160	647	RB	13	2.01	8.13
FS-119	6	EF	23-Aug-13	13.3	100	3.10	310	764	RB	22	2.88	7.10
FS-120	8	EF	14-Sep-13	13.5	100	1.54	154	1,672	RB	11	0.66	7.14
FS-121	9	MT	13-Sep-13	16.8	-	-	-	75.72	LSU	925	1,222	-
FS-45	10	EF	14-Sep-13	12.7	100	1.72	172	531	NFC	0	0.00	0.00
FS-122	11	EF	14-Sep-13	7.0	100	1.97	197	544	NFC	0	0.00	0.00
Total		**EF**			**900**	**22.49**	**2,249**	**8,605**		**446**	**5.18**	**19.83**

Note: [1] Effort is measured in seconds for Electrofishing and trap-hours for minnow traps, [2] CPUE for electrofishing is in number of fish per 100 EF seconds; CPUE for minnow traps is in number of fish per 100 trap-hours.
ID = identification; CPUE- Catch-Per-Unit-Effort, EF- backpack electrofishing; MT- minnow trapping; m = metre; m^2 = square metres; No./100 m^2 = numbers per 100 square metres, RB = rainbow trout; BB = burbot; LSU = longnose sucker; NFC = no fish caught, dash indicates no data.

Densities of rainbow trout were highest in Reach 1 (67.89/100 m^2), followed by Reach 2 (29.71/100 m²). Reaches 4, 5, 6 and 8 had lower densities of rainbow trout, but greater than Reach 3 (1.58/100 m^2), which had the lowest observed density. In Reach 8 only a few juveniles were caught and no YOY's. There were no rainbow trout caught in Reach 9, 10 and 11.

Reach 1 and 2 had good habitat for spawning and rearing rainbow trout. This likely explains why they had the highest densities of juvenile rainbow trout compared to upstream reaches. Reach 3 had extensive network of beaver dams which may have reduced the ability to catch fish and likely explains the low CPUE and density of fish caught. Reach 8 had low water levels during the survey and is likely why there were few fish caught. Reach 9 had good rearing habitat for juvenile rainbow trout but only longnose suckers were caught. The lack of fish in Reaches 10 and 11 could be the result of juvenile fish that may have already migrated out towards the lake. Alternatively, the pond may be a barrier to upstream rainbow trout migration, thereby preventing the use of Reach 10 and 11.

The longest and heaviest rainbow trout was caught in Reach 3 of Creek 705, and the shortest and lightest in Reach 6 (**Table 5.5-4**).

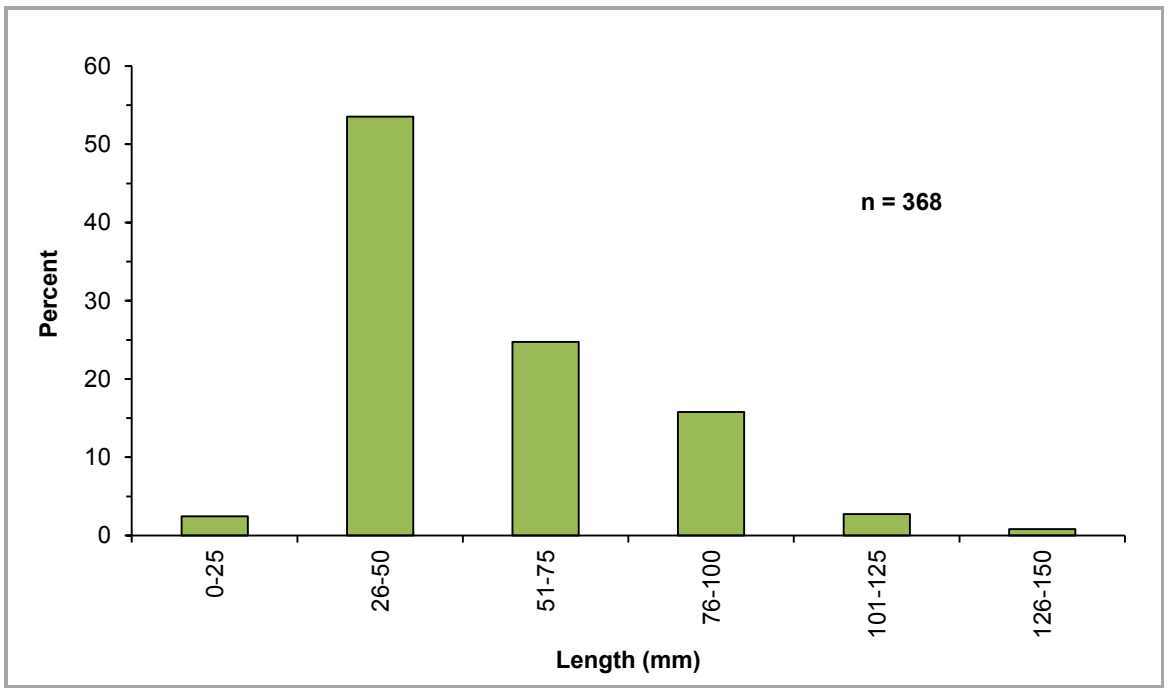
The majority of fish caught in Creek 705 were juvenile rainbow trout less than 100 mm long (**Figure 5.5-1**).

Plots of ln(weight) on ln(length) for rainbow trout showed no obvious outliers (**Figure 5.5-2**). A regression on ln(weight) on ln(length) was highly significant ($P < 0.001$) and explained 98% of the variance in ln(weight). The slope was close to 3.0, thereby validating the use of condition as an index of well-being.

Table 5.5-4: Summary of Biological Characteristics of Fish Captured in Creek 705, August and September 2013

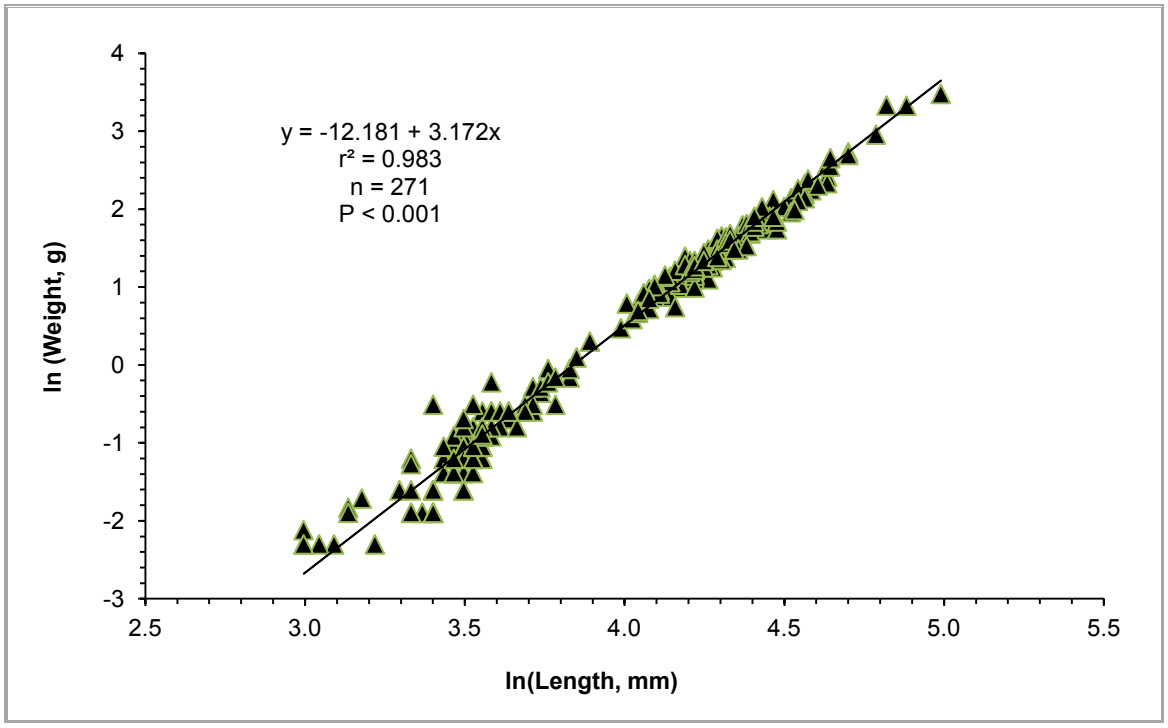
Reach	Species	Sampling Time 2013	Fork Length (mm)				Weight (g)				Condition Factor			
			n	mean	SE	Range	n	mean	SE	Range	n	mean	SE	Range
1	RB	August	183	48	2	26 - 120	88	3.5	0.3	0.2 - 15.3	88	1.04	0.01	0.62 - 1.39
1	BB	August	3	149	22	125 - 193	3	28.2	12.9	13.5 - 53.9	3	0.74	0.03	0.69 - 0.79
2	RB	August	104	59	3	29 - 147	104	3.7	0.5	0.2 - 32.4	104	0.99	0.02	0.56 - 1.30
3	RB	August	5	112	12	82 - 150	5	20.1	6.4	5.9 - 41.2	5	1.23	0.07	1.07 - 1.46
4	RB	August	30	55	3	34 - 84	30	2.3	0.3	0.3 - 7.6	30	1.12	0.04	0.76 - 1.71
5	RB	August	13	46	3	33 - 76	13	1.3	0.4	0.4 - 5.0	13	1.02	0.04	0.76 - 1.25
6	RB	August	22	33	4	20 - 82	22	0.8	0.4	0.1 - 6.3	22	1.07	0.06	0.56 - 1.50
8	RB	September	11	86	2	73 - 96	11	6.3	0.5	4.0 - 8.5	11	0.97	0.03	0.84 - 1.22
9	LSU	September	128	66	2	44 - 145	128	3.9	4.5	1.1 - 32.3	128	1.09	0.01	0.76 - 1.65
Total	**RB**		**368**	**54**	**1**	**20 - 150**	**271**	**3.6**	**0.3**	**0.1 - 32.4**	**271**	**1.01**	**0.01**	**0.56 - 1.71**

Note: mm = millimetre; g = grams; n = sample size; SE = standard error; RB = rainbow trout; BB = burbot; LSU = longnose sucker



Note: mm = millimetres; n = sample size

Figure 5.5-1: Length Frequency Distribution for Rainbow Trout, Creek 705, 2013



Note: ln = natural logarithm; g = grams; mm = millimetre; n = sample size

Figure 5.5-2: Linear Regression of Weight on Length for Rainbow Trout, Creek 705, 2013

A total of 925 longnose suckers were caught in the pond of Reach 9. They were the only fish species present in the reach. No longnose suckers were caught in any other reach. Juvenile longnose suckers tend to rear in habitats that are quiet and shallow (McPhail, 2007). YOY longnose suckers are also associated with softer substrates of seasonally flooded vegetation and swim in large schools (McPhail, 2007). This would be consistent with the habitat features of the pond in Reach 9.

The majority of longnose suckers were between 51 and 100 mm long (**Figure 5.5-3**), indicating that the pond is used mostly for rearing. Schools of fish shorter than 50 mm were seen, but they were too small to be caught in minnow traps.

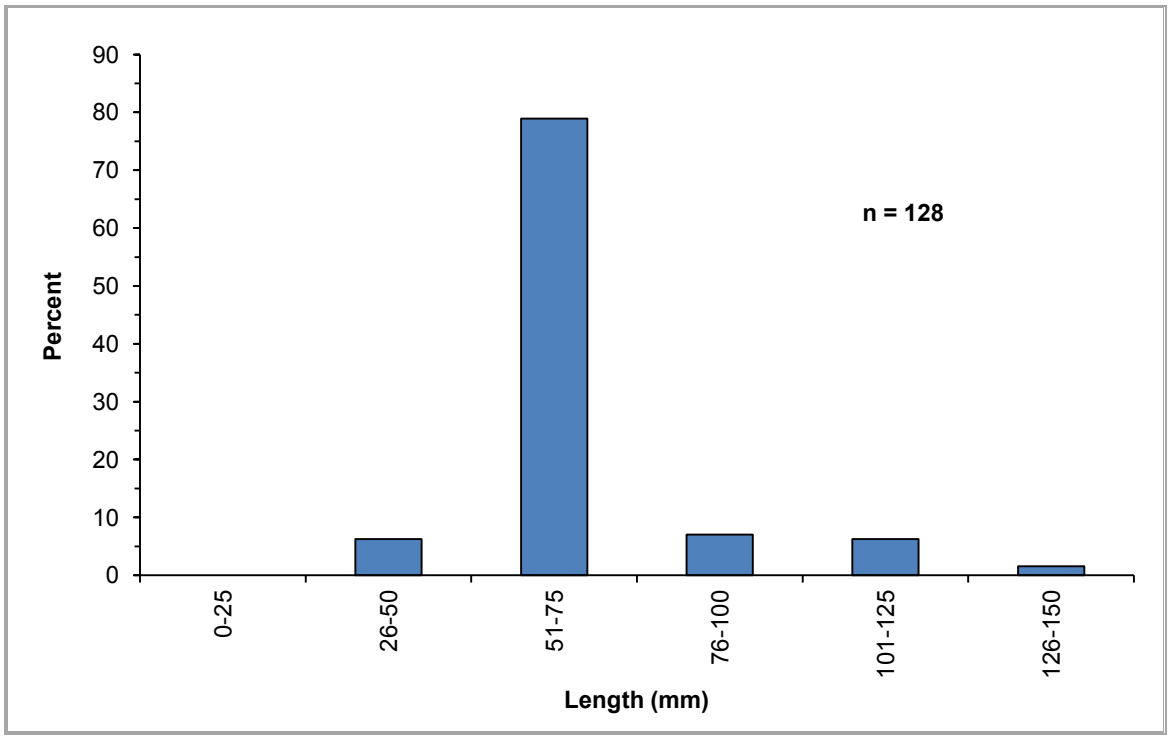


Figure 5.5-3: Length Frequency Distribution of Longnose Sucker, Creek 705, Reach 9, 2013

A plot of ln(length) on ln(weight) for longnose suckers showed no obvious outliers (**Figure 5.5-4**). A linear regression of ln(weight) on ln(length) was highly significant ($P < 0.001$) and explained 97% of the variance in ln(weight). The slope of the regression was close to 3.0 validating the use of condition as an index.

Burbot were only caught in Reach 1 of Creek 705. There were too few to justify an analysis of biological characteristics.

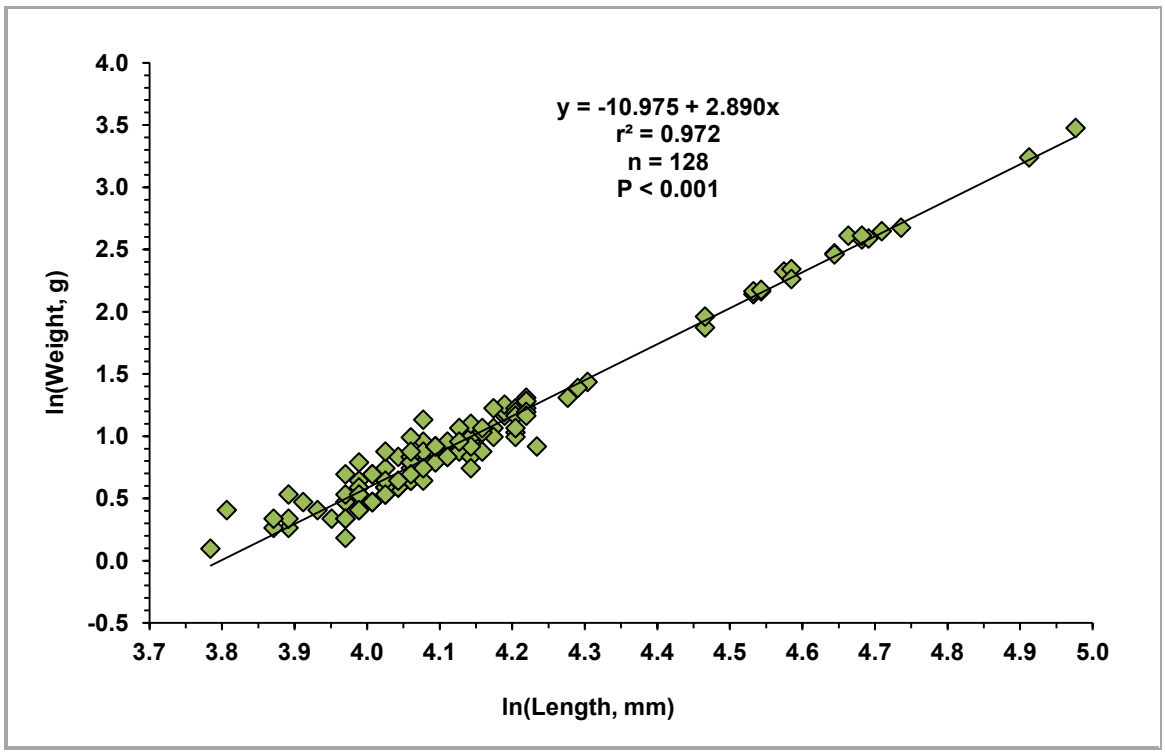


Figure 5.5-4: Linear Regression of Weight on Length for Longnose Sucker, Creek 705, Reach 9, 2013

5.6 Fish Habitat of Creek 505659

Creek 505659 is downstream from the mine site facility. It is a tributary of Creek 661. Mesohabitat of the creek is riffle or glide habitat in Reaches 1 and 3 (**Table 5.6-1**). Pools are located in Reach 2, the result of beaver damming.

Table 5.6-1: Habitat Features of Creek 505659, August 2013

Reach No.	Habitat Unit Type	Percent Composition (%)	Total Survey Length (m)	Total Area (m^2)	Mean Gradient (%)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Water Depth (m)	Mean Residual Pool Depth (m)	Substrate			Mean Functioning LWD	Cover Type		Off-Channel Habitat	Riparian Vegetation	
										Dominant	Sub-Dominant	Spawning Gravels		Dominant	Sub-Dominant		Type	Structure
1		**100**	**260**	**1,072.3**														
	Riffle	27	69	277.7	1.3	4.0	1.5	0.09	–	G	S, C, B	H, L	0	UC, IV	OV, B	–	C	MF
	Glide	67	175	748.1	1.0	4.3	1.7	0.13	–	G, S	S,G	H	3	UC, IV	OV, IV, UC	–	C	MF
	Other	6	16	46.4	1.0	2.9	2.5	0.28	–	S	G	L	5	SWD	UC	–	C	MF
2		**100**	**252**	**929.2**														
	Riffle	6	15	58.5	1.5	3.9	1.9	0.13	–	G	C, S	L, H	1	IV, OV	UC, IV	–	G/SHR, M	SHR, MF
	Pool	33	82	367.0	<1	4.5	3.5	0.56	0.50	S,G	G, S	H, L, N	0	UC, OV, DP	DP, UC, OV	none, SC	G, C	SHR, MF
	Glide	62	155	503.8	<1	3.3	2.4	0.35	–	G, S	S,G	L, H	2	OV	UC, IV	–	G	SHR
3		**100**	**248**	**1,241.7**														
	Riffle	63	155	740.1	1.8	4.8	2.4	0.19	–	G, C	S, C, G	H, L	9	SWD, OV	OV, IV, LWD, SWD	–	C	MF
	Glide	35	88	460.5	0.8	5.2	2.6	0.98	–	S,G	G, C	L	2	OV, IV	IV, OV	–	C	MF
	Other	2	5	41.0	1.5	8.2	2.2	0.59	–	S	G	L	8	LWD	OV	SC	C	MF

Note: Substrate: B = boulder; C = cobble; G = gravel; R = bedrock; S = fines
Spawning Gravels: H = high quality; L = low quality; N = none
Cover Type : B = boulders; C = cobbles; DP = deep pools; IV = instream vegetation; LWD = large woody debris; OV = overhanging vegetation
Off-Channel Habitat: SC = side channel; WL = wetland
Riparian Vegetation: C = conifer; M = mixed; MF = mature forest; SH = shrub; SHR = shrubs; G = grass
No. = number; dash indicates no data; m = metre; % = percent, m^2 = metres squared

Reach 1 of Creek 505659 is a second-order stream that drains into Creek 661. Glides (67%) are the predominant habitat type (**Plate 5.6-1**) followed by riffles (27%) and other habitat (6% - a debris jam). Gravel substrate is dominant in riffles and some glides. Silt is the predominant substrate in the debris jam and also in glides. Rainbow trout spawning habitat is high quality only in those glides with gravels and in some riffles. Cover for fish is provided by undercut banks and instream vegetation in both riffle and glide habitat, while small woody debris is dominant in the debris jams. Riparian vegetation consists of mature coniferous forest on both banks of the stream.



Plate 5.6-1: Glide Habitat in Reach 1 of Creek 505659, 15 August 2013

Reach 2 of Creek 505659 opens into a meadow with two beaver dams (**Plate 5.6-2**). Glides are the predominant habitat (62%) followed by pools (33%) and riffles (6%). Substrate in the riffle habitat is dominated by gravel. Glides have both gravel dominant habitat and silt dominant habitat (especially around the beaver dams). Pools have both silt and gravel-dominant substrates. Spawning gravels for rainbow trout can be found in patches in each habitat type, where silt content is low. Overhanging vegetation is present in all habitat types. Cover is available in riffle habitat as instream vegetation, and the beaver dams create deep pools with undercut banks. Riparian vegetation is a mix of shrubs with grasses and mature coniferous forest.



Plate 5.6-2: Looking Upstream Towards Beaver Dam, Reach 2 of Creek 505659, 15 August 2013

Riffles (63%) are the predominant habitat type in Reach 3 (**Plate 5.6-3**), with smaller amounts of glides (35%) and other habitat (2% - a log jam). The dominant substrates in this reach are gravels and cobble in riffles, silt and gravels in glides, and silt in the log jam. There are extensive areas of spawning gravels suitable for rainbow trout in some riffle habitat sections, and isolated pockets in the rest of the habitat types. Cover is provided by small woody debris and overhanging vegetation in riffles. Cover in glides is provided by overhanging vegetation and instream vegetation. Cover for rainbow trout in the log jam is large woody debris, which has also created a small off-channel that is accessible at most flows to fish. Reach 3 is located in a mature coniferous forest.



Plate 5.6-3: Riffle in Reach 3 of Creek 505659, 15 August 2013

5.7 Fish and Fish Habitat of Water Pipeline Stream Crossings

5.7.1 Fish Habitat

Nine stream crossings of the water pipeline were inventoried, and of these, eight were classified as fish-bearing streams of classes S2, S3 and S4 streams with widths of >5-20 m, 1.5-5 m, and <1.5 m, respectively (**Table 5.7-1**). The remaining stream crossing was classified as a NVC. Six of the sites cross pre-existing logging roads. Two sites (PL-1 and PL-2) are decommissioned logging roads and four sites (PL-3, PL-4, PL-6 and PL-8) have culverts that are already installed. Of the eight fish-bearing sites, seven had riffle-pool morphology and one had cascade-pool morphology. The dominant substrate material was either cobble or fines.

Table 5.7-1: Summary of Reconnaissance (1:20,000) Stream Habitat Features of Stream Crossings of Fresh Water Pipeline, August 2013

Freshwater Atlas Code	Local Name	Reach No.	Baseline Site Map ID	Sampling Date	Stream Order	Stream Classification	Stream Morphology/Habitat	Mean Gradient (%)	Mean B_fW (m)	Mean WW (m)	Mean Res. Pool (m)	Mean B_fD (m)	Bed Materials	Stream Cover (%)	Habitat Quality[1]			
															Over-Wintering	Rearing	Spawning	Migration
100-567134-610692-579340	Unnamed Tributary to Tatelkuz Lake	3	PL-1	17/08/2013	3	S3	Riffle-pool with cobble	2.80	2.10	1.30	0.38	0.85	Cobble	>20	N	P	N	P
100-567134-610692-579340-140014	Unnamed Tributary to Tatelkuz Lake	2	PL-2	17/08/2013	1	S3	Riffle-pool with cobble	1.60	1.80	0.80	0.30	0.42	Fines	>20	P	P	P	P
100-567134-610692-571602	Unnamed Tributary to Tatelkuz Lake	-	PL-3	17/08/2013	2	S2	Riffle-pool with gravel	1.80	5.20	1.10	0.37	0.90	Fines	>20	P	G	F	G
100-567134-610692-522527-314089	Unnamed Tributary to Davidson Creek	2	PL-4	18/08/2013	2	NVC	NS	NS	NS	NS	NS	NS	NS	5 - 20	NS	NS	NS	NS
100-567134-610692-522527-704454	704454	4	PL-5	21/08/2013	3	S3	Cascade-pool with cobble	7.20	3.70	2.40	0.39	0.31	Cobble	>20	P	G	P	P
100-567134-610692-571602-449278	Tributary of Tatelkuz Lake	-	PL-6	18/08/2013	1	S4	Riffle-pool with cobble	<1	0.28	0.00	0.00	0.28	Fines	5 - 20	N	N	N	N
100-567134-610692-671007-505659	585659	7	PL-7	21/08/2013	1	S4	Riffle-pool with cobble	2.80	1.10	1.20	0.20	0.26	Cobble	>20	N	P	N	N
100-567134-610692-522527-226858	Unnamed Tributary to Davidson Creek	5	PL-8	18/08/2013	1	S3	Riffle-pool	1.70	3.70	0.80	0.27	0.70	Fines	>20	N	G	P	P
100-567134-610692-671007-505659	585659	5	PL-9	21/08/2013	2	S3	Riffle-pool	2.20	1.60	1.80	0.23	0.24	Fines	5 - 20	P	G	G	P

Note: [1] Habitat Quality for rainbow trout: G = good; F = fair; P = poor; N = none; NS = not specified; No. = Number ; ID = identification; BfW = bankfull width; BfD = bankfull depth; WW = wetted width; NVC = non-visible channel; % = percent; Res. = residual; m = metre

Stream crossing PL-1 was a deactivated road crossing. The channel had low water levels with dry sections at the time of the survey (**Plate 5.7-1**). Cobble substrate is dominant with fines as the subdominant substrate resulting in a poor spawning habitat for rainbow trout. Due to the low flow, there were no suitable pools for overwintering habitat. Migration and rearing were considered poor during low flow due to poor connectivity. Riparian vegetation consisted of thick willows.



Plate 5.7-1: Downstream from Crossing PL-1, 17 August 2013

The water pipeline crossing at PL-2 is also a deactivated road crossing. The majority of the stream was dry and only one wetted width was recorded (**Plate 5.7-2**). Spawning habitat for rainbow trout was considered poor due the high silt content in riffles, fines being the dominant substrate in the survey section. Because the creek was dry, habitat suitable for overwintering, rearing and migrating were all rated as poor. Riparian habitat consisted of heavily willowed sections and downed trees over the creek that resulted in channel braiding.



Plate 5.7-2: Upstream from Stream Crossing PL-2, 17 August 2013

Rearing and migration habitat quality were both rated as good at the PL-3 crossing. There was sufficient flow during the sample survey, indicating that there is rearing habitat during the summer with good cover for juveniles. Quality of migration habitat is good for fish movement with the exception of 1 m-high beaver dam approximately 40 m upstream (**Plate 5.7-3**) that may be a barrier. Rainbow trout spawning habitat is fair because there are small patches of silt free gravels in pool tail-outs, however fines are the dominant substrate in most habitat types at this crossing.

Only overwintering was rated poor at this crossing due the lack of deep pools. This crossing had the widest mean bankfull width (5.2 m) and the deepest mean bankfull depth (0.9 m) of all the crossings. The dominant riparian vegetation was pine trees with alders and willows.



Plate 5.7-3: Beaver Dam Upstream from Stream Crossing PL-3, 17 August 2013

Stream crossing PL-4 is classified as an NVC. At the culvert crossing under the road there is water approximately 10 m upstream and downstream (**Plate 5.7-4**). Beyond a distance of 10 m there is no visible channel. As a result, there is no rainbow trout habitat for any life stages. Riparian vegetation comprises of sedges and a few pine trees.



Plate 5.7-4: Culvert at Stream Crossing PL-4, 18 August 2013

Stream crossing PL-5 is the only crossing of the fresh water pipeline route classified as a cascade-pool (**Plate 5.7-5**) because of its steep mean gradient (7.2%). Cobble substrate dominates this site with boulders as subdominant substrate, meaning there are few suitable gravel sections for rainbow trout spawning habitat. Rearing habitat for rainbow trout was considered good, there are abundant cover types provided by overhanging vegetation, small pools under falls, undercut banks, large woody debris and large boulders. Overwintering was rated as poor because the pools are small but there are boulders and undercut banks that may provide cover. The steep gradient and cascade could prevent migration during low flows, hence migration habitat quality was rated as poor. Riparian vegetation is a mature coniferous forest with some shrubs that are subdominant.



Plate 5.7-5: Cascade-Pool Habitat in Stream Crossing PL-5, 21 August 2013

Stream crossing PL-6 is situated at a road crossing with a culvert. There was no water downstream of the culvert at the time of the survey. Upstream of the culvert the channel was dry and the mean bankfull width (0.28 m) is the narrowest of all the nine stream crossings (**Plate 5.7-6**). Substrate was fines dominant with some gravel patches. Riparian vegetation consisted of alders and grasses. No discernable rainbow trout habitat was observed.



Plate 5.7-6: Dry Channel at Stream Crossing PL-6, 17 August 2013

The crossing at PL-7 is located in a mature coniferous forest with some shrubs, herbs, and mosses. The channel at this site was dry in some sections while other sections were subterranean for up to 1 m. Spawning habitat for rainbow trout was rated as none available because the substrate was cobble dominant and boulder subdominant with few good gravels sections. Rearing habitat was considered poor, there was cover for fish (i.e., boulders and large woody debris), but there was little water during the summer. Overwintering habitat was absent because there were no pools and the channel was either dry or had low water levels. Migration was rated as none due to poor connectivity because of large woody debris jams, low water flow, and sections of subterranean flow (**Plate 5.7-7**).



Plate 5.7-7: Looking Upstream at Subterranean Flows at Stream Crossing PL-7, 21 August 2013

Stream crossing PL-8 is located at a road crossing with a small perched culvert (**Plate 5.7-8**) with a cut block on either side. Salmonid habitat is rated poor for rainbow trout spawning due to a substrate dominated by fines. Downstream from crossing the water flows out of a perched culvert that could be a barrier to upstream fish migration. Rearing habitat was rated as good because there is lots of cover for juveniles from undercut banks. Overwintering habitat is absent for all life stages because there are no deep pools available. Riparian vegetation is shrub and grasses dominant with a few conifers.



Plate 5.7-8: Perched Culvert at Stream Crossing PL-8, 17 August 2013

Rearing and spawning habitat at stream crossing PL-9 was rated as good. Substrate in most habitat types is dominated by fines however patches of good silt-free gravels for rainbow trout spawning can be found. Cover for fish are undercut banks, large woody debris, boulders and some small pools (**Plate 5.7-9**). The quality of migration and overwintering habitat was rated as poor for rainbow trout. There are some small sections that flow underground that might make migration difficult. There were only a few shallow pools, boulders, and undercut banks that would provide cover for overwintering. Riparian vegetation consists of mature coniferous forest and subdominant is shrubs, herbs and grasses.



Plate 5.7-9: Riffle at Stream Crossing PL-9, 24 August 2013

5.7.2 Fish

Only six of the nine water pipeline stream crossings could be electrofished because three did not have water (**Table 5.7-2** and **Table 5.7-3**). Out of the seven sites that were electrofished, fish were only caught at two sites: PL-5 and PL-9. In PL-5 a rainbow trout (**Plate 5.7-10**) was caught in a pool below a small falls. Another fish was shocked but escaped netting; it was also a rainbow trout of similar size (~150 mm). In PL-9 only one rainbow trout was captured.

A previous electrofishing survey was conducted in Reach 7 of Creek 505659 near PL-7 on 2 August 2012. No fish were caught. Due to poor stream connectivity and no fish caught in either year of sampling, this site is assumed to be a S6 stream (i.e., non-fish bearing).

Table 5.7-2: Effort, Catch, and CPUE at Stream Crossings of Fresh Water Pipeline, August 2013

Stream	Site ID[1]	Reach	Gear Type	Date	Site Length (m)	Site Width (m)	Site Area (m^2)	Effort[2]	Species	Fish Catch	CPUE[3]	Density (No./m^2)
Unnamed	PL-1	-	EF	17-Aug-13	100	1.30	130	368	NFC	0	0.00	0.000
Unnamed	PL-3	-	EF	17-Aug-13	100	1.10	110	584	NFC	0	0.00	0.000
Creek 704454	PL-5	4	EF	23-Aug-13	100	2.40	240	489	RB	1	0.20	0.004
Creek 505659	PL-7	7	EF	21-Aug-13	100	1.20	120	136	NFC	0	0.00	0.000
Unnamed	PL-8	-	EF	18-Aug-13	100	0.80	80	667	NFC	0	0.00	0.000
Creek 505659	PL-9	5	EF	24-Aug-13	80	1.80	144	452	RB	1	0.22	0.007
Total							**824**	**2,696**		**2**	**0.001**	**0.002**

Note: [1]Sites PL-2, PL-4 and PL-6 were dry and could not be fished and are not included in the table. [2]Effort is measured in seconds for electrofishing and trap-hours for minnow traps. [3]CPUE for electrofishing is in number of fish per 100 EF seconds;
ID = identification; PL- fresh water pipeline site; EF = backpack electrofisher; m = metre; m^2 = metres squared; CPUE = Catch-Per-Unit-Effort;
NFC = no fish caught, No./m^2 = numbers per metres squared

Table 5.7-3: Summary of Biological Characteristics of Fish Captured at Stream Crossings of the Fresh Water Pipeline, August 2013

Species	Sampling Time	Fork Length (mm)				Weight (g)		Condition Factor	
	2013	n	mean	SE	Range	n	value	n	value
Rainbow trout	August	2	152.5	3.5	149 - 156	1	36.1	3.5	1.09

Note: mm = millimetres; g = grams; n = number; SE = standard error



Plate 5.7-10: Rainbow Trout at Stream Crossing PL-5, 23 August 2013

5.8 Fish and Fish Habitat at Stream Crossings of the Transmission Line, Mine Access Road, and Airstrip Access Road

Avison's report on the stream crossing survey first summarized the results of the survey conducted from June to August 2013 (**Annex 5.8-1**). The report then summarized the results of the surveys for stream crossings of the preferred alignments for the transmission line (i.e., version 9), the mine access road, and the airstrip access road. The preferred alignments included some stream crossings that had been surveyed in 2012 and some that had been surveyed in 2013.

Table 7 of **Annex 5.8-1** shows that **t**he preferred alignment for the transmission line crosses 161 streams: 143 for the transmission line proper, plus 9 for the Stellako re-route, and 9 for the Mills Ranch re-route. Of those 161 stream crossings, 101 (or 62.7%) were classified as NCD (i.e., non-classified drainage). An NCD cannot support fish. Another 3 stream crossings (or 2%) were classified as S6 or "non-fish-bearing, <3 m wide". The remaining 57 stream crossings (or 35%) were classified as fish-bearing. Of those 57 crossings, 24 (or 15% of the total number) were classified as S4 (<1.5 m wide), 23 (or 11%) were classified as S3 (1.5 to 5.0 m wide), 7 (or 4%) were classified as S2 (>5 to 20 m wide), and 3 (or 2%) were classified as S1 (>20 m wide).

Table 7 of **Annex 5.8-1** shows that **t**he preferred alignment of the mine access road crosses 109 streams: 100 crossings for the original alignment that was surveyed in 2012 plus an additional 9 crossings that were surveyed in 2013 due to a 1.5 km-long change in alignment. The distribution of stream crossings by stream class was similar to the distribution for the preferred transmission line: 64% NCD, 4% S6, 17% S4, 11% S3, and 5% S2.

Table 7 of **Annex 5.8-1** shows that the preferred alignment for the airstrip access road crosses 3 streams: 2 NCD and 1 S4.

The S1 stream crossings of the transmission line were different sites within the same reach of the Stellako River, representing two crossing options. They were too deep for fish habitat measurement, and so they are assumed to provide good habitat quality for all life stages of salmonid fish.

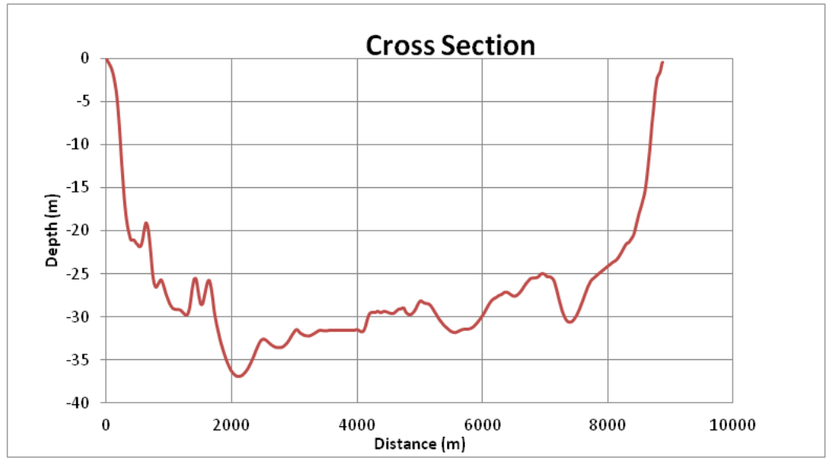
Fish habitat was generally assessed as “good” at all S2 streams, most of the S3 streams, and more than half of the S4 streams. Five of the 19 S4 streams did not receive a rating of “good” for any life history stage because these drainages contained little or no spawning gravels. They also have much fine sediment that is a result of the glacial-fluvial and glacial-lacustrine deposition typical for the region. A few were downstream of an NCD reach. Flows were shallow or intermittent and drainage hydrology may have been impacted by upstream or adjacent forest harvesting and/or cattle grazing.

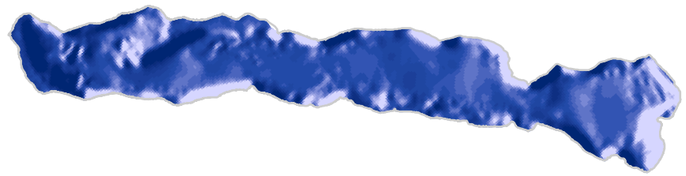
Rainbow trout was the most common fish species observed or captured during the surveys. A few brassy minnow and lake chub were observed or captured in some ponds near stream crossings.

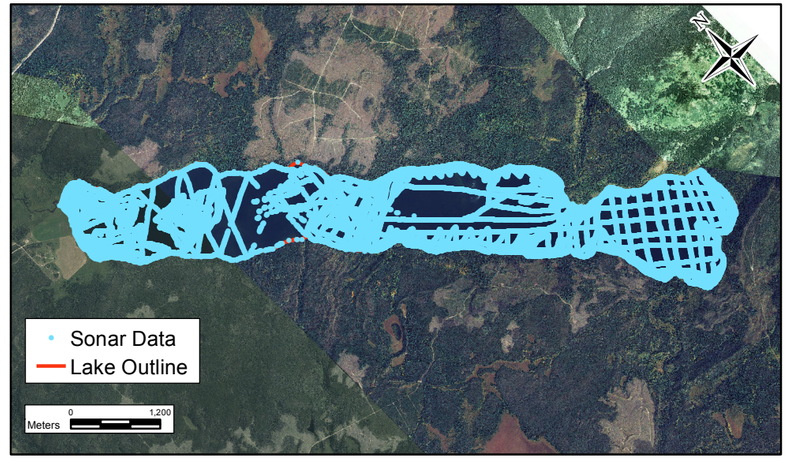
The vegetation community of the riparian zone varied depending on soil moisture and surrounding forest activity. Wetlands and recently burned or harvested areas were dominated by shrubs while mature forests contained mainly tree cover. Riparian tree species that were common to most of the sites included hybrid spruce, lodgepole pine, and balsam, while common shrubs included black twinberry, willow and alder. Nearly all mature pine was dead as a result of the mountain pine beetle infestation. This dead timber contributed to notable blowdown across stream channels, causing an impediment to potential navigation.

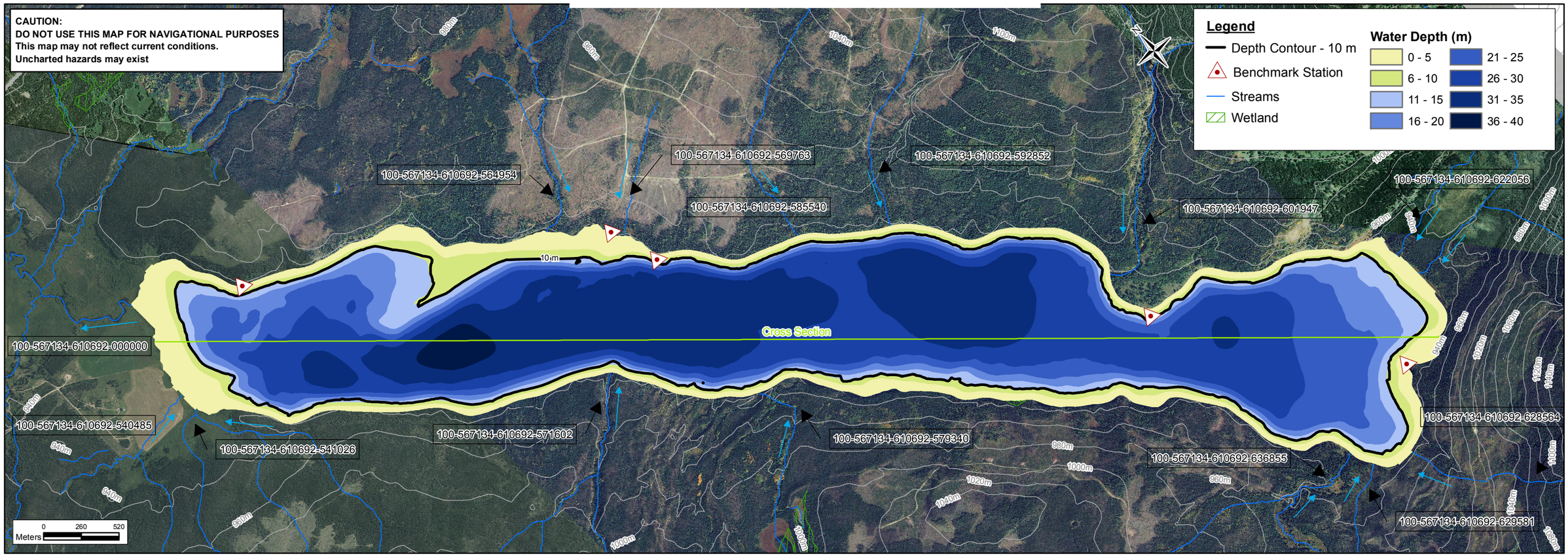
5.9 Bathymetry of Tatelkuz Lake

Over 36,000 depth soundings and edge-of-water observations were made in Tatelkuz Lake in May and June 2013. The bathymetric map created from those data shows a long, narrow, steep-sided lake with no islands (**Figure 5.9-1**).









REFERENCE:
Lake outline is digitized from Orthophoto and is not based on TRIM base data.

NOTES:
1 - Depths are in meters
2. Not intended for navigational use
3. Uncharted rocks shoals may exist

SURVEYED BY:	KM
SURVEYED DATE:	May 23-25 and June 7-9, 2013
FWA CODE:	100-567134-610692-000000
ORTHOPHOTO:	2011/ 2012
N.T.S:	093F/07

Statistics at Time of Survey

ELEVATION:	927.6 m	MEAN DEPTH:	21.4 m
SURFACE AREA:	9,100,000 sq.m	MAX DEPTH:	33.7 m
AREA ABOVE 6M CONTOUR:	1,010,000 sq. m	PERIMETER, MAIN SHORE:	25,000 m
VOLUME:	195,000,000 cu. m	PERIMETER, ISLANDS:	n/a
ABOVE WATER LEVEL:	0 m	BENCHMARK UTM:	383919 E, 5909388 N

CLIENT
newgold

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amec

ANALYST:	KA
QA:	MY
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:27,000

PROJECT
Blackwater Gold Project

TITLE
Tatelkuz Lake – Bathymetry Map

REV. NO:	A
DATE:	October, 2013
PROJECT NO:	VE52277
FIGURE NO:	5.9-1

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Four deep basins are distributed equidistantly along the length of the lake. The littoral zone is narrow along most of the shoreline with the exception of four shallow beaches located at the north and south ends of the lake, on the northeast shore, and along the southwest shore. The general features of the 2013 bathymetric map are consistent with those of the 1977 bathymetric map (Walsh and Hale, 1977).

The contours of the bathymetric map for Tatelkuz Lake were estimated to be at least as accurate as the sum of the accuracy of the RTK GPS and the echosounder. Vertical accuracy of the RTK-reported elevations is generally ±4 cm or better, relative to the base station control point. The vertical accuracy of the echosounder is approximately ±3 cm and varies with pitch and roll of the instrument, and with density and composition of the bed surface. The sum of those two accuracies is ±0.07 m, which for practical purposes was rounded up to ±0.1 m. This was ten times more accurate than the 1977 Tatelkuz bathymetric map.

Mean water surface elevation was 927.6 masl during the May survey and 927.77 masl during the June survey. The bathymetric map was prepared using a mean elevation of 927.6 masl. Surface area at that elevation is 9,100,000 m^2 or 910 ha. The littoral zone makes up 11.1% of total area or 1,010,000 m^2 (101 ha), and profundal area makes up the remaining 88.9%. Lake volume is 195,000,000 m^3, perimeter is 25,000 m, and maximum depth is 33.7 m. Therefore, mean depth is 21.4 m, relative depth is 1.0%, and the index of shoreline development is 2.3.

5.10 Littoral Fish Habitat of Tatelkuz Lake

5.10.1 Littoral Zone Area and Depth

The littoral zone of Tatelkuz Lake along the eastern and western shorelines is narrow (<25 m) and steep (>10%) and comprised of large substrates (i.e., cobble and boulders) (**Plate 5.10-1**). Sand/silt/gravel beaches are located at the northwest and southeast ends (**Plate 5.10-2**) where the littoral zone is wide (>150 m) and has a gradual gradient (<3%).

Low gradient, sand/silt/gravel beach areas at the northwest and southeast ends of the lake comprise approximately 36% of the total littoral area despite comprising only 23% of the total shoreline length (22.1 km). In comparison, steeper, rockier areas along the east and west shorelines comprise 67% of the total shoreline length, but only 48% of the total littoral area.

Figure 5.10-1 shows an overview of habitat in the littoral zone of Tatelkuz Lake. **Annex 5.10-1** shows smaller-scale maps showing more detail of the littoral habitat and distribution of submergent and emergent vegetation around the lake.



Plate 5.10-1: Typical Cobble-Boulder Habitat along the Eastern Shoreline of Tatelkuz Lake, July 2013



Plate 5.10-2: Gravel/fines Habitat in Southeast End of Tatelkuz Lake, July 2013

5908000 388000 390000 5906000 392000 5904000

386000 5906000 5902000 392000 5900000 390000 388000 5902000 386000 5904000 384000

N

Tatelkuz Lake

Scale: 1:23,000

0 0.5 1 2

Kilometres

Substrates : Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Source: Shoreline Habitat Classification conducted July 2013.

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

CLIENT

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amec

ANALYST: WR

QA: MY

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:23,000

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO: 5.10-1

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5.10.2 Littoral Zone Habitat Classes

In general, substrates in Tatelkuz Lake change from coarse to fine with increasing depth and distance from shore. This is particularly true along the longer and steeper east and west shorelines. This is due to the combined effects of ice scour and frost-heaving in winter and wave action in summer and fall. Frost-heaving causes the larger substrates to be sorted from largest on top to smallest on bottom while ice scour pushes the larger substrates up the shoreline. Wave action continues this gradation during the open-water season. This phenomenon is not nearly as prominent in the northwest and southeast ends of the lake. They are relatively homogenous gravel/silt/sand beaches that generally extend from the high water mark out to at least the 3 m depth contour.

A total of 11 unique littoral habitat classes exist in Tatelkuz Lake (**Table 5.10-1**). These include: Gravel-fines substrate classes with and without emergent and submergent vegetation; Fines-gravel substrate classes with and without emergent and submergent vegetation; and cobble-boulder substrate classes with and without submergent vegetation. Gravel-cobble, Cobble-gravel, and Boulder-cobble substrate classes also exist in the lake, but never with aquatic vegetation. **Annex 5.10-2** shows photographs of these unique littoral habitat classes.

Three habitat classes dominate the littoral zone of Tatelkuz Lake (**Table 5.10-1**). In order of relative abundance, these are: fines-gravel substrates with no vegetation (36% of total littoral area <4 m deep), cobble-gravel substrates with no vegetation (31%) and gravel-fines with no vegetation (14%). Together, these three littoral habitat classes comprised 81% of the littoral habitat in Tatelkuz Lake.

Cobble-gravel substrate with no vegetation are the most abundant littoral habitat class in the 0 to 0.5 m depth stratum of Tatelkuz Lake, comprising 43% of this depth stratum's total area (136,982 m^2). These larger substrates are almost exclusively found along the steep, eastern and western shorelines (**Figure 5.10-1**).

Fines-gravel substrates with no vegetation comprise 15% of the 0 to 0.5 m depth stratum and 31% of the 0.5 to 1.0 m depth strata. When areas with emergent and submergent vegetation are included, littoral areas with fines-gravel substrates comprise 16% of the 0 to 0.5 depth stratum and 52% of the 0.5 to 1.0 m depth stratum. The majority of these finer, shallower substrate littoral classes are found in the northwest and southeast ends of the lake.

Cobble-gravel substrates with no vegetation (37%), fines-gravel substrates with no vegetation (35%), and gravel-fines substrates with no vegetation (14%) comprise the majority of littoral habitat in the 1.0 to 2.0 depth stratum. Combined, fines-gravel substrates with emergent and submergent vegetation comprise 13% of this depth stratum. This habitat is largely found in the deeper, offshore areas where macrophyte beds grow in the northwest end of the lake.

Table 5.10-1: Relative Abundance and Spatial Area of Littoral Habitat Classes in Tatelkuz Lake

Habitat Code	Description	Spatial Area by Depth Strata (m^2)				Total Area (m^2)	% of Total Littoral Area
		0.0 to 0.5 m	0.5 to 1.0 m	1.0 to 2.0 m	2.0 to 4.0 m		
Gf-NV	Gravel-fines-no vegetation	12,689	5,650	30,114	70,227	118,680	14.1
Gc-NV	Gravel-cobble-no vegetation	12,731	33,430	2,602	1	48,764	5.8
Cg-NV	Cobble-gravel-no vegetation	58,270	23,683	80,491	98,686	261,131	31.0
Cb-NV	Cobble-boulder-no vegetation	15,439	37	38	4	15,518	1.8
Bc-NV	Boulder-cobble-no vegetation	7,893	0	0	0	7,893	0.9
Fg-NV	Fines-gravel-no vegetation	20,478	44,009	76,232	158,454	299,173	35.5
Gf-EV	Gravel-fines-emergent vegetation	6,647	224	26	750	7,647	0.9
Fg-EV	Fines-gravel-emergent vegetation	502	28,590	15,821	14,031	58,942	7.0
Gf-SV	Gravel-fines-submergent vegetation	785	6,035	2,054	57	8,931	1.1
Fg-SV	Fines-gravel-submergent vegetation	855	2,066	11,860	0	14,781	1.8
Cb-SV	Cobble-boulder-submergent vegetation	693	0	0	0	693	<0.1
Total Area (m^2)		**136,982**	**143,724**	**219,238**	**342,210**	**842,154**	
% of Total Littoral Area		**16.3**	**17.1**	**26.0**	**40.6**		**100.0**

Note: Gf-gravel dominant/fines subdominant; Gc-Gravel dominant/cobble subdominant; Cg-Cobble dominant/gravel subdominant; Cb-Cobble dominant/boulder subdominant; Bc-Boulder dominant/cobble subdominant; Fg-Fines dominant/gravel subdominant; NV-no vegetation; EV-emergent vegetation; SV-submergent vegetation

Fines-gravel substrates with no vegetation comprise the majority (46%) of the littoral habitat classes within the 2.0 m to 4.0 depth stratum. Cobble-gravel substrates with no vegetation (29%) and gravel-fines substrates with no vegetation (21%) were the next most abundant littoral habitat classes in this depth stratum.

Substrate classes with emergent or submergent vegetation comprise only about 10% of the littoral area < 4m deep of the lake (**Table 5.10-1**). Most emergent and submergent vegetation was associated with fines-gravel substrates (81%) or gravel-fines substrates (18%) located at the northwest and southeast ends of the lake (**Table 5.10-1** and **Figure 5.10-1**). These include beds of emergent *Potamogeton* sp. (i.e., northern pondweed) and *Sparganium* sp. (i.e., floating burr-weed), which grow in water from approximately 0.5 m to 3.0 m deep (**Plate 5.10-3**). Substrates with emergent or submergent vegetation represented only 4% of the total littoral area within the 2.0 to 4.0 m depth contour. These data support the field observations that aquatic plants generally do not grow at water depths >3 m in Tatelkuz Lake.

Beds of submergent *Elodea* sp. (i.e., water-weed) are also present in the northwest end of the lake, primarily around the entrance to Chedakuz Creek (**Figure 5.10-1** and **Plate 5.10-4**). Beds of emergent vegetation in the south-eastern end of the lake are smaller, do not extend as deep, and are more isolated than in the north-western end of the lake. A unique bed of *Elodea* sp. is present in the southeast end of the lake, growing within the finer sediments of a cobble-boulder dominated bay. There are no aquatic plants along the steeper, rockier east and west shorelines of Tatelkuz Lake (**Plate 5.10-5**).

A unique, but regularly occurring, feature of the Tatelkuz Lake littoral zone is the presence of gravel-fines substrates on the small peninsulas that frequently extend out into the lake along the east and west shorelines (**Plate 5.10-6**). These peninsulas are typically steep (>20%) and exposed to north and south winds. Gravel-fine substrates dominates these peninsulas from the water's edge down to the 4 m depth contour and are one of the possible spawning locations for lake-spawning salmonids (e.g., mountain whitefish and kokanee) in the lake.



Plate 5.10-3: Emergent Weed Bed in Northwestern End of Tatelkuz Lake, July 2013



Plate 5.10-4: Submergent Weeds near Chedakuz Creek in Northwestern End of Tatelkuz Lake, July 2013



Plate 5.10-5: Cobble/gravel Shoreline along Eastern Shore of Tatelkuz Lake, July 2013



Plate 5.10-6: Gravel-Fine Substrates at Typical Exposed Peninsulas, July 2013

5.11 Limnology of Tatelkuz Lake

5.11.1 Physical Limnology

5.11.1.1 Vertical profiles

Vertical profiles of temperature and DO concentration taken in Tatelkuz Lake in 2013 show that the lake was fully mixed as of 28 January 2013, but had developed thermal stratification by 8 July 2013 and maintained it to at least 7 October 2013 (**Annex 5.11-1**; **Table 5.11-1** and **Figure 5.11-1**).

On 28 January 2013, the lake had narrow ranges of temperature (1.2 to 3.4°C) and DO (6.5 to 8.9 mg/L) throughout the water column (**Figure 5.11-1**).

Table 5.11-1: Physical Limnology Parameters Measured in Tatelkuz Lake, 2013

Date	Temp. Range (°C)	DO Range (mg/L)	Specific Conductivity Range (µS/cm)	pH Range	Secchi Depth (m)	1% Euphotic Depth ($Z_{1\%}$, m)	Thermo Cline Depth (m)
28 Jan	1.2 – 3.4	0.1 – 8.9	-	-	-	-	N/A
8 Jul	4.8 – 18.8	0.7 – 9.0	-	-	-	-	2.0 – 11.0
17 Jul	4.8 – 17.2	6.5 – 9.0	139 – 152	6.9 – 8.0	3.75	10.1	3.0 – 12.0
23 Jul	5.1 – 19.0	0.3 – 9.4	138 – 162	7.0 – 8.2	3.75	10.1	4.0 – 9.0
15 Aug	5.2 – 20.7	4.5 – 9.1	150 – 212	7.3 – 8.8	3.70	10.0	3.5 – 13.0
16 Aug	5.1 – 20.4	4.0 – 9.2	150 – 209	7.4 – 8.9	3.70	10.0	3.0 – 14.5
7 Oct	5.5 – 10.7	1.6 – 12.3	-	-	-	-	8.0 – 13.0

Note: °C = degrees Celsius; DO = dissolved oxygen; µS/cm = microSiemens per centimetre; m = metre; mg/L = milligram per litre; '-' = not sampled/calculated; % = percent; N/A = not applicable. Thermocline not present during winter.

By 8 July 2013, Tatelkuz Lake started to develop a thermocline as the water in the upper 10 m increased in temperature to a maximum of 18.8°C. DO concentrations remained between 6.6 and 8.9 mg/L – similar to the range observed on 28 January 2013. A distinct epilimnion or upper layer continued to develop further by 17 July 2013. This was accompanied by a reduction in DO concentrations in the 5 and 9 m deep layer due to a reduction in oxygen diffusion across the thermocline.

By 15 August 2013, thermal stratification reached its greatest extent with a distinct epilimnion in the upper 3 m, a thermocline from 3 to 13 m deep, and a hypolimnion below 13 m. Water temperature changed from 20°C at the surface to 6.4°C within the 10 m deep thermocline. The highest DO concentrations were in the upper 4 m due to diffusion across the air-water interface, and DO concentrations were lower within the thermocline.

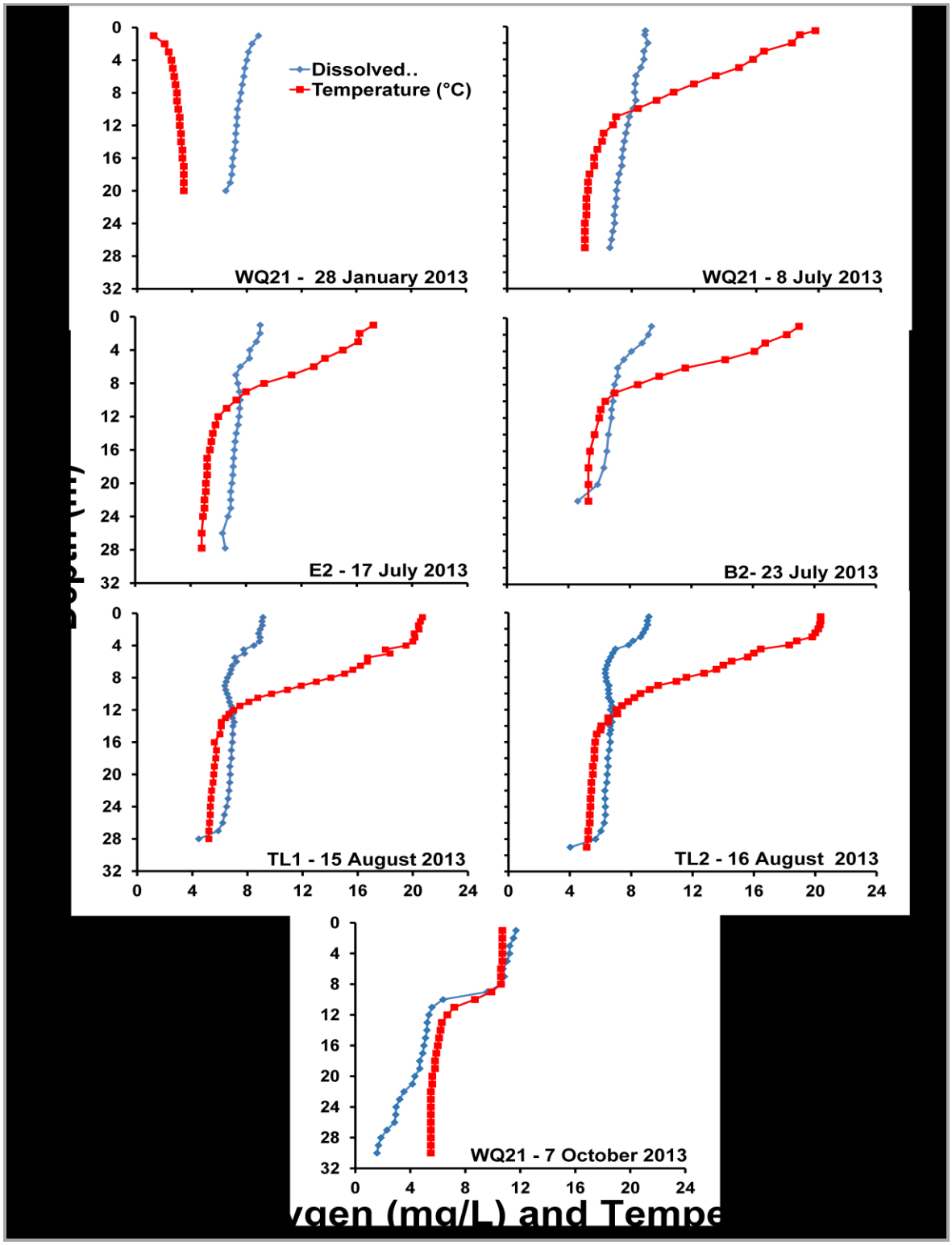


Figure 5.11-1: Vertical Profiles of Temperature and DO Concentrations, Tatelkuz Lake, 2013

By 7 October 2013, temperatures had fallen throughout the water column. Temperatures within the epilimnion ranged from 10.6°C to 10.7°C, and the depth of the epilimnion had increased to 8 m. DO concentrations closely mimicked the thermal stratification of the lake.

Vertical profiles taken at northern and southern sites in both July and August showed few differences, indicating strong horizontal mixing.

5.11.1.2 Secchi Depths

Secchi depths in Tatelkuz Lake ranged from 3.70 to 3.75 m in July and August 2013, showing little differences between the northern and southern halves of the lake (**Table 5.11-1**). The maximum depth for photosynthetic production (i.e., $Z_{1\%}$) ranged from 10.0 to 10.1 m. Since mean depth of the lake is 21.4 m, photosynthesis only occurred in the upper half of the lake.

5.11.1.3 Comparisons among Lakes

The physical limnology of Tatelkuz Lake differs from that of the three headwater lakes due to differences in size, shape, elevation, volume of inflows, and position within the hydrological system (**Table 5.11-2**).

Table 5.11-2: Bathymetry of Tatelkuz Lake and Headwater Lakes of the Blackwater LSA

Lake	Elevation (m)	Surface Area (m^2)	Volume (m^3)	Maximum Depth (m)	Mean Depth (m)	Surface-Volume Ratio (m^{-1})	Perimeter (m)
01682LNRS	1,345	91,881	509,173	16.3	5.5	0.18	1,667
01538UEUT	1,346	357,375	1,946,905	11.2	5.5	0.18	4,304
01428UEUT	1,354	169,304	522,815	7.6	3.1	0.32	2,508
Tatelkuz	928	9,100,000	196,000,000	33.7	21.4	0.05	25,000

Tatelkuz Lake is much bigger and deeper than the three headwater lakes. For example, maximum depth of Tatelkuz Lake (33.7 m) is twice the maximum depth of Lake 01682LNRS (16.3 m), three times the maximum depth of Lake 01538UEUT (11.2 m), and over four times the maximum depth of Lake 01428UEUT (7.6 m). Tatelkuz Lake is deep enough to stratify in summer, but only Lake 01682LNRS is deep enough to stratify (**Figure 5.11-2**). The other two headwater lakes are well mixed throughout summer. Stratification meant that bottom temperatures of Tatelkuz Lake in 2013 were similar to those of Lake 01682LNRS in 2012, but lower than those of the other two headwater lakes.

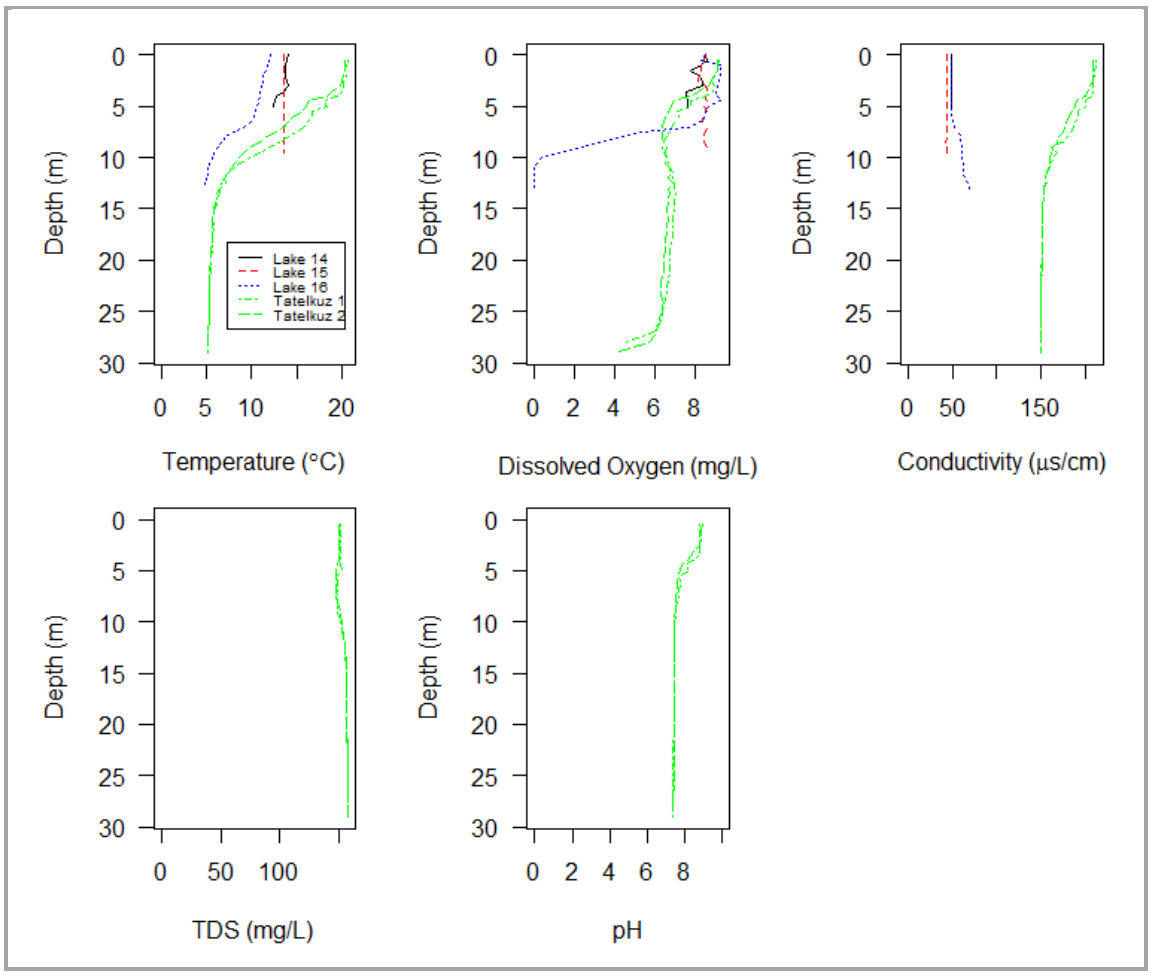


Figure 5.11-2: ***Mid-Summer Vertical Profiles of Temperature, Dissolved Oxygen, Specific Conductivity (upper panels), Total Dissolved Solids, and pH (lower panels) of Tatelkuz Lake and Three Headwater Lakes***

Tatelkuz Lake is a narrow, elliptical, steep-sided lake, but the three headwater lakes are shallow, lens-shaped lakes. This is best shown by the ratio of surface area to volume (**Table 5.11-2**). The surface-volume ratio of Tatelkuz Lake (0.04 m^{-1}) is one-third that of lakes 01682LNRS and 01538UEUT (0.18 m^{-1}) and one-sixth that of Lake 01428UEUT (0.32 m^{-1}).

All other factors were equal, this would suggest that DO concentrations in Tatelkuz Lake, particularly those below the thermocline, would be lower than those in the three headwater lakes due to reduced rate of oxygen diffusion across the air-water interface. However, the opposite is true – DO concentrations in Tatelkuz Lake never fall below 4 mg/L, but those in Lake 01682LNRS fall to zero during summer (**Figure 5.11-2**). The reason is that the inflow of water from the 14 tributaries, particularly middle Chedakuz Creek, replenishes DO fast enough to compensate for the lower rate of oxygen diffusion from the atmosphere.

The greater inflow per unit volume into Tatelkuz Lake compared to the headwater lakes, and the position of Tatelkuz Lake as a valley bottom lake, has produced one of the most striking differences between Tatelkuz Lake and the three headwater lakes – the much higher conductivity in Tatelkuz Lake (**Figure 5.11-2**). In 2013, conductivity ranged from 93 to 212 µS/cm in Tatelkuz Lake, which was three to five times higher than the ranges measured in the headwater lakes in August and September 2012 (34-43 µS/cm for Lake 01538UEUT, 32-48 for Lake 01428UEUT, and 42-69 µS/cm for Lake 01682LNRS). The reason is that the three headwater lakes are at the head of watersheds and receive relatively little inflows, while Tatelkuz Lake receives inflows from many upstream watersheds.

Higher conductivity typically implies higher rates of biological production. This was partially confirmed by Secchi depth, which was slightly deeper in Tatelkuz Lake (3.7 m) than in Lake 01428UEUT (3.0 m), but it was exceeded by both lakes 01538UEUT (5.7 m) and 01682LNRS (5.7 m).

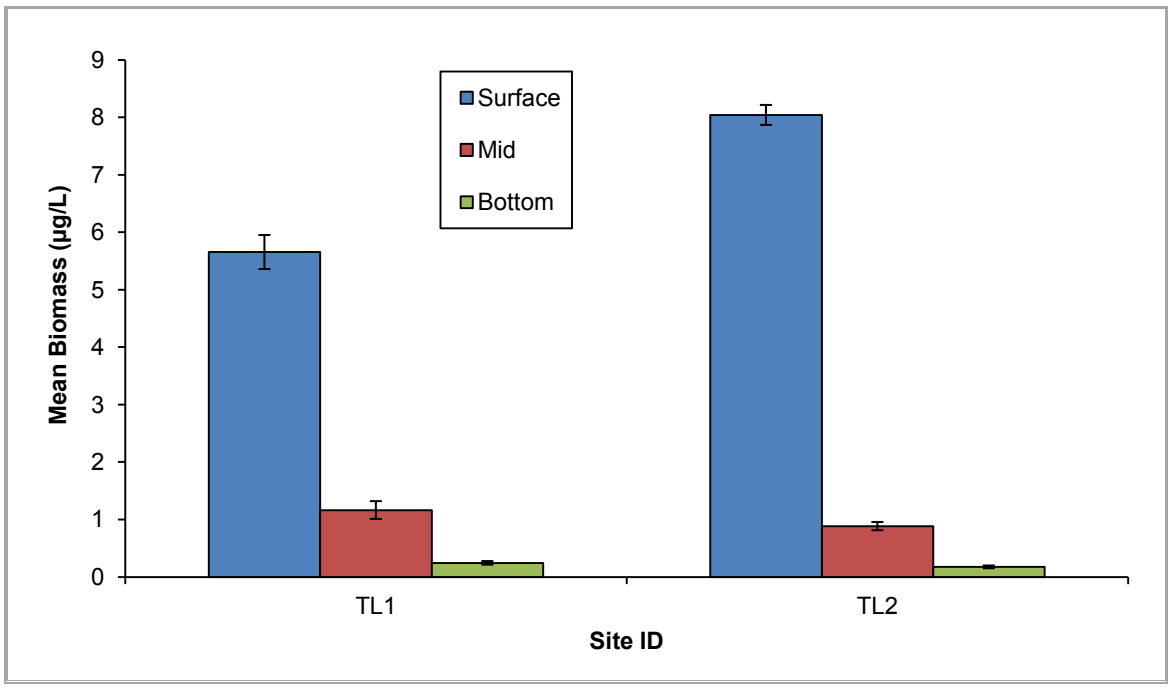
Summer surface temperatures of Tatelkuz Lake were notably warmer than all three headwater lakes (**Figure 5.11-2**). This was due mainly to the lower elevation of Tatelkuz Lake (928 m) compared to the three headwater lakes (1,345 to 1,354 m). This phenomenon was first observed in streams of the LSA during 2011, 2012 and 2013 – water temperatures during all seasons decrease with increasing elevation (AMEC, 2013b).

5.11.2 Phytoplankton Community

Annex 5.11-2 shows phytoplankton biomass (i.e., chlorophyll *a* concentrations) at each depth and sampling site, and **Annex 5.11-3** shows the taxonomic composition of phytoplankton samples at each depth and sampling site.

5.11.2.1 Biomass

Mean phytoplankton biomass was highest in the epilimnion of Tatelkuz Lake (i.e., at a depth of 1 m) where light intensity was greatest, and decreased with increasing depth (**Table 5.11-3**). Mean biomass was several times lower just below the thermocline at mid-depths of 13 and 15 m, and several times lower again at a bottom depth of 27 m. Mean phytoplankton biomasses-at-depth were similar at both sampling sites within Tatelkuz Lake, supporting the idea of strong horizontal mixing of phytoplankton within the lake.

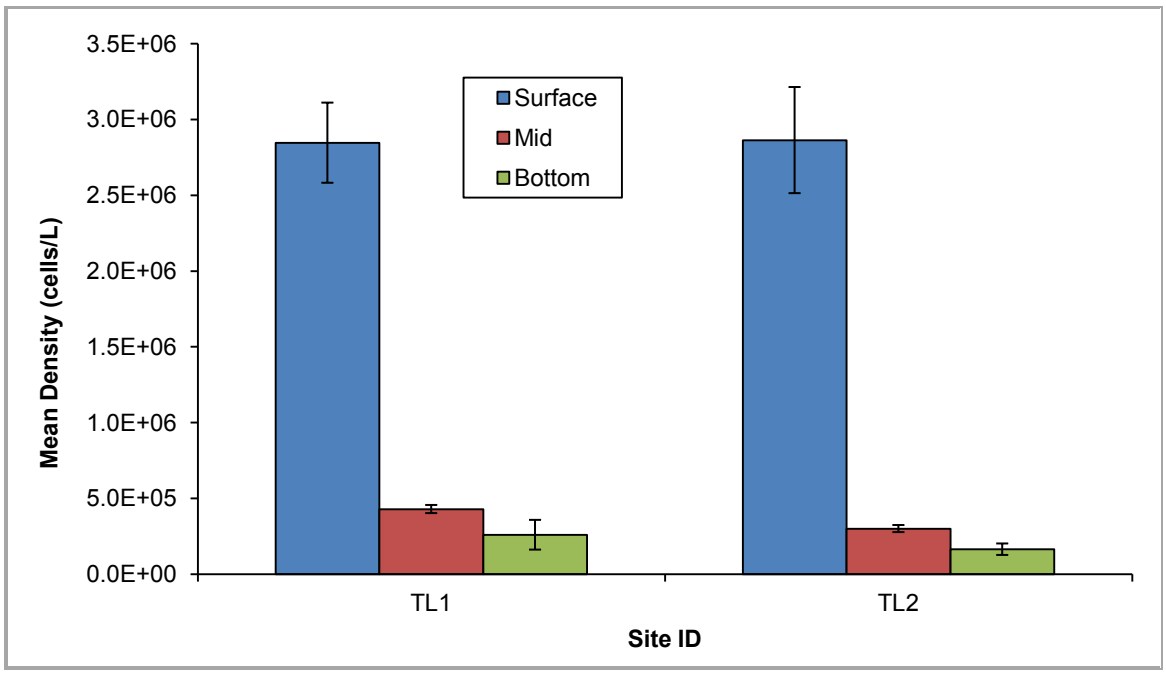


Note: Mid = sample taken at bottom of thermocline; µg/L = microgram per litre; ID = identification; error bars are SE of the mean

Figure 5.11-3: Phytoplankton Biomass, Tatelkuz Lake, August 2013

5.11.2.2 Total Density

The mean density of phytoplankton (expressed as cells/L) showed a similar pattern with site and depth as phytoplankton biomass (**Annex 5.11-3** and **Figure 5.11-4**).



Note: Mid = sample taken at bottom of thermocline; L = litres; ID = identification; error bars are SE of the mean

Figure 5.11-4: Phytoplankton Density, Tatelkuz Lake, August 2013

5.11.2.3 Taxonomic Composition and Diversity

A total of 114 taxa were present in the phytoplankton samples (**Annex 5.11-3**). Green algae (Chlorophyceae) was the most diverse group (51 taxa), followed by blue-green algae (Cyanophyceae; 25 taxa) and the diatoms (21 taxa).

Chrysophytes (i.e., golden algae and diatoms) were the predominant major taxa throughout the water column at both sample sites (**Table 5.11-3**). However, cyanobacteria (i.e., blue-green algae) were slightly more abundant in the surface waters at site TL2 (31.3%) than chrysophytes (30.9%). *Cyclotella bodanica* was typically the most abundant species of algae within all samples below the thermocline at both sample sites (**Annex 5.11-3**). *Rhodomonas minuta* was the most abundant species within the epilimnion.

Chlorophyta (i.e., green algae) is a preferred food for zooplankton, but only represented up to 19.2% of total community density. Grazing by zooplankton may have contributed to its relatively low abundance. Cyanobacteria were abundant at both sites. Dinoflagellates and Euglenoids were uncommon to absent (**Table 5.11-3**).

Table 5.11-3: Mean Density and Relative Abundance of Major Phytoplankton Taxa, Tatelkuz Lake, 2013

Taxa	TL1[1]						TL2[2]					
	Surface		Mid		Bottom		Surface		Mid		Bottom	
	(cells/L)	(%)	(cells/L)	(%)	(cells/L)	(%)	(cells/L)	(%)	(cells/L)	(%)	(cells/L)	(%)
Chlorophyta	549,879	13.8	63,689	19.2	10,939	4.1	434,654	11.2	60,383	18.0	34,518	16.5
Chrysophyta[3]	1,318,564	33.0	210,032	42.6	238,913	90.4	1,203,334	30.9	169,194	50.4	115,906	55.5
Cryptophyta	1,147,912	28.7	63,689	12.9	4,521	1.7	1,031,225	26.5	35,296	10.5	44,535	21.3
Cyanobacteria	972,878	24.4	121,548	24.7	7,876	3.0	1,217,922	31.3	68,990	20.5	12,640	6.1
Dinoflagellates	2,042	0.1	1,945	0.4	0.0	0.0	3,208	0.1	1,896	0.6	1,167	0.6
Euglenophyta	2,917	0.1	972	0.2	1,896	0.7	4,375	0.1	0	0.0	0	0.0

Note: [1] surface samples taken from 1 m depth; mid samples taken from 13 m depth; bottom samples taken from 27 m depth
[2] surface samples taken from 1 m depth; mid samples taken from 15 m depth; bottom samples taken from 27 m depth
[3] including diatoms

Mean genus richness (S) of phytoplankton was highest in the epilimnion and decreased with increasing depth (**Table 5.11-4**). The same pattern was observed at both sampling sites. Diversity (H') at TL1 followed the same trend with depth as genus richness. However, at TL2 H' was relatively uniform throughout the water column. Phytoplankton evenness (J) showed the opposite pattern with depth as S and H'.

Table 5.11-4: Mean Diversity and Evenness of Phytoplankton Communities, Tatelkuz Lake, 2013

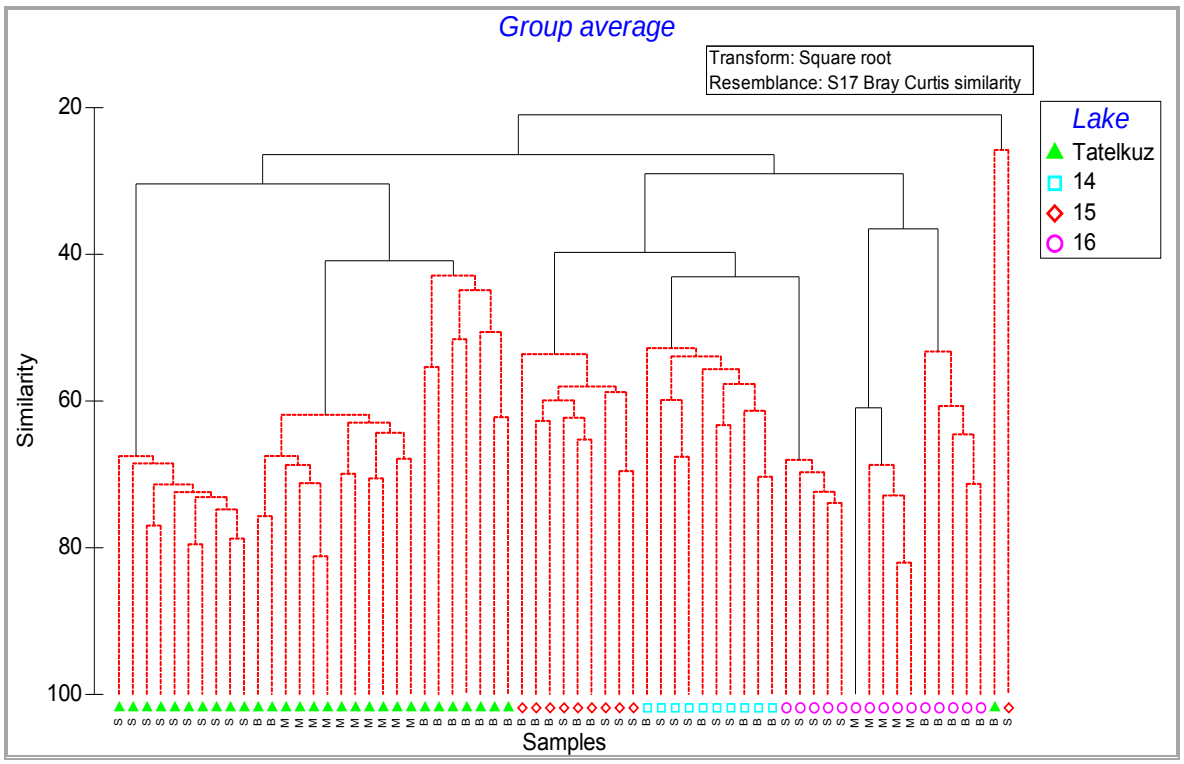
Sampling Site	Genus Richness (S)		Shannon's Diversity (*H'*)		Evenness (*J*)	
	Mean	SE	Mean	SE	Mean	SE
TL1 Surface	24	1	2.1	0.02	0.29	0.01
TL1 Mid	14	1	2.0	0.03	0.48	0.03
TL1 Bottom	10	2	1.4	0.14	0.40	0.03
TL2 Surface	21	2	1.9	0.05	0.29	0.02
TL2 Mid	14	1	2.0	0.05	0.45	0.01
TL2 Bottom	11	1	2.0	0.04	0.62	0.01

Note: TL = Tatelkuz Lake; SE = standard error

5.11.2.4 Comparisons of Phytoplankton Communities among Lakes

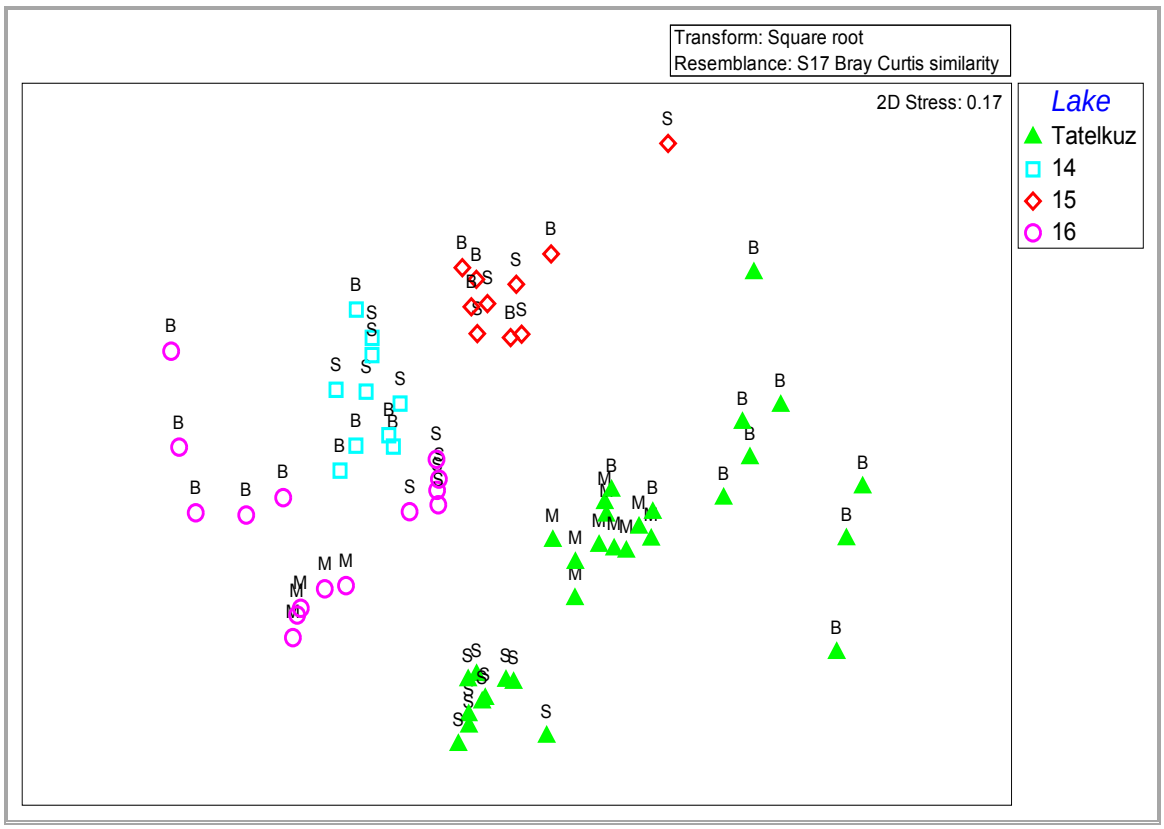
Clustering analysis indicated that, with the exception of two replicate outliers, Tatelkuz Lake phytoplankton communities at all depths show significant divergence from those of the other lakes in the Project area (**Annex 5.11-4** and **Figure 5.11-5**). Within the headwater lake group, each lake's communities differ significantly from the others (**Figure 5.11-5** and **Figure 5.11-6**). For lakes 01428UEUT and 01538UEUT, which lack thermal stratification, both bottom and surface samples group together. For Lake 01682LNRS, each depth class (surface, mid-water and bottom) is distinct, although surface samples are more closely related to those of lakes 01428UEUT and 01538UEUT. Similarly, Tatelkuz Lake depth classes also show significant divergence but like Lake 01682LNRS, mid-water samples are most closely related to bottom samples from the same lake (**Figure 5.11-6**). For biomass, structuring of phytoplankton communities mirrored that described for abundance.

To simplify comparisons of taxa that discriminated between Tatelkuz Lake and the other headwater lakes, phytoplankton samples were aggregated according to lake group (Tatelkuz and headwater) and thermocline position ("above" and "below").



Note: Community differences measured with Bray-Curtis Index of similarity; data was square-root transformed; solid black lines = statistically significant differences; dashed pink lines = non-significant differences; S = surface; M = mid-water (below thermocline); B = bottom.

Figure 5.11-5: Cluster Analysis of Phytoplankton Communities of Tatelkuz Lake and Headwater Lakes 01428UEUT, 01538UEUT, and 01682LNRS with Respect to Sampling Depth



Note: proximity between points indicates community similarity among samples; S = surface; M = mid-water (below thermocline); B = bottom

Figure 5.11-6: MDS Ordination of Phytoplankton Communities of Tatelkuz Lake in Relation to Headwater Lakes 01428UEUT, 01538UEUT, and 01682LNRS and Sampling Depth

In surface waters, over a third of the observed dissimilarity in Tatelkuz Lake was based on the abundance of the blue-green algae *Aphanizomenon flos-aquae,* the flagellate Cryptophyte *Rhodomonas minuta* Skuja, and the green algae *Monoraphidium* spp. (**Table 5.11-5**). Of the top ten discriminating taxa, all were more abundant in Tatelkuz Lake surface waters. For biomass, *A. Flos-aquae* by itself contributed 41% of the dissimilarity observed in surface waters of Tatelkuz Lake and the headwater lakes, where it was over 50 times the biomass in Tatelkuz Lake as it was in the headwater lakes. The diatoms *Cyclotella bodanica* (more abundant in Tatelkuz Lake) and *Stephanodiscus niagarae* (more abundant in the headwater lakes), and the green algae *Botryococcus* sp. (more abundant in the headwater lakes) were also key discriminating taxa in terms of biomass.

In general, surface waters of Tatelkuz Lake were numerically dominated by blue-green algae and Cryptophyte flagellates (each representing 38% by abundance) while the headwater lakes were dominated by green algae (43% of individuals).

Table 5.11-5: Summary of Mean Phytoplankton Taxa Density and Biomass and Contributions to Bray-Curtis dissimilarity (SIMPER analysis) above the Thermocline in Tatelkuz Lake and Headwater Lakes

Species	Mean		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Density (number/m^3)				
Aphanizomenon flos-aquae	761,117	1,472	12.97	12.97
Rhodomonas minuta Skuja	900,449	82,691	10.29	23.26
Monoraphidium spp	283,365	8	8.21	31.47
Aphanocapsa delicatissima West & West	204,865	27,919	4.61	36.08
Katablepharis ovalis Skuja	100,027	376	4.60	40.68
Cyclotella bodanica Grunow	132,452	20,624	3.60	44.27
Cryptomonas erosa Ehrenberg	28,849	64	2.50	46.77
Aphanothece sp	25,815	8	2.49	49.26
Romeria chlorina Bocher	19,366	0	2.17	51.42
Haptophyte Erkenia/Chrysochromulina	13,964	1,164	1.68	53.11
Biomass (µg/L)				
Aphanizomenon flos-aquae	19,491	11	41.51	41.51
Cyclotella bodanica Grunow	1,785	172	9.14	50.64
Stephanodiscus niagarae Ehrenberg	1.3	418	6.05	56.69
Botryococcus sp	0	91	2.88	59.57
Cryptomonas erosa (Ehrenberg)	95	0.2	2.81	62.39
Rhodomonas minuta Skuja	140	12	2.54	64.93
Aphanocapsa delicatissima West & West	112	16	2.10	67.03
Aphanothece sp	23	0	1.48	68.51
Eudorina elegans Ehrenberg	19	0	1.30	69.81
Snowella lacustris (Chodat) Komarek et Hindak	14	12	1.22	71.03

Note: Highest dissimilarity contributions indicate top ten taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

For waters below the thermocline, density in Tatelkuz Lake was higher in only two of the top ten taxa that discriminated Tatelkuz Lake from Lake 01682LNRS (the only headwater lake that was stratified) (**Table 5.11-6**). These two taxa (*A. flos-aquae and C. bodanica*), were also the two most prominent for Tatelkuz Lake in surface waters. For biomass, similar findings were revealed as in surface waters, where *A. flos-aquae* and *C. bodanica* were greatly elevated in Tatelkuz Lake and contributed almost 40% of the observed dissimilarity. The third most important taxa for discriminating lakes was the flagellate *Trachemolomas volvocina*, which was more abundant in Lake 01682LNRS.

Table 5.11-6: Summary of Mean Phytoplankton Taxa Density and Biomass and Contributions to Bray-Curtis dissimilarity (SIMPER analysis) below the Thermocline in Tatelkuz Lake and Headwater Lakes

Species	Mean		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Density (number/m^3)				
Cyclotella / *Stephanodiscus* sp.	2,596	78,630	6.44	6.44
Cyrptomonas phaseolus Skuja	0	77,367	6.30	12.74
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina) small	2,347	80,571	6.28	19.02
Synechocystis sp.	0	36,047	5.77	24.79
Trachemolomas volvocina Ehrenberg	107	54,135	5.26	30.05
Cryptomonas marssonii Skuja	12	52,231	5.26	35.31
Aphanizomenon flos-aquae	33,856	0	4.68	39.98
Cyclotella bodanica Grunow	99,679	24,280	4.52	44.51
Chlorella sp.	1,035	24,649	4.08	48.59
Aphanocapsa sp.	0.0	11,550	3.26	51.86
Biomass (µg/L)				
Aphanizomenon flos-aquae	780	0	20.05	20.05
Cyclotella bodanica Grunow	1,467	197	19.57	39.62
Trachemolomas volvocina Ehrenberg	0.5	215	9.04	48.67
Cyrptomonas phaseolus Skuja	0	53	4.48	53.15
Cryptomonas erosa Ehrenberg	1.5	46	4.11	57.25
Cryptomonas reflexa Skuja	0	47	3.96	61.22
Cryptomonas marssonii Skuja	0	34	3.58	64.8
Aphanocapsa sp.	0	12	3.18	67.98
Aphanocapsa delicatissima West & West	1.3	7.8	1.81	69.79
Cyclotella ocellata Pantocsek	3.5	0	1.53	71.32

Note: Highest dissimilarity contributions indicate top ten taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

Within Tatelkuz Lake, the observed differences in community structure were largely driven (~49%) by the abundance of five taxa (*Rhodomonas minuta*, *A. flos-aquae*, *Monoraphidium* spp., *Aphanocapsa delicatissima* and *Katablepharis ovalis*), which were all more abundant in surface waters (**Table 5.11-7**). For biomass, *A. flos-aquae* was again most important for discriminating above and below thermocline communities followed by *A. delicatissima*. The top ten taxa had more biomass above than below the thermocline.

Table 5.11-7: Summary of Mean Phytoplankton Taxa Density and Biomass and Contributions to Bray-Curtis Dissimilarity (SIMPER analysis) Collected Above and Below the Thermocline in Tatelkuz Lake

Species	Mean		Contribution (%)	Cumulative (%)
	Tatelkuz Above Thermocline	Tatelkuz Below Thermocline		
Abundance (number/m^3)				
Rhodomonas minuta Skuja	900,449	13,764	15.49	15.49
Aphanizomenon flos-aquae	761,117	33,856	13.02	28.5
Monoraphidium spp	283,365	6,561	8.52	37.02
Aphanocapsa delicatissima West & West	204,865	1,896	7.61	44.63
Katablepharis ovalis Skuja	100,027	8,403	4.21	48.84
Aphanothece sp	25,815	0	3.06	51.91
Cryptomonas erosa Ehrenberg	28,849	565	2.80	54.7
Unidentified naked Chrysophyte sp (*Ochromonas*/*Chromulina*)	30,092	2,347	2.52	57.23
Romeria chlorina Bocher	19,366	223	2.37	59.59
Cyclotella bodanica Grunow	132,452	99,679	2.15	61.75
Biomass (µg/L)				
Aphanizomenon flos-aquae	138.3	24.4	13.13	13.13
Aphanocapsa delicatissima West & West	10.5	0.5	4.82	17.95
Cryptomonas erosa Ehrenberg	8.3	0.3	4.55	22.5
Rhodomonas minuta Skuja	11.7	1.1	4.53	27.03
Aphanothece sp	4.5	0.0	4.05	31.08
Snowella lacustris (Chodat) Komarek et Hindak	2.5	0.0	2.97	34.05
Asterionella formosa Hansall	3.8	0.5	2.56	36.6
Eudorina elegans Ehrenberg	1.6	0.1	2.54	39.14
Monoraphidium spp	3.3	0.3	2.40	41.54
Tabellaria flocculosa (Roth) Kuetzing	1.0	0.6	2.25	43.8

Note: Highest dissimilarity contributions indicate top ten taxa that best discriminate phytoplankton communities in the two habitats.

5.11.2.5 Environmental Influences on Phytoplankton Communities

For both measures of density and biomass, a significant amount of phytoplankton community structure was correlated with environmental variables (Rho: 0.71; P<0.01) (**Table 5.11-8**). The best set of explanatory variables included sample depth, DO, and conductivity. Similar results were obtained for measures of biomass where the set of DO,

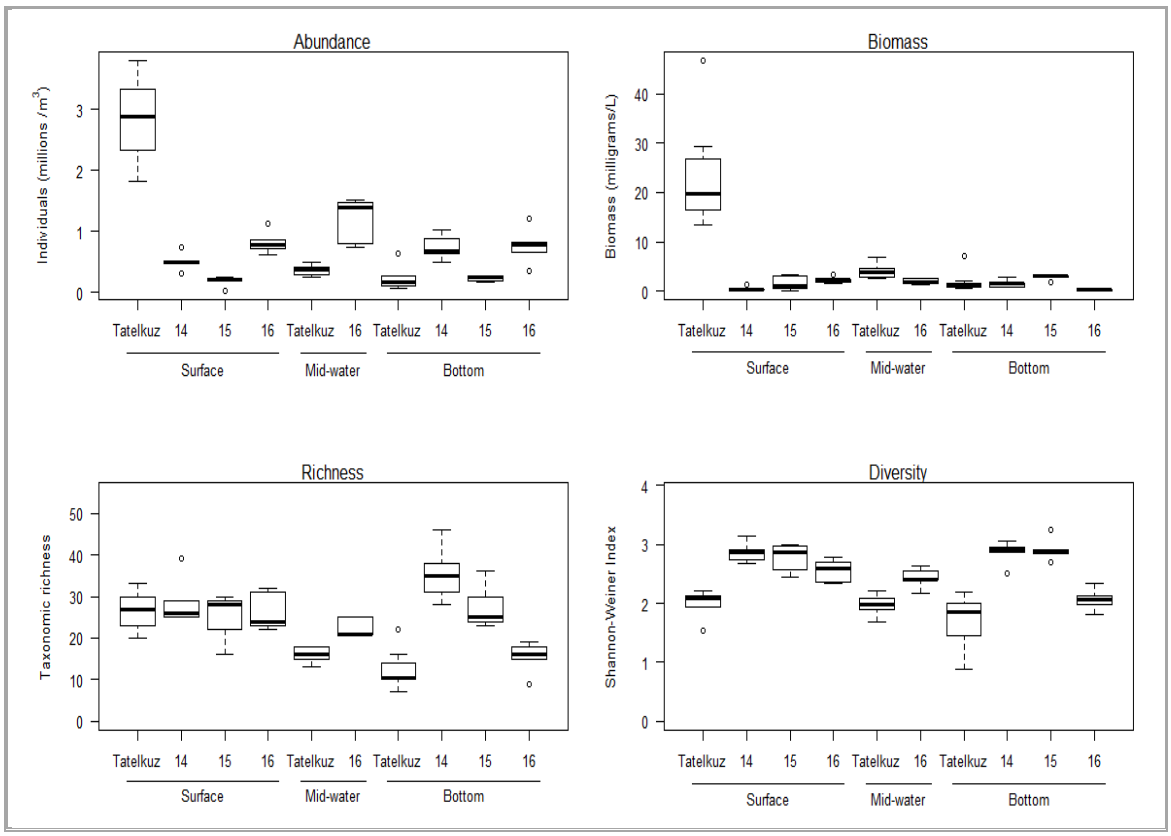
conductivity, and Secchi depth were marginally superior (Rho: 0.64; P<0.01) to DO and conductivity (Rho: 0.63) and conductivity alone (Rho: 0.61). While water depth, light penetration, and conductivity are well-known correlates of phytoplankton abundance (Lambou et al., 1983), DO is more likely an artefact of the relative location of sampling to the thermocline.

Table 5.11-8: Environmental Conditions Associated with Phytoplankton Communities of Four Lakes

Lake	Secchi Depth (m)	Thermocline Zone	Zone	Replicates	Depth (m)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)
Lake 01428UEUT	3.0	Above	Surface	5	1.0	13.8	8.30	48.4
			Bottom	5	4.5	12.6	7.60	47.9
Lake 01538UEUT	5.7	Above	Surface	5	1.0	13.6	8.27	44.1
			Bottom	5	8.5	13.6	8.43	41.1
Lake 01682LNRS	5.7	Above	Surface	5	1.0	11.8	9.31	49.1
		Below	Mid	5	10.5	5.3	0.08	61.3
			Bottom	5	13.0	4.8	0.00	68.8
Tatelkuz Lake Site 1	3.7	Above	Surface	5	1.0	20.55	9.06	211.7
		Below	Mid	5	13.0	6.4	6.91	153.7
			Bottom	5	27.0	5.2	5.88	149.9
Tatelkuz Lake Site 2	3.7	Above	Surface	5	1.0	20.4	9.06	209.3
		Below	Mid	5	15.0	5.8	6.60	151.8
			Bottom	5	27.0	5.2	6.02	150.1

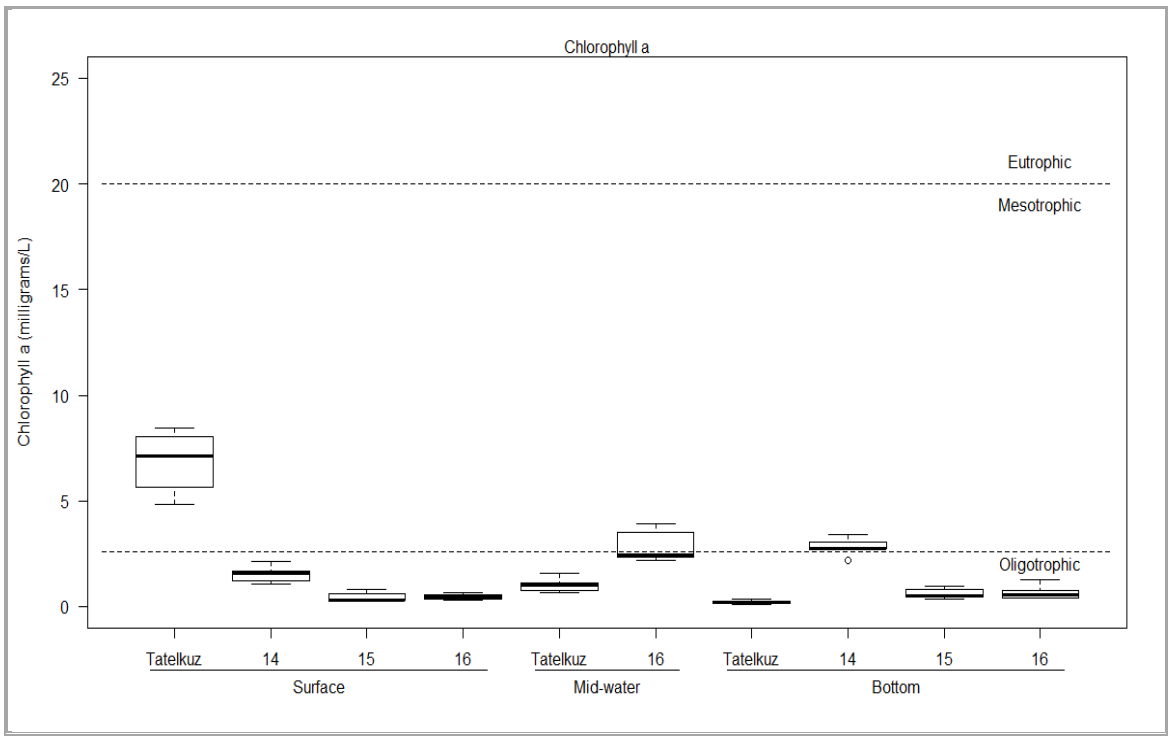
5.11.2.6 Phytoplankton Community Metrics

Tatelkuz Lake had significantly higher density (or abundance) and biomass in surface waters compared to the headwater lakes (**Annex 5.11-5**, **Figure 5.11-7** and **Table 5.11-9**). While biomass below the thermocline remained significantly elevated in Tatelkuz Lake, density of phytoplankton was significantly lower than in Lake 01682LNRS – the only headwater lake that had hypolimnetic habitat. Taxonomic richness of Tatelkuz Lake was the same in surface waters but significantly lower below the thermocline, while Shannon-Weiner diversity was significantly less than the headwater lakes in both habitats (**Figure 5.11-7** and **Table 5.11-9**). Like density, chlorophyll *a* was significantly elevated above the thermocline in Tatelkuz but was significantly less than Lake 01682LNRS's below the thermocline. Surface chlorophyll *a* levels also indicated a mesotrophic status for Tatelkuz Lake versus an oligotrophic state for the headwater lakes (**Figure 5.11-8**).



Note: box = mid-quartiles; error bars = 1.5X interquartile data; bolded lines within each box = median value.

Figure 5.11-7: Metrics of Phytoplankton Communities of Tatelkuz Lake and Headwater Lakes 14, 15 and 16



Note: box = mid-quartiles; error bars = 1.5X interquartile data; bolded lines within each box = median value; trophic state thresholds taken from USEPA (1978).

Figure 5.11-8: Chlorophyll a Concentrations of Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Table 5.11-9: Summary Statistics of Phytoplankton Metrics of Tatelkuz Lake and Headwater Lakes

Habitat	Metric	Tatelkuz		Headwater Lakes[a]		t (d.f. = 33,1)	P[b]
		Mean	Range	Mean	Range		
Above Thermocline	Density (number/m^3)	2,854,887	1,815,935-3,792,325	500,987	24,495-1,132,812	96.08	<0.001
	Biomass (µg/L)	23,099	13,517-46,681	1,485	148-3,241	-11.08	<0.001
	Taxa Richness	27	20-33	27	16-39	0.79	0.435
	Diversity (Shannon-Weiner Index)	2.03	1.54-2.22	2.73	2.34-3.15	9.20	<0.001
	Chlorophyll *a* (µg/L)	6.85	4.82-8.45	0.82	0.29-2.11	-13.87	<0.001
Below Thermocline	Density (number/m^3)	288,404	65,625-634,481	728,354	163,355-1,516,921	-6.94	<0.001
	Biomass (µg/L)	2,912	480-7,197	1,682	95-3,399	2.50	0.019
	Taxa Richness	14	7-22	25	9-46	-3.12	0.004
	Diversity (Shannon-Weiner Index)	1.84	0.89-2.20	2.57	1.82-3.25	-3.14	0.004
	Chlorophyll *a* (µg/L)	0.62	0.12-1.59	1.75	0.35-3.94	-3.65	0.001

Note: [a] = includes Lakes 14, 15 and 16 for above thermocline but only Lake 01682LNRS for below thermocline;
[b] = bolded values are significant at P<0.05.

Lake morphology and edaphic factors (e.g., nutrients) interact to influence biotic communities in waterbodies (Ryder, 1974). For photosynthetic organisms like phytoplankton, lake morphology can influence the volume of the photic zone and the mixing and concentration of nutrients. Edaphic factors (i.e., water chemistry) can also limit blooms of algae. Accordingly, phytoplankton communities studied in the Blackwater LSA reflect the different nutrient levels of headwater lakes and Tatelkuz Lake and the stratification of Tatelkuz Lake and Lake 01682LNRS.

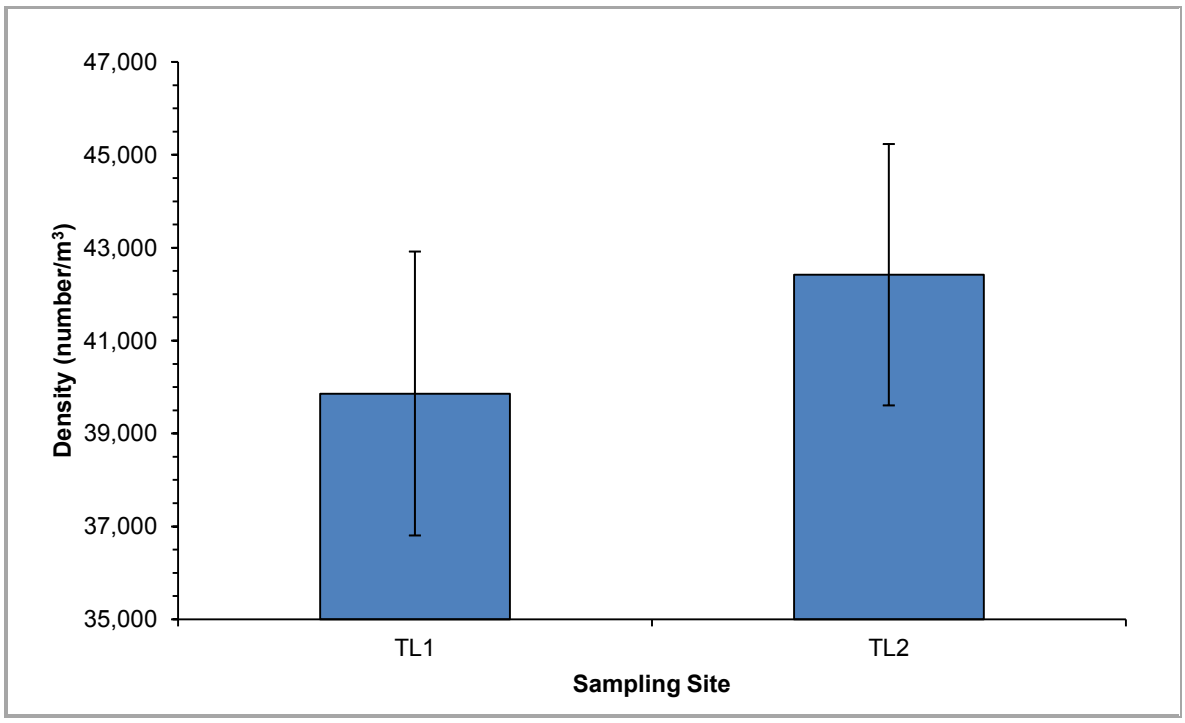
Edaphic differences, related to land-use, between Tatelkuz Lake and the headwater lakes overshadowed the effects caused the presence of a thermocline. In the surface waters of Tatelkuz Lake, these differences included elevated levels of chlorophyll *a* (eight times greater), greatly increased phytoplankton abundance (five-fold increase) and biomass (15 times greater), lower taxonomic diversity and the elevated presence of blue-green (e.g., *A. flos-aquae*). These differences align well with expectations of nutrient-enriched lakes (US EPA, 1978; Willen, 2000).

Lake morphology remained important because phytoplankton communities segregated according to location in the water column when the lake was stratified. Plankton communities in lakes that were not stratified were similar throughout the waterbody, indicating no barriers to mixing. In contrast, stratified lakes (Tatelkuz Lake and Lake 01682LNRS) showed differences in community structure through the water column, with mid-water samples (collected below the thermocline) being most similar to bottom samples. The reduced light penetration at depth is not favourable to photosynthesizing organisms and consequently phytoplankton density and biomass were reduced in the bottom samples relative to surface waters. This decline in density and biomass was greater in Tatelkuz Lake where light penetration in the hypolimnion was reduced due to its increased depth and reduced water clarity.

5.11.3 Zooplankton Community

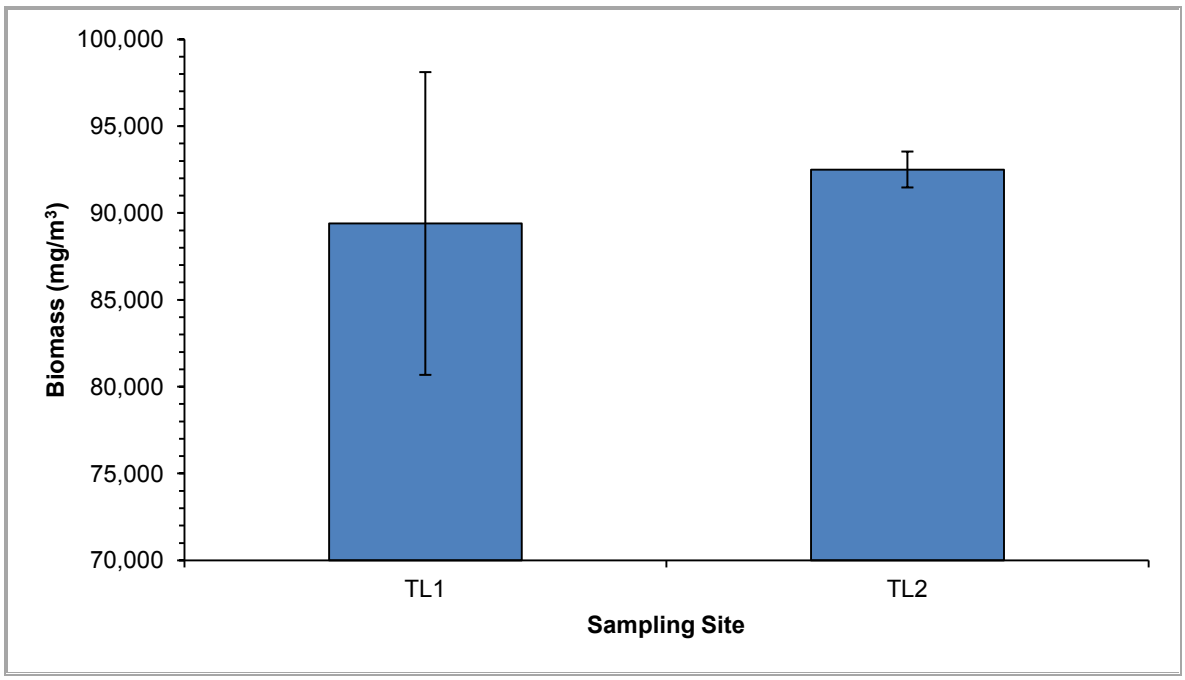
5.11.3.1 Density and Biomass

Mean zooplankton density and biomass measured over the entire water column were similar between the northern and southern sampling sites of Tatelkuz Lake (**Annex 5.11-6** and **Figure 5.11-9** and **Figure 5.11-10**). This supports the idea of strong horizontal mixing within the lake.



Note: m^3 = cubic metre; Error bars are SE of the mean

Figure 5.11-9: Mean Zooplankton Density, Tatelkuz Lake, August 2013



Notes: µg/m^3 = microgram per cubic metre; Error bars are SE of the mean

Figure 5.11-10: Mean Zooplankton Biomass, Tatelkuz Lake, August 2013

5.11.3.2 Taxonomic Composition and Diversity

Copepods were the predominant zooplankton taxon by density within Tatelkuz Lake (**Table 5.11-10**). The dominant copepod at both sample locations was cyclopoid nauplii. Rotifers were the second most common taxon. The dominant rotifer species at both sample sites was *Kellicotia longispina*. Ciliophors and cladocerans were not highly represented within the Tatelkuz Lake zooplankton population. Cladocerans were the least common taxon represented within site TL1. However, Ciliophors had a slightly lower density than cladocerans at site TL2.

Table 5.11-10: Mean Density and Relative Abundance of Major Zooplankton Taxa, Tatelkuz Lake, 2013

Taxonomic Group	TL1		TL2	
	Density (number/m^3)	Percent	Density (number/m^3)	Percent
Rotifers	1,912	36.46	1,727	36.65
Copepods	3,921	49.19	4,863	52.74
Cladocerans	587	5.60	519	5.38
Ciliophors	3,491	8.76	5,540	5.22

Note: TL = Tatelkuz Lake; 1 = site 1; 2 = site 2; m^3 = cubic metre;

Zooplankton species richness (S) was similar at both sampling sites within Tatelkuz Lake, ranging between 16 and 19 taxa (**Annex 5.11-6** and **Table 5.11-11**). Both diversity (H') and evenness (J) were slightly higher at site TL2 than at site TL1.

Table 5.11-11: Mean Diversity and Evenness of Zooplankton Communities, Tatelkuz Lake, August 2013

Site	Richness (*S*)		Shannon's Diversity (*H'*)		Evenness (J)	
	Mean	Range	Mean	SE	Mean	SE
TL1	17	16 – 19	2.15	0.06	0.49	0.02
TL2	18	17 – 19	2.10	0.09	0.45	0.03

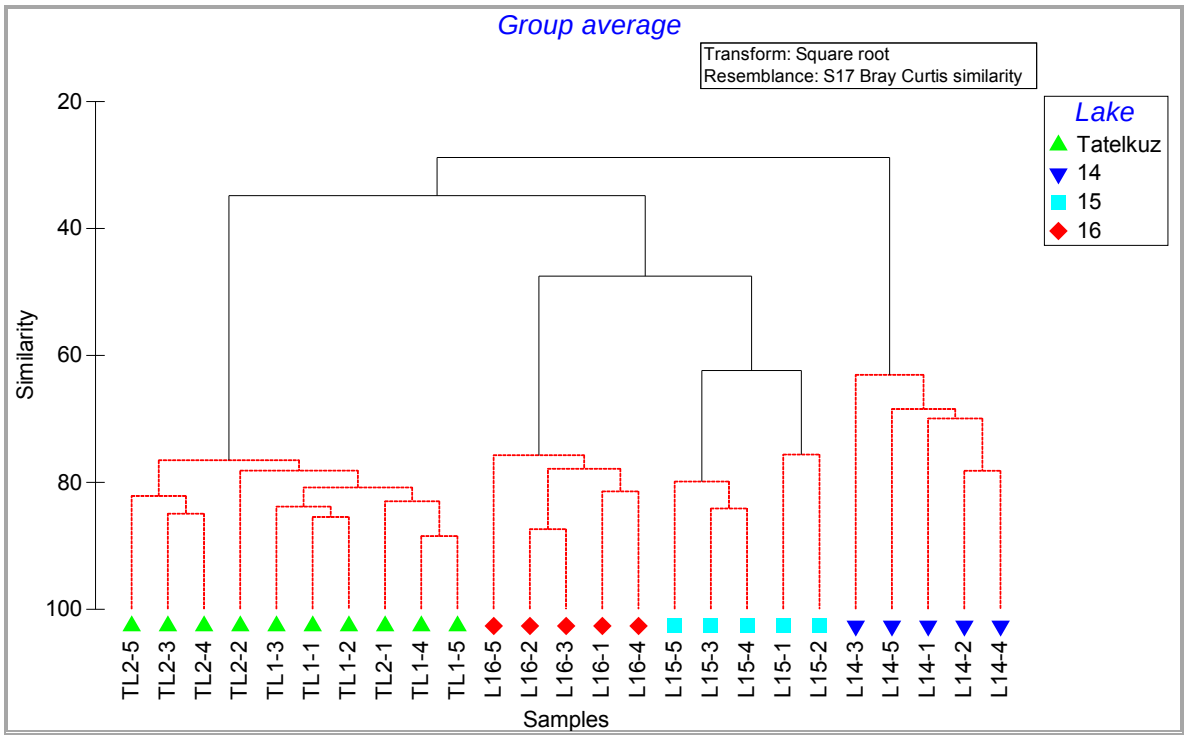
Note: TL = Tatelkuz Lake; 1 = site 1; 2 = site 2; SE = standard error

5.11.3.3 Comparison of Zooplankton Communities among Lakes

Annex 5.11-7 shows detailed information used in multivariate statistical analyses of lake zooplankton communities.

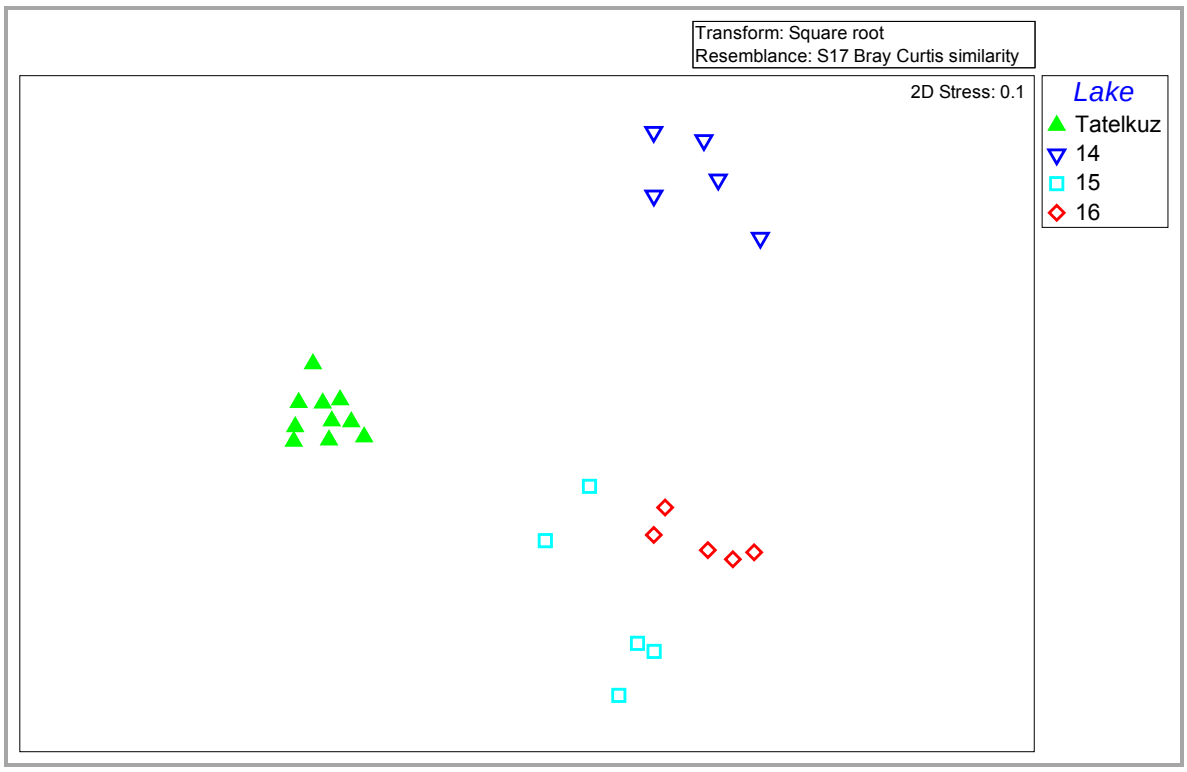
Zooplankton communities showed very strong differentiation by lake (**Figure 5.11-11** and **Figure 5.11-12**). Unlike phytoplankton and BMI, the most prominent differences in zooplankton density were observed between Lake 01428UEUT and the remaining lakes (Tatelkuz Lake and lakes 01538UEUT and 01682LNRS). Lakes within the latter group were all distinct but Tatelkuz Lake communities were different from those in Lakes 01538UEUT and 01682LNRS. No significant structuring of zooplankton communities occurred within lakes, except for Lake 01538UEUT.

For biomass, structuring of zooplankton communities showed near identical patterns to those observed for lake BMIs and phytoplankton in that Tatelkuz Lake diverged from the group of headwater lakes and each headwater lake was distinct (**Figure 5.11-13**).



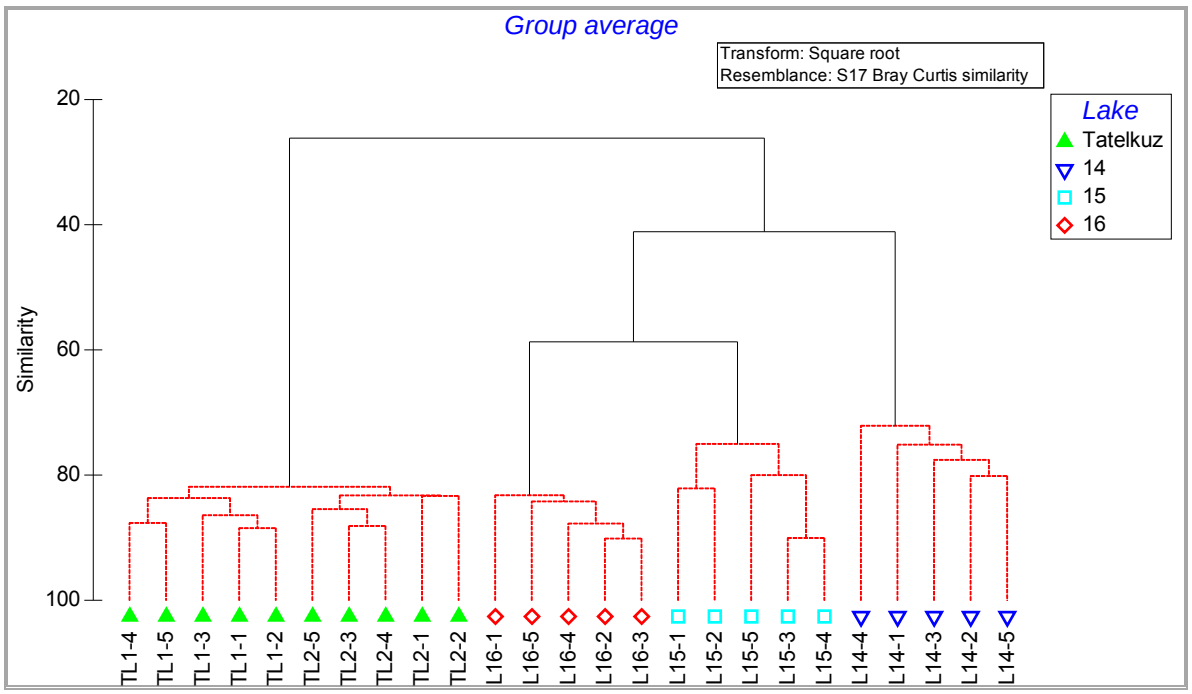
Note: Community differences measured with Bray-Curtis Index of similarity; data was square-root transformed; solid black lines = statistically significant differences (P<0.05); dashed pink lines = non-significant differences.

Figure 5.11-11: Cluster Analysis of Zooplankton Community Density of Tatelkuz Lake and Headwater Lakes 14, 15 and 16



Note: proximity between points indicates community similarity among samples; data was square root transformed.

Figure 5.11-12: MDS ordination of Zooplankton Community Density of Tatelkuz Lake in Relation to Headwater Lakes 14, 15, and 16



Note: Community differences measured with Bray-Curtis Index of similarity; data was square-root transformed; solid black lines = statistically significant differences (P<0.05); dashed pink lines = non-significant differences.

Figure 5.11-13: Cluster Analysis of Zooplankton Community Biomass of Tatelkuz Lake and Lakes 14, 15 and 16

At higher taxonomic levels, Lake 01428UEUT and Lake 01538UEUT were characterized by a very high proportion of rotifers (88% and 74% respectively) and very low proportions of cladocerans and copepods (**Table 5.11-12**). In contrast, taxa were much more evenly distributed across Tatelkuz Lake and Lake 01682LNRS samples.

Table 5.11-12: Distribution of Major Taxa in Tatelkuz Lake and Headwater Lakes

Taxa	Lake 01428UEUT		Lake 01538UEUT		Lake 01682LNRS		Tatelkuz Lake	
	(number/m^3)	(%)	(number/m^3)	(%)	(number/m^3)	(%)	(number/m^3)	(%)
Calanoida	1,197.1	0	5,627.4	7	1,868.5	6	46,847.0	11
Cladocera	3,013.7	1	4,674.4	6	2,828.4	9	22,562.9	5
Cyclopoida	5,970.3	2	6,087.4	8	11,460.4	36	163,045.4	40
Ciliophora	27,275.5	9	4,089.3	5	426.9	1	28,535.3	7
Rotifera	281,065.5	88	59,792.7	74	15,050.7	48	150,386.5	37
Total	318,522.1	100	80,271.1	100	31,634.8	100	411,377.1	100

Over half of the zooplankton community differentiation observed between Tatelkuz Lake and headwater lakes was contributed from two copepod taxa (Cyclopoids and *Diaptomus ashlandi*), three rotifers (*Synchaeta* sp., *Conochilus unicornis* and *Vorticella* sp.), and a protozoan (*Trichocerca multicrinis*) (**Table 5.11-13**). For biomass, the cladoceran *Daphnia longiremis* was the best taxa to differentiate waterbodies followed by three copepods (*Diaptomus ashlandi,* Cyclopoid and *Diaptomus nudus*) and the rotifer *Synchaeta* sp., which collectively contributed over half of the observed dissimilarity. Interestingly, several taxa found in Tatelkuz Lake were absent in the headwater lakes and vice versa and in one case this occurred with taxa in the same genus (*Diaptomus*). Of the top ten discriminating taxa, eight were more abundant and seven had higher biomass in Tatelkuz Lake.

Table 5.11-13: Summary of Mean Zooplankton Taxa Abundance and Contributions to Bray-Curtis Dissimilarity (SIMPER analysis) in Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Species	Mean		Contribution (%)	Cumulative (%)
	Tatelkuz Lake	Headwater Lakes[a]		
Abundance (number/m^3)				
Cyclopoid (nauplii)	14,791.4	730.6	13.52	13.52
Diaptomus ashlandi Marsh	4,462.2	0.0	9.49	23.02
Synchaeta sp	16.0	4,438.2	7.97	30.99
Conochilus unicornis Rousselet	3,456.3	1,171.0	6.49	37.48
Trichocerca multicrinis Kellicott	2,098.6	0.0	6.48	43.96
Vorticella sp	1,866.2	482.2	5.62	49.57
Euchlanis calpidia Myers	1,268.8	0.0	5.05	54.62
Daphnia longiremis Sars	1,410.0	7.8	4.88	59.5
Keratella cochlearis Gosse	177.4	1,629.7	4.82	64.32
Kellicotia longispina Kellicott	4,083.2	2,112.3	4.31	68.63
Biomass (µg/L)				
Daphnia longiremis Sars	22,758.7	34.0	13.42	13.42
Diaptomus ashlandi Marsh	19,343.2	0.0	12.96	26.38
Cyclopoid (nauplii)	17,747.6	663.6	10.07	36.45
Diaptomus nudus Marsh	0.0	5,614.5	7.05	43.5
Synchaeta sp	25.2	6,927.2	7.03	50.54
Daphnia geleatea (and *rosea*) Sars	0.0	4,201.6	6.04	56.57
Trichocerca multicrinis Kellicott	3,323.5	0.0	5.36	61.93
Diaphanosoma brachyurum Lievin	3,287.9	0.0	5.31	67.24
Euchlanis calpidia Myers	2,875.1	0.0	4.99	72.23
Conochilus unicornis Rousselet	4,033.5	503.6	4.35	76.58

Note: Highest dissimilarity contributions indicate ten top taxa that best discriminate phytoplankton communities in Tatelkuz Lake from headwater lakes.

5.11.3.4 Environmental Influences on Zooplankton Communities

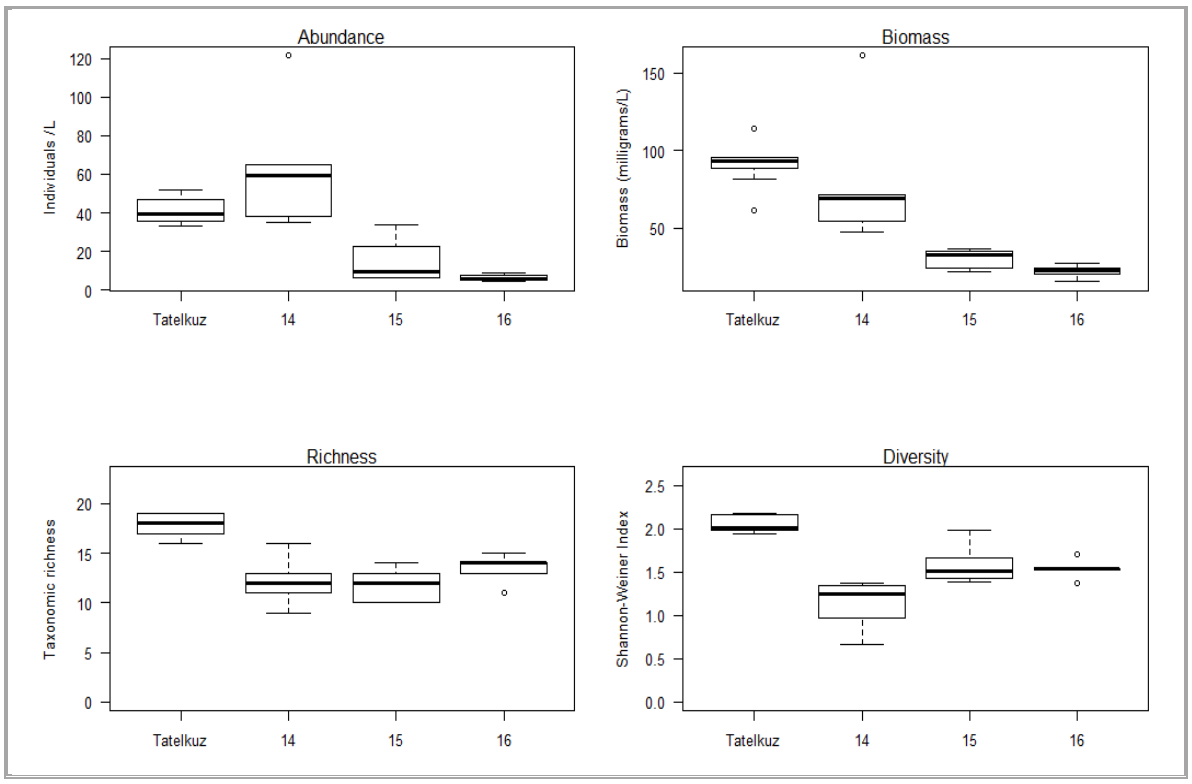
Combinations of three environmental variables (conductivity, bottom DO, and Secchi depth) were considered for their influence on zooplankton community structure across lakes. Conductivity alone had the best correlation with zooplankton community abundance (Rho: 0.60; P<0.01) and biomass (Rho: 0.79; P<0.01). It is worth noting that several environmental variables (depth, surface temperature, and chlorophyll *a*) were removed because they were highly correlated with conductivity and therefore they must be considered as alternate candidates to conductivity in potentially driving community structure. Both conductivity and chlorophyll *a*, surrogates of production, would be expected to increase prey availability, while temperature is known to influence zooplankton feeding rates (Loiterton et al., 2004).

5.11.3.5 Zooplankton Community Metrics

Metrics of Tatelkuz Lake zooplankton communities did not show the magnitude of differences that were apparent from the multivariate analyses and from the analyses of other taxa in Tatelkuz Lake (BMI and phytoplankton) (**Annex 5.11-8** and **Table 5.11-14**). Abundance of zooplankton in Tatelkuz Lake was on average higher than the headwater lakes but was not significantly different. In fact, Lake 01428UEUT had the highest mean densities of zooplankton. While zooplankton biomass was highest in Tatelkuz Lake, its difference was only double that of the mean headwater lake (**Table 5.11-14**), and was small compared to that observed for phytoplankton communities (which had 15 times the biomass at the surface). Part of this discrepancy can be attributed to the relatively small size of the dominant taxa in Lake 01428UEUT (i.e., rotifers) and the integrated nature of zooplankton sampling (i.e., abundance in stratified lakes is moderated by inclusion of low productivity hypolimnetic waters).

Interestingly, measures of taxonomic richness and diversity were significantly elevated in Tatelkuz Lake (**Figure 5.11-14** and **Table 5.11-14**). These results are inconsistent with nutrient enriched lakes (Jeppesen et al., 2011), but perhaps reflect the habitat diversity of Tatelkuz Lake, which provides habitat (e.g., temperature, productivity, etc.) for taxa of different environmental tolerances. Lake 01682LNRS's relatively high richness and diversity, despite its low biomass and abundance (**Figure 5.11-14**), supports this suggestion.

Zooplankton communities of the LSA were very distinct and, like BMI and phytoplankton communities, were influenced by lake morphology and physical factors. Conductivity (or its correlates chlorophyll *a*, surface temperature and water depth) was highly correlated with variation in the density and biomass of zooplankton communities and suggests that the higher nutrient concentrations of Tatelkuz Lake have affected its zooplankton communities but to a lesser degree than other ecosystem components such as BMIs and phytoplankton. Furthermore, differences in some univariate metrics such as richness and diversity were not consistent with expectations from the literature for nutrient enriched waters (Jeppesen et al., 2011).



Note: box = mid-quartiles; error bars = 1.5X interquartile data; bolded lines within each box = median value.

Figure 5.11-14: Metrics of Zooplankton Communities of Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Table 5.11-14: Summary Statistics of Zooplankton Communities of Tatelkuz Lake and Headwater Lakes

Metric	Tatelkuz Lake		Headwater Lakes[a]		t (d.f. = 23,3)	P[b]
	Mean	Range	Mean	Range		
Abundance (number/m^3)	41,137.7	33,101.3-51,780.5	28,695.2	4,477.0-121,358.8	-1.185	0.248
Biomass (µg/L)	90,944.8	61,394.4-113,990.0	44,338.2	15,472.0-161,281.7	-3.826	<0.001
Taxa Richness	18	16-19	12	9-16	-7.704	<0.001
Diversity (Shannon-Weiner Index)	2.05	1.94-2.18	1.41	0.66-1.98	-6.313	<0.001

Note: [a] = includes Lakes 14, 15 and 16 for above thermocline but only Lake 01682LNRS for below thermocline;
[b] = bolded values are significant at P<0.05.

Unlike lake BMIs and phytoplankton, Tatelkuz Lake zooplankton communities were only distinct from the group of headwater lakes when using multivariate measures of biomass

and univariate measures of total biomass, richness and diversity. When using multivariate measures of abundance, Lake 01428UEUT had the most divergent zooplankton community. Such differences indicate that other factors besides nutrients (e.g., predation from fish assemblages, lake morphology, etc.) are influencing zooplankton community abundance in the study area to a greater degree (Jeppesen et al., 2011). For example, the numerical prevalence of small-bodied rotifers in Lake 01428UEUT could be a consequence of a higher proportion of optimal habitat (e.g., absence of low productivity hypolimnetic habitat) or differential predation pressure on large-bodied zooplankton.

5.11.4 Benthic Macroinvertebrate Community

Annex 5.11-9 shows the density and taxonomy of Tatelkuz Lake BMI samples (both littoral and profundal), and **Annex 5.11-10** shows photographs of each of the littoral zone sites where BMI samples were taken. **Annex 5.11-11** shows the detailed information used in multivariate statistical analyses of those BMI samples.

Table 5.11-15 shows the habitat characteristics of each of the 20 littoral zone BMI sampling sites. The locations and depths of the 10 profundal BMI samples are the same as the vertical profiles taken at sites TL-1 and TL-2 (**Table 4.11-6**).

5.11.4.1 Comparisons of Lake BMI Communities among Lakes

The first step in analysis of Tatelkuz BMI data was to compare all BMI samples among all habitat types and all four lakes to identify key differences that may focus subsequent analysis. To include both littoral zone samples, which were collected with kick nets, and profundal samples, which were collected by Ekman dredge, community data were converted from densities for each taxon to simple presence/absence for each taxon.

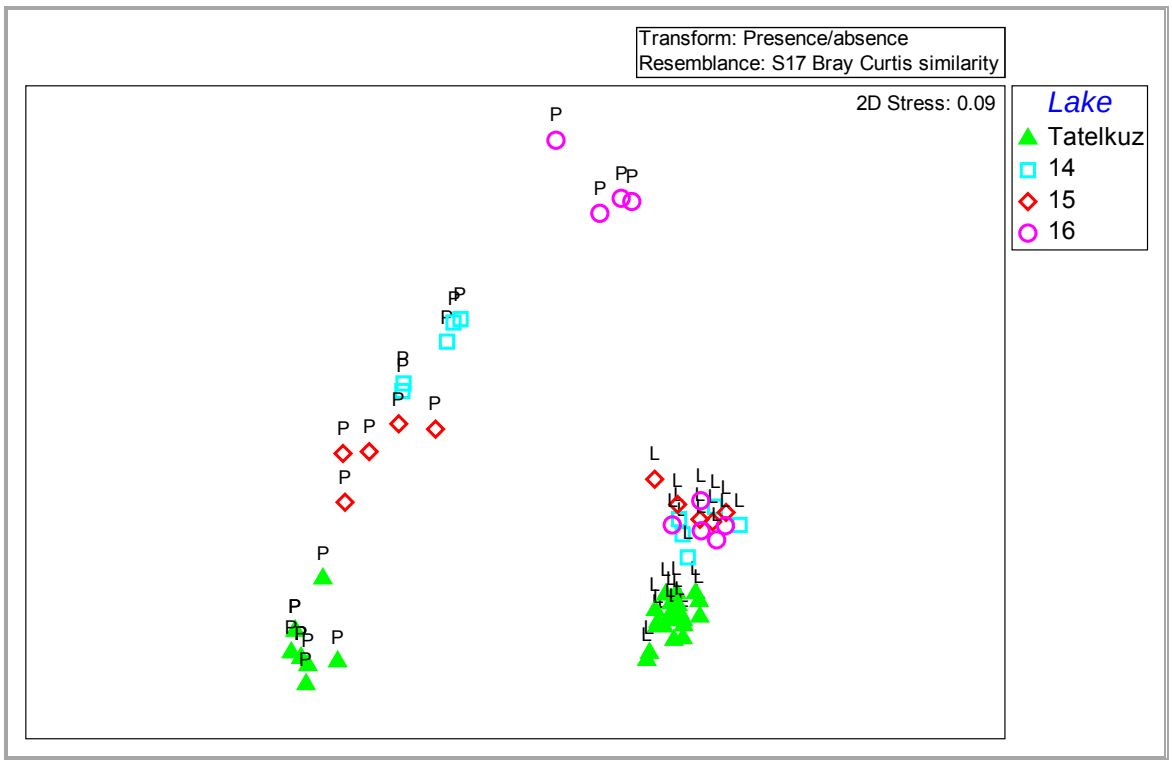
MDS analysis showed differences in communities that were associated with habitat zone and lake (**Figure 5.11-15**). Furthermore, it segregated Tatelkuz Lake communities to the lower part of the plot, regardless of habitat type. This comparison should be interpreted with caution because the more spatially extensive sampling methods employed with kick nets are likely to collect more specimens compared to Ekman dredges. While transformation of such data to presence-absence data reduces the sampling bias, there remains some likelihood that more species will be collected in kick nets.

The next step in analysis was to treat BMI community data from littoral and profundal habitats separately.

Table 5.11-15: Habitat Characteristics of Littoral BMI Sampling Sites, Tatelkuz Lake, August 2013

Site ID	Date	Location (UTM)[1]		Length (m)	Width (m)	Max. Depth (m)	pH	Water Temperature (°C)	DO Concentration (mg/L)	Water Conductivity (µS/cm)	Dominant Substrate	Algae Cover (%)	Aquatic Veg. Type	Aquatic Veg. Cover (%)	Riparian Veg. Type	Undercut Bank (%)	Large Woody Debris Cover (%)	Small Woody Debris
		Easting	Northing															
TL-1		385856	5907635	37.2	8	0.75	8.74	21.4	8.25	216.1	Cg	60	S	5	T/S/G	n.d.	10	5
TL-2		386462	5907070	48	4.8	0.75	8.83	22.1	7.91	217.5	Cg	70	S	25	T/S/G	25	10	5
TL-3		387208	5906669	64.7	3.7	0.5	8.95	23.4	8.17	223.2	Cg	75	S	10	T/S	70	100 [1]	1
TL-4		388824	5904917	47.6	7.2	0.75	8.75	22.9	8.67	222.1	Cg	100	n.d.	5	T/S/G	25	30	5
TL-5	12 Aug	390721	5902721	42.4	7.6	0.75	8.72	22	8.07	221.3	Cg	80	S	25	G/S	5	30	5
TL-6		391850	5901940	29	53.5	0.75	8.97	20.9	9.13	219.4	F	0	S	30	T/S	5	25	50 [1]/ 10 [2]
TL-7		391858	5901550	31	70	0.75	8.20	19	8.84	268.5	Fo	0	S	30	G/S/T	100	5 [1]	5 [2]
TL-8		391760	5901281	14	48	0.75	8.35	22.8	7.43	225	Fo	0	S	25	T	50	30	5 [2]
TL-9		391088	5900873	52	5	0.75	8.74	21.5	7.27	216.2	Fg	0	S	15	T	5	50 [1]	50 [1]
TL-10	13 Aug	390766	5900866	18	44.5	0.75	9.24	22.9	9.34	218.8	Fg	5	S	50	T/S/G	30	75 [1]	15 [2]
TL-11		390414	5901383	31.5	3.5	0.45	8.75	20.4	7.92	211.9	Cg	90	S	20	T/S	80	40 [1]/ 10 [2]	10
TL-12		389870	5902356	31	8	0.75	8.83	21	7.51	231.8	Cg	80	S	10	T/S	50	30 [1]/ 5 [2]	10 [2]
TL-13		389674	5902558	41	6.5	0.75	8.85	21.1	7.73	230.9	Cg	90	n.d.	0	T/S	100	30	30
TL-14		388980	5903362	35	6	0.75	8.88	21.4	8.19	232.4	Cg	90	n.d.	0	T/S	100	10 [1]	5 [2]
TL-15		387455	5905132	53.5	8.5	0.75	8.93	21.2	7.27	229.7	Gc	70	S	5	T/S/G	30	15 [1]	90 [1]/ 5 [2]
TL-16		385297	5906826	21	31.5	0.75	8.95	21	8.29	212.9	Gf	80	S	30	S/G	100	5 [1]	30 [1]/ 10 [2]
TL-17	14 Aug	385241	5907056	116	18	0.75	8.95	21	8.29	212.9	Gf	80	S	30	S/G	100	5 [1]	30 [1]/ 10 [2]
TL-18	16 Aug	385620	5907832	19.5	64	0.75	9.08	20.3	9.49	206.7	Fg	15	S	30	S/G	100	5 [1]	15 [1]/ 15 [2]
TL-19		385234	5907180	26	90	0.75	8.51	15.8	11.07	186.1	Fg	20	S/E	45/10	S/G	0	5 [1]	1 [1]
TL-20	25 Aug	385348	5907449	30	97	0.75	8.66	18.6	13.65	187.3	Fg	10	S/E	35	S/G	0	1 [1]	5 [1]

Note: Dominant substrate: Dominant = capitalized, sub-dominant = lower case; S = submerged, E = emergent; T = trees, S = shrubs, G = grasses;
[1]along shoreline, [2]in water.



Note: P-profundal collections; L: littoral kick net collections.

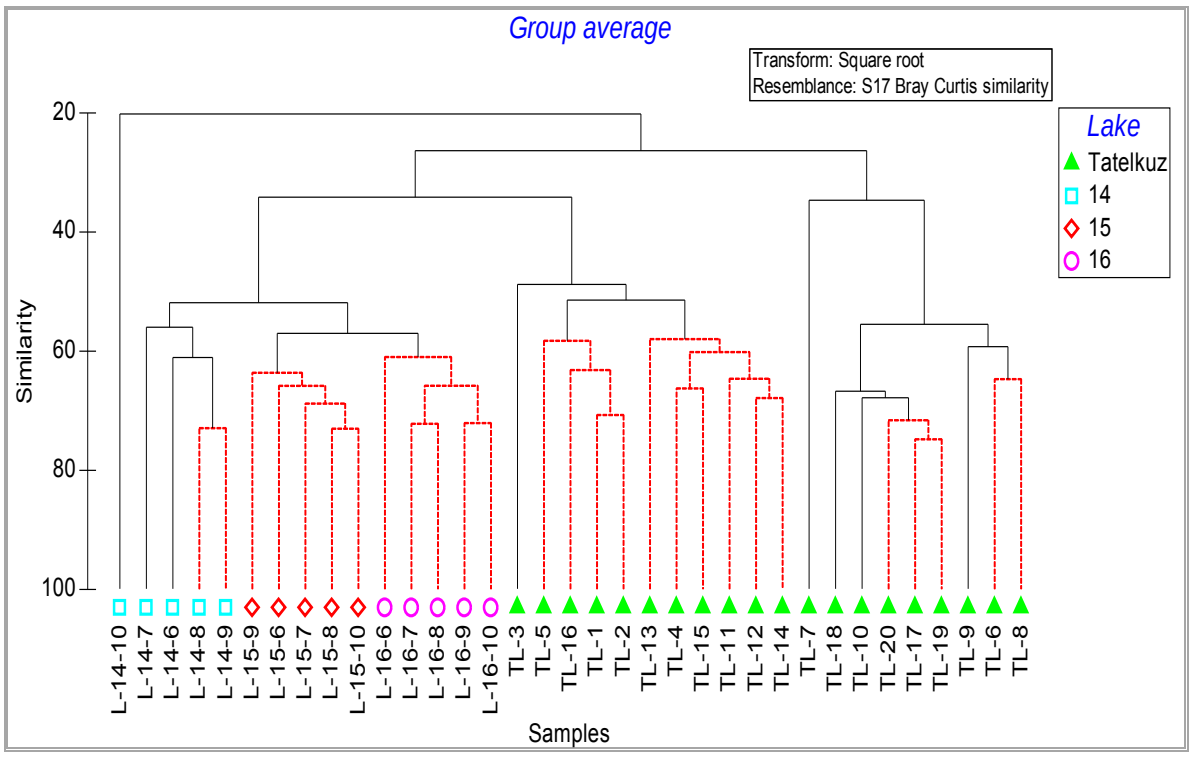
Figure 5.11-15: MDS of Presence/Absence BMI Data in Tatelkuz Lake and Lakes 14, 15, and 16

5.11.4.2 Littoral BMI Community Characteristics

Littoral BMI communities showed significant structure across lakes (**Figure 5.11-16**). Tatelkuz Lake communities differed significantly from the headwater lakes (Global R: 0.746, P<0.001). However, among Tatelkuz Lake samples, significant structure remained. For example, one set of sites (n = 11) were more closely associated with headwater lakes than they were with the remainder of the Tatelkuz littoral sites (**Figure 5.11-17**).

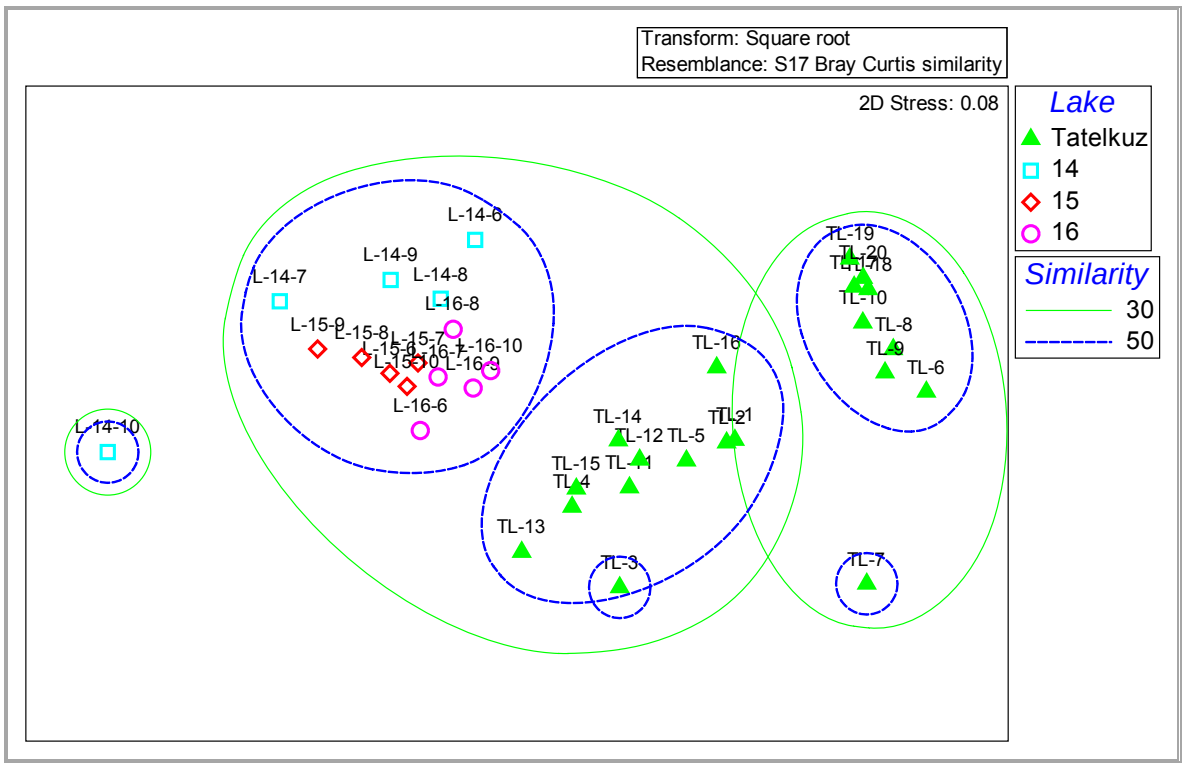
Key differences in species assemblages between Tatelkuz Lake and the three headwater lakes are identified in **Table 5.11-16**, where approximately one quarter of the dissimilarity in communities was attributed to *Hyalella* amphipods, other unidentified amphipods, paraleptophlebeid mayflies, *Caenis* mayflies and *Planorbid* snails. All of these taxa, except the paraleptophlebeid mayflies, were more abundant in Tatelkuz Lake. In fact, the vast majority of taxa were more abundant in Tatelkuz Lake samples relative to headwater lakes (**Table 5.11-16**).

Among the habitat variables that were available (DO concentration and conductivity) for all littoral samples, conductivity explained a significant amount of the variation observed in community structure among lakes for littoral communities (Rho = 0.604; P<0.01).



Note: Community differences were measured with the Bray-Curtis Index of similarity on square-root transformed data.
Samples joined by solid black lines indicate sample groups with statistically significant differences.
Samples joined by dashed pink lines indicate non-significant differences.

Figure 5.11-16: Cluster Analysis of Littoral BMI Communities of Tatelkuz Lake and Headwater Lakes 14, 15, and 16



Note: Proximity between points indicates community similarity among samples

Figure 5.11-17: MDS ordination of Littoral BMI Communities of Tatelkuz Lake Compared with Headwater Lakes 14, 15, and 16

Table 5.11-16: Summary of Mean Littoral BMI Taxa Abundance and Contributions to Bray-Curtis dissimilarity (SIMPER analysis), Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater		
Hyalella sp.	16,389	1,313	9.44	9.44
Amphipoda	3,007	0	6.27	15.7
Paraleptophlebia sp.	0.3	571	3.36	19.06
Caenis sp.	831	0.7	3.26	22.32
Planorbidae	976	60	2.65	24.97
Gammarus sp.	721	391	2.57	27.53
Pisidiidae	940	680	2.32	29.86
Glyptotendipes sp.	469	12	2.07	31.92
Mystacides sp.	408	20	1.94	33.86
Dicrotendipes sp.	334	13	1.92	35.78
Lumbriculidae	293	23	1.76	37.54
Stylaria sp.	196	0.9	1.68	39.22

Table continues…

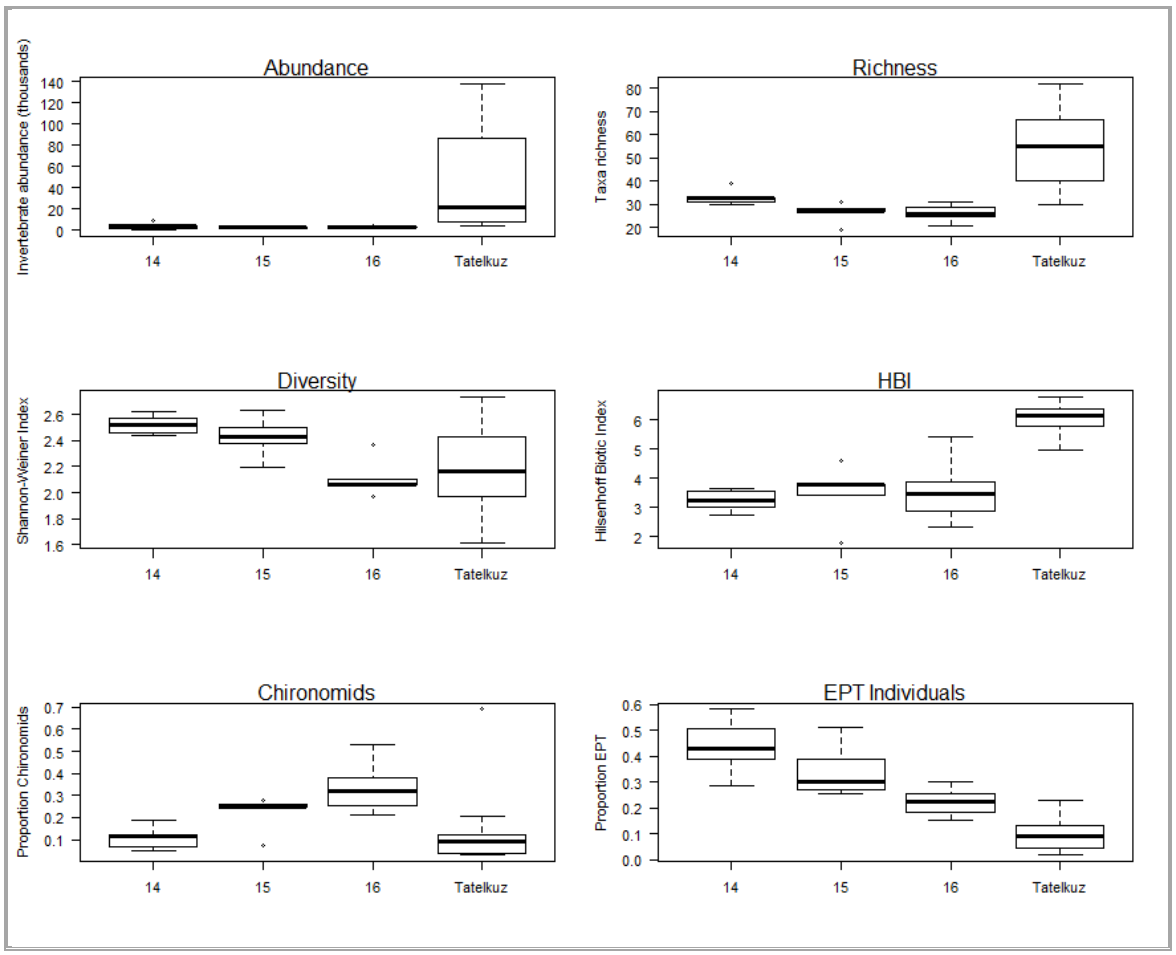
Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater		
Paratanytarsus sp.	97	167	1.67	40.89
Callibaetis sp.	344	29	1.64	42.53
Nais sp.	203	0	1.54	44.07
Trombidiformes	171	2.6	1.47	45.55
Caenidae	0	100	1.43	46.98
Tanytarsus sp.	142	34	1.38	48.36
Tubificinae immature	89	0	1.28	49.63
Pisidium sp.	123	22	1.19	50.82

Note: Highest dissimilarity contributions indicate top 20 taxa that best discriminate BMI communities in Tatelkuz from headwater lakes.

In accordance with the observed significant differences in littoral BMI community structure, several metrics showed differences between headwater lakes 01428UEUT, 01538UEUT, and 01682LNRS and Tatelkuz (**Figure 5.11-18** and **Table 5.11-17**). These results for Tatelkuz littoral BMI communities generally aligned well with expectations for a nutrient enriched system (Barbour et al., 1999). Mean abundance in Tatelkuz was an order of magnitude higher than in the headwater lakes, while EPT taxa, which are sensitive to nutrients, were significantly lower. Furthermore, the mean values of the HBI (Mandaville, 2002) were “Fair” in Tatelkuz Lake compared to the average condition of “Excellent” in the headwater lakes.

Some metrics however did not correspond to expectations of nutrient enrichment. The proportion of chironomids (considered pollution tolerant taxa) were found to be of marginally lower abundance in Tatelkuz, while taxonomic richness was significantly elevated in Tatelkuz. No differences in Shannon-Weiner diversity were observed between the two groups of lakes,

The third step in analysis was to determine what habitat characteristic were responsible for differences in littoral BMI communities among sampling sites within Tatelkuz Lake.



Note: box = mid-quartiles; error bars = 1.5X interquartile data; bolded lines within each box = median value.

Figure 5.11-18: Metrics of Littoral BMI Communities of Tatelkuz Lake and Three Headwater Lakes

Table 5.11-17: Summary Statistics of Littoral BMI, Tatelkuz Lake, and Headwater Lakes

Habitat	Metric	Tatelkuz		Headwater Lakes[a]		F (d.f. = 33,1)	P[b]
		Mean	Range	Mean	Range		
Littoral	Abundance	45,712	3,584-137,695	3,162	240-9,360	13.6	<0.001
	Taxa Richness	54	30-82	29	19-39	37.1	<0.001
	Diversity (Shannon-Weiner Index)	2.2	1.6-2.7	2.35	1.97-2.64	3.16	0.085
	HBI	6.06	4.6-6.8	3.43	1.79-5.39	129.9	<0.001
	Percent Chironomids	0.1	0.03-0.7	0.22	0.047-0.53	4.66	0.032
	Percent EPT	0.1	0.02-0.2	0.34	0.15-0.58	53.41	<0.001

Note: [a] = Includes Lakes 14, 15, and 16; [b] = bolded values significant at α=0.05

5.11.4.3 Tatelkuz Lake Littoral Communities

Analysis of substrate type of BMI sampling sites indicated significant differences across classes (Global R: 0.70, P<0.001; **Figure 5.11-19**). There were insufficient replicates to compare BMI communities for every pair of substrate classes, however Cobble/Gravel communities (the most sampled) were significantly different from Fine/Organic (P = 0.018), Fine/Gravel (P<0.001) and Gravel/Fine (P = 0.036) and Fine/Organic communities were different from Fine/Gravel communities (P = 0.048). The only pairing with sufficient statistical resolution (i.e., enough samples) that did not detect differences was Fine/Gravel and Gravel/Fine.

Examinations of BMI abundance and richness across substrate classes indicated a more rich and abundant BMI community in the fine habitats (Fine/Gravel, Fine and Fine/Organic) than in the coarse habitats (Cobble/Gravel, Gravel/Cobble and Gravel/Fine) (**Figure 5.11-20**). Abundance on fine substrates was 4.3 times greater while richness was 1.4 times greater.

Despite the influence of substrate type on abundance and richness, coarse substrates in Tatelkuz Lake still had levels (19,670 individuals and 45 taxa per sample) that exceeded mean levels of the three headwater lakes.

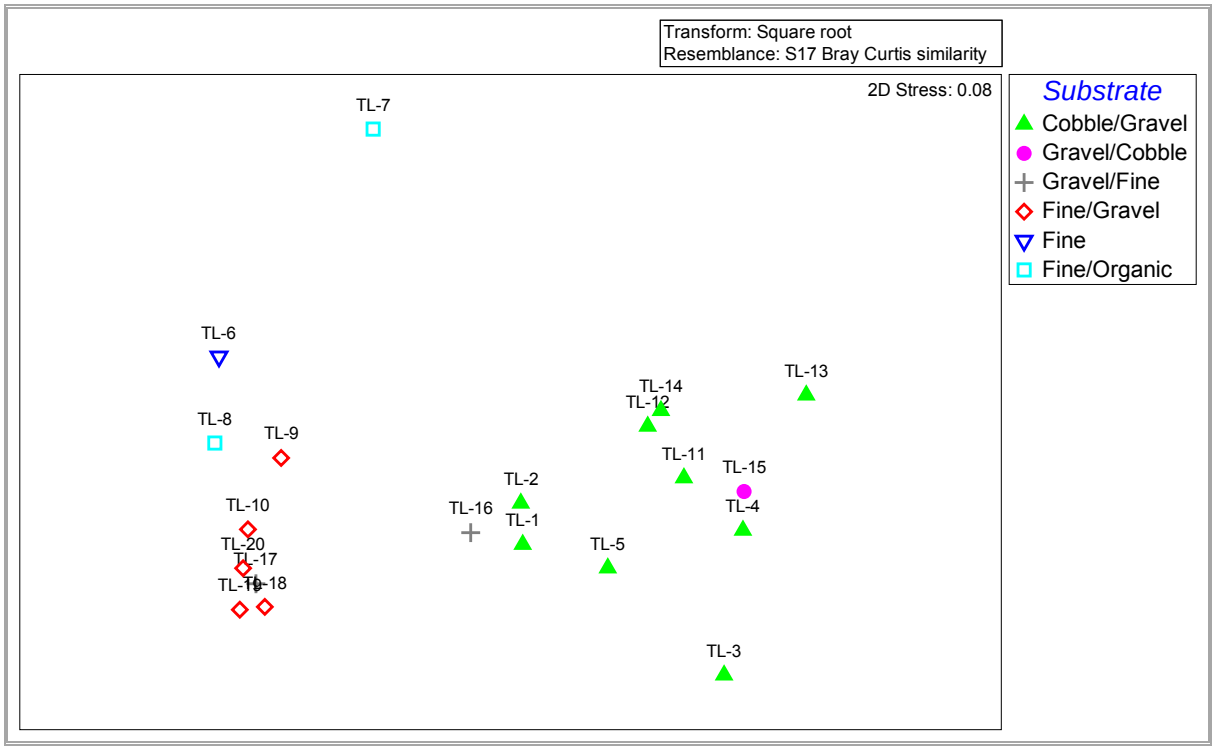
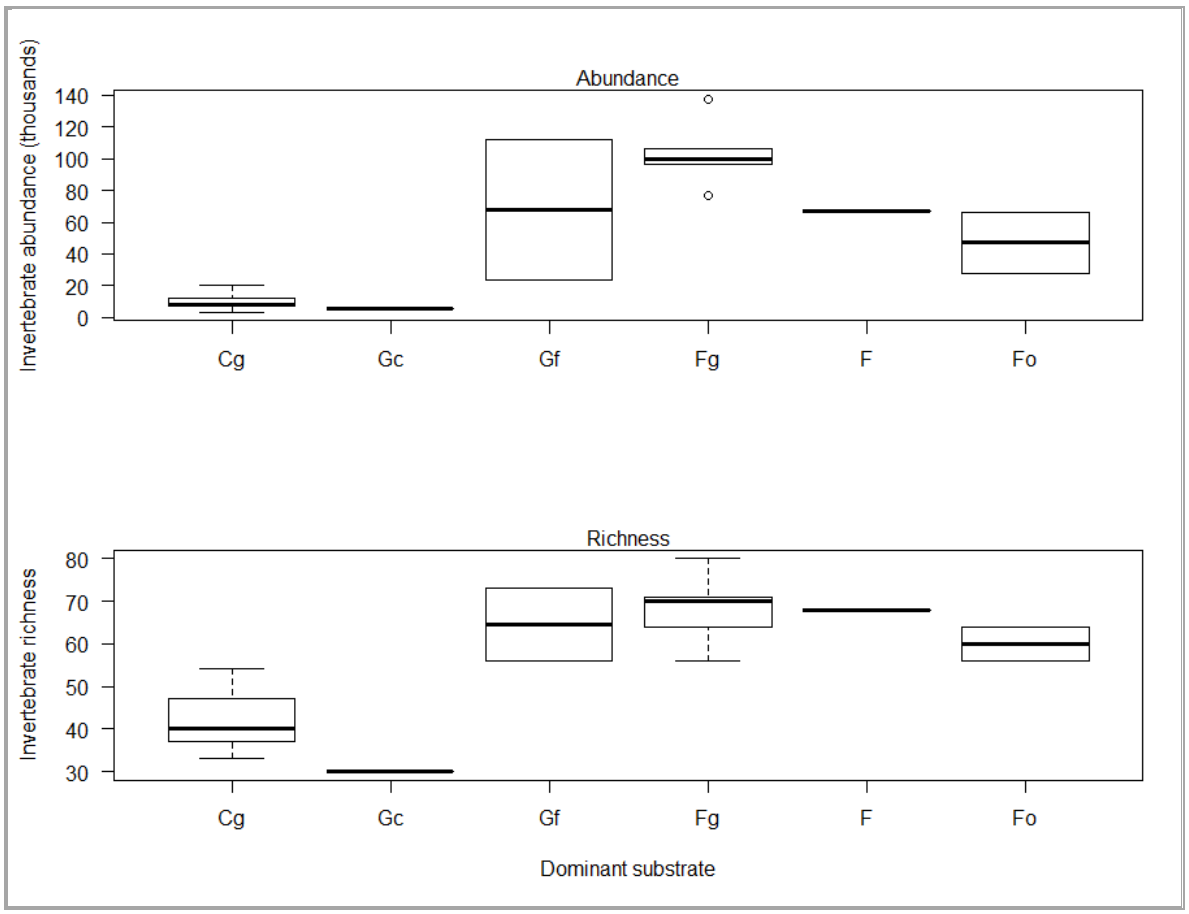


Figure 5.11-19: MDS of Littoral BMI Communities in Relation to Substrate Type, Tatelkuz Lake, August 2013



Note: box = mid-quartile; error bars = 1.5 X interquartile range; bolded lines = median value; Substrates: uppercase = dominant; lower case = subdominant; c = cobble; g = gravel; F = fine; o = organic.

Figure 5.11-20: Littoral BMI Community Abundance and Taxa Richness in Relation to Substrate Type, Tatelkuz Lake, August 2013

To simplify multivariate comparisons of communities, substrates were analyzed in 'Coarse" and "Fine" groups described above. Highest dissimilarity contributions indicate the taxa that best discriminate BMI communities were between coarse and fine substrate classes. The SIMPER analysis (**Table 5.11-18**) indicated many common species across substrate groupings but a general trend of increased abundance was observed for most of the taxa over fine substrates. The only taxa that had greater abundance in the top 20 taxa that differentiated the communities was *Gammarus* sp.

Table 5.11-18: Summary of littoral BMI Bray-Curtis dissimilarity analysis from coarse and fine substrates, Tatelkuz Lake, 2013

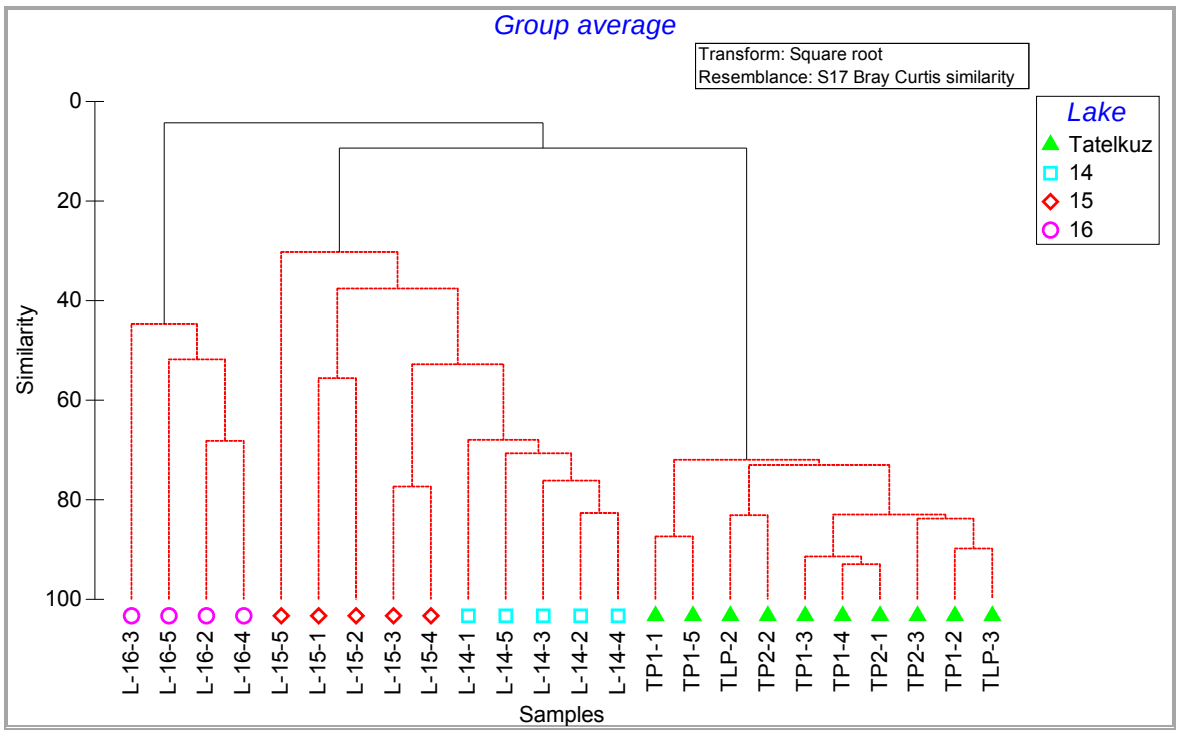
Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Coarse	Fine		
Hyalella sp.	6,023	41,473	11.85	11.85
Amphipoda	1,021	7,951	5.56	17.41
Planorbidae	416	2,255	3.51	20.92
Caenis sp.	619	1,207	2.74	23.66
Gammarus sp.	1,113	292	2.36	26.02
Pisidiidae	490	1,889	2.35	28.37
Glyptotendipes sp.	178	1,163	2.13	30.50
Tanytarsus sp.	12	603	2.10	32.60
Callibaetis sp.	111	933	2.04	34.64
Nais sp.	39	691	1.88	36.52
Orthocladius complex	8	269	1.85	38.37
Mystacides sp.	204	845	1.82	40.19
Ephemera simulans	4	370	1.82	42.01
Dicrotendipes sp.	129	820	1.67	43.68
Paratanytarsus sp.	17	337	1.52	45.20
Procladius sp.	5	298	1.42	46.62
Cryptochironomus sp.	2.7	210	1.35	47.96
Lymnaea sp.	1.8	286	1.34	49.30
Pisidium sp.	40.2	334	1.33	50.63
Cricotopus sp.	0	215	1.32	51.95

Note: Displays only the top 20 taxa

Applying the BEST analysis to continuous environmental data, the set of environmental variables that were most correlated with the Tatelkuz littoral communities were conductivity, algae cover and aquatic vegetation cover (submergent) (Rho: 0.683, P<0.01). Of these variables, algal cover was the best single contributor to the correlation (Rho: 0.584).

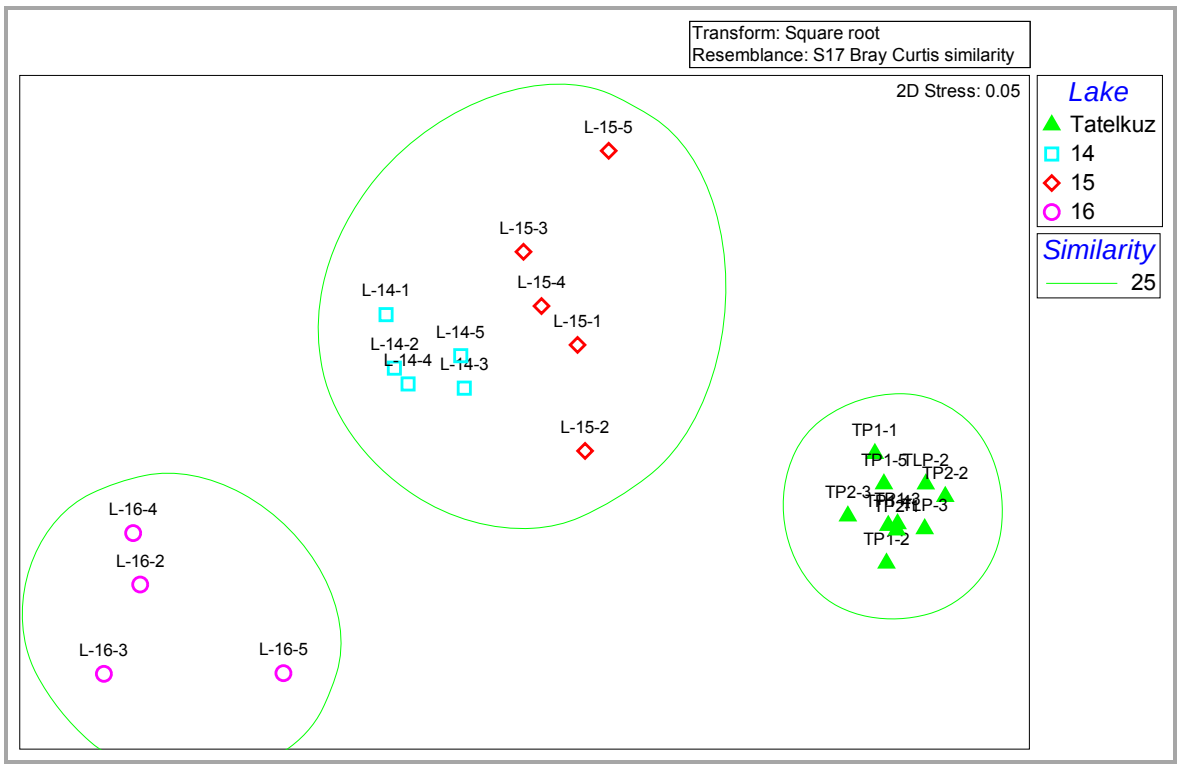
5.11.4.4 Profundal BMI Community Characteristics

The profundal BMI community of Tatelkuz Lake was significantly different than those collected from the headwater lakes (Global R: 0.736, P<0.001; **Figure 5.11-21** and **5.11-22**). However, unlike littoral communities, profundal samples showed no additional structure within Tatelkuz Lake). Almost half of the observed dissimilarity arose from the greater abundance of two dominant taxa (*Chironomus* sp. midges and Tubificid worms) in Tatelkuz Lake relative to the headwater lakes (**Table 5.11-19**).



Note: Community differences measured with Bray-Curtis Index of similarity; data was square-root transformed; solid black lines = statistically significant differences; dashed pink lines = non-significant differences.

Figure 5.11-21: Cluster Analysis of Profundal BMI Communities of Tatelkuz Lake and Headwater Lakes 14, 15 and 16



Note: proximity between points indicates community similarity among samples

Figure 5.11-22: MDS Ordination of Profundal BMI Communities of Tatelkuz Lake in Relation to Lakes 14, 15, and 16

Table 5.11-19: Mean Abundance and Contributions of Profundal BMI Taxa to Bray-Curtis Dissimilarity (SIMPER analysis) in Tatelkuz Lake and Headwater Lakes 14, 15 and 16

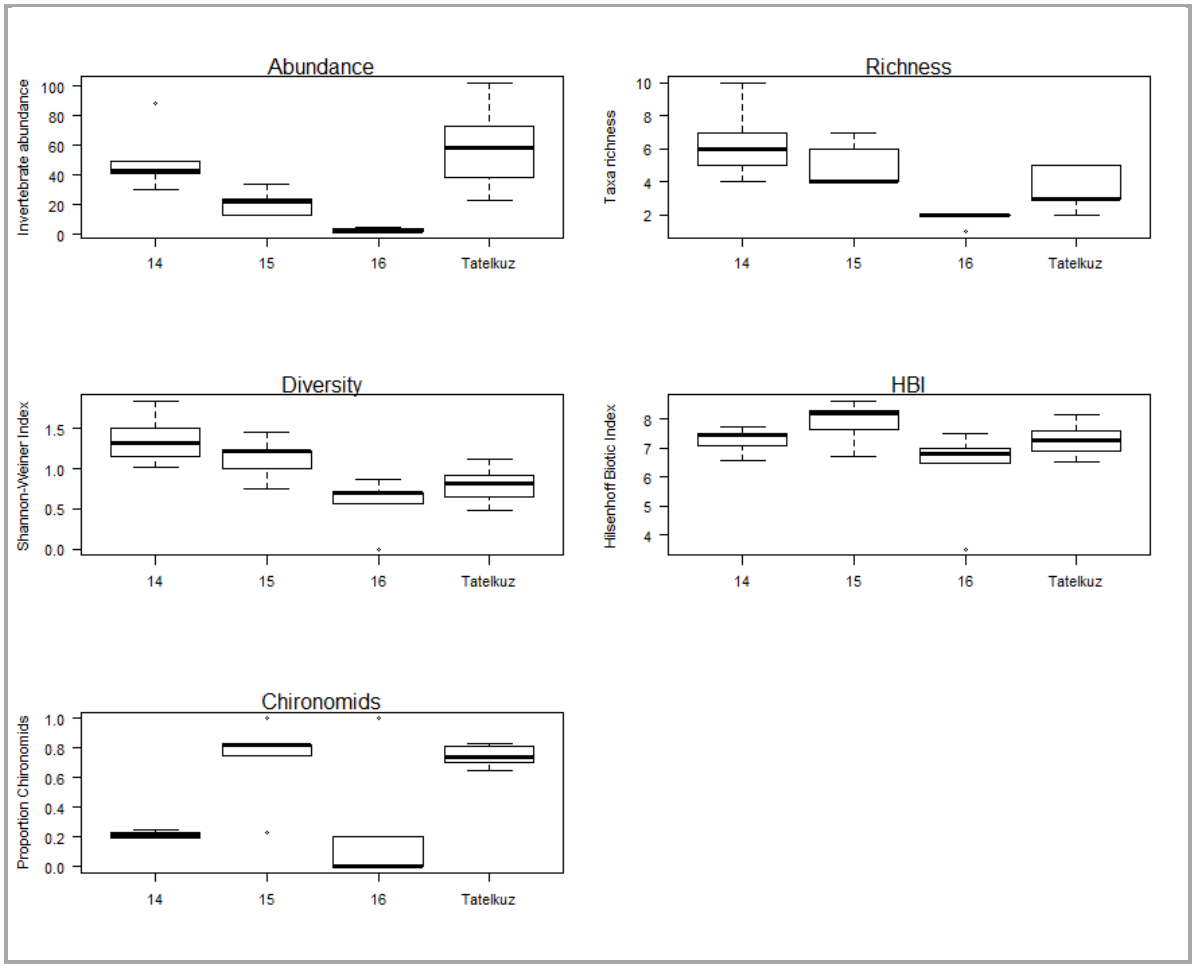
Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater		
Chironomus sp.	37	0.52	29.35	29.35
Tubificinae immature	13	0	19.53	48.88
Procladius sp.	0.01	4.9	9.97	58.85
Pisidium sp.	0	5.3	9.72	68.57
Phaenopsectra sp.	2.8	0	8.45	77.02
Chaoborus sp.	0	1.3	6.07	83.09
Pisidiidae	0	0.7	3.54	86.63
Piona sp.	0	0.2	2.12	88.75
Pristina sp.	0.09	0	1.39	90.13

Note: sp. = species; % = percent; Highest dissimilarity contributions indicate taxa that best discriminate BMI communities in Tatelkuz from headwater lakes.

Variation in profundal BMI communities across lakes was strongly correlated to patterns in environmental conditions (Rho = 0.65, P<0.01). The best correlation for a single

environmental variable was with DO concentration (Rho: 0.65), followed by conductivity (Rho: 0.63). As conductivity was heavily correlated with sample depth (Rho = 0.98), the latter was excluded from the analysis but in the interpretation of these results should be considered interchangeable with conductivity.

Some metrics of Tatelkuz profundal BMI communities were significantly higher than those of the headwater lakes, reflecting the nutrient enriched waters (**Figure 5.11-23** and **Table 5.11-20**). However, scores for taxa richness and the HBI were not significantly different (both rated as “Fairly Poor”).



Note: box = mid-quartile; error bars = 1.5X interquartile range; bolded lines = median value.

Figure 5.11-23: Metrics of Profundal BMI Communities of Tatelkuz Lake and Headwater Lakes 14, 15, and 16

Table 5.11-20: Summary Statistics of BMI Metrics for Profundal Areas of Tatelkuz and Headwater Lakes

Habitat	Metric	Tatelkuz		Headwater Lakes[a]		F (d.f. = 23,1)	P[b]
		Mean	Range	Mean	Range		
Profundal	Abundance	59	23-102	25	2-88	12.11	**<0.002**
	Taxa Richness	3	2-5	4	1-10	1.41	0.247
	Diversity (Shannon-Weiner Index)	0.80	0.48-1.12	1.02	0.00-1.85	2.18	0.153
	HBI	7.31	6.52-8.16	7.15	3.50-8.65	0.17	0.687
	Percent Chironomids	0.75	0.65-0.83	0.39	0.00-1.00	8.96	**0.006**

Note: HBI = Hilsenhoff Biotic Index; d.f. = degrees of freedom; [a] = includes Lakes 14, 15, and 16;
[b] = Bolded values significant at α=0.05

The BMI communities of Tatelkuz Lake are distinct from those sampled in the headwater lakes. These differences likely arise from a combination of the nutrient-enriched condition and the unique morphology and habitat heterogeneity of Tatelkuz Lake relative to the smaller lakes.

The nutrient-enriched nature of the lake is evident from its water conductivity (three to four times higher), elevated plankton biomass, and altered plankton community structure, and also from the BMI communities sampled in lower Chedakuz Creek in 2012 (AMEC, 2013b). While most metric results associated with the lake BMI communities of Tatelkuz Lake align well with expectations for nutrient-enriched lakes (e.g., elevated abundance and HBI scores and low proportion of sensitive EPT taxa), some metrics did not. For example, a system with elevated nutrients would be expected to have a higher proportion of tolerant chironomids and lower taxa richness. However, littoral communities in Tatelkuz Lake had significantly lower proportions of chironomids than the headwater lakes and significantly higher taxa richness. For the latter, elevated taxa richness might be explained by presence of taxonomically rich substrates (e.g., fines) that did not occur in the three headwater lakes.

Profundal BMI communities also showed some signs of nutrient enrichment (e.g., elevated abundance and heightened proportions of chironomids). However, the reduced strength of metric differences relative to littoral BMI communities suggest that environmental factors associated with profundal habitats (e.g., low dissolved oxygen and reduced primary productivity) overshadow the influences of nutrient enrichment in Tatelkuz Lake.

Within Tatelkuz Lake littoral BMI communities, the community structure observed reflects the habitat heterogeneity of the lake. Factors such as substrate size and algae cover were important in segregating communities. For substrate size, communities in coarse substrates were more similar to coarse substrate communities in the headwater lakes than they were to Tatelkuz Lake communities over fine substrates. This underscores the importance of considering habitat during assessments of BMI communities and is reflected in the methods of well-established monitoring protocols (e.g., Reynoldson et al., 1997).

Blackwater Gold Project

Fish and Aquatic Resources
2013 Baseline Report

Part 3 Results

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5.12 Tatelkuz Lake Fish Community

5.12.1 Fish Species Composition

A total of 10 species of fish were observed or captured in Tatelkuz Lake in July 2013 (**Table 5.12-1**). This was three species more than were reported by Walsh and Hale (1977). Brassy minnow, slimy sculpin, and white sucker were captured for the first time in July 2013.

Table 5.12-1: Fish Species Captured in Tatelkuz Lake, July 2013

Common Name	Scientific Name	BC Fish Species Code
Kokanee	*Oncorhynchus nerka*	KO
Rainbow trout	*Oncorhynchus mykiss*	RB
Mountain whitefish	*Prosopium williamsoni*	MW
Burbot	*Lota lota*	BB
Brassy minnow	*Hybognathus hankinsoni*	BMC
Northern pikeminnow	*Ptycheilus oregonensis*	NSC
Slimy sculpin	*Cottus cognatus*	CCG
Largescale sucker	*Catostomus macrocheilus*	CSU
Longnose sucker	*Catostomus catostomus*	LSU
White sucker	*Catostomus commersonii*	WSU

Only brassy minnow is classified as sensitive or vulnerable according to the BC Conservation Data Centre (BC CDC) (BC CDC, 2013). The BC Provincial Conservation Status ranking of brassy minnow is S2S3. This means brassy minnow is a Blue-listed species and is considered to be of special concern because of characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened. Brassy minnow is not ranked by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC, 2013).

5.12.1.1 Rainbow Trout

Rainbow trout (**Plate 5.12-1**) was the most common fish species captured in Tatelkuz Lake in July 2013, comprising 49.9% of the 1,254 fish that were observed or captured (**Table 5.12-2**). It is also the predominant species in streams of the Blackwater LSA because juvenile rainbow trout rear in stream habitat for at least one summer and sometimes two or three summers before migrating into their lake of residence (AMEC, 2013b).



Plate 5.12-1: Rainbow Trout Caught by Gillnet in Tatelkuz Lake, 18 July 2013

Rainbow trout belong to the Family Salmonidae. Unlike other members of the *Oncorhynchus* genus, rainbow trout can spawn multiple times in a lifetime instead of spawning once and dying. All rainbow trout in Tatelkuz Lake spend their entire lives in fresh water.

Rainbow trout are spring spawners (**Table 5.12-3**). Once water temperature rises above 4°C (McPhail, 2007), adults migrate from overwintering lakes or rivers to tributary streams, spawn, and then quickly return to their lakes or rivers of residence (Scott and Crossman, 1973). In Tatelkuz Lake, rainbow trout begin migrating to spawning grounds in May and finish spawning by the end of June.

Embryos incubate in gravel for several weeks and fry emerge to rear in stream habitat. Juveniles spend their first summer in streams – and sometimes stay as long as 1 or 2 years if there is available habitat – and then migrate to their overwintering lake or river. There, they rear and forage until becoming sexually mature adults, typically within 3 to 5 years.

Rainbow trout in streams feed primarily on benthic invertebrates, drifting aquatic insects and terrestrial insects that fall on the water surface. Once in lakes, they will also feed on zooplankton and other fish, if those prey are available.

Table 5.12-2: Number of Fish Captured from Tatelkuz Lake, July 2013

Gear Type	Species										Total
	KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Gillnetting											
Length, weight, released live	7	30	6	0	0	11	2	2	17	2	77
Length, weight, mortality	127	406	51	0	0	52	0	7	27	1	671
Length, weight, aging structure, mortality	24	54	15	1	0	4	0	0	3	0	101
Length, weight, stomach contents, mortality	27	31	5	0	0	0	0	0	0	0	63
Length, weight, aging structure, tissue metals, mortality	0	30	24	0	0	0	0	0	0	0	54
Length, weight, aging structure, stomach contents, mortality	35	67	49	0	0	0	0	0	0	0	152
Length, weight, aging structure, tissue metals, stomach contents, mortality	0	5	9	0	0	0	0	0	0	0	14
Escaped during sampling	2	2	2	0	0	1	0	2	0	0	9
Total	**222**	**625**	**161**	**1**	**0**	**68**	**2**	**11**	**47**	**3**	**1,140**
Minnow Trapping											
Length, weight, released live	0	1	0	0	31	18	58	0	6	0	114
Total	**0**	**1**	**0**	**0**	**31**	**18**	**58**	**0**	**6**	**0**	**114**
Grand Total	**222**	**626**	**161**	**1**	**31**	**86**	**60**	**11**	**53**	**3**	**1,254**

Notes: KO = kokanee, RB = rainbow trout, MW = mountain whitefish, BB = burbot; BMC = brassy minnow; NSC = northern pikeminnow, CCG = slimy sculpin, CSU = largescale sucker; LSU = longnose sucker; WSU = white sucker

Table 5.12-3: Life history Periodicity Chart for the Ten Fish Species Captured in Tatelkuz Lake in July 2013

Species	Life Stage – Activity	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Kokanee	Adult migration/spawning																								
	Embryo incubation																								
	Juvenile migration																								
	Juvenile rearing																								
	Juvenile overwintering																								
	Adult rearing																								
	Adult overwintering																								
Rainbow trout	Adult migration/spawning																								
	Embryo incubation																								
	Juvenile migration (lake dwelling)																								
	Juvenile rearing																								
	Juvenile overwintering																								
	Adult rearing																								
	Adult overwintering																								
Mountain whitefish	Adult spawning																								
	Embryo incubation																								
	Juvenile migration																								
	Juvenile rearing																								
	Juvenile overwintering																								
	Adult rearing																								
	Adult migration																								
	Adult overwintering																								

Species	Life Stage – Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Burbot	Adult migration/spawning												
	Embryo incubation												
	Juvenile rearing												
	Adult rearing												
Brassy minnow	Adult spawning												
	Embryo incubation												
	Juvenile rearing												
	Juvenile overwintering												
	Adult rearing												
	Adult overwintering												
Northern pikeminnow	Adult spawning												
	Embryo incubation												
	Juvenile rearing												
	Juvenile overwintering												
	Adult rearing												
	Adult overwintering												
Slimy sculpin	Adult migration/spawning												
	Embryo incubation												
	Juvenile rearing												
	Adult rearing												
Largescale sucker	Adult spawning												
	Embryo incubation												
	Juvenile migration												
	Juvenile rearing												

Species	Life Stage – Activity	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	Juvenile overwintering																								
	Adult rearing																								
	Adult overwintering																								
Longnose sucker	Adult migration/spawning																								
	Embryo incubation																								
	Juvenile migration																								
	Juvenile rearing																								
	Juvenile overwintering																								
	Adult rearing																								
	Adult overwintering																								
White sucker	Adult migration/spawning																								
	Embryo incubation																								
	Juvenile migration																								
	Juvenile rearing																								
	Juvenile overwintering																								
	Adult rearing																								
	Adult overwintering																								

Note: Red bars represents embryo stages, blue bars represents adult stages, and green bars represents juvenile stages

Rainbow trout are the most popular freshwater sport fish in BC, and are harvested in Tatelkuz Lake by members of the Lhoosk'uz Dene Nation. In an interview with residents of Indian Reserve (IR) #28 on 4 July 2013, they reported that they fish for rainbow trout, suckers, and kokanee in Tatelkuz Lake, Davidson Creek, and in lower and middle Chedakuz Creek, usually in the spring (i.e., when rainbow trout and suckers conduct spawning migrations into streams). Residents of IR #28 rely heavily on fish resources as a food source, with three to four meals per week consisting of fish (Interviews with Lhoosk'uz Dene Elders, 2013).

Based on the results of the 2011 and 2012 stream surveys (AMEC, 2013b), and on a microsatellite DNA analysis, one population of rainbow trout is assumed to spawn in each watershed of the LSA. The exception is rainbow trout in those watersheds with headwater lakes, in which case one additional population is assumed to exist for each headwater lake. Therefore, representatives from at least five and perhaps six separate spawning populations may reside in Tatelkuz Lake: one from Turtle Creek, one from lower Davidson Creek (and possibly from the headwater lake of Davidson Creek if juveniles migrate downstream past barriers to upstream passage), one from Creek 661, and one from each of the lower and middle reaches of Chedakuz Creek.

It is currently unknown what proportion each of these populations makes to the Tatelkuz Lake population sampled in July 2013 because there are no identifiable phenotypic (i.e., visible) differences between individuals from different populations.

5.12.1.2 Kokanee

Kokanee (**Plate 5.12-2**) was the second most common species captured in Tatelkuz Lake, comprising 17.7% of total fish captured (**Table 5.12-2**).

Kokanee live in lakes where they feed mostly on zooplankton and small fish (McPhail, 2007). In late summer and fall, when water temperatures drop below 12°C (Ford et al., 1995; McPhail, 2007), adult kokanee in BC typically migrate from their residence lakes to tributary streams to spawn (Scott and Crossman, 1973). In the LSA and RSA, kokanee spawners were observed in spawning creeks from mid-July to mid-September (**Table 5.12-3**). In lakes, kokanee may also spawn in inshore areas where upwelling or subsurface flows exist (McPhail, 2007). Kokanee lake spawning has not been observed in Tatelkuz Lake.

On the spawning grounds, females establish territories and dig nests (referred to as "redds") into which they deposit their eggs. After fertilization of eggs by a male, the female covers the nest with gravel. Adults die within several weeks of spawning, and embryos incubate in gravel over winter. Fry emerge after ice break-up, which occurs in late May (**Table 5.12-3**), and quickly migrate to their residence lake.

Juveniles rear in their residence lakes over summer and early fall. Overwintering begins once an ice cover forms over residence lakes.



Plate 5.12-2: Kokanee Caught by Gillnet in Tatelkuz Lake, 19 July 2013

Kokanee are a popular sport fish in BC, and have been harvested by residents of IF #28 in the LSA and RSA (Interviews with Lhoosk'uz Dene Elders, 2013)

Tatelkuz and Kuyakuz lakes are the two residence lakes for kokanee in the LSA and RSA, respectively. Kokanee are not present in the four headwater lakes of the LSA.

Microsatellite DNA analysis of kokanee tissue samples collected in the LSA in 2012 showed three broad groupings of kokanee, one of which is present in Kuyakuz Lake and its tributaries, and two of which are present in Tatelkuz Lake and its tributaries (AMEC, 2013b).

There are assumed to be at least two groups of kokanee populations in Tatelkuz Lake (**Section 5.15.1**). The first group includes populations that spawn from mid-July to late August in Davidson Creek, Creek 661, Creek 522107, Creek 601947, and middle Chedakuz Creek. The second group spawns in September in lower Chedakuz Creek just downstream of the outlet of Tatelkuz Lake. Temperature differences between the spawning grounds maintain the separation of the two populations. Water temperatures are always higher in lower Chedakuz Creek than in higher-elevation tributaries such as Davidson Creek and Creek 661, thereby allowing later spawning of some kokanee in lower Chedakuz Creek than in other tributaries.

5.12.1.3 Mountain Whitefish

Mountain whitefish (**Plate 5.12-3**) was the third most common species captured in Tatelkuz Lake in 2013 (**Table 5.12-2**), comprising 12.8% of the total number of fish observed and captured.

Mountain whitefish is one of many species of whitefishes (Subfamily Coregoninae) in the northern hemisphere. It is a lake-resident fish that spawns in large tributary streams in late fall (September to October) (Roberge et al., 2002) (**Table 5.12-3**). No nest is prepared. Instead, eggs are broadcast over gravel. Adults return to lakes immediately after spawning. Embryos develop in the gravel over winter and fry emerge in spring and immediately migrate to residence lakes. Their diet consists mainly of BMI.



Plate 5.12-3: Mountain Whitefish Caught by Gillnet in Tatelkuz Lake, 18 July 2013

In BC, mountain whitefish is a sport fish and historically a food fish.

Population structure of mountain whitefish in Tatelkuz Lake is not well understood because of low catches in streams of the LSA in 2011 and 2012 (AMEC, 2013b). Microsatellite DNA analyses were carried out only for rainbow trout and kokanee. Most mountain whitefish residing in Tatelkuz Lake are assumed to spawn in lower or middle Chedakuz Creek. This is because Chedakuz Creek is the main inlet and outlet of the lake and is the largest stream in the immediate vicinity of the lake. Mountain whitefish spawn in larger creeks and rivers (Roberge et al., 2002) and typically avoid smaller tributaries. However, the use of Chedakuz

Creek by mountain whitefish for spawning has not been confirmed due to the difficulty in installing hoop nets in such a large stream, particularly at higher fall discharges.

The mountain whitefish spawning survey of fall 2012 showed that mountain whitefish spawners are present in low numbers in lower Davidson Creek and in Creek 705. This indicates the existence of at least two populations in the LSA: one population that resides in Tatelkuz Lake and spawns in lower Davidson Creek and, perhaps, lower and middle Chedakuz Creek, and a second population that resides in one or more lakes in the Fawnie Creek Watershed. However, the Fawnie Creek population would not contribute to the Tatelkuz Lake population due to its location on the other side of Mount Davidson.

5.12.1.4 Northern Pikeminnow

Northern pikeminnow (**Plate 5.12-4**) was the fourth most common species captured in Tatelkuz Lake in July 2013 (**Table 5.12-2**), comprising 6.9% of the total number of fish captured and observed. It is the largest native member of the minnow family (Family Cyprinidae) in British Columbia.



Plate 5.12-4: Northern Pikeminnow Caught by Gillnet in Tatelkuz Lake, 18 July 2013

Northern pikeminnow are mainly found in lakes and slow-moving rivers, with adults preferring deeper habitat than juveniles (Scott and Crossman, 1973). The diet of juvenile northern pikeminnow is dominated by insects and plankton while adults feed primarily on fish. This species is the dominant predator of the Tatelkuz Lake fish community.

Northern pikeminnow spawn in spring when water temperature reaches the threshold temperature of 12°C (**Table 5.12-3**). Spawning typically takes place in shallow water over a gravel-dominated substrate. Spawning sites can be located along lake shores or on stream riffles immediately upstream of lakes. No nest is prepared. Eggs are broadcast over gravel and settle into interstices following fertilization. Fry emerge in approximately 6 days and migrate to shallow lake habitats to rear.

The population structure of northern pikeminnow in the LSA and RSA is not well understood because of low catches in 1977 and 2013. However, there is at least one population in Tatelkuz Lake. At present, it is unclear where northern pikeminnow in Tatelkuz Lake spawn. It is likely to be in Chedakuz Creek or Tatelkuz Lake itself because no northern pikeminnow were captured during the spring hoopnetting survey conducted in Davidson Creek, Creek 661 and Turtle Creek in 2011.

5.12.1.5 Slimy Sculpin

Slimy sculpin (**Plate 5.12-5**) was the fifth most common species captured in Tatelkuz Lake in 2013 (**Table 5.12-2**), comprising 4.8% of the total number of fish captured and observed. It was the only member of the sculpin family (Family Cottidae) captured from Tatelkuz Lake in July 2013. All but two slimy sculpin were captured in minnow traps and they comprised the largest portion of the total minnow trap catch (58 of 114 or 51%).



Plate 5.12-5: Slimy Sculpin Caught by Minnow Trap in Tatelkuz Lake, 18 July 2013

Slimy sculpin are typically found along lake bottoms or in cool, rocky streams. Their diet generally consists of aquatic insect larvae and nymphs (Scott and Crossman, 1973). Slimy sculpin are prey for larger, predaceous fishes such as northern pikeminnow, rainbow trout, and burbot.

Slimy sculpin spawning typically occurs in mid-March to early April, when water temperature reaches 4°C (**Table 5.12-3**). Males excavate and defend nest cavities beneath flat rocks in preparation for spawning. Females enter the nest and deposit their adhesive eggs on the ceiling of the nest. Males then guard the eggs until they hatch, usually for approximately one month. Larvae typically remain in the nest for 2 weeks after hatching.

The population structure of slimy sculpin in the LSA and RSA is not well understood because of low catches in 1977 and in 2013. There is at least one population in Tatelkuz Lake.

5.12.1.6 Longnose Sucker

Longnose sucker (**Plate 5.12-6**) was the sixth most common species captured in Tatelkuz Lake in July 2013 (**Table 5.12-2**), comprising 4.2% of the total number of fish captured or observed. It belongs to the sucker family (Family Catostomidae). It resides in both lakes and rivers and feeds exclusively on BMIs.



Plate 5.12-6: Longnose Sucker Caught by Gill Net in Tatelkuz Lake, 20 July 2013

Immediately after ice-out in spring, adult longnose suckers migrate to spawning sites in tributary streams and along lake beaches (Roberge et al., 2002) (**Table 5.12-3**). Eggs are sticky and are deposited on the surface of gravel (Scott and Crossman, 1973). Adults quickly return to their residence area, whether lake or stream. Fry hatch several weeks later and migrate to their residence lake.

In historical times, it was a common food for dogs in northern Canada (Scott and Crossman, 1973).

Tatelkuz and Kuyakuz lakes are probably the primary residence lakes for longnose sucker in the LSA and RSA. Burns (1977) reported them present in Kuyakuz Lake, and Walsh and Hale (1977) reported them present in Tatelkuz Lake. In 2012, they were captured in the two headwater lakes of Creek 705 (Lake 01538UEUT and Lake 01428UEUT), but not in Lake 01682LNRS, the headwater lake of Davidson Creek.

The population structure of longnose sucker in the LSA and RSA is not well understood because of low catches. A working hypothesis is the presence of at least four separate populations – one each for Tatelkuz Lake, Kuyakuz Lake, Lake 01538UEUT, and Lake 01428UEUT.

5.12.1.7 Brassy Minnow

Brassy minnow (**Plate 5.12-7**) was the seventh most common species captured in 2013 (**Table 5.12-2**), comprising 2.5% of the total number of fish observed and captured. Brassy minnow are small in body size and belong to the Family Cyprinidae.

They are found mainly in small streams and wetlands where they feed on a wide assortment of plants and small invertebrates. Distribution in BC is disjunct, with isolated populations in the lower Fraser Valley and in the Nechako Lowlands near Vanderhoof and Prince George (McPhail, 2007; Nowosad, 2013). For this reason, brassy minnow is classified by the BC CDC (2013) as “S2S3” (i.e., “Imperilled. Special concern. Vulnerable to extirpation or extinction.”).

Spawning of brassy minnow begins in mid-June and continues to early August (McPhail, 2007) (**Table 5.12-3**). They usually lay their eggs in late spring among the vegetation in shallow areas of streams or lakes, adjoining lagoons and in flooded marshes. Embryo development is rapid and fry emerge in less than 1 week.

The population structure of brassy minnow in the LSA and RSA is not well understood because of low catches in 1977 and 2013. There is at least one population in Tatelkuz Lake.



Plate 5.12-7: Brassy Minnow Caught by Minnow Trap in Tatelkuz Lake, 18 July 2013

5.12.1.8 Largescale Sucker

Largescale sucker (**Plate 5.12-8**) was the eighth most common species captured in Tatelkuz Lake in 2013 (**Table 5.12-2**), comprising 0.9% of the total number of fish captured or observed. It belongs to the sucker family (Family Catostomidae).

Largescale sucker reside in both lakes and slow-moving rivers. Adults feed primarily on BMI and periphyton, while juveniles feed on plankton.

Largescale sucker spawn in the spring, after water temperatures reach a minimum of 8°C (**Table 5.12-3**). Spawning takes place over coarse gravel or cobble substrates. Spawning sites are typically located in shallow water areas of lakes or adjacent to riffles in rivers. No nest is created, although the substrate is cleaned and a shallow depression is created during egg release. Eggs are broadcast over the cleaned gravel and adhere to the gravel surface. Fry emerge between 7 and 20 days after fertilization, depending on temperature.

The population structure of largescale sucker in the LSA and RSA is not well understood because of low catches in 1977 and 2013. Tatelkuz and Kuyakuz lakes are the primary residence lakes for longnose sucker in the LSA and RSA (Burns, 1977).



Plate 5.12-8: Largescale Sucker Caught by Gill Net in Tatelkuz Lake, 20 July 2013

5.12.1.9 White Sucker

White sucker was the ninth most common species captured in Tatelkuz Lake in 2013 (**Table 5.12-2**), comprising 0.2% of the total number of fish captured or observed. It belongs to the sucker family (Family Catostomidae).

Like the longnose sucker, it resides in lakes and streams and migrates to tributaries in spring to spawn (Scott and Crossman, 1975) (**Table 5.12-3**). It feeds on BMI.

Its population structure in the LSA and RSA is not well understood because of low catches. One population exists in Tatelkuz Lake, and at least one other population exists in a watershed along the transmission line corridor (AMEC, 2013b).

5.12.1.10 Burbot

Burbot (**Plate 5.12-9**) was the tenth most common species captured in Tatelkuz Lake in 2013 (**Table 5.12-2**), comprising 0.1% of the total number of fish captured.



Plate 5.12-9: Burbot Caught by Electrofishing in Creek 705, 14 August 2013

Burbot are the only freshwater member of the cod family (Family Gadidae). They are also the only species in the LSA and RSA that spawns in mid-winter (January to March), mainly on lake shoals or in the outlets of lakes (Scott and Crossman, 1973) (**Table 5.12-3**). Embryos take 1 to 2 months to develop, depending on temperature (McPhail, 2007). Juveniles feed on algae and BMI. Adult burbot are predators of fish eggs and juveniles, as well as of BMI.

Burbot population structure in Tatelkuz Lake is not well understood because of low catches. One population exists in Tatelkuz Lake and at least one population exists in the Fawnie Creek Watershed, based on the capture of four burbot in June 2011 as they passed through hoop nets in lower Creek 705 (AMEC, 2013b) and the capture of several burbot in lower Creek 705 in July 2013. Their capture during the rainbow trout spawning season in 2011 suggests they were intent on eating rainbow trout eggs.

5.12.2 Sampling Effort, Catch, and CPUE

This section summarizes sampling effort, catch, and CPUE for the fish-sampling program conducted in Tatelkuz Lake in July 2013. **Annex 5.12-1** shows detailed data on sampling effort, catch, and CPUE for both gillnets and minnow traps. **Table 5.12-4** shows the total effort, total catch and total CPUE of each gillnet set in Tatelkuz Lake in 2013.

Table 5.12-4: Total Gillnet Effort, Catch and CPUE in Tatelkuz Lake, July 2013

Sampling Date	Set ID	Gillnet Type	Depth (m)	Net Area (m^2)	Soak Time (h)	Species	Total Catch	Total CPUE[1]
15-Jul-13	A1N5Nord	Nordic	0 – 5	55	1.6	RB	9	245.9
15-Jul-13	A1O15Nord	Nordic	10 – 15	113	1.6	NFC	0	0.0
15-Jul-13	A1N5	RIC Floating	0 – 5	219	1.9	RB	34	198.0
15-Jul-13	A1O20	RIC Sinking	15 – 20	219	14.5	MW, NSC, LSU, BB	13	9.8
15-Jul-13	A2N5	RIC Sinking	0 – 5	219	2.1	RB, KO, MW, NSC, WSU	59	308.1
15-Jul-13	A2O15	RIC Sinking	10 – 15	219	1.9	NFC	0	0.0
16-Jul-13	B2O15Nord	Nordic	10 – 15	55	3.1	NFC	0	0.0
16-Jul-13	B1O5	RIC Floating	0 – 5	219	3.9	RB, KO, LSU	32	91.1
16-Jul-13	B2O5	RIC Floating	0 – 5	219	3.8	RB, KO	12	35.1
16-Jul-13	G2N5	RIC Floating	0 – 5	219	2.7	RB, MW, NSC	40	160.5
16-Jul-13	H1N5	RIC Floating	0 – 5	219	2.3	RB, MW, NSC, LSU, CSU	49	231.9
16-Jul-13	I1N5	RIC Floating	0 – 5	219	2.1	RB, KO, NSC	15	78.9
16-Jul-13	I2N5	RIC Floating	0 – 5	219	1.8	RB, MW	34	203.3
16-Jul-13	A2O15	RIC Sinking	10 – 15	219	13.0	RB, KO	5	4.2
16-Jul-13	B1O15	RIC Sinking	10 – 15	219	12.5	MW, LSU	7	6.1
16-Jul-13	B1O25	RIC Sinking	20 – 25	219	4.1	MW	3	8.1
16-Jul-13	B1O30	RIC Sinking	25 – 30	219	4.7	MW, LSU	2	4.7
16-Jul-13	B2O20	RIC Sinking	15 – 20	219	3.8	NSC	1	2.9
16-Jul-13	B2O30	RIC Sinking	25 – 30	219	3.9	NFC	0	0.0
16-Jul-13	C2O15	RIC Sinking	10 – 15	219	12.0	RB, KO	35	32.0
17-Jul-13	G1O10	Nordic	5 – 10	113	4.0	NFC	0	0.0
17-Jul-13	G2O15	Nordic	10 – 15	113	3.5	NFC	0	0.0
17-Jul-13	H1O20	Nordic	15 – 20	55	3.6	NFC	0	0.0
17-Jul-13	H2N5	Nordic	0 – 5	55	1.6	NFC	0	0.0
17-Jul-13	I1N10	Nordic	5 – 10	55	3.3	NFC	0	0.0
17-Jul-13	I2N5	Nordic	0 – 5	113	3.0	NFC	0	0.0
17-Jul-13	F2N5	RIC Floating	0 – 5	219	2.3	RB, KO, MW, NSC	78	369.2
17-Jul-13	G1N5	RIC Floating	0 – 5	219	3.4	RB, KO, NSC, CSU	21	67.4
17-Jul-13	H1O5	RIC Floating	0 – 5	219	5.3	RB, KO, NSC	16	33.4
17-Jul-13	I2O5	RIC Floating	0 – 5	219	5.4	RB, KO	16	32.6
17-Jul-13	G1O15	RIC Sinking	10 – 15	219	4.3	NFC	0	0.0
17-Jul-13	G2O20	RIC Sinking	15 – 20	219	17.9	RB, KO	2	1.2
17-Jul-13	G2O25	RIC Sinking	20 – 25	219	5.3	LSU	4	8.4
17-Jul-13	H1O25	RIC Sinking	20 – 25	219	17.8	KO, MW	2	1.2
17-Jul-13	H2O15	RIC Sinking	10 – 15	219	4.2	NFC	0	0.0
17-Jul-13	I1O15	RIC Sinking	10 – 15	219	2.2	MW, LSU	4	20.2
17-Jul-13	I2N10	RIC Sinking	5 – 10	219	3.3	MW	2	6.7
17-Jul-13	I2O15	RIC Sinking	10 – 15	219	18.3	KO, MW, LSU	9	5.4
18-Jul-13	A2N10	Nordic	5 – 10	113	7.2	RB, KO	3	8.8
18-Jul-13	A2O20	Nordic	15 – 20	113	6.3	NFC	0	0.0
18-Jul-13	C1N5	Nordic	0 – 5	55	2.9	RB, KO, MW, LSU	22	327.9

Table continues…

Sampling Date	Set ID	Gillnet Type	Depth (m)	Net Area (m^2)	Soak Time (h)	Species	Total Catch	Total CPUE[1]
18-Jul-13	C1O35	Nordic	30 – 35	113	6.2	NFC	0	0.0
18-Jul-13	C2O20	Nordic	15 – 20	113	14.7	NFC	0	0.0
18-Jul-13	D2O25	Nordic	20 – 25	113	5.5	NFC	0	0.0
18-Jul-13	E1O15	Nordic	10 – 15	55	16.1	CCG	1	2.7
18-Jul-13	E1O20	Nordic	15 – 20	55	5.8	RB, KO	2	15.1
18-Jul-13	B2O5	RIC Floating	0 – 5	219	2.6	RB, KO, NSC	42	174.9
18-Jul-13	D1O5	RIC Floating	0 – 5	219	5.7	RB, KO	36	69.7
18-Jul-13	E1N5	RIC Floating	0 – 5	219	3.6	RB, KO, NSC	25	77.2
18-Jul-13	E2O5	RIC Floating	0 – 5	219	5.7	RB, KO	20	38.4
18-Jul-13	A2O20	RIC Sinking	15 – 20	219	14.2	KO, MW, LSU, CSU	16	12.4
18-Jul-13	B1N10	RIC Sinking	5 – 10	219	2.5	RB, KO, MW, CSU	11	48.6
18-Jul-13	C1N10	RIC Sinking	5 – 10	219	4.7	RB, KO, NSC, LSU	27	62.5
18-Jul-13	D1O20	RIC Sinking	15 – 20	219	5.4	NFC	0	0.0
18-Jul-13	D1O25	RIC Sinking	20 – 25	219	16.4	KO	1	0.7
18-Jul-13	D2O20	RIC Sinking	15 – 20	219	16.7	NFC	0	0.0
18-Jul-13	D2O35	RIC Sinking	30 – 35	219	5.9	LSU	3	5.6
18-Jul-13	E2O15	RIC Sinking	10 – 15	219	5.6	LSU	1	2.0
18-Jul-13	F1O25	RIC Sinking	20 – 25	219	5.7	NFC	0	0.0
18-Jul-13	G2N10	RIC Sinking	5 – 10	219	2.7	RB, KO, MW	17	68.2
19-Jul-13	B1N5	Nordic	0 – 5	55	3.8	RB, KO	17	197.3
19-Jul-13	C1O25	Nordic	20 – 25	113	3.1	NFC	0	0.0
19-Jul-13	C2N10	Nordic	5 – 10	55	4.3	LSU	4	40.8
19-Jul-13	C2O10	Nordic	5 – 10	113	4.0	NFC	0	0.0
19-Jul-13	C2O30	Nordic	25 – 30	55	4.4	NFC	0	0.0
19-Jul-13	C2N5	RIC Floating	0 – 5	219	4.2	RB, KO	39	101.4
19-Jul-13	D2N5	RIC Floating	0 – 5	219	5.6	RB, KO	24	47.1
19-Jul-13	D1N10	RIC Sinking	5 – 10	219	3.1	MW, LSU	9	31.5
19-Jul-13	E2N10	RIC Sinking	5 – 10	219	5.5	RB, KO, MW, LSU, CSU	11	22.0
19-Jul-13	G2N10	RIC Sinking	5 – 10	219	6.0	NFC	0	0.0
19-Jul-13	H1O10	RIC Sinking	5 – 10	219	4.9	KO	3	6.7
19-Jul-13	I1O20	RIC Sinking	15 – 20	219	5.4	MW, NSC, LSU	16	32.5
20-Jul-13	C1N5	Nordic	0 – 5	55	16.4	RB, MW, CCG	4	10.7
20-Jul-13	B2N5	RIC Floating	0 – 5	219	17.3	RB, KO, NSC, LSU, CSU	54	34.2
20-Jul-13	F1N5	RIC Floating	0 – 5	219	17.1	RB, KO, NSC, LSU	95	60.9
20-Jul-13	F1O20	RIC Sinking	15 – 20	219	17.1	RB	1	0.6
20-Jul-13	G2O10	RIC Sinking	5 – 10	219	16.2	KO, MW, NSC, LSU	59	40.1
20-Jul-13	I2N10	RIC Sinking	5 – 10	219	17.3	RB, KO, MW, NSC, WSU, LSU, CSU	73	46.4

Note: [1] CPUE for gill-netting is number of fish/100 m^2/day
CPUE = Catch-Per-Unit-Effort; RB = rainbow trout; KO = kokanee; MW = mountain whitefish; BB = burbot; NSC = northern pikeminnow; CCG = slimy sculpin; LSU = longnose sucker; CSU = largescale sucker; WSU = white sucker; m^2 = metres squared; NFC = no fish captured

5.12.2.1 Effort

A total of 78 individual gillnet sets were made during the survey (**Table 5.12-5**). These included 52 RISC gillnet sets (19 floating and 36 sinking), 9 nearshore Nordic net sets, and 14 offshore Nordic net sets. Combined, these sets resulted in 479.0 hours of gillnetting over the 5 day survey. In addition, a total of 126 minnow traps were set over the duration of the survey at 25 different sites. In total, these sets resulted in 3,289.6 trap-hours of minnow trap effort.

The sampling design described in **Section 4.12.1** was based on distributing gillnet sampling effort to those lake cells, habitats, and depth strata that were known from the preliminary results of the hydroacoustic survey to contain most of the observable fish in the lake. The simplest and most easily understood means of showing that distribution of effort was to plot total gillnet soak time on sampling cells, habitats, and depth. Soak time is not the same as fishing effort, but it is a more easily understood surrogate of effort.

Table 5.12-5: Summary of Gillnet Fishing Effort, Tatelkuz Lake, July 2013

Gear type	Number of Sets	Effort (h)
RISC floating	19	300.6
RISC sinking	36	96.6
Nordic nearshore	9	44,1
Nordic pelagic	14	81.8
Total	**78**	**479.0**

A plot of total soak time on nearshore and offshore habitat within each pooled lake sampling cell (A to I) showed that soak time was distributed across all cells without any obvious spatial trends (**Figure 5.12-1**). It also showed that more soak time was expended in offshore habitat than in nearshore habitat. Mean total soak time (pooled across cells A to I) was 41 hours (range: 23 to 55 hours) for offshore habitat compared to 17 hours (range: 3 to 33 hours) for nearshore habitat.

A plot of total soak time on day and night sets within pooled sampling cells showed an approximately uniform distribution of soak time across sampling cells (**Figure 5.12-2**). It also showed that more total soak time was expended on night sets than on day sets, although the differences were relatively small and there was substantial variation among cells. Mean total soak time (pooled across cells A to I) was 32 hours (range: 16 to 43 hours) for night sets compared to 26 hours (range: 8 to 34 hours) for day sets.

A plot of total soak time on each of the seven depth strata showed that soak time decreased with depth (**Figure 5.12-3**).

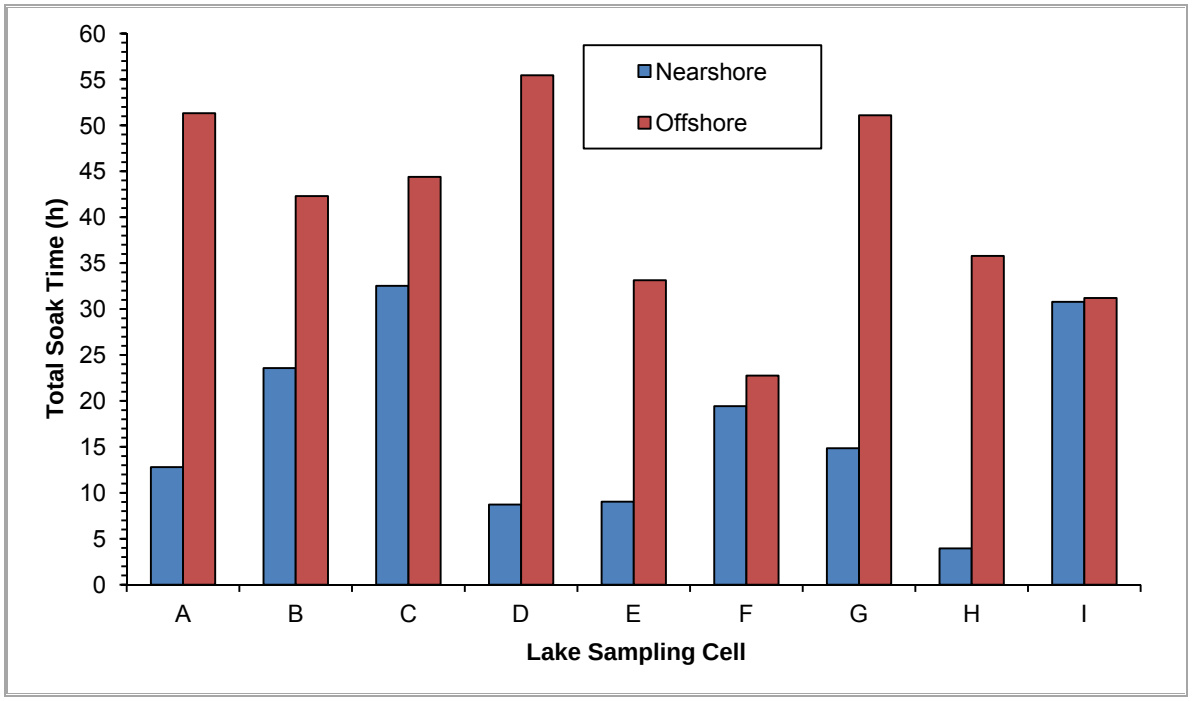


Figure 5.12-1: Total Gillnet Soak Time by Lake Sampling Cell and Nearshore and Offshore Habitat, Tatelkuz Lake, July 2013

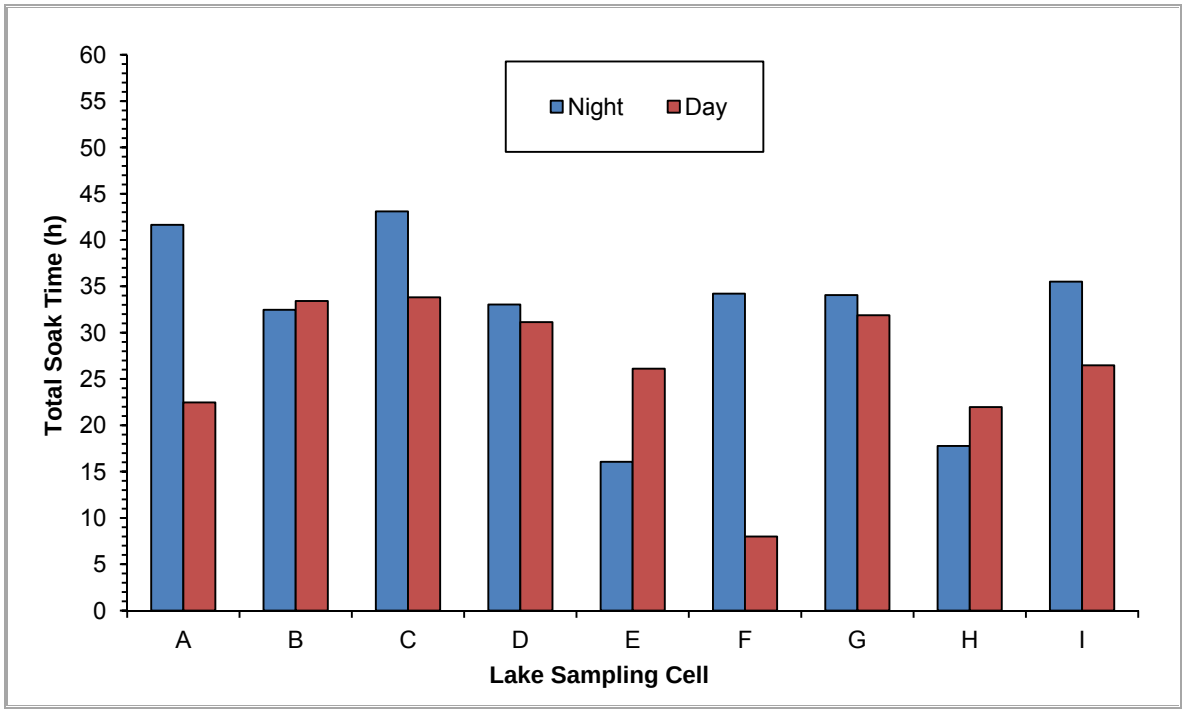


Figure 5.12-2: Total Gillnet Soak Time by Lake Sampling Cell and Time of Day, Tatelkuz Lake, July 2013

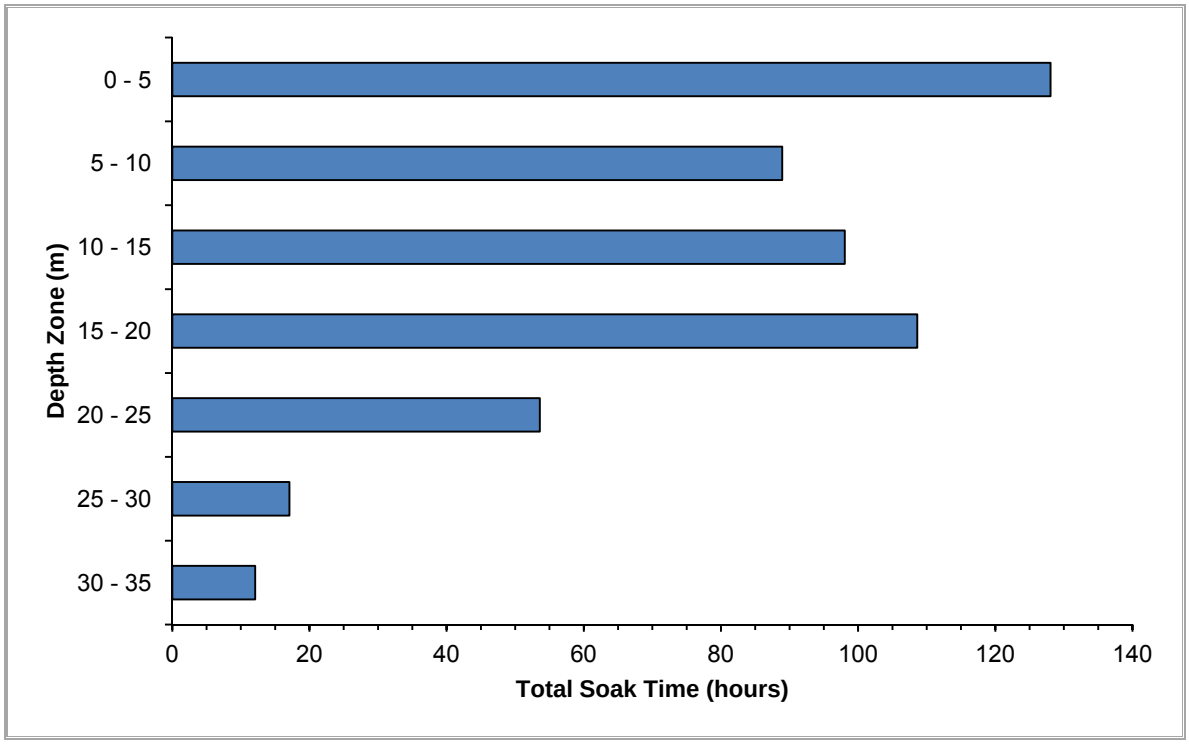


Figure 5.12-3: Total Gillnet Soak Time by Depth, Tatelkuz Lake, July 2013

5.12.2.2 Catch

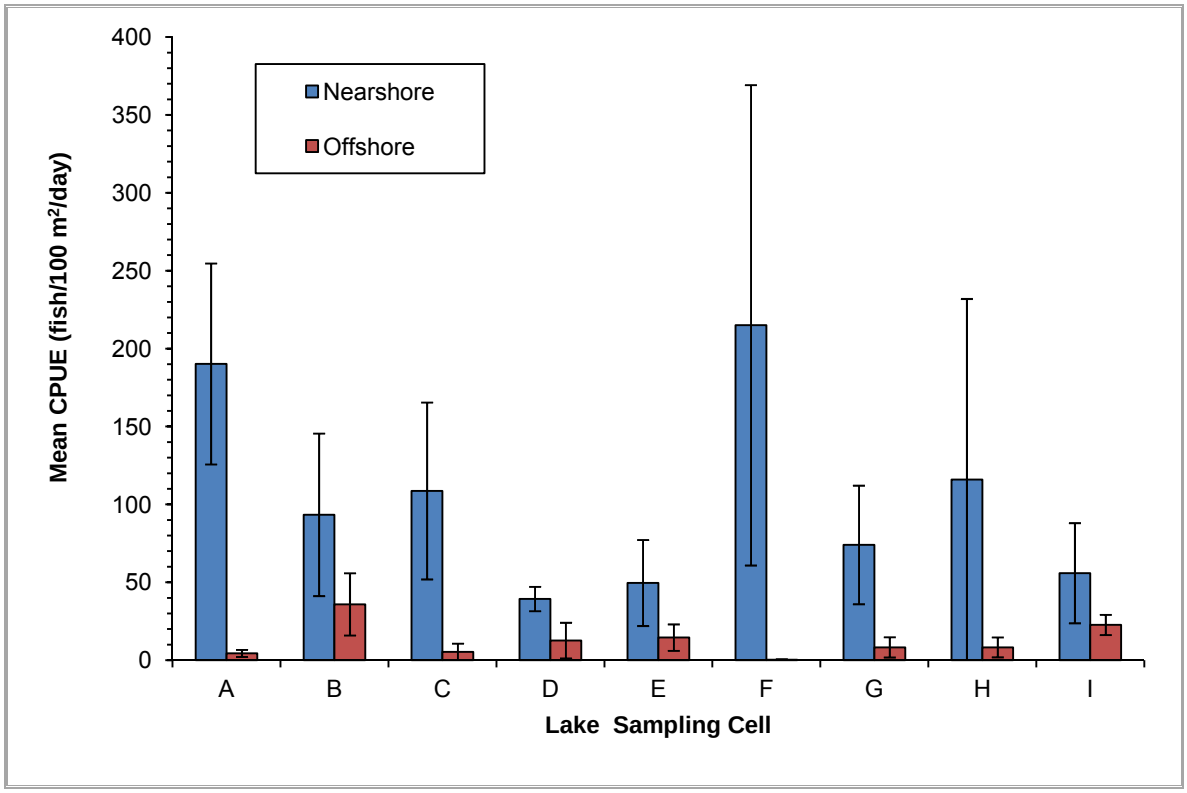
A total of 1,254 fish were captured in Tatelkuz Lake in July 2013 (**Table 5.12-2**). Of those 1,254 fish, 1,140 fish (or 91.1% of the total) were captured in gillnets and 114 fish (or 8.9%) were captured in minnow traps. Rainbow trout was the most common species (49.9%), followed by kokanee (17.7%), mountain whitefish (12.8%), northern pikeminnow (6.9%), slimy sculpin (4.8%), longnose sucker (4.2%), brassy minnow (2.5%), largescale sucker (0.9%), white sucker (0.2%), and burbot (0.1%).

Nine fish (0.7% of the total) were counted and identified to species, but escaped live before length and weight could be measured (**Table 5.12-2**). Another 191 fish (15.2% of the total) were identified to species, measured for length and weight, and then released live. The remaining 1,054 fish (84.1% of the total) either died during capture or were killed for collection of otoliths, stomach contents, and/or tissue samples for metals analysis. All of those fish were measured for length and weight.

5.12.2.3 Gillnet CPUE

Total gillnet CPUE ranged from 0 to 308.1 fish/100 m^2/day for individual gillnet sets (**Table 5.12-4**).

A plot of mean total gillnet CPUE (±SE) on pooled sampling cells A to I (divided into nearshore and offshore habitats) showed that nearshore gillnet CPUE was higher than offshore gillnet CPUE in all nine pooled cells (**Figure 5.12-4**). Mean gillnet CPUE for all nearshore areas (101.8 fish/100 m^2/day) was an order of magnitude greater than mean gillnet CPUE for all offshore areas (14.5 fish/100 m^2/day).

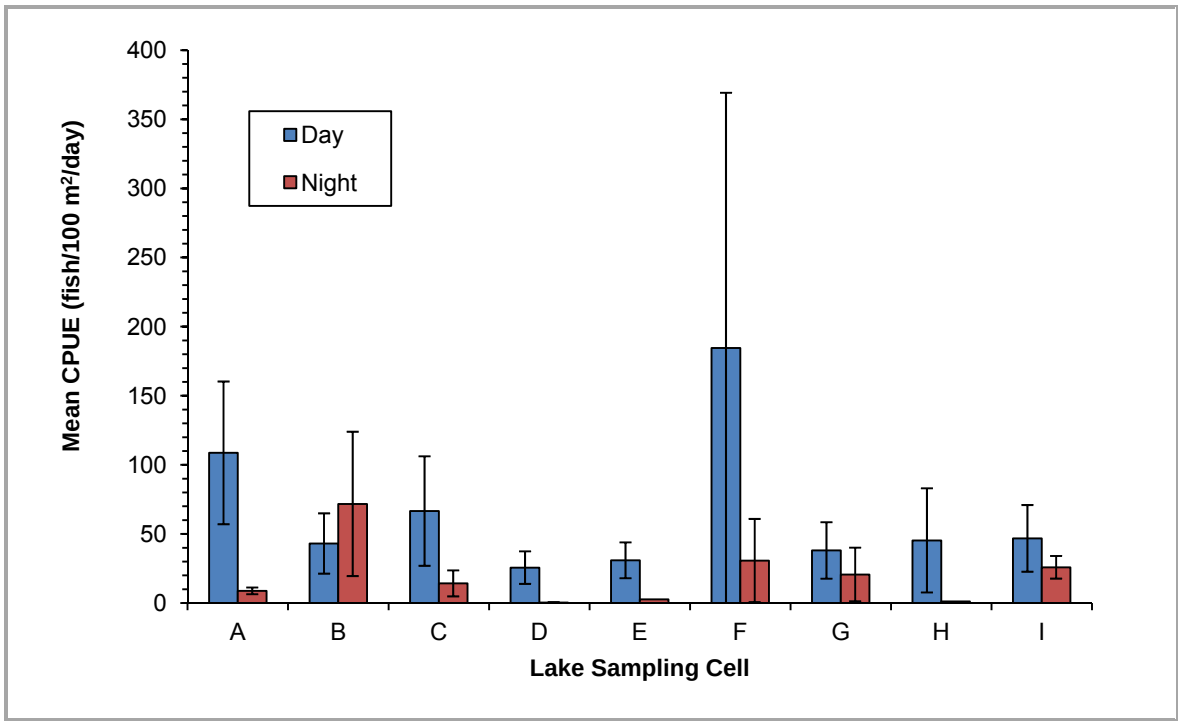


Note: CPUE = Catch-Per-Unit-Effort; m^2 = square metres; Error bars are SE

Figure 5.12-4: Mean Gillnetting CPUE by Sampling Cell and Nearshore and Offshore Habitats, Tatelkuz Lake, July 2013

Mean nearshore gillnet CPUE was highest in cells A (190.2 fish/100 m^2/day) and F (215.0 fish/100 m^2/day) and lowest in calls D 39.3 fish/100 m^2/day) and E (49.6 fish/ 100 m^2/day). However, the variances of the nearshore mean gillnet CPUE were high enough that there were little meaningful differences in mean nearshore gillnet CPUE among sampling cells. Mean offshore CPUE was similar among cells.

For eight of the nine sampling cells, mean gillnet CPUE (±SE) was higher for sets conducted during the day than sets conducted at night (**Figure 5.12-5**). Cell B was the exception. Mean gillnet CPUE for all pooled day sets (56.1 fish/100 m^2/day) was twice as high as mean gillnet CPUE for night sets (23.3 fish/100 m^2/day). However, the variances of the mean CPUE were high enough that there is little meaningful difference in mean gillnet CPUE between day and night sets at the level of sampling cells or pooled over all sampling cells.

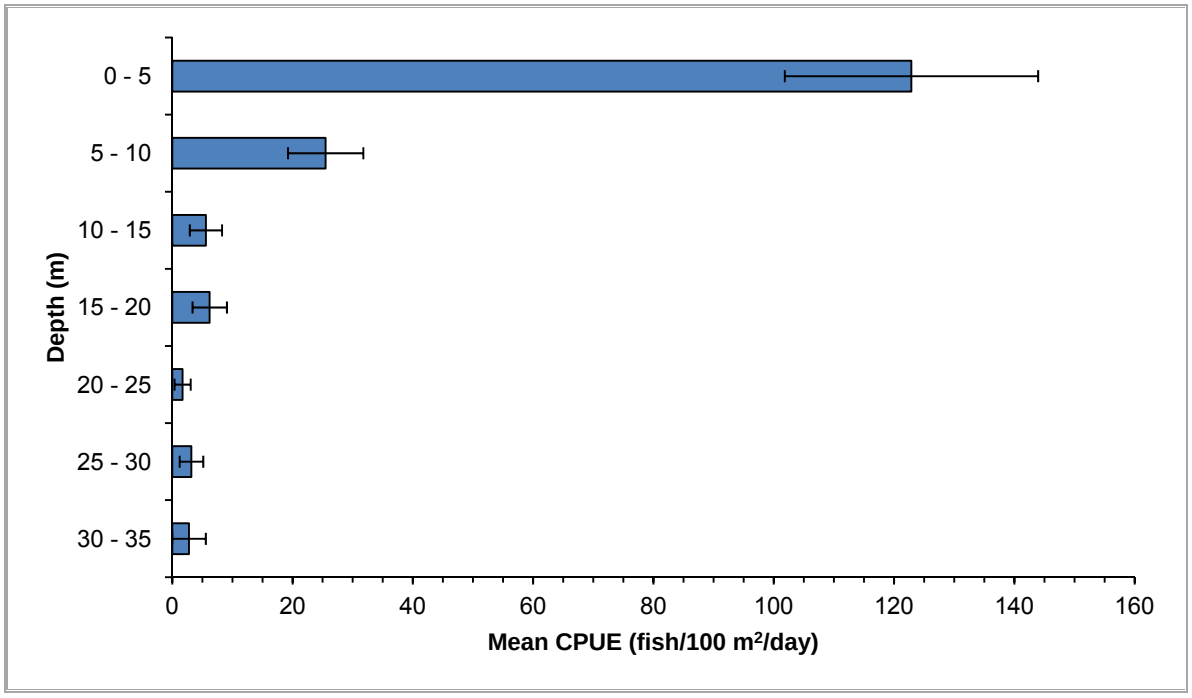


Note: CPUE = Catch-Per-Unit-Effort; m^2 = metres squared; Error bars are SE

Figure 5.12-5: Mean Gillnetting CPUE by Sampling Cell and Time of Day, Tatelkuz Lake, July 2013

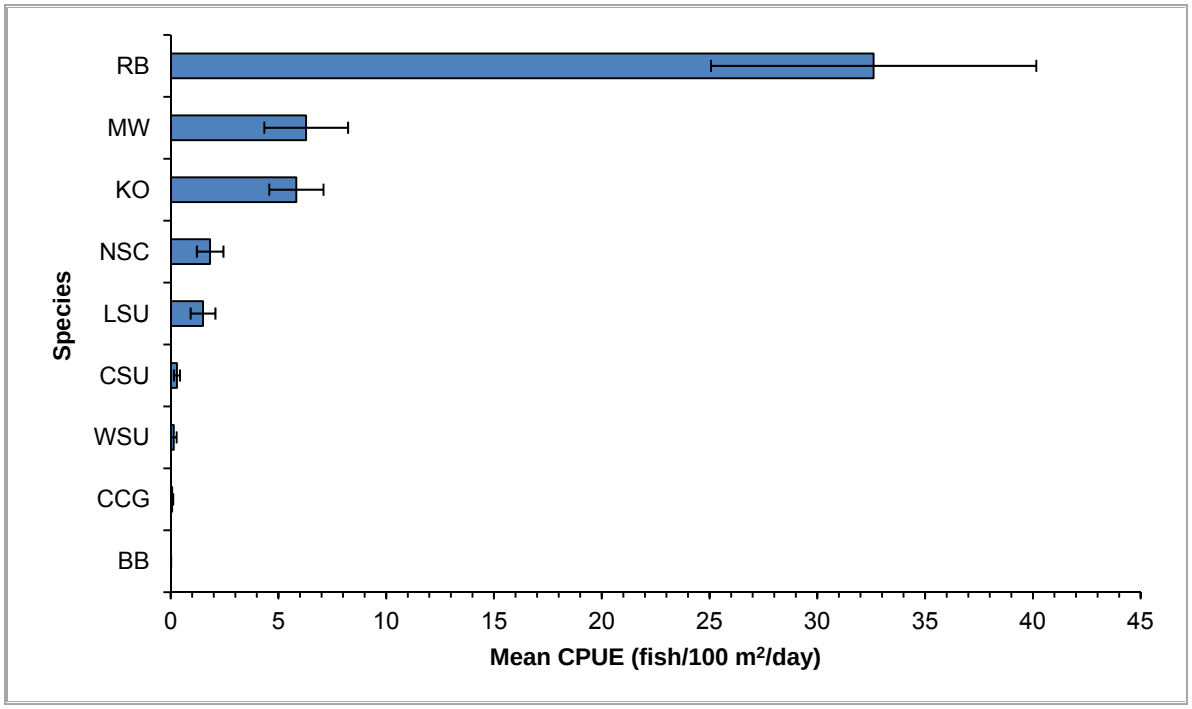
Mean gillnet CPUE (±SE) was highest in the 0 to 5 m depth stratum of Tatelkuz Lake (122.9 fish/100 m^2/day) and decreased with depth (**Figure 5.12-6**). Mean gillnet CPUE for the upper two depth strata (0-5 and 5-10 m) were different from each other and from the mean gillnet CPUE for the five lowest depth strata (i.e., 10-15, 15-20, 20-25, 25-30, and 30-35 m), but the mean gillnet CPUE for the deepest five depth strata were similar. These results confirm that gillnet CPUE was higher in nearshore habitat than in offshore habitat.

When pooled among species, mean gillnet CPUE was highest for rainbow trout (32.6 fish/100 m^2/day) (**Figure 5.12-7**). Mountain whitefish (6.3 fish/100 m^2/day) and kokanee (5.8 fish/100 m^2/day) had lower but similar mean gillnet CPUE. Northern pikeminnow (1.8 fish/100 m^2/day) and longnose sucker (1.5 fish/100 m^2/day) also showed lower but similar mean gillnet CPUE. The other four species captured by gillnets had mean CPUE values less than 1.0 fish/100 m^2/day.



Note: CPUE = Catch-Per-Unit-Effort; m = metre; m^2 = square metres; Error bars are SE

Figure 5.12-6: Profile of CPUE (±1 SE) with Depth Strata for Fish Captured by Gillnets in Tatelkuz Lake, July 2013

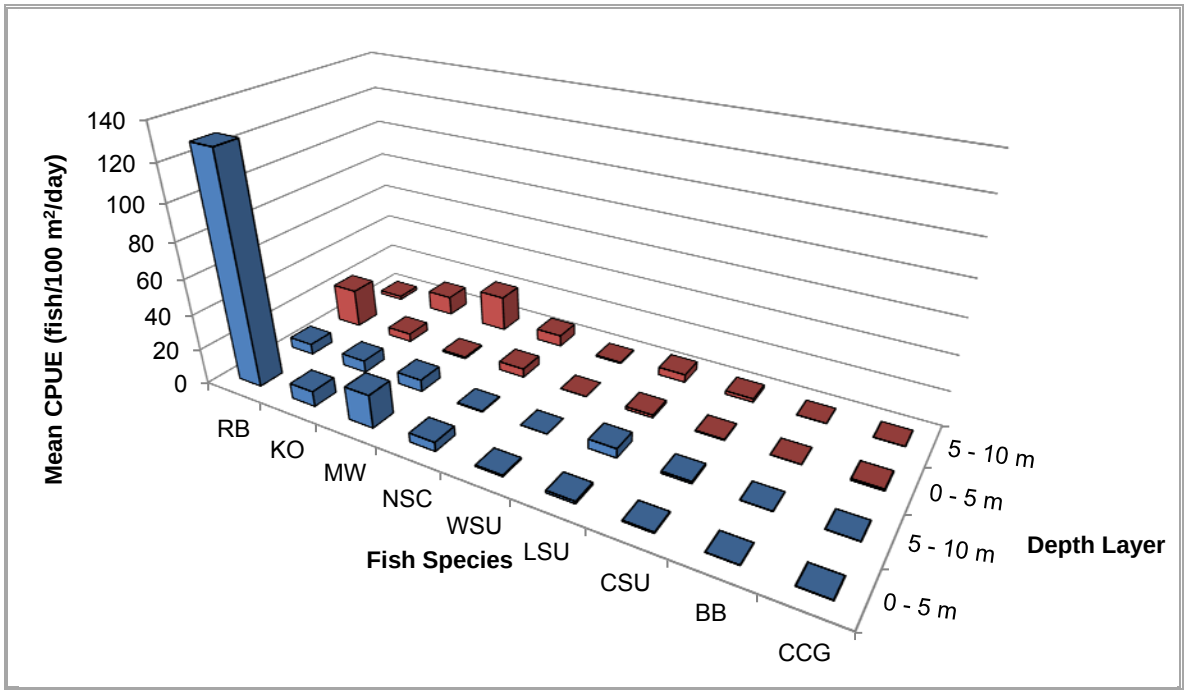


Note: CPUE = Catch-Per-Unit-Effort; m^2 = square metres; Error bars are SE; RB = rainbow trout; MW = mountain whitefish; KO = kokanee; NSC = northern pikeminnow; LSU = longnose sucker; CSU = largescale sucker; WSU = white sucker; CCG = slimy sculpin; BB = burbot

Figure 5.12-7: Mean Gillnetting CPUE by Fish Species, Tatelkuz Lake, July 2013

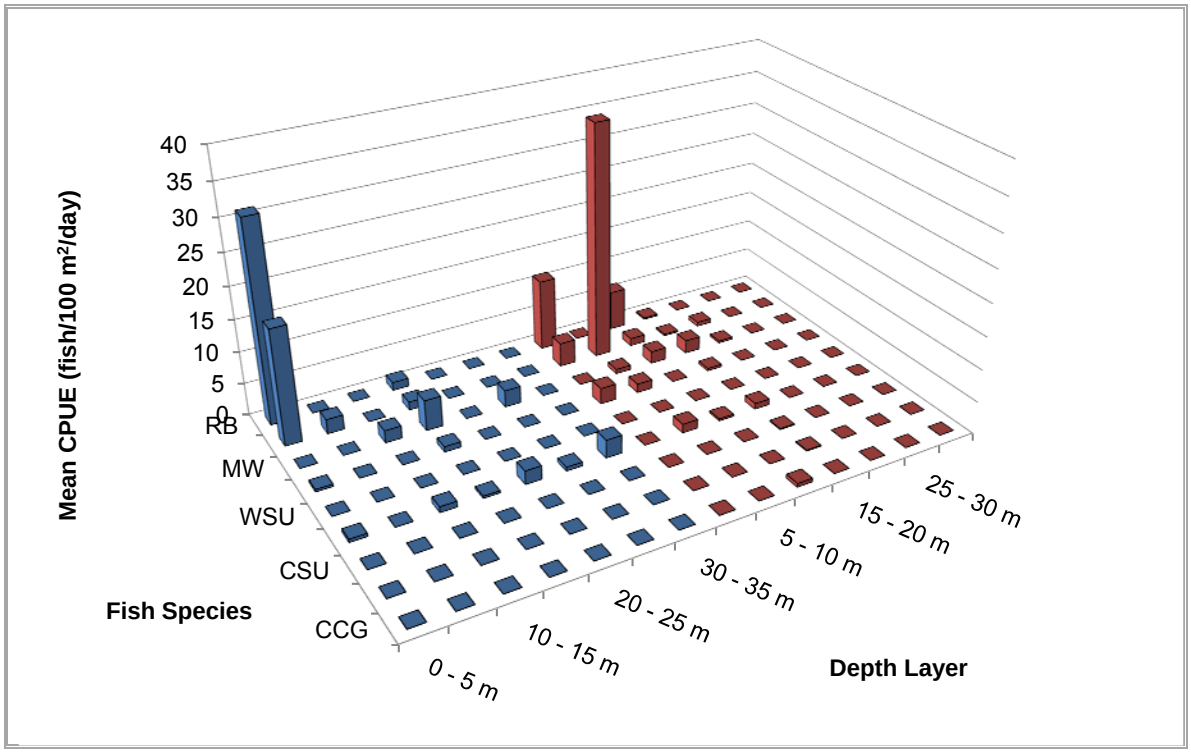
Mean CPUE by species, habitat type, and depth class showed that rainbow trout, kokanee, and mountain whitefish were the most abundant species in both nearshore and offshore habitat during both day and night (**Figure 5.12-8** and **Figure 5.12-9**). During the day, rainbow trout were especially abundant in the nearshore zone and near the lake surface (0-5 m) in both habitats. At night, their nearshore abundance decreased and offshore they moved deeper in the water column. Kokanee were more abundant offshore than near shore in both diel periods. In offshore areas they were most abundant in the 0-5 m depth layer during the day and shifted slightly deeper, mainly to the 5-10 m layer, at night. Mountain whitefish were more numerous near shore than offshore both day and night. Near shore they were more abundant 0-5 m during the day and 5-10 m at night. Offshore they occurred almost entirely below 10 m during both periods.

In summary, rainbow trout CPUE were highest in surface sets. Deeper in the water column they occupied the upper water column and the slopes of the lake basin, but not the midwater pelagic zone. Kokanee catch rates were high in surface sets, but highest in midwater sets, indicating that they were abundant in the upper water column and were the main species in the midwater pelagic zone. Mountain whitefish were most abundant in bottom sets, and were also captured in midwater sets, indicating that they were semi-pelagic. Northern pikeminnow and longnose sucker were also semi-pelagic. Burbot and largescale sucker were only caught in bottom sets, indicating they were benthic species.



Note: CPUE = Catch-Per-Unit-Effort; m^2 = square metres; RB = rainbow trout; MW = mountain whitefish; KO = kokanee; NSC = northern pikeminnow;
LSU = longnose sucker; CSU = largescale sucker; CCG = slimy sculpin; BB = burbot

Figure 5.12-8: Mean Gillnetting CPUE by Fish Species, Nearshore Habitat, and Depth, Day (blue) and Night (red), Tatelkuz Lake, July 2013



Note: CPUE = Catch-Per-Unit-Effort; m^2 = metres squared; RB = rainbow trout; MW = mountain whitefish; KO = kokanee; NSC = northern pikeminnow; LSU = longnose sucker; CSU = largescale sucker; CCG = slimy sculpin; BB = burbot

Figure 5.12-9: Mean Gillnetting CPUE by Fish Species, Offshore Habitat, and Depth, Day (blue) and Night (red), Tatelkuz Lake, July 2013

5.12.2.4 Minnow Trap CPUE

A total of 3,138.6 hours of minnow trap effort was expended in Tatelkuz Lake in July 2013 (**Annex 5.12-1** and **Table 5.12-6**. A total of 112 fish, including 58 slimy sculpin, 29 northern pikeminnow, 18 brassy minnow, six longnose suckers, and one kokanee were captured. Mean total minnow trapping CPUE was 2.9 fish/100 trap-hours.

Table 5.12-6: Minnow Trap Effort, Catch, and CPUE in Tatelkuz Lake, July 2013

Sampling Date	Set ID	Number of Traps	Soak Time (h)	Species	Total Catch	Total CPUE[1]
16-Jul-13	A2MT1-6	6	161.0	NFC	0	0.0
16-Jul-13	B2MT1-6	6	152.0	CCG	4	2.6
16-Jul-13	C2MT1-6	6	149.0	CCG	5	3.4
16-Jul-13	D2MT1-6	6	147.0	NFC	0	0.0
16-Jul-13	F1MT1-6	6	152.5	CCG	3	2.0
16-Jul-13	G1MT1-6	6	124.9	CCG	1	0.8
16-Jul-13	I1MT1-6	6	145.5	NSC, CCG	7	4.8

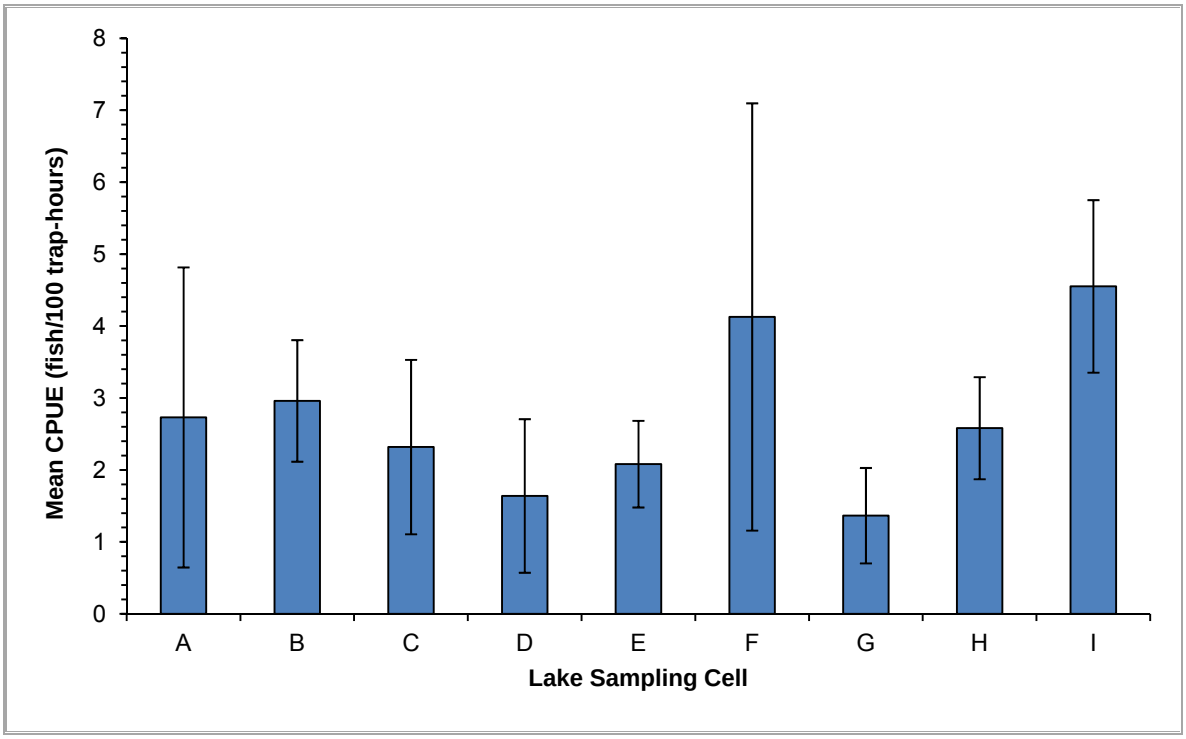
Table continues…

Sampling Date	Set ID	Number of Traps	Soak Time (h)	Species	Total Catch	Total CPUE[1]
16-Jul-13	I2MT1-6	6	156.0	CCG	4	2.6
17-Jul-13	A1MT1-6	6	157.5	LSU, CCG, BMC	8	5.1
17-Jul-13	B2MT7-12	6	152.0	CCG	5	3.3
17-Jul-13	D1MT1-6	6	152.5	NSC, BMC	5	3.3
17-Jul-13	E2MT1-6	6	159.0	CCG	6	3.8
17-Jul-13	F2MT1-6	6	126.2	LSU, BMC	21	16.6
17-Jul-13	H1MT1-6	6	143.9	NSC,CCG	3	2.1
17-Jul-13	H2MT1-6	6	150.9	CCG	2	1.3
17-Jul-13	I2MT7-12	6	143.3	RB, CCG	9	6.3
18-Jul-13	A1MT7-12	6	128.5	BMC	4	3.1
18-Jul-13	E1MT1-6	6	170.4	LSU, CCG	2	1.2
18-Jul-13	E1MT7-12	6	161.5	NFC	0	0.0
18-Jul-13	E2MT7-12	6	146.7	NSC	3	2.0
18-Jul-13	F1MT7-12	6	162.5	BMC	1	0.6
18-Jul-13	F1MT13-18	6	141.5	NSC, BMC	2	1.4
18-Jul-13	F2MT7-12	6	134.5	NFC	0	0.0
18-Jul-13	H1MT7-12	6	161.5	NSC, CCG	7	4.3
19-Jul-13	C1MT1-6	6	156.0	CCG	2	1.3
19-Jul-13	E2MT13-18	6	146.5	NSC, CCG	5	3.4
19-Jul-13	G1MT7-12	6	155.5	NSC	3	1.9

Note: [1] CPUE for minnow trapping is number of fish per 100 trap-hours
CPUE = Catch-Per-Unit-Effort; ID = identification; No. = number; m^2 = metres squared; RB = rainbow trout; NSC = northern pikeminnow; BMC = brassy minnow; CCG = slimy sculpin; LSU = longnose sucker; NFC = no fish captured

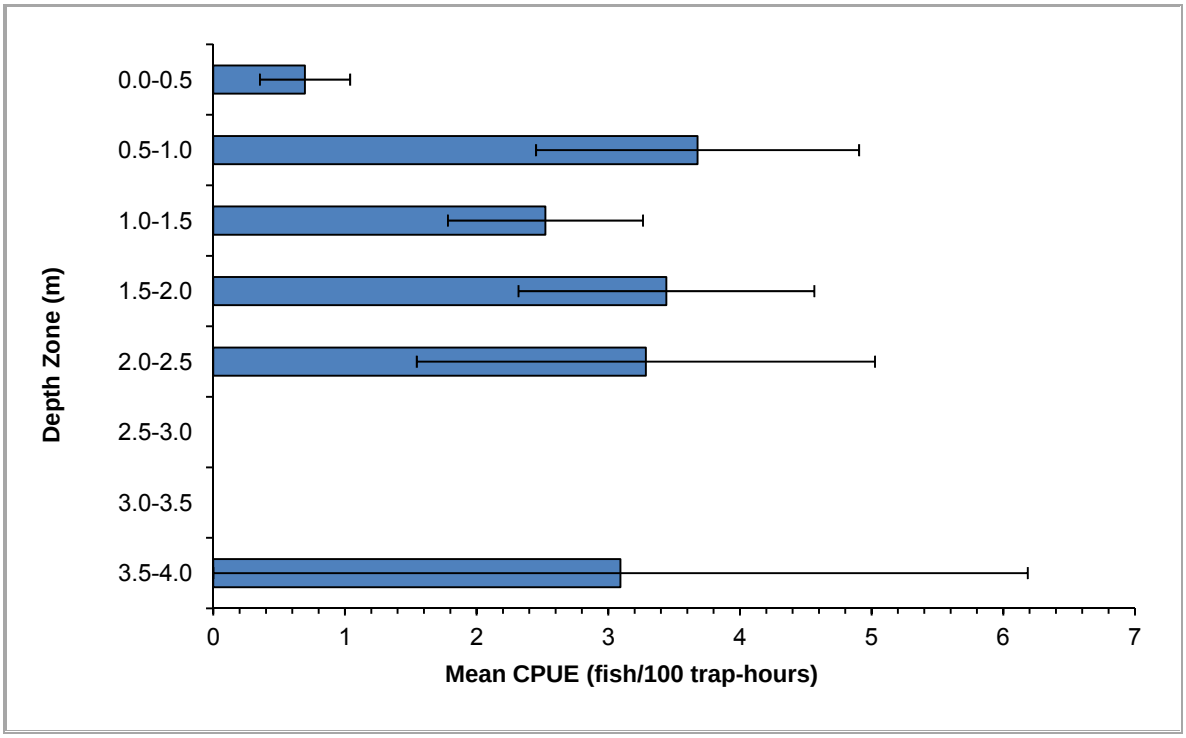
Pooled by sampling cell, mean minnow trap CPUE (±SE) ranged from 1.4 to 4.6 fish/ 100 trap-hours. Variances were too high within cells of the lake to show any statistically significant differences in minnow trap CPUE among cells (**Figure 5.12-10**).

Pooled by 0.5 m depth strata, mean minnow trapping CPUE (±SE) was lowest in the 0 m to 0.5 m depth strata (0.7 fish/100 trap-hours), but similarly higher among all other five depth strata (**Figure 5.12-11**). Mean minnow trap CPUE for the lower five depth strata ranged from 2.5 to 3.7 fish/100 trap-hours.



Note: CPUE = Catch-Per-Unit-Effort; Error bars are SE

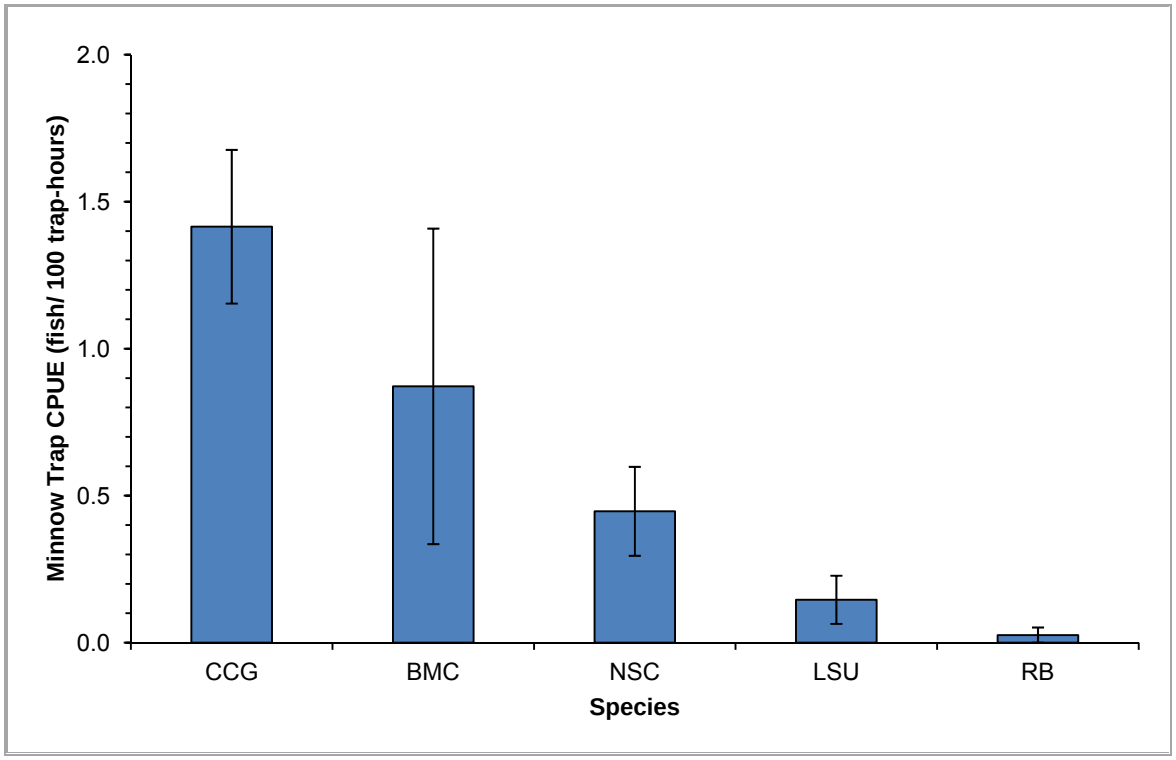
Figure 5.12-10: Mean Minnow Trap CPUE by Lake Sampling Cell, Tatelkuz Lake, July 2013



Note: CPUE = Catch-Per-Unit-Effort; m = metre; Error bars are SE

Figure 5.12-11: Mean Minnow Trap CPUE among Depth Strata, Tatelkuz Lake, July 2013

Pooled over all sampling cells and depths, mean minnow trapping CPUE (±SE) was highest for slimy sculpin (1.4 fish/100 trap-hours) and lowest for rainbow trout (0.03 fish/100 trap-hours) (**Figure 5.12-12**).



Note: CPUE = Catch-Per-Unit-Effort; Error bars are SE; BMC = brassy minnow, CCG = slimy sculpin; RB = rainbow trout; LSU = longnose sucker; NSC = northern pikeminnow;

Figure 5.12-12: Mean Minnow Trapping CPUE by Fish Species, Tatelkuz Lake, July 2013

5.12.3 Fish Biological Characteristics

This section summarizes the biological characteristics of fish captured in Tatelkuz Lake in July 2013. The majority of biological information was collected on kokanee, rainbow trout, and mountain whitefish – the three most common fish species captured or observed in 2013 (**Annex 5.12-2** and **Figure 5.12-3**).

5.12.3.1 Size, Age, and Growth

Mean length of the ten fish species ranged from 57 to 370 mm (**Table 5.12-7**). Slimy sculpin (57 mm) and brassy minnow (68 mm) were the two smallest species, and white sucker (370 mm) and largescale sucker (364 mm) were the longest and heaviest species.

Table 5.12-7: Mean Length, Weight, Condition Factor, and Age of Fish Species, Tatelkuz Lake, July 2013

Species	Fork Length (mm)				Weight (g)				Condition Factor				Age (year)			
	n	Mean	SE	Range	n	Mean	SE	Range	n	Mean	SE	Range	n	Mean	SE	Range
Brassy minnow	31	68	2	43 - 94	-	-	-	-	-	-	-	-	-	-	-	-
Burbot	1	323	-	323 - 323	1	195	-	195 - 195	1	0.58	-	0.58 - 0.58	1	5	-	5 - 5
Kokanee	222	191	2	107 - 231	210	90	3	13 - 207	210	1.21	0.01	0.66 - 2.59	58	3	0.1	1 - 5
Largescale sucker	9	364	35	110 - 455	7	662	126	15 - 1000	7	1.35	0.05	1.13 - 1.53	-	-	-	-
Longnose sucker	53	272	16	63 - 470	28	446	52	5.8 - 1175	28	1.26	0.02	1.02 - 1.41	3	6	0.9	4 - 7
Mountain whitefish	161	210	5	115 - 347	150	137	9	15 - 408	150	1.10	0.01	0.71 - 1.39	97	6	0.3	2 - 14
Northern pikeminnow	86	249	12	62 - 495	62	339	48	18.6 - 1550	62	1.16	0.01	0.89 - 1.40	4	11	1.3	8 - 14
Rainbow trout	625	184	2	75 - 463	581	89	3	4 - 438	581	1.13	0.01	0.75 – 1.42	153	3	0.1	1 – 6
Slimy sculpin	60	57	2	35 - 103	-	-	-	-	-	-	-	-	-	-	-	-
White sucker	3	370	10	352 - 387	3	739	65	625 - 850	3	1.45	0.01	1.43 - 1.47	-	-	-	-

Note: mm = millimetre; g = gram; n = sample size; SE = standard error.

Mean condition factor ranged from 0.58 for burbot to 1.35 for largescale sucker and 1.45 for white sucker. With the exception of burbot, mean condition factor fell within a narrow range of 1.10 to 1.45. These differences among species largely reflect differences in body shape. Burbot have relatively low condition because they are a slender, eel-like species. Suckers have relatively high condition because they are compact, barrel-shaped species.

Mean age of fish species ranged from 5 to 11 years. Northern pikeminnow had the oldest mean age (11 years), but mountain whitefish and northern pikeminnow both had maximum recorded ages for an individual of 14 years. Kokanee and rainbow trout both had the lowest mean ages (3 years) of the six species for which ages were determined. However, very few (i.e., n<5) burbot, northern pikeminnow or longnose sucker were aged. Age data was not available for four of the ten species: brassy minnow, largescale sucker, slimy sculpin, and white sucker.

Linear regressions of ln(weight) on ln(length) were calculated for seven of the ten species. There were no weight data for brassy minnow. Only one burbot and two of the 60 slimy sculpin captured were weighed. This precluded linear regressions for these three species. All seven regressions were highly significant ($P<0.001$), with the exception of the white sucker, where $P = 0.006$ due to the small sample size ($n = 3$) (**Figure 5.12-13**). Regressions explained at least 97% of the variation in ln(weight). Regression slopes ranged from 2.94 to 3.25, which was close to the value of 3.0 assumed by the formula for condition, thereby validating the use of that index.

Length-frequency distributions showed that the majority of kokanee, rainbow trout, and mountain whitefish were between 100 and 350 mm in length (**Figure 5.12-14**). Brassy minnow and slimy sculpin were all below 150 mm long. Northern pikeminnow, longnose sucker, and largescale sucker exhibited a wider range of lengths, ranging from 50 to 500 mm in length. Largescale sucker, white sucker and burbot catches were low in number and dominated by a few large individuals.

Age-frequency distributions show that kokanee and rainbow trout have similar lifespans, with maximum ages of 5 and 6 years, respectively (**Figure 5.12-15**). The 3-year age category contained the largest number of individuals of both species. The age-frequency distribution for mountain whitefish was much wider, with a range of 2 to 14 years. Most mountain whitefish captured were <9 years old.

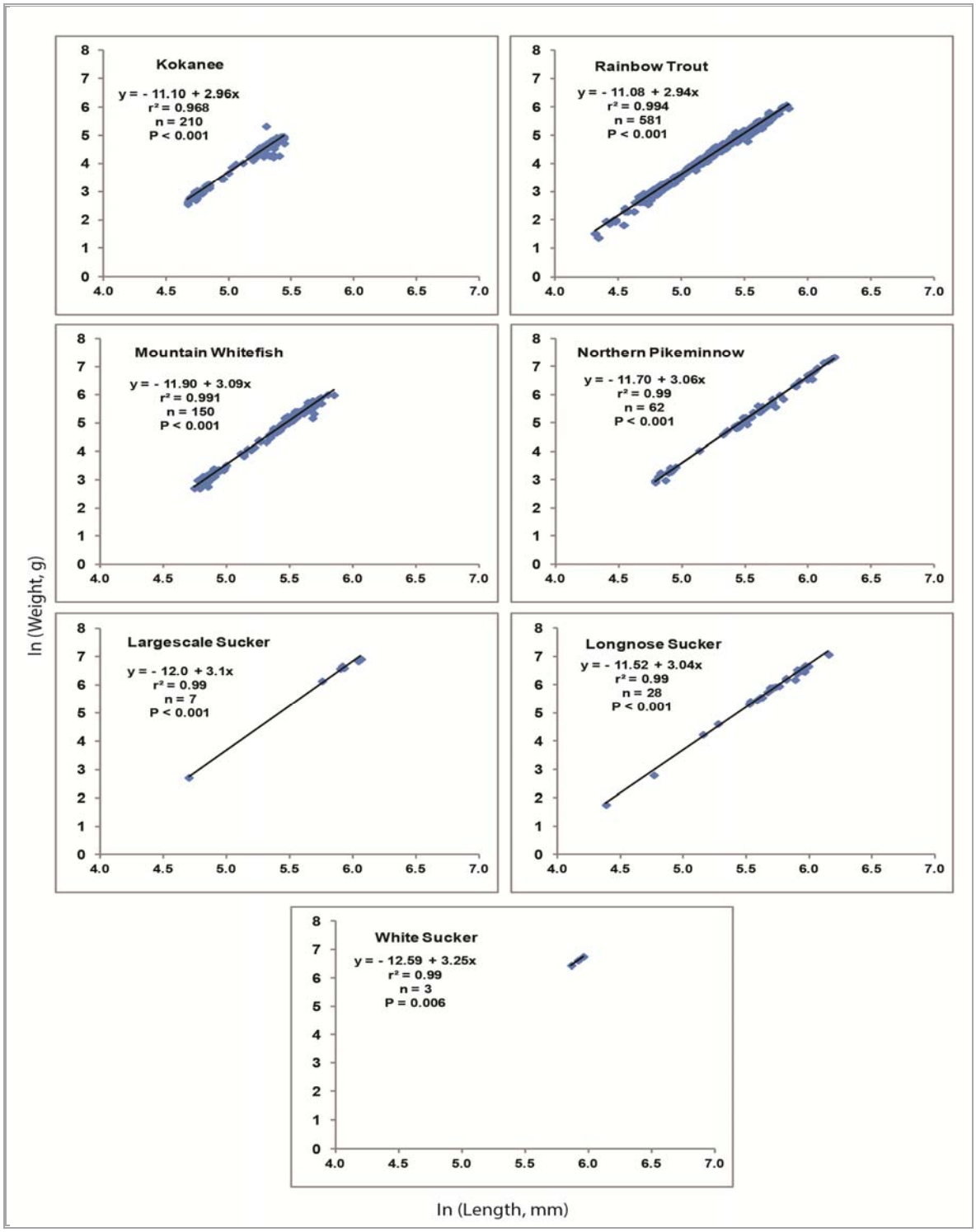


Figure 5.12-13: Linear Regressions of Weight on Length for Fish Species, Tatelkuz Lake, July 2013

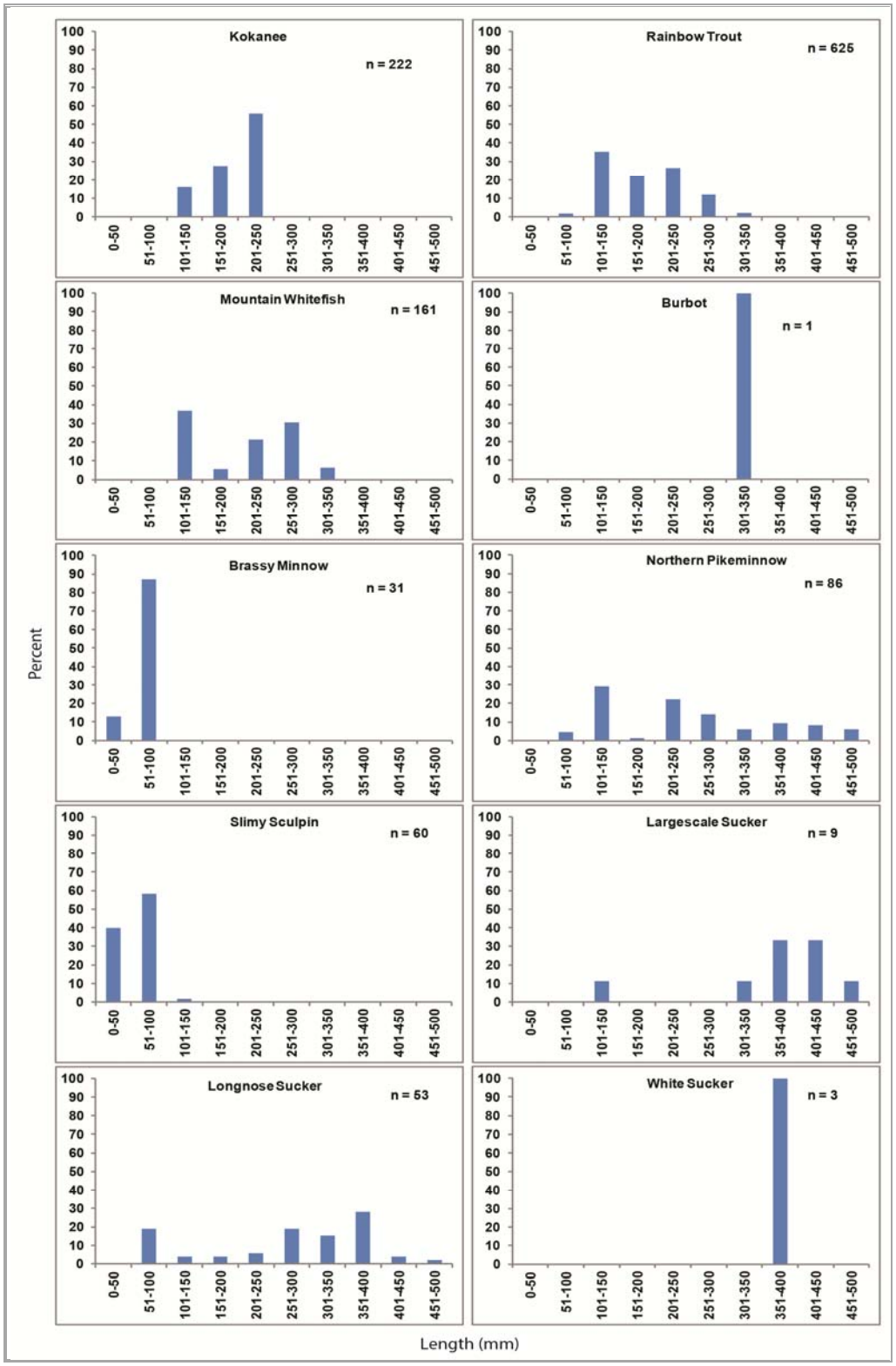


Figure 5.12-14: Length-Frequency Distributions of Ten Fish Species, Tatelkuz Lake, July 2013

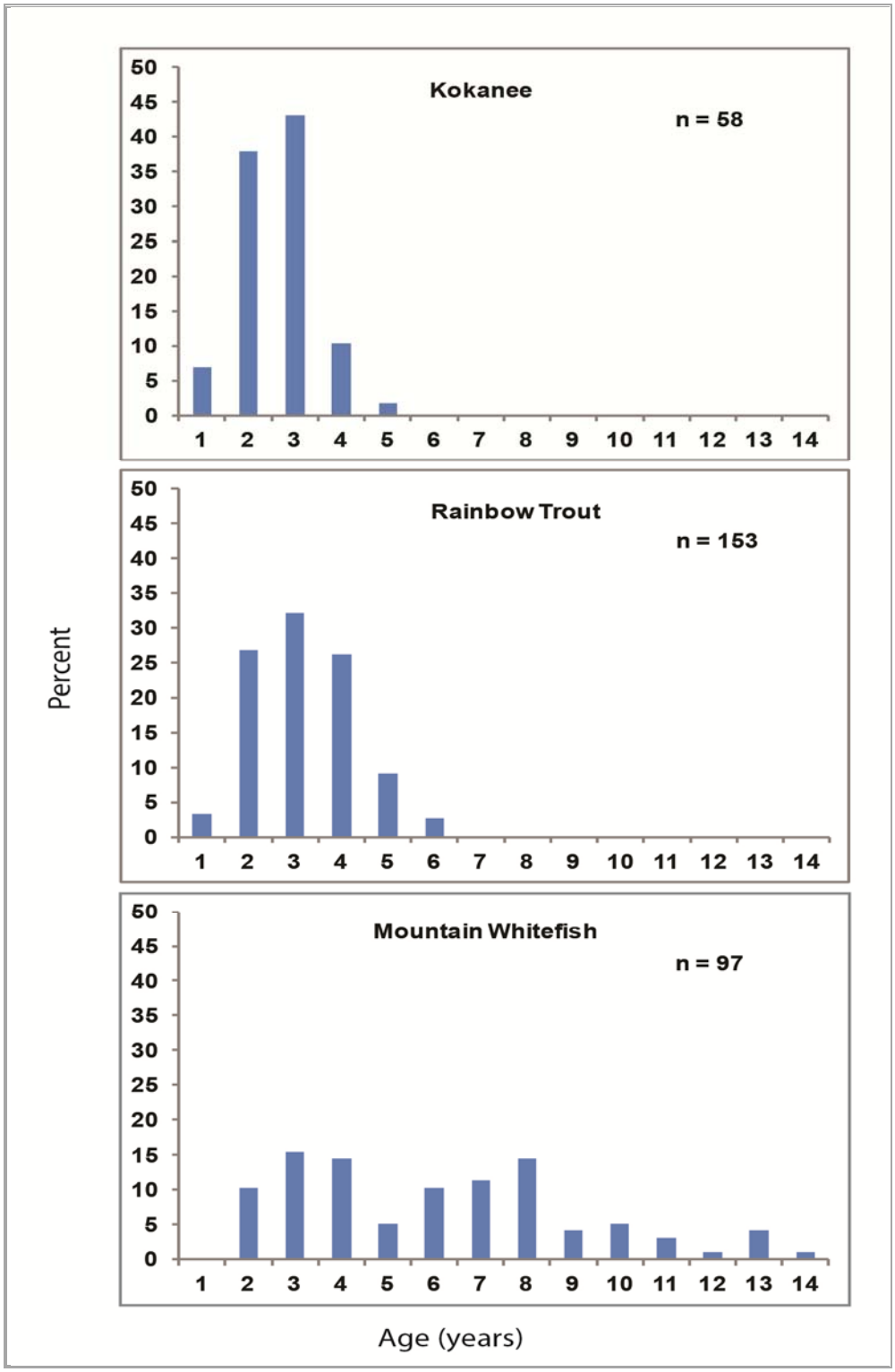


Figure 5.12-15: Age-Frequency Distributions of Kokanee, Rainbow Trout, and Mountain Whitefish, Tatelkuz Lake, July 2013

von Bertalanffy growth models were successfully fit to length-age data for rainbow trout, kokanee, and mountain whitefish (**Figure 5.12-16, Figure 5.12-17** and **Figure 5.12-18**). Growth models explained 76% of the variance in length-at-age for mountain whitefish, but only 41% for kokanee and 32% for rainbow trout. The two reasons for this variation in fit among species were the wider age range of mountain whitefish than rainbow trout and kokanee and the greater variation in length-at-age of rainbow trout and kokanee than in length-at-age of mountain whitefish.

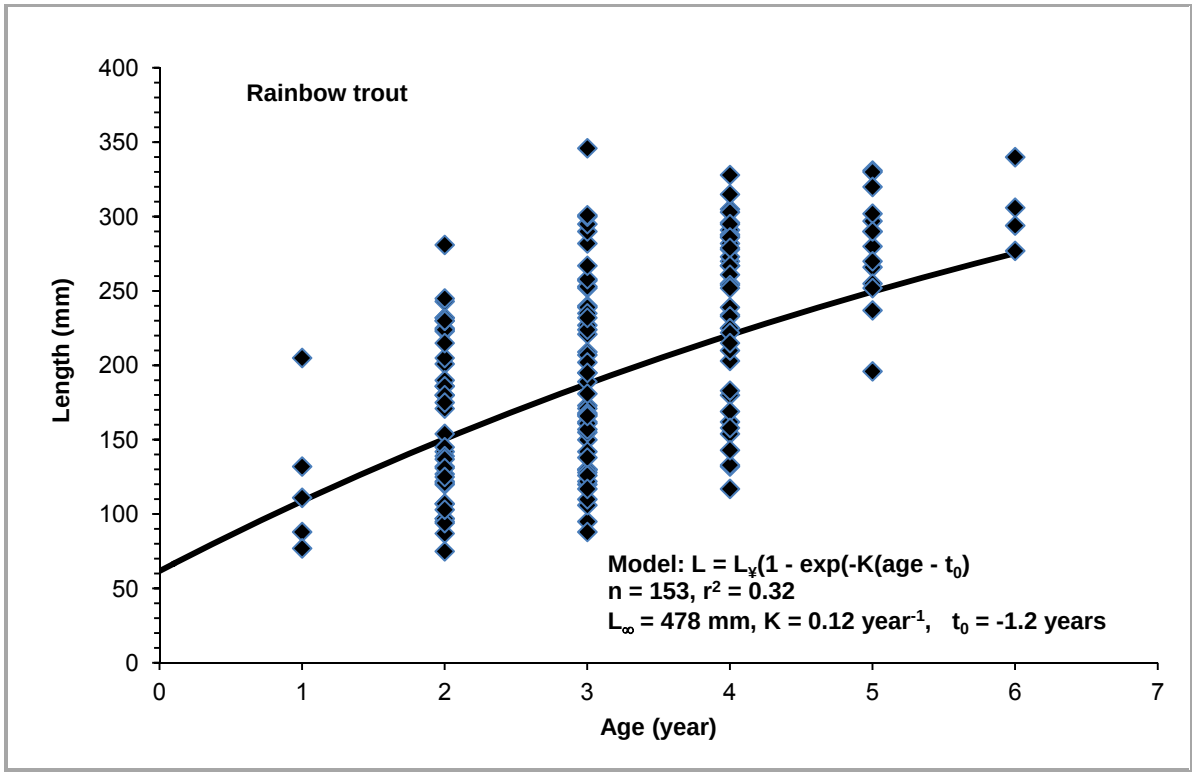


Figure 5.12-16: Growth of Rainbow Trout, Tatelkuz Lake, July 2013

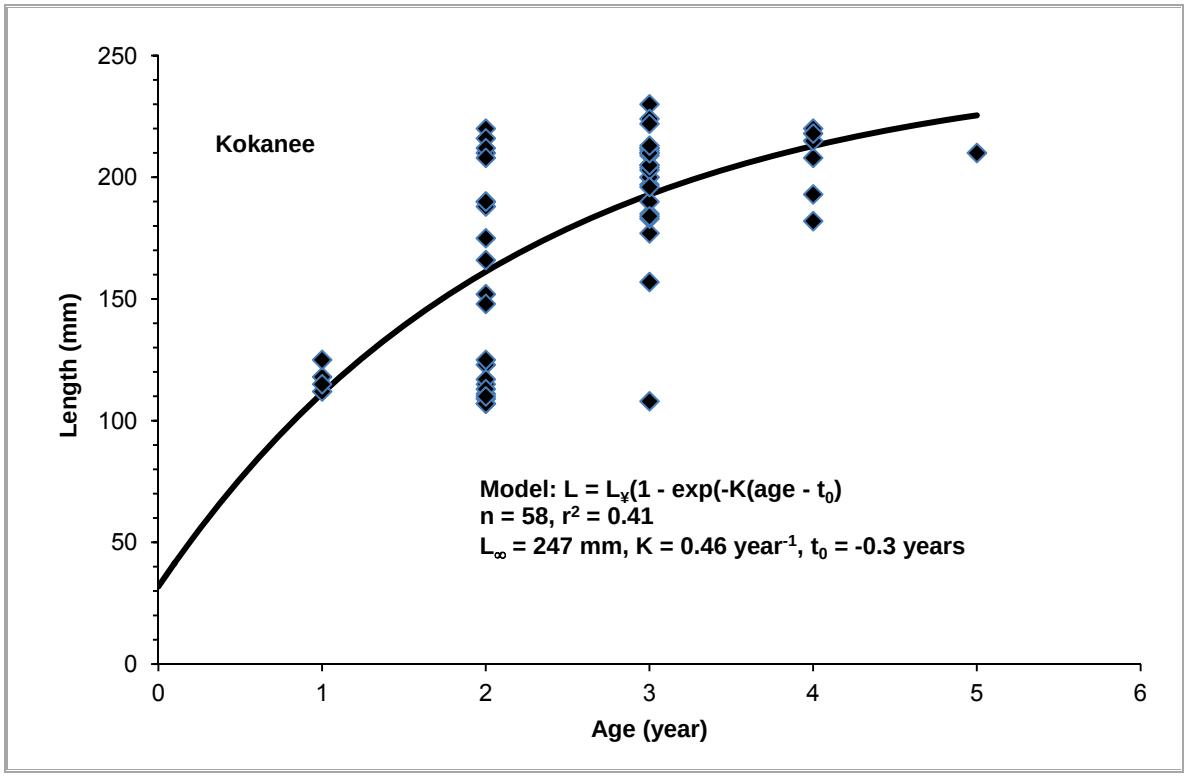


Figure 5.12-17: Growth of Kokanee, Tatelkuz Lake, July 2013

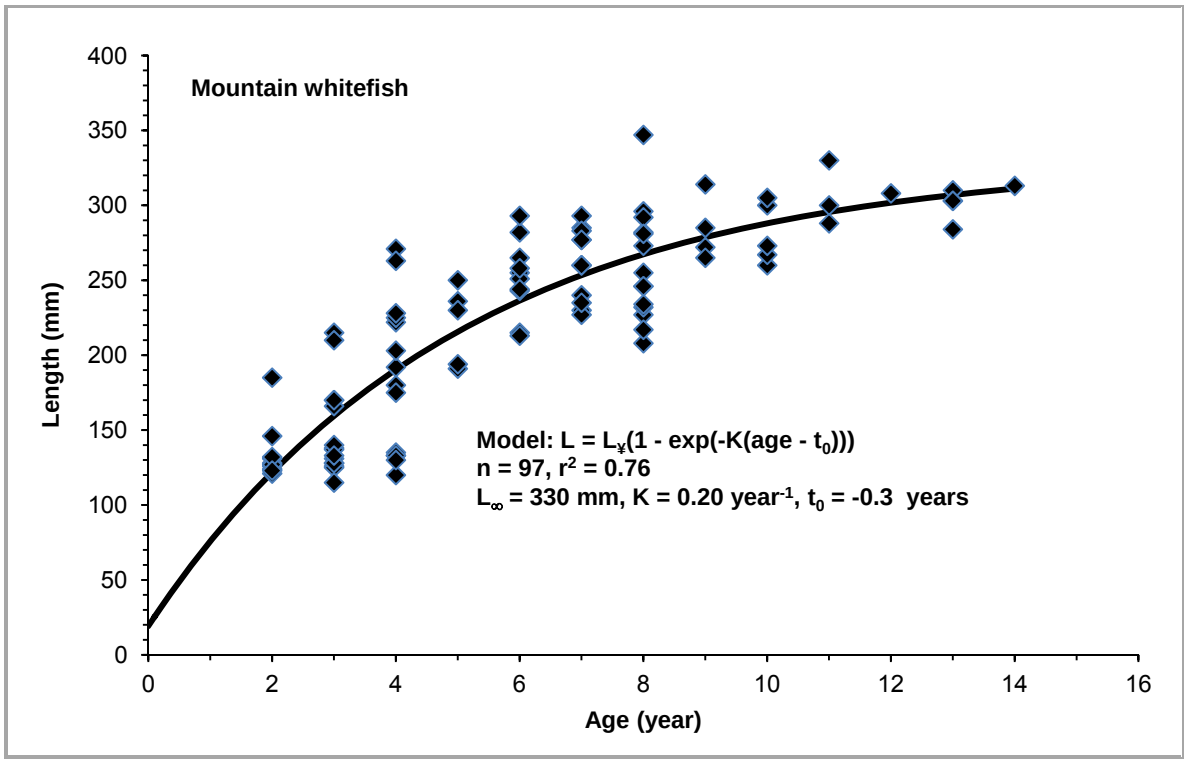


Figure 5.12-18: Growth of Mountain Whitefish, Tatelkuz Lake, July 2013

5.12.3.2 Sex Ratio

Sex ratios were calculated for only four of the ten species (kokanee, rainbow trout, mountain whitefish, and northern pikeminnow) (**Table 5.12-8**) because there were insufficient data for the other five species. No brassy minnow, largescale sucker, slimy sculpin, or white sucker were autopsied, and too few burbot or longnose sucker were sexed to allow calculation of a sex ratio. Sex ratios ranged from 0.4 for kokanee to 2.5 for rainbow trout. The wide variation in sex ratio was due to the relatively small sample sizes compared to those typically needed for a more accurate estimate of this ratio.

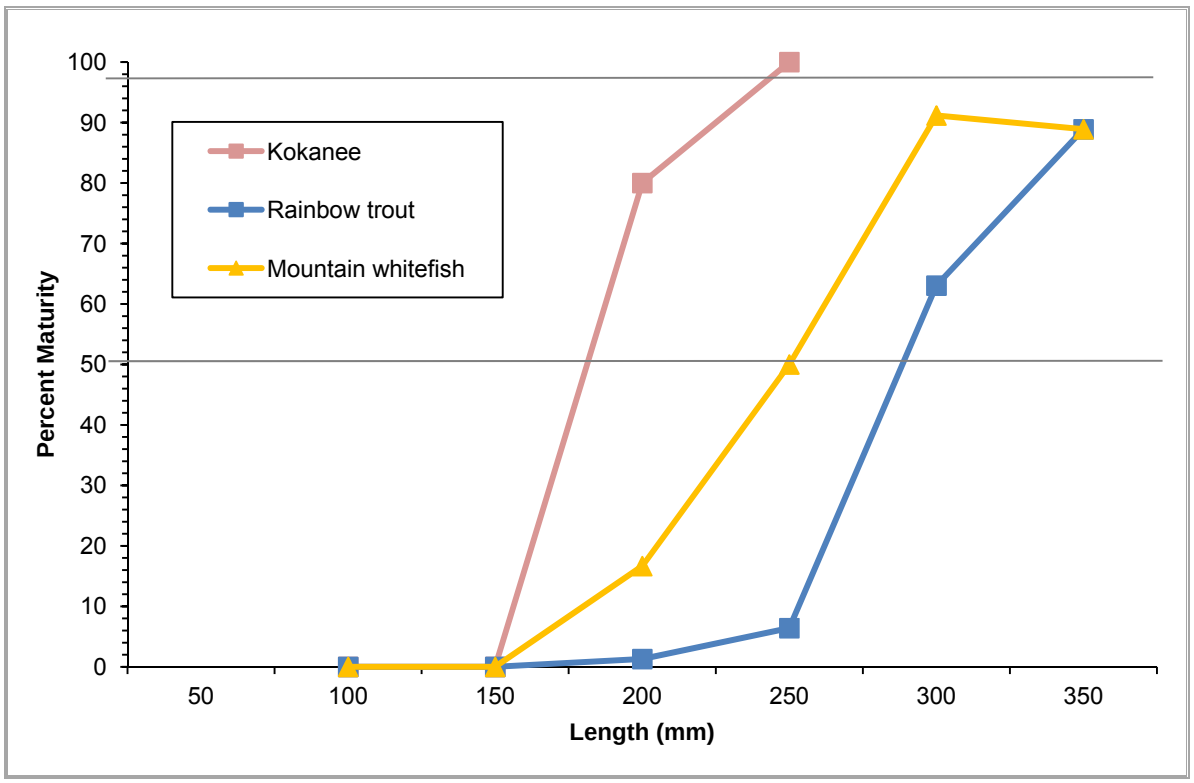
Table 5.12-8: Sex Ratio of Fish Species, Tatelkuz Lake, July 2013

Population	Number Female	Number Male	Total Number Male and Female	Sex Ratio
burbot	1	0	1	-
kokanee	30	68	98	0.4
longnose sucker	1	0	1	-
mountain whitefish	48	25	78	1.9
northern pikeminnow	1	2	3	0.5
rainbow trout	66	26	92	2.5
Total	**147**	**121**	**273**	**1.2**

Note: Sex ratio = (number of females)/(number of males); dash indicates no data available.

5.12.3.3 Sexual Maturation

Lengths at 50% maturity for kokanee, mountain whitefish, and rainbow trout were approximately 180, 250, and 290 mm, respectively (**Figure 5.12-19**). No fish were mature at lengths below 150 mm. Kokanee has an approximate mean length at 95% maturity of 240 mm. Lengths at 95% maturity could not be determined for rainbow trout and mountain whitefish due to small sample sizes.



Note: mm = millimetre

Figure 5.12-19: Percent Maturity at Length of Kokanee, Rainbow Trout, and Mountain Whitefish, Tatelkuz Lake, July 2013

5.12.3.4 Gonadosomatic Index (GSI)

Gonad weights were measured only for kokanee, rainbow trout, and mountain whitefish (**Of the** 84 kokanee autopsied, 80 (or 95%) were classified as mature and four (or 5%) were classified as immature. None were classified as spent. This is the pattern expected of a species preparing to spawn later in the summer, which they did from late July to September 2013.

Mean GSI for kokanee was higher for mature fish than for immature fish, although the difference was much greater for females than males. The two immature males were much closer to reaching maturity than the two immature females.

Of the 38 rainbow trout autopsied, 21 (or 55%) were classified as immature, 15 (or 39%) were classified as maturing (none were classified as mature), and one (or 3%) was classified as spent. This is the pattern expected of a species that has just completed spawning, as they did in May and June 2013. The maturing fish were sub-adults that would likely have spawned for the first time in the spring of 2014.

Table 5.12-9). No ripe fish were identified, and only one spent male rainbow trout was identified.

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Table 5.12-9: Mean GSI for Rainbow Trout, Mountain Whitefish, and Kokanee, Tatelkuz Lake, July 2013

Species	Sex	Maturity Stage	n	Mean	SE	Range
Kokanee	Female	Immature	2	0.8	0.2	0.6 – 1.0
		Mature	23	9.0	0.6	4.4 – 16.0
		Spent	0	–	–	–
	Male	Immature	2	4.8	0.1	4.6 - 4.9
		Mature	57	5.0	0.3	0.4 - 11.2
		Spent	0	–	–	–
Rainbow trout	Female	Immature	19	0.6	0.1	0.2 – 2.0
		Maturing	13	1.4	0.6	0.5 - 8.3
		Spent	1	0.6	–	0.6 - 0.6
	Male	Immature	3	0.3	0.2	0.1 - 0.6
		Maturing	2	4.2	0.4	3.8 - 4.6
		Spent	0	–	–	–
Mountain whitefish	Female	Immature	5	2.1	0.3	1.7 - 3.4
		Mature	32	2.5	0.2	0.9 - 4.8
		Spent	0	–	–	–
	Male	Immature	2	0.3	0.2	0.1 - 0.5
		Mature	10	1.5	0.3	0.3 – 3.0
		Spent	0	–	–	–

Note: n = sample size; SE = standard error; dash indicates no data.

Mean GSI for rainbow trout was higher for maturing fish than for immature fish and for spent fish. Mean GSI of maturing rainbow trout was lower than mean GSI of mature kokanee, particularly for females.

Of the 49 mountain whitefish autopsied, seven (or 14%) were classified as immature, and 42 (or 86%) were classified as mature. There were no spent fish. This is the pattern expected of a species preparing to spawn in autumn 2013.

Mean GSI for mountain whitefish was higher for mature fish than for immature fish, although the difference was much greater for males than for females. The five immature females were much closer to reaching maturity than the two immature males.

5.12.3.5 Hepatosomatic Index (HSI)

Mean HSI for the pooled sexes was highest for kokanee (1.50) followed by rainbow trout (1.08) and mountain whitefish (1.01) (**Table 5.12-10**). The mean HSIs for rainbow trout and mountain whitefish were almost identical, considering the variance of the means. Mean HSI was higher for females than for males in each of the three species, with the greatest difference shown by kokanee. The simplest explanation for these results is that kokanee were storing glycogen in their livers in preparation for imminent spawning, but rainbow trout had consumed their reserves of glycogen during spring spawning, and mountain whitefish had not yet begun to store glycogen in their livers for autumn spawning.

Table 5.12-10: Mean HSI for Rainbow Trout, Mountain Whitefish, and Kokanee, Tatelkuz Lake, July 2013

Species	Sex	n	Mean	SE	Range
Kokanee	**Total**	**78**	**1.65**	**0.08**	**0.20 – 5.10**
	Female	21	2.15	0.21	0.50 – 5.10
	Male	51	1.50	0.08	0.20 – 4.20
Rainbow trout	**Total**	**152**	**1.08**	**0.03**	**0.18 – 2.57**
	Female	40	1.08	0.07	0.18 – 2.57
	Male	13	1.02	0.07	0.62 – 1.48
Mountain whitefish	**Total**	**74**	**1.01**	**0.04**	**0.14 – 2.07**
	Female	41	1.14	0.10	0.56 – 2.07
	Male	17	0.83	0.10	0.14 – 1.34

Note: n = sample size; SE = standard error; The 'Total' category includes fish of unknown sex.

5.12.3.6 Diet

Of the 12 kokanee stomachs sampled from Tatelkuz Lake in July 2013, seven contained prey items and five were empty (**Annex 5.12-3**; **Table 5.12-11**). Between 1 and 68 prey items were identified in the seven stomachs with contents. Amphipoda (amphipods) were the most abundant prey, comprising 66.7% of all prey items consumed. These were followed by Diptera (true flies; 25.5%), Trichoptera (caddisflies; 6.9%), and Ephemoptera (mayflies; 1.0%) larva (**Figure 5.12-20**). While amphipods were the most abundant of all prey items found in kokanee stomachs, they were only found in the stomach of a single individual (B205-014). The most frequently consumed prey items by kokanee were chironomid larva (midges; Diptera), which occurred in five of twelve stomachs (i.e., a frequency of occurrence of 5/12), followed by caddisflies (3/12), mayflies (1/12), and amphipods (1/12) (**Table 5.12-11**).

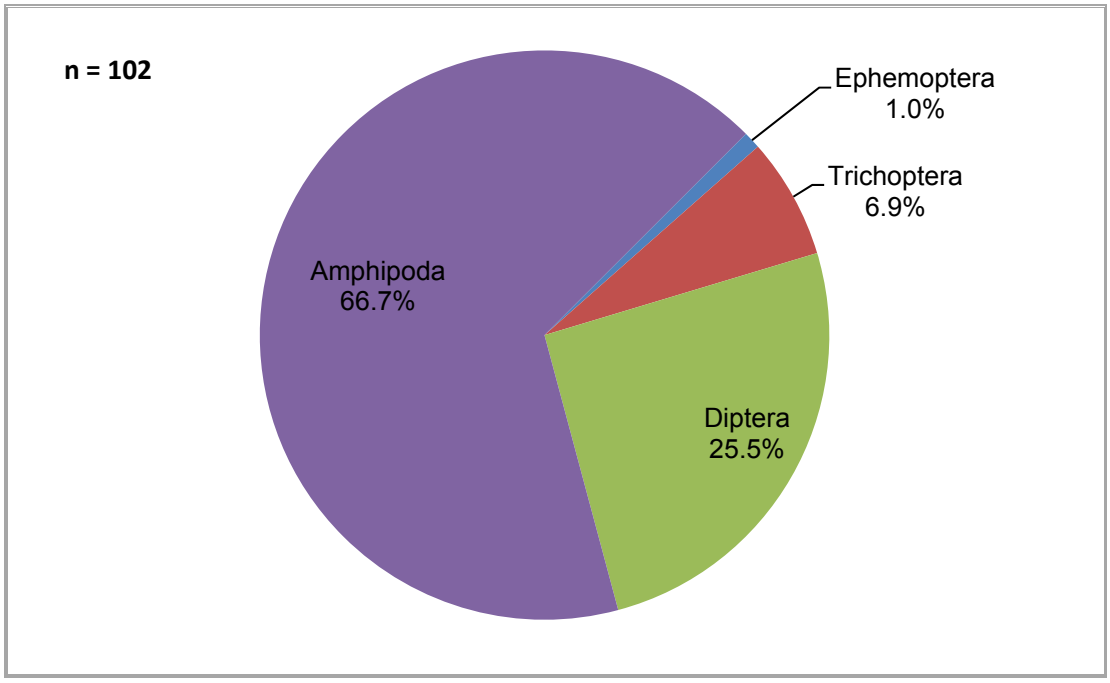
All of the 12 rainbow trout stomachs sampled from Tatelkuz Lake in July 2013 contained prey items (**Table 5.12-12**). Between four and 116 prey items were identified in individual stomachs. The most abundant prey were chironomid larva (64.2%), followed by beetles (Coleoptera; 21.1%), and amphipods (10.3%) (**Figure 5.12-21**). The most frequently consumed prey were beetles (12/12) and chironomids (11/12).

All of the 13 mountain whitefish stomachs contained prey items (**Table 5.12-13**). Between 35 and 537 prey items were identified in individual stomachs. Dipterans comprised the majority of identifiable prey items (95.3%), almost exclusively chironomid larva. These were followed by caddisflies (14.3%), and beetles (0.4%) (**Figure 5.12-22**). The most commonly consumed prey item was chironomid larva, which was found in all 13 stomachs sampled.

Table 5.12-11: Stomach Contents of Kokanee, Tatelkuz Lake, July 2013

Common Name	Order	Sample Number (Fish Length)												Total Number	Relative Abundance (%)	Frequency of Occurrence
		G2N10-004 (215 mm)	G2N10-007 (212 mm)	G2N10-010 (221 mm)	G2N10-011 (202 mm)	H1O10-002 (216 mm)	H1O10-003 (180 mm)	C2N5-035 (208 mm)	A2O20-011 (190 mm)	B205-007 (200 mm)	B205-012 (206 mm)	B205-013 (182 mm)	B205-014 (220 mm)			
Mayfly	Ephemoptera	0	0	0	0	0	0	0	0	1	0	0	0	1	1.0	1/12
Caddisfly	Trichoptera	0	0	0	0	0	0	1	0	1	5	0	0	7	6.9	3/12
True Fly	Diptera	0	0	0	3	8	0	0	1	5	9	0	0	26	25.5	5/12
Amphipod	Amphipoda	0	0	0	0	0	0	0	0	0	0	0	68	68	66.7	1/12
Grand Total		**0**	**0**	**0**	**3**	**8**	**0**	**1**	**1**	**7**	**14**	**0**	**68**	**102**	**-**	**-**

Note: mm = millimetre; % = percent; relative abundance = (total number*100/grand total; dash indicates no data.



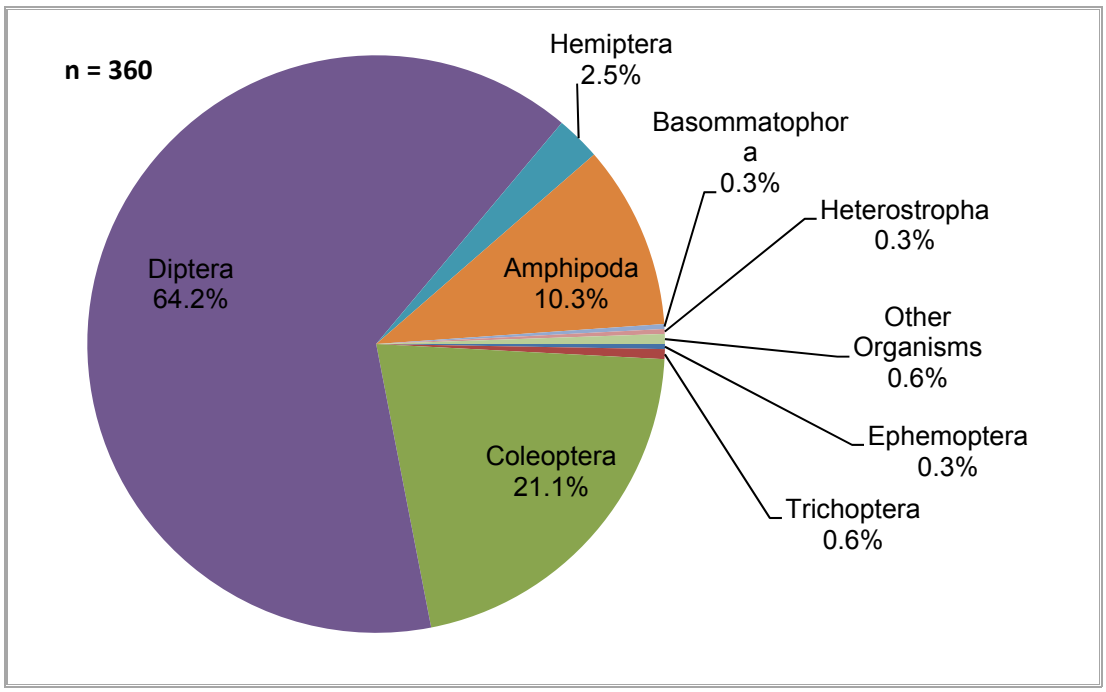
Note: n = number of samples

Figure 5.12-20: Relative Abundance of Prey Items, Kokanee, Tatelkuz Lake, July 2013

Table 5.12-12: Stomach Contents of Rainbow Trout, Tatelkuz Lake, July 2013

Common Name	Order	Sample Number (Fish Length)												Total Number	Relative Abundance (%)	Frequency of Occurrence
		C2N5-001 (257 mm)	C2N5-004 (242 mm)	B205-016 (239 mm)	B205-017 (233 mm)	B205-018 (221 mm)	B205-019 (238 mm)	B205-020 (235 mm)	B205-021 (235 mm)	B205-022 (200 mm)	B205-023 (203 mm)	B205-024 (216 mm)	B205-025 (210 mm)			
Mayfly	Ephemoptera	0	0	0	0	0	0	1	0	0	0	0	0	1	0.3	1/12
Caddisfly	Trichoptera	0	0	0	0	0	0	0	0	0	0	1	1	2	0.6	2/12
Beetle	Coleoptera	2	1	11	7	1	12	4	8	1	14	1	14	76	21.1	12/12
True Fly	Diptera	2	13	8	4	2	4	0	3	115	48	3	29	231	64.2	11/12
True Bug	Hemiptera	0	0	0	3	0	0	4	0	0	0	0	2	9	2.5	3/12
Amphipod	Amphipoda	0	0	2	33	2	0	0	0	0	0	0	0	37	10.3	3/12
Basommatophoran	Basommatophora	0	0	1	0	0	0	0	0	0	0	0	0	1	0.3	1/12
	Heterostropha	0	0	1	0	0	0	0	0	0	0	0	0	1	0.3	1/12
Other Organisms	-	0	0	0	0	0	0	1	0	0	1	0	0	2	0.6	2/12
Grand Total		**4**	**14**	**23**	**47**	**5**	**16**	**10**	**11**	**116**	**63**	**5**	**46**	**360**	**-**	**-**

Notes: mm = millimetre; % = percent; relative abundance = (total number*100/grand total; dash indicates no data.



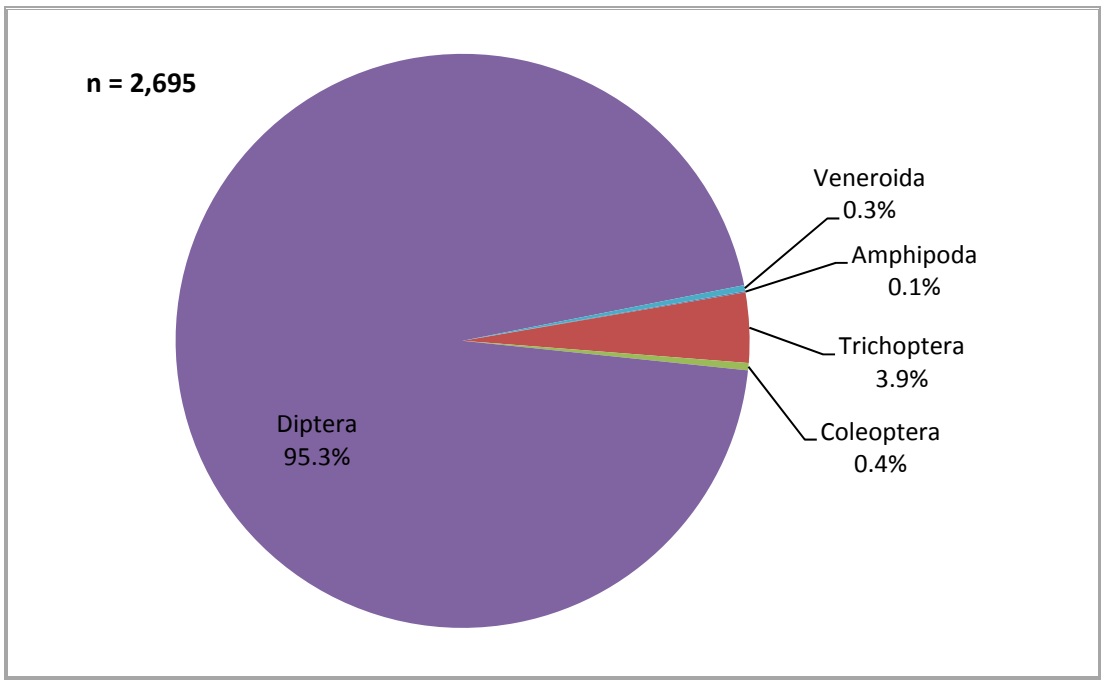
Note: n = number of samples

Figure 5.12-21: Relative Abundance of Prey Items of Rainbow Trout, Tatelkuz Lake, July 2013

Table 5.12-13: Stomach Contents of Mountain Whitefish, Tatelkuz Lake, July 2013

Common Name	Order	Sample Number (Fish Length)													Total Number	Relative Abundance (%)	Frequency of Occurrence
		I1O20-002 (242 mm)	I1O20-003 (217 mm)	I1O20-004 (300 mm)	I1O20-005 (258 mm)	I1O20-006 (281 mm)	I1O20-007 (308 mm)	I1O20-025 (240 mm)	I1O20-026 (265 mm)	D1N10-002 (288 mm)	D1N10-003 (282 mm)	D1N10-006 (213 mm)	E2N10-004 (277 mm)	A2O20-009 (227 mm)			
Caddisfly	Trichoptera	0	0	0	0	0	0	0	0	13	1	0	92	0	106	3.9	3/13
Beetle	Coleoptera	0	0	0	0	0	0	0	0	3	8	0	0	0	11	0.4	2/13
True Fly	Diptera	69	126	238	198	93	252	75	128	520	457	375	1	35	2,567	95.3	13/13
Amphipod	Amphipoda	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0.1	2/13
	Veneroida	0	0	5	0	1	3	0	0	0	0	0	0	0	9	0.3	3/13
	Grand Total	69	126	243	198	94	255	75	128	537	467	375	93	35	2,695	-	-

Note: mm = millimetre; % = percent; relative abundance = (total number*100/grand total; dash indicates no data.



Note: n = number of samples

Figure 5.12-22: Relative Abundance of Prey Items of Mountain Whitefish, Tatelkuz Lake, July 2013

5.13 Tatelkuz Lake Fish Tissue Metal Concentrations

This section describes metals concentrations in tissues of rainbow trout and mountain whitefish sampled from Tatelkuz Lake from 12 to 19 July 2013, and compares then with metal concentrations measured in rainbow trout sampled from streams and headwater lakes of the Blackwater LSA in 2011 and 2012, to values in the scientific literature, and to provincial and federal guidelines.

5.13.1 Statistical Summary

Annex 5.13-1 shows the percent moisture, metal concentrations, and percent lipids for individual rainbow trout and mountain whitefish whole-body, muscle and liver samples. **Annex 5.13-2** shows statistical summaries (FoD, means, SE, and minimum and maximum) of those data by species and tissue type.

Note that the numbers of whole fish samples shown in those two annexes were incremented by one for each of the two fish species because of the inclusion of two split samples. This means that the total number of analyzed whole fish samples was 20 instead of 19 for mountain whitefish and 21 instead of 20 for rainbow trout.

5.13.2 Size and Age of Fish

Mean length, weight, and condition of rainbow trout sampled for tissue metal concentrations were similar to those of mountain whitefish, but mean age of mountain whitefish was greater than that of rainbow trout (**Table 5.13-1** and **Table 5.13-2**).

Table 5.13-1: Biological Data of Rainbow Trout Analyzed for Metal Concentrations, Tatelkuz Lake, July 2013

Variable	Unit	n	Mean	SE	Min.	Max.
Length	mm	30	225	12	110	320
Weight	g	30	152	18	18	324
Condition	g/mm^3	30	1.10	0.20	0.92	1.42
Age	year	29	4	0.2	2	6
Gonad weight	g	1	1.6	-	1.6	1.6
Gonadosomatic index	%	1	0.9	-	0.9	0.9
Liver weight	g	10	2.2	0.2	1.3	3.3
Hepatosomatic index	%	10	0.9	0.1	0.6	1.4

Note: n = sample size, SE = standard error, Min. = minimum, Max. = maximum
Dashes indicate statistic could not be calculated. NA = not applicable.

Table 5.13-2: Biological Data of Mountain Whitefish Analyzed for Metal Concentrations, Tatelkuz Lake, July 2013

Variable	Unit	n	Mean	SE	Min.	Max.
Length	mm	29	225	11	124	347
Body weight	g	29	149	18	19	403
Condition	g/mm^3	29	1.10	0.02	0.81	1.38
Age	year	29	6	0	2	10
Gonad weight	g	8	7.1	1.5	3.1	14.0
Gonadosomatic index	%	8	2.7	0.4	1.7	4.8
Liver weight	g	10	2.3	0.4	0.4	4.5
Hepatosomatic index	%	10	1.2	0.2	0.6	2.1

Note: n = sample size, SE = standard error, Min. = minimum, Max. = maximum
Dashes indicate no data available.

Sex ratio of mountain whitefish (0.9; n = 21) was close to the expected value of 1.0, but sex ratio of rainbow trout (2.5; n = 14) was much higher. This suggests that sex ratio converged on the expected value of 1.0 with increasing sample size. Only 48% (n = 29) of rainbow trout were sexually mature, compared to 72% (n = 25) for mountain whitefish.

Percent maturity, mean gonad weight, mean GSI, mean liver weight and mean HSI of mountain whitefish were substantially higher than those of rainbow trout. These differences reflect the different reproductive timing of the two species. Rainbow trout in Tatelkuz Lake were recovering from spawning in May and June, hence their gonads were spent and gonadosomatic index was low. Sex was difficult to identify from visual examination of the

gonads so percent maturity was low. Energy reserves were low, so liver weight and HSI were low.

In contrast, mountain whitefish were maturing in preparation for spawning in autumn so their gonads were larger and GSI was higher than those of rainbow trout. Sex was easier to identify so percent maturity was almost twice as high as that of rainbow trout. Energy reserves were greater hence mean liver weight and mean HSI were higher.

5.13.3 Mean Metal Concentrations

Mean metal concentrations (plus SE, minimum and maximum) shown in **Annex 5.13-2** were calculated only for those concentrations that were above MDL. This meant that of the total of 3,401 individual values in the data set (including fish length, percent moisture and percent lipid), only 2,202 (or 64.75%) were above MDL and 1,199 (or 35.25%) were below MDL and hence excluded from statistical analysis. To maximize the use of data, all metal concentrations below their MDL were replaced with one-half the MDL and then mean metal concentrations (plus SE, minimum and maximum) were re-calculated (**Table 5.13-3**).

Examination of these data showed that mean concentrations of a number of metals differed substantially among the three tissue types (**Table 5.13-3**). For example, mean zinc concentration in liver tissue of rainbow trout was six times greater than in muscle tissue, and mean calcium concentration in whole rainbow trout was 16 times higher than in rainbow trout muscle and 60 times higher than in rainbow trout liver.

This was expected because of the different biological functions of liver and muscle tissue and the presence of cartilage and bone in whole fish samples. Livers were expected to have the highest concentrations of heavy metals because one of the functions of livers is to detoxify blood by removing and storing metals. Whole fish samples were expected to have the lowest metal concentrations because of the presence of metal-poor bone and cartilage.

Because of the large number of variables in the data set summarized in **Table 5.13-3**, a multivariate approach (i.e., a PCA) was required to show trends in metal concentrations between fish species and among tissue types. PCA was also required to show differences among rainbow trout tissue metal data collected from Tatelkuz Lake in 2013 and rainbow trout tissue metal data collected from streams and headwater lakes of the LSA in 2011 and 2012 (AMEC, 2013b).

Table 5.13-3: Mean Metal Concentrations in Tissues of Rainbow Trout and Mountain Whitefish, Tatelkuz Lake, July 2013

Species		Rainbow trout						Rainbow trout						Rainbow trout						Mountain whitefish						Mountain whitefish						Mountain whitefish					
Tissue type		Whole Fish						Muscle						Liver						Whole Fish						Muscle						Liver					
Variables	Unit	n	FoD	Mean	SE	Min.	Max.	n	FoD	Mean	SE	Min.	Max.	n	FoD	Mean	SE	Min.	Max.	n	FoD	Mean	SE	Min.	Max.	n	FoD	Mean	SE	Min.	Max.	n	FoD	Mean	SE	Min.	Max.
Length	mm	21	21/21	200	14	110	287	10	10/10	283	7	252	320	10	10/10	283	7	252	320	20	20/20	203	11	124	282	10	10/10	275	11	235	347	10	10/10	275	11	235	347
Moisture	%	21	21/21	77.4	0.8	70.2	91.3	10	10/10	77.5	0.4	76.2	79.3	10	10/10	77.0	0.3	76.1	78.6	20	20/20	74.6	0.5	70.1	77.9	10	10/10	77.2	0.4	75.0	78.7	10	10/10	74.8	0.4	72.0	77.3
Aluminum (Al)	mg/kg wwt	21	17/21	3.95	2.39	0.41	50.90	10	0/10	0.20	0.00	0.20	0.20	10	9/10	0.93	0.15	0.43	1.63	20	20/20	18.05	5.23	0.56	83.80	10	3/10	0.52	0.17	0.76	1.51	10	6/10	2.07	0.96	0.43	7.79
Antimony (Sb)	mg/kg wwt	21	0/21	0.001	0.000	0.001	0.001	10	0/10	0.0010	0.0000	0.0010	0.0010	10	1/10	0.0011	0.0001	0.0023	0.0023	20	0/20	0.001	0.000	0.001	0.001	10	0/10	0.0010	0.0000	0.0010	0.0010	10	1/10	0.0011	0.0001	0.0023	0.0023
Arsenic (As)	mg/kg wwt	21	21/21	0.0274	0.0037	0.0086	0.0695	10	10/10	0.0526	0.0314	0.0051	0.3080	10	10/10	0.0280	0.0073	0.0141	0.0840	20	20/20	0.0565	0.0066	0.0253	0.1470	10	10/10	0.0513	0.0329	0.0116	0.3470	10	10/10	0.0427	0.0090	0.0214	0.1180
Barium (Ba)	mg/kg wwt	21	21/21	0.243	0.034	0.084	0.853	10	510	0.009	0.001	0.011	0.014	10	0/10	0.005	0.000	0.005	0.005	20	20/20	0.406	0.059	0.116	1.180	10	9/10	0.019	0.003	0.010	0.039	10	6/10	0.021	0.007	0.011	0.070
Beryllium (Be)	mg/kg wwt	21	0/21	0.001	0.000	0.001	0.001	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	20	0/20	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010
Bismuth (Bi)	mg/kg wwt	21	0/21	0.001	0.000	0.001	0.001	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	20	0/20	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010
Boron (B)	mg/kg wwt	21	0/21	0.10	0.00	0.10	0.10	10	0/10	0.10	0.00	0.10	0.10	10	0/10	0.10	0.00	0.10	0.10	20	0/20	0.1	0.0	0.1	0.1	10	0/10	0.10	0.00	0.10	0.10	10	0/10	0.10	0.00	0.10	0.10
Cadmium (Cd)	mg/kg wwt	21	18/21	0.0030	0.0002	0.0024	0.0044	10	0/10	0.0010	0.0000	0.0010	0.0010	10	10/10	0.0408	0.0052	0.0207	0.0692	20	10/20	0.0027	0.0006	0.0023	0.0136	10	0/10	0.0010	0.0000	0.0010	0.0010	10	10/10	0.0102	0.0014	0.0046	0.0173
Calcium (Ca)	mg/kg wwt	21	21/21	4742	371	1790	8050	10	10/10	305	34	195	482	10	10/10	79	3	66.8	93.7	20	20/20	5966	329	3070	7900	10	10/10	373	38	215	642	10	10/10	72	8	49.5	127.0
Cesium (Cs)	mg/kg wwt	21	21/21	0.0032	0.0003	0.0016	0.0071	10	10/10	0.0037	0.0005	0.0025	0.0071	10	10/10	0.0020	0.0003	0.0013	0.0037	20	19/20	0.0030	0.0003	0.0014	0.0065	10	10/10	0.0030	0.0005	0.0014	0.0064	10	8/10	0.0020	0.0005	0.0011	0.0059
Chromium (Cr)	mg/kg wwt	21	20/21	0.120	0.028	0.011	0.479	10	2/10	0.007	0.001	0.012	0.014	10	8/10	0.018	0.004	0.011	0.050	20	19/20	0.128	0.025	0.024	0.446	10	0/10	0.005	0.000	ND	ND	10	5/10	0.009	0.002	0.011	0.018
Cobalt (Co)	mg/kg wwt	21	21/21	0.0123	0.0016	0.0053	0.0312	10	3/10	0.0030	0.0006	0.0040	0.0067	10	10/10	0.0256	0.0042	0.0146	0.0520	20	19/20	0.0164	0.0019	0.0073	0.0408	10	5/10	0.0039	0.0007	0.0043	0.0080	10	10/10	0.0329	0.0048	0.0129	0.0592
Copper (Cu)	mg/kg wwt	21	21/21	0.987	0.077	0.444	1.860	10	10/10	0.255	0.016	0.202	0.347	10	10/10	106.070	21.607	23	239	20	20/20	0.434	0.015	0.320	0.631	10	10/10	0.242	0.008	0.188	0.280	10	10/10	1.736	0.105	1.24	2.27
Gallium (Ga)	mg/kg wwt	21	1/21	0.0025	0.0005	0.0131	0.0131	10	1/10	0.0037	0.0017	0.0191	0.0191	10	0/10	0.0020	0.0000	0.0000	0.0000	20	8/20	0.0055	0.0013	0.0042	0.0223	10	2/10	0.0055	0.0023	0.0188	0.0201	10	1/10	0.0023	0.0003	0.0051	0.0051
Iron (Fe)	mg/kg wwt	21	21/21	19.6	2.5	10.5	66.4	10	10/10	3.61	0.17	2.92	4.70	10	10/10	272.50	32.90	145	461	20	20/20	37.4	7.2	10.8	131.0	10	10/10	3.85	0.21	2.81	4.84	10	10/10	86.99	11.82	57.3	158.0
Lead (Pb)	mg/kg wwt	21	21/21	0.0276	0.0040	0.0046	0.0751	10	2/10	0.0027	0.0005	0.0054	0.0056	10	4/10	0.0058	0.0022	0.0055	0.0242	20	19/20	0.0482	0.0157	0.0041	0.2900	10	1/10	0.0030	0.0009	0.0115	0.0115	10	8/10	0.0113	0.0038	0.0055	0.0423
Lithium (Li)	mg/kg wwt	21	0/21	0.010	0.000	ND	ND	10	0/10	0.010	0.000	0.010	0.010	10	0/10	0.010	0.000	0.010	0.010	20	0/20	0.010	0.000	0.010	0.010	10	0/10	0.010	0.000	0.010	0.010	10	0/10	0.010	0.000	0.010	0.010
Magnesium (Mg)	mg/kg wwt	21	21/21	296	8	204	367	10	10/10	273	7	226	297	10	10/10	161	3	141	176	20	20/20	324	7	275	416	10	10/10	283	6	241	308	10	10/10	200	9	173	266
Manganese (Mn)	mg/kg wwt	21	21/21	3.24	0.56	0.89	11.60	10	10/10	0.115	0.009	0.06	0.16	10	10/10	0.919	0.039	0.76	1.20	20	20/20	6.66	1.16	0.99	21.50	10	10/10	0.273	0.041	0.122	0.510	10	10/10	1.607	0.170	0.99	2.61
Mercury (Hg)	mg/kg wwt	21	21/21	0.0558	0.0041	0.0300	0.1000	10	10/10	0.0665	0.0056	0.0424	0.0945	10	10/10	0.1252	0.0092	0.0861	0.1770	20	20/20	0.0381	0.0021	0.0209	0.0532	10	10/10	0.0486	0.0050	0.0270	0.0820	10	10/10	0.1453	0.0134	0.078	0.214
Molybdenum (Mo)	mg/kg wwt	21	21/21	0.0107	0.0007	0.0064	0.0204	10	0/10	0.0020	0.0000	0.0020	0.0020	10	10/10	0.2197	0.0146	0.177	0.318	20	19/20	0.0120	0.0025	0.0044	0.0547	10	1/10	0.0022	0.0002	0.0043	0.0043	10	10/10	0.1471	0.0130	0.080	0.209
Nickel (Ni)	mg/kg wwt	21	6/21	0.012	0.003	0.012	0.059	10	2/10	0.007	0.001	0.011	0.014	10	0/10	0.005	0.000	0.005	0.005	20	10/20	0.031	0.009	0.010	0.155	10	1/10	0.042	0.037	0.376	0.376	10	2/10	0.006	0.001	0.010	0.011
Phosphorus (P)	mg/kg wwt	21	21/21	4273	208	2760	6310	10	10/10	2370	22	2240	2470	10	10/10	3108	64	2780	3450	20	20/20	4986	200	3470	6300	10	10/10	2414	36	2180	2550	10	10/10	3734	141	3260	4560
Potassium (K)	mg/kg wwt	21	21/21	3460	43	2810	3690	10	10/10	4226	63	3720	4360	10	10/10	3303	55	2930	3600	20	20/20	3560	78	2430	4170	10	10/10	4323	101	3820	4750	10	10/10	4090	169	3240	4810
Rhenium (Re)	mg/kg wwt	21	0/21	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	20	0/20	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	ND	ND	10	0/10	0.0010	0.0000	0.0010	0.0010
Rubidium (Rb)	mg/kg wwt	21	21/21	2.02	0.15	1.32	3.65	10	10/10	2.19	0.23	1.48	3.57	10	10/10	1.77	0.17	1.07	2.57	20	20/20	1.67	0.11	0.88	3.00	10	10/10	1.87	0.26	1.31	4.15	10	10/10	3.41	0.63	1.62	8.74
Selenium (Se)	mg/kg wwt	21	21/21	0.220	0.007	0.158	0.291	10	10/10	0.197	0.028	0.090	0.376	10	10/10	6.240	1.456	1.28	15.80	20	20/20	0.206	0.013	0.121	0.389	10	10/10	0.131	0.008	0.095	0.166	10	10/10	0.766	0.065	0.500	1.120
Silver (Ag)	mg/kg wwt	21	21/21	0.0121	0.0015	0.0010	0.0256	10	1/10	0.0008	0.0003	0.0034	0.0034	10	10/10	2.1940	0.3312	1.29	4.39	20	4/20	0.0008	0.0002	0.0011	0.0038	10	0/10	0.0005	0.0000	0.0005	0.0005	10	10/10	0.0081	0.0023	0.0012	0.0258
Sodium (Na)	mg/kg wwt	21	21/21	668	28	438	930	10	10/10	452	27	299	624	10	10/10	1433	63	1040	1740	20	20/20	685	22	558	818	10	10/10	455	13	408	534	10	10/10	1285	109	750	1880
Strontium (Sr)	mg/kg wwt	21	21/21	4.53	0.41	1.60	9.75	10	10/10	0.225	0.024	0.137	0.349	10	10/10	0.069	0.005	0.051	0.092	20	20/20	5.20	0.32	2.59	7.46	10	10/10	0.257	0.025	0.159	0.426	10	10/10	0.060	0.008	0.038	0.119
Tellurium (Te)	mg/kg wwt	21	0/21	0.0020	0.0000	0.0020	0.0020	10	0/10	0.0020	0.0000	0.0020	0.0020	10	2/10	0.0043	0.0017	0.0091	0.0182	20	0/20	0.0020	0.0000	ND	ND	10	0/10	0.0020	0.0000	0.0020	0.0020	10	0/10	0.0020	0.0000	0.0020	0.0020
Thallium (Tl)	mg/kg wwt	21	21/21	0.00177	0.00014	0.00108	0.00322	10	10/10	0.00159	0.00021	0.00096	0.00307	10	10/10	0.00865	0.00138	0.00326	0.01610	20	19/20	0.00199	0.00013	0.00115	0.00308	10	10/10	0.00128	0.00012	0.00051	0.00179	10	10/10	0.00484	0.00069	0.00261	0.01020
Thorium (Th)	mg/kg wwt	21	1/21	0.0014	0.0004	0.0090	0.0090	10	0/10	0.0010	0.0000	0.0010	0.0010	10	0/10	0.0010	0.0000	0.0010	0.0010	20	7/20	0.0021	0.0004	0.0023	0.0090	10	0/10	0.0010	0.0000	0.0010	0.0010	10	1/10	0.0017	0.0007	0.0079	0.0079
Tin (Sn)	mg/kg wwt	21	12/21	0.030	0.004	0.023	0.075	10	0/10	0.010	0.000	0.010	0.010	10	0/10	0.010	0.000	0.010	0.010	20	14/20	0.031	0.006	0.020	0.132	10	0/10	0.010	0.000	0.010	0.010	10	0/10	0.010	0.000	0.010	0.010
Uranium (U)	mg/kg wwt	21	19/21	0.00098	0.00019	0.00042	0.00351	10	0/10	0.00020	0.00000	0.00020	0.00020	10	10/10	0.00242	0.00085	0.00041	0.00940	20	18/20	0.00318	0.00052	0.00044	0.00851	10	1/10	0.00023	0.00003	0.00045	0.00045	10	10/10	0.00367	0.00102	0.00043	0.01140
Vanadium (V)	mg/kg wwt	21	13/21	0.056	0.019	0.023	0.417	10	0/10	0.010	0.000	0.010	0.010	10	10/10	0.047	0.007	0.020	0.086	20	18/20	0.103	0.017	0.022	0.283	10	0/10	0.010	0.000	0.010	0.010	10	8/10	0.045	0.011	0.027	0.121
Yttrium (Y)	mg/kg wwt	21	4/21	0.0028	0.0015	0.0025	0.0331	10	0/10	0.0010	0.0000	0.0010	0.0010	10	1/10	0.0012	0.0002	0.0033	0.0033	20	14/20	0.0110	0.0027	0.0021	0.0488	10	0/10	0.0010	0.0000	0.0010	0.0010	10	5/10	0.0031	0.0008	0.0026	0.0079
Zinc (Zn)	mg/kg wwt	21	21/21	32.2	1.9	21.8	52.1	10	10/10	4.15	0.11	3.64	4.76	10	10/10	26.09	1.98	20.20	41.80	20	20/20	16.9	0.7	11.3	25.3	10	10/10	4.07	0.18	3.48	5.14	10	10/10	20.19	0.56	18.20	24.00
Zirconium (Zr)	mg/kg wwt	21	1/21	0.021	0.001	0.047	0.047	10	0/10	0.020	0.000	0.020	0.020	10	1/10	0.026	0.006	0.075	0.075	20	3/20	0.025	0.003	0.044	0.068	10	0/10	0.020	0.000	0.020	0.020	10	0/10	0.020	0.000	0.020	0.020
Methyl Mercury	mg/kg wwt	3	3/3	0.0332	0.0048	0.0272	0.0426	3	3/3	0.0140	0.0041	0.0071	0.0214	3	3/3	0.0338	0.0149	0.0155	0.0634	4	4/4	0.0195	0.0038	0.0116	0.0298	3	3/3	0.0127	0.0018	0.0106	0.0163	3	3/3	0.0469	0.0103	0.0326	0.0669
Lipid Content	%wwt	21	21/21	3.0	0.4	1.1	7.0	10	9/10	1.3	0.2	0.6	2.2	0	0/0	-	-	-	-	20	20/20	3.7	0.3	1.3	6.6	10	10/10	2.0	0.4	0.7	5.3	0	0/0	-	-	-	-

Note: All statistics calculated by replacing values below MDL by half the MDL.
% = percent, mg = milligrams, wwt = wet weight, MDL = Method Detection Limit, n = sample size, FoD = frequency of detection ([n>MDL]/n), SE = standard error, min= minimum, max = maximum.
Dashes indicate no data available.

5.13.4 PCA

A PCA of fish tissue metal concentrations was done to identify major trends in the data. All fish tissue metals data collected from 2011 to 2013 were pooled into a single data matrix in which each row was a tissue sample and each column was an analytical variable.

To conduct the PCA, metals that contained little or no information were removed from the 2013 data matrix. A threshold of 10% of values above MDL was set, which meant that eight metals were removed from the 2013 data matrix: antimony (2.5%>MDL), beryllium (0%>MDL), bismuth (0%>MDL), boron (0%>MDL), lithium (0%>MDL), rhenium (0%>MDL), tellurium (2.5%>MDL), and zirconium (6.2%>MDL).

Methyl-mercury and lipids were also removed from the 2013 data matrix, even though the majority of concentrations that were measured were above detection limits, because there were too many cells without values: 62 for methyl-mercury (or 76% of the 81 cells in the data matrix) and 21 for lipids (or 26%). This follows from the general guideline that variables should not be included in a PCA if more than 10% of the values are missing.

For the remaining 31 metals, values below detection limits were replaced with one-half the detection limit. Percent moisture was removed from the data matrix because all metal concentrations were already expressed as mg/kg wet weight.

This left a 2013 data matrix with 32 variables and 81 records or 2,592 cells. It was combined with the 2011-2012 data matrix of 32 variables and 217 records (or 6,944 cells) for a total matrix of 32 variables and 298 records (or 9,536 cells).

A scree plot showed that the first three components were the only meaningful components (**Figure 5.13-1**). Hence, PCA reduced 32 variables to 3 – a tenfold reduction.

The first three principle components extracted by PCA explained a cumulative total of 66.2% of the total variance of the data matrix (**Table 5.13-4**). The first component, PC1, explained 35.8% of the total variance and was significantly ($P<0.001$) positively correlated with 22 metals including heavy metals such as zinc, iron, manganese, cobalt, uranium, molybdenum, vanadium, cadmium, copper, arsenic, barium, and lead. PC1 was significantly ($P<0.001$) negatively correlated with potassium. PC1 was interpreted as representing the concentration of heavy metals.

The second component, PC2, explained 21.9% of the total variance and was significantly ($P<0.001$) positively correlated with strontium, calcium, barium, aluminum, yttrium, and manganese and significantly ($P<0.001$) negatively correlated with mercury, copper, silver, selenium, thallium, and molybdenum (**Table 5.13-4**). Calcium is a structural metal because it is found in high concentrations in bones. Strontium is a calcium surrogate. Heavy metals such as mercury do not bind to bones and so they were negatively correlated with PC2. PC2 was interpreted as the concentration of structural metals.

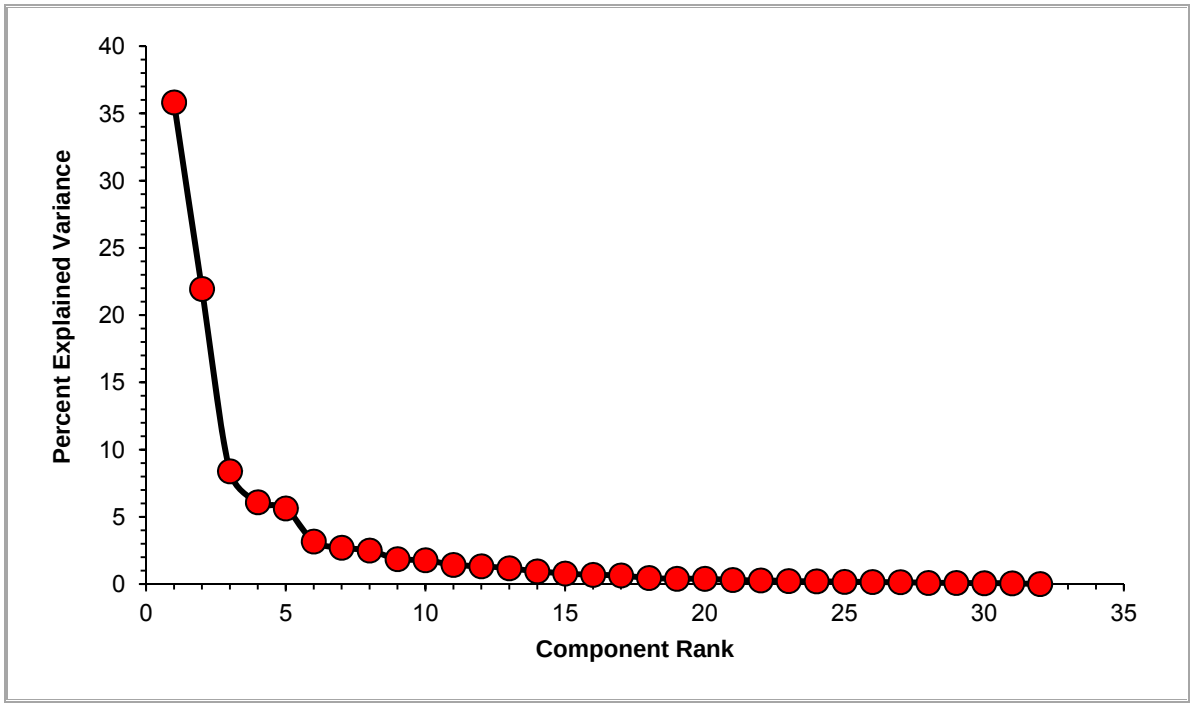


Figure 5.13-1: Scree Plot for PCA of Rainbow Trout and Mountain Whitefish Tissue Metals, 2011-2013

Table 5.13-4: PCA Loading Table for Fish Tissue Metals Concentrations, Blackwater LSA, 2011-2013

Variable	PC1	PC2	PC3
% variance	35.8	21.9	8.4
lnZn	**0.91**	0.02	0.10
lnFe	**0.87**	-0.39	-0.10
lnMn	**0.86**	0.38	-0.03
lnCo	**0.85**	-0.06	-0.18
lnU	**0.85**	0.14	0.13
lnMo	**0.81**	**-0.54**	-0.06
lnV	**0.80**	0.26	-0.35
lnAl	**0.78**	**0.41**	-0.05
lnCd	**0.77**	**-0.44**	-0.15
lnNa	**0.77**	-0.38	-0.10
lnP	**0.77**	0.38	0.05
lnAg	**0.68**	**-0.65**	0.04
lnCu	**0.67**	**-0.70**	-0.02
lnCr	**0.64**	0.22	0.15
lnSe	**0.64**	**-0.64**	-0.24
lnY	**0.57**	**0.49**	-0.02
lnSn	**0.54**	0.00	-0.18

Table continues…

Variable	PC1	PC2	PC3
lnBa	**0.53**	**0.73**	0.29
lnTl	**0.52**	**-0.63**	0.46
lnNi	**0.47**	0.08	0.28
lnPb	**0.47**	0.38	0.22
lnAs	**0.46**	0.13	0.23
lnK	**-0.42**	-0.07	-0.03
lnCa	0.25	**0.90**	0.13
lnSr	0.34	**0.80**	0.36
lnHg	0.07	**-0.73**	0.25
lnMg	0.06	**0.71**	0.21
lnCs	-0.04	-0.23	**0.90**
lnRb	-0.03	-0.32	**0.80**
lnLength	-0.09	-0.26	0.28
lnTh	0.28	0.34	-0.16
lnGa	0.21	0.40	-0.25

Note: **Bolded** (P<0.001); Underlined (0.001<P<0.05)

The third component, PC3, explained 8.4% of the total variance and was significantly (P<0.001) positively correlated with cesium and rubidium – two metals that have similar chemical and physical properties (**Table 5.13-4**). These two metals are rare compared with other metals and may indicate the type of bedrock present in some locations in the Blackwater RSA. Therefore, PC3 was interpreted as representing a geological signature of part of the study area, i.e., location.

Fish length, thallium, and gallium were not significantly correlated (P>0.001) with PC1, PC2 or PC3 (**Table 5.13-4**).

A plot of PC2 scores on PC1 scores for mountain whitefish sampled from Tatelkuz Lake in July 2013 (**Figure 5.13-2**) separated the three types of tissues without any overlap. Whole fish samples had high PC1 and PC2 scores (i.e., high concentrations of heavy metals and structural metals), liver samples had high PC1 scores but low PC2 scores (i.e., high concentrations of heavy metals but low concentrations of structural metals), and muscle samples had low PC1 scores, and PC2 scores that were between whole fish and liver samples (i.e., low concentrations of heavy metals and intermediate concentrations of structural metals).

Plots of PC2 scores on PC1 scores for rainbow trout sampled from Tatelkuz Lake in July 2013 and from streams and lakes in 2011-2012 (**Figure 5.13-3** to **Figure 5.13-5**) showed a similar separation of tissue types with very little overlap.

However, there were differences between the two species in mean PC1 and PC2 scores. For example, mountain whitefish liver tissues generally had lower PC1 scores than rainbow trout liver tissues, indicating lower concentrations of heavy metals in mountain whitefish livers than in rainbow trout livers.

There were also differences in mean PC1 and PC2 scores among sampling sites for rainbow trout. For example, PC1 scores for all three types of rainbow trout tissue were generally higher for streams than for lakes, indicating higher concentrations of heavy metals in juvenile, stream-resident rainbow trout than in adult lake-resident trout.

This counter-intuitive observation is supported by the finding that total selenium concentrations are substantially higher in juvenile stream-resident rainbow trout than in older, larger, mature lake-resident rainbow trout. **Section 5.13.7** describes tissue selenium concentrations in greater detail.

Also, PC2 scores for rainbow trout whole fish and muscle tissues were generally lower for Lake 01682LNRS than for all other lakes and streams (**Figure 5.13-2** and **Figure 5.13-3**). These site-specific differences in PC2 scores were not present for rainbow trout liver tissues (**Figure 5.13-4**). These observations support the idea that rainbow trout from Lake 01682LNRS are an isolated population. Lake 01682LNRS is the headwater lake of Davidson Creek. A barrier to upstream migration is present below the outlet of that lake (AMEC, 2013b), which means that rainbow trout may pass over the barrier but cannot return, thereby isolating Lake 01682LNRS from immigrants.

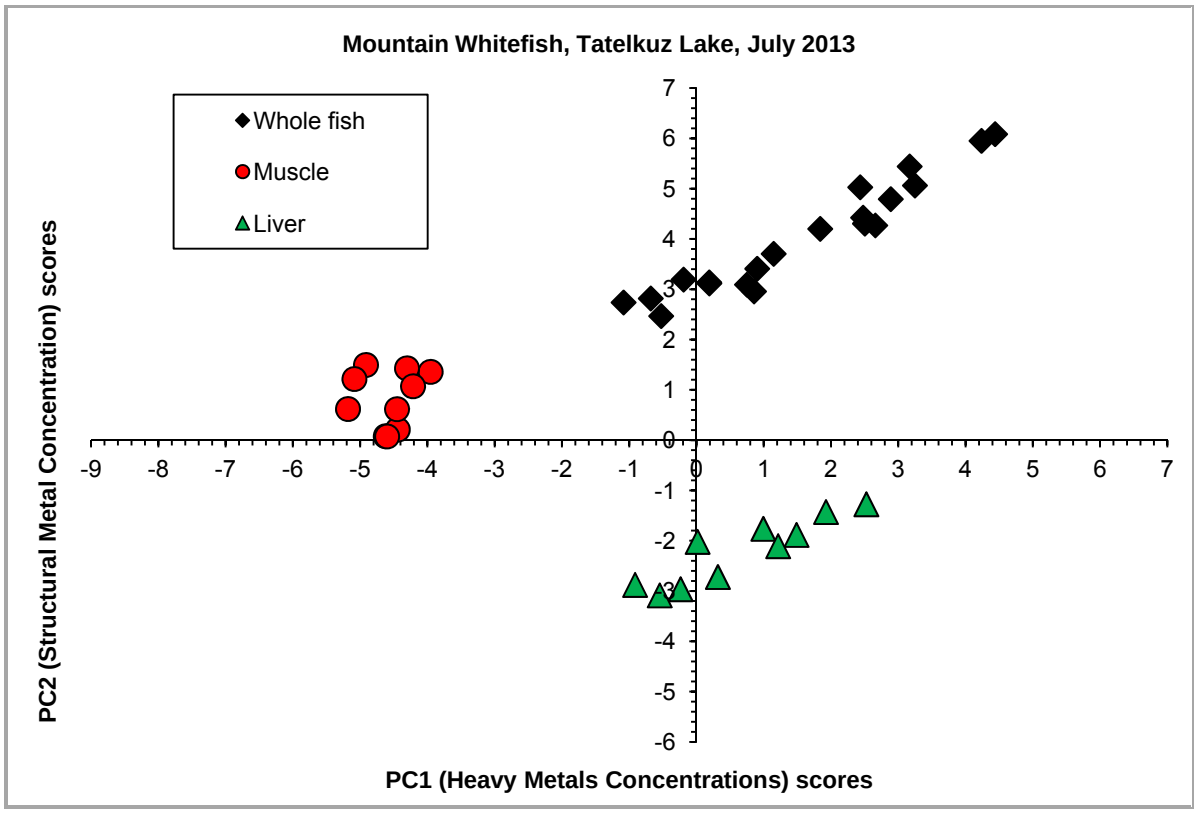


Figure 5.13-2: Plot of PC2 Scores on PC1 Scores for Mountain Whitefish Tissues, Tatelkuz Lake, July 2013

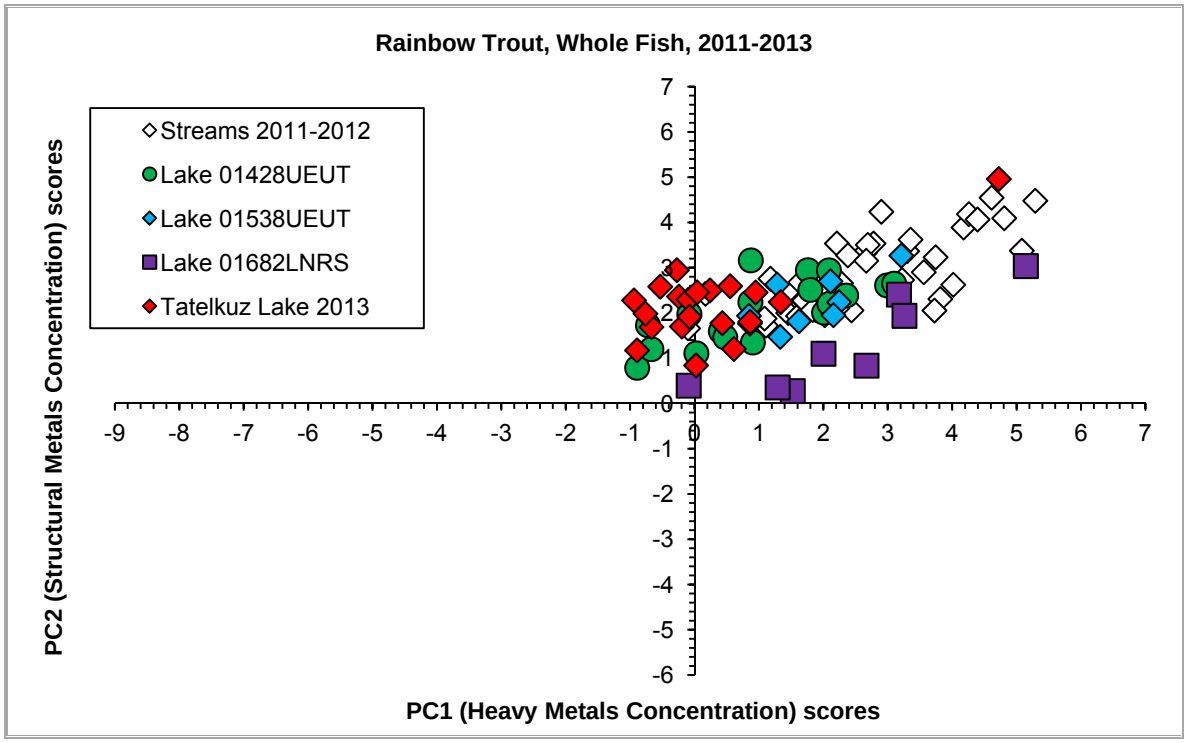


Figure 5.13-3: Plot of PC2 Scores on PC1 Scores for Whole Rainbow Trout, 2011-2013

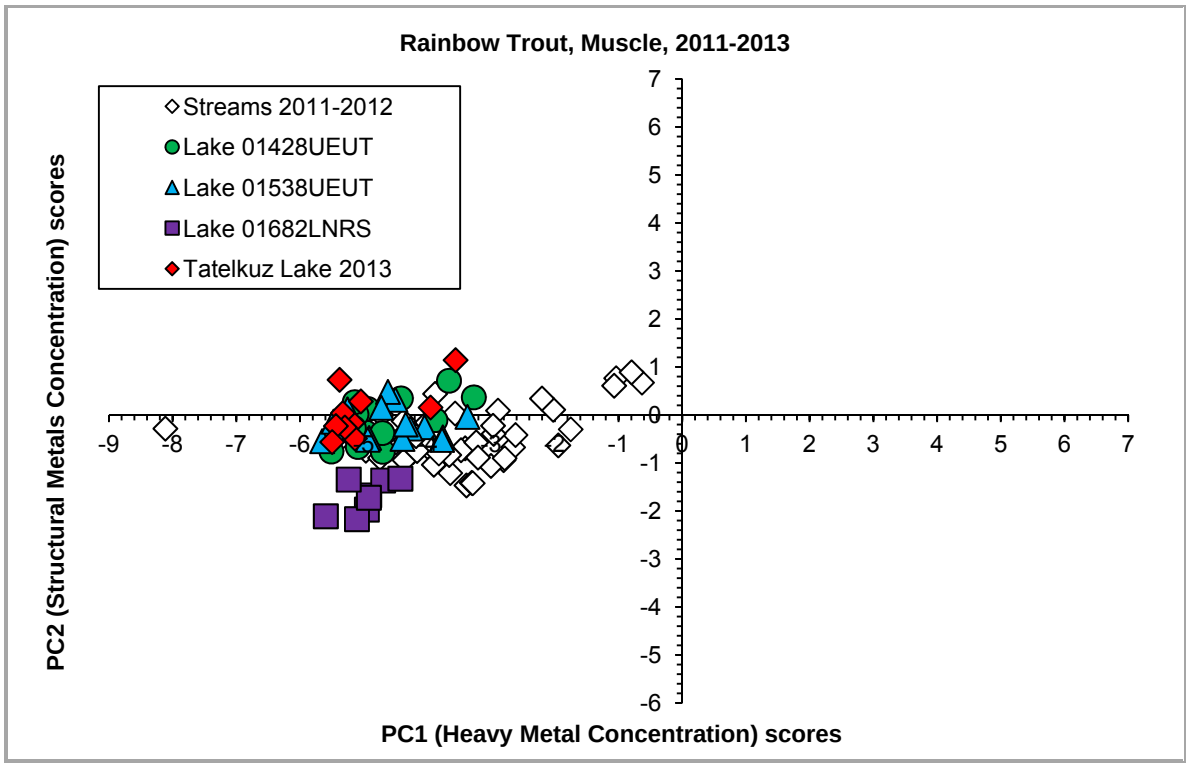


Figure 5.13-4: Plot of PC2 Scores on PC1 Scores for Rainbow Trout Muscle Tissue, 2011-2013

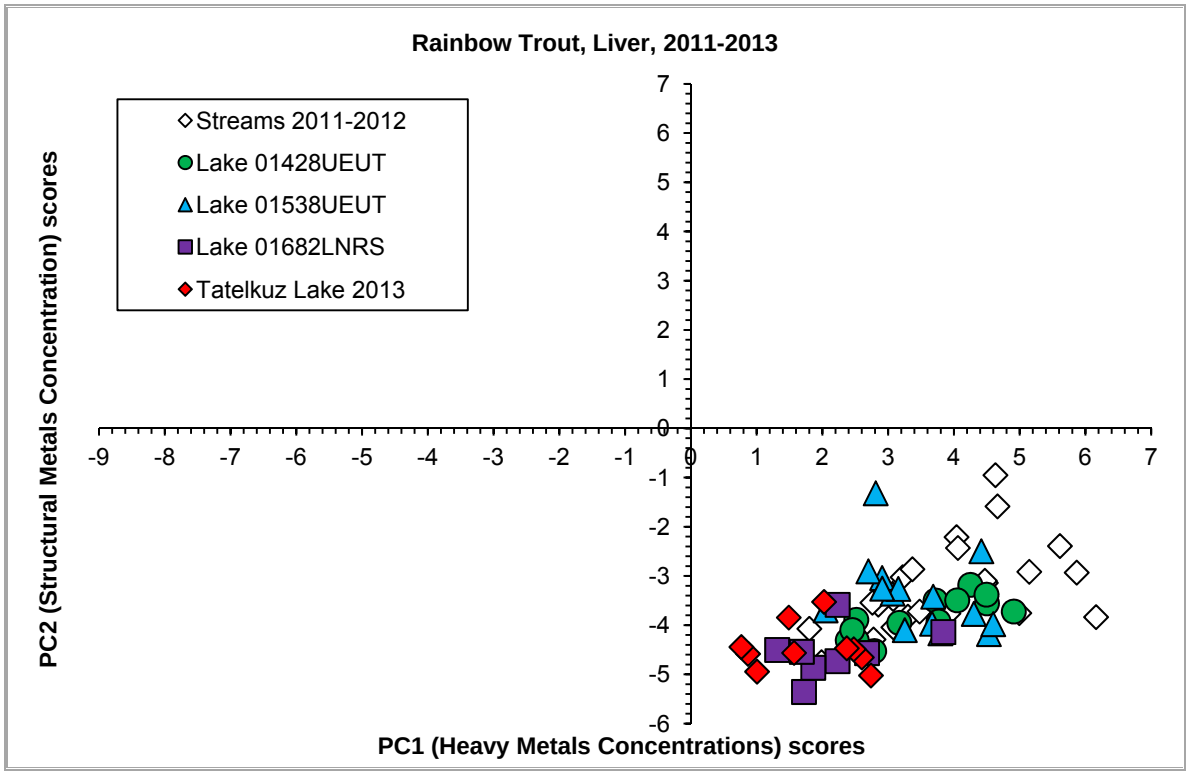
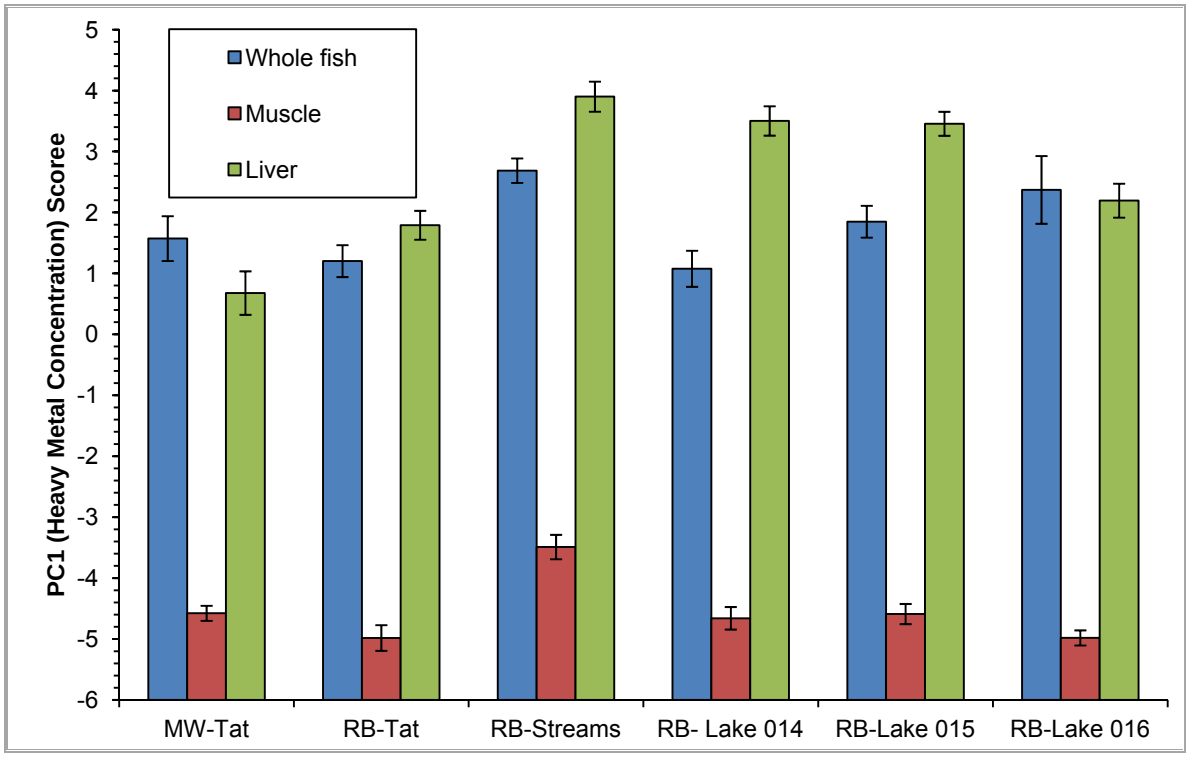


Figure 5.13-5: Plot of PC2 Scores on PC1 Scores for Rainbow Trout Liver Tissue, 2011-2013

Comparison of mean PC1 scores between mountain whitefish and rainbow trout of Tatelkuz Lake, and among rainbow trout sampled in streams and headwater lakes in 2011 and 2012, showed that heavy metal concentrations in muscle tissue were similar between the two species and among stream and lake sites (**Figure 5.13-6**). Rainbow trout captured from streams (i.e., juveniles) had slightly higher mean PC1 scores in muscle than mountain whitefish from Tatelkuz Lake and from rainbow trout from other locations.

Mean PC1 was higher in liver tissue than whole fish for most rainbow trout, but the opposite was the case for mountain whitefish (**Figure 5.13-6**). Mean PC1 in liver tissue was highest for rainbow trout sampled from streams (i.e., juveniles), followed by rainbow trout from Lake 01428UEUT, Lake 01538UEUT, Lake 01682LNRS, and Tatelkuz Lake, and mountain whitefish from Tatelkuz Lake.

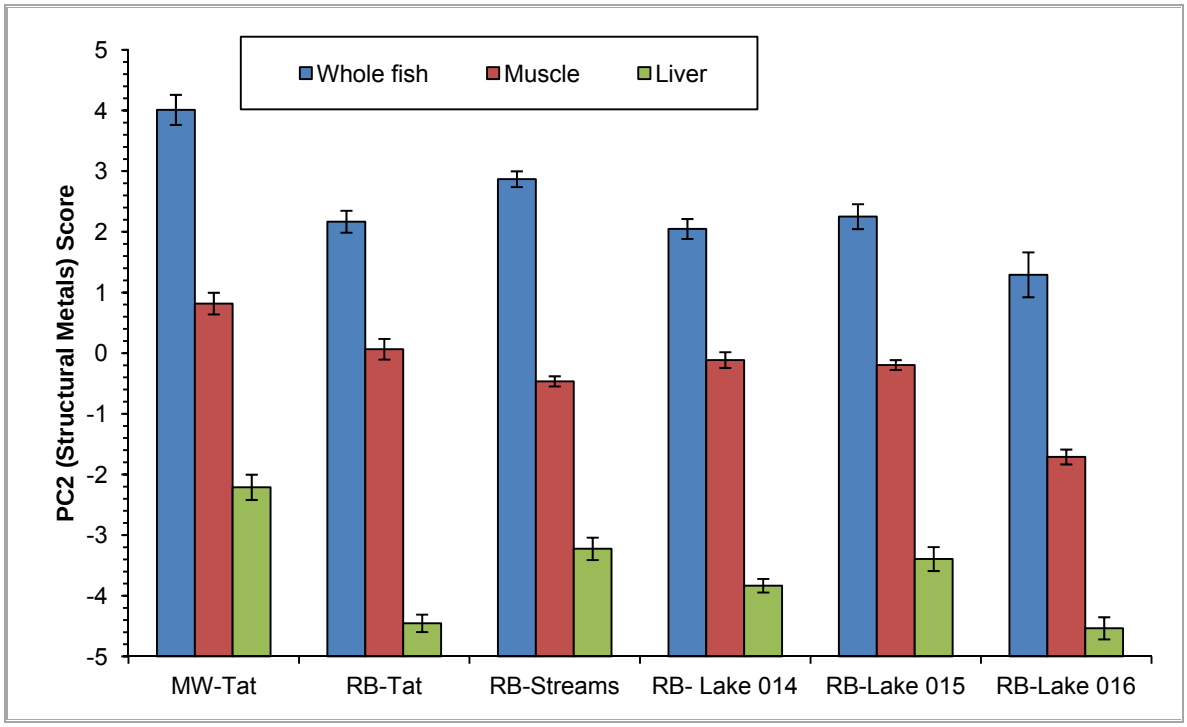


Note: Error bars are SE of the mean

Figure 5.13-6: Mean PC1 Scores for Mountain Whitefish and Rainbow Trout by Tissue Type and Sampling Site, 2011-2013

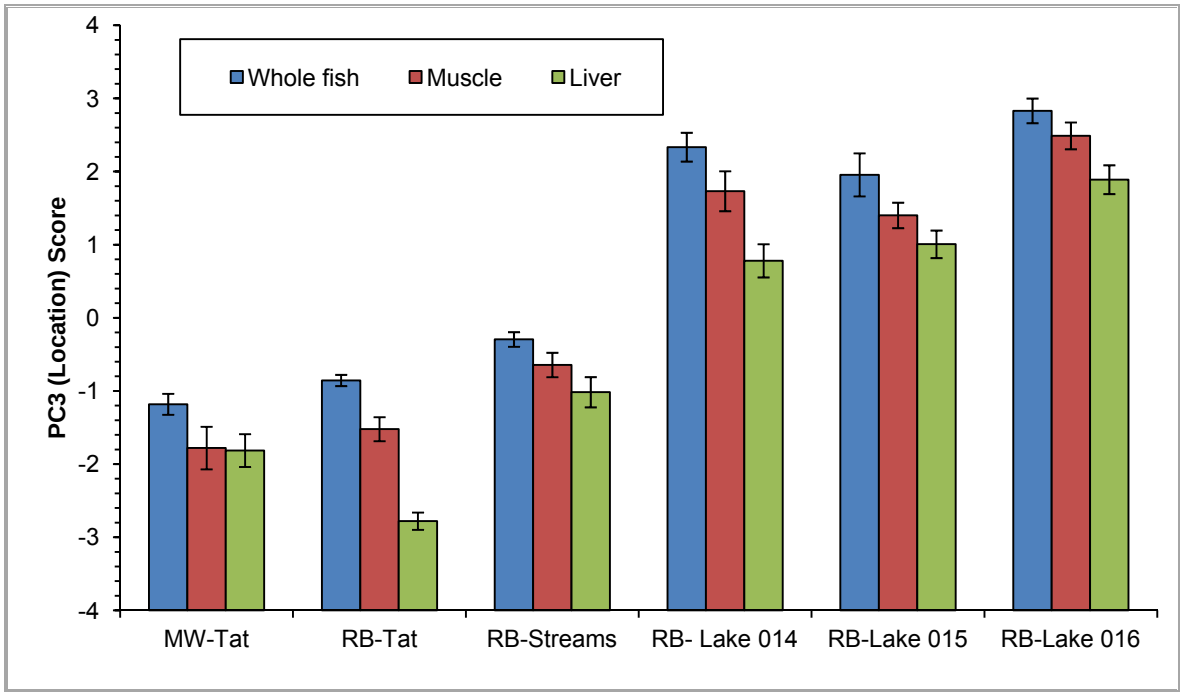
Comparison of mean PC2 scores between mountain whitefish and rainbow trout of Tatelkuz Lake, and among rainbow trout sampled in streams and headwater lakes in 2011 and 2012, showed that concentrations of structural metals were highest for whole fish and lowest for liver for both species and across all sampling sites (**Figure 5.13-7**) – a different pattern than that observed for PC1 (**Figure 5.13-6**). Concentrations of structural metals in all three types of tissue were higher in mountain whitefish than in rainbow trout. Rainbow trout of Lake 01682LNRS had the lowest mean PC2 scores in all three types of tissue.

Comparison of mean PC3 scores between mountain whitefish and rainbow trout of Tatelkuz Lake, and among rainbow trout sampled in streams and headwater lakes in 2011 and 2012, showed that PC3 scores followed the same ranking as PC2 scores – highest for whole fish and lowest for liver for both species and all sampling sites (**Figure 5.13-8**). Mean PC3 scores for all three types of tissues were highest in the three headwater lakes sampled in 2011-2012 and lowest in mountain whitefish of Tatelkuz Lake. However, mean PC3 concentrations for rainbow trout of Tatelkuz Lake were similar to those of mountain whitefish. Hence, the trend appears to follow elevation rather than species or stream-lake habitat.



Note: Error bars are SE of the mean

Figure 5.13-7: Mean PC2 Scores for Mountain Whitefish and Rainbow Trout by Tissue Type and Sampling Site, 2011-2013



Note: Error bars are SE of the mean

Figure 5.13-8: Mean PC3 Scores for Mountain Whitefish and Rainbow Trout by Tissue Type and Sampling Site, 2011-2013

5.13.5 Total Mercury

Mercury (Hg) is one of the few metals that have no known biological function, and is highly toxic to plants and animals (Eisler, 2006). All tissue samples collected from mountain whitefish and rainbow trout in Tatelkuz Lake in July 2013 were analyzed for total mercury concentrations, and all concentrations were above the MDL (**Table 5.13-3**).

5.13.5.1 Mountain Whitefish

Mean total mercury concentrations for mountain whitefish were highest in liver tissue and lowest in whole fish (**Table 5.13-3**). Specifically, mean total mercury concentration in mountain whitefish liver tissue (0.1453 mg/kg wwt) was 3.0 times higher than the mean for mountain whitefish muscle tissue (0.0486 mg/kg wwt), and 3.8 times higher than the mean for whole mountain whitefish (0.0381 mg/kg wwt) (**Table 5.13-3** and **Figure 5.13-9**).

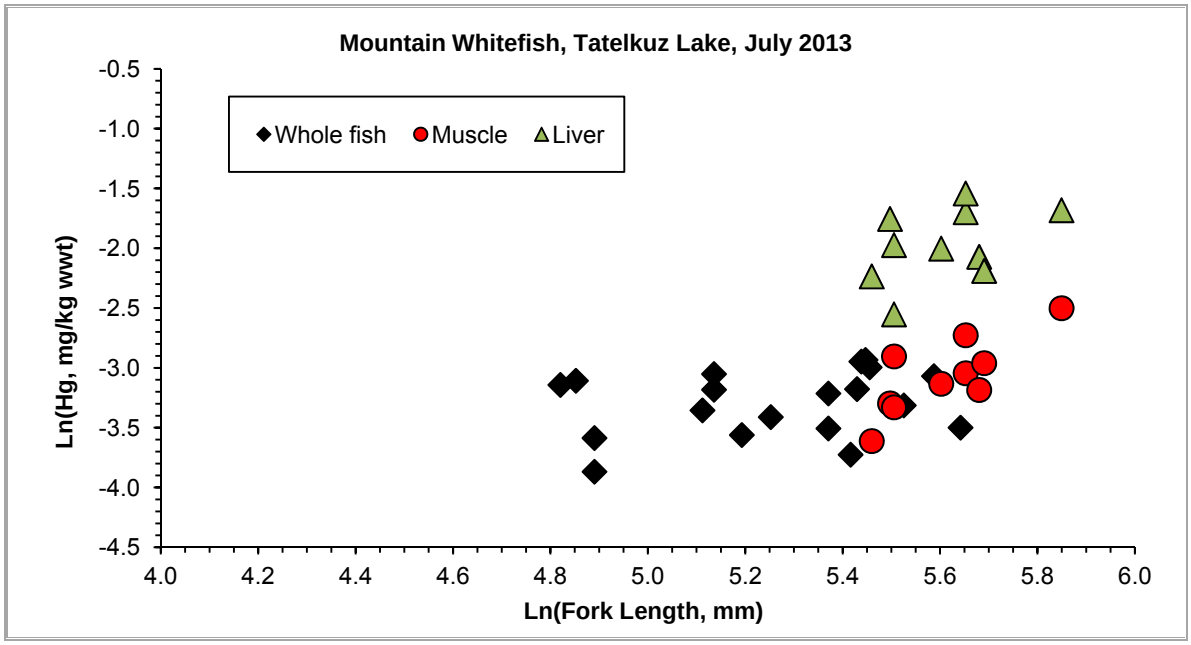


Figure 5.13-9: Plot of Total Mercury Concentration on Fork Length for Mountain Whitefish Tissue Samples, Tatelkuz Lake, July 2013

There were no significant (P>0.05) correlations between total mercury concentrations in mountain whitefish tissues and fish body length.

Mean total mercury concentration in muscle tissue and whole fish samples of mountain whitefish from Tatelkuz Lake in July 2013 fell within the range of concentrations reported for mountain whitefish in the Canadian Fish Mercury Database (Depew et al., 2013) (**Table 5.13-5**). The database contains data from fish populations across Canada sampled from 1967 to 2010. However, the mean total mercury concentrations for mountain whitefish of Tatelkuz Lake were lower than the median mercury concentration for mountain whitefish

in the database, suggesting lower total mercury concentrations in the Blackwater LSA than in most other environments across Canada.

Table 5.13-5: Total Mercury Concentrations of Rainbow Trout and Mountain Whitefish from the Canadian Fish Mercury Database

Species	Tissue Type	Hg Concentration (mg/kg wwt)			
		Count	Median	Minimum	Maximum
Rainbow trout	Skinless fillet	3,014	0.11	<MDL	0.94
	Skin-on fillet	172	0.10	<MDL	0.29
	Whole fish	57	0.01	<DL	0.34
	Muscle	97			
	Liver	17			
Mountain whitefish	Skinless fillet	524	0.06	<MDL	0.33
	Skin-on fillet	62	0.07	<MDL	0.17
	Whole fish	12	0.07	0.02	0.40

Source: DePew et al. (2013)

Health Canada has established a total mercury guideline for human consumption of fish of 0.5 mg/kg wwt mercury (Health Canada, 2013). This guideline was established to protect people who consistently eat large amounts of fish. None of the mountain whitefish tissue samples collected from Tatelkuz Lake in July 2013 exceeded that total mercury guideline.

5.13.5.2 Rainbow Trout

Rainbow trout showed a similar but not identical rank order of mean total mercury concentrations among tissue types as mountain whitefish. Mean total mercury concentration in liver tissue (0.1252 mg/kg wwt) was 1.9 times higher than the mean for muscle tissue (0.0665 mg/kg wwt), and 2.2 times higher than the mean for whole fish (0.0558 mg/kg wwt) (**Table 5.13-3**).

These mean total mercury concentrations for rainbow trout are similar to those reported by BC MOE for rainbow trout sampled from 24 uncontaminated lakes in BC (Rieberger, 1992) (**Table 5.13-6**). Mean total mercury concentration in muscle tissue was 35% higher than the mean for rainbow trout muscle tissue sampled from Tatelkuz Lake in July 2013, but the mean total mercury concentration in liver tissue was 12% lower than the mean for rainbow trout liver tissue sampled from Tatelkuz Lake in July 2013.

Table 5.13-6: Total Mercury Concentrations of Rainbow Trout from 24 Uncontaminated BC Lakes

Tissue Type	Count	Hg Concentration (mg/kg wwt)	
		Mean	SE
Muscle	97	0.09	0.01
Liver	17	0.11	0.02

Source: Rieberger (1992)

Mean total mercury concentration in muscle tissue of rainbow trout from Tatelkuz Lake in July 2013 is also lower than the median concentrations reported for rainbow trout of the Canadian Fish Mercury Database (Depew et al., 2013) (**Table 5.13-5**). However, the mean total mercury concentration in whole rainbow trout from Tatelkuz Lake in July 2013 was greater than the median whole-body concentration for whole-body samples (Depew et al., 2013).

Because total mercury binds to protein and is not metabolized or excreted, its concentration is sometimes positively correlated with body size. A plot of total mercury concentration of whole rainbow trout samples on fish length, ln-transformed to normalize the frequency distribution, showed that the Tatelkuz Lake data fell within the range observed for most samples collected from streams and lakes of the LSA in 2011 and 2012 (**Figure 5.13-10**). The exceptions were whole fish total mercury concentrations of rainbow trout from Lake 01682LNRS, the headwater lake of Davidson Creek, which were higher than all other samples. That population of rainbow trout is isolated from exchange with other populations of rainbow trout because of a barrier to upstream migration below the outlet of the lake. Rainbow trout from Lake 01682LNRS can pass over the barrier, but are unlikely to be able to return to their natal lake.

A linear regression of ln(Hg) on ln(length) for whole fish samples taken from Tatelkuz Lake in July 2013 was highly significant ($P<0.001$) and explained 45% of the variance in ln(Hg) (**Figure 5.13-10**). A regression of ln(Hg) on ln(length) for all whole fish samples collected from 2011 to 2013 was significant ($n = 96$, $P = 0.023$) but it only explained 5% of the variance in ln(Hg). This was due to including the anomalously high total mercury concentrations measured from Lake 01682LNRS. If those eight samples were excluded, the regression was not significant ($n = 88$, $P = 0.052$).

The lack of correlation between total mercury concentration in whole fish samples and fish length are supported by other studies. For example, Avison (2010) reported no significant ($P>0.05$) correlation of total mercury and fork length for 65 whole rainbow trout collected from the Chu Molybdenum Project area in the northeast corner of the Blackwater RSA.

A plot of total mercury concentration on body length for rainbow trout muscle samples collected from Tatelkuz Lake in July 2013 showed that the data fell within the range measured from most stream and lake samples collected in 2011 and 2012 (**Figure 5.13-11**). The exceptions were total mercury concentrations measured from muscle samples collected in Lake 01682LNRS, which were higher than all other total mercury concentrations in muscle tissue. There was also one anomalously low rainbow trout muscle sample collected from Chedakuz Creek in 2011-2012. There were no significant correlations ($P>0.05$) of total mercury concentration on body length for Tatelkuz Lake rainbow trout muscle samples or for all rainbow trout muscle samples combined.

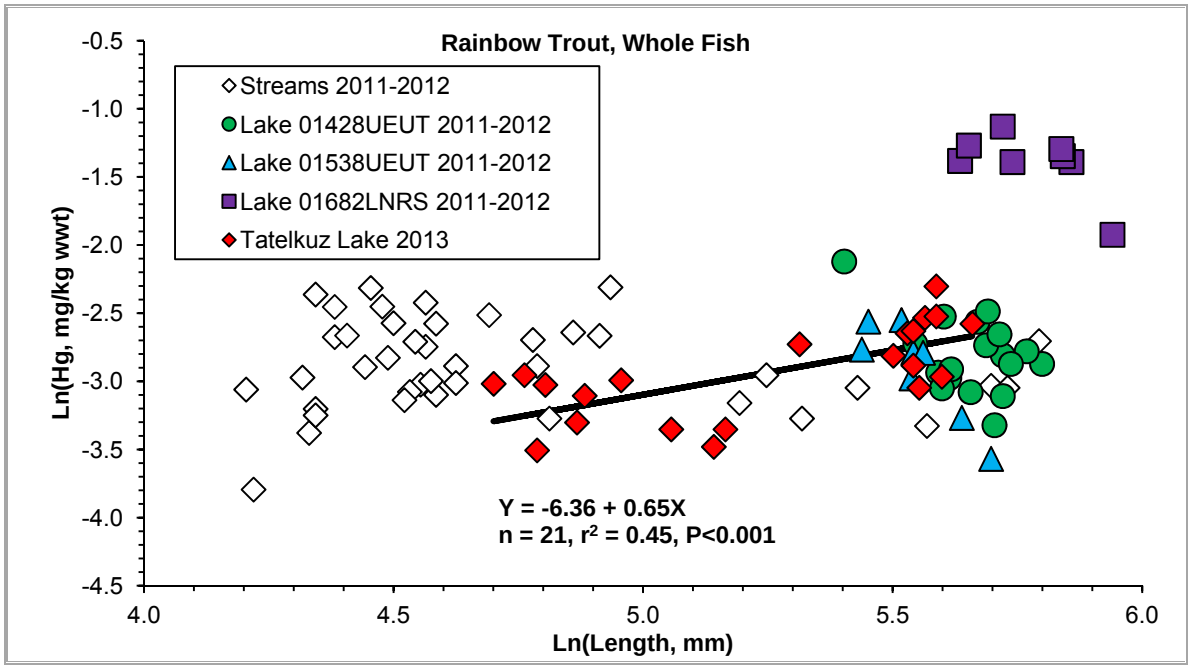


Figure 5.13-10: Plot of Total Mercury Concentration on Fork Length for Rainbow Trout Whole Fish Samples, 2011-2013

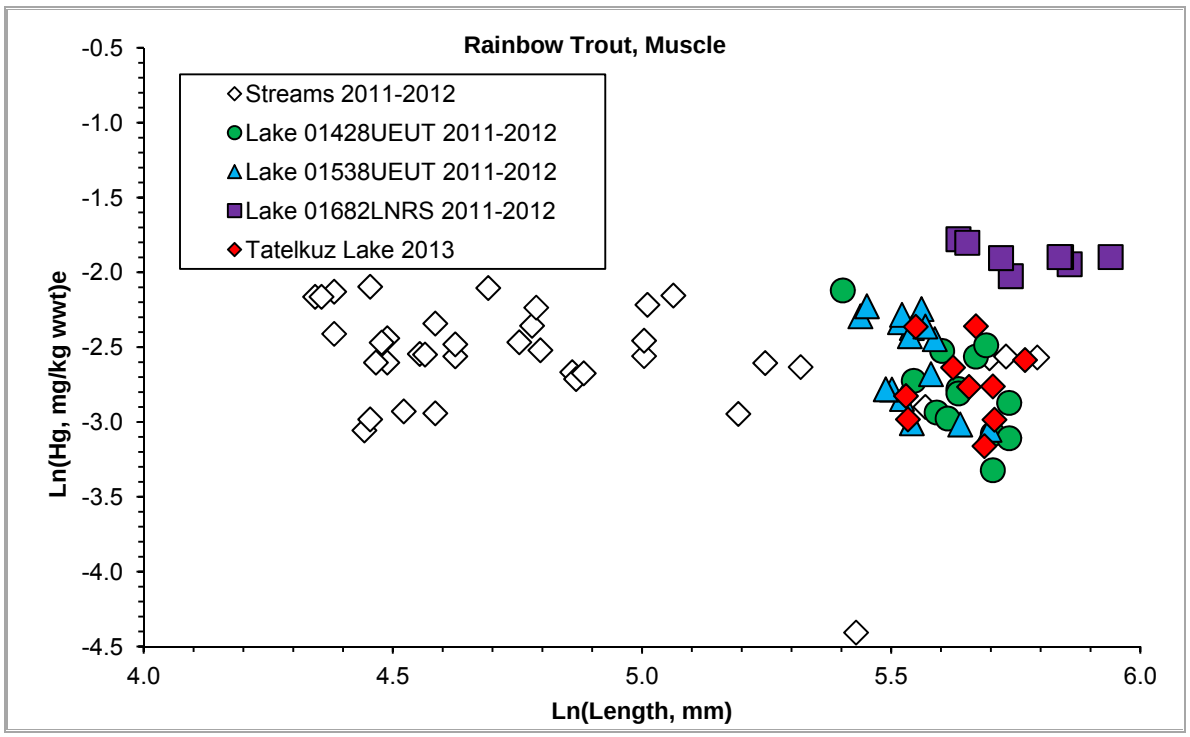


Figure 5.13-11: Plot of Total Mercury Concentration on Fork Length for Rainbow Trout Muscle Samples, 2011-2013

Rieberger (1992) also reported no significant (P>0.05) correlation of total mercury and fork length for muscle tissue sampled from 97 rainbow trout captured from 24 uncontaminated lakes in BC.

A plot of total mercury concentration on body length for rainbow trout liver samples collected from Tatelkuz Lake in July 2013 also showed that the data fell within the range measured from most stream and lake samples of rainbow trout livers collected from the Blackwater LSA in 2011 and 2012 (**Figure 5.13-12**). The exceptions were two anomalously low total mercury concentrations – one collected from Creek 661 and one from Davidson Creek. There was no significant correlation (P>0.05) of total mercury concentration on body length for Tatelkuz Lake rainbow trout livers. There was a significant positive correlation for all rainbow trout liver samples combined (n = 69, P<0.001), but it was due solely to the two anomalous stream samples. When those two samples were excluded, the correlation disappeared (n = 67, P>0.05).

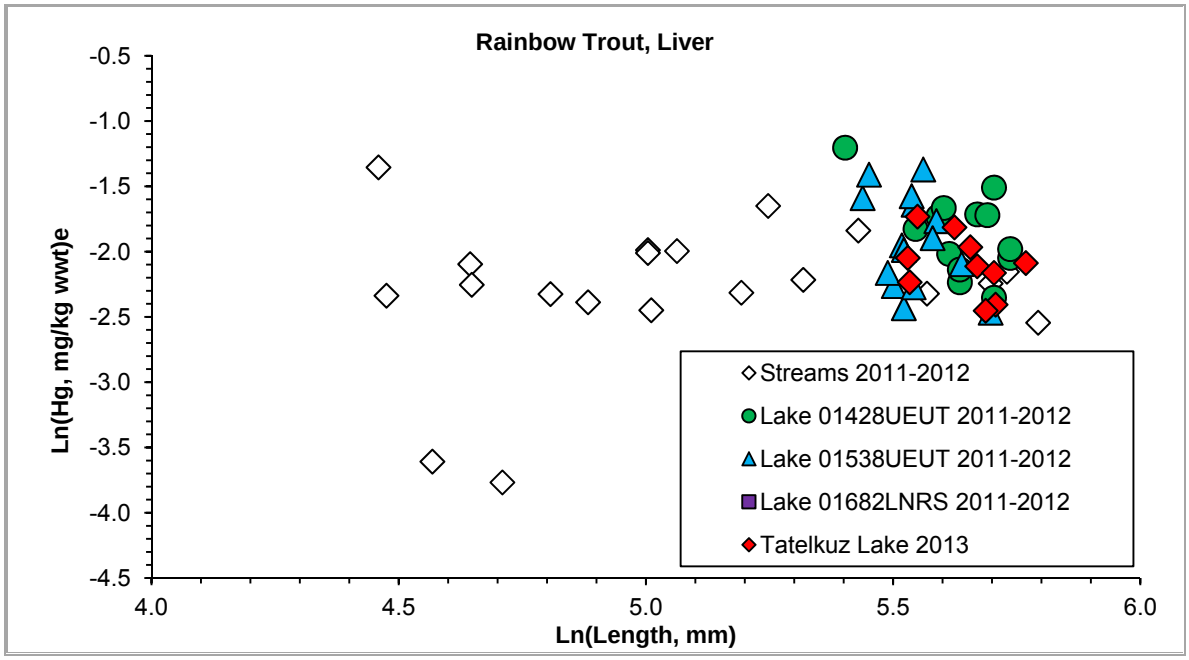


Figure 5.13-12: Plot of Total Mercury Concentration on Fork Length for Rainbow Trout Liver Samples, 2011-2013

Rieberger (1992) also reported no significant correlation between total mercury and fork length for liver tissue sampled from 97 rainbow trout captured from 24 uncontaminated lakes in BC.

None of the rainbow trout tissue samples collected from Tatelkuz Lake in July 2013 exceeded Health Canada's total mercury guideline of 0.5 mg/kg wwt for human consumption of fish (Health Canada, 2013).

5.13.6 Methyl-mercury

Methyl-mercury (MeHg) is the form of mercury most readily taken up by fish, and is the most harmful form of mercury to aquatic biota (Eisler, 2006). Methyl-mercury concentrations were measured from 19 fish tissue samples collected from Tatelkuz Lake in July 2013: 9 rainbow trout and 10 mountain whitefish (**Table 5.13-7**). That number was 24% of the total number of tissue samples taken from Tatelkuz Lake in July 2013. All 19 methyl-mercury concentrations were above the MDL.

Table 5.13-7: Number of Fish Tissue Samples Analyzed for Methyl-Mercury Concentration, 2012-2013

Species	Tissue	Sampling Year		Total
		2012	2013	
Rainbow trout	Whole fish	6	3	9
	Muscle	5	3	8
	Liver	2	3	5
	Subtotal	13	9	22
Mountain whitefish	Whole fish	0	4	4
	Muscle	0	3	3
	Liver	0	3	3
	Subtotal	0	10	10
Combined species	Whole fish	6	7	13
	Muscle	5	6	11
	Liver	2	6	8
Total		**13**	**19**	**32**

In 2012, methyl-mercury concentrations (and total mercury concentrations) were measured from 13 rainbow trout tissue samples collected from streams and lakes of the LSA (**Table 5.13-7**). That number was 6% of the total number of tissue samples collected in the LSA in 2012. Therefore, methyl-mercury concentrations and total mercury concentrations were available for a total of 22 rainbow trout and 10 mountain whitefish.

5.13.6.1 Mountain Whitefish

For mountain whitefish sampled from Tatelkuz Lake in July 2013, mean methyl-mercury concentrations for liver (0.0469 mg/kg wwt, SE = 0.0103) were twice as high as for whole fish (0.0195 mg/kg wwt, SE = 0.0038) and more than three times as high as for muscle (0.0127 mg/kg wwt, SE = 0.0018) (**Table 5.13-3** and **Figure 5.13-13**). However, there was considerable variation in methyl-mercury concentration within tissue types.

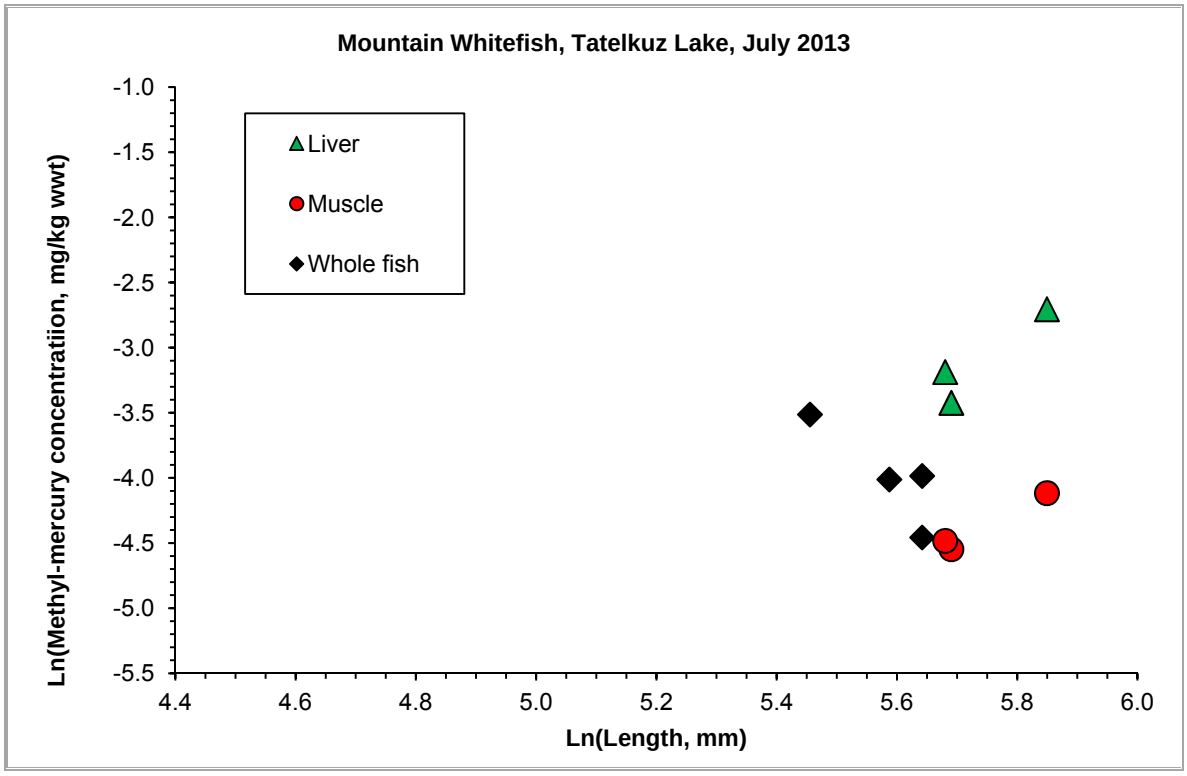


Figure 5.13-13: Plot of Methyl-Mercury Concentrations on Fork Length for Mountain Whitefish, Tatelkuz Lake, July 2013

Mountain whitefish methyl-mercury concentrations ranged from 20% to 60% of total mercury concentration for each tissue sample. The mean percentage was 36% (SE = 4, n =13). A linear regression of methyl-mercury concentration on total mercury concentration was highly significant ($P<0.001$) and explained 80% of the variation in methyl-mercury concentration (**Figure 5.13-14**). The intercept of the regression was not significantly ($P>0.05$) different from zero, and the slope of the regression was 0.32, indicating that, on average, methyl-mercury concentration was 32% of total mercury concentration.

BC MOE and the Canadian Council of Ministers of the Environment (CCME) established a methyl-mercury Tissue Residue Guideline (TRG) of 0.033 mg/kg wwt for protection of piscivorous wildlife (BC MOE, 2013a; CCME, 2000). For the fish samples collected from Tatelkuz Lake in July 2013, 2 of the 13 measurements of methyl-mercury for mountain whitefish (both livers) (**Figure 5.13-14**) exceeded that TRG.

The CCME developed the methyl-mercury TRG using the *Protocol for Derivation of Tissue Residue Guidelines for the Protection of Wildlife that Consume Aquatic Biota* (CCME, 1998), following the equation:

$$TRG = TDI/(FI/W)$$

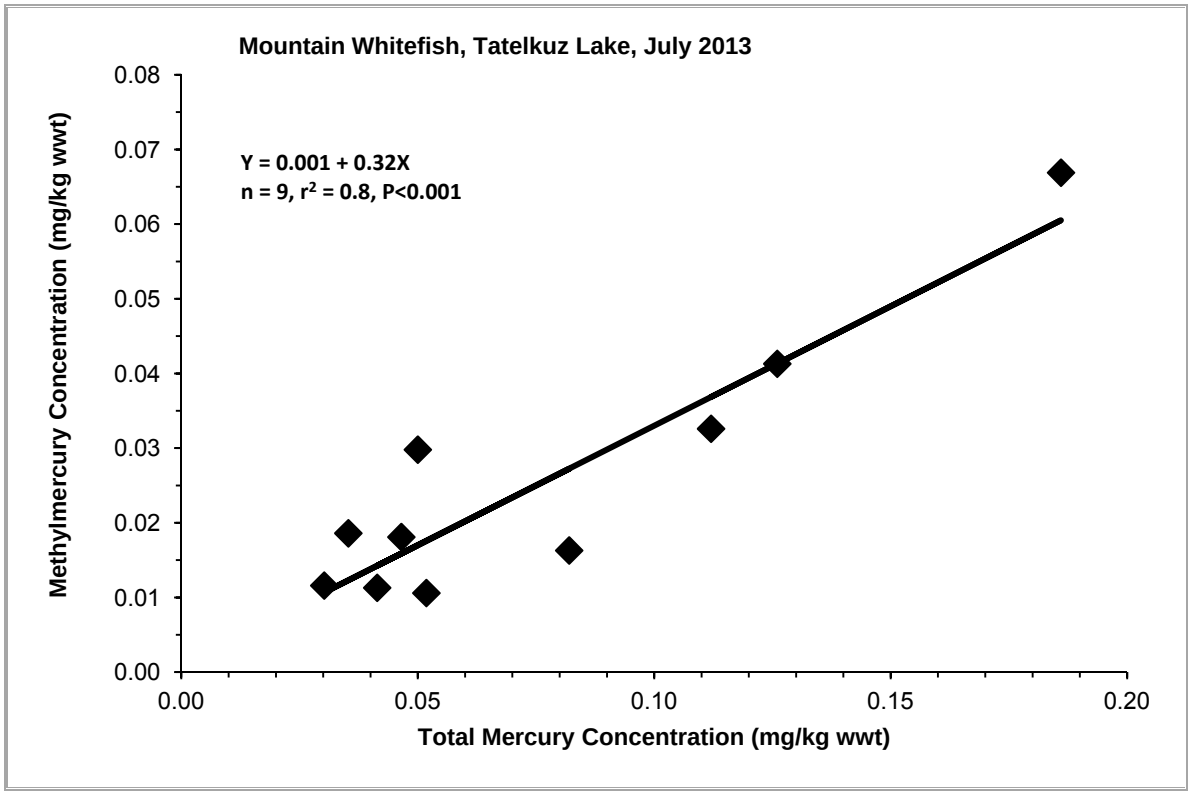


Figure 5.13-14: Linear Regression of Methyl-Mercury Concentration on Total Mercury Concentrations, Mountain Whitefish, Tatelkuz Lake, July 2013

where TDI = Tolerable Daily Intake of methyl-mercury (mg per kg body weight per day), FI = food ingestion rate (kg/day), and W = body weight (kg wwt).

CCME (2000) set the TDI as 0.031 mg/kg wwt/d, based on avian toxicological data, and the ratio of FI to W at 0.94, the highest ratio available, based on data for Wilson's storm-petrel (*Oceanites oceanicus*) (CCME, 1998). The value of 0.033 mg/kg wwt was the lowest for all avian and mammal species for which data on TDI, FI and W were available; hence, it was chosen by CCME (2000) as the TRG for protection of all aquatic biota.

Wilson's storm-petrel is not present in the Blackwater aquatics LSA and RSA, which means a methyl-mercury TRG of 0.033 mg/kg wwt is not applicable to the LSA and RSA.

A site-specific TRG for methyl-mercury was calculated in AMEC (2013b) by identifying the bird species listed on Table 1 of the *Protocol for Derivation of Tissue Residue Guidelines for the Protection of Wildlife that Consume Aquatic Biota* that are present in the Blackwater aquatics RSA. A total of 15 species were reported as present based on direct observations of seven species in the Blackwater wildlife RSA (AMEC, 2013b) and the inferred presence of another eight species that were identified as "likely present" based on records reported by *Birds of British Columbia* (Campbell et al., 1990), the *British Columbia Breeding Bird Atlas* (2013) and eBird (2013). The FI/W ratios for those 15 species ranged from a low of 0.11 for bald eagle (*Haliaeetus leucocephalas*) to a high of 0.50 for belted kingfisher (*Ceryle alcyon*).

Therefore, TDI of 0.031 mg/kg wwt was divided by a maximum FI/W ratio of 0.50 to obtain a site-specific methyl-mercury TRG of 0.062 mg/kg wwt.

Only one mountain whitefish sample exceeded that site-specific methyl-mercury TRG: a liver from a 347 mm-long fish.

5.13.6.2 Rainbow Trout

For rainbow trout sampled from Tatelkuz Lake in July 2013, mean methyl-mercury concentrations for whole fish (0.0332 mg/kg wwt, SE = 0.0048) and liver (0.0338 mg/kg wwt, SE = 0.0149) tissues were almost three times higher than for muscle tissue (0.0140 mg/kg wwt, SE = 0.041) (**Table 5.13-3** and **Figure 5.13-15**). As with mountain whitefish, there was substantial variation in concentrations within tissue types.

A different pattern was observed for rainbow trout sampled from streams and lakes of the LSA in 2012: mean methyl-mercury concentration of liver tissue (0.0810 mg/kg wwt, SE = 0.0520) was twice as high as the means for muscle tissue (0.0432 mg/kg, SE = 0.0235) and whole fish (0.0407 mg/kg wwt, SE = 0.0076) (**Figure 5.13-15**).

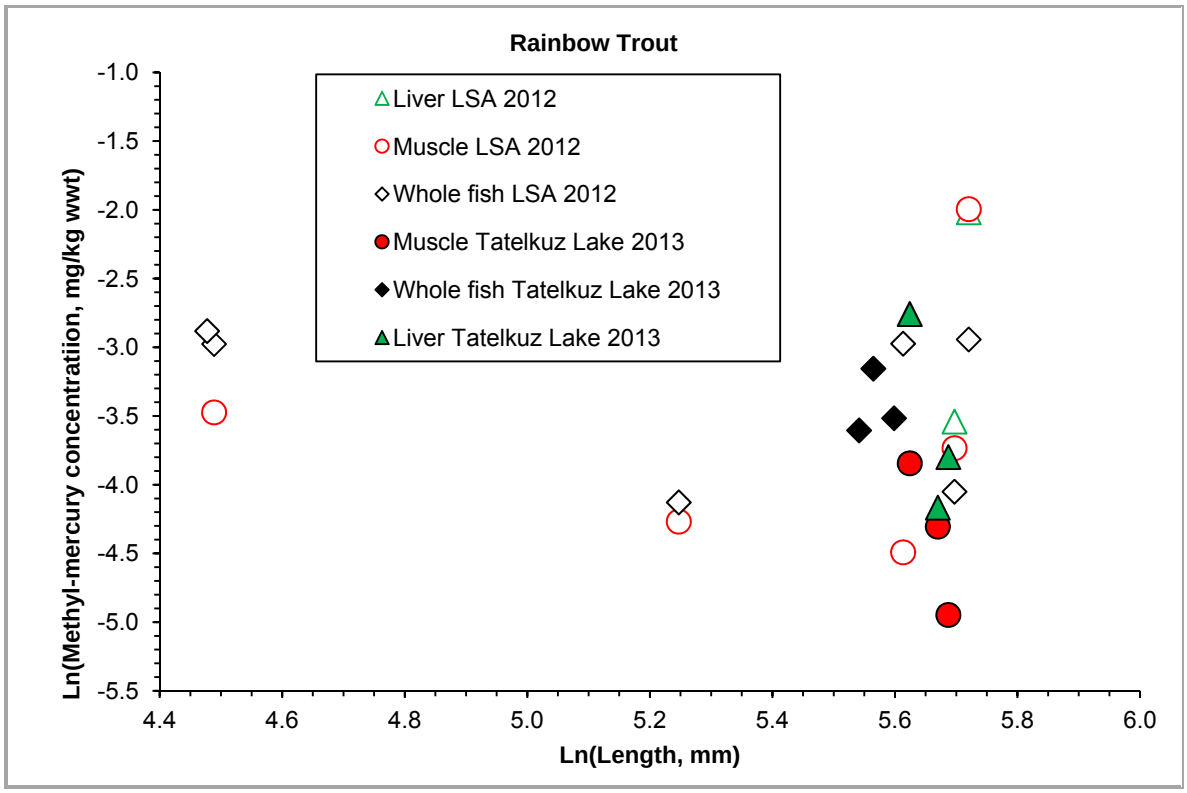


Figure 5.13-15: Plot of Methyl-Mercury Concentrations on Fork Length for Rainbow Trout, Blackwater LSA, 2012-2013

For rainbow trout sampled from Tatelkuz Lake in July 2013, methyl-mercury concentration ranged from 13% to 58% of total mercury concentration for each tissue sample, and the

mean percentage was 33% (SE = 6, n = 9). For rainbow trout sampled from the LSA in 2012, methyl-mercury concentration ranged from 17% to 100% of total mercury concentration for each tissue sample, and the mean percentage was 51% (SE = 7, n = 13). For all rainbow trout combined the mean was 44% (SE = 5, n = 22, range = 13% to 100%.

A linear regression of methyl-mercury concentration on total mercury concentration for rainbow trout was highly significant (P<0.001) and explained 75% of the variation in methyl-mercury concentration (**Figure 5.13-16**). The intercept of the regression was not significantly (P = 0.33) different from zero, and the slope of the regression was 0.51, indicating that, on average, rainbow trout methyl-mercury concentration was 51% of total mercury concentration.

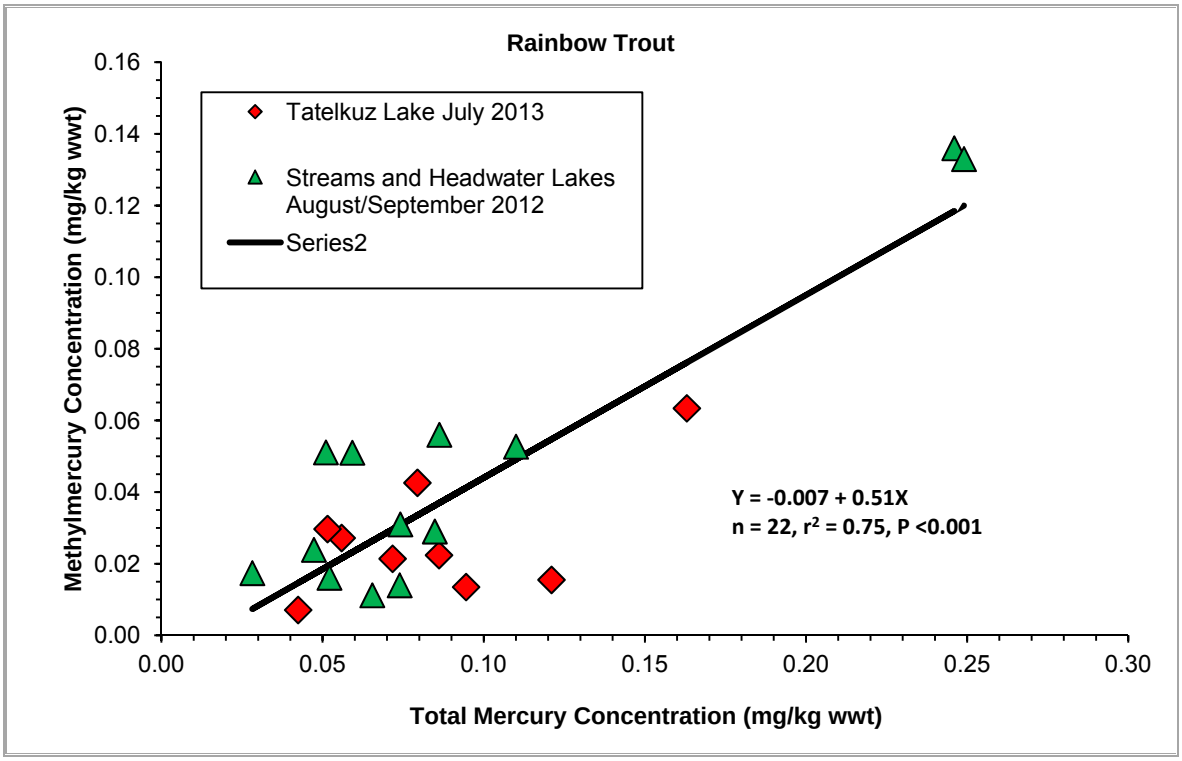


Figure 5.13-16: Linear Regression of Methyl-Mercury Concentration on Total Mercury Concentrations, Rainbow Trout, Blackwater LSA, 2012-2013

Two of the nine measurements of methyl-mercury for rainbow trout (one liver and one whole fish) (**Figure 5.13-16**) exceeded that the TRG established by BC MOE. One liver tissue sample from a 277 mm-long rainbow trout from Tatelkuz Lake exceeded that site-specific TRG. For the rainbow trout sampled from streams and lakes of the LSA in 2012, one sample exceeded the site-specific methyl-mercury TRG. That trout was captured from Lake 01682LNRS, the headwater lake of the Davidson Creek Watershed, on 19 September 2012. It had a methyl-mercury concentration of 0.1360 mg/kg wwt for the muscle sample, and 0.1330 mg/kg wwt for the liver sample.

5.13.7 Total Selenium

Selenium (Se) is an essential micronutrient for all animals, but it is toxic in high concentrations (BC MOE, 2013b). Its primary toxic effect on fish is on egg and larval mortality. Adults transfer (or depurate) selenium from their muscles and organs to developing eggs and sperm. Elevated concentrations may cause deformities in embryos and larvae that lead to death.

Selenium bioaccumulates as it passes up aquatic food chains. The greatest rate of bioconcentration occurs at the base of the food chain as bacteria, periphyton, and phytoplankton take up selenium from the water (BC MOE, 2013b). Hence, selenium is taken up by fish mainly from their diet rather than from the water they breathe. Selenium concentrations in fish muscle tissue are usually similar to selenium concentrations in their diet (BC MOE, 2013b). Selenium bioaccumulation is greater in standing water environments (i.e., lentic) such as ponds and slow-moving streams than in flowing-water environments (i.e., lotic) such as creeks and rivers (BC MOE, 2013b).

5.13.7.1 Mountain Whitefish

For mountain whitefish sampled from Tatelkuz Lake in July 2013, mean total selenium concentration was highest for liver tissue (mean = 0.766 mg/kg wwt) and lowest for muscle tissue (mean = 0.131 mg/kg wwt), with whole fish having an intermediate concentration (mean = 0.206 mg/kg wwt) (**Table 5.13-3** and **Figure 5.13-17**). No significant (P>0.05) correlations were found between total selenium concentration and fish length for whole fish, muscle or liver tissue (**Figure 5.13-17**).

To the best of our knowledge, there are no published data available on selenium concentrations in mountain whitefish tissues from other sites in British Columbia or Canada (BC MOE, 2013b). However, BC MOE (2013b) does present selenium tissue concentrations from other fish species reported from sites in Canada and the United States, that indicate that the selenium concentrations measured in mountain whitefish from Tatelkuz Lake were low.

For example, the US Department of the Interior's (US DOI) National Irrigation Water Quality Program (US DOI, 1998 cited in BC MOE, 2013b) summarized fish tissue data from US and global sources. After excluding data from selenium-contaminated sites, mean whole fish selenium concentration was between 0.4 and 0.6 mg/kg wwt (i.e., 1.6 and 2.4 mg/kg dwt, assuming 75% moisture content). That range is two to three times higher than the whole fish mean selenium concentration for mountain whitefish from Tatelkuz Lake.

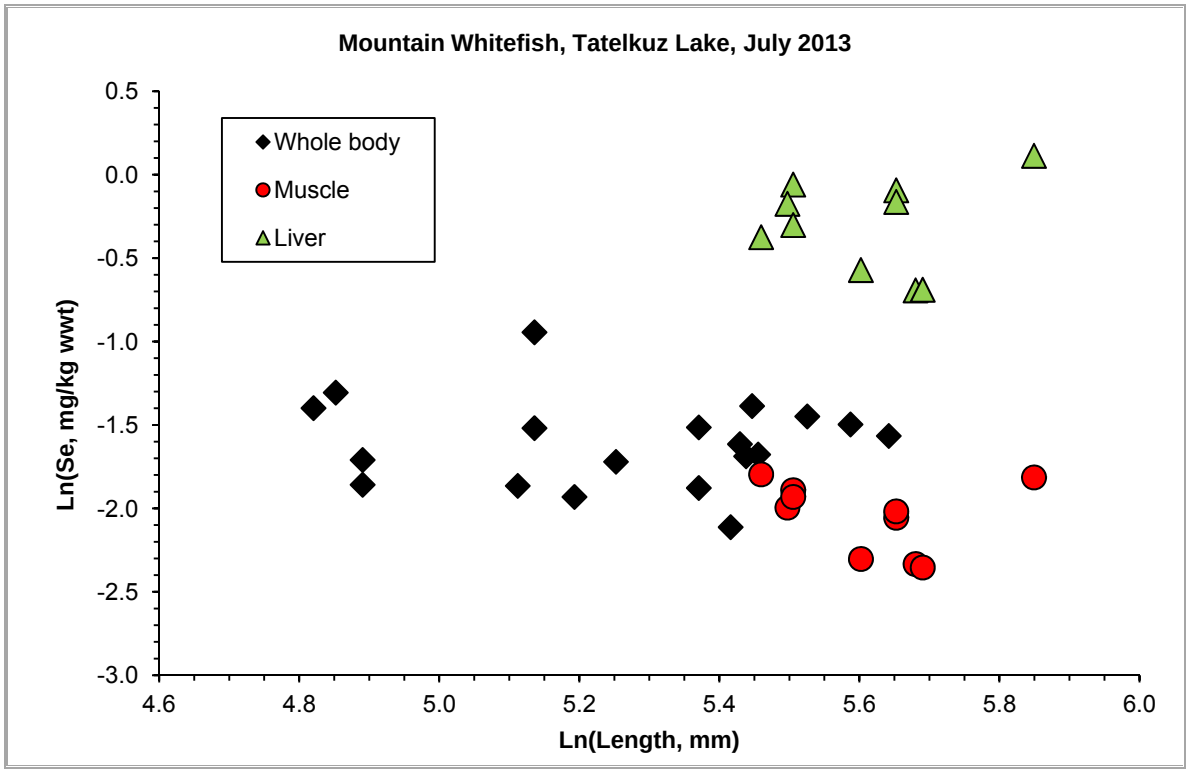


Figure 5.13-17: Plot of Total Selenium on Fork Length for Mountain Whitefish, Tatelkuz Lake, July 2013

DeForest (2009) summarized available fish tissue selenium data at sites unaffected by industrial activities in Canada and the US to establish a typical background concentration. From a database of 902 whole fish samples, the author calculated 50th and 90th percentile selenium concentrations of 0.7 and 1.7 mg/kg wwt (i.e., 2.9 and 6.8 mg/kg dwt, assuming 75% moisture content). Those percentile concentrations were three and eight times higher than the whole fish mean selenium concentrations for mountain whitefish from Tatelkuz Lake.

From a database of 403 samples of muscle tissue, DeForest (2009) calculated 50th and 90th percentile selenium concentrations of 0.4 and 1.2 mg/kg wwt (i.e., 1.6 and 4.8 mg/kg dwt, assuming 75% moisture content). Those percentile concentrations were 12 and 37 times higher than the muscle tissue mean for mountain whitefish from Tatelkuz Lake.

BC MOE (2013b) summarized data on selenium concentrations from samples of whole fish and muscle tissue reported for Canadian sites not contaminated by selenium. Mean concentrations of whole fish ranged from 0.4 to 2.0 mg/kg wwt (i.e., 1.6 to 7.9 mg/kg dwt, assuming 75% moisture content) for slimy sculpin measured in north-eastern BC watersheds, and 0.8 mg/kg wwt (i.e., 3.4 mg/kg dwt, assuming 75% moisture content) for rainbow trout from Blind River, north-eastern BC. These mean concentrations are two to ten times higher than the whole fish mean selenium concentration for mountain whitefish from Tatelkuz Lake.

Mean selenium concentrations of muscle tissue included 1.0 mg/kg wwt (i.e., 4.0 mg/kg dwt, assuming 75% moisture content) for westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) from the Elk River of south-eastern BC (BC MOE, 2013b). That mean selenium concentration is eight times higher than the mean selenium concentration for mountain whitefish muscle tissue from Tatelkuz Lake.

The BC MOE and the BC Ministry of Health recommend (BC MOE, 2013b) that where elevated selenium concentrations in aquatic environments are a concern, selenium concentrations in edible portions of consumed fish tissue be monitored and compared to the following screening values: 1.8 mg/kg wwt for 7 servings/week; 3.6 mg/kg wwt for 4 servings/week; and 12.6 mg/kg wwt for 1 serving/week (1 serving = 8 ounces). Exceeding any of the above screening values may prompt site-specific investigations to determine possible health risks. None of the mountain whitefish muscle, liver and whole fish samples collected from Tatelkuz Lake in July 2013 exceeded the lowest of those three guidelines.

5.13.7.2 Rainbow Trout

For rainbow trout sampled from Tatelkuz Lake in July 2013, mean total selenium concentration was highest for liver tissue (mean = 6.240 mg/kg wwt) and lowest for muscle tissue (mean = 0.197 mg/kg wwt), with whole fish having an intermediate concentration (mean = 0.220 mg/kg wwt) (**Table 5.13-3**). This is the same rank order observed for mountain whitefish collected from Tatelkuz Lake.

A plot of total selenium concentration on fish length for rainbow trout liver samples showed that the Tatelkuz Lake liver selenium concentrations fell within the range observed for samples collected from streams and the three headwater lakes of the LSA in 2011 and 2012 (**Figure 5.13-18**). There was no significant ($P>0.05$) correlation between total selenium concentrations in rainbow trout livers and fish length.

A plot of total selenium concentration on fish length for whole rainbow trout samples showed that the Tatelkuz Lake data fell within the range observed for samples collected from the three headwater lakes of the LSA in 2011 and 2012 (**Figure 5.13-19**), but was lower than the concentrations measured in whole rainbow trout sampled from streams in 2011 and 2012. The highest whole fish total mercury concentrations were observed in juvenile rainbow trout less than 145 mm long (i.e., ln(length) = 5.0) sampled from streams in 2011 and 2012.

There was no significant ($P>0.05$) correlation of rainbow trout total selenium concentration with fish length for whole fish samples from Tatelkuz Lake. However, there was a highly significant ($P<0.001$) negative correlation of rainbow trout total selenium concentration with fish length for all whole fish samples collected from streams and lakes from 2011 to 2013. A linear regression of pooled whole fish total selenium concentrations on fish length explained 64% of the variance in ln(Se) (**Figure 5.13-19**). This correlation was due entirely to elevated total selenium concentrations measured in whole rainbow trout sampled from streams in 2011 and 2012. The correlation disappeared when those juveniles were excluded.

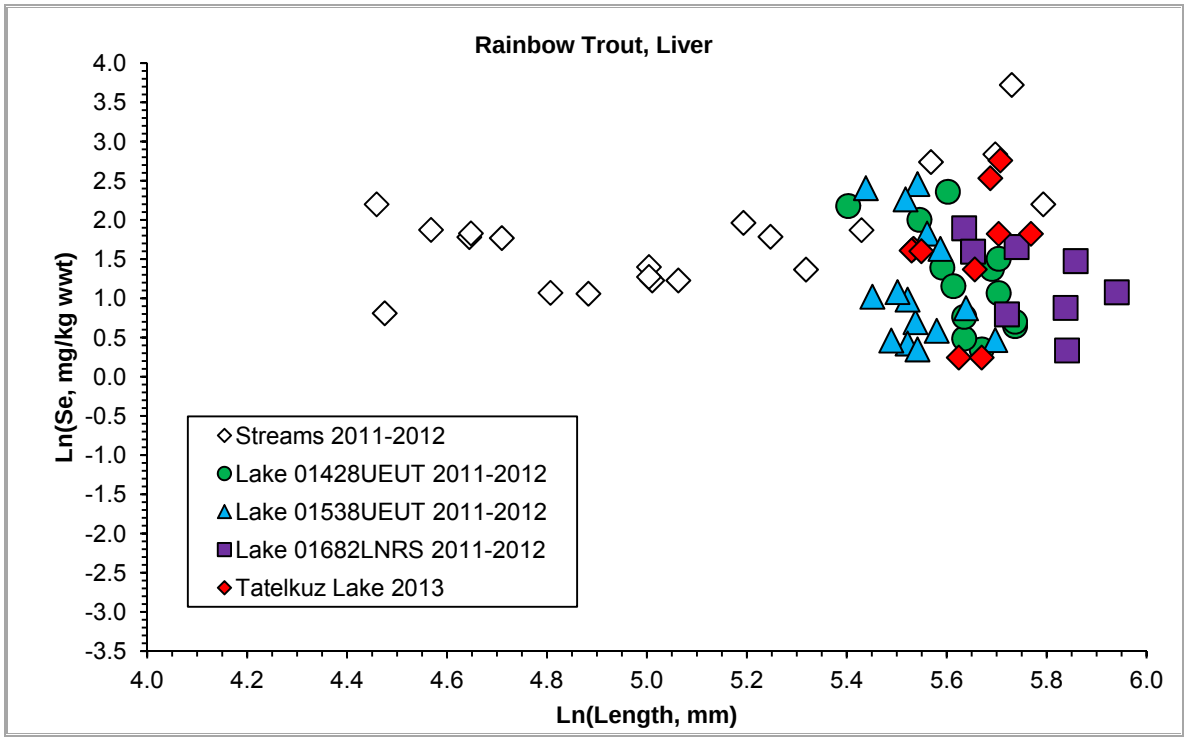


Figure 5.13-18: Plot of Total Selenium on Fork Length for Rainbow Trout Livers, 2011-2013

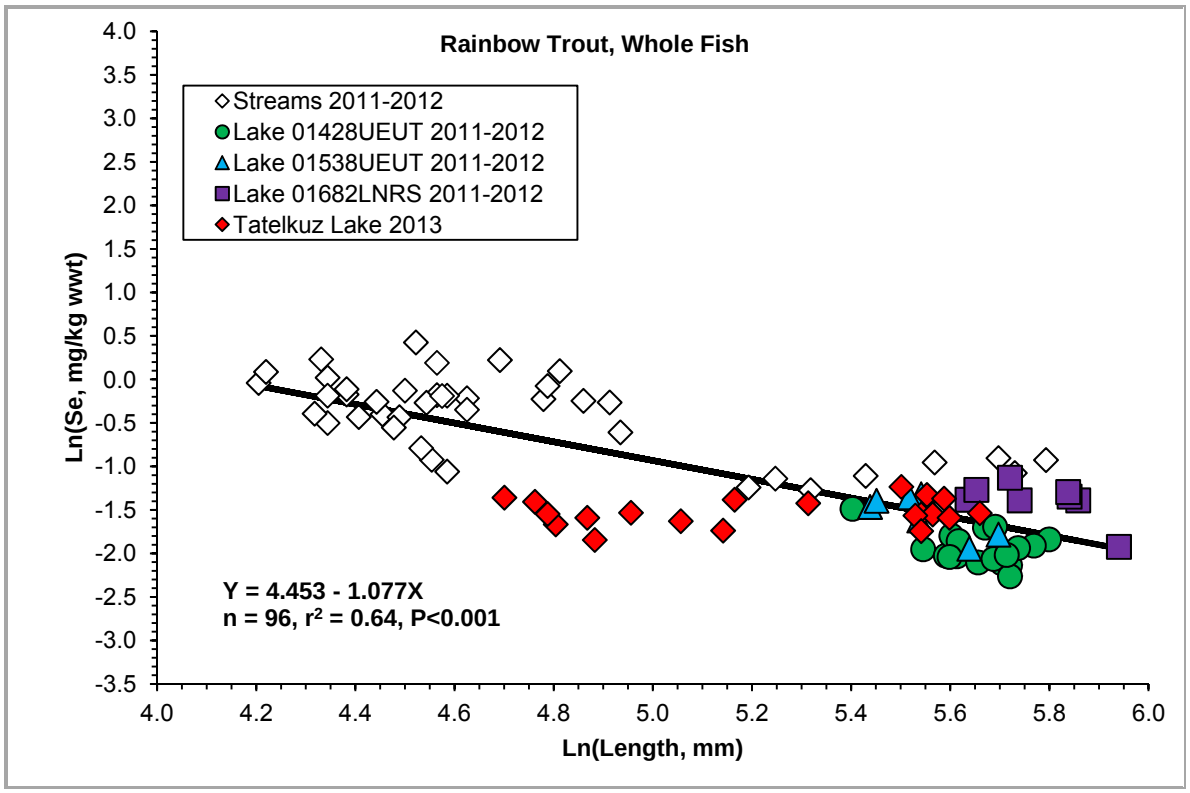


Figure 5.13-19: Plot of Total Selenium on Fork Length for Whole Rainbow Trout, 2011-2013

Avison (2010) also reported a significant (P<0.05) negative correlation of selenium concentration and fork length for whole fish samples of rainbow trout collected from the Chu Molybdenum Project area.

A plot of total selenium concentration on fish length for rainbow trout muscle samples showed that the Tatelkuz Lake data fell within and slightly above the range for samples collected from Lake 01682LNRS (the headwater lake of Davidson Creek, and was higher than most of the values observed for lakes 01428UEUT and 01583UEUT (**Figure 5.13-20**). However, total selenium concentrations for muscle tissues from Tatelkuz Lake rainbow trout were lower than the concentrations measured in juvenile rainbow trout less than 145 mm long sampled from streams in 2011 and 2012.

There was no significant (P>0.05) correlation of total selenium concentration with fish length for rainbow trout muscle samples from Tatelkuz Lake. However, there was a highly significant (P<0.001) correlation of total selenium concentration with fish length for all muscle samples collected from streams and lakes from 2011 to 2013 (**Figure 5.13-20**). A linear regression of pooled whole fish total selenium concentrations on fish length explained 65% of the variance in ln(Se). This correlation was due entirely to elevated total selenium concentrations measured in rainbow trout sampled from streams in 2011 and 2012. The correlation disappeared when those fish were excluded.

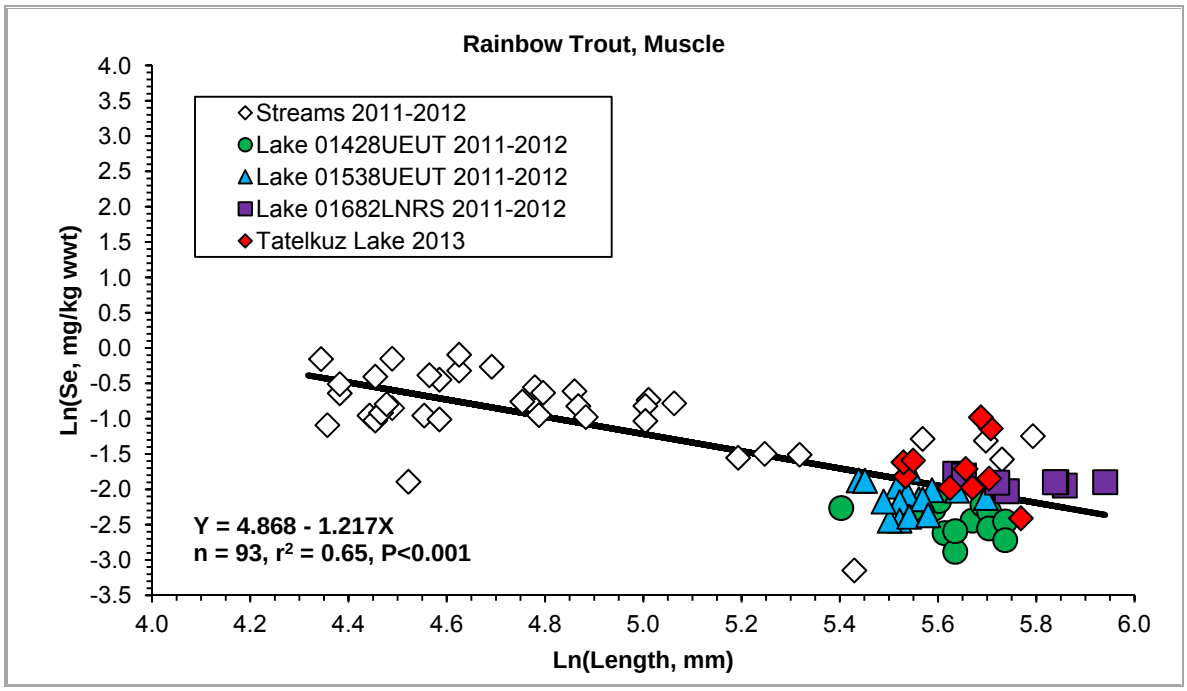


Figure 5.13-20: Linear Regression of Total Selenium on Fork Length for Muscle Tissues from Rainbow Trout

The most reasonable explanation for the negative correlations of total selenium concentration with fish length for both muscle and whole fish samples of rainbow trout is that it reflects the difference between selenium uptake from diet and selenium depuration into

eggs and milt. Both processes are linked to changes in body size and habitat. Juvenile rainbow trout accumulate selenium in their livers and muscle as they feed and grow in streams. Sexually mature adults living in lakes also accumulate selenium in their tissues, but are able to transfer some of it from muscle tissue into eggs and milt. Hence, their total selenium concentrations in muscle and whole fish samples are lower than those of juvenile fish. It is also possible that total selenium concentrations are lower in prey found in lakes compared with prey in streams.

BC MOE established a draft total selenium whole-body tissue guideline for protection of aquatic life of 1 mg/kg wwt (assuming 75% moisture content) (BC MOE, 2013b). That guideline was exceeded by all of the rainbow trout liver samples collected from Tatelkuz Lake, but none of the muscle or whole fish samples. The guideline was also exceeded by all 59 of the liver samples collected from lakes and streams in 2011 and 2012, but by none of the muscle samples. Eight whole rainbow trout collected from streams in 2011 and 2012 exceeded the guideline.

5.14 Tatelkuz Lake Hydroacoustic Survey

Detailed results of the hydroacoustic survey are shown in **Annexes 5.14-1** and **5.14-2** of this report (Stables, 2013).

5.14.1 Survey Conditions

Sampling conditions during the survey were suitable for acoustics. Although weather conditions were often blustery, the time allowed for sampling made it possible to obtain the calm conditions necessary for reliable side-looking acoustics throughout the lake. Plankton in the upper water column that sometimes interferes with the detection of fish was sporadic and not an appreciable problem. Most of the lake was ideal for acoustics, with relatively steep shorelines and few shallow littoral areas, minimizing boundary areas where fish are difficult to detect. In general, the quality of the resulting acoustic data was good for both day and night sampling periods on all transects.

5.14.2 Total Number and Density of Fish

Fish densities and spatial distribution patterns were distinctly different on day and night acoustic surveys. During the day, fish were sparsely scattered over the 0-20 m depth range, whereas many more fish were seen with acoustics at night, mainly in a single layer between 5 and 10 m that often touched the edges of the lake basin. Areal fish density (i.e., number of fish/ha) was much higher throughout the lake at night than during the day. These observations showed that many of the fish in Tatelkuz Lake were unavailable to acoustics during the day (in nearshore areas or close to the lake surface or bottom), and that night was the better period to estimate fish abundance.

The night-time estimate of total fish number (±95% confidence limits) for all species combined was 775,286 (±134,418 fish or ±17% of the total), for an overall aerial fish density

of 864 fish/ha (**Table 5.14-1**). This is an underestimate because benthic fish species that were undetectable with acoustics and that were not caught in large numbers in gillnets were not included in the population estimate. Those species included slimy sculpin, brassy minnow, burbot, largescale sucker, and white sucker.

Table 5.14-1: Number and Density of Fish in Tatelkuz Lake, July 2013, from Hydroacoustic Survey

Species	Number				Density (number/ha)		
	Estimate	Lower 95% CL	Upper 95% CL	Percent of Total	Estimate	Lower 95% CL	Upper 95% CL
Kokanee	606,274	503,207	709,340	78.2	676	561	791
Rainbow trout	117,068	97,167	136,970	15.1	130	108	153
Mountain whitefish	26,360	21,879	30,841	3.4	29	24	34
Longnose sucker	13,955	11,583	16,328	1.8	16	13	18
Northern pikeminnow	11,629	9,652	13,606	1.5	13	11	15
Total	**775,286**	**643,487**	**907,085**	**100.0**	**864**	**717**	**1,011**

Note: CL = confidence limit.
Density calculated from lake surface area fo 897 ha.

Fish numbers were much higher in the offshore zone (749,986 fish) than in the nearshore zone (25,300 fish). In the nearshore zone, abundance was close to equal in the 0 to 5 m and 5 to 10 m depth layers. In the offshore zone, 98% of the fish were in the upper 15 m of the water column, with 76% in the 5 to 10 m layer alone, and no fish below 30 m. This concentration of fish in a single narrow layer was unusual.

Acoustic data apportioned by gill net catches indicated that kokanee were the most numerous fish in Tatelkuz Lake, numbering 606,274 fish, or 78.2% of the total number of fish for large and small fish size groups combined (**Table 5.14-1**). Rainbow trout were the second most common species, followed by mountain whitefish, longnose sucker, and northern pikeminnow. Based on a lake surface area of 897 ha, individual species densities were: 676 kokanee/ha, 130 rainbow trout/ha, 29 mountain whitefish/ha, 16 longnose sucker/ha, and 13 northern pikeminnow/ha (**Table 5.14-1**).

The high number of kokanee was not surprising considering their predominance in the large volume of the offshore pelagic zone, the most abundant habitat in the lake. Likewise, the abundance of littoral and semi-pelagic species was limited by the lesser amount of littoral and slope zone habitat available in Tatelkuz Lake.

Numerical estimate for total fish (species combined) and kokanee appear credible for several reasons. First, the precision of the total abundance estimate was high (± 17% of the total compared to a typical range of ±15 to 40%) due to a fairly uniform night-time spatial distribution of fish. Second, the whole-lake fish density estimates of 864 total fish/ha (all species combined) and 676 kokanee/ha are comparable with densities reported for other water bodies of western Canada and the US. In Stave Reservoir of southwestern BC, the total fish density for nearshore and offshore zones combined was 137 to 527 fish/ha and

kokanee density was 135 to 513 fish/ha from 2005 to 2009 (Stables and Perrin, 2010). In both zones of Coquitlam Reservoir of southwestern BC, total fish and kokanee densities were 538 and 214 fish/ha, respectively (Bussanich et al. 2005). Pelagic surveys of kokanee in western reservoirs (where no nearshore sampling was conducted and other species were not listed) have reported densities of 576 kokanee/ha in Dworshak Reservoir (Idaho) in 2005 (Stark, 2006), 307 to 670 kokanee/ha in Lake Pend Oreille (Idaho) for 2006-2008 (Maiolie et al., 2008; Schoby et al., 2009; Wahl et al., 2010), and 156 to 901 kokanee/ha in Kootenay Reservoir of southeastern BC from 1985 to 2006 including years of fertilization (Schindler et al., 2009).

Abundance estimates for individual species of large fish (≥100 mm long) appear reliable because they were well sampled by gillnets for the most part. That is, there was adequate sample size and spatial and temporal coverage. However, minimal gillnet coverage of the 5-10 m offshore cell, where the abundance estimate from acoustics was high, reduced the certainty of the individual species abundance estimates. Even so, the conclusion that most large fish in this cell and in the lake were kokanee was supported by other data, such as species composition in adjacent spatial cells and known habitat and temperature preferences of the species present (Coutant, 1977; Jobling, 1981). Abundance estimates for individual species of fish less than 100 mm long are less certain due to low catches of small fish in gillnets despite adequate spatial and temporal coverage.

Due to inadequate species composition information for small fish, it was assumed for individual species abundance estimates that all small fish in the offshore zone were kokanee and that all small fish in the nearshore zone were rainbow trout. Based on several considerations, the former assumption seems well founded, while the latter one is more doubtful but only affected a small fraction (2.5%) of the total abundance estimate for all species combined. Abundance estimates for individual species of the small fish size group (<100 mm) were undermined by lack of good species composition data due to low catches of small fish in gill nets. Even so, the assumption that all small fish in the offshore zone were kokanee is not unreasonable.

The predominance of older kokanee in the offshore gill net catches suggests that kokanee fry from the 2012 year class should have been abundant there, too. The small TS values measured in Tatelkuz Lake were an appropriate size for kokanee fry. The temperature of the 5-10 m depth layer where most small fish were found was 6-13°C, the preferred temperature range for kokanee, not rainbow trout (Coutant, 1977; Jobling, 1981). Small fish species (threespine stickleback, redside shiner, and prickly sculpin) that inhabit the pelagic zone of some kokanee lakes in BC were not present in Tatelkuz Lake. Increasing the acoustic processing threshold from -65 dB to -63 dB had only a fractional effect on the count of fish, indicating that the invertebrates *Mysis sp.* and *Chaoborus sp*. did not contribute appreciably to the abundance estimate (MacLellan and Hume, 2010). The combination of these facts strongly suggests that most small fish in the offshore zone were kokanee fry. The assumption that all small fish in the more species-complex nearshore zone were rainbow trout was more speculative. However, this only calls into question a minor fraction of the whole lake population estimate (2.5%) due to the relatively small size of this zone. Trawling

or additional effort with small-mesh gill nets may have improved species composition estimates for the small fish size group, but with the fish densities typical of BC lakes it can be difficult to obtain a sufficient sample of small fish without a great deal of effort.

In summary, the hydroacoustic survey produced an underestimate of total fish number and total aerial density due to the inability to record counts of bottom-dwelling fish species. However, the total count and the counts of kokanee, rainbow trout, mountain whitefish, longnose sucker, and northern pikeminnow have relatively high precision for surveys of this kind because of the good surveying conditions, the simple, steep-sided bathymetry of Tatelkuz Lake, and the extensive gillnet coverage.

5.14.3 Biomass of Fish

The biomass and biomass density of the five most abundant fish species was calculated by multiplying the number of each species estimated from the hydroacoustic survey (**Table 5.14-1**) by their mean body weights from the gillnet survey (**Table 5.12-6**). Total biomass was 78,761 kg or 78.8 tonnes (**Table 5.14-2**). Kokanee remained the predominant species by biomass, followed by rainbow trout, but mountain whitefish fell to fifth place after longnose sucker and northern pikeminnow due to the larger mean weights of those two species.

Table 5.14-2: Biomass and Biomass Density of Fish in Tatelkuz Lake, July 2013, from Hydroacoustic Survey

Species	Number	Mean Weight (g)	Biomass (kg)	Biomass Density (kg/ha)
Kokanee	606,274	90	54,565	60.8
Rainbow trout	117,068	89	10,419	11.6
Mountain whitefish	26,360	137	3,611	4.0
Longnose sucker	13,955	446	6,224	6.9
Northern pikeminnow	11,629	339	3,942	4.4
Total	**775,286**	**na**	**78,761**	**87.8**

Note: na = not available. Mean weights from **Table 5.12-6**. Biomass density assumes a lake surface area of 897 ha.

5.15 Kokanee Spawner Survey

This section presents the results of the 2013 kokanee spawner survey together with the results of the 2011 and 2012 spawner surveys so as to provide a complete description of kokanee spawner timing, spatial distribution, density, total spawner number, and habitat choices in the Blackwater LSA.

Annex 5.15-1 shows the detailed results of the 2013 kokanee spawner surveys, and AMEC (2013b) shows the results of the 2011 and 2012 kokanee spawner surveys. **Table 5.15-1** summarizes the data collected in 2011, 2012 and 2013 on survey dates, numbers of spawners, linear density of spawners, number of redds, and linear density of redds.

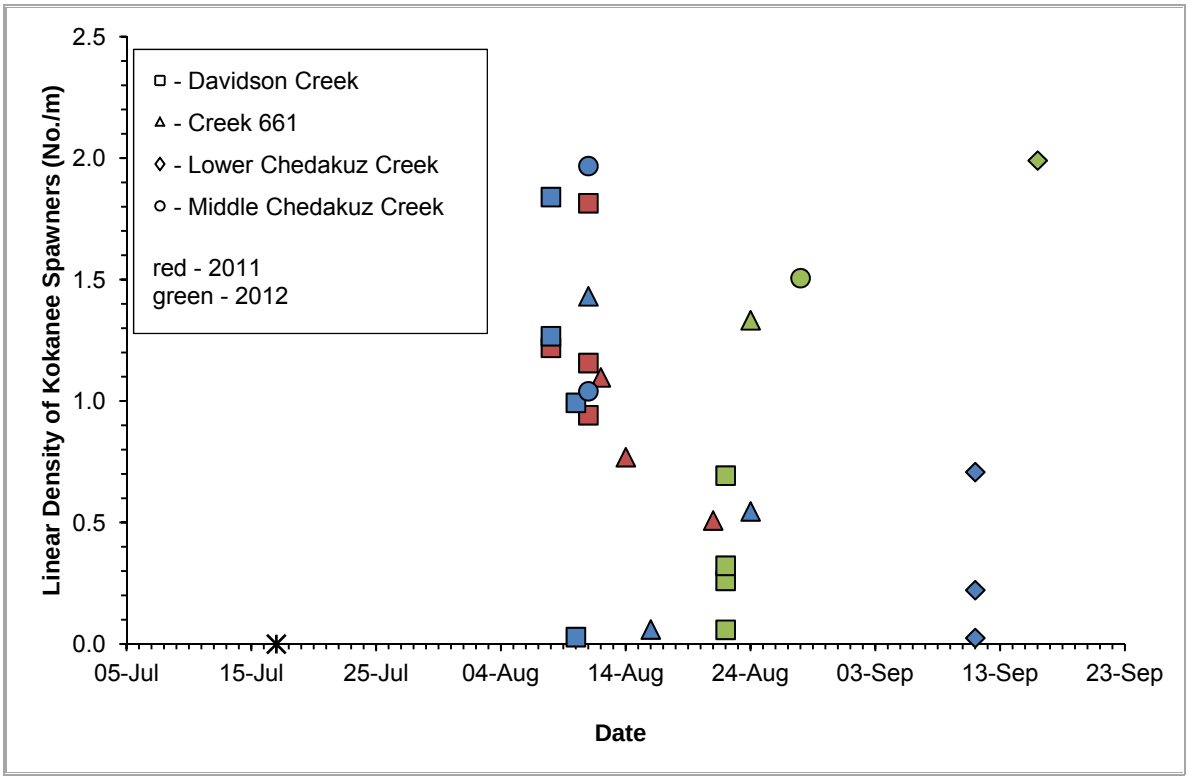
Table 5.15-1: Linear Densities of Spawning Kokanee and Redds, 2011-2013

Stream	Year	Date	Reach	Length Surveyed (m)	Stream Wetted Width (m)	Area Surveyed (m²)	Number of Kokanee					Total Dead	Number of KO Redds	KO Linear Density (Number/m)	KO Redd Density (Number/m)
							Migrating	Holding	Spawning	Spent	Total Live				
Davidson Creek	2011	08-Aug	1	1,375.0	5.3	7,287.5	–	–	–	–	1,677	–	210	1.22	0.15
		11-Aug	2	499.0	5.0	2,505.0	–	–	–	–	470	–	50	0.94	0.10
		11-Aug	3	1,182.0	4.3	5,118.1	–	–	–	–	2,145	–	122	1.81	0.10
		11-Aug	4	2,136.0	5.7	12,111.1	–	–	–	–	2,471	–	133	1.16	0.06
	2012	22-Aug	1	1,375.0	5.3	7,287.5	7	12	339	–	358	–	75	0.26	0.05
		22-Aug	2	499.0	5.0	2,505.0	6	16	324	–	346	–	40	0.69	0.08
		22-Aug	3	1,182.0	4.3	5,118.1		19	362	–	381	–	54	0.32	0.05
		22-Aug	4	1,177.0	5.7	6,673.6	6	1	62	–	69	–	19	0.06	0.02
	2013	08-Aug	1	508.2	5.3	2,693.5	5	514	121	4	644	93	67	1.27	0.13
		08-Aug	2	502.7	5.0	2,523.6	52	683	167	23	925	18	91	1.84	0.18
		10-Aug	3	502.5	4.3	2,175.8	28	80	386	5	499	4	61	0.99	0.12
		10-Aug	4	1,332.0	5.7	7,552.3	4	31	2	1	38	0	1	0.03	0.00
Creek 661	2011	12-Aug	1	3,483.8	3.6	12,681.1	–	–	–	–	3,824	–	679	1.10	0.19
		14-Aug	2	824.0	4.0	3,263.0	–	–	–	–	634	–	48	0.77	0.06
		21-Aug	3	3,043.0	3.4	10,285.3	–	–	–	–	1,548	–	7	0.51	0.00
	2012	24-Aug	1	2,159.0	3.6	7,858.8	174	401	2,303		2,878	–	517	1.33	0.24
		–	2	–	–	–	–	–	–	–	–	–	–	–	–
		–	3	–	–	–	–	–	–	–	–	–	–	–	–
	2013	11-Aug	1	505.7	3.6	1,840.7	80	602	38	4	724	3	0	1.43	0.00
		24-Aug	2	507.2	4.0	2,008.5	21	249	6	1	277	1	0	0.55	0.00
		16-Aug	3	500.0	3.4	1,690.0	24	0	6	–	30	0	0	0.06	0.00
Lower Chedakuz Creek	2012	–	13	–	–	–	–	–	–	–	–	-	–	–	–
		–	14	–	–	–	–	–	–	–	–	-	–	–	–
		16-Sep	15	1,238.0	13.3	16,502.5	–	–	–	–	2,464	–	218	1.99	0.18
	2013	11-Sep	13	521.0		0.0	2	1	2	8	13	106	6	0.02	0.01
		11-Sep	14	514.0	14.6	7,494.1	1	81	28	4	114	106	9	0.22	0.02
		11-Sep	15	500.0	13.3	6,665.0	37	280	26	11	354	70	61	0.71	0.12
Middle Chedakuz Creek	2012	28-Aug	17-18	2,270.0	–	–	1,099	34	2,286	–	3,419	–	698	1.51	0.31
	2013	11-Aug	19	279	–	–	35	360	145	9	549	4	2	1.97	0.01
		11-Aug	20	222	–	–	19	179	32	1	231	0	5	1.04	0.02

Note: m = metre; m² = square metres

5.15.1 Spawn Timing

The earliest kokanee spawners were observed on 17 July 2013 in lower Davidson Creek (**Figure 5.15-1**). Spawners were still present in reaches 1 to 4 of Davidson Creek during surveys conducted from 8 to 22 August in 2011, 2012 and 2013 (**Table 5.15-1**). Therefore, the kokanee spawning period in Davidson Creek extends from mid-July to at least the third week in August (**Table 5.15-2**). Since kokanee spawners were still present during the survey of 22 August 2012, the spawning period probably extends to the end of August. The peak of the spawning period is between 8 and 12 August – the mid-point of that 6 week period.



Note: Star indicates observation of spawners in lower Davidson Creek on July 17

Figure 5.15-1: Plot of Linear Density of Kokanee Spawners on Date, Blackwater LSA, 2011-2013

Table 5.15-2: Kokanee Spawn Timing, 2011-2013.

Stream	July		August				September			
	17-23	24-31	1-8	9-16	17-23	24-31	1-7	8-15	16-22	23-31
Davidson Creek										
Creek 661										
Lower Chedakuz Creek										
Middle Chedakuz Creek										

Note: Bold borders indicate probable peak spawn timing period

Kokanee spawners were present in Creek 661 during surveys conducted from 11 to 24 August in 2011, 2012 and 2013 (**Table 5.15-1** and **Figure 5.15-1**). This suggests a spawn timing similar to that of Davidson Creek. However, spawners were not observed in Creek 661 during a reconnaissance survey conducted in July 2013. Also, unlike Davidson Creek, relatively high linear densities of kokanee spawners were observed on 24 August 2012, indicating that the spawning period extended later in the year than in Davidson Creek. Therefore, it is probable that kokanee spawn timing in Creek 661 extends throughout August and probably into the first week in September (**Table 5.15-2**). Peak spawning is in the mid-point of this 5 week period – sometime between 11 and 24 August.

Kokanee spawners were present in lower Chedakuz Creek from 11 to 16 September in 2012 and 2013 (**Table 5.15-1** and **Figure 5.15-1**). A reconnaissance surevy conducted in the last week of August 2013 found no kokanee spawners in lower Chedakuz Creek, so the earliest spawners probably do not arrive on the spawning grounds until the first week of September. Since peak linear densities were observed on 16 September 2012, the spawning period probably extends for at least one more week, i.e., until the end of September. Therefore, it is probable that kokanee spawn timing in lower Chedakus Creek extends throughout September and that peak spawning is in mid-September (**Table 5.15-2**).

Kokanee spawners were present in middle Chedakuz Creek from 11 to 28 August in 2012 and 2013 (**Table 5.15-1** and **Figure 5.15-1**). This suggests a spawn timing similar to that of Creek 661, which makes sense because Creek 661 is a tributary to the northern end of middle Chedakuz Creek. Therefore, kokanee spawn timing in middle Chedkuz Creek was assumed to extend throughout August and probably into the first week in September (**Table 5.15-2**). Peak spawning is in the mid-point of this 5 week period – sometime between 11 and 28 August.

In summary, kokanee spawners are assumed to be present in streams of the Blackwater LSA from mid-July to the end of September – a 10 week long period (**Table 5.15-2**). The major differences among streams are that:

- Kokanee first enter Davidson Creek in mid-July, which is at least 2 weeks earlier than any of the other four streams, and have the longest spawning period – 6 weeks. Peak spawning is between 8 and 12 August;
- Kokanee enter Creek 661 and middle Chedakuz Creek in early August and leave in early September. Peak spawning is in the second and third week of August; and
- Kokanee enter lower Chedakuz Creek in early September – 6 weeks later than Davidson Creek – and peak spawning is in mid-September.

These differences in spawn timing among stream are largely due to differences in water temperature. Davidson Creek had both the earliest and longest spawning period and much lower mean water temperatures than lower Chedakuz Creek (**Annex 5.2-1** and **Table 5.15-3**). It also has slightly lower mean water temperatures than Creek 661.

Table 5.15-3: Mean Monthly Stream Water Temperatures, Blackwater LSA, 2011-2013

Stream	Year	July Water Temperature (°C)	August Water Temperature (°C)	September Water Temperature (°C)
Lower Davidson Creek	2011	8.5	9.2	7.4
	2012	11.0	11.0	7.7
	2013	11.1	12.0	8.8
	combined years	10.2	10.7	8.0
Lower Creek 661	2011	9.6	9.7	7.6
	2012	11.4	10.8	8.0
	combined years	10.5	10.2	7.7
Lower Chedakuz Creek	2011	12.2	13.8	10.9
	2012	15.7	16.0	11.9
	combined years	14.0	14.9	11.4

Optimal water temperatures for spawning of sockeye salmon – the anadromous life history variant of kokanee – range from 10.6 to 12.8ºC (BC MOE, 2001). (BC MOE has not defined temperature optima for kokanee.) Comparison of those optima with water temperatures measured in streams of the LSA during the kokanee spawning periods defined in **Table 5.15-2** show that kokanee were observed to spawn within these temperature optima most of the time. In Davidson Creek, for example, suitable water temperatures for spawning occurred from mid-July to the end of August in both 2012 and 2013 but not in 2011 when water temperatures were below the optima (**Figure 5.15-2**).

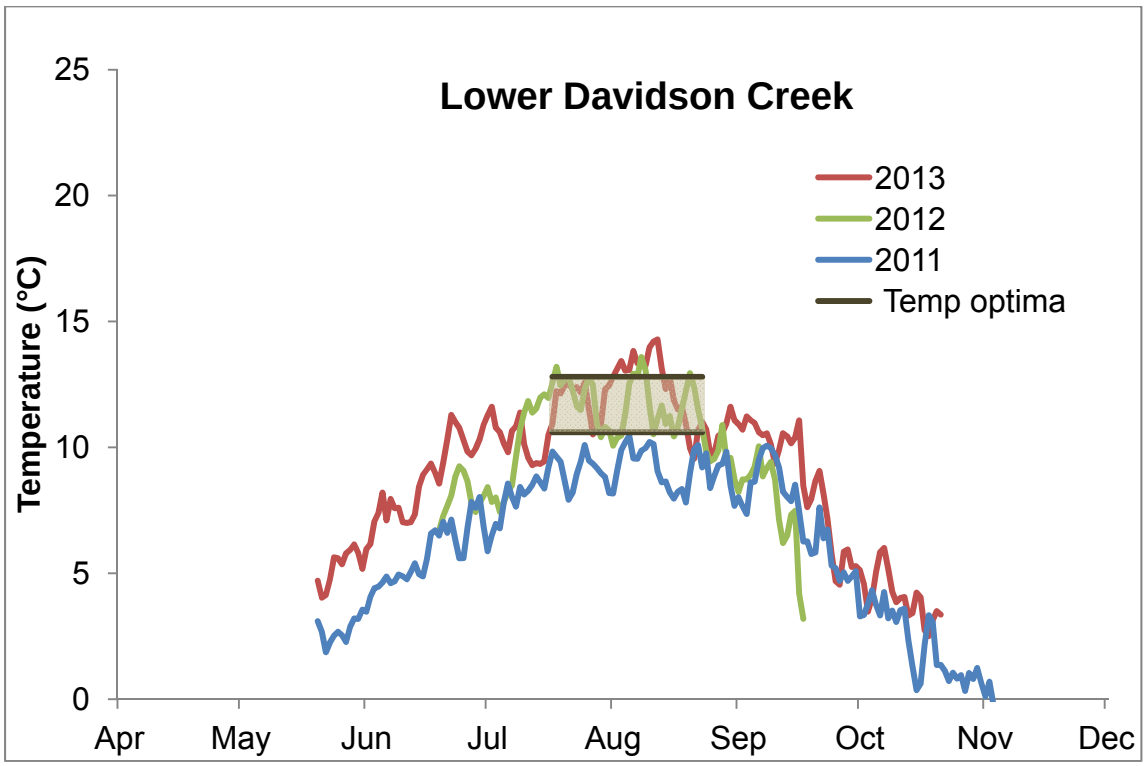


Figure 5.15-2: Mean Daily Water Temperature in Lower Davidson Creek Compared to BC Guidelines for Kokanee Spawning (black), 2011-2013

In lower Creek 661, optimal water temperatures for koanee spawning occurred in July and August 2012, but not in 2011 when temperatures were below the optima (**Figure 5.15-3**).

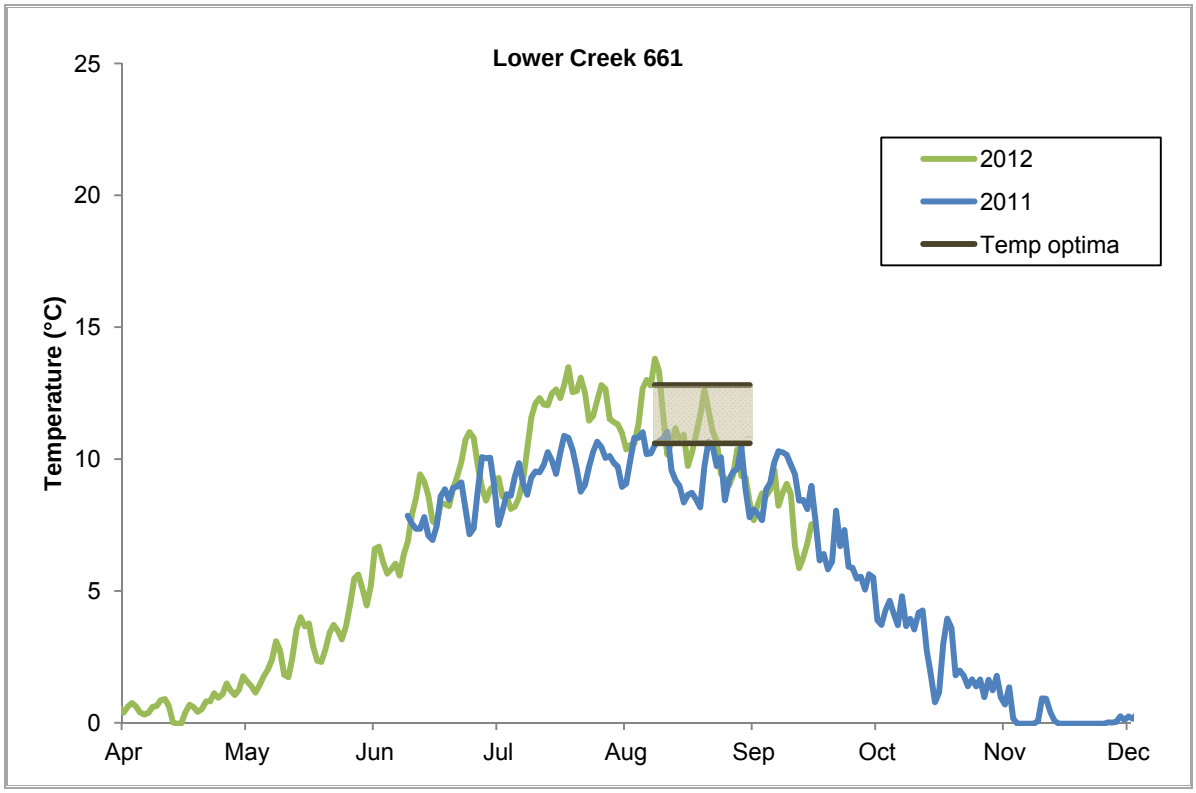


Figure 5.15-3: Mean Daily Water Temperature in Lower Creek 661 Compared to BC Guidelines for Kokanee Spawning (black), 2011-2012

Optimal spawning temperatures were not observed in lower Chedakuz Creek until the second half of September, which is when spawning kokanee were observed (**Figure 5.15-4**).

In summary, timing of kokanee spawning in streams of the Blackwater LSA follows water temperature on the spawning grounds. The earliest spawning occurs in the coldest stream (lower Davidson Creek) and the latest spawning occurs in the warmest stream (lower Chedakuz Creek). The differences in spawn timing between the Davidson Creek population and the lower Chedakuz Creek populations are so large – over 1 month – that there is little likelihood of overlap of spawners.

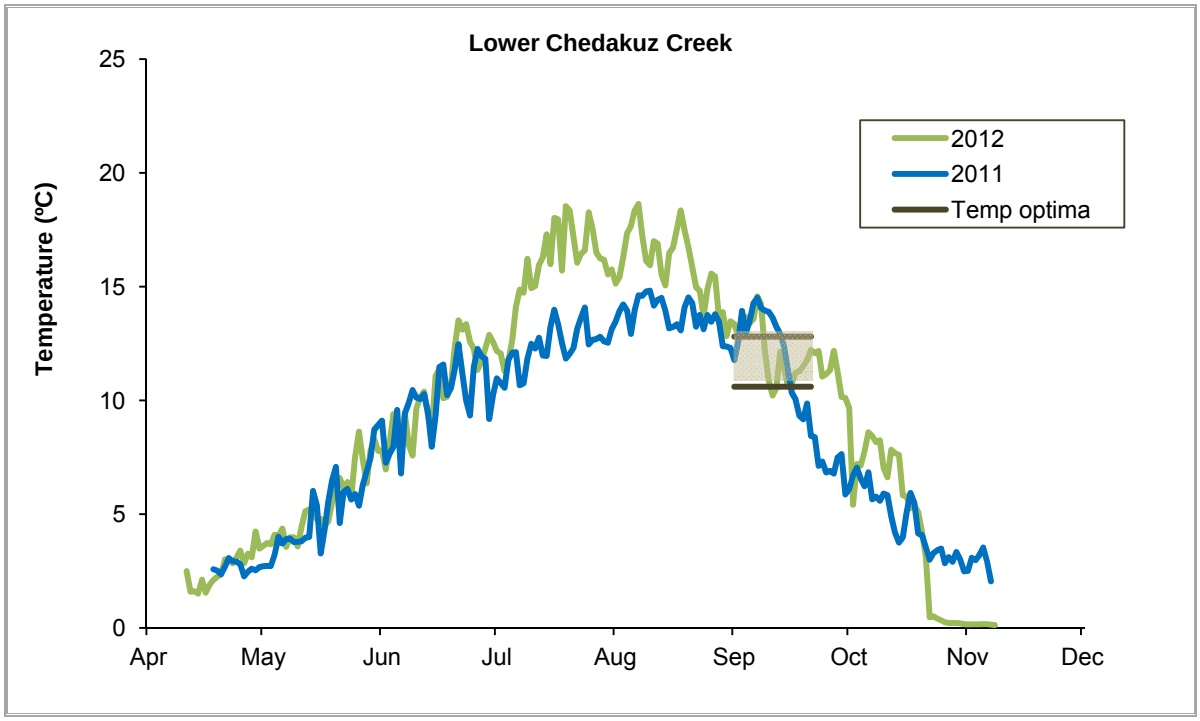


Figure 5.15-4: Mean Daily Water Temperatures in Lower Chedakuz Creek Compared to BC Guidelines for Kokanee Spawning (black), 2011-2012

5.15.2 Spatial Distribution of Spawners

The upstream extent of kokanee spawner migration (or downstream in the case of lower Chedakuz Creek) varied among years in each of the four streams that were surveyed (**Table 5.15-4**).

Table 5.15-4: Upstream Extent of Kokanee Spawner Distribution in the LSA, 2011-2013

Stream	Year	Distance[a] (m)	Reach
Davidson Creek	2011	5,193	1 to 4
	2012	4,234	1 to 4
	2013	3,681	1 to 4
Creek 661	2011	7,400	1 to 3
	2012	7,400	1 to 3
	2013	5,034	1 to 3
Lower Chedakuz Creek	2012	3,613	15[b]
	2013	5,873	13 to 15
Middle Chedakuz Creek	2012	1,834	17 to 18[c]
	2013	4,068	17 to 20

Note: a: Distance from confluence or outlet; m = metres
b: Only one reach was surveyed, no surveying completed past this point.
c. Kokanee distribution uncertain past this point.

This reflected the distribution of spawner density among reaches in each stream. For example, linear density of kokanee spawners in Reach 4 of Davidson Creek fell from 1.16 spawner/m in 2011 to 0.02 spawner/m in 2012 to 0.0 spawner/m in 2013 (**Table 5.15-1**). In turn, the upstream extend of spawning in Davidson Creek fell from 5,193 m in 2011 to 4,234 m in 2012 and 3,681 in 2013 (**Table 5.15-4**).

A similar correlation between linear density and upstream extent was observed in Creek 661. Linear density of spawners in Reach 3 of Creek 661 fell from 0.51 spawner/m in 2011 to 0.06 spawner/m in 2013 (**Table 5.15-1**), and upstream extent of spawning also fell from 7,400 m in 2011 to 5,034 m in 2013 (**Table 5.15-4**). (Reach 3 was not surveyed in 2012.)

Similar comparisons among years between linear density of spawners and their upstream extent could not be made for lower Chedakuz Creek and middle Chedakuz Creek. For both streams, spawner surveys were only done in 2012 and 2013 (**Table 5.15-1**). For lower Chedakuz Creek, only one reach was surveyed in 2012. For middle Chedakuz Creek, different reaches were surveyed in 2012 and 2013.

5.15.3 Percent Mortality of Spawners

Both live and dead kokanee spawners were counted in 2013, but only live kokanee spawners were counted in 2011 and 2012 (**Table 5.15-1**). Therefore, only the 2013 surveys provided data on percent mortality of spawners (**Table 5.15-5**).

Table 5.15-5: Percent Mortality of Kokanee Spawners, Blackwater LSA, 2013

Stream	Reach	Number of Spawners			Percent Mortality
		Live	Dead	Total	
Davidson Creek	1	644	93	737	12.6
Davidson Creek	2	925	18	943	1.9
Davidson Creek	3	499	4	503	0.8
Davidson Creek	4	38	0	38	0.0
Total		**2,106**	**115**	**2,221**	**5.2**
Creek 661	1	724	3	727	0.4
Creek 661	2	277	1	278	0.4
Creek 661	3	30	0	30	0.0
Total		**1,031**	**4**	**1,035**	**0.4**
Lower Chedakuz Creek	13	13	106	119	89.1
Lower Chedakuz Creek	14	114	106	220	48.2
Lower Chedakuz Creek	15	354	70	424	16.5
Total		**481**	**282**	**763**	**37.0**
Middle Chedakuz Creek	19	549	4	553	0.7
Middle Chedakuz Creek	20	231	0	231	0.0
Total		**780**	**4**	**784**	**0.5**
All Streams Combined		**4,398**	**405**	**4,803**	**8.4**

Percent mortality was highest in lower Chedakuz Creek (37.0%), followed by Davidson Creek (5.2%), middle Chedakuz Creek (0.5%), and Creek 661 (0.4%). Since percent

mortality is expected to rise with time during a spawning period, this pattern suggests that spawning was more further advanced in lower Chedakuz Creek than in Davidson Creek in 2013, and that spawning in Davidson Creek was more further advanced than spawning in Creek 661 and middle Chedakuz Creek in 2013.

This pattern agrees with the timing of spawning for lower Chedakuz Creek, but not for the other three streams. Peak spawning in lower Chedakuz Creek is expected to occur in mid-September. The spawner survey of lower Chedakuz Creek was conducted on 11 September 2013, which was close enough to the middle of September that a percent mortality of 37.0% would be expected.

Peak spawning in Davidson Creek is expected to occur during the first two weeks of August. The spawner survey of Davidson Creek in 2013 was conducted between 8 and 10 August, which is within the expected peak spawning period. A relatively low percent mortality of 0.4% suggests that spawning in Davidson Creek may have been delayed in 2013.

Peak spawning in Creek 661 and middle Chedakuz Creek is expected to occur in mid-August – sometime between 11 and 24 August. The spawner surveys of Creek 661 in 2013 was conducted between 11 and 24 August, and the spawning survey of middle Chedakuz Creek was conducted on 11 August. Both were within the expected peak spawning period. However, a relatively low percent mortality of 0.5% and 0.4% for Creek 661 and middle Chedakuz Creek, respectively, suggests that spawning in both creeks may also have been delayed in 2013.

An alternate explanation for the lack of correspondence between percent mortality and spawn timing in three of the four streams in 2013 is that counts of dead spawners are underestimates of the true number of dead spawners because dying and dead fish are washed out of the spawning streams before they can be counted. The spatial distribution of percent mortality supports this alternate explanation.

For all four streams, percent mortality was highest in the downstream reach and decreased with upstream distance. This pattern was observed in lower Chedakuz Creek even though the spawners had to migrate from Tatelkuz Lake through the “upstream” Reaches 15 and 14 to arrive at the downstream Reach 13. The most likely explanation for this spatial pattern is that dying and dead spawners drift downstream and collect in the furthest downstream reach in each stream. It is also reasonable to assume that dead and dying fish would continue to be washed further downstream out of Davidson Creek and Creek 661 and into lower and middle Chedakuz Creek, respectively, where they would not be counted.

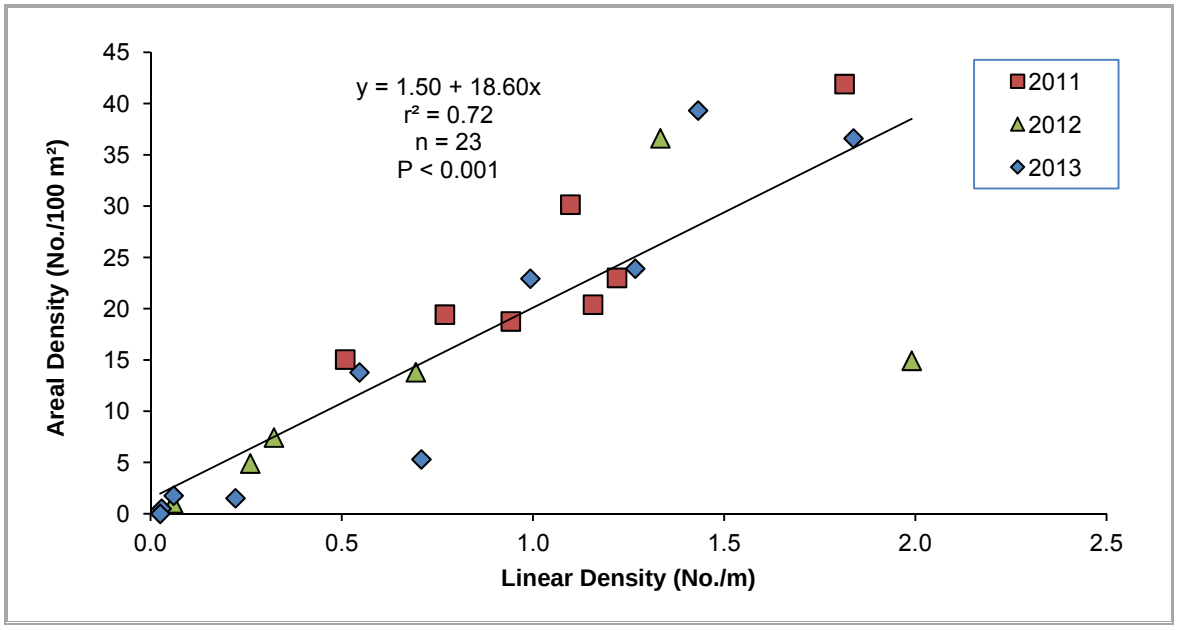
A second reason why counts of dead spawners may underestimate the true number of dead spawners is that scavengers such as eagles may remove carcasses from a stream before they can be counted. This idea is supported by the differences in water depth between lower Chedakuz Creek and Davidson Creek, Creek 661, and middle Chedakuz Creek. Relatively deep water in lower Chedakuz Creek may reduce the ability of scavenging birds to remove dead spawners from that stream, resulting in apparently higher percent mortality for that stream.

If dead counts are not reliable estimates of the true number of dead fish due to downstream dispersion and scavenging of carcasses, then only live counts are reliable estimators of spawner density.

5.15.4 Aerial Density and Linear Density of Spawners

Aerial densities of kokanee spawners and kokanee redds could not be calculated for surveys conducted on middle Chedakuz Creek because of the absence of data on wetted width for that stream. Therefore, to include middle Chedakuz Creek in analyses, linear densities were used instead of aerial densities.

One of the assumptions of the use of linear spawner density as a surrogate of aerial spawner density is that the two variables are highly correlated. A linear regression of aerial spawner density on linear spawner density for the combined data of the three survey years confirmed this assumption. The two variables are highly signficantly ($P<0.001$) and positively correlated (**Figure 5.15-5**). Linear density explained 72% of the variance in aerial density, and the intercept of the regression is not significantly different from zero ($P>0.05$). Based on the scatter of data around the regression line there do not appear to be any differences among the three survey years in the relationship between the two variables.



Note: n = sample number; No.=– number; m = metre; m² - square metre

Figure 5.15-5: Linear Regression of Kokanee Spawner Areal Density on Linear Density, 2011-2013

5.15.5 Linear Density of Spawners

In 2013, the highest linear density of spawning kokanee (1.97 fish/m) was observed in Reach 19 of middle Chedakuz Creek, followed by Reach 2 of Davidson Creek (1.84 fish/m) (**Table 5.15-6** and **Figure 5.15-6**).

Table 5.15-6: Linear and Areal Densities of Spawning Kokanee and Redds, 2013.

Stream	BC Freshwater Atlas Code	Reach	Length of Survey (m)	Mean Wetted Width (m)	Area Assessed (m^2)	Number of Kokanee	Number of Redds	Kokanee Linear Density (Number/m)	Redd Linear Density (Number/m)	Kokanee Areal Density (Number/100 m^2)	Redd Areal Density (Number/100 m^2)
Davidson Creek	100-567134-610692-522527	1	508.2	5.3	2,693.5	644	67	1.27	0.13	23.91	2.49
Davidson Creek	100-567134-610692-522527	2	502.7	5.0	2,523.6	924	91	1.84	0.18	36.62	3.61
Davidson Creek	100-567134-610692-522527	3	502.5	4.3	2,175.8	499	61	0.99	0.12	22.93	2.80
Davidson Creek	100-567134-610692-522527	4	1,332.0	5.7	7,552.3	38	1	0.03	0.00	0.50	0.01
Creek 661	100-567134-610692-671007	1	505.7	3.6	1,840.7	724	0	1.43	0.00	39.33	0.00
Creek 661	100-567134-610692-671007	2	507.2	4.0	2,008.5	277	0	0.55	0.00	13.79	0.00
Creek 661	100-567134-610692-671007	3	500.0	3.4	1,690.0	30	0	0.06	0.00	1.78	0.00
Lower Chedakuz Creek	100-567134-610692	13	521.0	–	–	13	6	0.02	0.01	–	–
Lower Chedakuz Creek	100-567134-610692	14	514.0	14.6	7,494.1	114	9	0.22	0.02	1.52	0.12
Lower Chedakuz Creek	100-567134-610692	15	500.0	13.3	6,665.0	354	61	0.71	0.12	5.31	0.92
Middle Chedakuz Creek	100-567134-610692	19	279.0	–	–	549	2	1.97	0.01	–	–
Middle Chedakuz Creek	100-567134-610692	20	222.0	–	–	231	5	1.04	0.02	–	–
Middle Chedakuz Creek	100-567134-610692	22	342.9	–	–	0	0	0.00	0.00	–	–
Middle Chedakuz Creek	100-567134-610692	23	772.5	–	–	0	0	0.00	0.00	–	–
Middle Chedakuz Creek	100-567134-610692	26	616.8	–	–	0	0	0.00	0.00	–	–

Note: m = metre; m^2 = square metres; No. = number; dash indicates no data, width data not available from Reconnaissance (1:20,000) Inventory because middle Chedakuz Creek is outside the LSA, therefore areal density could not be calculated.

372000 376000 380000 384000 388000 392000

5908000 5904000 5900000 5896000

Turtle Creek
Davidson Creek
Tatelkuz Lake Tributaries
Creek 661
Tatelkuz Lake
NECHAKO RANGE
Snake Lake
TurtleCreek
Davidson Creek
Creek 100
Creek 428073
Creek 636773
Creek 688328
Creek 704454
Creek 505659
Creek 146920
Creek 543585
Creek 314089
Creek 226858
Chedakuz Creek

1 2 3 4 13 14 15 16 17 18 19 20 21 22 23 24 25 26

N

Legend

- Reach Break
- Kluskus-Ootsa FSR
- Contour (20 m)
- Stream
- Lake

Project Components

- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Airstrip Extent
- Proposed Mine Site

Surveyed Kokanee Density

- 1.51 - 2.00
- 1.10 - 1.50
- 0.51 - 1.00
- 0.01 - 0.50
- No fish observed

Fish and Aquatic Resources LSA (Watersheds)

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Scale:1:67,000

0 0.5 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution
Knight Pieshold 'Year 17' Drawing May 24, 2013

CLIENT: newgold

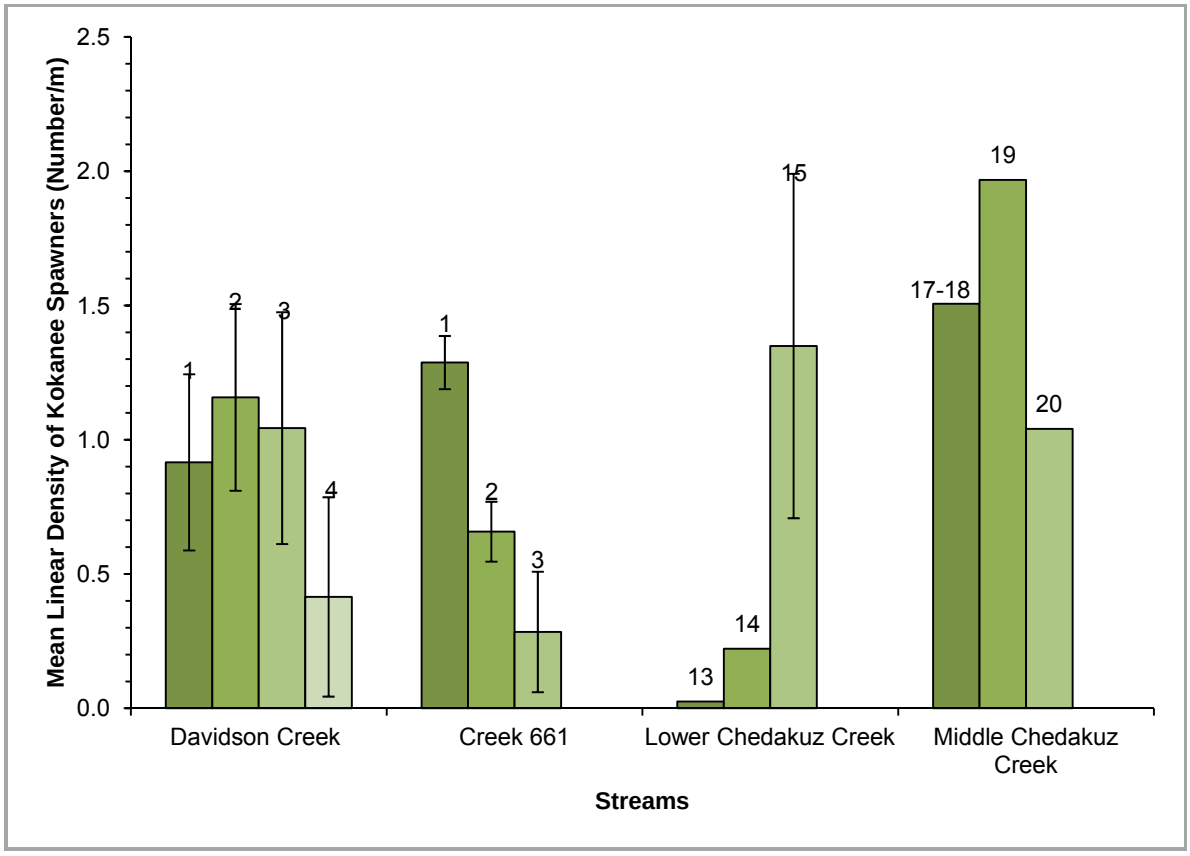
PROJECT: Blackwater Gold Project

Surveyed Kokanee Density

DATE: December, 2013	ANALYST: WR	**Figure** 5.15-6
JOB No: VE52277	QA/QC: MY	PDF FILE: 10-100-189_KokaneeDensity.pdf
GIS FILE: 10-100-189_KokaneeDensity.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-189_KokaneeDensity.mxd

In Davidson Creek, over the years 2011 to 2013, the highest mean linear density of kokanee spawners was in Reach 2 and the lowest was in Reach 4 (**Annex 5.15-2** and **Figure 5.15-7**).



Note: Error bars indicate standard error of the mean; the number indicates the reach number

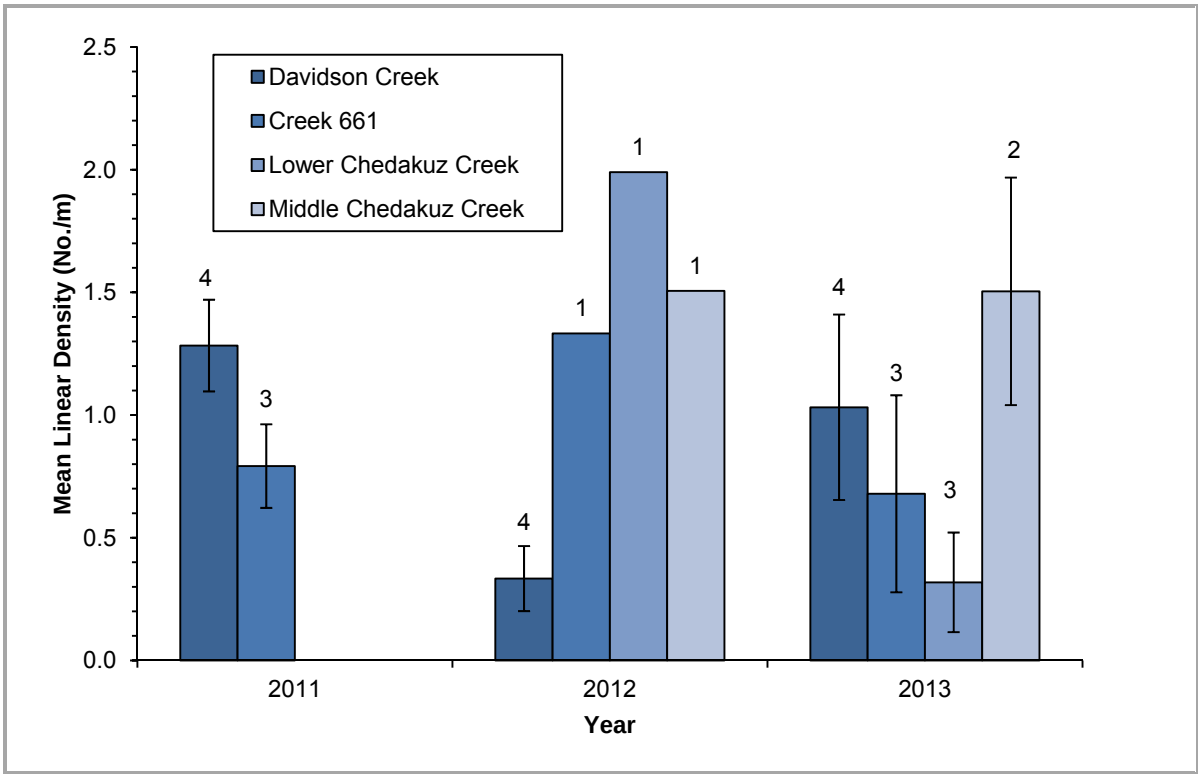
Figure 5.15-7: Mean Linear Density of Kokanee Spawners by Reach and Stream, 2011-2013

In Creek 661, mean linear kokanee spawner density was highest in Reach 1 and declined with upstream distance in Reaches 2 and 3 (**Figure 5.15-7**).

A similar pattern was shown in lower Chedakuz Creek where mean linear kokanee spawner density was highest in Reach 15 immediately downstream of the outlet of Tatelkuz Lake and decreased with downstream distance in Reaches 14 and 15 (**Figure 5.15-7**).

In middle Chedakuz Creek, mean linear density of kokanee spawners was highest in Reach 19 near the confluence with Creek 661, and lowest in Reach 20 upstream of the confluence with Creek 661 (**Figure 5.15-7**). No kokanee were observed in reaches 21 to 26 upstream of Reach 20. These observations suggest that the population of kokanee that resides in Kuyakuz Lake may not use spawning habitat in middle Chedakuz Lake, but may focus its spawning effort on inlet streams to Kuyakuz Lake such as upper Chedakuz Creek.

When pooled by streams within years, mean linear kokanee spawner density in Davidson Creek was similar in 2011 and 2013 but much lower in 2012 (**Figure 5.15-8**). In Creek 661, mean linear kokanee spawner densities was similar among the three years. In lower Chedakuz Creek, it was higher in 2012 than in 2013, and in middle Chedakuz Creek it was similar in 2012 and 2013.



Note: Error bars indicate the standard error; the number above indicates the number of surveys

Figure 5.15-8: Mean Linear Density of Kokanee Spawners by Stream and Year

5.15.6 Kokanee Spawner Number

More kokanee spawners are estimated to have spawned in the Blackwater LSA in 2013 (19,584 fish) than in 2012 (15,805 fish) or 2011 (12,745 fish) (**Table 5.15-7**). These differences reflect differences in the spatial extent of the spawner survey. In 2011, only Davidson Creek and Creek 661 were surveyed. In 2012, all four streams were surveyed, but only one reach was surveyed in each of lower Chedakuz Creek and middle Chedakuz Creek. In 2013, all four streams were surveyed again, but three reaches were surveyed in lower Chedakuz Creek and four reaches in middle Chedakuz Creek.

The most accurate estimate of the number of kokanee that spawn in the Blackwater LSA each year was calculated by combining all data from the three survey years (**Table 5.15-7**). A total of 24,988 kokanee spawners was calculated, of which middle Chedakuz Creek contributed 9.805 (or 39.2% or the total), followed by Creek 661 (5,893 or 23.6%), lower Chedakuz Creek (5,343 or 21.4%), and Davidson Creek (3,947 or 15.8%).

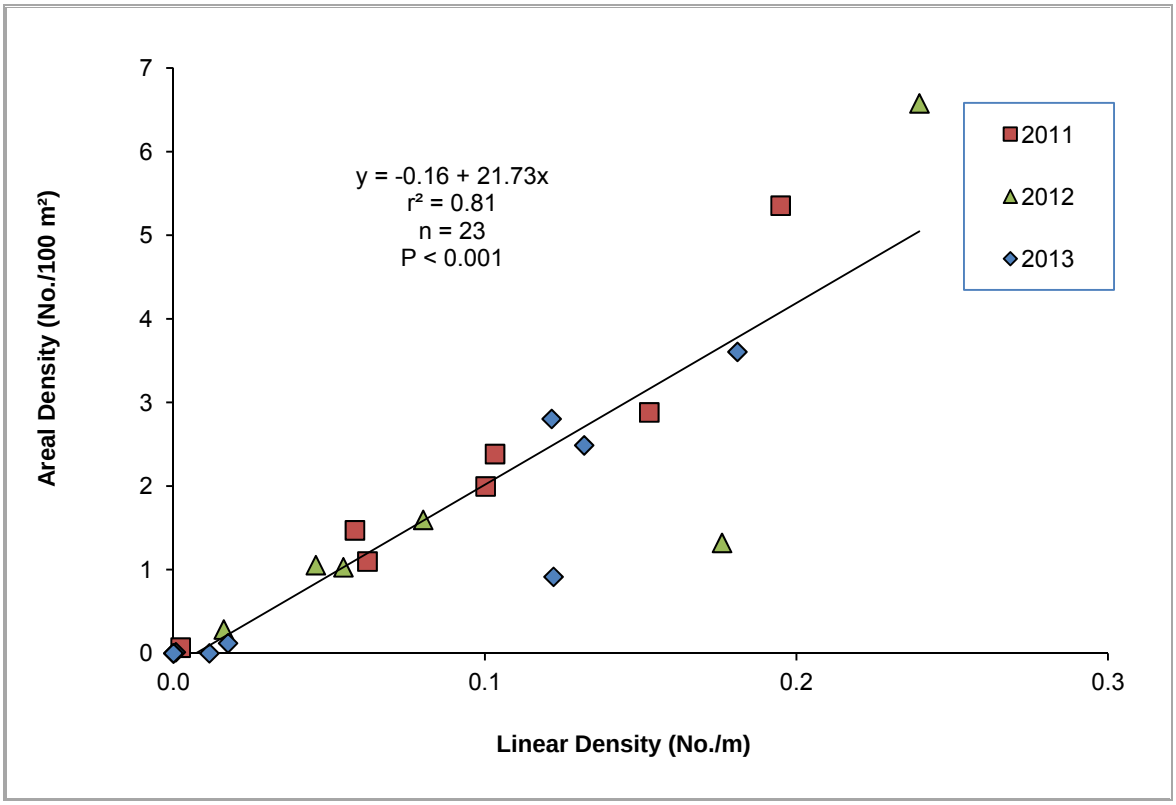
Table 5.15-7: Estimated Number of Kokanee Spawners in the LSA, 2011-2013

Stream	Reach	Reach Length (m)	2011			2012			2013			Years Combined				
			Linear Density (No./m)	Estimated Number of KO	Percentage of Total KO (%)	Linear Density (No./m)	Estimated Number of KO	Percentage of Total KO (%)	Linear Density (No./m)	Estimated Number of KO	Percentage of Total KO (%)	Mean Linear Density (No./m)	SE	n	Estimated Number of KO	Percentage of Total KO (%)
Davidson Creek	1	1,373.9	1.22	1,676	13.1	0.26	358	2.3	1.27	1,741	8.9	0.92	0.33	3	1,258	5.0
	2	498.5	0.94	470	3.7	0.69	346	2.2	1.84	916	4.7	1.16	0.35	3	577	2.3
	3	1,184.3	1.81	2,149	16.9	0.32	382	2.4	0.99	1,176	6.0	1.04	0.43	3	1,236	4.9
	4	2,112.2	1.16	2,444	19.2	0.06	124	0.8	0.03	60	0.3	0.41	0.37	3	876	3.5
	Total	**5,168.9**		**6,738**	**52.9**		**1,209**	**7.6**		**3,894**	**19.9**				**3,947**	**15.8**
Creek 661	1	3,483.8	1.10	3,824	30.0	1.33	4,644	29.4	1.43	4,988	25.5	1.29	0.10	3	4,485	17.9
	2	824.9	0.77	635	5.0	–	–	–	0.55	450	2.3	0.66	0.11	2	543	2.2
	3	3,043.0	0.51	1,548	12.1	–	–	–	0.06	183	0.9	0.28	0.22	2	865	3.5
	Total	**7,351.7**		**6,007**	**47.1**		**4,644**	**29.4**		**5,621**	**28.7**				**5,893**	**23.6**
Lower Chedakuz Creek	13	8,698.4	–	–	–	–	–	–	0.02	217	1.1	0.02	–	1	217	0.9
	14	1,133.8	–	–	–	–	–	–	0.22	251	1.3	0.22	–	1	251	1.0
	15	3,612.8	–	–	–	1.99	7,191	45.5	0.71	2,558	13.1	1.35	0.64	2	4,874	19.5
	Total	**13,445.0**					**7,191**	**45.5**		**3,026**	**15.5**				**5,343**	**21.4**
Middle Chedakuz Creek	17-18	1833.7	–	–	–	1.51	2,762	17.5	–	–	–	1.51	–	1	2,762	11.1
	19	1734.4	–	–	–	–	–	–	1.97	3,413	17.4	1.97	–	1	3,413	13.7
	20	3488.9	–	–	–	–	–	–	1.04	3,630	18.5	1.04	–	1	3,630	14.5
	Total	**7,057.0**					**2,762**	**17.5**		**7,043**	**36.0**				**9,805**	**39.2**
Total		**33,022.6**		**12,745**	**100.0**		**15,805**	**100.0**		**19,584**	**100.0**				**24,988**	**100.0**

Note: No./m = number of fish per metre; No. = number; KO = kokanee; % = percent; m = metre; n = sample number; SE = standard error; dash indicates reach was not sampled

5.15.7 Aerial Density and Linear Density of Redds

A linear regression of aerial redd density on linear redd density for the combined data of the three survey years (**Figure 5.15-9**) was similar to the linear regression of aerial spawner density on linear spawner density shown in **Figure 5.15-5**. The two variables are highly signficantly (P<0.001) and positively correlated. Linear redd density explained 81% of the variance in aerial redd density, and the intercept of the regression was not significantly different from zero (P>0.05). Based on the scatter of data around the regression line there do not appear to be any differences among the three survey years in the relationship between the two variables for redds.



Note: n = sample number; No. = number; m = metre; m² = square metre

Figure 5.15-9: Linear Regression of Kokanee Redd Areal Density on Linear Density, 2011-2013

5.15.8 Spawner Number and Redd Number

One of assumptions involved in counting the number of redds is that redd number may be a potential surrogate for the number of spawners, particularly in those situations in which the peak of spawning may have been missed.

This assumption was confirmed by a linear regression of spawner number on redd number for the combined data of 2011 to 2013. The regression was highly significantly (P<0.001)

and positively correlated (**Figure 5.15-10**). The regression explained 78% of the variance in spawner number. The intercept was significantly (P<0.001) different from zero, indicating that spawners were counted in sections where no redds were observed. The regression slope has a value of 5.0, indicating that the production of each kokanee redd requires an average of five spawners.

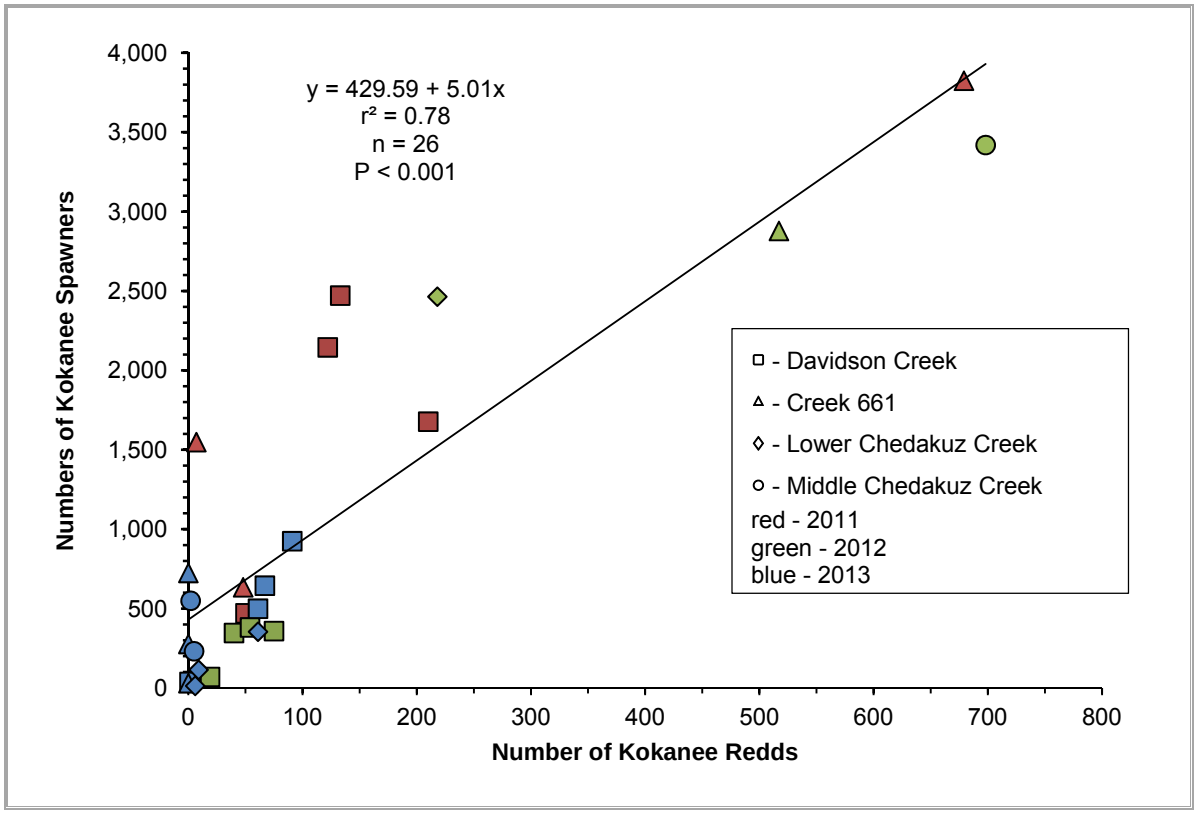


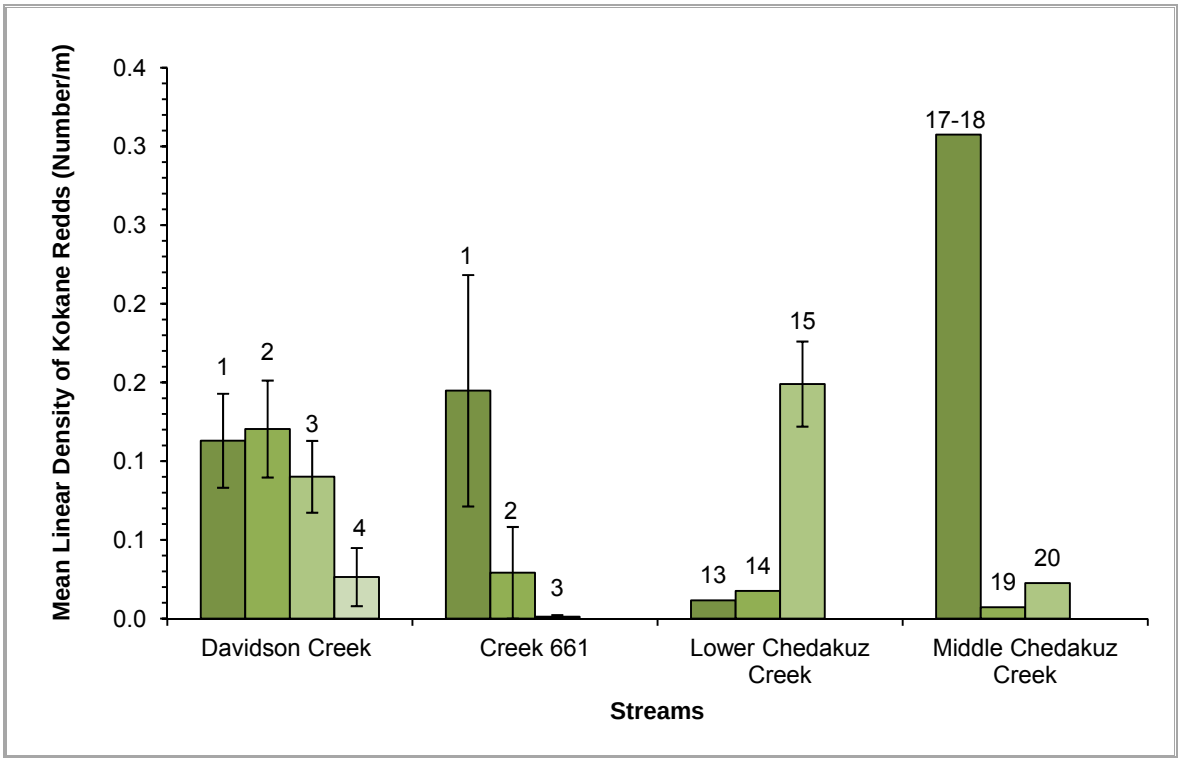
Figure 5.15-10: Linear Regression of Number of Kokanee Spawners on Number of Kokanee Redds in the LSA, 2011-2013

There are several reasons why the number of spawners is not identical to the number of redds (i.e., a regression slope of 1.0). The first is that not all spawning kokanee that arrive on the spawning grounds survive to mate and dig redds because they die from parasites and disease during in-stream migration, or are eaten by wildlife such as eagles and bears soon after they arrive on the spawning grounds. The second reason is that competition among spawners for limited spawning habitat may result in sub-dominant female spawners being forced by dominant females into marginal habitat (Burgner, 1991). It is probably more difficult to successfully mate and dig redds in marginal habitat than high-quality habitat. The third reason is redd superpositioning – the digging up of older redds by more recent arrivals on the spawning grounds. All of these mechanisms operate to varying degrees in salmonid populations.

5.15.9 Linear Density of Kokanee Redds

In 2013, the highest linear density of redds was observed in Reach 2 of Davidson Creek (0.18 redds/m) (**Table 5.15-6**).

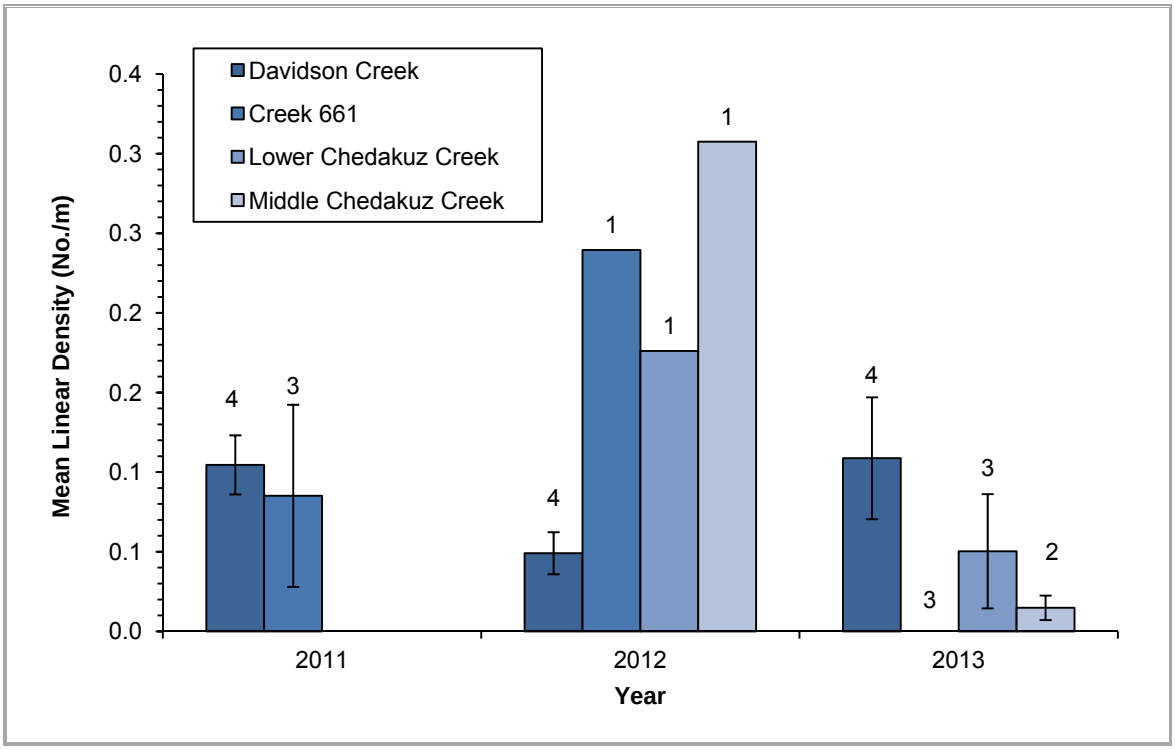
Similar spatial patterns were observed for mean linear densities of kokanee redds (**Figure 5.15-11**) as were observed for mean linear densities of spwners (**Figure 5.15-7**). The single difference was in middle Chedakuz Creek where redd density was highest for Reaches 17 and 18 and lower for Reaches 19 and 20. Spawner densities were higher in Reach 19 than in Reaches 17-18 and 20.



Note: Error bars indicate the standard error; the number above indicates the reach number

Figure 5.15-11: Mean Linear Density of Kokanee Redds by Reach and Stream, 2011-2013

Mean linear densities of kokanee redds showed similar patterns among streams and years (**Figure 5.15-12**) as mean linear densities of spawners (**Figure 5.15-8**).



Note: Error bars indicate the standard error; the number above indicates the number of surveys

Figure 5.15-12: Mean Linear Density of Kokanee Redds by Stream and Year

5.15.10 Habitat Characteristics of Redds

Habitat type (glide, riffle and pool) was assigned to each of the 2,093 redds counted in the three survey years (**Table 5.15-8**).

Table 5.15-8: Habitat Types Assigned to Kokanee Redds, Blackwater LSA, 2013

Stream	Year	Date	Reach	Number of Redds			
				Glide	Riffle	Pool	Total
Davidson Creek	2011*	08-Aug	1	–	–	2	2
		11-Aug	2	–	–	–	0
		11-Aug	3	84	19	4	107
		11-Aug	4	121	7	5	133
	2012	22-Aug	1	35	39	1	75
		22-Aug	2	16	24	0	40
		22-Aug	3	30	24	0	54
		22-Aug	4	7	12	0	19
	2013	08-Aug	1	37	17	13	67
		08-Aug	2	62	23	6	91
		10-Aug	3	30	8	23	61
		10-Aug	4	1	0	0	1
Total				**423**	**173**	**54**	**650**

Table continues…

Stream	Year	Date	Reach	Number of Redds			
Creek 661	2011	12-Aug	1	509	41	129	679
		14-Aug	2	44	0	4	48
		21-Aug	3	7	0	0	7
	2012	24-Aug	1	212	300	5	517
		–	2	–	–	–	–
		–	3	–	–	–	–
	2013	11-Aug	1	0	0	0	0
		24-Aug	2	0	0	0	0
		16-Aug	3	0	0	0	0
Total				**772**	**341**	**138**	**1,251**
Lower Chedakuz Creek	2012	–	13	–	–	–	–
		–	14	–	–	–	–
		16-Sep	15	162	54	2	218
	2013	11-Sep	13	3	0	3	6
		11-Sep	14	9	0	0	9
		11-Sep	15	54	5	5	64
Total				**228**	**59**	**10**	**297**
Middle Chedakuz Creek	2012	28-Aug	17-18	501	193	4	698
	2013	11-Aug	19	2	0	0	2
		11-Aug	20	5	0	0	5
Total				**508**	**193**	**4**	**705**
Totals				**1,931**	**766**	**206**	**2,903**
Percent				**66.5**	**26.4**	**7.1**	**100.0**

Note: * There were more redds counted but not all had habitat type assigned; dash indicates no data.

In each of the four streams, redds were found predominantly in glides, followed by riffles and pools. Pooled over all four streams, 66.5% were found in glide habitat, 26.4% in riffle habitat and 7.1% in pool habitat (**Figure 5.15-13**).

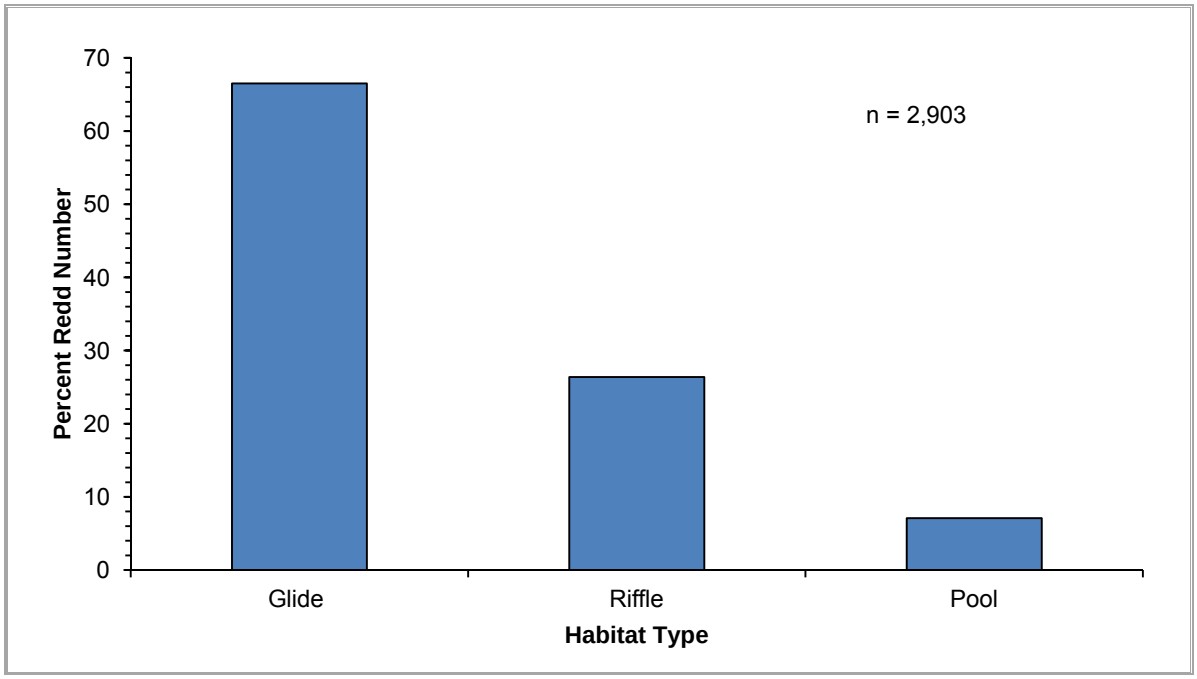


Figure 5.15-13: Distribution of Kokanee Redds by Habitat Type, Blackwater LSA, 2011-2013

Redd depth was measured only in the 2011 and 2012 surveys (**Table 5.15-9**). In each of the four streams, the majority of redds were found in 0.21 to 0.40 m depth range. Pooled over all four streams, 58.2% of the 2,451 redds for which depth was measured were at a depth of 0.21 to 0.40 m, followed by 30.2% at a depth of 0.00 to 0.19 m, and 7.0% at a depth of 0.41 to 0.60 m (**Figure 5.15-14**). Nineteen redds or 0.8% of the total were reported to be at depths greater than 1.0 m.

Table 5.15-9: Kokanee Redd Depths, Blackwater LSA, 2011-2012

Stream	Year	Date	Reach	Number of Redds by Depth (m)						
				0.00-0.20	0.21-0.40	0.41-0.60	0.61-0.80	0.81-1.00	>1.00	Total
Davidson Creek	2011	08-Aug	1	–	8	–	–	–	–	8
		11-Aug	2	4	6	0	0	0	0	10
		11-Aug	3	6	5	0	0	0	7	18
		11-Aug	4	22	55	21	0	2	3	103
	2012	22-Aug	1	25	47	3	0	0	0	75
		22-Aug	2	6	34	0	0	0	0	40
		22-Aug	3	17	37	0	0	0	0	54
		22-Aug	4	0	18	0	1	0	0	19
Total				**80**	**210**	**24**	**1**	**2**	**10**	**327**
Creek 661	2011	12-Aug	1	112	413	95	14	3	4	641
		14-Aug	2	23	13	12	0	0	0	48
		21-Aug	3	3	4	0	0	0	0	7
	2012	24-Aug	1	237	272	0	0	0	3	512
Total				**375**	**702**	**107**	**14**	**3**	**7**	**1,208**

Table continues…

Stream	Year	Date	Reach	Number of Redds by Depth (m)						
Lower Chedakuz Creek	2012	16-Sep	15	35	97	10	50	24	2	218
Total				**35**	**97**	**10**	**50**	**24**	**2**	**218**
Middle Chedakuz Creek	2012	28-Aug	17-18	250	418	30	0	0	0	698
Total				**250**	**418**	**30**	**0**	**0**	**0**	**698**
Totals				**740**	**1,427**	**171**	**65**	**29**	**19**	**2,451**
Percent				**30.2**	**58.2**	**7.0**	**2.7**	**1.2**	**0.8**	**100.0**

Note: m = metre; Dashes indicate no depths were recorded

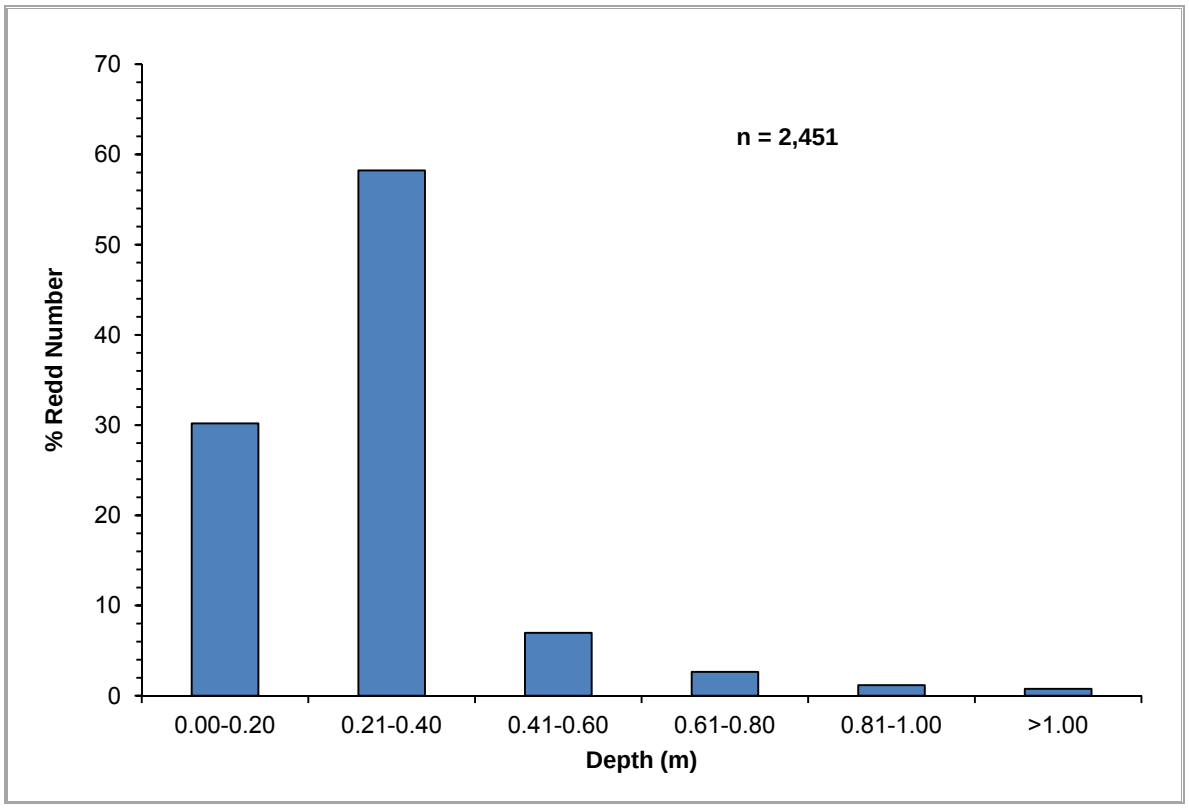


Figure 5.15-14: Distribution of Kokanee Redds by Depth, Blackwater LSA, 2011-2012

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ANNEXES

Annex 4.3-1
Fish Sampling Permits, 2013

Ministry of
Forests, Lands and
Natural Resource Operations

FISH COLLECTION PERMIT
Environmental Impact Assessment

File: 34770-20

Permit No.: PG13-86954

Permit Holder: AMEC Environmental & Infrastructure – Ian D. Matchett
600 – 4445 Lougheed Highway, Burnaby BC V5C 0E4

Client No.: 21541

Authorized Persons: Ian D. Matchett, Pier van Dishoeck, Rosalyn Smedley, Michael McGurk, Stephanie Christensen, Stephanie Lyons, Lisa Nordin, Brett McLeod, Dave Stanley, Ben Pittman

Pursuant to section 19 of the *Wildlife Act*, RSBC 1996, Chap. 488, and section 18 of the Angling and Scientific Regulations, BC Reg. 125/90, the above named persons are hereby authorized to collect fish for scientific purposes from non-tidal waters subject to the conditions set forth in this Permit:

Permitted Sampling Period: July 1, 2013 to December 31, 2013
Permitted Waterbodies: Omineca Region – See Appendix C
Permitted Sampling Techniques: All (subject to permit terms and conditions)
Potential Species: RB, MW, LSU, CSU, NSC, BB, KO, CCG (subject to permit terms and conditions)
Permitted Lethal Sampling: Up to 20 RB from Tatelkuz Lake (180-609800); up to a combined total of up to 20 MW and or LSU from Tatelkuz Lake (180-609800) (subject to permit terms and conditions)

Provincial Conditions: (Permit holders must be aware of all terms and conditions):
See Appendix A.
Exempt: # 14 – Exceed daily catch quota and use of bait.
Region Specific Conditions:
See Appendix A.

Authorized by:
Susanne Williamson, Fisheries Information Specialist
A person authorized by the Regional Manager
Recreational Fisheries & Wildlife Programs
Omineca Region

Date: May 24, 2013 Permit Fee $25

Any contravention or failure to comply with the terms and conditions of this permit is an offense under the *Wildlife Act*, RSBC 1996, Chap. 488 and B.C. Reg. 125/90.

Appendix A: Fish Collection Permit Conditions

Any Variation of the following terms and conditions will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.

Provincial Conditions

1. This collecting permit is not valid
   - in national parks,
   - in provincial parks unless a Park Use Permit is also obtained,
   - in tidal waters,
   - for eulachon or for salmon* other than kokanee, or
   - for collecting fish by angling unless the permit holder and crew members possess a valid angling licence.

   This collecting permit is **only** valid for species listed as threatened, endangered or extirpated under the Species at Risk Act (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

   *Contact the Department of Fisheries and Oceans for fish collecting permits for salmon, eulachon or SARA listed species (see Appendix B).

2. The permit holder (or the project supervisor) named on the application for a scientific collection permit will carry a copy of this permit while engaged in fish collecting and produce it upon request of a conservation officer, fisheries officer or constable.

3. Any specimens surplus to scientific requirements and any species not authorized for collection in this permit shall be immediately and carefully released at the point of capture.

4. Fish collected under authority of this permit shall not be used for food or any purpose other than the objectives set out in the approved application for a scientific collection permit. The permit holder shall not sell, barter, trade, or give away, or offer to sell, barter, trade or give away fish collected under authority of this permit. Dead fish shall be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.

5. No fish collected under authority of this permit shall be
   - transported alive unless authorized by this permit, or
   - transplanted unless separately authorized by the Federal/Provincial Fish Transplant Committee.

6. The permit holder shall, within 90 days of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and shall be submitted as required by the permit issuer. All submissions must be filed electronically to: http://www.env.gov.bc.ca/fish_data_sub/index.html

   Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: fishdatasub@gov.bc.ca

7. This collecting permit is subject to cancellation at any time and shall be surrendered to a conservation officer on demand or to the issuer upon written notice of its cancellation.

8. This permit is valid only for the activities approved on the application form and in accordance with any restrictions set out therein.

9. This permit is valid only for trained, qualified staff named in the Application. The permit holder will comply with all Worker's Compensation Board requirements and other regulatory requirements. Permit holders are responsible for ensuring staff members listed on the permit are properly certified for specific sampling methods or activities (e.g. electroshocking).

10. Any workers not listed on the permit must be supervised by the permit holder or one of the additional persons as named on the permit.

Appendix A: Fish Collection Permit Conditions Continued

11. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g. Whirling disease) and / or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.

12. No electrofishing is to take place in waters below five degrees C.

13. Electrofishing may not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

14. Angling must only occur in accordance with the regulations specified in the current BC Freshwater Fishing Regulations Synopsis.

Region Specific Conditions

Omineca Region

- No electrofishing will be permitted between September 15 and June 15 in streams containing bull trout.
- Voucher specimens for all regionally significant red and blue-listed species (3 per species), with exception to SARA-listed white sturgeon (*Acipenser transmontanus*), must be submitted to the Regional Fish Information Specialist as per RISC standards.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Didymo, see: https://www.professionalbiology.com/sites/default/files/pdfs/Didymo.pdf
- When lethal sampling has occurred for the purposes of environmental effects monitoring or impact assessment, the permit holder shall, within 90 days of the expiry of this permit, submit a report that summarizes all raw data related to the lethal program. This would typically include location of catch, species, fish tissue metals analysis, fish tissue moisture content, fish length and fish weight, at minimum. Interim reports may also be required and shall be submitted as required by the permit issuer. All fish tissue analysis data related to the lethal program must be submitted ALONG with the standard sampling effort data submission template to http://www.env.gov.bc.ca/fish_data_sub/index.html. Questions regarding submission requirements for lethal sampling may be directed to Susanne.Williamson@gov.bc.ca.
- Lethal fish sampling for metal analysis to environmental studies must have an approved sampling plan prior to any field work; discussion should be held with Environmental Impact Biologists: Bruce Carmichael 250-565-6455 and/or James Jacklin 250-565-7103.

COLUMBIA

Appendix B: Table 1 - Species at Risk

The following are species at risk that have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either endangered, threatened or a species of special concern. Species also listed under the Species at Risk Act (SARA) are identified with an asterisk, and are subject to additional permitting requirements through the Federal Department of Fisheries and Oceans (DFO).

Common Name	Scientific Name
Benthic Paxton Lake Stickleback	**Gasterosteus sp.*
Benthic Vananda Creek Stickleback	**Gasterosteus sp.*
Limnetic Paxton Lake Stickleback	**Gasterosteus sp.*
Limnetic Vananda Creek Stickleback	**Gasterosteus sp.*
Nooksack Dace	**Rhinichthys sp.*
Morrison Creek Lamprey	**Lampetra richardsoni*
Vancouver Lamprey (Cowichan Lake Lamprey)	**Lampetra macrostoma*
Cultus Pygmy Sculpin	**Cottus sp.*
Shorthead Sculpin	**Cottus confusus*
Hotwater Physa	**Physella wrighti*
Limnetic Enos Lake Stickleback	*Gasterosteus sp.*
Benthic Enos Lake Stickleback	*Gasterosteus sp.*
Salish Sucker	*Catostomus sp.*
Speckled Dace	*Rhinichthys osculus*
Charlotte Unarmoured Stickleback	*Gasterosteus aculeatus*
Columbia Mottled Sculpin	*Cottus bairdi hubbsi*
Giant Stickleback	*Gasterosteus sp.*
Green Sturgeon	*Acipenser medirostris*
Umatilla Dace	*Rhinichthys umatilla*
White Sturgeon	*Acipenser transmontanus*

Applications for permits to specifically collect and retain listed species must be reviewed by the appropriate Recovery Team, who will screen permits to ensure that any impacts on listed species are acceptable. For white sturgeon the contact is Steve McAdam (steve.mcadam@gov.bc.ca). For listed non-game freshwater fish the contact is Jordan Rosenfeld (jordan.rosenfeld@gov.bc.ca), co-chair of the Non-Game Freshwater Fish Recovery Team.

Appendix C: Permitted Waterbodies

WATERBODY	BC WATERSHED CODE
Creek 661	180-609800-66100
Turtle Creek	180-609800-39700
Creek 700	180-609800-39700-70000
Creek 705	180-637900-56400-70500
Davidson Creek	180-609800-48100
Chedakuz Creek	180-609800
Tatelkuz Lake	180-609800
Unnamed Lake	180-637900-56400-70500
Unnamed Lake	180-637900-56400-70500-7270
Unnamed Lake	180-609800-48100
Snake Lake	180-609800-55500
Smaller tributaries to streams noted above will be sampled as well.	

Fisheries and Oceans Canada | Pêches et Océans Canada

Licence Number: XHAB 76 2013

Valid From: 01-Jul-2013
Expiry Date: 31-Oct-2013

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
Fish sampling to investigate the potential impacts of a proposed gold mine near Vanderhoof.

Licence Holder:

FIN: 128030		Amec Environmental & Infrastructure
Suite 600, 4445 Lougheed Hwy		
Burnaby BC V5C 0E4		Contact Number: 604-295-8267
		Fax Number: 604-294-4464

Contact Party:

FIN: 129080	Smedley, Rosalyn	Contact Number: 604-295-8629

Individuals or groups assisting with the authorized activity:

Other Qualified AMEC staff and other qualified Ecofor staff are approved to work under this licence.

FIN: 129717	Brett Mcleod	Contact Number: 604-295-6134
FIN: 129075	Stephanie Lyons	Contact Number: 604-295-8063
FIN: 124733	Pier Van Dishoeck	Contact Number: 604-294-3811
FIN: 129080	Rosalyn Smedley	Contact Number: 604-295-8629
FIN: 129077	Ian Matchett	Contact Number: 604-295-6134
FIN: 131266	Michael Mcgurk	Contact Number: 604-295-6134

Species, Quantity of Fish, Area(s) and Gear:

Species:	All Anadromous Salmon Species, all anadramous salmon
Gear:	Electroshocker Gill Net Net, Dip Net, Trap Rod And Reel Seine, Other Trap, Gee/Minnow
Licence Area:	Creek 705- WSC: 180-637900-56400-70500; Davidson Creek - WSC: 180-609800-48100; Tatelkuz Lake - WSC: 180-609800; Creek 700- WSC: 180-609800-39700-70000; Creek 661- WSC: 180-609800-66100; Turtle Creek-WSC180-609800-39700; Chedakuz Creek - WSC: 180-609800
Units:	Individuals (live)
Additional Descriptions:	Smaller tributaries to the streams and lakes noted can be sampled as well.

Reporting Requirements:

Final Report **Due Date** 12-Dec-13

Terms and Conditions:

Definitions

"DFO" means the Department of Fisheries and Oceans.
"electofishing" means using an electric current to attract and temporarily immobilize a fish to allow capture.
"fish" means chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*).

Prior to the commencement of fishing

Prior to conducting any work, Phil Taylor, C&P Field Supervisor, Prince George office (250-561-5530) is to be contacted.

Licence to be carried

Copies of this licence must accompany the collecting personnel, be on board any collecting vessel and be carried with the transport vehicle at all times during collection and transport of samples. The licence must be produced upon the request of a fishery officer or fishery guardian.

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of any fishery officer or fishery guardian.

Use of Electofishing Devices:

Electrofishing is only permitted after extensive use of other gear during sampling activity indicates no presence of juvenile salmonids.

A trained and certified electrofisher operator must be a part of the electrofishing crew.

Electrofishing is not permitted in the vicinity of spawning salmon or redds. Electrofishing can be severly damaging to eggs and alevins and must be avoided where eggs and alevins may be present.

Electrofishing is not permitted in water with a temperature below 5 degrees Celsius.

Release of Fish

All fish must be released into the water body or course from which they originated, and as near as possible to the location from which they were sampled.

Fish must be released in a manner that causes the least possible harm.

Reports:

A report will be required by DFO at the end of the project. The report must contain at minimum:

(a) sampling date, time, crew, stream name, watershed name;
(b) GPS position of site (s);
(c) number of captured aquatic organisms by species; and
(d) if conducted, bio-sampling data (lengths, weights).

No sampling of non-anadromous species

No sampling of non-anadromous fish species and steelhead is to be undertaken unless prior approval has been provided by the BC Ministry of Environment.

Revocation of licence

This licence may be revoked or amended by the Department prior to the expiry date as may be considered necessary by the Department.

Licence Issued: 05 June 2013

Licence Printed: 05 June 2013
Licence Issued By: CINDY LOTT

Licence Number: XHAB 76 2013 - Amendment 1

Valid From: 01-Jul-2013
Expiry Date: 31-Oct-2013

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
Fish sampling to investigate the potential impacts of a proposed gold mine near Vanderhoof.

Licence Holder:

FIN: 128030		Amec Environmental & Infrastructure
Suite 600, 4445 Lougheed Hwy		
Burnaby BC V5C 0E4		Contact Number: 604-295-8267
		Fax Number: 604-294-4464

Contact Party:

FIN: 129080	Smedley, Rosalyn	Contact Number: 604-295-8629

Individuals or groups assisting with the authorized activity:

Other Qualified AMEC staff and other qualified Ecofor staff are approved to work under this licence.

FIN: 129717	Brett Mcleod	Contact Number: 604-295-6134
FIN: 129075	Stephanie Lyons	Contact Number: 604-295-8063
FIN: 124733	Pier Van Dishoeck	Contact Number: 604-294-3811
FIN: 129080	Rosalyn Smedley	Contact Number: 604-295-8629
FIN: 129077	Ian Matchett	Contact Number: 604-295-6134
FIN: 131266	Michael Mcgurk	Contact Number: 604-295-6134

Species, Quantity of Fish, Area(s) and Gear:

Species:	All Anadromous Salmon Species
Gear:	Electroshocker Gill Net Net, Dip Net, Trap Rod And Reel Seine, Beach Trap, Gee/Minnow
Licence Area:	Fawnie Creek - WSC: 180-637900-56400-86200; Creek 705- WSC: 180-637900-56400-70500; Davidson Creek - WSC: 180-609800-48100; Tatelkuz Lake - WSC: 180-609800; Creek 700- WSC: 180-609800-39700-70000; Creek 661- WSC: 180-609800-66100; Turtle Creek-WSC180-609800-39700; Top Lake - WSC: 180-637900-56400; Chedakuz Creek - WSC: 180-609800
Units:	Individuals (live)
Additional Descriptions:	Smaller tributaries to the streams and lakes noted can be sampled as well.

Reporting Requirements:

Final Report **Due Date** 12-Dec-13

Terms and Conditions:

Definitions

"DFO" means the Department of Fisheries and Oceans.
"electrofishing" means using an electric current to attract and temporarily immobilize a fish to allow capture.
"fish" means chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*).

Prior to the commencement of fishing

Prior to conducting any work, Phil Taylor, C&P Field Supervisor, Prince George office (250-561-5530) is to be contacted.

Licence to be carried

Copies of this licence must accompany the collecting personnel, be on board any collecting vessel and be carried with the transport vehicle at all times during collection and transport of samples. The licence must be produced upon the request of a fishery officer or fishery guardian.

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of any fishery officer or fishery guardian.

Use of Electrofishing Devices:

Electrofishing is only permitted after extensive use of other gear during sampling activity indicates no presence of juvenile salmonids.

A trained and certified electrofisher operator must be a part of the electrofishing crew.

Electrofishing is not permitted in the vicinity of spawning salmon or redds. Electrofishing can be severly damaging to eggs and alevins and must be avoided where eggs and alevins may be present.

Electrofishing is not permitted in water with a temperature below 5 degrees Celsius.

Release of Fish

All fish must be released into the water body or course from which they originated, and as near as possible to the location from which they were sampled.

Fish must be released in a manner that causes the least possible harm.

Reports:

A report will be required by DFO at the end of the project. The report must contain at minimum:

(a) sampling date, time, crew, stream name, watershed name;
(b) GPS position of site (s);
(c) number of captured aquatic organisms by species; and
(d) if conducted, bio-sampling data (lengths, weights).

No sampling of non-anadromous species

No sampling of non-anadromous fish species and steelhead is to be undertaken unless prior approval has been provided by the BC Ministry of Environment.

Revocation of licence

This licence may be revoked or amended by the Department prior to the expiry date as may be considered necessary by the Department.

Replaced due to Area Changed

Licence Issued: 13 June 2013

Licence Printed: 13 June 2013
Licence Issued By: CINDY LOTT

Amendment to fish permit number XHAB 76 2013.

New sampling locations to be added (see attached map for locations of waterbodies):

Waterbody	BC Watershed Code
Fawnie Creek	180-637900-56400-86200
Top Lake	180-637900-56400

DRAFT

360000 375000 390000 405000

5925000 5910000 5895000 5880000

N

Natalkuz Lake
Entiako River
East Erhorn Creek
Erhorn Creek
Big Bend
Euchiniko River
Goose Lake
Brewster Lakes
Proposed Transmission Line
Kluskus FSR
Capoose Lake
Capoose Creek
Lake 113
Mills Lake
Chedakuz Creek
Chutanli Lake
Tauk Creek
Kluskus Blue FSR
Turtle Creek
Kluskus Ootsa FSR
Tatelkuz Lake
Proposed Water Pipeline Route
Van Tine Creek
Top Lake
Davidson Creek
Creek 661
Exploration Road
Proposed Mine Access Road
Suscha Lake
Suscha Creek
Chedakuz Creek
Creek 705
Fawnie Creek
Laidman Lake
Mathews Creek
Kuyakuz Lake
Williamson Lake
West Road (Blackwater) River
Euchiniko Lakes
Kluskus Creek
Kushya River
Kluskus Lakes
Bishop Creek
Tsacha Lake

Legend

- Existing Road
- Kluskus FSR
- Kluskus Blue FSR
- Kluskus Ootsa FSR
- Proposed Exploration Road
- Stream
- Waterbody
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Water Pipeline Route
- Proposed Mine Site

Catchments

- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Study Areas

- Mine Site Regional Study Area
- Mine Site Local Study Area

Scale:1:200,000

0 1 2 4 6 8 10
Kilometres

Reference
BC Goverenment GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish and Aquatic Resource Study Areas

DATE:	ANALYST:	
April, 2013	MY	**Figure** 2.1
JOB No: VE52095	QA/QC: BM	PDF FILE: 10-100-002_v8_aquatic_SA.pdf
GIS FILE: 10-100-002_v8_aquatic.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Licence Number: XHAB 76 2013 - Amendment 2

Valid From: 01-Jul-2013
Expiry Date: 31-Oct-2013

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
Fish sampling to investigate the potential impacts of a proposed gold mine near Vanderhoof.

Licence Holder:

FIN: 128030		Amec Environmental & Infrastructure
Suite 600, 4445 Lougheed Hwy		
Burnaby BC V5C 0E4		Contact Number: 604-295-8267
		Fax Number: 604-294-4464

Contact Party:

FIN: 129080	Smedley, Rosalyn	Contact Number: 604-295-8629

Individuals or groups assisting with the authorized activity:

Other Qualified AMEC staff and other qualified Ecofor staff are approved to work under this licence.

FIN: 129717	Brett Mcleod	Contact Number: 604-295-6134
FIN: 129075	Stephanie Lyons	Contact Number: 604-295-8063
FIN: 124733	Pier Van Dishoeck	Contact Number: 604-294-3811
FIN: 129080	Rosalyn Smedley	Contact Number: 604-295-8629
FIN: 129077	Ian Matchett	Contact Number: 604-295-6134
FIN: 131266	Michael Mcgurk	Contact Number: 604-295-6134

Species, Quantity of Fish, Area(s) and Gear:

Species:	All Anadromous Salmon Species
Gear:	Electroshocker Gill Net Net, Dip Net, Trap Rod And Reel Seine, Beach Trap, Gee/Minnow
Licence Area:	Fawnie Creek - WSC: 180-637900-56400-86200; Tatelkuz Lake - WSC: 180-609800; Davidson Creek - WSC: 180-609800-48100; Creek 705- WSC: 180-637900-56400-70500; Creek 700- WSC: 180-609800-39700-70000; Matthews Creek WSC: 180-637900-56400-54900; Creek 661- WSC: 180-609800-66100; Turtle Creek-WSC180-609800-39700; Top Lake - WSC: 180-637900-56400; Chedakuz Creek - WSC: 180-609800
Units:	Individuals (live)
Additional Descriptions:	Smaller tributaries to the streams and lakes noted can be sampled as well.

Reporting Requirements:

Final Report **Due Date** 12-Dec-13

Terms and Conditions:

Definitions

"DFO" means the Department of Fisheries and Oceans.
"electrofishing" means using an electric current to attract and temporarily immobilize a fish to allow capture.
"fish" means chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*).

Prior to the commencement of fishing

Prior to conducting any work, Phil Taylor, C&P Field Supervisor, Prince George office (250-561-5530) is to be contacted.

Licence to be carried

Copies of this licence must accompany the collecting personnel, be on board any collecting vessel and be carried with the transport vehicle at all times during collection and transport of samples. The licence must be produced upon the request of a fishery officer or fishery guardian.

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of any fishery officer or fishery guardian.

Use of Electrofishing Devices:

Electrofishing is only permitted after extensive use of other gear during sampling activity indicates no presence of juvenile salmonids.

A trained and certified electrofisher operator must be a part of the electrofishing crew.

Electrofishing is not permitted in the vicinity of spawning salmon or redds. Electrofishing can be severly damaging to eggs and alevins and must be avoided where eggs and alevins may be present.

Electrofishing is not permitted in water with a temperature below 5 degrees Celsius.

Release of Fish

All fish must be released into the water body or course from which they originated, and as near as possible to the location from which they were sampled.

Fish must be released in a manner that causes the least possible harm.

Reports:

A report will be required by DFO at the end of the project. The report must contain at minimum:

(a) sampling date, time, crew, stream name, watershed name;
(b) GPS position of site (s);
(c) number of captured aquatic organisms by species; and

(d) if conducted, bio-sampling data (lengths, weights).

No sampling of non-anadromous species

No sampling of non-anadromous fish species and steelhead is to be undertaken unless prior approval has been provided by the BC Ministry of Environment.

Revocation of licence

This licence may be revoked or amended by the Department prior to the expiry date as may be considered necessary by the Department.

Replaced due to Area Changed

Licence Issued: 09 August 2013

Licence Printed: 09 August 2013
Licence Issued By: GLADYS COCKERHAM-CLEARY

Amendment to fish permit number XHAB 76 2013.

New sampling locations to be added (see attached map for locations of waterbodies):

Waterbody	BC Watershed Code
Fawnie Creek	180-637900-56400-86200
Top Lake	180-637900-56400

DRAFT

360000 375000 390000 405000

5925000 5910000 5895000 5880000

N

Natalkuz Lake
Entiako River
East Erhorn Creek
Erhorn Creek
Big Bend
Euchiniko River
Goose Lake
Brewster Lakes
Proposed Transmission Line
Kluskus FSR
Capoose Lake
Capoose Creek
Lake 113
Mills Lake
Chedakuz Creek
Chutanli Lake
Tauk Creek
Kluskus Blue FSR
Turtle Creek
Kluskus Ootsa FSR
Tatelkuz Lake
Proposed Water Pipeline Route
Van Tine Creek
Top Lake
Davidson Creek
Creek 661
Exploration Road
Proposed Mine Access Road
Suscha Lake
Suscha Creek
Chedakuz Creek
Creek 705
Fawnie Creek
Laidman Lake
Mathews Creek
Kuyakuz Lake
Williamson Lake
West Road (Blackwater) River
Euchiniko Lakes
Kluskus Creek
Kushya River
Kluskus Lakes
Bishop Creek
Tsacha Lake

Legend

- Existing Road
- Kluskus FSR
- Kluskus Blue FSR
- Kluskus Ootsa FSR
- Proposed Exploration Road
- Stream
- Waterbody
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Water Pipeline Route
- Proposed Mine Site

Catchments

- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Study Areas

- Mine Site Regional Study Area
- Mine Site Local Study Area

Scale:1:200,000

0 1 2 4 6 8 10
Kilometres

Reference
BC Goverenment GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish and Aquatic Resource Study Areas

DATE:	ANALYST:	
April, 2013	MY	**Figure** 2.1
JOB No: VE52095	QA/QC: BM	PDF FILE: 10-100-002_v8_aquatic_SA.pdf
GIS FILE: 10-100-002_v8_aquatic.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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347500 350000 352500 355000 357500 360000 362500 365000 367500 370000 372500 375000

5897500 5895000 5892500 5890000 5887500 5885000 5882500 5880000 5877500

Falls Falls

BEAVER DAM

BEAVER DAM

Beaver Dam

Fawnie Creek

Laidman Lake

Davidson Creek

SU:

LKC:

LKC:

Moose Lake

Williamson Lake

Mathews Creek

RB:

BEAVER DAM

Cascade

BEAVER DAM

BEAVER DAM

BEAVER DAM

BEAVER DAM

Wolf Lake

Nagico Lake

West Road (Blackwater) River

West Road (Blackwater) River

Tsacha Lake

N

Legend

- Fish Obstacle (FISS)
- Exisiting Road
- Forest Service Road
- Stream
- Waterbody
- Indian Reserve
- CROWN FEDERAL
- CROWN MUNICIPAL
- CROWN PROVINCIAL
- PRIVATE
- UNKNOWN
- Mathews Creek Watershed

FISS

- LKC - Lake Chub
- RB - Rainbow Trout
- SU - Sucker (General)

Scale:1:90,000

0 0.5 1 2 3 4 5

Kilometres

Reference

BC Goverenment GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

FISS Matthew's Creek

DATE: November, 2012	ANALYST: MY	**Figure**
JOB No: VE52095	QA/QC: BO	PDF FILE: 10-100-089_v2_FISS_matthews_creek.pdf
GIS FILE: 10-100-089_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Licence Number: XHAB 76 2013 - Amendment 3

Valid From: 01-Jul-2013
Expiry Date: 31-Oct-2013

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
Fish sampling to investigate the potential impacts of a proposed gold mine near Vanderhoof.

Licence Holder:

FIN: 128030		Amec Environmental & Infrastructure
Suite 600, 4445 Lougheed Hwy		
Burnaby BC V5C 0E4		Contact Number: 604-295-8267
		Fax Number: 604-294-4464

Contact Party:

FIN: 129080	Smedley, Rosalyn	Contact Number: 604-295-8629

Individuals or groups assisting with the authorized activity:

Other Qualified AMEC staff and other qualified Avison Management Staff are approved to work under this licence.

FIN: 129717	Brett Mcleod	Contact Number: 604-295-6134
FIN: 129075	Stephanie Lyons	Contact Number: 604-295-8063
FIN: 124733	Pier Van Dishoeck	Contact Number: 604-294-3811
FIN: 129080	Rosalyn Smedley	Contact Number: 604-295-8629
FIN: 129077	Ian Matchett	Contact Number: 604-295-6134
FIN: 131266	Michael Mcgurk	Contact Number: 604-295-6134

Species, Quantity of Fish, Area(s) and Gear:

Species:	All Anadromous Salmon Species
Gear:	Electroshocker Gill Net Net, Dip Net, Trap Rod And Reel Seine, Beach Trap, Gee/Minnow
Licence Area:	Fawnie Creek - WSC: 180-637900-56400-86200; Tatelkuz Lake - WSC: 180-609800; Davidson Creek - WSC: 180-609800-48100; Creek 705- WSC: 180-637900-56400-70500; Creek 700- WSC: 180-609800-39700-70000; Matthews Creek WSC: 180-637900-56400-54900; Creek 661- WSC: 180-609800-66100; Turtle Creek-WSC180-609800-39700; Top Lake - WSC: 180-637900-56400; Chedakuz Creek - WSC: 180-609800
Units:	Individuals (live)
Additional Descriptions:	Smaller tributaries to the streams and lakes noted can be sampled as well.

Reporting Requirements:

Final Report **Due Date** 12-Dec-13

Terms and Conditions:

Definitions

"DFO" means the Department of Fisheries and Oceans.
"electrofishing" means using an electric current to attract and temporarily immobilize a fish to allow capture.
"fish" means chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*).

Prior to the commencement of fishing

Prior to conducting any work, Phil Taylor, C&P Field Supervisor, Prince George office (250-561-5530) is to be contacted.

Licence to be carried

Copies of this licence must accompany the collecting personnel, be on board any collecting vessel and be carried with the transport vehicle at all times during collection and transport of samples. The licence must be produced upon the request of a fishery officer or fishery guardian.

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of any fishery officer or fishery guardian.

Use of Electrofishing Devices:

Electrofishing is only permitted after extensive use of other gear during sampling activity indicates no presence of juvenile salmonids.

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Electrofishing is not permitted in the vicinity of spawning salmon or redds. Electrofishing can be severly damaging to eggs and alevins and must be avoided where eggs and alevins may be present.

Electrofishing is not permitted in water with a temperature below 5 degrees Celsius.

Release of Fish

All fish must be released into the water body or course from which they originated, and as near as possible to the location from which they were sampled.

Fish must be released in a manner that causes the least possible harm.

Reports:

A report will be required by DFO at the end of the project. The report must contain at minimum:

(a) sampling date, time, crew, stream name, watershed name;
(b) GPS position of site (s);
(c) number of captured aquatic organisms by species; and

(d) if conducted, bio-sampling data (lengths, weights).

No sampling of non-anadromous species

No sampling of non-anadromous fish species and steelhead is to be undertaken unless prior approval has been provided by the BC Ministry of Environment.

Revocation of licence

This licence may be revoked or amended by the Department prior to the expiry date as may be considered necessary by the Department.

Replaced due to For Licence Amendment Purposes Only

Licence Issued: 06 September 2013

Licence Printed: 06 September 2013
Licence Issued By: CINDY LOTT

Amendment to fish permit number XHAB 76 2013.

New sampling locations to be added (see attached map for locations of waterbodies):

Waterbody	BC Watershed Code
Fawnie Creek	180-637900-56400-86200
Top Lake	180-637900-56400

DRAFT

360000 375000 390000 405000

5925000 5910000 5895000 5880000

N

Natalkuz Lake
Entiako River
East Erhorn Creek
Erhorn Creek
Big Bend
Euchiniko River
Goose Lake
Brewster Lakes
Proposed Transmission Line
Kluskus FSR
Capoose Lake
Capoose Creek
Lake 113
Mills Lake
Chedakuz Creek
Chutanli Lake
Tauk Creek
Kluskus Blue FSR
Turtle Creek
Kluskus Ootsa FSR
Tatelkuz Lake
Proposed Water Pipeline Route
Van Tine Creek
Top Lake
Davidson Creek
Creek 661
Exploration Road
Proposed Mine Access Road
Suscha Lake
Suscha Creek
Chedakuz Creek
Creek 705
Fawnie Creek
Laidman Lake
Mathews Creek
Kuyakuz Lake
Williamson Lake
West Road (Blackwater) River
Euchiniko Lakes
Kluskus Creek
Kushya River
Kluskus Lakes
Bishop Creek
Tsacha Lake

Legend

- Existing Road
- Kluskus FSR
- Kluskus Blue FSR
- Kluskus Ootsa FSR
- Proposed Exploration Road
- Stream
- Waterbody
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Water Pipeline Route
- Proposed Mine Site

Catchments

- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek

Study Areas

- Mine Site Regional Study Area
- Mine Site Local Study Area

Scale:1:200,000

0 1 2 4 6 8 10
Kilometres

Reference
BC Goverenment GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Fish and Aquatic Resource Study Areas

DATE:	ANALYST:	
April, 2013	MY	**Figure** 2.1
JOB No: VE52095	QA/QC: BM	PDF FILE: 10-100-002_v8_aquatic_SA.pdf
GIS FILE: 10-100-002_v8_aquatic.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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347500 350000 352500 355000 357500 360000 362500 365000 367500 370000 372500 375000

5897500 5895000 5892500 5890000 5887500 5885000 5882500 5880000 5877500

Falls Falls

BEAVER DAM

BEAVER DAM

Beaver Dam

Fawnie Creek

Laidman Lake

Davidson Creek

SU:

LKC:

LKC:

Moose Lake

Williamson Lake

Mathews Creek

RB:

BEAVER DAM

Cascade

BEAVER DAM

BEAVER DAM

BEAVER DAM

BEAVER DAM

Wolf Lake

Nagico Lake

West Road (Blackwater) River

West Road (Blackwater) River

Tsacha Lake

N

Legend

- Fish Obstacle (FISS)
- Exisiting Road
- Forest Service Road
- Stream
- Waterbody
- Indian Reserve
- CROWN FEDERAL
- CROWN MUNICIPAL
- CROWN PROVINCIAL
- PRIVATE
- UNKNOWN
- Mathews Creek Watershed

FISS

- LKC - Lake Chub
- RB - Rainbow Trout
- SU - Sucker (General)

Scale:1:90,000

0 0.5 1 2 3 4 5

Kilometres

Reference

BC Goverenment GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

FISS Matthew's Creek

DATE: November, 2012	ANALYST: MY	**Figure**
JOB No: VE52095	QA/QC: BO	PDF FILE: 10-100-089_v2_FISS_matthews_creek.pdf
GIS FILE: 10-100-089_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Annex 5.1-1
Overwintering Habitat Data, March 2013

Table 5.1-1A: Overwintering Habitat Data in Streams, March 2013

Watershed	Stream/Lake Name	Reach	Site Number	Date Sampled	Air Temp (°C)	Habitat Type	Sample Number	Snowpack (cm)	Ice Depth (cm)	Water Depth (cm)	Dissolved Oxygen (mg/L)	Water Temp (°C)	Conductivity (µS/cm)	pH	General Comments
Davidson Creek	Davidson Creek	1	DO-09	12-Mar-13	0	Riffle/Pool/Glide	1	36	0.48	7	12.90	-0.47	123	6.63	Sampled a range of habitat types, notably thick ice within reach near bridge crossing, limited water depths and flow beneath ice, over-wintering habitat limited by thick ice and low flows through reach, no groundwater seeps observed, poor hydraulic connectivity
							2	18	0.62	36	12.94	-0.46	138	7.03	
							3	15	0.54	23	12.97	-0.46	137	7.26	
							4	12	0.50	27	12.91	-0.47	137	7.33	
							5	35	0.56	11	12.98	-0.47	132	7.39	
							6	38	0.32	-	-	-	-	-	
							7	8	0.77	28	12.88	-0.46	119	7.47	
							8	0	0.66	5	-	-	-	-	
Davidson Creek	Davidson Creek	3	DO-09	16-Mar-13	-2	Riffle/Pool/Glide	1	16	0.05	32	14.04	-0.46	133	6.96	Patches of open water, <5% open water, water flowing, good flow, good overwintering potential
							2	0	0.00	11	14.15	-0.46	130	7.30	
							3	35	0.11	52	14.11	-0.46	131	7.15	
Davidson Creek	Davidson Creek	4	DO-19	16-Mar-13	0	Riffle/Pool/Glide	1	36	0.04	23	14.40	-0.46	132	7.66	Less open water compared to Reach 5, some sections recently open, mostly glides/riffles, <5% open water near site
							2	26	0.24	64	14.54	-0.46	130	7.67	
							3	15	0.07	21	14.66	-0.46	132	7.66	
							4	31	0.02	38	14.48	-0.46	131	7.68	
							5	11	0.03	19	14.44	-0.46	131	7.67	
							6	8	0.02	12	14.47	-0.46	131	7.68	
Davidson Creek	Davidson Creek	5	DO-19	16-Mar-13	0	Riffle/Pool/Glide	1	0	0.00	10	14.12	-0.30	127	7.66	Moderate to good overwintering potential, open water sections, relatively thin ice in 2013
							2	0	0.00	18	14.14	-0.30	127	7.65	
							3	23	0.05	47	14.24	-0.30	128	7.67	
Davidson Creek	Davidson Creek	6	DO-19	16-Mar-13	3	Riffle/Pool/Glide	1	0	0.00	12	14.24	-0.37	113	7.63	~40% open water near site, good flow, ice development in pool areas, riffles open, moderate to good overwintering potential
							2	0	0.00	17	14.10	-0.37	113	7.61	
							3	8	0.04	65	14.09	-0.37	113	7.62	
Davidson Creek	Davidson Creek	8	DO-08	15-Mar-13	4	Pool	1	0	0.00	41	13.44	0.63	109	7.58	Open water sections throughout reach, estimated ice cover ~60% to 70%, no groundwater seeps, good hydraulic connectivity, good winter cover for juvenile rainbow trout
							2	0	0.00	49	13.57	0.58	109	7.59	
							3	0	0.00	62	13.76	0.40	110	7.64	
							4	0	0.00	44	13.76	0.49	109	7.64	
							5	0	0.00	40	13.34	0.61	110	7.61	
Davidson Creek	Davidson Creek	10	DO-06	14-Mar-13	3	Pool	1	50	0.08	27	12.41	-0.43	65	6.17	Open sections every 10 m to 20 m, good flow observed beneath ice, poor to fair over-wintering potential, no groundwater seeps observed, potential groundwater influenced
							2	52	0.09	29	12.56	-0.43	64	6.40	
							3	40	0.07	22	12.27	-0.43	63	6.56	
							4	0	0.00	51	12.36	-0.43	60	6.68	
							5	42	0.08	35	12.26	-0.45	58	6.75	
Davidson Creek	Creek 636713	3	DO-22	11-Mar-13	4	Pool	1	35	0.06	-	-	-	-	-	Frozen to bed, elevated ice sheets with no water beneath, ~30 cm to 50 cm snow cover, dewatered, no groundwater seeps observed or hydraulic connectivity, no over-wintering habitat potential
							2	46	0.04	-	-	-	-	-	
							3	44	0.06	-	-	-	-	-	
							4	38	0.08	-	-	-	-	-	
							5	41	0.08	-	-	-	-	-	
Davidson Creek	Creek 688328	1	DO-23	12-Mar-13	1	Pool	1	46	0.19	15	12.16	-0.45	73	7.47	Audible flow beneath ice in some sections, no over-wintering habitat potential, dewatered sections, pools have shallow water and low flow only, limited pool distribution, no groundwater seeps observed, poor hydraulic connectivity
							2	0	0.15	03	-	-	-	-	
							3	55	0.32	3	-	-	-	-	
							4	41	0.10	19	12.39	-0.46	67	7.42	
							5	35	0.15	10	12.30	-0.46	47	7.36	
Davidson Creek	Creek 688328	2	DO-04	15-Mar-13	4	Pool	1	42	1.05	-	-	-	-	-	Frozen to bed, no water, no flow, standing water, no overwintering habitat potential, frozen to bed at most sites
							2	45	0.04	-	-	-	-	-	
							3	85	0.15	-	-	-	-	-	
							4	114	0.07	12	12.80	-0.47	26	6.84	
							5	105	0.12	12	12.50	-0.42	37	6.67	
Davidson Creek	Creek 704454	5	DO-21	11-Mar-13	2	Pool	1	28	0.18	-	-	-	-	-	Pockets of water beneath ice, poor hydraulic connectivity, no groundwater seeps observed, large substrate, limited pool distribution, over-wintering habitat potential limited
							2	56	0.16	22	11.99	-0.46	38	5.59	
							3	42	0.31	-	-	-	-	-	
							4	12	0.32	-	-	-	-	-	
							5	45	0.12	14	11.88	-0.46	27	6.17	

Table continues…

Watershed	Stream/Lake Name	Reach	Site Number	Date Sampled	Air Temp (°C)	Habitat Type	Sample Number	Snowpack (cm)	Ice Depth (cm)	Water Depth (cm)	Dissolved Oxygen (mg/L)	Water Temp (°C)	Conductivity (µS/cm)	pH	General Comments
Turtle Creek	Turtle Creek	3	DO-02	11-Mar-13	2	Pool	1	0	0.11	65	12.75	-0.37	222	7.39	Recent open water conditions evident, thin ice, open water sections in faster flowing glides and riffles, over-wintering habitat present, limited by cover complexity, no groundwater seeps observed, good hydraulic connectivity
							2	0	0.12	75	12.09	-0.30	229	7.44	
							3	0	0.11	103	12.71	0.28	224	7.44	
							4	0	0.14	105	13.06	-0.29	226	7.30	
							5	0	0.10	63	13.05	0.33	238	6.83	
Turtle Creek	Turtle Creek	7	DO-03	15-Mar-13	4	Pool	1	0	0.03	65	11.66	-0.20	208	6.77	Uniform large channel morphology, limited winter cover for juvenile rainbow trout, 100% fine substartes, instream vegetation, deep water habitat ~0.75 m, lack of deep pool habitat and channel complexity, no groundwater seeps, good hydraulic connectivity, winter cover is a limiting factor of overwintering habitat potential
							2	0	0.06	73	11.64	-0.33	169	7.07	
							3	0	0.05	71	11.86	-0.27	208	7.16	
							4	0	0.05	97	11.83	-0.27	209	7.24	
							5	0	0.07	88	11.87	-0.30	186	7.25	
Creek 661	Creek 661	1	DO-15	17-Mar-13	-4	Riffle/Pool/Glide	1	0	0.00	18	14.59	-0.48	76	7.75	Good, strong flow, open water sections throughout, ~20% to 30% open water, good overwintering habitat potential
							2	14	0.25	62	14.25	-0.46	52	7.77	
							3	0	0.00	26	14.55	-0.47	46	7.82	
							4	0	0.00	20	14.64	-0.47	53	7.78	
							5	12	0.06	38	14.66	-0.47	56	7.80	
							6	6	0.04	12	14.68	-0.47	42	7.81	
Creek 661	Creek 661	3	DO-15	17-Mar-13	3	Riffle/Pool/Glide	1	0	0.00	18	14.30	-0.37	130	7.62	Open water sections throughout study area, ~30% to 40% open water, riffle/glides open, pools partially open, good overwintering habitat potential
							2	0	0.00	17	14.30	-0.37	135	7.63	
							3	0	0.03	46	14.33	-0.37	130	7.64	
							4	0	0.00	53	14.23	-0.37	130	7.61	
							5	0	0.02	19	14.43	-0.38	122	7.61	
							6	0	0.00	18	14.44	-0.38	130	7.62	
Creek 661	Creek 661	4	DO-15	17-Mar-13	1	Riffle/Pool/Glide	1	0	0.00	12	14.20	-0.33	91	7.51	Open water sections throughout, ~20% to 30% open water, riffles open, glides are partially open, pools typically have ice cover, good overwintering habitat potential
							2	4	0.03	38	14.19	-0.35	91	7.50	
							3	0	0.00	19	14.20	-0.42	91	7.47	
							4	0	0.00	28	14.18	-0.46	88	7.44	
							5	14	0.03	14	14.18	-0.44	73	7.44	
Creek 661	Creek 661	5	DO-20	16-Mar-13	3	Pool	1	30	1.03	-	-	-	-	-	Frozen to bed, all sampling locations frozen to bed, no overwintering habitat potential
							2	5	1.10	-	-	-	-	-	
							3	12	0.98	-	-	-	-	-	
							4	14	1.05	-	-	-	-	-	
							5	32	0.89	-	-	-	-	-	
Creek 661	Creek 505659	2	DO-13	17-Mar-13	-6	Pool	1	4	0.15	96	10.82	-0.34	103	6.68	Groundwater seep ~50 m upstream of DO-13.5, deep water beneath thin ice, moderate overwintering potential, good low under ice, habitat limited by lack of channel complexity and cover
							2	2	0.13	109	11.07	-0.34	104	7.02	
							3	8	0.10	104	11.01	-0.33	104	7.02	
							4	5	0.12	100	10.62	-0.36	96	6.96	
							5	0	0.02	102	10.99	-0.34	103	6.96	
Creek 705	Creek 705	3	DO-16	15-Mar-13	5	Pool	1	46	0.29	12	5.81	-0.46	243	6.41	Good flow noted at DO-16.3, water depth relatively shallow below ice, low to moderate overwintering habitat potential
							2	55	0.26	1	-	-	-	-	
							3	68	0.08	22	12.18	-0.46	53	6.83	
							4	55	0.10	17	13.54	-0.46	20	6.99	
							5	44	0.08	19	12.46	-0.46	54	6.69	
Chedakuz Creek	Chedakuz Creek	13	DO-25	17-Mar-13	1	Pool	1	0	0.00	54	13.35	1.12	155	7.39	100% open water, open water throughout, good overwintering habitat potential
							2	0	0.00	125	13.83	1.05	152	7.61	
							3	0	0.00	145	14.02	1.18	152	7.65	
							4	0	0.00	122	13.91	1.16	153	7.64	
							5	0	0.00	125	14.02	1.39	152	7.68	

Notes: °C = degrees Celsius, m = metres, mg/L = milligram per litre, µS/cm = microSiemens per centimetre, NTU = nephorimetric turbidity units

Table 5.1-1B: Overwintering Habitat Data in Lakes, March 2013

Watershed	Lake Name	Reach	Site Number	Date Sampled	Air Temp (°C)	Habitat Type	Sample Number	Field UTM	Snowpack (cm)	Ice Depth (cm)	Water Depth (m)	Depth (m)	Dissolved Oxygen (mg/L)	Water Temp (°C)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Secchi Depth (m)	Photo Documentation	General Comments
Davidson Creek	Lake 01682LNRS	12	DO-05	08-Mar-12	2	Lake	1	10U 371274 5894054	23	103	14.5	1	9.45	2.28	66	5.90	-	-	01-03 Site photos, 04 Ice hole, 05-07 aerial view of outlet, small pockets of open water ~150 m from lake, 08 aerial view of lake	
												2	7.84	3.32	61	6.31	-	-		
												3	6.97	3.52	61	6.30	-	-		
												4	6.60	3.52	61	6.22	-	-		
												5	5.91	3.50	61	6.19	-	-		
												6	5.01	3.56	62	6.13	-	-		
												7	4.10	3.58	62	6.11	-	-		
												8	3.42	3.60	63	6.08	-	-		
												9	3.31	3.61	66	6.01	-	-		
												10	3.43	3.65	75	5.99	-	-		
												11	3.90	3.69	122	6.05	-	-		
												12	4.41	3.71	215	6.30	-	-		
												13	4.45	3.71	216	6.37	-	-		
												14	4.43	3.71	216	6.39	-	-		
Creek 705	Lake 01428UEUT	2	DO-18	14-Mar-13	4	Lake	1	10U 369440 5895686	23	89	5.0	1	7.65	2.45	54	6.41	-	-	20-21 sampling site, 22 ice hole	Site sampling 13-Mar-13, re-sampled 14-Mar-13,
												2	4.51	3.58	61	6.46	-	-		
												3	3.18	3.87	69	6.54	-	-		
												4	0.70	4.30	116	6.36	-	-		
												5	0.42	4.14	165	6.56	-	-		
Creek 705	Lake 01538UEUT	6	DO-17	14-Mar-13	3	Lake	1	10U 370201 5893722	15	108	9.0	1	9.45	2.89	48	6.37	-	-	09-12 sampling, 13 ice hole, 14-16 outlet of lake, ice free sections limited, 17-19 aerial view of lake	Site sampling 13-Mar-13, re-sampled 14-Mar-13
												2	8.70	3.51	48	6.49	-	-		
												3	8.25	3.64	48	6.56	-	-		
												4	8.13	3.64	49	6.62	-	-		
												5	7.09	3.75	50	6.65	-	-		
												6	5.39	3.90	53	6.64	-	-		
												7	2.27	4.21	59	6.58	-	-		
												8	0.61	4.57	76	6.47	-	-		
												9	0.36	4.70	105	6.61	-	-		

Notes: °C = degrees Celsius, m = metres, mg/L = milligram per litre, µS/cm = microSiemens per centimetre, NTU = nephorimetric turbidity units

Annex 5.2-1
Mean Monthly Water Temperatures of Streams in the LSA, 2013

Annex 5.2-1: Mean, Maximum, and Minimum Monthly Stream Temperatures by Month and Year and Pooled Years

	Upper Davidson Creek	Middle Davidson Creek	Lower Davidson Creek	Creek 428073	Middle Creek 661	Lower Turtle Creek	Middle Turtle Creek
Site ID	**H10**	**H2**	**H4**	**H9**	**H1**	**ST-03**	**H6**
2013							
Jan	-	-	-	-	0.04	-	-
Feb	-	-	-	-	-0.05	-	-
Mar	-	-	-	-	-0.08	-	-
Apr	-	-	-	-	0.05	-	-
May	3.09	3.11	5.25	12.70	4.03	-	-
Jun	6.87	6.97	8.68	15.27	8.99	-	-
Jul	9.28	9.28	11.08	17.90	10.04	-	-
Aug	10.99	11.67	12.00	19.38	9.90	-	-
Sep	7.21	-	8.76	-	7.19	9.57	10.18
Oct	2.95	-	4.08	-	3.41	4.03	4.67
Nov	-	-	-	-	-	-	-
Dec	-	-	-	-	-	-	-
2011, 2012, and 2013 Pooled							
Jan	0.02	-	-	-	0.06	-0.06	-
Feb	0.04	-	-	-	0.08	-0.06	-
Mar	0.04	-	-	-	0.14	-0.06	-
Apr	0.03	-	-	-	0.40	0.01	-
May	2.07	1.92	3.99	11.66	2.75	4.64	-
Jun	5.79	5.18	7.49	14.75	8.17	10.41	10.89
Jul	8.47	8.32	10.17	18.13	10.01	12.52	13.23
Aug	9.29	9.37	10.73	18.11	9.57	12.11	12.58
Sep	6.55	6.16	7.96	11.23	7.15	9.19	9.76
Oct	2.11	1.84	3.13	5.14	2.57	3.20	4.67
Nov	0.00	0.08	-0.18	-	-0.18	-0.02	-
Dec	0.03	-	-	-	-	-0.06	-

Note: dash indicates no data

Minimum temperature by month

Maximum temperature by month

Monthly temperature data available from one monitoring station only

Annex 5.3-1
Electrofishing Effort, Catch and CPUE, Stream Surveys, Blackwater LSA, 2013

Annex 5.3-1: Electrofishing effort, catch and CPUE, stream surveys, Blackwater LSA, 2013

Gazetted / Local Name	Date	Reach	Site	Method	# of Traps / Rods	Time In	Date Out	Time Out	Total Effort[1]	Species	Total Fish	CPUE[2]	EF settings	Voltage	Water temp	Conductivity	pH	Comments
Davidson Creek	09-Jul-13	1	FI-66	EF	n/a	11:30	09-Jul-13	12:45	3134	RB	2	0.06	I5	500	10.9	83	7.0	3 Pass
Davidson Creek	11-Jul-13	2	FI-67	EF	n/a	11:51	11-Jul-13	13:32	2234	RB	13	0.58	I5	700	8.7	84	7.4	
Davidson Creek	10-Jul-13	3	FI-68	EF	n/a	12:30	10-Jul-13	13:39	1212	RB	4	0.33	I5	600	10.1	81	7.0	
Davidson Creek	11-Jul-13	4	FI-69	EF	n/a	13:30	11-Jul-13	14:39	1213	MW	1	0.08	I5	600	10.1	81	7.0	
Creek 705	14-Aug-13	1	FI-115	EF	n/a	9:30	14-Aug-13	10:20	4326	RB	258	5.96	I5	400	10.7	95	6.5	3 Pass
Creek 705	13-Aug-13	2	FI-114	EF	n/a	9:42	13-Aug-13	10:30	3045	RB	104	3.42	I5	300	12.0	80	6.6	3 Pass
Creek 705	16-Aug-13	3	FI-116	EF	n/a	14:05	16-Aug-13	14:35	934	RB	5	0.54	I5	400	13.6	70	6.7	
Creek 705	21-Aug-13	4	FI-117	EF	n/a	9:15	21-Aug-13	10:03	568	RB	30	5.28	I5	300	7.1	53	6.3	
Creek 705	23-Aug-13	5	FI-118	EF	n/a	8:30	23-Aug-13	9:13	647	RB	13	2.01	I6	300	11.0	42	6.8	
Creek 705	23-Aug-13	6	FI-119	EF	n/a	13:06	23-Aug-13	13:30	764	RB	22	2.88	I6	400	14.6	42	7.6	
Creek 705	14-Sep-13	8	FI-120	EF	n/a	12:18	14-Sep-13	14:13	1672	RB	11	0.66	J5	700	12.5	86	-	2 Pass
Creek 705	13-Sep-13	9	FI-121	MT	1	9:18	13-Sep-13	15:50	6.53	LSU	10	153.14	-	-	16.8	87	7.3	Trap 1
Creek 705	13-Sep-13	9	FI-121	MT	1	9:20	13-Sep-13	16:02	6.7	LSU	4	59.70	-	-	16.8	87	7.3	Trap 2
Creek 705	13-Sep-13	9	FI-121	MT	1	9:25	13-Sep-13	16:10	6.75	LSU	1	14.81	-	-	16.8	87	7.3	Trap 3
Creek 705	13-Sep-13	9	FI-121	MT	1	9:28	13-Sep-13	16:12	6.73	LSU	9	133.73	-	-	16.8	87	7.3	Trap 4
Creek 705	13-Sep-13	9	FI-121	MT	1	9:31	13-Sep-13	16:30	6.98	LSU	191	2736.39	-	-	16.8	87	7.3	Trap 5
Creek 705	13-Sep-13	9	FI-121	MT	1	9:15	13-Sep-13	17:28	8.22	LSU	141	1715.33	-	-	16.8	87	7.3	Trap 6
Creek 705	13-Sep-13	9	FI-121	MT	1	9:20	13-Sep-13	17:38	8.30	LSU	8	96.39	-	-	16.8	87	7.3	Trap 7
Creek 705	13-Sep-13	9	FI-121	MT	1	9:25	13-Sep-13	17:15	8.83	LSU	17	192.53	-	-	16.8	87	7.3	Trap 8
Creek 705	13-Sep-13	9	FI-121	MT	1	9:32	13-Sep-13	16:46	8.23	LSU	240	2916.16	-	-	16.8	87	7.3	Trap 9
Creek 705	13-Sep-13	9	FI-121	MT	1	9:36	13-Sep-13	17:03	8.45	LSU	304	3597.63	-	-	16.8	87	7.3	Trap 10
Creek 705	14-Sep-13	10	FI-45	EF	n/a	15:04	14-Sep-13	15:16	531	NFC	0	0	I6	700	10	85	8.7	
Creek 705	14-Sep-13	11	FI-122	EF	n/a	15:14	14-Sep-13	16:25	544	NFC	0	0	J5	700	6.5	85	-	
Unnamed	17-Aug-13	3	PL-1	EF	n/a	-	17-Aug-13	-	368	NFC	0	0	-	-	11.5	215	7	
Unnamed	17-Aug-13	-	PL-3	EF	n/a	-	17-Aug-13	-	584	NFC	0	0	-	-	10.5	156	7.5	
Creek 704454	23-Aug-13	4	PL-5	EF	n/a	17:42	23-Aug-13	18:09	489	RB	1	0.20449898	I6	400	10	29	8.1	
Creek 505659	21-Aug-13	7	PL-7	EF	n/a	16:15	21-Aug-13	16:46	136	NFC	0	0	I6	400	6	91	7.2	
Unnamed	18-Aug-13	5	PL-8	EF	n/a	-	18-Aug-13	-	667	NFC	0	0	-	-	10.4	195	6.9	
Creek 505659	24-Aug-13	5	PL-9	EF	n/a	15:16	24-Aug-13	15:51	452	RB	1	0.22123894	I6	300	6.9	96	6.7	Trap 1
Chedakuz Creek	23-Jul-13	15	–	MT	1	17:40	25-Jul-13	14:35	44.92	CCG	2	4.45235975	-	-	-	-	-	Trap 2
Chedakuz Creek	23-Jul-13	15	–	MT	1	17:46	25-Jul-13	13:10	43.4	NFC	0	0	-	-	-	-	-	Trap 3
Chedakuz Creek	23-Jul-13	15	–	MT	1	17:52	25-Jul-13	12:58	43.1	LSU	1	2.32018561	-	-	-	-	-	Trap 4
Chedakuz Creek	23-Jul-13	15	–	MT	1	17:55	25-Jul-13	12:55	43	NFC	0	0	-	-	-	-	-	Trap 5
Chedakuz Creek	23-Jul-13	15	–	MT	1	17:58	25-Jul-13	12:45	42.78	CCG	1	2.33754091	-	-	-	-	-	Trap 6
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:05	25-Jul-13	12:32	41.55	NFC	0	0	-	-	-	-	-	Trap 7
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:08	25-Jul-13	12:25	41.72	NFC	0	0	-	-	-	-	-	Trap 8
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:11	25-Jul-13	12:20	41.85	NFC	0	0	-	-	-	-	-	Trap 9
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:14	25-Jul-13	12:17	41.95	NFC	0	0	-	-	-	-	-	Trap 10
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:17	25-Jul-13	12:15	42.03	LSU	1	2.37925291	-	-	-	-	-	Trap 11
Chedakuz Creek	23-Jul-13	15	–	MT	1	18:20	25-Jul-13	12:10	42.17	NFC	0	0	-	-	-	-	-	Trap 12

Note: EF - electrofishing; MT - minnow trapping; CPUE - catch-per-unit-effort; LSU - longnose sucker; F - female; BB - burbot; MW - mountain whitefish; RB - rainbow trout; SC - scales; OT - otolith

[1] EF effort is in seconds; MT effort is in trap-hours

[2] EF CPUE is in # fish/100 seconds; MT CPUE is in # fish/100 trap hours

n/a- not applicable; dash indicates no data

Annex 5.3-2
Fish Biological Characteristics, Stream Surveys, July 2013

Annex 5.3-2: Fish Biological Characteristics, Stream Surveys, 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Davidson Creek	09-Jul-13	1	FI-67	EF	20-001	RB	51	2.55	1.92	U	I	SC	SC	0	–	F	Released
Davidson Creek	09-Jul-13	1	FI-67	EF	20-002	RB	52	1.85	1.32	U	I	SC	SC	0	–	F	Released
Davidson Creek	10-Jul-13	3	FI-68	EF	20-003	RB	52	1.75	1.24	U	I	SC, OT	SC	–	2	F	Mortality
Davidson Creek	10-Jul-13	3	FI-68	EF	20-004	RB	56	2.25	1.28	U	I	SC	SC	0	–	F	Released
Davidson Creek	10-Jul-13	3	FI-68	EF	20-005	RB	104	10.15	0.90	U	I	SC	SC	1	–	F	Released
Davidson Creek	10-Jul-13	3	FI-68	EF	20-006	RB	68	3.35	1.07	U	I	SC	SC	0	–	F	Released
Davidson Creek	10-Jul-13	3	FI-68	EF	20-007	MW	127	19.50	0.95	U	I	SC	SC	1	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-008	RB	59	2.20	1.07	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-009	RB	58	2.00	1.03	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-010	RB	48	1.30	1.18	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-011	RB	64	2.35	0.90	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-012	RB	59	2.55	1.24	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-013	RB	47	1.30	1.25	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-014	RB	56	2.15	1.22	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-015	RB	39	0.60	1.01	U	I	SC	envelope empty	–	–	–	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-016	RB	57	2.45	1.32	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-017	RB	221	125.00	1.16	U	M	SC	SC	3	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-018	RB	39	0.35	0.59	U	I	SC	envelope empty	–	–	–	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-019	RB	60	2.10	0.97	U	I	SC	SC	0	–	F	Released
Davidson Creek	11-Jul-13	2	FI-67	EF	20-020	RB	50	1.60	1.28	U	I	SC, OT	SC	–	1	F	Mortality
Creek 705	14-Aug-13	1	FI-115	EF	20-021	BB	125	13.50	0.69	U	U	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-022	RB	81	5.40	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-023	RB	87	6.40	0.97	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-024	RB	75	3.95	0.94	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-025	RB	73	4.10	1.05	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-026	RB	80	5.80	1.13	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-027	RB	62	2.70	1.13	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-028	RB	92	8.50	1.09	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-029	RB	81	5.70	1.07	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-030	RB	66	4.00	1.39	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-031	RB	72	4.20	1.13	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-032	RB	120	–	–	U	I	–	–	–	–	–	Lost
Creek 705	14-Aug-13	1	FI-115	EF	20-033	RB	71	4.40	1.23	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-034	RB	110	15.30	1.15	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-035	RB	95	8.80	1.03	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-036	RB	72	3.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-037	RB	103	11.20	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-038	RB	82	6.30	1.14	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-039	RB	84	6.20	1.05	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-040	RB	83	5.90	1.03	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-041	RB	71	3.00	0.84	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-042	RB	60	2.70	1.25	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-043	RB	64	3.10	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-044	RB	63	2.90	1.16	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-045	RB	60	2.80	1.30	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-046	RB	58	2.50	1.28	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	14-Aug-13	1	FI-115	EF	20-047	RB	68	3.40	1.08	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-048	RB	72	3.50	0.94	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-049	RB	85	5.70	0.93	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-050	RB	54	1.60	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-051	RB	35	0.30	0.70	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-052	RB	34	0.40	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-053	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-054	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-055	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-056	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-057	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-058	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-059	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-060	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-061	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-062	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-063	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-064	RB	26	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-065	RB	39	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-066	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-067	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-068	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-069	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-070	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-071	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-072	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-073	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-074	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-075	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-076	RB	30	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-077	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-078	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-079	RB	38	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-080	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-081	RB	30	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-082	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-083	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-084	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-085	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-086	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-087	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-088	RB	39	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-089	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-090	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-091	RB	39	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-092	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-093	RB	36	–	–	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	14-Aug-13	1	FI-115	EF	20-094	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-095	RB	31	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-096	RB	29	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-097	RB	31	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-098	RB	30	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-099	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-100	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-101	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-102	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-103	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-104	RB	28	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-105	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-106	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-107	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-108	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-109	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-110	RB	27	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-111	RB	28	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-112	RB	38	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-113	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-114	RB	30	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-115	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-116	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-117	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-118	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-119	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-120	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-121	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-122	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-123	RB	38	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-124	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-125	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-126	RB	38	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-127	RB	38	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-128	RB	37	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-129	RB	36	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-130	RB	35	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-131	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-132	RB	31	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-133	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-134	RB	29	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-135	RB	85	6.60	1.07	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-136	RB	87	8.30	1.26	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-137	RB	96	10.20	1.15	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-138	RB	74	4.60	1.14	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-139	RB	85	–	–	U	I	–	–	–	–	–	Lost
Creek 705	14-Aug-13	1	FI-115	EF	20-140	RB	79	5.70	1.16	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	14-Aug-13	1	FI-115	EF	20-141	RB	84	7.50	1.27	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-142	RB	98	9.40	1.00	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-143	RB	85	6.60	1.07	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-144	RB	96	9.00	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-145	RB	64	2.70	1.03	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-146	RB	59	2.65	1.29	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-147	RB	79	5.10	1.03	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-148	RB	79	4.90	0.99	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-149	RB	64	3.10	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-150	RB	66	3.10	1.08	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-151	RB	65	–	–	U	I	–	–	–	–	–	Lost
Creek 705	14-Aug-13	1	FI-115	EF	20-152	RB	75	4.60	1.09	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-153	RB	73	4.60	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-154	RB	68	3.70	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-155	RB	72	4.40	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-156	RB	69	3.60	1.10	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-157	RB	62	2.40	1.01	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-158	RB	73	4.40	1.13	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-159	RB	85	6.50	1.06	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-160	RB	29	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-161	RB	29	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-162	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-163	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-164	RB	42	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-165	RB	39	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-166	RB	33	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-167	RB	32	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-168	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-169	RB	34	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-170	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-171	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-172	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-173	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-174	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-175	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-176	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-177	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-178	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-179	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-180	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-181	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-182	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-183	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-184	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-185	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-186	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-187	RB	<40	–	–	U	I	–	–	–	–	–	Released

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Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	14-Aug-13	1	FI-115	EF	20-188	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-189	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-190	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-191	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-192	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-193	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-194	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-195	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-196	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-197	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-198	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-199	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-200	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-201	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-202	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-203	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-204	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-205	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-206	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-207	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-208	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-209	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-210	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-211	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-212	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-213	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-214	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-215	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-216	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-217	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-218	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-219	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-220	BB	130	17.30	0.79	U	U	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-221	BB	193	53.90	0.75	U	U	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-222	RB	103	10.30	0.94	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-223	RB	75	5.10	1.21	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-224	RB	71	3.60	1.01	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-225	RB	65	2.70	0.98	U	I	–	–	–	–	–	Released ate a RB YOY
Creek 705	14-Aug-13	1	FI-115	EF	20-226	RB	68	3.00	0.95	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-227	RB	63	2.40	0.96	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-228	RB	66	3.30	1.15	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-229	RB	27	0.20	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-230	RB	32	0.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-231	RB	34	0.40	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-232	RB	32	0.35	1.07	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-233	RB	34	0.40	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-234	RB	32	0.30	0.92	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	14-Aug-13	1	FI-115	EF	20-235	RB	34	0.35	0.89	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-236	RB	34	0.30	0.76	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-237	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-238	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-239	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-240	RB	36	0.40	0.86	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-241	RB	40	0.60	0.94	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-242	RB	38	0.50	0.91	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-243	RB	35	0.45	1.05	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-244	RB	34	0.45	1.14	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-245	RB	38	0.50	0.91	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-246	RB	36	0.55	1.18	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-247	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-248	RB	38	0.55	1.00	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-249	RB	37	0.45	0.89	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-250	RB	32	0.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-251	RB	32	0.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-252	RB	34	0.35	0.89	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-253	RB	35	0.55	1.28	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-254	RB	30	0.20	0.74	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-255	RB	35	0.35	0.82	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-256	RB	29	0.15	0.62	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-257	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-258	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-259	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-260	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-261	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-262	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-263	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-264	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-265	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-266	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-267	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-268	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-269	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-270	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-271	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-272	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-273	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-274	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-275	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-276	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-277	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-278	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-279	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-280	RB	<40	–	–	U	I	–	–	–	–	–	Released
Creek 705	14-Aug-13	1	FI-115	EF	20-281	RB	<40	–	–	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Aug-13	2	FI-114	EF	20-282	RB	65	2.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-283	RB	63	2.90	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-284	RB	63	2.90	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-285	RB	72	4.20	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-286	RB	68	3.50	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-287	RB	59	2.40	1.17	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-288	RB	35	0.30	0.70	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-289	RB	35	0.35	0.82	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-290	RB	76	4.70	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-291	RB	67	3.20	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-292	RB	84	6.20	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-293	RB	68	3.20	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-294	RB	64	2.10	0.80	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-295	RB	33	0.35	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-296	RB	86	6.20	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-297	RB	84	6.80	1.15	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-298	RB	58	2.10	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-299	RB	97	10.80	1.18	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-300	RB	86	6.70	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-301	RB	84	6.20	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-302	RB	83	6.10	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-303	RB	74	4.40	1.09	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-304	RB	79	6.00	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-305	RB	76	5.00	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-306	RB	68	3.50	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-307	RB	74	4.40	1.09	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-308	RB	76	4.70	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-309	RB	69	3.50	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-310	RB	70	3.50	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-311	RB	57	2.20	1.19	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-312	RB	56	1.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-313	RB	120	19.20	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-314	RB	71	3.90	1.09	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-315	RB	132	27.80	1.21	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-316	RB	32	0.35	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-317	RB	32	0.25	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-318	RB	33	0.25	0.70	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-319	RB	33	0.20	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-320	RB	36	0.45	0.96	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-321	RB	44	0.60	0.70	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-322	RB	34	0.35	0.89	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-323	RB	32	0.25	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-324	RB	32	0.25	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-325	RB	33	0.20	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-326	RB	61	2.60	1.15	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-327	RB	34	0.30	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-328	RB	34	0.35	0.89	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Aug-13	2	FI-114	EF	20-329	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-330	RB	30	0.15	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-331	RB	30	0.20	0.74	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-332	RB	31	0.30	1.01	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-333	RB	41	0.55	0.80	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-334	RB	30	0.20	0.74	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-335	RB	32	0.25	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-336	RB	35	0.35	0.82	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-337	RB	30	0.15	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-338	RB	33	0.25	0.70	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-339	RB	78	5.25	1.11	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-340	RB	110	14.80	1.11	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-341	RB	73	4.50	1.16	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-342	RB	33	0.40	1.11	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-343	RB	35	0.40	0.93	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-344	RB	90	7.60	1.04	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-345	RB	74	3.85	0.95	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-346	RB	73	4.60	1.18	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-347	RB	63	3.10	1.24	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-348	RB	60	2.40	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-349	RB	74	5.20	1.28	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-350	RB	80	6.10	1.19	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-351	RB	67	3.80	1.26	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-352	RB	73	4.10	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-353	RB	60	2.65	1.23	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-354	RB	94	9.55	1.15	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-355	RB	73	5.05	1.30	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-356	RB	73	4.40	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-357	RB	75	5.15	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-358	RB	70	4.10	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-359	RB	103	13.10	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-360	RB	100	10.00	1.00	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-361	RB	68	3.80	1.21	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-362	RB	61	2.50	1.10	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-363	RB	147	32.35	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-364	RB	33	0.35	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-365	RB	30	0.30	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-366	RB	32	0.40	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-367	RB	35	0.45	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-368	RB	30	0.15	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-369	RB	70	4.20	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-370	RB	33	0.30	0.83	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-371	RB	29	0.15	0.62	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-372	RB	30	0.20	0.74	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-373	RB	31	0.25	0.84	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-374	RB	64	3.35	1.28	U	I	–	–	–	–	–	Mortality
Creek 705	13-Aug-13	2	FI-114	EF	20-375	RB	76	5.20	1.18	U	I	–	–	–	–	–	Mortality

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Aug-13	2	FI-114	EF	20-376	RB	104	12.75	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-377	RB	81	6.15	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-378	RB	81	5.50	1.03	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-379	RB	35	0.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-380	RB	33	0.35	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-381	RB	32	0.25	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-382	RB	34	0.30	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-383	RB	30	0.15	0.56	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-384	RB	34	0.25	0.64	U	I	–	–	–	–	–	Released
Creek 705	13-Aug-13	2	FI-114	EF	20-385	RB	33	0.30	0.83	U	I	–	–	–	–	–	Released
Creek 705	16-Aug-13	3	FI-116	EF	20-386	RB	104	14.20	1.26	U	I	–	–	–	–	–	Released
Creek 705	16-Aug-13	3	FI-116	EF	20-387	RB	82	5.90	1.07	U	I	–	–	–	–	–	Released
Creek 705	16-Aug-13	3	FI-116	EF	20-388	RB	124	27.90	1.46	U	I	–	–	–	–	–	Released
Creek 705	16-Aug-13	3	FI-116	EF	20-389	RB	150	–	–	U	I	–	–	–	–	–	Lost
Creek 705	16-Aug-13	3	FI-116	EF	20-390	RB	100	–	–	U	I	–	–	–	–	–	Lost
Creek 705	21-Aug-13	4	FI-117	EF	21-001	RB	76	5.35	1.22	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-002	RB	73	4.00	1.03	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-003	RB	62	3.15	1.32	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-004	RB	84	7.55	1.27	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-005	RB	68	3.15	1.00	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-006	RB	57	1.95	1.05	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-007	RB	57	2.05	1.11	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-008	RB	55	2.20	1.32	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-009	RB	43	0.95	1.19	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-010	RB	59	2.05	1.00	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-011	RB	68	2.70	0.86	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-012	RB	60	2.75	1.27	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-013	RB	58	2.50	1.28	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-014	RB	36	0.80	1.71	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-015	RB	68	3.55	1.13	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-016	RB	66	3.60	1.25	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-017	RB	67	3.30	1.10	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-018	RB	59	2.34	1.14	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-019	RB	34	0.60	1.53	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-020	RB	42	0.70	0.94	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-021	RB	41	0.60	0.87	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-022	RB	34	0.30	0.76	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-023	RB	40	0.55	0.86	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-024	RB	41	0.75	1.09	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-025	RB	57	2.00	1.08	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-026	RB	34	0.35	0.89	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-027	RB	42	0.75	1.01	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-028	RB	36	0.55	1.18	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-029	RB	75	4.75	1.13	U	I	–	–	–	–	–	Released
Creek 705	21-Aug-13	4	FI-117	EF	21-030	RB	68	3.40	1.08	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-001	RB	33	0.45	1.25	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-002	RB	37	0.55	1.09	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
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Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	23-Aug-13	5	FI-118	EF	22-003	RB	46	0.85	0.87	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-004	RB	43	0.80	1.01	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-005	RB	46	0.95	0.98	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-006	RB	47	1.10	1.06	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-007	RB	40	0.55	0.86	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-008	RB	39	0.45	0.76	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-009	RB	68	3.55	1.13	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-010	RB	44	0.85	1.00	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-011	RB	49	1.35	1.15	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-012	RB	35	0.41	0.96	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	5	FI-118	EF	22-013	RB	76	4.95	1.13	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-001	LSU	96	10.80	1.22	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-002	RB	70	3.80	1.11	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-003	RB	82	6.30	1.14	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-004	RB	78	4.40	0.93	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-005	RB	28	0.15	0.68	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-006	RB	38	0.55	1.00	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-007	RB	28	0.20	0.91	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-008	RB	30	0.15	0.56	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-009	RB	28	0.15	0.68	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-010	RB	28	0.30	1.37	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-011	RB	31	0.35	1.17	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-012	RB	22	0.10	0.94	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-013	RB	23	0.16	1.32	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-014	RB	24	0.18	1.30	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-015	RB	23	0.15	1.23	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-016	RB	32	0.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-017	RB	33	0.50	1.39	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-018	RB	21	0.10	1.08	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-019	RB	25	0.10	0.64	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-020	RB	28	0.28	1.28	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-021	RB	20	0.10	1.25	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-022	RB	20	0.12	1.50	U	I	–	–	–	–	–	Released
Creek 705	23-Aug-13	6	FI-119	EF	23-023	RB	20	0.10	1.25	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-001	RB	92	7.10	0.91	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-002	RB	73	4.00	1.03	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-003	RB	80	4.60	0.90	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-004	RB	96	8.50	0.96	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-005	RB	77	4.40	0.96	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-006	RB	88	5.70	0.84	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-007	RB	94	8.20	0.99	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-008	RB	88	6.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-009	RB	93	7.30	0.91	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-010	RB	87	6.70	1.02	U	I	–	–	–	–	–	Released
Creek 705	14-Sep-13	8	FI-120	EF	24-011	RB	82	6.70	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-012	LSU	54	2.2	1.40	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-013	LSU	59	2.3	1.12	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Sep-13	9	FI-121	MT	24-014	LSU	58	2.2	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-015	LSU	68	3.4	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-016	LSU	49	1.7	1.44	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-017	LSU	57	2.3	1.24	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-018	LSU	63	2.6	1.04	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-019	LSU	60	2.4	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-020	LSU	66	3.2	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-021	LSU	61	2.5	1.10	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-022	LSU	62	2.5	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-023	LSU	58	1.9	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-024	LSU	57	1.8	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-025	LSU	58	2.2	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-026	LSU	57	1.8	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-027	LSU	61	2.3	1.01	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-028	LSU	53	1.6	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-029	LSU	55	1.6	0.96	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-030	LSU	58	1.9	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-031	LSU	67	2.8	0.93	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-032	LSU	49	1.3	1.10	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-033	LSU	44	1.1	1.29	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-034	LSU	50	1.6	1.28	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-035	LSU	54	1.90	1.21	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-036	LSU	57	1.80	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-037	LSU	59	2.60	1.27	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-038	LSU	58	2.30	1.18	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-039	LSU	69	2.50	0.76	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-040	LSU	54	1.50	0.95	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-041	LSU	59	3.10	1.51	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-042	LSU	63	2.70	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-043	LSU	58	2.20	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-044	LSU	54	1.70	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-045	LSU	58	1.90	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-046	LSU	55	2.00	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-047	LSU	60	2.50	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-048	LSU	66	3.30	1.15	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-049	LSU	54	1.80	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-050	LSU	53	2.00	1.34	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-051	LSU	56	1.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-052	LSU	53	1.60	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-053	LSU	62	2.40	1.01	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-054	LSU	49	1.40	1.19	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-055	LSU	48	1.30	1.18	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-056	LSU	65	2.90	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-057	LSU	63	2.30	0.92	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-058	LSU	52	1.40	1.00	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-059	LSU	56	1.90	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-060	LSU	68	3.70	1.18	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Sep-13	9	FI-121	MT	24-061	LSU	53	1.40	0.94	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-062	LSU	65	2.70	0.98	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-063	LSU	53	1.70	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-064	LSU	56	2.10	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-065	LSU	58	2.30	1.18	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-066	LSU	54	1.70	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-067	LSU	53	1.40	0.94	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-068	LSU	54	1.50	0.95	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-069	LSU	58	2.10	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-070	LSU	56	2.40	1.37	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-071	LSU	63	3.00	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-072	LSU	59	2.40	1.17	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-073	LSU	56	1.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-074	LSU	60	2.50	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-075	LSU	55	1.60	0.96	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-076	LSU	53	1.20	0.81	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-077	LSU	59	1.90	0.93	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-078	LSU	56	1.70	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-079	LSU	58	2.69	1.38	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-080	LSU	58	2.20	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-081	LSU	66	3.50	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-082	LSU	64	2.40	0.92	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-083	LSU	45	1.50	1.65	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-084	LSU	62	2.90	1.22	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-085	LSU	104	11.80	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-086	LSU	67	3.40	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-087	LSU	56	1.80	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-088	LSU	68	3.60	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-089	LSU	56	1.90	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-090	LSU	67	2.70	0.90	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-091	LSU	61	2.60	1.15	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-092	LSU	58	2.20	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-093	LSU	60	2.20	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-094	LSU	67	3.30	1.10	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-095	LSU	93	8.50	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-096	LSU	72	3.70	0.99	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-097	LSU	64	2.80	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-098	LSU	74	4.20	1.04	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-099	LSU	104	11.70	1.04	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-100	LSU	63	2.50	1.00	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-101	LSU	61	2.30	1.01	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-102	LSU	55	1.60	0.96	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-103	LSU	108	13.20	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-104	LSU	145	32.30	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-105	LSU	136	25.50	1.01	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-106	LSU	106	13.60	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-107	LSU	111	14.10	1.03	U	I	–	–	–	–	–	Released

Annex 5.3-2
Stream Fish Biological Characteristics,
Blackwater LSA 2013

Stream	Date	Reach	Baseline Map Site ID	Method[1]	Fish ID	Species[2]	Length (mm)	Weight (g)	Condition	Sex[3]	Maturity[4]	Age Structure	Age Structure Read	Scale Age	Otolith Age	Age Confidence	Comments
Creek 705	13-Sep-13	9	FI-121	MT	24-108	LSU	94	8.70	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-109	LSU	109	13.30	1.03	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-110	LSU	108	13.60	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-111	LSU	87	6.50	0.99	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-112	LSU	73	4.00	1.03	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-113	LSU	93	8.70	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-114	LSU	58	2.00	1.03	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-115	LSU	94	8.80	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-116	LSU	67	3.20	1.06	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-117	LSU	97	10.20	1.12	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-118	LSU	60	2.50	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-119	LSU	62	2.60	1.09	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-120	LSU	98	10.4	1.10	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-121	LSU	114	14.5	0.98	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-122	LSU	98	9.6	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-123	LSU	87	7.1	1.08	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-124	LSU	57	1.9	1.03	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-125	LSU	58	2.4	1.23	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-126	LSU	68	3.6	1.14	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-127	LSU	59	2.1	1.02	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-128	LSU	51	1.5	1.13	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-129	LSU	56	1.7	0.97	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-130	LSU	60	2.50	1.16	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-131	LSU	55	2.00	1.20	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-132	LSU	65	3.40	1.24	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-133	LSU	63	2.10	0.84	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-134	LSU	68	3.30	1.05	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-135	LSU	64	2.80	1.07	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-136	LSU	48	1.40	1.27	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-137	LSU	64	2.90	1.11	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-138	LSU	67	2.90	0.96	U	I	–	–	–	–	–	Released
Creek 705	13-Sep-13	9	FI-121	MT	24-139	LSU	68	3.20	1.02	U	I	–	–	–	–	–	Released
Creek 704454	23-Aug-13	4	PL-5	EF	24-140	RB	156	–	–	U	I	–	–	–	–	–	Weigh scale malfunction, missed one RB of similar size
Creek 505659	24-Aug-13	5	PL-9	EF	24-141	RB	149	36.10	1.09	U	I	–	–	–	–	–	Released
Chedakuz Creek	23-Jul-13	15	–	MT	25-001	CCG	54	–	–	U	U	–	–	–	–	–	Released
Chedakuz Creek	23-Jul-13	15	–	MT	25-002	CCG	94	–	–	U	U	–	–	–	–	–	Released
Chedakuz Creek	23-Jul-13	15	–	MT	25-003	LSU	74	–	–	U	I	–	–	–	–	–	Released
Chedakuz Creek	23-Jul-13	15	–	MT	25-004	CCG	99	–	–	U	U	–	–	–	–	–	Released
Chedakuz Creek	23-Jul-13	15	–	MT	25-005	LSU	69	–	–	U	I	–	–	–	–	–	Released

Note: g - grams; mm - millimetre; OT - otolith; SC - scales; Y - yes

[1] EF - electrofishing; MT - minnow trapping

[2] BB - burbot; LSU - longnose sucker; MW - mountain whitefish; RB - rainbow trout

[3] F - female; M - male; U - unknown

[4] I - immature; M - mature

dash indicated no data

Annex 5.4-1
Fish Habitat Assessment Procedure Data, Stream Surveys, Blackwater LSA, 2013

Table 1 Fisheries Habitat Assessment Procedures (FHAP) Data for Chedakuz Creek - Reach 15

Level 1 Fish Habitat Survey Data Form
Stream Name: Chedakuz Creek
Freshwater Atlas 100-567134-610692
Reach: 15

Subsampling Fractions: 1 R | 1 P | 2 G | 4 O

Survey Dates: 24-Jul-13
Weather: Sunny
Field Crew: BH, RS

No.	Transect	Reach	Habitat Unit		Gradient	Mean Depth					Mean Width		Pools Only				Bed Material Type				Total LWD Tally	Functional LWD Tally			Cover						Off-Channel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Active Channel Width (m)
						Bankfull	Water (m)				Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-Dom.	Spawning Gravels			10-20 cm	20-50 cm	>50 cm	Cover Type	%	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure		
			Type	Cat	(%)	(m)	0.25	0.50	0.75	Mean	(m)	(m)	Depth	(m)	(m)	Type			Type	Amount																	
1	1	1	G	1	0.5	0.35	0.69	0.91	0.73	0.78	14.5	11.8	-	-	-	-	S	G	R	L	8	8	0	0	SWD	< 5	IV	5-10	-	-	SL	G	4	none	G	SHR	1	N	12
1	2	1	G	1	0.5	0.3	0.74	0.64	0.52	0.63	22.7	19.6	-	-	-	-	S	G	R	L	-	-	-	-	LWD	< 1	IV		-	-	SL	G	10	none	SH	SHR	0	N	19.6
1	3	1	G	1	0.5	0.45	0.36	0.54	0.47	0.46	15.3	13.3	-	-	-	-	S	G	R	L	-	-	-	-	SWD	< 1	IV	5-10	-	-	N	-	-	none	G/SH	SHR	0	N	13.3
2	1	1	O	3	0.5	0.2	0.23	0.36	0.45	0.35	N/A	12.6	-	-	-	-	S	-	-	N	2	2	0	0	IV	100	LWD	< 1	-	-	SL	G	-	none	G	SHR	0	N	-
2	2	1	O	3	0.5	0.21	0.34	0.29	0.4	0.34	N/A	9.4	-	-	-	-	S	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	none	-	-	-	-	-
2	3	1	O	3	0.5	0.2	0.21	0.27	0.6	0.36	N/A	8.2	-	-	-	-	S	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	none	-	-	-	-	-
3	1	1	R	1	1	0.4	0.41	0.48	0.39	0.43	18.5	16.8	-	-	-	-	S	G	R	L	0	0	0	0	SWD	1	IV	< 5	OV	< 1	N	-	-	none	SH/G	SHR	< 1	N	16.8
3	2	1	R	1	1	0.32	0.29	0.37	0.49	0.38	18	16.8	-	-	-	-	G	S	R	H	0	0	0	0	SWD	< 1	IV	< 1	-	-	N	-	-	none	G	SHR	0	N	16.8
3	3	1	R	1	1	0.37	0.31	0.32	0.25	0.29	19.4	17.7	-	-	-	-	G	S	R	H	0	0	0	0	SWD	5	IV	< 1	-	-	N	-	-	none	SH/G	SHR	0	N	17.7
4	1	1	P	1	0.5	0.2	0.92	1.14	1.06	1.04	38	35.6	1.75	0.49	1.26	S	S	G	-	-	1	1	0	0	DP	80	IV	45	-	-	SL	G	45	none	G	SHR	0	N	35.6
4	2	1	P	1	0.5	0.19	1.08	1.57	1.48	1.38	37.9	34.7	-	-	-	-	S	G	-	-	-	-	-	-	DP	80	IV	60	-	-	SL	G	45	none	G	SHR	0	N	34.5
4	3	1	P	1	0.5	0.25	1.13	1.3	1.3	1.24	33.2	30.6	-	-	-	-	S	G	-	-	-	-	-	-	DP	70	IV	50	-	-	N	N	0	none	G	SHR	0	N	30.5
5	1	1	G	1	0.5	0.45	0.28	0.63	0.54	0.48	29.5	26.4	-	-	-	-	G	S	R	H	4	4	0	0	SWD	< 5	IV	15	-	-	N	N	N	none	SH	SHR	0	N	26.4
5	2	1	G	1	0.5	0.3	0.72	0.87	0.59	0.73	24	22.4	-	-	-	-	S	S	R	L	-	-	-	-	SWD	10	IV	10	-	-	N	N	N	none	G	SHR	0	N	-
5	3	1	G	1	0.5	0.25	0.28	0.27	0.53	0.36	26.6	16.2	-	-	-	-	S	G	R	L	-	-	-	-	SWD	5-10	IV	<5	-	-	N	N	N	none	G	SHR	0	N	16.2
6	1	1	P	1	0.5	0.24	1.15	1.18	0.95	1.09	33.6	31.1	2.3	0.65	1.65	S	S	S	R	N	2	2	0	0	SWD	1	IV	60	-	-	SL	G	-	none	G	SHR	0	N	31.1
6	2	1	P	1	0.5	0.29	1.37	2.2	1.51	1.69	37.5	34.9	-	-	-	-	S	S	R	N	-	-	-	-	SWD	< 1	IV	65	-	-	-	-	-	none	G	SHR	0	N	-
6	3	1	P	1	0.5	0.25	1.28	0.97	1.08	1.11	37.3	34.5	-	-	-	-	S	S	R	N	-	-	-	-	SWD	1	IV	55	-	-	SL	G	-	none	G	SHR	0	N	34.5
Habitat Unit Total			R	1																	0																	
Habitat Unit Total			P	1																	1																	
Habitat Unit Total			G	1																	12																	
Habitat Unit Total			O	3																	2																	
Habitat Unit Mean			R	1	1.0	0.36	0.34	0.39	0.38	0.37	18.63	17.10	-	-	-	-	G, S	S, G	R	H, L	0.0	0.0	0.0	0.0	SWD	3.0	IV	-	-	-	N	-	-	None	SH, G	SHR	0	N	17.1
Habitat Unit Mean			P	1	0.5	0.24	1.16	1.39	1.23	1.26	36.25	33.57	2.03	0.57	1.46	S	S	G, S	R	N	1.5	1.5	0.0	0.0	DP, SWD	46.4	IV	-	-	-	SL, N	G, N	30	None	G	SHR	0	N	33.24
Habitat Unit Mean			G	1	0.5	0.35	0.51	0.64	0.56	0.57	22.10	18.28	-	-	-	-	S,G	G, S	R	L, H	6.0	6.0	0.0	0.0	SWD, LWD	10.0	IV	-	-	-	SL, N	N, G	7	None	SH, G	SHR	0,1	N	17.5
Habitat Unit Mean			O	3	0.5	0.20	0.26	0.31	0.48	0.35	N/A	10.07	-	-	-	-	S	-	-	N	2.0	2.0	0.0	0.0	IV	100.0	LWD	-	-	-	SL	G	-	None	G	SHR	0	N	0

Notes Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 2 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 1, 2013

Level 1 Fish Habitat Survey Data Form
Stream Name: Creek 705
Freshwater Atlas Code: 100-567134-641477-543682-698692
Reach: 1

Subsampling Fractions: 2 R | 2 P | 4 G | 1 O

Survey Dates: 14-Aug-13
Weather: Overcast
Field Crew: BH, RS

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m) 0.25	0.50	0.75	Mean	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	20-50 cm	>50 cm	Cover Type	%	Cover Type	%	Off-Channel Habitat Type	Access	Length (m)	Disturbance Indicators	Riparian Vegetation Type	Structure	Canopy Closure	Barriers
1	1	1	G	1	11	1	1.13	0.29	0.3	0.18	0.26	6.8	3	-	-	-	-	G	C	R	L	1	1	0	0	SWD	10	UC	10	none	none	none	none	SH	SH SH	1	N
2	1	11	R	1	12	2	0.91	0.13	0.11	0.08	0.11	6.5	3.3	-	-	-	-	C	G	R	H	0	0	0	0					none	none	none	none	SH	SH SH	1	N
3	1	64	P	1	10	<1	1.16	1.05	0.92	0.53	0.83	6.9	3.1	1.12	0.12	1	S	C	S	R	L	4	3	1	0	DP	60	LWD	20	none	none	none	EB,DW	SH	SH SH	1	N
4	1	78	G	1	20	2	1.12	0.17	0.29	0.37	0.28	7.9	2	-	-	-	-	G	S	R	H	0	0	0	0	SWD	10	UC	5	none	none	none	none	C	M M	1	N
5	1	98	R	1	5	2	1	0.13	0.09	0.19	0.14	6.8	5.8	-	-	-	-	C	G	R	L	1	1	0	0	UC	5	OV	5	none	none	none	EB	C	M M	1	N
6	1	120	P	1	11	<1	1.2	0.56	0.58	0.52	0.55	8.5	5.9	0.59	0.05	0.54	S	S	C	R	H	0	0	0	0	OV	30	DP	10	none	none	none	EB	C	M M	2	N
7	1	172	P	1	13	<1	0.8	0.41	0.56		0.49	10	7.1	0.76	0.05	0.71	S	S	G	R	H	16	7	9	0	LWD	50	UC	10	none	none	none	EB,PD	C	M M	2	N
8	1	185	R	1	14	3	1.3	0.06	0.07	0.04	0.06	5.8	1.5	-	-	-	-	C	G	R	L	3	3	0	0	UC	5	LWD	5	none	none	none	none	C	M M	2	N
9	1	244	R	1	6	2	1.1	0.04	0.07	0.06	0.06	7.6	6.1	-	-	-	-	C	G	R	H	16	7	9	0	LWD	40	UC	10	none	none	none	JM,EB	M	YF M	1	N
Habitat Unit Total			R	1	101.75																	20														
Habitat Unit Total			P	1	45.33																	20														
Habitat Unit Total			G	1	139.5																	1														
Habitat Unit Mean			R	1	9	2.25	1.08	0.09	0.09	0.09	0.09	6.68	4.18	-	-	-	-	G	C,S	R	L,H	5	2.75	2.25	0	UC, LWD		OV, LWD, UC		none	none	none	none,EB, JM	SH,C,M	SH,M,YF	1,2	N
Habitat Unit Mean			P	1	11	<1	1.05	0.67	0.69	0.53	0.62	8.47	5.37	0.82	0.07	0.75	S,D	S,G	G,S	R	H,L,N	6.7	3.3	3.3	0.0	LWD,OV,DP		DP,UC, LWD		none	none	none	EB,DW,PD	SH,C	SH,M	2,1	N
Habitat Unit Mean			G	1	4	<1	1.13	0.23	0.30	0.28	0.27	7.35	2.50	-	-	-	-	G,S	S,G	R	L,H	0.5	0.5	0.0	0.0	SWD		UC		none	none	none	none	SH,C	SH,M	1	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable

Table 3 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 2, 2013

Level 1 Fish Habitat Survey Data Form
Stream Name: Creek 705
Freshwater Atlas Code: 100-567134-641477-543682-698692
Reach: 2

Subsampling Fractions: 2 1 2 1
R P G O

Survey Dates: 15-Aug-13
Weather: Partly Cloudy
Field Crew: BH, RS

No.	Reach Number	Distance (m)	Habitat Unit		Length (m)	Gradient (%)	Mean Depth					Mean Width		Pools Only				Bed Material Type				Total LWD Tally	Functional LWD Tally			Cover		Cover		Off-Channel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers
							Bankfull (m)	Water (m)				Bankfull (m)	Wetted (m)	Max Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub-Dom.	Spawning Gravels			10-20 cm	20-50 cm	>50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure (%)	
			Type	Cat				0.25	0.50	0.75	Mean									Type	Amount															
1	2	0	G	1	13	1	0.82	0.13	0.17	0.16	0.15	6.4	2.1	-	-	-	-	C	G	R	L	2	1	1	0	OV	10	LWD	2	none	none	none	EB	SH	SHR SHR	3	N
2	2	13	R	1	8	1.5	0.62	0.07	0.12	0.04	0.08	8.6	4	-	-	-	-	C	G	R	L	4	1	3	0	LWD	5	OV	5	SC	G	8.2	MB	SH	SHR SHR	1	N
3	2	21	P	1	11	<1	0.8	0.34	0.51	0.29	0.38	10	6.2	0.54	0.04	0.5	S	C	G	R	L	5	2	3	0	LWD	5	OV	8	none	none	none	PD	SH	SHR SHR	1	N
4	2	33	R	1	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	54	G	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	62	R	1	19	1.5	0.84	0.13	0.08	0.1	0.10	5.5	3.2	-	-	-	-	C	G	R	L	0	0	0	0	B	5	OV	10	none	none	none	none	SH	SHR SHR	2	N
7	2	81	P	1	14	<1	1.05	0.36	0.53	0.43	0.44	5.6	4.3	0.69	0.05	0.64	S	C	G	R	L	6	6	0	0	DP	30	LWD	10	none	none	none	none	SH	SHR SHR	1	N
8	2	95	R	1	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	2	110	P	1	10	<1	0.88	0.41	0.55	0.43	0.46	7.5	3.8	0.68	0.07	0.61	S	C	G	R	L	6	4	2	0	LWD	10	B	5	none	none	none	PD	SH	SHR SHR	2	N
10	2	120	R	1	17	1	1.13	0.14	0.1	0.06	0.10	8.9	1.5	-	-	-	-	C	G	R	L	5	1	4	0	OV	10	B	5	none	none	none	none	M	YF YF	1	N
11	2	137	G	1	41	1	1.05	0.29	0.27	0.12	0.23	7.4	3.7	-	-	-	-	C	G	R	L	6	1	4	1	OV	35	LWD	5	none	none	none	none				
12	2	178	R	1	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	2	192	G	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	2	200	R	1	19	2	1.05	0.11	0.22	0.12	0.15	7.1	2.7	-	-	-	-	C	G	R	L	6	2	4	0	B	5	OV	20	SC	G	20.3	none	C	M M	2	N
15	2	219	O	1	15	1	0.76	0.05	0.14	0.16	0.12	7.8	4.6	-	-	-	-	C	G	R	L	16	5	7	4	LWD	60	OV	20	none	none	none	old LWD JM	C	M M	1	N
16	2	234	R	1	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Habitat Unit Total			R	1	129																	15														
Habitat Unit Total			P	1	35																	17														
Habitat Unit Total			G	1	70																	8														
Habitat Unit Total			O	1	15																	16														
Habitat Unit Mean			R	1	16	1.50	0.91	0.11	0.13	0.08	0.11	7.53	2.85	-	-	-	-	C	G	R	L	3.75	1	2.75	0	LWD,B,OV		OV,B		SC,none	G,none	8.2,none,20.3	MB,none	SH,M,C	SHR,YF,M	1,2	N
Habitat Unit Mean			P	1	12	<1	0.91	0.37	0.53	0.38	0.43	7.70	4.77	0.64	0.05	0.58	S	C	G	R	L	5.7	4.0	1.7	0.0	LWD,DP		OV,LWD,B		none	none	none	PD,none	SH	SHR,YF,M	1,2	N
Habitat Unit Mean			G	1	18	1.00	0.94	0.21	0.22	0.14	0.19	6.90	2.90	-	-	-	-	C	G	R	L	4.0	1.0	2.5	0.5	OV		LWD		none	none	none	EB,none	SH	SHR	3	N
Habitat Unit Mean			O	1	15	1.00	0.76	0.05	0.14	0.16	0.12	7.80	4.60	-	-	-	-	C	G	R	L	16	5	7	4	LWD		OV		none	none	none	old LWD JM	C	M	1	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Tabble 4 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 3, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 705 — Subsampling Fractions: 1 1 1 1 — Survey Dates: 16-Aug-13

Freshwater Atlas Code: 100-567134-641477-543682-698692 — R P G O — Weather: Overcast

Reach: 3 — Field Crew: BH, RS

						Mean Depth					Mean Width		Pools Only				Bed Material Type				Total	Functional LWD Tally			Cover						Off-Channel Habitat			Disturbance	Riparian Vegetation			Barriers
No.	Reach	Habitat Unit		Length	Gradient	Bankfull	Water (m)				Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-	Spawning Gravels		LWD	10-20 cm	20-50 cm	>50 cm	Cover	%	Cover	%	Cover	%	Type	Access	Length	Indicators	Type	Structure	Canopy	
	Number	Type	Cat	(m)	(%)	(m)	0.25	0.50	0.75	Mean	(m)	(m)	Depth	(m)	(m)	Type		Dom.	Type	Amount	Tally				Type		Type		Type				(m)				Closure	
1	3	P	1	120	<0.5	1.1	0.8	1	1.15	0.98	3.5	25.3	1.25	0.05	1.2	D	G	S	R	N	1	1	0	0	DP	35	UC	10	OV	10	none	none	none	beaver	G	SHR SHR	0	BD
1	3	P	1	-	-	1.15	0.87	0.84	0.93	0.88	2.5	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	3	P	1	-	-	0.84	0.43	0.44	0.67	0.51	3.5	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	3	P	1	-	-	1.05	0.57	0.7	0.67	0.65	3.5	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	3	P	1	-	-	0.85	0.42	0.54	0.52	0.49	4.6	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Habitat Unit Total		P	1	120																	1																
Habitat Unit Mean		P	1	120	<0.5	1.00	0.62	0.70	0.79	0.70	3.52	8.46	1.25	0.05	1.20	D	G	S	R	N	1.0	1.0	0.0	0.0	DP	-	UC	-	OV	-	none	none	none	beaver	G	SHR	0	BD

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 5 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 4, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 705 Subsampling Fractions: Fractions: 3 1 3 1 Survey Dates: 21-Aug-13

Freshwater Atlas Code: 100-567134-641477-543682-698692 R P G O Weather: Sunny

Reach: 4 Field Crew: RS, SL, VC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Bed Material Type Spawning Gravels Type	Bed Material Type Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers
1	4	0	R	1	8	1	0.53	0.10	1.75	1.8	-	-	-	-	C	G,S	R	L	2	2	0	0	B	25	OV	30	none	none	none	none	C	MF MF	1	N
2	4	8	G	1	7	1	0.5	0.12	2	2.05	-	-	-	-	C	G	R	L	1	0	1	0	IV	60	OV	10	none	none	none	none	C	MF SHR	1	N
3	4	15	R	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	4	23	G	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	4	28	R	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	4	33	G	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	4	36	R	1	53	1	0.35	0.07	2.25	1.1	-	-	-	-	C	G	R	L	4	1	3	0	IV	60	OV	10	none	none	none	none	C	MF MF	1	X
8	4	89	G	1	2	1	0.43	0.12	2.2	2.6	-	-	-	-	C	G	R	L	0	0	0	0	IV	80	OV	10	none	none	none	none	C	MF MF	2	N
9	4	91	P	1	3	1	0.65	0.33	2.5	2.8	0.33	0.08	0.25	S	C	G	R	L	0	0	0	0	OV	75	B	5	none	none	none	none	C	MF MF	4	N
10	4	94	R	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	4	101	P	1	3	1	0.54	0.36	2.4	2.6	0.36	0.09	0.25	S	C	G	R	L	0	0	0	0	OV	40	IV	60	none	none	none	D/S of beaver dam	C	MF MF	1	BD
12	4	104	P	1	16	0.5	0.82	0.82	3.9	9.9	1.2	0.05	1.15	D	S	C	R	N	0	0	0	0	IV	50	OV	30	WL	P	flooded	U/S of beaver dam	G	SHR SHR	1	BD
13	4	120	G	1	10	0.5	0.52	0.60	1.4	9.3	-	-	-	-	C	S	R	N	0	0	0	0	IV	90	OV	20	WL	P	20	U/S of beaver dam	G	SHR SHR	1	N
14	4	130	P	1	25	0.5	0.865	0.87	3.3	3	0.93	0.4	0.53	S	S	G	R	L	0	0	0	0	IV	65	OV	10	WL	P	15	none	G	SHR SHR	1	N
15	4	155	G	1	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	4	204	R	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	4	210	G	1	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	4	219	R	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	4	226	G	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	4	231	R	1	12	4	0.3	0.06	2.2	2	-	-	-	-	C	G	R	L	3	3	0	0	IV	75	OV	45	none	none	none	none	C	MF MF	3	N
21	4	243	G	1	2	0.5	0.45	0.11	3.6	3.5	-	-	-	-	C	G	R	L	0	0	0	0	IV	75	OV	30	none	none	none	none	C	MF MF	3	N
22	4	245	P	1	7	0.5	0.7	0.30	3.7	3.7	0.37	0.06	0.31	S	C	G	R	L	1	1	0	0	OV	40	IV	20	none	none	none	none	C	MF MF	3	N
	Habitat Unit Total		R	1	106														9															
	Habitat Unit Total		P	1	54														1															
	Habitat Unit Total		G	1	92														1															
	Habitat Unit Mean		R	1	13	2.00	0.39	0.08	2.07	1.63	-	-	-	-	C	G,S	R	L	3	2	1	0	B,IV	-	OV	-	none	none	none	none	C	MF	1,3	N,X
	Habitat Unit Mean		P	1	11	0.70	0.72	0.54	3.16	4.40	0.64	0.14	0.50	S,D	C,S	G,C	R	L,N	0.2	0.2	0.0	0.0	OV,IV	-	B,IV,OV	-	none, WL	none,P	he, flooded,	none,BD	C,G	MF,SHR	4,1,3	N,BD
	Habitat Unit Mean		G	1	10	0.75	0.48	0.24	2.30	4.95	-	-	-	-	C	G,S	R	L,N	0.3	0.0	0.3	0.0	IV	-	OV	-	none, WL	none,P	none, 20	none,BD	C,G	MF,SHR	1,2,3	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 6 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 5, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 705 Subsampling Fractions: 4 1 3 1 Survey Dates: 23-Aug-13

Freshwater Atlas Code: 100-567134-641477-543682-698692 R P G O Weather: Overcast

Reach: 5 Field Crew: RS, SL, VC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Bed Material Type Spawning Gravels Type	Bed Material Type Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure (%)	Barriers	Comments
1	5	0	G	1	17	0.5	0.4	0.08	1.1	1.15	-	-	-	-	C	G	R	L	0	0	0	0	IV	80	OV	10	SC	P	3.6	none	C	MF MF	1	N	-
2	5	17	R	1	17	1.5	0.27	0.07	1.9	2.35	-	-	-	-	C	G	R	L	5	0	4	1	IV	90	OV	15	none	none	none	none	C	MF MF	2	N	-
3	5	48	P	1	8	0.5	0.5	0.18	3.1	3.56	0.28	0.06	0.22	D	C	G	R	L	2	0	2	0	IV	60	OV	10	none	none	none	none	C	MF MF	3	N	-
4	5	56	R	1	47	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	5	103	G	1	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	5	115	R	1	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	5	128	G	1	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	off-channel stream
8	5	158	R	1	33	3	0.25	0.07	1.65	1.8	-	-	-	-	C	G	R	L	6	5	1	0	IV	60	OV	10	none	none	none	none	C	MF MF	3	N	-
9	5	191	G	1	3	0.05	0.42	0.13	1.4	1.4	-	-	-	-	G	C	R	H	0	0	0	0	IV	50	OV	30	SC	G	3.4	none	C	MF MF	2	N	-
10	5	194	R	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	5	196	G	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	5	202	P	1	8	0.05	0.27	0.30	1.3	1.25	0.47	0.06	0.41	S	G	C	R	H	1	1	0	0	IV	30	OV	10	none	none	none	none	C	MF MF	2	N	-
13	5	210	G	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	5	218	R	1	11	3.5	0.22	0.06	2.2	1.95	-	-	-	-	C	G	R	L	3	0	3	0	IV	80	OV	10	SC	G	4	none	C	MF MF	1	N	-
15	5	229	P	1	3	0.05	0.55	0.41	2.9	3.1	0.6	0.04	0.56	S	G	C	R	H	5	3	1	1	LWD	20	OV	5	none	none	none	none	C	MF MF	1	N	-
16	5	232	R	1	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	5	258	P	1	27	0.05	1.25	0.93	3.6	4.2	1.1	0.05	1.05	S	S	G	R	L	1	1	0	0	OV	5	DP	50	SC	G	5	none	G	Shr Shr	1	N	-
Habitat Unit Total			R	1	149														14																
Habitat Unit Total			P	1	46														9																
Habitat Unit Total			G	1	76														0																
Habitat Unit Mean			R	1	21	3.50	0.25	0.07	1.92	2.03	-	-	-	-	C	G	R	L	4.7	1.7	2.7	0.3	IV	-	OV	-	none,SC	none,G	none,4	none	C	MF	1,2,3	N	
Habitat Unit Mean			P	1	12	0.16	0.64	0.46	2.73	3.03	0.61	0.05	0.56	D,S	C,G,S	G,C	R	L,H	2.3	1.3	0.8	0.3	IV,LWD,OV	-	OV,DP	-	none,SC	none,G	none,5	none	C,G	MF,SHR	3,2,1	N	
Habitat Unit Mean			G	1	13	0.28	0.41	0.11	1.25	1.28	-	-	-	-	C,G	G,C	R	L,H	0.0	0.0	0.0	0.0	IV	-	OV	-	SC	P,G	3.6,3.4	none	C	MF	1,2	N	

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 7 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 6, 2013

Level 1 Fish Habitat Survey Data Form
Stream Name: Creek 705 — Subsampling Fractions: 1 1 2 1 — Survey Dates: 23-Aug-13
Freshwater Atlas Code: 100-567134-641477-543682-698692 — R P G O — Weather: Rain
Reach: 6 — Field Crew: RS, SL, VC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers
1	6	0	G	1	112	0.5	1.2	0.60	4.10	5.01	-	-	-	-	S	C	R	L	0	0	0	0	OV	10	C	15	WL	P	45	none	G	SHR SHR	0	N
2	6	112	P	1	111	0.5	0.85	0.79	57.00	57.00	>1	-	-	S	S	C	R	L	1	1	0	0	DP	50	C	15	WL	P	75	none	G	SHR SHR	0	N
3	6	223	R	1	19	2.5	0.27	0.08	1.30	1.33	-	-	-	-	C	G	R	L	1	1	0	0	IV	90	OV	70	SC	P	4	MC	G	MF MF	2	N
4	6	242	G	1	3	0.5	0.27	0.16	4.60	4.60	-	-	-	-	C	G	R	L	0	0	0	0	IV	90	C	20	none	none	none	none	C	MF MF	1	N
5	6	245	P	1	10	0.5	0.42	0.35	3.8	3.75	0.37	0.07	0.3	S	S	C	R	N	6	6	0	0	LWD	10	IV	10	none	none	none	none	C	MF MF	1	N
6	6	255	G	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	6	257	R	1	8	1.5	0.17	0.08	0.96	0.94	-	-	-	-	C	G	R	L	2	0	2	0	IV	90	OV	60	none	none	none	MC	C	MF MF	2	N
	Habitat Unit Total		R	1	27														3															
	Habitat Unit Total		P	1	121														7															
	Habitat Unit Total		G	1	117														0															
	Habitat Unit Mean		R	1	14	2.00	0.22	0.08	1.13	1.14	-	-	-	-	C	G	R	L	1.5	0.5	1	0	IV	-	OV	-	SC,none	P,none	4,none	MC	G,C	MF	2	N
	Habitat Unit Mean		P	1	61	0.50	0.64	0.57	30.40	30.38	0.37	0.07	0.30	D,S	S	C	R	L,N	3.5	3.5	0.0	0.0	DP,LWD	-	C,IV	-	WL, none	P,none	75,none	none	G,C	SHR,MF	0,1	N
	Habitat Unit Mean		G	1	39	0.50	0.74	0.38	4.35	4.81	-	-	-	-	S,C	C,G	R	L	0.0	0.0	0.0	0.0	OV,IV	-	C	-	WL, none	P,none	45,none	none	G,C	SHR,MF	0,1	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 8 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 8, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 705 Subsampling Fractions: 3 1 2 1 Survey Dates: 12-Sep-13

Freshwater Atlas Code: 100-567134-641477-543682-698692 R P G O Weather: Sunny

Reach: 8 Field Crew: RS, IM, RC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers
1	8	10	R	1	10.3	4.5	0.18	0.04	2.1	2.3	-	-	-	-	C	S	R	L	1	0	1	0	IV	75	OV	20	none	-	-	PD	C	MF MF	3	N
2	8	14	G	1	3.4	6.5	0.32	0.10	1.1	1.57	-	-	-	-	C	S	R	L	0	0	0	0	IV	75	OV	30	none	-	-	none	C	MF MF	3	N
3	8	21	R	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	8	23	G	1	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	8	29	R	1	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	8	33	G	1	3.4	0.5	0.35	0.08	0.75	0.9	-	-	-	-	C	S	R	L	2	0	1	1	IV	50	LWD	50	none	-	-	none	C	MF MF	4	N
7	8	59	R	1	26.7	7	0.22	0.07	0.7	0.57	-	-	-	-	C	S	R	L	7	0	2	5	IV	80	OV	40	none	-	-	none	C	MF MF	3	N
8	8	68	O	1	8.8	4	0.29	0.09	5.1	3.7	-	-	-	-	S	C	R	N	10	0	9	1	LWD	80	IV	60	none	-	-	PD	C	MF MF	2	N
9	8	86	R	1	20.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	8	113	G	1	26.2	2.5	0.18	0.07	1.12	1.22	-	-	-	-	S	C	R	N	10	1	8	1	IV	90	LWD	70	none	-	-	none	C	MF MF	3	N
11	8	122	R	1	8.9	4	0.26	0.04	2.1	2.1	-	-	-	-	C	S	R	N	1	0	1	0	IV	65	OV	50	none	-	-	none	C	MF MF	2	N
12	8	126	G	1	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	8	132	R	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Habitat Unit Total			R	1	85.4														9															
Habitat Unit Total			G	1	39.4														12															
Habitat Unit Total			O	1	8.8														10															
Habitat Unit Mean			R	1	12	5.17	0.22	0.05	1.63	1.66	-	-	-	-	C	S	R	L, N	3.00	0.00	1.33	1.67	IV	-	OV	-	none	none	none	PD	C	MF	3,2	N
Habitat Unit Mean			G	1	8	3.17	0.28	0.08	0.99	1.23	-	-	-	-	C,S	C	R	L, N	4.00	0.33	3.00	0.67	IV	-	OV, LWD	-	none	none	none	none	C	MF	3,4	N
Habitat Unit Mean			O	1	9	4.00	0.29	0.09	5.10	3.70	-	-	-	-	S	C	R	N	10.00	0.00	9.00	1.00	LWD	-	IV	-	none	none	none	PD	C	MF	2	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 9 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 10, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 705 — Subsampling Fractions: 2 1 2 1 — Survey Dates: 12-Sep-13

Freshwater Atlas Code: 100-567134-641477-543682-698692 — R P G O — Weather: Sunny

Reach: 10 — Field Crew: RS, IM, RC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers
1	10	26	G	1	25.5	1	0.31	0.13	1.7	1.71	-	-	-	-	S		R	N	0	0	0	0	OV	20	IV	5	none	none	none	none	G	SHR SHR	1	N
2	10	28	P	1	2.3	0.5	0.53	0.25	2	1.7	0.33	0.08	0.25	S	S	C	R	N	1	0	1	0	SWD	15	OV	10	none	none	none	none	G	SHR SHR	1	N
3	10	48	R	1	20.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	10	49	P	1	1.3	0.5	0.65	0.29	2.24	2.1	0.35	0.09	0.26	S	S	B	R	N	0	0	0	0	B	35	OV	10	none	none	none	none	C	YF PS	1	N
5	10	121	G	1	71.3	1	0.3	0.12	1.83	1.65	-	-	-	-	S	C	R	L	3	0	3	0	IV	40	OV	15	none	none	none	none	C	MF YF	1	N
6	10	135	R	1	14.2	0.5	0.35	0.04	1.2	1.21	-	-	-	-	G	S	R	H	0	0	0	0	OV	15	SWD	5	none	none	none	none	G	SHR SHR	1	N
7	10	138	P	1	3.2	0.5	0.62	0.24	1.16	1.54	0.4	0.04	0.36	S	G	S	R	H	0	0	0	0	OV	20	-	-	-	-	-	-	G	SHR SHR	1	N
8	10	144	G	1	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	10	156	R	1	12.1	1	0.3	0.04	1.93	1.5	-	-	-	-	G	S	R	H	0	0	0	0	OV	20	IV	5	none	none	none	none	G	YF SHR	1	N
10	10	161	G	1	4.5	1	0.3	0.11	1.32	1.55	-	-	-	-	G	S	R	H	0	0	0	0	OV	15	IV	5	none	none	none	none	C	SHR SHR	1	N
11	10	176	R	1	15.6	1	0.16	0.04	1.33	1.93	-	-	-	-	G	S	R	H	0	0	0	0	SWD	10	IV	20	none	none	none	none	C	MF MF	3	N
12	10	181	G	1	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	10	194	G	1	12.7	8	0.38	0.05	0.7	1.07	-	-	-	-	C	G	R	H	7	0	6	1	LWD	40	IV	60	none	none	none	none	C	MF MF	3	N
14	10	234	C	1	40.4	12	0.41	0.07	0.93	1.64	-	-	-	-	C	B	R	L	10	1	9	0	B	60	OV	60	none	none	none	none	C	MF MF	3	N
15	10	240	G	1	5.9	0.5	0.33	0.18	0.53	1.22	-	-	-	-	G	C	R	H	5	1	4	0	LWD	70	OV	60	none	none	none	none	C	MF MF	3	N
16	10	258	G	1	18.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Habitat Unit Total		R	1	62														0															
	Habitat Unit Total		P	1	6.8														1															
	Habitat Unit Total		G	1	149.2														15															
	Habitat Unit Total		C	1	40.4														10															
	Habitat Unit Mean		R	1	16	0.83	0.27	0.04	1.49	1.55	-	-	-	-	G	S	R	H	0	0.00	0.00	0.00	OV, SWD	-	IV, SWD	-	none	none	none	none	G,C	SHR,MF,YF	1,3	N
	Habitat Unit Mean		P	1	2	0.50	0.60	0.26	1.80	1.78	0.36	0.07	0.29	S	S,G	C,B,S	R	N,H	0	0.00	0.33	0.00	SWD,B,OV	-	OV	-	none	none	none	none	G,C	SHR,YF,PS	1	N
	Habitat Unit Mean		G	1	19	2.30	0.32	0.12	1.22	1.44	-	-	-	-	S,G,C	C,S,G	R	H,L,N	3	0.20	2.60	0.20	OV,LWD,IV	-	IV,OV	-	none	none	none	none	C,G	MF,SHR,YF	1,3	N
	Habitat Unit Mean		C	1	40	12.00	0.41	0.07	0.93	1.64	-	-	-	-	C	B	R	L	10	1.00	9.00	0.00	B	-	OV	-	none	none	none	none	C	MF	3	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 10 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 705, Reach 11, 2013

Level 1 Fish Habitat Survey Data Form
Stream Name: Creek 705 — Subsampling Fractions: 1 (R) 1 (P) 1 (G) 1 (O) — Survey Dates: 12-Sep-13
Freshwater Atlas Code: 100-567134-641477-543682-698692 — Weather: Sunny
Reach: 11 — Field Crew: RS, IM, RC

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	Functional LWD Tally 20-50 cm	Functional LWD Tally >50 cm	Cover Cover Type	Cover %	Cover Type	Cover %	Off-Channel Habitat Type	Off-Channel Habitat Access	Off-Channel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers
1	11	23	C	1	23.1	7.0	0.24	0.07	1.18	0.77	-	-	-	-	G	C	R	L	14	7	7	0	IV	80	LWD	15	none	none	none	none	C	MF MF	3	N
2	11	26	G	1	3.1	0.5	0.32	0.15	1.65	1.94	-	-	-	-	C	G	R	N	2	1	1	0	IV	85	OV	15	none	none	none	none	C	MF MF	2	C
3	11	43	C	1	16.9	6.0	0.24	0.07	2.45	2.69	-	-	-	-	C	G	R	N	13	5	8	0	IV	80	LWD	25	none	none	none	none	C	MF MF	3	N
4	11	67	C	1	24.0	8.0	0.29	0.14	1.93	1.85	-	-	-	-	C	S	R	N	16	5	11	0	IV	85	LWD	10	none	none	none	none	C	MF MF	3	C
5	11	73	C	1	6.1	-	0.25	0.13	1.14	1.57	-	-	-	-	C	S	R	N	11	6	5	0	IV	85	LWD	10	none	none	none	none	C	MF MF	3	C
6	11	102	C	1	29.0	5.5	0.26	0.08	2.26	2.48	-	-	-	-	C	S	R	N	20	7	12	1	IV	80	LWD	15	none	none	none	none	C	MF MF	3	C
7	11	144	C	1	42.2	10.0	0.24	0.08	2.23	2.71	-	-	-	-	C	S	R	N	24	8	16	0	IV	75	LWD	10	SC	N	6	none	C	MF MF	3	C
8	11	186	C	1	42.0	13.0	0.28	0.07	2.50	2.74	-	-	-	-	C	S	R	N	30	13	16	1	IV	85	LWD	15	none	none	none	none	C	MF MF	2	C
9	11	198	R	1	11.2	3.5	0.17	0.08	1.29	0.75	-	-	-	-	C	G	R	L	4	2	2	0	IV	70	OV	10	SC	P	8	none	C	MF MF	3	C
10	11	218	C	1	20.3	8.0	0.14	0.04	2.83	2.92	-	-	-	-	G	C	R	L	9	5	4	0	LWD	15	OV	10	none	none	none	none	C	MF MF	2	C
11	11	222	G	1	4.1	0.5	0.29	0.14	3.10	1.30	-	-	-	-	G	C	R	L	0	0	0	0	IV	40	OV	10	none	none	none	none	C	MF MF	2	C
12	11	272	C	1	50.0	11.0	0.20	0.10	1.62	0.91	-	-	-	-	C	G	R	L	36	20	16	0	IV	30	OV	20	none	none	none	none	C	MF MF	3	C
Habitat Unit Total			R	1	11.2														4															
Habitat Unit Total			G	1	7.2														2															
Habitat Unit Total			C	1	253.6														173															
Habitat Unit Mean			R	1	11	4	0.17	0.08	1.29	0.75	-	-	-	-	C	G	R	L	4	2	2	0	IV	-	OV	-	SC	P	8	none	C	MF	3	C
Habitat Unit Mean			G	1	4	1	0.31	0.15	2.38	1.62	-	-	-	-	C,G	C,G	R	L,N	1	0.5	0.5	0	IV	-	OV	-	none	none	none	none	C	MF	2	C
Habitat Unit Mean			C	1	28	9	0.24	0.09	2.02	2.07	-	-	-	-	C,G	C,G,S	R	N,L	19.22222	8.444444	10.55556	0.222222	IV, LWD	-	LWD, OV	-	none	none	none	none	C	MF	3,2	N,C

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 11 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 505659, Reach 1, 2013
Level 1 Fish Habitat Survey Data Form
Stream Name: Creek 505659
Freshwater Atlas Code: 100-567134-610692-671007-505659
Reach: 1

Subsampling Fractions: 4 R | 1 P | 4 G | 2 O

Survey Dates: 15-Aug-13
Weather: Partly Sunny
Field Crew: BH, RS

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m) 0.25	0.50	0.75	Mean	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravels Type	Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	20-50 cm	>50 cm	Cover Cover Type	%	Cover Type	%	Off-Channel Habitat Type	Access	Length (m)	Disturbance Indicators	Riparian Vegetation Type	Structure	Canopy Closure	Barriers
1	1	0	R	1	3	1	0.92	0.11	0.08	0.06	0.08	4.6	1.3	-	-	-	-	G	S	R	H	0	0	0	0	UC	5	OV	25	none	none	none	none	C	MF MF	3	N
2	1	3	G	1	4	1	1.13	0.08	0.12	0.1	0.10	3.2	1.9	-	-	-	-	G	S	R	H	2	2	0	0	UC	10	OV	5	none	none	none	none	C	MF MF	3	N
3	1	7	R	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	15	G	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	1	19	R	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	1	21	G	1	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	40	O	1	8	1	1.13	0.3	0.2	0.35	0.28	2.9	2.5	-	-	-	-	S	G	R	L	5	5	0	0	SWD	25	UC	20	none	none	none	JM	C	MF MF	3	N
8	1	48	G	1	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	1	70	R	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1	72	G	1	8	1	0.77	0.11	0.14	0.14	0.13	4.9	1.5	-	-	-	-	G	S	R	H	4	4	0	0	UC	10	IV	10	none	none	none	none	C	MF MF	2	N
11	1	80	R	1	4	1.5	0.71	0.1	0.05	0.05	0.07	5.1	1.4	-	-	-	-	G	C	R	L	0	0	0	0	UC	10	OV	5	none	none	none	none	C	MF MF	3	N
12	1	84	O	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	1	92	R	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	1	94	G	1	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	1	123	R	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	1	128	G	1	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	1	143	R	1	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	1	152	G	1	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	1	173	R	1	2	1	0.79	0.07	0.14	0.11	0.11	3.2	1.6	-	-	-	-	G	C	R	L	0	0	0	0	IV	20	OV	10	none	none	none	none	C	MF MF	1	N
20	1	175	G	1	9	<1	1.04	0.09	0.1	0.22	0.14	4.7	1.6	-	-	-	-	S	G	R	H	4	4	0	0	IV	60	UC	20	none	none	none	none	C	MF MF	2	N
21	1	184	R	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	1	186	G	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	1	189	R	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	1	196	G	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	1	202	R	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	1	208	G	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	1	215	R	1	4	1.5	0.75	0.14	0.14	0.06	0.11	3.2	1.8	-	-	-	-	G	B	R	H	1	1	0	0	IV	15	B	10	none	none	none	none	C	MF MF	3	N
28	1	219	G	1	8	1	0.77	0.21	0.12	0.18	0.17	4.3	1.8	-	-	-	-	G	S	R		1	1	0	0	IV	25	OV	10	none	none	none	none	C	MF MF	3	N
29	1	227	R	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	1	232	G	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	1	236	R	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	1	244	G	1	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	1	262	R	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Habitat Unit Total		R	1	69																	1														
	Habitat Unit Total		P	1	0																															
	Habitat Unit Total		G	1	175																	11														
	Habitat Unit Total		O	1	16																	5														
	Habitat Unit Mean		R	1	5	1.25	0.79	0.11	0.10	0.07	0.09	4.03	1.53	-	-	-	-	G	S,C,B	R	H,L	0.25	0.25	0	0	UC,IV	-	OV,B	-	none	none	none	none	C	MF MF	3,1	N
	Habitat Unit Mean		P	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Habitat Unit Mean		G	1	12	1.00	0.93	0.12	0.12	0.16	0.13	4.28	1.70	-	-	-	-	G,S	S,G	R	H	2.8	2.8	0.0	0.0	UC,IV	-	OV,IV,UC	-	none	none	none	none	C	MF MF	3,2	N
	Habitat Unit Mean		O	1	8	1.00	1.13	0.30	0.20	0.35	0.28	2.90	2.50	-	-	-	-	S	G	R	L	5	5	0	0	SWD	-	UC	-	none	none	none	JM	C	MF MF	3	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 12 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 505659, Reach 2, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 505659 | Subsampling Fractions: 2 2 4 1 | Survey Dates: 15-Aug-13

Freshwater Atlas Code: 100-567134-610692-671007-505659 | R P G O | Weather: Partly Sunny

Reach: 2 | Field Crew: BH, RS

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m) 0.25	0.50	0.75	Mean	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravels Type	Spawning Gravels Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	20-50 cm	>50 cm	Cover Cover Type	%	Cover Type	%	Off-Channel Habitat Type	Access	Length (m)	Disturbance Indicators	Riparian Vegetation Type	Structure	Canopy Closure	Barriers
1	2	0	P	1	8	<1	1.1	0.58	0.62	0.38	0.53	5.4	4.5	0.65	0.07	0.58	S	S	G	R	H	1	1	0	0	UC	15	DP	30	none	none	none	none	G	SHR SHR	0	N
2	2	8	G	1	17	<1	1.08	0.39	0.41	0.4	0.40	2.1	1.7	-	-	-	-	G	S	R	L	0	0	0	0	OV	50	UC	40	none	none	none	none	G	SHR SHR	0	N
3	2	25	R	1	5	1.5	1.1	0.35	0.06	0.09	0.17	3.5	2.4	-	-	-	-	G	C	R	L	1	1	0	0	IV	60	UC	20	none	none	none	none	G/Sh,M	SHR SHR	1	N
4	2	30	G	1	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	44	P	1	3	<1	1.04	0.24	0.44	0.45	0.38	4.5	3.6	0.48	0.08	0.4	S	G	S	R	L	0	0	0	0	OV	50	UC	10	none	none	none	none	C	MF MF	3	N
6	2	47	R	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	2	51	G	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	2	59	P	1	10	<1	1.32	0.65	0.69	0.61	0.65	4	2.7	0.75	0.29	0.46	D	S	G	R	N	0	0	0	0	DP	60	OV	20	SC	P	8	old BD U/S	C	MF MF	2	BD
9	2	69	G	1	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	2	87	P	1	6	<1	1.23	0.48	0.8	0.83	0.70	4	3	0.83	0.18	0.55	S	G	S	R	H	0	0	0	0	DP	50	OV	10	none	none	none	old BD U/S	G	SHR SHR	1	BD
11	2	93	P	1	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	2	148	G	1	98	<1	0.95	0.23	0.23	0.44	0.30	4.4	3	-	-	-	-	S	G	R	H	3	3	0	0	OV	15	IV	10	none	none	none	none	G	SHR SHR	1	N
13	2	246	R	1	6	1.5	0.92	0.08	0.09	0.13	0.10	4.3	1.4	-	-	-	-	G	S	R	H	0	0	0	0	OV	40	IV	10	none	none	none	none	M	MF SHR	2	N
	Habitat Unit Total		R	1	15																	1														
	Habitat Unit Total		P	1	82																	1														
	Habitat Unit Total		G	1	155																	3														
	Habitat Unit Mean		R	1	5	1.50	1.01	0.22	0.08	0.11	0.13	3.90	1.90	-	-	-	-	G	C,S	R	L,H	0.5	0.5	0	0	IV,OV	-	UC,IV	-	none	none	none	none	G/SH,M	SHR, MF	1,2	N
	Habitat Unit Mean		P	1	16	<1	1.17	0.49	0.64	0.57	0.56	4.48	3.45	0.68	0.16	0.50	S,D	S,G	G,S	R	H,L,N	0.3	0.3	0.0	0.0	UC,OV,DP	-	DP,UC,OV	-	none, SC	none, P	none, 8	none, BD	G,C	SHR, MF	0,3,2,1	N, BD
	Habitat Unit Mean		G	1	31	<1	1.02	0.31	0.32	0.42	0.35	3.25	2.35	-	-	-	-	G,S	S,G	R	L,H	1.5	1.5	0.0	0.0	OV	-	UC,IV	-	none	none	none	none	G	SHR, SHR	0,1	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Table 13 Fisheries Habitat Assessment Procedures (FHAP) Data for Creek 505659, Reach 3, 2013

Level 1 Fish Habitat Survey Data Form

Stream Name: Creek 505659 | Subsampling Fractions: 2 2 4 1 | Survey Dates: 15-Aug-13

Freshwater Atlas Code: 100-567134-610692-671007-505659 | R P G O | Weather: Partly Sunny

Reach: 3 | Field Crew: BH, RS

No.	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m) 0.25	0.50	0.75	Mean	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravels Type	Amount	Total LWD Tally	Functional LWD Tally 10-20 cm	20-50 cm	>50 cm	Cover Cover Type	%	Cover Type	%	Off-Channel Habitat Type	Access	Length (m)	Disturbance Indicators	Riparian Vegetation Type	Structure	Canopy Closure	Barriers
1	3	0	G	1	9	0.5	0.71	0.12	0.22	0.4	0.25	6	3	-	-	-	-	S	G	R	L	2	1	1	0	OV	10	IV	5	none	none	none	none	C	MF MF	2	N
2	3	9	R	1	6	1	0.68	0.07	0.07	0.09	0.08	5.1	1.5	-	-	-	-	G	S	R	H	1	1	0	0	SWD	10	OV	5	none	none	none	none	C	MF MF	2	N
3	3	15	G	1	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	26	R	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	33	G	1	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	50	R	1	5	2	0.74	0.07	0.06	0.09	0.07	5.9	2.8	-	-	-	-	G	C	R	L	1	0	1	0	OV	45	IV	15	none	none	none	none	C	MF MF	1	N
7	3	55	G	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	3	62	R	1	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	3	101	G	1	4	1	0.89	0.14	0.22	0.1	0.15	4.2	2.3	-	-	-	-	G	C	R	L	2	2	0	0	IV	10	OV	15	none	none	none	none	C	MF MF	1	N
10	3	105	R	1	51	2	0.62	0.1	0.09	0.11	0.10	3.7	1.9	-	-	-	-	C	G	R	L	29	13	16	0	OV	30	LWD	20	none	none	none	none	C	MF MF	1	N
11	3	156	G	1	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	3	170	O	1	5	1.5	0.82	0.01	0.04	0.06	0.04	8.2	2.2	-	-	-	-	S	G	R	L	8	7	0	1	LWD	20	OV	5	SC	G	19	MC,JM,MB	C	MF MF	2	N
13	3	175	R	1	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	3	199	G	1	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	3	218	R	1	7	2	0.71	0.05	0.09	0.18	0.11	4.4	3.3	-	-	-	-	G	S	R	H	3	3	0	0	OV	5	SWD	5	none	none	none	none	C	MF MF	3	N
16	3	225	G	1	7	1	0.75	0.18	0.27	0.23	0.23	5.5	2.5	-	-	-	-	S	G	R	L	3	3	0	0	OV	30	IV	5	none	none	none	none	C	MF MF	3	N
17	3	232	R	1	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Habitat Unit Total		R	1	155																	34														
	Habitat Unit Total		P	1	0																															
	Habitat Unit Total		G	1	88																	7														
	Habitat Unit Total		O	1	5																	8														
	Habitat Unit Mean		R	1	19	1.75	0.69	0.07	0.08	0.12	0.09	4.78	2.38	-	-	-	-	G,C	S,C,G	R	H,L	8.5	4.25	4.25	0	SWD,OV	-	OV,IV,LWD,SWD	-	-	-	-	none	C	MF MF	2,1,3	N
	Habitat Unit Mean		P	1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Habitat Unit Mean		G	1	11	0.83	0.78	0.15	0.24	0.24	0.21	5.23	2.60	-	-	-	-	S,G	G,C	R	L	2.3	2.0	0.3	0.0	OV,IV	-	IV,OV	-	-	-	-	none	C	MF MF	2,1,3	N
	Habitat Unit Mean		O	1	5	1.50	0.82	0.01	0.04	0.06	0.04	8.20	2.20	-	-	-	-	S	G	R	L	8	7	0	1	LWD	-	OV	-	SC	G	19	MC,JM,MB	C	MF MF	2	N

Notes: Habitat Type: G- glide; P- pool; R-riffle; O - other
Habitat Category: 1 - primary; 2 - secondary; 3 - tertiary
Substrate: B - boulder; C - cobble; G - gravel; R - bedrock; S - fines
Pool Type: S - scour; D - dam; O - other
Spawning Gravels: H - high quality; Low - low quality; N - none
Cover Type: B - boulders; C - cobbles; DP - deep pools; IV - instream vegetation; LWD - large woody debris; OV - overhanging vegetation
Off-channel Habitat: SC - side channel; SL- slough; WL - wetland; N- no access to fish; P - only at high flows; G - access at most flows
Riparian Vegetation: C - conifer; M - mixed; INIT - non-vegetated; YF - young forest; MF - mature forest; S - shrub; G - grass; SHR - shrubs and herbs
Canopy Closure: 1 - 1-20%; 2 - 21-40%; 3 - 41-70%; 4 - 71-90%; 5 - >90
Barriers: N - none; X - log; BD - beaver dam
No. - number; m - metre; % - percent; cm - centimetre; N/A - not applicable; dash indicates no data

Annex 5.8-1
Survey of Transmission Line Stream Crossings, 2013

newgold

AVISON MANAGEMENT SERVICES LTD.

FISH AND FISH HABITAT INVENTORY NEW GOLD BLACKWATER PROJECT



December 2013

Executive Summary

An enhanced fish and fish habitat inventory was conducted at 287 sites in drainages of the Mt Davidson/Nechako plateau region, south of Vanderhoof, B.C. This is the total number of sites included in version 9 of the alignment which is the final preferred alignment. These sites were identified to be potential stream crossing locations for new or upgraded infrastructure associated with the Blackwater project owned by New Gold. The inventory began with an initial desktop review that included collecting previous classification data and information on historical fish presence at regional and local scales. This was followed by a field program which consisted of stream classification, fish sampling, riparian vegetation assessment, measurement of navigable waters criteria, and culvert assessments where applicable. The office review included the evaluation of 13 sites as non-classified drainages (NCDs) and no visible channels (NVCs), based on previous classification data and GIS information. An additional 173 NCDs were classed during the field surveys. There were 8 streams that were assessed as non-fish bearing based on existing sampling information and the presence of downstream barriers or reach gradients of >20%. The remaining classifications were known or defaulted fish streams with mainly good overall fish habitat, with the exception of 13 reaches that rated poorly in all four habitat categories. The most common species observed or captured during sampling was rainbow trout. There were no anadromous fish captured, but there are existing records of salmon utilizing the Nechako and Stellako Rivers, as well as the lower reaches of Greer and Swanson Creeks. The nearest species at risk is the white sturgeon located in the middle reaches of the Nechako River, approximately 4.5km from the nearest crossing location.

Riparian vegetation was variable and largely dependent on soil moisture and surrounding forest activity. Wetlands and recently burned or harvested areas were dominated by shrubs while mature forests contained mainly tree cover. Riparian tree species that were common to most of the sites included hybrid spruce, lodgepole pine, and balsam, while common shrubs included black twinberry, willow and alder. Nearly all mature pine was dead as a result of the mountain pine beetle infestation. This dead timber contributed to notable blowdown across stream channels, causing an impediment to potential navigation.

There were 17 existing road crossings with closed-bottom culverts that were determined to be a barrier to fish passage during all or part of the year. Most of them were undersized and unembedded, and should be replaced with a structure appropriate for the gradient and habitat quality if the road is upgraded in the future.

For the purpose of this report, one section will specifically focus only on sites visited in 2013. These sites work to make up version 9 of the final preferred alignment as changes were made from last year's version to include 2 re-routes and the addition of air strip access sites.

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1 Introduction

This report summarizes an enhanced Fish and Fish Habitat Inventory (FFHI) conducted in the 2013 field season for the Blackwater Project owned by New Gold. The purpose of this inventory is to provide baseline fish and fish habitat information for the New Gold Blackwater project in the Mt. Davidson/Nechako Plateau area and to provide some commentary on current fish habitat in order to develop best management practices for fish habitat conservation as the project moves forward.

The inventory consisted of a desktop review and a field sampling program at stream sites located south of Vanderhoof in the Mt Davidson/Nechako Plateau area. Objectives of the FFHI included collecting stream channel, fish, and riparian vegetation information to: 1) support baseline descriptions of the fish and fish habitat that may be impacted or improved by the project, and 2) outline stream characteristics that have historically been used for Navigable Waters reporting.

In 2012, versions 1-5 of the transmission line and access road alignment were developed and subsequent crossings and waterways were classified and assessed. The field work for versions 1-5 was completed in the summer and fall of 2012 and a report was written and submitted to AMEC outlining the potential for fish habitat, fish barriers, and information about present fish species, current habitat, vegetation assessments, and navigable waters information.

In 2013 a re-route of the transmission line was developed and versions 6-9 were created. In the new alignment, approximately 1.5 kms of new access road was included and 105 sites were added. Due to the changes in the alignment, a 2013 FFHI survey was necessary in order to classify water bodies and crossings that were not previously assessed. Although there was some overlap between versions 1-5 and versions 6-9, only new sites were assessed in 2013.

All results from the field sampling phase as well as 2002-2006 classifications were entered into a comprehensive MS Access database that included several component-specific information tables (i.e. stream classification, fish sampling, riparian vegetation, culvert assessment, navigable waters data) that can be linked and queried by site ID. Summaries of this information can be found in the Appendix section of this document. Field sheets for each site were scanned as a group, labeled and saved electronically. Photo files were labeled by their corresponding roll and picture number on each field sheet and were referenced in the database. Photo documentation and field card summaries are also included as an appendix of this document. All information was saved to DVD and included with this report submission to AMEC.

The final transmission line and access road alignment was developed as version 9 and is considered to be the preferred final alignment. For the preferred final alignment, all older data was excluded and only new and relevant sites will be included, as they will directly apply to the EA process.

This report has been prepared in two parts. The first part is an overview of the 2013 FFHI survey and results for the transmission line versions 6-8b and 1.5 km access road revision as well as version 9, the final preferred alignment. The purpose of part one is to outline the work that was completed in the 2013 field season and the resulting data from the new sites. The second part discusses the preferred final alignment which includes work completed in 2012 and 2013, and references only those watercourses that are within 100 meters of this alignment. The purpose of the second part is to discuss the crossings and watercourses that are directly applicable to the Environmental Assessment (EA) review of the final alignment.

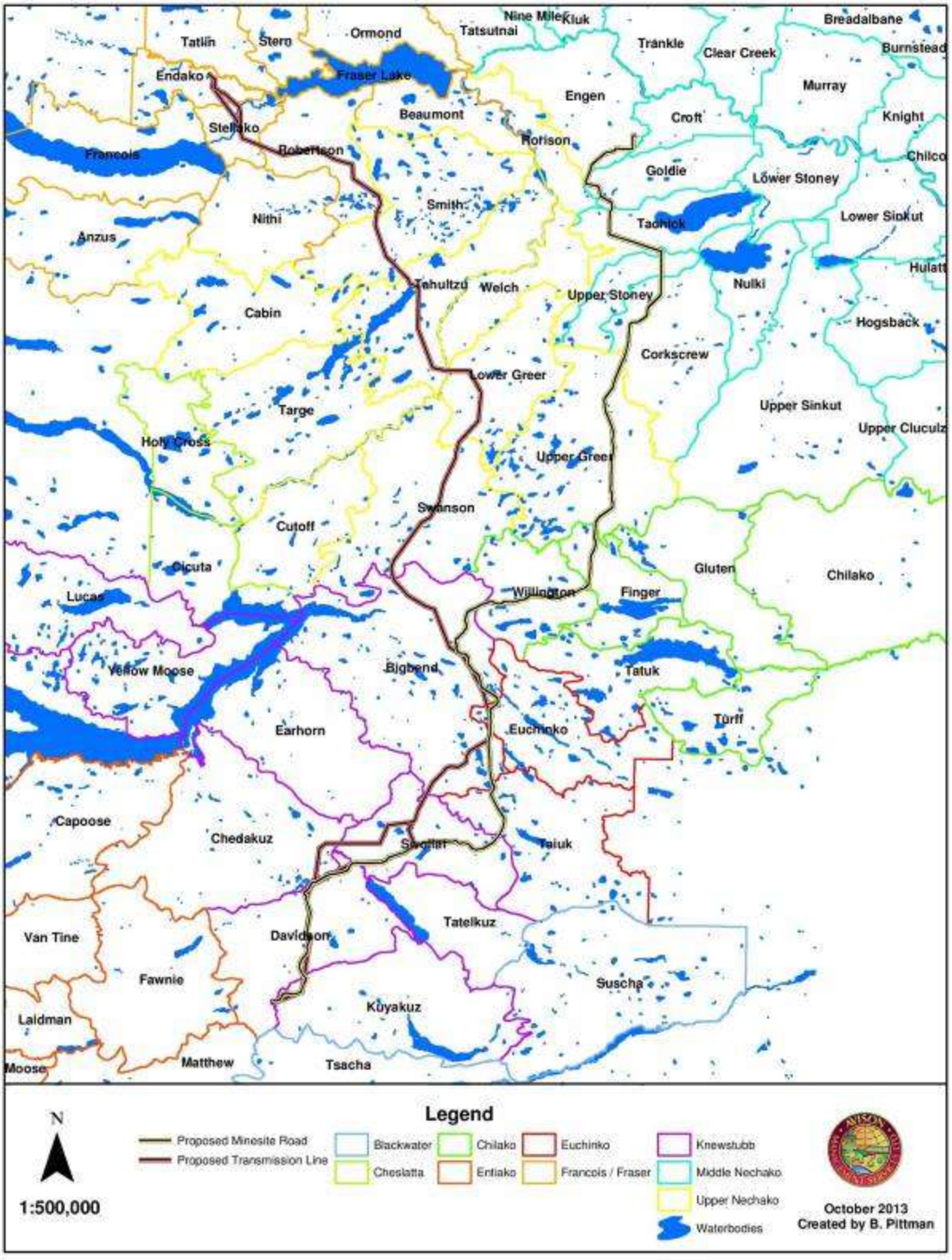


Figure 1: Location plan of the final preferred alignment for the proposed transmission line and mine access road with associated sub-basins and basins.

1.1 Project Description

The 2013 FFHI survey will work in conjunction with the 2012 FFHI survey report to provide a complete overview of fish habitat along the proposed transmission line for the New Gold Blackwater project. The 2013 FFHI survey focuses specifically on versions 6-8b and version 9 which is the preferred final alignment.

A multi-faceted approach was taken in order to ensure that all necessary information was gained for the purpose of analyzing current fish habitat along the route. There are several factors that need to be taken into consideration when determining fish habitat. For this reason, at the time that field work was done, the following assessments were completed: stream classification, navigable waters, vegetation, culvert passage, and fish sampling. Together, these assessments can be used to determine: presence or absence of fish at this time, if fish are present which species have been found, what the value of current fish habitat is, and the possible implications to fish habitat once construction begins.

1.1.1 2013 FFI Study

The 2013 re-route of New Gold Blackwater's transmission line includes versions 6-8b and finally version 9. The revisions and re-routes occurred for a number of reasons including the avoidance of private property which is evident in the Mills ranch re-route. The final preferred alignment, version 9, was updated from version 8b to include 3 additional sites which were used to assess the air strip access road. In 2013, the FFHI survey included 105 new sites which were located south of Vanderhoof in the Mt Davidson/ Nechako plateau area.

1.1.2 Preferred Final Alignment

The preferred final alignment for the transmission line and mine access road includes information from both the 2012 and 2013 FFHI surveys.

The total length for the transmission line is 160.2 km and it crosses 12 different subbasins within the Francois/Fraser, Upper Nechako, Knewstubb, and Euchinko basins. There are 168 watercourse crossings that were included in the FFHI of the proposed transmission line, 92 of which were assessed in 2013 because they were located on rerouted portions of the alignment. The total length of rerouted portions of the final preferred alignment for the proposed transmission line is 89.1 km. Two segments of the preferred final alignment for the proposed transmission line include two possible routes for the transmission line. This first section contains two possible routes for crossing the Stellako River and the second section contains two route options that go around or through private property (Barry Mills' Ranch). Both options were included in this report because a decision has not been made on which route to take in each case.

The mine access road is 142.6 km long and it crosses 14 different subbasins within the Middle Nechako, Upper Nechako, Chilako, Knewstubb, and Euchinko basins. There are 119 watercourse crossings that were included the FFHI of the proposed minesite access road, 13 of which were assessed during the 2013 survey. Reroutes for the proposed mine access road accounted for 7.1 km of the final preferred alignment.

Detailed maps of the preferred final alignment with watercourse crossing locations can be found in Appendix B.

2 Methodology

2.1 Background Information Review

In order to assess historical fish distributions in the watershed basins potentially affected by the project, a provincial database called iMapBC2.0 and non-thematic GIS shapefiles with local data for fish observations and stream assessments were cross-referenced to determine the potential fish streams to be encountered during the field sample. The database provided a large-scale look at the watershed basins, providing information about watershed delineation, fish observation points, and stream center-line network mapping. While the database did provide information about the study area as a whole it was not very useful in providing site-level details about each crossing. Many of the streams that are crossed by the proposed alignment have already been assessed in different locations by several companies. Before the field assessment of the v005 sites in 2012, AMEC provided GIS shapefiles with information on streams that were assessed between 2002 and 2006. This information was then used to determine if sites were to be potentially dropped from the field sampling plan because there is already enough data for an accurate assessment of them.

2.2 FFHI Site Selection and Sample Design

FFHI site locations were pre-determined by AMEC; however, at the beginning of the 2013 field season, new alignments were assessed in the office and new 2013 sites were developed accordingly. The sites selected for the desktop review and field sampling program represented locations where mapped drainages were crossed by the proposed transmission line and proposed or existing roads that may be constructed or upgraded as the Blackwater Project proceeds. These geo-referenced crossing locations were provided by AMEC with associated 1:20 000 and 1:50 000 watershed codes (WSC) and gazetted names where this information existed. The original list of sites was revised 8 times over the course of the program because of changes in infrastructure alignment; the locations described here represent crossings outlined in Version 9. A series of maps detailing the site information for the crossing locations can be found in Appendix A along with a table with coordinates and watershed codes for each site.

The sub-basins associated with the crossings are located within the Cheslatta, Chilako, Euchinko, Francois/Fraser, Knewstubb (Neckako Reservoir), and Nechako (middle and upper) watersheds (Fig. 1). Access routes to most of the sites are firstly via the Kluskus Forest Service Road from Vanderhoof, then by utilizing secondary roads including the Kluskus-500 and Davidson-1000 Forest Service Roads. The

northernmost transmission line sites are reached via Highway 16 west from Vanderhoof to the community of Fraser Lake, then south on Francois Lake Road and various secondary roads. Access to a number of the transmission line sites involves hiking several kilometers from the nearest road.

The identified reaches were cross-referenced with historical fish observation records obtained online and stream classification data from 2002-2006. The stream classification information was provided by AMEC for the area immediately surrounding the original road and transmission line alignment. Subsequent versions of the alignments were implemented in areas where this background data was not provided; however, that is not to say that the stream reaches had not been previously classified, only that the information was not available. This data was combined with geographic information to determine the sample size for the field phase of the program.

First-order streams with a short reach upstream of the crossing that had been previously classified as NVC (no visible channel) or NCD and had no obvious lentic point of origin, such as a lake or wetland, were not included in the field sampling design and the last known assessment was deemed acceptable for reporting.

There were 14 identified crossing sites not included in the field sampling phase of the inventory. These were omitted from the sample design after a review of previous classifications and existing fish data suggested the drainages at these sites were not streams and did not contain fish habitat. Most had been previously classified as NCD or NVC and were characterized by short 1st order upstream reaches. The previous assessments were accepted as standing classifications for 2012 (Table 1).

The 2013 site selection focused on reroutes associated with v009 of the alignment. During the course of the 2012-2013 off-season the alignment went through several changes (from v006 to v008b). At the beginning of the 2013 sample season the most up to date alignment was v009, which is the preferred alignment. Several portions of the reroutes crossed the same watercourses as the v005 alignment, which was assessed in 2012. To avoid duplicating sample efforts those v009 sites that were within 200m of the old v005 crossings, which had already been assessed, were dropped from the field sample design. If there was a change in stream order or significant change in riparian vegetation based on aerial photography between the old and new site, then the v009 was included in the field sample design regardless of its proximity to a previously assessed crossing.

In 2013 the final number of crossings projected for the field sample design included 92 sites associated with the proposed transmission line, 9 sites associated with existing roads, 1 site associated with proposed roads, and 3 sites associated with the proposed air strip access road, making 105 sites in total. There was often more than one site located within the same reach (ie. one road and one transmission line site), and in those cases, just one field survey was planned but both crossings are included in the results database for ease of reference.

2.3 Fish Data and Previous Classification By Reach

Locational data for general fish observations were obtained as a non-thematic GIS shapefile from the Fisheries Information Summary System (FISS). Observations were widespread across the specified watersheds, with many fish observations above possible obstacles to upstream passage. The potential for fish presence was assessed at each crossing location based upon records of observation: 1) in the same reach as the proposed crossing; 2) in any reach or tributary upstream of the proposed crossing; or 3) in the next downstream reach of the proposed crossing, or, if it was Reach 1, in the next ordered stream and there was no known barrier to migration. Using these criteria to assess the potential for fish presence at the crossing locations without considering other site-specific information, 206 sites were identified as possible fish-bearing streams in the preferred final alignment. Sixty-seven of those sites were pertinent to the 2013 field surveys.

The same sites were cross referenced with data from stream classifications conducted in 2002-2006 and in a few cases, there was an observation of fish upstream of a reach that had been identified as a "non-classified drainage" (NCD) or when "no visible channel" (NVC) was present and it became apparent that there may have been hydrological changes between the time of the observation and the classification. Tables summarizing historical fish data and previous stream reach classifications can be found in the Appendix L.

2.4 Stream Classification and Fish Sampling

The FFHI field work for versions 6-9 and the final preferred alignment commenced on June 25, 2013 and was completed by August 17, 2013. Methodology described in *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory* (RISC 2001) was the standard protocol for general site descriptions and stream classifications at all crossing locations included in the field sampling design. A reach description was completed in accordance with the provincial site card requirements with the exception of survey length at sites that were also planned for navigable waters data collection. At those selected sites, the survey length was 200m rather than 100m to facilitate additional data collection requirements. Information on the FFHI field cards included the following information where applicable to support the evaluation of fish habitat quality and determine classification:

- Stream Name;
- Reach Number;
- Site Number, UTM and Length;
- Access;
- Date, Time, Agency and Crew;
- Channel Measurements: Width and Wetted Width;
- Gradient;
- Bankfull Width and Stage;
- Stream Cover (Overhanging vegetation, LWD, SWD, Boulders, Undercut Banks, and Instream Vegetation);
- Crown Closure;
- Bank Characteristics [Left Bank and Right Bank Shape, Texture, Riparian Vegetation Stage];
- Flood Signs;

- Channel Morphology;
- Bed Material;
- Disturbance Indicators;
- Channel Pattern;
- Islands and Bars;
- Coupling and Confinement;
- Site Features.

The comment section included the following information where applicable:

- Type and condition of existing crossing structure;
- Fish Observations;
- Obvious evidence of habitation by fish (eg. redds);
- All major features (i.e. fish passage barriers, beaver dams, clay slides, and any other features affecting fish values);
- Any obvious fish habitat limitations;
- Preliminary identification of obvious Fisheries Sensitive Zones as per the procedures outlined in the *Forest Practices Code of British Columbia Fish-Stream Identification Guidebook*;
- The assessed stream classification at the time of the field survey.

Fish habitat was assessed for spawning (salmonid), rearing, overwintering, and migration potential at all streams that were known or assumed to be fish-bearing. Attributes that were considered during the assessment included: water flow and depth; the presence of deep pools and proximity to lentic overwintering areas; connectivity to other fish bearing waters; substrate size, composition and embeddedness; and the diversity and abundance of cover types.

All field data was recorded on the applicable field forms (Resources Inventory Committee 2001) and the site was identified with a ribbon labeled “Blackwater FFHI-[site number]2012”.

The objective of fish sampling in the context of this project was to characterize fish communities at all road crossings and to determine fish-bearing status at streams that may be impacted by the proposed transmission line. The sampling effort is described as follows:

- Road crossings: One hundred lineal meters of electrofishing was conducted (50m upstream of crossing and 50m downstream) and two minnow traps were set overnight at all sites that were field confirmed to: 1) have met the requirements for a stream as per the Forest Practices Code *Fish Stream Identification Guidebook* or, 2) contain open water of sufficient volume to support fish and were connected to fish bearing waters. This strategy was implemented to describe fish presence at the crossing site, regardless of whether or not the drainage met the requirements for a stream. Sites that were not included in this sample plan were located at Davidson Creek, Chedakuz River and Turtle Creek which had been sampled for fish in 2011.

- Transmission line crossings: Presence/absence fish sampling at transmission line sites was conducted primarily using the electrofisher to aid in the assessment of the fish-bearing status of the stream. Using this methodology, sampling ceased after the first fish was captured.

Fish sampling methodology generally followed protocols as outlined in the "Fish Sampling Procedures" in the FPC *Fish Stream Identification Guidebook*. Electrofishing field crews used a Smith-Root Model 12-B backpack electrofisher; all personnel involved in electrofishing activities were certified.

All fish specimens captured were tallied on provincial individual fish data cards. Care was taken to ensure that all captured fish were kept alive until the end of sampling. In order to accomplish this, fish were identified and measured (fork-length) quickly and released back into the waters from which they were captured. Photos were taken of each species captured at each site.

2.5 Fish Habitat Quality Evaluation

Quality of fish habitat was observed during field reconnaissance and a qualitative evaluation of the field data was completed at the FFHI site using professional judgment. All aspects of fish habitat were taken into consideration at the time of the site visit and habitat value was rated separately based on the following life stages: spawning, rearing, and overwintering. Once habitat for each life stage was assessed, an overall score was given to habitat value and was listed as being either none, poor, fair, good, or excellent. Table 1 identifies some of the factors that were taken in to consideration when professional judgment was used to determine overall fish habitat. It is important to note that the habitat quality that was assessed in the field may not always fit into Table 1; however, it can be used as a baseline for factors that were taken into consideration at the time of habitat evaluation.

Table 1. Summary of Habitat Quality Rating Description

Habitat Quality Rating	Description
Excellent	Available habitat is highly suitable. No limitations to suitability are identified for most or all life stages for species under consideration.
Good	Available habitat has slight limitations for most life stages of species under consideration; moderate limitations may be present for one life stage.
Fair	Available habitat is capable of supporting all or most life stages of species under consideration, but may not be most desirable habitat. Severe limitations may be present for one life stage; slight to moderate limitations are present for other life stages.
Poor	Moderate to severe limitations in habitat suitability are present for some or all life stages of species under consideration.
None	Habitat suitability is negligible or nonexistent for some or all stages of fish life history.

2.6 Riparian Vegetation

Information pertaining to riparian vegetation was collected at every site that was classified as a fish stream. Canopy closure over each reach was assessed first in totality, then approximated with the assumption that it was cut back to 3m in height (2m for primarily coniferous riparian). Both values were recorded to provide an estimate on the quantity that may be lost owing to future clearing activities, with the difference between the two specific to the construction of the transmission line. Dominant, sub-dominant, and present tree species within 15 m of the streambank were recorded and the same categories were used for woody shrubs. The height and diameter of a dominant tree were also measured.

Methodology followed procedures described in the *Timber Pricing Branch Cruising Manual* (Province of BC 2012). Canopy closure was estimated using visual observation and the BC Silviculture Survey crown closure reference card (Province of BC 2011).

2.7 Fish Passage

If the field crews suspected that an existing closed-bottom crossing structure impeded fish passage at one of the sites classified as a fish stream, an assessment was completed as per *Field Assessment for Determining Fish Passage Status of Closed Bottom Structures* (BC Ministry of Environment 2011). Criteria that were measured for this assessment include culvert embeddedness, outlet drop, stream width ratio, culvert slope, and length. A final ranking of "barrier", "potential barrier" or "passable" was given after the evaluation of the scoring matrix for each site.

2.8 Navigable Waters Evaluation

Field data collection was used to determine if the subject crossing met the criteria of "Minor Navigable Waters" as outlined in Transport Canada's (2010) *Minor Works and Waters Order* and the *Minor Waters Users Guide 2010.* The five Transport Canada navigable water characteristics are:

- average depth;
- average width;
- channel slope;
- sinuosity ratio; and
- frequency of natural obstacles.

Based on the above characteristics, the following measurements and observations pertaining to Navigable Waters criteria were recorded in the field:

- average stream channel bankfull depth
- average stream width
- evidence of past use
- sinuosity
- Number of natural obstacles
- estimations of flow levels and distances these are maintained

- impediments to navigation

Methodology followed procedures described in the *Minor Waters User Guide* (Transport Canada 2010). Measurement of all of the above information was planned for proposed and existing road crossings located at streams measuring >3m in width, and a predetermined selection of streams measuring 1.2-3m in width. However, after the first half of sample sites were completed in 2012, it was apparent that sinuosity could not be measured effectively because of the large amount of blowdown common to the region's beetle-killed forests and values were not close to the threshold for failure. In the interest of time and with the knowledge that the blowdown was more of a navigational issue than sinuosity, this measurement was dropped for the remainder of the sites. Streams less than 1.2m, the remaining streams measuring 1.2-3m wide, and all transmission line sites less than 15m wide and were >1000m from a recreational lake were not included in this data collection.

3 Results

3.1 2013 FFHI Study

Using the data collected during the 2013 field season, tables and appendices were created based on stream classification, fish sampling, riparian vegetation, fish passage and closed bottomed structures, and navigable waters information. Of the 105 sites that were assessed and sampled, 72 were Non-Classified Drainages (NCDs) and 33 were streams (S6-S1). Fish presence was verified through visual observation and fishing efforts at 11 sites with rainbow trout being the most common species. Patterns were seen in the riparian vegetation that was present at the 33 stream sites and the data was compiled into a table with both the Latin and common name of the dominant and sub dominant species. Only one culvert was assessed during the 2013 field season and navigable waters information was gained for thirty-eight stream sites.

3.1.1 Stream Classification and Fish Habitat

There was a total of 72 NCDs classified at drainages associated with all crossing types (Table 2). Many of these were mapped waterlines that appeared to flow into fish-bearing streams and were identified as having the potential for fish presence, but upon field inspection were nothing more than depressions or seams with a wetter soil type (Fig. 2). Non-classified drainages such as this are common in the region owing to a relatively flat landscape and poor soil drainage. There is no fish habitat and often very little open water observed in these drainages with the exception of spring melt water. Aspen, alder and willow species are common to these sites. Details on all NCD reaches can be found in the Appendix.

Table 2. 2013 FFHI stream classifications for version 9 of the alignment.

Classification	Crossing Type						Total
	Airstrip Road	Existing Road	Proposed Road	Transmission Line	Stellako Reroute	Mills Reroute	
NCD	2	9		52	4	5	72
S4	1		1	14	1	2	19
S3				7		1	8
S2				2		1	3
S1				1	1		2
S6				1			1
Total	3	100	9	143	9	9	
						Grand Total	105

[1]Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage.

Of the 33 sites that were sampled, 1 was an S6, 19 were S4, 8 were S3, 3 were S2, and 2 were S1. The 1 site (TL-962) classified as a non-fish bearing stream (S6) was assessed with consideration to previous sampling information, the absence of substantial habitat quality, and the presence of multiple potential downstream barriers. The channel was nearly dry at the time of survey, therefore, electrofishing efforts were nearly impossible and minnow traps were unable to be set. Based on the poor habitat conditions that were observed during the 2013 survey, the previous classification of S6 was determined appropriate.



Figure 2. Poorly drained NCDs typical of the region. TL-963(left); TL- 908 (right)

Two of the S1s that were classed represent different sites within the same reach of the Stellako River, representing two options for a transmission line crossing. The water depth and velocity at S1 sites were assessed to be too dangerous to wade into, therefore, some data was omitted for these sites. GIS technology and historical information was used to confirm that the average channel width at these sites was greater than 20m.

The remaining fish-bearing classifications (S2-S4) were spread among the road and transmission line crossings with most being transmission line sites. The objective for the transmission line sites was to confirm fish presence/absence only and in the absence of a multi-seasonal, comprehensive sampling inventory, all reaches less than 20% gradient without an identified barrier between the specified reach and known fish-bearing water bodies must be defaulted to fish-bearing, regardless of the capture success of a single-event sample (BC Ministry of Forests 1998). Therefore, with consideration to the above criteria, all transmission line sites were given defaulted fish-bearing classifications with the exception of the one S6 site described previously. Details on all classified stream reaches can be found in the Appendix.

Fish habitat was generally assessed as good at all S2 streams, most of the S3 streams, and more than half of the S4 streams. There were five of the nineteen S4 streams that did not receive a rating of "good" for any of the four habitat categories (Table 3). These drainages contained little or no spawning gravels and an abundance of fine sediment that is a result of the glacial-fluvial and glacial-lacustrine deposition typical for the region. A few were downstream of an NCD reach. Flows were shallow or intermittent and drainage hydrology may have been impacted by upstream or adjacent forest harvesting and/or cattle grazing. Sampling was attempted at several of the sites, but the only fish observed were at AP-905.

Table 3. Streams found to not have a habitat quality rating of good in any of the types of fish habitat from the 2013 scope of work

		Habitat Type				
Site ID	**Classification**	**S**	**R**	**O**	**M**	**Comments**
AP-905	S4	P	F	F	F	S3 stream with fair fish habitat. 250mm fish seen.
MR-004	S4	P	F	P	P	S4 with intermittent dry sections and overall poor fish habitat.
SR-004	S4	P	P	P	P	Dry S4 with d/s barrier to migration and no upstream perennial habitat.
TL-1011	S4	P	F	F	P	S4 with marginal fish habitat. Defaulted to fish bearing status.
TL-1026	S4	P	F	P	P	Low quality stream defaulted fish bearing. Does not provide migration to good upstream habitat.

S = Spawning Habitat; R = Rearing Habitat; O = Overwintering Habitat; M = Migration Habitat. Habitat ratings are: N = None; P = Poor; F = Fair; G = Good.

Classifications, habitat ratings, and associated reach information for all sites were entered into a MS Access database. If a stream had not been assigned a 50k watershed code, it was given an Interim Locational Point (ILP) number that represented the last 5 digits of the 20k WSC to facilitate reporting to the permitting agencies. If there was no existing 20k watershed code, an arbitrary ILP was assigned. Reach numbers were given to each crossing location by counting upstream starting from the stream mouth, with the use of contour and water layers to support reach break locations.

3.1.2 Fish Sampling

Fish were observed or captured at 11 of the 27 sites sampled in 2013. Rainbow trout were the most common species captured and were found in all habitat types. If fish were observed during the stream classification survey at a proposed transmission line crossing, the observation was recorded and sampling was not conducted because the objective was simply to confirm fish presence at these sites. Likewise, once a fish was captured during sampling at a reach that was planned only for a transmission line crossing, capture efforts ceased.

Of the 33 streams that were assessed, 27 were sampled for fish by means of electrofishing and minnow trapping. At 16 of the sites, no fish were caught or observed. At 7 of the sites, fish were visually observed, and at 4 sites, fish were caught through electrofishing. Of the fish caught through electro-fishing, rainbow trout was the identified species at 3 of the 4 sites with the final site having an unidentified fish species. The unidentified species was due to the fish being in transition between juvenile and adult stage of life, however, par marks were observed.

Catch Per Unit Effort (CPUE) values were calculated for both electrofishing and minnow trapping for every sampled stream. Refer to Appendix D for a summary of CPUE values for sites sampled in 2013.

A summary table of the fish species caught for each site can be found in Appendix D. Individual fish data is included in the digital database submission.

3.1.3 Riparian Vegetation

Riparian vegetation was assessed at all fish-bearing reaches. While species were similar among sites, abundance and distribution was varied and dependent on habitat and forest activity. Predictably, wetlands and recently burned sites exhibited the most woody shrub cover while trees were dominant in live mature forests (Fig. 3). Canopy cover ranged from 1-18% among sites and the difference in canopy between total estimated and that which was approximated at a specified cut height ranged from 0 to 14% with an average loss of 2.58%. Dominant tree species were mainly spruce and pine with occasional balsam. Aspen and black cottonwoods were the dominant trees at wetter sites. The most commonly observed shrub species included alder, willow, and black twinberry. A table summarizing riparian vegetation data for each site can be found in the Appendix.



Figure 3. Differences in riparian vegetation between burned block (left; AE-57) and mature forest (right; AP-905)

3.1.4 Fish Passage and Closed Bottom Structures

One culvert (at site AA-002) was assessed and scored as a barrier to fish passage at an existing road crossing (Table 4). Fish passage is scored for closed-bottom structures using different criteria which are then added together and compared with threshold values. Overall scores greater than 20 indicate the culvert is likely a barrier to fish passage for part or all of the year. The culvert that received a failing score did so because it was not continuously embedded and it was undersized, which may create velocity barriers and may limit upstream passage, especially in spring during freshet. At this site, fish were caught downstream of the existing CBS during electro fishing efforts. If road upgrading is planned, the culvert should be replaced with a drainage structure appropriate for the habitat and gradient as per the *Fish Stream Crossing Guidebook* (MFLNRO 2012).

Table 4. Characteristics of culverts determined to be barriers to fish passage. SWR= stream:channel width ratio.

Site ID	Embedded	Outlet drop (cm)	Culvert Slope %	SWR	Length (m)	Score	Comments
AA-002	N	0	5	1.3	37	29	Length and slope of embedded culvert create velocity barrier.

3.1.5 Navigable Waters

There were 33 sites where preliminary information was recorded as it related to Navigable Waters reporting prior to the 2012 amendment of the Act. Of these, 16 streams measured a channel width of less than 1.2m or depth less than 0.3m, meaning they met the primary review qualifications for minor waters (Transport Canada 2010a,b). There are other factors that may downgrade streams from navigable to minor waters for streams that have a channel width between 1.2 - 3m. These include:

- A channel gradient >4%.

- A depth <0.6m.
- A sinuosity ratio > 2. Sinuosity is measured as stream channel length / valley length.
- 3 or more obstacles counted in 200m.

There were 11 additional sites that were downgraded based on one or more of the above criteria. Sinuosity was never close to the threshold for failure, which is not surprising considering that the typical stream pattern in the region is irregular-wandering rather than sinuous (local knowledge). The most common issue regarding navigability was excessive blowdown in and across the stream channels (Fig. 4), which is likely owing to the large quantities of beetle-killed pine in the area.



Figure 4. Windblown timber across channels at AE-007 (left) and TL-004 (right).

There were six streams at proposed transmission line crossings that did not qualify as minor waters. In accordance with the pre-2012 Navigable Waters Protection Act additional measurements were taken at these sites to describe minimum and average depths, minimum widths, and the lengths over which these were observed within the 200m survey (Table 5).

Most of the streams located at the proposed transmission line crossings qualified for a “Minor Works” designation because channel widths were less than 15m in width and the location of the crossing was more than 1000m from a lake. Exceptions include TL-1025 (Fifteen Creek), TL-1021 (Tahultzu Creek), TL-1010, TL-1024, TL-961, and TL-962 which are less than 1000m from lakes. SR-003 (Stellako River) and TL-1025 (Nechako River) have an average channel width greater than 15m. There was extensive beaver damming noted at TL-1025, limiting any navigation.

Table 5. Additional measurements taken at transmission line sites that were not classified as Minor Waters as per the NWPA

Site ID	Mean BfW (m)	Mean BfD (m)	Mean Gradient (%)	Sinuosity	Blockages	Min width (m)	Min width L (m)	Av width L (m)	Min depth (m)	Min depth L (m)	Mod level (m)	High level (m)	Substrate	Navigability
MR-002	12	0.7	3	ns	0	6	4	150	0.3	75	0.9	1.5	fines and Gravels	S2 stream with good flows. Navigation is not impeded by anything. No evidence of recreational use.
SR-003														Stellako River - large river with no blockages in 200m reach centered on crossing site. Swiftwater makes data collection for Nav waters unsafe.

TL-1021	6.5	0.6	2	ns	1	5	75	75	0.3	50	0.5	0.8	Fines	S2 stream that is navigable
TL-1029	3.4	0.6	4.5	1.18	28	1.4	10	150	0.1	150	0.3	0.5		Significant amount of LWD causing blockages throughout surveyed reach.
TL-1064	12.52	1.3	2.5	ns	3	8	5	120	0.15	40	0.6	1.1	Fines and Gravels	S2 stream with good flows. Several shallow sections (0.15m) could impede navigation.
TL-1065														Nechako River - large river with no blockages in 200m reach centered on crossing site. Visual estimation of

| | | |

3.2 Preferred Final Alignment

Historical fish distributions and potential obstructions were considered during the desktop review of existing information. Fourteen crossings were omitted from the field sampling program because sufficient information was available from previous classifications of the same reach (Table 6).

Twenty of the proposed transmission line crossings are located in the Cheslatta watershed, with all of the associated drainages connected to the Swanson Creek system, a 28 km long, 4th order stream. Swanson Creek supports a variety of species including rainbow trout, mountain whitefish and numerous coarse or non-game fish. Chinook and sockeye salmon have been observed in the lower reaches and although there are also known obstacles to migration, there have been observations of chinook upstream of the potential barriers.

There are 16 existing road crossings associated with the project identified in the Chilako watershed and all of the drainages are a part of the Finger Creek system, a 17 km long, 4th order stream. Observed fish species in Finger Creek include rainbow trout, kokanee, prickly sculpin, and redside shiner. There are documented obstacles upstream of Finger Lake including beaver dams and waterfalls that may limit fish passage.

There were 17 crossings associated with the transmission line and existing roads in the Euchinko watershed. All associated drainages flow into an unnamed system that eventually empties into Taiuk Creek. This 4th order, unnamed stream is 17 km in length and fish that have been observed throughout including rainbow trout, lake chub, and several unidentified species. There are no obstacles to passage identified on this stream or in upstream tributaries.

The Francois/Fraser watershed includes 41 proposed transmission line crossings. The crossed drainages empty into the Robertson Creek and Stellako River systems. Both of these eventually empty into Fraser Lake. Robertson Creek is an 11km long, 4th order drainage with reported observations of lake chub, rainbow trout, longnose sucker, and redside shiner. There are no identified obstacles along Robertson Creek or in its upper tributaries. The Stellako River connects Francois Lake to Fraser Lake and supports Dolly Varden, kokanee, mountain whitefish, rainbow trout, and a variety of non-game fish. The Stellako contains important spawning reaches for chinook and sockeye salmon, and both species are observed throughout the river every year. Known obstacles to fish passage that may impede upstream migrations include a 1.5 m waterfall and numerous beaver dams.

There are 100 potential crossings identified in the Lower Nechako Reservoir watershed also known as the Knewstubb Lake basin. The crossings represent a mix of proposed and existing roads and proposed transmission line sites. The identified drainages are part of the Chedakuz Creek or Big Bend Creek systems. Chedakuz Creek is a 53 km long 5th order stream that flows north-west from Tatelkuz Lake to the Nechako Reservoir. There is not a lot of documented fish information for Chedakuz, but it is locally known to support rainbow trout and provide spawning habitat for kokanee. Additional fish observations in Tatelkuz Lake include mountain whitefish and several non-game species. Big Bend Creek is a 37 km, 4th order stream that flows from the Brewster lakes to the Nechako Reservoir. Documented species

distributions are also scarce for Big Bend Creek, but include rainbow trout and prickly sculpin. Several sucker species are also known to be present in the Brewster lakes.

The remaining 93 drainages are associated both with existing road or proposed transmission line crossings. The crossed drainages are part of the Stoney Creek, Engen Creek, Tahultzu Creek, Greer Creek, and 3 unnamed systems which eventually empty into the Nechako River, or they represent smaller tributaries that empty directly into the Nechako. The most common salmonid identified in these drainages is rainbow trout, especially in the upper reaches and tributaries. Except for the Nechako River, the only records of anadromous fish observations include coho, chinook, and sockeye salmon in the lower reaches of Greer Creek.

The nearest and only species at risk identified in all of the drainages above is the red-listed Nechako white sturgeon, which is concentrated in the middle reaches of the Nechako River, about 4.5 km from the nearest proposed crossing.

There were a total of 173 NCDs classified at drainages associated with all crossing types (Table 7). Many of these were mapped waterlines that appeared to flow into fish-bearing streams and were identified as having the potential for fish presence (Section 4.2), but upon field inspection were nothing more than depressions or seams with a wetter soil type (Fig. 2). Non-classified drainages such as this are common in the region owing to a relatively flat landscape and poor soil drainage. There is no fish habitat and often very little open water observed in these drainages with the exception of spring meltwater. Aspen, alder and willow species are common to these sites. Details on all NCD reaches can be found in the Appendix.

The 8 sites classified as non-fish bearing streams (S6) were assessed with consideration to previous sampling information , the absence of upstream overwintering habitat, and the presence of an identified downstream barrier or reach gradient of >20%. In most of these cases, the channel was dry or nearly dry at the time of survey and/or previously classed as non-fish bearing.

Two of the S1s that were classed represent different sites within the same reach of the Stellako River, representing two options for a transmission line crossing. The Nechako River is the third S1 site that will be potentially crossed by a transmission line. The water depth and velocity at these sites were assessed to be too dangerous to wade into, so some data was omitted for these sites. GIS technology was used to confirm average channel width at these sites was greater than 20m.

The remaining fish-bearing classifications (S2-S4) were spread among the road and transmission line crossings. The objective for the transmission line sites was to confirm fish presence/absence only and in the absence of a multi-seasonal, comprehensive sampling inventory, all reaches less than 20% gradient without an identified barrier between the specified reach and known fish-bearing water bodies must be defaulted to fish-bearing, regardless of the capture success of a single-event sample (BC Ministry of Forests 1998). Therefore, with consideration to the above criteria, all transmission line sites were given defaulted fish-bearing classifications with the exception of the S6 site described previously as well as 2 others from the 2012 FFHI. Details on all classified stream reaches can be found in the Appendix.

Fish habitat was generally assessed as good at all S2 streams, most of the S3 streams, and more than half of the S4 streams. There were thirteen S4 streams that did not receive a rating of "good" for any of the four habitat categories (Table 8). These drainages contained little or no spawning gravels and an abundance of fine sediment that is a result of the glacial-fluvial and glacial-lacustrine deposition typical for the region. A few were downstream of an NCD reach. Flows were shallow or intermittent and drainage hydrology may have been impacted by upstream or adjacent forest harvesting and/or cattle grazing. Sampling was attempted at several of the sites, but the only fish observed were at AE-14 and AP-905.

Site summaries for each stream crossing site of the final preferred alignment can be found in Appendix G.

Table 6: Previous classifications accepted without field sampling.

Site ID	Prev. class†	Prev. class yr.	Comments
AE-004	NCD	2002	Organic depression with no fish habitat.
AE-008	NCD	2002	No defined channel, discontinuous flow, pockets of standing water. Not a stream.
AE-050	NVC	2006	No evidence of scoured channel, alluvial deposits, or water.
AE-051	NVC	2006	No evidence of scoured channel or alluvial deposits. Some moisture tolerant vegetation present.
AE-054	NCD	2006	Isolated puddling in a 5m wide wet area. No connectivity to fish habitat observed.
AE-066	NVC	2002	No scoured channel, alluvial deposits, or water present.
AE-067	NCD	2002	Seepage area with some overland flow and underground flow. No scoured channel or alluvial deposits. Not a stream.
TL-918	NCD	2002	No defined channel, discontinuous flow, pockets of standing water. Not a stream.
MR-005	NCD	2002	No visible channel at this location. No evidence of water flow at any time of the year.
TL-953	NCD	2006	Previous classification. Grassy swale in cutblock with no scouring, alluvial deposits, flow, or channel. Not a stream.
TL-977	S6	2002	Data from previous classification done in 2002. Stream loses channel definition d/s of site and culvert may be potential barrier.
TL-978	NCD	2002	Classified in 2002. NCD with no lentic origin. Assume previous classification
TL-979	NCD	2003	Classified in 2002. NCD with no lentic origin. Assume previous classification
TL-1079	NCD	2002	Organic depression with no fish habitat.

†NCD= Non-classified drainage; NVC= Non-visible channel; NPC= No previous classification data; S6= Non-fish bearing stream <3m wide.

Table 7. Summary of stream classifications for final preferred alignment

	Crossing Type						
Classification	Airstrip Road	Existing Road	Proposed Road	Transmission Line	Stellako Reroute	Mills Reroute	Total
NCD	2	65	5	90	6	5	173
S4	1	16	2	21	1	2	43
S3		11	1	21	1	1	35
S2		4	1	6		1	12
S1				2	1		3
S6		4		3			7
Total	3	100	9	143	9	9	
						Grand Total	273

[1]Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage.

Table 8. Streams found to contain poor overall fish habitat.

		Habitat[2]				
Site ID	Classification[1]	S	R	O	M	Comments
AE-013	S4	F	F	P	P	Downstream of crossing, channel has been degraded from harvesting. U/s is better, but hanging culvert restricts fish passage.
AE-014	S4	P	F	F	P	Dewatered in some sections
AE-020	S4	P	F	P	P	Upstream of crossing is NCD. D/s reach drains into small lake.
AE-035	S4	F	F	P	P	Dry channel at this time.
AE-061	S4	P	F	P	P	Dry/intermittent channel with 40% gradient d/s of existing crossing.
AE-072	S4	N	P	N	N	Shallow, muddy watercourse dry at time of survey. Cutblock altered hydrology. NCD upstream of crossing. Channel d/s at 10U 416771 5970527.
AE-074	S4	N	F	P	P	Shallow, muddy channel nearly dry at time of survey. Poor overall habitat, but no apparent barriers to fish-bearing waters d/s.
AP-905	S4	P	F	F	F	S3 stream with fair fish habitat. 250mm fish seen.
MR-004	S4	P	F	P	P	S4 with intermittent dry sections and overall poor fish habitat.
SR-004	S4	P	P	P	P	Dry S4 with d/s barrier to migration and no upstream perennial habitat.

TL-970	S4	F	F	P	P	Dry channel at this time.
TL-1011	S4	P	F	F	P	S4 with marginal fish habitat. Defaulted to fish bearing status.
TL-1026	S4	P	F	P	P	Low quality stream defaulted fish bearing. Does not provide migration to good upstream habitat.

[1] - S = spawning habitat; R = rearing habitat; O = overwintering habitat; M = migrating habitat; F = fair habitat; P = poor habitat; N = nil habitat
[2] - S4 streams have an average channel width of 0m to 1.5m

3.2.1 Transmission Line Final Preferred Alignment

The preferred final alignment for the proposed transmission line was classified and found to contain 101 NCDs and 60 streams, 3 of which were assessed to be non-fish bearing (Table 9). Summary information for NCDs can be found in Appendix H.1 and summary information for classified streams can be found in Appendix H.2.

Table 9. Stream classification breakdown for all transmission line sites of the preferred final alignment.

	Crossing Type			
Classification[1]	**Transmission Line**	**Stellako Reroute**	**Mills Reroute**	**Total**
NVC				0
NCD	90	6	5	101
S4	21	1	2	24
S3	21	1	1	23
S2	6		1	7
S1	2	1		3
S6	3			3
Total	143	9	9	
			Grand Total	161

[1]Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage.

3.2.2 Access Road Final Preferred Alignment

The preferred final alignment for the proposed transmission line was classified and found to contain 72 NCDs and 40 streams, 4 of which were assessed to be non-fish bearing (Table 10). Summary information for NCDs can be found in Appendix I.1 and summary information for classified streams can be found in Appendix I.2.

Table 10. Stream classification breakdown for all road sites of the preferred final alignment.

	Crossing Type			
Classification	**Airstrip Road**	**Existing Road**	**Proposed Road**	**Total**
NVC				0
NCD	2	65	5	72
S4	1	16	2	19
S3		11	1	12
S2		4	1	5
S1				0
S6		4		4
Total	3	100	9	
			Grand Total	112

[1]Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage.

3.2.3 Summary of Fish Sampling Efforts

Fish were observed or captured at 35 of the sites sampled in 2012 and 2013. Rainbow trout were the most common species captured (Fig. 5) and were found in all habitat types. Brassy minnow and Lake chub were captured in slow moving stream sections close to ponds. There was one dead sockeye salmon observed at a Stellako River site (TL-119 from the v5 of the alignment). If fish were observed during the stream classification survey at a proposed transmission line crossing, the observation was recorded and sampling was not conducted because the objective was simply to confirm fish presence at these sites. Likewise, once a fish was captured during sampling at a reach that was planned only for a transmission line crossing, capture efforts ceased.





Figure 5. Rainbow trout captured at AE-059 (left) and AE-055 (right).

Total numbers of fish captured at road sites were understandably higher than transmission line crossing sites because the sampling effort was more intensive and consisted of electofishing for 100m and an overnight set of 2 minnow traps. There were 585 fish that were positively identified as rainbow trout at streams associated with road crossings which translated to 87.7% of the total fish captured. The remaining fish were brassy minnow (4.5%), lake chub (1.6%), white sucker (0.2%), and species that could not be positively identified (6%) usually because they escaped during electrofishing. Sampling was attempted but unsuccessful at 10 road sites. The average fork-length of rainbow trout was 66mm among all sites; with the largest measuring 220mm.

Catch Per Unit Effort (CPUE) values were calculated for both electrofishing and minnow trapping for every sampled stream. A summary table of the fish species caught for each site can be found in Appendix J. Individual fish data is included in the digital database submission.

3.2.4 Fish Passage and Closed Bottomed Structures

Seventeen culverts were scored as barriers to fish passage at existing road crossings (Table 11). Fish passage is scored for closed-bottom structures using different criteria which are then added together and compared with threshold values. Overall scores greater than 20 indicate the culvert is likely a barrier to fish passage for part or all of the year. Most of the culverts that received a failing score did so because they were not embedded and undersized, which may create velocity barriers and limit upstream passage, especially in spring during freshet. Site TL-917 had observations of fish both upstream and downstream of the existing CBS, as well as connectivity to perennial habitat both upstream and downstream of the CBS. If road upgrading is planned, the culverts should be replaced with a drainage structure appropriate for the habitat and gradient as per the *Fish Stream Crossing Guidebook* (MFLNRO 2012).

Table 11. Characteristics of culverts determined to be barriers to fish passage. SWR= stream:channel width ratio.

Site ID	Embedded	Outlet drop (cm)	Culvert Slope %	SWR	Length (m)	Score	Comments
AE-001	N	0	2	4.24	14.79	21	Culvert may be undersized for discharge - also center of culvert seems compressed.
AE-007	N	0	5	1.55	ns	26	Potential velocity barrier in spring.
AE-013	N	90	2	2.1	ns	31	Small hanging culvert is definite barrier to migration.
AE-014	N	12	3	1.22	18.2	21	Potential velocity barrier in spring.
AE-021	N	23	1	2.2	15	29	2 culverts, both slightly caved in and undersized.
AE-030	N	0	1	4.2	24.8	24	3 culverts should be replaced by an Arch.
AE-049	N	15	1	1.6	26	29	Good crossing upgrade site.
AE-055	N	10	2	2.95	25	24	Upstream backwatering with shift to wetland type.
AE-059	N	36	2	2.06	25	34	Culvert likely limits upstream migration and should be replaced.
AE-061	N	0.55	4	1.3	25	26	Minimal flows running through culvert. Poor fish habitat stream. NCD u/s of culvert and gradient barrier d/s of culvert.
AE-068	N	0	3	2.3	19	24	Culvert undersized and not embedded. Likely restricts upstream migration during wetter seasons.
AE-071	N	0	1	1.3	28	21	May restrict passage during freshet.
AE-075	N	0	2	1.2	32	24	May restrict passage during freshet.
AE-076	N	0	1	1.7	25	24	No outlet drop, but potential barrier in spring b/c of size and lack of embeddedness.
TL-023	N	0	1	1.14	20.2	21	This culvert is 39m downstream of TL23.
TL-917	N	0	5	1.55	ns	26	Potential velocity barrier in spring, but fish obs on both sides of culvert at time of sample.
AA-002	N	0	5	1.3	37	29	Length and slope of embedded culvert create velocity barrier.

3.2.5 NWPA Minor Waters Assessment

There were 101 sites where preliminary information was recorded as it related to Navigable Waters reporting prior to the 2012 amendment of the Act. Of these, 40 streams measured a channel width of less than 1.2m or depth less than 0.3m, meaning they met the initial criteria for minor waters (Transport Canada 2010a,b). There are other factors that may downgrade streams from navigable to minor waters for streams that have a channel width between 1.2 - 3m. These include:

- A channel gradient >4%.
- A depth <0.6m.
- A sinuosity ratio > 2. Sinuosity is measured as stream channel length / valley length .
- 3 or more obstacles counted in 200m.

There were 29 additional sites that were downgraded based on one or more of the above criteria. Sinuosity was never close to the threshold for failure, which is not surprising considering that the typical stream pattern in the region is irregular-wandering rather than sinuous (local knowledge). The most common issue regarding navigability was excessive blowdown in and across the stream channels (Fig. 4), which is likely owing to the large quantities of beetle-killed pine in the area.

There were 9 streams at proposed or existing road sites that did not qualify as minor waters, but in every case, navigability was assessed to be poor because of shallow flows and obstacles in the channel such as boulders, vegetation, and large woody debris (Table 12). Additional measurements were taken at these sites to describe minimum and average depths, minimum widths, and the lengths over which these were observed within the 200m survey (Appendix).

Most of the streams located at the proposed transmission line crossings qualified for a “Minor Works” designation because channel widths were less than 15m in width and the location of the crossing was more than 1000m from a lake. Exceptions include TL-025 (Big Bend Creek), TL-1025 (Fifteen Creek), and TL-1021 (Tahultzu Creek) which are less than 1000m from lakes, SR-003 and TL-937 (Stellako River) and TL-082 (Nechako River). There was extensive beaver damming noted at TL-025 and TL-1025, limiting any navigation.

Table 12. Road sites where stream channels not classified as minor works or minor waters. BfW= Bankfull width; BfD = Bankfull depth.

Site ID	Mean BfW (m)	Mean BfD (m)	Mean Gradient (%)	Sinuosity	Blockages	Navigability
AE-001	3.9	0.77	1.5	1.09	4	Thick growth of willow in channel.
AE-002	3.3	0.37	1	1.14	4	Grass and sedge in channel would make navigation difficult
AE-003	12.1	0.93	3	1.1	0	Frequent mid channel bars and low water levels. Bridge clearance is 3.1m.
AE-030	7.5	0.67	2.5	1.65	14	Heavily beaver dammed.
AE-037	6.6	1.07	1	2	6	Many shallow sections, couldn't paddle canoe through.
AE-057	2	1.1	3	ns	2	Boulders and low flow limit navigation.
AE-068	5.8	0.75	4	1.33	4	Frequent fallen logs fallen over channel. Shallow flows at time of survey.
AP-004	6.5	0.46	1.5	1.27	3	Abundant blowdown across banks, navigation would be extrememly limited.
AE-907	4.2	0.92	2	1.02	5	Boulders and abundant woody debris would make navigation difficult.

4 Closing

The majority of the 2013 field-verified stream classifications reflect 2002-2006 data where classifications already exist; however, there are some differences. These differences can be explained in part by the increase in harvest activity in the area over the last 10 years, which has likely led to altered hydrology and changes in stream discharge rates. Additionally, the rapid regeneration of streamside deciduous trees in logged areas often leads to increased beaver activity which can also alter stream flows and channel morphology.

Through electro fishing and minnow trapping efforts, it was discovered that the majority of the fish species captured or observed in the streams were rainbow trout. Other species identified during sampling included brassy minnow, lake chub, and white sucker. There were no anadromous fish captured. One spawned sockeye salmon was observed at a Stellako River site. The streams with historical observations of anadromous fish include the Stellako and Nechako Rivers and the lower reaches of Swanson and Greer Creeks. The nearest species at risk is the white sturgeon, which has historically been observed in the middle reaches of the Nechako River.

Riparian vegetation varies among sites and often depends on soil moisture and surrounding forest activity. Wetlands and recently burned or harvested areas are dominated by shrub riparian vegetation while mature forests contain the most standing timber. The average amount of canopy that would be lost to clearing activities (as estimated to a specified cut height of 3 m) is 4.9%.

In addition to the Stellako and Nechako Rivers, there were 12 sites that did not qualify as minor waters/minor works as they are defined in the Navigable Waters Protection Act (2010). Although these 12 sites did not meet the standard requirements to downgrade to minor waters/minor works, navigation would be limited because of the large volume of windblown timber across and inside the channels, which may be attributed in part to the abundance of mountain-pine beetle killed timber in the region.

Seventeen existing crossings contain closed-bottom culverts that were determined to impede fish passage during all or part of the year. The most common characteristics that support these determinations include undersized culverts and lack of embeddedness, inferring that upstream passage would be limited because of velocity barriers, especially during freshet or after storm events. If road upgrading is being considered, it is recommended that these culverts be replaced with an appropriate structure in areas where upstream fish habitat exists.

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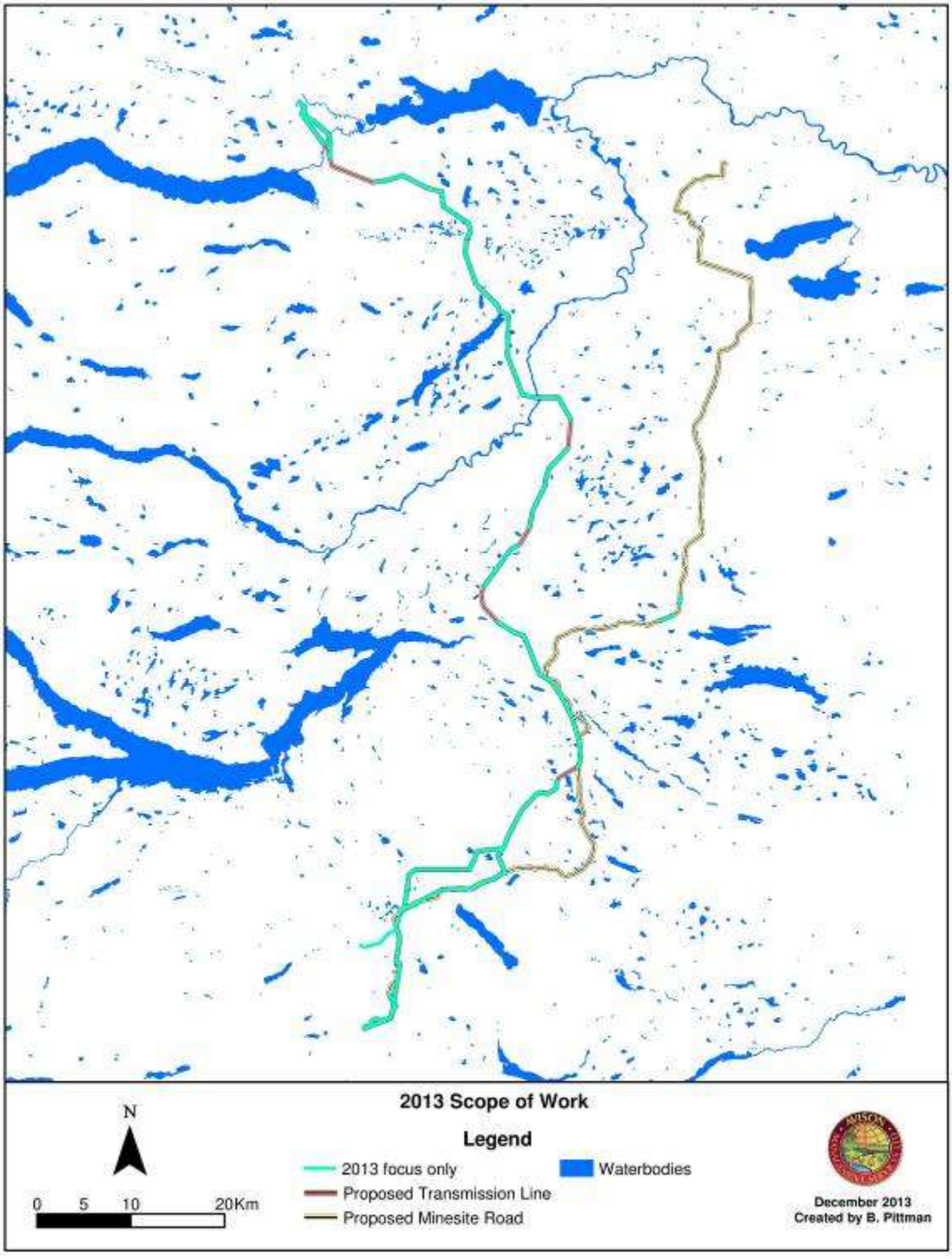
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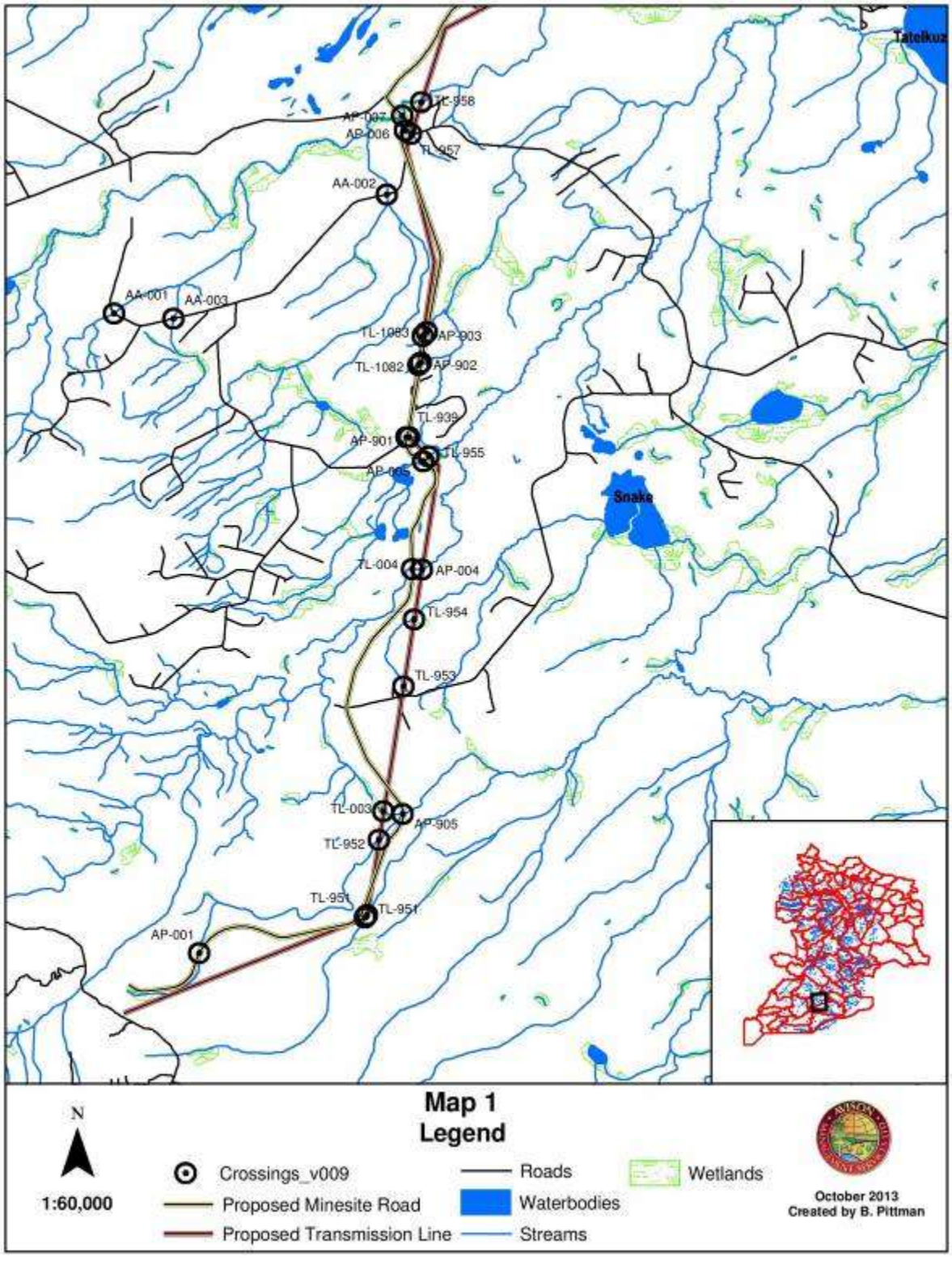
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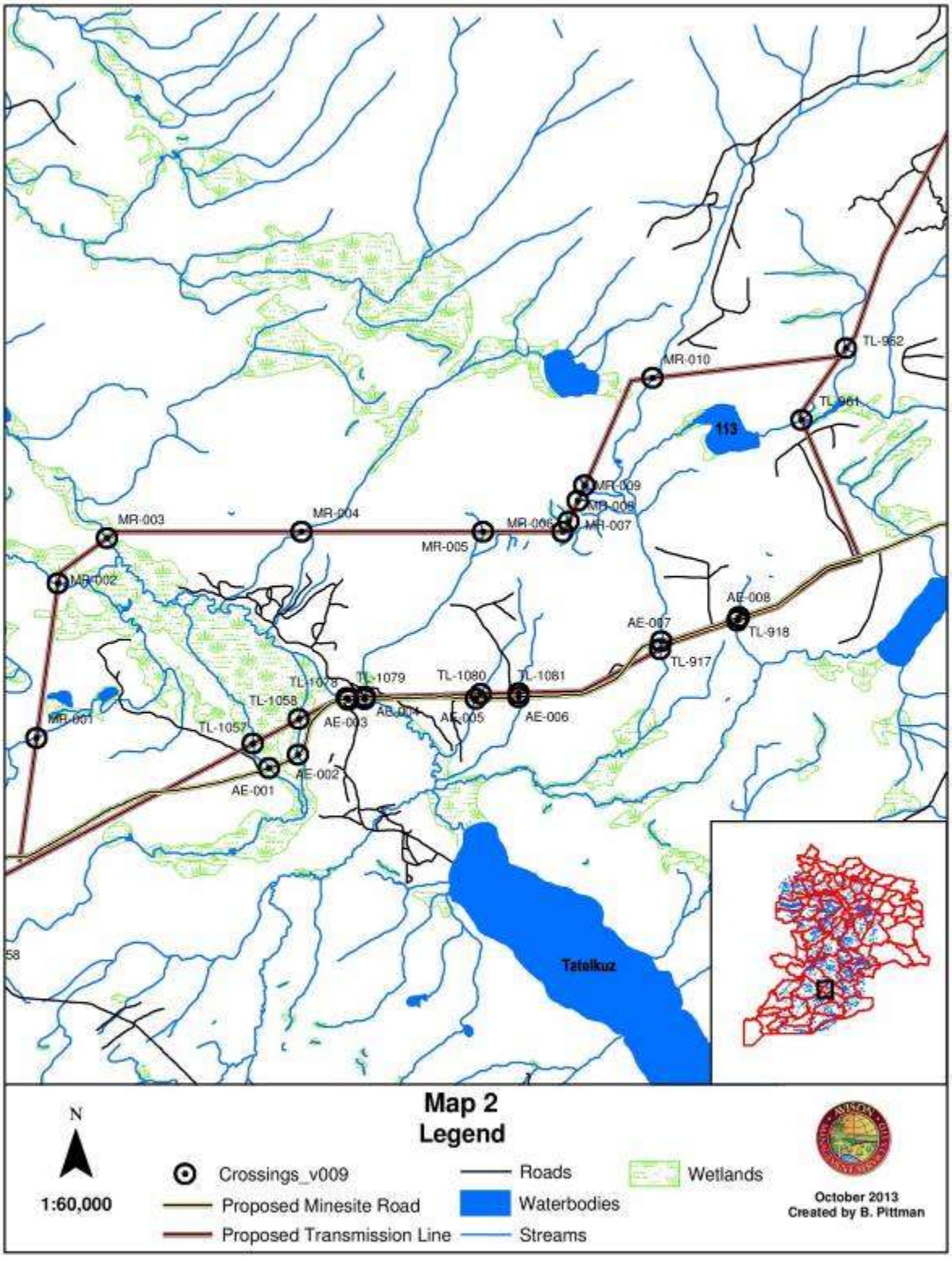
APPENDICES

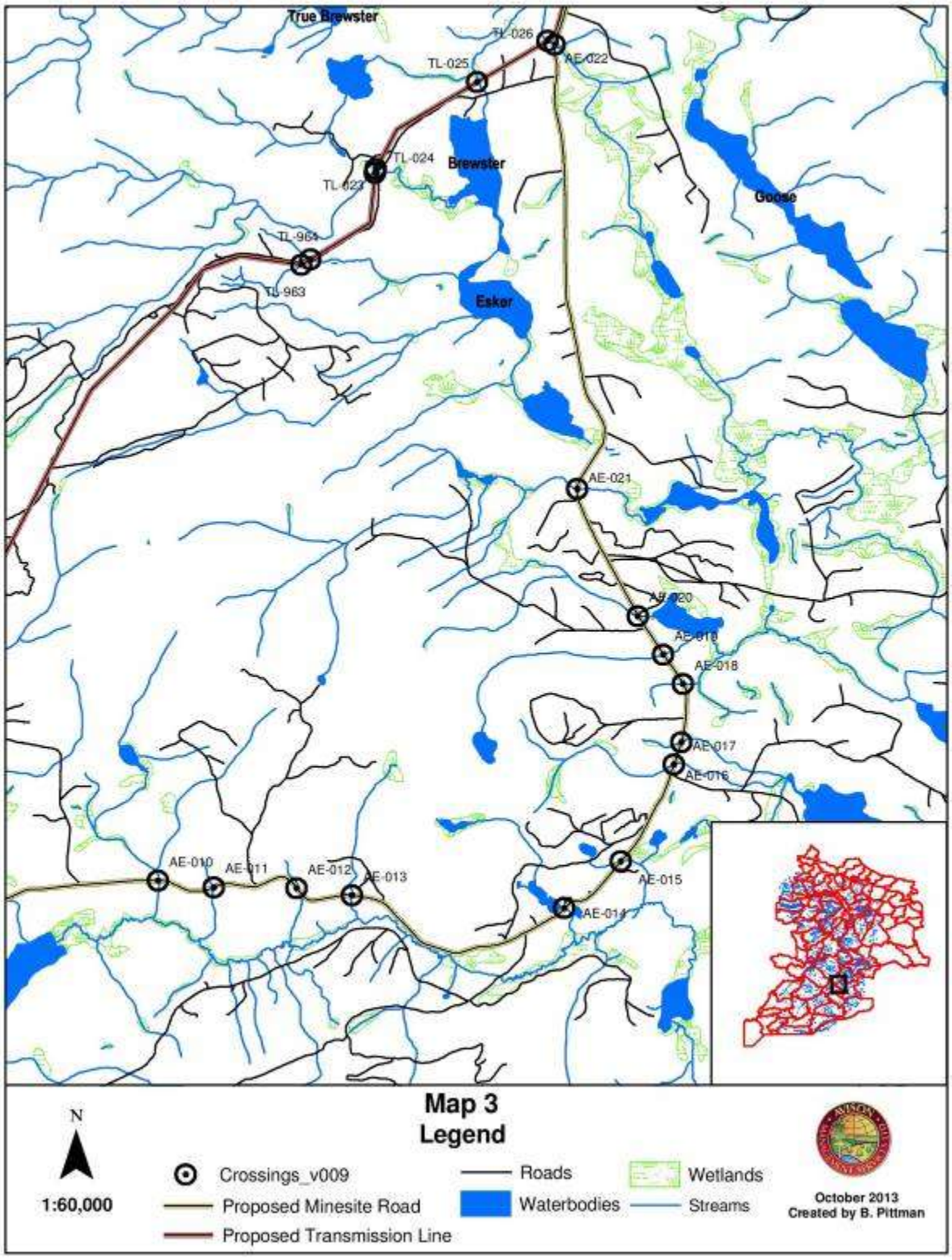
Appendix A – Final Preferred Alignment with 2013 sample areas

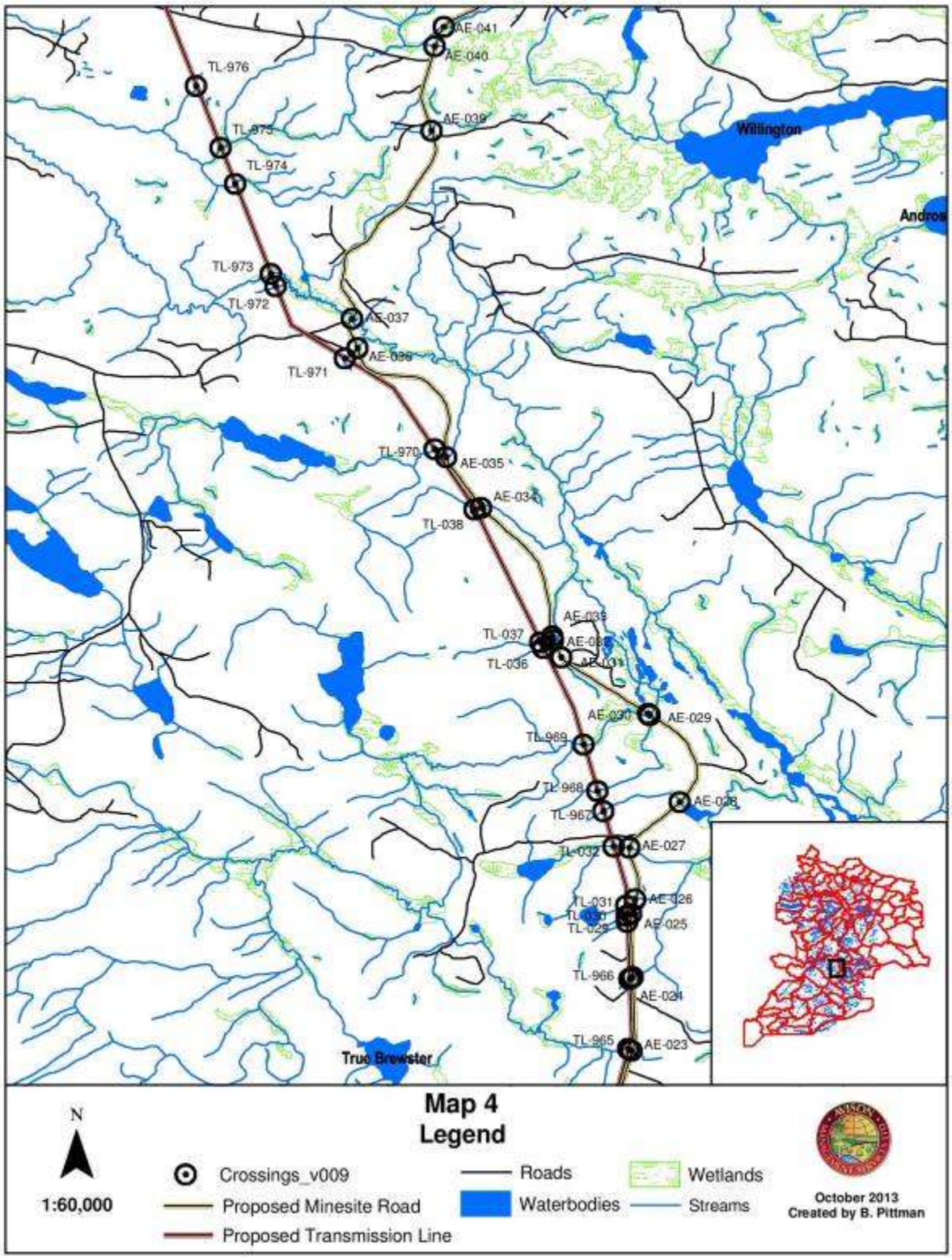


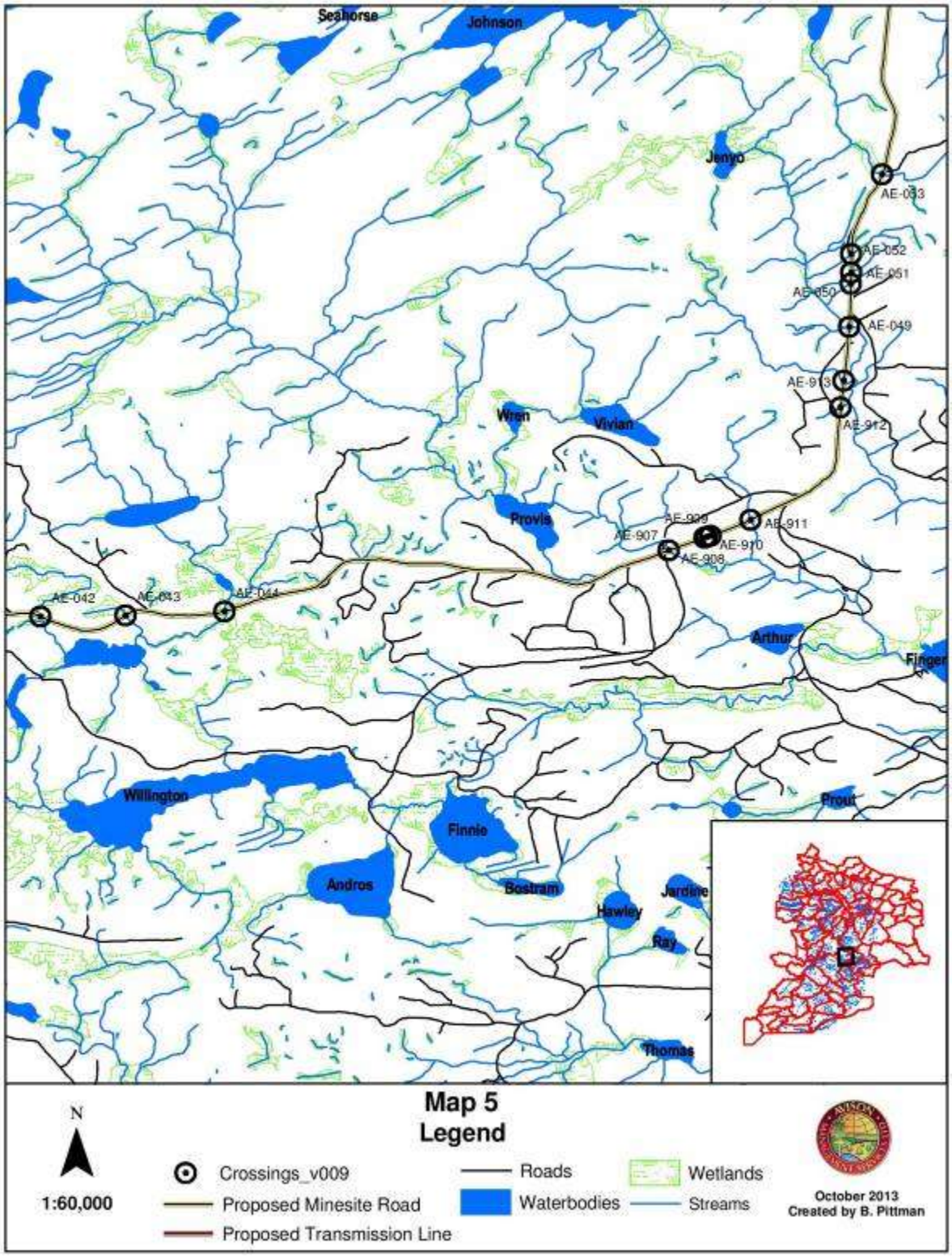
Appendix B.1 - Crossing Location Maps – Geographic coordinates for each site can be found the table located at the end of this appendix

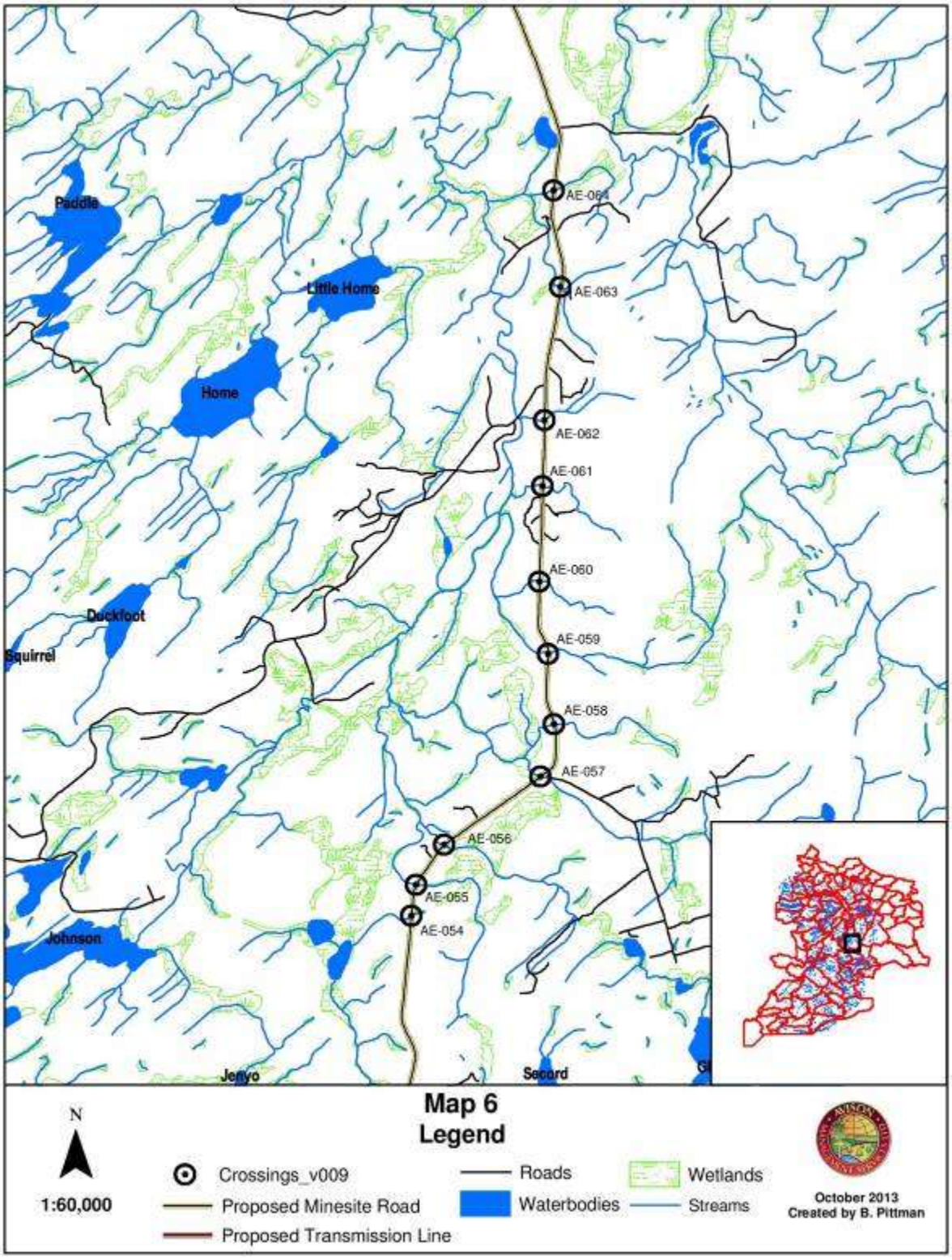


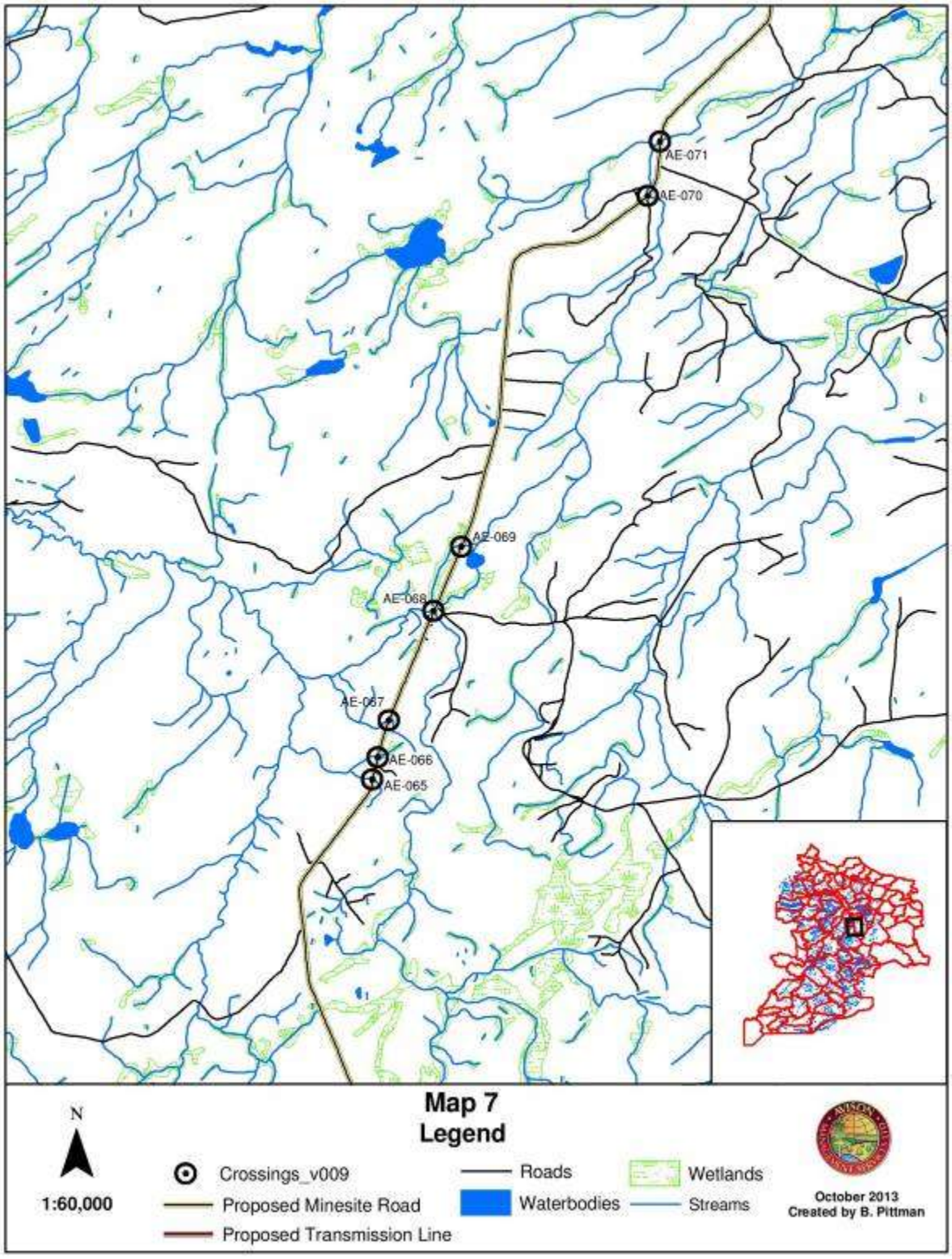

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Proposed Minesite Road
Proposed Transmission Line
Roads
Waterbodies
Streams
Wetlands
October 2013
Created by B. Pittman

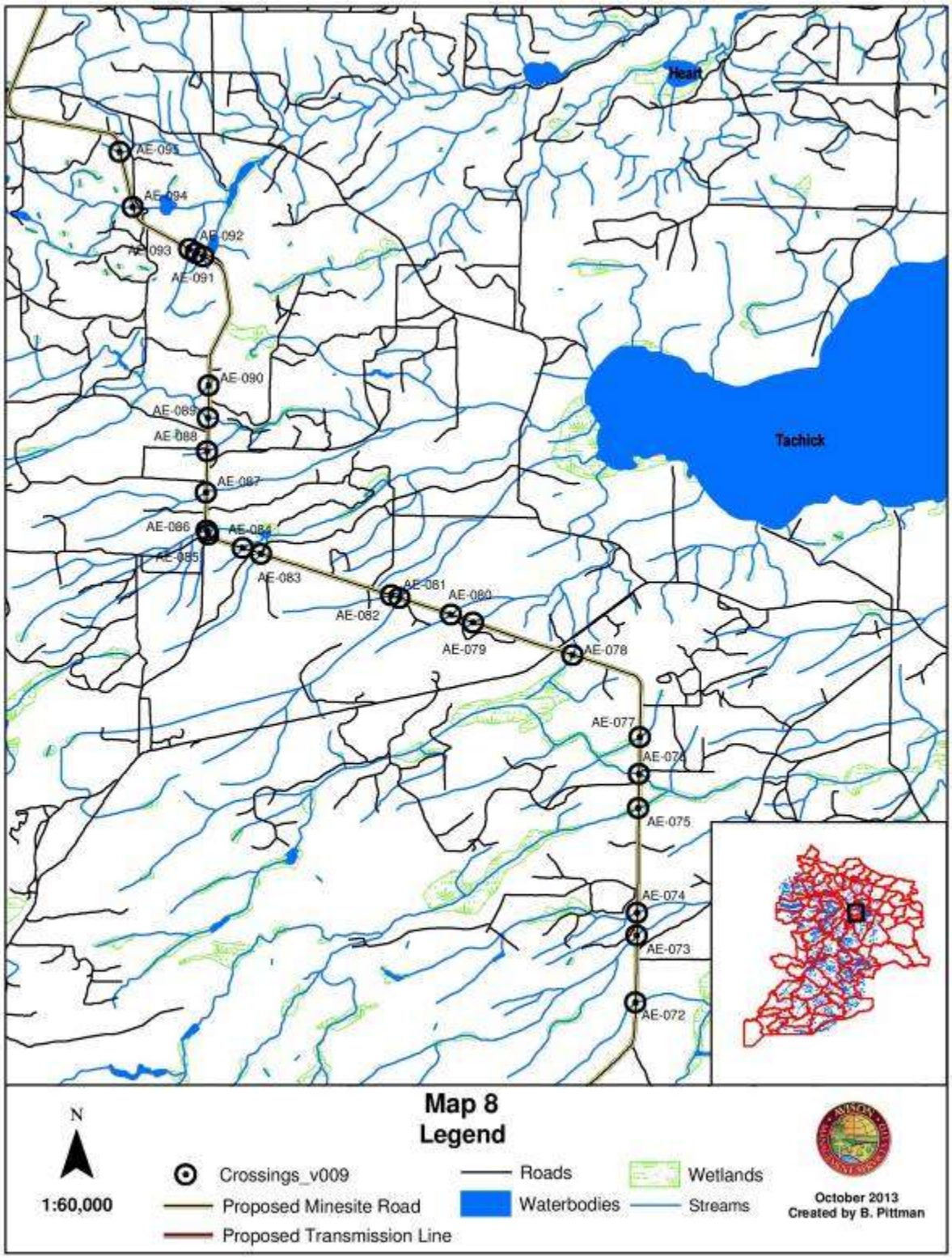

True Brewster
TL-026
AE-022
TL-025
TL-024
Brewster
TL-023
Goose
TL-964
TL-963
Esker
AE-021
AE-020
AE-019
AE-018
AE-017
AE-016
AE-010
AE-011
AE-012
AE-013
AE-015
AE-014
Map 3
Legend
N
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Proposed Minesite Road
Proposed Transmission Line
Roads
Waterbodies
Wetlands
Streams
October 2013
Created by B. Pittman

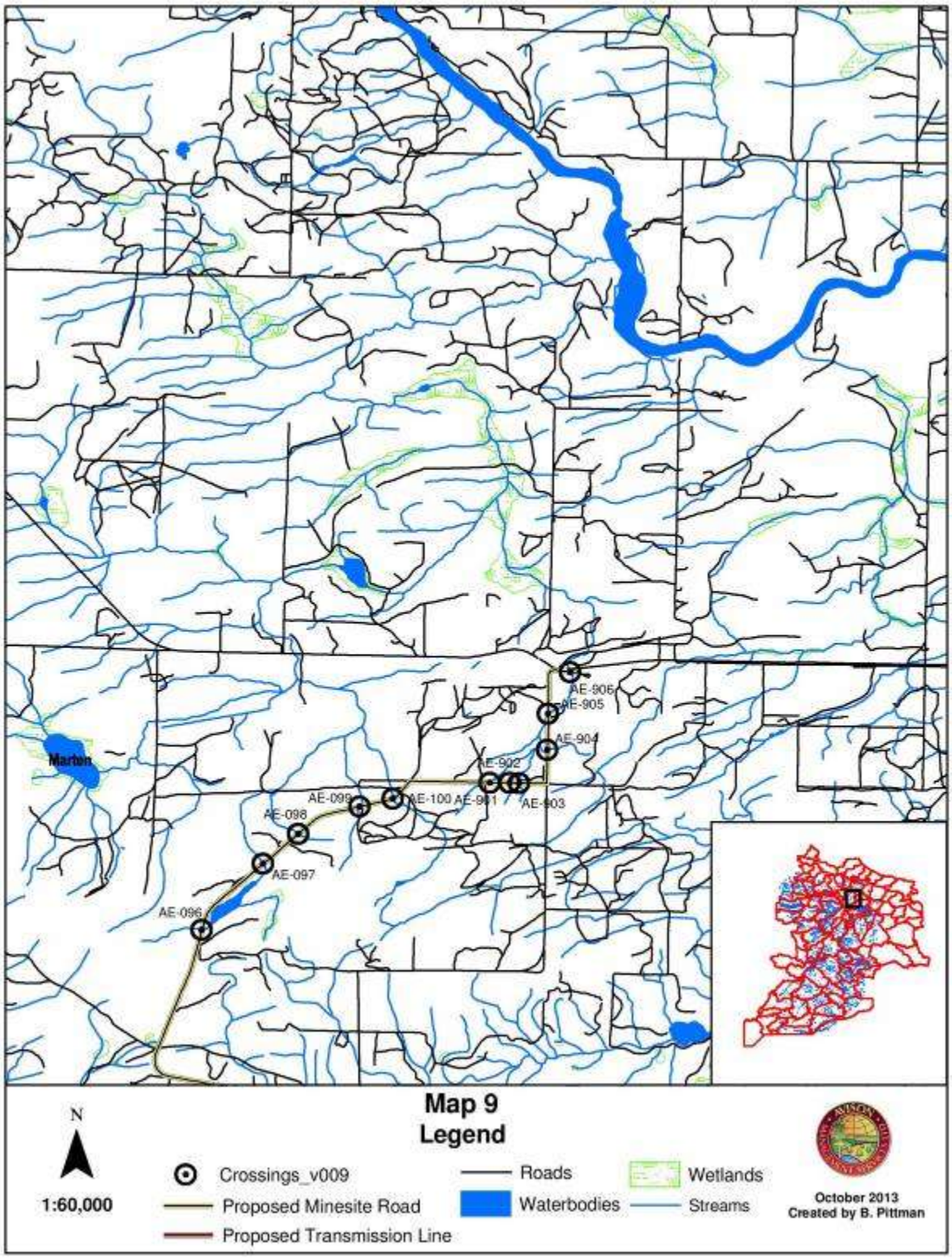

AE-041
AE-040
AE-039
TL-976
TL-975
TL-974
TL-973
TL-972
TL-971
TL-970
TL-038
TL-037
TL-036
TL-989
TL-968
TL-967
TL-032
TL-031
TL-029
TL-966
TL-965
AE-037
AE-035
AE-034
AE-030
AE-029
AE-028
AE-027
AE-026
AE-025
AE-024
AE-023
Willington
True Brewster
Map 4
Legend
N
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Crossings_v009
Proposed Minesite Road
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Roads
Waterbodies
Wetlands
Streams
October 2013
Created by B. Pittman

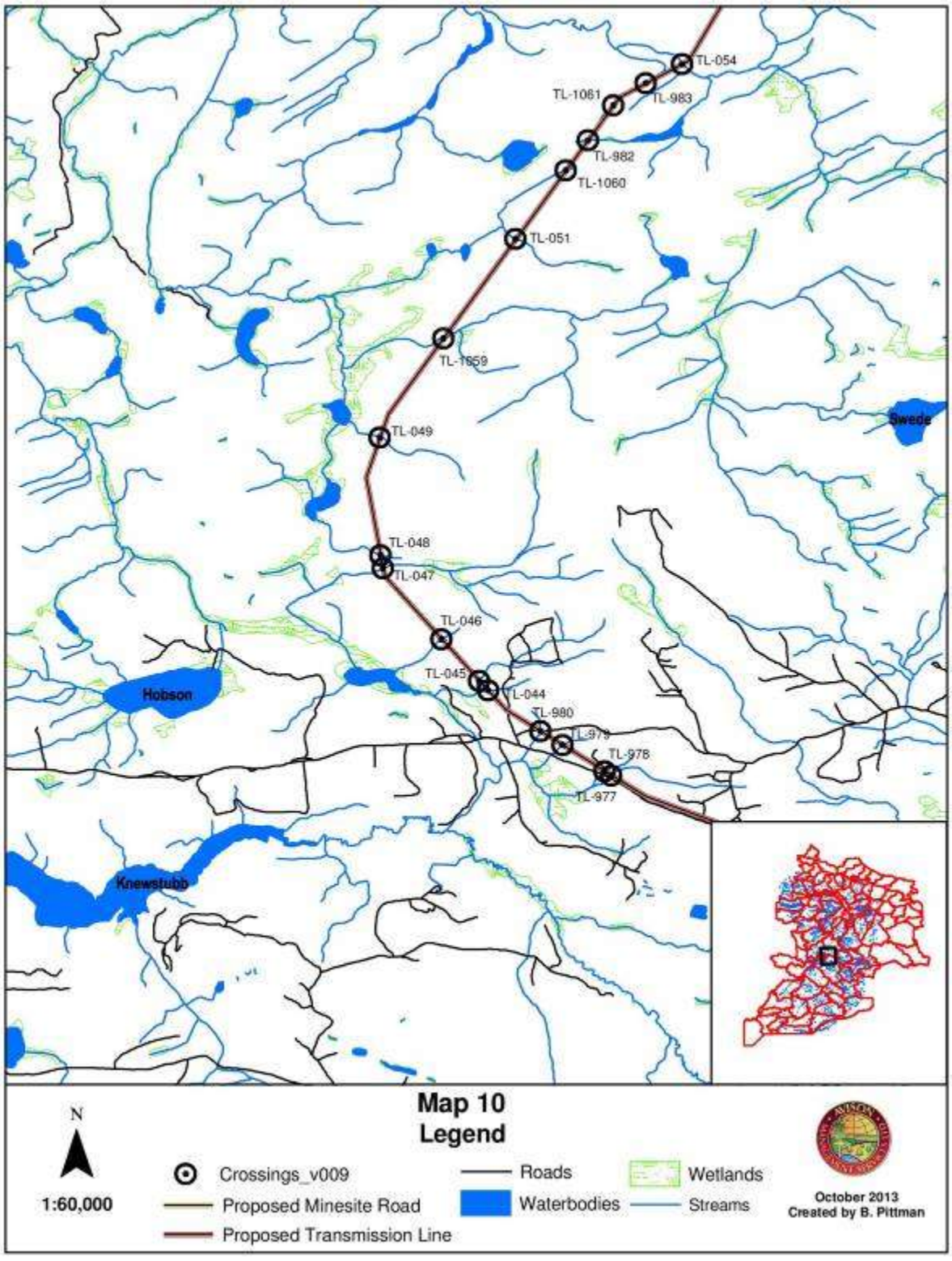

Seahorse
Johnson
Jenyo
AE-053
AE-052
AE-051
AE-050
AE-049
AE-913
AE-912
Wren
Vivian
Provis
AE-909
AE-911
AE-907
AE-910
AE-908
AE-042
AE-043
AE-044
Arthur
Finger
Willington
Finnie
Prout
Andros
Bostram
Jardine
Hawley
Ray
Thomas
Map 5
Legend
N
1:60,000
Crossings_v009
Proposed Minesite Road
Proposed Transmission Line
Roads
Waterbodies
Wetlands
Streams
October 2013
Created by B. Pittman

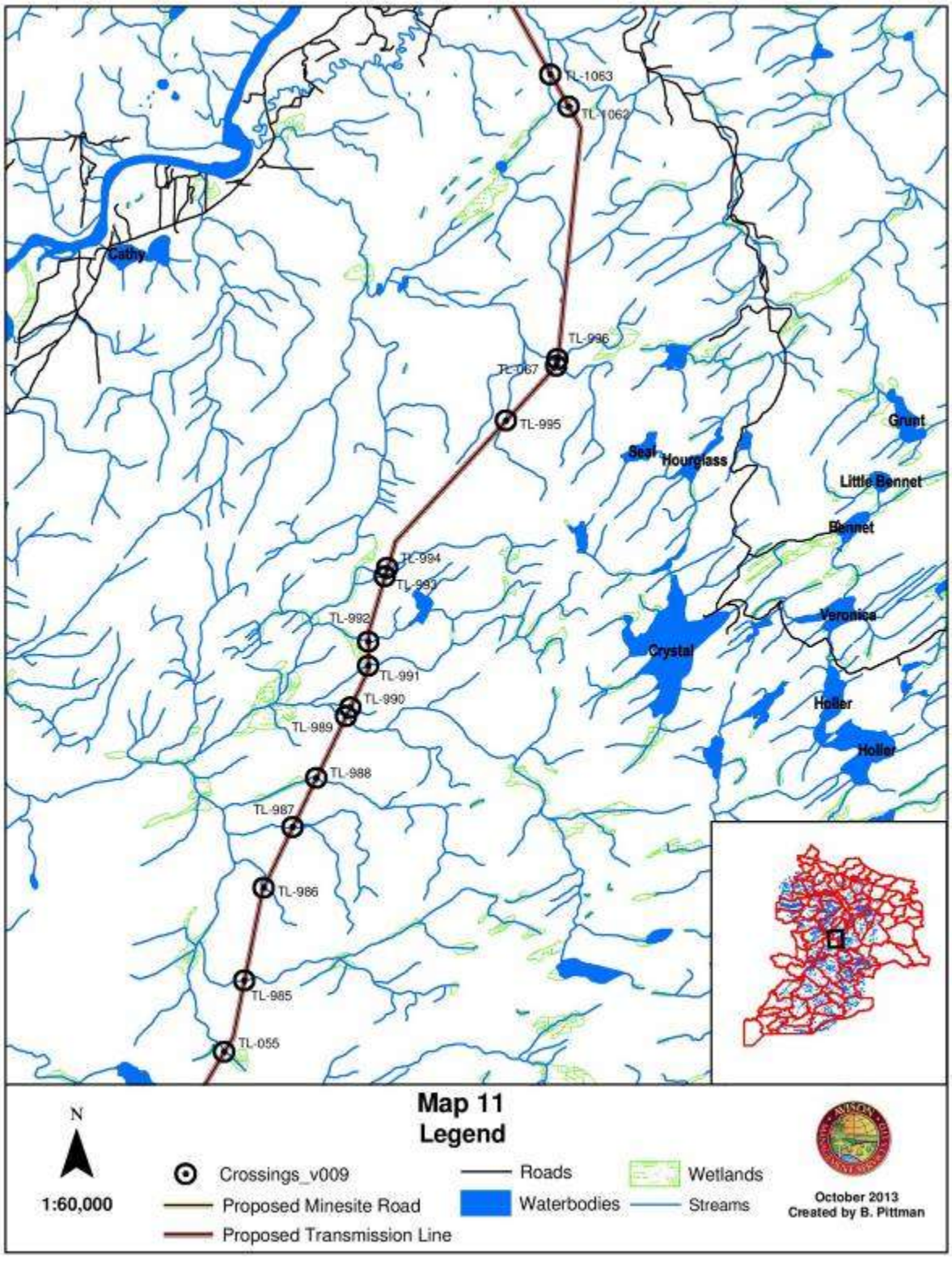

Paddle
Little Home
Home
Duckfoot
Squirrel
Johnson
Jenyo
Secord
AE-064
AE-063
AE-062
AE-061
AE-060
AE-059
AE-058
AE-057
AE-056
AE-055
AE-054
N
1:60,000
Map 6
Legend
Crossings_v009
Proposed Minesite Road
Proposed Transmission Line
Roads
Waterbodies
Wetlands
Streams
October 2013
Created by B. Pittman

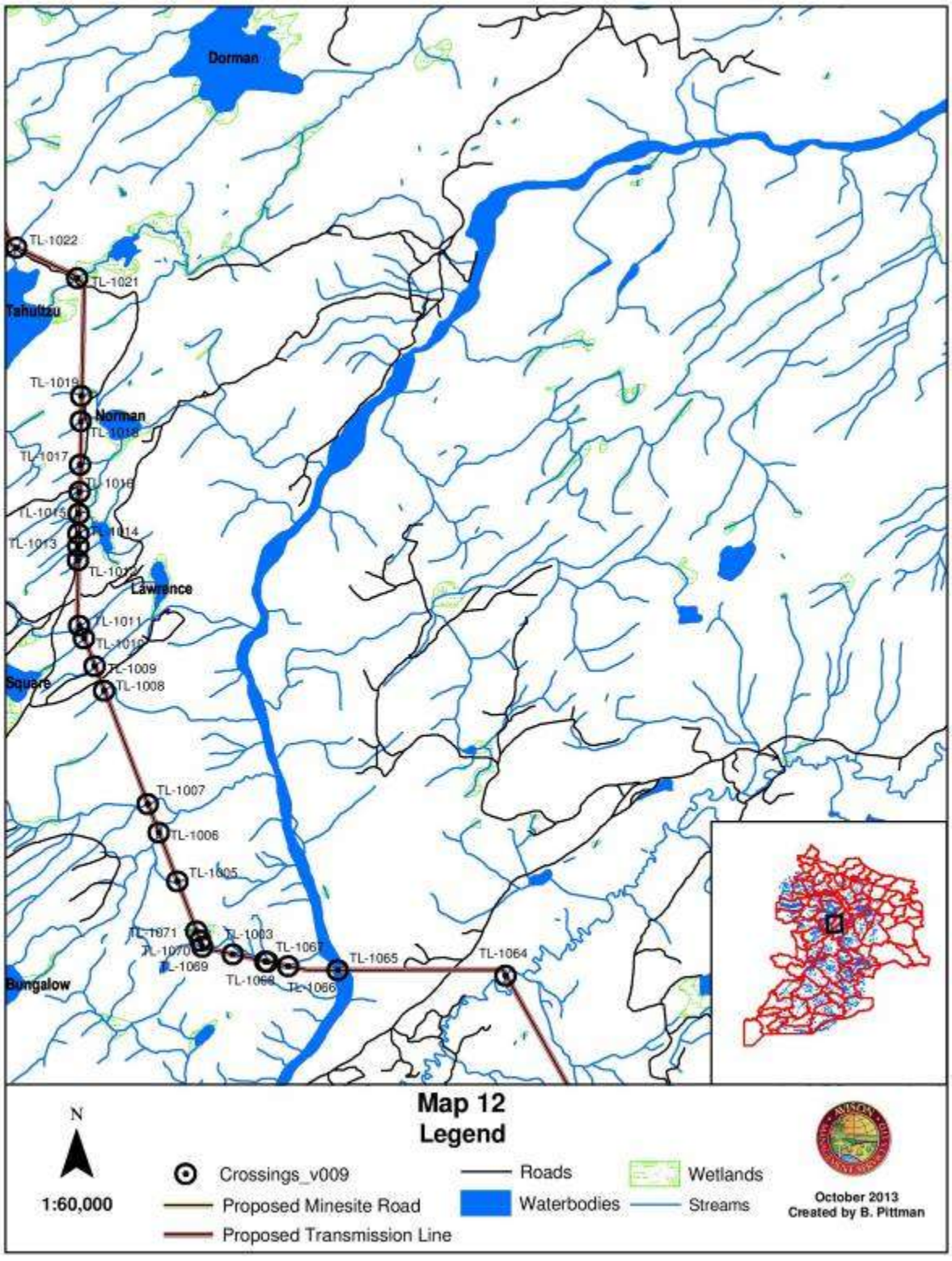

AE-071
AE-070
AE-069
AE-068
AE-067
AE-066
AE-065
Map 7
Legend
N
1:60,000
Crossings_v009
Proposed Minesite Road
Proposed Transmission Line
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Wetlands
Streams
October 2013
Created by B. Pittman

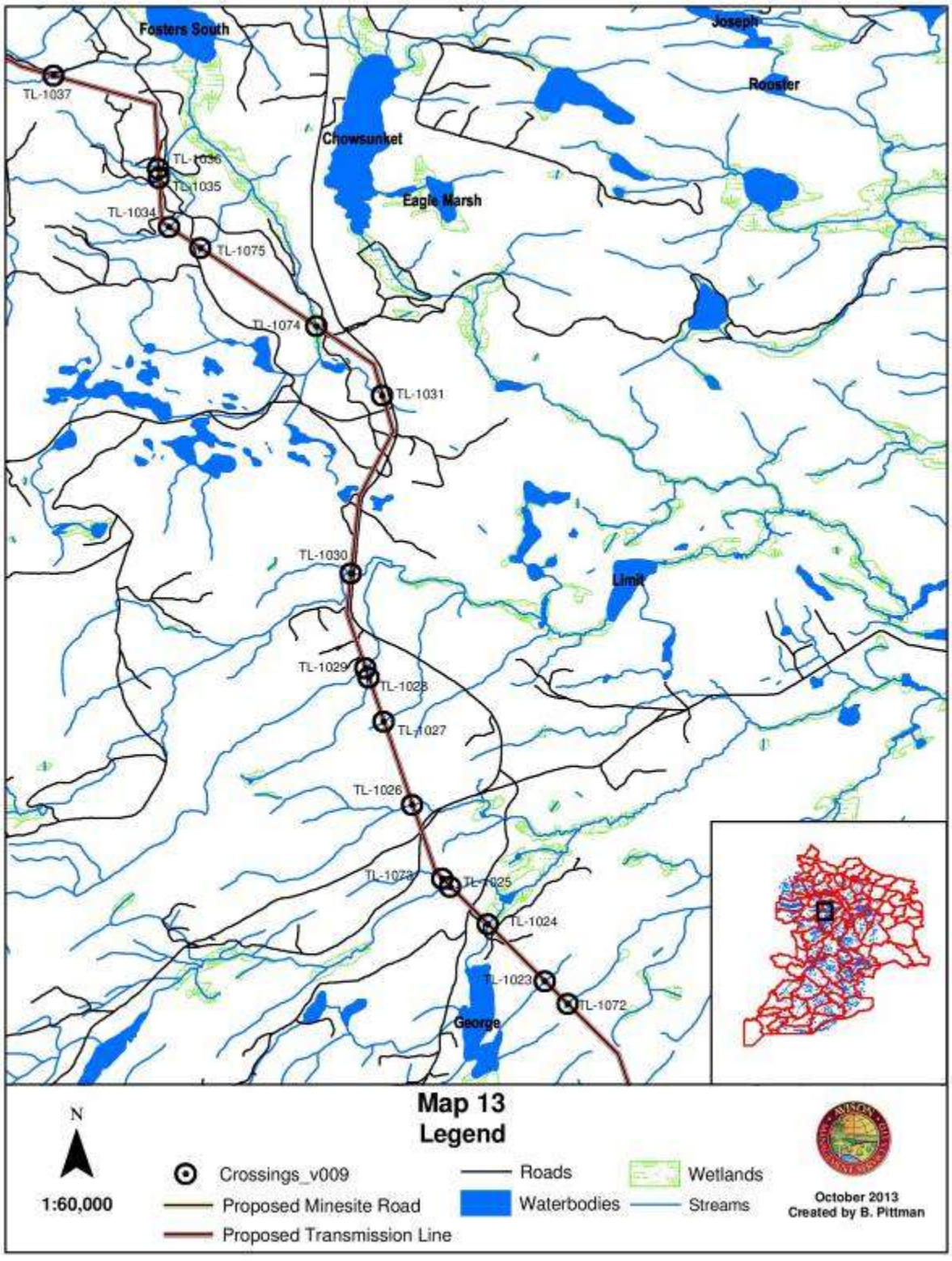

Heart
Tachick
AE-095
AE-094
AE-092
AE-093
AE-091
AE-090
AE-089
AE-088
AE-087
AE-086
AE-084
AE-085
AE-083
AE-081
AE-080
AE-082
AE-079
AE-078
AE-077
AE-076
AE-075
AE-074
AE-073
AE-072
N
1:60,000
Map 8
Legend
Crossings_v009
Proposed Minesite Road
Proposed Transmission Line
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October 2013
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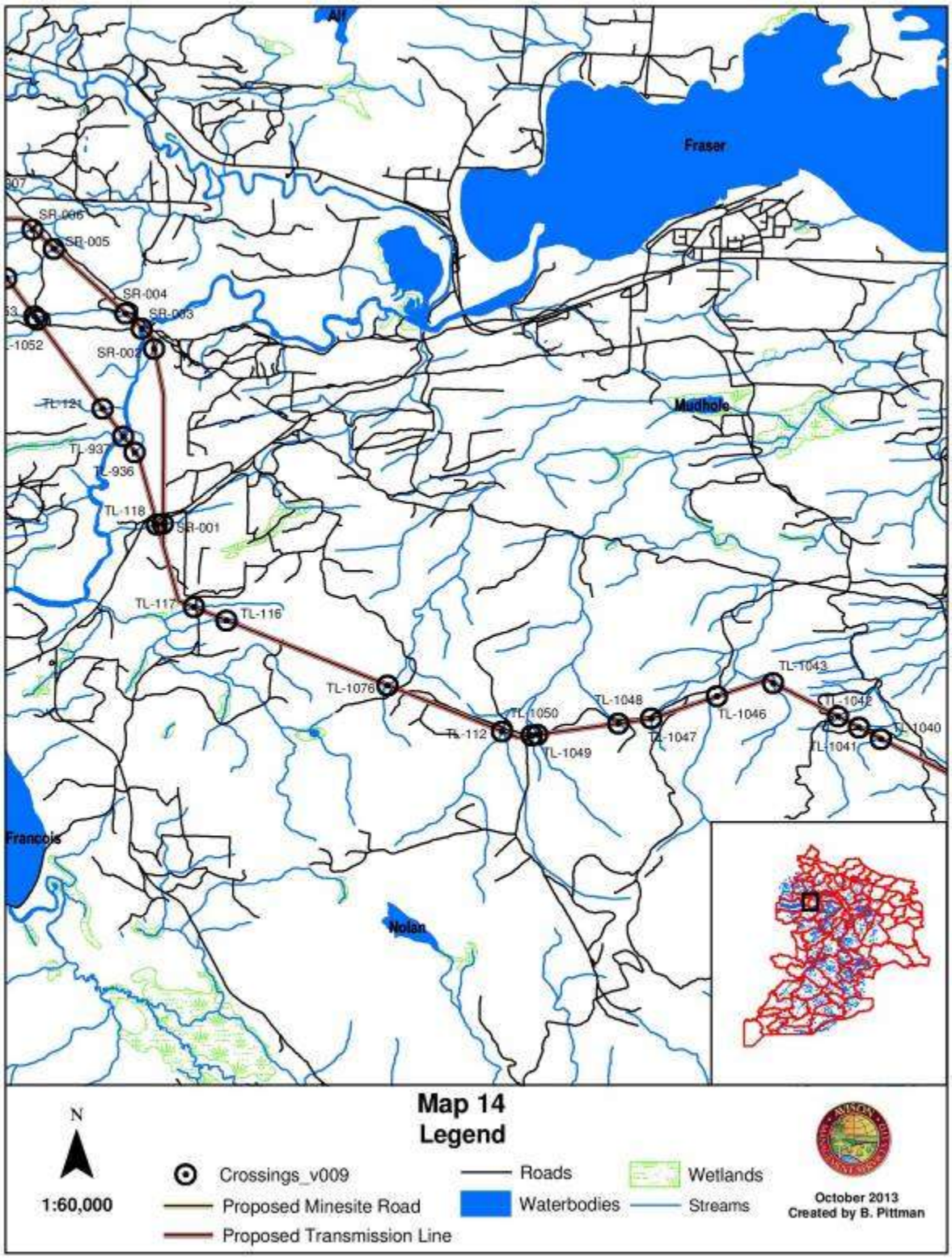

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AE-905
AE-904
AE-902
AE-903
AE-901
AE-100
AE-099
AE-098
AE-097
AE-096
Marion
N
1:60,000
Map 9
Legend
Crossings_v009
Proposed Minesite Road
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TL-054
TL-1061
TL-983
TL-982
TL-1060
TL-051
TL-1659
TL-049
TL-048
TL-047
TL-046
TL-045
TL-044
TL-980
TL-979
TL-978
TL-977
Swede
Hobson
Knewstubb
Map 10
Legend
N
1:60,000
Crossings_v009
Proposed Minesite Road
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TL-1063
TL-1062
Cathy
TL-996
TL-1067
TL-995
Grunt
Seal
Hourglass
Little Bennet
Bennet
TL-994
TL-993
TL-992
Veronica
Crystal
TL-991
TL-990
TL-989
Holler
Holler
TL-988
TL-987
TL-986
TL-985
TL-055
N
1:60,000
Map 11
Legend
Crossings_v009
Proposed Minesite Road
Proposed Transmission Line
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Dorman
TL-1022
TL-1021
Tahultzu
TL-1019
Norman
TL-1018
TL-1017
TL-1016
TL-1015
TL-1014
TL-1013
TL-1012
Lawrence
TL-1011
TL-1010
TL-1009
Squere
TL-1008
TL-1007
TL-1006
TL-1005
TL-1071
TL-1003
TL-1070
TL-1067
TL-1065
TL-1064
TL-1069
TL-1068
TL-1066
Bungalow
Map 12
Legend
N
1:60,000
Crossings_v009
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Fosters South
Joseph
Rooster
TL-1037
Chowsunket
TL-1036
TL-1035
Eagle Marsh
TL-1034
TL-1075
TL-1074
TL-1031
TL-1030
Limit
TL-1029
TL-1028
TL-1027
TL-1026
TL-1025
TL-1024
TL-1023
TL-1072
George
Map 13
Legend
N
1:60,000
Crossings_v009
Proposed Minesite Road
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Fraser
Mudhole
Francois
Nolan
SR-006
SR-005
SR-004
SR-003
SR-002
SR-001
TL-121
TL-937
TL-936
TL-118
TL-117
TL-116
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TL-112
TL-1050
TL-1049
TL-1048
TL-1047
TL-1046
TL-1043
TL-1042
TL-1041
TL-1040
Map 14
Legend
N
1:60,000
Crossings_v009
Proposed Minesite Road
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Created by B. Pittman

Appendix B.2 – Site information for each crossing site along the preferred final alignment

WSC= Watershed Code. Non-essential zeros on the following end of the watershed codes have been omitted.

Site ID	UTM Easting	UTM Northing	20k WSC	50k WSC	ILP	Name	Reach num	Surveyed 2012	Survey date	Crew	Survey Length
AE-001	382926	5908533	100-567134-610692-480511	180-609800-39700		Unnamed	1	Yes	08/15/12	BP/CR	200
AE-002	383295	5908709	100-567134-610692-480511		80511	Turtle Creek	1	Yes	08/10/12	BP/BP	200
AE-003	383943	5909410	100-567134-610692	180-609800		Chedakuz Creek	1	Yes	08/15/12	BP/CR	200
AE-004	384153	5909419	100-567134-610692-494661	180-609800-45100		Unnamed	1	No	06/13/02		
AE-005	385581	5909422	100-567134-610692-513545	180-609800-47584		Unnamed	1	Yes	08/09/12	BP/CR	100
AE-006	386131	5909447	100-567134-610692-520894		20894	Unnamed	1	Yes	08/09/12	LN/BP	140
AE-007	387959	5910160	100-567134-610692-522107-063231	180-609800-48200-06400		Unnamed	1	Yes	08/10/12	CR/LN	200
AE-008	388957	5910470	100-567134-610692-522107-202099	180-609800-48200-21431		Unnamed	1	No	05/16/02		
AE-010	393225	5911777	100-567134-610692-522107-363302	180-609800-48200-39800		Unnamed	2	Yes	08/10/12	BP/BP	100
AE-011	393939	5911692	100-567134-610692-522107-389013		89013	Unnamed	1	Yes	08/10/12	BP/BP	100
AE-012	395003	5911678	100-567134-610692-522107-445492		45492	Unnamed	1	Yes	08/15/12	LN/BP	100
AE-013	395715	5911590	100-567134-610692-522107-482792	180-609800-48200-52989		Unnamed	1	Yes	08/15/12	LN/BP	100

AE-014	398443	5911423	100-567134-610692-522107-614160	180-609800-48200-66500		Unnamed	1	Yes	08/16/12	BP/CR	100
AE-015	399166	5912025	100-567134-610692-522107-662145	180-609800-48200-70700		Unnamed	1	Yes	08/18/12	CR/BP	100
AE-016	399850	5913268	100-500560-248839-739271-895222	170-246000-80000-99700		Unnamed	1	Yes	08/17/12	CR/BP	100
AE-017	399948	5913553	100-500560-248839-739271-895222-022094	170-246000-80000-99700		Unnamed	1	Yes	08/17/12	CR/BP	100
AE-018	399969	5914296	100-500560-248839-739271-422284-152342-566137-353520		53520	Unnamed	1	yes	08/17/12	CR/BP	100
AE-019	399713	5914676	100-500560-248839-739271-422284-152342	170-246000-80000-48300-15700		Unnamed	5	Yes	08/17/12	CR/BP	100
AE-020	399388	5915170	100-500560-248839-739271-422284-152342-626462	170-246000-80000-48300-1570-5955		Unnamed	1	Yes	09/20/12	KR/BP	100
AE-021	398607	5916799	100-500560-248839-739271-422284	170-246000-80000-48300		Unnamed	5	Yes	09/25/12	KR/BP	200
AE-022	398318	5922495	100-567134-581072-796569	180-579900-81800		Unnamed	3	Yes	10/04/12	KR/BP	100
AE-023	398521	5923162	100-567134-581072-796569-024088		24088	Unnamed	1	Yes	09/13/12	KR/BP	100
AE-024	398534	5924109	100-500560-248839-952068-064975-725103		25103	Unnamed	1	Yes	09/07/12	CM/KR	100
AE-025	398516	5924918	100-500560-248839-952068-064975-202289-304738		04738	Unnamed	1	Yes	09/07/12	CM/KR	100

AE-026	398566	5925107	100-500560-248839-952068-064975-202289	180-579900-47200-76200		Unnamed	1	Yes	09/07/12	CM/KR	100
AE-027	398493	5925766	100-500560-248839-952068	180-579900-47200		Unnamed	1	Yes	09/07/12	CM/KR	100
AE-028	399141	5926350	100-500560-248839-945420		45420	Unnamed	1	Yes	09/07/12	CM/KR	100
AE-029	398755	5927466	100-567134-581072-604068		04068	Unnamed	1	Yes	09/05/12	KR/BP	100
AE-030	398735	5927483	100-567134-581072	180-579900		Big Bend Creek	1	Yes	09/05/12	KR/BP	200
AE-031	397620	5928205	100-567134-581072-558749-382606	180-579900-49900		Unnamed	2	Yes	09/05/12	KR/BP	100
AE-032	397510	5928425	100-567134-581072-558749-382606-020991		20991	Unnamed	1	Yes	09/05/12	KR/BP	100
AE-033	397500	5928478	100-567134-581072-558749		58749	Unnamed	1	Yes	09/05/12	KR/BP	100
AE-034	396586	5930125	100-567134-581072-548781		48781	Unnamed	2	Yes	09/05/12	KR/BP	100
AE-035	396138	5930775	100-567134-581072-492383	180-579900-40900		Unnamed	1	Yes	09/05/12	KR/BP	100
AE-036	395000	5932174	100-567134-581072-457721		57721	Unnamed	1	Yes	08/30/12	BP/KR	100
AE-037	394928	5932548	100-567134-581072	180-579900		Big Bend Creek	4	Yes	08/30/12	CM/BP/KR	200
AE-039	395950	5934959	100-567134-581072-295086-387727		87727	Unnamed	1	Yes	08/30/12	CM/BP/KR	100
AE-040	395994	5936044	100-567134-581072-295086-499654-138603		38603	Unnamed	2	Yes	08/30/12	CM/BP/KR	100

AE-041	396111	5936291	100-567134-581072-295086-499654		99654	Unnamed	1	Yes	08/30/12	CM/BP/KR	100
AE-042	398836	5937303	100-567134-069486-983379-824188-625326		25326	Unnamed	1	Yes	08/30/12	CM/BP/KR	100
AE-043	399931	5937318	100-567134-069486-983379-852626		52626	Unnamed	1	Yes	08/30/12	CM/BP/KR	100
AE-044	401200	5937370	100-567134-069486-983379	180-069000-98200		Finger Creek	10	Yes	08/30/12	CM/BP/KR	200
AE-049	409226	5941021	100-567134-069486-983379-238456	180-069000-98200-20500		Cabin Creek	2	Yes	08/27/12	CM/BP/KR	100
AE-050	409244	5941575	100-567134-069486-983379-238456-592177		92177	Unnamed	1	No	06/25/06		
AE-051	409250	5941718	100-567134-069486-983379-238456-607996		07996	Unnamed	1	No	06/25/06		
AE-052	409226	5941937	100-567134-069486-983379-238456-626232		26232	Unnamed	1	Yes	08/28/12	CM/BP/KR	100
AE-053	409648	5942978	100-567134-069486-983379-238456-720549-229209		29209	Unnamed	2	Yes	08/28/12	CM/BP/KR	100
AE-054	409767	5945517	100-567134-069486-983379-238456-720549-630462		30462	Unnamed	1	No	06/25/06		
AE-055	409828	5945915	100-567134-483452-693735-476207-081537		81537	Unnamed	2	Yes	08/27/12	CM/BP/KR	200
AE-056	410190	5946427	100-567134-483452-693735-476207-081537-326085		26085	Unnamed	1	Yes	08/27/12	CM/BP/KR	100

AE-057	411427	5947301	100-567134-483452-693735-476207	180-481700-67800-49600		Unnamed	3	Yes	08/23/12	CM/BP/KR	200
AE-058	411598	5947974	100-567134-483452-693735-476207-298703		98703	Unnamed	2	Yes	08/27/12	CM/BP/KR	100
AE-059	411520	5948874	100-567134-483452-693735-383595	180-481700-67800-39600		Unnamed	2	Yes	08/27/12	CM/BP/KR	100
AE-060	411412	5949798	100-567134-483452-693735-383595-196153		96153	Unnamed	1	Yes	08/27/12	CM/BP/KR	100
AE-061	411449	5951023	100-567134-483452-693735-370833		70833	Unnamed	1	Yes	08/27/12	CM/BP/KR	100
AE-062	411475	5951866	100-567134-483452-693735-324533		24533	Unnamed	2	Yes	08/07/12	CR/LN	100
AE-063	411682	5953576	100-567134-483452-693735-181095	180-481700-67800-18200		Unnamed	2	Yes	08/22/12	CM/BP/KR	100
AE-064	411597	5954813	100-567134-483452-693735-181095-182409	180-481700-67800-18200-1390-0980		Unnamed	1	Yes	08/22/12	CM/BP/KR	100
AE-065	411643	5960366	100-567134-483452-630755-562355		62355	Unnamed	2	Yes	08/22/12	CM/BP/KR	100
AE-066	411710	5960649	100-567134-483452-630755		30755	Unnamed	2	No	09/24/02		
AE-067	411854	5961123	100-567134-483452-614607-017175		17175	Unnamed	1	No	09/12/02		
AE-068	412429	5962525	100-567134-483452-614607	180-481700-58800		Unnamed	3	Yes	08/23/12	CM/BP/KR	200
AE-069	412778	5963348	100-567134-269222-562302-669670-631038	180-271000-57300		Unnamed	4	Yes	08/22/12	CM/BP/KR	100

AE-070	415179	5967852	100-567134-269222-562302	180-271000-57300		Unnamed	1	Yes	08/22/12	CM/BP/KR	100
AE-071	415339	5968546	100-567134-269222-562302	180-271000-57300		Unnamed	1	Yes	08/16/12	LN/BP	50
AE-072	416768	5970625	100-567134-269222-562302-308076	180-271000-57300-38100		Unnamed	1	Yes	08/17/12	LN/BP	100
AE-073	416787	5971489	100-567134-269222-562302-169262	180-271000-57300-18800-2780		Unnamed	2	Yes	08/17/12	LN/BP	100
AE-074	416790	5971776	100-567134-269222-562302-169262-236709	180-271000-57300-18800		Unnamed	2	Yes	08/17/12	LN/BP	100
AE-075	416805	5973117	100-567134-269222	180-271000		Stony Creek	20	Yes	08/15/12	LN/BP	145
AE-076	416816	5973555	100-567134-269222-672757	180-271000-67300		North Stony Creek	1	Yes	08/07/12	BP,BP, CR,LN	185
AE-077	416824	5974029	100-567134-269222-672757-125735		25735	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-078	415960	5975079	100-567134-269222-288930		88930	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-079	414683	5975496	100-567134-269222-288930-556932-251731		51731	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-080	414397	5975597	100-567134-269222-288930-556932	180-271000-30100		Unnamed	3	Yes	09/16/12	LN/BP	50
AE-081	413738	5975813	100-567134-269222-288522		88522	Unnamed	2	Yes	09/16/12	LN/BP	50
AE-082	413634	5975847	100-567134-269222-288522-346226		46226	Unnamed	1	Yes	09/16/12	LN/BP	50

AE-083	411962	5976376	100-567134-269222-288477-131554-522552	180-271000-29700-10700-5460		Unnamed	1	Yes	09/16/12	LN/BP	50
AE-084	411724	5976452	100-567134-269222-288477-131554-526972	180-271000-29700-10700-5460		Unnamed	1	Yes	09/16/12	LN/BP	50
AE-085	411284	5976625	100-567134-269222-288477-131554-612428		12428	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-086	411261	5976680	100-567134-269222-288477-131554	180-271000-29700-10700		Unnamed	2	Yes	09/16/12	LN/BP	50
AE-087	411253	5977166	100-567134-269222-288477-309940		09940	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-088	411267	5977697	100-567134-269222-288477-509812		09812	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-089	411279	5978121	100-567134-269222-288477	180-271000-29700		Tachick Creek	2	Yes	09/16/12	LN/BP	50
AE-090	411290	5978540	100-567134-269222-288477-579865		79865	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-091	411216	5980191	100-567134-269222-164824-819166-584924	180-271000-17100-81200-0250		Unnamed	1	Yes	09/16/12	LN/BP	50
AE-092	411125	5980239	100-567134-269222-164824-820757-134845-301013		01013	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-093	411038	5980286	100-567134-269222-164824-820757-134845		34845	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-094	410314	5980829	100-567134-269222-164824-820757	180-271000-17100-81200		Unnamed	1	Yes	09/16/12	LN/BP	100

AE-095	410146	5981532	100-567134-269222-164824-882208		82208	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-096	409318	5983859	100-567134-321619-591319-301392-213098		13098	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-097	410105	5984706	100-567134-321619-591319-301392-213098		13098	Unnamed	3	Yes	09/16/12	LN/BP	50
AE-098	410558	5985088	100-567134-321619-591319-301392-213098-437113		37113	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-099	411348	5985439	100-567134-321619-591319-301392-213098-249376		49376	Unnamed	1	Yes	09/16/12	LN/BP	100
AE-100	411775	5985542	100-567134-321619-591319-301392-213098-205713		05713	Unnamed	1	Yes	09/16/12	LN/BP	50
AE-901	413021	5985748	100-567134-321619		21619	Unnamed	1	No	06/25/13	LN/BP	100
AE-902	413272	5985744	100-567134-321619-902285		02285	Unnamed	1	No	06/25/13	LN/BP	100
AE-903	413394	5985741	100-567134-321619-902285-464650		64650	Unnamed	1	No	06/25/13	LN/BP	100
AE-904	413757	5986165	100-567134-321619-897217		97217	Unnamed	1	No	06/25/13	LN/BP	100
AE-905	413767	5986630	100-567134-321619	180-321200-37200		Engen Creek	1	No	06/25/13	LN/BP	100
AE-906	414052	5987166	100-567134-321619	180-321200-37200		Engen Creek	2	No	06/25/13	LN/BP	100
AP-001	376179	5895044	100-567134-610692-671007-505659	180-609800-66100-55900-3270		Unnamed	5	Yes	08/08/12	LN/CR/BP/BP	100

AP-004	378962	5900138	100-567134-610692-522527	180-609800-48100		Davidson Creek	2	Yes	08/09/12	LN/BP	200
AP-005	379062	5901517	100-567134-610692-522527-428073	180-609800-48100-36100		Unnamed	1	Yes	08/09/12	LN/BP	200
AP-006	378832	5905763	100-567134-610692-480511-367135		67135	Unnamed	1	Yes	08/09/12	CR/BP	100
AP-007	378796	5905952	100-567134-610692-480511	180-609800-39700		Turtle Creek	3	Yes	08/09/12	CR/BP	200
AP-901	378853	5901829	ILP 164		164	Unnamed	1	Yes	10/03/12	KR/BP	100
AP-902	379035	5902785	ILP 166		166	Unnamed	1	Yes	10/03/12	KR/BP	100
AP-903	379109	5903177	ILP 167		167	Unnamed	1	Yes	10/03/12	KR/BP	100
TL-003	378678	5896989	100-567134-610692-671007-505659-348488		48488	Unnamed	1	Yes	08/08/12	LN/CR/BP/BP	100
TL-004	378937	5900138	100-567134-610692-522527	180-609800-48100		Davidson Creek	2	Yes	08/09/12	LN/BP	200
TL-023	395861	5920724	100-567134-581072-851257	180-579900-88100		Esker Creek	1	Yes	10/02/12	KR/BP	100
TL-024	395974	5920952	100-567134-581072-851257-223363		23363	Unnamed	1	Yes	10/02/12	KR/BP	100
TL-025	397313	5922083	100-567134-581072	180-579900		Big Bend Creek	8	Yes	10/02/12	KR/BP	200
TL-026	398231	5922544	100-567134-581072-796569	180-579900-81800		Unnamed	3	Yes	10/04/12	KR/BP	100
TL-029	398372	5924767	100-500560-248839-952068-064975-202289-304738		04738	Unnamed	1	Yes	09/07/12	CM/KR	100
TL-030	398378	5924863	100-500560-248839-952068-064975-202289-304738-348773		48773	Unnamed	1	Yes	09/07/12	CM/KR	100

TL-031	398387	5924995	100-500560-248839-952068-064975-202289	180-579900-47200-76200		Unnamed	1	Yes	09/07/12	CM/KR	100
TL-032	398437	5925770	100-500560-248839-952068	180-579900-47200		Unnamed	1	Yes	09/07/12	CM/KR	100
TL-036	397492	5928388	100-567134-581072-558749-382606-020991		20991	Unnamed	1	Yes	09/05/12	KR/BP	100
TL-037	397462	5928456	100-567134-581072-558749		58749	Unnamed	1	Yes	09/05/12	KR/BP	100
TL-038	396527	5930101	100-567134-581072-548781		48781	Unnamed	2	Yes	09/05/12	KR/BP	100
TL-044	389457	5938275	100-567134-581072-246180-266430-225232		25232	Unnamed	1	Yes	09/04/12	CM/BP	100
TL-045	389360	5938381	100-567134-581072-246180-266430		66430	Unnamed	2	Yes	09/04/12	CM/BP	100
TL-046	388866	5938922	100-567134-581072-246180-334534		34534	Unnamed	1	Yes	09/04/12	CM/BP	100
TL-047	388056	5939808	100-567134-581072-246180		46180	Unnamed	3	Yes	09/04/12	CM/BP	100
TL-048	388007	5940053	100-567134-509773-339107-437144		37144	Unnamed	5	Yes	09/04/12	CM/BP	100
TL-049	388035	5941544	100-567134-509773-339107-437144-187893		87893	Unnamed	2	Yes	09/04/12	CM/BP	100
TL-051	389873	5944049	100-567134-509773-339107-396465		96465	Unnamed	3	Yes	09/04/12	CM/BP	100
TL-054	391997	5946283	100-567134-509773	180-507600		Swanson Creek	3	Yes	09/04/12	CM/BP	100

TL-055	393008	5947843	100-567134-509773-253156-253259-320954	180-507600-26200-24400-4870		Unnamed	13	Yes	09/10/12	CM/BP	100
TL-067	397350	5956570	100-567134-483452-005364-346411-246527	180-481700-00300-4060		Unnamed	4	Yes	09/13/12	KR/BP	100
TL-112	376172	5985287	100-567134-374775-709017	180-374000-71300-30700		Unnamed	5	Yes	10/10/12	CM/BP	100
TL-116	372591	5986603	100-567134-374775-948201-102919-234422		34422	Unnamed	1	No	07/24/13	KR/CC	100
TL-117	372152	5986764	100-567134-374775-948201-102919-206654		06654	Unnamed	1	No	07/10/13	BP/CC	100
TL-118	371695	5987835	100-567134-374775-948201-095055		95055	Unnamed	1	Yes	10/11/12	CM/BP	100
TL-121	371105	5989335	100-567134-374775-948201-077318		77318	Unnamed	1	Yes	10/25/12	KR/BP	100
TL-127	369148	5992126	100-567134-374775-948201-023010-036907-351538	180-374000-95200-01900-0370-5260		Unnamed	5	Yes	10/25/12	KR/BP	100
TL-128	369027	5992299	100-567134-374775-948201-023010-036907-351538-682690		82690	Unnamed	1	Yes	10/25/12	KR/BP	100
TL-917	387970	5909923	100-567134-610692-522107-063231	180-609800-48200-06400		Unnamed	1	Yes	08/10/12	CR/LN	200
TL-918	388919	5910348	100-567134-610692-522107-202099	180-609800-48200-21431		Unnamed	1	No	05/16/02		
TL-936	371416	5988737	100-567134-374775-948201-079597		79597	Unnamed	1	Yes	10/11/12	CM/BP	100

TL-937	371321	5989026	100-567134-374775-948201	180-374000-95200	48201	Stellako River	3	Yes	10/11/12	CM/BP	100
TL-939	378821	5901829	ILP 164		164	Unnamed	1	Yes	10/03/12	KR/BP	100
AE-907	406843	5938277	100-567134-069486-983379-338511	180-069000-98200-31000		Roy Creek	2	Yes	08/28/12	CM/BP /KR	200
AE-908	407368	5938313			168	Unnamed	1	No	08/09/13	KR/CC	100
AE-909	407394	5938322			169	Unnamed	1	No	08/09/13	KR/CC	100
AE-910	407445	5938340			170	Unnamed	1	No	08/09/13	KR/CC	100
AE-911	407960	5938545	100-567134-069486-983379-338511-133482		33482	Unnamed	1	yes	08/28/12	CM/BP /KR	100
AE-912	409037	5939951	100-567134-069486-983379-238456-464522		64522	Unnamed	1	Yes	08/28/12	CM/BP /KR	100
AE-913	409155	5940327	100-567134-069486-983379-238456-489341		89341	Unnamed	1	Yes	08/30/12	CM/BP /KR	100
AP-905	378803	5896992	100-567134-610692-671007-505659		05659	Unnamed	1	No	07/30/13	KR/CC	100
MR-001	379939	5908923	100-567134-610692-425776	180-609800-37200		Unnamed	3	No	08/16/13	KR/BP	100
MR-002	380214	5910902	100-567134-610692	180-609800		Chedakuz Creek	1	No	08/06/13	KR/CC	200
MR-003	380847	5911485	100-567134-610692-432738	180-609800-38123		Unnamed	1	No	08/06/13	KR/CC	100
MR-004	383344	5911565	100-567134-610692-460788	180-609800-41100		Unnamed	1	No	07/29/13	KR/CC	100
MR-005	385670	5911564	100-567134-610692-494661-749864		49864	Unnamed	1	No	06/13/02		

MR-006	386694	5911563	100-567134-610692-522107-063231-347436-792948-497293		97293	Unnamed	1	No	08/01/13	KR/CC	100
MR-007	386771	5911698	100-567134-610692-522107-063231-347436-792948		92948	Unnamed	1	No	08/01/13	KR/CC	100
MR-008	386888	5911964	100-567134-610692-522107-063231-347436-446973		46973	Unnamed	1	No	08/01/13	KR/CC	100
MR-009	386974	5912157	100-567134-610692-522107-063231-351992-030554		30554	Unnamed	1	No	08/01/13	KR/CC	100
MR-010	387848	5913537	100-567134-610692-522107-063231-351992	180-609800-48200-06400		Unnamed	1	No	07/26/13	KR/CC	100
SR-001	371789	5987851	100-567134-374775-948201-095055		95055	Unnamed	1	Yes	10/11/13	CM/BP	100
SR-002	371679	5990092	100-567134-374775-948201-072981		72981	Unnamed	1	No	07/10/13	BP/CC	100
SR-003	371520	5990351	100-567134-374775-948201	180-374000-95200		Stellako River	1	No	08/17/13	KR/BP	200
SR-004	371311	5990541	100-567134-374775-948201-067903	180-374000-95200-06500		Unnamed	1	No	07/17/13	KR/BP	100
SR-005	370395	5991372	100-567134-374775-948201-023010-036907-483445	180-374000-95200-01900-0370-7340		Unnamed	1	No	07/17/13	KR/BP	100
SR-006	370120	5991621	100-567134-374775-948201-023010-036907	180-374000-95200-01900-0370		Unnamed	1	No	07/17/13	KR/BP	100

SR-007	369186	5992149	100-567134-374775-948201-023010-036907-351538	180-374000-95200-01900-0370-5260		Unnamed	1	Yes	10/25/12	KR/BP	100
SR-008	369053	5992304	100-567134-374775-948201-023010-036907-351538-682690		82690	Unnamed	2	Yes	10/25/12	KR/BP	100
SR-009	369044	5993214	100-567134-374775-948201-023010-073769	180-374000-95200-01900-0750		Unnamed	1	Yes	10/19/12	KR/BP	100
TL-951	378341	5895698	100-567134-610692-671007-505659-146920	180-609800-66100-55900		Unnamed	3	Yes	09/24/12	CM/BP	100
TL-951.1	378320	5895665	100-567134-610692-671007-505659-146920	180-609800-66100-55900		Unnamed	3	Yes	09/24/12	CM/BP	100
TL-952	378494	5896661	100-567134-610692-671007-505659	180-609800-66100-55900-3270		Unnamed	3	Yes	08/08/12	LN/BP/ CR/BP	200
TL-953	378809	5898631	100-567134-610692-579340-841297		41297	Unnamed	6	No	07/12/06		100
TL-954	378946	5899491	100-567134-610692-579340-841297		41297	Unnamed	2	Yes	09/24/12	CM/BP	100
TL-955	379135	5901580	100-567134-610692-522527-428073	180-609800-48100-36100		Unnamed	1	Yes	08/09/12	LN/BP	200
TL-957	378904	5905716	100-567134-610692-480511-367135		67135	Unnamed	1	Yes	08/09/12	CR/BP	100
TL-958	379037	5906127	100-567134-610692-480511	180-609800-39700		Turtle Creek	3	Yes	08/09/12	CR/BP	200

TL-961	389758	5912997	100-567134-610692-522107-063231	180-609800-48200-06400-3440		Unnamed	3	No	07/30/13	KR/CC	100
TL-962	390329	5913918	100-567134-610692-522107-063231-638299	180-609800-48200-06400-3440-5086		Unnamed	2	No	07/31/13	KR/CC	100
TL-963	395064	5919673	100-567134-581072-878917	180-579900-92700-31545		Unnamed	3	No	07/25/13	KR/CC	100
TL-964	395183	5919745	100-567134-581072-878917	180-579900-91819		Unnamed	3	No	07/25/13	KR/CC	100
TL-965	398480	5923189	100-567134-581072-796569-024088		24088	Unnamed	1	Yes	09/13/12	KR/BP	100
TL-966	398491	5924083	100-500560-248839-952068-064975-725103		25103	Unnamed	1	Yes	09/07/12	CM/KR	100
TL-967	398156	5926237	100-500560-248839-945420		45420	Unnamed	1	Yes	09/07/12	CM/KR	100
TL-968	398081	5926491	100-567134-581072-604068		04068	Unnamed	1	Yes	09/05/12	KR/BP	100
TL-969	397906	5927089	100-567134-581072	180-579900		Big Bend Creek	5	Yes	09/05/12	KR/BP	200
TL-970	395992	5930875	100-567134-581072-492383	180-579900-40900		Unnamed	1	Yes	09/05/12	KR/BP	100
TL-971	394839	5932042	100-567134-581072-457721		57721	Unnamed	1	Yes	08/30/12	BP/KR	100
TL-972	393950	5932965	100-567134-581072-418953		18953	Unnamed	1	No	07/23/13	KR/CC	100
TL-973	393887	5933122	100-567134-581072	180-579900		Big Bend Creek	5	Yes	09/26/12	KR	200
TL-974	393428	5934279	100-567134-581072-295086-219362	180-579900-14300-23200		Unnamed	2	No	07/24/13	KR/CC	100

TL-975	393243	5934743	100-567134-581072-295086	180-579900-14300		Unnamed	1	No	07/11/13	CM/KR	100
TL-976	392928	5935536	100-567134-581072-295086-167040		67040	Unnamed	1	No	07/11/13	CM/KR	100
TL-977	391072	5937188	100-567134-581072-246180-131694		31694	Unnamed	2	No	05/28/02		
TL-978	390981	5937244	100-567134-581072-246180-131694-414454		14454	Unnamed	1	No	05/28/02		
TL-979	390445	5937578	100-567134-581072-246180-131694-129753		29753	Unnamed	1	No	05/28/02		
TL-980	390160	5937755	100-567134-581072-246180-131694-085866		85866	Unnamed	1	No	07/11/13	CM/KR	100
TL-982	390770	5945330	100-567134-509773-569914		69914	Unnamed	3	Yes	09/04/12	CM/BP	100
TL-983	391512	5946058	100-567134-509773-527607		27607	Unnamed	1	No	07/12/13	KR/BP	100
TL-985	393221	5948783	100-567134-509773-253156-253259	180-507600-26200-24400		Unnamed	1	Yes	09/10/12	CM/BP	100
TL-986	393469	5949975	100-567134-509773-253156-253259-178981		78981	Unnamed	1	No	07/12/13	KR/BP	100
TL-987	393843	5950751	100-567134-509773-253156-253259-133188	180-481700-67800-39600		Unnamed	1	No	07/11/13	BP/CC	100
TL-988	394145	5951379	100-567134-509773-253156-253259-095526		95526	Unnamed	3	Yes	09/10/12	CM/BP	100
TL-989	394526	5952170	100-567134-509773-253156	180-507600-26200		Unnamed	3	Yes	09/10/12	CM/BP	100

TL-990	394581	5952285	100-567134-509773-253156-422321		22321	Unnamed	1	No	07/11/13	BP/CC	100
TL-991	394809	5952818	100-567134-509773-253156-403239		03239	Unnamed	1	No	07/11/13	BP/CC	100
TL-992	394812	5953129	100-567134-509773-253156-365872-219236	180-507600-26200-37900		Unnamed	2	Yes	09/10/12	CM/BP	100
TL-993	395023	5953965	100-567134-509773-253156-365872-383989		83989	Unnamed	1	No	07/11/13	BP/CC	100
TL-994	395054	5954071	100-567134-509773-253156-365872		65872	Unnamed	2	No	07/11/13	BP/CC	100
TL-995	396578	5955960	100-567134-483452-005364-346411-246527-435740		35740	Unnamed	1	No	07/11/13	BP/CC	100
TL-996	397240	5956745	100-567134-483452-005364-346411-246527-525824		25824	Unnamed	1	No	07/11/13	BP/CC	100
TL-1003	392745	5962272	100-567134-476950-427041		27041	Unnamed	1	No	07/02/13	CM/KR	100
TL-1005	392035	5963206	100-567134-472392-188458-116997		16997	Unnamed	1	No	07/02/13	CM/KR	100
TL-1006	391796	5963829	100-567134-472392	180-470500		Unnamed	2	No	06/27/13	CM/KR	100
TL-1007	391653	5964199	100-567134-472392-137966	180-470500-14700		Unnamed	1	No	07/03/13	CM/KR	100
TL-1008	391096	5965651	100-567134-470833	180-469000		Unnamed	1	No	07/03/13	CM/KR	100
TL-1009	390975	5965964	100-567134-468495-243247		43247	Unnamed	1	No	07/03/13	CM/KR	100
TL-1010	390839	5966319	100-567134-468495	180-466400		Unnamed	3	No	06/27/13	CM/KR	100

TL-1011	390777	5966480	100-567134-468495-454918	180-466400-82400		Unnamed	1	No	07/03/13	CM/KR	100
TL-1012	390761	5967322	100-567134-463689-790071		90071	Unnamed	1	No	06/28/13	CM/KR	100
TL-1013	390764	5967504	100-567134-463689		63689	Unnamed	1	No	06/28/13	CM/KR	100
TL-1014	390768	5967661	100-567134-463689-784672		84672	Unnamed	1	No	06/28/13	CM/KR	100
TL-1015	390773	5967920	100-567134-463689-737924		37924	Unnamed	1	No	06/28/13	CM/KR	100
TL-1016	390779	5968201	100-567134-463689-682532		82532	Unnamed	1	No	06/28/13	CM/KR	100
TL-1017	390786	5968543	100-567134-463689-614435		14435	Unnamed	1	No	06/28/13	CM/KR	100
TL-1018	390797	5969105	100-567134-463689-540545		40545	Unnamed	1	No	06/28/13	CM/KR	100
TL-1019	390804	5969428	100-567134-463689-536465-348208		48208	Unnamed	1	No	06/28/13	CM/KR	100
TL-1021	390749	5970935	100-567134-433409	180-431600		Tahultzu Creek	19	No	06/27/13	CM/KR	200
TL-1022	389970	5971325	100-567134-433409-729688		29688	Unnamed	1	No	06/27/13	CM/KR	100
TL-1023	388774	5972830	100-567134-408281-229646-609745-254415		54415	Unnamed	1	No	07/04/13	CM/KR	100
TL-1024	388040	5973563	100-567134-408281-229646-609745	180-406900-25000-60700		Unnamed	1	No	07/04/13	CM/KR	100
TL-1025	387563	5974040	100-567134-408281-229646	180-406900-25000		Fifteen Creek	6	No	07/04/13	CM/KR	100
TL-1026	387073	5975092	100-567134-408281-229646-553111	180-406900-25000-55300		Unnamed	1	No	07/04/13	CM/KR	100
TL-	386709	5976155	100-567134-408281-		21858	Unnamed	1	No	10/05/12	KR/BP	100

1027			621858								
TL-1028	386514	5976723	100-567134-408281-698246		98246	Unnamed	1	No	07/10/13	CM/KR	100
TL-1029	386473	5976842	100-567134-408281	180-406900		Smith Creek	5	No	07/10/13	CM/KR	100
TL-1030	386285	5978055	100-567134-408281-655084	180-406900-70300		Unnamed	1	No	07/10/13	CM/KR	100
TL-1031	386687	5980338	100-567134-374775-709017-097750		97750	Unnamed	1	No	07/02/13	BP/CC	100
TL-1034	383954	5982493	100-567134-374775-709017-097750-655255-205293		05293	Unnamed	1	No	07/02/13	BP/CC	100
TL-1035	383820	5983126	100-567134-374775-709017-097750-655255	180-374000-71300-01800-70400		Unnamed	1	No	07/02/13	BP/CC	100
TL-1036	383813	5983240	100-567134-374775-709017-097750-655255-194565		94565	Unnamed	1	No	07/02/13	BP/CC	100
TL-1037	382469	5984432	100-567134-374775-709017-097750-580521		80521	Unnamed	1	No	07/02/13	BP/CC	100
TL-1040	381005	5985094	100-567134-374775-709017-097750-388019-413178	180-374000-71300-01800-4100-4210-655		Unnamed	1	No	07/02/13	BP/CC	100
TL-1041	380726	5985238	100-567134-374775-709017-097750-388019-413178-329245		29245	Unnamed	1	No	07/02/13	BP/CC	100
TL-1042	380453	5985380	100-567134-374775-709017-097750-388019	180-374000-71300-01800-4100		Unnamed	1	No	07/04/13	BP/CC	100

TL-1043	379624	5985810	100-567134-374775-709017-460089-583143	180-374000-71300-30700-1820-5260		Unnamed	1	No	07/03/13	BP/CC	100
TL-1046	378903	5985641	100-567134-374775-709017-460089	180-374000-71300-30700-1820		Unnamed	5	No	07/10/13	BP/CC	100
TL-1047	378056	5985356	100-567134-374775-709017-460089-547927	180-374000-71300-30700-1820-5830		Unnamed	1	No	07/02/13	BP/CC	100
TL-1048	377635	5985292	100-567134-374775-709017-700524	180-374000-71300-30700-5720		Unnamed	1	No	07/02/13	BP/CC	100
TL-1049	376597	5985148	100-567134-374775-709017-745099	180-374000-71300-30700-6680-4550		Unnamed	1	No	07/04/13	BP/CC	100
TL-1050	376524	5985138	100-567134-374775-709017-745099-137615	180-374000-71300-30700-6680		Unnamed	6	No	07/05/13	BP/CC	100
TL-1052	370180	5990459	100-567134-374775-948201-067903	180-374000-95200-06500		Unnamed	1		07/17/13	KR/BP	100
TL-1053	370145	5990507	100-567134-374775-948201-067903-290144		90144	Unnamed	1	No	07/17/13	KR/BP	100
TL-1054	369786	5990993	100-567134-374775-948201-023010-036907-483445	180-374000-95200-01900-0370-7340		Unnamed	1	Yes	10/25/12	KR/BP	100
TL-1055	369550	5991314	100-567134-374775-948201-023010-036907	180-374000-95200-01900-0370		Unnamed	2	Yes	10/25/12	KR/BP	100

TL-1056	369370	5991557	100-567134-374775-948201-023010-036907-554634	180-374000-95200-01900-0370-7250		Unnamed	1	Yes	10/25/12	KR/BP	100
TL-1057	382716	5908851	100-567134-610692-480511	180-609800-39700		Unnamed	1	Yes	08/15/12	BP/CR	200
TL-1058	383308	5909163	100-567134-610692-480511		80511	Turtle Creek	1	Yes	08/10/12	BP/BP	200
TL-1059	388913	5942791	100-567134-509773-339107	180-507600-34800		Unnamed	2	Yes	09/04/12	CM/BP	100
TL-1060	390485	5944941	100-567134-509773-339107-396465-585074		85074	Unnamed	1	No	07/12/13	KR/BP	100
TL-1061	391095	5945775	100-567134-509773-527607		27607	Unnamed	1	No	07/12/13	KR/BP	100
TL-1062	397380	5959982	100-567134-483452-137086-384243		84243	Unnamed	1	No	07/23/13	KR/PD	100
TL-1063	397148	5960394	100-567134-483452-137086	180-481700-11700		Unnamed	2	No	07/23/13	KR/PD	100
TL-1064	396245	5962001	100-567134-483452	180-481700		Greer Creek	6	No	07/18/13	KR/BP	200
TL-1065	394094	5962069	100-567134	180		Nechako River	3	No	07/18/13	KR/BP	100
TL-1066	393456	5962121	100-567134-476950		76950	Unnamed	1	No	07/02/13	CM/KR	200
TL-1067	393189	5962178	100-567134-476950-320651		20651	Unnamed	1	No	07/02/13	CM/KR	200
TL-1068	393165	5962183	100-567134-476950		76950	Unnamed	1	No	07/02/13	CM/KR	100
TL-1069	392356	5962371	100-567134-476950		76950	Unnamed	1	No	07/02/13	CM/KR	100
TL-	392328	5962444	100-567134-476950-		38478	Unnamed	1	No	07/02/13	CM/KR	100

1070			738478								
TL-1071	392281	5962567	100-567134-476950-738478		38478	Unnamed	1	No	07/02/13	CM/KR	100
TL-1072	389066	5972539	100-567134-433409-462023-675778		75778	Unnamed	1	No	08/15/13	KR/PD	100
TL-1073	387460	5974143	100-567134-408281-229646-640959		40959	Unnamed	1	No	07/04/13	CM/KR	100
TL-1074	385841	5981225	100-567134-374775-709017-097750	180-374000-71300-01800		Unnamed	2	No	07/03/13	BP/CC	100
TL-1075	384353	5982225	100-567134-374775-709017-097750-727689		27689	Unnamed	1	No	07/02/13	BP/CC	100
TL-1076	374678	5985779	100-567134-374775-709017-341978	180-374000-71300		Unnamed	3	Yes	10/11/12	CM/BP	100
TL-1077	368859	5992869	100-567134-374775-948201-023010-073769	180-374000-95200-01900-0750		Unnamed	1	Yes	10/19/12	KR/BP	100
TL-1078	383923	5909432	100-567134-610692	180-609800		Chedakuz Creek	1	Yes	08/15/12	BP/CR	200
TL-1079	384154	5909448	100-567134-610692-494661	180-609800-45100		Unnamed	1	No	06/13/02		100
TL-1080	385639	5909486	100-567134-610692-513545	180-609800-47584		Unnamed	1	Yes	08/09/12	BP/CR	100
TL-1081	386128	5909498	100-567134-610692-520894		20894	Unnamed	1	Yes	08/09/12	LN/BP	140
TL-1082	379002	5902757			171	Unnamed	1	Yes	10/03/12	KR/BP	100
TL-1083	379058	5903128			172	Unnamed	1	Yes	10/03/12	KR/BP	100
AA-001	375092	5903417			173	Unnamed	1	No	07/29/13	KR/CC	100

AA-002	378594	5904942	100-567134-610692-480511-486033		86033	Unnamed	1	No	07/29/13	KR/CC	100
AA-003	375858	5903350	100-567134-610692-480511-392467	180-609800-39700-40000		Unnamed	1	No	07/29/13	KR/CC	100

Appendix C - Results Summary for 2013 FFHI study

Summary of stream assessments for 2013 field sample

Site ID	Class†	Gradient	Morphology	B_fW€	B_fD€	ResPool€	Species*	Habitat Quality‡				Comments
								S	R	O	M	
AA-001	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry, vegetated strip of timber b/w 2 plantations. No scouring, alluvial deposits, or water. Not a stream.
AA-002	S4	3.5	Cobble-Pool	1.12	0.57	0.17	NFC	P	G	P	F	S4 with good rearing habitat. Spawning, overwintering habitat not very good.
AA-003	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scoured channel or alluvial deposits. Occasional small wet areas along mapped watercourse. Not a stream.
AE-901	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	d/s of crossing has been dammed for a watering hole. NCD runs through hay field and has no scouring or alluvial deposits.
AE-902	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Culvert at road crossing, with hay fields on both sides. No scouring or alluvial deposits. Not a stream.
AE-903	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Culvert at road crossing located on private property made of hayfields. No scouring, no alluvial deposits. Not a stream.
AE-904	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Tributary to an NCD. Some saturated pools with evidence of water. No scouring, no alluvial deposits, no flows. Not a stream.
AE-905	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Moist ground and dry pockets. No scoured channel, no alluvial deposits. Not a stream.
AE-906	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring >100m. No alluvial deposits. Moist ground with water tolerant vegetation lining mapped watercourse.
AE-908	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.

AE-909	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.
AE-910	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.
AP-905	S4	1.5	Riffle-pool	1.45	0.5	0.13	RB	P	F	F	F	S3 stream with fair fish habitat. 250mm fish seen.
MR-001	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Slight depression in yound pine forest. Some evidence of spring runoff. No scoured channel. No alluvial deposits.
MR-002	S2	3	Riffle-Pool	12.1	0.93	0.59	NS	G	G	G	G	Excellent overall habitat
MR-003	S4	1.5	Riffle-pool	0.6	0.37	0.04	NFC	P	G	F	F	S4 with indirect connectivity to good OW habitat and direct connectivity to fish bearing stream.
MR-004	S4	2.5	Riffle-pool	0.8	0.4	0.09	NFC	P	F	P	P	S4 with intermittent dry sections and overall poor fish habitat.
MR-006	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry, vegetated upland area between two small wetlands. No scoured channel, no alluvial deposits, no evidence of ephemeral runoff.
MR-007	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Wetland with lots of segdes. ~10cm of standing water throughout, but no scoured channel or alluvial deposits. Not a stream.
MR-008	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Open sedge wetland with pockets of open water. One area (5mx5m) water >1m in depth. No scoured channel or alluvial deposits. Not a stream.
MR-009	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Small wetland with open water. No scoured channel or alluvial deposits. Not a stream.
MR-010	S3	1.5	Riffle-Pool	2.38	0.53	0.23	RB	F	G	F	G	S3 with abuundant fish habitat and direct connectivity to a important kokanee spawning S2.

SR-001	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A few patches of willow is only indicator of moisture at this site.
SR-002	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No evidence of any kind of drainage. No scoured channel, no alluvial deposits, no water. Not a stream.
SR-003	S1											Stellako river too wide and deep to safely perform stream assessment. Defaulted S1 based on historical data.
SR-004	S4	9	Riffle-pool	1.02	0.43	0	C	P	P	P	P	Dry S4 with d/s barrier to migration and no upstream perennial habitat.
SR-005	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Drainage appears ephemeral, with evidence of seasonal pooling. No socured channel, no alluvial deposits. Not a stream.
SR-006	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry, vegetated depression. No scoured channel, no alluvial deposits, no water.
TL-116	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring , alluvial deposits, or open water along this swath of alder. Not a stream.
TL-117	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Rich vegetation with no scouring, alluvial deposits, or open water. Not a stream.
TL-961	S3	2.5	Riffle-pool	1.95	0.43	0.15	SPP	G	G	G	G	Good fish habitat with unidentified fish observed during survey.
TL-962	S6	6.5	Riffle-pool	0.95	0.4	0.52	NFC	P	G	P	P	Previously classified as S6. Agree with previous classification. Treat as non-fishbearing stream.
TL-963	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60m scoured section d/s of existing road crossing down steep section. No scouring or alluvial deposits outside this area. Not a stream.
TL-964	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Wetland type with water tolerant vegetation. Pooled water in areas. No scoured channel or alluvial deposits. Not a stream.
TL-972	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry, vegetated gulley. No scouring, no alluvial deposits, no water. Not a stream.

TL-974	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dense strip of Salix and sedges. Scouring present, but none >100m. Several beaver dams have impounded water. Not a stream.
TL-975	S3	2	Riffle-Pool	2.82	0.6	0.24	SPP	G	G	G	G	S3 with good fish habitat. Visual observation of fish.
TL-976	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Saturated soils and pooling evident, but no socured channel or alluvial deposits. Not a stream.
TL-980	S4	2.5	Riffle-pool	0.81	0.15	0.06	NFC	G	G	P	F	S4 stream with no fish caught during survey.
TL-983	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water. Mapped watercourse is a strip of alder. Not a stream.
TL-986	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scoured channel or alluvial deposits, but there is evidence of ephemeral pooling. Not a stream.
TL-987	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or water. Open corridor through Spruce stand. Not a stream.
TL-990	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Discontinuous puddling in small gulley. Not a stream.
TL-991	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Wetland dominated by sedges and willow. Discontinuous ponded areas. No scouring or alluvial deposits. Not a stream.
TL-993	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water in this shallow depression. Not a stream.
TL-994	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring > 20m. Scoured sections fo contain mineral alluvium, but elsewhere is fully vegetated with no channel definition. Not a stream.
TL-995	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring >60m. Appears to be a stream at crossing, but there is not enough channel definition to be considered a stream.

TL-996	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water. Equisetum spp only indicator of a drainage. Not a stream.
TL-1003	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, no alluvial deposits, no open water. Not a stream.
TL-1005	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Wet depression in a drainage. No scouring >3m. No alluvial deposits covering >3m. Not a stream.
TL-1006	S4	4	Riffle-pool	1.3	0.4	0.13	NFC	G	G	F	G	S4 stream with no fish caught during survey, but fish presence documented in u/s and d/s reaches.
TL-1007	S4	2.5	Riffle-pool	1.01	0.62	0.26	SPP	P	G	F	G	S4 stream with really good rearing habitat, but poor spawning and overwintering portential.
TL-1008	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Site disturbed by forestry activities, resulting in ponded water. No scouring or alluvial deposits. Not a stream.
TL-1009	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Very small, discontinuous scoured sections. Some of the drainage is saturated. Not a stream.
TL-1010	S4	2.5	RP	1.05	0.43	0.1	NFC	P	G	P	F	S4 with no fish caught, but stream connects two lakes so defaulted fish bearing
TL-1011	S4	1.5	RP	0.73	0.27	0.08	NFC	P	F	F	P	S4 with marginal fish habitat. Defaulted to fish bearing status.
TL-1012	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry vegetated area. No scouring, alluvial deposits, or water. Not a stream.
TL-1013	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring > 3m. No alluvial deposits. Discontinuous saturation and pooling. Not a stream.
TL-1014	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Saturated soil with dense moisture tolerant plant species.
TL-1015	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring > 5m. No alluvial deposits. Lonicera involucrata dominates.

TL-1016	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Discontinuous pooling and moist pockets of soil. No scouring or alluvial deposits. Not a stream.
TL-1017	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Water pooling at culvert on existing road. Water not seen elsewhere in drainage. Not a stream.
TL-1018	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Some water flowing over soil. Not a stream.
TL-1019	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Moist soil with some standing water. No scouring or alluvial deposits. Not a stream.
TL-1021	S2	2	LC	7.15	0.21		SPP	P	G	F	G	Stream runs through 25m wide wetland type. Fish bearing status confirmed. u/s of crossing wetland vegetation narrows up.
TL-1022	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Intermittent 1-2m scoured sections. Saturated soil elsewhere. No alluvial deposits. Not a stream.
TL-1023	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Some standing water. Ground is saturated. Not a stream.
TL-1024	S3	0.5	RP	2.09	0.33	0.08	SPP	G	G	M	G	Good looking S3 with known fish presence and provides connectivity between fish bearing lakes.
TL-1025	S3	2.5	RP	3.33	0.47	0.13	RB	G	G	F	G	S3 stream with good fish habitat.
TL-1026	S4	5.5	RP	1.32	0.47	0.36	NFC	P	F	P	P	Low quality stream defaulted fish bearing. Does not provide migration to good upstream habitat.
TL-1028	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Discontinuous scouring and alluvial deposits. Remainder of drainage is vegetated. Not a stream.
TL-1029	S3	4.5	Riffle-pool	3.4	0.6	0.2	RB	G	G	F	F	Channel in gulley with notable overhanging vegetation. Visual observations of 10+ RB in resting pools during survey.

TL-1030	S3	1.5	RP	1.7	0.2	0.1	NFC	G	F	P	P	S3 stream at low flows with significant woody debris in the channel. Good cover but not a lot of water for fish to occupy.
TL-1031	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Wet ground with occasional puddles. Not a stream.
TL-1034	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Dry, vegetated ground. Not a stream.
TL-1035	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Occasional scouring, no alluvial deposits, no water. Mapped watercourswe in shallow gulley. Not a stream.
TL-1036	S4	1.5	RP	1.27	0.47	0.23	NFC	P	G	P	P	Defaulted S4 stream with marginal habitat and not a lot of drainage u/s of the proposed crossing.
TL-1037	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water. Mature poplar and aspen indicate ground moisture. Not a stream..
TL-1040	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, occasional alluvial deposits. Not a stream.
TL-1041	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water. Ground along mapped watercourse is moist. Not a stream.
TL-1042	S4	3.5	RP	1.48	0.53	0.12	NFC	P	G	P	P	Stream provides good rearing habitat, but low flows and numerous debris jam make for poor spawning, migrating and overwintering habitat.
TL-1043	S4	5	RP	1.15	1.4	0.66	NFC	P	G	P	P	Stream provides good rearing habitat, but low flows and numerous debris jam make for poor spawning, migrating and overwintering habitat.
TL-1046	S3	6	RP	1.97	0.87	0.08	NFC	P	G	P	P	Slightly wider stream that TL1043 runs into. Stream only provides good rearing habitat, with little to no spawning, overwintering or migrating habitat.
TL-1047	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring >5m, some alluvial deposits in scoured sections. Low flows. Not a stream.

TL-1048	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or water. Not a stream.
TL-1049	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, trace alluvial deposits, small discharge of water. Alluvial deposits found in isolated pools. Not a stream.
TL-1050	S4	7.5	CP	0.88	0.37	0.08	NFC	P	G	P	P	Debris jams make migration difficult. Plenty of rearing habitat. 28% slope d/s of crossing could limit migration as well
TL-1052	S4	4	Riffle-pool	1.1	.5	0.15	NS	P	G	P	P	Stream 90% frozen at time of assessment. 1" of ice cover.
TL-1053	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dry, vegetated strip of moisture tolerant vegetation. No scouring, alluvial deposits, or water. Not a stream.
TL-1060	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Saturated strip among alder and sedges. Discontinuous pooling. No scouring or alluvial deposits. Not a stream.
TL-1061	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or open water. Mapped watercourse is a strip of alder. Not a stream.
TL-1062	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits. Wet drainage area. Not a stream.
TL-1063	S4	3.5	Riffle-pool	0.79	0.4	0.06	NFC	P	G	P	P	Small stream with marginal fish habitat. Defaulted fish bearing because of connectivity to d/s fish bearing stream (Greer Creek)
TL-1064	S2	2.5	Riffle-pool	12.52	1.3	0.67	SPP	G	G	G	G	Nice S2 stream with visual observation of fish and good fish habitat across the board.
TL-1065	S1											Major river that was too deep and swift to safely perform assessment. Historical data shows large fish community.
TL-1066	S4	6.5	Riffle-pool	0.67	0.37	0.05	NFC	P	G	P	P	Small defaulted S4 with marginal fish habitat. Same reach as TL1067
TL-1067	S4	6.5	Riffle-pool	0.67	0.37	0.05	NFC	P	G	P	P	Small defaulted S4 with marginal fish habitat. Same reach as TL1066

TL-1068	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, no alluvial deposits, no water. Moss and alder found along mapped watercourse. Not a stream.
TL-1069	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, no alluvial deposits, no water. Mosses found along mapped watercourse. Not a stream.
TL-1070	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring or alluvial deposits in wetland type with lots of alder. Some standing water. Not a stream
TL-1071	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or water. Not a stream.
TL-1072	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Medium sized black spruce/sedge wetland. Currently dry, but soils are saturated.No scoured channel or alluvial deposits.
TL-1073	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or water. Several dry depressions. Moisture tolerant vegetation present. Not a stream.
TL-1074	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Alignment crosses 60m wetland section with no scouring or alluvial deposits. No open water or channel. Not a stream.
TL-1075	NCD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No scouring, alluvial deposits, or water. Mapped watercourse runs through mapped gulley. Not a stream

***- Species codes: NFC= No Fish Caught; SPP= Unidentified Species; NS= Not Sampled; RB= Rainbow trout; LKC =Lake Chub; BMC Brassy minnow; WSU: White sucker**

†- Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage, NVC = no visible channel, NPC = no previous classification information was available.

‡- Habitat refers to a qualitative assessment of fish habitat based on four different types of fish habitat. S = spawning habitat; R = rearing; O = overwintering; and M = migrating. Each habitat type within each site was given a rating for habitat quality: N = nil; P = poor; F = fair; G = good; and E = excellent. These ratings were assessed based on the professional judgement of the field assessors.

€- BfW= Bankfull width; Bfd= Bankfull depth; ResPool=Residual Pool.

Appendix D – Fish Sampling Summary for the 2013 FFHI

Fish Sampling Summary for 2013 FFHI

Site ID	Sp 1	Sp1 stage	Sp1 count	Sp1 minL (mm)	Sp1 maxL (mm)	Sp 2	Sp2 stage	Sp2 count	Sp2 minL (mm)	Sp2 maxL (mm)	MT set time	EF sec.	CPUE	Comments
AP-905	RB	A	1	150	150						21h 10m	646	0.001548	One escapee during electrofishing. Fork length estimated
MR-003	NFC		0								0	74	0	Moderate fish habitat. Very thick overhanging veg makes electrofishing very difficult due to limited visibility.
MR-004	NFC		0								0	59	0	Intermittently dry channel with little habitat to sample from.
MR-010	RB	J	1	110	110						0	149	0.006711	Good overall fish habitat. Only 1 fish caught because presence absence for TL sites. SWD prevented capture of fish following electrshocking.
TL-961	SPP										0	0		Visual observation of unidentified fish, Fork Length est. 30-50mm
TL-962	NFC		0								0	106	0	Several barriers noted on this year's and previous surveys. No fish caught in either survey.
TL-975	SPP										0	56		Visual observation of unidentified fish (4). Fork length estimated at 20mm.
TL-980	NFC		0								18h 15m	205	0	No fish caught during survey. None caught during 2002 survey either. No known barriers from either survey.
TL-1006	NFC		0								22h 30m	432	0	although no fish caught during survey, there is historical data for fish presence.
TL-1007	SPP										0	0		visual observation of unidentified fish. Fork length est at 50-100mm.
TL-1010	NFC		0								22h 20	145	0	low water stage and abundance of overhanging veg made it quite difficult to efficiently fish.

						m				
TL-1011	NFC		0			0	113	0		low water stage and abundance of overhanging veg made it quite difficult to efficiently fish.
TL-1021	SPP					0	0			Visual observation of fish to confirm fish bearing status.
TL-1024	SPP					0	0			Visual observation of fish to confirm fish bearing status.
TL-1025	RB	J	4	50	110	0	42	0.095238		High conductivity required EF to be set at low voltage. 4 escapees.
TL-1026	NFC		0			0	126	0		Low flows prevented minnow trapping and no fish were caught via electrofishing.
TL-1029	RB	J	10			0	0			Fish observed in resting pools throughout survey.
TL-1030	NFC		0			20h 15m	478	0		woody debris jams and pools characterize this stream. Sampling efficiency not very high on this one.
TL-1036	NFC		0			20h 14m	782	0		Both minnow trapping and electrofishing yielded no fish caught.
TL-1042	NFC		0			0	380	0		Very thick shrub layer lowered sampling efficiency greatly. Numerous debris jams (~30cm high) would impede fish migration.
TL-1043	NFC		0			0	355	0		Very thick shrub layer lowered sampling efficiency greatly. Numerous debris jams (~30cm high) would impede fish migration.
TL-1046	NFC		0			22h 27m	592	0		Numerous debris jams and overhanging veg lowered sampling efficiency. Downstream reaches have been documented as fish bearing.
TL-1050	NFC		0			0	269	0		Numerous debris jams and overhanging veg lowered sampling efficiency. Downstream reaches have been documented as fish bearing.
TL-1052	NFC		0			0	321	0		Dry downstream. Poor fish habitat.

TL-1063	NFC	0	0	214	0	Marginal fish habitat with lots of overhanging vegetation which decreased sampling efficiency.
TL-1064	SPP		0	0		Visual observation to confirm fish bearing status.
AA-002	SPP		19h 40m	216	0	one esacpee during EF.

Sp1 and Sp2 columns give the species identification of fish caught based on the following code system: NFC = no fish caught; RB = Rainbow trout (Oncorhynchus mykiss); SPP = unidentified species. Stage refers to lifestage of fish caught. MinL and MaxL refer to the minimum and maximum fork lengths in mm. MT hours/min refers to the length of time that minnow traps were set at the sample site. EF sec refers to the number of seconds that the electrofisher was in operation during the sample. CPUE = Catch Per Unit Effort, and is calculated by dividing the number of fish caught by the duration of sampling in seconds. The CPUE values listed here are based off of the electrofishing samples because no fish were caught with a minnow trap during the 2013 field season.

Appendix E – Riparian Vegetation Summary

Summary of Riparian Vegetation for 2013 FFHI Sites

Site ID	Dom. Trees	Sub-dom. trees	Dom. Shrubs	Sub-dom. Shrubs	Canopy all (%)	Canopy cut (%)	Comments
AA-002	Sx, Pl		Loni inv.	Alnu cri.	12	10	Dense shrub layer dominates riparian with occasional tree. Mature forest >15m away from stream.
AP-905	Sx, Bl		Alnu cri.		8	5	Riparian dominated by mature coniferous trees with sparce shrub layer.
MR-002	Sx, Pl		Sali spp	Loni inv	2	1	Right bank shrub dominated and left bank dominated by coniferous forest.
MR-003	Sx	Pl, Sb	Betu gla	Sali spp	16	15	Coniferous veg on right bank. Left bank dominated by 1-4 m shrubs.
MR-004	Sx, Pl		Sali spp.	Shep can, Loni inv	6	2	Very little understory shrub or herbaceous layer over 1m. Conifers up to the stream edge.
MR-010	Sx	Pl	Alnu cri.	Loni inv	8	4	Stream in mature coniferous forest with 3m shrub buffer.
SR-003	Sx	Ac	Alnu cri.		3	2	Mature coniferous forest on both banks. Not a substantial shrub layer.
SR-004	Sx, At	Pl	Loni inv., Rubu par.	Alnu cri.	15	12	Aspen dominant within 10m of stream. Cover dominated by dense herbaceous layer.
TL-1006	Pl	Sx	Alnu cri., Loni inv.	Loni inv.	10	8	Crossing in 60m swath of pine between two cutblocks.
TL-1007	Sx	Pl	Alnu cri., Loni inv.	Sali spp.	8	6	Stream has lots of mature spruce in riparian with pine stand surrounding, with alder dominating around crossing site.
TL-1010	Sx	Pl	Loni inv.	Alnu cri.	8	6	Crossing is in cutblock with ~8yr old stand of pine/spruce surrounding riparian.
TL-1011	Sx, Pl	At	Alnu cri.	Loni inv.	12	11	Riparian dominated by alder with plantations on both sides of the stream, ~20m away.
TL-1021	Sx	Pl	Sali spp		1	1	Wetland type with sedges,grasses, and Salix within 25m of stream. Trees dominate further away.
TL-1024	Sx, Pl		Sali spp.	Alnu cri.	7	5	Crossing site spans across 70m wetland type with Salix spp dominating. Channel definition maintained throughout.

TL-1025	Sx, Pl		Alnu cri	Oplo hor	11	8	Riaprian dominated by shrubs within 10m of stream. Coniferous trees dominate further out from stream.
TL-1026	Pl	Sx	Alnu cri.	Loni inv.	15	14	Riparian dominated by alder, and several water tolerant species present.
TL-1029	Sx, Bl	Ac	Alnu cri.	Loni inv.	6	2	Alder dominated riparian that transitions to spruce/fir stand away from stream.
TL-1030	Sx	Pl	Alnu cri.	Sali spp.	13	11	~25m wide swath of alder dominated shrub community in a pine/spruce stand.
TL-1036	Sx	Bl, At	Loni inv., Alnu cri.	Oplo hor.	23	14	Stream in mature conifer stand with swath of alder dominated riparian veg along stream.
TL-1042	Bl	Sx	Oplo hor	Alnu cri	15	12	Gulley dominated by Devil's Club and alder around stream, shifting to a fir stand as one moves away from the stream.
TL-1043	Bl, Sx	Pl	Oplo hor., Alnu cri.	Vibu edu.	18	10	Riparian veg dominated by devil's club and alder in a mature conifer stand.
TL-1046	Bl		Oplo hor	Rubu par., Alnu cri.	14	12	Devil's club dominated riparian with mature alder present throughout. Mature trees dot the riparian.
TL-1050	Pl	At	Alnu cri.	Loni inv., Rubu par., Olpo hor.	14	10	Riparian mainly shrubs with alder dominating and occasional aspen close to the stream
TL-1052	Sx	Ac, Pl	Alnu cri.	Loni inv.	16	14	10m swath of dense shrubs surrounds stream. Mature spruce stand dominates from there.
TL-1063	Sx	Pl	Alnu cri.	Loni inv.	15	12	Riaprian dominated by alder with a thick shrub layer. 5m out from stream mature spuce stand dominates.
TL-1064	Sx	Pl	Alnu cri.	Sali spp.	3	1	u/s of crossing - mature spruce forest; d/s of crossing - alder/willow dominated grazing lands
TL-1065	At, Sx	Pl	Sali spp.	Alnu cri., Loni inv.	1	1	Right bank is dominated by mature conifers. Left bank is dominated by deciduous tree stand. Vegetated island in middle of river.
TL-1066	Sx	Pl	Alnu cri.	Loni inv.	13	9	Thick shrub layer around stream with coniferous trees beginning ~7m away from stream.
TL-1067	Sx	Pl	Alnu cri.	Loni inv.	13	9	Thick shrub layer around stream with coniferous trees beginning ~7m away from stream.
TL-961	Sx	Pl	Sali spp., Loni inv.		6	4	4m swath of Salix spp, grasses, and sedges line stream.

TL-962	Sx, Pl	At, Bl	Alnu cri.	Loni inv., Ribe lac., Sali spp.	10	9	stream crossing in ~5yr old plantation with majority of canopy cover from alder.
TL-975	Pl	Sx	Sali spp.	Loni inv.	9	8	Riparian dominated by shrubs within 10m of stream, with mature forest on left bank and cutblock on right bank.
TL-980	Sx	Pl	Alnu cri.	Loni inv.	7	5	Crossing site located on existing road. Black twinberry and alder dominant cover veg.

Dom. Trees = dominant trees; Sub-Dom. trees = subdominant trees; Dom. Shrub = dominant shrub; Sub-Dom. shrub = sub-dominant shrub. Tree species codes as per: http://www.env.gov.bc.ca/wld/documents/wrp/wrt6/codes.html. Tree Species: Ac - *Populus balsamifera* (Poplar); At: *Populus tremuloides* (Trembling Aspen); Bl: *Abies lasiocarpa* (Subalpine Fir); Pl: *Pinus contorta* (Lodgepole Pine); Sb: *Picea mariana* (Black Spruce); Sx- *Picea cross* (Spruce Hybrid). Shrub abbreviations are first four letter of the genus name and first three letters of the species name: Alnu cri: *Alnus crispa* (Alder); Betu gla: *Betula glandulosa* (Scrub Birch); Loni inv: *Lonicera involucrata* (Black Twinberry); Oplo hor: *Oplopanax horridus* (Devil's Club); Rubu par: *Rubus parviflorus* (Thimbleberry); Ribe lac: *Ribes lacustre* (Black Gooseberry); Sali spp: *Salix species* (Willow); Shep can: *shepherdia canadensis* (Soopolallie); Vibu edu: *Viburnum edule* (Highbush Cranberry).

Appendix F – 2013 Minor waters site data

Summary of Minor Navigable Waters Determination from 2013 sample year

Site ID	Survey Year	Stream Name	Mean BfW (m)	Mean BfD (m)	Mean Gradient (%)	Sinuosity	Blockages	Navigability	Minor waters?	Minor works?
AA-001	2013	Unnamed						Not a stream		
AA-002	2013	Unnamed	1.12	0.57	3.5	ns	ns	Several exposed clusters of cobble severely impede navigation.	Yes	Yes
AA-003	2013	Unnamed						Not a stream		
AE-901	2013	Unnamed						Not a stream		
AE-902	2013	Unnamed						Not a stream		
AE-903	2013	Unnamed						Not a stream		
AE-904	2013	Unnamed						Not a stream		
AE-905	2013	Engen Creek						Not a stream		
AE-906	2013	Engen Creek						Not a stream		
AE-908	2013	Unnamed						Not a stream		
AE-909	2013	Unnamed						Not a stream		
AE-910	2013	Unnamed						Not a stream		
AP-905	2013	Unnamed	1.93	0.5	1.5	ns	ns	Stream is relatively shallow and has numerous blockages. Blockages not tallied because Mean_BfD below threshold for minor waters classification.	Yes	No
MR-001	2013	Unnamed						Not a stream		
MR-002	2013	Unnamed	12	0.7	3	ns	0	S2 stream with good flows. Navigation is not impeded by anything. No evidence of recreational use.	No	Yes
MR-003	2013	Unnamed	0.6	0.37	1.5	ns	ns	Small stream that a canoe would not fit into.	Yes	Yes
MR-004	2013	Unnamed	0.82	0.4	2.5	ns	ns	intermittant small, shallow channel. >1000m from lake - minor works	Yes	Yes
MR-005	2013	Unnamed						Not a stream		
MR-006	2013	Unnamed						Not a stream		
MR-007	2013	Unnamed						Not a stream		

MR-008	2013	Unnamed						Not a stream		
MR-009	2013	Unnamed						Not a stream		
MR-010	2013	Unnamed	2.38	0.53	1.5	ns	8	S3 stream with frequent blockages. 8 obstacles in 100m survey length.	Yes	Yes
SR-001	2013	Unnamed						Not a stream		
SR-002	2013	Unnamed						Not a stream		
SR-003	2013	Stellako River						Stellako River - large river with no blockages in 200m reach centered on crossing site. Swiftwater makes data collection for Nav waters unsafe.	No	No
SR-004	2013	Unnamed	1.02	0.43	9	ns	ns	Small, dry channel. >1000m from lake - minor works	Yes	Yes
SR-005	2013	Unnamed						Not a stream		
SR-006	2013	Unnamed						Not a stream		
SR-007	2013	Unnamed						Not a stream		
SR-008	2013	Unnamed						Not a stream		
TL-116	2013	Unnamed						Not a stream		
TL-117	2013	Unnamed						Not a stream		
TL-961	2013	Unnamed	1.95	0.43	2.5	ns	ns	Fish bearing S3. 560m from lake - not minor works	Yes	No
TL-962	2013	Unnamed	0.95	0.4	6.5	ns	ns	Small, low discharge stream that a canoe would not fit into. 870m from small lake.	Yes	No
TL-963	2013	Unnamed						Not a stream		
TL-964	2013	Unnamed						Not a stream		
TL-972	2013	Unnamed						Not a stream		
TL-974	2013	Unnamed						Not a stream		
TL-975	2013	Unnamed	2.82	0.6	2	ns	8	S3 stream with frequent blockages. >1000m from lake. Beaver dam upstream of crossing site.	Yes	Yes
TL-976	2013	Unnamed						Not a stream		
TL-980	2013	Unnamed	0.81	0.27	2.5	ns	ns	Small stream that a canoe would not fit into.	Yes	Yes
TL-983	2013	Unnamed						Not a stream		
TL-986	2013	Unnamed						Not a stream		
TL-987	2013	Unnamed						Not a stream		
TL-988	2013	Unnamed						Not a stream		

TL-990	2013	Unnamed						Not a stream		
TL-991	2013	Unnamed						Not a stream		
TL-993	2013	Unnamed						Not a stream		
TL-994	2013	Unnamed						Not a stream		
TL-995	2013	Unnamed						Not a stream		
TL-996	2013	Unnamed						Not a stream		
TL-1003	2013	Unnamed						Not a stream		
TL-1005	2013	Unnamed						Not a stream		
TL-1006	2013	Unnamed	1.3	0.4	4	ns	ns	Small, shallow stream.	Yes	Yes
TL-1007	2013	Unnamed	1.01	0.62	2.5	ns	ns	Small, shallow stream.	Yes	Yes
TL-1008	2013	Unnamed						Not a stream		
TL-1009	2013	Unnamed						Not a stream		
TL-1010	2013	Unnamed	1.05	0.43	2.5	ns	ns	Small, shallow stream that a canoe would not fit into. Small lake 750m u/s from crossing site.	Yes	No
TL-1011	2013	Unnamed	0.73	2.67	1.5	ns	ns	Small, shallow stream that a canoe would not fit into. >1000m from a lake.	Yes	Yes
TL-1012	2013	Unnamed						Not a stream		
TL-1013	2013	Unnamed						Not a stream		
TL-1014	2013	Unnamed						Not a stream		
TL-1015	2013	Unnamed						Not a stream		
TL-1016	2013	Unnamed						Not a stream		
TL-1017	2013	Unnamed						Not a stream		
TL-1018	2013	Unnamed						Not a stream		
TL-1019	2013	Unnamed						Not a stream		
TL-1021	2013	Tahultzu Creek	6.5	0.6	2	ns	1	S2 stream that is navigable	No	No
TL-1022	2013	Unnamed						Not a stream		
TL-1023	2013	Unnamed						Not a stream		
TL-1024	2013	Unnamed	2.09	0.33	0.5	ns	ns	Shallow stream with multiple blockages observed (total blockages not tallied - Mean BfD makes site minor waters). 370m u/s from small lake.	Yes	No
TL-1025	2013	Fifteen Creek	3	0.47	2.5	ns	39	Stream has numerous blockages that would impede navigation. <1000m from a lake.	No	No
TL-1026	2013	Unnamed	1.32	0.47	5.5	ns	ns	Shallow stream. >1000m from any lake.	Yes	Yes

TL-1027	2013	Unnamed						Not a stream		
TL-1028	2013	Unnamed						Not a stream		
TL-1029	2013	Smith Creek	3.4	0.6	4.5	1.18	28	Significant amount of LWD causing blockages throughout surveyed reach.	No	Yes
TL-1030	2013	Unnamed	1.7	0.2	1.5	ns	ns	Shallow stream in which a canoe could be paddled.	Yes	Yes
TL-1031	2013	Unnamed						Not a stream		
TL-1034	2013	Unnamed						Not a stream		
TL-1035	2013	Unnamed						Not a stream		
TL-1036	2013	Unnamed	1.27	0.47	1.5	ns	ns	Shallow stream with occasional LWD spanning across. >1000m from a lake.	Yes	Yes
TL-1037	2013	Unnamed						Not a stream		
TL-1040	2013	Unnamed						Not a stream		
TL-1041	2013	Unnamed						Not a stream		
TL-1042	2013	Unnamed	1.48	0.53	3.5	ns	ns	Stream has numerous SWD blockages.	Yes	Yes
TL-1043	2013	Unnamed	1.15	0.4	5	ns	ns	Small stream that a canoe would not fit into.	Yes	Yes
TL-1046	2013	Unnamed	1.97	0.87	6	ns	ns	Small stream with multiple SWD jams	Yes	Yes
TL-1047	2013	Unnamed						Not a stream		
TL-1048	2013	Unnamed						Not a stream		
TL-1049	2013	Unnamed						Not a stream		
TL-1050	2013	Unnamed	0.88	0.37	7.5	ns	ns	Small stream that a canoe would not fit into.	Yes	Yes
TL-1052	2013	Unnamed	1.02	0.43	9	ns	ns	Small, dry channel. >1000m from lake - minor works	Yes	Yes
TL-1053	2013	Unnamed						Not a stream		
TL-1054	2013	Unnamed						Not a stream		
TL-1055	2013	Unnamed						Not a stream		
TL-1056	2013	Unnamed						Not a stream		
TL-1060	2013	Unnamed						Not a stream		
TL-1061	2013	Unnamed						Not a stream		
TL-1062	2013	Unnamed						Not a stream		
TL-1063	2013	Unnamed	0.79	0.4	3.5	ns	ns	Small, shallow stream that a canoe could not fit into.	Yes	Yes
TL-1064	2013	Greer Creek	12.52	1.3	2.5	ns	3	S2 stream with good flows. Several shallow sections (0.15m) could impede navigation.	No	Yes

TL-1065	2013	Nechako River						Nechako River - large river with no blockages in 200m reach centered on crossing site. Visual estimation of Mean_BfW > 15m. Swiftwater makes data collection for Nav waters unsafe.	No	No
TL-1066	2013	Unnamed	0.67	0.37	6.5	ns	ns	Very small stream which would not fit a canoe.	Yes	Yes
TL-1067	2013	Unnamed	0.67	0.37	6.5	ns	ns	Very small stream which would not fit a canoe.	Yes	Yes
TL-1068	2013	Unnamed						Not a stream		
TL-1069	2013	Unnamed						Not a stream		
TL-1070	2013	Unnamed						Not a stream		
TL-1071	2013	Unnamed						Not a stream		
TL-1072	2013	Unnamed						Not a stream		
TL-1073	2013	Unnamed						Not a stream		
TL-1074	2013	Unnamed						Not a stream		
TL-1075	2013	Unnamed						Not a stream		

Notes: Mean BfW is the mean bankfull width; Mean BfD is the mean bankfull depth; Navigablity column gives general comments on the navigability of the stream.

Appendix G – Summary Cards and Photodocumentation for each classified stream crossing on the preferred final alignment

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
			29-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
378593			5904942		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.4	7.66	154	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.12			1.13		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.17		
Bed Material	Cobble, Fines		Morph.	Cascade-pool	
D (cm)	14		D95 (cm)	46	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	S	T	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Regular Meanders	None	Side, Span	Partially	Unconfined			
Fish Species Present	Unknown						
Habitat Comments							
Spawning	Poor: Low flow, shallow, inappropriate substrate						
Rearing	Good: (especially D/S) deep pools and U/C banks						
Overwintering	Poor: but could be potential connectivity U/S or D/S						
Migration							
General Comments: Assessed 50m on either side of road crossing. D/S material is gravel/cobble, U/S material is fines/cobble. Better fish habitat D/S with more deep pools, U/S often goes underground for 5m sections and banks are more vertical than undercut.							



Photo Roll: BP31 Photo number:46
Comments: Potential fish barrier



Photo Roll: BP31 Photo Number: 49
Comments: Vegetation, photo taken of crossing from D/S vantage



Photo Roll: BP 31 Photo Number: 47
Comments: 25m U/S of road crossing



Photo Roll: BP 31 Photo number: 48
Comments: D/S from road crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AA002 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			15-Aug-12		
Watercourse Name			Tributary to		
Unnamed			Mackay River		
UTM Location (NAD 83 Zone 10N)					
382326			5908533		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11.3	7.9	196	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.85			3.58		
Bankfull depth (m)			Residual pool depth (m)		
0.7			N/A		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	0.14	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Vascular			
Crown Closure Class	41-70%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	N	T	T	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	None	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Mostly organic substrate						
Rearing	Fair: Tons of cover						
Overwintering	Fair: Deep pools, may not freeze over winter						
Migration							
General Comments: Connects to a fish bearing stream (Turtle Creek).							



Photo Roll: BP 21 Photo number: 28
Comments: U/S view



Photo Roll: BP 21 Photo Number: 29
Comments: D/S view



Photo Roll: BP21 Photo Number: 27
Comments: Culvert, U/S site



Photo Roll: BP 21 Photo number: 34
Comments: Willow overgrowth

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Watercourse Crossing Summary Sheet
Site AE001/TL-1057 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			10-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
383295			5908709		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	12.7	8.5	187	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.25			3.53		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.18		
Bed Material	Fines, Gravel		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	N	N	S	S	S	D	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Anastomising	None	Decoupled	Unconfined			
Fish Species Present							
Habitat Comments							
Spawning	Poor: Fine substrate and slow water velocity						
Rearing	Good: Lots of cover						
Overwintering	Good: Possible connectivity to lake						
Migration							
General Comments: Several beaver dams D/S of crossing (open bottome culvert) have created a wide wet area (approx. 40m wide).							



Photo Roll: BP20 Photo number: 28
Comments: View U/S of crossing



Photo Roll: BP20 Photo Number: 28
Comments: View D/S of crossing



Photo Roll: BP20 Photo Number: 31
Comments: Vascular in stream vegetation



Photo Roll: Photo number: 36
Comments: Beaver Activity

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Watercourse Crossing Summary Sheet
Site AE002/ TL-1058 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			15-Aug-12		
Watercourse Name			Tributary to		
Chedakuz Creek					
UTM Location (NAD 83 Zone 10N)					
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	18.3	8.2	140	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
12.13			11.18		
Bankfull depth (m)			Residual pool depth (m)		
0.9			0.59		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	2.5		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Algae, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	T	D	S	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Diagonal, Mid	Partially Coupled	Ocassionally Confined			
Fish Species Present	Kokanee and Rainbow trout						
Habitat Comments							
Spawning	Good: Lots of gravel						
Rearing	Good: lots of cover and deep pools						
Overwintering	Good: Deep pools and connectivity to Tatelkuz Lake						
Migration							
General Comments:							



Photo Roll: BP20 Photo number: 37
Comments: View U/S of crossing



Photo Roll: BP20 Photo Number: 38
Comments: View D/S of crossing



Photo Roll: BP20 Photo Number: 39
Comments: 100m U/S of site



Photo Roll: BP20 Photo number:42
Comments: 100m D/S of site

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Watercourse Crossing Summary Sheet
Site AE003/ TL-1078 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			09-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
380131			5909447		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S6			140		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	14.4	7.2	116	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.61			0.33		
Bankfull depth (m)			Residual pool depth (m)		
0.2			0.08		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	28	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	N	S	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Coupled	Unconfined			
Fish Species Present							
Habitat Comments							
Spawning	None						
Rearing	None						
Overwintering	None						
Migration							
General Comments: 140m D/S, channel dispels into a wetland, no possible fish passage. Mainly dry in measured channel.							



Photo Roll: LN1 Photo number: 43
Comments: U/S of road culvert



Photo Roll: LN1 Photo Number: 39
Comments: D/S dry channel bed



Photo Roll: LN1 Photo Number: 40
Comments: channel losing definition in D/S wetland



Photo Roll: LN1 Photo number: 41
Comments: Wet pockets throughout wetland

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Watercourse Crossing Summary Sheet
Site AE006/ TL-1081 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			10-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
387958			5910159		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.1	8.2	145	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.61			2.29		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.12		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	7		D95 (cm)	46	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Diagonal, Mid	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Excellent: good flow and abundant gravels						
Rearing	Excellent: Many fish caught under banks and LWD						
Overwintering	Good: Some deeper sections, likely stays open all year round.						
Migration							
General Comments: Nice S3 with excellent habitat.							



Photo Roll: LN1 Photo number: 45
Comments: U/S of crossing



Photo Roll: LN1 Photo Number:46
Comments: D/S view of channel



Photo Roll: LN1 Photo Number: 47
Comments: Fish



Photo Roll: LN1 Photo number: 48
Comments: Riparian vegetation Culvert inlet

Fish and Fish Habitat Inventory
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Watercourse Crossing Summary Sheet
Site AE007/ TL-917 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			10-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
393225			5911777		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S6			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
N/A			N/A		
Bankfull depth (m)			Residual pool depth (m)		
N/A			N/A		
Bed Material	N/A		Morph.	N/A	
D (cm)	N/A		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
Right Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	N/A			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pattern	Islands	Bars	Coupling	Confinement			
Fish Species Present							
Habitat Comments							
Spawning	None						
Rearing	None						
Overwintering	None						
Migration							
General Comments: Confirmed as previously classified S6							



Photo Roll: BP20 Photo number: 39
Comments: 20-22% gradient barrier



Photo Roll: BP20 Photo number:40
Comments: 20-22% Gradient Barrier

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Watercourse Crossing Summary Sheet
Site AE010 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			15-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
395720			5915896		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.5	8.1	129	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.82			0.73		
Bankfull depth (m)			Residual pool depth (m)		
1.2			0.19		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	10	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Shrub			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	T	N	D	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Coupled	Frequently Confined			
Fish Species Present	NFC						
Habitat Comments							
Spawning	See comments						
Rearing	See comments						
Overwintering	See comments						
Migration							
General Comments: Nice S4, very good habitat U/S of crossing but poor D/S due to cutblocks on wither side of stream. Stream dewaters 50-75m D/S and channel has been degraded by blowdown. U/S is great but hanging culvert and lack of plunge pool likely prevents passage.							



Photo Roll: LN2 Photo number: 9
Comments: Scoured channel U/S of crossing



Photo Roll: LN2 Photo Number: 3
Comments: 50m D/S, dewatered channel



Photo Roll: LN2 Photo Number: 6
Comments: Culvert barrier



Photo Roll: LN2 Photo number: 11
Comments: Riparian vegetation

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Watercourse Crossing Summary Sheet
Site AE013 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			16-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
398443			5911423		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	17.1	8.1	109	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.78			0.48		
Bankfull depth (m)			Residual pool depth (m)		
0.33			0.12		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	8	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	N	N	N	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Occasionally Confined			
Fish Species Present	Rainbow trout, Brassy minnow						
Habitat Comments							
Spawning	Poor: low flow and poor substrate						
Rearing	Fair: good cover but stream is dry in places						
Overwintering	Fair: No pools, stream puddles in places, but is connected to a lake.						
Migration							
General Comments: S4, abundant western toads.							



Photo Roll: BP21 Photo number:46
Comments: U/S view



Photo Roll: BP21 Photo Number:47
Comments: D/S view



Photo Roll: BP21 Photo Number: 49
Comments: Adult brassy minnow



Photo Roll: BP21 Photo number: 52
Comments: Juvenile rainbow trout

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE014 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			17-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
399713			5914675		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.9	7.7	222	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.98			0.77		
Bankfull depth (m)			Residual pool depth (m)		
0.3			0.10		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	2.5		D95 (cm)	15	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	D	N	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meander	None	Side	Partially Coupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Good gravel bottom and decent flow						
Rearing	Good: plenty of overhead cover and undercut banks						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Fished August 2, 2013. No fish caught U/S of culvert. Habitat degrades as you move U/S away from small lake (more fines, slower flow). Culvert likely acts as a barrier as there is a 40cm outlet drop.							



Photo Roll:BP21 Photo number: 66
Comments: U/S view, 50m D/S of site



Photo Roll: BP21 Photo Number:68
Comments: D/S view 50m D/S of site



Photo Roll: BP21 Photo Number: 69
Comments: U/S view 50m U/S of site



Photo Roll: BP21 Photo number: 70
Comments: Riparian vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE019 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			12-Sep-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
399399			5915161		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	7.1	8.6	296	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.50			0.44		
Bankfull depth (m)			Residual pool depth (m)		
0.8			0.07		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	2	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	N	S	T	D	S	M
Pattern	Islands	Bars	Coupling	Confinement			
Straight	None	Span	Decoupled	Unconfined			
Fish Species Present	No Fish Caought						
Habitat Comments							
Spawning	None: Fine substrate, lots of sediment in water						
Rearing	Fair: Good cover from overhanging veg. and banks.						
Overwintering	Poor: No deep pools, likely freezes in winter.						
Migration							
General Comments: U/S is NCD but reach continues 100m D/S of crossing. Channel is scoured but no alluvial, drains into a small lake100m D/S of reach. Culvert at crossing is in poor condition.							



Photo Roll: BP23 Photo number: 132
Comments: U/S NCD



Photo Roll: BP23 Photo Number: 128
Comments: D/S view



Photo Roll: BP23 Photo Number: 129
Comments: Lake that the stream drains into



Photo Roll: BP23 Photo number: 131
Comments: Poor condition of U/S culvert

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE020 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			11-Sep-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
398607			5916799		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	5.4	9.2	254	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.93			1.38		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.16		
Bed Material	Fines, Gravels		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	D	N	S	T	T	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Diagonal, Span	Decoupled	Unconfined			
Fish Species Present	Lake chub, rainbow trout, white sucker						
Habitat Comments							
Spawning	Good: areas with gravel substrate but lots of fines						
Rearing	Fair: Lots of cover from LWD and banks						
Overwintering	Fair: some deep pools in stream and potential connectivity to large we areas U/S and D/S						
Migration							
General Comments: U/S is a slow channel through sedge for 30m before entering mature forest. D/S is shallower, 110m D/S a tributary enters and the stream widens.							



Photo Roll: BP23 Photo number: 225
Comments: U/S from culvert



Photo Roll: BP23 Photo Number: 219
Comments: D/S from culvert



Photo Roll: BP23 Photo Number: 221
Comments: Culvert outlet



Photo Roll: BP23 Photo number: 224
Comments: Culvert inlet

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE021 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			11-Oct-04		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
398318			5922525		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	2.3	7.1	165	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.06			1.0		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.27		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	13	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	D	N	S	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	Occasionl	Side, Span	Decoupled	Unconficed			
Fish Species Present	No Fish Caught						
Habitat Comments					
Spawning	Poor: Very little appropriate substrate				
Rearing	Good: Lots of cover				
Overwintering	Fair: Some larger pools, D/S widens out				
Migration					
General Comments: U/S of road crossing is an NCD into a wetland. Too cold to electrofish. Default S4.					



Photo Roll: BP23 Photo number: 232
Comments: U/S view



Photo Roll: BP23 Photo Number: 233
Comments: D/S view



Photo Roll: BP23 Photo Number: 234
Comments: Lack of channel U/S of road



Photo Roll: BP23 Photo number: 235
Comments: Lack of channel U/S of road

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE022/TL-026 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			05-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
398734			5927483		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	11.2	8.2	190	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
6.7			5.5		
Bankfull depth (m)			Residual pool depth (m)		
0.7			0.57		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	S	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Infrequent	Side, Mid, span	Decoupled	Decoupled			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: Sediment laden water with silty fines on the bottom						
Rearing	Excellent: tons of cover from a variety of sources						
Overwintering	Good: deep protected pools						
Migration							
General Comments: Lots of beaver dams D/S creating deep pools. Lots of sediment U/S and D/S.							



Photo Roll: BP23 Photo number: 42
Comments: U/S view



Photo Roll: BP23 Photo Number: 44
Comments: D/S view



Photo Roll: BP23 Photo Number: 45
Comments: Culvert outlet



Photo Roll: BP23 Photo number: 46
Comments: U/S from 100m navigable waters point

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE030 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			05-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
396137			5930775		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.12			N/A		
Bankfull depth (m)			Residual pool depth (m)		
0.4			N/A		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	10	
Stream banks					
Fines	Shape	Vertical			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	N	S	T	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	None	Coupled	Confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Fair: Good substrate but no water						
Rearing	Good: lots of cover						
Overwintering	Poor: Currently dry, no evidence of deep pools						
Migration							
General Comments: Default S4.							



Photo Roll: BP23 Photo number: 29
Comments: U/S channel



Photo Roll: BP23 Photo Number: 31
Comments: D/S view



Photo Roll: BP23 Photo Number: 30
Comments: Culvert outlet

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE035 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			30-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
394928			5932540		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.8	8.0	205	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
6.63			5.12		
Bankfull depth (m)			Residual pool depth (m)		
1.1			3.65		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	3.5		D95 (cm)	12	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Clumped	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	T	D	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	Occasional	Side, Span	Partially coupled	Occasionally Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Lots of gravels but higher turbidity due to fines						
Rearing	Rearing: Fair: Good substrate and cover						
Overwintering	Fair: Lots of deep pools, not likely to freeze over winter						
Migration							
General Comments: Most fish found D/S with numerous beaver dams U/S.							



Photo Roll: CM1 Photo number: 31
Comments: U/S view



Photo Roll: CM1 Photo Number: 29
Comments: Beaver dam U/S of inlet



Photo Roll: CM1 Photo Number: 28
Comments: Culvert inlet



Photo Roll: CM1 Photo number: 27
Comments: Rainbow trout caught with electro-fisher

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE037/TL-973 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			30-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
401200			5937370		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.5	7.7	190	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.99			0.76		
Bankfull depth (m)			Residual pool depth (m)		
o.53			0.02		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	.1		D95 (cm)	.1	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Wetland			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Wetland			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	T	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Occasionally confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Very fine substrate						
Rearing	Fair: Lots of cover						
Overwintering	Poor: Low flow, no deep pools						
Migration							
General Comments: Abundance of cover from willows and grasses, in a wetland type, very low flow in places and no deep pools. Channel runs through sedge and wetland.							



Photo Roll: BP22 Photo number: 162
Comments: U/S view of wetland



Photo Roll: BP22 Photo Number: 159
Comments: D/S view from crossing



Photo Roll: BP22 Photo Number: 160
Comments: Culvert outlet barrel



Photo Roll: BP22 Photo number: 161
Comments: D/S of Culvert outlet

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE044 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			27-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
409226			5941021		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.9	8.4	96	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.47			2.08		
Bankfull depth (m)			Residual pool depth (m)		
1.13			0.15		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	.1		D95 (cm)	3	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	S	T	D	S	S	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meander	Occasional	Side	Partially Coupled	Occasionally confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: some gravels sections but lots of fines						
Rearing	Good: Lots of cover from veg. and undercut banks						
Overwintering	Fair: Some deep pools						
Migration							
General Comments: S3 with numerous fish caught, both adults and juveniles present.							



Photo Roll: BP22 Photo number: 118
Comments: D/S view, 100m D/S from crossing



Photo Roll: BP22 Photo Number: 119
Comments: U/S view, 100m D/S of crossing



Photo Roll: BP22 Photo Number:122
Comments: Rainbow trout caught with EF



Photo Roll: BP22 Photo number: 121
Comments: U/S view, 100m U/S of crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE049 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			28-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
409663			5942976		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S6			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.6	9.5	80	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.80			0.74		
Bankfull depth (m)			Residual pool depth (m)		
0.57			0.14		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	.1		D95 (cm)	16	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially coupled	Occasionally confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	None: Inappropriate substrate, low flows						
Rearing	Fair: Lots of cover from banks and veg.						
Overwintering	Fair: Some deep pools						
Migration							
General Comments: NCD D/S, no definite channel, no alluvial deposit. Water found close to culvert but no continuity closer to wetland. Discontinuous water is a fish barrier.							



Photo Roll: BP22 Photo number: 112
Comments: U/S view of S6 reach



Photo Roll: BP22 Photo Number: 113
Comments: D/S view



Photo Roll: BP22 Photo Number: 110
Comments: U/S lack of connectivity, potential barrier



Photo Roll: BP22 Photo number: 111
Comments: D/S pooled water in wetland

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE053 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			27-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
409828			5945915		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.8	8.3	130	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.33			1.06		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.53		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	42	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	N	D	N	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: Lack of gravels and decent flow						
Rearing	Good: Lots of cover						
Overwintering	Fair: Connectivity to a pond D/S and some deeper pools near culvert						
Migration							
General Comments: S4 with some large rainbow trout but a noticeable lack of small juveniles. Wetland type about 30m U/S of culvert.							



Photo Roll: BP22 Photo number: 88
Comments: U/S view



Photo Roll: BP22 Photo Number: 87
Comments: D/S view



Photo Roll: BP22 Photo Number: 90
Comments: Rainbow trout caught with EF



Photo Roll: BP22 Photo number: 100
Comments: D/S view showing in stream debris

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE055 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			27-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
410189			5946406		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.8	8.1	268	T	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.12			0.93		
Bankfull depth (m)			Residual pool depth (m)		
0.3			N/A		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	15	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N	N	N	T	N	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: no appropriate substrate						
Rearing	Good: Lots of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: S4 with very poor habitatsilterd vegetation, stream dewaters in portions which could be a result of the culvert. Some backwatering U/S of culvert.							



Photo Roll: BP22 Photo number: 80
Comments: U/S view, narrow channel lots of overhanging veg.



Photo Roll: BP22 Photo Number: 81
Comments: D/S view of channel



Photo Roll: BP22 Photo Number: 82
Comments: View U/S 50m from culvert



Photo Roll: BP22 Photo number: 83
Comments: View D/S 50m from culvert

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE056 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			25-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
411427			5961730		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.5	9	95	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.98			1.53		
Bankfull depth (m)			Residual pool depth (m)		
1.3			0.14		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	3.5		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	S	D	S	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Sinuous	None	Side	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: gravel patches and good flow, but some fines						
Rearing	Good: Lots of cover						
Overwintering	Fair: Deep pools in spots, may not freeze over winter						
Migration							

General Comments: Potential barrier 70m U/S. D/S is in a burn block, very sinuous. Vegetation changes significantly from U/S to D/S.



Photo Roll: BP22 Photo number: 65
Comments: Culvert outlet drop



Photo Roll: BP22 Photo Number: 66
Comments: D/S view from culvert



Photo Roll: BP22 Photo Number: 64
Comments: U/S 100m from culvert



Photo Roll: BP22 Photo number: 63
Comments: D/S 100m from culvert

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE057 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			27-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
411598			5947973		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S6			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
N/A	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
N/A			N/A		
Bankfull depth (m)			Residual pool depth (m)		
N/A			N/A		
Bed Material	N/A		Morph.	N/A	
D (cm)	N/A		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
Right Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	N/A			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pattern	Islands	Bars	Coupling	Confinement			
N/A	N/A	N/A	N/A	N/A			
Fish Species Present	N/A						
Habitat Comments							
Spawning	N/A						
Rearing	N/A						
Overwintering	N/A						
Migration							
General Comments: Classified as an S6 in 2005 with an impassible NCD reach D/S. Lots of pooled water, connected scoured main channel D/S but little discharge. One barrier observed, probably not possible for fish to get through.							



Photo Roll: BP22 Photo number: 60
Comments: U/S grown over vegetation



Photo Roll: BP22 Photo Number: 61
Comments: D/S pooled water



Photo Roll: BP22 Photo Number: 62
Comments: Likely barrier to fish

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE058 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			27-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
411519			5948873		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.2	9	69	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.92			1.42		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.51		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	4		D95 (cm)	54	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	S	D	S	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	Side, Diagonal	Partially coupled	Occasionally Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Lots of gravels						
Rearing	Good: Abundant cover						
Overwintering	Fair: May not freeze over winter						
Migration							

General Comments: S3 fishbearing with plenty of cover. Borderline cascade but cobble was sub-dominant, more riffle than cascade.



Photo Roll: BP22 Photo number: 52
Comments: U/S view



Photo Roll: BP22 Photo Number: 53
Comments: D/S view



Photo Roll: BP22 Photo Number: 50
Comments: U/S 100m



Photo Roll: BP22 Photo number: 49
Comments: D/S 100m

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New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE059 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			09-Aug-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
411447			5951027		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.88			0.4		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.11		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	14		D95 (cm)	42	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	N	T	N	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular meandering	None	Side	Partially coupled	Unconfined			
Fish Species Present	Not Fished						
Habitat Comments							
Spawning	None: Fines and cobbles						
Rearing	Fair: Good cover in undercut banks but mostly in very steep sections						
Overwintering	Poor: Dry channel, no pools, possible connectivity D/S						
Migration							
General Comments: 40% slope D/S of crossing is a fish barrier. U/S of crossing is an NCD so was assessed 100m D/S of crossing.							



Photo Roll: BP31 Photo number: 109
Comments: U/S of crossing



Photo Roll: BP31 Photo Number: 106
Comments: Steep slope D/S of crossing



Photo Roll: BP31 Photo Number: 107
Comments: Steep slope D/S of crossing



Photo Roll: BP31 Photo number: 108
Comments: Riparian veg.

Fish and Fish Habitat Inventory
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Watercourse Crossing Summary Sheet
Site AE061 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			23-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
412428			5962524		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.9	10.8	90	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
5.83			4.17		
Bankfull depth (m)			Residual pool depth (m)		
0.8			0.26		
Bed Material	Cobble, Gravel		Morph.	Cascade Pool	
D (cm)	20		D95 (cm)	60	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N	S	D	S	S	T	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Sinuous	Occasional	Side, Diagonal, Mid, Span	Partially Coupled	Occasionally Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Appropriate substrate and good flows						
Rearing	Fair: moderate cover						
Overwintering	Fair: some deep pools but not enough to support all resident fish						
Migration							
General Comments: Plenty of fish but little rearing habitat, tributary to this stream likely has high rearing potential.							



Photo Roll: BP22 Photo number: 18
Comments: U/S view of wide channel, some woody debris



Photo Roll: BP22 Photo Number: 19
Comments: D/S view with beaver dam and lots of vegetation on either side



Photo Roll: BP22 Photo Number: 20
Comments: Rainbow trout caught with EF



Photo Roll: BP22 Photo number: 22
Comments: D/S from crossing 100m

Fish and Fish Habitat Inventory
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Watercourse Crossing Summary Sheet
Site AE068 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			22-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
415179			5967852		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.9	8.8	149	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.23			1.34		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.16		
Bed Material	Gravel, fines		Morph.	Riffle Pool	
D (cm)	0.5		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Young Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	T	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: very high flows						
Rearing	Good: Lots of cover						
Overwintering	Fair: high water levels as a result of dams						
Migration							
General Comments: Running through a burned plot of land. Very high water level.							



Photo Roll: BP22 Photo number: 1
Comments: U/S view, can see a pinch point with lots of water rushing through



Photo Roll: BP22 Photo Number: 2
Comments: D/S view, can see a plunge pool

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE070 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			16-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
415338			5968546		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			50		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	17.5	7.8	234	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.73			2.37		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.43		
Bed Material	Gravel, Fine		Morph.	Riffle Pool	
D (cm)	5		D95 (cm)	24	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Clumped	Moss, algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	S	T	T	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Mid	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Excellent: Lots of gravel, good flow						
Rearing	Excellent: Abundant cover from a variety of sources						
Overwintering	Fair: Few deep pools						
Migration							
General Comments: Many fish captured							



Photo Roll: LN2 Photo number: 122
Comments: U/S view, blow-down blocking channel



Photo Roll: LN2 Photo Number: 126
Comments: S view, woody debris in channel



Photo Roll: LN2 Photo Number: 121
Comments: Culvert inlet



Photo Roll: LN2 Photo number: 125
Comments: Rainbow trout caught U/S

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE071 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			17-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
416767			5970624		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.2			N/A		
Bankfull depth (m)			Residual pool depth (m)		
0.2			N/A		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	0.1	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	None			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	N	N	D	T	L
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Very fine substrate, no alluvial deposits						
Rearing	Poor: Little cover						
Overwintering	Poor: Dry at this time						
Migration							
General Comments: Apparent barriers D/S, default fish bearing as juveniles may be present during wetter seasons.							



Photo Roll: LN2 Photo number: 116
Comments: U/S view near road, shallow channel



Photo Roll: LN2 Photo Number: 117
Comments: Dry channel D/S



Photo Roll: LN2 Photo Number: 118
Comments: Riparian vegetation



Photo Roll: LN2 Photo number: 120
Comments: U/S NCD reach

Fish and Fish Habitat Inventory
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Watercourse Crossing Summary Sheet
Site AE072 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			17-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
416786			5971489		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11	6.8	644	T	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.0			1.0		
Bankfull depth (m)			Residual pool depth (m)		
0.2			N/A		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	0.1	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	None			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	N	N	N	N	D	N	L
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: Very fine substrate						
Rearing	Good: Decent Cover						
Overwintering	Poor: No deep pools, but some flooding D/S of culvert						
Migration							
General Comments: Drainage runs through wetland U/S and D/S. U/S ceases to be a stream after 25m, but fish caught in residual pools of NCD. Consider all as fish bearing. Culvert may be undersized.							



Photo Roll: LN2 Photo number: 103
Comments: U/S view, channel turns to an NCD



Photo Roll: LN2 Photo Number: 112
Comments: D/S view at road and beaver dam



Photo Roll: LN2 Photo Number: 107
Comments: Rainbows caught in a residual pool



Photo Roll: LN2 Photo number: 111
Comments: Riparian vegetatio

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE073 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			17-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
416790			5971776		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.9	7.8	309	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.88			0.67		
Bankfull depth (m)			Residual pool depth (m)		
0.33			0.06		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	0.1	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	N	N	T	N	D	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	None: No appropriate substrate						
Rearing	Fair: Lots of cover for juvenile rearing						
Overwintering	None: No deep pools, nearly dewaters in several points						
Migration							
General Comments: Too shallow for minnow traps. No apparent barriers to fish. Default S4.							



Photo Roll: LN2 Photo number: 99
Comments: U/S view with a shallow pool



Photo Roll: LN2 Photo Number: 100
Comments: D/S view, shallow weak channel



Photo Roll: LN2 Photo Number: 98
Comments: Salamander caught with electro-fisher



Photo Roll: LN2 Photo number: 97
Comments: Small brushy channel D/S

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE074 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			15-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
416805			5973117		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			145		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	12.5	8.0	309	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.87			1.93		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.20		
Bed Material	Cobble, Gravel		Morph.	Riffle Pool	
D (cm)	6		D95 (cm)	44	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Cobble			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Undercut			
	Texture	Cobble			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	S	D	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Frequent	Side, Mid, Span	Decoupled	Unconfined			
Fish Species Present	Rainbow						
Habitat Comments							
Spawning	Poor: Limited gravels						
Rearing	Excellent: Lots of good cover and larger sized substrate						
Overwintering	Fair: Occasional deep pools						
Migration							
General Comments: No barriers to habitat observed. U/S is private property so survey done 100m D/S of crossing							



Photo Roll: LN2 Photo number: 19
Comments: U/S view from D/S survey area



Photo Roll: LN2 Photo Number:20
Comments: D/S view



Photo Roll: LN2 Photo Number: 15
Comments: Culvert outlet



Photo Roll: LN2 Photo number: 16
Comments: Culvert inlet

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE075 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			07-Aug-12		
Watercourse Name			Tributary to		
North Stoney Creek					
UTM Location (NAD 83 Zone 10N)					
416840			5473547		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			188		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	13.5	8.0	345	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.5			0.61		
Bankfull depth (m)			Residual pool depth (m)		
0.7			0.02		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	14		D95 (cm)	70	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Moss, vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	S	S	T	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Br	Coupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Fairly good substrate						
Rearing	Good: Lots of cover						
Overwintering	Poor: some dewatering and no deep pools						
Migration							
General Comments: Almost entirely dewatered, some water in small residual pools with fish spotted in all pools.							



Photo Roll: BP20 Photo number: 3
Comments: U/S view



Photo Roll: BP20 Photo Number: 4
Comments: D/S view



Photo Roll: BP20 Photo Number: 6
Comments: Fish caught



Photo Roll: BP20 Photo number: 8
Comments: Dewatered channel showing culvert

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE076 – North Stoney Creek

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			28-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
406842			5935676		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	12.6	8.3	94	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
4.23			2.17		
Bankfull depth (m)			Residual pool depth (m)		
0.9			0.12		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	10		D95 (cm)	33	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	N/A			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	N/A			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Clumped	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	S	T	T	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
N/A	None	Side	Partially coupled	Occasionally Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Lots of gravel						
Rearing	Excellent: Abundant cover from veg, cobble, and functional woody debris						
Overwintering	Poor: No deep pool, likely freezes over						
Migration							
General Comments: S3 with great fish habitat. Significcant amount of large woody debris.							



Photo Roll: BP22 Photo number: 154
Comments: U/S view



Photo Roll: BP22 Photo Number: 153
Comments: D/S view



Photo Roll: BP22 Photo Number: 155
Comments: Fish caught



Photo Roll: BP22 Photo number: 156
Comments: Culvert inlet

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE907 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			28-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
407942			5038360		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.5	8.4	141	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.93			0.57		
Bankfull depth (m)			Residual pool depth (m)		
0.3			0.09		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	12	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	Moss			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	T	T	N	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	N/A	Partially Coupled	Occasionally Confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Very fine bed material						
Rearing	Good: Abundant cover						
Overwintering	Poor: Low flow and no deep pools						
Migration							
General Comments: Low flow, U/S runs though a 15-20 year plantation so possible increased drainage. Several obstacles observed. More than 100m of channel but runs into an NCD U/S.							



Photo Roll: BP22 Photo number: 138
Comments: U/S channel



Photo Roll: BP22 Photo Number: 139
Comments: D/S view, alluvial deposits



Photo Roll: BP22 Photo Number: 143
Comments: View of channel with scouring and alluvial



Photo Roll: BP22 Photo number: 144
Comments: View of channel with scouring and alluvial

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE911 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road					
Site NID.			Survey Date		
A			30-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
408883			5990442		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.7	8.8	125	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.07			0.58		
Bankfull depth (m)			Residual pool depth (m)		
0.67			0.03		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	3.8	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fine			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	S	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Coupled	Frequently Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: several gravel patches throughout						
Rearing	Good: Lots of cover						
Overwintering	Poor: Shallow water and no deep pools						
Migration							
General Comments: Abundance of overhanging veg., open bottom culvert with lots of debris.							



Photo Roll: BP22 Photo number: 129
Comments: U/S view



Photo Roll: BP22 Photo Number: 130
Comments: D/S view



Photo Roll: BP22 Photo Number: 131
Comments: View of channel



Photo Roll: BP22 Photo number: 132
Comments: scoured channel

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AE913 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			09-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
378952			5900138		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11.4	7.6	68	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
6.45			5.18		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.35		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	7		D95 (cm)	21	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Moss, Algae, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	D	S	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Diagonal, Mid	Partially coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Nice gravels and good flow						
Rearing	Good: abundant cover						
Overwintering	Good: Lots of deep pools						
Migration							
General Comments:							



Photo Roll: LN1 Photo number: 32
Comments: U/S view



Photo Roll: LN1 Photo Number: 33
Comments: D/S view with woody debris blockage



Photo Roll: LN1 Photo Number: 36
Comments: View of stream with riparian veg.



Photo Roll: LN1 Photo number: 37
Comments: Photo showing stream width and alluvial

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AP-004/ TL-004 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			09-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
379062			5901516		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	14.2	8.8	130	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.23			1.23		
Bankfull depth (m)			Residual pool depth (m)		
0.34			0.15		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	0.5		D95 (cm)	21	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	S	T	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: good substrate						
Rearing	Good: Abundant cover						
Overwintering	Fair: Occasional pooling and connectivity to lake						
Migration							
General Comments: Sandy substrate U/S may be due to adjacent cutblock, gravel and cobbles dominate D/S. Recently installed bridge at crossing. Fish caught, good habitat.							



Photo Roll: LN1 Photo number: 17
Comments: U/S view of scoured channel with low flow



Photo Roll: LN1 Photo Number: 18
Comments: D/S view with large woody debris



Photo Roll: LN1 Photo Number: 21
Comments: Recent bridge at crossing



Photo Roll: LN1 Photo number: 20.1
Comments: Fish caught

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AP-005/ TL-955 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road & Transmission Line					
Site NID.			Survey Date		
A			09-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
375796			5905951		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	13.6	8.1	184	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.20			3.56		
Bankfull depth (m)			Residual pool depth (m)		
0.8			0.36		
Bed Material	Gravel, cobble		Morph.	Riffle Pool	
D (cm)	2		D95 (cm)	60	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					

SWD	LWD	B	UB	DP	OV	IV	Total
T	T	S	D	S	S	S	A

Pattern	Islands	Bars	Coupling	Confinement
Irregular Meandering	None	Side, Diagonal, Mid, Span	Decoupled	Unconfined

Fish Species Present	N/A
Habitat Comments	
Spawning	Fair: lots of gravels, decent flow
Rearing	Good: Lots of cover
Overwintering	Good: deep pools and connectivity to lake
Migration	
General Comments:	



Photo Roll: BP20 Photo number: 11
Comments: U/S of bridge site



Photo Roll: BP20 Photo Number: 12
Comments: D/S view from bridge site



Photo Roll: BP20 Photo Number: 13
Comments: U/S 100m from bridge site



Photo Roll: BP20 Photo number: 17
Comments: Riparian vegetation and stream characteristics

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AP-007/ TL-958 – Unnamed Watercourse

Watercourse Survey and Geographical Information Access Road							
Site NID.			Survey Date				
A			30-Jul-13				
Watercourse Name			Tributary to				
Unnamed							
UTM Location (NAD 83 Zone 10N)							
378800			5896990				
Subbasin			Minor Waters (Y/N)				
			Y				
Stream Classification			Site Length (m)				
S4			100				
Water Chemistry Data							
Season	Temp	pH	EC (µs)	Turbidity			
Summer	6.9	7.46	70	C			
Physical Channel and Stream Bank Information							
Channel width (m)			Wetted width (m)				
1.45			1.68				
Bankfull depth (m)			Residual pool depth (m)				
0.5			0.13				
Bed Material	Gravel, Fines		Morph.	Riffle Pool			
D (cm)	9		D95 (cm)	47			
Stream banks							
Left Bank	Shape	Undercut					
	Texture	Fines					
	Rip. Veg.	Coniferous					
	Stage	Mature Forest					
Right Bank	Shape	Undercut					
	Texture	Fines					
	Rip. Veg.	Coniferous					
	Stage	Mature Forest					
LWD FNC	LWD Dist.	Instream Veg.					
Few	Even	Moss					
Crown Closure Class	1-20%						
Cover							
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	T	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	Side	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: Some gravel patches but flow in these areas is quite fast						
Rearing	Fair: Some deeper pools and undercut banks for cover but fast flow						
Overwintering	Fair: Limited deep pools, possible connectivity to winter habitat though						
Migration							
General Comments: Stream assessed 50m on either side of the proposed road crossing. S3 with overall faif habitat.							



Photo Roll: BP31 Photo number: 54
Comments: U/S view from crossing



Photo Roll: BP31 Photo Number: 55
Comments: D/S view from crossing



Photo Roll: BP31 Photo Number: 56
Comments: Vegetation

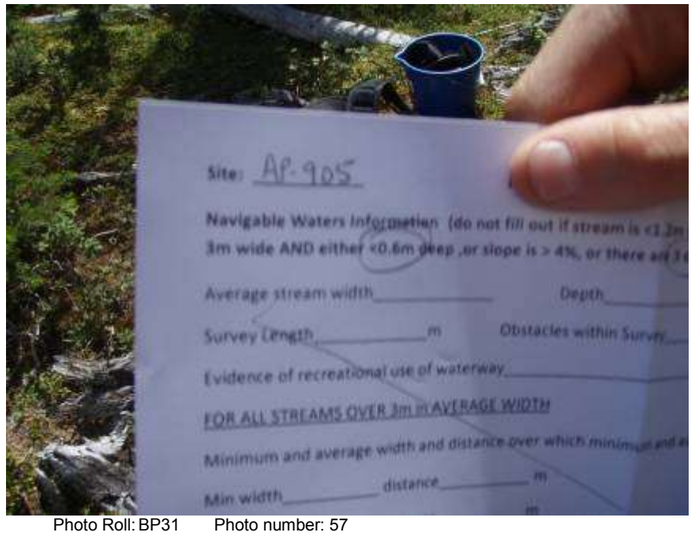


Photo Roll: BP31 Photo number: 57
Comments: Veg. assessment form

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site AP905– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			15-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
N/A			N/A		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	18.3	8.2	140	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
12.03			11.18		
Bankfull depth (m)			Residual pool depth (m)		
0.9			0.59		
Bed Material	Gravel, Cobble		Morph.	Large Channel	
D (cm)	2.5		D95 (cm)	22	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C& D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C& D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Algae, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	T	D	S	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side, Diagonal, Mid	Partially Coupled	Occasionally confined			
Fish Species Present	Kokanee and Rainbow trout						
Habitat Comments							
Spawning	Good: lots of gravels						
Rearing	Good: lots of cover and pools						
Overwintering	Good: deep pools and connectivity to Tatelkuz creek						
Migration							
General Comments:							



Photo Roll: BP21 Photo number: 37
Comments: U/S view



Photo Roll: BP21 Photo Number: 38
Comments: D/S view



Photo Roll: BP21 Photo Number: 39
Comments: U/S 100m from site



Photo Roll: BP21 Photo number: 42
Comments: D/S 100m from site

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site MR002 – Chedakuz Creek

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			06-Aug-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
380846			5911490		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Spring	6.2	7.58	196	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.6			0.65		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.04		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	8		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	N	N	D	N	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	N/A						
Rearing	N/A						
Overwintering	N/A						
Migration							
General Comments: Small S4 along edge of large shrub birch wetland.							



Photo Roll: BP31 Photo number: 85
Comments: U/S view



Photo Roll: BP31 Photo Number: 86
Comments: D/S view



Photo Roll: BP31 Photo Number: 87
Comments: Riparian vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site MR-003 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			29-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
383356			5911575		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.1	7.48	181	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.82			0.63		
Bankfull depth (m)			Residual pool depth (m)		
0.2			0.09		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	12		D95 (cm)	34	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	T	T	D	N	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	None	Partially Coupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	None: Only cobble and fines present						
Rearing	Poor-Fair: moderate cover but many dry sections and low flow						
Overwintering	Poor: no deep pools, much of stream is dry						
Migration							
General Comments: Of the 100m surveyed, 50m was dry. Small pools with low flow present, overall poor habitat.							



Photo Roll: BP31 Photo number: 52
Comments: U/S view



Photo Roll: BP31 Photo Number: 53
Comments: D/S view



Photo Roll: BP31 Photo Number:51
Comments: Vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site MR-004 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			26-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
387927			5913640		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.3	7.85	125	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.35			2.38		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.23		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	18		D95 (cm)	36	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	D	S	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	Occasional	Side, Mid	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Some gravel patches but lots of cobble and fast flow						
Rearing	Good: lots of cover						
Overwintering	Fair: Good flow, deep pools, and connectivity to a wetland D/S						
Migration							
General Comments:							



Photo Roll: BP31 Photo number: 34
Comments: U/S view



Photo Roll: BP31 Photo Number: 35
Comments: D/S view



Photo Roll: BP31 Photo Number: 36
Comments: Riparian Veg.



Photo Roll: BP31 Photo number:37
Comments: Site Card

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site MR-010 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			17-Jul-13		
Watercourse Name			Tributary to		
Stellako					
UTM Location (NAD 83 Zone 10N)					
371520			5990351		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S1			N/A		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
N/A	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
N/A			N/A		
Bankfull depth (m)			Residual pool depth (m)		
N/A			N/A		
Bed Material	N/A		Morph.	N/A	
D (cm)	N/A		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
Right Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	N/A			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pattern	Islands	Bars	Coupling	Confinement			
N/A	N/A	N/A	N/A	N/A			
Fish Species Present	N/A						
Habitat Comments							
Spawning	N/A						
Rearing	N/A						
Overwintering	N/A						
Migration							
General Comments: Too wide and deep to safely perform an assessment. Default S1 based on historical data and GIS information.							



Photo Roll: BP30 Photo number: 134
Comments: U/S view



Photo Roll: BP30 Photo Number: 135
Comments: D/S view

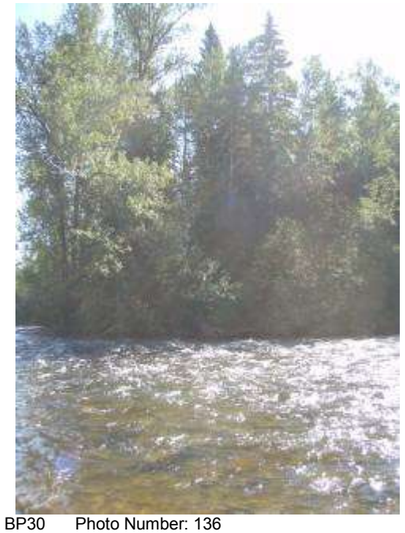


Photo Roll: BP30 Photo Number: 136
Comments: Right bank



Photo Roll: BP30 Photo number: 137
Comments: Left Bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site SR-003 – Stellako River

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			17-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
371308			5990534		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.02			N/A		
Bankfull depth (m)			Residual pool depth (m)		
0.4			N/A		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	9		D95 (cm)	20	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	T	N	D	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Partially Coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Poor: Very little appropriate substrate						
Rearing	Fair: Lots of cover, very good when water is present						
Overwintering	Poor: Currently dry, no deep pools						
Migration							
General Comments: 80m D/S is an S4 that is connected to the Stellako but there is a 40% gradient barrier between this site and the S4. Channel was dry at the time of assessment.							



Photo Roll: BP30 Photo number: 141
Comments: U/S view



Photo Roll: BP30 Photo Number: 142
Comments: D/S view



Photo Roll: BP30 Photo Number: 143
Comments: Vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site SR-004 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			19-Oct-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
568752			5992689		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	4.0	9.0	274	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.82			1.42		
Bankfull depth (m)			Residual pool depth (m)		
0.8			0.10		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	13	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	S	N	S	N	S	T	N/A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	Occasional	Side	Partially Coupled	Occasionally confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Some gravels						
Rearing	Good: Lots of cover						
Overwintering	Poor: Will likely freeze but may be connected to the Stellako						
Migration							
General Comments: Good habitat, runs through a gulley, steep in some sections.							



Photo Roll: BP24 Photo number: 129
Comments: U/S view



Photo Roll: BP24 Photo Number: 130
Comments: D/S view

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site SR-009/ TL-1077 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			02-Oct-12		
Watercourse Name			Tributary to		
Unnamed			Mackay River		
UTM Location (NAD 83 Zone 10N)					
395860			5920723		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	4.3	9.1	211	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.08			2.02		
Bankfull depth (m)			Residual pool depth (m)		
0.5			1.82		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	23		D95 (cm)	14	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Deciduous			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	S	N	T	T	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	Occasional	Side	Partially Coupled	Occasionally Confined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Good flows and substrate						
Rearing	Good: Tons of cover						
Overwintering	Good: Direct connectivity to Brewster Lake						
Migration							
General Comments: S3 with high quality habitat and direct connectivity to a fish bearing lake.							



Photo Roll: BP23 Photo number: 192
Comments: U/S view



Photo Roll: BP23 Photo Number: 193
Comments: D/S view

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-023 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			02-Oct-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
397313			5922082		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	8.0	8.7	179	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
4.18			3.87		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.32		
Bed Material	Fines, Gravel		Morph.	Riffle pool	
D (cm)	0.1		D95 (cm)	14	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Algae, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	D	N	S	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	Occasional	Side	Decoupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Good substrate						
Rearing	Good: Lots of cover						
Overwintering	Good Connectivity to a lake						
Migration							
General Comments: Half in mature forest, half in wetland with beaver activity and lots of pooling. Fish bearing visually confirmes.							



Photo Roll: BP23 Photo number: 201
Comments: U/S VIEW



Photo Roll: BP23 Photo Number: 202
Comments: D/S view

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-025 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
387969			5940073		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	9.0	8.4	268	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.24			0.75		
Bankfull depth (m)			Residual pool depth (m)		
0.7			0.06		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	7	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	D	N	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Partially coupled	Occasionally Confined			
Fish Species Present	No fish Caught						
Habitat Comments							
Spawning	Good: Lots of gravel patches throughout						
Rearing	Good: Quite a bit of cover						
Overwintering	Poor: No deep pools and low flows						
Migration							
General Comments: No fish caught but conditions are good for rearing and stream is connected to a lake.							



Photo Roll: BP23 Photo number: 10
Comments: U/S view



Photo Roll: BP23 Photo Number:9
Comments: UD/S view

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-048 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
391977			5946302		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	12.0	8.8	113	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.43			1.92		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.18		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	5.5		D95 (cm)	19	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	None			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	D	N	T	N	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side, Diagonal, Mid, Span	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Excellent: great substrate and good flows						
Rearing	Good: Lots of cover						
Overwintering	Fair: no deep pools and lower flows at this time of year.						
Migration							
General Comments: Very little crown cover around stream, mostly willow and some alder with trees starting several meters away.							



Photo Roll: BP23 Photo number: 23
Comments: U/S view



Photo Roll: BP23 Photo Number: 24
Comments: D/S view

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-054 – Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			13-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
397324			5956583		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	7.1	9.0	103	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.85			0.75		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.06		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	7	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	N/A	Vascular			
Crown Closure Class		21-40%			
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	D	N	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	Side, Span	Decoupled	Unconfined			
Fish Species Present		N/A					
Habitat Comments							
Spawning	Poor: Very little appropriate substrate, wetland U/S could be a barrier and there are very low flows						
Rearing	Good: Lots of cover						
Overwintering	Poor: No pools, most likely freezes						
Migration							
General Comments: Too low levels to fish. Turns into an NCD U/S as it enters a small wetland. Default S4.							



Photo Roll: BP23 Photo number: 112
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 113
Comments: D/S view from crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-067– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			27-Jun-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
391814			5963839		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Spring	15.7	7.7	109	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.30			1.42		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.13		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	6	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Pole Sapling			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Pole Sapling			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	None			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	T	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Unconfined			
Fish Species Present	No fish Caught						
Habitat Comments							
Spawning	Good: Patches of gravel throughout						
Rearing	Excellent: tons of cover						
Overwintering	Poor: Fast flow but fairly shallow water with no deep pools						
Migration							
General Comments: No fish caught, default S4.							



Photo Roll: CM1 Photo number: 1
Comments: U/S view from crossing



Photo Roll: CM1 Photo Number: 2
Comments: D/S view from crossing



Photo Roll: CM1 Photo Number: 3
Comments: Vegetation



Photo Roll: CM1 Photo number: 4
Comments: U/S Vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1006– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			03-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
391693			5964209		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	12.3	8.6	203	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.01			1.0		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.26		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	6	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	S	N	T	T	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Mid. Span	Partially Coupled	Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: All fines with some cobble						
Rearing	Good: Lots of pools and cover						
Overwintering	Poor: Some deep pools but pretty low flow, could freeze						
Migration							
General Comments: Fish visually observed. U/S in more of a wetland type, D/S in coniferous forest. Approx. 30m high fairly steep gulley going into site.							



Photo Roll: CM2 Photo number: 48
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 49
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 50
Comments: Vegetation



Photo Roll: CM2 Photo number: 51
Comments: Vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1007– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			27-Jun-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
390839			5966319		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Spring	13.8	8.0	144	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.05			0.88		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.10		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	13	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	S	S	N	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	Occasional	Side	Partially Coupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Some gravel but mostly cobble and fines						
Rearing	Good: Lots of cover						
Overwintering	Poor: Very shallow with low flow						
Migration							
General Comments: No fish caught but connectivity to lakes U/S and D/S.							



Photo Roll: CM1 Photo number: 5
Comments: U/S view from crossing



Photo Roll: CM1 Photo Number: 6
Comments: D/S view from crossing



Photo Roll: CM1 Photo Number: 7
Comments: Left bank vegetation



Photo Roll: CM1 Photo number: 8
Comments: Right bank vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1010– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			03-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
390777			5966480		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.7	8.5	123	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.73			0.77		
Bankfull depth (m)			Residual pool depth (m)		
0.3			0.08		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	5	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Algae			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
SD	T	N	T	N	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Decoupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: No appropriate substrate						
Rearing	Fair: Good cover but very shallow in places						
Overwintering	Fair: Stream will run dry or freeze but potential connectivity D/S to Lawrence Lake						
Migration							
General Comments: U/S of site, stream becomes NCD, in some areas channel spreads out into multiple channels.							



Photo Roll: CM2 Photo number: 60
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 61
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 62
Comments: Vegetation



Photo Roll: CM2 Photo number: 63
Comments: Site Card

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1011– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			27-Jun-13		
Watercourse Name			Tributary to		
Tahultzu Creek					
UTM Location (NAD 83 Zone 10N)					
390749			5970935		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Spring	20.6	8.2	209	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
7.15			7.03		
Bankfull depth (m)			Residual pool depth (m)		
0.7			N/A		
Bed Material	Fines		Morph.	Large Channel	
D (cm)	0.1		D95 (cm)	0.1	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
T	N	N	N	N	S	D	A
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	None	Decoupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Poor: Mostly fine substrate						
Rearing	Good: Lots of cover from Lilly pads and willows						
Overwintering	Fair: some deep pools but failry slow flow, may freeze						
Migration							
General Comments: Visually observed fish.							



Photo Roll: CM1 Photo number: 9
Comments: U/S view from crossing including veg.



Photo Roll: CM1 Photo Number: 10
Comments: D/S view from crossing including veg.

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1021– Tahultzu Creek

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
388012			5973515		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	14.6	8.3	101	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.09			1.67		
Bankfull depth (m)			Residual pool depth (m)		
0.3			0.08		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	S	T	T	N	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side	Partially Coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: lots of gravel but not much depth						
Rearing	Fair: ok cover						
Overwintering	Fair: Possibly connected to a small lake						
Migration							
General Comments: Minnows observed. Outlet drop at the culvert may be a barrier.							



Photo Roll: CM2 Photo number: 69
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 70
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 68
Comments: Vegetation, wetland area



Photo Roll: CM2 Photo number: 67
Comments: Minnows observed U/S of crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1024– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
387525			5974058		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	14.3	8.3	102	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.33			2.07		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.13		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	1.5		D95 (cm)	18	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Clumped	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	D	T	T	N	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	Occasional	Side, Mid	Coupled	Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Lots of gravels and cover but somewhat fast flows						
Rearing	Good: Lots of cover from a variety of things						
Overwintering	Fair: Good flows, likely connects to a D/S wetland						
Migration							
General Comments: Stream in a gulley with steep gradient on either side.							



Photo Roll: CM2 Photo number: 78
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 79
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 80
Comments: Vegetation, right bank



Photo Roll: CM2 Photo number: 81
Comments: Vegetation, left bank

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New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1025– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
367072			5975078		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11.5	8.3	116	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.32			0.82		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.36		
Bed Material	Cobble, Boulder		Morph.	Riffle Pool	
D (cm)	9		D95 (cm)	14	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	S	T	N	D	S	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side, Mid	Partially coupled	Frequently Confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: No appropriate substrate						
Rearing	Fair: Lots of coverbut very shallow with low flow						
Overwintering	Poor: No deep pools, and low flow. Likely freezes.						
Migration							
General Comments: In a gulley with slopes on either side, lots of blowdown and overhanging veg., currently low flow.							



Photo Roll: CM2 Photo number: 83
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 84
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 85
Comments: Vegetation, left bank



Photo Roll: CM2 Photo number: 86
Comments: Vegetation, right bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1026– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			05-Oct-12		
Watercourse Name			Tributary to		
Smith Creek					
UTM Location (NAD 83 Zone 10N)					
386498			5977434		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	4.1	8.7	139	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
3.38			2.22		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.20		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	2		D95 (cm)	23	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	T	T	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Occasional	Side	Coupled	Frequently Confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Adequate flows, some decent substrate						
Rearing	Good: Lots of cover						
Overwintering	Fair: Connectivity to S2 stream but not a lot of OW within this reach						
Migration							
General Comments: Fish visually observed. In a gulley with significant amount of overhanging woody debris. Lots of rainbow trout observed in resting pools throughout survey length							



Photo Roll: BP23 Photo number: 243
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 244
Comments: D/S view from crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1029– Smith Creek

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
386278			5978054		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9.6	8.4	124	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.70			1.06		
Bankfull depth (m)			Residual pool depth (m)		
0.2			0.10		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	6		D95 (cm)	6	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	T	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side	Partially Coupled	Frequently confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Good: Lots of gravels and cover						
Rearing	Fair: Lots of cover but shallow water						
Overwintering	Poor: Very low flowand shallow water. Likely runs dry or freezes						
Migration							
General Comments: Currently very low flow and shallow water, may be a barrier U/S somewhere. Tons of cover, fairly high banks on either side.							



Photo Roll: CM3 Photo number: 100
Comments: U/S view from crossing



Photo Roll: CM3 Photo Number: 101
Comments: D/S view from crossing



Photo Roll: CM3 Photo Number: 102
Comments: Vegetation



Photo Roll: CM3 Photo number: 103
Comments: Vegetation

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1030– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			02-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
383813			5983240		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.9	7.26	72	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.27			1.15		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.23		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	3		D95 (cm)	25	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	S	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side	Partially coupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Low flows						
Rearing	Good: Plenty of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Stream flows in to a wetland complex D/S.							



Photo Roll: BP30 Photo number: 47
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 48
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 49
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 50
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1036– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
380453			5985238		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.1	7.16	27	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.48			1.12		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.12		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	4		D95 (cm)	19	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C& D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C& D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	N	S	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side, Span	Partially Coupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Fair: unsorted substrate with ok flows, numerous SWD jams are potential barriers						
Rearing	Good: Tons of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Stream flows through small gulley, 3m deep and 30m wide.							



Photo Roll: BP30 Photo number: 57
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 58
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 59
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 60
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1042– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			03-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
379624			5985810		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.9	7.08	37	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.15			0.82		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.66		
Bed Material	Cobble, Gravel		Morph.	Cascade Pool	
D (cm)	9		D95 (cm)	20	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	T	T	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Coupled	Frequently Confined			
Fish Species Present	No fish Caught						
Habitat Comments							
Spawning	Poor: Innadequate flows and substrate						
Rearing	Good: Lots of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: In a gulley with extremely dense shrub layer. Difficult to see stream, lots of SWD jams and low flow made fishing difficult.							



Photo Roll: BP30 Photo number: 51
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 52
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 53
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 54
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1043– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
378905			5985641		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S#			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	9	7.55	53	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.97			1.38		
Bankfull depth (m)			Residual pool depth (m)		
0.9			0.08		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	15		D95 (cm)	35	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	T	T	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side, Mid	Coupled	Frequently confined			
Fish Species Present	No Fish caught						
Habitat Comments							
Spawning	Fair: unsorted substrate, multiple SWD jams						
Rearing	Good: tons of cover						
Overwintering	Poor: No deep pools						
Migration							

General Comments: Stream flows through wide gulley. Several debris jams throughout stream, several dry side channels indicate high sediment transport during high flows.



Photo Roll: BP30 Photo number: 70
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 71
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 72
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 73
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1046– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			05-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
376524			5485138		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.6	7.39	88	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.88			0.80		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.08		
Bed Material	Cobble, Fines		Morph.	Cascade Pool	
D (cm)	3		D95 (cm)	22	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Young Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	N	N	T	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Coupled	Unconfined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Poor: Inappropriate substrate						
Rearing	Good: Lots of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Several SWD jams limit U/S movement of juveniles and inaccessible to spawners. Potential barrier with a 28% gradient that goes for a ways. No place to put minnow traps so only electro-fished. Default S4.							



Photo Roll: BP30 Photo number: 64
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 66
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 67
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 68
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1050– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			25-Oct-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
370275			5990517		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	0.8	8.6	205	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.12			0.93		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.15		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	12	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	S	T	S	T	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Diagonal	Partially coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments					
Spawning	Some gravel, but sporadically clumped				
Rearing	Good: Lots of cover				
Overwintering	Poor: Already covered in 1 inch of ice				
Migration					
General Comments: Stream 90% frozen at time of assessment					



Photo Roll: BP30 Photo number: 152
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 153
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 154
Comments: Vegetation



Photo Roll: BP30 Photo number: 155
Comments: Vegetation

Fish and Fish Habitat Inventory
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Watercourse Crossing Summary Sheet
Site TL-1052– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			04-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
388591			5942708		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	10.4	8.7	157	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.33			1.57		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.14		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	3.5		D95 (cm)	10	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	None			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	T	N	D	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Decent substrate but low flow						
Rearing	Good: Lots of cover and lot of juveniles observed						
Overwintering	Good: Direct connectivity to a lake						
Migration							
General Comments: Fish seen throughout. Wide channel with abundant cover.							



Photo Roll: BP23 Photo number: 15
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 14
Comments: D/S view from crossing



Photo Roll: BP23 Photo Number: 16
Comments: Rainbow Trout caught

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1059– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			23-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
397163			5960381		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11.6	7.76	148	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.74			0.82		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.06		
Bed Material	Fines, Gravels		Morph.	Riffle Pool	
D (cm)	8		D95 (cm)	29	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	T	D	N	S	N	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	Side	Decoupled	Unconfined			
Fish Species Present	No fish Caught						
Habitat Comments							
Spawning	None: No appropriate substrate, low flows						
Rearing	Fair: Good cover but low flows and potential barriers						
Overwintering	Poor: No deep pools but potential connectivity to D/S wetland and small lake						
Migration							
General Comments: Overall poor habitat, frequently scours underground, some 30-40cm drops in stream bed.							



Photo Roll: BP31 Photo number: 02
Comments: U/S view from crossing



Photo Roll: BP31 Photo Number: 03
Comments: D/S view from crossing



Photo Roll: BP31 Photo Number: 05
Comments: Vegetation



Photo Roll: BP31 Photo number: 04
Comments: Stream bed

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1063– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			18-Jul-13		
Watercourse Name			Tributary to		
Greer Creek					
UTM Location (NAD 83 Zone 10N)					
396238			5961985		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	18.7	7.5	105	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
12.52			10.22		
Bankfull depth (m)			Residual pool depth (m)		
1.3			0.67		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	12		D95 (cm)	34	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Shrub			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	T	D	D	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	Side	Partially coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Fair: some gravel patches but mostly fines						
Rearing	Good: decent amount of cover						
Overwintering	Good: Fast water and deep pools, may stay open through winter						
Migration							
General Comments: Visually observed fish							



Photo Roll: BP30 Photo number: 178
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 177
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 179
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 176
Comments: Obstacle

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1064– Greer Creek

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			18-Jul-13		
Watercourse Name			Tributary to		
Nechako					
UTM Location (NAD 83 Zone 10N)					
394094			5962069		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S1			N/A		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
N/A			N/A		
Bankfull depth (m)			Residual pool depth (m)		
N/A			N/A		
Bed Material	N/A		Morph.	N/A	
D (cm)	N/A		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
Right Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
LWD FNC	LWD Dist.	Instream Veg.			
N/A	N/A	N/A			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pattern	Islands	Bars	Coupling	Confinement			
N/A	N/A	N/A	N/A	N/A			
Fish Species Present	N/A						
Habitat Comments							
Spawning	N/A						
Rearing	N/A						
Overwintering	N/A						
Migration							
General Comments: Too wide and deep to safely assess. Classed as S1 based on historical data and GIS information.							



Photo Roll: BP30 Photo number: 172
Comments: U/S view from crossing



Photo Roll: BP30 Photo Number: 173
Comments: D/S view from crossing



Photo Roll: BP30 Photo Number: 170
Comments: Vegetation, right bank



Photo Roll: BP30 Photo number: 171
Comments: Vegetation, left bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1065– Nechako

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			02-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
393304			5962113		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	11.1	8.3	184	M	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.67			0.34		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.05		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	14	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Occasionally confined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	None: All fines with occasional cobble						
Rearing	Good: Tons of cover						
Overwintering	None: would freeze or run dry						
Migration							
General Comments: Very shallow, flow could be a barrier, some sections of sub-surface flow. Too shallow to fish or minnow trap, default S4.							



Photo Roll: CM2 Photo number: 28
Comments: U/S view from crossing



Photo Roll: CM2 Photo Number: 29
Comments: D/S view from crossing



Photo Roll: CM2 Photo Number: 30
Comments: Vegetation, left bank



Photo Roll: CM2 Photo number: 31
Comments: Vegetation, right bank

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-1066/ TL-1067– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Oct-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
376171			5985287		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	4.4	8.3	405	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1,73			0.75		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.07		
Bed Material	Cobble, Gravel		Morph.	Cascade Pool	
D (cm)	3.3		D95 (cm)	25.5	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Cobble			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Clumped	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	N	S	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Unconfined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Lots of gravel						
Rearing	Fai: Quite a bit of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Very low water at this time. Too cold to fish.							



Photo Roll: BP24 Photo number: 22
Comments: U/S view from crossing



Photo Roll: BP24 Photo Number: 23
Comments: D/S view from crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-112– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			25-Oct-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
371105			5989334		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S6			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	62.4	8.6	190	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.02			0.1		
Bankfull depth (m)			Residual pool depth (m)		
1.0			0.02		
Bed Material	Cobble, Gravel		Morph.	Cascade Pool	
D (cm)	8		D95 (cm)	22	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Mixed C & D Forest			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
D	T	S	T	N	T	N	M
Pattern	Islands	Bars	Coupling	Confinement			
Sinuous	None	Diagonal, Span	Coupled	Confined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Poor: Some gravel but gradient is a barrier						
Rearing	Poor: some good cover but steep gradient would creat high water velocity in spring						
Overwintering	Good: Connected to Stellako						
Migration							
General Comments: In a steep gulley. Nearly dry with a 20% grade.							



Photo Roll: BP25 Photo number: 51
Comments: U/S view from crossing



Photo Roll: BP25 Photo Number: 52
Comments: D/S view from crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-121– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			11-Oct-12		
Watercourse Name			Tributary to		
Stellako					
UTM Location (NAD 83 Zone 10N)					
N/A			N/A		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S1			N/A		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	N/A	N/A	N/A	N/A	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
N/A			N/A		
Bankfull depth (m)			Residual pool depth (m)		
N/A			N/A		
Bed Material	N/A		Morph.	N/A	
D (cm)	N/A		D95 (cm)	N/A	
Stream banks					
Left Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
Right Bank	Shape	N/A			
	Texture	N/A			
	Rip. Veg.	N/A			
	Stage	N/A			
LWD FNC	LWD Dist.	N/A			
N/A	N/A	N/A			
Crown Closure Class	N/A				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pattern	Islands	Bars	Coupling	Confinement			
N/A	N/A	N/A	N/A	N/A			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	N/A						
Rearing	N/A						
Overwintering	N/A						
Migration							
General Comments: Reach 3 of the Stellako. Too wide and deep to safely assess. Veg. assessment done and photos taken.							



Photo Roll: BP24 Photo number: 32
Comments: U/S view from crossing



Photo Roll: BP24 Photo Number: 33
Comments: D/S view from crossing



Photo Roll: BP24 Photo Number: 30
Comments: Vegetation, overview of valley



Photo Roll: BP24 Photo number: 31
Comments: Dead spawning Coho

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-937– Stellako (reach 3)

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			24-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
378195			5895475		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	7.3	9.2	87	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.72			1.68		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.22		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	2.5		D95 (cm)	13	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	D	S	T	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Mid	Partially Coupled	Occasionally Confined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Lots of Gravel						
Rearing	Good: Lots of cover						
Overwintering	Good: Lots of deep pools and good flow						
Migration							
General Comments: Fish visually observed.							



Photo Roll: BP23 Photo number: 158
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 159
Comments: D/S view from crossing

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-951/ TL-951.1– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			08-Aug-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
378147			5896270		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	8.4	8.5	90	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.61			1.63		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.16		
Bed Material	Fines, Cobble		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	23	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	D	T	T	S	N/A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	None	Partially Coupled	Unconfined			
Fish Species Present	Unidentified species						
Habitat Comments							
Spawning	Poor: Mostly fines						
Rearing	Good: lots of cover from banks and instream veg.						
Overwintering	Good: known to run all year						
Migration							

General Comments: Visually observed a western toad and unidentified fish species.



Photo Roll: LN1 Photo number: 8
Comments: U/S view from crossing



Photo Roll: LN1 Photo Number: 9
Comments: D/S view from crossing



Photo Roll: LN1 Photo Number: 12
Comments: Vegetation



Photo Roll: LN1 Photo number: 10
Comments: U/S 100m

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-952– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			30-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
389763			5912993		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	20.8	7.9	123	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.95			1.83		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.15		
Bed Material	Gravel, cobble		Morph.	Riffle Pool	
D (cm)	19		D95 (cm)	42	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Clumped	Moss, Algae, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	T	S	M
Pattern	Islands	Bars	Coupling	Confinement			
Meandering	None	Side, Mid, Span	Decoupled	Unconfined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Fair: Some sections of well sorted gravels and slower flows						
Rearing	Good: Lots of cover						
Overwintering	Good: Connectivity to a small lake						
Migration							
General Comments: Visually spotted rainbow trout in small pools near instream veg. and banks. Access road has been deactivated and the culvert at the crossing has been taken out.							



Photo Roll: BP31 Photo number: 64
Comments: U/S view from crossing



Photo Roll: BP31 Photo Number: 65
Comments: D/S view from crossing



Photo Roll: BP31 Photo Number: 66
Comments: Vegetation



Photo Roll: BP31 Photo number: 67
Comments: Site card

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-961– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			31-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
390322			5913903		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	10.1	7.4	141	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.95			0.9		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.52		
Bed Material	Fines, Gravel		Morph.	Riffle Pool	
D (cm)	4		D95 (cm)	22	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Young Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					

SWD	LWD	B	UB	DP	OV	IV	Total
S	N	N	D	T	S	T	M

Pattern	Islands	Bars	Coupling	Confinement
Meandering	None	Side, Mid	Partially coupled	Unconfined

Fish Species Present	No fish Caught

Habitat Comments	
Spawning	Poor: Some very short sections of gravel but mostly fines
Rearing	Fair: Decent amount of cover
Overwintering	Poor: No deep pools, very low flow, barrier between lake connectivity
Migration	

General Comments: Stream has been harvested up to the bank edge within the last 10 years, 2 potential barriers found within 100m. Culvert on access road has been removed.



Photo Roll: BP31 Photo number: 68
Comments: U/S view from crossing



Photo Roll: BP31 Photo Number: 69
Comments: D/S view from crossing



Photo Roll: BP31 Photo Number: 70
Comments: Vegetation



Photo Roll: BP31 Photo number: 71
Comments: Fish Barrier

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-962– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			05-Sept-12		
Watercourse Name			Tributary to		
Big Bend Creek					
UTM Location (NAD 83 Zone 10N)					
398734			5927483		
Subbasin			Minor Waters (Y/N)		
			N		
Stream Classification			Site Length (m)		
S2			200		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	11.2	8.2	190	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
6.7			5.5		
Bankfull depth (m)			Residual pool depth (m)		
0.7			0.57		
Bed Material	Fines		Morph.	Riffle Pool	
D (cm)	0.1		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
Right Bank	Shape	Vertical			
	Texture	Fines			
	Rip. Veg.	Shrub			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Even	Vascular			
Crown Closure Class	21-40%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	S	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	Infrequent	Side, Mid, span	Decoupled	Decoupled			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Poor: Sediment laden water with silty fines on the bottom						
Rearing	Excellent: tons of cover from a variety of sources						
Overwintering	Good: deep protected pools						
Migration							
General Comments: Lots of beaver dams D/S creating deep pools. Lots of sediment U/S and D/S.							



Photo Roll: BP23 Photo number: 42
Comments: U/S view



Photo Roll: BP23 Photo Number: 44
Comments: D/S view



Photo Roll: BP23 Photo Number: 45
Comments: Culvert outlet



Photo Roll: BP23 Photo number: 46
Comments: U/S from 100m navigable waters point

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-969 – Big Bend Creek

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			11-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
393246			5934775		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	13.1	8.0	172	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
2.82			2.57		
Bankfull depth (m)			Residual pool depth (m)		
0.6			0.24		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	22		D95 (cm)	37	
Stream banks					
Left Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Sloping			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss, Vascular			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	T	T	S	T	D	T	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Diagonal	Partially Coupled	Occasionally Confined			
Fish Species Present	Unknown						
Habitat Comments							
Spawning	Good: Lots of gravels and cover						
Rearing	Good: Lots of cover						
Overwintering	Good: Some deep pools, decent flow, connected to a wetland with U/S dammed areas						
Migration							
General Comments: Beaver dam U/S of site, some channel in wetland area. Minnows visually spotted.							



Photo Roll: CM4 Photo number: 5
Comments: U/S view from crossing



Photo Roll: CM4 Photo Number: 8
Comments: D/S view from crossing



Photo Roll: CM4 Photo Number: 9
Comments: Vegetation



Photo Roll: CM4 Photo number: 6
Comments: U/S dammed area

Fish and Fish Habitat Inventory
New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-975– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			11-Jul-13		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
390160			5937755		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Summer	7.3	8.5	177	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
0.81			0.82		
Bankfull depth (m)			Residual pool depth (m)		
0.2			0.06		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	15		D95 (cm)	24	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Fines			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	N	S	N	T	D	M
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Meandering	None	None	Partially coupled	Occasionally Confined			
Fish Species Present	No fish Caught						
Habitat Comments							
Spawning	Good: Lots of gravels and good cover						
Rearing	Good: Decent cover from undercut banks and veg.						
Overwintering	Fair: Small stream with low flow, may freeze.						
Migration							
General Comments: Fairly steep banks on either side of stream. U/S of road turns into NCD, assessed D/S from road.							



Photo Roll: CM4 Photo number: 12
Comments: U/S view from crossing



Photo Roll: CM4 Photo Number: 13
Comments: D/S view from crossing



Photo Roll: CM4 Photo Number: 14
Comments: Vegetation, left bank



Photo Roll: CM4 Photo number: 16
Comments: Vegetation overview

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Watercourse Crossing Summary Sheet
Site TL-980– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
393335			5948824		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	6.3	9.2	136	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.53			1.16		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.11		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	4		D95 (cm)	25	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Few	Even	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Diagonal, Mid	Partially coupled	Occasionally confined			
Fish Species Present	No Fish Caught						
Habitat Comments							
Spawning	Excellent: Lots of gravels and debris						
Rearing	Excellent: Lots of cover						
Overwintering	Fair: Deep pools ann ddecent flow						
Migration							
General Comments: Stream gradient gets steeper as you move D/S.							



Photo Roll: BP23 Photo number: 74
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 75
Comments: D/S view from crossing

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Watercourse Crossing Summary Sheet
Site TL-985– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
395117			5952106		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S3			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	6.9	8.6	109	C	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.78			1.51		
Bankfull depth (m)			Residual pool depth (m)		
0.5			0.12		
Bed Material	Gravel, Cobble		Morph.	Riffle Pool	
D (cm)	5		D95 (cm)	22	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
Abundant	Clumped	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	D	T	S	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Mid	Partially Coupled	Frequently confined			
Fish Species Present	Rainbow trout						
Habitat Comments							
Spawning	Good: Lots of gravels						
Rearing	Good: Abundant cover						
Overwintering	Fair: some deep pools, but not many and low flow						
Migration							
General Comments: Huge amounts of blowdown and woody debris. Cutblock on either side, in a young pine plantation.							



Photo Roll: BP23 Photo number: 88
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 89
Comments: D/S view from crossing

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Watercourse Crossing Summary Sheet
Site TL-989– Unnamed Watercourse

Watercourse Survey and Geographical Information Transmission Line					
Site NID.			Survey Date		
A			10-Sept-12		
Watercourse Name			Tributary to		
Unnamed					
UTM Location (NAD 83 Zone 10N)					
395007			5953176		
Subbasin			Minor Waters (Y/N)		
			Y		
Stream Classification			Site Length (m)		
S4			100		
Water Chemistry Data					
Season	Temp	pH	EC (µs)	Turbidity	
Fall	8.1	8.0	116	L	
Physical Channel and Stream Bank Information					
Channel width (m)			Wetted width (m)		
1.18			1.13		
Bankfull depth (m)			Residual pool depth (m)		
0.4			0.11		
Bed Material	Gravel, Fines		Morph.	Riffle Pool	
D (cm)	1.5		D95 (cm)	11	
Stream banks					
Left Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
Right Bank	Shape	Undercut			
	Texture	Gravel			
	Rip. Veg.	Coniferous			
	Stage	Mature Forest			
LWD FNC	LWD Dist.	Instream Veg.			
None	N/A	Moss			
Crown Closure Class	1-20%				
Cover					
SWD	LWD	B	UB	DP	OV	IV	Total
S	S	T	S	N	D	T	A
Pattern	Islands	Bars	Coupling	Confinement			
Irregular Wandering	None	Side, Span	Decoupled	Frequently confined			
Fish Species Present	N/A						
Habitat Comments							
Spawning	Good: Lots of gravel patched						
Rearing	Good: Lots of cover						
Overwintering	Poor: No deep pools						
Migration							
General Comments: Fish visually observed at crossing.							



Photo Roll: BP23 Photo number: 95
Comments: U/S view from crossing



Photo Roll: BP23 Photo Number: 96
Comments: D/S view from crossing



Photo Roll: BP23 Photo Number: 92
Comments: Fish seen in stream



Photo Roll: BP23 Photo number: 5793
Comments: Fish seen in stream

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New Gold Blackwater Project

Watercourse Crossing Summary Sheet
Site TL-992– Unnamed Watercourse

Appendix H.1 – Summary Table for all Non-classified drainages along the preferred final alignment of the transmission line

FIELD OBSERVATIONS FOR ALL Transmission Line NON-CLASSIFIED DRAINAGES

Site ID	Comments
MR-001	Slight depression in yound pine forest. Some evidence of spring runoff. No scoured channel. No alluvial deposits.
MR-005	No visible channel at this location. No evidence of water flow at any time of the year.
MR-006	Dry, vegetated upland area between two small wetlands. No scoured channel, no alluvial deposits, no evidence of ephemeral runoff.
MR-007	Wetland with lots of segdes. ~10cm of standing water throughout, but no scoured channel or alluvial deposits. Not a stream.
MR-008	Open sedge wetland with pockets of open water. One area (5mx5m) water >1m in depth. No scoured channel or alluvial deposits. Not a stream.
MR-009	Small wetland with open water. No scoured channel or alluvial deposits. Not a stream.
SR-001	A few patches of willow is only indicator of moisture at this site.
SR-002	No evidence of any kind of drainage. No scoured channel, no alluvial deposits, no water. Not a stream.
SR-005	Drainage appears ephemeral, with evidence of seasonal pooling. No socured channel, no alluvial deposits. Not a stream.
SR-006	Dry, vegetated depression. No scoured channel, no alluvial deposits, no water.
SR-007	Shallow gully at bottom of hillsope. Dry and vegetated with no channel.
SR-008	Dry and vegetated drainage in strip of aspen. No scouring or deposits. Not a stream. Same reach as TL-128.
TL-003	Nothing at UTM to indicate a drainage. Suspect water drains out wetland above to the north.
TL-024	Black spruce wetland. No channel or connectivity to Esker Creek.
TL-029	Checked d/s at AE-025. Some scouring, but none over 10m. Mostly saturated soil with moss and horsetail.
TL-030	Checked d/s at AE-025. Some scouring, but none over 10m. Mostly saturated soil with moss and horsetail.
TL-031	No water or channel. Classed d/s at AE-026 (same reach).
TL-032	Pooled water with no continuous channel. Classed d/s at AE-027(same reach).
TL-036	Moisture loving plants, but no open water, channel, or culvert at crossing. Assessed d/s at AE-032 (same reach).
TL-037	A few aspen, but otherwise no evidence of a waterway. No culvert at crossing. Assessed d/s at AE-033 (same reach).
TL-038	Some evidence of flow upstream of road, but no scoured channel or culvert at crossing. Assessed d/s at AE-034 (same reach).
TL-044	Some scouring and deposits, but no sections greater than 10m. No water and limited connectivity between scoured sections. Not a stream.
TL-045	No scouring, deposits, or water.
TL-046	Only indicator of moisture is a few aspen. No drainage at this site.
TL-047	No sign of a watercourse.
TL-049	No scoured channel. Drainage runs through plantation. Willow throughout.
TL-051	No alluvial deposits, some scoured channel, but dry and vegetated throughout.

TL-055	Very saturated ground with sub-surface flow. Some channelization near road, but disappears near the site. Wetland type.
TL-116	No scouring , alluvial deposits, or open water along this swath of alder. Not a stream.
TL-117	Rich vegetation with no scouring, alluvial deposits, or open water. Not a stream.
TL-118	A few patches of willow is only indicator of moisture at this site.
TL-127	Shallow gully at bottom of hillsope. Dry and vegetated with no channel.
TL-128	Dry and vegetated drainage in strip of aspen. No scouring or deposits.
TL-918	No defined channel, discontinuous flow, pockets of standing water. Not a stream.
TL-936	Dry pockets within willow and alder growth. No scouring or deposits.
TL-939	Depression on edge of cutblock. No scouring or other sign of flow.
TL-953	Previous classification. Grassy swale in cutblock with no scouring, alluvial deposits, flow, or channel. Not a stream.
TL-954	Standing water in wetland type in cutblock. Likely sink for runoff. No channel found.
TL-957	No channel, scouring, water, or alluvial deposits.
TL-963	60m scoured section d/s of existing road crossing down steep section. No scouring or alluvial deposits outside this area. Not a stream.
TL-964	Wetland type with water tolerant vegetation. Pooled water in areas. No scoured channel or alluvial deposits. Not a stream.
TL-965	No channel or any indicator of seasonal drainage. Some mature aspen indicating moist soil.
TL-966	Mossy coniferous area along plantation. No scoured channel.
TL-967	Some channeling and pools of water but not continuous. Classed d/s at AE-028 (same reach).
TL-968	Not visited. Assume previous classification.
TL-971	Dry and vegetated. Gulley upstream of road, but no scoured channel.
TL-972	Dry, vegetated gulley. No scouring, no alluvial deposits, no water. Not a stream.
TL-974	Dense strip of Salix and sedges. Scouring present, but none >100m. Several beaver dams have impounded water. Not a stream.
TL-976	Saturated soils and pooling evident, but no socured channel or alluvial deposits. Not a stream.
TL-978	Classified in 2002. NCD with no lentic origin. Assume previous classification
TL-979	Classified in 2002. NCD with no lentic origin. Assume previous classification
TL-982	Vegetated wet area; no channel or alluvial deposits.
TL-983	No scouring, alluvial deposits, or open water. Mapped watercourse is a strip of alder. Not a stream.
TL-986	No scoured channel or alluvial deposits, but there is evidence of ephemeral pooling. Not a stream.
TL-987	No scouring, alluvial deposits, or water. Open corridor through Spruce stand. Not a stream.
TL-988	Saturated strip among alder and sedges. Discontinuous pooling. No scouring or alluvial deposits. Not a stream.
TL-990	No scouring or alluvial deposits. Discontinuous puddling in small gulley. Not a stream.
TL-991	Wetland dominated by sedges and willow. Discontinuous ponded areas. No scouring or alluvial deposits. Not a stream.
TL-993	No scouring, alluvial deposits, or open water in this shallow depression. Not a stream.

TL-994	No scouring > 20m. Scoured sections fo contain mineral alluvium, but elsewhere is fully vegetated with no channel definition. Not a stream.
TL-995	No scouring >60m. Appears to be a stream at crossing, but there is not enough channel definition to be considered a stream.
TL-996	No scouring, alluvial deposits, or open water. Equisetum spp only indicator of a drainage. Not a stream.
TL-1003	No scouring, no alluvial deposits, no open water. Not a stream.
TL-1005	Wet depression in a drainage. No scouring >3m. No alluvial deposits covering >3m. Not a stream.
TL-1008	Site disturbed by forestry activities, resulting in ponded water. No scouring or alluvial deposits. Not a stream.
TL-1009	Very small, discontinuous scoured sections. Some of the drainage is saturated. Not a stream.
TL-1012	Dry vegetated area. No scouring, alluvial deposits, or water. Not a stream.
TL-1013	No scouring > 3m. No alluvial deposits. Discontinuous saturation and pooling. Not a stream.
TL-1014	No scouring or alluvial deposits. Saturated soil with dense moisture tolerant plant species.
TL-1015	No scouring > 5m. No alluvial deposits. Lonicera involucrata dominates.
TL-1016	Discontinuous pooling and moist pockets of soil. No scouring or alluvial deposits. Not a stream.
TL-1017	No scouring or alluvial deposits. Water pooling at culvert on existing road. Water not seen elsewhere in drainage. Not a stream.
TL-1018	No scouring or alluvial deposits. Some water flowing over soil. Not a stream.
TL-1019	Moist soil with some standing water. No scouring or alluvial deposits. Not a stream.
TL-1022	Intermittent 1-2m scoured sections. Saturated soil elsewhere. No alluvial deposits. Not a stream.
TL-1023	No scouring or alluvial deposits. Some standing water. Ground is saturated. Not a stream.
TL-1027	Alder swale through plantation. Some scouring, but infrequent.
TL-1028	Discontinuous scouring and alluvial deposits. Remainder of drainage is vegetated. Not a stream.
TL-1031	No scouring or alluvial deposits. Wet ground with occasional puddles. Not a stream.
TL-1034	No scouring or alluvial deposits. Dry, vegetated ground. Not a stream.
TL-1035	Occasional scouring, no alluvial deposits, no water. Mapped watercourswe in shallow gulley. Not a stream.
TL-1037	No scouring, alluvial deposits, or open water. Mature poplar and aspen indicate ground moisture. Not a stream..
TL-1040	No scouring, occasional alluvial deposits. Not a stream.
TL-1041	No scouring, alluvial deposits, or open water. Ground along mapped watercourse is moist. Not a stream.
TL-1047	No scouring >5m, some alluvial deposits in scoured sections. Low flows. Not a stream.
TL-1048	No scouring, alluvial deposits, or water. Not a stream.
TL-1049	No scouring, trace alluvial deposits, small discharge of water. Alluvial deposits found in isolated pools. Not a stream.

TL-1053	Dry, vegetated strip of moisture tolerant vegetation. No scouring, alluvial deposits, or water. Not a stream.
TL-1054	Scattered scouring, but no continuous channel. Site is at end of mature alder swale.
TL-1055	50m scoured channel and evidence of spring run off. May be because of 5% gradient. Not enough to be a stram.
TL-1056	Slight depression with some evidence of meltwater runoff, but no scoured channel or alluvial deposits.
TL-1060	Saturated strip among alder and sedges. Discontinuous pooling. No scouring or alluvial deposits. Not a stream.
TL-1061	No scouring, alluvial deposits, or open water. Mapped watercourse is a strip of alder. Not a stream.
TL-1062	No scouring or alluvial deposits. Wet drainage area. Not a stream.
TL-1068	No scouring, no alluvial deposits, no water. Moss and alder found along mapped watercourse. Not a stream.
TL-1069	No scouring, no alluvial deposits, no water. Mosses found along mapped watercourse. Not a stream.
TL-1070	No scouring or alluvial deposits in wetland type with lots of alder. Some standing water. Not a stream
TL-1071	No scouring, alluvial deposits, or water. Not a stream.
TL-1072	Medium sized black spruce/sedge wetland. Currently dry, but soils are saturated.No scoured channel or alluvial deposits.
TL-1073	No scouring, alluvial deposits, or water. Several dry depressions. Moisture tolerant vegetation present. Not a stream.
TL-1074	Alignment crosses 60m wetland section with no scouring or alluvial deposits. No open water or channel. Not a stream.
TL-1075	No scouring, alluvial deposits, or water. Mapped watercourse runs through mapped gulley. Not a stream
TL-1076	Evidence of snowmelt runoff, but no continuous channel or alluvial deposits.
TL-1079	Organic depression with no fish habitat.
TL-1080	Some ponded water at culvert, but no scoured channel.
TL-1082	Slight depression in mature forest with mossy bed. No scoured channel.
TL-1083	Dry and mossy drainage entering cutblock. No sign of scour or recent flow.

Appendix H.2 - Summary Table for all classified streams along the preferred final alignment of the transmission line

Summary of stream assessments for final preferred alignment of the transmission line

Site ID	Class †	Gradient	Morphology	B_fW €	B_fD €	ResPool €	Species *	Habitat Quality ‡				Comments
								S	R	O	M	
MR-002	S2	3	Riffle-Pool	12.1	0.93	0.59	NS	G	G	G	G	Excellent overall habitat
MR-003	S4	1.5	Riffle-pool	0.6	0.37	0.04	NFC	P	G	F	F	S4 with indirect connectivity to good OW habitat and direct connectivity to fish bearing stream.
MR-004	S4	2.5	Riffle-pool	0.8	0.4	0.09	NFC	P	F	P	P	S4 with intermittent dry sections and overall poor fish habitat.
MR-010	S3	1.5	Riffle-Pool	2.38	0.53	0.23	RB	F	G	F	G	S3 with abuundant fish habitat and direct connectivity to a important kokanee spawning S2.
SR-003	S1											Stellako river too wide and deep to safely perform stream assessment. Defaulted S1 based on historical data.
SR-004	S4	9	Riffle-pool	1.02	0.43	0	C	P	P	P	P	Dry S4 with d/s barrier to migration and no upstream perennial habitat.
SR-009	S3	3	Riffle-pool	1.8	0.72	0.1	NS	F	G	P	F	Drainage runs through gulley with some steeper sections.
TL-004	S2	1.5	Riffle-pool	6.5	0.46	0.35	NS	G	G	G	G	Excellent habitat. Use historical data for fish distributions. Same reach as AP-004.
TL-023	S3	3	Riffle-pool	2.3	0.5	0.3	NS	G	G	G	G	Known fish presence.
TL-025	S3	2	Riffle-Pool	4.2	0.46	0.32	SPP	G	G	G	G	Unidentified fish observed during survey.
TL-026	S4	2.5	Riffle-Pool	1.1	0.56	0.27	NS	P	G	F	P	Moderate overall habitat. No fish observed. Same reach as AE22.

TL-048	S4	3	Riffle-pool	1.23	0.70	0.05	NFC	G	G	P	P	Low water levels at this time, but otherwise good habitat.
TL-054	S3	4	Riffle-pool	3.4	0.57	0.18	RB	G	G	F	F	Very good fish habitat.
TL-067	S4	2.5	Riffle-pool	0.9	0.43	0.06	NS	P	G	P	P	Very little water at this time. Stream turns NCD upstream at UTM 10U 397332 5956569
TL-112	S3	5	Cascade-pool	1.7	0.53	0.1	NS	G	G	P	P	Very low water levels at this time, likely freezes over in winter.
TL-121	S6	26	Cascade-pool	1	1.0	0.02	NS	N	N	N	N	Steep reach in large gulley down to Nechako. Nearly dry at time of survey. No upstream OW habitat.
TL-917	S3	2.5	Riffle-Pool	2.6	0.55	0.12	RB,SPP	G	G	G	G	Excellent overall habitat. Surveyed at AE-007 location (same reach).
TL-937	S1		Riffle-pool				NS					Too large to measure. GIS estimated 35m width. Known fish bearing.
TL-951	S3	1	Riffle-pool	1.7	0.62	0.22	SPP	G	G	G		Same reach as TL-901. Surveyed at point between the two sites UTM 10U 378331 5895679. Unidentified fish obs during survey.
TL-951.1	S3	1	Riffle-pool	1.7	0.62	0.22	SPP	G	G	G		Same reach as TL-901. Surveyed at point between the two sites UTM 10U 378331 5895679. Unidentified fish obs during survey.
TL-952	S3	3.8	Riffle-pool	1.6	0.45	0.18	SPP	P	G	G	F	Stream is known to run year round. Surveyed closer to TL903 (same reach)- UTM 378602 5896790
TL-955	S4	6.3	Riffle-pool	1.2	0.37	0.15	RB, SPP	F	G	F	G	Sandy substrate u/s of crossing may be due to adjacent cutblock. Gravel/cobble d/s.
TL-958	S3	1.5	Riffle-pool	3.2	.76	0.35	NS	F	G	G	G	Unidentified fish obs. during survey. See 2011 Ecofor for full fish data.
TL-961	S3	2.5	Riffle-pool	1.95	0.43	0.15	SPP	G	G	G	G	Good fish habitat with unidentified fish observed during survey.

TL-962	S6	6.5	Riffle-pool	0.95	0.4	0.52	NFC	P	G	P	P	Previously classified as S6. Agree with previous classification. Treat as non-fishbearing stream.
TL-969	S2	2.5	Riffle-pool	7.5	0.67	0.57	RB	P	G	G	G	S2 stream with notable beaver activity. Survey taken d/s at road (AE-30).
TL-970	S4	2	Riffle-pool	1.1	0.45	0	NS	F	F	P	P	Dry channel at this time.
TL-973	S2	1.5	Riffle-pool	5.7	0.78	0.95	RB	F	G	G	G	Numerous beaver dams. Fish observed throughout survey.
TL-975	S3	2	Riffle-Pool	2.82	0.6	0.24	SPP	G	G	G	G	S3 with good fish habitat. Visual observation of fish.
TL-977	S6	12.25	Riffle-pool	1.12	0.37	0.06	NFC	F	G	P	P	Data from previous classification done in 2002. Stream loses channel definiton d/s of site and culvert may be potential barrier.
TL-980	S4	2.5	Riffle-pool	0.81	0.15	0.06	NFC	G	G	P	F	S4 stream with no fish caught during survey.
TL-985	S4	3.3	Riffle-pool	1.5	0.54	0.11	NFC	G	G	G	P	Very good fish habitat. NFC, but no apparent barriers.
TL-989	S3	2.5	Riffle-pool	1.8	0.57	0.12	RB	G	G	F	G	Excessive blowdown b/c of cutblocks on either side.
TL-992	S4	1.5	Riffle-pool	1.2	0.37	0.11	SPP	G	G	P	F	Good spawning and rearing potential; fish observed at crossing.
TL-1006	S4	4	Riffle-pool	1.3	0.4	0.13	NFC	G	G	F	G	S4 stream with no fish caught during survey, but fish presence documented in u/s and d/s reaches.
TL-1007	S4	2.5	Riffle-pool	1.01	0.62	0.26	SPP	P	G	F	G	S4 stream with really good rearing habitat, but poor spawning and overwintering portential.
TL-1010	S4	2.5	RP	1.05	0.43	0.1	NFC	P	G	P	F	S4 with no fish caught, but stream connects two lakes so defaulted fish bearing

TL-1011	S4	1.5	RP	0.73	0.27	0.08	NFC	P	F	F	P	S4 with marginal fish habitat. Defaulted to fish bearing status.
TL-1021	S2	2	LC	7.15	0.21		SPP	P	G	F	G	Stream runs through 25m wide wetland type. Fish bearing status confirmed. u/s of crossing wetland vegetation narrows up.
TL-1024	S3	0.5	RP	2.09	0.33	0.08	SPP	G	G	M	G	Good looking S3 with known fish presence and provides connectivity between fish bearing lakes.
TL-1025	S3	2.5	RP	3.33	0.47	0.13	RB	G	G	F	G	S3 stream with good fish habitat.
TL-1026	S4	5.5	RP	1.32	0.47	0.36	NFC	P	F	P	P	Low quality stream defaulted fish bearing. Does not provide migration to good upstream habitat.
TL-1029	S3	4.5	Riffle-pool	3.4	0.6	0.2	RB	G	G	F	F	Channel in gulley with notable overhanging vegetation. Visual observations of 10+ RB in resting pools during survey.
TL-1030	S3	1.5	RP	1.7	0.2	0.1	NFC	G	F	P	P	S3 stream at low flows with significant woody debris in the channel. Good cover but not a lot of water for fish to occupy.
TL-1036	S4	1.5	RP	1.27	0.47	0.23	NFC	P	G	P	P	Defaulted S4 stream with marginal habitat and not a lot of drainage u/s of the proposed crossing.
TL-1042	S4	3.5	RP	1.48	0.53	0.12	NFC	P	G	P	P	Stream provides good rearing habitat, but low flows and numerous debris jam make for poor spawning, migrating and overwintering habitat.
TL-1043	S4	5	RP	1.15	1.4	0.66	NFC	P	G	P	P	Stream provides good rearing habitat, but low flows and numerous debris jam make for poor spawning, migrating and overwintering habitat.
TL-1046	S3	6	RP	1.97	0.87	0.08	NFC	P	G	P	P	Slightly wider stream that TL1043 runs into. Stream only provides good rearing habitat, with little to no spawning, overwintering or migrating habitat.

TL-1050	S4	7.5	CP	0.88	0.37	0.08	NFC	P	G	P	P	Debris jams make migration difficult. Plenty of rearing habitat. 28% slope d/s of crossing could limit migration as well
TL-1052	S4	4	Riffle-pool	1.1	.5	0.15	NS	P	G	P	P	Stream 90% frozen at time of assessment. 1" of ice cover.
TL-1057	S3	1.5	Large Channel	3.9	0.77	0	NFC	P	G	G	G	Channel in wetland type; overgrown with willows
TL-1058	S3	1	Large Channel	3.3	0.37	0	NS	P	G	G	G	Beaver dams have created ponding
TL-1059	S3	2.5	Riffle-pool	2.3	0.64	0.14	RB	F	G	G	F	Fish observed througout survey
TL-1063	S4	3.5	Riffle-pool	0.79	0.4	0.06	NFC	P	G	P	P	Small stream with marginal fish habitat. Defaulted fish bearing because of connectivity to d/s fish bearing stream (Greer Creek)
TL-1064	S2	2.5	Riffle-pool	12.5	1.3	0.67	SPP	G	G	G	G	Nice S2 stream with visual observation of fish and good fish habitat across the board.
TL-1065	S1											Major river that was too deep and swift to safely perform assessment. Historical data shows large fish community.
TL-1066	S4	6.5	Riffle-pool	0.67	0.37	0.05	NFC	P	G	P	P	Small defaulted S4 with marginal fish habitat. Same reach as TL1067
TL-1067	S4	6.5	Riffle-pool	0.67	0.37	0.05	NFC	P	G	P	P	Small defaulted S4 with marginal fish habitat. Same reach as TL1066
TL-1077	S3	3	Riffle-pool	1.8	0.72	0.1	NS	F	G	P	F	Drainage runs through gulley with some steeper sections.
TL-1078	S2	3	Riffle-Pool	12.1	0.93	0.59	NS	G	G	G	G	Excellent overall habitat

TL-1081	S6	4.5	Riffle-Pool	0.6	0.2	0.08	NS	N	N	N	N	Mainly dry channel. 140m d/s of road, channel dissipates into small vegetated wetland. No possible fish passage, no perennnial habitat upstream.

***- Species codes: NFC= No Fish Caught; SPP= Unidentified Species; NS= Not Sampled; RB= Rainbow trout; LKC =Lake Chub; BMC Brassy minnow; WSU: White sucker †- Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage, NVC = no visible channel, NPC = no previous classification information was available. ‡- Habitat refers to a qualitative assessment of fish habitat based on four different types of fish habitat. S = spawning habitat; R = rearing; O = overwintering; and M = migrating. Each habitat type within each site was given a rating for habitat quality: N = nil; P = poor; F = fair; G = good; and E = excellent. These ratings were assessed based on the professional judgement of the field assessors. €- BfW= Bankfull width; Bfd= Bankfull depth; ResPool=Residual Pool.**

Appendix I.1 – Summary table for all non-classified drainages along the proposed access road preferred final alignment

FIELD OBSERVATIONS FOR ALL NON-CLASSIFIED DRAINAGES ON THE ACCESS ROAD

Site ID	Comments
AE-004	Organic depression with no fish habitat.
AE-005	Some ponded water at culvert, but no scoured channel.
AE-008	No defined channel, discontinuous flow, pockets of standing water. Not a stream.
AE-011	Waterline is in dry pine flat. No stream found.
AE-012	No culvert at crossing. No drainage found to cross within 100m of site. Photos of weak channel 10m to the south running parallel to road.
AE-015	Pooled water in depressed area. No channel or sign of flow.
AE-016	Moist depression. No channel, water, or alluvial deposits.
AE-017	Ponded water with no connectivity between pools. No channel.
AE-018	Some muddy pockets in alder stand. No channel, water, or deposition.
AE-023	No channel or any indicator of seasonal drainage. Some mature aspen indicating moist soil.
AE-024	Mossy coniferous area along plantation. No scoured channel.
AE-025	Some scouring, but none over 10m. Mostly saturated soil with moss and horsetail.
AE-026	No water or channel.
AE-027	Pooled water with no continuous channel.
AE-028	Some channeling and pools of water but not continuous.
AE-029	Willow swale. No culvert at crossing.
AE-031	Dry and vegetated drainage with no sign of recent flow. No continuous channel. Gulley upstream.
AE-032	Moisture loving plants, but no open water, channel, or culvert at crossing.
AE-033	A few aspen, but otherwise no evidence of a waterway. No culvert at crossing.
AE-034	Some evidence of flow upstream of road, but no scoured channel or culvert at crossing.
AE-036	Dry and vegetated. Gulley upstream of road, but no scoured channel.
AE-039	No scouring, no water, no alluvial deposits.
AE-040	Evidence of past ponding, but no channel.
AE-041	No scouring, water, no alluvial deposits.
AE-042	No scouring, water, no alluvial deposits.
AE-043	70m of scoured channel in this reach. Flows out of wetland and dissipates.
AE-050	No evidence of scoured channel, alluvial deposits, or water.
AE-051	No evidence of scoured channel or alluvial deposits. Some moisture tolerant vegetation present.
AE-052	Some scouring downstream of culvert, likely due to cutblock run-off. Not enough to be a stream.
AE-054	Isolated puddling in a 5m wide wet area. No connectivity to fish habitat observed.
AE-060	No channel, but pooled water 4-8m wide. Red colouration and algae present. Fish-bearing waters d/s - sampled to determine FSZ. NFC.
AE-062	Small, dry pockets in low lying areas. No connectivity to fish-bearing waters.
AE-063	80m of poorly scoured channel. Stagnant water. No flow or definite scouring. No alluvial deposits.
AE-064	Scoured sections, but none over 10m in lenth. Some pooling, but no continuous channel or alluvial deposits.
AE-065	No scoured channel or alluvial deposits. Evidence of snowmelt runoff at culvert.
AE-066	No scoured channel, alluvial deposits, or water present.
AE-067	Seepage area with some overland flow and underground flow. No scoured channel or alluvial deposits. Not a stream.
AE-069	Ponded water in wetland type with limited to no connectivity between pools.

AE-077	Private property u/s and d/s but obvious NCD from rd. Hayfields on both sides-no drainage structure at crossing.
AE-078	Hayfields. No drainage structure at crossing. No indication of water except for a few aspen.
AE-079	Some dry pockets near culvert, but no scoured channel or alluvial deposits.
AE-080	Small drainage through moist soil type and farmers field. No evidence of a channel. Dry and vegetated at time of survey.
AE-081	No sign of a channel or recent flow. Some moisture loving spp indicate wetter soil type. No drainage structure at crossing.
AE-082	No drainage structure at crossing. No sign of water, scouring, or alluvial deposits.
AE-083	Willow and aspen to indicate moist ground, but no channel, scour or alluvial deposits observed.
AE-084	Weak channel u/s but discontinuous and no connectivity to culvert at crossing. No definite channel d/s, only occasional dry pockets. Private property (fields) both sides of crossing.
AE-085	u/s is farmer's field w/lagoon. d/s some Aspen, but no sign of water or channel. No drainage structure at crossing.
AE-086	Large watering hole u/s, dry and vegetated d/s. Private property both sides. No sign of water or a channel.
AE-087	Private property both sides of crossing. Cattle grazing.Ponded water upstream that appears to have come from ditchline. Drainage dissipates d/s of culvert. No channel on either side.
AE-088	A dry and vegetated depression along slight hillslope. No sign of a channel or recent flow.
AE-089	Lower reaches of Tachick are fish bearing; historical beaver issues along stream. This reach impacted by cattle grazing and no channel is evident. No water beyond small pool at culvert inlet. Some rocky substrate, but likely from road crossing.
AE-090	Rancher's fields on both sides of crossing. No sign of a channel, alluvial deposits, or flow. Dry and vegetated.
AE-091	Dry draw from rancher's property. Culvert at crossing appears to drain ditchline. No channel and culvert is infilled with sediment.
AE-092	Dry and vegetated aspen swale. No sign of scour or water. Old cutblock u/s, now used for grazing.
AE-093	Dry draw with aspen but no sign of water or a channel. Rancher's property u/s.
AE-094	Dry and vegetated gulley. Some dry pockets, but no scoured channel. Willow swale d/s, but no open water.
AE-095	No channel upstream; culvert drains ditchline. D/s is strip of aspen, but drainage stops after 20m and no sign of flow beyond. Evidence of cattle/wildlife watering.
AE-096	No drainage structure at crossing. No sign of a watercourse. Culvert 30m from UTM drains ditchline. Cutblock upstream.
AE-097	Standing water near both ends of culvert. No sign of flow or channel. Water dissipates in cutblock d/s.
AE-098	Water at culvert, but no scoured channel. No flow or continuation of watercourse past the treeline.
AE-099	Definite channel for 50m u/s of crossing and 5m d/s on hillslope, but discontinuous afterward. Dry at this time. Likely carries snowmelt from upslope cutblock.
AE-100	Moist alder swale. No scouring or open water u/s. Some puddling d/s but no flow or channel.
AE-901	d/s of crossing has been dammed for a watering hole. NCD runs through hay field and has no scouring or alluvial deposits.
AE-902	Culvert at road crossing, with hay fields on both sides. No scouring or alluvial deposits. Not a stream.
AE-903	Culvert at road crossing located on private property made of hayfields. No scouring, no alluvial deposits. Not a stream.
AE-904	Tributary to an NCD. Some saturated pools with evidence of water. No scouring, no alluvial deposits, no flows. Not a stream.
AE-905	Moist ground and dry pockets. No scoured channel, no alluvial deposits. Not a stream.

AE-906	No scouring >100m. No alluvial deposits. Moist ground with water tolerant vegetation lining mapped watercourse.
AE-908	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.
AE-909	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.
AE-910	Ponded water in a very small wetland. No scouring or flow detected. No inflow or outflow. Not a stream.
AE-912	No scouring, water, no alluvial deposits.
AP-001	Dry and vegetated draw down hillside. No sign of water or scoured channel.
AP-006	No channel, scouring, water, or alluvial deposits.
AP-901	Depressed area at edge of cutblock. No scoured channel.
AP-902	Slight depression in mature forest with mossy bed. No scoured channel.
AP-903	Dry and mossy drainage entering cutblock. No sign of scour or recent flow.

Appendix I.2 Summary table for classified streams along the preferred final alignment of the proposed roads

Summary of stream crossings for the final preferred alignment of the proposed roads

Site_ID	Class †	Gradient	Morphology	B_fW €	B_fD €	ResPool €	Species *	Habitat Quality ‡				Comments
								S	R	O	M	
AE-001	S3	1.5	Large Channel	3.9	0.77	0	NFC	P	G	G	G	Channel in wetland type; overgrown with willows
AE-002	S3	1	Large Channel	3.3	0.37	0	NS	P	G	G	G	Beaver dams have created ponding
AE-003	S2	3	Riffle-Pool	12.1	0.93	0.59	NS	G	G	G	G	Excellent overall habitat
AE-006	S6	4.5	Riffle-Pool	0.6	0.2	0.08	NS	N	N	N	N	Mainly dry channel. 140m d/s of road, channel dissipates into small vegetated wetland. No possible fish passage, no perennnial habitat upstream.
AE-007	S3	2.5	Riffle-Pool	2.6	0.55	0.12	RB,SPP	G	G	G	G	Excellent overall habitat
AE-010	S6	22	Cascade-pool	0.8	0.7	0.1	NFC	N	N	N	N	This data from 2002/03 classification. Only confirmation of gradient barrier in 2012.
AE-013	S4	9.3	Riffle-Pool	0.8	0.4	0.19	NFC	F	F	P	P	Downstream of crossing, channel has been degraded from harvesting. U/s is better, but hanging culvert restricts fish passage.
AE-014	S4	7.5	Riffle-Pool	0.8	0.36	0.1	RB, BMC	P	F	F	P	Dewatered in some sections
AE-019	S4	2.5	Riffle-Pool	0.9	0.26	0.09	RB	G	G	P	P	Small, shallow stream but good spawning habitat. Gradient barrier noted in 2002 survey, but fish obs during survey in 2012.
AE-020	S4	1.5	Large Channel	0.5	0.76	0	NFC	P	F	P	P	Upstream of crossing is NCD. D/s reach drains into small lake.
AE-021	S3	3.4	Riffle-Pool	2	0.45	0.16	LKC, WSU, RB, SPP	F	G	F	F	Gravel patches, but a lot of fines-limiting spawning habitat.
AE-022	S4	2.5	Riffle-Pool	1.1	0.56	0.27	NS	P	G	F	P	Upstream of road crossing is NCD in wetland. Downstream is S4.
AE-030	S2	2.5	Riffle-pool	7.5	0.67	0.57	RB	P	G	G	F	Heavily dammed, creating sediment build up and deep pools.
AE-035	S4	2	Riffle-pool	1.1	0.45	0	NS	F	F	P	P	Dry channel at this time.

AE-037	S2	1	Riffle-pool	6.6	1.07	0.61	RB	F	G	G	G	Numerous beaver dams upstream of crossing.
AE-044	S4	1	Riffle-pool	1	0.52	0.02	NFC	P	G	P	F	Runs through sedge wetland.
AE-049	S3	1	Riffle-pool	2.5	1.13	0.15	RB	F	G	F	F	Fish bearing S3 with sediment build up and pooling.
AE-053	S6	2.5	Riffle-pool	0.8	0.58	0.14	NS	N	N	N	N	Classed/sampled previously as non-fish bearing. This survey to confirm downstream barrier.
AE-055	S4	2.5	Riffle-pool	1.3	0.46	0.26	RB	P	G	F	F	Wetland type upstream of culvert ~30m
AE-056	S4	1.5	Large Channel	1.1	0.61	0	NFC	P	G	P	P	Heavy silt cover in places. Poor habitat value. Sections of dewatering.
AE-057	S3	3	Riffle-pool	2	1.1	0.14	RB	F	G	F	F	Downstream is a burned block. Channel and veg different.
AE-058	S6	3	Riffle-pool	0.5	ns	0.02	NFC	N	N	N	N	This data from 2005 classification. Only confirmation of channel and barrier in 2012.
AE-059	S3	4	Riffle-pool	1.9	0.62	0.51	RB	G	G	F	P	Nearly a cascade pool morphology, but more riffle. Lots of cover in this stream.
AE-061	S4	20	Riffle-pool	0.88	0.43	0.11	NS	P	F	P	P	Dry/intermittent channel with 40% gradient d/s of existing crossing.
AE-068	S2	4	Cascade-pool	5.8	0.75	0.26	RB	G	F	F	G	Nice stream but not a lot of rearing habitat - tribs are likely used for rearing .
AE-070	S4	2.5	Riffle-pool	1.2	0.42	0.16	RB	P	G	F	F	Very high flow in channel through burned area.
AE-071	S3	1.5	Riffle-pool	2.7	0.47	0.23	RB	G	G	F	F	Logged upstream of road, but stream is productive throughout reach.
AE-072	S4	2	Large-channel	1.2	0.22	0	NS	N	P	N	N	Shallow, muddy watercourse dry at time of survey. Cutblock altered hydrology. NCD upstream of crossing. Channel d/s at 10U 416771 5970527.
AE-073	S4	1	Large-channel	1	0.2	0	RB	N	G	P	P	Drainage is intermittently scoured and runs through WL upstream. More NCD than a stream, but fish were obs in res.pools.
AE-074	S4	5.5	Large-channel	0.9	0.33	0.03	NFC	N	F	P	P	Shallow, muddy channel nearly dry at time of survey. Poor overall habitat, but no apparent barriers to fish-bearing waters d/s.
AE-075	S3	3.5	Riffle-pool	1.9	0.5	0.19	RB, SPP	P	G	F	G	Survey conducted d/s of crossing - private property upstream.
AE-076	S3	2.5	Riffle-pool	1.5	0.68	0.02	RB, SPP	F	G	P	P	Borderline S3/S4, additional channel measurements taken. Av. W= 1.52m. Almost entirely dewatered at time of survey.
AE-907	S3	2	Riffle-pool	4.2	0.92	0.12	RB	G	G	P	G	Good overall habitat.

AE-911	S4	3	Riffle-pool	1	0.27	0.09	NS	P	G	P	P	Mossy bottom with low flow. Too shallow to sample for fish. Surveyed at 10U 407944 5938577
AE-913	S4	2	Riffle-pool	1.1	0.69	0.03	RB	G	G	P	P	Gravel patches for spawning.
AP-004	S2	1.5	Riffle-pool	6.5	0.46	0.35	NS	G	G	G	G	Excellent habitat. Use historical data for fish distributions
AP-005	S4	6.3	Riffle-pool	1.2	0.37	0.15	RB, SPP	F	G	F	G	Sandy substrate u/s of crossing may be due to adjacent cutblock. Gravel/cobble d/s.
AP-007	S3	1.5	Riffle-pool	3.2	.76	0.35	NS	F	G	G	G	Unidentified fish obs. during survey. See 2011 Ecofor for full fish data.
AP-905	S4	1.5	Riffle-pool	1.45	0.5	0.13	RB	P	F	F	F	S3 stream with fair fish habitat. 250mm fish seen.

***- Species codes: NFC= No Fish Caught; SPP= Unidentified Species; NS= Not Sampled; RB= Rainbow trout; LKC =Lake Chub; BMC Brassy minnow; WSU: White sucker**

†- Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage, NVC = no visible channel, NPC = no previous classification information was available.

‡- Habitat refers to a qualitative assessment of fish habitat based on four different types of fish habitat. S = spawning habitat; R = rearing; O = overwintering; and M = migrating. Each habitat type within each site was given a rating for habitat quality: N = nil; P = poor; F = fair; G = good; and E = excellent. These ratings were assessed based on the professional judgement of the field assessors.

€- BfW= Bankfull width; Bfd= Bankfull depth; ResPool=Residual Pool.

Appendix J – Fish Sampling Summary for Preferred Final Alignment

Fish Sampling Summary for Preferred Final Alignment

Site ID	Sp1	Sp1 stage	Sp1 count	Sp1 minL (mm)	Sp1 maxL (mm)	Sp2	Sp2 stage	Sp2 count	Sp2 minL (mm)	Sp2 maxL (mm)	MT set time	CPUE (MT)	EF sec.	CPUE (EF)	Comments
AE-001	NFC										21h 45m	0	322	0	Possibility of escapees because of dense vegetation in channel.
AE-007	RB	J	40	25	130	SPP	J	10	30	65	21h 30m	0.047	1020	0.047	SPP are escapees and their sizes are estimates
AE-013	NFC										26h	0	78	0	EF and trapped in shallow pools upstream and downstream of culvert.
AE-014	BMC	A	30	35	78	RB	J	8	25	57	19h 15m	0.485	170	0.094	BMC caught u/s and d/s of culvert; RB caught only d/s.
AE-019	RB	J	2	60	60						19h 10m	0	212	0.009	Two rainbow trout escapees during electrofishing. Fork length estimated.
AE-020	NFC										22h	0	164	0	Fished 100m d/s of crossing close to small lake.
AE-021	LKC	J	11	21	94	RB	J	2	74	74	22h	0.341	N/A	0	All caught in traps. Other spp include one white sucker and one unidentifed escapee.
AE-022	NFC										19h 15m	0	61	0	EF and trapped in shallow pools upstream and downstream of culvert.
AE-030	RB	J	25	44	44						0	0	659	0.038	Difficult to fish beaver ponds - 24 fish were escapees during EF.
AE-037	RB	A, J	41	37	220						18h 55m	0.026	525	0.076	Most fish found d/s of beaver dams.
AE-043	NFC										N/A	N/A	N/A	N/A	70m of scoured channel flowing from shallow wetland. Stream dissipates d/s. Sampled for possible resident popn. NFC
AE-044	NFC										23h 15m	0	225	0	Dark water, may have been escapees.
AE-049	RB	J,A	113	27	136						17h 30m	0.057	523	0.212	A lot of overhanging veg and LWD, may have facilitated escapees
AE-055	RB	A	7	98	185						20h 50m	0	208	0.034	All adult fish. Caught EF only. No fish in traps.

AE-056	NFC										23h	0	255	0	Dense overhanging veg-increased risk of escapees.
AE-057	RB	J	24	32	100	SPP		15			16h 50m	0.03	256	0.098	One in MT, the remainder caught EF. Count includes 15 unidentified escapees.
AE-059	RB	J	30	29	73						19h 15m	0.026	289	0.1	Most caught with EF.
AE-060	NFC										0	0	126	0	NCD with 4-8m pooled of water. Next ordered stream is fish-bearing, but 600m away. No evidence of fish presence here.
AE-068	RB	J,A	18	100	160						N/A	N/A	784	0.022	Adults caught with EF, but juveniles escaped.
AE-070	RB	J	9	40	100						23h	0.087	259	0.019	Excessive blowdown may have facilitated escapees.
AE-071	RB	J	55	25	130						24h	0.083	254	0.201	Fish captured both upstream and downstream of culvert. Only 50m sampled.
AE-073	RB	J	4	35	100						24h	0	65	0.062	1 fish caught EF short channel u/s of culvert (25m). Remaining in residual pools in NCD-like section u/s.
AE-074	NFC										0	0	98	0	Too shallow for minnow traps. Nothing caught with EF. Entire sample taken d/s of crossing - WL upstream.
AE-075	RB	J	2	34	140	SPP	J	7	30	55	21h 15m	0	470	0.013	7 escapees could not be positively identified. Lengths are estimated. NFC in minnow traps.
AE-076	RB	J	53	28	55	SPP	J	2	ns	ns	0	0	43	1.279	All fish stranded in residual pools. Many more present than recorded, but only subsample was captured for representative ID/ measurement.
AE-907	RB	J, A	143	35	118						N/A	N/A	467	0.302	49 Escapees noted in the count.
AE-911	NFC										17h	0	80	0	Low flows, but stream is directly connected to fish bearing stream.
AE-913	RB	J	5	41	81						23h	0.043	255	0.012	High density of overhanging veg may have affected sampling success.
AP-005	RB	J	7	48	125	SPP	J	5			20h 45m	0.072	186	0.048	5 Escapees could not be positively identified
AP-905	RB	A	1	150	150						21h 10m	0	646	0.002	One escapee during electrofishing. Fork length estimated

MR-003	NFC		0				0	0	74	0	Moderate fish habitat. Very thick overhanging veg makes electrofishing very difficult due to limited visibility.
MR-004	NFC		0				0	0	59	0	Intermittently dry channel with little habitat to sample from.
MR-010	RB	J	1	110	110		0	0	149	0.007	Good overall fish habitat. Only 1 fish caught because presence absence for TL sites. SWD prevented capture of fish following electrshocking.
TL-961	SPP						0	0	0	0	Visual observation of unidentified fish, Fork Length est. 30-50mm
TL-962	NFC		0				0	0	106	0	Several barriers noted on this year's and previous surveys. No fish caught in either survey.
TL-975	SPP						0	0	56	0	Visual observation of unidentified fish (4). Fork length estimated at 20mm.
TL-980	NFC		0				18h 15m	0	205	0	No fish caught during survey. None caught during 2002 survey either. No known barriers from either survey.
TL-1006	NFC		0				22h 30m	0	432	0	although no fish caught during survey, there is historical data for fish presence.
TL-1007	SPP						0	0	0	0	visual observation of unidentified fish. Fork length est at 50-100mm.
TL-1010	NFC		0				22h 20m	0	145	0	low water stage and abundance of overhanging veg made it quite difficult to efficiently fish.
TL-1011	NFC		0				0	0	113	0	low water stage and abundance of overhanging veg made it quite difficult to efficiently fish.
TL-1021	SPP						0	0	0	0	Visual observation of fish to confirm fish bearing status.
TL-1024	SPP						0	0	0	0	Visual observation of fish to confirm fish bearing status.
TL-1025	RB	J	4	50	110		0	0	42	0.095	High conductivity required EF to be set at low voltage. 4 escapees.
TL-1026	NFC		0				0	0	126	0	Low flows prevented minnow trapping and no fish were caught via electrofishing.

TL-1029	RB	J	10		0	0	0	0	Fish observed in resting pools throughout survey.
TL-1030	NFC		0		20h 15m	0	478	0	woody debris jams and pools characterize this stream. Sampling efficiency not very high on this one.
TL-1036	NFC		0		20h 14m	0	782	0	Both minnow trapping and electrofishing yielded no fish caught.
TL-1042	NFC		0		0	0	380	0	Very thick shrub layer lowered sampling efficiency greatly. Numerous debris jams (~30cm high) would impede fish migration.
TL-1043	NFC		0		0	0	355	0	Very thick shrub layer lowered sampling efficiency greatly. Numerous debris jams (~30cm high) would impede fish migration.
TL-1046	NFC		0		22h 27m	0	592	0	Numerous debris jams and overhanging veg lowered sampling efficiency. Downstream reaches have been documented as fish bearing.
TL-1050	NFC		0		0	0	269	0	Numerous debris jams and overhanging veg lowered sampling efficiency. Downstream reaches have been documented as fish bearing.
TL-1052	NFC		0		0	0	321	0	Dry downstream. Poor fish habitat.
TL-1063	NFC		0		0	0	214	0	Marginal fish habitat with lots of overhanging vegetation which decreased sampling efficiency.
TL-1064	SPP				0	0	0	0	Visual observation to confirm fish bearing status.
AA-002	SPP				19h 40m	0	216	0.005	one esacpee during EF.

Sp1 and Sp2 columns give the species identification of fish caught based on the following code system: NFC = no fish caught; RB = Rainbow trout (Oncorhynchus mykiss); BMC = Brassy minnow (*Hybognathus hankinsoni*); LKC = Lake chub (*Couesius plumbeus*); WSU = White sucker (*Catastomus commersoni*); SPP = unidentified species. Stage refers to lifestage of fish caught: J = Juvenile; A = Adult. MinL and MaxL refer to the minimum and maximum fork lengths in mm. MT hours/min refers to the length of time that minnow traps were set at the sample site. EF sec refers to the number of seconds that the electrofisher was in operation during the sample. CPUE = Catch Per Unit Effort, and is calculated by dividing the number of fish caught by the duration of sampling in seconds for electrofishing and in hours for minnow trapping. The CPUE values for electrofishing and minnow trapping were kept separate because these sample methods have different catch efficiencies and therefore would give biased values were they to be combined.

Appendix K – NWPA Minor Waters Assessment for the Preferred Final Alignment

NWPA Minor Waters Assessment for the Preferred Final Alignment

Site ID	UTM Easting	UTM Norhing	Name	Mean BfW (m)	Mean BfD (m)	Mean Gradient (%)	Sinuosity	Blockages	Minor waters?
AA-002	378594	5904942	Unnamed	1.12	0.57	3.5	ns	ns	Yes
AE-001	382926	5908533	Unnamed	3.9	0.77	1.5	1.09	4	No
AE-002	383295	5908709	Turtle Creek	3.3	0.37	1	1.14	4	No
AE-003	383943	5909410	Chedakuz Creek	12.1	0.93	3	1.1	0	No
AE-006	386131	5909447	Unnamed	0.6	0.2	4.5	ns	ns	Yes
AE-007	387959	5910160	Unnamed	2.6	0.55	2.5	1.27	5	Yes
AE-010	393225	5911777	Unnamed	0.8	0.7	22	ns	ns	Yes
AE-013	395715	5911590	Unnamed	0.8	0.4	9.3	ns	ns	Yes
AE-014	398443	5911423	Unnamed	0.8	0.36	7.5	ns	ns	Yes
AE-019	399713	5914676	Unnamed	0.9	0.26	2.5	ns	ns	Yes
AE-020	399388	5915170	Unnamed	0.5	0.76	1.5	ns	ns	Yes
AE-021	398607	5916799	Unnamed	2	0.45	3.4	1.31	16	Yes
AE-022	398318	5922495	Unnamed	1.1	0.56	2.5	ns	ns	Yes
AE-030	398735	5927483	Big Bend Creek	7.5	0.67	2.5	1.65	14	No
AE-035	396138	5930775	Unnamed	1.1	0.45	2	ns	ns	Yes
AE-037	394928	5932548	Big Bend Creek	6.6	1.07	1	2	6	No
AE-044	401200	5937370	Finger Creek	1	0.52	1	ns	ns	Yes
AE-049	409226	5941021	Cabin Creek	2.47	1.13	1	ns	4	Yes
AE-053	409648	5942978	Unnamed	0.8	0.58	2.5	ns	ns	Yes
AE-055	409828	5945915	Unnamed	1.3	0.46	2.5	ns	4	Yes
AE-056	410190	5946427	Unnamed	1.12	0.61	1.5	ns	0	Yes
AE-057	411427	5947301	Unnamed	2	1.1	3	ns	2	No
AE-058	411598	5947974	Unnamed	0.5	ns	3	ns	ns	Yes
AE-059	411520	5948874	Unnamed	1.9	0.62	4	ns	3	Yes
AE-061	411449	5951023	Unnamed	0.9	0.43	20	ns	ns	Yes
AE-068	412429	5962525	Unnamed	5.8	0.75	4	1.33	4	No
AE-070	415179	5967852	Unnamed	1.2	0.42	2.5	ns	ns	Yes
AE-071	415339	5968546	Unnamed	2.7	0.47	1.5	ns	4	Yes
AE-072	416768	5970625	Unnamed	1.2	0.22	2	ns	ns	Yes
AE-073	416787	5971489	Unnamed	1	0.2	1	ns	ns	Yes
AE-074	416790	5971776	Unnamed	0.9	0.33	5.5	ns	ns	Yes
AE-075	416805	5973117	Stony Creek	1.9	0.5	3.5	1.31	5	Yes
AE-076	416816	5973555	North Stony Creek	1.5	0.68	2.5	1.23	4	Yes
AE-907	406843	5938277	Unnamed	4.2	0.92	2	1.02	5	No
AE-911	407960	5938545	Unnamed	1	0.27	3	ns	ns	Yes
AE-913	409155	5940327	Unnamed	1.1	1	2	ns	ns	Yes
AP-004	378962	5900138	Davidson Creek	6.5	0.46	1.5	1.27	3	No
AP-005	379062	5901517	Unnamed	1.2	0.33	6.3	1.12	3	Yes
AP-007	378796	5905952	Turtle Creek	3.2	0.76	1.5	1.64	0	No
AP-905	378803	5896992	Unnamed	1.93	0.5	1.5	ns	ns	Yes
MR-002	380214	5910902	Unnamed	12	0.7	3	ns	0	No
MR-003	380847	5911485	Unnamed	0.6	0.37	1.5	ns	ns	Yes

MR-004	383344	5911565	Unnamed	0.82	0.4	2.5	ns	ns	Yes
MR-010	387848	5913537	Unnamed	2.38	0.53	1.5	ns	8	Yes
SR-004	371311	5990541	Unnamed	1.02	0.43	9	ns	ns	Yes
SR-009	369044	5993214	Unnamed	1.8	0.72	3	ns	ns	No
TL-004	378937	5900138	Davidson Creek	6.5	0.46	1.5	1.27	3	No
TL-023	395861	5920724	Esker Creek	2.3	0.5	3	ns	ns	Yes
TL-025	397313	5922083	Big Bend Creek	4.2	0.46	2	1.05	5	No
TL-026	398231	5922544	Unnamed	1.1	0.56	2.5	ns	ns	Yes
TL-048	388007	5940053	Unnamed	1.23	0.70	3	ns	ns	Yes
TL-054	391997	5946283	Swanson Creek	3.4	0.57	4	ns	ns	No
TL-067	397350	5956570	Unnamed	0.9	0.43	2.5	ns	ns	Yes
TL-1006	391796	5963829	Unnamed	1.3	0.4	4	ns	ns	Yes
TL-1007	391653	5964199	Unnamed	1.01	0.62	2.5	ns	ns	Yes
TL-1010	390839	5966319	Unnamed	1.05	0.43	2.5	ns	ns	Yes
TL-1011	390777	5966480	Unnamed	0.73	2.67	1.5	ns	ns	Yes
TL-1021	390749	5970935	Tahultzu Creek	6.5	0.6	2	ns	1	No
TL-1024	388040	5973563	Unnamed	2.09	0.33	0.5	ns	ns	Yes
TL-1025	387563	5974040	Fifteen Creek	3	0.47	2.5	ns	39	Yes
TL-1026	387073	5975092	Unnamed	1.32	0.47	5.5	ns	ns	Yes
TL-1029	386473	5976842	Smith Creek	3.4	0.6	4.5	1.18	28	No
TL-1030	386285	5978055	Unnamed	1.7	0.2	1.5	ns	ns	Yes
TL-1036	383813	5983240	Unnamed	1.27	0.47	1.5	ns	ns	Yes
TL-1042	380453	5985380	Unnamed	1.48	0.53	3.5	ns	ns	Yes
TL-1043	379624	5985810	Unnamed	1.15	0.4	5	ns	ns	Yes
TL-1046	378903	5985641	Unnamed	1.97	0.87	6	ns	ns	Yes
TL-1050	376524	5985138	Unnamed	0.88	0.37	7.5	ns	ns	Yes
TL-1052	370180	5990459	Unnamed	1.02	0.43	9	ns	ns	Yes
TL-1057	382716	5908851	Unnamed	3.9	0.77	1.5	1.09	4	No
TL-1058	383308	5909163	Unnamed	3.3	0.37	1	1.14	4	No
TL-1059	388913	5942791	Unnamed	2.33	0.64	2.5	ns	ns	No
TL-1063	397148	5960394	Unnamed	0.79	0.4	3.5	ns	ns	Yes
TL-1064	396245	5962001	Greer Creek	12.52	1.3	2.5	ns	3	No
TL-1066	393456	5962121	Unnamed	0.67	0.37	6.5	ns	ns	Yes
TL-1067	393189	5962178	Unnamed	0.67	0.37	6.5	ns	ns	Yes
TL-1077	368859	5992869	Unnamed	1.8	0.72	3	ns	ns	No
TL-1078	383923	5909432	Chedakuz Creek	12.1	0.93	3	1.1	0	No
TL-1081	386128	5909498	Unnamed	0.6	0.2	4.5	ns	ns	Yes
TL-112	376172	5985287	Unnamed	1.7	0.53	5	ns	ns	Yes
TL-121	371105	5989335	Unnamed	1	1	26	ns	ns	Yes
TL-917	387970	5909923	Unnamed	2.6	0.55	2.5	1.27	5	Yes
TL-951	378341	5895698	Unnamed	1.7	0.62	1	ns	ns	No
TL-951.1	378320	5895665	Unnamed	1.7	0.62	1	ns	ns	No
TL-952	378494	5896661	Unnamed	1.6	0.45	3.8	1.05	3	Yes
TL-955	379135	5901580	Unnamed	1.2	0.33	6.3	1.12	3	Yes
TL-958	379037	5906127	Unnamed	3.2	0.76	1.5	1.64	0	No
TL-961	389758	5912997	Unnamed	1.95	0.43	2.5	ns	ns	Yes
TL-962	390329	5913918	Unnamed	0.95	0.4	6.5	ns	ns	Yes
TL-969	397906	5927089	Big Bend Creek	7.5	0.5	2.5	ns	9	No

TL-970	395992	5930875	Unnamed	1.1	0.45	2	ns	ns	Yes
TL-973	393887	5933122	Big Bend Creek	5.7	0.78	1.5	1.7	12	No
TL-975	393243	5934743	Unnamed	2.82	0.6	2	ns	8	Yes
TL-977	391072	5937188	Unnamed	1.12	0.37	12.5	ns	ns	Yes
TL-980	390160	5937755	Unnamed	0.81	0.27	2.5	ns	ns	Yes
TL-985	393221	5948783	Unnamed	1.53	0.54	3.3	ns	ns	Yes
TL-989	394526	5952170	Unnamed	1.8	0.57	2.5	ns	ns	Yes
TL-992	394812	5953129	Unnamed	1.2	0.37	1.5	ns	ns	Yes

APPENDIX L – POTENTIAL FISH BEARING STATUS OF STREAM CROSSINGS FOR THE 2013 SAMPLE

Potential for fish-bearing status of the mapped drainages at locations crossed by project infrastructure and classifications from 2002-2006. Where no fish information is given, no observations were recorded in any reach upstream of the site, in the next downstream reach, or if reach 1, in the next ordered stream.

Site ID	Map interpreted potential for fish-bearing status of crossed drainages	Prev. classification†	Year prev. classed
AA-001	tributary to fish-bearing Turtle Creek	NVC	2004
AA-002	tributary to fish-bearing Turtle Creek	S4	2004
AA-003	tributary to fish-bearing Turtle Creek	NCD	2004
AE-901	unidentified spp obs in next ordered stream	NPC	
AE-902	unidentified spp obs in next ordered stream	NPC	
AE-903	unidentified spp obs in next ordered stream	NPC	
AE-904	unidentified spp obs in next ordered stream	NPC	
AE-905	unidentified spp obs in small lake downstream	NPC	
AE-906	unidentified spp obs in small lake downstream	NPC	
AE-908	No fish obs.	NPC	
AE-909	No fish obs.	NPC	
AE-910	No fish obs.	NPC	
AP-905	unidentified spp obs downstream near confluence	S3	2006
MR-001	tributary to fish-bearing stream	S4	2006
MR-002	rainbow trout and kokanee obs. historically throughout stream.	S2	2006
MR-003	tributary to fish-bearing Chedakuz Creek	NCD	2002
MR-004	tributary to fish-bearing Chedakuz Creek	NPC	
MR-006	tributary to fish-bearing stream	NPC	
MR-007	tributary to fish-bearing stream	NPC	
MR-008	tributary to fish-bearing stream	NPC	
MR-009	tributary to fish-bearing stream	NPC	
MR-010	rainbow trout obs.	S3	2002
SR-001	direct tributary to Stellako River	NPC	
SR-002	direct tributary to Stellako River	NPC	
SR-003	Stellako River. Known fish bearing incl salmon.	NPC	
SR-004	direct tributary to Stellako River	NPC	
SR-005	tributary to fish-bearing stream	NPC	
SR-006	tributary to fish-bearing stream	NPC	
TL-116	tributary to fish bearing stream	NPC	
TL-117	tributary to fish bearing stream	NPC	
TL-961	unidentified spp obs in upstream reaches	S3	2002
TL-962	no fish obs.	S6	2002
TL-963	tributary to fish-bearing stream	S6	2003

TL-964	tributary to fish-bearing stream	S6	2003
TL-972	tributary to fish-bearing stream	NPC	
TL-974	tributary to fish-bearing stream	NPC	
TL-975	fish obs in upstream tributaries	NPC	
TL-976	direct trbutary to fish-bearing stream	NPC	
TL-980	no fish obs.	S4	2002
TL-983	no fish obs.	NPC	
TL-986	tributary to fish bearing stream	NPC	
TL-987	tributary to fish-bearing stream	NPC	
TL-990	tributary to fish-bearing stream	NPC	
TL-991	unidentified spp obs in next ordered stream	NPC	
TL-993	no fish obs.	NPC	
TL-994	no fish obs.	NPC	
TL-995	unidentified spp obs d/s in next ordered stream	NPC	
TL-996	unidentified spp obs d/s in next ordered stream	NPC	
TL-1003	no fish obs.	NPC	
TL-1005	no fish obs.	NPC	
TL-1006	tributary to Nechako River	NPC	
TL-1007	tributary to Nechako River	NPC	
TL-1008	direct tributary to Nechako River	NPC	
TL-1009	no fish obs.	NPC	
TL-1010	no fish obs.	NPC	
TL-1011	no fish obs.	NPC	
TL-1012	no fish obs.	NPC	
TL-1013	no fish obs.	NPC	
TL-1014	no fish obs.	NPC	
TL-1015	no fish obs.	NPC	
TL-1016	no fish obs.	NPC	
TL-1017	no fish obs.	NPC	
TL-1018	no fish obs.	NPC	
TL-1019	no fish obs.	NPC	
TL-1021	unidentified fish obs. d/s in lake.	NPC	
TL-1022	tributary to fish bearing lake	NPC	
TL-1023	tributary to fish-bearing Fifteen Creek	NPC	
TL-1024	tributary to fish-bearing Fifteen Creek	NPC	
TL-1025	known fish-bearing Fifteen Creek	NPC	
TL-1026	tributary to fish-bearing Fifteen Creek	NPC	
TL-1028	tributary to fish-bearing Smith Creek	NPC	
TL-1029	tributary to fish-bearing Smith Creek	NPC	
TL-1030	rainbow trout obs in Smith Creek	NPC	
TL-1031	no fish obs.	NPC	
TL-1034	no fish obs.	NPC	

TL-1035	no fish obs.	NPC
TL-1036	no fish obs.	NPC
TL-1037	no fish obs.	NPC
TL-1040	no fish obs.	NPC
TL-1041	no fish obs.	NPC
TL-1042	no fish obs.	NPC
TL-1043	no fish obs.	NPC
TL-1046	no fish obs.	NPC
TL-1047	no fish obs.	NPC
TL-1048	no fish obs.	NPC
TL-1049	no fish obs.	NPC
TL-1050	unidentified spp obs upstream	NPC
TL-1052	direct tributary to Stellako River	NPC
TL-1053	no fish obs.	NPC
TL-1060	no fish obs.	NPC
TL-1061	tributary to fish-bearing stream	NPC
TL-1062	unidentified spp obs d/s in next ordered stream	NPC
TL-1063	unidentified spp obs d/s in next ordered stream	NPC
TL-1064	known fish-bearing Greer Creek	NPC
TL-1065	Nechako River known fish-bearing incl salmon	NPC
TL-1066	direct tributary to Nechako River	NPC
TL-1067	tributary to Nechako River	NPC
TL-1068	direct tributary to Nechako River	NPC
TL-1069	tributary to NechakoRiver	NPC
TL-1070	tributary to NechakoRiver	NPC
TL-1071	tributary to NechakoRiver	NPC
TL-1072	tributary to fish-bearing Dorman Lake	NPC
TL-1073	tributary to fish-bearing Fifteen Creek	NPC
TL-1074	no fish obs.	NPC
TL-1075	no fish obs.	NPC

†Fish streams are classified S1–S4. Class S1 streams are > 20 m wide; S2 streams are > 5 - 20 m wide; S3 streams are 1.5 - 5 m wide; and S4 streams are < 1.5 m wide. Streams without fish are classified S5 or S6. Class S5 streams are > 3 m wide, and S6 streams are < 3 m wide. NCD = non-classified drainage, NVC = no visible channel, NPC = no previous classification information was available.

Annex 5.10-1
Small-scale (1:5,720) Littoral Habitat Maps of Tatelkuz Lake

5908500 386000 5908000 386500 5907500 387000

385500 5908500 385000 5908000

5907000 387000 5906500 386500

N

Chedakuz Creek

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

385000 385500 386000

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

CLIENT

newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

amec

ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

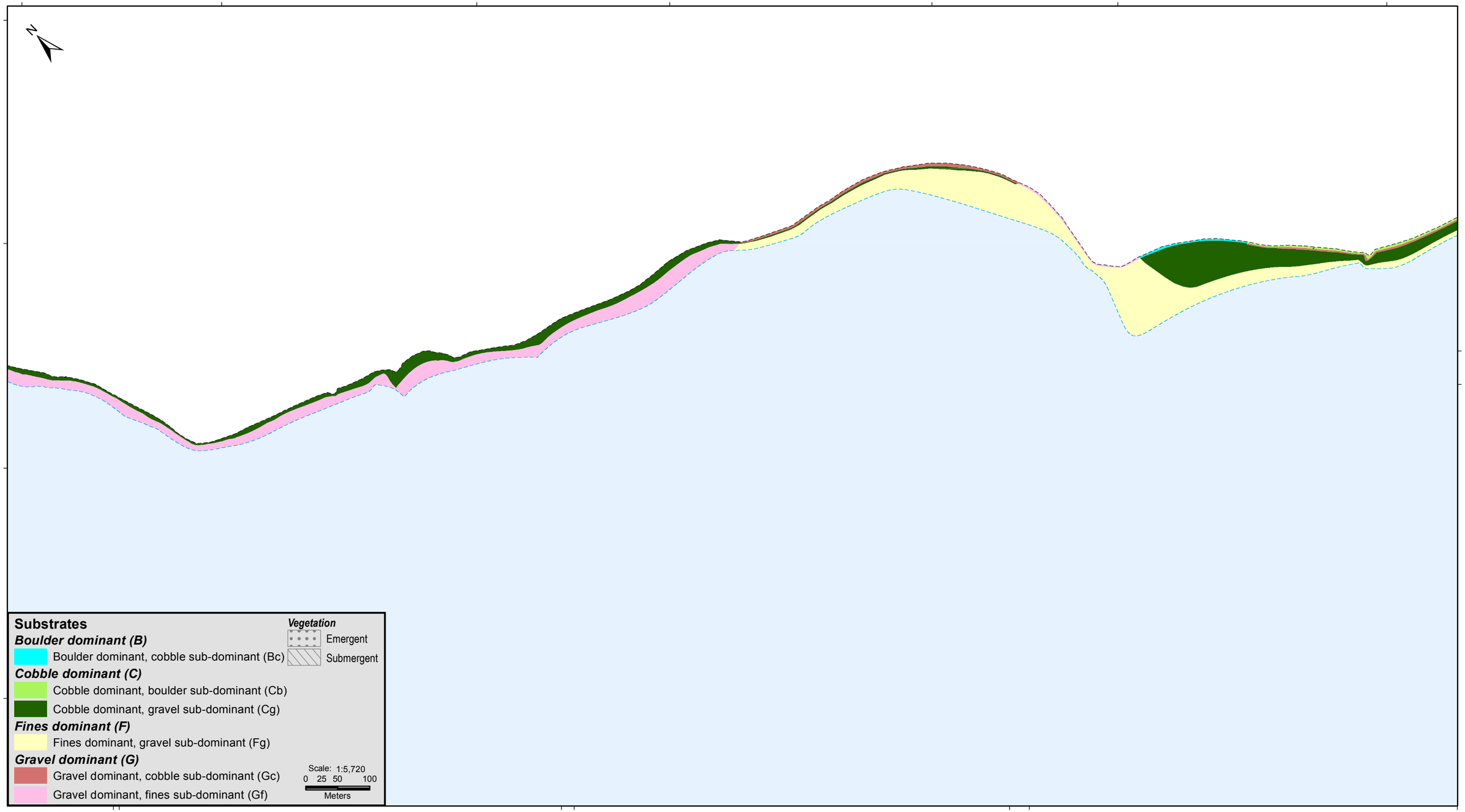
FIGURE NO:

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5908000 386500 5907500 387000 5907000 387500 5906500

5906000 386000 5907500 385500

N



Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

5906000 387500

385500 386000 386500 387000

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

CLIENT

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amec

ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT

Blackwater Gold Project

TITLE

Tatelkuz Lake Littoral Habitat

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO:

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

387000 5907000 387500 5906500 388000 5906000 388500

N

5907000 386500 5906500 387000 5905500 387500 5905000 388500 5905500 388000 5905000

Substrates

Boulder dominant (B)

- Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

- Cobble dominant, boulder sub-dominant (Cb)
- Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

- Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

- Gravel dominant, cobble sub-dominant (Gc)
- Gravel dominant, fines sub-dominant (Gf)

Vegetation

- Emergent
- Submergent

Scale: 1:5,720
0 25 50 100
Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

- Maximum lake elevation (927.6masl)
- Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

CLIENT: newgold

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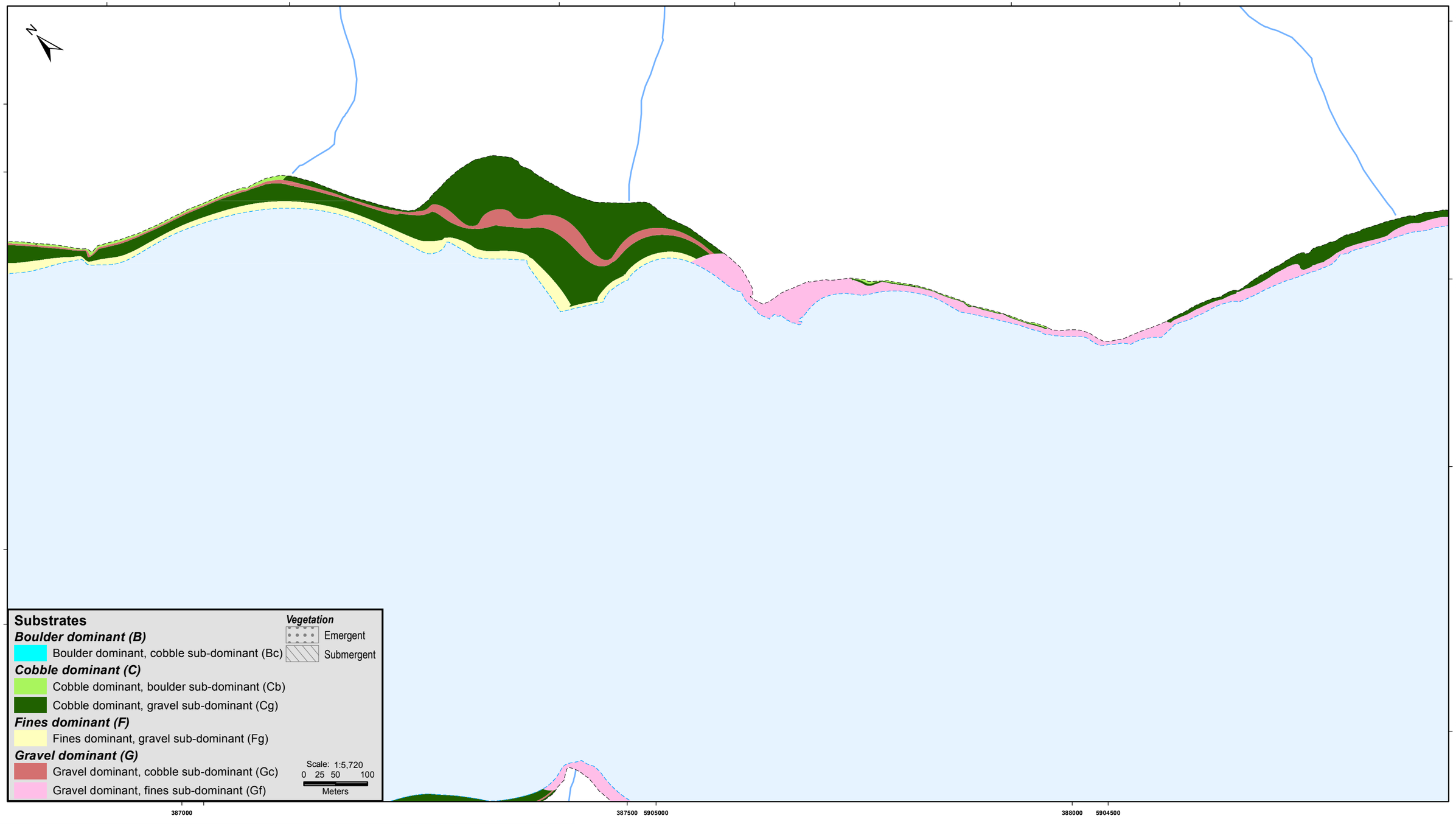
amec

ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	



Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

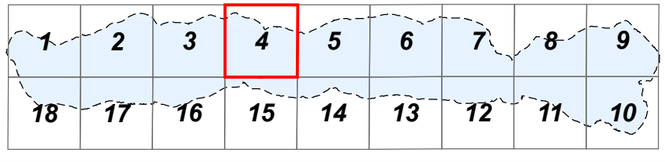
Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters



Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

CLIENT: newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

amec

ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

388500 5905500 389000 5905000 389500 5904500 390000

390000 5904000 389500 5903500

388000 5904500 388500 5904000 389000 5903500 5905000

N

Substrates

Boulder dominant (B)

- Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

- Cobble dominant, boulder sub-dominant (Cb)
- Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

- Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

- Gravel dominant, cobble sub-dominant (Gc)
- Gravel dominant, fines sub-dominant (Gf)

Vegetation

- Emergent
- Submergent

Scale: 1:5,720
0 25 50 100
Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

- Maximum lake elevation (927.6masl)
- Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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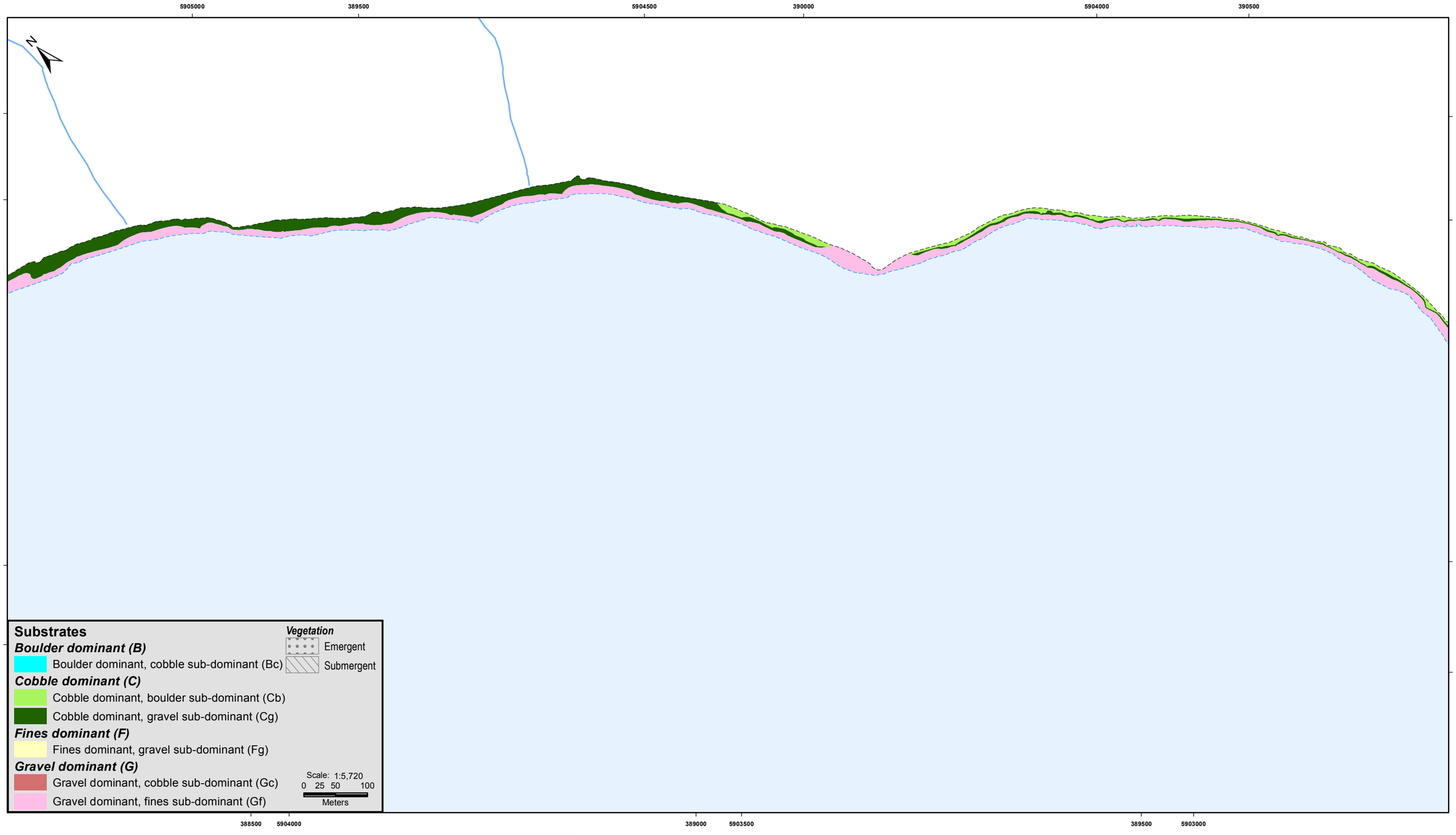
ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

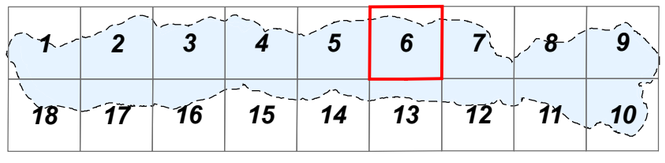
PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd





Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT

Blackwater Gold Project

TITLE

Tatelkuz Lake Littoral Habitat

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

5904500 390000 5904000 390500 5903500 391000 5903000

N

5904500
389500
5904000
389000

391000 5902500

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

389000 5903500 389500 5903000 390000 5902500 390500

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquaticsBaseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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amec

ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO:

5903500 391000 5903000 391500 5902500 392000

390500 392000 390000 5902000 5903500 391500 5903000 5901500 390000 5902500 390500 5902000 391000 5901500

N

Substrates

Boulder dominant (B)

- Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

- Cobble dominant, boulder sub-dominant (Cb)
- Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

- Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

- Gravel dominant, cobble sub-dominant (Gc)
- Gravel dominant, fines sub-dominant (Gf)

Vegetation

- Emergent
- Submergent

Scale: 1:5,720
0 25 50 100
Meters

1 2 3 4 5 6 7 8 9
18 17 16 15 14 13 12 11 10

- Maximum lake elevation (927.6masl)
- Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

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ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

5903000 391500 5902500 392000 5902000 392500

N

5903000
391000
5902500
390500

5901500
392500
5901000
392000

390500 5902000 391000 5901500 391500 5901000

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_Tatelkuz\LakeBathymetry_v3.mxd

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amec

ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

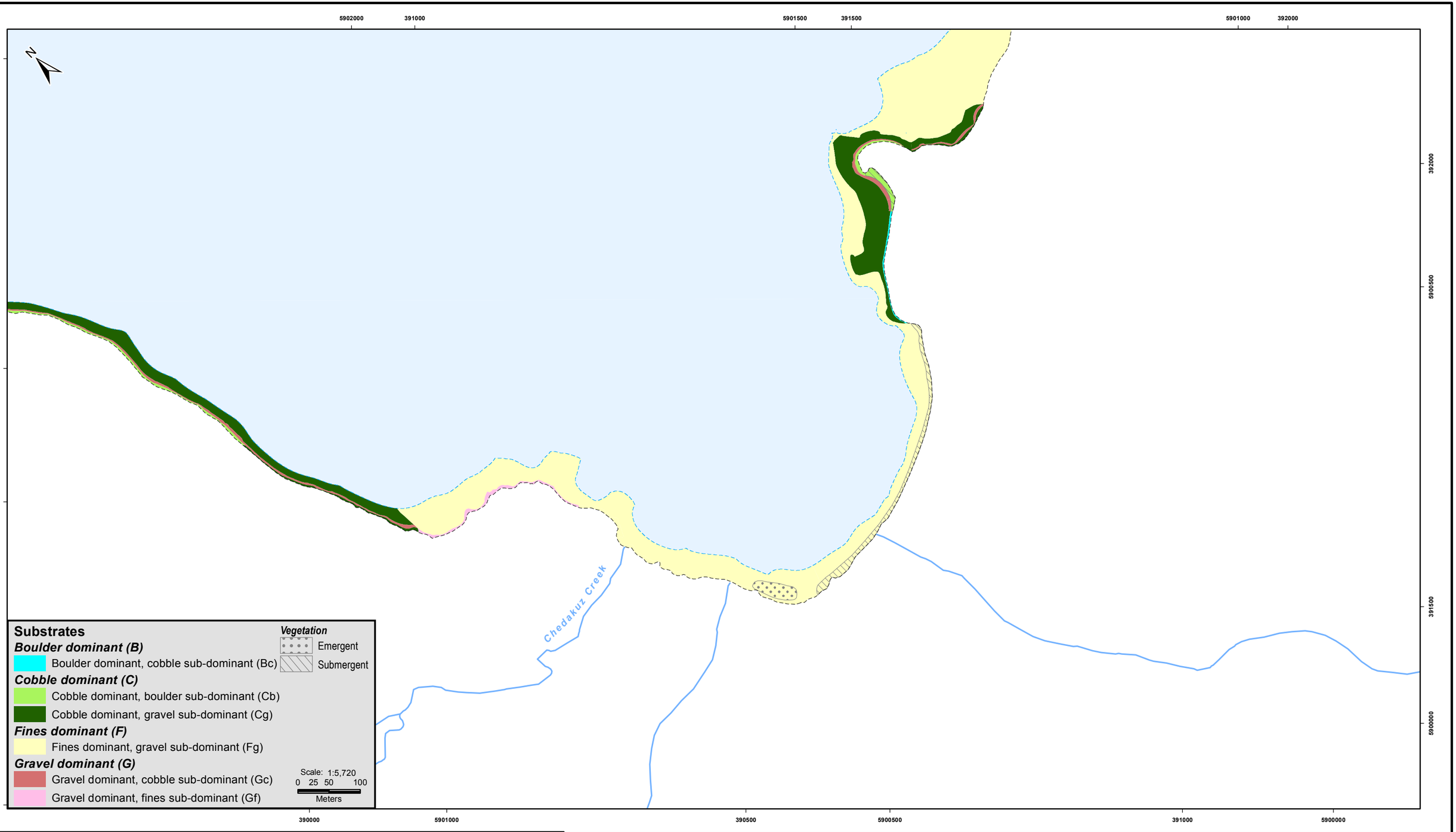
PROJECT

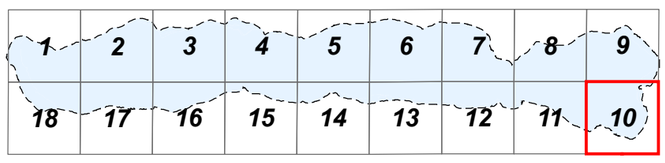
Blackwater Gold Project

TITLE

Tatelkuz Lake Littoral Habitat

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	





Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

CLIENT: newgold

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ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

5903000 390000 5902500 390500 5902000 391000 5901500

N

5903000 389500 5902500 389000

391000 5901000

Chedakuz Creek

Substrates

Boulder dominant (B)
- Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)
- Cobble dominant, boulder sub-dominant (Cb)
- Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)
- Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)
- Gravel dominant, cobble sub-dominant (Gc)
- Gravel dominant, fines sub-dominant (Gf)

Vegetation
- Emergent
- Submergent

Scale: 1:5,720
0 25 50 100
Meters

389000 5902000 389500 5901500 390000 5901000 390500

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

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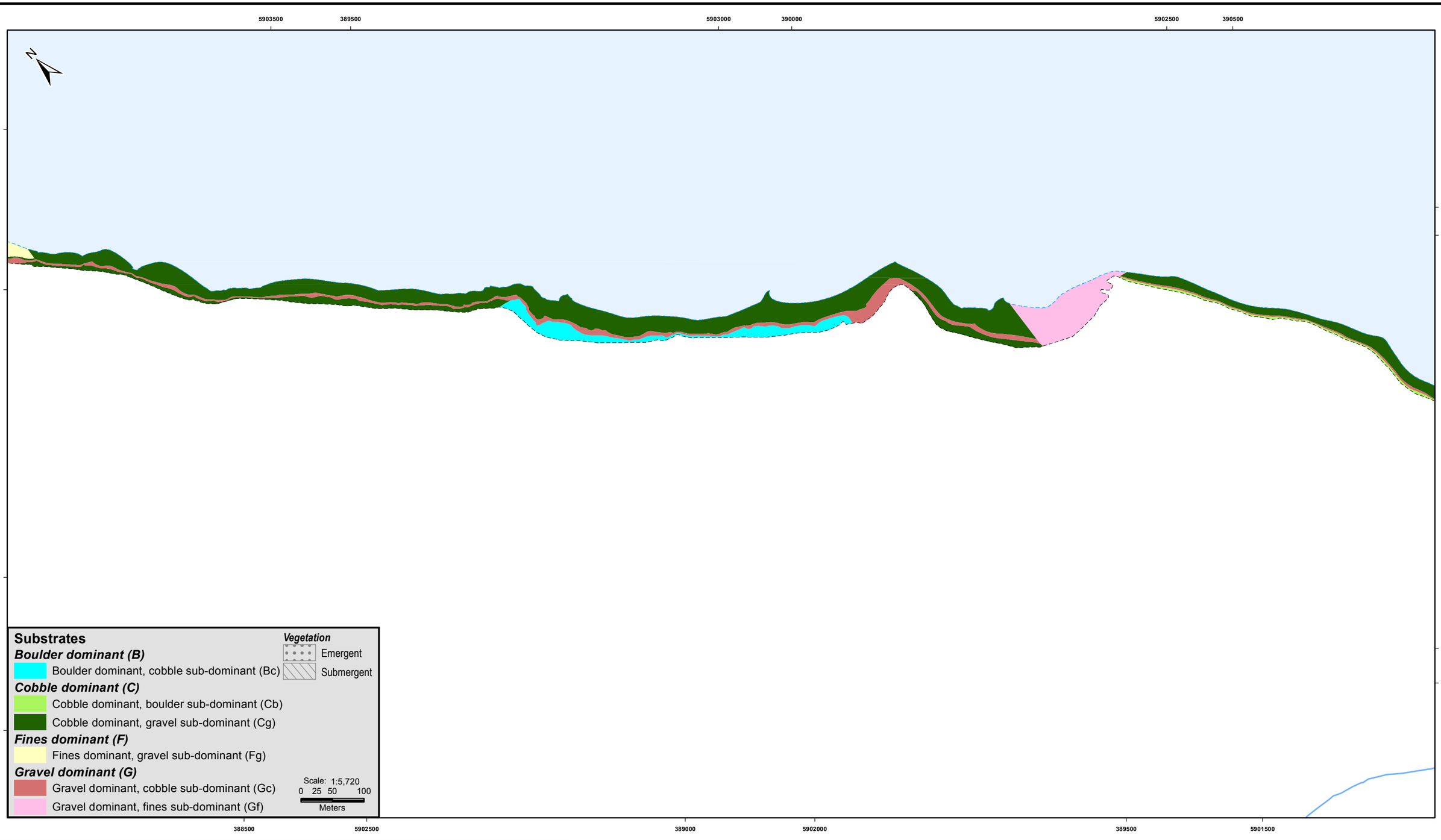
amec

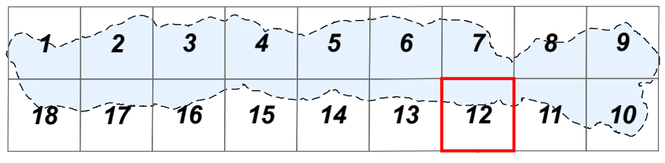
ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	





Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

388500 5904000 389000 5903500 389500 5903000 390000

390000 389500 389000 388500 388000 387500

5903500 388000 5903000 388500 5902500 389000

N

Substrates

Boulder dominant (B)

- Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

- Cobble dominant, boulder sub-dominant (Cb)
- Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

- Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

- Gravel dominant, cobble sub-dominant (Gc)
- Gravel dominant, fines sub-dominant (Gf)

Vegetation

- Emergent
- Submergent

Scale: 1:5,720
0 25 50 100
Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

- Maximum lake elevation (927.6masl)
- Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

CLIENT: newgold

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ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

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5903500

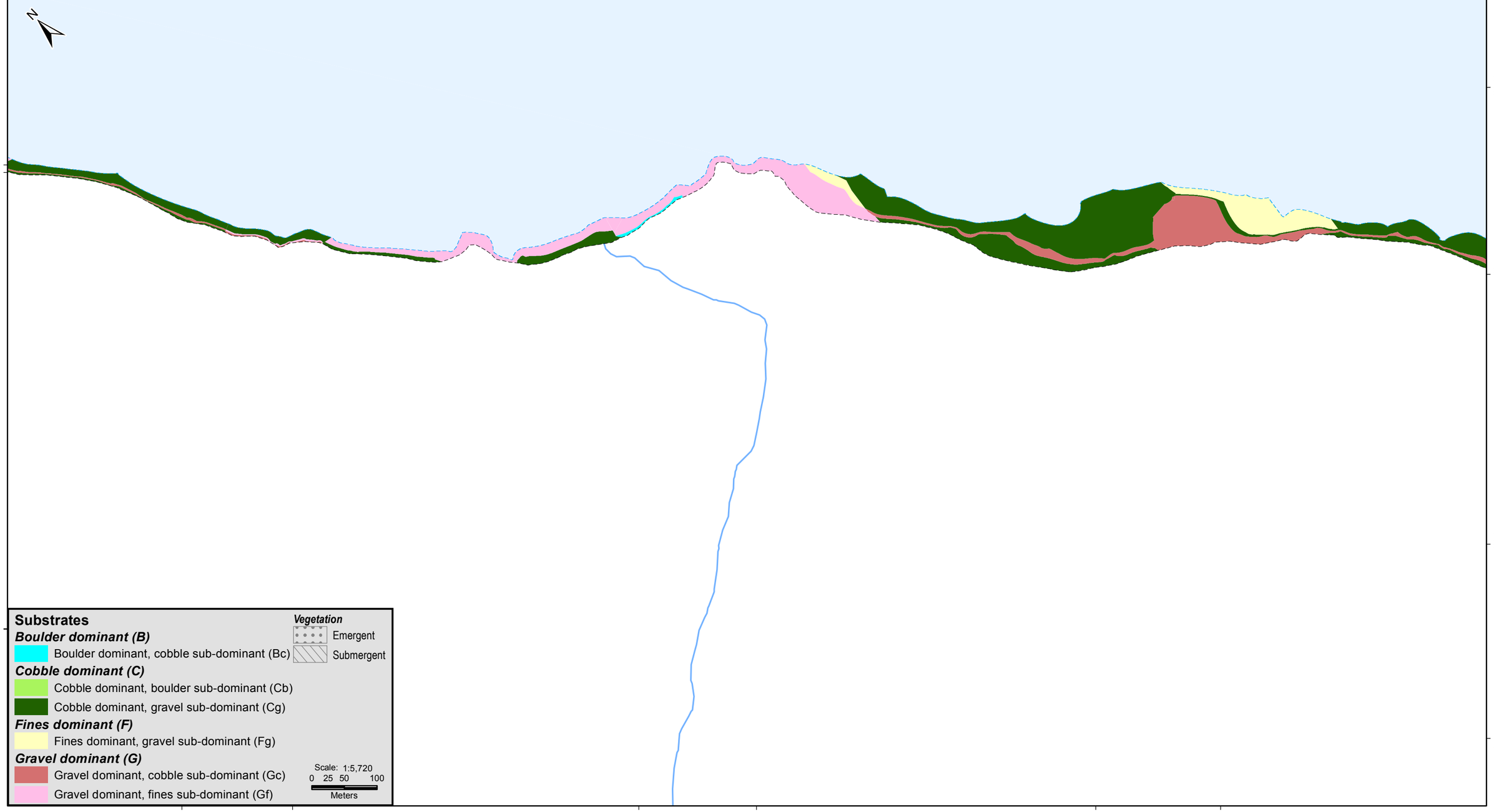
389000

388500

5903000

387500

387000



387000 5904000 387500 5903500 388000 5903000

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

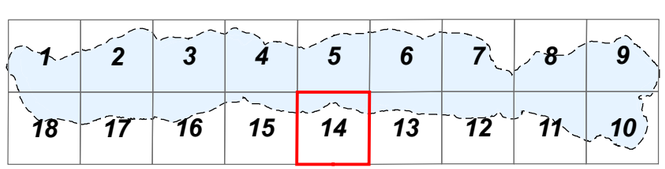
Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters



Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO:

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

387000 5905500 387500 5905000 388000 5904500 388500

N

5905500 386500 5905000 386500 5904500 387000 5904000 387500 5903500 388500 5904000 386000 5903500

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

CLIENT: newgold

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amec

ANALYST: WR
QA: MM
DATUM: NAD83
PROJECTION: UTM Zone 10
SCALE: 1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

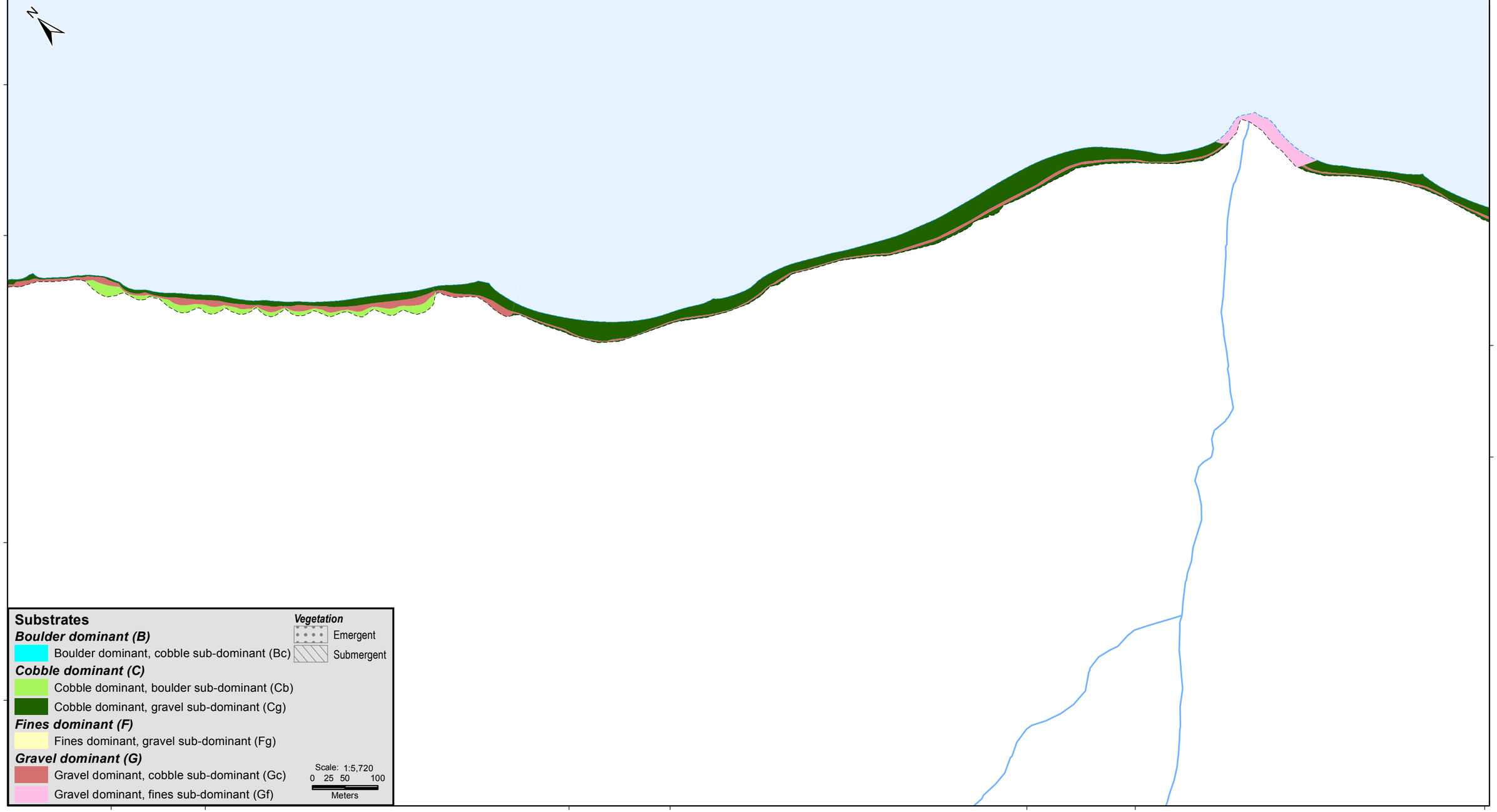
REV. NO: A
DATE: November, 2013
PROJECT NO: VE52277
FIGURE NO:

5906500 386500 5906000 387000 5905500 387500

N

5906500 386000 5906000 385500

5905000 387500 5904500



Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

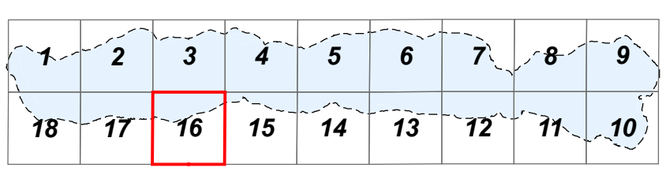
Submergent

Scale: 1:5,720

0 25 50 100

Meters

385500 5905500 386000 5905000 386500 5904500 387000



Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

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ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO:

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

5907000 386000 5906500 386500 5906000 387000

385500 387000 5905500

5907000 386500

385000 5905000

5906500

5906000 385500 5905500 386000 5905000

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

1 2 3 4 5 6 7 8 9

18 17 16 15 14 13 12 11 10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

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amec

ANALYST: WR

QA: MM

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: 1:5,720

PROJECT

Blackwater Gold Project

TITLE

Tatelkuz Lake Littoral Habitat

REV. NO: A

DATE: November, 2013

PROJECT NO: VE52277

FIGURE NO:

5908000 385000 5907500 385500 5907000 386000 5906500

N

5908000
384500
5907500
384000

5906000
386000

384000 5907000 384500 5906500 385000 5906000 385500

Substrates

Boulder dominant (B)

Boulder dominant, cobble sub-dominant (Bc)

Cobble dominant (C)

Cobble dominant, boulder sub-dominant (Cb)

Cobble dominant, gravel sub-dominant (Cg)

Fines dominant (F)

Fines dominant, gravel sub-dominant (Fg)

Gravel dominant (G)

Gravel dominant, cobble sub-dominant (Gc)

Gravel dominant, fines sub-dominant (Gf)

Vegetation

Emergent

Submergent

Scale: 1:5,720

0 25 50 100

Meters

1	2	3	4	5	6	7	8	9
18	17	16	15	14	13	12	11	10

Maximum lake elevation (927.6masl)

Bathymetry contour - 4.0m (923.5masl)

Source: Shoreline Habitat Classification conducted July 2013.

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\10_fisheries-aquatics\Baseline\10-100-185_TatelkuzLakeBathymetry_v3.mxd

CLIENT: newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
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amec

ANALYST:	WR
QA:	MM
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:5,720

PROJECT: Blackwater Gold Project

TITLE: **Tatelkuz Lake Littoral Habitat**

REV. NO:	A
DATE:	November, 2013
PROJECT NO:	VE52277
FIGURE NO:	

Annex 5.10-2
Photographs of Tatelkuz Lake Littoral Zone Habitat, July 2013



Plate 1: From Pin Looking Offshore, Transect Gf sh-1, Tatelkuz Lake, July 21, 2013



Plate 2: Shoreline Substrates, Transect Gf sh-1, Tatelkuz Lake, July 21, 2013



Plate 3: Typical Littoral Habitat with Gf Substrate, Tatelkuz Lake, July 14, 2013



Plate 4: Offshore End of Transect Looking Onshore, Transect Cg-st-2, Tatelkuz Lake, July 21, 2013



Plate 5: Shoreline Substrates, Transect Cg-st-2, Tatelkuz Lake, July 21, 2013



Plate 6: Typical Littoral Habitat with Cg substrate, Tatelkuz Lake, July 14, 2013



Plate 7: From Pin Looking Offshore, Transect Cb-st-3, Tatelkuz Lake, July 21, 2013



Plate 8: Shoreline Looking Downstream to Outlet, Transect Cb-st-3, Tatelkuz Lake, July 21, 2013



Plate 9: Typical Littoral Habitat with Cb Substrate, Tatelkuz Lake, July 21, 2013



Plate 10: Substrates Underwater Close to Shoreline, Transect Gf-st-4, Tatelkuz Lake, July 22, 2013



Plate 11: Offshore Looking Downstream to Outlet, Transect Gf-st-4, Tatelkuz Lake, July 22, 2013



Plate 12: Typical littoral habitat with Gf substrate, Tatelkuz Lake, July 14, 2013



Plate 13: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Gc-sh-5, Tatelkuz Lake, July 22, 2013



Plate 14: Substrates Underwater 1 m Offshore, Transect Gc-sh-5, Tatelkuz Lake, July 22, 2013



Plate 15: Typical Littoral Habitat with Gc Substrate, Tatelkuz Lake, July 14, 2013



Plate 16: Across the Measuring Tape Looking Downstream to Lake Outlet Showing Riparian Vegetation, Transect Cb-st-6, Tatelkuz Lake, July 22, 2013



Plate 17: End of the Transect Looking Onshore, Transect Cb-st-6, Tatelkuz Lake, July 22, 2013



Plate 18: Typical Littoral Habitat with Cb substrate, Tatelkuz Lake, July 14, 2013



Plate 19: From the Pin Looking Offshore, Transect Gf-sh-7, Tatelkuz Lake, July 22, 2013



Plate 20: Substrates at the Shoreline, Transect Gf-sh-7, Tatelkuz Lake, July 22, 2013

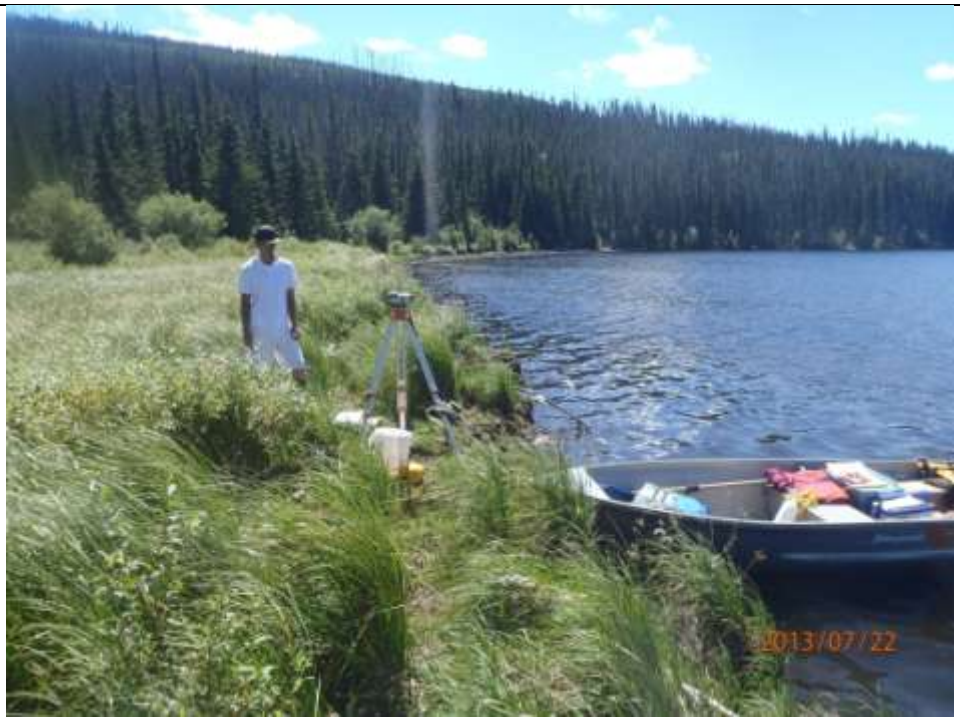


Plate 21: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Fg-sh-8, Tatelkuz Lake, July 22, 2013



Plate 22: From the End of the Transect Looking Onshore, Transect Fg-sh-8, Tatelkuz Lake, July 22, 2013



Plate 23: Typical Littoral Habitat with Fg Substrate, Tatelkuz Lake, July 14, 2013



Plate 24: From the Pin Looking Offshore, Transect Cb-sh-10, Tatelkuz Lake, July 22, 2013



Plate 25: Substrates at Shoreline, Transect Cb-sh-10, Tatelkuz Lake, July 22, 2013



Plate 26: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Cb-st-11, Tatelkuz Lake, July 22, 2013



Plate 27: Riparian Vegetation, Transect Cb-st-11, Tatelkuz Lake, July 22, 2013



Plate 28: Across the Measuring Tape Looking Downstream to the Lake Outlet, Transect Gf-st-12, Tatelkuz Lake, July 22, 2013



Plate 29: Substrates Underwater 0.5 m Offshore, Transect Gf-st-12, Tatelkuz Lake, July 22, 2013



Plate 30: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Bc-sh-13, Tatelkuz Lake, July 22, 2013



Plate 31: Shoreline Substrates, Transect Bc-sh-13, Tatelkuz Lake, July 22, 2013



Plate 32: Typical Littoral Habitat with Bc Substrate, Tatelkuz Lake, July 14, 2013



Plate 33: Across the Measuring Tape Looking Downstream to the Lake Outlet, Transect Cb-sh-14, Tatelkuz Lake, July 23, 2013

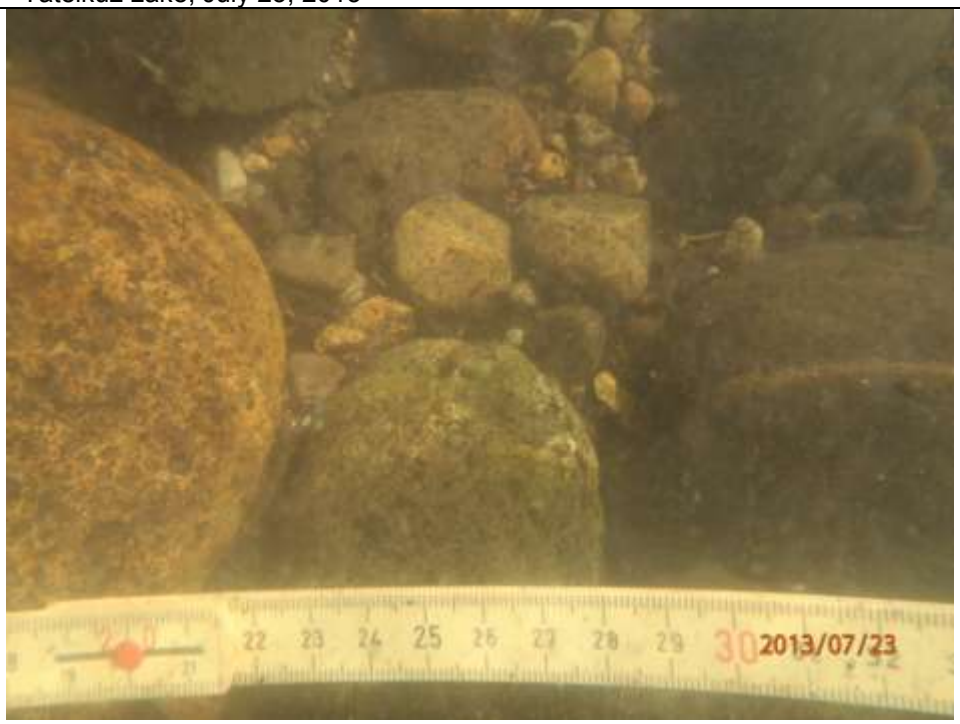


Plate 34: Substrates Underwater at 1 m from Shore, Transect Cb-sh-14, Tatelkuz Lake, July 23, 2013



Plate 35: Across the Measuring Tape Looking Downstream to the Lake Outlet, Transect Cg-sh-15, Tatelkuz Lake, July 23, 2013



Plate 36: End of Transect Looking Onshore, Transect Cg-sh-15, Tatelkuz Lake, July 23, 2013



Plate 37: From the Pin Looking Offshore, Transect Gc-sh-16, Tatelkuz Lake, July 23, 2013



Plate 38: Substrates at the Shoreline, Transect Gc-sh-16, Tatelkuz Lake, July 23, 2013



Plate 39: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Gf-st-17, Tatelkuz Lake, July 23, 2013



Plate 40: Substrates Underwater at 1 m from Shore, Transect Gf-st-17, Tatelkuz Lake, July 23, 2013



Plate 41: Across the Measuring Tape Looking Downstream to the Lake Outlet, Transect Bc-st-18, Tatelkuz Lake, July 23, 2013



Plate 42: Substrates at the Shoreline, Transect Bc-st-18, Tatelkuz Lake, July 23, 2013



Plate 43: From the Pin Looking Offshore, Transect Gc-st-19, Tatelkuz Lake, July 23, 2013

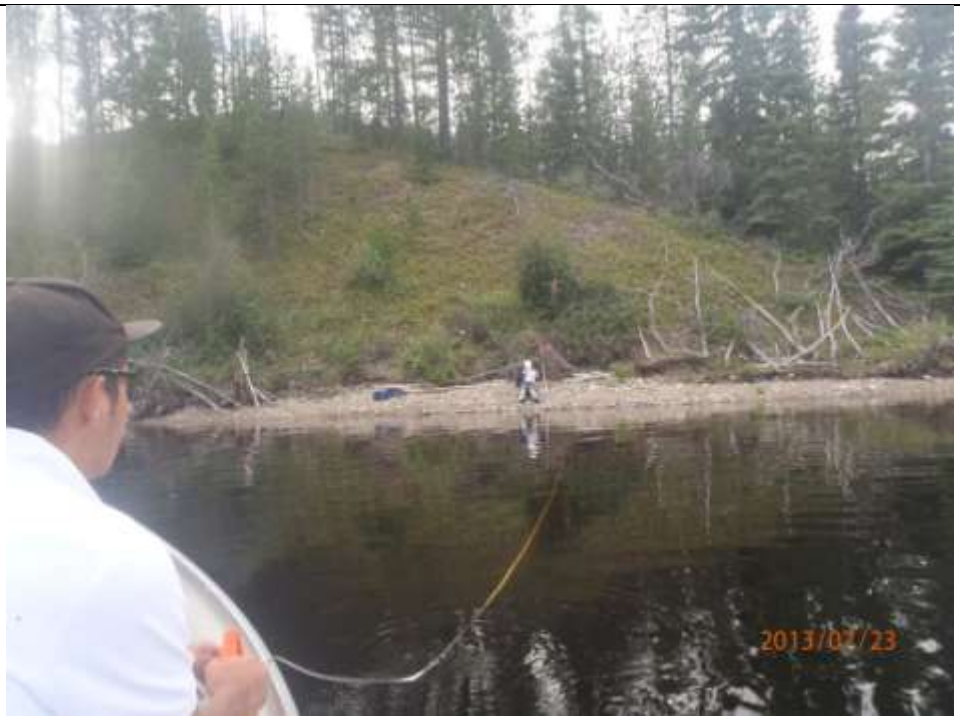


Plate 44: From the End of the Transect Looking Onshore, Transect Gc-st-19, Tatelkuz Lake, July 23, 2013



Plate 45: From the Pin Looking Offshore, Transect Cg-st-20, Tatelkuz Lake, July 23, 2013



Plate 46: Substrates Underwater 1 m from Shore, Transect Cg-st-20, Tatelkuz Lake, July 23, 2013



Plate 47: Across the Measuring Tape Looking Upstream to the Lake Inlet, Transect Gc-sh-21, Tatelkuz Lake, July 23, 2013



Plate 48: Riparian Vegetation, Transect Gc-sh-21, Tatelkuz Lake, July 23, 2013



Plate 49: Across the Measuring Tape Looking Downstream to the Lake Outlet, Transect Fg-sh-22, Tatelkuz Lake, July 23, 2013



Plate 50: Substrates at the Shoreline, Transect Fg-sh-22, Tatelkuz Lake, July 23, 2013

Annex 5.11-1
Vertical Profile Data, Tatelkuz Lake, 2013

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
28-Jan	1.0	1.2	62.5	8.86	-	-	-	-
	2.0	2.0	60.6	8.38	-	-	-	-
	3.0	2.3	59.2	8.12	-	-	-	-
	4.0	2.5	58.7	8.00	-	-	-	-
	5.0	2.6	57.7	7.85	-	-	-	-
	6.0	2.7	57.3	7.78	-	-	-	-
	7.0	2.8	56.7	7.67	-	-	-	-
	8.0	2.9	56.1	7.57	-	-	-	-
	9.0	2.9	55.4	7.47	-	-	-	-
	10.0	3.0	54.4	7.32	-	-	-	-
	11.0	3.1	54.3	7.29	-	-	-	-
	12.0	3.1	54.1	7.26	-	-	-	-
	13.0	3.2	53.7	7.19	-	-	-	-
	14.0	3.2	53.6	7.17	-	-	-	-
	15.0	3.3	53.3	7.11	-	-	-	-
	16.0	3.3	52.4	6.98	-	-	-	-
	17.0	3.4	52.0	6.95	-	-	-	-
	18.0	3.4	51.8	6.90	-	-	-	-
	19.0	3.4	51.0	6.79	-	-	-	-
	20.0	3.4	48.6	6.47	-	-	-	-
8-July	0.5	19.8	97.3	8.89	-	-	-	-
	1.0	18.8	96.6	8.85	-	-	-	-
	2.0	18.3	96.3	9.04	-	-	-	-
	3.0	16.5	89.0	8.79	-	-	-	-
	4.0	15.8	88.9	8.79	-	-	-	-
	5.0	14.9	85.8	8.59	-	-	-	-
	6.0	13.4	79.4	8.28	-	-	-	-
	7.0	12.0	75.7	8.23	-	-	-	-
	8.0	10.7	73.7	8.19	-	-	-	-
	9.0	9.6	72.3	8.27	-	-	-	-
	10.0	8.4	69.2	8.10	-	-	-	-
	11.0	7.0	65.0	7.85	-	-	-	-
	12.0	6.8	63.5	7.75	-	-	-	-
	13.0	6.2	61.6	7.63	-	-	-	-
	14.0	6.1	60.6	7.53	-	-	-	-
	15.0	5.8	59.6	7.45	-	-	-	-
	16.0	5.6	58.7	7.38	-	-	-	-
	17.0	5.6	58.6	7.37	-	-	-	-
	18.0	5.3	56.9	7.20	-	-	-	-
	19.0	5.2	56.1	7.11	-	-	-	-
	20.0	5.2	55.3	7.02	-	-	-	-

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	21.0	5.1	55.3	7.03	-	-	-	-
	22.0	5.1	54.6	6.95	-	-	-	-
	23.0	5.1	54.0	6.88	-	-	-	-
	24.0	5.0	53.9	6.91	-	-	-	-
	25.0	5.0	53.2	6.79	-	-	-	-
	26.0	5.0	52.4	6.71	-	-	-	-
	27.0	5.0	51.7	6.60	-	-	-	-
	28.0	4.8	6.4	0.72	-	-	-	-
	28.5	4.8	0.7	0.10	-	-	-	-
17 Jul	1.0	17.2	94.5	9.03	139.0	118.0	-	8.01
	2.0	16.2	91.8	9.02	139.0	115.0	-	7.90
	3.0	16.1	89.4	8.75	138.0	114.0	-	7.85
	4.0	15.0	83.5	8.28	137.0	113.0	-	7.79
	5.0	13.7	79.5	8.25	138.0	108.0	-	7.72
	6.0	12.9	72.3	7.59	139.0	107.0	-	7.63
	7.0	11.3	66.5	7.27	139.0	103.0	-	7.45
	8.0	9.3	64.6	7.41	143.0	100.0	-	7.40
	9.0	8.0	63.7	7.53	145.0	100.0	-	7.36
	10.0	7.3	63.0	7.59	146.0	98.0	-	7.25
	11.0	6.6	61.6	7.54	147.0	95.0	-	7.22
	12.0	6.0	60.3	7.50	148.0	94.0	-	7.20
	13.0	5.8	59.4	7.43	149.0	94.0	-	7.17
	14.0	5.6	58.2	7.29	149.0	94.0	-	7.11
	15.0	5.5	57.3	7.22	149.0	95.0	-	7.06
	16.0	5.4	56.6	7.16	149.0	93.0	-	7.05
	17.0	5.2	56.2	7.11	149.0	93.0	-	7.06
	18.0	5.2	55.8	7.08	152.0	93.0	-	7.02
	19.0	5.2	55.5	7.05	150.0	93.0	-	7.05
	20.0	5.1	55.0	6.98	150.0	93.0	-	7.03
	21.0	5.1	54.6	6.90	150.0	93.0	-	7.03
	22.0	5.0	54.2	6.90	150.0	93.0	-	7.00
	23.0	5.0	53.9	6.90	150.0	94.0	-	6.90
	24.0	4.9	52.2	6.70	150.0	94.0	-	7.00
	26.0	4.8	48.9	6.30	150.0	94.0	-	6.90
	27.8	4.8	50.5	6.50	150.0	94.0	-	6.90
23 Jul	1.0	19.0	101.2	9.40	139.0	124.0	-	8.20
	2.0	18.2	97.9	9.20	139.0	121.0	-	8.10
	3.0	16.8	90.5	8.80	138.0	117.0	-	7.90
	4.0	16.1	82.8	8.10	138.0	114.0	-	7.90
	5.0	14.2	74.2	7.60	140.0	110.0	-	7.70
	6.0	11.6	66.8	7.20	142.0	104.0	-	7.50

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	7.0	9.9	62.8	7.20	143.0	101.0	-	7.40
	8.0	8.5	59.8	7.00	146.0	98.0	-	7.30
	9.0	7.0	57.3	6.90	147.0	96.0	-	7.30
	10.0	6.4	56.1	6.90	147.0	95.0	-	7.20
	11.0	6.1	55.5	6.80	148.0	94.0	-	7.20
	12.0	6.0	54.7	6.80	148.0	94.0	-	7.20
	14.0	5.7	52.9	6.60	149.0	94.0	-	7.20
	16.0	5.4	51.9	6.50	149.0	93.0	-	7.10
	18.0	5.3	50.2	6.30	149.0	93.0	-	7.10
	20.0	5.3	47.0	5.90	149.0	93.0	-	7.10
	22.0	5.3	36.9	4.60	149.0	93.0	-	7.10
	24.0	5.3	9.0	0.98	149.0	93.0	-	7.10
	26.0	5.2	2.2	0.27	158.0	98.0	-	7.00
	28.0	5.2	3.1	0.43	162.0	101.0	-	7.00
	28.5	5.1	9.1	1.16	160.0	99.0	-	7.90
	0.5	20.7	101.4	9.12	-	211.8	150.2	8.84
	1.0	2.4	100.7	9.10	-	211.0	150.2	8.84
	1.5	20.4	100.5	9.08	-	210.4	150.2	8.82
	2.0	20.3	97.2	8.76	-	209.7	150.2	8.81
	2.5	20.1	98.5	8.81	-	209.5	150.2	8.78
	3.0	20.1	98.0	8.80	-	209.4	150.2	8.77
	3.5	20.0	97.8	8.87	-	209.0	150.2	8.73
	4.0	19.0	86.1	8.03	-	200.4	150.2	8.26
	4.5	18.0	81.8	7.72	-	199.9	150.2	8.07
	5.0	17.1	74.2	7.18	-	194.2	148.9	7.95
	5.5	16.7	72.8	7.08	-	191.8	148.9	7.85
	6.0	16.0	71.1	7.00	-	188.2	147.6	7.78
15 Aug Descent	6.5	15.7	68.6	6.80	-	187.1	148.2	7.74
	7.0	15.0	66.9	6.74	-	183.9	147.6	7.70
	7.5	14.2	64.5	6.61	-	180.4	147.6	7.66
	8.0	13.0	61.9	6.51	-	175.7	148.2	7.61
	8.5	11.6	59.8	6.50	-	170.5	148.9	7.57
	9.0	10.5	58.2	6.46	-	166.6	149.5	7.51
	9.5	10.0	58.4	6.56	-	165.2	150.8	7.49
	10.0	9.0	57.6	6.66	-	161.9	151.5	7.48
	10.5	7.9	58.0	6.87	-	158.3	152.8	7.47
	11.0	7.4	57.2	6.88	-	156.8	153.4	7.47
	11.5	7.0	57.2	6.93	-	155.5	154.1	7.46
	12.0	6.6	56.9	6.96	-	154.3	154.7	7.46
	12.5	6.4	57.0	7.03	-	153.4	154.7	7.45
	13.0	6.2	56.4	6.98	-	152.9	155.4	7.46

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	13.5	6.1	56.6	7.03	-	152.5	155.4	7.45
	14.0	6.0	56.3	6.99	-	152.3	155.4	7.45
	15.0	6.0	55.5	6.96	-	151.8	155.4	7.45
	16.0	5.8	55.5	6.95	-	151.7	156.0	7.45
	17.0	5.7	54.5	6.80	-	151.5	156.0	7.45
	18.0	5.7	54.3	6.83	-	151.3	156.0	7.45
	19.0	5.6	53.2	6.70	-	151.1	156.0	7.43
	20.0	5.5	53.6	6.77	-	150.8	156.0	7.44
	21.0	5.5	53.4	6.72	-	150.7	156.0	74.30
	22.0	5.4	52.8	6.67	-	150.5	156.7	7.42
	23.0	5.4	52.8	6.68	-	150.3	156.7	7.42
	24.0	5.3	52.2	6.60	-	150.3	156.7	7.42
	25.0	5.3	50.3	6.36	-	150.2	156.7	7.41
	26.0	5.3	50.4	6.37	-	150.0	156.7	7.41
	27.0	5.2	49.0	6.11	-	149.9	156.7	7.40
	28.0	5.2	35.1	4.46	-	149.8	157.3	7.34
15 Aug Ascent	1.0	20.7	100.7	9.01	-	212.3	150.2	8.84
	2.0	20.6	100.4	9.08	-	210.3	150.2	8.82
	3.0	20.2	99.6	9.03	-	209.5	150.2	8.82
	4.0	20.0	97.8	8.90	-	209.1	150.2	8.80
	5.0	19.6	90.3	8.39	-	207.4	155.2	8.49
	6.0	17.4	76.7	7.39	-	195.3	148.9	7.84
	6.5	16.7	72.2	7.01	-	191.3	148.2	7.75
	7.0	16.3	70.1	6.88	-	190.7	148.2	7.72
	7.5	15.9	69.4	6.85	-	188.0	147.6	7.70
	8.0	15.1	65.4	6.57	-	184.0	147.6	7.61
	8.5	14.4	62.7	6.41	-	181.6	147.6	7.56
	9.0	13.3	59.7	6.25	-	155.9	148.2	7.52
	9.5	11.8	57.8	6.28	-	171.3	148.9	7.50
	10.0	10.5	57.1	6.41	-	166.3	150.2	7.48
	10.5	9.6	56.3	6.44	-	163.9	150.8	7.48
	11.0	8.8	56.0	6.51	-	162.0	151.5	7.48
	11.5	7.9	56.8	6.73	-	158.2	152.8	7.47
	12.0	7.4	56.1	6.75	-	157.0	153.4	7.46
	12.5	6.9	56.1	6.85	-	155.3	154.1	7.46
	13.0	6.6	55.9	6.84	-	154.5	154.7	7.45
	14.0	6.2	55.8	6.91	-	152.7	155.4	7.45
	15.0	6.0	55.5	6.91	-	152.4	155.4	7.44
	16.0	5.4	54.8	6.85	-	151.9	155.4	7.44
	17.0	5.8	54.8	6.86	-	151.7	156.0	7.44
	18.0	5.7	54.7	6.86	-	151.6	156.0	7.43

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	19.0	5.6	53.5	6.75	-	151.3	156.0	7.42
	20.0	5.6	53.4	6.73	-	151.1	156.0	7.42
	21.0	5.5	53.1	6.70	-	150.8	156.0	7.41
	22.0	5.4	52.5	6.66	-	150.6	156.7	7.40
	23.0	5.3	50.8	6.50	-	150.4	156.7	7.40
	24.0	5.3	50.2	6.38	-	150.3	156.7	7.40
	25.0	5.3	49.5	6.29	-	150.2	156.7	7.38
	26.0	5.2	47.0	6.03	-	150.0	156.7	7.37
	27.0	5.2	43.6	5.65	-	149.9	156.7	7.36
	28.0	5.2	35.1	4.46	-	149.8	157.3	7.34
16 Aug Descent	0.5	20.4	101.5	9.16	-	209.4	149.5	8.92
	1.0	20.4	100.0	9.09	-	209.4	149.5	8.91
	1.5	20.4	101.6	9.16	-	209.6	149.5	8.92
	2.0	20.3	99.4	8.93	-	209.5	149.5	8.92
	2.5	20.3	100.7	9.11	-	209.9	149.5	8.89
	3.0	20.2	100.1	9.06	-	208.6	149.5	8.84
	3.5	20.1	98.5	8.91	-	208.9	150.2	8.79
	4.0	19.5	93.6	8.52	-	206.1	149.5	8.55
	4.5	16.6	73.2	7.13	-	191.3	148.2	7.97
	5.0	16.2	70.8	6.91	-	189.0	147.6	7.81
	5.5	15.8	69.0	6.82	-	186.4	147.6	7.77
	6.0	15.4	67.4	6.72	-	185.2	147.6	7.72
	6.5	14.7	64.8	6.57	-	180.7	147.6	7.67
	7.0	13.9	62.6	6.46	-	178.7	147.6	7.64
	7.5	13.2	61.3	6.43	-	176.1	147.6	7.61
	8.0	12.4	60.4	6.43	-	173.2	148.2	7.58
	8.5	11.6	59.3	6.44	-	170.8	148.9	7.56
	9.0	10.7	59.0	6.53	-	167.2	149.5	7.54
	9.5	9.8	57.1	6.47	-	164.0	150.2	7.51
	10.0	9.3	56.7	6.49	-	162.8	150.8	7.50
	10.5	8.8	55.5	6.42	-	161.4	151.5	7.49
	11.0	8.4	57.0	6.74	-	159.3	152.1	7.49
	11.5	7.9	57.0	6.76	-	158.2	152.8	7.48
	12.0	7.6	56.2	6.73	-	157.3	153.4	7.47
	12.5	7.1	56.6	6.84	-	155.9	154.1	7.47
	13.0	6.8	55.5	6.75	-	155.1	154.1	7.47
	13.5	6.5	54.8	6.75	-	153.8	154.7	7.47
	14.0	6.2	53.8	6.63	-	152.9	155.4	7.47
	14.5	6.0	53.6	6.67	-	152.4	155.4	7.45
	15.0	5.8	53.8	6.72	-	151.9	156.0	7.46
	16.0	5.7	53.3	6.68	-	151.5	156.0	7.45

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	17.0	5.6	53.0	6.64	-	151.3	156.0	7.45
	18.0	5.6	51.2	6.47	-	151.1	156.0	7.44
	19.0	5.5	51.6	6.49	-	150.8	156.0	7.44
	20.0	5.5	50.9	6.41	-	150.8	156.0	7.44
	21.0	5.4	50.7	6.40	-	150.7	156.0	7.44
	22.0	5.4	50.9	6.41	-	150.6	156.7	7.43
	23.0	5.4	50.3	6.36	-	150.5	156.7	7.43
	24.0	5.4	49.6	6.29	-	150.4	156.7	7.43
	25.0	5.3	50.3	6.38	-	150.3	156.7	7.42
	26.0	5.3	49.8	6.29	-	150.1	156.7	7.43
	27.0	5.2	47.8	6.05	-	150.0	156.5	7.41
	28.0	5.2	46.6	5.83	-	149.8	156.7	7.41
	29.0	5.1	31.9	4.02	-	150.2	157.3	7.35
16 Aug Ascent	0.5	20.3	101.1	9.15	-	209.1	149.5	8.94
	1.0	20.3	99.9	9.02	-	209.1	149.5	8.91
	1.5	20.2	99.2	8.97	-	209.2	149.5	8.89
	2.0	20.1	98.7	8.92	-	209.2	149.5	8.85
	2.5	19.7	92.0	8.45	-	207.6	150.2	8.65
	3.0	19.4	88.5	8.16	-	203.5	149.5	8.31
	3.5	17.5	76.5	7.33	-	196.4	148.9	7.87
	4.0	17.1	74.4	7.14	-	194.8	148.9	7.81
	4.5	16.3	69.7	6.81	-	190.2	148.2	7.72
	5.0	15.8	67.3	6.68	-	187.4	147.6	7.66
	5.5	15.4	64.8	6.50	-	185.3	147.6	7.62
	6.0	13.7	60.7	6.30	-	177.3	147.6	7.56
	6.5	13.3	60.3	6.31	-	176.2	147.6	7.55
	7.0	13.2	59.0	6.20	-	176.4	147.6	7.53
	7.5	12.3	57.9	6.20	-	172.9	148.2	7.51
	8.0	10.8	57.2	6.30	-	168.2	148.9	7.49
	8.5	10.3	56.5	6.33	-	165.7	150.2	7.48
	9.0	8.8	56.6	6.57	-	160.8	151.5	7.47
	9.5	8.6	56.1	6.54	-	160.4	151.5	7.47
	10.0	7.9	55.6	6.60	-	158.2	152.8	7.46
	10.5	7.6	55.4	6.63	-	157.6	152.8	7.46
	11.0	7.2	55.1	6.66	-	156.0	154.1	7.46
	11.5	6.9	54.9	6.70	-	155.4	154.1	7.46
	12.0	6.5	53.5	6.56	-	154.2	154.7	7.45
	13.0	6.2	52.7	6.55	-	153.1	155.4	7.45
	14.0	5.9	53.1	6.62	-	152.1	155.4	7.44
	15.0	5.7	51.4	6.47	-	151.6	156.0	7.44
	16.0	5.6	52.3	6.59	-	151.3	156.0	7.43

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	17.0	5.6	51.6	6.49	-	151.0	156.0	7.44
	18.0	5.6	51.4	6.47	-	151.1	156.0	7.43
	19.0	5.5	51.6	6.50	-	150.9	156.0	7.43
	20.0	5.5	51.2	6.46	-	150.8	156.7	7.43
	21.0	5.4	51.1	6.42	-	150.7	156.7	7.43
	22.0	5.4	49.1	6.15	-	150.6	156.7	7.41
	23.0	5.3	49.4	6.23	-	150.4	156.7	7.43
	24.0	5.3	50.0	6.33	-	150.4	156.7	7.41
	25.0	5.3	49.3	6.26	-	150.2	156.7	7.41
	26.0	5.3	48.7	6.19	-	150.1	156.7	7.41
	27.0	5.2	47.0	5.99	-	150.1	156.7	7.38
	28.0	5.2	43.3	5.53	-	149.8	156.7	7.36
	29.0	5.1	31.9	4.02	-	150.2	157.3	7.35
7 Oct	0.5	10.7	115.2	12.26	-	-	-	-
	1.0	10.7	105.8	11.69	-	-	-	-
	2.0	10.7	103.6	11.51	-	-	-	-
	3.0	10.7	101.8	11.23	-	-	-	-
	4.0	10.7	101.4	11.22	-	-	-	-
	5.0	10.7	100.5	11.04	-	-	-	-
	6.0	10.6	97.1	10.75	-	-	-	-
	7.0	10.6	98.1	10.84	-	-	-	-
	8.0	10.6	96.0	10.63	-	-	-	-
	9.0	9.9	85.2	9.61	-	-	-	-
	10.0	8.7	55.9	6.39	-	-	-	-
	11.0	7.2	46.3	5.58	-	-	-	-
	12.0	6.7	44.5	5.36	-	-	-	-
	13.0	6.3	42.7	5.23	-	-	-	-
	14.0	6.2	42.1	5.21	-	-	-	-
	15.0	6.1	41.4	5.11	-	-	-	-
	16.0	6.0	40.5	4.99	-	-	-	-
	17.0	5.9	39.2	4.91	-	-	-	-
	18.0	5.8	37.6	4.69	-	-	-	-
	19.0	5.8	37.6	4.69	-	-	-	-
	20.0	5.6	35.1	4.33	-	-	-	-
	21.0	5.6	33.2	4.16	-	-	-	-
	22.0	5.5	29.0	3.54	-	-	-	-
	23.0	5.5	25.8	3.23	-	-	-	-
	24.0	5.5	23.6	2.97	-	-	-	-
	25.0	5.5	23.4	2.94	-	-	-	-
	26.0	5.5	22.9	2.86	-	-	-	-
	27.0	5.5	18.3	2.30	-	-	-	-

Date	Depth (m)	Temp (°C)	DO (% sat)	DO (mg/L)	Specific Conductivity (µS/cm)	Cond. (µS/cm)	TDS (mg/L)	pH
	28.0	5.5	15.2	1.87	-	-	-	-
	29.0	5.5	13.5	1.68	-	-	-	-
	30.0	5.5	12.6	1.58	-	-	-	-

Note: m = metre; °C = degrees Celsius; % = percent; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; Sp. Cond. = specific conductivity; Cond. = conductivity; TDS = total dissolved solids; "-" = no data

Annex 5.11-2
Phytoplankton Biomass, Tatelkuz Lake, August 2013

Annex 5.11-2: Phytoplankon Biomass, Tatelkuz Lake, 15 and 16 August 2013

Water Body: Tatelkuz Lake
Crew: SL/WC/VC
TL1 UTM: 389694 5903124
TL2 UTM: 387247 5905786

Sample ID	Date Sampled	Sample Depth (m)	Lake Depth (m)	Volume Filetered (mL)	Chlorophyll a Concentration (µg/L)	Detection Limit (µg/L)
TL1 - S1	15-Aug-13	1	> 30	1,000	5.49	0.10
TL1 - S2	15-Aug-13	1	> 30	750	6.67	0.10
TL1 - S3	15-Aug-13	1	> 30	1,000	5.65	0.10
TL1 - S4	15-Aug-13	1	> 30	1,000	5.64	0.10
TL1 - S5	15-Aug-13	1	> 30	1,000	4.82	0.10
TL1 - M1	15-Aug-13	13	> 30	1,000	1.37	0.01
TL1 - M2	15-Aug-13	13	> 30	1,000	1.14	0.01
TL1 - M3	15-Aug-13	13	> 30	1,000	1.59	0.01
TL1 - M4	15-Aug-13	13	> 30	1,000	1.04	0.01
TL1 - M5	15-Aug-13	13	> 30	1,000	0.677	0.01
TL1 - D1	15-Aug-13	27	> 30	500	0.352	0.01
TL1 - D2	15-Aug-13	27	> 30	500	0.2	0.01
TL1 - D3	15-Aug-13	27	> 30	500	0.24	0.01
TL1 - D4	15-Aug-13	27	> 30	500	0.169	0.01
TL1 - D5	15-Aug-13	27	> 30	500	0.258	0.01
TL2 - S1	16-Aug-13	1	29.4	750	8.02	0.10
TL2 - S2	16-Aug-13	1	29.4	750	8.41	0.10
TL2 - S3	16-Aug-13	1	29.4	750	7.74	0.10
TL2 - S4	16-Aug-13	1	29.4	750	7.58	0.10
TL2 - S5	16-Aug-13	1	29.4	750	8.45	0.10
TL2 - M1	16-Aug-13	15	29.4	1,000	0.687	0.01
TL2 - M2	16-Aug-13	15	29.4	1,000	0.965	0.01
TL2 - M3	16-Aug-13	15	29.4	1,000	0.752	0.01
TL2 - M4	16-Aug-13	15	29.4	1,000	1.08	0.01
TL2 - M5	16-Aug-13	15	29.4	1,000	0.933	0.01
TL2 - D1	16-Aug-13	27	29.4	1,000	0.265	0.01
TL2 - D2	16-Aug-13	27	29.4	1,000	0.124	0.01
TL2 - D3	16-Aug-13	27	29.4	1,000	0.173	0.01
TL2 - D4	16-Aug-13	27	29.4	1,000	0.151	0.01
TL2 - D5	16-Aug-13	27	29.4	1,000	0.156	0.01

Note: Samples were obtained using a Van Dorn; filtered and then frozen until analyzed
Duplicate results outside of laboratory QAQC limits due to sample heterogeneity
UTM = Universal Transverse Mercator, Zone 10
m = metre; mL = millilitre; µg = microgram

Annex 5.11-3
Phytoplankton Taxonomic Composition and Density, Tatelkuz Lake, August 2013

Annex 5.11-3: Phytoplankton Taxonomic Composition and Density, Tatelkuz Lake, August 2013

Units: Number of units/L	Lake Name	Tatelkuz Lake					Tatelkuz Lake					Tatelkuz Lake					
	Depth	Surface (1 m)					Mid (13 m)					Bottom (27 m)					
	Sample	TL1-S1	TL1-S2	TL1-S3	TL1-S4	TL1-S5	TL1-M1	TL1-M2	TL1-M3	TL1-M4	Tl1-M5	TL1-D1	TL1-D2	TL1-D3	TL1-D4	TL1-D5	TL2-S1
	Date sampled	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	16-Aug-13
	Volume Sampled (L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Taxonomy																	
DIATOMS																	
Achnanthes minutissima Kuetzing		0	0	0	0	0	0	0	0	0	0	0	0	0	2,917	153,152	29,171
Amphora spp.		0	0	0	0	0	0	0	0	0	0	0	5,834	0	0	0	0
Asterionella formosa Hansall		7,292	7,292	7,292	21,878	14,585	0	4,861	0	0	3,646	43,757	2,917	8,751	5,834	7,292	7,292
Aulacoseira spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyclotella/Stephanodiscus sp		0	0	7,292	0	0	0	0	0	4,861	10,939	14,585	0	2,917	11,668	3,646	14,585
Cocconeis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Cyclotella ocellata Pantocsek		0	0	0	0	0	9,723	0	0	0	0	29,171	2,917	8,751	0	3,646	21,878
Cyclotella bodanica Grunow		58,342	109,393	255,253	218,788	102,100	77,790	116,686	102,100	170,168	178,677	481,335	84,598	125,438	43,757	25,525	131,272
Fragilaria capucina Desmazieres		0	0	0	0	0	0	0	4,861	0	0	0	0	0	0	0	0
Fragilaria crotonensis Kitton		0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,292	0
Fragilaria construens (Ehrenberg) Grunow		7,292	0	0	0	0	0	0	0	4,861	3,646	43,757	0	0	0	0	0
Fragilaria sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Navicula sp		0	0	0	0	0	0	0	0	0	0	0	2,917	0	0	7,292	0
Nitzschia clausii Hantzsch		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Nitzschia sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizosolenia longiseta Ehrenberg		0	0	0	14,585	0	0	0	0	0	14,585	0	0	0	0	3,646	0
Stephanodiscus niagarae Ehrenberg		0	0	0	0	0	0	0	0	0	0	0	0	2,917	0	0	0
Stephanodiscus sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Synedra sp		0	7,292	0	0	0	0	0	0	0	0	0	0	0	11,668	0	0
Synedra ulna (Nitzsch) Ehr.		0	0	0	0	0	0	4,861	0	0	0	0	0	0	0	0	0
Tabellaria flocculosa (Roth) Kuetzing		7,292	0	0	0	7,292	0	4,861	0	14,585	0	7,292	5,834	0	0	0	0
CHLOROPHYCEAE																	
Ankyra lanceolata (Kors) Fott		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorella sp		0	7,292	0	0	0	4,861	0	0	0	0	0	0	0	0	0	0
Chlamydomonas globosa Snow		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlamydomonas sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	7,292
Closterium acutum var. *variable* (Lemmermann) W. Krieger		0	0	0	0	0	0	4,861	0	4,861	0	0	0	0	0	0	0
Closteriopsis longissima Lemmermann		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Crucigenia quadrata Morren		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crucigenia rectangularis (A. Braun) Gay		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Elakatothrix gelatinosa Wille		0	0	0	14,585	0	0	0	4,861	0	0	0	0	0	0	0	7,292
Elakatothrix genevensis (Reverdin) Hindak		0	0	7,292	7,292	7,292	0	0	0	0	0	0	0	0	0	0	0
Eudorina elegans Ehrenberg		0	0	0	21,878	0	0	0	0	4,861	3,646	0	0	0	0	0	0
Gloeocystis planctonica (W. & G.S. West) Lemmermann		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coenochlorisis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gloeocystis sp		0	0	0	0	7,292	0	0	0	0	3,646	0	0	0	0	3,646	0
Korshikoviella sp		0	7,292	7,292	7,292	7,292	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium braunii Naegeli		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium dybowskii (Wolosz) Hindak et. Kom.-Legn.		0	0	0	0	0	0	4,861	0	0	0	0	0	0	0	0	0
Monoraphidium minutum (Nag.) Komarkova-Legenerova		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium setiforme Komarkova-Legenerova		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium skujae Fott		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium spp		255,254	196,910	335,477	379,235	350,063	43,757	34,033	38,895	19,447	7,292	0	0	0	2,917	0	153,152
Monoraphidium sp2		0	0	0	0	0	0	0	0	0	7,292	0	0	0	0	0	0
Oocystis borgei Snow		7,292	7,292	0	0	7,292	0	0	4,861	0	0	0	0	0	0	0	0
Oocystis Eremosphaeria G.M. Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis gigas Archer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis parva W. & G.S. West		7,292	7,292	7,292	29,171	7,292	0	0	0	4,861	3,646	0	0	0	0	10,939	7,292
Oocystis pusilla Hansgirg		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis pyriformis Prescott		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis solitaria Wittrock		0	0	0	0	0	9,723	4,861	0	0	7,292	0	0	0	0	0	0
Oocystis socialis Ostenf		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quadrigula closteriodes (Bohlin) Printz		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus obliquus (Turpin) Kuetzing		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaerocystis Schroeteri Chodat		7,292	43,757	7,292	7,292	0	0	0	0	0	0	0	0	0	0	0	0
Tetraedron minimum (A. Braun) Hansgirg		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chromulina sp.		0	7,292	51,050	21,878	0	0	0	4,861	0	0	0	0	0	0	0	21,878
Dinobryon bavaricum Imhof		0	0	0	0	0	0	0	0	4,861	0	0	0	0	0	0	0
Dinobryon divergens Imhof		0	0	0	0	0	0	0	0	0	3,646	0	0	0	2,917	0	0
Dinobryon sp (loose monad)		0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epipyxis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas*/*Chromulina*)-large		43,757	109,394	43,757	65,636	72,929	43,757	48,619	38,895	34,033	25,525	0	17,503	0	2,917	3,646	36,464
Unidentified naked Chrysophyte sp (*Ochromonas*/*Chromulina*)-small		14,585	29,171	43,757	36,464	29,171	24,309	4,861	4,861	4,861	3,646	0	0	0	0	0	0

Annex 5.11-3: Phytoplankton Taxonomic Composition and Density, Tatelkuz Lake, August 2013

Units: Number of units/L	Lake Name	Tatelkuz Lake					Tatelkuz Lake					Tatelkuz Lake					
	Depth	Surface (1 m)					Mid (13 m)					Bottom (27 m)					
	Sample	TL1-S1	TL1-S2	TL1-S3	TL1-S4	TL1-S5	TL1-M1	TL1-M2	TL1-M3	TL1-M4	Tl1-M5	TL1-D1	TL1-D2	TL1-D3	TL1-D4	TL1-D5	TL2-S1
	Date sampled	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	16-Aug-13
	Volume Sampled (L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Taxonomy																	
Haptophyte *(Erkenia/Chrysochromulina)*		21,878	43,757	51,050	21,878	58,343	0	0	0	0	0	0	0	0	0	0	0
Kephyrion petasatum Conrad		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallomonas sp		0	0	7,292	36,463	14,585	0	0	0	4,861	0	0	0	0	0	0	0
Ochromonas sp		0	7,292	14,585	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedinella sp		7,292	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudokephyrion ellipsoideum (Pascher) Schmid		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudokephyrion millerense K.H. Nicholls		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stichogloea doederleinii (Schmidle) Wille		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uroglena sp		21,878	14,585	7,292	14,585	21,878	0	0	0	0	0	0	0	2,917	0	0	0
CRYPTOPHYCEAE																	
Cryptomonas erosa Ehrenberg		43,757	29,171	36,464	145,859	65,636	0	0	14,585	4,861	7,292	7,292	0	0	0	0	21,878
Cryptomonas marssonii Skuja		0	7,292	14,585	7,292	14,585	0	0	0	4,861	0	0	0	0	0	0	0
Cyrptomonas phaseolus Skuja		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas pyrenoidifera Geitler		0	29,171	0	14,585	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas reflexa Skuja		7,292	0	21,878	21,878	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas rostratiformis Skuja		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptophyte *(Chroomonas sp)*		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Katablepharis ovalis Skuja		29,171	65,636	87,515	94,808	109,394	9,723	4,861	14,585	4,861	0	0	0	0	0	0	65,636
Rhodomonas lens Pascher & Ruttner		0	0	0	0	0	0	4,861	0	0	0	0	0	0	0	0	0
Rhodomonas minuta Skuja		831,400	1,042,896	845,986	1,422,131	743,884	87,515	29,171	63,205	53,481	14,585	0	8,751	0	2,917	3,646	1,064,775
CYANOBACTERIA																	
Anabaena affinis Lemmermann		0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena circinalis Rabenhorst		0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena flos-aquae Brebisson		0	0	0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Anabaena solitaria f. planctonica (Brunnthaler) Komarek		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena solitaria Klebahn		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanocapsa delicatissima West & West		160,445	291,719	335,477	320,891	189,617	9,723	14,585	14,585	9,723	3,646	0	0	0	0	0	175,031
Aphanocapsa elachista W. & G.S. West		7,292	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanizomenon flos-aquae (Linne) Ralfs		685,540	656,368	568,852	787,642	452,164	68,067	87,515	165,307	145,859	69,283	7,292	2,917	8,751	5,834	3,646	1,779,487
Aphanocapsa sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanothece clathrata W & G.S. West		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,292
Aphanothece sp		36,464	87,515	7,292	14,585	21,878	0	0	0	0	0	0	0	0	0	0	21,878
Chroococcus limneticus Lemmermann		0	0	0	7,292	0	0	0	0	0	0	0	0	0	0	3,646	0
Chroococcus sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Cylindrospermum sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnothrix sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,646	0
Nostoc sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudanabaena limnetica Komarek		7,292	0	0	7,292	0	0	0	0	0	0	0	0	0	0	0	0
Romeria chlorina Bocher		14,585	7,292	43,757	7,292	21,878	0	9,723	4,861	0	0	0	0	0	0	0	7,292
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snowella arachnoidea Komarek et Hindak		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snowella lacustris (Chodat) Komarek et Hindak		0	14,585	0	21,878	14,585	0	0	0	0	0	0	0	0	0	0	43,757
Synechocystis sp (uni-cell)-spherical		14,585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Synechococcus sp (unicell)-rod-shaped		0	7,292	7,292	0	0	0	0	4,861	0	0	0	0	0	0	0	0
Woronichinia naegeliana (Unger) Elenkii		0	0	0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
EUGLENOPHYCEAE																	
Euglena acus Ehrenberg		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euglena sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trachemolomas volvocina Ehrenberg		0	7,292	0	0	7,292	4,861	0	0	0	0	0	5,834	0	0	3,646	0
DINOPHYCEAE																	
Ceratium hirundinella (O.F. Muller) Schrank		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,458
Gymnodinium helveticum Pen.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnodinium ordinatum Skuja		0	0	0	0	2,917	9,723	0	0	0	0	0	0	0	0	0	0
Gymnodinium sp		0	7,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		**2,326,437**	**2,887,992**	**2,858,823**	**3,792,325**	**2,365,820**	**403,532**	**384,081**	**486,184**	**500,767**	**371,930**	**634,481**	**140,022**	**160,442**	**93,346**	**269,828**	**3,626,052**

Note: L = litre; m = metre; sp = species

Annex 5.11-3: Phytoplankton Taxonomic Composition and Density, Tatell

Units: Number of units/L	Lake Name	Tatelkuz Lake				Tatelkuz Lake					Tatelkuz Lake				
	Depth	Surface (1 m)				Mid (15 m)					Bottom (27 m)				
	Sample	TL2-S2	TL2-S3	TL2-S4	TL2-S5	TL2-M1	TL2-M2	TL2-M3	TL2-M4	TL2-M5	TL2-D1	TL2-D2	TL2-D3	TL2-D4	TL2-D5
	Date sampled	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13
	Volume Sampled (L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Taxonomy															
DIATOMS															
Achnanthes minutissima Kuetzing		0	0	0	0	0	0	0	0	2,917	0	2,917	0	0	0
Amphora spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asterionella formosa Hansall		14,585	0	29,171	7,292	0	0	0	0	0	0	11,668	2,917	0	2,430
Aulacoseira spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyclotella/Stephanodiscus sp		14,584	0	21,878	0	0	7,292	2,917	5,834	2,917	2,917	2,917	2,917	0	4,861
Cocconeis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyclotella ocellata Pantocsek		7,292	0	0	14,585	0	3,646	8,751	0	11,668	14,585	5,834	17,503	2,917	0
Cyclotella bodanica Grunow		102,100	167,737	116,686	116,686	131,273	178,677	90,432	84,598	119,604	58,343	17,502	84,598	78,764	26,739
Fragilaria capucina Desmazieres		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fragilaria crotonensis Kitton		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fragilaria construens (Ehrenberg) Grunow		0	0	0	0	3,646	0	0	0	0	0	0	0	0	0
Fragilaria sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Navicula sp		0	0	0	7,292	0	0	0	0	0	0	0	0	0	0
Nitzschia clausii Hantzsch		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitzschia sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizosolenia longiseta Ehrenberg		7,292	0	7,292	0	0	0	0	0	0	0	0	2,917	0	0
Stephanodiscus niagarae Ehrenberg		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Stephanodiscus sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Synedra sp		0	0	0	0	0	0	0	2,917	0	0	2,917	0	0	0
Synedra ulna (Nitzsch) Ehr.		0	0	0	0	0	0	0	0	2,917	0	0	0	0	0
Tabellaria flocculosa (Roth) Kuetzing		7,292	0	0	7,292	3,646	0	2,917	0	2,917	0	0	5,834	0	4,861
CHLOROPHYCEAE															
Ankyra lanceolata (Kors) Fott		7,292	7,292	7,292	0	0	0	0	0	0	0	0	0	0	0
Chlorella sp		0	0	0	7,292	0	0	5,834	5,834	5,834	8,751	0	11,668	20,420	0
Chlamydomonas globosa Snow		0	0	0	0	0	0	5,834	0	2,917	0	0	0	0	0
Chlamydomonas sp		0	0	0	0	3,646	10,939	0	0	0	0	0	0	0	0
Closterium acutum var. *variable* (Lemmermann) W. Krieger		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Closteriopsis longissima Lemmermann		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crucigenia quadrata Morren		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crucigenia rectangularis (A. Braun) Gay		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elakatothrix gelatinosa Wille		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak		0	0	0	7,292	0	0	0	2,917	0	0	0	0	0	0
Eudorina elegans Ehrenberg		7,292	21,878	7,292	0	0	0	0	2,917	0	0	0	0	0	0
Gloeocystis planctonica (W. & G.S. West) Lemmermann		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coenochlorisis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gloeocystis sp		7,292	0	0	0	0	3,646	0	0	2,917	2,917	2,917	2,917	0	0
Korshikoviella sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium braunii Naegeli		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium dybowskii (Wolosz) Hindak et. Kom.-Legn.		0	7,292	0	0	0	0	0	0	0	0	0	2,917	0	0
Monoraphidium minutum (Nag.) Komarkova-Legenerova		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium setiforme Komarkova-Legenerova		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium skujae Fott		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium spp		386,528	226,082	211,496	0	3,646	7,292	14,585	23,337	8,751	0	0	5,834	5,834	2,430
Monoraphidium sp2		0	0	0	408,407	0	0	0	0	0	0	0	0	0	0
Oocystis borgei Snow		14,585	7,292	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis Eremosphaeria G.M. Smith		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Oocystis gigas Archer		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis parva W. & G.S. West		21,878	7,292	14,585	0	0	0	0	0	0	0	0	0	0	0
Oocystis pusilla Hansgirg		0	0	0	0	0	0	0	0	0	5,834	0	0	0	0
Oocystis pyriformis Prescott		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis solitaria Wittrock		7,292	0	0	7,292	0	0	5,834	2,917	0	2,917	0	0	5,834	2,430
Oocystis socialis Ostenf		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quadrigula closteriodes (Bohlin) Printz		0	0	0	0	0	0	0	2,917	0	0	0	0	0	0
Scenedesmus obliquus (Turpin) Kuetzing		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaerocystis Schroeteri Chodat		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetraedron minimum (A. Braun) Hansgirg		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chromulina sp.		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Dinobryon bavaricum Imhof		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dinobryon divergens Imhof		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dinobryon sp (loose monad)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epipyxis sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas*/*Chromulina*)-large		58,343	29,171	80,222	51,050	10,939	40,111	29,171	29,171	23,337	11,668	0	32,089	26,254	7,292
Unidentified naked Chrysophyte sp (*Ochromonas*/*Chromulina*)-small		102,101	36,464	36,464	29,171	3,646	3,646	11,668	5,834	11,668	0	0	5,834	2,917	0

Annex 5.11-3: Phytoplankton Taxonomic Composition and Density, Tatell

Units: Number of units/L	Lake Name	Tatelkuz Lake				Tatelkuz Lake					Tatelkuz Lake				
	Depth	Surface (1 m)				Mid (15 m)					Bottom (27 m)				
	Sample	TL2-S2	TL2-S3	TL2-S4	TL2-S5	TL2-M1	TL2-M2	TL2-M3	TL2-M4	TL2-M5	TL2-D1	TL2-D2	TL2-D3	TL2-D4	TL2-D5
	Date sampled	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13
	Volume Sampled (L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Taxonomy															
Haptophyte *(Erkenia/Chrysochromulina)*		43,757	0	0	0	0	0	0	0	0	0	0	0	0	0
Kephyrion petasatum Conrad		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallomonas sp		0	0	0	7,292	0	0	0	0	0	0	0	0	0	0
Ochromonas sp		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Pedinella sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudokephyrion ellipsoideum (Pascher) Schmid		0	0	7,292	0	0	7,292	0	0	0	0	0	0	0	0
Pseudokephyrion millerense K.H. Nicholls		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stichogloea doederleinii (Schmidle) Wille		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uroglena sp		7,292	0	14,585	7,292	0	0	0	0	2,917	2,917	0	0	0	0
CRYPTOPHYCEAE															
Cryptomonas erosa Ehrenberg		0	7,292	29,171	7,292	0	3,646	2,917	0	0	0	0	0	0	0
Cryptomonas marssonii Skuja		0	0	0	7,292	0	0	0	0	0	0	0	0	0	0
Cyrptomonas phaseolus Skuja		21,878	14,585	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas pyrenoidifera Geitler		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas reflexa Skuja		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas rostratiformis Skuja		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptophyte *(Chroomonas sp)*		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Katablepharis ovalis Skuja		160,445	51,050	233,375	189,617	10,939	29,171	8,751	23,337	14,585	23,337	35,006	35,006	55,426	4,861
Rhodomonas lens Pascher & Ruttner		7,292	0	0	0	0	0	0	0	0	0	2,917	0	0	2,430
Rhodomonas minuta Skuja		1,064,775	401,114	1,115,826	685,540	21,878	29,171	5,834	14,585	11,668	2,917	0	32,089	26,254	2,430
CYANOBACTERIA															
Anabaena affinis Lemmermann		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena circinalis Rabenhorst		0	0	0	0	0	0	0	0	0	2,917	0	0	0	0
Anabaena flos-aquae Brebisson		0	0	0	0	3,646	0	0	0	0	0	0	0	0	0
Anabaena solitaria f. planctonica (Brunnthaler) Komarek		0	0	7,292	0	0	0	0	0	0	0	0	0	0	0
Anabaena solitaria Klebahn		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabaena sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanocapsa delicatissima West & West		218,789	123,980	189,617	109,394	10,939	3,646	5,834	0	2,917	0	0	5,834	0	0
Aphanocapsa elachista W. & G.S. West		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanizomenon flos-aquae (Linne) Ralfs		933,501	583,438	1,050,189	466,750	43,757	47,404	52,509	96,267	55,426	11,668	11,668	14,585	8,751	4,861
Aphanocapsa sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanothece clathrata W & G.S. West		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphanothece sp		7,292	36,464	29,171	29,171	0	0	0	0	0	0	0	0	0	0
Chroococcus limneticus Lemmermann		7,292	0	14,585	0	3,646	0	2,917	0	0	0	0	0	0	0
Chroococcus sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cylindrospermum sp		0	0	0	0	0	0	0	0	0	2,917	0	0	0	0
Limnothrix sp		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Nostoc sp		0	0	0	0	0	7,292	0	0	0	0	0	0	0	0
Pseudanabaena limnetica Komarek		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Romeria chlorina Bocher		36,464	21,878	21,878	29,171	0	0	5,834	2,917	0	0	0	0	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snowella arachnoidea Komarek et Hindak		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snowella lacustris (Chodat) Komarek et Hindak		7,292	7,292	7,292	0	0	0	0	0	0	0	0	0	0	0
Synechocystis sp (uni-cell)-spherical		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
Synechococcus sp (unicell)-rod-shaped		14,585	51,050	0	36,464	0	0	0	0	0	0	0	0	0	0
Woronichinia naegeliana (Unger) Elenkii		0	0	0	0	0	0	0	0	0	0	0	0	0	0
EUGLENOPHYCEAE															
Euglena acus Ehrenberg		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euglena sp		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trachemolomas volvocina Ehrenberg		0	0	7,292	14,585	0	0	0	0	0	0	0	0	0	0
DINOPHYCEAE															
Ceratium hirundinella (O.F. Muller) Schrank		0	7,292	0	0	0	0	0	0	0	0	0	0	0	0
Gymnodinium helveticum Pen.		0	0	0	0	0	0	2,917	0	2,917	0	5,834	0	0	0
Gymnodinium ordinatum Skuja		0	0	0	0	0	3,646	0	0	0	0	0	0	0	0
Gymnodinium sp		7,292	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		**3,332,862**	**1,815,935**	**3,289,111**	**2,253,511**	**255,247**	**386,517**	**265,456**	**306,299**	**288,794**	**154,605**	**102,097**	**265,459**	**233,371**	**65,625**

Note: L = litre; m = metre; sp = species

Annex 5.11-4
Cluster Analysis of Phytoplankton Taxa from Tatelkuz Lake and Headwater Lakes 14, 15, and 16

Table 5.11-4A: Mean density and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected above the thermocline in Tatelkuz Lake and in headwater lakes 14, 15 and 16

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Aphanizomenon flos-aquae	761,116.7	1,471.5	12.97	12.97
Rhodomonas minuta Skuja	900,449.2	82,690.8	10.29	23.26
Monoraphidium spp.	283,364.6	7.8	8.21	31.47
Aphanocapsa delicatissima West & West	204,864.9	27919.1	4.61	36.08
Katablepharis ovalis Skuja	100,026.7	376.4	4.6	40.68
Cyclotella bodanica Grunow	132,452.3	206,23.8	3.6	44.27
Cryptomonas erosa Ehrenberg	28,849.0	63.8	2.5	46.77
Aphanothece sp.	25,814.8	7.8	2.49	49.26
Romeria chlorina Bocher	19,365.5	0.0	2.17	51.42
Haptophyte (Erkenia/ Chrysochromulina)	13,964.1	1,164.2	1.68	53.11
Oocystis solitaria Wittrock	291.7	11,111.3	1.43	54.54
Unidentified naked Chrysophyte sp. (Ochromonas/Chromulina) small	30,091.8	30,635.5	1.41	55.95
Unidentified naked Chrysophyte sp. (Ochromonas/Chromulina) large	57,015.9	37,225.8	1.37	57.32
Uroglena sp.	8,359.4	3.9	1.37	58.69
Pseudokephyrion ellipsoideum (Pascher) Schmid	291.7	9,011.7	1.31	60
Snowella lacustris (Chodat) Komarek et Hindak	7,306.8	4,806.6	1.27	61.27
Cyclotella/ *Stephanodiscus* sp	2,254.4	9,714.1	1.24	62.51
Asterionella formosa Hansall	9,745.6	869.1	1.2	63.71
Synechococcus sp. (unicell)-rod-shaped	5,019.7	0.0	1.16	64.87
Monoraphidium setiforme Komarkova-Legenerova	72.9	5,643.0	1.14	66.01
Korshikoviella sp.	1,166.9	7,617.8	1.06	67.07
Chromulina sp.	4,796.9	27.0	1.02	68.09

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Stephanodiscus niagarae Ehrenberg	72.9	3,880.0	0.97	69.06
Dinobryon sp. (loose monad)	72.9	3,724.7	0.91	69.97
Gloeocystis sp.	291.7	4,287.6	0.91	70.88
Aphanocapsa elachista W. & G.S. West	291.7	3,464.5	0.9	71.78
Oocystis parva W. & G.S. West	9,059.2	5,035.3	0.89	72.67
Stichogloea globosa Starmach	0.0	3,452.7	0.87	73.54
Monoraphidium dybowskii (Wolosz) Hindak et. Kom.-Legn.	72.9	2,821.7	0.86	74.4
Dinobryon divergens Imhof	0.0	2,838.8	0.8	75.21
Mallomonas sp.	2,328.1	623.0	0.8	76.01
Oocystis borgei Snow	2,137.2	3,006.3	0.79	76.8
Sphaerocystis schroeteri Chodat	2,166.0	446.9	0.78	77.58
Cryptomonas marssonii Skuja	2,477.1	174.2	0.77	78.34
Elakatothrix genevensis (Reverdin) Hindak	1,166.9	3,301.7	0.76	79.11
Eudorina elegans Ehrenberg	2,177.2	0.0	0.72	79.83
Botryococcus sp.	0.0	1,960.7	0.71	80.53
Trachemolomas volvocina Ehrenberg	1,420.5	136.4	0.63	81.16
Tabellaria flocculosa (Roth) Kuetzing	1,166.9	379.9	0.61	81.77
Ankyra lanceolata (Kors) Fott	656.4	845.1	0.59	82.36
Cyclotella ocellata Pantocsek	1,253.9	5.9	0.58	82.93
Cryptomonas reflexa Skuja	1,453.1	7.8	0.57	83.51
Cryptomonas pyrenoidifera Geitler	1,421.3	3.9	0.55	84.06
Chroococcus limneticus Lemmermann	850.3	449.4	0.55	84.61
Aulacoseira sp.	0.0	1,206.9	0.51	85.12

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Anabaena solitaria f. planctonica (Brunnthaler) Komarek	72.9	839.3	0.47	85.59
Cyrptomonas phaseolus Skuja	722.0	31.1	0.47	86.06
Crucigenia quadrata Morren	0.0	976.6	0.45	86.51
Ochromonas sp.	850.3	7.8	0.44	86.95
Limnothrix sp.	72.9	549.0	0.42	87.37
Tetraedron minimum	0.0	806.0	0.42	87.79
Rhizosolenia longiseta Ehrenberg	850.3	0.0	0.41	88.2
Chlorella sp.	291.7	205.9	0.39	88.59
Elakatothrix gelatinosa Wille	425.2	45.3	0.36	88.95
Navicula sp.	72.9	268.3	0.35	89.3
Synechocystis sp.	425.2	7.8	0.35	89.65
Pedinella sp.	291.7	70.1	0.34	89.99
Gymnodinium ordinatum Skuja	29.2	358.7	0.34	90.33

Note: number/m^3 = individuals per cubic metre; sp = species; % = percent; Highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

Table 5.11-4B: Mean biomass and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected above the thermocline in Tatelkuz Lake and headwater lakes 14, 15 and 16

Species	Mean Biomass (µg/L)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Aphanizomenon flos-aquae	19,491.0	11.0	41.51	41.51
Cyclotella bodanica Grunow	1,785.1	172.1	9.14	50.64
Stephanodiscus niagarae Ehrenberg	1.3	417.8	6.05	56.69
Botryococcus sp	0.0	91.4	2.88	59.57
Cryptomonas erosa Ehrenberg	95.1	0.2	2.81	62.39
Rhodomonas minuta Skuja	139.9	12.4	2.54	64.93
Aphanocapsa delicatissima West & West	112.1	16.1	2.1	67.03
Aphanothece sp	23.0	0.0	1.48	68.51
Eudorina elegans Ehrenberg	18.6	0.0	1.3	69.81
Snowella lacustris (Chodat) Komarek et Hindak	14.0	12.0	1.22	71.03
Anabaena solitaria f. planctonica (Brunnthaler) Komarek	0.1	16.7	1.21	72.24
Asterionella formosa Hansall	17.8	1.2	1.09	73.33
Stichogloea globosa Starmach	0.0	12.7	1.06	74.39
Aphanocapsa elachista W. & G.S. West	0.6	11.0	1.06	75.45
Monoraphidium spp	11.1	0.0	1.03	76.48
Ceratium hirundinella (O.F. Muller) Schrank	10.1	0.0	1.01	77.49
Tabellaria flocculosa (Roth) Kuetzing	6.8	2.0	0.96	78.45
Mallomonas sp	7.8	0.5	0.89	79.34
Gymnodinium sp	6.5	0.4	0.88	80.22
Katablepharis ovalis Skuja	8.2	0.0	0.83	81.05
Trachemolomas volvocina Ehrenberg	5.8	0.7	0.82	81.87
Sphaerocystis schroeteri Chodat	4.3	0.8	0.69	82.56
Anabaena spiroides Klebahn	0.0	5.1	0.65	83.21
Gloeocystis sp	0.2	5.3	0.64	83.85

Species	Mean Biomass (µg/L)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Oocystis borigei Snow	3.6	3.6	0.64	84.49
Chroococcus limneticus Lemmermann	2.0	1.3	0.58	85.07
Fragilaria crotonensis Kitton	0.0	3.8	0.56	85.64
Gymnodinium ordinatum Skuja	1.8	0.2	0.54	86.17
Cryptomonas reflexa Skuja	3.1	0.0	0.54	86.71
Oocystis solitaria Wittrock	0.1	3.4	0.52	87.23
Anabaena affinis Lemmermann	3.1	0.0	0.51	87.74
Cryptomonas pyrenoidifera Geitler	2.7	0.0	0.48	88.22
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina) large	16.4	11.6	0.46	88.68
Cryptomonas marssonii Skuja	2.0	0.1	0.45	89.13
Crucigenia rectangularis (A. Braun) Gay	0.6	0.8	0.44	89.57
Aulacoseira sp.	0.0	2.0	0.43	90

Note: µg/L = microgramme per litre; % = percent; sp = species; highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

Table 5.11-4C: Mean density and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected below the thermocline in Tatelkuz Lake and headwater lakes 14, 15 and 16

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
Cyclotella / *Stephanodiscus* sp	2,595.9	78,629.8	6.44	6.44
Cyrptomonas phaseolus Skuja	0.0	77,367.4	6.3	12.74
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina) small	2,347.4	80,570.8	6.28	19.02
Synechocystis sp	0.0	36,046.8	5.77	24.79
Trachemolomas volvocina Ehrenberg	106.5	54,135.3	5.26	30.05
Cryptomonas marssonii Skuja	12.2	52,230.5	5.26	35.31
Aphanizomenon flos-aquae	33,856.0	0.0	4.68	39.98
Cyclotella bodanica Grunow	99,679.1	24,279.9	4.52	44.51
Chlorella sp.	1034.9	24649.0	4.08	48.59
Aphanocapsa sp.	0.0	11,549.8	3.26	51.86
Unidentified naked Chrysophyte sp. (Ochromonas/Chromulina) large	16,276.7	45,569.4	2.91	54.76
Aphanocapsa delicatissima West & West	1,895.7	19,507.7	2.86	57.62
Pseudanabaena limnetica Komarek	0.0	11289.1	2.85	60.47
Rhodomonas minuta Skuja	13,764.0	17,121.7	2.79	63.26
Cryptomonas reflexa Skuja	0.0	15567.6	2.77	66.03
Cryptomonas erosa Ehrenberg	565.5	12,737.4	2.61	68.64
Crucigenia quadrata Morren	0.0	8,056.9	2.43	71.07
Monoraphidium spp	6561.0	0.0	2.03	73.1
Katablepharis ovalis Skuja	8,403.4	7,002.3	1.98	75.08
Oocystis solitaria Wittrock	794.7	7,788.1	1.95	77.02
Cyclotella ocellata Pantocsek	3151.7	0.0	1.5	78.53
Mallomonas sp.	12.2	4,232.8	1.49	80.02
Asterionella formosa Hansall	1849.0	72.9	1.23	81.25
Oocystis borgei Snow	12.2	2,323.2	1.13	82.38
Gloeocystis sp.	394.4	850.3	1.04	83.42
Haptophyte	0.0	1,287.4	0.92	84.35

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater Lakes		
(Erkenia/Chrysochromulina)				
Tabellaria flocculosa (Roth) Kuetzing	1,111.6	0.0	0.87	85.22
Limnothrix sp.	9.1	761.2	0.75	85.97
Oocystis pusilla Hansgirg	14.6	578.4	0.72	86.7
Achnanthes minutissima Kuetzing	765.6	0.0	0.72	87.42
Dicronema cf. *vlklanum* Prauser	0.0	918.1	0.64	88.06
Cryptomonas pyrenoidifera Geitler	0.0	566.4	0.57	88.63
Fragilaria construens (Ehrenberg) Grunow	399.2	0.0	0.51	89.14
Chroococcus limneticus Lemmermann	76.4	240.6	0.5	89.64
Chromulina sp.	12.2	291.7	0.49	90.12

Note: number/m^3 = individuals per cubic metre; Highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

Table 5.11-4D: Mean biomass and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected below the thermocline in Tatelkuz Lake and headwater lakes 14, 15, and 16

Species	Mean Biomass (µg/L)		Mean Dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative (%)
	Tatelkuz	Headwater				
Aphanizomenon flos-aquae	780.1	0.0	15.4	1.61	20.05	20.05
Cyclotella bodanica Grunow	1,466.9	196.8	15.03	1.47	19.57	39.62
Trachemolomas volvocina Ehrenberg	0.5	214.9	6.94	1.4	9.04	48.67
Cyrptomonas phaseolus Skuja	0.0	53.4	3.44	1.19	4.48	53.15
Cryptomonas erosa Ehrenberg	1.5	46.4	3.15	1.06	4.11	57.25
Cryptomonas reflexa Skuja	0.0	46.8	3.04	0.78	3.96	61.22
Cryptomonas marssonii Skuja	0.0	33.6	2.75	1.09	3.58	64.8
Aphanocapsa sp	0.0	11.7	2.44	0.92	3.18	67.98
Aphanocapsa delicatissima West & West	1.3	7.8	1.39	1.09	1.81	69.79
Cyclotella ocellata Pantocsek	3.5	0.0	1.18	0.97	1.53	71.32
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina) large	4.9	13.8	1.17	1.34	1.53	72.85
Mallomonas sp	0.0	4.8	1.07	0.76	1.4	74.25
Pseudanabaena limnetica Komarek	0.0	2.1	0.91	1.46	1.19	75.43
Gymnodinium helveticum Pen.	2.0	0.0	0.91	0.35	1.18	76.62
Tabellaria flocculosa (Roth) Kuetzing	2.0	0.0	0.85	0.74	1.11	77.73
Cyclotella/*Stephanodiscus* sp	1.0	3.6	0.85	1.12	1.11	78.84
Crucigenia quadrata Morren	0.0	1.6	0.83	1.1	1.08	79.92
Asterionella formosa Hansall	1.1	0.1	0.81	0.84	1.06	80.98
Oocystis borgei Snow	0.0	2.2	0.8	0.92	1.04	82.01
Chlorella sp	0.1	1.3	0.79	0.81	1.02	83.03
Rhodomonas minut Skuja	2.0	2.5	0.77	1.37	1	84.04
Anabaena solitaria f. planctonica (Brunnthaler) Komarek	0.0	2.6	0.76	0.33	0.99	85.03
Oocystis solitaria Wittrock	0.4	2.2	0.71	1.23	0.93	85.96
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina) small	0.0	1.4	0.61	1.47	0.79	86.75
Euglena acus Ehrenberg	0.0	0.7	0.6	0.41	0.78	87.53
Gloeocystis sp	0.1	0.6	0.57	0.67	0.75	88.27
Fragilaria construens (Ehrenberg) Grunow	1.1	0.0	0.52	0.42	0.67	88.94
Aulacoseira sp.	0.0	1.1	0.51	0.33	0.66	89.61
Cryptomonas pyrenoidifera Geitler	0.0	1.1	0.51	0.59	0.66	90.27

Note: µg/L = microgram per litre; SD = standard deviation; % = percent; sp = species; highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes

Table 5.11-4E: Mean density and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected below and above the thermocline in Tatelkuz Lake

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz Above Thermocline	Tatelkuz Below Thermocline		
Rhodomonas minuta Skuja	900,449.2	13,764.0	15.49	15.49
Aphanizomenon flos-aquae	761,116.7	33,856.0	13.02	28.5
Monoraphidium spp	283,364.6	6,561.0	8.52	37.02
Aphanocapsa delicatissima West & West	204,864.9	1,895.7	7.61	44.63
Katablepharis ovalis Skuja	100,026.7	8,403.4	4.21	48.84
Aphanothece sp	25,814.9	0	3.06	51.91
Cryptomonas erosa Ehrenberg	28,849.0	565.5	2.8	54.7
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina)-small	30,091.8	2,347.4	2.52	57.23
Romeria chlorina Bocher	19,365.5	223.2	2.37	59.59
Cyclotella bodanica Grunow	132,452.3	99,679.1	2.15	61.75
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina)-large	57,015.9	16,276.7	2.15	63.9
Haptophyte (Erkenia/Chrysochromulina)	13,964.2	0	2.11	66
Oocystis parva W. & G.S. West	9,059.2	137.6	1.6	67.6
Uroglena sp	8,359.4	65.6	1.59	69.18
Snowella lacustris (Chodat) Komarek et Hindak	7,306.8	0	1.58	70.77
Synechococcus sp (unicell)-rod-shaped	5,019.7	12.2	1.41	72.18
Asterionella formosa Hansall	9,745.6	1,849	1.36	73.54
Chromulina sp.	4,796.9	12.2	1.22	74.76
Cyclotella ocellata Pantocsek	1,253.9	3,151.7	1.16	75.92
Cyclotella/*Stephanodiscus* sp	2,254.4	2,595.9	1.1	77.02
Eudorina elegans Ehrenberg	2,177.2	84.8	0.91	77.92
Cryptomonas marssonii Skuja	2,477.1	12.2	0.91	78.83
Oocystis borgei Snow	2,137.2	12.2	0.88	79.71
Mallomonas sp	2,328.0	12.9	0.88	80.59
Sphaerocystis schroeteri Chodat	2,166.0	0	0.82	81.41
Tabellaria flocculosa (Roth) Kuetzing	1,166.9	1,111.6	0.8	82.21
Achnanthes minutissima Kuetzing	291.7	765.6	0.79	82.99
Trachemolomas volvocina Ehrenberg	1,420.5	106.5	0.75	83.75
Chlorella sp	291.7	1,034.9	0.72	84.46
Cryptomonas reflexa Skuja	1,453.1	0	0.67	85.13
Cryptomonas pyrenoidifera Geitler	1,421.3	0	0.64	85.78
Oocystis solitaria Wittrock	291.7	794.7	0.64	86.42
Elakatothrix genevensis (Reverdin) Hindak	1,166.9	7.3	0.64	87.05

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
Rhizosolenia longiseta Ehrenberg	850.3	138.3	0.6	87.65
Korshikoviella sp	1,166.9	0	0.6	88.25
Chroococcus limneticus Lemmermann	850.3	76.4	0.57	88.82
Gloeocystis sp	291.7	394.4	0.53	89.35
Cyrptomonas phaseolus Skuja	722.0	0	0.52	89.88
Ochromonas sp	850.3	0	0.51	90.39

Note: Mean dissimilarity = 70.25; number/m^3 = individuals per cubic metre; % = percent; sp = species; highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities in Tatelkuz from headwater lakes.

Table 5.11-4F: Mean biomass and contributions to Bray-Curtis dissimilarity (SIMPER analysis) of phytoplankton taxa collected below and above the thermocline in Tatelkuz Lake

Species	Mean Biomass (µg/L)		Contribution (%)	Cumulative (%)
	Tatelkuz Above Thermocline	Tatelkuz Below Thermocline		
Aphanizomenon flos-aquae	138.30	24.40	13.13	13.13
Aphanocapsa delicatissima West & West	10.50	0.53	4.82	17.95
Cryptomonas erosa Ehrenberg	8.29	0.36	4.55	22.5
Rhodomonas minuta Skuja	11.70	1.10	4.53	27.03
Aphanothece sp	4.54	0.00	4.05	31.08
Snowella lacustris (Chodat) Komarek et Hindak	2.50	0.00	2.97	34.05
Asterionella formosa Hansall	3.76	0.50	2.56	36.6
Eudorina elegans Ehrenberg	1.56	0.13	2.54	39.14
Monoraphidium spp	3.28	0.32	2.4	41.54
Tabellaria flocculosa (Roth) Kuetzing	1.04	0.62	2.25	43.8
Cyclotella bodanica Grunow	41.86	36.97	2.04	45.83
Trachemolomas volvocina Ehrenberg	0.96	0.10	1.97	47.8
Mallomonas sp	1.10	0.01	1.96	49.76
Cyclotella ocellata Pantocsek	0.27	1.08	1.91	51.68
Oocystis borgei Snow	0.94	0.01	1.86	53.54
Katablepharis ovalis Skuja	2.79	0.58	1.75	55.29
Ceratium hirundinella (O.F. Muller) Schrank	0.62	0.00	1.68	56.97
Sphaerocystis schroeteri Chodat	0.83	0.00	1.62	58.59
Romeria chlorina Bocher	0.96	0.02	1.62	60.21
Cryptomonas marssonii Skuja	0.71	0.00	1.54	61.74
Cyclotella/*Stephanodiscus* sp	0.35	0.66	1.46	63.21
Uroglena sp	0.72	0.01	1.44	64.65
Chromulina sp.	0.56	0.00	1.35	66
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina)-large	4.00	1.80	1.35	67.35
Cryptomonas reflexa Skuja	0.52	0.00	1.31	68.65
Chroococcus limneticus Lemmermann	0.40	0.04	1.28	69.93
Oocystis parva W. & G.S. West	0.55	0.01	1.27	71.2
Gymnodinium sp	0.50	0.00	1.24	72.45
Cryptomonas pyrenoidifera Geitler	0.48	0.00	1.2	73.65
Unidentified naked Chrysophyte sp (Ochromonas/Chromulina)-small	0.76	0.12	1.15	74.8
Oocystis solitaria Wittrock	0.06	0.24	1.06	75.86
Fragilaria construens (Ehrenberg) Grunow	0.02	0.19	1	76.86
Gloeocystis sp	0.08	0.12	0.92	77.77
Gymnodinium ordinatum Skuja	0.14	0.02	0.87	78.65
Stephanodiscus niagarae Ehrenberg	0.12	0.02	0.87	79.52
Gymnodinium helveticum Pen.	0.00	0.21	0.86	80.38

Species	Mean Biomass (µg/L)		Contribution	Cumulative
Haptophyte (Erkenia/Chrysochromulina)	0.20	0.00	0.81	81.19
Aphanocapsa elachista W. & G.S. West	0.15	0.00	0.75	81.93
Synechococcus sp (unicell)-rod-shaped	0.14	0.00	0.72	82.66
Anabaena affinis Lemmermann	0.18	0.00	0.72	83.38
Chlorella sp	0.04	0.09	0.71	84.08
Ochromonas sp	0.16	0.00	0.71	84.79
Elakatothrix genevensis (Reverdin) Hindak	0.14	0.00	0.69	85.48
Chlamydomonas sp	0.00	0.08	0.63	86.11
Cyrptomonas phaseolus Skuja	0.10	0.00	0.62	86.73
Anabaena solitaria Klebahn	0.12	0.00	0.62	87.35
Woronichinia naegeliana (Unger) Elenkii	0.10	0.00	0.57	87.92
Rhizosolenia longiseta Ehrenberg	0.06	0.01	0.53	88.44
Cryptomonas rostratiformis Skuja	0.09	0.00	0.53	88.97
Achnanthes minutissima Kuetzing	0.01	0.03	0.52	89.49
Korshikoviella sp	0.09	0.00	0.52	90.01

Note: Mean dissimilarity = 58.84; µg/L = microgram per litre; % = percent; sp = species; highest dissimilarity contributions indicate taxa that best discriminate phytoplankton communities above and below the thermocline in Tatelkuz Lake.

Annex 5.11-5
Metrics of Phytoplankton Samples from Tatelkuz Lake and Headwater Lakes 14, 15, and 16

Annex 5.11-5: Phytoplankton Metrics of Samples from Tatelkuz Lake and Headwater Lakes 14, 15, 16

Lake	Sample	Density (number/m^3)	Biomass (µg/L)	Taxa Richness	Diversity (Shannon-Weiner Index)	Chlorophyll *a* (µg/L)
Lake 14 (Surface)	**mean**	**505,619**	**575**	**29**	**2.87**	**1.53**
	L14-S1	729,260	1438	39	3.15	1.57
	L14-S2	495,898	428	25	2.67	2.11
	L14-S3	306,281	310	25	2.87	1.66
	L14-S4	520,204	337	29	2.90	1.07
	L14-S5	476,450	365	26	2.74	1.22
Lake 14 (Bottom)	**mean**	**739,959**	**1560**	**36**	**2.86**	**2.82**
	L14-D6	870,256	2718	38	2.91	2.18
	L14-D7	500,754	1576	31	2.95	3.05
	L14-D8	670,920	897	35	2.87	2.73
	L14-D9	1,025,835	1698	46	3.05	2.74
	L14-D10	632,031	914	28	2.50	3.41
Lake 15 (Surface)	**mean**	**178,849**	**1645**	**25**	**3.41**	**0.47**
	L15-S1	247,951	673	29	2.97	0.82
	L15-S2	224,613	3130	28	3.00	0.60
	L15-S3	24,495	148	16	2.45	0.29
	L15-S4	210,030	3221	22	2.57	0.32
	L15-S5	187,156	1053	30	2.88	0.29
Lake 15 (Bottom)	**mean**	**222,863**	**2872**	**28**	**2.91**	**0.62**
	L15-D6	256,703	1846	24	2.69	0.95
	L15-D7	245,031	3132	36	3.25	0.45
	L15-D8	271,289	3076	30	2.90	0.51
	L15-D9	163,355	3399	23	2.84	0.82
	L15-D10	177,939	2907	25	2.88	0.35
Lake 16 (Surface)	**mean**	**818,493**	**2235**	**26**	**2.56**	**0.47**
	L16-S1	777,897	1734	22	2.34	0.34
	L16-S2	855,688	2247	23	2.37	0.32
	L16-S3	707,401	1626	24	2.59	0.47
	L16-S4	618,668	2328	31	2.78	0.56
	L16-S5	1,132,812	3241	32	2.71	0.67
Lake 16 (Mid)	**mean**	**1,184,845**	**2042**	**23**	**2.43**	**2.88**
	L16-M6	743,860	1370	25	2.63	2.45
	L16-M7	797,342	1526	25	2.55	2.18
	L16-M8	1,385,647	1949	21	2.17	3.94
	L16-M9	1,480,457	2677	21	2.39	2.36
	L16-M10	1,516,921	2687	21	2.41	3.49
Lake 16 (Bottom)	**mean**	**765,748**	**252**	**15**	**2.07**	**0.69**
	L16-D11	780,330	294	18	1.99	0.78
	L16-D12	357,346	95	9	1.82	1.28
	L16-D13	816,799	245	15	2.06	0.54
	L16-D14	663,646	115	16	2.14	0.42
Tatelkuz Lake 1 (Surface)	**mean**	**2,846,279**	**19672**	**29**	**2.12**	**5.65**
	TL1-S1	2,326,437	18140	27	1.93	5.49
	TL1-S2	2,887,992	19914	32	2.14	6.67

Lake	Sample	Density (number/m^3)	Biomass (µg/L)	Taxa Richness	Diversity (Shannon-Weiner Index)	Chlorophyll *a* (µg/L)
	TL1-S3	2,858,823	19507	30	2.22	5.65
	TL1-S4	3,792,325	24920	29	2.08	5.64
	TL1-S5	2,365,820	15878	27	2.22	4.82
Tatelkuz Lake 1 (Mid)	**mean**	**429,299**	**4983**	**16**	**2.01**	**1.16**
	TL1-M1	403,532	2683	13	2.16	1.37
	TL1-M2	384,081	4560	16	2.09	1.14
	TL1-M3	486,184	6158	15	2.00	1.59
	TL1-M4	500,767	6886	18	1.95	1.04
	TL1-M5	371,930	4628	17	1.85	0.68
Tatelkuz Lake 1 (Bottom)	**mean**	**259,624**	**2352**	**11**	**1.39**	**0.24**
	TL1-D1	634,481	7197	8	0.96	0.35
	TL1-D2	140,022	1364	10	1.46	0.20
	TL1-D3	160,442	1991	7	0.89	0.24
	TL1-D4	93,346	727	10	1.76	0.17
	TL1-D5	269,828	480	22	1.90	0.26
Tatelkuz Lake 2 (Surface)	**mean**	**2,863,494**	**26527**	**25**	**1.94**	**8.04**
	TL2-S1	3,626,052	46681	21	1.54	8.02
	TL2-S2	3,332,862	26686	33	2.08	8.41
	TL2-S3	1,815,935	16531	20	2.09	7.74
	TL2-S4	3,289,111	29218	27	1.93	7.58
	TL2-S5	2,253,511	13517	23	2.08	8.45
Tatelkuz Lake 2 (Mid)	**mean**	**300,463**	**3213**	**16**	**1.96**	**0.88**
	TL2-M1	255,247	2786	13	1.68	0.69
	TL2-M2	386,517	4022	16	1.90	0.97
	TL2-M3	265,456	2739	18	2.20	0.75
	TL2-M4	306,299	3481	15	1.97	1.08
	TL2-M5	288,794	3037	18	2.03	0.93
Tatelkuz Lake 2 (Bottom)	**mean**	**164,231**	**1098**	**12**	**2.02**	**0.17**
	TL2-D1	154,605	1079	14	2.08	0.27
	TL2-D2	102,097	810	11	2.00	0.12
	TL2-D3	265,459	1592	16	2.20	0.17
	TL2-D4	233,371	1518	10	1.83	0.15
	TL2-D5	65,625	491	11	1.99	0.16

Note: inds/m^3 = individuals per cubic metre; µg/L = microgram per litre.

Annex 5.11-6
Density and Biomass of Zooplankton, Tatelkuz Lake, August 2013

Table 5.11-6A: Density and taxonomy of zooplankton, Tatelkuz Lake, August 2013

Lake Name	Tatelkuz Lake				
Sample ID	TL1-1	TL1-2	TL1-3	TL1-4	TL1-5
Date Sampled	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13
Volume Sampled (m^3)	21.98	21.98	21.98	22.765	21.98
Units: number of organisms/m^3					
Taxonomy					
Rotifera					
Ascomorpha saltans (Bartsch)					
*Asplanchna herricki (*de Guerne)		290.618			
Collotheca mutabilis (Harring)		1,453.091	355.200	2,340.949	2,615.564
*Collotheca pelagica (*Rousselet)					
Conochilus unicornis (Rousselet)	6,135.273	6,393.600	3,907.200	1,820.738	2,034.327
Euchlanis calpidia (Myers)	2,260.364	2,615.564	1,776.000	780.316	1,453.091
*Euchlanis meneta (*Myers)			355.200		
Filinia terminalis (Plate)					
Gastropus stylifer (Imhof)	322.909	871.855	355.200	520.211	581.236
Kellicotia longispina (Kellicott)	5,166.545	4,940.509	4,972.800	2,080.844	3,778.036
Keratella cochlearis (Gosse)	645.818	290.618		520.211	
Keratella hiemalis (Carlin)		290.618			
Notommata sp					
Polyathra dolicoptera (Idelson)					
Polyathra major (Burckhardt)		290.618			
Synchaeta sp			355.200		
Trichocerca multicrinis (Kellicott)	1,937.455	2,615.564	2,486.400	1,560.633	1,162.473
Trichocerca rousseleti (Voigt)	322.909				
Ciliophora					
Vorticella sp	3,229.091	6,102.982	3,196.800	2,601.054	2,324.945
Calanoida					
*Diaptomus ashlandi (*Marsh)	5,490.909	4,670.061	6,238.909	0,3257.176	4,945.455
Calanoid copepodid	145.455	72.970	218.909		24.242
Calanoid (nauplii)					290.618
Cyclopoida					
Cyclops bicuspidatus thomasi (S. A. Forbes)	1,200.000	1,131.030	1,276.970	1,054.482	1,163.636
Cyclopoid copepodid	181.818	182.424	36.485	93.732	121.212
Cyclopoid (nauplii)	16,145.455	13,368.436	8,880.000	15,346.221	12,496.582
Cladocera					
Daphnia longiremis (Sars)	2,145.455	1,313.455	1,714.788	632.689	1,284.848
Diaphanosoma brachyurum (Lievin)	981.818	583.758	364.848	304.628	484.848
Chydorus sphaericus (O.F. Muller)	109.091				
Bosmina longirostris (O.F. Muller)	254.545	218.909	182.424	164.030	315.152
Cladocera immature	36.364		36.485	23.433	

Note: m^3 = cubic metres

Lake Name	Tatelkuz Lake				
Sample ID	TL2-1	TL2-2	TL2-3	TL2-4	TL2-5
Date Sampled	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	15-Aug-13
Volume Sampled (m^3)	21.20	21.20	21.20	21.20	21.20
Units: number of organisms/m^3					
Taxonomy					
Rotifera					
Ascomorpha saltans (Bartsch)				446.792	
*Asplanchna herricki (*de Guerne)					
Collotheca mutabilis (Harring)	3,574.340	2,457.358	1,340.377	1,340.377	915.925
*Collotheca pelagica (*Rousselet)		491.472	446.792	446.792	915.925
Conochilus unicornis (Rousselet)	3,127.547	1,965.887	3,574.340	4,467.925	2,747.774
Euchlanis calpidia (Myers)	446.792	982.943	893.585	893.585	1,373.887
*Euchlanis meneta (*Myers)					
Filinia terminalis (Plate)	446.792			893.585	457.962
Gastropus stylifer (Imhof)	446.792		893.585		457.962
Kellicotia longispina (Kellicott)	2,680.755	4,423.245	4,021.132	4,021.132	5,495.547
Keratella cochlearis (Gosse)		982.943		1,340.377	
Keratella hiemalis (Carlin)					
Notommata sp	1,340.377	2,457.358	893.585	446.792	
Polyathra dolicoptera (Idelson)			446.792	446.792	
Polyathra major (Burckhardt)					
Synchaeta sp	446.792				
Trichocerca multicrinis (Kellicott)	3,574.340	1,965.887	1,340.377	3,127.547	1,831.849
Trichocerca rousseleti (Voigt)					
Ciliophora					
Vorticella sp	2,233.962	8,846.491			
Calanoida					
*Diaptomus ashlandi (*Marsh)	4,150.943	3,566.792	4201.258	4,377.358	4,100.629
Calanoid copepodid	150.943	25.660			25.157
Calanoid (nauplii)			893.585		
Cyclopoida					
Cyclops bicuspidatus thomasi (S.A. Forbes)	1,232.704	1,411.321	1,157.233	1,031.447	1,056.604
Cyclopoid copepodid	150.943		50.314	50.314	50.314
Cyclopoid (nauplii)	13,403.774	20,150.340	12,956.981	13,850.566	23,814.038
Cladocera					
Daphnia longiremis (Sars)	1,433.962	1,103.396	1,911.950	1,484.277	1,383.648
Diaphanosoma brachyurum (Lievin)	1,257.862	667.170	276.730	327.044	477.987
Chydorus sphaericus (O.F. Muller)		51.321	50.314		
Bosmina longirostris (O.F. Muller)	176.101	179.623	125.786	100.629	75.472
Cladocera immature	75.472	51.321	50.314	50.314	100.629

Note: m^3 = cubic metres

Annex 5.11-7
Cluster Analysis of Zoopplankton Taxa from Tatelkuz Lake and Headwater Lakes 14, 15, and 16

Table 5.11-7A: Diversity Indices of Zooplankton Community, Tatelkuz Lake, August 2013

Lake	Tatelkuz Lake									
Sample	TL1-1	TL1-2	TL1-3	TL1-4	TL1-5	TL2-1	TL2-2	TL2-3	TL2-4	TL2-5
Metric										
Taxa (S)	18	19	18	16	16	19	18	19	19	17
Shannon (H')	2.125	2.271	2.251	1.945	2.135	2.291	2.069	2.180	2.196	1.746
Evenness (J)	0.465	0.510	0.528	0.437	0.529	0.520	0.440	0.466	0.473	0.337

Table 5.11-7B: Environmental Conditions Associated with Zooplankton Samples from Tatelkuz Lake and Lakes 14, 15 and 16

Lake	Secchi Depth (m)	Thermocline Area	Sample Zone Range	Replicates	Sample Depth (m)	Temperature (°C)	DO concentration (mg/L)	Water Conductivity (µS/cm)	Chlorophyll a (µg/L)
Lake 14	3.0	Above	Surface	5	1.0	13.8	8.30	48.4	1.53
			Bottom	5	5.0	12.4	7.64	48.1	2.82
Lake 15	5.7	Above	Surface	5	1.0	13.6	8.27	44.1	0.47
			Bottom	5	9.5	13.6	8.49	44.0	0.62
Lake 16	5.7	Above	Surface	5	1.0	11.8	9.31	49.1	0.47
		Below	Bottom	5	13.0	4.8	0.0	68.8	0.69
Tatelkuz Lake Site 1	3.7	Above	Surface	5	1.0	20.55	9.06	211.7	5.65
		Below	Bottom	5	28.0	5.2	4.46	149.8	0.24
Tatelkuz Lake Site 2	3.7	Above	Surface	5	1.0	20.4	9.06	209.3	8.04
		Below	Bottom	5	29.0	5.1	4.02	150.2	0.17

Note: m = metre; °C = degree Celsius; mg/L = milligram per litre; µS/cm = microSiemen per centimetre; µg/L = microgram per litre.

Table 5.11-7C: Mean Biomass and Contributions to Bray-Curtis Dissimilarity (Simper Analysis) of Zooplankton Taxa Collected in Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Species	Average Biomass (µg/L)		Contribution (%)	Cumulative (%)
	Tatelkuz Lake	Headwater Lakes[a]		
Cyclopoid (nauplii)	14,791.4	730.6	13.52	13.52
Diaptomus ashlandi Marsh	4,462.2	0.0	9.49	23.02
Synchaeta sp	16.0	4,438.2	7.97	30.99
Conochilus unicornis Rousselet	3,456.3	1,171.0	6.49	37.48
Trichocerca multicrinis Kellicott	2,098.6	0.0	6.48	43.96
Vorticella sp	1,866.2	482.2	5.62	49.57
Euchlanis calpidia Myers	1,268.8	0.0	5.05	54.62
Daphnia longiremis Sars	1,410.0	7.8	4.88	59.5
Keratella cochlearis Gosse	177.4	1,629.7	4.82	64.32
Kellicotia longispina Kellicott	4,083.2	2,112.3	4.31	68.63
Collotheca mutabilis Harring	1,363.8	139.7	4.19	72.82
Daphnia geleatea (and *rosea*) Sars	0.0	541.0	3.29	76.11
Diaphanosoma brachyurum Lievin	537.8	0.0	3.27	79.38
Diaptomus nudus Marsh	0.0	508.5	3.26	82.64
Gastropus stylifer Imhof	344.8	123.9	2.43	85.07
Cyclops bicuspidatus thomasi S. A. Forbes	1,169.0	448.2	1.9	86.97
Notommata sp	188.2	0.0	1.89	88.85
Collotheca pelagica Rousselet	89.7	0.0	1.34	90.2

Note: [a] = includes Lakes 14, 15 and 16; µg/L = microgram per litre; % = percent; sp = species; highest dissimilarity contributions indicate taxa that best discriminate zooplankton communities in Tatelkuz from headwater lakes.

Table 5.11-7D: Mean Density and Contributions to Bray-Curtis Dissimilarity (Simper Analysis) of Zooplankton Taxa Collected in Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Species	Mean Density (number/m^3)		Contribution (%)	Cumulative (%)
	Tatelkuz Lake	Headwater Lakes[a]		
Daphnia longiremis Sars	22,758.7	34.0	13.42	13.42
Diaptomus ashlandi Marsh	19,343.2	0.0	12.96	26.38
Cyclopoid (nauplii)	17,747.6	663.6	10.07	36.45
Diaptomus nudus Marsh	0.0	5,614.5	7.05	43.5
Synchaeta sp	25.2	6,927.2	7.03	50.54
Daphnia geleatea (and rosea) Sars	0.0	4,201.6	6.04	56.57
Trichocerca multicrinis Kellicott	3,323.5	0.0	5.36	61.93
Diaphanosoma brachyurum Lievin	3,287.9	0.0	5.31	67.24
Euchlanis calpidia Myers	2,875.1	0.0	4.99	72.23
Conochilus unicornis Rousselet	4,033.5	503.6	4.35	76.58
Kellicotia longispina Kellicott	4,681.3	1,658.9	3.05	79.63
Cyclops bicuspidatus thomasi S.A. Forbes	6,326.6	4,111.4	2.93	82.56
Keratella cochlearis Gosse	112.8	970.3	2.61	85.17
Notommata sp	556.5	0.0	2.13	87.3
Collotheca mutabilis Harring	504.9	53.9	1.65	88.95
Vorticella sp	300.7	79.6	1.5	90.45

Note: [a] = Headwater lakes include Lakes 14, 15 and 16; number/m^3 = individuals per cubic metre; % = percent; sp = species; Highest dissimilarity contributions indicate taxa that best discriminate zooplankton communities in Tatelkuz from headwater lakes.

Table 5.11-7E: Diversity Indices of Profundal BMI for Littoral and Profundal Zones of Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Lake	Sample	Abundance	Taxa Richness	Shannon-Weiner Index	HBI	Chironomids (%)	EPT taxa (%)
Lake 14	**mean**	**50.2**	**6.4**	**1.37**	**7.28**	**22**	**2**
	L-14-1	41	10	1.85	6.56	20	12
	L-14-2	30	5	1.32	7.1	23	0
	L-14-3	88	6	1.16	7.73	19	0
	L-14-4	49	4	1.02	7.53	24	0
	L-14-5	43	7	1.51	7.47	21	0
Lake 15	**mean**	**21.2**	**5**	**1.13**	**7.90**	**72**	**3**
	L-15-1	24	7	1.46	7.64	75	13
	L-15-2	13	4	1.22	8.31	100	0
	L-15-3	22	6	1.01	8.23	82	0
	L-15-4	34	4	0.76	8.65	82	0
	L-15-5	13	4	1.22	6.69	23	0
Lake 16	**mean**	**3**	**1.8**	**0.56**	**6.26**	**24**	**0**
	L-16-1	2	2	0.69	7.5	100	0
	L-16-2	2	1	0.00	7	0	0
	L-16-3	2	2	0.69	3.5	0	0
	L-16-4	4	2	0.56	6.5	0	0
	L-16-5	5	2	0.87	6.8	20	0
Tatelkuz Lake Site 1	**mean**	**42.6**	**3**	**0.79**	**7.36**	**76**	**0**
	TP1-1	23	2	0.65	6.522	65	0
	TP1-2	67	5	1.12	6.896	72	0
	TP1-3	47	3	0.79	7.617	79	0
	TP1-4	38	3	0.91	7.605	82	0
	TP1-5	38	2	0.48	8.158	82	0
Tatelkuz Lake Site 2	**mean**	**75**	**3.8**	**0.81**	**7.27**	**74**	**0**
	TP2-1	49	3	0.97	6.857	73	0
	TP2-2	67	3	0.67	7.09	70	0
	TP2-3	102	3	0.62	7.451	74	0
	TP2-4	73	5	0.92	6.945	70	0
	TP2-5	84	5	0.86	7.988	83	0

Annex 5.11-8
Metrics of Zooplankton Samples from Tatelkuz Lake and Headwater Lakes 14, 15, and 16

Annex 5.11-8: Zooplankton Metrics of Samples from Tatelkuz Lake and Lakes 14, 15, 16

Lake	Sample	Density (number/m^3)	Biomass (µg/L)	Taxa Richness	Diversity (Shannon-Weiner Index)
Lake 14	**mean**	**63,704.4**	**80,880.5**	**12**	**1.12**
	L14-1	37,949.7	47,473.2	13	1.25
	L14-2	59,379.8	69,446.4	16	1.34
	L14-3	35,023.7	54,468.7	9	0.97
	L14-4	121,358.8	161,281.7	11	0.66
	L14-5	64,810.2	71,732.8	12	1.37
Lake 15	**mean**	**16,054.2**	**29,965.1**	**12**	**1.59**
	L15-1	34,041.4	36,536.3	12	1.67
	L15-2	22,970.7	32,438.0	14	1.98
	L15-3	6,737.4	24,065.7	13	1.38
	L15-4	6,738.9	21,898.3	10	1.42
	L15-5	9,782.8	34,887.1	10	1.52
Lake 16	**mean**	**6,327.0**	**22,168.9**	**13**	**1.53**
	L16-1	4,477.0	15,472.0	11	1.54
	L16-2	8,857.2	24,310.1	14	1.70
	L16-3	7,662.0	27,481.4	13	1.52
	L16-4	5,647.0	20,634.7	15	1.54
	L16-5	4,991.5	22,946.1	14	1.37
Tatelkuz Lake 1	**mean**	**39,859.1**	**89,390.5**	**17**	**2.03**
	TL1-1	46,711.3	113,990.0	18	2.00
	TL1-2	47,696.7	94,462.7	19	2.18
	TL1-3	36,709.8	95,750.5	18	1.98
	TL1-4	33,101.3	61,394.4	16	1.99
	TL1-5	35,076.3	81,355.0	16	1.99
Tatelkuz Lake 2	**mean**	**42,416.3**	**92,499.1**	**18**	**2.08**
	TL2-1	40,351.2	92,836.6	19	2.17
	TL2-2	51,780.5	93,106.2	18	2.16
	TL2-3	35,525.0	92,498.1	19	2.02
	TL2-4	39,143.6	88,829.6	19	2.09
	TL2-5	45,281.3	95,224.8	17	1.94

Note: number/m^3 = individuals per cubic metre; µg/L = microgram per litre

Annex 5.11-9
Benthic Macroinvertebrate Taxonomy, Tatelkuz Lake, August 2013

Annex 5.11-9: Benthic Macroinvertebrate Taxonomy, Tatelkuz Lake, August 2013

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6	TL-7	TL-8	TL-9	TL-10
Date:	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13
Percent Sampled (%)	8 [1]	5 [1]	5 [1]	6 [1]	5 [1]	5 [1]/100 [2]	3 [1]/14 [2]/100 [3]	4 [1]/100 [2]/	3 [1]/100 [2]	2 [1]/100 [2]/22 [3]
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	20	1	0	1	4
| Family: Baetidae	0	0	0	0	0	0	0	1	0	9
Baetis sp.	0	0	0	0	0	0	7	0	0	0
Callibaetis sp.	113	80	20	33	60	501	322	1276	200	2146
Centroptilum sp.	0	180	40	17	20	0	2	0	33	0
| Family: Caenidae	0	0	0	0	0	0	0	0	0	0
Caenis sp.	3488	460	140	267	80	22	0	155	1139	692
| Family: Ephemerellidae	0	0	0	0	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0	1	0	0	0
| Family: Ephemeridae	0	0	0	0	0	20	0	600	0	50
Ephemera simulans	0	20	0	0	20	160	0	1790	4450	1035
| Family: Leptohyphidae	0	0	0	0	0	0	0	0	0	0
Tricorythodes sp.	0	0	0	0	0	0	0	0	1	0
| Family: Leptophlebiidae	63	0	0	50	60	40	7	25	0	782
Paraleptophlebia sp.	0	0	0	0	0	0	0	0	0	109
| Order: Plecoptera	0	0	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0	5
| Order: Trichoptera	25	20	0	0	0	103	67	0	4	52
| Family: Hydroptilidae	0	0	0	0	0	0	0	0	0	0
Agraylea sp.	0	0	0	0	0	0	0	25	0	0
Hydroptila sp.	0	0	0	0	0	0	0	0	0	0
Oxyethira sp.	50	180	0	0	0	123	67	910	133	107
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Lepidostoma sp.	0	0	0	0	0	0	0	0	0	0
| Family: Leptoceridae	0	160	20	0	40	1	7	400	135	250
Ceraclea sp.	0	0	0	0	0	0	0	0	0	0
Mystacides sp.	338	640	40	67	180	42	0	864	848	1638
Oecetis sp.	0	80	20	17	20	81	0	278	168	259
Triaenodes sp.	0	0	0	0	0	0	0	0	0	0
| Family: Limnephilidae	63	40	0	0	0	0	41	0	0	54
Glyphopsyche irrorata	0	20	0	0	0	0	8	0	0	1
Limnephilus sp.	0	0	0	0	0	0	0	0	1	37
| Family: Molannidae	0	0	0	0	0	0	0	0	0	0
Molanna sp.	0	0	20	0	0	0	0	0	0	102
| Family: Philopotamidae	0	0	0	0	0	0	0	0	0	0
Wormaldia sp.	0	0	0	0	0	0	0	0	0	50
| Family: Phryganeidae	0	0	0	0	0	40	7	0	0	0
Phryganea sp.	0	0	0	0	0	1	0	2	2	0
| Family: Polycentropodidae	75	20	0	50	0	0	0	0	0	3
Nyctiophylax sp.	0	0	0	0	0	0	0	0	0	0
Polycentropus sp.	100	60	0	50	40	0	0	77	36	7
| Order: Coleoptera	0	0	0	0	0	0	0	0	0	10
| Family: Dytiscidae	0	0	0	0	0	0	0	0	0	5
Agabus sp.	0	0	0	0	0	0	0	0	0	0
Oreodytes sp.	0	0	100	150	80	0	5	1	33	5
| Subfamily: Hydroporinae	50	140	40	0	340	40	0	0	33	0
| Family: Elmidae	0	0	0	0	0	0	0	0	0	0
Heterlimnius sp.	0	0	0	0	0	1	0	0	0	0
| Family: Gyrinidae	0	0	0	0	0	0	0	0	0	0
Dineutus sp.	0	0	0	0	0	2	0	26	1	0
| Family: Haliplidae	0	0	0	0	0	0	0	0	0	0
Brychius sp.	0	0	0	0	0	0	14	0	0	0
Haliplus sp.	0	0	0	0	0	0	15	0	0	5
Peltodytes sp.	0	0	0	0	0	0	0	0	0	50
| Order: Diptera	0	0	0	0	0	0	0	0	1	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0	0	0
Bezzia sp.	13	0	0	0	0	122	332	25	0	0
Culicoides sp.	0	0	0	0	0	0	0	0	0	0
Probezzia sp.	13	20	0	17	20	141	142	476	168	286
Sphaeromias sp.	25	0	0	0	0	40	100	0	0	50
| Family: Chaoboridae	0	0	0	0	0	0	0	0	0	0
Chaoborus sp.	0	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	75	0	760	0	1380	127	419	0	0	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	275	160	0	0	280	133	274	0	0	0
Cryptochironomus sp.	0	0	0	0	0	1410	347	325	439	114
Dicrotendipes sp.	538	400	140	17	200	2000	158	1383	485	3135
Glyptotendipes sp.	0	80	60	17	140	405	67	1739	1105	4235
Lauterborniella sp.	13	0	0	0	0	0	0	0	0	0
Microtendipes pedellus	388	20	0	83	80	0	0	0	304	349
Parachironomus sp.	150	260	40	0	200	917	124	8	0	616
Paracladopelma sp.	0	0	0	0	0	0	0	0	0	11
Paratendipes sp.	0	0	0	0	0	0	0	0	0	0
Phaenopsectra sp.	0	0	0	0	0	0	0	0	1167	491
Polypedilum sp.	0	0	0	0	0	316	336	0	933	195
Stenochironomus sp.	0	0	0	0	0	0	0	0	0	0
Stictochironomus sp.	113	400	380	0	0	1729	1276	323	4	0
Zavrelia sp.	163	20	0	0	20	1	0	325	0	0
| Tribe: Pseudochironomini	0	0	0	0	0	0	0	0	0	0
Pseudochironomus sp.	13	0	0	0	0	0	164	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0	0
Cladotanytarsus sp.	0	0	0	0	0	0	1	475	9	350
Paratanytarsus sp.	0	0	20	17	0	1253	524	1148	19	570
Stempellina sp.	0	0	0	0	0	20	0	0	0	0
Tanytarsus sp.	13	0	0	0	40	2600	1200	1104	233	14
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Potthastia longimana group	0	0	0	0	0	80	21	0	33	0
Potthastia sp.	0	0	0	0	0	0	71	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0	0
Brillia sp.	0	0	0	0	0	0	0	0	0	0
Cricotopus sp.	0	0	0	0	0	400	767	10	11	1281
Heterotrissocladius sp.	0	0	0	0	0	0	1972	0	0	0
Metriocnemus sp.	0	0	0	0	0	0	0	0	0	0
Nanocladius sp.	0	0	0	0	0	0	0	0	0	0
Orthocladius complex	63	100	40	0	20	253	9904	0	0	250
Parakiefferiella sp.	0	0	0	0	0	160	0	0	0	0
Psectrocladius sp.	63	0	0	0	100	0	4	0	0	0
Synorthocladius sp.	0	0	0	50	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	0	0

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6	TL-7	TL-8	TL-9	TL-10
Date:	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13
Percent Sampled (%)	8 [1]	5 [1]	5 [1]	6 [1]	5 [1]	5 [1]/100 [2]	3 [1]/14 [2]/100 [3]	4 [1]/100 [2]/	3 [1]/100 [2]	2 [1]/100 [2]/22 [3]
| **Tribe: Corynoneurini**	0	0	0	0	0	0	0	0	0	0
Corynoneura sp.	88	60	40	17	0	40	0	0	167	283
| **Subfamily: Prodiamesinae**	0	0	0	0	0	0	0	0	0	0
Odontomesa sp.	0	0	0	0	0	0	480	0	0	0
Prodiamesa sp.	0	0	0	0	0	0	158	0	0	0
| **Subfamily: Tanypodinae**	0	0	0	0	0	0	0	0	0	0
| **Tribe: Pentaneurini**	0	0	0	0	0	0	0	0	0	0
Ablabesmyia sp.	13	0	0	0	20	0	21	127	0	150
Labrundinia sp.	0	20	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	33	60	1	1029	0	0	0
| **Tribe: Procladiini**	0	0	0	0	0	0	0	0	0	0
Procladius sp.	13	40	0	0	0	1827	66	636	0	255
| **Family: Empididae**	0	0	0	0	0	0	0	0	0	0
Chelifera/ Metachela	0	0	0	0	0	0	0	0	0	0
Clinocera sp.	0	0	0	0	0	0	74	0	0	0
| **Family: Tabanidae**	0	20	0	0	20	0	0	0	19	0
| **Order: Hemiptera**	0	0	0	0	0	0	0	0	0	0
| **Family: Corixidae**	88	120	40	0	0	322	458	152	133	358
Corisella sp.	0	0	0	0	0	21	0	0	0	0
Sigara sp.	0	0	40	0	0	5	1	50	0	6
| **Order: Odonata**	0	0	0	0	0	0	0	0	0	0
| **Family: Aeshnidae**	0	0	0	0	0	1	0	0	0	0
Aeshna sp.	0	0	0	0	0	0	0	0	5	15
| **Family: Coenagrionidae**	13	20	0	0	0	22	0	30	6	4
| **Family: Corduliidae**	0	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| **Class: Malacostraca**	0	0	0	0	0	0	0	0	0	0
| **Order: Amphipoda**	1500	1580	0	600	1020	9463	1161	15139	18095	11314
| **Family: Crangonyctidae**	0	0	0	0	0	0	0	0	0	0
Crangonyx sp.	0	400	420	0	0	0	0	0	0	0
| **Family: Gammaridae**	0	0	0	0	0	0	0	0	0	0
Gammarus sp.	1763	2400	5040	1800	280	0	0	0	0	1232
| **Family: Hyalellidae**	0	0	0	0	0	0	0	0	0	0
Hyalella sp.	6763	9980	2420	1350	4020	31468	4387	32823	37587	59654
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0	0	0	0
| **Order: Trombidiformes**	113	120	0	17	20	230	100	179	875	1192
| **Family: Arrenuridae**	0	0	0	0	0	0	0	0	0	0
Arrenurus sp.	13	40	0	0	0	20	0	0	0	50
| **Family: Hydrodromidae**	0	0	0	0	0	0	0	0	0	0
Hydrodroma sp.	13	0	0	17	0	0	0	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0	0	0	0
Protzia sp.	88	0	0	0	0	0	0	0	0	0
| **Family: Hygrobatidae**	0	0	0	0	0	0	0	0	0	0
Hygrobates sp.	0	0	0	0	0	0	243	0	0	0
| **Family: Lebertiidae**	0	0	0	0	0	0	0	0	0	0
Lebertia sp.	0	0	0	83	0	20	14	0	0	0
| **Family: Limnesiidae**	0	0	0	0	0	40	0	1	0	0
Limnesia sp.	63	100	40	0	0	380	0	225	233	305
| **Family: Mideopsidae**	0	0	0	0	0	0	0	0	0	0
Mideopsis sp.	100	0	0	0	0	0	0	0	0	0
| **Family: Oxidae**	0	0	0	0	0	0	0	0	0	0
Frontipoda sp.	0	0	0	0	0	0	0	0	0	0
Oxus sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Pionidae**	0	0	0	0	0	0	0	0	0	0
Piona sp.	0	0	0	0	0	41	0	0	0	209
Tiphys sp.	0	0	0	0	0	0	0	0	200	0
| **Family: Unionicolidae**	0	0	0	0	0	0	0	0	0	0
Neumania sp.	0	60	40	0	0	220	40	1	133	205
Unionicola sp.	13	20	40	50	40	0	0	0	0	0
| **Order: Oribatei**	0	0	0	0	0	0	0	0	0	0
| **Family: Halacaridae**	0	0	0	0	0	0	0	0	0	0
| **Order: Sarcoptiformes**	0	0	0	0	0	0	0	0	0	0
| **Family: Hydrozetidae**	0	20	0	0	0	20	0	25	0	100
Phylum: Mollusca	0	0	0	0	0	0	0	0	0	0
| **Class: Bivalvia**	0	0	0	0	0	0	0	1	1	0
| **Order: Veneroida**	0	0	0	0	0	0	0	0	0	0
| **Family: Pisidiidae**	200	360	60	200	540	641	267	800	667	3664
Pisidium sp.	0	0	0	0	80	60	5	175	0	246
Sphaerium sp.	0	0	0	0	0	0	0	0	0	5
| **Class: Gastropoda**	125	20	0	0	260	200	3	1	0	21
| **Order: Basommatophora**	0	0	0	0	0	0	0	0	0	0
| **Family: Lymnaeidae**	38	20	0	0	0	0	0	25	0	0
Lymnaea sp.	0	20	0	0	20	322	1	276	1	250
Stagnicola sp.	0	0	0	0	0	0	0	0	0	5
| **Family: Physidae**	0	0	0	0	0	0	0	0	0	0
Physa sp.	0	0	0	0	0	61	6	1	1	40
| **Family: Planorbidae**	350	100	180	33	200	560	0	75	3834	4700
Gyraulus sp.	0	0	0	0	40	180	0	0	0	100
Helisoma sp.	0	0	0	0	0	0	0	0	0	0
Menetus opercularis	250	40	40	33	140	0	0	0	0	5
Promenetus sp.	0	0	0	0	0	0	0	0	0	0
Promenetus umbilicatellus	0	0	0	0	0	0	2	0	0	0
| **Order: Heterostropha**	0	0	0	0	0	0	0	0	0	0
| **Family: Valvatidae**	0	0	0	0	0	0	0	0	0	0
Valvata sincera	0	0	0	0	0	4	272	400	0	100
Valvata sp.	75	0	0	0	100	220	0	0	0	106
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| **Class: Hirudinea**	0	0	0	0	0	0	0	0	0	0
| **Order: Arhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Erpobdellidae**	0	0	0	0	20	0	0	32	3	26
Erpobdella sp.	0	0	20	0	0	0	0	0	0	0
| **Order: Rhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Glossiphoniidae**	163	100	140	17	60	40	1	125	500	33
| **Family: Piscicolidae**	0	0	0	0	0	0	1	1	0	14
| **Class: Oligochaeta**	0	0	0	0	0	0	0	0	0	0
| **Order: Lumbriculida**	0	0	0	0	0	0	0	0	0	0
| **Family: Lumbriculidae**	338	260	500	167	280	0	4	0	1048	626
| **Order: Tubificida**	0	0	0	0	0	0	0	0	0	0
| **Family: Enchytraeidae**	0	0	0	0	0	0	0	0	0	0
Enchytraeus	38	120	0	83	0	0	74	2	2	275

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6	TL-7	TL-8	TL-9	TL-10
Date:	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	12-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13	13-Aug-13
Percent Sampled (%)	8 [1]	5 [1]	5 [1]	6 [1]	5 [1]	5 [1]/100 [2]	3 [1]/14 [2]/100 [3]	4 [1]/100 [2]/	3 [1]/100 [2]	2 [1]/100 [2]/22 [3]
| **Family: Naididae**	0	0	0	0	20	0	0	0	67	0
Arcteonais lomondi	0	0	0	0	0	220	0	252	0	305
Chaetogaster diaphanus	0	0	0	0	0	0	0	0	0	0
Chaetogaster limnaei	0	0	0	0	0	0	0	0	0	0
Chaetogaster sp.	0	0	0	0	0	220	0	0	0	0
Nais sp.	38	140	0	50	300	5354	381	430	585	415
Pristina sp.	0	0	0	0	100	0	0	0	0	0
Slavina sp.	100	20	0	17	140	0	0	0	133	50
Stylaria lacustris	163	320	600	300	880	0	1	25	100	417
Uncinais uncinata	13	0	0	0	0	1623	0	227	0	11
Vejdovskyella sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Tubificidae**	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Tubificinae immature**	38	80	20	33	320	1	1	0	2	5
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	0	0	0	0	0	0	0	56
Phylum: Cnidaria	0	0	0	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0	0	0	0
| Order: Anthoathecatae	0	0	0	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0	0	0	0
Hydra sp.	0	0	0	17	100	0	0	0	0	50

Note: 1 = 400 um sieve size; 2 = 4000 um sieve size; 3 = 2000 um sieve size; 4 = 500 um sieve size

Annex 5.11-9: Benthic Macroinvertebra

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-11	TL-12	TL-13	TL-14	TL-15	TL-16	TL-17	TL-18	TL-19	TL-20
Date:	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	16-Aug-13	25-Aug-13	25-Aug-13
Percent Sampled (%)	5 [1]	5 [1]	9 [1]	5 [1]	6 [1]	6 [1]/100 [2]	4 [1]/100 [2]/ 11 [3]	2 [1]/4 [2]/6 [3]	2 [1]/16 [2]/ 30 [3]	5 [1]/8 [2]/18 [3]
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0	0
| Family: Baetidae	0	0	0	0	0	0	3	0	0	0
Baetis sp.	0	0	0	0	0	0	0	0	0	0
Callibaetis sp.	0	20	11	60	0	738	2134	2431	931	783
Centroptilum sp.	40	0	0	0	0	0	25	0	0	0
| Family: Caenidae	0	0	0	0	0	0	0	0	0	0
Caenis sp.	120	0	0	20	700	3026	7058	1272	12448	2864
| Family: Ephemerellidae	0	0	0	0	0	0	0	0	13	0
Drunella grandis group	0	0	0	0	0	0	0	0	0	0
| Family: Ephemeridae	0	60	0	20	0	0	0	0	0	0
Ephemera simulans	0	60	0	0	33	0	0	0	0	0
| Family: Leptohyphidae	0	0	0	0	0	0	0	0	0	0
Tricorythodes sp.	0	0	0	0	0	0	0	0	0	0
| Family: Leptophlebiidae	40	0	11	60	33	184	637	203	2445	933
Paraleptophlebia sp.	0	0	0	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	11	20	0	0	50	186	0	12
| Family: Hydroptilidae	0	0	0	0	0	0	0	70	0	0
Agraylea sp.	0	0	0	0	0	0	0	117	19	0
Hydroptila sp.	0	0	0	0	0	0	0	0	0	0
Oxyethira sp.	20	20	0	0	0	50	887	0	303	227
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Lepidostoma sp.	0	0	11	0	0	1	0	23	0	0
| Family: Leptoceridae	0	40	11	180	0	150	1250	859	388	323
Ceraclea sp.	0	0	0	0	0	0	0	0	0	0
Mystacides sp.	280	40	0	280	150	235	1064	852	2866	1966
Oecetis sp.	0	0	22	60	0	150	787	137	1430	1430
Triaenodes sp.	0	0	0	0	0	0	1	0	13	0
| Family: Limnephilidae	40	40	11	0	0	34	219	0	231	299
Glyphopsyche irrorata	0	0	0	160	0	0	5	0	6	0
Limnephilus sp.	20	0	0	0	0	3	0	47	203	0
| Family: Molannidae	0	0	0	0	0	0	0	150	107	60
Molanna sp.	0	0	0	0	0	34	196	40	152	109
| Family: Philopotamidae	0	0	0	0	0	0	0	0	0	0
Wormaldia sp.	0	0	0	0	0	0	0	0	0	0
| Family: Phryganeidae	0	0	0	0	0	17	0	23	0	0
Phryganea sp.	0	0	0	0	0	0	9	0	3	12
| Family: Polycentropodidae	0	0	22	20	0	0	0	0	0	0
Nyctiophylax sp.	0	0	11	0	0	0	0	0	0	0
Polycentropus sp.	140	120	33	60	17	33	0	0	50	0
| Order: Coleoptera	0	0	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	23	0	0
Agabus sp.	0	0	0	0	0	0	0	17	0	0
Oreodytes sp.	140	20	44	60	50	0	0	87	0	0
| Subfamily: Hydroporinae	20	0	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0	0	0
Heterlimnius sp.	0	0	0	0	0	0	0	0	0	0
| Family: Gyrinidae	0	0	0	0	0	0	0	0	0	0
Dineutus sp.	0	20	0	0	0	0	0	0	0	0
| Family: Haliplidae	0	0	0	0	0	0	0	0	0	0
Brychius sp.	0	0	0	0	0	0	0	0	0	0
Haliplus sp.	0	0	0	0	0	0	0	0	9	0
Peltodytes sp.	0	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	130	0	152
Bezzia sp.	0	0	0	0	0	0	84	170	0	95
Culicoides sp.	0	0	0	0	0	0	0	0	106	6
Probezzia sp.	20	40	0	20	0	34	302	539	443	203
Sphaeromias sp.	0	0	0	0	0	0	0	0	0	0
| Family: Chaoboridae	0	0	0	0	0	0	0	0	0	0
Chaoborus sp.	0	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	0	0	0	0	0	0	0	2300	0	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	0	0	0	0	0	0	0	0	0	0
Cryptochironomus sp.	0	0	0	0	0	33	195	0	100	0
Dicrotendipes sp.	180	100	122	160	33	67	4	300	38	1091
Glyptotendipes sp.	400	160	144	160	33	150	2723	476	1061	2513
Lauterborniella sp.	0	0	0	0	0	0	0	0	0	0
Microtendipes pedellus	60	80	56	0	33	134	100	250	0	0
Parachironomus sp.	0	80	0	0	0	0	0	0	0	83
Paracladopelma sp.	0	0	0	0	0	17	1	0	0	0
Paratendipes sp.	0	0	78	0	0	0	0	0	0	0
Phaenopsectra sp.	0	100	0	60	17	122	0	300	0	17
Polypedilum sp.	0	0	0	0	0	1	0	300	0	0
Stenochironomus sp.	0	0	0	0	0	0	0	0	0	0
Stictochironomus sp.	0	0	0	0	0	0	45	0	0	0
Zavrelia sp.	0	80	0	0	0	0	0	0	0	0
| Tribe: Pseudochironomini	0	0	0	0	0	0	0	0	0	320
Pseudochironomus sp.	0	0	0	0	0	0	0	0	450	1014
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0	0
Cladotanytarsus sp.	0	0	0	0	0	0	0	0	600	423
Paratanytarsus sp.	0	80	0	100	0	0	510	316	75	0
Stempellina sp.	0	0	0	0	0	0	0	0	0	0
Tanytarsus sp.	0	0	0	40	0	67	293	140	927	267
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Potthastia longimana group	0	0	0	0	0	33	2	0	122	0
Potthastia sp.	0	0	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0	0
Brillia sp.	0	0	11	0	0	0	0	0	0	0
Cricotopus sp.	0	0	0	0	0	0	0	450	38	0
Heterotrissocladius sp.	0	0	0	0	0	0	0	0	0	0
Metriocnemus sp.	0	0	0	0	0	0	0	0	0	0
Nanocladius sp.	0	0	11	0	0	0	0	0	0	0
Orthocladius complex	0	0	0	20	0	2	0	0	0	0
Parakiefferiella sp.	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	0	40	0	0	0	0	0	250	0	140
Synorthocladius sp.	20	80	33	40	17	17	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	0	0

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-11	TL-12	TL-13	TL-14	TL-15	TL-16	TL-17	TL-18	TL-19	TL-20
Date:	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	16-Aug-13	25-Aug-13	25-Aug-13
Percent Sampled (%)	5 [1]	5 [1]	9 [1]	5 [1]	6 [1]	6 [1]/100 [2]	4 [1]/100 [2]/ 11 [3]	2 [1]/4 [2]/6 [3]	2 [1]/16 [2]/ 30 [3]	5 [1]/8 [2]/18 [3]
| **Tribe: Corynoneurini**	0	0	0	0	0	0	0	0	0	0
Corynoneura sp.	40	40	22	0	33	0	76	0	0	168
| **Subfamily: Prodiamesinae**	0	0	0	0	0	0	0	0	0	0
Odontomesa sp.	0	0	0	0	0	0	0	0	0	0
Prodiamesa sp.	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Tanypodinae**	0	0	0	0	0	0	0	0	0	0
| **Tribe: Pentaneurini**	0	0	0	0	0	0	0	0	0	0
Ablabesmyia sp.	0	0	0	0	0	33	204	126	19	11
Labrundinia sp.	0	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0	0	0	0
| **Tribe: Procladiini**	0	0	0	0	0	0	0	0	0	0
Procladius sp.	0	0	11	0	0	0	220	219	63	543
| **Family: Empididae**	0	0	0	0	0	0	0	0	0	0
Chelifera/ Metachela	0	0	22	0	0	0	0	0	0	0
Clinocera sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Tabanidae**	0	0	0	20	17	0	2	0	0	6
| **Order: Hemiptera**	0	0	0	0	0	0	0	0	0	0
| **Family: Corixidae**	0	60	0	40	33	51	265	137	291	92
Corisella sp.	0	0	0	0	0	0	9	40	258	127
Sigara sp.	0	0	33	20	0	0	1	0	0	87
| **Order: Odonata**	0	0	0	0	0	0	0	0	0	0
| **Family: Aeshnidae**	0	0	0	0	0	0	0	0	0	6
Aeshna sp.	0	20	11	40	0	0	2	0	0	0
| **Family: Coenagrionidae**	0	0	0	20	0	0	54	47	50	24
| **Family: Corduliidae**	0	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| **Class: Malacostraca**	0	0	0	0	0	0	0	0	0	0
| **Order: Amphipoda**	620	620	333	1000	333	2020	7325	5388	1008	12757
| **Family: Crangonyctidae**	0	0	0	0	0	0	0	0	0	0
Crangonyx sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Gammaridae**	0	0	0	0	0	0	0	0	0	0
Gammarus sp.	1220	1020	578	400	217	1011	471	3217	353	687
| **Family: Hyalellidae**	0	0	0	0	0	0	0	0	0	0
Hyalella sp.	2800	2640	1378	2580	3333	11393	59106	94966	51925	53021
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0	0	0	0
| **Order: Trombidiformes**	120	460	33	340	17	101	528	236	56	142
| **Family: Arrenuridae**	0	0	0	0	0	0	0	0	150	0
Arrenurus sp.	0	0	0	0	0	17	125	197	0	60
| **Family: Hydrodromidae**	0	0	0	0	0	0	0	0	0	0
Hydrodroma sp.	60	60	56	120	0	0	0	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0	0	0	0
Protzia sp.	0	0	0	0	0	0	0	0	0	80
| **Family: Hygrobatidae**	0	0	0	0	0	0	0	0	0	0
Hygrobates sp.	0	0	0	0	0	0	0	93	0	60
| **Family: Lebertiidae**	0	0	0	0	0	0	0	0	0	0
Lebertia sp.	20	0	0	0	0	17	26	23	0	12
| **Family: Limnesiidae**	0	0	0	0	0	33	0	0	0	0
Limnesia sp.	20	20	0	0	17	67	161	483	213	129
| **Family: Mideopsidae**	0	0	0	0	0	0	0	0	0	0
Mideopsis sp.	0	0	0	0	0	17	75	23	0	0
| **Family: Oxidae**	0	0	0	0	0	0	0	0	0	0
Frontipoda sp.	0	0	0	0	0	0	84	0	0	0
Oxus sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Pionidae**	0	0	0	0	0	0	0	100	0	0
Piona sp.	0	0	0	0	0	33	59	114	0	36
Tiphys sp.	0	0	0	0	0	0	0	117	0	0
| **Family: Unionicolidae**	0	0	0	0	0	0	0	0	0	0
Neumania sp.	60	100	22	40	0	17	0	23	0	0
Unionicola sp.	0	20	11	20	17	0	59	0	50	6
| **Order: Oribatei**	0	0	0	0	0	0	0	0	0	0
| **Family: Halacaridae**	0	0	0	0	0	0	0	0	0	0
| **Order: Sarcoptiformes**	0	0	0	0	0	0	0	0	0	0
| **Family: Hydrozetidae**	0	0	0	0	0	0	151	50	113	12
Phylum: Mollusca	0	0	0	0	0	0	0	0	0	0
| **Class: Bivalvia**	0	0	0	0	0	0	0	0	0	0
| **Order: Veneroida**	0	0	0	0	0	0	0	0	0	0
| **Family: Pisidiidae**	140	340	111	180	300	1583	5779	4379	5053	2932
Pisidium sp.	20	160	11	40	0	254	595	853	1403	1654
Sphaerium sp.	0	0	0	0	0	0	2	0	13	12
| **Class: Gastropoda**	20	0	11	40	33	0	69	87	68	288
| **Order: Basommatophora**	0	0	0	0	0	0	0	0	0	0
| **Family: Lymnaeidae**	0	0	0	0	0	50	25	0	0	820
Lymnaea sp.	20	0	0	0	0	0	7	907	617	782
Stagnicola sp.	20	0	0	0	0	0	0	0	0	6
| **Family: Physidae**	0	0	0	0	0	0	0	0	0	0
Physa sp.	0	0	11	0	0	17	21	133	189	103
| **Family: Planorbidae**	120	380	22	40	33	367	13567	5898	8598	2268
Gyraulus sp.	0	0	0	0	0	0	25	117	0	602
Helisoma sp.	0	0	0	0	0	1	3	0	13	0
Menetus opercularis	0	0	44	0	33	167	1253	1300	381	491
Promenetus sp.	40	0	0	0	0	0	18	0	50	0
Promenetus umbilicatellus	0	0	0	0	0	0	0	0	0	0
| **Order: Heterostropha**	0	0	0	0	0	0	0	0	0	0
| **Family: Valvatidae**	0	0	0	0	0	0	0	0	0	0
Valvata sincera	80	0	0	0	0	0	359	530	534	60
Valvata sp.	0	20	56	0	0	67	2	70	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| **Class: Hirudinea**	0	0	0	0	0	0	0	0	0	0
| **Order: Arhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Erpobdellidae**	20	0	0	20	0	4	29	47	57	12
Erpobdella sp.	0	0	0	0	0	0	0	0	0	0
| **Order: Rhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Glossiphoniidae**	20	40	33	40	17	17	199	200	23	31
| **Family: Piscicolidae**	0	0	11	0	0	1	9	0	6	0
| **Class: Oligochaeta**	0	0	0	0	0	0	0	0	0	0
| **Order: Lumbriculida**	0	0	0	0	0	0	0	0	0	0
| **Family: Lumbriculidae**	520	180	111	120	100	196	539	1091	946	780
| **Order: Tubificida**	0	0	0	0	0	0	0	0	0	0
| **Family: Enchytraeidae**	0	0	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	20	33	183	135	23	26	23

Lake Name	Tatelkuz Lake									
	Littoral									
Site:	TL-11	TL-12	TL-13	TL-14	TL-15	TL-16	TL-17	TL-18	TL-19	TL-20
Date:	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	14-Aug-13	16-Aug-13	25-Aug-13	25-Aug-13
Percent Sampled (%)	5 [1]	5 [1]	9 [1]	5 [1]	6 [1]	6 [1]/100 [2]	4 [1]/100 [2]/ 11 [3]	2 [1]/4 [2]/6 [3]	2 [1]/16 [2]/ 30 [3]	5 [1]/8 [2]/18 [3]
| **Family: Naididae**	0	0	0	0	0	0	0	0	38	140
Arcteonais lomondi	0	0	0	0	0	33	143	0	0	840
Chaetogaster diaphanus	0	0	0	0	0	0	0	70	0	0
Chaetogaster limnaei	0	0	0	0	0	0	0	23	0	0
Chaetogaster sp.	0	0	0	0	0	0	25	390	6	24
Nais sp.	0	80	0	20	0	33	180	430	257	240
Pristina sp.	0	0	0	0	0	0	0	0	0	47
Slavina sp.	0	40	0	0	50	17	75	0	0	52
Stylaria lacustris	20	0	0	0	33	285	490	2114	669	425
Uncinais uncinata	0	0	0	0	0	0	59	50	6	417
Vejdovskyella sp.	0	0	0	20	0	0	0	0	0	0
| **Family: Tubificidae**	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Tubificinae immature**	60	120	0	100	100	603	453	695	509	47
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	0	0	0	17	34	67	53	38
Phylum: Cnidaria	0	0	0	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0	0	0	0
| Order: Anthoathecatae	0	0	0	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0	0	0	0
Hydra sp.	0	0	0	0	0	67	25	164	0	52

Note: 1 = 400 um sieve size; 2 = 4000 um

Annex 5.11-9: Benthic Macroinvertebra

Lake Name	Tatelkuz Lake									
	Profundal					Profundal				
Site:	TL1-1	TL1-2	TL1-3	TL1-4	TL1-5	TL2-1	TL2-2	TL2-3	TL2-4	TL2-5
Date:	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13
Percent Sampled (%)	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0	0
| Family: Baetidae	0	0	0	0	0	0	0	0	0	0
Baetis sp.	0	0	0	0	0	0	0	0	0	0
Callibaetis sp.	0	0	0	0	0	0	0	0	0	0
Centroptilum sp.	0	0	0	0	0	0	0	0	0	0
| Family: Caenidae	0	0	0	0	0	0	0	0	0	0
Caenis sp.	0	0	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	0	0	0	0	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0	0	0	0	0
| Family: Ephemeridae	0	0	0	0	0	0	0	0	0	0
Ephemera simulans	0	0	0	0	0	0	0	0	0	0
| Family: Leptohyphidae	0	0	0	0	0	0	0	0	0	0
Tricorythodes sp.	0	0	0	0	0	0	0	0	0	0
| Family: Leptophlebiidae	0	0	0	0	0	0	0	0	0	0
Paraleptophlebia sp.	0	0	0	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	0	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0	0	0
Agraylea sp.	0	0	0	0	0	0	0	0	0	0
Hydroptila sp.	0	0	0	0	0	0	0	0	0	0
Oxyethira sp.	0	0	0	0	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Lepidostoma sp.	0	0	0	0	0	0	0	0	0	0
| Family: Leptoceridae	0	0	0	0	0	0	0	0	0	0
Ceraclea sp.	0	0	0	0	0	0	0	0	0	0
Mystacides sp.	0	0	0	0	0	0	0	0	0	0
Oecetis sp.	0	0	0	0	0	0	0	0	0	0
Triaenodes sp.	0	0	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0	0	0	0	0
Glyphopsyche irrorata	0	0	0	0	0	0	0	0	0	0
Limnephilus sp.	0	0	0	0	0	0	0	0	0	0
| Family: Molannidae	0	0	0	0	0	0	0	0	0	0
Molanna sp.	0	0	0	0	0	0	0	0	0	0
| Family: Philopotamidae	0	0	0	0	0	0	0	0	0	0
Wormaldia sp.	0	0	0	0	0	0	0	0	0	0
| Family: Phryganeidae	0	0	0	0	0	0	0	0	0	0
Phryganea sp.	0	0	0	0	0	0	0	0	0	0
| Family: Polycentropodidae	0	0	0	0	0	0	0	0	0	0
Nyctiophylax sp.	0	0	0	0	0	0	0	0	0	0
Polycentropus sp.	0	0	0	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0	0	0
Agabus sp.	0	0	0	0	0	0	0	0	0	0
Oreodytes sp.	0	0	0	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0	0	0
Heterlimnius sp.	0	0	0	0	0	0	0	0	0	0
| Family: Gyrinidae	0	0	0	0	0	0	0	0	0	0
Dineutus sp.	0	0	0	0	0	0	0	0	0	0
| Family: Haliplidae	0	0	0	0	0	0	0	0	0	0
Brychius sp.	0	0	0	0	0	0	0	0	0	0
Haliplus sp.	0	0	0	0	0	0	0	0	0	0
Peltodytes sp.	0	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0	0	0
Bezzia sp.	0	0	0	0	0	0	0	0	0	0
Culicoides sp.	0	0	0	0	0	0	0	0	0	0
Probezzia sp.	0	0	0	0	0	0	0	0	0	0
Sphaeromias sp.	0	0	0	0	0	0	0	0	0	0
| Family: Chaoboridae	0	0	0	0	0	0	0	0	0	0
Chaoborus sp.	0	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	0	0	0	0	0	0	0	0	0	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	15	36	33	24	31	28	47	75	45	58
Cryptochironomus sp.	0	0	0	0	0	0	0	0	0	0
Dicrotendipes sp.	0	0	0	0	0	0	0	0	0	0
Glyptotendipes sp.	0	0	0	0	0	0	0	0	0	0
Lauterborniella sp.	0	0	0	0	0	0	0	0	0	0
Microtendipes pedellus	0	0	0	0	0	0	0	0	0	0
Parachironomus sp.	0	0	0	0	0	0	0	0	0	0
Paracladopelma sp.	0	0	0	0	0	0	0	0	0	0
Paratendipes sp.	0	0	0	0	0	0	0	0	0	0
Phaenopsectra sp.	0	12	4	7	0	8	0	0	6	11
Polypedilum sp.	0	0	0	0	0	0	0	0	0	0
Stenochironomus sp.	0	0	0	0	0	0	0	0	0	0
Stictochironomus sp.	0	0	0	0	0	0	0	0	0	0
Zavrelia sp.	0	0	0	0	0	0	0	0	0	0
| Tribe: Pseudochironomini	0	0	0	0	0	0	0	0	0	0
Pseudochironomus sp.	0	0	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0	0
Cladotanytarsus sp.	0	0	0	0	0	0	0	0	0	0
Paratanytarsus sp.	0	0	0	0	0	0	0	0	0	0
Stempellina sp.	0	0	0	0	0	0	0	0	0	0
Tanytarsus sp.	0	0	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Potthastia longimana group	0	0	0	0	0	0	0	0	0	0
Potthastia sp.	0	0	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0	0
Brillia sp.	0	0	0	0	0	0	0	0	0	0
Cricotopus sp.	0	0	0	0	0	0	0	0	0	0
Heterotrissocladius sp.	0	0	0	0	0	0	0	0	0	0
Metriocnemus sp.	0	0	0	0	0	0	0	0	0	0
Nanocladius sp.	0	0	0	0	0	0	0	0	0	0
Orthocladius complex	0	0	0	0	0	0	0	0	0	0
Parakiefferiella sp.	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	0	0	0	0	0	0	0	0	0	0
Synorthocladius sp.	0	0	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	0	0

Lake Name	Tatelkuz Lake									
	Profundal					Profundal				
Site:	TL1-1	TL1-2	TL1-3	TL1-4	TL1-5	TL2-1	TL2-2	TL2-3	TL2-4	TL2-5
Date:	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13
Percent Sampled (%)	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]
| **Tribe: Corynoneurini**	0	0	0	0	0	0	0	0	0	0
Corynoneura sp.	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Prodiamesinae**	0	0	0	0	0	0	0	0	0	0
Odontomesa sp.	0	0	0	0	0	0	0	0	0	0
Prodiamesa sp.	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Tanypodinae**	0	0	0	0	0	0	0	0	0	0
| **Tribe: Pentaneurini**	0	0	0	0	0	0	0	0	0	0
Ablabesmyia sp.	0	0	0	0	0	0	0	0	0	0
Labrundinia sp.	0	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0	0	0	0
| **Tribe: Procladiini**	0	0	0	0	0	0	0	0	0	0
Procladius sp.	0	0	0	0	0	0	0	0	0	1
| **Family: Empididae**	0	0	0	0	0	0	0	0	0	0
Chelifera/ Metachela	0	0	0	0	0	0	0	0	0	0
Clinocera sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Tabanidae**	0	0	0	0	0	0	0	0	0	0
| **Order: Hemiptera**	0	0	0	0	0	0	0	0	0	0
| **Family: Corixidae**	0	0	0	0	0	0	0	0	0	0
Corisella sp.	0	0	0	0	0	0	0	0	0	0
Sigara sp.	0	0	0	0	0	0	0	0	0	0
| **Order: Odonata**	0	0	0	0	0	0	0	0	0	0
| **Family: Aeshnidae**	0	0	0	0	0	0	0	0	0	0
Aeshna sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Coenagrionidae**	0	0	0	0	0	0	0	0	0	0
| **Family: Corduliidae**	0	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| **Class: Malacostraca**	0	0	0	0	0	0	0	0	0	0
| **Order: Amphipoda**	0	0	0	0	0	0	0	0	0	0
| **Family: Crangonyctidae**	0	0	0	0	0	0	0	0	0	0
Crangonyx sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Gammaridae**	0	0	0	0	0	0	0	0	0	0
Gammarus sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Hyalellidae**	0	0	0	0	0	0	0	0	0	0
Hyalella sp.	0	1	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0	0	0	0
| **Order: Trombidiformes**	0	0	0	0	0	0	0	0	0	0
| **Family: Arrenuridae**	0	0	0	0	0	0	0	0	0	0
Arrenurus sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Hydrodromidae**	0	0	0	0	0	0	0	0	0	0
Hydrodroma sp.	0	0	0	0	0	0	1	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0	0	0	0
Protzia sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Hygrobatidae**	0	0	0	0	0	0	0	0	0	0
Hygrobates sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Lebertiidae**	0	0	0	0	0	0	0	0	0	0
Lebertia sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Limnesiidae**	0	0	0	0	0	0	0	0	0	0
Limnesia sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Mideopsidae**	0	0	0	0	0	0	0	0	0	0
Mideopsis sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Oxidae**	0	0	0	0	0	0	0	0	0	0
Frontipoda sp.	0	0	0	0	0	0	0	0	0	0
Oxus sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Pionidae**	0	0	0	0	0	0	0	0	0	0
Piona sp.	0	0	0	0	0	0	0	0	0	0
Tiphys sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Unionicolidae**	0	0	0	0	0	0	0	0	0	0
Neumania sp.	0	0	0	0	0	0	0	0	0	0
Unionicola sp.	0	0	0	0	0	0	0	0	0	0
| **Order: Oribatei**	0	0	0	0	0	0	0	0	0	0
| **Family: Halacaridae**	0	0	0	0	0	0	0	0	0	0
| **Order: Sarcoptiformes**	0	0	0	0	0	0	0	0	0	0
| **Family: Hydrozetidae**	0	0	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0	0	0
| **Class: Bivalvia**	0	0	0	0	0	0	0	0	0	0
| **Order: Veneroida**	0	0	0	0	0	0	0	0	0	0
| **Family: Pisidiidae**	0	0	0	0	0	0	0	0	0	0
Pisidium sp.	0	0	0	0	0	0	0	0	0	0
Sphaerium sp.	0	0	0	0	0	0	0	0	0	0
| **Class: Gastropoda**	0	0	0	0	0	0	0	0	0	0
| **Order: Basommatophora**	0	0	0	0	0	0	0	0	0	0
| **Family: Lymnaeidae**	0	0	0	0	0	0	0	0	0	0
Lymnaea sp.	0	0	0	0	0	0	0	0	0	0
Stagnicola sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Physidae**	0	0	0	0	0	0	0	0	0	0
Physa sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Planorbidae**	0	0	0	0	0	0	0	0	0	0
Gyraulus sp.	0	0	0	0	0	0	0	0	0	0
Helisoma sp.	0	0	0	0	0	0	0	0	0	0
Menetus opercularis	0	0	0	0	0	0	0	0	0	0
Promenetus sp.	0	0	0	0	0	0	0	0	0	0
Promenetus umbilicatellus	0	0	0	0	0	0	0	0	0	0
| **Order: Heterostropha**	0	0	0	0	0	0	0	0	0	0
| **Family: Valvatidae**	0	0	0	0	0	0	0	0	0	0
Valvata sincera	0	0	0	0	0	0	0	0	0	0
Valvata sp.	0	0	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| **Class: Hirudinea**	0	0	0	0	0	0	0	0	0	0
| **Order: Arhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Erpobdellidae**	0	0	0	0	0	0	0	0	0	0
Erpobdella sp.	0	0	0	0	0	0	0	0	0	0
| **Order: Rhynchobdellida**	0	0	0	0	0	0	0	0	0	0
| **Family: Glossiphoniidae**	0	0	0	0	0	0	0	0	0	0
| **Family: Piscicolidae**	0	0	0	0	0	0	0	0	0	0
| **Class: Oligochaeta**	0	0	0	0	0	0	0	0	0	0
| **Order: Lumbriculida**	0	0	0	0	0	0	0	0	0	0
| **Family: Lumbriculidae**	0	0	0	0	0	0	0	0	0	0
| **Order: Tubificida**	0	0	0	0	0	0	0	0	0	0
| **Family: Enchytraeidae**	0	0	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0	0	0

Lake Name	Tatelkuz Lake									
	Profundal					Profundal				
Site:	TL1-1	TL1-2	TL1-3	TL1-4	TL1-5	TL2-1	TL2-2	TL2-3	TL2-4	TL2-5
Date:	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	15-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13	16-Aug-13
Percent Sampled (%)	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]	100 [4]
| **Family: Naididae**	0	0	0	0	0	0	0	0	0	0
Arcteonais lomondi	0	0	0	0	0	0	0	0	0	0
Chaetogaster diaphanus	0	0	0	0	0	0	0	0	0	0
Chaetogaster limnaei	0	0	0	0	0	0	0	0	0	0
Chaetogaster sp.	0	0	0	0	0	0	0	0	0	0
Nais sp.	0	0	0	0	0	0	0	0	0	0
Pristina sp.	0	1	0	0	0	0	0	1	1	0
Slavina sp.	0	0	0	0	0	0	0	0	0	0
Stylaria lacustris	0	0	0	0	0	0	0	0	0	0
Uncinais uncinata	0	0	0	0	0	0	0	0	0	0
Vejdovskyella sp.	0	0	0	0	0	0	0	0	0	0
| **Family: Tubificidae**	0	0	0	0	0	0	0	0	0	0
| **Subfamily: Tubificinae immature**	8	17	10	7	7	13	19	26	20	13
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	0	0	0	0	0	0	0	0
Phylum: Cnidaria	0	0	0	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0	0	0	0
| Order: Anthoathecatae	0	0	0	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0	0	0	0
Hydra sp.	0	0	0	0	0	0	0	0	1	1

Note: 1 = 400 um sieve size; 2 = 4000 um

Annex 5.11-10
Littoral Benthic Macroinvertebrate Habitat Photographs, Tatelkuz Lake, August 2013



Plate 1: View of Shoreline at Littoral BMI Site TL-1, Tatelkuz Lake, August 12, 2013

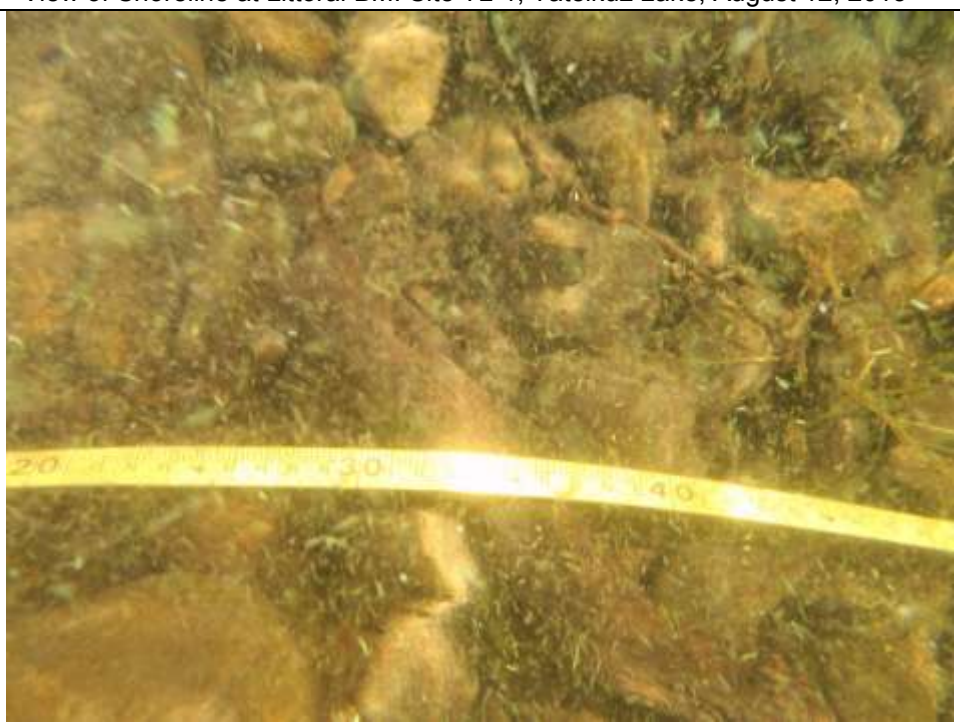


Plate 2: Underwater View of Substrate at Site TL-1, Tatelkuz Lake, August 12, 2013



Plate 3: View of Shoreline at Littoral BMI Site TL-2, Tatelkuz Lake, August 12, 2013



Plate 4: Underwater View of Substrate at Site TL-2, Tatelkuz Lake, August 12, 2013



Plate 5: View of Shoreline at Littoral BMI Site TL-3, Tatelkuz Lake, August 12, 2013

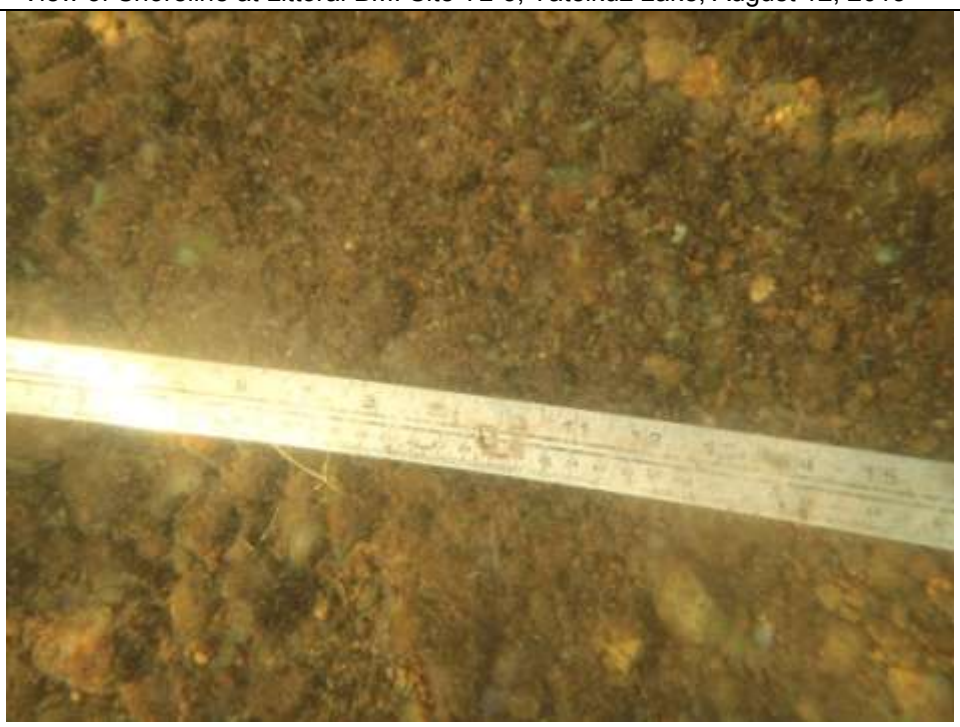


Plate 6: Underwater View of Substrate at Site TL-3, Tatelkuz Lake, August 12, 2013



Plate 7: View of Shoreline at Littoral BMI Site TL-4, Tatelkuz Lake, August 12, 2013



Plate 8: View of Substrate at Site TL-4, Tatelkuz Lake, August 12, 2013



Plate 9: View of Shoreline at Littoral BMI Site TL-5, Tatelkuz Lake, August 12, 2013



Plate 10: Underwater View of Substrate at Site TL-5, Tatelkuz Lake, August 12, 2013



Plate 11: View of Shoreline at Littoral BMI Site TL-6, Tatelkuz Lake, August 13, 2013



Plate 12: View of Substrate at Site TL-6, Tatelkuz Lake, August 13, 2013



Plate 13: View of Shoreline at Littoral BMI Site TL-7, Tatelkuz Lake, August 13, 2013



Plate 14: Underwater View of Substrate at Site TL-7, Tatelkuz Lake, August 13, 2013



Plate 15: View of Shoreline at Littoral BMI Site TL-8, Tatelkuz Lake, August 13, 2013



Plate 16: View of Substrate at Site TL-8, Tatelkuz Lake, August 13, 2013



Plate 17: View of Shoreline at Littoral BMI Site TL-9, Tatelkuz Lake, August 13, 2013

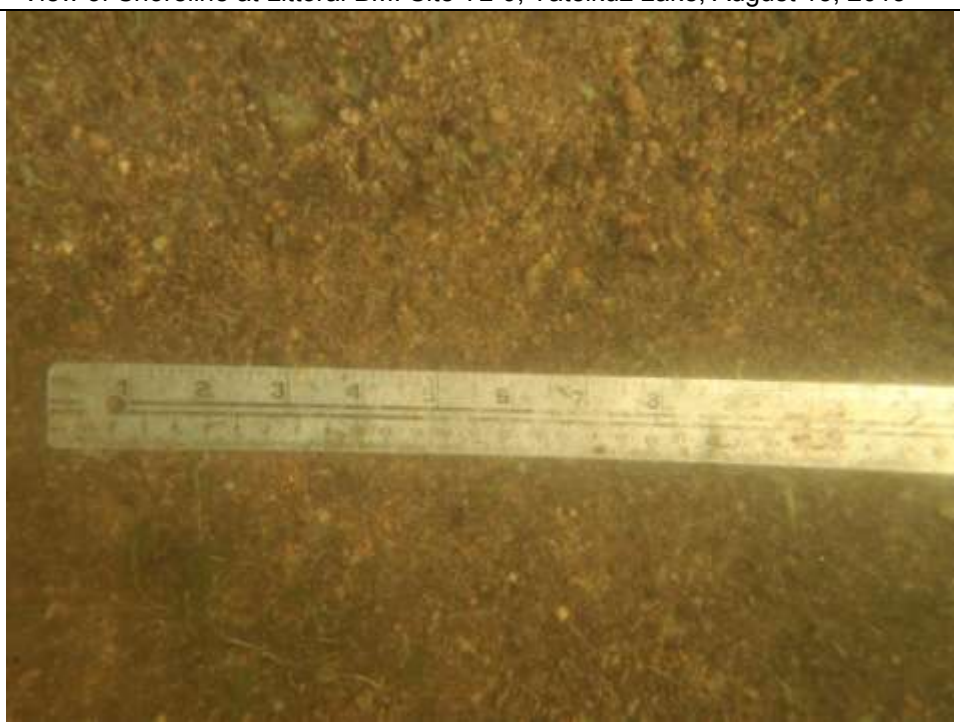


Plate 18: Underwater View of Substrate at Site TL-9, Tatelkuz Lake, August 13, 2013



Plate 19: View of Shoreline at Littoral BMI Site TL-10, Tatelkuz Lake, August 13, 2013

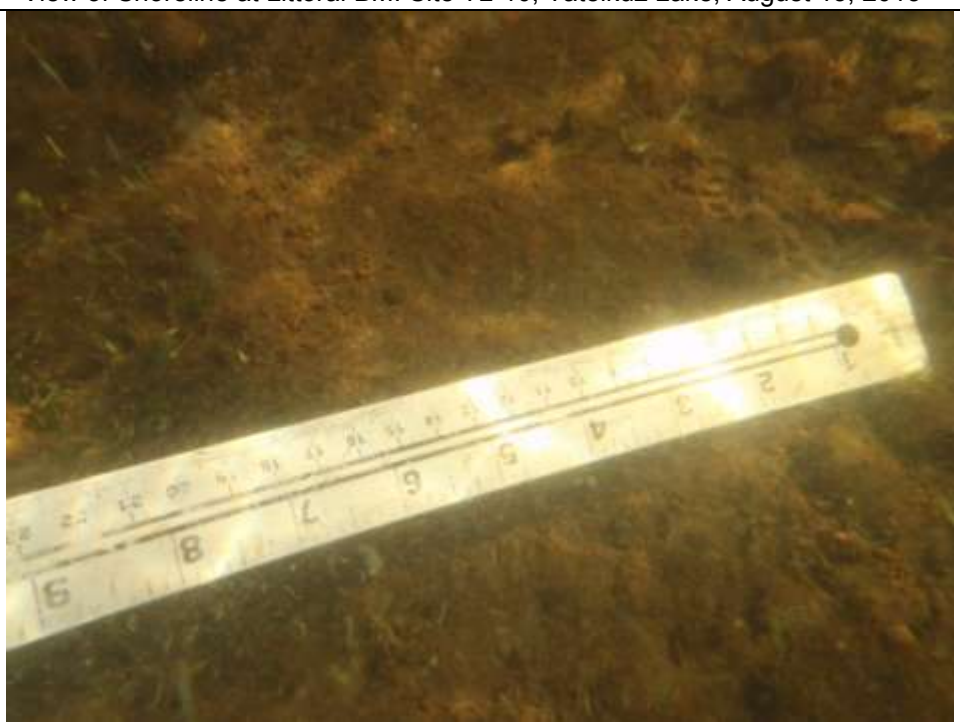


Plate 20: Underwater View of Substrate at Site TL-10, Tatelkuz Lake, August 13, 2013



Plate 21: View of Shoreline at Littoral BMI Site TL-11, Tatelkuz Lake, August 14, 2013



Plate 22: Underwater View of Substrate at Site TL-11, Tatelkuz Lake, August 14, 2013



Plate 23: View of Shoreline at Littoral BMI Site TL-12, Tatelkuz Lake, August 14, 2013

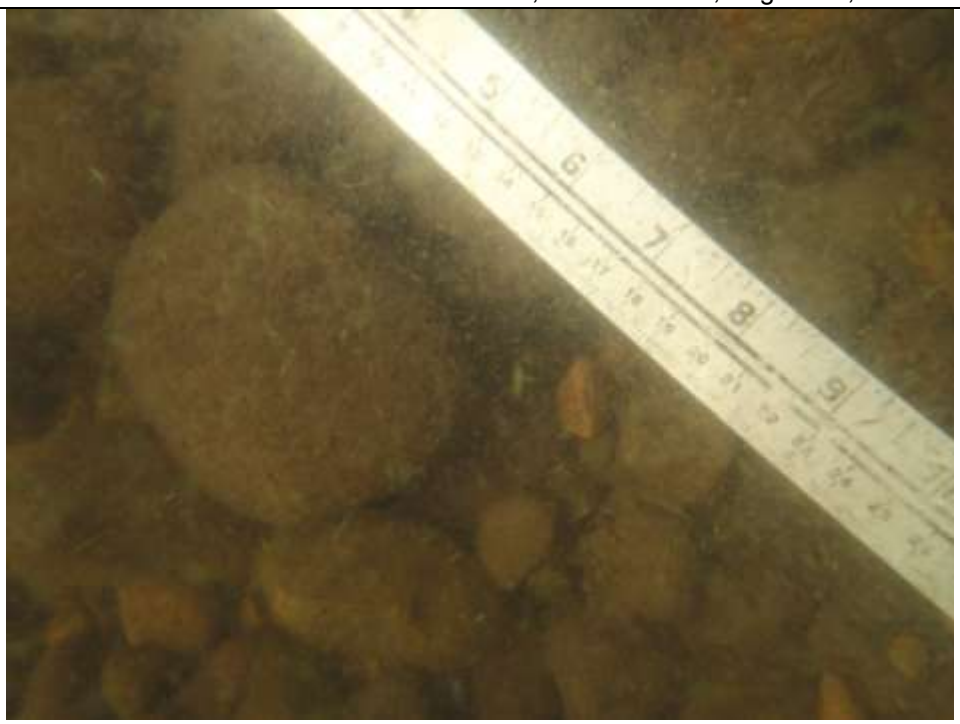


Plate 24: Underwater View of Substrate at Site TL-12, Tatelkuz Lake, August 14, 2013



Plate 25: View of Shoreline at Littoral BMI Site TL-13, Tatelkuz Lake, August 14, 2013

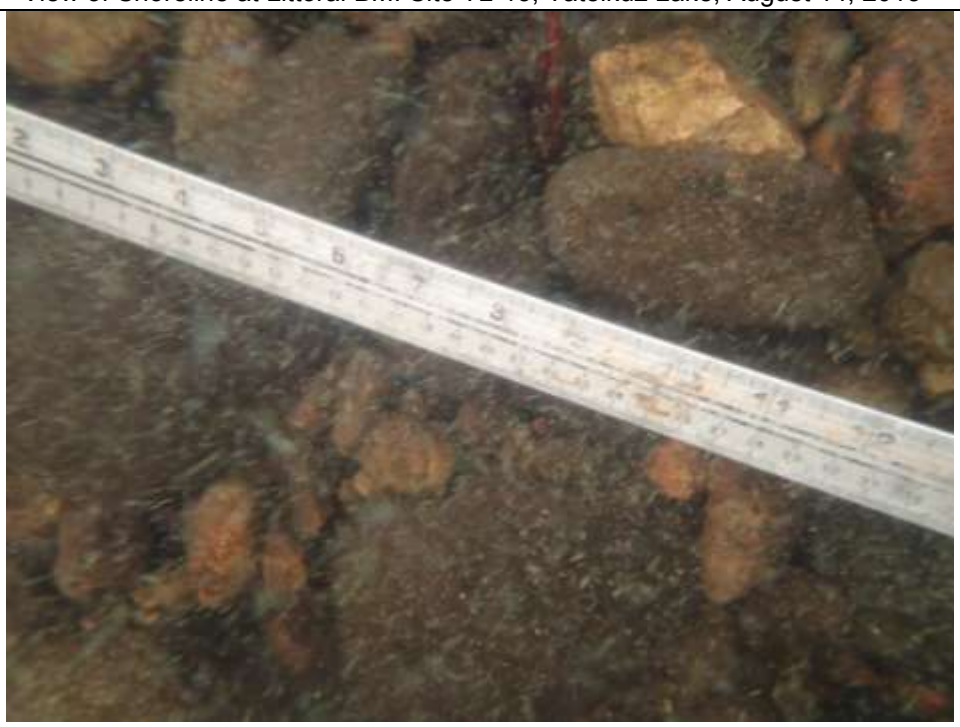


Plate 26: Underwater View of Substrate at Site TL-13, Tatelkuz Lake, August 14, 2013



Plate 27: View of Shoreline at Littoral BMI Site TL-14, Tatelkuz Lake, August 14, 2013



Plate 28: Underwater View of Substrate at Site TL-14, Tatelkuz Lake, August 14, 2013



Plate 29: View of Shoreline at Littoral BMI Site TL-15, Tatelkuz Lake, August 14, 2013

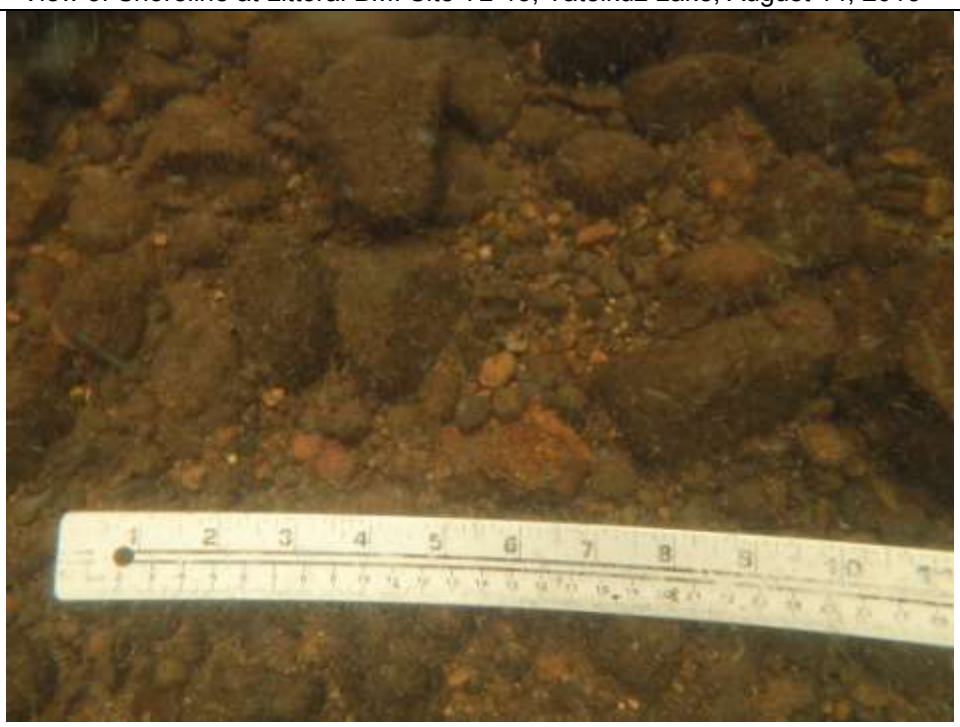


Plate 30: Underwater View of Substrate at Site TL-15, Tatelkuz Lake, August 14, 2013



Plate 31: View of Shoreline at Littoral BMI Site TL-16, Tatelkuz Lake, August 14, 2013

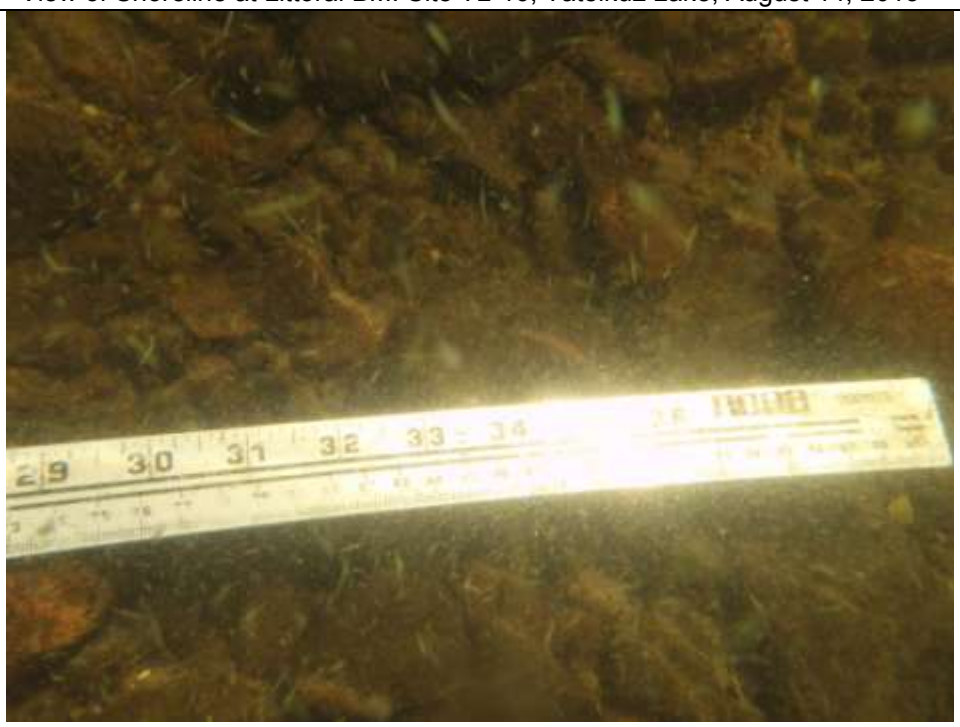


Plate 32: Underwater View of Substrate at Site TL-16, Tatelkuz Lake, August 14, 2013



Plate 33: View of Shoreline at Littoral BMI Site TL-17, Tatelkuz Lake, August 14, 2013



Plate 34: Underwater View of Substrate at Site TL-17, Tatelkuz Lake, August 14, 2013



Plate 35: View of Shoreline at Littoral BMI Site TL-18, Tatelkuz Lake, August 16, 2013



Plate 36: Underwater View of Substrate at Site TL-18, Tatelkuz Lake, August 16, 2013



Plate 37: View of Shoreline at Littoral BMI Site TL-19, Tatelkuz Lake, August 25, 2013



Plate 38: Underwater View of Substrate at Site TL-19, Tatelkuz Lake, August 25, 2013



Plate 39: View of Shoreline at Littoral BMI Site TL-20, Tatelkuz Lake, August 25, 2013



Plate 40: Underwater View of Substrate at Site TL-20, Tatelkuz Lake, August 25, 2013

Annex 5.11-11
Multivariate Analysis of Tatelkuz Lake BMI Data

Table 5.11-11A: Habitat Characteristics of Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Lake	Secchi Depth	Area	Replicates	Statistic	Sample Area (m^2)	Sample Depth (m)	DO concentration (mg/L)	Water conductivity (µS/cm)	Percent Presence across Replicates					
									Bottom substrate		Organic Matter-Areal Coverage		Macrophytes	Algae
									Coarse	Fine	Woody debris	Detritus		
Lake 14	3	Littoral	5	Mean	331.3	0.8	7.6	48.1	100	-	100	0	60	100
				Min	167.5	0.8	7.6	48.1						
				Max	615	0.8	7.6	48.1						
		Profundal	5	Mean	-	5.3	9.0	36.3	-	-	-	-	-	-
				Min	-	5.2	9.0	36.3						
				Max	-	5.4	9.0	36.3						
Lake 15	5.7	Littoral	5	Mean	264.2	0.8	8.4	43.9	100		80	20	80	80
				Min	105.5	0.8	8.0	44.0						
				Max	533	0.8	8.9	44.1						
		Profundal	5	Mean	-	9.3	8.6	44.0	-	-	-	-	-	-
				Min	-	9.2	8.6	44.0						
				Max	-	9.6	8.6	44.0						
Lake 16	5.7	Littoral	5	Man	146.5	0.8	9.1	49.0	100	-	80	0	100	100
				Min	113.2	0.8	8.8	49.0						
				Max	180	0.8	9.3	49.1						
		Profundal	5	Mean	-	14.0	0.0	68.8	-	-	-	-	-	-
				Min	-	14.0	0.0	68.8						
				Max	-	14.0	0.0	68.8						
Tatelkuz Lake	3.7	Littoral	20	Mean	871.2	0.8	8.6	219.5	60	40	23	-	21	51
				Min	110.3	0.8	7.3	186.1			1	-	0	0
				Max	2,910	0.8	13.7	268.5			100	-	50	100
		Profundal	10	Mean	-	28.5	4.2	150.0	-	-	-	-	-	-
				Min	-	28.0	4.0	149.8						
				Max	-	29.0	4.5	150.2						

Table 5.11-11B: Mean Abundance and Contributions to Bray-Curtis Dissimilarity (SIMPER analysis) of BMI Taxa Collected from Littoral Habitats in Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Group Tatelkuz	Group Headwater		
Hyalella sp.	16,389.12	1313.34	9.44	9.44
Amphipoda	3,007.43	0.00	6.27	15.7
Paraleptophlebia sp.	0.27	570.73	3.36	19.06
Caenis sp.	830.59	0.71	3.26	22.32
Planorbidae	975.94	59.75	2.65	24.97
Gammarus sp.	720.92	390.85	2.57	27.53
Pisidiidae	940.04	679.64	2.32	29.86
Glyptotendipes sp.	468.72	11.90	2.07	31.92
Mystacides sp.	408.44	19.80	1.94	33.86
Dicrotendipes sp.	333.79	12.67	1.92	35.78
Lumbriculidae	293.44	22.94	1.76	37.54
Stylaria sp.	196.28	0.88	1.68	39.22
Paratanytarsus sp.	97.02	166.93	1.67	40.89
Callibaetis sp.	343.73	29.48	1.64	42.53
Nais sp.	203.35	0.00	1.54	44.07
Trombidiformes	170.82	2.59	1.47	45.55
Caenidae	0.00	99.80	1.43	46.98
Tanytarsus sp.	141.61	34.11	1.38	48.36
Tubificinae immature	89.49	0.00	1.28	49.63
Pisidium sp.	123.43	21.90	1.19	50.82
Leptophlebiidae	121.88	0.07	1.19	52.01
Leptoceridae	112.57	0.18	1.14	53.15
Procladius sp.	69.06	42.64	1.11	54.26
Oecetis sp.	117.51	0.66	1.08	55.35
Menetus opercularis	87.24	47.89	1.06	56.4
Corixidae	90.63	1.06	1.04	57.44
Orthocladius complex	68.72	0.00	1.03	58.47
Microtendipes pedellus	53.00	0.00	1.02	59.5
Chironomidae	58.52	0.01	1	60.5
Stictochironomus sp.	59.44	0.00	0.96	61.46
Ephemera simulans	77.62	0.00	0.96	62.41
Leptophlebia sp.	0.00	43.56	0.94	63.35
Limnesia sp.	75.17	0.09	0.92	64.27
Oxyethira sp.	72.25	0.00	0.89	65.17
Tanypodinae	0.00	37.70	0.88	66.04
Probezzia sp.	89.49	10.37	0.87	66.91
Glossiphoniidae	66.26	6.92	0.85	67.76
Parachironomus sp.	46.24	0.00	0.82	68.58
Enchytraeus	27.14	44.49	0.79	69.37
Oreodytes sp.	19.98	1.37	0.76	70.13
Polycentropus sp.	25.91	4.04	0.75	70.89
Cricotopus bicinctus group	0.00	27.04	0.74	71.62
Naididae	2.34	27.56	0.72	72.34

Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Group Tatelkuz	Group Headwater		
Corynoneura sp.	29.38	3.50	0.7	73.04
Gastropoda	33.64	20.98	0.7	73.75
Neumania sp.	24.90	0.00	0.69	74.44
Lymnaea sp.	57.30	0.00	0.69	75.12
Cryptochironomus sp.	45.97	0.00	0.67	75.79
Phaenopsectra sp.	30.58	0.00	0.64	76.43
Valvata sincera	42.38	0.00	0.63	77.06
Limnephilus sp.	2.96	20.16	0.61	77.68
Slavina sp.	16.97	0.00	0.57	78.25
Microtendipes sp.	0.00	16.08	0.57	78.82
Limnephilidae	23.52	0.22	0.57	79.39
Cricotopus sp.	34.46	0.00	0.54	79.93
Polypedilum sp.	24.50	0.16	0.52	80.44
Chironomus sp.	13.69	0.00	0.5	80.95
Psectrocladius sp.	7.29	4.62	0.5	81.45
Unionicola sp.	9.42	0.10	0.49	81.93
Valvata sp.	13.62	0.00	0.48	82.41
Hydryphantidae	0.00	10.76	0.46	82.87
Hydroporinae	9.06	0.00	0.45	83.33
Uncinais uncinata	24.90	0.00	0.45	83.77
Micropsectra sp.	0.00	10.96	0.45	84.22
Hydrodroma sp.	4.33	0.01	0.44	84.66
Synorthocladius sp.	4.16	0.06	0.43	85.09
Sigara sp.	3.92	4.58	0.42	85.51
Arcteonais lomondi	22.47	0.00	0.42	85.93
Trichoptera	11.90	0.18	0.4	86.33
Lebertia sp.	3.84	3.28	0.4	86.72
Erpobdellidae	6.55	3.17	0.39	87.11
Cladotanytarsus sp.	20.07	0.00	0.38	87.5
Physa sp.	10.89	1.56	0.38	87.88
Arrenurus sp.	8.58	1.72	0.37	88.25
Centroptilum sp.	5.48	0.00	0.37	88.62
Ablabesmyia sp.	14.14	0.00	0.36	88.98
Crangonyx sp.	4.08	0.00	0.35	89.33
Zavrelia sp.	6.15	0.00	0.34	89.67
Heterotrissocladius sp.	4.93	0.25	0.34	90.01

Note: Highest dissimilarity contributions indicate taxa that best discriminate BMI communities in Tatelkuz from Headwater lakes. Only ranked taxa that represent the top 90% (cumulative) of dissimilarity in abundance are included.

Table 5.11-11C: Diversity Indices for Littoral and Profundal BMI, Tatelkuz Lake and Headwater Lakes 14, 15 and 16

Lake	Sample	Abundance	Taxa Richness	Shannon-Weiner Index	HBI	Chironomids (%)	EPT Taxa (%)
Lake 14	**mean**	**3,954.4**	**33.2**	**2.52**	**3.24**	**11**	**44**
	6	9,360	33	2.44	3.22	12	43
	7	1,865	33	2.52	3.65	18	58
	8	4,351	31	2.57	3.00	12	29
	9	3,956	30	2.46	2.75	5	51
	10	240	39	2.63	3.56	7	39
Lake 15	**mean**	**2,350.4**	**26.4**	**2.43**	**3.48**	**22**	**35**
	6	2,609	28	2.43	4.61	28	51
	7	3,055	31	2.50	3.78	25	30
	8	2,153	27	2.64	3.79	25	25
	9	1,615	19	2.19	1.79	7	39
	10	2,320	27	2.38	3.41	26	27
Lake 16	**mean**	**3,180.4**	**26.4**	**2.11**	**3.59**	**34**	**22**
	6	2,652	29	2.10	5.39	53	30
	7	2,750	26	2.06	2.87	25	15
	8	4,680	25	2.37	2.33	21	26
	9	2,580	31	2.06	3.47	32	22
	10	3,240	21	1.97	3.88	38	19
Tatelkuz Lake	**mean**	**45,712.3**	**54.1**	**2.19**	**6.06**	**12**	**10**
	1	18,856	54	2.44	6.33	10	23
	2	20,160	52	2.21	6.44	8	10
	3	11,560	33	2.02	6.57	13	3
	4	5,819	35	2.36	5.82	4	9
	5	12,500	48	2.74	6.16	20	4
	6	67,151	68	2.19	6.75	20	2
	7	28,025	64	2.54	5.92	69	2
	8	66,007	56	1.92	5.56	12	10
	9	76,526	56	1.81	4.95	6	9
	10	106,271	82	2.00	6.25	12	7
	11	7,600	37	2.39	6.21	9	9
	12	7,700	40	2.62	5.56	11	5
	13	3,584	40	2.42	6.10	14	4
	14	6,880	43	2.56	5.22	8	14
	15	5,865	30	1.81	6.42	3	16
	16	24,104	58	2.13	6.05	3	19
	17	111,707	75	1.95	5.72	4	13
	18	137,695	72	1.61	6.80	4	5
	19	99,641	65	2.00	6.19	4	22
	20	96,594	73	2.04	6.13	7	9

Table 5.11-11D: Mean Abundance and Contributions to Bray-Curtis Dissimilarity (SIMPER Analysis) of BMI Taxa Collected from Coarse and Fine Substrate Classes in Littoral Habitats of Tatelkuz Lake

Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Coarse	Fine		
Hyalella sp.	6,023.31	41,473.32	11.85	11.85
Amphipoda	1,020.80	7,951.29	5.56	17.41
Planorbidae	416.16	2,255.30	3.51	20.92
Caenis sp.	619.01	1,206.87	2.74	23.66
Gammarus sp.	1,112.89	292.41	2.36	26.02
Pisidiidae	489.74	1,888.77	2.35	28.37
Glyptotendipes sp.	177.96	1,163.49	2.13	30.5
Tanytarsus sp.	11.97	603.19	2.1	32.6
Callibaetis sp.	111.09	932.69	2.04	34.64
Nais sp.	39.06	690.64	1.88	36.52
Orthocladius complex	8.35	268.96	1.85	38.37
Mystacides sp.	204.49	845.06	1.82	40.19
Ephemera simulans	3.50	369.79	1.82	42.01
Dicrotendipes sp.	129.05	819.68	1.67	43.68
Paratanytarsus sp.	17.47	337.09	1.52	45.2
Procladius sp.	5.48	297.91	1.42	46.62
Cryptochironomus sp.	2.69	209.67	1.35	47.96
Lymnaea sp.	1.80	285.95	1.34	49.3
Pisidium sp.	40.20	334.16	1.33	50.63
Cricotopus sp.	0.00	215.21	1.32	51.95
Lumbriculidae	254.40	356.83	1.31	53.26
Stictochironomus sp.	22.47	147.87	1.3	54.57
Oecetis sp.	38.81	315.42	1.26	55.83
Leptophlebiidae	49.84	289.68	1.22	57.05
Stylaria sp.	159.01	259.53	1.21	58.26
Polypedilum sp.	0.01	149.82	1.15	59.41
Probezzia sp.	21.16	280.56	1.14	60.55
Chironomidae	37.33	99.20	1.13	61.68
Valvata sincera	5.38	163.84	1.08	62.76
Leptoceridae	61.47	217.86	1.05	63.8
Oxyethira sp.	30.47	168.22	1.03	64.83
Menetus opercularis	79.03	100.00	1.01	65.85
Limnesia sp.	23.52	207.07	0.97	66.81
Cladotanytarsus sp.	0.00	125.44	0.96	67.77
Uncinais uncinata	0.88	122.77	0.96	68.73
Trombidiformes	106.71	295.15	0.94	69.67
Corixidae	33.87	226.80	0.93	70.59
Phaenopsectra sp.	7.51	94.48	0.89	71.49
Tubificinae immature	113.42	58.98	0.89	72.37
Parachironomus sp.	23.23	95.45	0.88	73.26
Arcteonais lomondi	2.19	92.93	0.82	74.08
Microtendipes pedellus	61.00	42.12	0.76	74.84
Pseudochironomus sp.	0.09	67.73	0.73	75.57

Species	Mean Abundance		Contribution (%)	Cumulative (%)
	Coarse	Fine		
Bezzia sp.	1.12	50.84	0.66	76.23
Heterotrissocladius sp.	0.00	30.80	0.65	76.88
Gyraulus sp.	0.88	54.02	0.6	77.48
Corynoneura sp.	24.50	37.58	0.55	78.03
Thienemannimyia group	1.25	17.06	0.55	78.58
Gastropoda	25.00	49.00	0.55	79.13
Chironomus sp.	14.67	12.32	0.53	79.67
Neumania sp.	15.29	43.56	0.52	80.19
Physa sp.	1.00	45.56	0.52	80.71
Limnephilidae	17.98	33.41	0.52	81.23
Glossiphoniidae	58.37	79.03	0.51	81.75
Ablabesmyia sp.	5.48	34.46	0.49	82.23
Enchytraeus	26.32	28.52	0.49	82.72
Oreodytes sp.	33.06	6.60	0.48	83.2
Ephemeridae	1.04	20.25	0.46	83.66
Polycentropus sp.	41.47	9.36	0.45	84.11
Trichoptera	4.12	31.14	0.45	84.55
Valvata sp.	11.22	17.56	0.44	85.0
Chaetogaster sp.	0.18	27.46	0.43	85.43
Slavina sp.	22.28	10.43	0.43	85.85
Lymnaeidae	3.57	17.64	0.42	86.28
Hydrozetidae	1.96	25.81	0.42	86.7
Molanna sp.	4.12	24.01	0.42	87.12
Hygrobates sp.	0.00	16.97	0.4	87.51
Zavrelia sp.	6.50	5.66	0.39	87.9
Corisella sp.	0.06	22.85	0.39	88.29
Hydroporinae	16.08	2.28	0.38	88.67
Piona sp.	1.25	22.00	0.38	89.05
Psectrocladius sp.	4.08	13.76	0.38	89.43
Arrenurus sp.	4.41	17.39	0.36	89.79
Potthastia longimana group	0.36	14.36	0.35	90.14

Note: Highest dissimilarity contributions indicate taxa that best discriminate BMI communities in these two substrate classes. Only ranked taxa that represent the top 90% (cumulative) of dissimilarity in abundance are included.

Annex 5.12-1
Fish Effort, Catch, and CPUE, Tatelkuz Lake, July 2013

Annex 5.12-1: Tatelkuz Lake Fish Sampling Effort, Capture, and CPUE Data, July 2013

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	A1N5	RISC Floating	1	0 – 5	6.5	15-Jul-13	15:22	15-Jul-13	17:15	1.9	0	34	0	0	0	0	0	0	0	0	34	0.0	198.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	198.0
Tatelkuz Lake	A1N5Nord	Nordic	1	0 – 5	3.8	15-Jul-13	15:09	15-Jul-13	16:45	1.6	0	9	0	0	0	0	0	0	0	0	9	0.0	245.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	245.9
Tatelkuz Lake	A1O15Nord	Nordic	1	10 – 15	18.5	15-Jul-13	16:04	15-Jul-13	17:37	1.6	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A1O20	RISC Sinking	1	15 – 20	20.5	15-Jul-13	18:35	16-Jul-13	9:05	14.5	0	0	6	1	0	3	0	0	3	0	13	0.0	0.0	4.5	0.8	0.0	2.3	0.0	0.0	2.3	0.0	9.8
Tatelkuz Lake	A2N5	RISC Sinking	1	0 – 5	2.5	15-Jul-13	13:24	15-Jul-13	15:30	2.1	4	39	7	0	0	7	0	0	0	2	59	20.9	203.6	36.5	0.0	0.0	36.5	0.0	0.0	0.0	10.4	308.1
Tatelkuz Lake	A2O15	RISC Sinking	1	10 – 15	15.5	15-Jul-13	14:13	15-Jul-13	16:05	1.9	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A2O15	RISC Sinking	1	10 – 15	18.5	16-Jul-13	20:15	17-Jul-13	9:15	13.0	4	1	0	0	0	0	0	0	0	0	5	3.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
Tatelkuz Lake	B1O15	RISC Sinking	1	10 – 15	18.0	16-Jul-13	20:45	17-Jul-13	9:15	12.5	0	0	6	0	0	0	0	0	1	0	7	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.9	0.0	6.1
Tatelkuz Lake	B1O25	RISC Sinking	1	20 – 25	25.5	16-Jul-13	10:20	16-Jul-13	14:25	4.1	0	0	3	0	0	0	0	0	0	0	3	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1
Tatelkuz Lake	B1O30	RISC Sinking	1	25 – 30	26.0	16-Jul-13	9:25	16-Jul-13	14:07	4.7	0	0	1	0	0	0	0	0	1	0	2	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	2.3	0.0	4.7
Tatelkuz Lake	B1O5	RISC Floating	1	0 – 5	18.5	16-Jul-13	12:30	16-Jul-13	16:21	3.9	13	18	0	0	0	0	0	0	1	0	32	37.0	51.3	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	91.1
Tatelkuz Lake	B2O15Nord	Nordic	1	10 – 15	28.5	16-Jul-13	13:50	16-Jul-13	16:55	3.1	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	B2O20	RISC Sinking	1	15 – 20	28.0	16-Jul-13	11:20	16-Jul-13	15:07	3.8	0	0	0	0	0	1	0	0	0	0	1	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	2.9
Tatelkuz Lake	B2O30	RISC Sinking	1	25 – 30	27.5	16-Jul-13	10:45	16-Jul-13	14:40	3.9	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	B2O5	RISC Floating	1	0 – 5	17.0	16-Jul-13	13:00	16-Jul-13	16:45	3.8	4	8	0	0	0	0	0	0	0	0	12	11.7	23.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.1
Tatelkuz Lake	C2O15	RISC Sinking	1	10 – 15	22.5	16-Jul-13	21:15	17-Jul-13	9:15	12.0	2	33	0	0	0	0	0	0	0	0	35	1.8	30.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
Tatelkuz Lake	G2N5	RISC Floating	1	0 – 5	4.7	16-Jul-13	13:26	16-Jul-13	16:10	2.7	0	33	5	0	0	2	0	0	0	0	40	0.0	132.4	20.1	0.0	0.0	8.0	0.0	0.0	0.0	0.0	160.5
Tatelkuz Lake	H1N5	RISC Floating	1	0 – 5	10.0	16-Jul-13	13:11	16-Jul-13	15:30	2.3	0	30	16	0	0	1	0	1	1	0	49	0.0	142.0	75.7	0.0	0.0	4.7	0.0	4.7	4.7	0.0	231.9
Tatelkuz Lake	I1N5	RISC Floating	1	0 – 5	5.7	16-Jul-13	10:30	16-Jul-13	12:35	2.1	1	13	0	0	0	1	0	0	0	0	15	5.3	68.4	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	78.9
Tatelkuz Lake	I2N5	RISC Floating	1	0 – 5	9.3	16-Jul-13	10:00	16-Jul-13	11:50	1.8	0	17	16	0	0	0	0	0	0	0	34	0.0	101.7	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	203.3
Tatelkuz Lake	F2N5	RISC Floating	1	0 – 5	4.5	17-Jul-13	12:50	17-Jul-13	15:09	2.3	8	60	9	0	0	1	0	0	0	0	78	37.9	284.0	42.6	0.0	0.0	4.7	0.0	0.0	0.0	0.0	369.2
Tatelkuz Lake	G1N5	RISC Floating	1	0 – 5	13.0	17-Jul-13	10:45	17-Jul-13	14:10	3.4	1	15	0	0	0	4	0	1	0	0	21	3.2	48.1	0.0	0.0	0.0	12.8	0.0	3.2	0.0	0.0	67.4
Tatelkuz Lake	G1O10	Nordic	1	5 – 10	15.0	17-Jul-13	13:20	17-Jul-13	17:20	4.0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G1O15	RISC Sinking	1	10 – 15	22.5	17-Jul-13	10:00	17-Jul-13	14:15	4.3	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G2O15	Nordic	1	10 – 15	11.5	17-Jul-13	13:38	17-Jul-13	17:10	3.5	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G2O20	RISC Sinking	1	15 – 20	22.5	17-Jul-13	16:00	18-Jul-13	9:55	17.9	1	1	0	0	0	0	0	0	0	0	2	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Tatelkuz Lake	G2O25	RISC Sinking	1	20 – 25	23.5	17-Jul-13	11:45	17-Jul-13	17:00	5.3	0	0	0	0	0	0	0	0	4	0	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	8.4

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	H1O20	Nordic	1	15 – 20	19.0	17-Jul-13	13:53	17-Jul-13	17:30	3.6	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	H1O25	RISC Sinking	1	20 – 25	27.0	17-Jul-13	15:35	18-Jul-13	9:21	17.8	1	0	1	0	0	0	0	0	0	0	2	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Tatelkuz Lake	H1O5	RISC Floating	1	0 – 5	17.5	17-Jul-13	11:30	17-Jul-13	16:45	5.3	3	12	0	0	0	1	0	0	0	0	16	6.3	25.1	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	33.4
Tatelkuz Lake	H2N5	Nordic	1	0 – 5	4.6	17-Jul-13	10:16	17-Jul-13	11:54	1.6	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	H2O15	RISC Sinking	1	10 – 15	21.5	17-Jul-13	10:23	17-Jul-13	14:37	4.2	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	I1N10	Nordic	1	5 – 10	9.7	17-Jul-13	13:21	17-Jul-13	16:40	3.3	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	I1O15	RISC Sinking	1	10 – 15	18.5	17-Jul-13	10:45	17-Jul-13	12:55	2.2	0	0	3	0	0	0	0	0	1	0	4	0.0	0.0	15.2	0.0	0.0	0.0	0.0	0.0	5.1	0.0	20.2
Tatelkuz Lake	I2N10	RISC Sinking	1	5 – 10	9.5	17-Jul-13	10:30	17-Jul-13	13:45	3.3	0	0	2	0	0	0	0	0	0	0	2	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
Tatelkuz Lake	I2N5	Nordic	1	0 – 5	4.3	17-Jul-13	13:43	17-Jul-13	16:45	3.0	0	1	0	0	0	0	0	0	0	0	0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	I2O15	RISC Sinking	1	10 – 15	18.5	17-Jul-13	15:15	18-Jul-13	9:30	18.3	1	0	7	0	0	0	0	0	1	0	9	0.6	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	5.4
Tatelkuz Lake	I2O5	RISC Floating	1	0 – 5	18.0	17-Jul-13	11:00	17-Jul-13	16:23	5.4	7	9	0	0	0	0	0	0	0	0	16	14.3	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.6
Tatelkuz Lake	A2N10	Nordic	1	5 – 10	8.9	18-Jul-13	8:52	18-Jul-13	16:05	7.2	2	1	0	0	0	0	0	0	0	0	3	5.9	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
Tatelkuz Lake	A2O20	Nordic	1	15 – 20	19.5	18-Jul-13	12:15	18-Jul-13	18:30	6.3	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A2O20	RISC Sinking	1	15 – 20	19.5	18-Jul-13	18:51	19-Jul-13	9:00	14.2	1	0	10	0	0	0	0	1	4	0	16	0.8	0.0	7.7	0.0	0.0	0.0	0.0	0.8	3.1	0.0	12.4
Tatelkuz Lake	B1N10	RISC Sinking	1	5 – 10	9.2	18-Jul-13	9:11	18-Jul-13	11:40	2.5	2	2	5	0	0	0	0	2	0	0	11	8.8	8.8	22.1	0.0	0.0	0.0	0.0	8.8	0.0	0.0	48.6
Tatelkuz Lake	B2O5	RISC Floating	1	0 – 5	22.0	18-Jul-13	6:42	19-Jul-13	9:20	2.6	9	27	0	0	0	6	0	0	0	0	42	37.5	112.4	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	174.9
Tatelkuz Lake	C1N10	RISC Sinking	1	5 – 10	9.3	18-Jul-13	9:46	18-Jul-13	14:30	4.7	6	18	0	0	0	2	0	0	1	0	27	13.9	41.7	0.0	0.0	0.0	4.6	0.0	0.0	2.3	0.0	62.5
Tatelkuz Lake	C1N5	Nordic	1	0 – 5	3.5	18-Jul-13	9:19	18-Jul-13	12:15	2.9	1	18	2	0	0	0	0	0	1	0	22	14.9	268.3	29.8	0.0	0.0	0.0	0.0	0.0	14.9	0.0	327.9
Tatelkuz Lake	C1O35	Nordic	1	30 – 35	31.5	18-Jul-13	12:05	18-Jul-13	18:16	6.2	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	C2O20	Nordic	1	15 – 20	17.0	18-Jul-13	18:24	19-Jul-13	9:08	14.7	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D1O20	RISC Sinking	1	15 – 20	31.0	18-Jul-13	10:52	18-Jul-13	16:15	5.4	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D1O25	RISC Sinking	1	20 – 25	29.0	18-Jul-13	18:00	19-Jul-13	10:22	16.4	1	0	0	0	0	0	0	0	0	0	1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Tatelkuz Lake	D1O5	RISC Floating	1	0 – 5	28.0	18-Jul-13	11:05	18-Jul-13	16:45	5.7	15	21	0	0	0	0	0	0	0	0	36	29.0	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7
Tatelkuz Lake	D2O20	RISC Sinking	1	15 – 20	26.5	18-Jul-13	17:00	19-Jul-13	9:40	16.7	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D2O25	Nordic	1	20 – 25	22.5	18-Jul-13	11:20	18-Jul-13	16:48	5.5	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D2O35	RISC Sinking	1	30 – 35	31.5	18-Jul-13	11:30	18-Jul-13	17:24	5.9	0	0	0	0	0	0	0	0	3	0	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	5.6
Tatelkuz Lake	E1N5	RISC Floating	1	0 – 5	15.0	18-Jul-13	10:07	18-Jul-13	13:40	3.6	10	12	0	0	0	3	0	0	0	0	25	30.9	37.1	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	77.2
Tatelkuz Lake	E1O15	Nordic	1	10 – 15	14.0	18-Jul-13	17:45	19-Jul-13	9:48	16.1	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	2.7
Tatelkuz Lake	E1O20	Nordic	1	15 – 20	18.5	18-Jul-13	11:51	18-Jul-13	17:38	5.8	1	1	0	0	0	0	0	0	0	0	2	7.6	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	E2O15	RISC Sinking	1	10 – 15	23.5	18-Jul-13	10:00	18-Jul-13	15:35	5.6	0	0	0	0	0	0	0	0	1	0	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
Tatelkuz Lake	E2O5	RISC Floating	1	0 – 5	28.5	18-Jul-13	10:15	18-Jul-13	15:58	5.7	5	15	0	0	0	0	0	0	0	0	20	9.6	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.4
Tatelkuz Lake	F1O25	RISC Sinking	1	20 – 25	30.0	18-Jul-13	9:40	18-Jul-13	15:20	5.7	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G2N10	RISC Sinking	1	5 – 10	9.7	18-Jul-13	12:58	18-Jul-13	15:42	2.7	4	0	0	0	0	0	0	0	0	0	17	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.2
Tatelkuz Lake	B1N5	Nordic	1	0 – 5	2.8	19-Jul-13	15:37	19-Jul-13	19:23	3.8	1	16	0	0	0	0	0	0	0	0	17	11.6	185.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.3
Tatelkuz Lake	C1O25	Nordic	1	20 – 25	24.0	19-Jul-13	15:29	19-Jul-13	18:34	3.1	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	C2N10	Nordic	1	5 – 10	8.5	19-Jul-13	14:28	19-Jul-13	18:45	4.3	0	0	0	0	0	0	0	0	4	0	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.8	0.0	40.8
Tatelkuz Lake	C2N5	RISC Floating	1	0 – 5	5.8	19-Jul-13	14:42	19-Jul-13	18:55	4.2	3	36	0	0	0	0	0	0	0	0	39	7.8	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.4
Tatelkuz Lake	C2O10	Nordic	1	5 – 10	16.5	19-Jul-13	15:05	19-Jul-13	19:05	4.0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	C2O30	Nordic	1	25 – 30	28.0	19-Jul-13	14:47	19-Jul-13	19:10	4.4	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D1N10	RISC Sinking	1	5 – 10	7.1	19-Jul-13	15:17	19-Jul-13	18:25	3.1	0	0	7	0	0	0	0	0	2	0	9	0.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0	7.0	0.0	31.5
Tatelkuz Lake	D2N5	RISC Floating	1	0 – 5	8.3	19-Jul-13	12:25	19-Jul-13	18:00	5.6	3	21	0	0	0	0	0	0	0	0	24	5.9	41.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.1
Tatelkuz Lake	E2N10	RISC Sinking	1	5 – 10	7.0	19-Jul-13	12:11	19-Jul-13	17:40	5.5	3	2	4	0	0	0	0	1	1	0	11	6.0	4.0	8.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	22.0
Tatelkuz Lake	G2N10	RISC Sinking	1	5 – 10	7.5	19-Jul-13	11:15	19-Jul-13	17:13	6.0	9	1	3	0	0	0	0	0	0	0	0	16.5	1.8	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	H1O10	RISC Sinking	1	5 – 10	24.5	19-Jul-13	11:45	19-Jul-13	16:40	4.9	3	0	0	0	0	0	0	0	0	0	3	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
Tatelkuz Lake	I1O20	RISC Sinking	1	15 – 20	18.0	19-Jul-13	11:00	19-Jul-13	16:24	5.4	0	0	14	0	0	1	0	0	1	0	16	0.0	0.0	28.4	0.0	0.0	2.0	0.0	0.0	2.0	0.0	32.5
Tatelkuz Lake	B2N5	RISC Floating	1	0 – 5	4.8	19-Jul-13	18:40	20-Jul-13	12:00	17.3	7	29	0	0	0	13	0	2	3	0	54	4.4	18.3	0.0	0.0	0.0	8.2	0.0	1.3	1.9	0.0	34.2
Tatelkuz Lake	C1N5	Nordic	1	0 – 5	3.2	19-Jul-13	19:10	20-Jul-13	11:32	16.4	0	2	1	0	0	0	1	0	0	0	4	0.0	5.3	2.7	0.0	0.0	0.0	2.7	0.0	0.0	0.0	10.7
Tatelkuz Lake	F1N5	RISC Floating	1	0 – 5	16.0	19-Jul-13	17:48	20-Jul-13	10:55	17.1	15	66	0	0	0	10	0	0	4	0	95	9.6	42.3	0.0	0.0	0.0	6.4	0.0	0.0	2.6	0.0	60.9
Tatelkuz Lake	F1O20	RISC Sinking	1	15 – 20	21.5	19-Jul-13	18:09	20-Jul-13	11:15	17.1	0	1	0	0	0	0	0	0	0	0	1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Tatelkuz Lake	G2O10	RISC Sinking	1	5 – 10	26.5	19-Jul-13	17:26	20-Jul-13	9:35	16.2	54	0	1	0	0	2	0	0	2	0	59	36.7	0.0	0.7	0.0	0.0	1.4	0.0	0.0	1.4	0.0	40.1
Tatelkuz Lake	I2N10	RISC Sinking	1	5 – 10	10.0	19-Jul-13	16:54	20-Jul-13	10:10	17.3	17	3	32	0	0	10	0	3	7	1	73	10.8	1.9	20.3	0.0	0.0	6.4	0.0	1.9	4.4	0.6	46.4
Tatelkuz Lake	A1MT1-2	Minnow Trap	2	0.55	0.55	17-Jul-13	14:45	18-Jul-13	17:00	52.500	0	0	0	0	1	0	4	0	3	0	8	0.0	0.0	0.0	0.0	1.9	0.0	7.6	0.0	5.7	0.0	15.2
Tatelkuz Lake	A1MT11-12	Minnow Trap	2	1.25	1.25	18-Jul-13	17:20	19-Jul-13	14:45	42.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A1MT3-4	Minnow Trap	2	0.75	0.75	17-Jul-13	14:45	18-Jul-13	17:00	52.500	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A1MT5-6	Minnow Trap	2	0.8	0.8	17-Jul-13	14:45	18-Jul-13	17:00	52.500	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A1MT7-8	Minnow Trap	2	0.45	0.45	18-Jul-13	17:20	19-Jul-13	14:45	42.833	0	0	0	0	2	0	0	0	0	0	2	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	4.7
Tatelkuz Lake	A1MT9-10	Minnow Trap	2	0.73	0.73	18-Jul-13	17:20	19-Jul-13	14:45	42.833	0	0	0	0	2	0	0	0	0	0	2	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	4.7
Tatelkuz Lake	A2MT1-2	Minnow Trap	2	0.75	0.75	16-Jul-13	12:00	17-Jul-13	14:50	53.667	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	A2MT3-4	Minnow Trap	2	0.9	0.9	16-Jul-13	12:00	17-Jul-13	14:50	53.667	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	A2MT5-6	Minnow Trap	2	1	1	16-Jul-13	12:00	17-Jul-13	14:50	53.667	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	B2MT1-2	Minnow Trap	2	0.45	0.45	16-Jul-13	13:05	17-Jul-13	14:25	50.667	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	B2MT11-12	Minnow Trap	2	0.9	0.9	17-Jul-13	15:15	18-Jul-13	16:35	50.667	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	3.9
Tatelkuz Lake	B2MT3-4	Minnow Trap	2	0.9	0.9	16-Jul-13	13:05	17-Jul-13	14:25	50.667	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Tatelkuz Lake	B2MT5-6	Minnow Trap	2	2.35	2.35	16-Jul-13	13:05	17-Jul-13	14:25	50.667	0	0	0	0	0	0	3	0	0	0	3	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	5.9
Tatelkuz Lake	B2MT7-8	Minnow Trap	2	0.5	0.5	17-Jul-13	15:15	18-Jul-13	16:35	50.667	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Tatelkuz Lake	B2MT9-10	Minnow Trap	2	0.75	0.75	17-Jul-13	15:15	18-Jul-13	16:35	50.667	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	3.9
Tatelkuz Lake	C1MT1-2	Minnow Trap	2	0.38	0.38	19-Jul-13	15:00	20-Jul-13	17:00	52.000	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	C1MT3-4	Minnow Trap	2	0.8	0.8	19-Jul-13	15:00	20-Jul-13	17:00	52.000	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	1.9
Tatelkuz Lake	C1MT5-6	Minnow Trap	2	1.4	1.4	19-Jul-13	15:00	20-Jul-13	17:00	52.000	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	1.9
Tatelkuz Lake	C2MT1-2	Minnow Trap	2	0.45	0.45	16-Jul-13	12:50	17-Jul-13	13:40	49.667	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	C2MT3-4	Minnow Trap	2	0.8	0.8	16-Jul-13	12:50	17-Jul-13	13:40	49.667	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Tatelkuz Lake	C2MT5-6	Minnow Trap	2	0.95	0.95	16-Jul-13	12:50	17-Jul-13	13:40	49.667	0	0	0	0	0	0	4	0	0	0	4	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	8.1
Tatelkuz Lake	D1MT1-2	Minnow Trap	2	0.45	0.45	17-Jul-13	14:10	18-Jul-13	15:35	50.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D1MT3-4	Minnow Trap	2	0.75	0.75	17-Jul-13	14:10	18-Jul-13	15:35	50.833	0	0	0	0	2	1	0	0	0	0	3	0.0	0.0	0.0	0.0	3.9	2.0	0.0	0.0	0.0	0.0	5.9
Tatelkuz Lake	D1MT5-6	Minnow Trap	2	2.35	2.35	17-Jul-13	14:10	18-Jul-13	15:35	50.833	0	0	0	0	2	0	0	0	0	0	2	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	3.9
Tatelkuz Lake	D2MT1-2	Minnow Trap	2	0.45	0.45	16-Jul-13	12:30	17-Jul-13	13:00	49.000	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D2MT3-4	Minnow Trap	2	0.6	0.6	16-Jul-13	12:30	17-Jul-13	13:00	49.000	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	D2MT5-6	Minnow Trap	2	0.9	0.9	16-Jul-13	12:30	17-Jul-13	13:00	49.000	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	E1MT1-2	Minnow Trap	2	0.7	0.7	18-Jul-13	12:36	19-Jul-13	17:00	56.800	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	E1MT3-4	Minnow Trap	2	0.9	0.9	18-Jul-13	12:36	19-Jul-13	17:00	56.800	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1.8
Tatelkuz Lake	E1MT5-6	Minnow Trap	2	1.2	1.2	18-Jul-13	12:36	19-Jul-13	17:00	56.800	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1.8
Tatelkuz Lake	E1MT7-8	Minnow Trap	2	0.5	0.5	18-Jul-13	14:05	19-Jul-13	17:00	53.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	E1MT9-10	Minnow Trap	2	0.7	0.7	18-Jul-13	14:05	19-Jul-13	17:00	53.833	0	0	0	0	0	0	0	0	1	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	1.9
Tatelkuz Lake	E1MT11-12	Minnow Trap	2	1.1	1.1	18-Jul-13	14:05	19-Jul-13	17:00	53.833	0	0	0	0	0	0	0	0	1	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	1.9
Tatelkuz Lake	E2MT1-2	Minnow Trap	2	0.75	0.75	17-Jul-13	13:30	18-Jul-13	16:00	53.000	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8
Tatelkuz Lake	E2MT11-12	Minnow Trap	2	2	2	18-Jul-13	16:50	19-Jul-13	17:17	48.900	0	0	0	0	0	1	0	0	0	0	1	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0
Tatelkuz Lake	E2MT13-14	Minnow Trap	2	0.43	0.43	19-Jul-13	17:05	20-Jul-13	17:30	48.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	E2MT15-16	Minnow Trap	2	0.75	0.75	19-Jul-13	17:05	20-Jul-13	17:30	48.833	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Tatelkuz Lake	E2MT17-18	Minnow Trap	2	1.05	1.05	19-Jul-13	17:05	20-Jul-13	17:30	48.833	0	0	0	0	0	4	0	0	0	0	4	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	8.2
Tatelkuz Lake	E2MT3-4	Minnow Trap	2	0.85	0.85	17-Jul-13	13:30	18-Jul-13	16:00	53.000	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8
Tatelkuz Lake	E2MT5-6	Minnow Trap	2	0.9	0.9	17-Jul-13	13:30	18-Jul-13	16:00	53.000	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8
Tatelkuz Lake	E2MT7-8	Minnow Trap	2	0.25	0.25	18-Jul-13	16:50	19-Jul-13	17:17	48.900	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	E2MT9-10	Minnow Trap	2	1.25	1.25	18-Jul-13	16:50	19-Jul-13	17:17	48.900	0	0	0	0	0	2	0	0	0	0	2	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	4.1
Tatelkuz Lake	F1MT1-2	Minnow Trap	2	0.8	0.8	16-Jul-13	14:51	17-Jul-13	16:16	50.833	0	0	0	0	0	0	3	0	0	0	3	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	5.9
Tatelkuz Lake	F1MT3-4	Minnow Trap	2	1.3	1.3	16-Jul-13	14:51	17-Jul-13	16:16	50.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT5-6	Minnow Trap	2	2.1	2.1	16-Jul-13	14:51	17-Jul-13	16:16	50.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT7-8	Minnow Trap	2	0.6	0.6	18-Jul-13	13:32	19-Jul-13	16:35	54.167	0	0	0	0	1	0	0	0	0	0	1	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.8
Tatelkuz Lake	F1MT9-10	Minnow Trap	2	0.7	0.7	18-Jul-13	13:32	19-Jul-13	16:35	54.167	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT11-12	Minnow Trap	2	1.3	1.3	18-Jul-13	13:32	19-Jul-13	16:35	54.167	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT13-14	Minnow Trap	2	0.5	0.5	18-Jul-13	15:50	19-Jul-13	15:15	47.167	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT15-16	Minnow Trap	2	0.9	0.9	18-Jul-13	15:50	19-Jul-13	15:15	47.167	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F1MT17-18	Minnow Trap	2	1.75	1.75	18-Jul-13	15:50	19-Jul-13	15:15	47.167	0	0	0	0	1	1	0	0	0	0	2	0.0	0.0	0.0	0.0	2.1	2.1	0.0	0.0	0.0	0.0	4.2
Tatelkuz Lake	F2MT1-2	Minnow Trap	2	0.8	0.8	17-Jul-13	13:53	18-Jul-13	10:55	42.067	0	0	0	0	18	0	0	0	1	0	19	0.0	0.0	0.0	0.0	42.8	0.0	0.0	0.0	2.4	0.0	45.2
Tatelkuz Lake	F2MT3-4	Minnow Trap	2	1.1	1.1	17-Jul-13	13:53	18-Jul-13	10:55	42.067	0	0	0	0	1	0	0	0	0	0	1	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	2.4
Tatelkuz Lake	F2MT5-6	Minnow Trap	2	1.4	1.4	17-Jul-13	13:53	18-Jul-13	10:55	42.067	0	0	0	0	1	0	0	0	0	0	1	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	2.4
Tatelkuz Lake	F2MT7-8	Minnow Trap	2	0.25	0.25	18-Jul-13	16:20	19-Jul-13	14:45	44.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F2MT9-10	Minnow Trap	2	0.7	0.7	18-Jul-13	16:20	19-Jul-13	14:45	44.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	F2MT11-12	Minnow Trap	2	0.85	0.85	18-Jul-13	16:20	19-Jul-13	14:45	44.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G1MT1-2	Minnow Trap	2	0.5	0.5	16-Jul-13	15:23	17-Jul-13	11:12	41.633	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	2.4
Tatelkuz Lake	G1MT3-4	Minnow Trap	2	0.8	0.8	16-Jul-13	15:23	17-Jul-13	11:12	41.633	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G1MT5-6	Minnow Trap	2	2	2	16-Jul-13	15:23	17-Jul-13	11:12	41.633	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G1MT7-8	Minnow Trap	2	0.48	0.48	19-Jul-13	15:25	20-Jul-13	17:20	51.833	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	G1MT9-10	Minnow Trap	2	0.8	0.8	19-Jul-13	15:25	20-Jul-13	17:20	51.833	0	0	0	0	0	1	0	0	0	0	1	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	1.9
Tatelkuz Lake	G1MT11-12	Minnow Trap	2	2	2	19-Jul-13	15:25	20-Jul-13	17:20	51.833	0	0	0	0	0	2	0	0	0	0	2	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	3.9
Tatelkuz Lake	H1MT1-2	Minnow Trap	2	0.5	0.5	17-Jul-13	13:11	18-Jul-13	13:10	47.967	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	H1MT3-4	Minnow Trap	2	0.7	0.7	17-Jul-13	13:11	18-Jul-13	13:10	47.967	0	0	0	0	0	1	1	0	0	0	2	0.0	0.0	0.0	0.0	0.0	2.1	2.1	0.0	0.0	0.0	4.2

Water Body	Set ID	Method	No. of GN Sets or Minnow Traps	Set Depth (m)	Lake Depth (m)	Date In	Time In	Date Out	Time Out	Soak Time (hours)	Number Caught[1]										Total Caught	CPUE[2]										Total CPUE
											KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU		KO	RB	MW	BB	BMC	NSC	CCG	CSU	LSU	WSU	
Tatelkuz Lake	H1MT5-6	Minnow Trap	2	1.7	1.7	17-Jul-13	13:11	18-Jul-13	13:10	47.967	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.1
Tatelkuz Lake	H1MT7-8	Minnow Trap	2	0.7	0.7	18-Jul-13	13:25	19-Jul-13	16:20	53.833	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	3.7
Tatelkuz Lake	H1MT9-10	Minnow Trap	2	1.3	1.3	18-Jul-13	13:25	19-Jul-13	16:20	53.833	0	0	0	0	0	1	2	0	0	0	3	0.0	0.0	0.0	0.0	0.0	1.9	3.7	0.0	0.0	0.0	5.6
Tatelkuz Lake	H1MT11-12	Minnow Trap	2	1.9	1.9	18-Jul-13	13:25	19-Jul-13	16:20	53.833	0	0	0	0	0	1	1	0	0	0	2	0.0	0.0	0.0	0.0	0.0	1.9	1.9	0.0	0.0	0.0	3.7
Tatelkuz Lake	H2MT1-2	Minnow Trap	2	0.7	0.7	17-Jul-13	11:51	18-Jul-13	13:00	50.300	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	H2MT3-4	Minnow Trap	2	1.2	1.2	17-Jul-13	11:51	18-Jul-13	13:00	50.300	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	4.0
Tatelkuz Lake	H2MT5-6	Minnow Trap	2	1.7	1.7	17-Jul-13	11:51	18-Jul-13	13:00	50.300	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	I1MT1-2	Minnow Trap	2	1	1	16-Jul-13	11:03	17-Jul-13	11:18	48.500	0	0	0	0	0	3	0	0	0	0	3	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	6.2
Tatelkuz Lake	I1MT3-4	Minnow Trap	2	2	2	16-Jul-13	11:03	17-Jul-13	11:18	48.500	0	0	0	0	0	0	1	0	0	0	1	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.1
Tatelkuz Lake	I1MT5-6	Minnow Trap	2	4	4	16-Jul-13	11:03	17-Jul-13	11:18	48.500	0	0	0	0	0	0	3	0	0	0	3	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	6.2
Tatelkuz Lake	I2MT1-2	Minnow Trap	2	1	1	16-Jul-13	9:30	17-Jul-13	11:30	52.000	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8
Tatelkuz Lake	I2MT3-4	Minnow Trap	2	2	2	16-Jul-13	9:30	17-Jul-13	11:30	52.000	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8
Tatelkuz Lake	I2MT5-6	Minnow Trap	2	4	4	16-Jul-13	9:30	17-Jul-13	11:30	52.000	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tatelkuz Lake	I2MT7-8	Minnow Trap	2	0.5	0.5	17-Jul-13	11:42	18-Jul-13	10:35	47.767	0	1	0	0	0	0	0	0	0	0	1	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
Tatelkuz Lake	I2MT9-10	Minnow Trap	2	1	1	17-Jul-13	11:42	18-Jul-13	10:35	47.767	0	0	0	0	0	0	2	0	0	0	2	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	4.2
Tatelkuz Lake	I2MT11-12	Minnow Trap	2	1.8	1.8	17-Jul-13	11:42	18-Jul-13	10:35	47.767	0	0	0	0	0	0	6	0	0	0	6	0.0	0.0	0.0	0.0	0.0	0.0	12.6	0.0	0.0	0.0	12.6

Note: GN - gill netting; MT - minnow trapping;
GN soak time is in hours; MT soak time is in trap-hours

[2] KO - kokanee; RB – rainbow trout; MW – mountain whitefish; BB - burbot; BMC - brassy minnow; CCG – slimy sculpin; NSC – northern pikeminnow; LSU - longnose sucker; CSU – largescale sucker; WSU – white sucker ; NFC – no fish caught

[3] GN CPUE is in number of fish/100m^2/day; MT CPUE is in number of fish/100 trap-hours

Annex 5.12-2
Biological Characteristics of Fish, Tatelkuz Lake, July 2013

Annex 5.12-2: Biological Characteristics of Fish Caught in Tatelkuz Lake, July 2013

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
15-Jul-13	A1N5	GN	Day	A1N5-006	RB	204	96	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-007	RB	283	223	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-008	RB	300	309	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-009	RB	214	115	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-010	RB	175	55	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-011	RB	209	97	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-012	RB	280	243	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-013	RB	167	56	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-014	RB	139	31	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-015	RB	211	95	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-016	RB	221	133	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-017	RB	146	32	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-018	RB	143	32	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-019	RB	121	21	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-020	RB	120	18	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-021	RB	130	23	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-022	RB	84	6.5	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-023	RB	118	16.9	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-024	RB	115	16.2	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-025	RB	108	16.9	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-026	RB	181	63.4	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-027	RB	243	168	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-028	RB	268	189	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-029	RB	218	131	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-030	RB	210	101	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-031	RB	177	61	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-032	RB	168	56.2	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-033	RB	203	88	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-034	RB	198	86	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-005	RB	122	19.2	U	IM	J	–	0.2	SC	SC	2	F	–	–	No otoliths taken
15-Jul-13	A1N5	GN	Day	A1N5-001	RB	240	166	U	IM	J	0.3	1.6	SC,OT	OT	3	F	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-002	RB	196	83	U	IM	J	–	1	SC,OT	SC	5	F	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-003	RB	281	225	U	IM	J	–	3	SC,OT	OT	2	P	–	–	
15-Jul-13	A1N5	GN	Day	A1N5-004	RB	120	18.6	U	IM	J	–	0.2	SC,OT	OT	3	G	–	–	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-006	RB	173	55	F	IM	J	0.1	0.6	SC,OT	OT	3	F	–	–	Gonad weight is for one ovary
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-005	RB	82	7.1	U	IM	J	–	0.1	–	–	–	–	–	–	No ageing structures taken
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-007	RB	171	55.1	U	IM	J	–	0.4	SC,OT	OT	3	F	–	–	Only one otolith taken
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-004	RB	95	11.2	U	IM	J	–	0.1	SC,OT	OT	3	G	–	–	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-008	RB	209	104	F	IM	J	0.2	0.9	SC,OT	OT	3	F	–	–	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-009	RB	75	4.6	U	IM	J	–	–	SC,OT	OT	2	P	–	–	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-001	RB	290	250	F	IM	J	2	0.7	SC,OT	OT	5	F	–	Digested Material	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-003	RB	162	48	U	IM	J	–	0.5	SC,OT	OT	3	F	–	Scuds/Insect Larvae	
15-Jul-13	A1N5Nord	GN	Day	A1N5nord-002	RB	331	400	F	MTC	A	2.4	0.7	SC,OT	OT	5	F	–	Scuds	
15-Jul-13	A2N5	GN	Day	A2N5-017	KO	193	84	M	IM	J	3.9	1.5	SC,OT	OT	4	F	–	Empty	Cysts in body cavity
15-Jul-13	A2N5	GN	Day	A2N5-020	KO	220	130.8	M	M	A	5.8	2.1	SC,OT	OT	2	F	–	Digested Material/ Chironomids	Cysts in body cavity
15-Jul-13	A2N5	GN	Day	A2N5-014	MW	314	300	F	IM	J	6	4.8	SC,OT	OT	9	F	–	Chironomids	Cysts in body cavity
15-Jul-13	A2N5	GN	Day	A2N5-025	RB	282	225	M	MTC	A	–	2.3	SC,OT	OT	3	F	–	Digested Material	Cysts in body cavity
15-Jul-13	A2N5	GN	Day	A2N5-022	RB	232	140.3	F	MTC	A	11.6	3.6	SC,OT	OT	2	F	–	Scuds	Cysts in body cavity
15-Jul-13	A2N5	GN	Day	A2N5-027	RB	166	50	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-028	RB	175	62	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-029	RB	209	110	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-030	RB	136	30	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-031	RB	228	167	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
15-Jul-13	A2N5	GN	Day	A2N5-032	RB	210	113	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-033	RB	170	62	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-034	RB	180	65	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-035	RB	201	100	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-036	RB	179	65	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-037	RB	230	118	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-038	RB	126	21	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-039	RB	200	90	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-040	RB	115	19	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-041	RB	115	19	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-042	RB	122	21	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-043	RB	129	24	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-044	RB	140	30	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-045	RB	123	23	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-046	RB	135	27	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-047	RB	119	18	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-048	RB	124	22	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-049	RB	119	19	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-050	RB	137	28	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-051	RB	118	19	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-052	RB	102	10	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-053	RB	124	22	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-054	RB	125	21	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-055	RB	133	24.3	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-056	RB	129	24.6	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-057	RB	131	24.7	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-058	RB	120	22.1	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-059	RB	114	16.9	–	–	–	–	–	–	–	–	–	–	–	
15-Jul-13	A2N5	GN	Day	A2N5-003	NSC	365	550	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-004	NSC	270	275	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-005	NSC	280	250	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-006	NSC	233	135	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-007	NSC	228	125	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-008	NSC	138	29	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-009	NSC	136	27	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-001	WSU	387	850	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-002	WSU	352	625	–	–	–	–	–	–	–	–	–	–	–	Live release
15-Jul-13	A2N5	GN	Day	A2N5-018	KO	200	99.9	M	IM	J	4.9	1.7	SC,OT	OT	3	F	–	Scuds	
15-Jul-13	A2N5	GN	Day	A2N5-019	KO	210	110.6	F	M	A	10.9	2.7	SC,OT	OT	5	F	–	Empty	
15-Jul-13	A2N5	GN	Day	A2N5-012	MW	240	190	F	IM	J	3.4	2.9	SC,OT	OT	7	F	–	Chironomids	
15-Jul-13	A2N5	GN	Day	A2N5-013	MW	255	225	F	IM	J	3.9	2.5	SC,OT	OT	8	F	–	Chironomids	
15-Jul-13	A2N5	GN	Day	A2N5-011	MW	260	200	F	IM	J	3.4	2.2	SC,OT	OT	7	F	–	Digested Material	
15-Jul-13	A2N5	GN	Day	A2N5-016	MW	185	64	M	IM	J	–	0.7	SC,OT	OT	2	F	–	Digested Material	
15-Jul-13	A2N5	GN	Day	A2N5-015	MW	277	230	F	IM	J	7.8	2.3	SC,OT	OT	7	F	–	Empty	
15-Jul-13	A2N5	GN	Day	A2N5-010	MW	255	184	M	M	A	5.6	1.4	SC,OT	OT	6	F	–	Empty	
15-Jul-13	A2N5	GN	Day	A2N5-023	RB	239	158.2	F	IM	J	1.5	1.4	SC,OT	OT	3	F	–	Digested Material	
15-Jul-13	A2N5	GN	Day	A2N5-026	RB	195	100.9	M	IM	J	0.1	1.1	SC,OT	OT	3	F	–	Scuds	
15-Jul-13	A2N5	GN	Day	A2N5-024	RB	270	245	F	MTC	A	2.3	2.7	SC,OT	OT	4	F	–	Digested Material	
15-Jul-13	A2N5	GN	Day	A2N5-021	RB	297	340	U	ST	A	–	3.7	SC,OT	OT	5	F	–	Digested Material	
16-Jul-13	A1O20	GN	Night	A1O20-004	MW	208	99	U	IM	J	–	–	SC,OT	OT	8	F	–	–	Nematodes in air bladder
16-Jul-13	A1O20	GN	Night	A1O20-003	MW	243	176	F	MTC	A	2.9	2.1	SC,OT	OT	6	F	–	Empty	Nematodes in air bladder
16-Jul-13	A1O20	GN	Night	A1O20-002	MW	265	215	F	MTC	A	6.8	2.3	SC,OT	OT	6	P	–	Chironomids	Tape worms in stomach
16-Jul-13	A1O20	GN	Night	A1O20-009	BB	323	195	F	IM	J	1.5	7.3	OT	OT	5	G	–	Fish	
16-Jul-13	A1O20	GN	Night	A1O20-008	LSU	250	205	U	IM	J	–	–	FIN	FIN	7	G	–	–	
16-Jul-13	A1O20	GN	Night	A1O20-013	LSU	173	69	U	IM	J	–	–	FIN	FIN	4	G	–	–	
16-Jul-13	A1O20	GN	Night	A1O20-007	LSU	308	375	F	MTC	A	–	–	FIN	FIN	6	G	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
16-Jul-13	A1O20	GN	Night	A1O20-006	MW	227	120	M	IM	J	0.1	1.3	SC,OT	OT	8	F	–	Chironomids	
16-Jul-13	A1O20	GN	Night	A1O20-001	MW	273	209	F	MTC	A	4.4	2.3	SC,OT	OT	8	F	–	Empty	
16-Jul-13	A1O20	GN	Night	A1O20-005	MW	260	207	F	MTC	A	6.8	3	SC,OT	OT	10	F	–	Empty	
16-Jul-13	A1O20	GN	Night	A1O20-010	NSC	330	350	U	IM	J	–	–	FIN	FIN	10	G	–	–	
16-Jul-13	A1O20	GN	Night	A1O20-012	NSC	248	143	M	IM	J	–	–	FIN	FIN	8	G	–	–	
16-Jul-13	A1O20	GN	Night	A1O20-011	NSC	400	700	F	MAT	A	–	–	FIN	FIN	14	G	–	–	
16-Jul-13	B1O25	GN	Day	B1O25-003	MW	330	408	F	MTC	A	13.6	4.5	SC,OT	OT	11	F	–	Chironomids	
16-Jul-13	B1O25	GN	Day	B1O25-002	MW	273	211	F	MTC	A	4	2.7	SC,OT	OT	10	F	–	Digested Material	
16-Jul-13	B1O25	GN	Day	B1O25-001	MW	283	240	F	MTC	A	4.5	2.4	SC,OT	OT	7	F	–	Empty	
16-Jul-13	B1O30	GN	Day	B1O30-002	LSU	370	–	–	–	–	–	–	–	–	–	–	–	–	Escaped, approximate length
16-Jul-13	B1O30	GN	Day	B1O30-001	MW	210	90	M	IM	J	–	0.9	SC,OT	OT	3	F	–	Empty	
16-Jul-13	B1O5	GN	Day	B1O5-031	KO	182	78	F	IM	J	0.5	–	SC	SC	4	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-032	KO	203	105	M	M	–	3	–	SC,OT	OT	3	F	–	–	
16-Jul-13	B1O5	GN	Day	B1O5-020	KO	230	139	F	M	A	10.6	–	SC,OT	SC	3	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-022	KO	224	142	M	M	A	5.6	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-024	KO	211	114	F	M	A	6.8	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-025	KO	197	94	M	M	A	4.8	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-026	KO	205	105	M	M	A	4.6	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-027	KO	204	103	M	M	A	5.1	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-028	KO	188	86	M	M	A	4.8	–	SC,OT	OT	2	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-029	KO	200	96	M	M	A	3	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-030	KO	185	79	F	M	A	5.1	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-021	KO	220	129	M	M	A	3.5	–	SC,OT	OT	4	F	–	Empty	
16-Jul-13	B1O5	GN	Day	B1O5-023	KO	208	124	M	M	A	6.4	–	SC,OT	OT	4	F	–	Empty	
16-Jul-13	B1O5	GN	Day	B1O5-001	LSU	470	1175	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B1O5	GN	Day	B1O5-009	RB	225	131	F	IM	J	–	–	SC,OT	OT	2	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-011	RB	266	211	F	IM	J	–	–	SC,OT	OT	5	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-012	RB	232	145	F	IM	J	–	–	SC,OT	OT	2	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-015	RB	221	121	M	IM	J	–	–	SC,OT	OT	3	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-016	RB	202	95	F	IM	J	–	–	SC,OT	OT	3	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-017	RB	180	69	U	IM	J	–	–	SC,OT	SC	2	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-019	RB	205	94	U	IM	J	–	–	SC,OT	OT	1	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-008	RB	227	128	F	IM	J	2.6	–	SC,OT	OT	3	F	–	Beetle	
16-Jul-13	B1O5	GN	Day	B1O5-006	RB	207	100	F	IM	J	–	–	SC,OT	SC	3	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-013	RB	205	98	F	IM	J	–	–	SC,OT	OT	2	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-014	RB	234	145	F	IM	J	–	–	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-005	RB	201	96	F	IM	J	0.3	–	SC,OT	OT	2	F	–	Scuds	
16-Jul-13	B1O5	GN	Day	B1O5-018	RB	190	74	U	IM	J	–	–	SC,OT	SC	2	F	–	Scuds	
16-Jul-13	B1O5	GN	Day	B1O5-010	RB	223	117	U	IM	J	–	–	SC,OT	OT	2	F	–	Snails	
16-Jul-13	B1O5	GN	Day	B1O5-007	RB	290	229	F	MTC	A	2.3	–	SC,OT	OT	3	F	–	Beetle/Caddisfly	
16-Jul-13	B1O5	GN	Day	B1O5-003	RB	288	249	M	MTC	A	–	–	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-004	RB	186	85.6	M	MTC	A	3.9	–	SC,OT	SC	2	F	–	Digested Material	
16-Jul-13	B1O5	GN	Day	B1O5-002	RB	291	275	F	MTC	A	2	–	SC,OT	OT	4	F	–	Empty	
16-Jul-13	B2O20	GN	Day	B2O20-001	NSC	130	20	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-009	KO	194	97	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-010	KO	203	100	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-011	KO	202	103	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-012	KO	195	102	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-001	RB	305	292	–	–	–	–	–	SC, OT	OT	4	F	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-002	RB	216	108	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-003	RB	220	124	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-004	RB	231	129	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-005	RB	213	111	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-006	RB	155	46	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-007	RB	162	49	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	B2O5	GN	Day	B2O5-008	RB	145	33	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
16-Jul-13	G2N5	GN	Day	G2N5-031	MW	130	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
16-Jul-13	G2N5	GN	Day	G2N5-040	RB	150	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
16-Jul-13	G2N5	GN	Day	G2N5-030	MW	125	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-032	NSC	355	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-033	RB	255	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-034	RB	125	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-035	RB	190	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-036	RB	125	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-037	RB	125	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-038	RB	205	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-039	RB	225	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	G2N5	GN	Day	G2N5-028	MW	125	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-001	MW	126	21.4	U	IM	J	–	–	SC,OT	SC	2	F	–	Chironomids	
16-Jul-13	G2N5	GN	Day	G2N5-002	MW	128	22.3	U	IM	J	–	–	SC,OT	OT	3	F	–	Chironomids	
16-Jul-13	G2N5	GN	Day	G2N5-029	NSC	355	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-007	RB	135	26.3	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-008	RB	126	26	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-009	RB	115	17	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-010	RB	112	16	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-011	RB	109	15	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-012	RB	174	58	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-013	RB	210	110	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-014	RB	123	24	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-015	RB	229	127	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-016	RB	111	15	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-017	RB	127	25	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-018	RB	183	73	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-019	RB	142	34	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-020	RB	134	27	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-021	RB	255	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-022	RB	125	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-023	RB	190	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-024	RB	125	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-025	RB	126	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-026	RB	205	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-027	RB	225	–	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	G2N5	GN	Day	G2N5-003	RB	143	33.2	U	IM	J	–	–	SC,OT	OT	4	F	–	Ant	
16-Jul-13	G2N5	GN	Day	G2N5-005	RB	128	25.3	U	IM	J	–	–	SC,OT	OT	3	F	–	Chironomids	
16-Jul-13	G2N5	GN	Day	G2N5-004	RB	130	23.8	U	IM	J	–	–	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	G2N5	GN	Day	G2N5-006	RB	254	167.4	F	MTC	A	1.3	1.6	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	H1N5	GN	Day	H1N5-048	LSU	409	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	H1N5	GN	Day	H1N5-049	CSU	455	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	H1N5	GN	Day	H1N5-047	NSC	420	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	H1N5	GN	Day	H1N5-001	MW	129	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-002	MW	118	20	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-003	MW	135	28	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-004	MW	134	26	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-005	MW	135	27	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-006	MW	139	29	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-007	MW	134	30	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-008	MW	123	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-009	MW	131	26	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-010	MW	127	24	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-011	MW	132	26	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-012	MW	124	21	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-013	MW	122	21	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
16-Jul-13	H1N5	GN	Day	H1N5-014	MW	123	21	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-015	MW	132	27	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-016	MW	125	22	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-017	RB	142	34	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-018	RB	124	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-019	RB	124	22	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-020	RB	129	24	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-021	RB	165	51	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-022	RB	113	18	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-023	RB	222	116	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-024	RB	265	176	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-025	RB	116	20	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-026	RB	126	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-027	RB	215	114	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-028	RB	129	24	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-029	RB	130	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-030	RB	164	51	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-031	RB	256	162	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-032	RB	158	50	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-033	RB	129	26	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-034	RB	140	32	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-035	RB	126	22	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-036	RB	116	20	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-037	RB	206	104	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-038	RB	142	30	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-039	RB	146	135	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-040	RB	119	19	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-041	RB	109	17	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-042	RB	126	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-043	RB	149	38	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-044	RB	126	23	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-045	RB	113	18	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	H1N5	GN	Day	H1N5-046	RB	122	22	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	I1N5	GN	Day	I1N5-012	RB	121	19.8	–	–	–	–	0.2	OT	OT	2	P	–	Digested Material	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-008	RB	138	27.1	U	IM	J	–	0.2	SC,OT	OT	3	P	–	Digested Material	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-009	RB	103	13.8	U	IM	–	–	0.1	OT	OT	2	F	–	Digested Material	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-010	RB	137	30.2	U	IM	J	–	0.2	SC,OT	OT	2	F	–	Digested Material	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-011	RB	127	23.1	U	IM	J	–	0.2	SC,OT	OT	2	F	–	Digested Material	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-007	RB	166	43.4	U	IM	J	–	0.3	SC,OT	OT	3	F	–	Empty	Gonads are too small to weigh
16-Jul-13	I1N5	GN	Day	I1N5-015	KO	200	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
16-Jul-13	I1N5	GN	Day	I1N5-014	RB	250	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
16-Jul-13	I1N5	GN	Day	I1N5-001	RB	220	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	I1N5	GN	Day	I1N5-002	RB	118	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	I1N5	GN	Day	I1N5-003	RB	133	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	I1N5	GN	Day	I1N5-013	NSC	321	400	M	–	–	–	–	FIN	FIN	12	F	–	Fish	
16-Jul-13	I1N5	GN	Day	I1N5-005	RB	210	98	U	IM	J	0.2	0.9	SC,OT	OT	4	F	–	Chironomids	
16-Jul-13	I1N5	GN	Day	I1N5-006	RB	222	118	F	IM	J	0.2	1.3	SC,OT	OT	4	F	–	Digested Material/ Mayfly	
16-Jul-13	I1N5	GN	Day	I1N5-004	RB	195	81.2	M	MTC	A	3.1	1.1	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-033	MW	130	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
16-Jul-13	I2N5	GN	Day	I2N5-032	MW	129	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	I2N5	GN	Day	I2N5-001	RB	226	–	–	–	–	–	–	–	–	–	–	–	–	Live release
16-Jul-13	I2N5	GN	Day	I2N5-010	RB	111	15.9	U	IM	J	–	0.1	SC	SC	1	F	–	Digested Material	No otoliths found
16-Jul-13	I2N5	GN	Day	I2N5-019	MW	137	28.7	U	IM	J	–	0.1	SC	SC	3	F	–	Chironomids	No otoliths found
16-Jul-13	I2N5	GN	Day	I2N5-027	MW	127	19.9	U	IM	J	–	0.2	SC	SC	2	F	–	Scuds	No otoliths found
16-Jul-13	I2N5	GN	Day	I2N5-003	RB	267	215	F	MTC	A	1.7	3.6	SC,OT	SC	3	F	–	Digested Material	Residual eggs
16-Jul-13	I2N5	GN	Day	I2N5-002	RB	252	184	F	MTC	A	1.5	2.9	SC,OT	OT	5	F	–	Scuds	Residual eggs

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
16-Jul-13	I2N5	GN	Day	I2N5-030	MW	123	19.5	U	IM	J	–	0.2	SC,OT	OT	2	F	–	Chironomids	
16-Jul-13	I2N5	GN	Day	I2N5-021	MW	135	26.4	U	IM	J	–	0.4	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-022	MW	133	25	U	IM	J	–	0.2	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-023	MW	130	22.1	U	IM	J	–	0.2	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-028	MW	132	21.4	U	IM	J	–	0.2	SC,OT	OT	2	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-031	MW	115	15.1	U	IM	J	–	0.1	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-018	MW	138	27.5	U	IM	J	–	0.2	SC,OT	OT	3	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-020	MW	140	27.6	U	IM	J	–	0.2	SC,OT	OT	3	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-024	MW	125	19.3	U	IM	J	–	0.1	SC,OT	OT	3	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-025	MW	121	18.6	U	IM	J	–	0.2	SC,OT	OT	2	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-026	MW	131	26.2	U	IM	J	–	0.2	SC,OT	OT	3	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-029	MW	128	18.8	U	IM	J	–	0.1	SC,OT	OT	3	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-014	RB	117	18	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	I2N5	GN	Day	I2N5-015	RB	122	18	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	I2N5	GN	Day	I2N5-016	RB	118	18	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	I2N5	GN	Day	I2N5-017	RB	113	16	–	–	–	–	–	–	–	–	–	–	–	
16-Jul-13	I2N5	GN	Day	I2N5-005	RB	215	116	F	IM	J	0.4	1	SC,OT	OT	4	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-009	RB	126	20.4	U	IM	J	–	0.1	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-011	RB	132	26	U	IM	J	–	0.3	SC,OT	SC	1	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-012	RB	125	21.8	U	IM	J	–	0.3	SC,OT	OT	2	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-013	RB	117	18.9	U	IM	J	–	0.2	SC,OT	OT	3	F	–	Digested Material	
16-Jul-13	I2N5	GN	Day	I2N5-006	RB	181	69	M	IM	J	0.1	0.7	SC,OT	OT	3	F	–	Leech/Caddisfly	
16-Jul-13	I2N5	GN	Day	I2N5-007	RB	158	48	U	IM	J	–	0.6	SC,OT	OT	4	F	–	Empty	
16-Jul-13	I2N5	GN	Day	I2N5-008	RB	131	27	U	IM	J	–	0.4	SC,OT	OT	2	F	–	Scuds	
16-Jul-13	I2N5	GN	Day	I2N5-004	RB	279	221	F	MTC	A	2.7	4	SC,OT	OT	4	F	–	Scuds	
17-Jul-13	A2O15	GN	Night	A2O15-001	RB	203	85	M	IM	–	–	–	OT	OT	4	F	WF	–	1 parasite on eye, cysts in stomach
17-Jul-13	A2O15	GN	Night	A2O15-005	KO	109	16.5	U	IM	–	–	0.2	OT	OT	2	P	–	Empty	
17-Jul-13	A2O15	GN	Night	A2O15-003	KO	123	24.8	U	IM	–	–	0.2	OT	OT	2	F	–	Zooplankton	
17-Jul-13	A2O15	GN	Night	A2O15-004	KO	125	25.9	U	IM	–	–	0.3	OT	OT	2	F	–	Zooplankton	
17-Jul-13	A2O15	GN	Night	A2O15-002	KO	210	109	F	M	–	11	2.5	SC,OT	OT	2	F	–	Digested Material	
17-Jul-13	B1O15	GN	Night	B1O15-005	MW	215	115	F	IM	–	–	–	OT	OT	6	F	WF	–	2 parasites in gills
17-Jul-13	B1O15	GN	Night	B1O15-007	LSU	412	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	B1O15	GN	Night	B1O15-004	MW	215	123	F	IM	–	–	–	OT	OT	3	P	WF	–	Nematodes in air bladder
17-Jul-13	B1O15	GN	Night	B1O15-001	MW	263	203	F	MTC	–	2.9	1.3	SC,OT	OT	4	F	M,L (Archived)	–	Nematodes in air bladder
17-Jul-13	B1O15	GN	Night	B1O15-002	MW	251	203	M	MTC	–	–	–	OT	OT	6	F	WF	–	Nematodes in air bladder
17-Jul-13	B1O15	GN	Night	B1O15-003	MW	225	134	M	MTC	–	–	–	OT	OT	4	F	WF	–	Nematodes in air bladder
17-Jul-13	B1O15	GN	Night	B1O15-006	MW	180	58	U	IM	–	–	–	OT	OT	4	F	WF	–	
17-Jul-13	B2MT3	MT	Night	B2MT3-001	CCG	54	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	B2MT5	MT	Night	B2MT5-001	CCG	56	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	B2MT5	MT	Night	B2MT5-002	CCG	71	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	B2MT5	MT	Night	B2MT5-003	CCG	53	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2MT3	MT	Night	C2MT3-001	CCG	47	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2MT5	MT	Night	C2MT5-001	CCG	87	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2MT5	MT	Night	C2MT5-002	CCG	52	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2MT5	MT	Night	C2MT5-003	CCG	55	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2MT5	MT	Night	C2MT5-004	CCG	45	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-001	KO	112	17.8	U	IM	–	–	0.1	OT	OT	1	F	–	Empty	
17-Jul-13	C2O15	GN	Night	C2O15-002	KO	108	15.4	U	IM	–	–	0.2	OT	OT	3	P	–	Zooplankton	
17-Jul-13	C2O15	GN	Night	C2O15-004	RB	228	135.4	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-007	RB	118	19.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-008	RB	126	22.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-009	RB	119	22.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-010	RB	111	18.3	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-011	RB	130	27	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-012	RB	116	20	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-013	RB	114	17.6	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
17-Jul-13	C2O15	GN	Night	C2O15-014	RB	161	52.4	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-015	RB	112	17.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-016	RB	126	23.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-017	RB	123	21.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-018	RB	109	15.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-019	RB	135	27.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-020	RB	118	19.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-021	RB	120	21.2	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-022	RB	106	16.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-023	RB	127	21.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-024	RB	130	23.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-025	RB	117	18	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-026	RB	115	18.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-027	RB	127	24.4	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-028	RB	109	18.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-029	RB	125	23.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-030	RB	109	17.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-031	RB	111	17.2	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-032	RB	131	26.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-033	RB	117	19.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-034	RB	126	21.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-035	RB	126	22.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-003	RB	180	61.3	U	IM	–	–	–	OT	OT	4	F	WF (Archived)	–	
17-Jul-13	C2O15	GN	Night	C2O15-005	RB	200	91.5	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	C2O15	GN	Night	C2O15-006	RB	144	36	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F1MT1	MT	Night	F1MT1-001	CCG	51	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F1MT1	MT	Night	F1MT1-002	CCG	48	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F1MT1	MT	Night	F1MT1-003	CCG	43	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-078	MW	285	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	F2N5	GN	Day	F2N5-079	NSC	480	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	F2N5	GN	Day	F2N5-075	RB	115	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	F2N5	GN	Day	F2N5-076	RB	112	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	F2N5	GN	Day	F2N5-077	RB	130	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	F2N5	GN	Day	F2N5-024	RB	189	79	U	IM	–	–	–	SC,OT	OT	3	F	–	–	Only one otolith
17-Jul-13	F2N5	GN	Day	F2N5-020	RB	186	69.9	–	–	–	–	–	SC,OT	OT	2	P	–	–	Only one otolith
17-Jul-13	F2N5	GN	Day	F2N5-003	KO	209	73.9	M	M	A	7.26	0.18	SC,OT	OT	3	F	–	Digested Material	Parasites
17-Jul-13	F2N5	GN	Day	F2N5-069	RB	290	256.7	F	MTC	–	–	2.5	OT	OT	5	F	M,L	–	Parasites on fins
17-Jul-13	F2N5	GN	Day	F2N5-008	KO	208	72.2	M	M	A	7.8	3	SC,OT	OT	2	P	–	Empty	Parasites, only one otolith
17-Jul-13	F2N5	GN	Day	F2N5-001	KO	212	68.7	F	M	A	9.2	2.7	SC,OT	SC	2	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-002	KO	222	72.6	F	M	A	11.6	3.7	SC	SC	3	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-004	KO	184	68.7	M	M	A	7.7	0.11	SC,OT	OT	3	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-006	KO	196	70.4	M	M	A	4.4	1.3	SC,OT	OT	3	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-005	KO	205	72.8	M	M	A	0.26	1.3	SC,OT	OT	3	F	–	Leech	
17-Jul-13	F2N5	GN	Day	F2N5-007	KO	212	74.5	F	M	A	8	1.2	SC,OT	SC	3	F	–	Scuds,Chironomids	
17-Jul-13	F2N5	GN	Day	F2N5-059	MW	131	25.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-060	MW	145	28.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-061	MW	121	21.3	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-062	MW	131	21.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-063	MW	140	28.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-064	MW	129	22.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-065	MW	120	17	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-066	MW	125	20.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-019	RB	194	78.1	U	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-021	RB	201	94.5	U	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-016	RB	224	129.7	F	IM	–	–		–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-018	RB	224	133.1	U	IM	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
17-Jul-13	F2N5	GN	Day	F2N5-022	RB	117	16.7	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-023	RB	220	120.6	F	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-025	RB	180	66.7	U	IM	–	–	–	SC,OT	OT	2	F	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-026	RB	215	110.5	U	IM	–	–	–	SC	missing env	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-027	RB	139	31.8	U	IM	–	–	–	SC	SC	2	F	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-028	RB	119	17.7	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-029	RB	210	110.2	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-031	RB	125	22.2	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-032	RB	115	19.7	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-033	RB	111	16	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-034	RB	124	20.1	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-035	RB	211	94.5	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-036	RB	127	21.7	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-037	RB	252	165.9	U	IM	–	–	–	SC,OT	OT	3	F	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-038	RB	215	118.5	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-039	RB	190	74.6	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-040	RB	156	44.9	U	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-041	RB	165	48.8	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-042	RB	205	92.1	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-043	RB	127	23.3	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-044	RB	178	61.4	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-045	RB	209	98.5	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-046	RB	140	34.4	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-047	RB	132	26.7	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-048	RB	143	35.1	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-049	RB	188	72.8	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-050	RB	123	22.7	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-051	RB	172	59.9	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-052	RB	180	67.3	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-053	RB	145	35.8	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-054	RB	135	27.7	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-055	RB	124	23	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-056	RB	116	18.5	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-057	RB	117	17.6	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-058	RB	124	20.7	–	IM	–	–	–	–	–	–	–	–	–	
17-Jul-13	F2N5	GN	Day	F2N5-011	RB	295	240	U	IM	NS	–	3.9	SC	SC	3	F	–	Beetle	
17-Jul-13	F2N5	GN	Day	F2N5-013	RB	215	113.8	U	IM	A	–	0.6	SC,OT	OT	2	F	–	Beetle	
17-Jul-13	F2N5	GN	Day	F2N5-014	RB	230	135.4	U	IM	J	–	1.3	SC,OT	OT	2	P	–	Beetle	
17-Jul-13	F2N5	GN	Day	F2N5-009	RB	224	19.3	M	IM	NS	0.6	1	SC,OT	OT	3	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-010	RB	230	139.9	U	IM	NS	–	1.5	OT	OT	2	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-012	RB	232	134.9	F	IM	A	0.4	1.4	SC,OT	OT	3	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-015	RB	169	55.7	U	IM	J	–	0.4	SC,OT	OT	4	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-017	RB	233	143.1	U	IM	–	–	1.7	SC,OT	OT	4	F	–	Digested Material	
17-Jul-13	F2N5	GN	Day	F2N5-068	RB	295	276.6	U	M	–	–	3.3	OT	OT	4	F	M,L	–	
17-Jul-13	F2N5	GN	Day	F2N5-070	RB	300	261.6	U	M	–	–	1.6	OT	OT	3	F	M,L	–	
17-Jul-13	F2N5	GN	Day	F2N5-071	RB	286	243.7	U	M	–	–	2.2	OT	OT	4	F	M,L	–	
17-Jul-13	F2N5	GN	Day	F2N5-067	RB	277	232.1	F	MTC	–	–	2.8	OT	OT	6	G	M,L	–	
17-Jul-13	F2N5	GN	Day	F2N5-072	RB	255	176.4	F	MTC	–	–	–	OT	OT	4	F	WF	–	
17-Jul-13	F2N5	GN	Day	F2N5-073	RB	261	201.5	F	MTC	–	–	–	OT	OT	4	F	WF	–	
17-Jul-13	F2N5	GN	Day	F2N5-074	RB	270	205.6	F	MTC	–	–	–	OT	OT	5	F	WF	–	
17-Jul-13	F2N5	GN	Day	F2N5-030		Skipped number		–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1MT1	MT	Night	G1MT1-001	CCG	66	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1N5	GN	Day	G1N5-006	KO	210	107	F	M	–	7.5	2.2	SC,OT	OT	3	F		Empty	
17-Jul-13	G1N5	GN	Day	G1N5-001	CSU	430	1000	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1N5	GN	Day	G1N5-002	NSC	417	900	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1N5	GN	Day	G1N5-003	NSC	483	1450	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
17-Jul-13	G1N5	GN	Day	G1N5-004	NSC	495	1550	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1N5	GN	Day	G1N5-005	NSC	120	19.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	G1N5	GN	Day	G1N5-012	RB	225	126.7	F	IM	–	–	–	OT	OT	4	F	WF (Archived)	–	
17-Jul-13	G1N5	GN	Day	G1N5-013	RB	117	18.3	U	IM	–	–	–	OT	OT	4	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-014	RB	130	25.6	U	IM	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-015	RB	122	20.2	U	IM	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-016	RB	157	49.1	U	IM	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-017	RB	142	32.1	U	IM	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-018	RB	110	18.9	U	IM	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-019	RB	175	61.3	U	IM	–	–	–	OT	OT	2	P	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-020	RB	132	27.3	U	IM	–	–	–	OT	OT	2	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-021	RB	120	20.8	U	IM	–	–	–	OT	OT	2	F	WF	–	
17-Jul-13	G1N5	GN	Day	G1N5-010	RB	252	178.6	U	IM	–	–	1.3	OT	broken	–	–	M,L	Digested Material	
17-Jul-13	G1N5	GN	Day	G1N5-011	RB	225	122	F	IM	–	–	1.2	OT	OT	4	F	M,L (Archived)	Digested Material	
17-Jul-13	G1N5	GN	Day	G1N5-009	RB	237	141.4	F	IM	–	–	1.1	OT	OT	5	F	M,L (Archived)	Scuds	
17-Jul-13	G1N5	GN	Day	G1N5-007	RB	301	303	F	MTC	–	–	1.9	OT	OT	3	F	M,L	–	
17-Jul-13	G1N5	GN	Day	G1N5-008	RB	253	188	F	MTC	–	1.6	2	OT	OT	3	F	M,L	Digested Material	
17-Jul-13	G2O20	GN	Night	G2O20-001	RB	–	–	–	–	–	–	–	–	–	–	–	–	–	Live release, no length data
17-Jul-13	G2O25	GN	Day	G2O25-002	LSU	265	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	G2O25	GN	Day	G2O25-003	LSU	287	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	G2O25	GN	Day	G2O25-004	LSU	361	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	G2O25	GN	Day	G2O25-001	LSU	289	311.2	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-001	RB	320	324.2	M	MTC	–	–	2	OT	OT	5	F	M,L	–	Internal parasites
17-Jul-13	H1O5	GN	Day	H1O5-016	RB	463	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	H1O5	GN	Day	H1O5-015	RB	255	176.1	U	M	–	–	–	OT	OT	5	F	WF	–	Tapeworms in gut
17-Jul-13	H1O5	GN	Day	H1O5-008	KO	204	104.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-009	KO	206	103.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-010	KO	207	104.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-011	NSC	432	1054.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-002	RB	181	60.9	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-003	RB	231	130	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-004	RB	140	27.3	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-005	RB	182	59.6	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-006	RB	171	56.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-007	RB	169	54.1	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	H1O5	GN	Day	H1O5-012	RB	245	154.7	F	MTC	–	–	–	OT	OT	2	P	WF	–	
17-Jul-13	H1O5	GN	Day	H1O5-013	RB	252	155.6	F	MTC	–	–	–	OT	OT	4	F	WF	–	
17-Jul-13	H1O5	GN	Day	H1O5-014	RB	258	173.6	M	MTC	–	–	–	OT	OT	3	F	WF	–	
17-Jul-13	I1MT1	MT	Night	I1MT1-001	NSC	121	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT1	MT	Night	I1MT1-002	NSC	116	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT1	MT	Night	I1MT1-003	NSC	132	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT3	MT	Night	I1MT3-001	CCG	60	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT5	MT	Night	I1MT5-001	CCG	82	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT5	MT	Night	I1MT5-002	CCG	78	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1MT5	MT	Night	I1MT5-003	CCG	42	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1O15	GN	Day	I1O15-004	LSU	265	232.5	–	U	–	–	–	–	–	–	–	–	–	
17-Jul-13	I1O15	GN	Day	I1O15-001	MW	272	240.9	F	M	–	–	1.7	OT	OT	9	F	M, L (Archived)	–	
17-Jul-13	I1O15	GN	Day	I1O15-002	MW	284	273.2	F	MTC	–	–	2.9	OT	OT	13	F	M, L(Archived)	–	
17-Jul-13	I1O15	GN	Day	I1O15-003	MW	260	225	F	MTC	–	–	2.1	OT	OT	7	F	M, L (Archived)	–	
17-Jul-13	I2MT1	MT	Night	I2MT1-001	CCG	57	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2MT1	MT	Night	I2MT1-002	CCG	53	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2MT3	MT	Night	I2MT3-001	CCG	66	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2MT3	MT	Night	I2MT3-002	CCG	56	–	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2N10	GN	Day	I2N10-001	MW	250	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	I2N10	GN	Day	I2N10-002	MW	290	–	–	–	–	–	–	–	–	–	–	–	–	Live release
17-Jul-13	I2N5	GN	Day	I2N5-001	RB	265	–	–	–	–	–	–	–	–	–	–	–	–	Live release

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
17-Jul-13	I2O5	GN	Day	I2O5-001	RB	328	391.7	M	ST	–	–	–	SC	SC	4	F	–	–	No otolith
17-Jul-13	I2O5	GN	Day	I2O5-010	KO	210	126.6	–	–	–	–	–	OT	OT	3	F	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-011	KO	196	87.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-012	KO	215	108.8	–	–	–	–	–	OT	OT	4	F	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-013	KO	196	23.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-014	KO	218	116.7	–	–	–	–	–	OT	OT	4	F	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-015	KO	211	106.4	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-016	KO	213	108.5	–	–	–	–	–	OT	OT	3	F	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-002	RB	281	226.1	U	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-003	RB	210	104	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-004	RB	230	136.5	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-005	RB	270	202.4	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-006	RB	213	106	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-007	RB	135	26.7	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-008	RB	160	148.8	–	–	–	–	–	–	–	–	–	–	–	
17-Jul-13	I2O5	GN	Day	I2O5-009	RB	134	26.8	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-007	BMC	48	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-005	LSU	84	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-006	LSU	65	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-008	LSU	68	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-001	CCG	86	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-002	CCG	72	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-003	CCG	57	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A1MT1	MT	Night	A1MT1-004	CCG	55	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A2N10	GN	Day	A2N10-001	RB	202	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	A2N10	GN	Day	A2N10-002	KO	200	92.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	A2N10	GN	Day	A2N10-003	KO	215	132.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	B1N10	GN	Day	B1N10-007	KO	210	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	B1N10	GN	Day	B1N10-008	RB	235	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	B1N10	GN	Day	B1N10-009	RB	305	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	B1N10	GN	Day	B1N10-010	CSU	–	–	–	–	–	–	–	–	–	–	–	–	–	Lost out of net
18-Jul-13	B1N10	GN	Day	B1N10-011	CSU	–	–	–	–	–	–	–	–	–	–	–	–	–	Lost out of net
18-Jul-13	B1N10	GN	Day	B1N10-001	KO	216	119	M	M	–	6.4	2	OT	OT	2	F	–	Empty	
18-Jul-13	B1N10	GN	Day	B1N10-006	MW	124	19	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	B1N10	GN	Day	B1N10-005	MW	235	179	M	IM	–	–	2.4	SC,OT	OT	7	F	M,L	Chironomids	
18-Jul-13	B1N10	GN	Day	B1N10-002	MW	293	330	F	M	–	14	4.5	SC,OT	OT	7	F	M,L	Chironomids	
18-Jul-13	B1N10	GN	Day	B1N10-003	MW	296	209	F	MTC	–	5.1	3.5	SC,OT	OT	8	F	M,L	Chironomids	
18-Jul-13	B1N10	GN	Day	B1N10-004	MW	271	214	F	MTC	–	4.1	2.5	SC,OT	OT	4	F	M,L	Chironomids	
18-Jul-13	B2MT11	MT	Night	B2MT11-001	CCG	46	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	B2MT11	MT	Night	B2MT11-001	CCG	45	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	B2MT7	MT	Night	B2MT7-001	CCG	91	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	B2MT9	MT	Night	B2MT9-001	CCG	40	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	B2MT9	MT	Night	B2MT9-002	CCG	48	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-027	LSU	385	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	C1N10	GN	Day	C1N10-026	RB	205	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	C1N10	GN	Day	C1N10-003	KO	190	97.1	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-004	KO	192	86.8	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-005	KO	206	116	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-006	KO	222	126.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-007	KO	208	120.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-008	KO	197	86.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-001	NSC	470	1350	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-002	NSC	423	950	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-009	RB	123	22	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-010	RB	187	72.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-011	RB	205	98.5	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
18-Jul-13	C1N10	GN	Day	C1N10-012	RB	206	93.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-013	RB	178	63.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-014	RB	200	92.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-015	RB	200	91.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-016	RB	203	89.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-017	RB	193	85.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-018	RB	203	97.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-019	RB	250	174.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-020	RB	217	124.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-021	RB	257	173.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-022	RB	258	190.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-023	RB	296	321.3	–	–	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-024	RB	294	275.1	–	–	–	–	–	OT	OT	6	P	–	–	
18-Jul-13	C1N10	GN	Day	C1N10-025	RB	268	198.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-003	MW	244	180	M	MTC	–	–	2.2	SC,OT	OT	6	F	M,L	–	ALS ID number is C1N5NORD-003
18-Jul-13	C1N5	GN	Day	C1N5-004	MW	246	169	F	MTC	–	3.7	3.5	SC,OT	OT	8	F	M,L	–	ALS ID number is C1N5NORD-004
18-Jul-13	C1N5	GN	Day	C1N5-005	RB	287	262	M	MTC	–	–	–	SC,OT	OT	4	F	WF	–	ALS ID number is C1N5NORD-005
18-Jul-13	C1N5	GN	Day	C1N5-006	RB	224	133	U	IM	–	–	–	SC,OT	OT	2	F	WF (Archived)	–	Archived as ID number C1N5NORD-006
18-Jul-13	C1N5	GN	Day	C1N5-020	RB	230	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	C1N5	GN	Day	C1N5-021	RB	145	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	C1N5	GN	Day	C1N5-022	RB	165	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	C1N5	GN	Day	C1N5-002	KO	205	108	M	M	–	6.4	2.4	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-001	LSU	80	5.8	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-007	RB	228	124	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-008	RB	193	99	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-009	RB	220	121	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-010	RB	184	78	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-011	RB	154	42	–	–	–	–	–	OT	OT	4	P	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-012	RB	173	58	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-013	RB	121	21	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-014	RB	120	20	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-015	RB	107	16	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-016	RB	107	14	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-017	RB	97	10	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-018	RB	97	10	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	C1N5	GN	Day	C1N5-019	RB	87	7.5	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	D1MT3	MT	Night	D1MT3-001	BMC	76	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1MT3	MT	Night	D1MT3-002	BMC	74	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1MT3	MT	Night	D1MT3-003	NSC	126	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1MT5	MT	Night	D1MT5-001	BMC	70	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1MT5	MT	Night	D1MT5-002	BMC	45	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-022	KO	212	104.2	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-023	KO	177	73.2	–	–	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-024	KO	211	112	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-025	KO	199	95.8	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-026	KO	200	96.2	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-027	KO	195	99.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-028	KO	200	99.9	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-029	KO	209	119.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-030	KO	213	94.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-031	KO	220	127.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-032	KO	200	97.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-033	KO	205	114	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-034	KO	220	133.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-035	KO	175	69.8	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-036	KO	190	87.4	–	–	–	–	–	OT	OT	3	F	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
18-Jul-13	D1O5	GN	Day	D1O5-001	RB	130	25.7	–	–	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-002	RB	142	32.9	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-003	RB	150	38.2	–	–	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-004	RB	154	40.4	–	–	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-005	RB	175	67.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-006	RB	168	54.6	–	–	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-007	RB	201	102.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-008	RB	220	122.7	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-009	RB	250	165.2	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-010	RB	246	155.1	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-011	RB	208	107.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-012	RB	184	74.2	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-013	RB	247	174.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-014	RB	278	225	–	–	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-015	RB	216	107.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-016	RB	265	210	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-017	RB	260	210	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-018	RB	282	210	–	–	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-019	RB	208	94.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-020	RB	206	92.2	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D1O5	GN	Day	D1O5-021	RB	202	89.6	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D2O35	GN	Day	D2O35-001	LSU	360	482	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D2O35	GN	Day	D2O35-002	LSU	335	487	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	D2O35	GN	Day	D2O35-003	LSU	365	602	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-005	RB	183	68.8	U	IM	–	–	0.5	SC,OT	OT	4	F	–	Beetle	Internal parasites
18-Jul-13	E1N5	GN	Day	E1N5-025	NSC	405	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, fish lost
18-Jul-13	E1N5	GN	Day	E1N5-023	KO	205	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	E1N5	GN	Day	E1N5-024	KO	225	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	E1N5	GN	Day	E1N5-015	KO	214	124.9	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-016	KO	201	111.7	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-017	KO	214	117.4	F	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-018	KO	216	134.1	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-019	KO	217	129.3	F	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-020	KO	209	112.5	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-021	KO	211	121.9	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-022	KO	193	86.9	F	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-001	NSC	455	1274.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-002	NSC	360	565.7	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-006	RB	180	65.7	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-007	RB	180	72.3	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-008	RB	206	113	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-009	RB	215	118.7	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-010	RB	206	109	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-013	RB	222	120.2	U	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-012	RB	267	204.3	U	IM	–	–	–	SC,OT	OT	4	F	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-003	RB	162	51.2	U	IM	–	–	0.5	SC,OT	OT	4	F	–	Digested Material	
18-Jul-13	E1N5	GN	Day	E1N5-004	RB	161	50.3	M	IM	–	0.3	0.5	SC,OT	OT	3	F	–	Digested Material	
18-Jul-13	E1N5	GN	Day	E1N5-011	RB	235	141.7	–	MTC	–	–	–	SC,OT	OT	3	F	–	–	
18-Jul-13	E1N5	GN	Day	E1N5-014	RB	239	145.5	F	MTC	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	E1O20	GN	Day	E1O20-002	KO	207	101.5	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E1O20	GN	Day	E1O20-001	RB	77	3.96	–	–	–	–	–	OT	OT	1	F	–	–	
18-Jul-13	E2MT1	MT	Night	E2MT1-001	CCG	36	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2MT1	MT	Night	E2MT1-002	CCG	35	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2MT3	MT	Night	E2MT3-001	CCG	48	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2MT3	MT	Night	E2MT3-002	CCG	55	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2MT5	MT	Night	E2MT5-001	CCG	44	–	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
18-Jul-13	E2MT5	MT	Night	E2MT5-002	CCG	45	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O15	GN	Day	E2O15-001	LSU	375	–	–	–	–	–	–	–	–	–	–	–	–	Length approximate, live release
18-Jul-13	E2O5	GN	Day	E2O5-008	RB	193	81	M	IM	–	–	–	–	–	–	–	–	–	Internal cysts
18-Jul-13	E2O5	GN	Day	E2O5-005	KO	166	56	M	IM	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-001	KO	203	109	M	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-002	KO	207	101	F	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-003	KO	183	81	M	M	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-004	KO	195	82	F	M	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-006	RB	243	152	F	IM	–	–	–	OT	OT	2	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-007	RB	303	274	M	IM	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-011	RB	173	55	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-013	RB	219	111	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-014	RB	205	95	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-015	RB	206	93	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-016	RB	250	170	F	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-017	RB	172	66	U	IM	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-018	RB	167	57	U	IM	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-019	RB	155	42	U	IM	–	–	–	OT	OT	3	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-020	RB	133	27	U	IM	–	–	–	OT	OT	4	F	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-010	RB	160	50	M	M	–	–	–	OT	not in env	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-009	RB	253	168	M	MTC	–	–	–	–	–	–	–	–	–	
18-Jul-13	E2O5	GN	Day	E2O5-012	RB	280	192	F	MTC	–	–	–	OT	OT	5	F	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-002	BMC	80	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-003	BMC	71	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-004	BMC	94	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-005	BMC	74	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-006	BMC	70	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-007	BMC	66	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-008	BMC	68	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-009	BMC	74	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-010	BMC	68	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-011	BMC	72	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-012	BMC	72	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-013	BMC	69	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-014	BMC	76	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-015	BMC	71	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-016	BMC	69	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-017	BMC	63	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-018	BMC	72	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-019	BMC	45	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT1	MT	Night	F2MT1-001	LSU	81	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT3	MT	Night	F2MT3-001	BMC	55	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	F2MT5	MT	Night	F2MT5-001	BMC	82	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	G2N10	GN	Day	G2N10-003	KO	210	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	G2N10	GN	Day	G2N10-004	KO	215	–	–	–	–	–	–	–	–	–	–	–	–	Live release
18-Jul-13	G2N10	GN	Day	G2N10-001	KO	215	121.8	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	G2N10	GN	Day	G2N10-002	KO	213	124.4	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	G2O20	GN	Night	G2O20-001	KO	110	15.7	U	IM	–	–	–	OT	OT	2	F	–	Zooplankton	
18-Jul-13	H1MT3	MT	Night	H1MT2-002	NSC	146	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	H1MT3	MT	Night	H1MT2-001	CCG	54	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	H1MT5	MT	Night	H1MT4-001	CCG	52	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	H1O25	GN	Night	H1025-001	KO	212	123	M	M	–	4.7	1.8	SC,OT	OT	3	F	–	Zooplankton	
18-Jul-13	H1O25	GN	Night	H1025-002	MW	124	19.1	U	IM	–	–	–	OT	OT	2	F	WF	–	
18-Jul-13	H2MT3	MT	Night	H2MT3-001	CCG	54	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	H2MT3	MT	Night	H2MT3-002	CCG	49	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT11	MT	Night	I2MT4-001	CCG	59	–	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
18-Jul-13	I2MT11	MT	Night	I2MT4-002	CCG	54	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT11	MT	Night	I2MT4-003	CCG	47	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT11	MT	Night	I2MT4-004	CCG	60	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT11	MT	Night	I2MT4-005	CCG	50	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT11	MT	Night	I2MT4-006	CCG	65	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT7	MT	Night	I2MT1-003	RB	114	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT9	MT	Night	I2MT2-003	CCG	46	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2MT9	MT	Night	I2MT2-004	CCG	62	–	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2O15	GN	Night	I2O15-004	MW	246	180	F	MTC	–	3.1	1.8	SC,OT	OT	8	F	M,L	Chironomids	Nematodes in air bladder
18-Jul-13	I2O15	GN	Night	I2O15-002	KO	222	126	M	M	–	3.3	2.1	–	–	–	–	–	Empty	
18-Jul-13	I2O15	GN	Night	I2O15-001	LSU	252	223	–	–	–	–	–	–	–	–	–	–	–	
18-Jul-13	I2O15	GN	Night	I2O15-005	MW	230	132	F	IM	–	–	–	SC,OT	OT	5	P	WF	–	
18-Jul-13	I2O15	GN	Night	I2O15-009	MW	133	23.7	U	IM	–	–	–	OT	OT	3	F	WF	–	
18-Jul-13	I2O15	GN	Night	I2O15-008	MW	234	137	M	IM	–	–	–	SC,OT	OT	8	F	WF	Chironomids	
18-Jul-13	I2O15	GN	Night	I2O15-007	MW	228	137	M	IM	–	–	–	SC,OT	OT	4	F	WF	Empty	
18-Jul-13	I2O15	GN	Night	I2O15-006	MW	232	137	M	IM	–	–	–	SC,OT	OT	8	F	WF	Plankton, Copeopods	
18-Jul-13	I2O15	GN	Night	I2O15-003	MW	285	257	M	M	–	5	1.5	SC,OT	OT	9	F	M,L	Chironomids	
19-Jul-13	A1MT7	MT	Night	A1MT7-001	BMC	68	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	A1MT7	MT	Night	A1MT7-002	BMC	68	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	A1MT9	MT	Night	A1MT9-001	BMC	71	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	A1MT9	MT	Night	A1MT9-002	BMC	55	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	A2O20	GN	Night	A2O20-013	LSU	288	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	A2O20	GN	Night	A2O20-014	LSU	333	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	A2O20	GN	Night	A2O20-015	LSU	205	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	A2O20	GN	Night	A2O20-016	CSU	428	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	A2O20	GN	Night	A2O20-007	MW	230	147	M	IM	–	0.7	1.5	SC,OT	OT	7	F	–	Empty	Nematodes
19-Jul-13	A2O20	GN	Night	A2O20-010	MW	222	113	M	MTC	–	–	1.1	SC,OT	OT	4	F	–	Empty	Nematodes
19-Jul-13	A2O20	GN	Night	A2O20-003	MW	282	253	M	M	–	–	–	SC,OT	OT	6	F	WF	–	Nematodes in air bladder
19-Jul-13	A2O20	GN	Night	A2O20-002	MW	285	251	F	M	–	12	–	SC,OT	OT	7	F	M,L	–	Parasites on liver
19-Jul-13	A2O20	GN	Night	A2O20-011	KO	190	86	M	M	–	3.2	0.9	SC	SC	2	F	–	Taken for Analysis	
19-Jul-13	A2O20	GN	Night	A2O20-012	LSU	195	101	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	A2O20	GN	Night	A2O20-005	MW	170	47	U	IM	–	–	–	SC,OT	SC	3	F	WF	–	
19-Jul-13	A2O20	GN	Night	A2O20-006	MW	133	22.2	U	IM	–	–	–	SC,OT	OT	4	F	WF	–	
19-Jul-13	A2O20	GN	Night	A2O20-004	MW	267	213	M	M	–	–	–	SC,OT	OT	10	F	WF	–	
19-Jul-13	A2O20	GN	Night	A2O20-008	MW	236	160	M	M	–	3.9	1.1	SC,OT	OT	5	F	–	Empty	
19-Jul-13	A2O20	GN	Night	A2O20-001	MW	347	403	F	MTC	–	9.9	–	SC,OT	OT	8	F	M,L	–	
19-Jul-13	A2O20	GN	Night	A2O20-009	MW	227	128	F	MTC	–	1.6	1.2	SC,OT	OT	7	F	–	Taken for Analysis	
19-Jul-13	B1N5	GN	Day	B1N5-017	KO	230	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	B1N5	GN	Day	B1N5-014	RB	118	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	B1N5	GN	Day	B1N5-015	RB	162	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	B1N5	GN	Day	B1N5-016	RB	143	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	B1N5	GN	Day	B1N5-005	RB	136	27	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-006	RB	125	21	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-007	RB	144	31	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-008	RB	130	26	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-009	RB	113	15	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-010	RB	95	10	–	–	–	–	–	OT	OT	2	P	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-011	RB	106	14	–	–	–	–	–	OT	OT	3	F	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-012	RB	88	7.5	–	–	–	–	–	OT	OT	3	P	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-013	RB	88	7	–	–	–	–	–	OT	OT	1	F	–	–	
19-Jul-13	B1N5	GN	Day	B1N5-001	RB	242	179	F	IM	–	1.2	3.1	–	–	–	–	–	Digested Material	
19-Jul-13	B1N5	GN	Day	B1N5-004	RB	162	50	U	IM	–	–	0.3	–	–	–	–	–	Digested Material	
19-Jul-13	B1N5	GN	Day	B1N5-002	RB	197	89	U	IM	–	–	1	–	–	–	–	–	Empty	
19-Jul-13	B1N5	GN	Day	B1N5-003	RB	184	75	U	IM	–	–	1.2	–	–	–	–	–	Scuds	
19-Jul-13	B2O5	GN	Night	B205-013	KO	182	76	U	IM	–	–	1.2	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-008	KO	194	75	F	M	–	3.4	1.5	–	–	–	–	–	Empty	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
19-Jul-13	B2O5	GN	Night	B205-009	KO	210	114	M	M	–	3.8	1.4	–	–	–	–	–	Empty	
19-Jul-13	B2O5	GN	Night	B205-010	KO	213	116	F	M	–	18.1	2.5	–	–	–	–	–	Empty	
19-Jul-13	B2O5	GN	Night	B205-011	KO	224	132	M	M	–	4	2	–	–	–	–	–	Empty	
19-Jul-13	B2O5	GN	Night	B205-015	KO	213	113	F	M	–	11.5	1.7	–	–	–	–	–	Empty	
19-Jul-13	B2O5	GN	Night	B205-007	KO	200	105	F	M	–	4.6	1.8	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-012	KO	206	117	M	M	–	5.9	2	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-014	KO	220	121	M	M	–	4.3	2.1	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-001	NSC	409	863	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-002	NSC	375	664	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-003	NSC	303	348	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-004	NSC	400	816	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-005	NSC	252	179	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-006	NSC	303	311	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-021	RB	235	148	–	–	–	–	–	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-026	RB	183	78	U	IM	–	–	0.9	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-027	RB	195	85	U	IM	–	0.1	1	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-028	RB	183	72	U	IM	–	0.1	1.2	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-029	RB	172	62	U	IM	–	0.1	0.6	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-030	RB	195	81	U	IM	–	0.1	0.5	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-031	RB	190	81	U	IM	–	0.1	0.9	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-032	RB	193	91	U	IM	–	0.1	0.5	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-033	RB	175	63	U	IM	–	0.1	0.6	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-034	RB	183	69	U	IM	–	0.1	0.5	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-035	RB	182	73	U	IM	–	0.1	1.1	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-036	RB	187	73	U	IM	–	0.1	0.8	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-037	RB	172	62	U	IM	–	0.1	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-038	RB	168	55	U	IM	–	0.1	0.9	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-039	RB	158	49	U	IM	–	0.1	1.1	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-040	RB	124	22	U	IM	–	0.1	0.3	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-041	RB	125	23	U	IM	–	0.1	0.1	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-042	RB	127	23	U	IM	–	–	–	–	–	–	–	–	–	
19-Jul-13	B2O5	GN	Night	B205-016	RB	239	163	F	IM	–	0.9	1.9	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-017	RB	233	151	U	IM	–		1.4	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-018	RB	221	113	F	IM	–	0.2	1.1	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-019	RB	238	165	U	IM	–	0.1	1.7	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-020	RB	235	139	F	IM	–	0.6	1.4	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-022	RB	200	94	F	IM	–	0.2	0.7	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-023	RB	203	102	U	IM	–	<0.1	0.7	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-024	RB	216	117	U	IM	–	–	0.9	–	–	–	–	–	Taken for Analysis	
19-Jul-13	B2O5	GN	Night	B205-025	RB	210	111	U	IM	–	–	1.2	–	–	–	–	–	Taken for Analysis	
19-Jul-13	C2N10	GN	Day	C2N10-001	LSU	83	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N10	GN	Day	C2N10-002	LSU	68	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N10	GN	Day	C2N10-003	LSU	81	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N10	GN	Day	C2N10-004	LSU	82	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N5	GN	Day	C2N5-038	RB	175	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N5	GN	Day	C2N5-039	RB	251	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	C2N5	GN	Day	C2N5-010	RB	255	151	F	ST	–	0.9	1.8	–	–	–	–	–	–	Residual eggs, 1 ovary
19-Jul-13	C2N5	GN	Day	C2N5-036	KO	215	118	M	M	–	6.4	1.3	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-037	KO	204	101	M	M	–	6.4	1.6	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-035	KO	208	109	M	M	–	6.3	1.6	–	–	–	–	–	Taken for analysis	
19-Jul-13	C2N5	GN	Day	C2N5-002	RB	267	175	F	IM	–	–	–	SC,OT	OT	4	F	WF	–	
19-Jul-13	C2N5	GN	Day	C2N5-003	RB	171	58	U	IM	–	–	–	SC,OT	SC	2	F	WF	–	
19-Jul-13	C2N5	GN	Day	C2N5-005	RB	240	164	U	IM	–	<0.2	1.5	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-006	RB	235	144	U	IM	–	<0.2	1.6	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-007	RB	222	131	U	IM	–	<0.2	1.4	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-008	RB	235	140	F	IM	–	0.5	1.7	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
19-Jul-13	C2N5	GN	Day	C2N5-009	RB	204	100	U	IM	–	<0.2	0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-012	RB	226	127	F	IM	–	0.9	0.7	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-013	RB	220	116	U	IM	–	<0.2	1.2	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-014	RB	195	83	U	IM	–		0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-015	RB	220	127	U	IM	–	<0.2	1.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-016	RB	228	128	F	IM	–	1.3	1.1	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-017	RB	221	120	M	IM	–	<0.2	1.6	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-018	RB	193	81	U	IM	–	<0.2	0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-019	RB	185	72	U	IM	–	<0.2	0.7	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-020	RB	193	83	U	IM	–	<0.2	0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-021	RB	185	80	U	IM	–	<0.2	1	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-022	RB	188	74	U	IM	–	<0.2	0.5	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-023	RB	208	93	U	IM	–	<0.2	–	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-024	RB	190	79	M	IM	–	<0.2	0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-025	RB	214	113	F	IM	–	0.3	0.8	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-026	RB	175	61	U	IM	–	<0.2	0.6	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-027	RB	151	40	U	IM	–	<0.2	0.4	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-028	RB	173	58	U	IM	–	<0.2	0.7	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-029	RB	165	49	U	IM	–	<0.2	0.5	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-030	RB	132	25	U	IM	–	<0.2	0.3	OT	OT	4	F	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-031	RB	119	18	U	IM	–	<0.2	0.4	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-032	RB	122	20	U	IM	–	<0.2	0.3	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-033	RB	115	17	U	IM	–	<0.2	–	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-034	RB	113	16	U	IM	–	<0.2	–	–	–	–	–	–	–	
19-Jul-13	C2N5	GN	Day	C2N5-001	RB	257	200	U	IM	–	–	2.8	SC,OT	OT	3	F	M,L	Taken for Analysis	
19-Jul-13	C2N5	GN	Day	C2N5-004	RB	242	155	F	MTC	–	2.1	2	–	–	–	–	–	Taken for Analysis	
19-Jul-13	C2N5	GN	Day	C2N5-011	RB	238	153	U	U	–		1.7	–	–	–	–	–	–	
19-Jul-13	D1N10	GN	Day	D1N10-008	LSU	310	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	D1N10	GN	Day	D1N10-009	LSU	350	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	D1N10	GN	Day	D1N10-004	MW	128	20.8	U	IM	–	–	–	OT	OT	2	F	WF	–	
19-Jul-13	D1N10	GN	Day	D1N10-005	MW	220	107	F	IM	–	–	1.2	–	–	–	–	–	Empty	
19-Jul-13	D1N10	GN	Day	D1N10-006	MW	213	108.6	F	IM	–	–	1	SC,OT	OT	6	F	–	Taken for Analysis	
19-Jul-13	D1N10	GN	Day	D1N10-001	MW	191	80.4	M	M	–	–	0.5	SC,OT	OT	5	F	WF	–	
19-Jul-13	D1N10	GN	Day	D1N10-007	MW	250	171.5	F	M	–	–	2.2	SC,OT	OT	5	F	–	Empty	
19-Jul-13	D1N10	GN	Day	D1N10-002	MW	288	292.7	F	M	–	–	–	SC,OT	OT	11	F	–	Taken for Analysis	
19-Jul-13	D1N10	GN	Day	D1N10-003	MW	282	310.8	F	M	–	–	3.8	SC,OT	OT	8	F	–	Taken for Analysis	
19-Jul-13	D1O25	GN	Night	D1O25-001	KO	230	133	F	M	–	12.7	2.9	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-023	RB	133	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	D2N5	GN	Day	D2N5-024	RB	123	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	D2N5	GN	Day	D2N5-001	KO	205	100	M	M	–	4.5	1	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-002	KO	185	87	M	M	–	5.9	0.7	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-022	KO	192	91	M	M	–	3	1.2	–	–	–	–	–	Empty	
19-Jul-13	D2N5	GN	Day	D2N5-019	RB	124	22	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-020	RB	124	22	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-021	RB	123	20	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-007	RB	228	137	F	IM	–	–	0.9	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-012	RB	175	64	U	IM	–	–	0.7	–	–	–	–	–	Ant	
19-Jul-13	D2N5	GN	Day	D2N5-011	RB	164	55	U	IM	–	–	1	–	–	–	–	–	Beetle	
19-Jul-13	D2N5	GN	Day	D2N5-003	RB	264	189	U	IM	–	–	–	–	–	–	–	–	Beeltes/Ant/Scud	
19-Jul-13	D2N5	GN	Day	D2N5-004	RB	273	227	M	IM	–	–	1.5	OT	OT	4	F	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-005	RB	240	169	U	IM	–	–	2	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-008	RB	258	174	F	IM	–	2.2	1.8	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-009	RB	220	117	U	IM	–	–	1	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-013	RB	164	49	U	IM	–	–	0.6	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-014	RB	152	42	U	IM	–	–	0.5	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-015	RB	151	38	U	IM	–	–	0.4	–	–	–	–	–	Digested Material	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
19-Jul-13	D2N5	GN	Day	D2N5-016	RB	148	36	U	IM	–	–	0.2	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-017	RB	127	26	U	IM	–	–	0.2	–	–	–	–	–	Digested Material	
19-Jul-13	D2N5	GN	Day	D2N5-010	RB	185	73	U	IM	–	–	1.1	–	–	–	–	–	Empty	
19-Jul-13	D2N5	GN	Day	D2N5-018	RB	136	30	U	IM	–	–	–	–	–	–	–	–	–	
19-Jul-13	D2N5	GN	Day	D2N5-006	RB	270	209	F	MTC	–	1.6	2.5	–	–	–	–	–	Empty	
19-Jul-13	E1MT2	MT	Night	E1MT2-001	CCG	50	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E1MT3	MT	Night	E1MT4-001	CCG	103	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E1MT5	MT	Night	E1MT2-002	LSU	63	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E1MT6	MT	Night	E1MT4-002	LSU	124	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E1O15	GN	Night	E1O15-001	CCG	66	–	–	–	–	–	–	–	–	–	–	–	–	Error in weight (39 g)
19-Jul-13	E2MT11	MT	Night	E2MT11-001	NSC	137	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E2MT9	MT	Night	E2MT9-001	NSC	141	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E2MT9	MT	Night	E2MT9-002	NSC	126	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E2N10	GN	Day	E2N10-003	MW	310	355	F	MTC	–	8.6	3.6	SC,OT	OT	13	F	–	Sand/Digested Material	Sand in stomach
19-Jul-13	E2N10	GN	Day	E2N10-008	KO	217	122	F	M	–	10.6	2.4	–	–	–	–	–	Empty	
19-Jul-13	E2N10	GN	Day	E2N10-009	KO	190	90	M	M	–	4	1.4	–	–	–	–	–	Empty	
19-Jul-13	E2N10	GN	Day	E2N10-010	KO	202	110	M	M	–	5.5	2	–	–	–	–	–	Empty	
19-Jul-13	E2N10	GN	Day	E2N10-001	LSU	317	385	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E2N10	GN	Day	E2N10-002	CSU	376	731	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	E2N10	GN	Day	E2N10-006	MW	131	23	U	IM	–	>0.2	–	OT	OT	2	P	–	–	
19-Jul-13	E2N10	GN	Day	E2N10-005	MW	282	282	F	MTC	–	7.4	1.9	–	–	–	–	–	Caddisfly	
19-Jul-13	E2N10	GN	Day	E2N10-004	MW	277	246	F	MTC	–	3.9	2.5	SC,OT	OT	7	F	–	Taken for Analysis/ Caddisflies	
19-Jul-13	E2N10	GN	Day	E2N10-011	RB	190	71	U	IM	–	>0.2	0.9	–	–	–	–	–	Beetle	
19-Jul-13	E2N10	GN	Day	E2N10-007	RB	145	37	U	IM	–	>0.2	0.7	OT	OT	2	F	–	Scuds	
19-Jul-13	F1MT17	MT	Night	F1MT17-001	BMC	80	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	F1MT17	MT	Night	F1MT17-002	NSC	113	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	F1MT7	MT	Night	F1MT7-001	BMC	43	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	G2N10	GN	Day	G2N10-012	KO	206	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	G2N10	GN	Day	G2N10-013	RB	135	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	G2N10	GN	Day	G2N10-007	KO	212	114	M	M	–	8.7	1.6	–	–	–	–	–	Taken for Analysis	Parasites on stomach
19-Jul-13	G2N10	GN	Day	G2N10-001	MW	292	302	F	M	–	5.8	4.4	SC,OT	OT	8	F	–	Chironomids	Sand in the stomach
19-Jul-13	G2N10	GN	Day	G2N10-005	KO	222	130	M	M	–	9.6	1.4	–	–	–	–	–	Empty	
19-Jul-13	G2N10	GN	Day	G2N10-006	KO	206	107	M	M	–	6	1.5	–	–	–	–	–	Empty	
19-Jul-13	G2N10	GN	Day	G2N10-008	KO	210	109	F	M	–	14	2.3	–	–	–	–	–	Empty	
19-Jul-13	G2N10	GN	Day	G2N10-009	KO	214	124	M	M	–	4.4	1	–	–	–	–	–	Empty	
19-Jul-13	G2N10	GN	Day	G2N10-004	KO	215	127	M	M	–	4.3	2.1	–	–	–	–	–	Taken for Analysis	
19-Jul-13	G2N10	GN	Day	G2N10-010	KO	221	131	F	M	–	15	3	–	–	–	–	–	Taken for Analysis	
19-Jul-13	G2N10	GN	Day	G2N10-011	KO	202	95	M	M	–	4.9	1.3	–	–	–	–	–	Taken for Analysis	
19-Jul-13	G2N10	GN	Day	G2N10-003	MW	166	51.6	U	IM	–	–	–	SC,OT	OT	3	F	WF	–	
19-Jul-13	G2N10	GN	Day	G2N10-002	MW	238	182	F	MTC	–	2.8	2.3	–				–	Digested Material	
19-Jul-13	H1MT11	MT	Night	H1MT4-003	NSC	96	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT11	MT	Night	H1MT4-002	CCG	90	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT7	MT	Night	H1MT1-001	CCG	50	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT7	MT	Night	H1MT1-002	CCG	48	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT9	MT	Night	H1MT2-003	NSC	62	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT9	MT	Night	H1MT2-004	CCG	58	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1MT9	MT	Night	H1MT2-005	CCG	48	–	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	H1O10	GN	Day	H1O10-003	KO	180	73	F	IM	–	0.7	0.9	–	–	–	–	–	Taken for Analysis	
19-Jul-13	H1O10	GN	Day	H1O10-002	KO	216	124	M	M	–	4.2	2.1	–	–	–	–	–	Taken for Analysis	
19-Jul-13	H1O10	GN	Day	H1O10-001	KO	190	77	F	M	–	3.4	2	–	–	–	–	–	Empty	
19-Jul-13	I1O20	GN	Day	I1O20-33	MW	280	–	–	–	–	–	–	–	–	–	–	–	–	Live release
19-Jul-13	I1O20	GN	Day	I1O20-006	MW	281	231.3	M	M	–	4.6	1.8	SC,OT	OT	8	F	–	Taken for Analysis	Worms in cavity
19-Jul-13	I1O20	GN	Day	I1O20-32	LSU	117	16.4	–	–	–	–	–	–	–	–	–	–	–	
19-Jul-13	I1O20	GN	Day	I1O20-001	MW	170	50.3	U	IM	–	–	0.4	SC,OT	OT	3	F	WF	–	
19-Jul-13	I1O20	GN	Day	I1O20-003	MW	217	107.1	U	IM	–	–	1.3	SC,OT	OT	8	F	–	Taken for Analysis	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
19-Jul-13	I1O20	GN	Day	I1O20-002	MW	242	147.8	M	M	–	1.7	0.2	–	–	–	–	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-004	MW	300	305.2	F	M	–	10.6	4.3	SC,OT	OT	11	F	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-005	MW	258	181.9	F	M	–	3.2	2	SC,OT	OT	6	F	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-007	MW	308	352.8	F	M	–	14	2.7	SC,OT	OT	12	F	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-27	MW	250	161	M	MTC	–	0.6	0.9	–	–	–	–	–	–	
19-Jul-13	I1O20	GN	Day	I1O20-28	MW	245	182	M	MTC	–	0.6	1.2	–	–	–	–	–	–	
19-Jul-13	I1O20	GN	Day	I1O20-29	MW	242	167	F	MTC	–	3.6	2.6	–	–	–	–	–	–	
19-Jul-13	I1O20	GN	Day	I1O20-30	MW	257	201	M	MTC	–	2.2	1.5	–	–	–	–	–	–	
19-Jul-13	I1O20	GN	Day	I1O20-25	MW	240	148	M	MTC	–	1.3	1.3	–	–	–	–	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-26	MW	265	218	F	MTC	–	2	4.1	SC,OT	OT	9	F	–	Taken for Analysis	
19-Jul-13	I1O20	GN	Day	I1O20-31	NSC	120	18.6	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-020	KO	231	113	M	M	–	5.3	1.5	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-021	KO	208	113	M	M	–	6	1.7	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-022	KO	216	120	F	M	–	7.3	2	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-023	KO	215	106	F	M	–	8	0.5	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-024	KO	200	97	M	M	–	5.9	1.2	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-025	KO	205	104	M	M	–	4.5	1.7	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-019	KO	218	125	M	M	–	5.9	1.4	–	–	–	–	–	Empty	
20-Jul-13	B2N5	GN	Night	B2N5-014	LSU	295	363	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-015	LSU	390	795	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-016	LSU	277	257	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-017	CSU	371	783	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-018	CSU	365	711	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-001	NSC	280	250	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-002	NSC	260	219	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-003	NSC	257	185	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-004	NSC	240	178	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-005	NSC	212	115	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-006	NSC	275	222	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-007	NSC	271	222	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-008	NSC	280	268	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-009	NSC	232	142	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-010	NSC	133	26	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-011	NSC	133	27	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-012	NSC	245	179	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-013	NSC	123	23	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-046	RB	172	57	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-047	RB	165	57	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-048	RB	186	73	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-049	RB	133	29	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-050	RB	132	24	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-051	RB	132	26	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-052	RB	130	26	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-053	RB	116	18	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-054	RB	120	18	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-029	RB	257	188	F	IM	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-030	RB	244	174	U	IM	–	–	2.9	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-031	RB	224	131	F	IM	–	–	2.3	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-032	RB	260	164	F	IM	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-033	RB	255	194	F	IM	–	–	2.9	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-034	RB	228	138	F	IM	–	–	1.4	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-035	RB	228	133	U	IM	–	–	1.5	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-036	RB	257	175	U	IM	–	–	1.6	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-037	RB	225	123	M	IM	–	–	0.9	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-038	RB	233	126	U	IM	–	–	1.5	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-039	RB	219	118	F	IM	–	–	8	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
20-Jul-13	B2N5	GN	Night	B2N5-040	RB	251	164	U	IM	–	–	1.8	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-041	RB	200	100	U	IM	–	–	1.4	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-042	RB	170	52	U	IM	–	–	0.9	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-043	RB	193	85	M	IM	–	–	0.7	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-044	RB	190	79	U	IM	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-045	RB	193	87	U	IM	–	–	–	–	–	–	–	–	–	
20-Jul-13	B2N5	GN	Night	B2N5-026	RB	330	412	M	MTC	–	–	4.5	SC,OT	OT	5	F	–	Digested Material	
20-Jul-13	B2N5	GN	Night	B2N5-028	RB	256	179	F	MTC	–	–	2.1	–	–	–	–	–	Digested Material	
20-Jul-13	B2N5	GN	Night	B2N5-027	RB	346	392	M	MTC	–	–	5.8	OT	OT	3	F	–	Empty	
20-Jul-13	C1MT3	MT	Night	C1MT3-001	CCG	45	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	C1MT5	MT	Night	C1MT5-001	CCG	45	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	C1N5	GN	Night	C1N5-001	MW	258	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	C1N5	GN	Night	C1N5-002	RB	205	100	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	C1N5	GN	Night	C1N5-003	RB	94	6.2	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	C1N5	GN	Night	C1N5-004	CCG	70	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	E2MT15	MT	Night	E2MT15-001	CCG	90	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	E2MT17	MT	Night	E2MT17-001	NSC	145	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	E2MT17	MT	Night	E2MT17-002	NSC	143	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	E2MT17	MT	Night	E2MT17-003	NSC	128	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	E2MT17	MT	Night	E2MT17-004	NSC	146	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-015	KO	142	32	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-016	KO	197	93	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-017	KO	220	134	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-018	KO	213	111	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-019	KO	210	123	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-020	KO	215	117	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-021	KO	206	105	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-022	KO	203	104	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-023	KO	215	113	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-024	KO	210	121	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-025	KO	230	144	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-026	KO	209	116	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-027	KO	202	111	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-028	KO	215	127	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-029	KO	227	143	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-001	LSU	370	677	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-002	LSU	335	506	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-003	LSU	388	643	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-004	LSU	382	723	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-005	NSC	285	254	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-006	NSC	240	181	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-007	NSC	250	173	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-008	NSC	225	128	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-009	NSC	245	157	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-010	NSC	245	182	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-011	NSC	230	141	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-012	NSC	141	32	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-013	NSC	125	26	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-014	NSC	135	31	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-030	RB	219	120	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-031	RB	250	122	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-032	RB	245	178	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-033	RB	230	135	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-034	RB	224	130	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-035	RB	197	94	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-036	RB	219	114	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
20-Jul-13	F1N5	GN	Night	F1N5-037	RB	213	109	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-038	RB	224	128	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-039	RB	237	139	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-040	RB	306	289	–	–	–	–	–	OT	OT	6	F	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-041	RB	274	194	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-042	RB	247	170	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-043	RB	225	126	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-044	RB	238	151	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-045	RB	175	56	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-046	RB	180	64	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-047	RB	165	50	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-048	RB	258	195	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-049	RB	242	159	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-050	RB	200	93	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-051	RB	263	182	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-052	RB	218	122	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-053	RB	163	46	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-054	RB	125	22	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-055	RB	262	186	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-056	RB	140	30	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-057	RB	131	24	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-058	RB	170	58	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-059	RB	114	17	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-060	RB	108	14.5	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-061	RB	177	63	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-062	RB	195	89	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-063	RB	255	169	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-064	RB	184	69	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-065	RB	111	16	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-066	RB	122	23	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-067	RB	210	103	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-068	RB	255	182	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-069	RB	222	145	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-070	RB	243	168	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-071	RB	227	129	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-072	RB	130	25	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-073	RB	132	27	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-074	RB	108	14	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-075	RB	110	14	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-076	RB	284	229	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-077	RB	145	37	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-078	RB	249	177	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-079	RB	276	237	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-080	RB	121	21	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-081	RB	126	22	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-082	RB	116	15	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-083	RB	244	163	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-084	RB	231	151	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-085	RB	121	21	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-086	RB	111	14	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-087	RB	270	219	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-088	RB	215	117	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-089	RB	127	22	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-090	RB	115	17	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-091	RB	126	22	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-092	RB	131	26	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
20-Jul-13	F1N5	GN	Night	F1N5-093	RB	116	15	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-094	RB	107	15	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1N5	GN	Night	F1N5-095	RB	114	13	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	F1O20	GN	Night	F1O20-001	RB	302	287	–	–	–	–	–	OT	OT	5	P	–	–	
20-Jul-13	G1MT11	MT	Night	G1MT11-001	NSC	140	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G1MT11	MT	Night	G1MT11-002	NSC	77	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G1MT9	MT	Night	G1MT9-001	NSC	92	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-060	NSC	385	–	–	–	–	–	–	–	–	–	–	–	–	Live release
20-Jul-13	G2O10	GN	Night	G2O10-005	KO	197	102	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-006	KO	207	106	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-007	KO	194	97	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-008	KO	217	139	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-009	KO	210	105	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-010	KO	210	115	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-011	KO	183	81	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-012	KO	200	91	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-013	KO	197	99	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-014	KO	225	135	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-015	KO	195	90	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-016	KO	180	62	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-017	KO	206	114	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-018	KO	208	108	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-019	KO	182	72	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-020	KO	203	107	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-021	KO	187	82	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-022	KO	200	207	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-023	KO	203	104	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-024	KO	213	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-025	KO	214	124	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-026	KO	177	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-027	KO	180	67	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-028	KO	152	48	–	–	–	–	–	OT	OT	2	P	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-029	KO	127	25	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-030	KO	148	39	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-031	KO	140	32	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-032	KO	118	21	–	–	–	–	–	OT	OT	1	P	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-033	KO	125	25	–	–	–	–	–	OT	OT	1	P	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-034	KO	127	23	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-035	KO	115	19	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-036	KO	124	23	–	–	–	–	–	OT	broken	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-037	KO	111	17	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-038	KO	117	20	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-039	KO	113	20	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-040	KO	115	21	–	–	–	–	–	OT	OT	1	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-041	KO	116	20	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-042	KO	127	26	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-043	KO	115	16	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-044	KO	113	19	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-045	KO	–	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-047	KO	115	19	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-048	KO	114	17	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-049	KO	120	19	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-050	KO	113	20	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-051	KO	115	18	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-052	KO	114	15	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-053	KO	113	16	–	–	–	–	–	–	–	–	–	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
20-Jul-13	G2O10	GN	Night	G2O10-054	KO	121	20	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-055	KO	115	19	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-056	KO	112	17	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-057	KO	107	13	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-058	KO	115	17	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-059	KO	107	14	–	–	–	–	–	OT	OT	2	F	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-001	LSU	300	353	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-003	LSU	366	686	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-004	MW	315	–	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-002	NSC	415	707	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	G2O10	GN	Night	G2O10-046		Skipped number		–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-072	LSU	230	–	–	–	–	–	–	–	–	–	–	–	–	Live release
20-Jul-13	I2N10	GN	Night	I2N10-073	LSU	400	–	–	–	–	–	–	–	–	–	–	–	–	Live release
20-Jul-13	I2N10	GN	Night	I2N10-023	KO	182	75	F	M	–	8.1	1.9	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-024	KO	205	108	M	M	–	4.5	1.4	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-025	KO	197	81	M	M	–	4.1	1	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-026	KO	196	93	F	M	–	11	1.6	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-027	KO	205	102	M	M	–	5.5	1.7	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-028	KO	195	90	M	M	–	6.3	1.4	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-029	KO	210	105	F	M	–	8.4	2.3	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-030	KO	220	130	M	M	–	5	2.3	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-031	KO	207	103	M	M	–	5.5	1.6	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-032	KO	205	107	M	M	–	8.4	1.8	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-033	KO	204	100	M	M	–	3.4	2	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-034	KO	210	100	M	M	–	3.5	1.3	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-035	KO	196	94	M	M	–	3.2	1.4	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-036	KO	205	113	M	M	–	4.8	1.3	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-037	KO	210	104	M	M	–	5	1.1	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-038	KO	200	95	F	M	–	9	1.5	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-039	KO	157	54	M	M	–	3.1	1.2	OT	OT	3	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-011	LSU	273	257	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-012	LSU	395	767	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-013	LSU	301	365	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-014	LSU	400	779	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-015	LSU	380	659	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-017	CSU	421	932	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-018	CSU	316	460	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-019	CSU	110	15	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-045	MW	280	245	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-046	MW	275	229	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-048	MW	300	313	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-049	MW	272	224	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-050	MW	285	291	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-051	MW	279	266	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-052	MW	297	277	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-053	MW	254	192	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-054	MW	295	260	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-056	MW	290	252	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-057	MW	248	175	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-058	MW	226	115	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-059	MW	192	82	–	–	–	–	–	OT	OT	4	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-060	MW	267	230	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-061	MW	175	60	–	–	–	–	–	OT	OT	4	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-062	MW	194	78	–	–	–	–	–	OT	OT	5	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-063	MW	203	77	–	–	–	–	–	OT	OT	4	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-064	MW	146	31	–	–	–	–	–	OT	OT	2	F	–	–	

Date	Set #	Method[1]	Day/Night	Fish ID	Species[2]	Length (mm)	Weight (g)	Sex[3]	Maturity[4]	Stage	Gonad Weight (g)	Liver Weight (g)	Age Structure Taken[5]	Age Structure Read[5]	Age (years)	Age Confidence[6]	Tissue Metals[7]	Stomach Contents	Comments
20-Jul-13	I2N10	GN	Night	I2N10-065	MW	148	34	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-066	MW	140	29	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-067	MW	134	24	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-068	MW	135	23	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-069	MW	126	22	–	–	–	–	–	OT	OT	3	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-070	MW	128	16	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-071	MW	120	15	–	–	–	–	–	OT	OT	4	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-040	MW	293	178	F	M	–	6.7	1	SC,OT	OT	6	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-043	MW	303	287	M	M	–	5	–	SC,OT	OT	13	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-044	MW	303	335	F	M	–	11.6	–	SC,OT	OT	13	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-041	MW	268	220	F	MTC	–	4.1	2	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-042	MW	300	305	F	MTC	–	10.9	2.8	SC,OT	OT	10	P	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-047	MW	305	310	F	MTC	–	7.5	2.7	SC,OT	OT	10	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-055	MW	313	368	F	MTC	–	12.4	3.1	SC,OT	OT	14	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-001	NSC	296	288	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-002	NSC	310	265	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-003	NSC	275	253	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-004	NSC	225	134	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-005	NSC	205	100	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-006	NSC	232	129	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-007	NSC	229	127	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-008	NSC	170	57	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-009	NSC	243	165	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-010	NSC	235	139	–	–	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-020	RB	315	330	F	MTC	–	1.8	3.4	SC,OT	OT	4	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-021	RB	275	253	M	MTC	–	–	–	–	–	–	–	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-022	RB	340	438			–	–	–	SC,OT	OT	6	F	–	–	
20-Jul-13	I2N10	GN	Night	I2N10-016	WSU	371	743	–	–	–	–	–	–	–	–	–	–	–	

Note: g - grams; mm - millimetre; Y – yes; N – no
[1] GN - gill-netting; MT - minnow trapping
[2] KO - kokanee; RB – rainbow trout; MW – mountain whitefish; BB - burbot; BMC - brassy minnow; CCG – slimy sculpin; NSC – northern pikeminnow; LSU - longnose sucker; CSU – largescale sucker; WSU – white sucker
[3] F - female; M - male; U - unknown
[4] I - immature; MTC – maturing; M - mature; ST – spent; U – unknown
[5] OT - otolith; SC - scales;
[6] VG – very good; G – good; F – fair; P – poor; VP – very poor
[7] M = muscle; L – liver; WF – whole fish

Annex 5.12-3
Taxonomy of Rainbow Trout Stomachs, Tatelkuz Lake, July 2013

Table 5.12-3: Taxonomy of Rainbow Trout Stomachs, Tatelkuz Lake, July 2013

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	I1O20-002	I1O20-003	I1O20-004	I1O20-005	I1O20-006	I1O20-007	I1O20-025	I1O20-026	D1N10-002	D1N10-003	D1N10-006
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Taxonomy												
Low Level	**High Level**											
Ephemoptera	Ephemoptera	0	0	0	0	0	0	0	0	0	0	0
	Ephemera simulans	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Trichoptera	0	0	0	0	0	0	0	0	2	1	0
	Micrasema sp.	0	0	0	0	0	0	0	0	9	0	0
	Lepidostoma sp.	0	0	0	0	0	0	0	0	0	0	0
	Ceraclea sp.	0	0	0	0	0	0	0	0	2	0	0
	Oecetis sp.	0	0	0	0	0	0	0	0	0	0	0
	Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	Coleoptera	0	0	0	0	0	0	0	0	0	0	0
	Chrysomelidae	0	0	0	0	0	0	0	0	0	0	0
	Curculionidae	0	0	0	0	0	0	0	0	0	0	0
	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0
	Hydroporinae	0	0	0	0	0	0	0	0	0	8	0
	Dineutus sp.	0	0	0	0	0	0	0	0	3	0	0
	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0
Diptera	Diptera	0	0	0	0	0	0	0	0	0	0	0
	Chironomini	0	0	0	0	0	0	0	0	0	0	0
	Chironomus sp.	49	81	195	155	83	89	46	96	350	290	315
	Parachironomus sp.	0	0	0	0	0	0	0	0	0	0	0
	Phaenopsectra sp.	18	45	43	43	10	160	25	28	165	160	60

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	I1O20-002	I1O20-003	I1O20-004	I1O20-005	I1O20-006	I1O20-007	I1O20-025	I1O20-026	D1N10-002	D1N10-003	D1N10-006
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Taxonomy												
Low Level	**High Level**											
	Micropsectra/ Tanytarsus	0	0	0	0	0	0	0	0	5	7	0
	Ablabesmyia sp.	0	0	0	0	0	0	0	0	0	0	0
	Procladius sp.	2	0	0	0	0	3	4	4	0	0	0
	Corixidae	0	0	0	0	0	0	0	0	0	0	0
	Sigara sp.	0	0	0	0	0	0	0	0	0	0	0
	Gerridae	0	0	0	0	0	0	0	0	0	0	0
	Mesovelia sp.	0	0	0	0	0	0	0	0	0	0	0
	Saldidae	0	0	0	0	0	0	0	0	0	0	0
Amphipoda	Amphipoda	0	0	0	0	0	0	0	0	0	1	0
	Hyalella sp.	0	0	0	0	0	0	0	0	1	0	0
Veneroida	*Pisidium* sp.	0	0	5	0	1	3	0	0	0	0	0
Basommatophora	*Physa* sp.	0	0	0	0	0	0	0	0	0	0	0
Heterostropha	*Valvata* sp.	0	0	0	0	0	0	0	0	0	0	0
	All others	0	0	0	0	0	0	0	0	0	0	0

Table 5.12-3: Taxonomy of Rainbow Trout Stomachs, Tatelkuz Lake, July 2013 (continued)

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	G2N10-004	G2N10-007	G2N10-010	G2N10-011	H1O10-002	H1O10-003	C2N5-001	C2N5-004	C2N5-035	E2N10-004	A2O20-009
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Taxonomy												
Low Level	**High Level**											
Ephemoptera	Ephemoptera	0	0	0	0	0	0	0	0	0	1	0
	Ephemera simulans	0	0	0	0	0	0	0	0	0	1	0
Trichoptera	Trichoptera	0	0	0	0	0	0	2	1	0	0	0
	Micrasema sp.	0	0	0	0	0	0	0	0	0	0	0
	Lepidostoma sp.	0	0	0	0	0	0	0	0	0	0	0
	Ceraclea sp.	0	0	0	0	0	0	0	0	0	0	0
	Oecetis sp.	0	0	0	0	0	0	0	0	0	0	0
	Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	Coleoptera	0	0	0	0	0	0	0	0	0	0	0
	Chrysomelidae	0	0	0	0	0	0	1	1	0	1	0
	Curculionidae	0	0	0	2	8	0	1	12	0	0	0
	Dytiscidae	0	0	0	0	0	0	0	0	0	0	5
	Hydroporinae	0	0	0	0	0	0	0	0	0	0	0
	Dineutus sp.	0	0	0	1	0	0	0	0	0	0	28
	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0
Diptera	Diptera	0	0	0	0	0	0	0	0	0	0	0
	Chironomini	0	0	0	0	0	0	0	0	0	0	2
	Chironomus sp.	0	0	0	0	0	0	0	0	0	0	0
	Parachironomus sp.	0	0	0	0	0	0	0	0	0	0	0
	Phaenopsectra sp.	0	0	0	0	0	0	0	0	0	0	0
	Micropsectra/	0	0	0	0	0	0	0	0	0	0	0

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	G2N10-004	G2N10-007	G2N10-010	G2N10-011	H1O10-002	H1O10-003	C2N5-001	C2N5-004	C2N5-035	E2N10-004	A2O20-009
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Taxonomy												
Low Level	**High Level**											
	Tanytarsus											
	Ablabesmyia sp.	0	0	0	0	0	0	0	0	0	0	0
	Procladius sp.	0	0	0	0	0	0	0	0	0	0	0
	Corixidae	0	0	0	0	0	0	0	0	0	0	0
	Sigara sp.	0	0	0	0	0	0	0	0	0	0	0
	Gerridae	0	0	0	0	0	0	0	0	0	0	0
	Mesovelia sp.	0	0	0	0	0	0	0	0	0	0	0
	Saldidae	0	0	0	0	0	0	0	0	0	0	0
Amphipoda	Amphipoda	0	0	0	0	0	0	0	0	0	1	0
	Hyalella sp.	0	0	0	0	0	0	0	0	0	1	0
Veneroida	*Pisidium* sp.	0	0	0	0	0	0	2	1	0	0	0
Basommatophora	*Physa* sp.	0	0	0	0	0	0	0	0	0	0	0
Heterostropha	*Valvata* sp.	0	0	0	0	0	0	0	0	0	0	0
	All others	0	0	0	0	0	0	0	0	0	0	0

Table 5.12-3: Taxonomy of Rainbow Trout Stomachs, Tatelkuz Lake, July 2013 (continued)

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	A2O20-011	B205-007	B205-012	B205-013	B205-014	B205-016	B205-017	B205-018	B205-019	B205-020	B205-021
	Date	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**
	Gear	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**
	Habitat	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**
	% Subsampled	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Taxonomy												
Low Level	**High Level**											
Ephemoptera	Ephemoptera	0	1	0	0	0	0	0	0	0	0	0
	Ephemera simulans	0	0	0	0	0	0	0	0	0	1	0
Trichoptera	Trichoptera	0	1	5	0	0	0	0	0	0	0	0
	Micrasema sp.	0	0	0	0	0	0	0	0	0	0	0
	Lepidostoma sp.	0	0	0	0	0	0	0	0	0	0	0
	Ceraclea sp.	0	0	0	0	0	0	0	0	0	0	0
	Oecetis sp.	0	0	0	0	0	0	0	0	0	0	0
	Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	Coleoptera	0	0	0	0	0	6	5	0	1	2	3
	Chrysomelidae	0	0	0	0	0	2	0	1	6	1	5
	Curculionidae	0	0	0	0	0	1	1	0	3	1	0
	Dytiscidae	0	0	0	0	0	0	0	0	1	0	0
	Hydroporinae	0	0	0	0	0	0	0	0	0	0	0
	Dineutus sp.	0	0	0	0	0	0	0	0	0	0	0
	Staphylinidae	0	0	0	0	0	2	1	0	1	0	0
Diptera	Diptera	0	0	1	0	0	5	2	0	4	0	0
	Chironomini	0	3	8	0	0	3	2	2	0	0	3
	Chironomus sp.	1	0	0	0	0	0	0	0	0	0	0
	Parachironomus sp.	0	2	0	0	0	0	0	0	0	0	0
	Phaenopsectra sp.	0	0	0	0	0	0	0	0	0	0	0
	Micropsectra/	0	0	0	0	0	0	0	0	0	0	0

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	A2O20-011	B205-007	B205-012	B205-013	B205-014	B205-016	B205-017	B205-018	B205-019	B205-020	B205-021
	Date	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**	**19-07-2013**
	Gear	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**	**Gillnet**
	Habitat	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**	**Lake**
	% Subsampled	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Taxonomy												
Low Level	**High Level**											
	Tanytarsus											
	Ablabesmyia sp.	0	0	0	0	0	0	0	0	0	0	0
	Procladius sp.	0	0	0	0	0	0	0	0	0	0	0
	Corixidae	0	0	0	0	0	0	1	0	0	0	0
	Sigara sp.	0	0	0	0	0	0	0	0	0	3	0
	Gerridae	0	0	0	0	0	0	0	0	0	1	0
	Mesovelia sp.	0	0	0	0	0	0	1	0	0	0	0
	Saldidae	0	0	0	0	0	0	1	0	0	0	0
Amphipoda	Amphipoda	0	0	0	0	0	2	10	0	0	0	0
	Hyalella sp.	0	0	0	0	68	0	23	2	0	0	0
Veneroida	*Pisidium* sp.	0	0	0	0	0	0	0	0	0	0	0
Basommatophora	*Physa* sp.	0	0	0	0	0	1	0	0	0	0	0
Heterostropha	*Valvata* sp.	0	0	0	0	0	1	0	0	0	0	0
	All others	0	0	0	0	0	0	0	0	0	1	0

Table 5.12-3: Taxonomy of Rainbow Trout Stomachs, Tatelkuz Lake, July 2013 (continued)

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	B205-022	B205-023	B205-024	B205-025
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00
Taxonomy					
Low Level	**High Level**				
Ephemoptera	Ephemoptera	0	0	0	0
	Ephemera simulans	0	0	0	0
Trichoptera	Trichoptera	0	0	1	1
	Micrasema sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Ceraclea sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Polycentropodidae	0	0	0	0
Coleoptera	Coleoptera	0	8	1	12
	Chrysomelidae	0	5	0	1
	Curculionidae	0	1	0	1
	Dytiscidae	1	0	0	0
	Hydroporinae	0	0	0	0
	Dineutus sp.	0	0	0	0
	Staphylinidae	0	0	0	0
Diptera	Diptera	115	48	1	3
	Chironomini	0	0	1	26
	Chironomus sp.	0	0	0	0
	Parachironomus sp.	0	0	0	0
	Phaenopsectra sp.	0	0	0	0
	Micropsectra/ Tanytarsus	0	0	0	0
	Ablabesmyia sp.	0	0	1	0
	Procladius sp.	0	0	0	0
	Corixidae	0	0	0	0

	Water Body	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake	Tatelkuz Lake
	Fish ID	B205-022	B205-023	B205-024	B205-025
	Date	19-07-2013	19-07-2013	19-07-2013	19-07-2013
	Gear	Gillnet	Gillnet	Gillnet	Gillnet
	Habitat	Lake	Lake	Lake	Lake
	% Subsampled	100.00	100.00	100.00	100.00
Taxonomy					
Low Level	**High Level**				
	Sigara sp.	0	0	0	2
	Gerridae	0	0	0	0
	Mesovelia sp.	0	0	0	0
	Saldidae	0	0	0	0
Amphipoda	Amphipoda	0	0	0	0
	Hyalella sp.	0	0	0	0
Veneroida	*Pisidium* sp.	0	0	0	0
Basommatophora	*Physa* sp.	0	0	0	0
Heterostropha	*Valvata* sp.	0	0	0	0
	All others	0	1	0	0

Annex 5.13-1
Fish Tissue Metal Concentrations, Tatelkuz Lake, July 2013

Table 5.13-1A: Metal Concentrations in Rainbow Trout, Whole Body, Tatelkuz Lake, July 2013

Species		Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout
Sample ID		A2O15-001	G1N5-013	G1N5-014	G1N5-015	G1N5-016	G1N5-017	G1N5-018	G1N5-019	G1N5-020	G1N5-021	F2N5-072	F2N5-073	F2N5-074	H1O5-012	H1O5-013	H1O5-014	H1O5-015	C1N5NORD-005	C2N5-002	C2N5-003	C2N5-002
Tissue type		BLACKWATER GOLD PROJECT BASELINE REPORT	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE - SPLIT
Date Sampled		17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	18-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13
ALS Sample ID		ANNEX 5.11-6	L1342219-13	L1342219-14	L1342219-15	L1342219-16	L1342219-17	L1342219-18	L1342219-19	L1342219-20	L1342219-21	L1342219-34	L1342219-35	L1342219-36	L1342219-37	L1342219-38	L1342219-39	L1342219-40	L1342427-23	L1342448-15	L1342448-16	L1342448-18
Length (mm)		203	117	130	122	157	142	110	175	132	120	255	261	270	245	252	258	255	287	267	171	267
Physical Tests	**Units**																					
% Moisture	%	75.8	78.6	78.0	77.9	78.9	91.3	79.8	78.1	76.3	75.0	74.3	76.2	76.9	77.2	76.2	73.1	70.2	77.6	79.1	76.7	78.7
Total Metals																						
Aluminum (Al)	mg/kg wwt	0.95	1.14	3.09	<0.40	0.94	<0.40	0.64	0.53	<0.40	0.98	0.60	7.21	0.66	1.86	6.10	50.9	0.46	4.81	<0.40	0.96	0.41
Antimony (Sb)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt	0.0501	0.0419	0.0539	0.0187	0.0436	0.0244	0.0433	0.0265	0.0166	0.0369	0.0133	0.0293	0.0086	0.0094	0.0164	0.0695	0.0151	0.0167	0.0148	0.0119	0.0150
Barium (Ba)	mg/kg wwt	0.092	0.307	0.211	0.179	0.277	0.253	0.327	0.280	0.197	0.164	0.165	0.283	0.293	0.148	0.217	0.853	0.084	0.167	0.208	0.164	0.236
Beryllium (Be)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt	<0.0020	0.0033	0.0027	0.0035	0.0044	<0.0020	0.0027	0.0037	0.0024	0.0035	0.0033	0.0027	0.0036	0.0031	0.0035	0.0033	<0.0020	0.0029	0.0032	0.0040	0.0040
Calcium (Ca)	mg/kg wwt	2050	4320	5050	4340	4800	6370	4430	4570	5390	4830	2850	5180	8050	5070	2930	7220	2540	1790	6430	4210	7160
Cesium (Cs)	mg/kg wwt	0.0017	0.0016	0.0025	0.0046	0.0026	0.0037	0.0019	0.0016	0.0046	0.0025	0.0027	0.0032	0.0029	0.0025	0.0038	0.0061	0.0071	0.0031	0.0022	0.0031	0.0022
Chromium (Cr)	mg/kg wwt	0.121	0.025	0.014	<0.010	0.093	0.013	0.128	0.326	0.013	0.011	0.099	0.092	0.039	0.034	0.107	0.081	0.077	0.229	0.327	0.479	0.198
Cobalt (Co)	mg/kg wwt	0.0084	0.0108	0.0179	0.0312	0.0218	0.0095	0.0107	0.0077	0.0070	0.0147	0.0081	0.0095	0.0056	0.0053	0.0119	0.0280	0.0101	0.0171	0.0081	0.0076	0.0077
Copper (Cu)	mg/kg wwt	1.86	0.716	0.763	0.974	1.11	0.794	0.444	0.966	0.917	0.581	1.15	1.08	0.674	1.15	0.841	1.78	1.45	0.893	0.827	0.804	0.944
Gallium (Ga)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0131	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Iron (Fe)	mg/kg wwt	21.4	12.9	16.0	13.1	17.2	10.5	10.5	20.9	13.0	11.5	17.3	24.4	19.3	19.7	24.6	66.4	14.1	19.4	17.3	22.5	19.1
Lead (Pb)	mg/kg wwt	0.0052	0.0334	0.0214	0.0151	0.0144	0.0067	0.0387	0.0147	0.0169	0.0582	0.0751	0.0148	0.0485	0.0184	0.0332	0.0303	0.0239	0.0046	0.0256	0.0460	0.0343
Lithium (Li)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt	204	296	326	298	309	343	298	279	312	306	281	280	367	334	244	344	261	249	282	299	300
Manganese (Mn)	mg/kg wwt	0.923	4.27	5.25	7.04	11.6	4.51	4.98	2.82	2.15	4.36	0.903	1.45	1.54	1.49	1.91	3.86	0.885	2.03	1.35	3.16	1.46
Mercury (Hg)	mg/kg wwt	0.0654	0.0521	0.0368	0.0485	0.0350	0.0502	0.0489	0.0350	0.0448	0.0300	0.0559	0.0794	0.0515	0.0601	0.0709	0.0475	0.0721	0.0760	0.0802	0.0308	0.100
Molybdenum (Mo)	mg/kg wwt	0.0165	0.0088	0.0092	0.0091	0.0093	0.0093	0.0075	0.0116	0.0109	0.0104	0.0081	0.0112	0.0093	0.0067	0.0127	0.0204	0.0064	0.0149	0.0097	0.0112	0.0117
Nickel (Ni)	mg/kg wwt	0.059	<0.010	<0.010	0.015	0.012	<0.010	<0.010	<0.010	0.043	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	0.014	<0.010
Phosphorus (P)	mg/kg wwt	2850	3910	4520	3960	4270	5440	3940	4030	4640	4270	3310	4070	6310	4570	3210	5620	3140	2760	5220	4150	5550
Potassium (K)	mg/kg wwt	3320	3370	3690	3290	3580	3530	2810	3360	3520	3360	3540	3220	3440	3610	3660	3490	3460	3660	3520	3590	3630
Rhenium (Re)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt	1.41	1.32	3.14	3.65	3.13	2.00	1.44	1.48	2.13	2.68	1.67	1.51	1.60	1.52	1.75	3.00	2.34	2.10	1.36	1.76	1.35
Selenium (Se)	mg/kg wwt	0.241	0.245	0.204	0.189	0.196	0.216	0.257	0.251	0.158	0.213	0.212	0.212	0.204	0.291	0.209	0.265	0.175	0.215	0.254	0.176	0.245
Silver (Ag)	mg/kg wwt	0.0221	0.0075	0.0070	0.0112	0.0123	0.0068	0.0010	0.0083	0.0048	0.0044	0.0194	0.0162	0.0111	0.0137	0.0174	0.0142	0.0059	0.0192	0.0193	0.0062	0.0256
Sodium (Na)	mg/kg wwt	652	559	612	559	476	654	438	630	587	540	601	753	692	770	713	824	709	748	899	688	930
Strontium (Sr)	mg/kg wwt	1.78	4.84	4.85	4.25	5.39	6.82	4.33	4.30	5.11	4.39	2.49	4.52	6.63	4.17	2.56	9.75	2.40	1.60	5.36	3.69	5.82
Tellurium (Te)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt	0.00164	0.00226	0.00238	0.00139	0.00284	0.00175	0.00150	0.00108	0.00322	0.00128	0.00113	0.00150	0.00224	0.00142	0.00151	0.00307	0.00151	0.00154	0.00125	0.00129	0.00142
Thorium (Th)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0090	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Tin (Sn)	mg/kg wwt	0.051	<0.020	<0.020	<0.020	0.075	<0.020	<0.020	<0.020	<0.020	<0.020	0.045	0.053	0.042	0.045	0.049	0.032	0.031	0.023	0.042	<0.020	0.050
Uranium (U)	mg/kg wwt	<0.00040	0.00047	0.00112	0.00042	0.00061	0.00050	0.00072	0.00073	0.00057	0.00043	0.00099	0.00152	0.00351	0.00062	0.00134	0.00328	<0.00040	0.00106	0.00072	0.00051	0.00100
Vanadium (V)	mg/kg wwt	0.041	<0.020	0.023	<0.020	0.057	<0.020	<0.020	<0.020	<0.020	<0.020	0.038	0.129	0.065	0.037	0.054	0.417	0.055	0.087	0.035	<0.020	0.049
Yttrium (Y)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0031	<0.0020	<0.0020	0.0029	0.0331	<0.0020	0.0025	<0.0020	<0.0020	<0.0020
Zinc (Zn)	mg/kg wwt	39.9	27.1	23.3	21.8	22.2	23.9	25.6	29.2	27.0	22.8	30.5	39.1	35.8	36.9	31.5	46.4	29.8	36.7	44.0	30.3	52.1
Zirconium (Zr)	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.047	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals																						
Methyl Mercury	mg/kg wwt	-	-	-	-	-	-	-	-	-	-	0.0272	0.0426	0.0297	-	-	-	-	-	-	-	-
Aggregate Organics																						
Lipid Content	%wwt	7.0	1.8	1.9	2.9	3.3	3.4	1.1	1.2	2.0	3.1	4.3	5.2	3.7	3.0	2.5	2.8	6.9	3.5	1.2	1.7	1.3

Table 5.13-1B: Metal Concentrations in Rainbow Trout, Muscle, Tatelkuz Lake, July 2013

Species		Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout
Sample ID		G1N5-007	G1N5-008	G1N5-010	F2N5-067	F2N5-068	F2N5-069	F2N5-070	F2N5-071	H1O5-001	C2N5-001
Tissue type		BLACKWATER GOLD PROJECT BASELINE REPORT ANNEX 5.11-6	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE
Date Sampled			17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	19-JUL-13
ALS Sample ID			L1342219-9	L1342219-11	L1342219-22	L1342219-24	L1342219-26	L1342219-28	L1342219-30	L1342219-32	L1342448-13
Length (mm)			301	253	252	277	295	290	300	286	320	257
Physical Tests	**Units**										
% Moisture	%	76.2	79.2	77.3	77.1	77.2	79.3	76.4	78.6	77.5	76.6
Total Metals											
Aluminum (Al)	mg/kg wwt	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Antimony (Sb)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt	0.145	0.0051	0.0112	0.0102	0.308	0.0140	0.0062	0.0056	0.0137	0.0072
Barium (Ba)	mg/kg wwt	0.014	0.013	<0.010	0.011	0.011	<0.010	0.014	<0.010	<0.010	<0.010
Beryllium (Be)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Calcium (Ca)	mg/kg wwt	422	482	271	247	357	209	430	231	195	203
Cesium (Cs)	mg/kg wwt	0.0028	0.0027	0.0025	0.0057	0.0035	0.0028	0.0025	0.0036	0.0034	0.0071
Chromium (Cr)	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	0.014	<0.010	<0.010	<0.010
Cobalt (Co)	mg/kg wwt	0.0067	<0.0040	<0.0040	<0.0040	0.0056	<0.0040	<0.0040	0.0040	<0.0040	<0.0040
Copper (Cu)	mg/kg wwt	0.347	0.202	0.317	0.227	0.251	0.208	0.281	0.276	0.222	0.215
Gallium (Ga)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	0.0191	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Iron (Fe)	mg/kg wwt	4.02	3.04	3.93	2.92	3.80	3.85	4.70	3.41	3.33	3.12
Lead (Pb)	mg/kg wwt	0.0054	0.0056	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Lithium (Li)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt	294	261	271	294	297	226	271	267	271	281
Manganese (Mn)	mg/kg wwt	0.150	0.160	0.0972	0.128	0.129	0.0859	0.129	0.104	0.0647	0.101
Mercury (Hg)	mg/kg wwt	0.0506	0.0507	0.0593	0.0717	0.0424	0.0945	0.0632	0.0630	0.0754	0.0942
Molybdenum (Mo)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Nickel (Ni)	mg/kg wwt	<0.010	<0.010	0.011	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus (P)	mg/kg wwt	2420	2380	2380	2460	2470	2240	2310	2310	2350	2380
Potassium (K)	mg/kg wwt	4200	3720	4330	4350	4340	4360	4300	4090	4220	4350
Rhenium (Re)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt	3.27	1.60	2.18	2.59	2.03	1.55	1.48	1.73	1.86	3.57
Selenium (Se)	mg/kg wwt	0.321	0.163	0.199	0.138	0.376	0.139	0.158	0.181	0.090	0.204
Silver (Ag)	mg/kg wwt	0.0034	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Sodium (Na)	mg/kg wwt	389	299	438	427	478	624	490	429	516	432
Strontium (Sr)	mg/kg wwt	0.330	0.349	0.181	0.228	0.254	0.146	0.282	0.176	0.168	0.137
Tellurium (Te)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt	0.00307	0.00108	0.00155	0.00151	0.00248	0.00096	0.00108	0.00157	0.00122	0.00136
Thorium (Th)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Tin (Sn)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Vanadium (V)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Yttrium (Y)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc (Zn)	mg/kg wwt	3.64	3.76	4.23	3.88	4.76	4.45	4.54	3.93	4.27	4.03
Zirconium (Zr)	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals											
Methyl Mercury	mg/kg wwt	-	-	-	0.0214	0.0071	0.0135	-	-	-	-
Aggregate Organics											
Lipid Content	%wwt	1.0	1.6	1.0	2.2	1.9	0.6	1.8	1.2	<0.5	1.2

Table 5.13-1C: Metal Concentrations in Rainbow Trout, Liver, Tatelkuz Lake, July 2013

Species		Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout	Rainbow trout
Sample ID		G1N5-007	G1N5-008	G1N5-010	F2N5-067	F2N5-068	F2N5-069	F2N5-070	F2N5-071	H1O5-001	C2N5-001
Tissue type		BLACKWATER GOLD PROJECT BASELINE REPORT ANNEX 5.11-6	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER
Date Sampled			17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	19-JUL-13
ALS Sample ID			L1342219-10	L1342219-12	L1342219-23	L1342219-25	L1342219-27	L1342219-29	L1342219-31	L1342219-33	L1342448-14
Length (mm)			301	253	252	277	295	290	300	286	320	257
Physical Tests	**Units**										
% Moisture	%		77.3	77.0	78.2	78.6	76.9	76.3	76.1	77.0	76.2	76.1
Total Metals											
Aluminum (Al)	mg/kg wwt		0.43	0.73	<0.40	0.77	0.65	1.63	1.45	1.52	1.18	0.70
Antimony (Sb)	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt		0.0535	0.0156	0.0199	0.0141	0.0840	0.0146	0.0207	0.0154	0.0261	0.0160
Barium (Ba)	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt		0.0692	0.0399	0.0207	0.0267	0.0459	0.0625	0.0522	0.0339	0.0257	0.0315
Calcium (Ca)	mg/kg wwt		76.3	89	70.8	71.9	69	80.9	93.7	88.1	80.8	66.8
Cesium (Cs)	mg/kg wwt		0.0013	0.0016	0.0013	0.0030	0.0016	0.0013	0.0015	0.0018	0.0026	0.0037
Chromium (Cr)	mg/kg wwt		0.050	0.016	<0.010	0.011	0.036	0.017	0.015	0.011	0.015	<0.010
Cobalt (Co)	mg/kg wwt		0.0491	0.0146	0.0189	0.0181	&[Picture]	0.0168	0.0218	0.0242	0.0201	0.0206
Copper (Cu)	mg/kg wwt		160	52.9	44.9	68.4	Baseline Report	22.9	179	73.6	239	118
Gallium (Ga)	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Iron (Fe)	mg/kg wwt		301	241	168	145	257	230	402	343	461	177
Lead (Pb)	mg/kg wwt		0.0066	0.0242	0.0055	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0093	<0.0040
Lithium (Li)	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt		141	162	160	155	164	166	172	156	176	158
Manganese (Mn)	mg/kg wwt		0.785	1.20	0.953	0.965	0.890	0.878	0.971	0.756	0.927	0.868
Mercury (Hg)	mg/kg wwt		0.0902	0.107	0.129	0.163	0.0861	0.121	0.115	0.140	0.124	0.177
Molybdenum (Mo)	mg/kg wwt		0.242	0.211	0.182	0.177	0.192	0.187	0.276	0.192	0.318	0.220
Nickel (Ni)	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus (P)	mg/kg wwt		2910	3180	3230	2990	3300	3090	3450	2780	3200	2950
Potassium (K)	mg/kg wwt		3280	3280	2930	3240	3440	3220	3390	3350	3600	3300
Rhenium (Re)	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt		2.49	1.28	1.48	2.01	1.60	1.07	1.38	1.55	2.27	2.57
Selenium (Se)	mg/kg wwt		15.8	5.12	5.01	1.28	12.6	1.28	6.20	3.94	6.20	4.97
Silver (Ag)	mg/kg wwt		3.19	1.66	1.47	1.29	3.28	1.89	4.39	1.38	1.69	1.70
Sodium (Na)	mg/kg wwt		1500	1040	1400	1230	1640	1440	1740	1430	1350	1560
Strontium (Sr)	mg/kg wwt		0.064	0.086	0.058	0.063	0.062	0.056	0.090	0.064	0.092	0.051
Tellurium (Te)	mg/kg wwt		0.0091	<0.0040	<0.0040	<0.0040	0.0182	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt		0.0161	0.00660	0.0117	0.00671	0.0146	0.00374	0.00618	0.00723	0.0104	0.00326
Thorium (Th)	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Tin (Sn)	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)	mg/kg wwt		0.00148	0.00146	0.00041	0.00087	0.00118	0.00940	0.00417	0.00182	0.00269	0.00069
Vanadium (V)	mg/kg wwt		0.064	0.027	0.020	0.026	0.065	0.054	0.058	0.038	0.086	0.032
Yttrium (Y)	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	<0.0020
Zinc (Zn)	mg/kg wwt		23.6	20.2	22.9	21.6	23.5	41.8	28.3	27.8	28.8	22.4
Zirconium (Zr)	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.075	<0.040	<0.040	<0.040
Speciated Metals												
Methyl Mercury	mg/kg wwt		-	-	-	0.0634	0.0224	0.0155	-	-	-	-
Aggregate Organics												
Lipid Content	%wwt		-	-	-	-	-	-	-	-	-	-

Table 5.13-1D: Metal Concentrations in Mountain Whitefish, Whole Body, Tatelkuz Lake, July 2013

Species		Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish
Sample ID		B1O15-002	B1O15-003	B1O15-004	B1O15-005	B1O15-006	H1O25-002	I2O15-005	I2O15-006	I2O15-007	I2O15-008	I2O15-009	A2O20-003	A2O20-004	A2O20-005	A2O20-006	D1N10-001	D1N10-004	I1O20-001	G2N10-003	A2O20-003
Tissue type		BLACKWATER GOLD PROJECT BASELINE REPORT	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE FISH	WHOLE - SPLIT
Date Sampled			17-JUL-13	17-JUL-13	17-JUL-13	17-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13
ALS Sample ID		ANNEX 5.11-6	L1342219-2	L1342219-3	L1342219-4	L1342219-5	L1342427-1	L1342427-6	L1342427-7	L1342427-8	L1342427-9	L1342427-10	L1342448-5	L1342448-6	L1342448-7	L1342448-8	L1342448-9	L1342448-10	L1342448-11	L1342448-12	L1342448-17
Length (mm)		251	225	215	215	180	124	230	232	228	234	133	282	267	170	133	191	128	170	166	282
Physical Tests	**Units**																				
% Moisture	%	73.3	72.9	71.0	76.6	74.8	75.0	76.2	77.7	73.0	76.2	77.0	74.5	71.7	76.4	77.0	73.6	70.1	77.9	75.4	72.4
Total Metals																					
Aluminum (Al)	mg/kg wwt	8.33	1.16	2.99	1.50	70.2	83.8	24.9	2.02	0.79	16.3	23.8	17.3	6.08	0.56	23.2	4.85	0.97	44.1	4.57	23.6
Antimony (Sb)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt	0.0319	0.100	0.147	0.0415	0.0732	0.0894	0.0416	0.0253	0.0472	0.0361	0.0627	0.0381	0.0367	0.0373	0.0558	0.0521	0.0840	0.0598	0.0387	0.0324
Barium (Ba)	mg/kg wwt	0.464	0.132	0.232	0.150	0.750	0.793	0.444	0.376	0.116	0.242	0.501	0.572	0.305	0.225	0.395	1.18	0.185	0.431	0.185	0.435
Beryllium (Be)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt	0.0023	<0.0020	<0.0020	<0.0020	0.0045	0.0030	0.0032	0.0037	<0.0020	<0.0020	0.0136	0.0026	0.0023	<0.0020	<0.0020	0.0039	0.0026	<0.0020	<0.0020	0.0029
Calcium (Ca)	mg/kg wwt	7900	4000	7110	4320	6240	7610	5580	7710	6260	4110	6370	6810	4720	7830	6150	6750	7080	4060	5640	3070
Cesium (Cs)	mg/kg wwt	0.0027	0.0024	0.0046	0.0021	0.0053	0.0065	0.0032	0.0021	0.0014	0.0025	0.0029	0.0034	0.0031	0.0020	0.0031	0.0016	0.0017	0.0044	0.0018	0.0039
Chromium (Cr)	mg/kg wwt	0.130	0.060	0.026	0.049	0.127	0.088	0.085	0.090	0.070	0.117	0.040	0.304	0.024	0.067	0.082	0.266	0.049	0.157	0.446	0.285
Cobalt (Co)	mg/kg wwt	0.0151	0.0073	0.0089	0.0097	0.0408	0.0316	0.0195	0.0102	0.0096	0.0141	0.0245	0.0187	0.0114	0.0116	0.0177	0.0133	0.0113	0.0224	0.0096	0.0214
Copper (Cu)	mg/kg wwt	0.386	0.407	0.401	0.355	0.470	0.554	0.448	0.320	0.449	0.404	0.631	0.435	0.363	0.430	0.432	0.453	0.418	0.499	0.401	0.431
Gallium (Ga)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	0.0190	0.0223	0.0062	<0.0040	<0.0040	0.0048	0.0077	0.0042	<0.0040	<0.0040	0.0059	<0.0040	<0.0040	0.0111	<0.0040	0.0062
Iron (Fe)	mg/kg wwt	25.8	10.8	12.9	11.7	131	100	44.7	14.1	11.9	39.3	44.2	44.7	18.1	12.5	46.4	23.5	13.5	69.1	20.6	53.0
Lead (Pb)	mg/kg wwt	0.0166	0.0100	0.0076	<0.0040	0.0460	0.0829	0.0113	0.0057	0.0041	0.0073	0.155	0.0392	0.0071	0.0158	0.0557	0.120	0.290	0.0270	0.0145	0.0452
Lithium (Li)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt	348	295	334	281	326	416	306	346	337	287	314	331	302	359	329	343	332	297	318	275
Manganese (Mn)	mg/kg wwt	9.30	1.82	3.52	2.39	21.5	6.22	7.19	4.06	0.993	3.73	4.50	8.12	5.40	5.78	10.3	18.3	1.69	6.55	4.66	7.23
Mercury (Hg)	mg/kg wwt	0.0364	0.0241	0.0300	0.0402	0.0284	0.0432	0.0525	0.0532	0.0417	0.0500	0.0209	0.0302	0.0465	0.0473	0.0277	0.0330	0.0447	0.0415	0.0349	0.0353
Molybdenum (Mo)	mg/kg wwt	0.0076	0.0062	0.0110	0.0051	0.0120	0.0167	0.0083	0.0044	0.0044	0.0050	0.0128	0.0081	0.0121	0.0055	0.0090	0.0547	0.0109	0.0183	0.0195	0.0084
Nickel (Ni)	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	0.057	0.069	0.014	<0.010	<0.010	0.010	0.024	0.019	<0.010	<0.010	0.025	0.076	<0.010	0.090	0.155	0.027
Phosphorus (P)	mg/kg wwt	5990	3980	5580	3970	4870	6300	4540	5880	5290	3780	4810	5420	4220	6240	5420	5640	5820	3800	4700	3470
Potassium (K)	mg/kg wwt	3610	3740	3360	3410	3660	4170	3550	3180	3810	3490	2430	3460	3770	3980	3650	3790	3550	3510	3440	3640
Rhenium (Re)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt	1.42	2.82	3.00	1.58	1.84	1.79	1.36	1.04	1.64	1.11	0.876	1.40	1.55	1.78	2.00	1.55	1.57	1.63	1.92	1.44
Selenium (Se)	mg/kg wwt	0.235	0.121	0.153	0.220	0.145	0.247	0.185	0.250	0.199	0.187	0.156	0.209	0.224	0.219	0.181	0.179	0.271	0.389	0.155	0.191
Silver (Ag)	mg/kg wwt	<0.0010	<0.0010	<0.0010	0.0011	0.0038	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.0012	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Sodium (Na)	mg/kg wwt	622	569	604	719	558	751	722	805	685	710	<800	734	752	818	727	595	760	729	754	688
Strontium (Sr)	mg/kg wwt	6.62	3.47	6.46	3.55	5.30	7.46	4.90	6.93	5.45	3.39	4.64	5.69	4.07	7.30	5.58	5.26	6.56	3.84	4.84	2.59
Tellurium (Te)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt	0.00173	0.00197	0.00308	0.00176	0.00281	0.00266	0.00138	0.00199	0.00119	0.00139	0.00174	0.00270	0.00210	0.00142	0.00263	0.00153	0.00190	0.00115	0.00213	0.00258
Thorium (Th)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	0.0090	0.0034	0.0025	<0.0020	<0.0020	<0.0020	0.0030	0.0023	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	0.0053	<0.0020	0.0024
Tin (Sn)	mg/kg wwt	0.035	0.024	0.031	0.025	<0.020	<0.020	0.037	0.027	0.043	0.027	0.132	0.020	0.030	<0.020	<0.020	0.056	0.021	0.036	<0.020	0.023
Uranium (U)	mg/kg wwt	0.00543	<0.00040	0.00162	0.00082	0.00488	0.00299	0.00488	0.00648	0.00076	0.00274	0.00223	0.00851	0.00476	0.00112	0.00263	0.00314	0.00044	0.00370	0.00058	0.00564
Vanadium (V)	mg/kg wwt	0.148	0.032	0.055	0.051	0.243	0.283	0.128	0.068	0.060	0.104	0.086	0.179	0.110	0.029	0.073	0.033	<0.020	0.138	0.022	0.207
Yttrium (Y)	mg/kg wwt	0.0114	<0.0020	<0.0020	0.0021	0.0488	0.0268	0.0143	<0.0020	<0.0020	0.0102	0.0172	0.0117	0.0072	<0.0020	0.0137	0.0060	<0.0020	0.0266	0.0036	0.0151
Zinc (Zn)	mg/kg wwt	18.3	17.4	14.4	17.4	15.7	25.3	18.5	16.4	16.6	14.5	15.8	14.6	12.7	18.3	19.9	17.7	20.7	11.3	17.3	14.9
Zirconium (Zr)	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	0.068	<0.040	0.044	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.052	<0.040	<0.040
Speciated Metals																					
Methyl Mercury	mg/kg wwt	-	-	-	-	-	-	-	-	-	0.0298	-	0.0116	0.0181	-	-	-	-	-	-	0.0186
Aggregate Organics																					
Lipid Content	%wwt	6.6	6.2	5.5	4.4	3.3	2.5	2	2.8	4.7	2.9	3.0	4.0	5.0	1.5	1.8	4.3	1.3	2.6	4.4	5.3

Table 5.13-1E: Metal Concentrations in Mountain Whitefish, Muscle, Tatelkuz Lake, July 2013

Species		Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish
Sample ID		I2O15-003	I2O15-004	B1N10-002	B1N10-003	B1N10-004	B1N10-005	C1N5NORD-003	C1N5NORD-004	A2O20-001	A2O20-002
Tissue type		BLACKWATER GOLD PROJECT BASELINE REPORT	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE	MUSCLE
Date Sampled		ANNEX 5.11-6	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	19-JUL-13	19-JUL-13
ALS Sample ID			L1342427-4	L1342427-11	L1342427-13	L1342427-15	L1342427-17	L1342427-19	L1342427-21	L1342448-1	L1342448-3
Length (mm)		285	246	293	296	271	235	244	246	347	285
Physical Tests	**Units**										
% Moisture	%	76.3	77.8	75.0	77.6	75.9	77.0	77.1	77.6	78.6	78.7
Total Metals											
Aluminum (Al)	mg/kg wwt	<0.40	<0.40	<0.40	<0.40	<0.40	1.49	1.51	<0.40	<0.40	0.76
Antimony (Sb)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt	0.0152	0.0252	0.0116	0.347	0.0126	0.0236	0.0195	0.0245	0.0132	0.0208
Barium (Ba)	mg/kg wwt	0.011	0.013	<0.010	0.010	0.011	0.039	0.032	0.025	0.020	0.020
Beryllium (Be)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Calcium (Ca)	mg/kg wwt	310	215	312	306	484	340	642	440	310	373
Cesium (Cs)	mg/kg wwt	0.0014	0.0030	0.0017	0.0064	0.0014	0.0034	0.0026	0.0032	0.0032	0.0034
Chromium (Cr)	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (Co)	mg/kg wwt	<0.0040	0.0080	<0.0040	<0.0040	<0.0040	0.0064	0.0050	<0.0040	0.0054	0.0043
Copper (Cu)	mg/kg wwt	0.266	0.265	0.238	0.239	0.280	0.227	0.188	0.246	0.236	0.233
Gallium (Ga)	mg/kg wwt	0.0188	<0.0040	0.0201	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Iron (Fe)	mg/kg wwt	4.55	3.49	3.15	3.93	2.81	4.60	4.15	3.42	3.57	4.84
Lead (Pb)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0115	<0.0040	<0.0040	<0.0040	<0.0040
Lithium (Li)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt	287	241	308	278	277	289	281	303	282	288
Manganese (Mn)	mg/kg wwt	0.227	0.227	0.122	0.135	0.183	0.410	0.510	0.364	0.183	0.368
Mercury (Hg)	mg/kg wwt	0.0476	0.0548	0.0414	0.0518	0.0436	0.0270	0.0370	0.0358	0.0820	0.0654
Molybdenum (Mo)	mg/kg wwt	<0.0040	0.0043	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Nickel (Ni)	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.376	<0.010	<0.010
Phosphorus (P)	mg/kg wwt	2380	2180	2550	2290	2520	2480	2450	2490	2360	2440
Potassium (K)	mg/kg wwt	4320	4010	4730	3820	4750	4620	4050	4490	4190	4250
Rhenium (Re)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt	1.34	1.31	1.81	4.15	2.03	1.48	1.47	1.68	1.52	1.95
Selenium (Se)	mg/kg wwt	0.128	0.151	0.097	0.095	0.100	0.166	0.136	0.145	0.163	0.133
Silver (Ag)	mg/kg wwt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Sodium (Na)	mg/kg wwt	408	445	462	499	466	438	408	473	534	421
Strontium (Sr)	mg/kg wwt	0.212	0.159	0.195	0.215	0.314	0.232	0.426	0.307	0.198	0.309
Tellurium (Te)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt	0.00051	0.00110	0.00139	0.00179	0.00114	0.00177	0.00089	0.00137	0.00150	0.00135
Thorium (Th)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Tin (Sn)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00045	<0.00040
Vanadium (V)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Yttrium (Y)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc (Zn)	mg/kg wwt	4.00	3.50	3.89	5.14	5.02	3.94	3.48	4.11	3.70	3.93
Zirconium (Zr)	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals											
Methyl Mercury	mg/kg wwt	-	-	0.0113	0.0106	-	-	-	-	0.0163	-
Aggregate Organics											
Lipid Content	%wwt	1.3	2.0	1.7	5.3	1.4	1.8	3.1	1.7	0.7	1.4

Table 5.13-1F: Metal Concentrations in Mountain Whitefish, Liver, Tatelkuz Lake, July 2013

Species		Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish	Mountain whitefish
Sample ID		I2O15-003	I2O15-004	B1N10-002	B1N10-003	B1N10-004	B1N10-005	C1N5NORD-003	C1N5NORD-004	A2O20-001	A2O20-002
Tissue type		GOLD PROJECT BASELINE REPORT	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER	LIVER
Date Sampled		ANNEX 5.11-6	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	18-JUL-13	19-JUL-13	19-JUL-13
ALS Sample ID		285	L1342427-5	L1342427-12	L1342427-14	L1342427-16	L1342427-18	L1342427-20	L1342427-22	L1342448-2	L1342448-4
Length (mm)			246	293	296	271	235	244	246	347	285
Physical Tests	**Units**										
% Moisture	%	74.6	72.0	76.3	74.1	77.3	74.5	75.0	74.8	75.4	74.0
Total Metals											
Aluminum (Al)	mg/kg wwt	0.74	2.07	0.43	<0.40	<0.40	<0.40	7.79	<0.40	7.58	1.28
Antimony (Sb)	mg/kg wwt	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)	mg/kg wwt	0.0481	0.0264	0.0276	0.118	0.0328	0.0526	0.0417	0.0237	0.0350	0.0214
Barium (Ba)	mg/kg wwt	0.017	0.025	<0.010	<0.010	<0.010	0.020	0.045	<0.010	0.070	0.011
Beryllium (Be)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg wwt	0.0112	0.0093	0.0140	0.0067	0.0066	0.0092	0.0046	0.0067	0.0165	0.0173
Calcium (Ca)	mg/kg wwt	127	56.9	66.6	49.5	66.1	98.6	74.4	67.5	63.3	50.2
Cesium (Cs)	mg/kg wwt	0.0011	0.0022	<0.0010	0.0059	<0.0010	0.0021	0.0019	0.0024	0.0018	0.0017
Chromium (Cr)	mg/kg wwt	0.014	0.011	0.018	<0.010	<0.010	<0.010	0.011	<0.010	0.015	<0.010
Cobalt (Co)	mg/kg wwt	0.0298	0.0521	0.0193	0.0181	0.0129	0.0390	0.0592	0.0225	0.0416	0.0345
Copper (Cu)	mg/kg wwt	2.27	1.82	1.24	1.68	1.28	2.20	1.73	1.72	1.82	1.60
Gallium (Ga)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0051	<0.0040	<0.0040	<0.0040
Iron (Fe)	mg/kg wwt	155	72.1	67.3	73.1	62.3	57.3	158	68.2	85.6	71.0
Lead (Pb)	mg/kg wwt	0.0126	<0.0040	0.0192	0.0079	0.0055	0.0423	0.0088	<0.0040	0.0076	0.0055
Lithium (Li)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Magnesium (Mg)	mg/kg wwt	204	266	220	195	182	173	182	178	180	220
Manganese (Mn)	mg/kg wwt	1.34	2.61	1.57	1.16	1.02	1.80	1.83	0.993	1.44	2.31
Mercury (Hg)	mg/kg wwt	0.183	0.139	0.126	0.112	0.135	0.107	0.173	0.0779	0.186	0.214
Molybdenum (Mo)	mg/kg wwt	0.209	0.187	0.111	0.121	0.0798	0.185	0.142	0.117	0.177	0.142
Nickel (Ni)	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	0.011	<0.010
Phosphorus (P)	mg/kg wwt	4060	4560	4110	3690	3480	3380	3260	3310	3380	4110
Potassium (K)	mg/kg wwt	4610	4620	4540	3890	3550	3240	3650	3900	4090	4810
Rhenium (Re)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Rubidium (Rb)	mg/kg wwt	2.90	3.09	3.23	8.74	2.91	1.62	1.72	2.88	3.48	3.54
Selenium (Se)	mg/kg wwt	0.911	0.943	0.500	0.502	0.565	0.688	0.840	0.740	1.12	0.850
Silver (Ag)	mg/kg wwt	0.0258	0.0048	0.0026	0.0012	0.0072	0.0131	0.0041	0.0119	0.0042	0.0065
Sodium (Na)	mg/kg wwt	1110	750	1030	1100	1490	1880	1670	1500	1300	1020
Strontium (Sr)	mg/kg wwt	0.119	0.051	0.047	0.047	0.048	0.085	0.063	0.051	0.050	0.038
Tellurium (Te)	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)	mg/kg wwt	0.00261	0.00535	0.00262	0.0102	0.00344	0.00515	0.00521	0.00561	0.00473	0.00351
Thorium (Th)	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0079	<0.0020
Tin (Sn)	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)	mg/kg wwt	0.00505	0.00545	0.00371	0.00131	0.00043	0.00390	0.00131	0.00118	0.0114	0.00292
Vanadium (V)	mg/kg wwt	0.068	0.047	0.027	0.027	<0.020	0.031	0.121	<0.020	0.068	0.039
Yttrium (Y)	mg/kg wwt	0.0068	0.0027	<0.0020	<0.0020	<0.0020	0.0026	0.0055	<0.0020	0.0079	<0.0020
Zinc (Zn)	mg/kg wwt	21.7	24.0	18.2	21.0	18.5	20.5	19.1	19.2	20.8	18.9
Zirconium (Zr)	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals											
Methyl Mercury	mg/kg wwt	-	-	0.0413	0.0326	-	-	-	-	0.0669	-
Aggregate Organics											
Lipid Content	%wwt	-	-	-	-	-	-	-	-	-	-

Annex 5.13-2
Statistical Analysis of Fish Tissue Metal Concentrations, Tatelkuz Lake, July 2013

Annex 5.13-2: Statistical Analysis of Metal Concentr'ns in Rainbow Trout Mntn Whitefish, Tatelkuz Lake, July 2013

Species		Rainbow trout					Rainbow trout					Rainbow trout					Mountain whitefish					Mountain whitefish					Mountain whitefish				
Tissue type		WHOLE FISH					MUSCLE					LIVER					WHOLE FISH					MUSCLE					LIVER				
Variable	Units	FoD	Mean	SE	min	max	FoD	Mean	SE	min	max	FoD	Mean	SE	min	max	FoD	Mean	SE	min	max	FoD	Mean	SE	min	max	FoD	Mean	SE	min	max
Length	mm	21/21	200	14	110	287	10/10	283	7	252	320	10/10	283	7	252	320	20/20	203	11	124	282	10/10	275	11	235	347	10/10	275	11	235	347
Moisture	%	21/21	77.4	0.8	70.2	91.3	10/10	77.5	0.4	76.2	79.3	10/10	77.0	0.3	76.1	78.6	20/20	74.6	0.5	70.1	77.9	10/10	77.2	0.4	75.0	78.7	10/10	74.8	0.4	72.0	77.3
Aluminum (Al)	mg/kg wwt	17/21	4.84	2.63	0.41	50.90	0/10	<0.40	ND	ND	ND	9/10	1.01	0.14	0.43	1.63	20/20	18.05	5.23	0.56	83.80	3/10	1.25	0.14	0.76	1.51	6/10	3.32	1.08	0.43	7.79
Antimony (Sb)	mg/kg wwt	0/21	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	1/10	0.0023	ND	0.0023	0.0023	0/20	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	1/10	0.0023	ND	0.0023	0.0023
Arsenic (As)	mg/kg wwt	21/21	0.0274	0.0037	0.0086	0.0695	10/10	0.0526	0.0314	0.0051	0.3080	10/10	0.0280	0.0073	0.0141	0.0840	20/20	0.0565	0.0066	0.0253	0.1470	10/10	0.0513	0.0329	0.0116	0.3470	10/10	0.0427	0.0090	0.0214	0.1180
Barium (Ba)	mg/kg wwt	21/21	0.243	0.034	0.084	0.853	510	0.013	0.0005	0.011	0.014	0/10	<0.010	ND	ND	ND	20/20	0.406	0.059	0.116	1.180	9/10	0.020	0.003	0.010	0.039	6/10	0.031	0.007	0.011	0.070
Beryllium (Be)	mg/kg wwt	0/21	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/20	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND
Bismuth (Bi)	mg/kg wwt	0/21	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/20	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND
Boron (B)	mg/kg wwt	0/21	#DIV/0!	ND	ND	ND	0/10	<0.20	ND	ND	ND	0/10	<0.20	ND	ND	ND	0/20	<0.20	ND	ND	ND	0/10	<0.20	ND	ND	ND	0/10	<0.20	ND	ND	ND
Cadmium (Cd)	mg/kg wwt	18/21	0.0033	0.0001	0.0024	0.0044	0/10	<0.0020	ND	ND	ND	10/10	0.0408	0.0052	0.0207	0.0692	10/20	0.0041	0.0007	0.0023	0.0136	0/10	<0.0020	ND	ND	ND	10/10	0.0102	0.0014	0.0046	0.0173
Calcium (Ca)	mg/kg wwt	21/21	4742	371	1790	8050	10/10	305	34	195	482	10/10	78.7	2.9	66.8	93.7	20/20	5966	329	3070	7900	10/10	373	38	215	642	10/10	72.0	7.5	49.5	127.0
Cesium (Cs)	mg/kg wwt	21/21	0.0032	0.0003	0.0016	0.0071	10/10	0.0037	0.0005	0.0025	0.0071	10/10	0.0020	0.0003	0.0013	0.0037	19/20	0.0030	0.0003	0.0014	0.0065	10/10	0.0030	0.0005	0.0014	0.0064	8/10	0.0024	0.0005	0.0011	0.0059
Chromium (Cr)	mg/kg wwt	20/21	0.125	0.028	0.011	0.479	2/10	0.013	0.000	0.012	0.014	8/10	0.021	0.004	0.011	0.050	19/20	0.128	0.025	0.024	0.446	0/10	<0.010	ND	ND	ND	5/10	0.014	0.001	0.011	0.018
Cobalt (Co)	mg/kg wwt	21/21	0.0123	0.0016	0.0053	0.0312	3/10	0.0054	0.0004	0.0040	0.0067	10/10	0.0256	0.0042	0.0146	0.0520	19/20	0.0164	0.0019	0.0073	0.0408	5/10	0.0058	0.0005	0.0043	0.0080	10/10	0.0329	0.0048	0.0129	0.0592
Copper (Cu)	mg/kg wwt	21/21	0.987	0.077	0.444	1.860	10/10	0.255	0.016	0.202	0.347	10/10	106	22	23	239	20/20	0.434	0.015	0.320	0.631	10/10	0.242	0.008	0.188	0.280	10/10	1.74	0.10	1.24	2.27
Gallium (Ga)	mg/kg wwt	1/21	0.0131	ND	0.0131	0.0131	1/10	0.0191	ND	0.0191	0.0191	0/10	<0.0040	ND	0.0000	0.0000	8/20	0.0097	0.0015	0.0042	0.0223	2/10	0.0195	0.0003	0.0188	0.0201	1/10	0.0051	ND	0.0051	0.0051
Iron (Fe)	mg/kg wwt	21/21	19.6	2.5	10.5	66.4	10/10	3.61	0.17	2.92	4.70	10/10	273	33	145	461	20/20	37.4	7.2	10.8	131.0	10/10	3.85	0.21	2.81	4.84	10/10	87.0	11.8	57.3	158.0
Lead (Pb)	mg/kg wwt	21/21	0.0276	0.0040	0.0046	0.0751	2/10	0.0055	0.0000	0.0054	0.0056	4/10	0.0114	0.0027	0.0055	0.0242	19/20	0.0506	0.0159	0.0041	0.2900	1/10	0.0115	ND	0.0115	0.0115	8/10	0.0137	0.0039	0.0055	0.0423
Lithium (Li)	mg/kg wwt	0/21	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND	0/20	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND
Magnesium (Mg)	mg/kg wwt	21/21	296	8	204	367	10/10	273	7	226	297	10/10	161	3	141	176	20/20	324	7	275	416	10/10	283	6	241	308	10/10	200	9	173	266
Manganese (Mn)	mg/kg wwt	21/21	3.24	0.56	0.89	11.60	10/10	0.115	0.009	0.06	0.16	10/10	0.919	0.039	0.76	1.20	20/20	6.66	1.16	0.99	21.50	10/10	0.273	0.041	0.122	0.510	10/10	1.61	0.17	0.99	2.61
Mercury (Hg)	mg/kg wwt	21/21	0.0558	0.0041	0.0300	0.1000	10/10	0.0665	0.0056	0.0424	0.0945	10/10	0.1252	0.0092	0.0861	0.1770	20/20	0.0381	0.0021	0.0209	0.0532	10/10	0.0486	0.0050	0.0270	0.0820	10/10	0.145	0.013	0.078	0.214
Molybdenum (Mo)	mg/kg wwt	21/21	0.0107	0.0007	0.0064	0.0204	0/10	<0.0040	ND	ND	ND	10/10	0.220	0.015	0.177	0.318	19/20	0.0120	0.0025	0.0044	0.0547	1/10	0.0043	ND	0.0043	0.0043	10/10	0.147	0.013	0.080	0.209
Nickel (Ni)	mg/kg wwt	6/21	0.028	0.004	0.012	0.059	2/10	0.013	0.001	0.011	0.014	0/10	<0.010	ND	ND	ND	10/20	0.051	0.010	0.010	0.155	1/10	0.376	ND	0.376	0.376	2/10	0.011	0.0002	0.010	0.011
Phosphorus (P)	mg/kg wwt	21/21	4273	208	2760	6310	10/10	2370	22	2240	2470	10/10	3108	64	2780	3450	20/20	4986	200	3470	6300	10/10	2414	36	2180	2550	10/10	3734	141	3260	4560
Potassium (K)	mg/kg wwt	21/21	3460	43	2810	3690	10/10	4226	63	3720	4360	10/10	3303	55	2930	3600	20/20	3560	78	2430	4170	10/10	4323	101	3820	4750	10/10	4090	169	3240	4810
Rhenium (Re)	mg/kg wwt	0/21	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/20	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND
Rubidium (Rb)	mg/kg wwt	21/21	2.02	0.15	1.32	3.65	10/10	2.19	0.23	1.48	3.57	10/10	1.77	0.17	1.07	2.57	20/20	1.67	0.11	0.88	3.00	10/10	1.87	0.26	1.31	4.15	10/10	3.41	0.63	1.62	8.74
Selenium (Se)	mg/kg wwt	21/21	0.220	0.007	0.158	0.291	10/10	0.197	0.028	0.090	0.376	10/10	6.24	1.46	1.28	15.80	20/20	0.206	0.013	0.121	0.389	10/10	0.131	0.008	0.095	0.166	10/10	0.766	0.065	0.500	1.120
Silver (Ag)	mg/kg wwt	21/21	0.0121	0.0015	0.0010	0.0256	1/10	0.0034	ND	0.0034	0.0034	10/10	2.19	0.33	1.29	4.39	4/20	0.0017	0.0003	0.0011	0.0038	0/10	<0.0010	ND	ND	ND	10/10	0.0081	0.0023	0.0012	0.0258
Sodium (Na)	mg/kg wwt	21/21	668	28	438	930	10/10	452	27	299	624	10/10	1433	63	1040	1740	20/20	700	17	558	818	10/10	455	13	408	534	10/10	1285	109	750	1880
Strontium (Sr)	mg/kg wwt	21/21	4.53	0.41	1.60	9.75	10/10	0.225	0.024	0.137	0.349	10/10	0.069	0.005	0.051	0.092	20/20	5.20	0.32	2.59	7.46	10/10	0.257	0.025	0.159	0.426	10/10	0.060	0.008	0.038	0.119
Tellurium (Te)	mg/kg wwt	0/21	<0.0040	ND	ND	ND	0/10	<0.0040	ND	ND	ND	2/10	0.0137	0.0020	0.0091	0.0182	0/20	<0.0040	ND	ND	ND	0/10	<0.0040	ND	ND	ND	0/10	<0.0040	ND	ND	ND
Thallium (Tl)	mg/kg wwt	21/21	0.00177	0.00014	0.00108	0.00322	10/10	0.00159	0.00021	0.00096	0.00307	10/10	0.00865	0.00138	0.00326	0.01610	19/20	0.00199	0.00013	0.00115	0.00308	10/10	0.00128	0.00012	0.00051	0.00179	10/10	0.00484	0.00069	0.00261	0.01020
Thorium (Th)	mg/kg wwt	1/21	0.0090	ND	0.0090	0.0090	0/10	<0.0020	ND	ND	ND	0/10	<0.0020	ND	ND	ND	7/20	0.0038	0.0005	0.0023	0.0090	0/10	<0.0020	ND	ND	ND	1/10	0.0079	ND	0.0079	0.0079
Tin (Sn)	mg/kg wwt	12/21	0.045	0.003	0.023	0.075	0/10	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND	14/20	0.038	0.006	0.020	0.132	0/10	<0.020	ND	ND	ND	0/10	<0.020	ND	ND	ND
Uranium (U)	mg/kg wwt	19/21	0.00106	0.00019	0.00042	0.00351	0/10	<0.00040	ND	ND	ND	10/10	0.00242	0.00085	0.00041	0.00940	18/20	0.00333	0.00051	0.00044	0.00851	1/10	0.00045	ND	0.00045	0.00045	10/10	0.00367	0.00102	0.00043	0.01140
Vanadium (V)	mg/kg wwt	13/21	0.084	0.023	0.023	0.417	0/10	<0.020	ND	ND	ND	10/10	0.047	0.007	0.020	0.086	18/20	0.108	0.017	0.022	0.283	0/10	<0.020	ND	ND	ND	8/10	0.054	0.010	0.027	0.121
Yttrium (Y)	mg/kg wwt	4/21	0.0104	0.0033	0.0025	0.0331	0/10	<0.0020	ND	ND	ND	1/10	0.0033	ND	0.0033	0.0033	14/20	0.0153	0.0027	0.0021	0.0488	0/10	<0.0020	ND	ND	ND	5/10	0.0051	0.0008	0.0026	0.0079
Zinc (Zn)	mg/kg wwt	21/21	32.2	1.9	21.8	52.1	10/10	4.15	0.11	3.64	4.76	10/10	26.09	1.98	20.20	41.80	20/20	16.9	0.7	11.3	25.3	10/10	4.07	0.18	3.48	5.14	10/10	20.19	0.56	18.20	24.00
Zirconium (Zr)	mg/kg wwt	1/21	0.047	ND	0.047	0.047	0/10	#DIV/0!	ND	ND	ND	1/10	0.075	ND	0.075	0.075	3/20	0.055	0.003	0.044	0.068	0/10	<0.040	ND	ND	ND	0/10	<0.040	ND	ND	ND
Methyl Mercury	mg/kg wwt	3/3	0.0332	0.0048	0.0	0.0	3/3	0.0140	0.0041	0.0071	0.0214	3/3	0.0338	0.0149	0.0155	0.0634	4/4	0.0195	0.0038	0.0116	0.0298	3/3	0.0127	0.0018	0.0106	0.0163	3/3	0.0469	0.0103	0.0326	0.0669

mm = millimetres, mg = milligram, kg = kilogram, wwt = wet weight, n = sample size, MDL = method detection limit, FoD = frequency of detection (=[n>MDL]/n), SE = standard error, min= minimum, max = maximum.

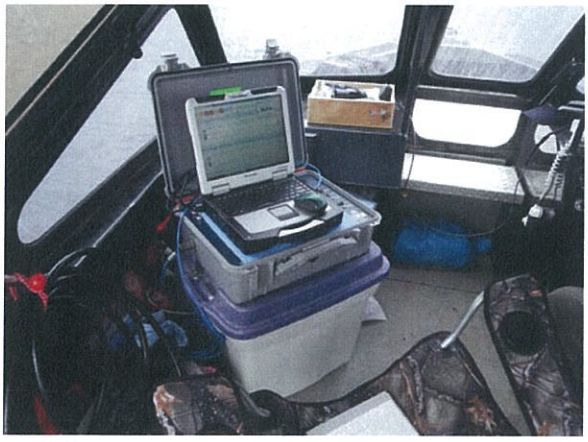
ND = Not Detected, Dashes indicate no data available.

Annex 5.14-1
Abundance and Distribution of Fish in Tatelkuz Lake, BC, in July 2013 from Coordinated Acoustic and Gill Net Surveys

ABUNDANCE AND DISTRIBUTION OF FISH IN TATELKUZ LAKE, BC IN JULY 2013 FROM COORDINATED ACOUSTIC AND GILL NET SURVEYS

Final Report
November 30, 2013





SHUKSAN

ABUNDANCE AND DISTRIBUTION OF FISH IN TATELKUZ LAKE, BC IN JULY 2013 FROM COORDINATED ACOUSTIC AND GILL NET SURVEYS

Submitted to

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Cover photos: Acoustic sampling on Tatelkuz Lake, July 2013. Photos by Brock Stables.

EXECUTIVE SUMMARY

In July 2013, coordinated surveys using mobile acoustics (scientific echo sounding) and gill netting were used to estimate fish abundance and distribution patterns in Tatelkuz Lake. Acoustic sampling was used to estimate absolute numbers of fish in the lake and to describe day and night spatial patterns of the total fish assemblage. The acoustic estimate was restricted to non-benthic species, and acoustic sampling was limited to areas offshore of the 2 m depth contour, with sample volumes very restricted shoreward of the 5 m depth contour. Gill netting, which sampled benthic and pelagic fish over the whole depth range in all habitats, was used to describe day and night spatial patterns of individual fish species and to determine species composition of the fish population for apportionment of the acoustic estimate. Acoustic and gill net sampling designs were stratified by nearshore and offshore sampling zones, bounded by the 10 m depth contour. Acoustic sampling took place July 9-12 during day and night periods. Gill netting was conducted July 15-20, also during both periods.

Fish densities and distribution patterns were distinctly different on day and night acoustic surveys. During the day, fish were sparsely scattered over the 0-20 m depth range, whereas many more fish were seen with acoustics at night, mainly in a layer between 5 and 10 m that often touched the edges of the lake basin. Areal fish density (fish/ha) was much higher throughout the lake at night than during the day. These observations showed that many of the fish in Tatelkuz Lake were unavailable to acoustics during the day (in nearshore areas or close to the lake surface or bottom), and that night was the better period to estimate fish abundance.

The night time total fish abundance estimate and 95% confidence limits for all species combined were 775,286 ±134,418 fish (±17% of the total), for an overall fish density of 864 fish/ha. Fish numbers were much higher in the offshore zone (749,986 fish) than in the nearshore zone (25,300 fish). In the nearshore zone, abundance was close to equal in the 0-5 m and 5-10 m depth layers. In the offshore zone, 98% of the fish were in the upper 15 m of the water column, with 76% in the 5-10 m layer alone, and no fish below 30 m.

Acoustic data apportioned by gill net catches indicated that kokanee were the most abundant fish in Tatelkuz Lake, numbering 606,375 fish, or 78.2% of the total fish community for large and small fish size groups combined. Numbers of other species were: 117,431 rainbow trout (15.1% of total), 26,237 mountain whitefish (3.4%), 13,763 longnose sucker (1.8%), and 11,498 northern pikeminnow (1.5%). Based on a lake surface area of 897 ha, individual species densities were: 676 kokanee/ha, 131 rainbow trout/ha, 29 mountain whitefish/ha, 15 longnose sucker/ha, and 13 northern pikeminnow/ha. The high abundance of kokanee was not surprising considering their predominance in the large volume of the offshore pelagic zone, the most abundant

habitat in the lake. Likewise, the abundance of littoral and semi-pelagic species was limited by the lesser amount of littoral and slope zone habitat available in Tatelkuz Lake. Benthic species that were undetectable with acoustics were not included in the population estimate.

Abundance estimates for individual species of large fish (≥ 100 mm long) appear reliable because they were well sampled by gill nets for the most part (adequate sample size and spatial and temporal coverage). However, minimal gill net coverage of the 5-10 m offshore cell, where the abundance estimate from acoustics was high, reduced the certainty of the individual species abundance estimates. Even so, the conclusion that most large fish in this cell and in the lake were kokanee was supported by other data, such as species composition in adjacent spatial cells and known habitat and temperature preferences of the species present. Abundance estimates for individual species of fish < 100 mm long are less certain due to extremely low catches of small fish in gill nets (insufficient sample size despite adequate spatial and temporal coverage). Due to inadequate species composition information for small fish, it was assumed for individual species abundance estimates that all small fish in the offshore zone were kokanee and that all small fish in the nearshore zone were rainbow trout. Based on several considerations, the former assumption seems well founded, while the latter one is more doubtful but only affected a small fraction (2.5%) of the total abundance estimate for all species combined.

ACKNOWLEDGEMENTS

This project was performed under contract to AMEC Environment & Infrastructure as part of the Blackwater Gold Project environmental baseline study for New Gold Inc. I am grateful to Michael McGurk (AMEC Senior Fisheries Biologist and Project Manager) for assistance with logistics, coordination of related field activities, and general project management. I also wish to thank Rosalyn Smedley (AMEC Fisheries Biologist, gill netting), Brad Horne (AMEC Senior Fisheries Biologist, gill netting), and Wayne Salewski (acoustics boat operator) for their valuable contributions to the sampling program.

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1.0 INTRODUCTION

Tatelkuz Lake is a 910 hectare natural lake located in central BC, 93 km southwest of Vanderhoof in the Nechako River watershed (Figure 1). Its physical characteristics include surface elevation 928 meters, mean depth 21.4 m, and maximum depth of 33.7 m (Figure 2, AMEC 2013, from May and June 2013 bathymetric surveys). From a previous reconnaissance level fish survey (Walsh and Hale 1977), it was known to contain at least seven fish species: mountain whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*), kokanee (*O. nerka*), northern pikeminnow (*Ptychocheilus oregonensis*), longnose sucker (*Catostomus catostomus*), large-scale sucker (*Catostomus macrocheilus*), and burbot (*Lota lota*).

Shuksan Fisheries Consulting (Shuksan) was contracted by AMEC Environment and Infrastructure (AMEC) to perform an acoustic survey of the lake in July 2013 as part of AMEC's Blackwater Gold Project fish and aquatic resources 2013 baseline study for New Gold Inc. In conjunction with the acoustic survey by Shuksan, AMEC performed gill netting to obtain complementary information about the fish community. The aim of these surveys was to obtain updated and more detailed information about fish in the lake. Both surveys were scheduled for mid-July when all members of the fish community were expected to be present in the lake (AMEC 2013).

Specific objectives of the acoustic survey were to:

- Conduct day and night acoustic surveys to describe diel differences in fish distribution patterns and to determine the best period for measuring fish abundance in the lake;
- Construct a total fish abundance estimate (species combined) with 95% confidence limits using data from the most suitable period;
- Construct abundance estimates for individual fish species by apportioning the total acoustic estimate using species composition from gill netting conducted by AMEC;
- Estimated the size distribution of fish based on acoustic target strength (TS).

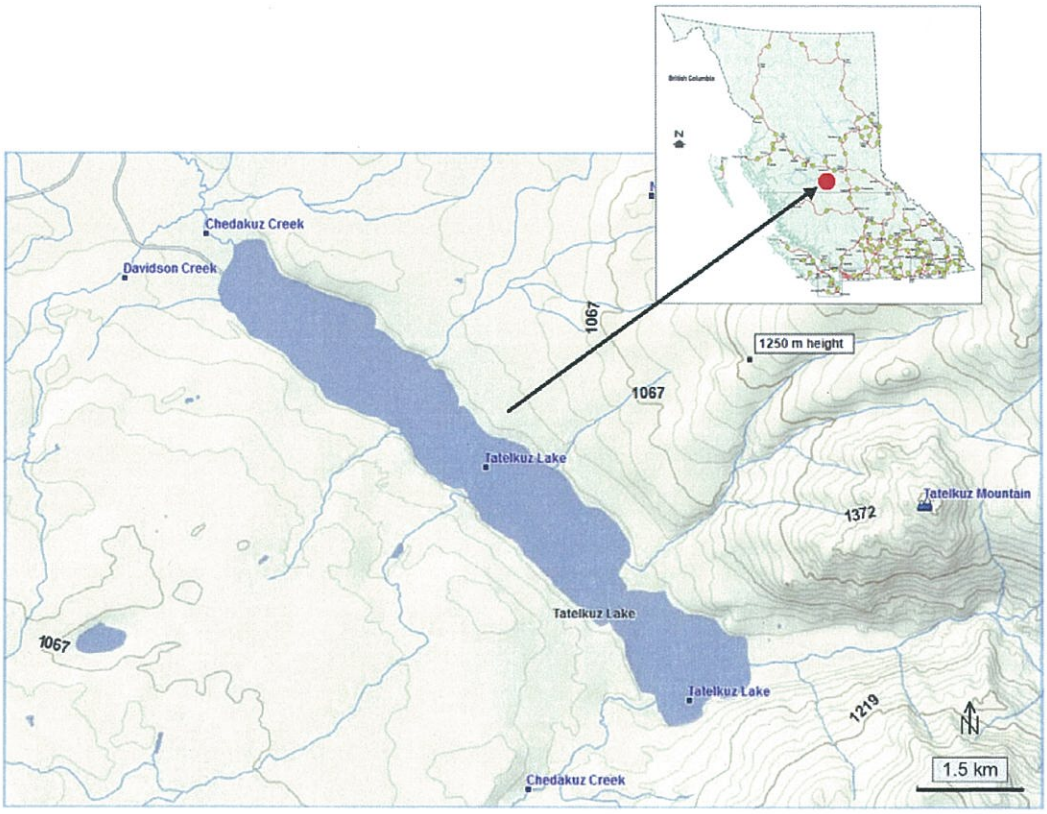


Figure 1. Tatelkuz Lake and its location in British Columbia.

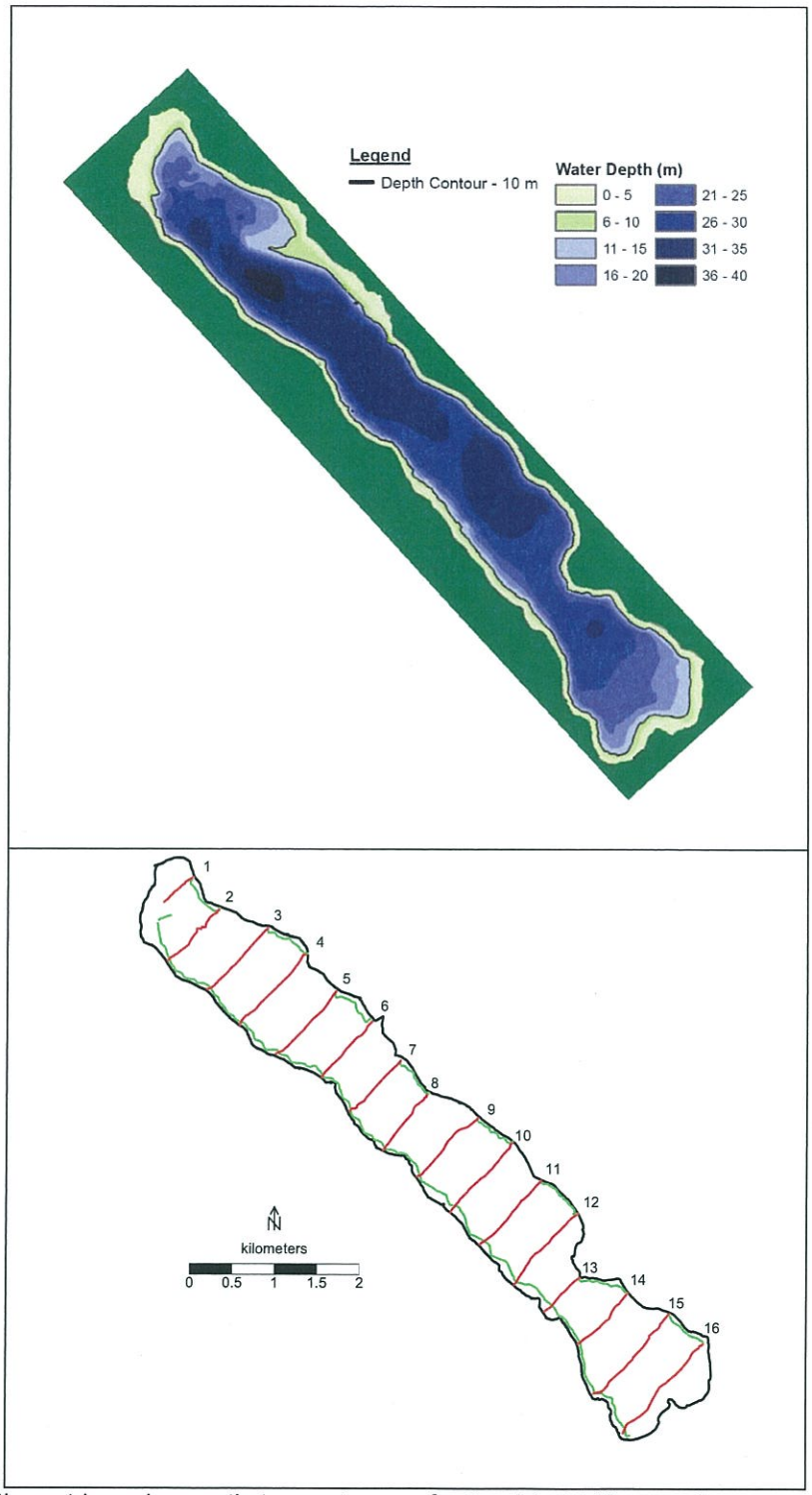


Figure 2. Bathymetric and acoustic transect maps for the July 2013 acoustic survey of Tatelkuz Lake. On the bathymetric map, the nearshore and offshore sampling zones are delineated by the black line at the 10 m depth contour. On the transect map, cross-lake transects are shown in red, shoreline transects in green. Bathymetric map provided by AMEC.

3.0 METHODS

In July 2013, coordinated mobile acoustic surveys (scientific echo sounding) and gill netting were used to estimate fish abundance and distribution patterns in Tatelkuz Lake. Protocols for this type of sampling scheme for large lakes are generally described in Beauchamp et al. (2009). Acoustics was used to estimate absolute abundance of fish and to describe spatial and temporal (day/night) patterns of the total fish assemblage. Gill netting was used to describe spatial and temporal patterns of individual fish species, to apportion the acoustic estimate among species, and to provide age, size, diet, and other biological information about the fish community. Gill netting was also used to sample fish at the lake surface and shoreward of the 5 m depth contour where the detection of fish with acoustics is greatly limited by acoustic beam geometry and interference from water column boundaries.

3.1 Acoustics

3.1.1 Acoustic Sampling

Acoustic survey methods generally followed protocols described in standard fisheries acoustics texts (Thorne 1983, Brandt 1996, Simmonds and MacLennan 2005), with special measures to ensure thorough coverage of the upper water column (Johnston 1981, Yule 2000, Beauchamp et al. 2009).

Acoustic sampling took place from July 9 -12 during day and night periods (day = sunrise to sunset; night = one hour after sundown to one hour before sunrise). No sampling took place during crepuscular hours. One survey of the whole lake was conducted during each period. A survey consisted of sampling 16 primary shore-to-shore cross-lake transects spaced at 550 m intervals, plus additional shoreline segments on each side of the lake (Figure 2). Cross lake transects were sampled shoreward as close as safety allowed, typically to about the 2 m depth contour. Shoreline transects were run in a loose zigzag pattern approximately between the 5 and 15 m depth contours, roughly following the shore of the lake with the side-looking transducer aimed toward the lake edge. Shoreline segments were mainly sampled when traveling between the ends of cross-lake transects, except that the entire south shore of the lake was covered in a continuous transect during the night survey. Due to changeable weather conditions, the daytime survey was performed over the course of 2 days. For the night survey, all cross-lake and north shore transects were sampled during a single night, while the south shoreline was sampled the following night.

Acoustic sampling was performed from a 6 m aluminum jet boat at transecting speeds of 1.3-1.6 m/s (Figure 3, Table 1). A dual transducer echo sounding system was used to obtain thorough coverage of the entire water column. A downward facing transducer sampled from 2 m beneath the water surface to the lake bottom (down-looking mode), while the second

transducer was aimed sideways from the boat, nearly horizontally (down 5°) to cover the upper 5 m of the water column (side-looking mode). The collection of side-looking data was deemed necessary because trout are often surface oriented (Johnston 1981, Stables and Thomas 1992, Yule 2000). The two transducers were sampled simultaneously at rate of 6-7 pings per second per transducer.

The echo sounding system consisted of a 200 kHz BioSonics DTX echo sounder and two split-beam transducers paired with a Garmin GPSmap 546 differential GPS. Beam dimensions (full angle) were 6.7° (circular) for both transducers. The echo sounder was operated by a computer, which also served as a data logger and allowed monitoring of data quality on echograms during collection. Latitude and longitude from the GPS were added to acoustic data files as they were logged. Data collection thresholds were -100 dB for down-looking and -80 dB for side-looking. Additional equipment specifications and data collection settings are shown in Table 1.

3.1.2 Acoustic Data Processing and Analysis

Fish were counted on electronic echograms according to standard echo-trace counting methods (Thorne 1983, Simmonds and MacLennan 2005). Computer files were processed in the office using Echoview© software to automatically recognize and extract fish traces, to measure target strength (TS, the acoustic size of fish), and to determine sampling volumes. Down-looking data were used to compute fish density at depths greater than 5 m, while side-looking data were used to represent the uppermost 5 m of the water column. Fish traces with mean TS greater than -30 dB were visually examined on echograms to validate them. Echoes smaller than -65 dB (down-looking) and -55 dB (side-looking) were excluded from processing to remove noise and non-fish targets from echograms. This approach allowed detection of fish as small as kokanee fry from down-looking data and age-1 trout (i.e., > 100 mm) from side-looking data. Occasional windy periods during the surveys required the higher threshold for side-looking data, which is very sensitive to noise from rough conditions (Yule 2000). Additional fish processing settings are listed in Table 1.

TS was determined by the split-beam method (Simmonds and MacLennan 2005). Accuracy of acoustic measurements was assured by field calibration tests. In-situ TS measurements of a -39.5 dB standard sphere indicated a calibration correction of 1.0 dB for the down-looking transducer (slight) and no correction for the side-looking transducer. The calibration correction was applied during data processing in Echoview. Lengths of individual fish detected with acoustics were estimated from down-looking TS using Love's (1977) equation for fish insonified within ±45 degrees of dorsal aspect:

$$\text{length (mm)} = 10 * 10^{((TS + 1.6 \log (kHz) + 61.6) / 18.4)}$$





Figure 3. Upper photo: The acoustics boat at the shore with the dual transducer pole mount tilted up out of the water. Lower photo: The boat on transect with the transducers deployed over the port side collecting data.

Table 1. Equipment specifications and settings for collection and processing of acoustic data collected from Tatelkuz Lake, July 2013. D = down-looking, S = side-looking, unspecified = both.

Project Phase	Category	Parameter	Value
Data collection	Transducers	Type[1]	Split-beam
"	"	Sound frequency (kHz)	206 D, 201 S
"	"	Nominal (full) beam angle	6.7° D, 6.7° S
"	"	Depth below lake surface	0.55 m
"	Settings	Pulse width	0.4 ms
"	"	Transmit power level (dB)	0.0
"	"	Collection threshold (dB)	-100 D, -80 S
"	"	Minimum data range[2]	0.5 m D, 1.0 m S
"	"	Time varied threshold	none
"	"	Ping rate per transducer	6-7 pps
"	GPS	Type[3]	Differential
"	"	Datum	NAD83
"	Other	Transecting speed	1.3-1.6 m/s
Data Analysis	General	Calibration offset (dB)	1.0 D, 0.0 S
"	"	Time varied gain	40 log R
"	"	Minimum threshold (dB)[4]	-65 D, -55 S
"	"	Maximum threshold (dB)[4]	-10
"	"	Beam pattern thresh.(dB)	-6
"	"	Beam full angle	6.7° D, 6.7° S
"	"	Single target filters	0.5-1.5 @ -6 dB
"	Range processed[2]	For fish abundance	5-35 m D, 10-25 m S
"	"	For TS	2-35 m D
"	Fish tracks per fish	Minimum # echoes	2 D, 2 S
"	"	Max range change	0.2 m
"	"	Max ping gap	1

[1] BioSonics DT-X split-beam.
[2] range from transducer.
[3] WAAS differential GPS.
[4] Processing threshold after application of calibration offset.

Because TS is affected by factors other than fish size (Simmonds and MacLennan 2005) and Love's (1977) equation is a generalization from many fish species and sizes, this equation provides an estimate of fish length that is useful, but less precise than a hands-on physical measurement. The relationship between side-looking TS and fish length is highly variable (Love 1977, Kubecka and Duncan 1998, Yule 2000), so fish length was not estimated from side-looking TS data.

TS data was used to subdivide fish detected with acoustics into small fish (< 100 mm long) and large fish (≥ 100 mm long) to facilitate apportionment among species. Per Love's (1977) ±45 degree model, fish with mean TS < -46.9 dB were considered to be < 100 mm long. Corresponding size groups from acoustic and gill net data were matched for apportionment of the acoustic estimate among species.

Depth intervals for data analysis were 0-5 m, 5-10 m, and so forth to 30-35 m, the deepest interval in Tatelkuz Lake. Horizontal sampling strata were the nearshore and offshore sampling zones (shoreward and offshore of the 10 m depth contour, respectively). Fish densities were summarized as fish/m^3 within sampling zones and depth intervals for the population estimate, and as fish/ha in 25 m long segments of transects for maps of fish density (fish/ha along transects). For each spatial cell of interest, fish/m^3 was calculated as the total number of fish counted divided by the volume sampled. The volume sampled in each spatial cell was calculated by Echoview using the acoustic beam angle, distance transected, and a correction for bottom intrusion. The wedge model for sampling volume (Keiser and Mulligan 1984) was used for all depth intervals. The effective beam angle for each depth interval was modeled considering the nominal beam angle, boat speed, ping rate, and hits required per fish trace, and the sampling volume was adjusted accordingly at ranges where the effective beam angle was less than the nominal beam angle. Under the conditions of the surveys, the effective beam angle was 5.3° for the 0-5 m range and > 6.2° for all other range intervals. A complete list of data analysis settings appears in Table 1.

Total fish abundance for the whole lake was computed from night time data using just the 16 cross-lake transects, which constituted a stratified systematic sampling design (Cochran 1977). Each transect provided one replicate of each depth interval in each sampling zone. Mean fish density of each depth interval was expanded in proportion to interval volume, and the resulting abundance estimates were summed to obtain the total population estimate. Depth interval volumes adjusted to the lake surface elevation at the time of the acoustic survey (927.4 m) were provided by AMEC from a recent bathymetric survey of the lake. Variance and 95% confidence intervals were calculated for a stratified systematic sample with horizontal and vertical stratification (sampling zones and depth intervals). Shoreline transects were used for mapping fish density but not for the abundance estimate because they did not meet the criteria of a systematic sampling design.

3.2 Species Composition from Gill Net Data

As part of a baseline study of Tatelkuz Lake (AMEC 2013), AMEC sampled the lake with gill nets to provide species composition data to support the acoustic survey and the resulting data were provided to Shuksan for analysis. In this analysis, catch per unit effort (CPUE) of individual fish species was used to represent their relative abundance in the fish population. AMEC conducted an independent analysis of this data to meet other objectives of their baseline report (AMEC 2013). A complete description of gill net sampling gear, methods, and survey design can be found in the AMEC report, while details particularly relevant to the acoustic survey are summarized below.

Gill netting was conducted between July 15 and 20, 2013, when the fish population and distribution patterns were expected to be much the same as during the acoustic survey conducted the week before. Stratification of the gill net survey matched that of the acoustic survey (day/night, nearshore/offshore, 5 m depth layers) to maximize compatibility of the data sets. All fish habitats of the lake were sampled, with effort distributed across a grid of 18 cells superimposed on a map of the lake. Surface, midwater, and bottom sets sampled littoral, benthic, and pelagic habitats over the whole water column. More effort was allocated to depth layers and areas of the lake where echograms from the acoustic survey suggested that fish were most abundant (ends of the lake and the 5-20 m depth range of the offshore zone at night). The standard RISC nets (knot-to-knot mesh size range 12.5-45 mm) and custom small-mesh gill nets (knot-to-knot mesh sizes 6.2,7.9, and 9.4 mm) that were used for the survey were ideal for fish of about 70-400 mm in length (RIC 1997, Lester et al. 2009), which would have sampled all fish in the lake except small fry.

In the analysis by Shuksan, a mean CPUE was calculated for each size group (small < 100 mm, large ≥ 100 mm) and species in each combination of sampling strata (diel period x sampling zone x depth layer), matching the stratification of the acoustic estimate. For the offshore strata at night, the degree to which each species was associated with the lake bottom was examined by summarizing their CPUE in each type of gill net set made in that sampling zone (set types: surface, midwater not touching bottom, midwater touching bottom, and bottom). Although not ideal, small-mesh net and RISC net catches were pooled for these analyses because 1) small-mesh nets caught both large and small fish, and 2) small-mesh nets provided a significant amount of the effort (number of sets) in the offshore area. Effort was described as set-hours x m^2 of net to standardize for different net sizes as much as possible.

3.3 Temperature and Dissolved Oxygen Profiles

AMEC made temperature and dissolved oxygen (DO) profiles of the water column at two offshore stations on July 17 and 23, within 11 days of the acoustic survey. One station was near the north end of the lake and the other was in the central portion. This information was collected to aid interpretation of vertical fish distribution patterns.

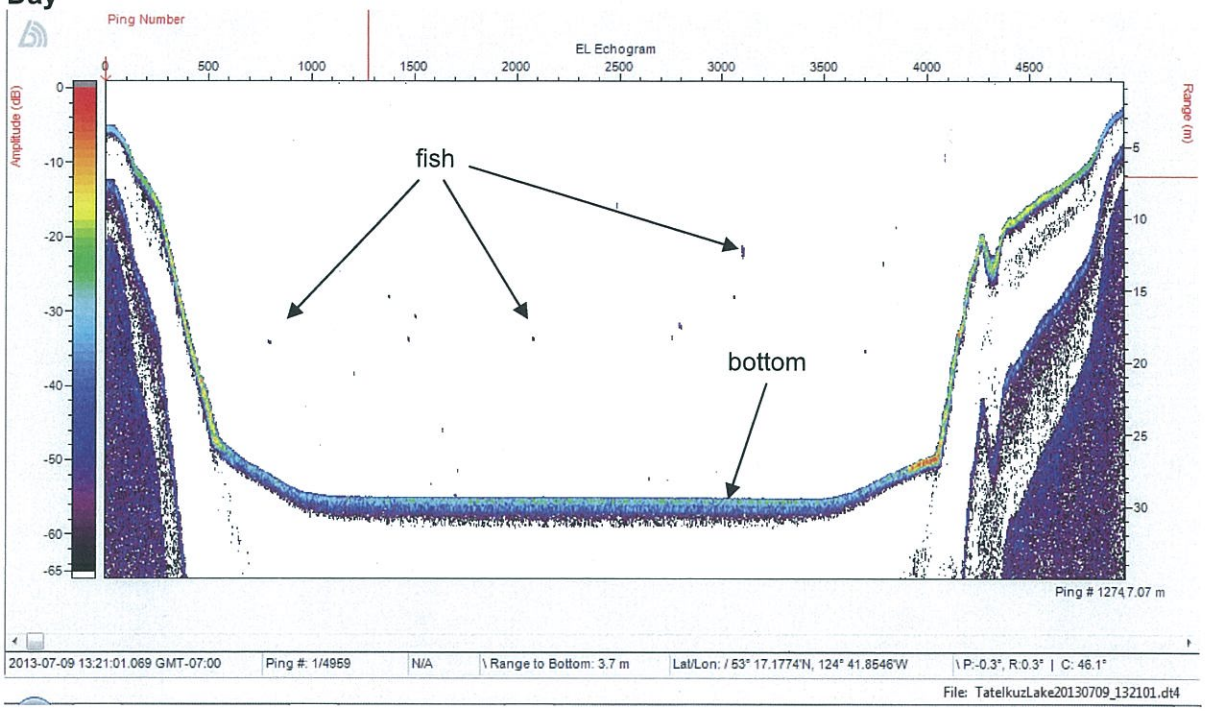
4.0 RESULTS

4.1 Acoustics

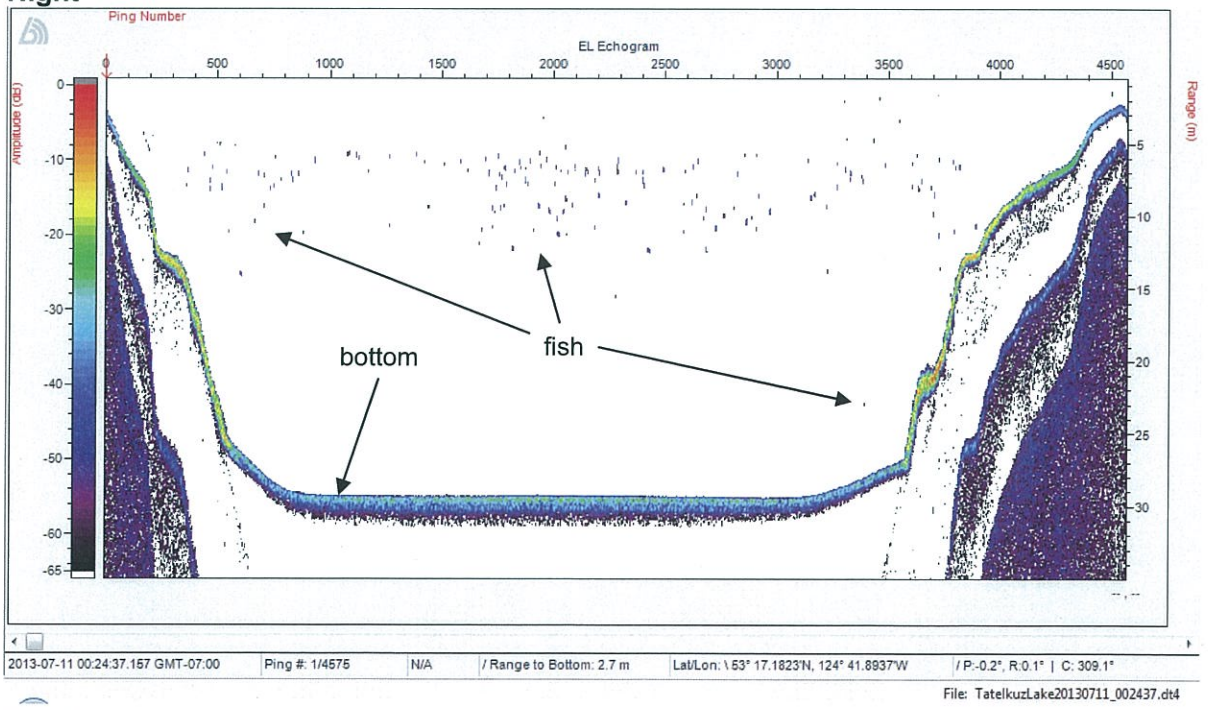
4.1.1 Day and Night Spatial Distributions of Fish

Fish densities and distribution patterns were distinctly different on day and night acoustic surveys. During the day, fish were sparsely scattered over the 0-20 m depth range, and this fish layer seldom touched the slopes of the lake basin (Figure 4). At night, many more fish were visible on echograms, mainly in a layer between 5 and 10 m that often touched the edges of the lake basin (Figure 4). The lower limit of this layer roughly corresponded with the depth at which the water temperature reached about 6°C (Figure 5). Areal fish density (fish/ha) was also much higher throughout the lake at night than during the day (Figure 6). These observations clearly showed that many of the fish in Tatelkuz Lake were unavailable to acoustics during the day (in nearshore areas or close to the lake surface or bottom), and that night was by far the better period from which to estimate the number of fish in the lake. The analysis of acoustic data that follows is therefore restricted to the night survey.

Day



Night



South North

Figure 4. Day and night echograms from the down-looking transducer on Transect 5, July 2013, Tatelkuz Lake. The processing threshold was -65 dB, capable of detecting fish as small as kokanee fry.

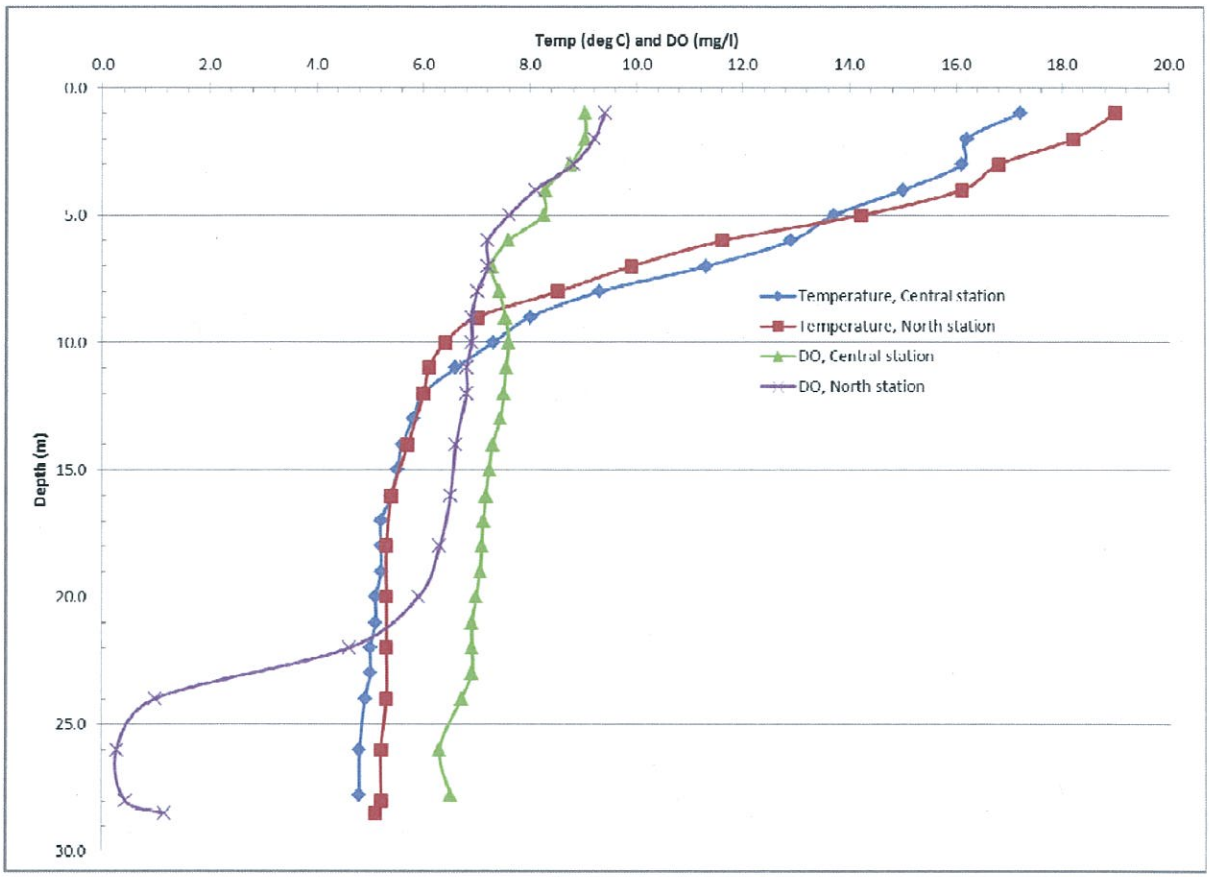
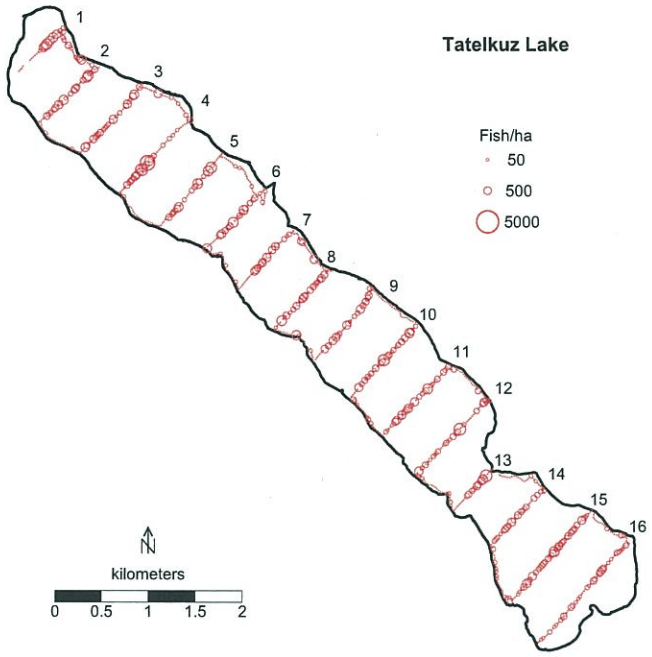


Figure 5. Temperature and dissolved oxygen profiles at north end and central lake stations on July 17 and 23, 2013. Measurements were provided by AMEC.

Day



Night

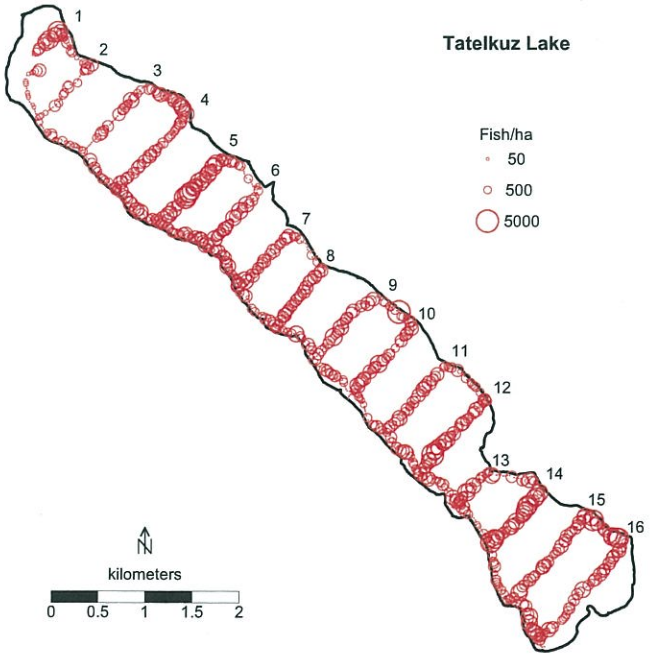


Figure 6. Areal fish densities (fish/ha for species combined) along 25 m transect segments by day (upper) and night (lower), Tatelkuz Lake, July 2013. Data are from down and side looking transducers combined.

4.1.2 Formulation of the Total Fish Abundance Estimate from the Night Acoustic Survey

Counts of fish detections by transect and depth layer formed the basis of the acoustic estimate of total fish abundance (species combined) and its confidence intervals. A total of 1,492 fish were detected during the night acoustic survey and fish density by transect layer (counts adjusted for volume sampled by the acoustic beam) ranged from 0.0 to 0.0351 fish/m^3 in the nearshore zone and from 0.0 to 0.0295 fish/m^3 in the offshore zone (Tables 2 and 3). For all transects combined, mean fish density was highest in the 5-10 m depth interval in both zones (nearshore = 0.0078 fish/m^3, offshore = 0.0153 fish/m^3), and fish density dropped off rapidly below 15 m in the offshore zone.

The night time total fish abundance estimate (species combined) for the whole lake was 775,286 ± 134,418 fish (±17%), for an overall fish density of 864 fish/ha (Table 4). Fish abundance was much higher in the offshore zone (749,986 fish) than in the nearshore zone (25,300 fish). In the nearshore zone, abundance was close to equal in the 0-5 m and 5-10 m depth layers. In the offshore zone, 98% of the fish were in the upper 15 m of the water column, with 76% in the 5-10 m layer alone, and no fish were found below 30 m.

Based on Love's (1977) ±45° model of target strength (TS), fish in nearshore and offshore habitats ranged from 10 to 898 mm in length (Figure 7), although the more conservative dorsal aspect model would make the maximum length 658 mm (Love 1977). Modes in the length frequency distribution from the ±45° model more closely matched those from gill netting, however, so it was considered the best representation of the overall fish assemblage of Tatelkuz Lake and used for subsequent analysis. Major modes in length frequency distributions estimated from TS occurred at 25-50 mm, 175-200 mm, and 350-400 mm in both sampling zones. A large portion of the fish in both zones, especially in the nearshore zone, was too small to be captured in RISC gill nets (< 100 mm in length) or small-mesh gill nets (< 70 mm in length). In the nearshore zone, small fish comprised > 69% of all fish in either depth layer (Table 5). In contrast, in the offshore zone, large fish (≥ 100 mm) made up a large fraction (> 57%) of all fish in the 5-15 m depth range that accounted for 90% of the total population estimate (Table 5).

Length frequency distributions from the gill net catch lacked a small fish component (< 100 mm) and did not include fish larger than 500 mm, but shared some other similarities with length frequency distributions from TS (Figure 7). In the nearshore zone, both methods showed modes at 175-225 and 350-400 mm, although the former one was much more dominant in the gill net data. In the offshore zone, both methods had major modes at 100-125 and 200-225 mm, and a smaller one at 375-425 mm.

Table 2. Counts of fish by transect and depth layer for all species combined, from the night acoustic survey of Tatelkuz Lake, July 2013. Data are from side-looking (0-5 m depth range) and down-looking (5-35 m) transducers on cross-lake transects only. Blank cells indicate where the reservoir bottom was shallower than the designated depth interval.

Zone	Depth range (m)	Fish Count by Transect																Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
nearshore	0-5	1	3	0	10	2	1	0	1	0	0	1	1	1	0	0	1	22
"	5-10	0	0	0	6	0	1	0	1	0	0	0	1	2	2	0	2	15
"	0-10	1	3	0	16	2	2	0	2	0	0	1	2	3	2	0	3	37
offshore	0-5	37	58	63	41	15	11	10	14	15	28	14	21	4	7	17	32	387
"	5-10	30	13	23	45	94	38	43	50	43	49	46	69	22	74	51	40	730
"	10-15	11	3	6	11	24	16	8	5	7	14	15	28	12	47	40	43	290
"	15-20		2	3	3	1	1	4	2	1	1	1	3	0	1	2	8	33
"	20-25		0	1	0	2	1	0	0	1	1	2	2	0	1	1		12
"	25-30		0	0	0	1	0	0	1	0	0	0	1	0	0			3
"	30-35						0	0	0	0								0
"	0-35	78	76	96	100	137	67	65	72	67	93	78	124	38	130	111	123	1,455

Table 3. Fish density (fish/m^3) by transect and depth layer for all species combined, from the night acoustic survey of Tatelkuz Lake, July 2013. Data are from side-looking (0-5 m depth range) and down-looking (5-25 m) transducers on cross-lake transects only. Blank cells indicate where the reservoir bottom was shallower than the designated depth interval.

Depth range (m)	Fish density by transect (fish/m^3)																Total		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	n	Mean	Var
0-5	0.0007	0.0021	0.0000	0.0111	0.0013	0.0004	0.0000	0.0145	0.0000	0.0000	0.0011	0.0007	0.0000	0.0000	0.0005	0.0022	16	0.00217	1.82E-05
5-10	0.0000	0.0000	0.0000	0.0351	0.0000	0.0060	0.0000	0.0206	0.0000	0.0000	0.0000	0.0134	0.0331	0.0000	0.0087	0.0078	16	0.00780	1.42E-04
0-10	0.0003	0.0011	0.0000	0.0231	0.0007	0.0032	0.0000	0.0176	0.0000	0.0000	0.0006	0.0071	0.0166	0.0000	0.0046	0.0050	32		
0-5	0.0034	0.0024	0.0022	0.0013	0.0007	0.0005	0.0004	0.0006	0.0007	0.0010	0.0005	0.0007	0.0003	0.0004	0.0008	0.0011	16	0.00106	7.23E-07
5-10	0.0234	0.0044	0.0068	0.0122	0.0295	0.0143	0.0152	0.0176	0.0132	0.0142	0.0137	0.0186	0.0268	0.0116	0.0087	0.0153	16	0.01534	4.53E-05
10-15	0.0083	0.0005	0.0009	0.0024	0.0040	0.0032	0.0015	0.0009	0.0011	0.0021	0.0024	0.0040	0.0089	0.0047	0.0062	0.0034	16	0.00342	6.46E-06
15-20		0.0003	0.0003	0.0005	0.0001	0.0002	0.0005	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0002	0.0024	0.0004	15	0.00040	3.35E-07
20-25		0.0000	0.0001	0.0000	0.0002	0.0001	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001		0.0001	14	0.00009	4.89E-09
25-30		0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000			0.0000	13	0.00003	2.51E-09
30-35						0.0000	0.0000	0.0000	0.0000							0.0000	5	0.00000	0.00E+00
0-35	0.0117	0.0013	0.0017	0.0027	0.0058	0.0026	0.0025	0.0028	0.0022	0.0029	0.0028	0.0040	0.0060	0.0034	0.0045	0.0029	95		

Table 4. Total fish abundance (species combined) in Tatelkuz Lake during July 2013, subdivided by sampling zone (nearshore and offshore) and depth layer. This estimate and the associated statistics are from the night acoustic survey of cross-lake transects only.

Zone	Depth range (m)	Mean no. per m^3	Variance	Sample size *	Stratum Volume (cubic m)	Pop est	SE of pop est	95% CL lower	95% CL upper
nearshore	0-5	0.00217	1.8E-05	16	5.5E+06	11,954	5,868	-554	24,461
"	5-10	0.00780	1.4E-04	16	1.7E+06	13,347	5,106	2,464	24,230
"	0-10			32	7.2E+06	25,300	7,778	9,436	41,165
offshore	0-5	0.00106	7.2E-07	16	3.7E+07	39,590	7,941	22,664	56,516
"	5-10	0.01534	4.5E-05	16	3.7E+07	573,346	62,869	439,343	707,348
"	10-15	0.00342	6.5E-06	16	3.6E+07	121,636	22,595	73,476	169,797
"	15-20	0.00040	3.3E-07	15	3.1E+07	12,596	4,706	2,502	22,690
"	20-25	0.00009	4.9E-09	14	2.6E+07	2,386	485	1,338	3,434
"	25-30	0.00003	2.5E-09	13	1.5E+07	431	211	-29	891
"	30-35	0.00000	0.0E+00	5	1.3E+06	0	0	0	0
"	0-35			95	1.8E+08	749,986	67,443	615,978	883,993
Combined						775,286	67,890	640,868	909,899

* Number of transects with corresponding depth intervals.

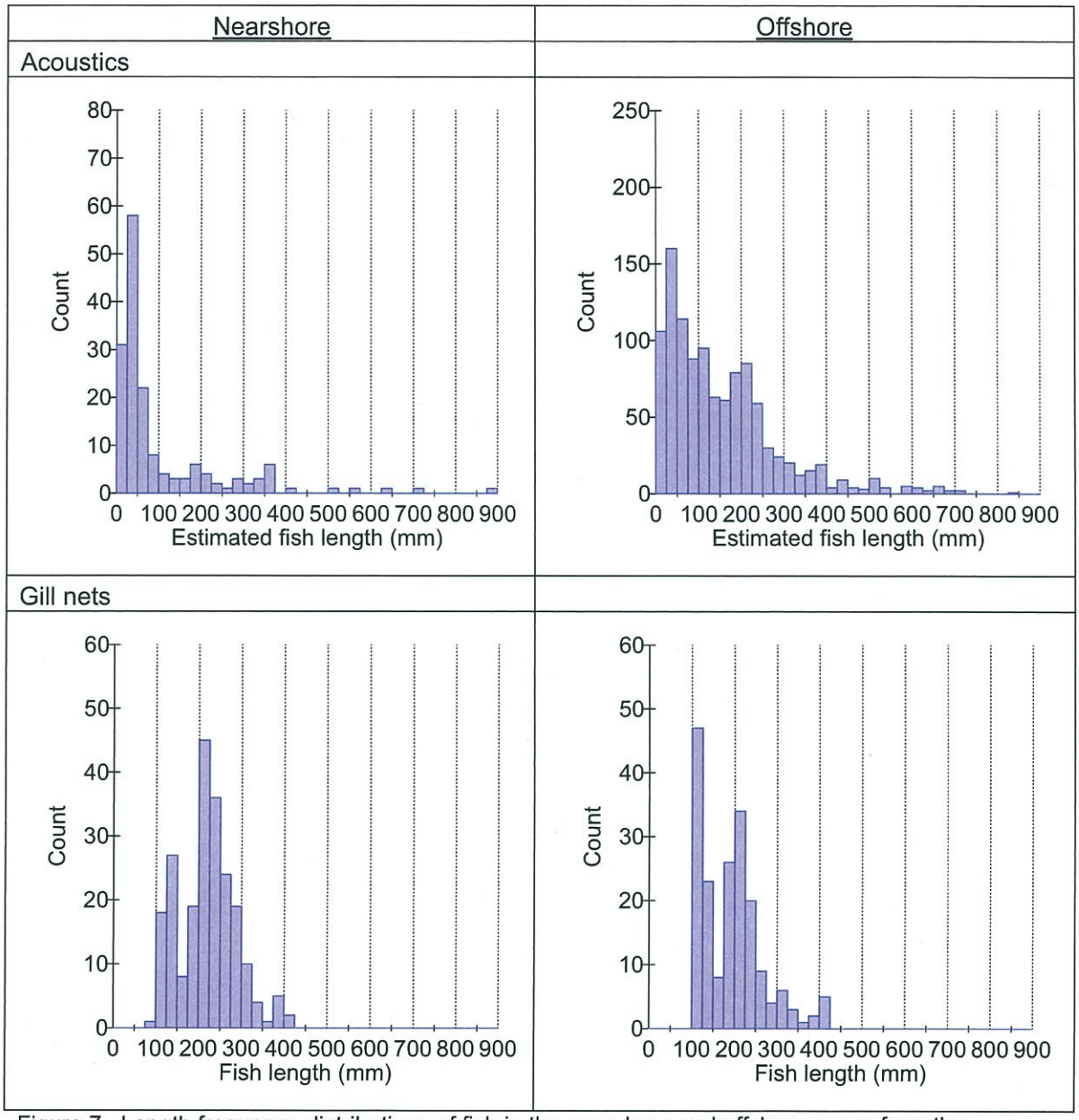


Figure 7. Length frequency distributions of fish in the nearshore and offshore zones from the night acoustic and gill net surveys of Tatelkuz Lake, July 2013. Lengths for acoustics were estimated from down-looking data only using Love's (1977) ±45° model. For both methods data from all depths were pooled within each zone. Cross-lake and shoreline transects were used for the nearshore zone; only cross-lake transects were used for the offshore zone.

Table 5. Counts and percentages of small (< 100 mm) and large (⩾100 mm) fish by sampling zone and depth layer from the Tatelkuz Lake, July, 2013 night acoustic survey. Fish sizes were estimated from TS using Love's (1977) ±45 degree relationship. Cross-lake and shoreline transects were used for the nearshore zone; only cross-lake transects were used for the offshore zone.

	Depth interval	Count			Percentage*	
Zone	(m)	< 100 mm	⩾ 100 mm	Total	< 100 mm	⩾ 100 mm
nearshore	0-5	17	3	20	85.00%	15.00%
"	5-10	111	48	159	69.81%	30.19%
offshore	0-5	16	2	18	88.89%	11.11%
"	5-10	309	421	730	42.33%	57.67%
"	10-15	111	179	290	38.28%	61.72%
"	15-20	22	11	33	66.67%	33.33%
"	20-25	11	1	12	91.67%	8.33%
"	25-30	3	0	3	95.83%	4.17%
"	30-35	0	0	0	0.00%	0.00%

* Due to low sample size, percentages for the offshore 25-30 m layer were estimated by pooling with the layer above.

4.2 Gill Netting

4.2.1 Species Composition of Small Fish

Catches of the "small fish" size group (< 100 mm in length) in gill nets were very low. Small-mesh gill nets that targeted this group captured 62 fish in total, of which only 19 were < 100 mm long. RISC nets captured just one small fish. Small fish were of three species: long nose sucker, rainbow trout, and slimy sculpin. Only three small fish were captured at night, the time of the acoustic survey for the fish abundance estimate, and only one of those, a slimy sculpin, was captured in the offshore zone (Table 6). Although AMEC (2013) found that many juvenile rainbow trout rear in stream habitat for at least one summer and sometimes two or three summers before migrating to the lake, gill netting in 2013 showed that some small rainbow trout occupied the nearshore zone both day and night. They were also present in the offshore zone during the day, but were not captured there at night. Beyond this minimal information, apportionment of small fish in the acoustic estimate was based on other knowledgeable assumptions.

Even though no kokanee fry were captured by gill netting, a high abundance of larger kokanee in the offshore zone (see large fish section below) implied that fry were numerous there, too, as is the usual case in kokanee lakes. At the time of the survey in mid-July, kokanee fry may have been too small to capture in the small mesh gill nets used for sampling, which are suitable for fish down to about 70 mm in length. Small fish species that sometimes share the offshore zone with kokanee fry in BC lakes

(threespine stickleback, redside shiner, prickly sculpin; Hume and MacLellan 2008) were not found in Tatelkuz Lake. None of them were captured by nets or other gear during 2013 or earlier sampling (AMEC 2013), although they are highly vulnerable to gill nets and minnow traps, so it was concluded that they are not present in the lake. Based on the information above, it was assumed for apportioning the acoustic estimate that all small fish in the offshore zone were kokanee. Due to the lack of quantitative information and for simplicity, apportionment of the acoustic estimate for the nearshore zone assumed that all small fish there were rainbow trout.

Table 6. Gill net catch of small fish (< 100 mm in length) by species in the nearshore and offshore zones during day and night sampling. Species name abbreviations: Ln sucker = longnose sucker, R trout = rainbow trout, S sculpin = slimy sculpin.

		Catch by species				Percent of catch by species			
Period	Zone	Ln sucker	R trout	S sculpin	Total	Ln sucker	R trout	S sculpin	Total
Day	Nearshore	5	10	0	15	33.3%	66.7%	0.0%	100.0%
	Offshore	0	1	0	1	0.0%	100.0%	0.0%	100.0%
Night	Nearshore	0	1	1	2	0.0%	50.0%	50.0%	100.0%
	Offshore	0	0	1	1	0.0%	0.0%	100.0%	100.0%
	Grand Total	5	12	2	19	26.3%	63.2%	10.5%	100.0%

4.2.2 Species Composition of Large Fish

RISC and small-mesh gill nets captured 1,117 fish that ranged from 102 to 495 mm in fork length, providing good habitat use and species composition information for the "large fish" size group of the acoustic estimate (≥ 100 mm).

Catch rates (CPUE) indicated that rainbow trout, kokanee, and mountain whitefish were the most abundant species in the nearshore and offshore zones both day and night (Figure 8). During the day, rainbow trout were especially abundant in the nearshore zone and near the lake surface in both zones (0-5 m). At night their nearshore abundance decreased and offshore they moved deeper in the water column. Kokanee were more abundant offshore than near shore in both diel periods. In offshore areas they were most abundant 0-5 m during the day and shifted slightly deeper, mainly to the 5-10 m layer, at night. Mountain whitefish were more numerous near shore than offshore both day and night. Near shore they were more abundant 0-5 m during the day and 5-10 m at night. Offshore they occurred almost entirely below 10 m during both periods. The trend for all three main species to shift deeper at night agrees with the higher abundance of fish seen at night on acoustic echograms and supports selection of the night acoustic survey as the basis for the fish abundance estimate.

Analysis of catch rates in the four types of gill net sets that were made in the offshore zone gave additional information about where in that zone the various fish species were during the night acoustic survey. Rainbow trout catch rates were highest in surface sets (Figure 9). Deeper in the water column they were captured only in midwater sets with one end touching the bottom, not in midwater sets that were completely away from the bottom, or in bottom sets. This shows that they occupied the upper water column and the slopes of the lake basin (the slope zone, Beauchamp et al. 2009), but not the midwater pelagic zone. Kokanee catch rates were high in surface sets, but highest in midwater sets not touching bottom, indicating that they were abundant in the upper water column and were the main species in the midwater pelagic zone. Mountain whitefish were most abundant in bottom sets, and were also captured in midwater sets not touching the bottom, indicating that they were semi-pelagic. Northern pike minnow and longnose sucker were also semi-pelagic. Burbot and largescale sucker were only caught in bottom sets, indicating they were benthic species that would have been undetectable with acoustics. Benthic species were excluded from species composition for the fish abundance estimate from acoustics (Tables 7 and 8).

In the 5-10 m layer of the offshore zone, where acoustics showed an especially high density of fish (Table 3), kokanee CPUE was particularly high (0.0153 fish x $hour^{-1}$ x m^2 of net, Table 8). This value was the highest for any species in any spatial cell, nearshore or offshore, and the highest in any offshore cell by a factor of 3.3, indicating that kokanee were very numerous in this spatial cell. However, this estimate was based on a single gill net set, and may have been somewhat biased against rainbow trout because it was made in the midwater pelagic zone where kokanee were predominant, not the slope zone where rainbow trout predominated (no bottom sets or midwater sets with one end touching the bottom were made, Figure 9). This problem did not occur in other cells where both zones were sampled and the number of sets was higher. In terms of the whole 5-10 offshore spatial cell, this error was probably small because the volume of the slope zone was much smaller than that of the midwater pelagic zone. However, compensation was made for this potential bias by computing the percentage of rainbow trout in the 5-10 m offshore cell using an estimate of what catches might have been if midwater sets had been made in the slope zone there. This was done by weighting actual catches in the offshore zone by relative abundance of kokanee and rainbow trout in the same layer of the nearshore zone:

$$\text{Estimated } (C_{RB,5\text{-}10m,off}) = C_{KO,5\text{-}10m,off} \times (C_{RB,5\text{-}10m,near} / C_{KO,5\text{-}10m,near}), \text{ and}$$

$$CPUE_{RB,5\text{-}10m,off} = C_{RB,5\text{-}10m,off} / E_{5\text{-}10m,off}$$

Where C = catch of fish, and
E = effort in set hours x m^2 of net

This adjustment increased rainbow trout species composition in the 5-10 m layer of the offshore zone from 0% to 14.5% (Table 8).

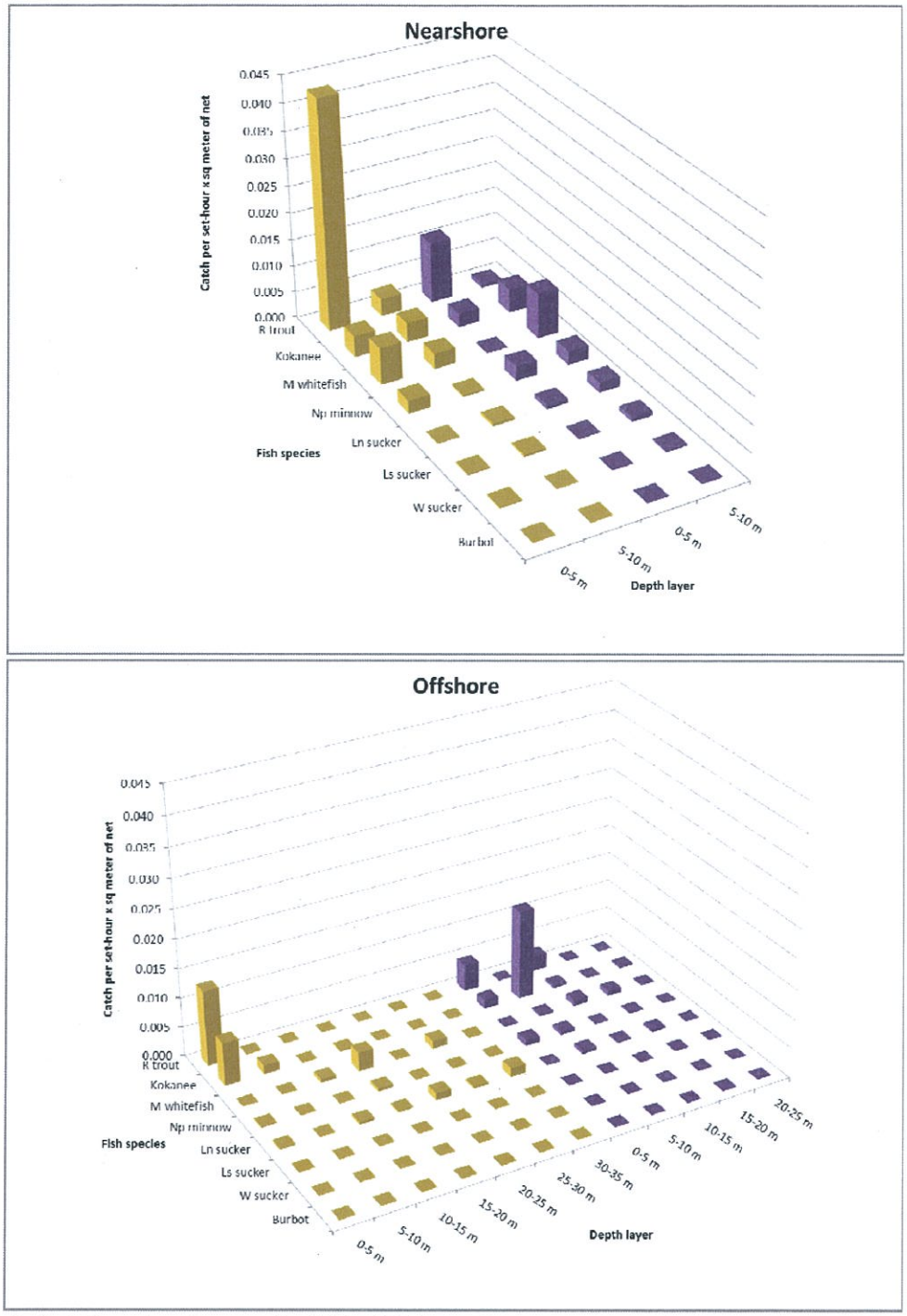


Figure 8. Relative abundance of individual fish species in nearshore (upper) and offshore (lower) sampling zones by diel period (gold = day, blue = night) and depth interval. Relative abundance is from gill net CPUE for RISC and small-mesh sets combined. Note that day and night CPUE may not be directly comparable due to differences in set duration and catchability of fish between periods. Species name abbreviations: R trout = rainbow trout , M whitefish = mountain whitefish, Np minnow = northern pikeminnow, Ln sucker = longnose sucker, Ls sucker = largescale sucker, W sucker = white sucker , S sculpin = slimy sculpin.

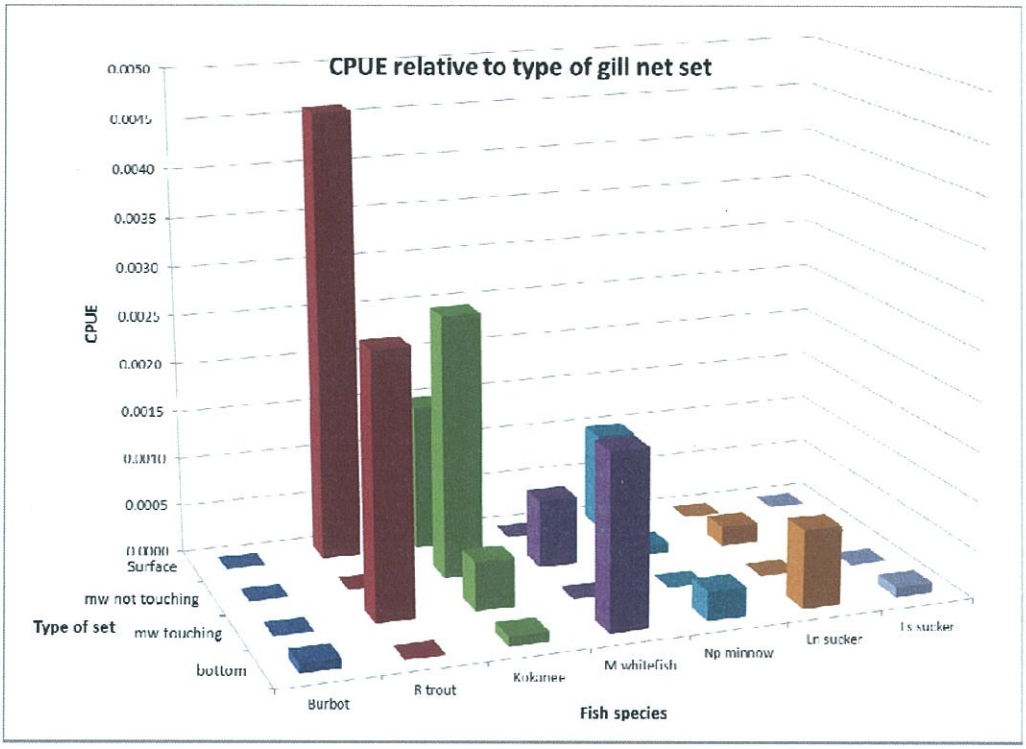


Figure 9. Relative abundance of individual fish species in the various types of gill net sets made in the offshore zone at night. CPUE (catch per set-hour x m^2 of net) was used as an index of relative abundance with data from RISC and small-mesh nets pooled.

Table 7. Species composition for apportionment of large fish (≥ 100 mm) in the nearshore zone population estimate for Tatelkuz Lake, July 2013. Data are from night time gill netting with data from RISC and small-mesh nets pooled. Benthic species (largescale and white suckers) are shown in Catch and CPUE tables, but are excluded from the final species composition estimate used to apportion acoustic counts.

		Fish Species							
Zone	Depth Layer	R trout	Kokanee	M whitefish	Np minnow	Ln sucker	Ls sucker	W sucker	Total
Nearshore	Catch by Depth layer								
"	0-5 m	96	22	1	23	7	2	0	151
"	5-10 m	3	17	32	10	7	3	1	73
"	CPUE (catch per m^2 of net x soak hours)								
"	0-5 m	0.0114	0.0026	0.0001	0.0027	0.0008	0.0002	0.0000	0.0179
"	5-10 m	0.0008	0.0045	0.0085	0.0026	0.0019	0.0008	0.0003	0.0193
"	Estimated species composition by layer for the acoustic estimate								
"	0-5 m	64.4%	14.8%	0.7%	15.4%	4.7%	0.0%	0.0%	100.0%
"	5-10 m	4.3%	24.6%	46.4%	14.5%	10.1%	0.0%	0.0%	100.0%

Table 8. Species composition for apportionment of large fish (≥ 100 mm) in the offshore zone population estimate for Tatelkuz Lake, July 2013. Data are from night time gill netting with data from RISC and small-mesh nets pooled. The 25-35 m depth range was not sampled during this period. Benthic species (largescale sucker and burbot) are shown in Catch and CPUE tables, but are excluded from the final species composition estimate used to apportion acoustic counts. Effort by depth layer (set-hours x m^2 of net) was: 0-5 m = 5,830; 5-10 m = 3,535; 10-15 m = 13,084; 15-20 m = 19,246; 20-25 m = 7,471.

		Fish Species							
Zone	Depth Layer	R trout	Kokanee	M whitefish	Np minnow	Ln sucker	Ls sucker	Burbot	Total
Offshore	Catch by Depth layer								
"	0-5 m	27	9	0	6	0	0	0	42
"	5-10 m	0	54	1	2	2	0	0	59
"	10-15 m	34	7	13	0	2	0	0	56
"	15-20 m	2	2	16	3	7	1	1	32
"	20-25 m	0	2	1	0	0	0	0	3
"	25-30 m	-	-	-	-	-	-	-	-
"	30-35 m	-	-	-	-	-	-	-	-
"	CPUE (catch per m^2 of net x soak hours)								
"	0-5 m	0.0046	0.0015	0.0000	0.0010	0.0000	0.0000	0.0000	0.0072
"	5-10 m	0.0000	0.0153	0.0003	0.0006	0.0006	0.0000	0.0000	0.0167
"	10-15 m	0.0026	0.0005	0.0010	0.0000	0.0002	0.0000	0.0000	0.0043
"	15-20 m	0.0001	0.0001	0.0008	0.0002	0.0004	0.0001	0.0001	0.0017
"	20-25 m	0.0000	0.0003	0.0001	0.0000	0.0000	0.0000	0.0000	0.0004
"	25-30 m	-	-	-	-	-	-	-	-
"	30-35 m	-	-	-	-	-	-	-	-
"	Estimated species composition by layer for the acoustic estimate								
"	0-5 m	64.3%	21.4%	0.0%	14.3%	0.0%	0.0%	0.0%	100.0%
"	5-10 m*	14.5%	78.3%	1.4%	2.9%	2.9%	0.0%	0.0%	100.0%
"	10-15 m	60.7%	12.5%	23.2%	0.0%	3.6%	0.0%	0.0%	100.0%
"	15-20 m	6.7%	6.7%	53.3%	10.0%	23.3%	0.0%	0.0%	100.0%
"	20-25 m	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%	0.0%	100.0%
"	25-30 m**	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%	0.0%	100.0%
"	30-35 m**	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%	0.0%	100.0%

* The percentage of rainbow trout in the 5-10 m layer offshore was computed using actual catches from the midwater pelagic zone and estimated catches from the slope zone in that layer.
** Estimated from the 20-25 m depth range.

4.3 Abundance of Individual Species from Acoustics and Gill Netting

Survey results indicated that kokanee were the most abundant fish in Tatelkuz Lake, with a population size of 606,375 fish, or 78.2% of the total fish population for large and small fish size groups combined (Table 9). Abundance of other species was: 117,431 rainbow trout (15.1% of total), 26,237 mountain whitefish (3.4%), 13,763

longnose sucker (1.8%), and 11,498 northern pikeminnow (1.5%). Based on a lake surface area of 897 ha, individual species densities were: 676 kokanee/ha, 131 rainbow trout/ha, 29 mountain whitefish/ha, 15 longnose sucker/ha, and 13 northern pikeminnow/ha (Table 9).

Large fish (≥ 100 mm long) were more abundant than small fish (< 100 mm long), with large fish numbering 420,359 (54.2% of total) compared to 354,927 small fish (45.8%, Table 9). Within the large fish size group, kokanee again greatly predominated (270,907 fish, 64.4% of size group total), followed by rainbow trout (97,953, 23.3%), mountain whitefish (26,237, 6.2%), and other minor species in the same order as for the whole population. Among small fish, the abundance estimate was 335,450 kokanee (94.5% of size group total) and 19,478 rainbow trout (5.5%). Other species were not present in the small fish abundance estimate because in the absence of adequate species composition data for this size group it was assumed that all small fish in the offshore zone were kokanee and all small fish in the nearshore zone were rainbow trout.

For the large fish size group, all species were much more numerous in the offshore zone than in the nearshore zone (Table 9). Peak abundance of large fish offshore was in the 5-10 m layer for all except mountain whitefish, which were most abundant 10-15 m (Figure 10). Rainbow trout were also quite abundant in the 10-15 m depth range offshore. In the nearshore zone, all large fish except rainbow trout were most abundant 5-10 m (Figure 10). Depth and sampling zone abundance comparisons by species are of little meaning for the small size group due to inadequate species composition information.

Table 9. Abundance estimates for individual fish species by size group, sampling zone, and depth layer, Tatelkuz Lake, July 2013. The estimates are from night time acoustic and gill net sampling. Fish/ha estimates are based on a lake surface area of 897 ha.

Fish		Depth range	Number of fish < 100 mm					
size-group	Zone	(m)	R trout	Kokanee	M whitefish	Np minnow	Ln sucker	Total
< 100 mm	nearshore	0-5	10,161	0	0	0	0	10,161
"	"	5-10	9,317	0	0	0	0	9,317
"	offshore	0-5	0	35,192	0	0	0	35,192
"	"	5-10	0	242,697	0	0	0	242,697
"	"	10-15	0	46,562	0	0	0	46,562
"	"	15-20	0	8,398	0	0	0	8,398
"	"	20-25	0	2,187	0	0	0	2,187
"	"	25-30	0	413	0	0	0	413
"	"	30-35	0	0	0	0	0	0
	nearshore fish < 100 mm		19,478	0	0	0	0	19,478
	offshore fish < 100 mm		0	335,450	0	0	0	335,450
	near and offshore fish < 100 mm		19,478	335,450	0	0	0	354,927

Fish		Depth range	Number of fish ≥ 100 mm					
size-group	Zone	(m)	R trout	Kokanee	M whitefish	Np minnow	Ln sucker	Total
≥ 100 mm	nearshore	0-5	1,155	265	13	276	84	1,793
"	"	5-10	175	993	1,869	584	409	4,029
"	offshore	0-5	2,828	941	0	629	0	4,398
"	"	5-10	47,944	258,898	4,629	9,589	9,589	330,649
"	"	10-15	45,570	9,384	17,417	0	2,703	75,074
"	"	15-20	281	281	2,238	420	978	4,198
"	"	20-25	0	133	66	0	0	199
"	"	25-30	0	12	6	0	0	18
"	"	30-35	0	0	0	0	0	0
	nearshore fish ≥ 100 mm		1,330	1,258	1,881	860	493	5,822
	offshore fish ≥ 100 mm		96,623	269,649	24,356	10,638	13,270	414,536
	near and offshore fish ≥ 100 mm		97,953	270,907	26,237	11,498	13,763	420,359
	Grand total for all fish		117,431	606,357	26,237	11,498	13,763	775,286
	Grand total fish/ha		131	676	29	13	15	864

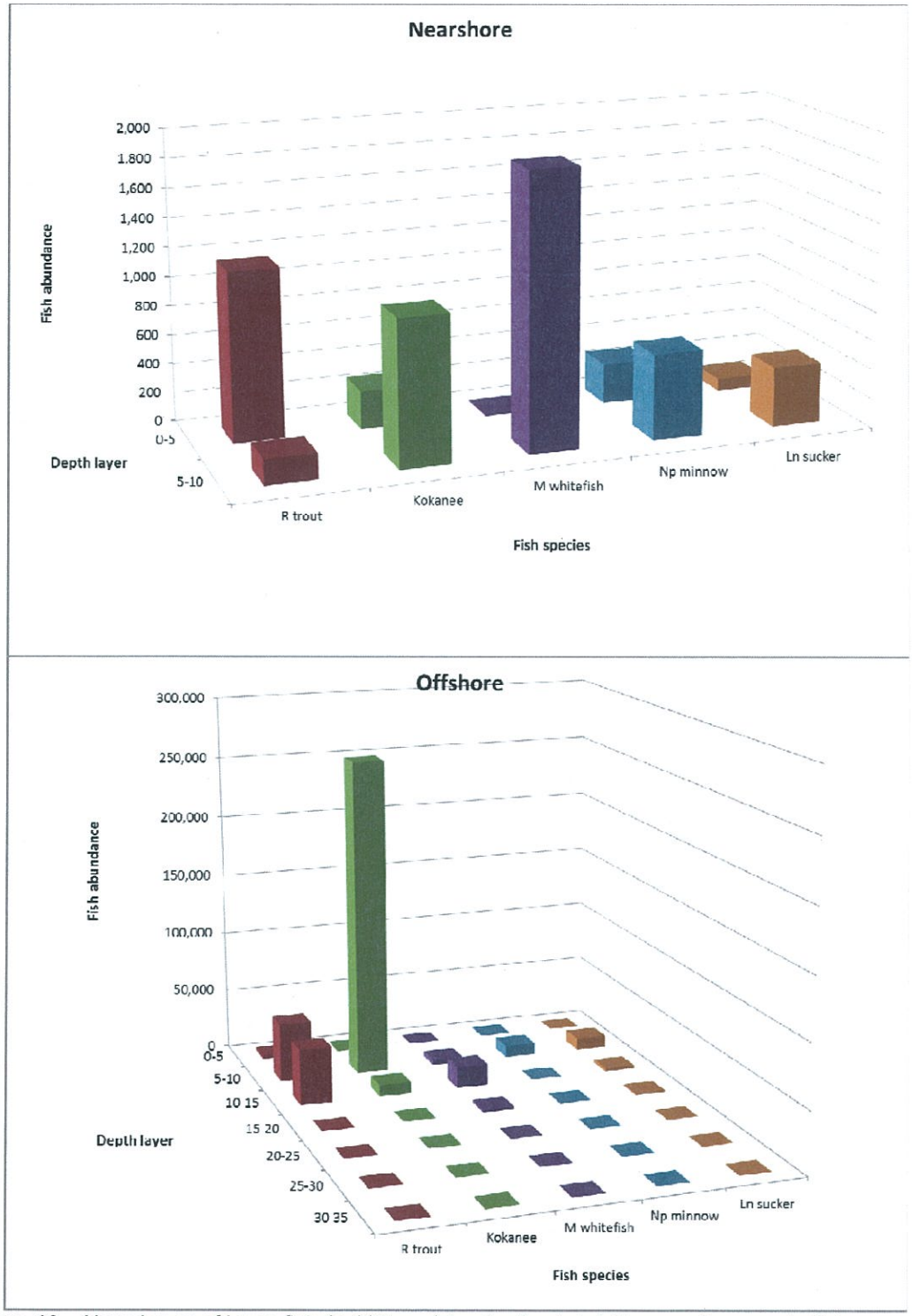


Figure 10. Abundance of large fish (≥ 100 mm) by depth at night in nearshore and offshore zones from combined acoustic and gill net data, Tatelkuz Lake, July 2013.

5.0 DISCUSSION

Sampling conditions during the survey were very suitable for acoustics. Although weather conditions were often blustery, the time allowed for sampling made it possible to obtain the calm conditions necessary for reliable side-looking acoustics throughout the lake. Plankton in the upper water column that sometimes interfered with the detection of fish was sporadic and not an appreciable problem. Most of the lake was ideal for acoustics, with relatively steep shorelines and few shallow littoral areas, minimizing boundary areas where fish are difficult to detect. In general, the quality of the resulting acoustic data was good for both day and night sampling periods on all transects.

All study objectives were met by the acoustic survey supported by gill net and thermal profile data. The data collected described temporal and spatial fish distribution patterns in the lake in detail, showing that rainbow trout, kokanee, and mountain whitefish were the most numerous species in both the nearshore and offshore sampling zones, with kokanee much more predominant offshore, especially away from the lake bottom. The nearshore fish assemblage, dominated by rainbow trout and mountain whitefish, extended offshore of the 10 m depth contour, the nominal boundary of the nearshore zone, but its outer limit could not be precisely determined from the available data. Many more fish were detected with acoustics at night than during the day because, as was indicated by gill netting, many fish shifted deeper in the water column and offshore at night, concentrating between the 5 and 15 m depths, with few below 20 m. At night, over 82% of the fish occurred in the upper water column (0-10 m), above the coldest water in the lake (5-6°C), with the densest fish layer from 5 and 10 m, where water temperatures matched the 6-13°C preferred night time temperature range of kokanee (D. Sebastian, BC MOE lake acoustics program - retired, personal communication). Surprisingly, a large number of rainbow trout were found 10-15 m deep at night, in 5-6°C water, but only along the edge of the lake basin (the slope zone). This finding was based on catches in several gill net sets, although most of these fish were captured in a single set at one location on the north shore of the lake. Rainbow trout, with a preferred temperature range of 11-22°C depending on acclimation temperature (Coutant 1977, Jobling 1981), usually occur mainly in surface waters when the temperature there is not excessively high. These patterns clearly showed that night, when fish were most accessible to acoustics, was the best period for estimating the number of fish in Tatelkuz Lake.

Abundance estimates for total fish (species combined) and kokanee appear credible. Precision of the total abundance estimate was high (± 17% of the total; typical range ±15-40%) due to a fairly uniform night time spatial distribution of fish. The whole-lake fish density estimates of 864 total fish/ha (all species combined) and 676

kokanee/ha appear credible in a non-exhaustive comparison to other water bodies of western Canada and the US for which comparable information is available. In Stave Reservoir (BC), the total fish density for nearshore and offshore zones combined was 137-527 fish/ha and kokanee density was 135-513 fish/ha from 2005 to 2009 (Stables and Perrin 2010). In both zones of Coquitlam Reservoir (BC), total fish and kokanee densities were 538 and 214 fish/ha (Bussanich et al. 2005). Pelagic surveys of kokanee in western reservoirs (no nearshore sampling was conducted and other species were not listed) have reported densities of 576 kokanee/ha in Dworshak Reservoir (Idaho) in 2005 (Stark 2006), 307-670 kokanee/ha in Lake Pend Oreille (Idaho) for 2006-2008 (Maiolie et al. 2008, Schoby et al. 2009, Wahl et al. 2010), and 156-901 kokanee/ha in Kootenay Reservoir (BC) from 1985-2006 including years of fertilization (Schindler et al. 2009).

Abundance estimates for individual species appeared reliable for the large fish size group (≥ 100 mm long). Large fish were for the most part well sampled by RISC and small-mesh gill nets (adequate sample size and spatial and temporal coverage; see the specific exception described below). Although gill nets are known to be size and species selective, RISC nets effectively sample salmonids and similarly shaped fish of 100-400 mm in length (RIC 1997), and gill netting is an accepted method of supplying species composition data for acoustic surveys of lakes when trawling is not performed (Beauchamp et al 2009). The high abundance of kokanee was not surprising considering their predominance in the large volume of the offshore pelagic zone, the most abundant habitat in the lake. Likewise, the abundance of littoral and semi-pelagic species was limited by the lesser amount of littoral and slope zone habitat available in Tatelkuz Lake. Observations that an unknown number of kokanee may have already migrated to Davidson Creek, a tributary stream, at the time of the acoustic survey (M. McGurk, AMEC, personal communication) suggest that adult kokanee numbers may have been somewhat underestimated.

Although gill net sampling was adequate for large fish species composition in most spatial cells, minimal coverage of the 5-10 m offshore cell where the acoustic estimate was high reduced the certainty of the individual species abundance estimates. Because gill netting in this spatial cell only sampled the offshore pelagic zone, which tended to favor kokanee and mountain whitefish, its species composition was adjusted to offset a possible bias against rainbow trout. This increased rainbow trout numbers in the lake by 47,944 fish, but the accuracy of this adjustment is uncertain. In any case, kokanee CPUE was particularly high in the pelagic portion of this and other spatial cells, which constituted the major part of the lake volume, supporting the conclusion that kokanee are the most abundant fish species in Tatelkuz Lake.

Abundance estimates for individual species of the small fish size group (< 100 mm) were undermined by lack of good species composition data due to extremely low catches of small fish in gill nets. Even so, the assumption that all small fish in the offshore zone were kokanee is not unreasonable. The predominance of older kokanee

in the offshore gill net catches suggests that kokanee fry from the 2012 year class should have been abundant there, too. The small TS values measured in Tatelkuz Lake were an appropriate size for kokanee fry. The temperature of the 5-10 m depth layer where most small fish were found was 6-13°C, the preferred temperature range for kokanee, not rainbow trout. Small fish species (threespine stickleback, redside shiner, and prickly sculpin) that inhabit the pelagic zone of some kokanee lakes in BC were not present in Tatelkuz Lake. Increasing the acoustic processing threshold from -65 dB to -63 dB had only a fractional effect on the count of fish, indicating that the invertebrates *Mysis sp.* and *Chaoborus sp.* did not contribute appreciably to the abundance estimate (MacLellan and Hume 2010). The combination of these facts strongly suggests that most small fish in the offshore zone were kokanee fry. The assumption that all small fish in the more species-complex nearshore zone were rainbow trout was more speculative. However, this only calls into question a minor fraction of the whole lake population estimate (2.5%) due to the relatively small size of this zone. Trawling or additional effort with small-mesh gill nets may have improved species composition estimates for the small fish size group, but with the fish densities typical of BC lakes it can be difficult to obtain a sufficient sample of small fish without a great deal of effort (D. Sebastian, BC MOE lake acoustics program - retired, personal communication).

It should be noted that benthic species of both size groups were excluded from the population estimate because they were probably mostly undetectable with acoustics. Semi-benthic species (mountain whitefish, longnose sucker, and northern pikeminnow) were probably underestimated by acoustics for a similar reason; however, gill netting showed that these species made up just a small fraction of the total fish assemblage for the large fish size group.

Although TS gives an inexact estimate of fish length, it was a useful supplement to size data from gill netting. For large fish (≥ 100 mm) in the offshore zone, the location and magnitude of modes in the length frequency distributions from TS and gill netting agreed fairly closely, suggesting that the two data sets were well matched and that gill net data was appropriate for apportioning the acoustic estimate of large fish in that zone. In the nearshore zone where the sample size from acoustics was much smaller, the position of modes and their size did not agree as well between the two methods, suggesting that they were less well matched in that zone. TS provided the only size information about the many fish < 100 mm in length that were barely sampled with RISC and small-mesh gill nets. The estimate that 55% of kokanee in the lake were fry is fairly low, but not unheard of compared to other western water bodies. Kokanee fry made up 44-89% (mean = 71%) of all kokanee in Kootenay Lake from 1985-2006 (Schindler 2009), and 69-78% (mean = 74%) of all kokanee in Lake Pend Oreille from 2006-2008 (Maiolie et al. 2008, Schoby et al. 2009, Wahl et al. 2010). The low fraction of fry in the 2013 Tatelkuz estimate suggests a weak age-0 cohort or strong cohorts of one or more older age groups. An alternate explanation is that kokanee fry may not have been fully recruited to the area accessible to acoustics at the time of the mid-July survey. Although

sampling in streams indicated that kokanee fry had migrated to Tatelkuz Lake by the time of the acoustic survey (M. McGurk, AMEC, personal communication), fry of some kokanee populations "remain inshore and forage in the littoral zone for variable amounts of time" after entering the lake before becoming fully pelagic (McPhail 2007). Whether or not fry use the littoral zone this way in a particular lake is probably related to food availability, thermal conditions, and predation risk (ibid). The failure of minnow traps and small mesh gill nets to capture any kokanee fry in the littoral zone (AMEC 2013) does not support the conjecture that kokanee may have an extended period of littoral residence in Tatelkuz Lake.

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Annex 5.14-2
Tatelkuz Lake Acoustic Survey Data, July 2013

Table 5.14-2A: Tatelkuz Lake BC, 2013 acoustic survey data appendices.

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Survey dates: July 9-12, 2013

Spreadsheet "ForAbundanceEstimate"	
Variable	Definition
LAKE$	Lake name: Tatelkuz
YEAR	Year of survey: 2013
PERIOD$	diel period: day = sunrise to sunset; night = one hour after sundown to one hour before sunrise
HABZONE$	Horizontal sampling strata: nearshore and offshore sampling zones, shoreward and offshore of the 10 m depth contour, respectively.
TRANSECT	cross-lake transect, numbered 1-16
LAYER	5-m thick depth layer, numbered 1-7, covering 0-35 m in total.
Upper_limit	Uppler depth limit of a layer
Lower_limit	lower depth limit of a layer
FISHCOUNT	count of fish in a transect-depth layer cell
CUBICM	volume swept by the acoustic beam in a transect-depth layer cell
FPCM	fish per cubic meter in a transect-depth layer cell
SOURCE$	transducer used for a transect-depth layer cell: downlooking or sidelooking

Spreadsheets "DayArealDensity" & "NightArealDensity"; each line of data represents one 25 m long interval of a transect for down and side-looking data combined.	
Variable	Definition
LON	longitude, NAD83
LAT	latitude, NAD83
FPHA	mean fish density per unit of lake surface area as fish per hectare, species combined
PERIOD$	diel period: day = sunrise to sunset; night = one hour after sundown to one hour before sunrise
HABZONE$	Horizontal sampling strata: nearshore and offshore sampling zones, shoreward and offshore of the 10 m depth contour, respectively.
TranType	Type of transect: shoreline = along the shore; cross-lake = perpendicular to shore, also used for the abundance estimate.

Table 5.14-2B: Tatelkuz Lake Hydroacoustics Abundance Estimates, July 2013.

LAKE$	YEAR	PERIOD$	HABZONE$	TRANSECT	LAYER	Upper_limit	Lower_limit	FISHCOUNT	CUBICM	FPCM	SOURCE$
Tatelkuz	2013	night	nearshore	1	1	0	5	1	1470	0.000680	Side
Tatelkuz	2013	night	nearshore	1	2	5	10	0	55	0.000000	down
Tatelkuz	2013	night	nearshore	2	1	0	5	3	1400	0.002144	Side
Tatelkuz	2013	night	nearshore	2	2	5	10	0	100	0.000000	down
Tatelkuz	2013	night	nearshore	2	3	10	15	0	2	0.000000	down
Tatelkuz	2013	night	nearshore	3	1	0	5	0	493	0.000000	Side
Tatelkuz	2013	night	nearshore	3	2	5	10	0	73	0.000000	down
Tatelkuz	2013	night	nearshore	3	3	10	15	0	11	0.000000	down
Tatelkuz	2013	night	nearshore	4	1	0	5	10	902	0.011085	Side
Tatelkuz	2013	night	nearshore	4	2	5	10	6	171	0.035126	down
Tatelkuz	2013	night	nearshore	4	3	10	15	0	5	0.000000	down
Tatelkuz	2013	night	nearshore	5	1	0	5	2	1499	0.001335	Side
Tatelkuz	2013	night	nearshore	5	2	5	10	0	162	0.000000	down
Tatelkuz	2013	night	nearshore	5	3	10	15	0	20	0.000000	down
Tatelkuz	2013	night	nearshore	6	1	0	5	1	2313	0.000432	Side
Tatelkuz	2013	night	nearshore	6	2	5	10	1	167	0.005983	down
Tatelkuz	2013	night	nearshore	6	3	10	15	0	16	0.000000	down
Tatelkuz	2013	night	nearshore	7	1	0	5	0	139	0.000000	Side
Tatelkuz	2013	night	nearshore	7	2	5	10	0	65	0.000000	down
Tatelkuz	2013	night	nearshore	7	3	10	15	0	16	0.000000	down
Tatelkuz	2013	night	nearshore	8	1	0	5	1	69	0.014532	Side
Tatelkuz	2013	night	nearshore	8	2	5	10	1	48	0.020643	down
Tatelkuz	2013	night	nearshore	8	3	10	15	0	1	0.000000	down
Tatelkuz	2013	night	nearshore	9	1	0	5	0	1424	0.000000	Side
Tatelkuz	2013	night	nearshore	9	2	5	10	0	58	0.000000	down
Tatelkuz	2013	night	nearshore	10	1	0	5	0	2104	0.000000	Side
Tatelkuz	2013	night	nearshore	10	2	5	10	0	71	0.000000	down
Tatelkuz	2013	night	nearshore	10	3	10	15	0	1	0.000000	down
Tatelkuz	2013	night	nearshore	11	1	0	5	1	908	0.001102	Side
Tatelkuz	2013	night	nearshore	11	2	5	10	0	102	0.000000	down
Tatelkuz	2013	night	nearshore	11	3	10	15	0	1	0.000000	down
Tatelkuz	2013	night	nearshore	12	1	0	5	1	1365	0.000732	Side
Tatelkuz	2013	night	nearshore	12	2	5	10	1	75	0.013411	down
Tatelkuz	2013	night	nearshore	12	3	10	15	0	0	0.000000	down
Tatelkuz	2013	night	nearshore	13	1	0	5	1	1216	0.000822	Side
Tatelkuz	2013	night	nearshore	13	2	5	10	2	109	0.018417	down
Tatelkuz	2013	night	nearshore	13	3	10	15	0	4	0.000000	down
Tatelkuz	2013	night	nearshore	14	1	0	5	0	496	0.000000	Side
Tatelkuz	2013	night	nearshore	14	2	5	10	2	60	0.033122	down
Tatelkuz	2013	night	nearshore	14	3	10	15	0	19	0.000000	down
Tatelkuz	2013	night	nearshore	15	1	0	5	0	950	0.000000	Side
Tatelkuz	2013	night	nearshore	15	2	5	10	0	57	0.000000	down
Tatelkuz	2013	night	nearshore	15	3	10	15	0	17	0.000000	down
Tatelkuz	2013	night	nearshore	16	1	0	5	1	1946	0.000514	Side
Tatelkuz	2013	night	nearshore	16	2	5	10	2	230	0.008687	down
Tatelkuz	2013	night	nearshore	16	3	10	15	0	3	0.000000	down
Tatelkuz	2013	night	offshore	1	1	0	5	37	11000	0.003364	Side
Tatelkuz	2013	night	offshore	1	2	5	10	30	1284	0.023371	down
Tatelkuz	2013	night	offshore	1	3	10	15	11	1328	0.008284	down
Tatelkuz	2013	night	offshore	2	1	0	5	58	24624	0.002355	Side
Tatelkuz	2013	night	offshore	2	2	5	10	13	2933	0.004432	down
Tatelkuz	2013	night	offshore	2	3	10	15	3	5551	0.000540	down
Tatelkuz	2013	night	offshore	2	4	15	20	2	6637	0.000301	down
Tatelkuz	2013	night	offshore	2	5	20	25	0	5106	0.000000	down
Tatelkuz	2013	night	offshore	2	6	25	30	0	442	0.000000	down

LAKE$	YEAR	PERIOD$	HABZONE$	TRANSECT	LAYER	Upper_limit	Lower_limit	FISHCOUNT	CUBICM	FPCM	SOURCE$
Tatelkuz	2013	night	offshore	3	1	0	5	63	28995	0.002173	Side
Tatelkuz	2013	night	offshore	3	2	5	10	23	3358	0.006850	down
Tatelkuz	2013	night	offshore	3	3	10	15	6	6378	0.000941	down
Tatelkuz	2013	night	offshore	3	4	15	20	3	8763	0.000342	down
Tatelkuz	2013	night	offshore	3	5	20	25	1	9305	0.000107	down
Tatelkuz	2013	night	offshore	3	6	25	30	0	5164	0.000000	down
Tatelkuz	2013	night	offshore	4	1	0	5	41	32267	0.001271	Side
Tatelkuz	2013	night	offshore	4	2	5	10	45	3697	0.012173	down
Tatelkuz	2013	night	offshore	4	3	10	15	11	4498	0.002445	down
Tatelkuz	2013	night	offshore	4	4	15	20	3	5809	0.000516	down
Tatelkuz	2013	night	offshore	4	5	20	25	0	7022	0.000000	down
Tatelkuz	2013	night	offshore	4	6	25	30	0	5564	0.000000	down
Tatelkuz	2013	night	offshore	5	1	0	5	15	20802	0.000721	Side
Tatelkuz	2013	night	offshore	5	2	5	10	94	3191	0.029459	down
Tatelkuz	2013	night	offshore	5	3	10	15	24	5951	0.004033	down
Tatelkuz	2013	night	offshore	5	4	15	20	1	8108	0.000123	down
Tatelkuz	2013	night	offshore	5	5	20	25	2	9915	0.000202	down
Tatelkuz	2013	night	offshore	5	6	25	30	1	9888	0.000101	down
Tatelkuz	2013	night	offshore	6	1	0	5	11	20693	0.000532	Side
Tatelkuz	2013	night	offshore	6	2	5	10	38	2661	0.014279	down
Tatelkuz	2013	night	offshore	6	3	10	15	16	4947	0.003234	down
Tatelkuz	2013	night	offshore	6	4	15	20	1	6655	0.000150	down
Tatelkuz	2013	night	offshore	6	5	20	25	1	8265	0.000121	down
Tatelkuz	2013	night	offshore	6	6	25	30	0	9270	0.000000	down
Tatelkuz	2013	night	offshore	6	7	30	35	0	49	0.000000	down
Tatelkuz	2013	night	offshore	7	1	0	5	10	22362	0.000447	Side
Tatelkuz	2013	night	offshore	7	2	5	10	43	2827	0.015212	down
Tatelkuz	2013	night	offshore	7	3	10	15	8	5410	0.001479	down
Tatelkuz	2013	night	offshore	7	4	15	20	4	7613	0.000525	down
Tatelkuz	2013	night	offshore	7	5	20	25	0	9533	0.000000	down
Tatelkuz	2013	night	offshore	7	6	25	30	0	10493	0.000000	down
Tatelkuz	2013	night	offshore	7	7	30	35	0	353	0.000000	down
Tatelkuz	2013	night	offshore	8	1	0	5	14	22268	0.000629	Side
Tatelkuz	2013	night	offshore	8	2	5	10	50	2846	0.017570	down
Tatelkuz	2013	night	offshore	8	3	10	15	5	5412	0.000924	down
Tatelkuz	2013	night	offshore	8	4	15	20	2	7569	0.000264	down
Tatelkuz	2013	night	offshore	8	5	20	25	0	9160	0.000000	down
Tatelkuz	2013	night	offshore	8	6	25	30	1	10151	0.000099	down
Tatelkuz	2013	night	offshore	8	7	30	35	0	460	0.000000	down
Tatelkuz	2013	night	offshore	9	1	0	5	15	22800	0.000658	Side
Tatelkuz	2013	night	offshore	9	2	5	10	43	3267	0.013163	down
Tatelkuz	2013	night	offshore	9	3	10	15	7	6189	0.001131	down
Tatelkuz	2013	night	offshore	9	4	15	20	1	8747	0.000114	down
Tatelkuz	2013	night	offshore	9	5	20	25	1	10950	0.000091	down
Tatelkuz	2013	night	offshore	9	6	25	30	0	11953	0.000000	down
Tatelkuz	2013	night	offshore	9	7	30	35	0	47	0.000000	down
Tatelkuz	2013	night	offshore	10	1	0	5	28	29092	0.000962	Side
Tatelkuz	2013	night	offshore	10	2	5	10	49	3449	0.014206	down
Tatelkuz	2013	night	offshore	10	3	10	15	14	6567	0.002132	down
Tatelkuz	2013	night	offshore	10	4	15	20	1	9244	0.000108	down
Tatelkuz	2013	night	offshore	10	5	20	25	1	11020	0.000091	down
Tatelkuz	2013	night	offshore	10	6	25	30	0	10916	0.000000	down
Tatelkuz	2013	night	offshore	11	1	0	5	14	27195	0.000515	Side
Tatelkuz	2013	night	offshore	11	2	5	10	46	3365	0.013669	down
Tatelkuz	2013	night	offshore	11	3	10	15	15	6334	0.002368	down
Tatelkuz	2013	night	offshore	11	4	15	20	1	8900	0.000112	down

LAKE$	YEAR	PERIOD$	HABZONE$	TRANSECT	LAYER	Upper_limit	Lower_limit	FISHCOUNT	CUBICM	FPCM	SOURCE$
Tatelkuz	2013	night	offshore	11	5	20	25	2	10768	0.000186	down
Tatelkuz	2013	night	offshore	11	6	25	30	0	10066	0.000000	down
Tatelkuz	2013	night	offshore	12	1	0	5	21	29100	0.000722	Side
Tatelkuz	2013	night	offshore	12	2	5	10	69	3712	0.018586	down
Tatelkuz	2013	night	offshore	12	3	10	15	28	7006	0.003997	down
Tatelkuz	2013	night	offshore	12	4	15	20	3	9693	0.000310	down
Tatelkuz	2013	night	offshore	12	5	20	25	2	11343	0.000176	down
Tatelkuz	2013	night	offshore	12	6	25	30	1	7089	0.000141	down
Tatelkuz	2013	night	offshore	13	1	0	5	4	13974	0.000286	Side
Tatelkuz	2013	night	offshore	13	2	5	10	22	1640	0.013413	down
Tatelkuz	2013	night	offshore	13	3	10	15	12	3077	0.003899	down
Tatelkuz	2013	night	offshore	13	4	15	20	0	4112	0.000000	down
Tatelkuz	2013	night	offshore	13	5	20	25	0	4736	0.000000	down
Tatelkuz	2013	night	offshore	13	6	25	30	0	1198	0.000000	down
Tatelkuz	2013	night	offshore	14	1	0	5	7	24141	0.000290	Side
Tatelkuz	2013	night	offshore	14	2	5	10	74	2760	0.026816	down
Tatelkuz	2013	night	offshore	14	3	10	15	47	5302	0.008865	down
Tatelkuz	2013	night	offshore	14	4	15	20	1	7497	0.000133	down
Tatelkuz	2013	night	offshore	14	5	20	25	1	9365	0.000107	down
Tatelkuz	2013	night	offshore	14	6	25	30	0	1329	0.000000	down
Tatelkuz	2013	night	offshore	15	1	0	5	17	38116	0.000446	Side
Tatelkuz	2013	night	offshore	15	2	5	10	51	4387	0.011626	down
Tatelkuz	2013	night	offshore	15	3	10	15	40	8436	0.004742	down
Tatelkuz	2013	night	offshore	15	4	15	20	2	11693	0.000171	down
Tatelkuz	2013	night	offshore	15	5	20	25	1	8822	0.000113	down
Tatelkuz	2013	night	offshore	16	1	0	5	32	39572	0.000809	Side
Tatelkuz	2013	night	offshore	16	2	5	10	40	4574	0.008745	down
Tatelkuz	2013	night	offshore	16	3	10	15	43	6932	0.006203	down
Tatelkuz	2013	night	offshore	16	4	15	20	8	3297	0.002427	down

Table 5.14-2C: Tatelkuz Lake Hydracoustic Density Estimates, Day

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.71302	53.30519	0	day	nearshore	shoreline
-124.71325	53.30501	156	day	nearshore	shoreline
-124.71352	53.30484	0	day	offshore	shoreline
-124.71344	53.30467	0	day	offshore	shoreline
-124.71329	53.30444	137	day	offshore	shoreline
-124.71314	53.30423	136	day	offshore	shoreline
-124.71299	53.30403	0	day	offshore	shoreline
-124.71277	53.30386	0	day	offshore	shoreline
-124.71246	53.30372	336	day	offshore	shoreline
-124.71214	53.30360	75	day	nearshore	shoreline
-124.71192	53.30342	91	day	nearshore	shoreline
-124.71177	53.30322	0	day	nearshore	shoreline
-124.71165	53.30302	0	day	nearshore	shoreline
-124.71151	53.30279	0	day	nearshore	shoreline
-124.71131	53.30261	68	day	offshore	shoreline
-124.71101	53.30251	187	day	offshore	shoreline
-124.71064	53.30242	343	day	nearshore	shoreline
-124.71030	53.30234	698	day	nearshore	shoreline
-124.70993	53.30229	0	day	nearshore	shoreline
-124.70962	53.30217	0	day	nearshore	shoreline
-124.70933	53.30204	0	day	nearshore	shoreline
-124.70902	53.30191	0	day	nearshore	shoreline
-124.70861	53.30181	140	day	nearshore	shoreline
-124.70096	53.29974	0	day	nearshore	shoreline
-124.70076	53.29965	0	day	offshore	shoreline
-124.70036	53.29965	0	day	offshore	shoreline
-124.70000	53.29963	0	day	nearshore	shoreline
-124.69966	53.29955	0	day	nearshore	shoreline
-124.69932	53.29944	0	day	offshore	shoreline
-124.69898	53.29936	0	day	offshore	shoreline
-124.69862	53.29927	0	day	nearshore	shoreline
-124.69827	53.29918	0	day	nearshore	shoreline
-124.69794	53.29909	612	day	nearshore	shoreline
-124.69760	53.29901	0	day	nearshore	shoreline
-124.69723	53.29893	0	day	nearshore	shoreline
-124.69689	53.29885	0	day	nearshore	shoreline
-124.69653	53.29877	0	day	offshore	shoreline
-124.69617	53.29869	0	day	offshore	shoreline
-124.69583	53.29868	93	day	offshore	shoreline
-124.69544	53.29863	0	day	nearshore	shoreline
-124.69519	53.29846	0	day	nearshore	shoreline
-124.69497	53.29830	0	day	offshore	shoreline
-124.69476	53.29811	68	day	offshore	shoreline
-124.69453	53.29793	0	day	offshore	shoreline
-124.69429	53.29774	0	day	offshore	shoreline
-124.69406	53.29759	0	day	offshore	shoreline
-124.69381	53.29742	0	day	nearshore	shoreline
-124.69365	53.29721	0	day	nearshore	shoreline
-124.69350	53.29700	137	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.69336	53.29680	0	day	nearshore	shoreline
-124.69322	53.29657	0	day	nearshore	shoreline
-124.69287	53.29655	0	day	nearshore	shoreline
-124.69272	53.29653	0	day	nearshore	shoreline
-124.68765	53.29330	0	day	nearshore	shoreline
-124.68777	53.29316	0	day	nearshore	shoreline
-124.68798	53.29299	0	day	nearshore	shoreline
-124.68762	53.29293	0	day	nearshore	shoreline
-124.68725	53.29290	0	day	nearshore	shoreline
-124.68696	53.29278	0	day	nearshore	shoreline
-124.68664	53.29265	0	day	nearshore	shoreline
-124.68634	53.29251	0	day	nearshore	shoreline
-124.68606	53.29237	0	day	nearshore	shoreline
-124.68583	53.29219	0	day	offshore	shoreline
-124.68551	53.29206	68	day	offshore	shoreline
-124.68520	53.29194	0	day	offshore	shoreline
-124.68483	53.29191	69	day	offshore	shoreline
-124.68445	53.29185	0	day	nearshore	shoreline
-124.68422	53.29170	0	day	nearshore	shoreline
-124.68398	53.29152	0	day	nearshore	shoreline
-124.68389	53.29131	0	day	nearshore	shoreline
-124.68371	53.29111	0	day	nearshore	shoreline
-124.68362	53.29090	0	day	nearshore	shoreline
-124.68339	53.29072	0	day	nearshore	shoreline
-124.68314	53.29056	0	day	nearshore	shoreline
-124.68298	53.29036	0	day	nearshore	shoreline
-124.68290	53.29014	72	day	nearshore	shoreline
-124.68284	53.28991	0	day	nearshore	shoreline
-124.68276	53.28969	0	day	nearshore	shoreline
-124.68255	53.28951	0	day	offshore	shoreline
-124.68224	53.28940	0	day	offshore	shoreline
-124.68187	53.28935	0	day	nearshore	shoreline
-124.68155	53.28923	0	day	nearshore	shoreline
-124.68135	53.28905	0	day	nearshore	shoreline
-124.68123	53.28884	0	day	nearshore	shoreline
-124.68118	53.28861	119	day	nearshore	shoreline
-124.68107	53.28839	0	day	nearshore	shoreline
-124.68090	53.28852	0	day	nearshore	shoreline
-124.68088	53.28876	0	day	nearshore	shoreline
-124.68082	53.28898	0	day	nearshore	shoreline
-124.68077	53.28919	0	day	nearshore	shoreline
-124.68075	53.28942	0	day	nearshore	shoreline
-124.68069	53.28965	99	day	nearshore	shoreline
-124.68064	53.28986	0	day	nearshore	shoreline
-124.67613	53.28587	0	day	nearshore	shoreline
-124.67622	53.28577	0	day	nearshore	shoreline
-124.67639	53.28558	0	day	nearshore	shoreline
-124.67601	53.28556	0	day	nearshore	shoreline
-124.67562	53.28561	0	day	nearshore	shoreline
-124.67543	53.28547	0	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.67531	53.28524	0	day	nearshore	shoreline
-124.67521	53.28502	0	day	offshore	shoreline
-124.67499	53.28486	365	day	offshore	shoreline
-124.67469	53.28472	296	day	offshore	shoreline
-124.67439	53.28459	0	day	offshore	shoreline
-124.67417	53.28440	0	day	nearshore	shoreline
-124.67398	53.28421	0	day	nearshore	shoreline
-124.67378	53.28402	0	day	offshore	shoreline
-124.67356	53.28384	0	day	offshore	shoreline
-124.67331	53.28370	0	day	nearshore	shoreline
-124.67316	53.28348	0	day	nearshore	shoreline
-124.67306	53.28326	0	day	offshore	shoreline
-124.67281	53.28310	578	day	offshore	shoreline
-124.67253	53.28295	0	day	offshore	shoreline
-124.67227	53.28279	0	day	offshore	shoreline
-124.67201	53.28263	0	day	nearshore	shoreline
-124.67175	53.28247	0	day	nearshore	shoreline
-124.67144	53.28233	0	day	nearshore	shoreline
-124.67125	53.28215	0	day	nearshore	shoreline
-124.67093	53.28205	0	day	offshore	shoreline
-124.67057	53.28198	0	day	offshore	shoreline
-124.67020	53.28200	0	day	nearshore	shoreline
-124.66991	53.28199	0	day	nearshore	shoreline
-124.66368	53.28039	0	day	nearshore	shoreline
-124.66362	53.28019	0	day	nearshore	shoreline
-124.66326	53.28017	0	day	nearshore	shoreline
-124.66300	53.28002	0	day	nearshore	shoreline
-124.66276	53.27984	0	day	nearshore	shoreline
-124.66252	53.27967	0	day	nearshore	shoreline
-124.66227	53.27950	0	day	nearshore	shoreline
-124.66199	53.27934	0	day	nearshore	shoreline
-124.66174	53.27919	0	day	nearshore	shoreline
-124.66142	53.27907	0	day	nearshore	shoreline
-124.66108	53.27897	0	day	nearshore	shoreline
-124.66076	53.27887	0	day	nearshore	shoreline
-124.66055	53.27869	0	day	nearshore	shoreline
-124.66028	53.27853	0	day	nearshore	shoreline
-124.65995	53.27842	0	day	nearshore	shoreline
-124.65966	53.27829	0	day	nearshore	shoreline
-124.65932	53.27818	0	day	nearshore	shoreline
-124.65904	53.27807	0	day	nearshore	shoreline
-124.65893	53.27786	0	day	nearshore	shoreline
-124.65884	53.27763	0	day	offshore	shoreline
-124.65855	53.27752	0	day	offshore	shoreline
-124.65817	53.27753	0	day	offshore	shoreline
-124.65783	53.27747	0	day	nearshore	shoreline
-124.65752	53.27733	0	day	nearshore	shoreline
-124.65720	53.27722	0	day	nearshore	shoreline
-124.65687	53.27713	0	day	nearshore	shoreline
-124.65647	53.27703	0	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65086	53.27254	0	day	offshore	shoreline
-124.65063	53.27248	0	day	offshore	shoreline
-124.65027	53.27252	256	day	offshore	shoreline
-124.64990	53.27254	0	day	offshore	shoreline
-124.64958	53.27244	0	day	offshore	shoreline
-124.64926	53.27230	0	day	offshore	shoreline
-124.64894	53.27221	0	day	nearshore	shoreline
-124.64869	53.27203	0	day	nearshore	shoreline
-124.64849	53.27185	0	day	offshore	shoreline
-124.64823	53.27170	0	day	nearshore	shoreline
-124.64794	53.27155	0	day	nearshore	shoreline
-124.64765	53.27140	0	day	nearshore	shoreline
-124.64747	53.27121	0	day	nearshore	shoreline
-124.64730	53.27101	0	day	offshore	shoreline
-124.64696	53.27092	0	day	offshore	shoreline
-124.64664	53.27083	0	day	nearshore	shoreline
-124.64656	53.27061	0	day	offshore	shoreline
-124.64639	53.27043	266	day	offshore	shoreline
-124.64604	53.27034	0	day	offshore	shoreline
-124.64572	53.27024	0	day	nearshore	shoreline
-124.64550	53.27006	0	day	nearshore	shoreline
-124.64531	53.26987	0	day	nearshore	shoreline
-124.64515	53.26966	0	day	nearshore	shoreline
-124.64505	53.26948	305	day	offshore	shoreline
-124.64463	53.26949	0	day	nearshore	shoreline
-124.64479	53.26944	83	day	nearshore	shoreline
-124.64517	53.26940	0	day	offshore	shoreline
-124.64303	53.26235	0	day	nearshore	shoreline
-124.64280	53.26226	0	day	nearshore	shoreline
-124.64244	53.26220	0	day	nearshore	shoreline
-124.64207	53.26216	0	day	nearshore	shoreline
-124.64172	53.26209	0	day	offshore	shoreline
-124.64134	53.26208	0	day	offshore	shoreline
-124.64101	53.26217	0	day	offshore	shoreline
-124.64063	53.26223	0	day	nearshore	shoreline
-124.64028	53.26220	0	day	nearshore	shoreline
-124.63996	53.26208	0	day	nearshore	shoreline
-124.63963	53.26197	0	day	nearshore	shoreline
-124.63934	53.26183	0	day	nearshore	shoreline
-124.63904	53.26170	0	day	offshore	shoreline
-124.63872	53.26180	0	day	offshore	shoreline
-124.63841	53.26194	0	day	offshore	shoreline
-124.63819	53.26212	0	day	offshore	shoreline
-124.63794	53.26222	109	day	offshore	shoreline
-124.63770	53.26205	0	day	offshore	shoreline
-124.63745	53.26188	0	day	offshore	shoreline
-124.63718	53.26173	70	day	offshore	shoreline
-124.63691	53.26156	0	day	offshore	shoreline
-124.63666	53.26140	0	day	nearshore	shoreline
-124.63641	53.26124	0	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.63619	53.26105	0	day	nearshore	shoreline
-124.63603	53.26085	0	day	offshore	shoreline
-124.63584	53.26063	0	day	offshore	shoreline
-124.63590	53.26077	136	day	offshore	shoreline
-124.63588	53.26100	0	day	nearshore	shoreline
-124.62785	53.25862	0	day	nearshore	shoreline
-124.62788	53.25848	0	day	nearshore	shoreline
-124.62799	53.25825	0	day	offshore	shoreline
-124.62781	53.25807	0	day	offshore	shoreline
-124.62753	53.25792	0	day	offshore	shoreline
-124.62722	53.25779	0	day	offshore	shoreline
-124.62687	53.25772	0	day	offshore	shoreline
-124.62651	53.25763	0	day	nearshore	shoreline
-124.62623	53.25749	0	day	nearshore	shoreline
-124.62599	53.25732	0	day	nearshore	shoreline
-124.62579	53.25713	112	day	nearshore	shoreline
-124.62552	53.25698	0	day	nearshore	shoreline
-124.62520	53.25686	0	day	nearshore	shoreline
-124.62487	53.25676	0	day	nearshore	shoreline
-124.62459	53.25660	0	day	nearshore	shoreline
-124.62425	53.25654	0	day	offshore	shoreline
-124.62387	53.25656	0	day	nearshore	shoreline
-124.62351	53.25650	210	day	nearshore	shoreline
-124.62315	53.25645	102	day	nearshore	shoreline
-124.62280	53.25637	0	day	nearshore	shoreline
-124.62258	53.25621	0	day	nearshore	shoreline
-124.62265	53.25598	0	day	nearshore	shoreline
-124.62247	53.25582	0	day	nearshore	shoreline
-124.62223	53.25571	0	day	nearshore	shoreline
-124.71723	53.29627	0	day	nearshore	shoreline
-124.71686	53.29628	0	day	nearshore	shoreline
-124.71680	53.29604	0	day	nearshore	shoreline
-124.71676	53.29582	0	day	nearshore	shoreline
-124.71657	53.29564	0	day	nearshore	shoreline
-124.71627	53.29550	0	day	nearshore	shoreline
-124.71595	53.29536	0	day	offshore	shoreline
-124.71583	53.29517	0	day	nearshore	shoreline
-124.71581	53.29493	0	day	nearshore	shoreline
-124.71556	53.29480	0	day	nearshore	shoreline
-124.71523	53.29469	0	day	nearshore	shoreline
-124.71489	53.29459	0	day	nearshore	shoreline
-124.71458	53.29447	0	day	nearshore	shoreline
-124.71428	53.29434	0	day	nearshore	shoreline
-124.71394	53.29424	0	day	nearshore	shoreline
-124.71360	53.29414	0	day	nearshore	shoreline
-124.71325	53.29408	0	day	nearshore	shoreline
-124.71290	53.29400	0	day	nearshore	shoreline
-124.71255	53.29391	0	day	nearshore	shoreline
-124.71221	53.29383	0	day	nearshore	shoreline
-124.71187	53.29375	68	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.71153	53.29366	0	day	nearshore	shoreline
-124.71122	53.29354	0	day	nearshore	shoreline
-124.71088	53.29345	0	day	nearshore	shoreline
-124.71068	53.29336	0	day	nearshore	shoreline
-124.70421	53.28946	0	day	nearshore	shoreline
-124.70391	53.28944	0	day	nearshore	shoreline
-124.70368	53.28928	0	day	nearshore	shoreline
-124.70349	53.28907	136	day	nearshore	shoreline
-124.70281	53.28831	0	day	nearshore	shoreline
-124.70250	53.28818	0	day	nearshore	shoreline
-124.70225	53.28803	0	day	nearshore	shoreline
-124.70204	53.28784	0	day	nearshore	shoreline
-124.70191	53.28764	0	day	nearshore	shoreline
-124.70168	53.28745	0	day	nearshore	shoreline
-124.70137	53.28730	0	day	nearshore	shoreline
-124.70111	53.28718	0	day	nearshore	shoreline
-124.70083	53.28703	0	day	nearshore	shoreline
-124.70055	53.28689	0	day	nearshore	shoreline
-124.70021	53.28676	0	day	nearshore	shoreline
-124.69986	53.28678	0	day	nearshore	shoreline
-124.69951	53.28672	0	day	nearshore	shoreline
-124.69914	53.28661	0	day	nearshore	shoreline
-124.69882	53.28654	0	day	nearshore	shoreline
-124.69847	53.28645	0	day	nearshore	shoreline
-124.69812	53.28638	0	day	nearshore	shoreline
-124.69777	53.28633	0	day	nearshore	shoreline
-124.69031	53.28415	0	day	nearshore	shoreline
-124.69006	53.28416	717	day	nearshore	shoreline
-124.68989	53.28393	0	day	nearshore	shoreline
-124.68962	53.28378	0	day	nearshore	shoreline
-124.68933	53.28364	0	day	nearshore	shoreline
-124.68898	53.28361	0	day	nearshore	shoreline
-124.68862	53.28367	0	day	nearshore	shoreline
-124.68826	53.28369	0	day	nearshore	shoreline
-124.68791	53.28362	81	day	nearshore	shoreline
-124.68771	53.28344	0	day	nearshore	shoreline
-124.68753	53.28326	0	day	nearshore	shoreline
-124.68741	53.28284	0	day	nearshore	shoreline
-124.68715	53.28268	0	day	nearshore	shoreline
-124.68703	53.28249	69	day	offshore	shoreline
-124.68710	53.28228	0	day	nearshore	shoreline
-124.68705	53.28206	0	day	nearshore	shoreline
-124.68671	53.28197	0	day	nearshore	shoreline
-124.68648	53.28182	0	day	nearshore	shoreline
-124.68631	53.28161	0	day	nearshore	shoreline
-124.68613	53.28142	0	day	nearshore	shoreline
-124.68591	53.28123	0	day	nearshore	shoreline
-124.68573	53.28107	0	day	nearshore	shoreline
-124.68544	53.28094	71	day	nearshore	shoreline
-124.68531	53.28074	0	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.68523	53.28051	0	day	nearshore	shoreline
-124.68518	53.28034	0	day	nearshore	shoreline
-124.67915	53.27635	0	day	nearshore	shoreline
-124.67890	53.27637	0	day	nearshore	shoreline
-124.67858	53.27622	0	day	nearshore	shoreline
-124.67823	53.27614	0	day	nearshore	shoreline
-124.67788	53.27608	0	day	nearshore	shoreline
-124.67751	53.27603	0	day	offshore	shoreline
-124.67714	53.27597	0	day	offshore	shoreline
-124.67680	53.27589	0	day	nearshore	shoreline
-124.67645	53.27582	0	day	nearshore	shoreline
-124.67606	53.27579	0	day	nearshore	shoreline
-124.67571	53.27578	773	day	nearshore	shoreline
-124.67534	53.27573	79	day	nearshore	shoreline
-124.67506	53.27558	0	day	nearshore	shoreline
-124.67487	53.27539	0	day	nearshore	shoreline
-124.67459	53.27524	0	day	nearshore	shoreline
-124.67442	53.27506	0	day	nearshore	shoreline
-124.67434	53.27484	0	day	nearshore	shoreline
-124.67380	53.27439	0	day	nearshore	shoreline
-124.67348	53.27449	0	day	nearshore	shoreline
-124.67339	53.27429	68	day	nearshore	shoreline
-124.67331	53.27406	0	day	nearshore	shoreline
-124.67319	53.27385	0	day	nearshore	shoreline
-124.67308	53.27365	0	day	nearshore	shoreline
-124.67303	53.27336	0	day	nearshore	shoreline
-124.66690	53.26954	0	day	nearshore	shoreline
-124.66651	53.26959	205	day	nearshore	shoreline
-124.66629	53.26948	73	day	nearshore	shoreline
-124.66610	53.26927	0	day	nearshore	shoreline
-124.66589	53.26908	68	day	nearshore	shoreline
-124.66566	53.26890	0	day	nearshore	shoreline
-124.66543	53.26873	0	day	nearshore	shoreline
-124.66516	53.26856	0	day	nearshore	shoreline
-124.66489	53.26843	0	day	nearshore	shoreline
-124.66466	53.26824	0	day	nearshore	shoreline
-124.66446	53.26805	0	day	nearshore	shoreline
-124.66429	53.26785	68	day	nearshore	shoreline
-124.66416	53.26765	204	day	nearshore	shoreline
-124.66393	53.26748	0	day	nearshore	shoreline
-124.66366	53.26731	68	day	nearshore	shoreline
-124.66345	53.26713	0	day	nearshore	shoreline
-124.66327	53.26694	0	day	nearshore	shoreline
-124.66305	53.26675	0	day	nearshore	shoreline
-124.66281	53.26657	0	day	nearshore	shoreline
-124.66252	53.26642	0	day	nearshore	shoreline
-124.66225	53.26632	0	day	nearshore	shoreline
-124.66203	53.26616	0	day	nearshore	shoreline
-124.65632	53.26224	0	day	nearshore	shoreline
-124.65600	53.26224	73	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65564	53.26215	0	day	nearshore	shoreline
-124.65541	53.26200	69	day	nearshore	shoreline
-124.65517	53.26182	0	day	nearshore	shoreline
-124.65491	53.26167	0	day	nearshore	shoreline
-124.65463	53.26151	0	day	nearshore	shoreline
-124.65433	53.26137	0	day	nearshore	shoreline
-124.65395	53.26134	0	day	nearshore	shoreline
-124.65364	53.26126	0	day	nearshore	shoreline
-124.65331	53.26113	0	day	nearshore	shoreline
-124.65306	53.26098	0	day	nearshore	shoreline
-124.65277	53.26083	0	day	nearshore	shoreline
-124.65245	53.26071	0	day	nearshore	shoreline
-124.65209	53.26063	0	day	nearshore	shoreline
-124.65174	53.26056	0	day	nearshore	shoreline
-124.65138	53.26050	79	day	nearshore	shoreline
-124.65105	53.26056	68	day	nearshore	shoreline
-124.65092	53.26038	0	day	nearshore	shoreline
-124.65092	53.26015	0	day	nearshore	shoreline
-124.65088	53.25992	0	day	nearshore	shoreline
-124.65079	53.25971	68	day	nearshore	shoreline
-124.65072	53.25949	0	day	nearshore	shoreline
-124.65064	53.25926	0	day	nearshore	shoreline
-124.65059	53.25903	0	day	nearshore	shoreline
-124.65050	53.25891	0	day	nearshore	shoreline
-124.64443	53.25542	0	day	nearshore	shoreline
-124.64412	53.25534	0	day	nearshore	shoreline
-124.64402	53.25517	203	day	nearshore	shoreline
-124.64413	53.25495	0	day	nearshore	shoreline
-124.64405	53.25473	0	day	nearshore	shoreline
-124.64385	53.25455	0	day	nearshore	shoreline
-124.64378	53.25432	0	day	nearshore	shoreline
-124.64379	53.25411	0	day	nearshore	shoreline
-124.64376	53.25388	137	day	nearshore	shoreline
-124.64364	53.25365	0	day	nearshore	shoreline
-124.64355	53.25345	0	day	nearshore	shoreline
-124.64353	53.25323	68	day	nearshore	shoreline
-124.64351	53.25300	68	day	nearshore	shoreline
-124.64346	53.25278	0	day	nearshore	shoreline
-124.64343	53.25255	68	day	nearshore	shoreline
-124.64342	53.25233	69	day	nearshore	shoreline
-124.64336	53.25211	0	day	nearshore	shoreline
-124.64323	53.25190	0	day	nearshore	shoreline
-124.64309	53.25169	0	day	nearshore	shoreline
-124.64293	53.25149	0	day	nearshore	shoreline
-124.64269	53.25133	0	day	nearshore	shoreline
-124.64249	53.25114	0	day	nearshore	shoreline
-124.64247	53.25092	0	day	nearshore	shoreline
-124.64242	53.25070	0	day	nearshore	shoreline
-124.64215	53.25055	68	day	nearshore	shoreline
-124.64180	53.25048	69	day	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64141	53.25049	68	day	nearshore	shoreline
-124.64118	53.25038	0	day	offshore	shoreline
-124.64128	53.25016	207	day	nearshore	shoreline
-124.72046	53.30119	0	day	nearshore	crosslake
-124.72025	53.30135	0	day	nearshore	crosslake
-124.71999	53.30149	0	day	nearshore	crosslake
-124.71976	53.30169	0	day	nearshore	crosslake
-124.71866	53.30227	0	day	nearshore	crosslake
-124.71838	53.30244	0	day	nearshore	crosslake
-124.71811	53.30260	0	day	nearshore	crosslake
-124.71784	53.30274	0	day	nearshore	crosslake
-124.71756	53.30290	0	day	nearshore	crosslake
-124.71729	53.30305	0	day	offshore	crosslake
-124.71700	53.30320	68	day	offshore	crosslake
-124.71674	53.30336	0	day	offshore	crosslake
-124.71647	53.30352	646	day	offshore	crosslake
-124.71621	53.30368	717	day	offshore	crosslake
-124.71594	53.30383	947	day	offshore	crosslake
-124.71567	53.30399	0	day	offshore	crosslake
-124.71545	53.30417	677	day	offshore	crosslake
-124.71519	53.30433	0	day	offshore	crosslake
-124.71492	53.30448	783	day	offshore	crosslake
-124.71464	53.30464	0	day	offshore	crosslake
-124.71438	53.30479	578	day	offshore	crosslake
-124.71410	53.30494	0	day	offshore	crosslake
-124.71383	53.30510	136	day	offshore	crosslake
-124.71359	53.30528	0	day	nearshore	crosslake
-124.71328	53.30539	143	day	nearshore	crosslake
-124.71303	53.30540	0	day	nearshore	crosslake
-124.70749	53.30158	0	day	nearshore	crosslake
-124.70785	53.30152	0	day	nearshore	crosslake
-124.70817	53.30139	311	day	offshore	crosslake
-124.70841	53.30124	136	day	offshore	crosslake
-124.70875	53.30113	68	day	offshore	crosslake
-124.70902	53.30099	136	day	offshore	crosslake
-124.70924	53.30081	870	day	offshore	crosslake
-124.70946	53.30062	792	day	offshore	crosslake
-124.70975	53.30049	0	day	offshore	crosslake
-124.71006	53.30037	281	day	offshore	crosslake
-124.71036	53.30022	0	day	offshore	crosslake
-124.71058	53.30005	0	day	offshore	crosslake
-124.71083	53.29988	0	day	offshore	crosslake
-124.71106	53.29970	299	day	offshore	crosslake
-124.71132	53.29953	500	day	offshore	crosslake
-124.71155	53.29937	294	day	offshore	crosslake
-124.71182	53.29921	0	day	offshore	crosslake
-124.71208	53.29905	155	day	offshore	crosslake
-124.71236	53.29890	0	day	offshore	crosslake
-124.71264	53.29873	0	day	offshore	crosslake
-124.71293	53.29859	68	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.71320	53.29847	748	day	offshore	crosslake
-124.71350	53.29832	0	day	offshore	crosslake
-124.71377	53.29815	157	day	offshore	crosslake
-124.71401	53.29799	657	day	offshore	crosslake
-124.71429	53.29783	0	day	offshore	crosslake
-124.71455	53.29768	407	day	offshore	crosslake
-124.71482	53.29751	229	day	offshore	crosslake
-124.71509	53.29736	0	day	offshore	crosslake
-124.71536	53.29721	205	day	offshore	crosslake
-124.71564	53.29705	165	day	offshore	crosslake
-124.71592	53.29691	374	day	offshore	crosslake
-124.71621	53.29677	0	day	offshore	crosslake
-124.71652	53.29664	0	day	offshore	crosslake
-124.71683	53.29650	0	day	offshore	crosslake
-124.71714	53.29636	0	day	nearshore	crosslake
-124.71732	53.29629	0	day	nearshore	crosslake
-124.71041	53.29338	0	day	nearshore	crosslake
-124.71024	53.29358	0	day	offshore	crosslake
-124.70999	53.29373	0	day	offshore	crosslake
-124.70971	53.29389	658	day	offshore	crosslake
-124.70944	53.29405	313	day	offshore	crosslake
-124.70919	53.29421	0	day	offshore	crosslake
-124.70892	53.29438	0	day	offshore	crosslake
-124.70865	53.29453	0	day	offshore	crosslake
-124.70839	53.29468	467	day	offshore	crosslake
-124.70809	53.29484	205	day	offshore	crosslake
-124.70783	53.29499	287	day	offshore	crosslake
-124.70755	53.29514	204	day	offshore	crosslake
-124.70727	53.29529	365	day	offshore	crosslake
-124.70700	53.29544	0	day	offshore	crosslake
-124.70672	53.29559	130	day	offshore	crosslake
-124.70646	53.29575	130	day	offshore	crosslake
-124.70620	53.29592	130	day	offshore	crosslake
-124.70595	53.29609	131	day	offshore	crosslake
-124.70569	53.29625	0	day	offshore	crosslake
-124.70544	53.29641	150	day	offshore	crosslake
-124.70517	53.29657	581	day	offshore	crosslake
-124.70490	53.29673	0	day	offshore	crosslake
-124.70463	53.29688	68	day	offshore	crosslake
-124.70438	53.29705	0	day	offshore	crosslake
-124.70411	53.29721	136	day	offshore	crosslake
-124.70385	53.29737	0	day	offshore	crosslake
-124.70360	53.29754	0	day	offshore	crosslake
-124.70337	53.29771	0	day	offshore	crosslake
-124.70312	53.29788	204	day	offshore	crosslake
-124.70289	53.29806	569	day	offshore	crosslake
-124.70266	53.29824	68	day	offshore	crosslake
-124.70247	53.29843	68	day	offshore	crosslake
-124.70224	53.29862	0	day	offshore	crosslake
-124.70202	53.29879	408	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.70179	53.29897	707	day	offshore	crosslake
-124.70156	53.29915	0	day	offshore	crosslake
-124.70134	53.29933	0	day	offshore	crosslake
-124.70114	53.29953	0	day	offshore	crosslake
-124.70094	53.29971	310	day	offshore	crosslake
-124.70072	53.29990	0	day	nearshore	crosslake
-124.70060	53.30002	0	day	nearshore	crosslake
-124.69283	53.29652	299	day	nearshore	crosslake
-124.69309	53.29635	0	day	nearshore	crosslake
-124.69336	53.29619	0	day	nearshore	crosslake
-124.69371	53.29611	0	day	nearshore	crosslake
-124.69399	53.29597	0	day	nearshore	crosslake
-124.69428	53.29582	0	day	nearshore	crosslake
-124.69457	53.29570	0	day	nearshore	crosslake
-124.69487	53.29557	68	day	nearshore	crosslake
-124.69512	53.29538	0	day	nearshore	crosslake
-124.69534	53.29521	0	day	nearshore	crosslake
-124.69558	53.29505	72	day	offshore	crosslake
-124.69586	53.29489	0	day	offshore	crosslake
-124.69613	53.29473	144	day	offshore	crosslake
-124.69638	53.29457	0	day	offshore	crosslake
-124.69664	53.29441	0	day	offshore	crosslake
-124.69692	53.29425	0	day	offshore	crosslake
-124.69716	53.29408	125	day	offshore	crosslake
-124.69738	53.29390	0	day	offshore	crosslake
-124.69765	53.29374	0	day	offshore	crosslake
-124.69789	53.29358	0	day	offshore	crosslake
-124.69815	53.29341	0	day	offshore	crosslake
-124.69839	53.29324	0	day	offshore	crosslake
-124.69863	53.29307	205	day	offshore	crosslake
-124.69886	53.29288	135	day	offshore	crosslake
-124.69912	53.29271	209	day	offshore	crosslake
-124.69936	53.29257	706	day	offshore	crosslake
-124.69963	53.29240	2083	day	offshore	crosslake
-124.69986	53.29223	296	day	offshore	crosslake
-124.70013	53.29206	128	day	offshore	crosslake
-124.70037	53.29189	500	day	offshore	crosslake
-124.70060	53.29172	1265	day	offshore	crosslake
-124.70085	53.29154	332	day	offshore	crosslake
-124.70111	53.29139	0	day	offshore	crosslake
-124.70137	53.29123	426	day	offshore	crosslake
-124.70162	53.29107	496	day	offshore	crosslake
-124.70187	53.29089	205	day	offshore	crosslake
-124.70214	53.29074	258	day	offshore	crosslake
-124.70240	53.29058	273	day	offshore	crosslake
-124.70266	53.29042	130	day	offshore	crosslake
-124.70294	53.29026	388	day	offshore	crosslake
-124.70318	53.29010	0	day	offshore	crosslake
-124.70342	53.28992	0	day	offshore	crosslake
-124.70367	53.28977	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.70395	53.28960	0	day	offshore	crosslake
-124.70421	53.28948	0	day	nearshore	crosslake
-124.69747	53.28636	0	day	nearshore	crosslake
-124.69726	53.28655	0	day	nearshore	crosslake
-124.69702	53.28672	0	day	offshore	crosslake
-124.69681	53.28691	0	day	offshore	crosslake
-124.69650	53.28705	68	day	offshore	crosslake
-124.69617	53.28715	340	day	offshore	crosslake
-124.69591	53.28731	68	day	offshore	crosslake
-124.69565	53.28747	196	day	offshore	crosslake
-124.69543	53.28764	225	day	offshore	crosslake
-124.69515	53.28779	204	day	offshore	crosslake
-124.69489	53.28795	407	day	offshore	crosslake
-124.69465	53.28812	678	day	offshore	crosslake
-124.69440	53.28829	0	day	offshore	crosslake
-124.69417	53.28848	0	day	offshore	crosslake
-124.69394	53.28865	0	day	offshore	crosslake
-124.69371	53.28883	128	day	offshore	crosslake
-124.69348	53.28901	0	day	offshore	crosslake
-124.69326	53.28919	0	day	offshore	crosslake
-124.69304	53.28937	0	day	offshore	crosslake
-124.69281	53.28955	0	day	offshore	crosslake
-124.69256	53.28971	196	day	offshore	crosslake
-124.69231	53.28988	0	day	offshore	crosslake
-124.69206	53.29005	205	day	offshore	crosslake
-124.69182	53.29022	128	day	offshore	crosslake
-124.69157	53.29039	853	day	offshore	crosslake
-124.69134	53.29056	298	day	offshore	crosslake
-124.69110	53.29074	0	day	offshore	crosslake
-124.69087	53.29092	0	day	offshore	crosslake
-124.69063	53.29109	128	day	offshore	crosslake
-124.69041	53.29126	0	day	offshore	crosslake
-124.69016	53.29144	204	day	offshore	crosslake
-124.68991	53.29161	864	day	offshore	crosslake
-124.68965	53.29177	0	day	offshore	crosslake
-124.68942	53.29194	1055	day	offshore	crosslake
-124.68919	53.29212	68	day	offshore	crosslake
-124.68898	53.29231	0	day	offshore	crosslake
-124.68876	53.29250	0	day	offshore	crosslake
-124.68854	53.29267	0	day	nearshore	crosslake
-124.68832	53.29285	0	day	nearshore	crosslake
-124.68808	53.29303	0	day	nearshore	crosslake
-124.68782	53.29320	0	day	nearshore	crosslake
-124.68766	53.29330	0	day	nearshore	crosslake
-124.68093	53.28997	0	day	nearshore	crosslake
-124.68104	53.28976	0	day	nearshore	crosslake
-124.68129	53.28959	0	day	nearshore	crosslake
-124.68158	53.28946	69	day	nearshore	crosslake
-124.68187	53.28929	0	day	nearshore	crosslake
-124.68214	53.28915	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.68242	53.28900	306	day	offshore	crosslake
-124.68267	53.28884	161	day	offshore	crosslake
-124.68293	53.28867	0	day	offshore	crosslake
-124.68319	53.28851	225	day	offshore	crosslake
-124.68344	53.28834	0	day	offshore	crosslake
-124.68370	53.28817	0	day	offshore	crosslake
-124.68396	53.28800	284	day	offshore	crosslake
-124.68419	53.28785	758	day	offshore	crosslake
-124.68445	53.28767	203	day	offshore	crosslake
-124.68461	53.28747	68	day	offshore	crosslake
-124.68484	53.28731	224	day	offshore	crosslake
-124.68510	53.28713	72	day	offshore	crosslake
-124.68534	53.28697	0	day	offshore	crosslake
-124.68563	53.28682	0	day	offshore	crosslake
-124.68588	53.28665	876	day	offshore	crosslake
-124.68615	53.28649	0	day	offshore	crosslake
-124.68638	53.28632	296	day	offshore	crosslake
-124.68664	53.28616	204	day	offshore	crosslake
-124.68691	53.28600	0	day	offshore	crosslake
-124.68718	53.28585	298	day	offshore	crosslake
-124.68745	53.28569	0	day	offshore	crosslake
-124.68772	53.28554	578	day	offshore	crosslake
-124.68800	53.28539	410	day	offshore	crosslake
-124.68828	53.28524	0	day	offshore	crosslake
-124.68852	53.28507	0	day	offshore	crosslake
-124.68881	53.28492	0	day	offshore	crosslake
-124.68909	53.28477	0	day	offshore	crosslake
-124.68938	53.28463	0	day	offshore	crosslake
-124.68966	53.28448	0	day	offshore	crosslake
-124.68995	53.28433	0	day	offshore	crosslake
-124.69030	53.28417	0	day	nearshore	crosslake
-124.69039	53.28412	0	day	nearshore	crosslake
-124.68496	53.28025	0	day	nearshore	crosslake
-124.68467	53.28042	0	day	offshore	crosslake
-124.68443	53.28060	0	day	offshore	crosslake
-124.68421	53.28077	0	day	offshore	crosslake
-124.68397	53.28095	0	day	offshore	crosslake
-124.68372	53.28112	0	day	offshore	crosslake
-124.68350	53.28128	0	day	offshore	crosslake
-124.68324	53.28145	0	day	offshore	crosslake
-124.68297	53.28161	0	day	offshore	crosslake
-124.68272	53.28178	0	day	offshore	crosslake
-124.68246	53.28194	468	day	offshore	crosslake
-124.68219	53.28210	500	day	offshore	crosslake
-124.68194	53.28227	352	day	offshore	crosslake
-124.68170	53.28244	156	day	offshore	crosslake
-124.68144	53.28261	271	day	offshore	crosslake
-124.68119	53.28277	535	day	offshore	crosslake
-124.68095	53.28294	204	day	offshore	crosslake
-124.68069	53.28311	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.68045	53.28328	659	day	offshore	crosslake
-124.68021	53.28345	156	day	offshore	crosslake
-124.67997	53.28362	0	day	offshore	crosslake
-124.67975	53.28380	0	day	offshore	crosslake
-124.67958	53.28401	457	day	offshore	crosslake
-124.67935	53.28417	72	day	offshore	crosslake
-124.67909	53.28434	477	day	offshore	crosslake
-124.67881	53.28448	148	day	offshore	crosslake
-124.67853	53.28462	0	day	offshore	crosslake
-124.67821	53.28476	0	day	offshore	crosslake
-124.67793	53.28491	0	day	offshore	crosslake
-124.67765	53.28505	204	day	offshore	crosslake
-124.67738	53.28521	0	day	offshore	crosslake
-124.67713	53.28536	68	day	offshore	crosslake
-124.67683	53.28551	161	day	offshore	crosslake
-124.67654	53.28566	0	day	offshore	crosslake
-124.67616	53.28585	0	day	nearshore	crosslake
-124.67049	53.28216	0	day	nearshore	crosslake
-124.67073	53.28199	0	day	offshore	crosslake
-124.67090	53.28177	0	day	offshore	crosslake
-124.67117	53.28162	428	day	offshore	crosslake
-124.67142	53.28144	0	day	offshore	crosslake
-124.67166	53.28128	501	day	offshore	crosslake
-124.67193	53.28112	267	day	offshore	crosslake
-124.67221	53.28095	127	day	offshore	crosslake
-124.67247	53.28080	203	day	offshore	crosslake
-124.67270	53.28064	127	day	offshore	crosslake
-124.67296	53.28047	296	day	offshore	crosslake
-124.67322	53.28030	0	day	offshore	crosslake
-124.67347	53.28013	363	day	offshore	crosslake
-124.67370	53.27996	0	day	offshore	crosslake
-124.67396	53.27979	0	day	offshore	crosslake
-124.67421	53.27963	272	day	offshore	crosslake
-124.67446	53.27946	477	day	offshore	crosslake
-124.67472	53.27929	431	day	offshore	crosslake
-124.67497	53.27913	156	day	offshore	crosslake
-124.67519	53.27895	0	day	offshore	crosslake
-124.67543	53.27877	68	day	offshore	crosslake
-124.67566	53.27861	409	day	offshore	crosslake
-124.67593	53.27844	0	day	offshore	crosslake
-124.67619	53.27827	195	day	offshore	crosslake
-124.67646	53.27812	0	day	offshore	crosslake
-124.67672	53.27796	68	day	offshore	crosslake
-124.67700	53.27783	0	day	offshore	crosslake
-124.67730	53.27767	432	day	offshore	crosslake
-124.67756	53.27752	82	day	offshore	crosslake
-124.67783	53.27735	0	day	offshore	crosslake
-124.67806	53.27719	870	day	offshore	crosslake
-124.67831	53.27701	0	day	offshore	crosslake
-124.67854	53.27685	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.67879	53.27667	0	day	offshore	crosslake
-124.67903	53.27650	70	day	nearshore	crosslake
-124.67929	53.27631	0	day	nearshore	crosslake
-124.67303	53.27332	0	day	nearshore	crosslake
-124.67261	53.27346	0	day	nearshore	crosslake
-124.67238	53.27363	0	day	nearshore	crosslake
-124.67215	53.27381	0	day	offshore	crosslake
-124.67190	53.27397	0	day	offshore	crosslake
-124.67165	53.27414	0	day	offshore	crosslake
-124.67138	53.27430	0	day	offshore	crosslake
-124.67110	53.27445	498	day	offshore	crosslake
-124.67080	53.27459	0	day	offshore	crosslake
-124.67054	53.27474	284	day	offshore	crosslake
-124.67029	53.27492	0	day	offshore	crosslake
-124.67004	53.27508	0	day	offshore	crosslake
-124.66979	53.27525	501	day	offshore	crosslake
-124.66954	53.27542	0	day	offshore	crosslake
-124.66928	53.27558	538	day	offshore	crosslake
-124.66901	53.27574	203	day	offshore	crosslake
-124.66875	53.27590	196	day	offshore	crosslake
-124.66851	53.27607	0	day	offshore	crosslake
-124.66826	53.27624	0	day	offshore	crosslake
-124.66802	53.27641	0	day	offshore	crosslake
-124.66778	53.27659	0	day	offshore	crosslake
-124.66756	53.27677	566	day	offshore	crosslake
-124.66731	53.27693	205	day	offshore	crosslake
-124.66706	53.27708	68	day	offshore	crosslake
-124.66683	53.27727	0	day	offshore	crosslake
-124.66658	53.27744	0	day	offshore	crosslake
-124.66634	53.27761	140	day	offshore	crosslake
-124.66610	53.27778	0	day	offshore	crosslake
-124.66582	53.27793	154	day	offshore	crosslake
-124.66557	53.27810	0	day	offshore	crosslake
-124.66537	53.27829	578	day	offshore	crosslake
-124.66515	53.27847	0	day	offshore	crosslake
-124.66493	53.27865	298	day	offshore	crosslake
-124.66471	53.27883	0	day	offshore	crosslake
-124.66452	53.27901	382	day	offshore	crosslake
-124.66432	53.27922	70	day	offshore	crosslake
-124.66415	53.27941	205	day	offshore	crosslake
-124.66401	53.27962	406	day	offshore	crosslake
-124.66395	53.27984	74	day	offshore	crosslake
-124.66389	53.28006	0	day	offshore	crosslake
-124.66382	53.28029	223	day	offshore	crosslake
-124.66370	53.28051	0	day	nearshore	crosslake
-124.65615	53.27682	0	day	nearshore	crosslake
-124.65646	53.27667	136	day	offshore	crosslake
-124.65671	53.27650	0	day	offshore	crosslake
-124.65698	53.27633	0	day	offshore	crosslake
-124.65723	53.27617	394	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65748	53.27600	711	day	offshore	crosslake
-124.65773	53.27583	149	day	offshore	crosslake
-124.65798	53.27566	0	day	offshore	crosslake
-124.65823	53.27551	402	day	offshore	crosslake
-124.65848	53.27533	0	day	offshore	crosslake
-124.65873	53.27517	335	day	offshore	crosslake
-124.65900	53.27501	0	day	offshore	crosslake
-124.65926	53.27485	203	day	offshore	crosslake
-124.65952	53.27469	68	day	offshore	crosslake
-124.65979	53.27453	0	day	offshore	crosslake
-124.66005	53.27436	203	day	offshore	crosslake
-124.66029	53.27420	68	day	offshore	crosslake
-124.66054	53.27403	0	day	offshore	crosslake
-124.66080	53.27387	332	day	offshore	crosslake
-124.66107	53.27372	333	day	offshore	crosslake
-124.66133	53.27355	0	day	offshore	crosslake
-124.66161	53.27339	1155	day	offshore	crosslake
-124.66186	53.27323	286	day	offshore	crosslake
-124.66213	53.27307	203	day	offshore	crosslake
-124.66242	53.27292	0	day	offshore	crosslake
-124.66267	53.27277	0	day	offshore	crosslake
-124.66294	53.27261	364	day	offshore	crosslake
-124.66318	53.27244	68	day	offshore	crosslake
-124.66344	53.27227	0	day	offshore	crosslake
-124.66366	53.27209	219	day	offshore	crosslake
-124.66392	53.27193	73	day	offshore	crosslake
-124.66419	53.27177	204	day	offshore	crosslake
-124.66443	53.27160	68	day	offshore	crosslake
-124.66468	53.27143	297	day	offshore	crosslake
-124.66491	53.27126	0	day	offshore	crosslake
-124.66515	53.27108	204	day	offshore	crosslake
-124.66540	53.27092	0	day	offshore	crosslake
-124.66565	53.27075	581	day	offshore	crosslake
-124.66589	53.27056	0	day	offshore	crosslake
-124.66611	53.27039	0	day	offshore	crosslake
-124.66635	53.27022	0	day	nearshore	crosslake
-124.66657	53.27004	0	day	nearshore	crosslake
-124.66682	53.26986	0	day	nearshore	crosslake
-124.66707	53.26967	0	day	nearshore	crosslake
-124.66178	53.26609	0	day	nearshore	crosslake
-124.66156	53.26629	0	day	nearshore	crosslake
-124.66132	53.26646	136	day	nearshore	crosslake
-124.66106	53.26661	69	day	offshore	crosslake
-124.66081	53.26679	0	day	offshore	crosslake
-124.66054	53.26695	0	day	offshore	crosslake
-124.66029	53.26712	68	day	offshore	crosslake
-124.66003	53.26728	69	day	offshore	crosslake
-124.65978	53.26744	416	day	offshore	crosslake
-124.65951	53.26759	533	day	offshore	crosslake
-124.65924	53.26775	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65898	53.26792	204	day	offshore	crosslake
-124.65873	53.26808	594	day	offshore	crosslake
-124.65848	53.26825	68	day	offshore	crosslake
-124.65821	53.26841	266	day	offshore	crosslake
-124.65794	53.26857	273	day	offshore	crosslake
-124.65767	53.26873	569	day	offshore	crosslake
-124.65740	53.26887	68	day	offshore	crosslake
-124.65715	53.26904	142	day	offshore	crosslake
-124.65690	53.26921	0	day	offshore	crosslake
-124.65663	53.26937	592	day	offshore	crosslake
-124.65641	53.26954	0	day	offshore	crosslake
-124.65614	53.26970	0	day	offshore	crosslake
-124.65587	53.26987	206	day	offshore	crosslake
-124.65560	53.27002	0	day	offshore	crosslake
-124.65533	53.27017	157	day	offshore	crosslake
-124.65505	53.27032	136	day	offshore	crosslake
-124.65477	53.27047	250	day	offshore	crosslake
-124.65451	53.27062	881	day	offshore	crosslake
-124.65424	53.27079	0	day	offshore	crosslake
-124.65397	53.27095	157	day	offshore	crosslake
-124.65371	53.27110	77	day	offshore	crosslake
-124.65343	53.27126	0	day	offshore	crosslake
-124.65317	53.27142	79	day	offshore	crosslake
-124.65292	53.27158	274	day	offshore	crosslake
-124.65265	53.27174	0	day	offshore	crosslake
-124.65241	53.27191	0	day	offshore	crosslake
-124.65215	53.27207	0	day	offshore	crosslake
-124.65192	53.27225	297	day	offshore	crosslake
-124.65168	53.27242	137	day	offshore	crosslake
-124.65143	53.27259	75	day	offshore	crosslake
-124.65121	53.27277	205	day	offshore	crosslake
-124.65100	53.27295	0	day	nearshore	crosslake
-124.64460	53.26945	121	day	nearshore	crosslake
-124.64507	53.26943	0	day	offshore	crosslake
-124.64542	53.26933	502	day	offshore	crosslake
-124.64566	53.26917	271	day	offshore	crosslake
-124.64587	53.26900	0	day	offshore	crosslake
-124.64615	53.26883	0	day	offshore	crosslake
-124.64640	53.26867	0	day	offshore	crosslake
-124.64664	53.26849	242	day	offshore	crosslake
-124.64688	53.26833	0	day	offshore	crosslake
-124.64712	53.26815	0	day	offshore	crosslake
-124.64736	53.26798	0	day	offshore	crosslake
-124.64763	53.26782	0	day	offshore	crosslake
-124.64787	53.26766	0	day	offshore	crosslake
-124.64813	53.26750	0	day	offshore	crosslake
-124.64840	53.26733	0	day	offshore	crosslake
-124.64866	53.26717	132	day	offshore	crosslake
-124.64891	53.26701	0	day	offshore	crosslake
-124.64917	53.26684	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64932	53.26673	1262	day	offshore	crosslake
-124.64968	53.26647	286	day	offshore	crosslake
-124.64992	53.26634	205	day	offshore	crosslake
-124.65016	53.26618	0	day	offshore	crosslake
-124.65042	53.26601	296	day	offshore	crosslake
-124.65071	53.26585	0	day	offshore	crosslake
-124.65098	53.26571	68	day	offshore	crosslake
-124.65127	53.26557	68	day	offshore	crosslake
-124.65154	53.26540	205	day	offshore	crosslake
-124.65180	53.26525	68	day	offshore	crosslake
-124.65205	53.26509	0	day	offshore	crosslake
-124.65231	53.26492	0	day	offshore	crosslake
-124.65257	53.26476	0	day	offshore	crosslake
-124.65283	53.26460	205	day	offshore	crosslake
-124.65308	53.26444	69	day	offshore	crosslake
-124.65335	53.26427	68	day	offshore	crosslake
-124.65361	53.26411	136	day	offshore	crosslake
-124.65387	53.26395	0	day	offshore	crosslake
-124.65413	53.26378	68	day	offshore	crosslake
-124.65438	53.26361	0	day	offshore	crosslake
-124.65465	53.26345	68	day	offshore	crosslake
-124.65491	53.26329	273	day	offshore	crosslake
-124.65517	53.26314	0	day	offshore	crosslake
-124.65543	53.26298	104	day	offshore	crosslake
-124.65569	53.26282	0	day	offshore	crosslake
-124.65596	53.26266	664	day	nearshore	crosslake
-124.65622	53.26251	0	day	nearshore	crosslake
-124.65650	53.26235	0	day	nearshore	crosslake
-124.65018	53.25894	0	day	nearshore	crosslake
-124.64999	53.25912	0	day	nearshore	crosslake
-124.64972	53.25930	0	day	nearshore	crosslake
-124.64948	53.25947	0	day	nearshore	crosslake
-124.64920	53.25961	0	day	offshore	crosslake
-124.64893	53.25977	0	day	offshore	crosslake
-124.64870	53.25994	0	day	offshore	crosslake
-124.64845	53.26011	0	day	offshore	crosslake
-124.64820	53.26028	204	day	offshore	crosslake
-124.64794	53.26045	339	day	offshore	crosslake
-124.64768	53.26061	0	day	offshore	crosslake
-124.64742	53.26077	205	day	offshore	crosslake
-124.64714	53.26092	136	day	offshore	crosslake
-124.64687	53.26107	68	day	offshore	crosslake
-124.64662	53.26124	475	day	offshore	crosslake
-124.64637	53.26141	360	day	offshore	crosslake
-124.64612	53.26158	0	day	offshore	crosslake
-124.64587	53.26174	475	day	offshore	crosslake
-124.64561	53.26191	717	day	offshore	crosslake
-124.64537	53.26207	69	day	offshore	crosslake
-124.64511	53.26224	1241	day	offshore	crosslake
-124.64487	53.26241	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64463	53.26258	0	day	offshore	crosslake
-124.64437	53.26276	0	day	nearshore	crosslake
-124.64418	53.26289	0	day	nearshore	crosslake
-124.63595	53.26109	0	day	nearshore	crosslake
-124.63614	53.26087	0	day	nearshore	crosslake
-124.63639	53.26072	137	day	offshore	crosslake
-124.63666	53.26056	0	day	offshore	crosslake
-124.63693	53.26040	226	day	offshore	crosslake
-124.63720	53.26024	0	day	offshore	crosslake
-124.63747	53.26008	294	day	offshore	crosslake
-124.63774	53.25993	0	day	offshore	crosslake
-124.63796	53.25974	0	day	offshore	crosslake
-124.63819	53.25957	0	day	offshore	crosslake
-124.63844	53.25940	0	day	offshore	crosslake
-124.63869	53.25923	273	day	offshore	crosslake
-124.63894	53.25907	137	day	offshore	crosslake
-124.63922	53.25892	137	day	offshore	crosslake
-124.63952	53.25877	273	day	offshore	crosslake
-124.63979	53.25861	0	day	offshore	crosslake
-124.64002	53.25845	409	day	offshore	crosslake
-124.64028	53.25828	136	day	offshore	crosslake
-124.64052	53.25811	0	day	offshore	crosslake
-124.64077	53.25794	137	day	offshore	crosslake
-124.64103	53.25778	572	day	offshore	crosslake
-124.64126	53.25760	0	day	offshore	crosslake
-124.64149	53.25743	203	day	offshore	crosslake
-124.64175	53.25727	298	day	offshore	crosslake
-124.64202	53.25710	344	day	offshore	crosslake
-124.64228	53.25694	204	day	offshore	crosslake
-124.64253	53.25678	0	day	offshore	crosslake
-124.64281	53.25663	68	day	offshore	crosslake
-124.64306	53.25646	0	day	offshore	crosslake
-124.64330	53.25629	135	day	offshore	crosslake
-124.64355	53.25612	157	day	offshore	crosslake
-124.64380	53.25595	159	day	offshore	crosslake
-124.64403	53.25579	0	day	offshore	crosslake
-124.64430	53.25562	0	day	nearshore	crosslake
-124.64449	53.25549	0	day	nearshore	crosslake
-124.64109	53.25018	0	day	nearshore	crosslake
-124.64083	53.25036	0	day	offshore	crosslake
-124.64055	53.25051	0	day	offshore	crosslake
-124.64026	53.25065	0	day	offshore	crosslake
-124.64000	53.25081	68	day	offshore	crosslake
-124.63982	53.25101	68	day	offshore	crosslake
-124.63961	53.25118	0	day	offshore	crosslake
-124.63935	53.25135	68	day	offshore	crosslake
-124.63908	53.25152	321	day	offshore	crosslake
-124.63887	53.25169	0	day	offshore	crosslake
-124.63862	53.25187	612	day	offshore	crosslake
-124.63838	53.25204	274	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.63815	53.25222	202	day	offshore	crosslake
-124.63793	53.25240	0	day	offshore	crosslake
-124.63771	53.25257	547	day	offshore	crosslake
-124.63746	53.25274	0	day	offshore	crosslake
-124.63722	53.25292	206	day	offshore	crosslake
-124.63696	53.25309	0	day	offshore	crosslake
-124.63671	53.25325	204	day	offshore	crosslake
-124.63646	53.25342	205	day	offshore	crosslake
-124.63622	53.25359	272	day	offshore	crosslake
-124.63597	53.25375	273	day	offshore	crosslake
-124.63571	53.25392	204	day	offshore	crosslake
-124.63545	53.25408	0	day	offshore	crosslake
-124.63519	53.25425	274	day	offshore	crosslake
-124.63495	53.25442	137	day	offshore	crosslake
-124.63470	53.25459	204	day	offshore	crosslake
-124.63447	53.25476	407	day	offshore	crosslake
-124.63423	53.25493	867	day	offshore	crosslake
-124.63400	53.25510	68	day	offshore	crosslake
-124.63374	53.25527	273	day	offshore	crosslake
-124.63349	53.25544	498	day	offshore	crosslake
-124.63324	53.25561	204	day	offshore	crosslake
-124.63299	53.25577	273	day	offshore	crosslake
-124.63275	53.25594	205	day	offshore	crosslake
-124.63249	53.25612	0	day	offshore	crosslake
-124.63225	53.25629	137	day	offshore	crosslake
-124.63201	53.25645	341	day	offshore	crosslake
-124.63175	53.25662	68	day	offshore	crosslake
-124.63151	53.25679	271	day	offshore	crosslake
-124.63125	53.25695	273	day	offshore	crosslake
-124.63101	53.25713	274	day	offshore	crosslake
-124.63080	53.25731	0	day	offshore	crosslake
-124.63058	53.25749	274	day	offshore	crosslake
-124.63033	53.25765	0	day	offshore	crosslake
-124.63005	53.25782	0	day	offshore	crosslake
-124.62979	53.25797	546	day	offshore	crosslake
-124.62954	53.25813	136	day	offshore	crosslake
-124.62926	53.25829	137	day	offshore	crosslake
-124.62900	53.25845	68	day	offshore	crosslake
-124.62874	53.25861	0	day	offshore	crosslake
-124.62848	53.25877	0	day	nearshore	crosslake
-124.62818	53.25894	0	day	nearshore	crosslake
-124.62238	53.25562	0	day	nearshore	crosslake
-124.62274	53.25553	213	day	nearshore	crosslake
-124.62303	53.25539	68	day	nearshore	crosslake
-124.62321	53.25519	68	day	offshore	crosslake
-124.62351	53.25505	68	day	offshore	crosslake
-124.62381	53.25492	136	day	offshore	crosslake
-124.62416	53.25484	204	day	offshore	crosslake
-124.62438	53.25471	68	day	offshore	crosslake
-124.62456	53.25451	0	day	offshore	crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.62484	53.25436	0	day	offshore	crosslake
-124.62510	53.25419	68	day	offshore	crosslake
-124.62534	53.25402	0	day	offshore	crosslake
-124.62557	53.25385	68	day	offshore	crosslake
-124.62583	53.25368	0	day	offshore	crosslake
-124.62607	53.25351	0	day	offshore	crosslake
-124.62631	53.25334	299	day	offshore	crosslake
-124.62655	53.25317	433	day	offshore	crosslake
-124.62678	53.25299	433	day	offshore	crosslake
-124.62699	53.25281	296	day	offshore	crosslake
-124.62721	53.25264	0	day	offshore	crosslake
-124.62746	53.25246	0	day	offshore	crosslake
-124.62770	53.25228	204	day	offshore	crosslake
-124.62794	53.25211	346	day	offshore	crosslake
-124.62820	53.25196	68	day	offshore	crosslake
-124.62845	53.25179	0	day	offshore	crosslake
-124.62871	53.25164	68	day	offshore	crosslake
-124.62897	53.25147	136	day	offshore	crosslake
-124.62923	53.25131	0	day	offshore	crosslake
-124.62947	53.25113	0	day	offshore	crosslake
-124.62970	53.25095	0	day	offshore	crosslake
-124.62992	53.25078	0	day	offshore	crosslake
-124.63014	53.25059	68	day	offshore	crosslake
-124.63035	53.25041	68	day	offshore	crosslake
-124.63055	53.25022	0	day	offshore	crosslake
-124.63079	53.25004	68	day	offshore	crosslake
-124.63102	53.24987	0	day	offshore	crosslake
-124.63128	53.24972	205	day	offshore	crosslake
-124.63156	53.24955	272	day	offshore	crosslake
-124.63180	53.24940	0	day	offshore	crosslake
-124.63205	53.24923	0	day	offshore	crosslake
-124.63229	53.24904	0	day	offshore	crosslake
-124.63250	53.24886	68	day	offshore	crosslake
-124.63273	53.24868	339	day	offshore	crosslake
-124.63296	53.24850	69	day	offshore	crosslake
-124.63319	53.24833	136	day	offshore	crosslake
-124.63345	53.24817	0	day	offshore	crosslake
-124.63370	53.24801	0	day	offshore	crosslake
-124.63395	53.24784	68	day	offshore	crosslake
-124.63422	53.24769	69	day	offshore	crosslake
-124.63445	53.24750	0	day	offshore	crosslake
-124.63469	53.24734	0	day	offshore	crosslake
-124.63496	53.24718	137	day	offshore	crosslake
-124.63518	53.24700	0	day	offshore	crosslake
-124.63545	53.24684	0	day	offshore	crosslake
-124.63575	53.24671	0	day	offshore	crosslake
-124.63606	53.24658	68	day	offshore	crosslake
-124.63634	53.24645	69	day	nearshore	crosslake
-124.63663	53.24628	0	day	nearshore	crosslake
-124.63684	53.24618	0	day	nearshore	crosslake

Table 5.14-2D: Tatelkuz Lake Hydracoustic Density Estimates, Night.

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.71320	53.30498	104	night	nearshore	shoreline
-124.71340	53.30480	873	night	nearshore	shoreline
-124.71339	53.30460	781	night	offshore	shoreline
-124.71311	53.30444	650	night	offshore	shoreline
-124.71285	53.30427	274	night	offshore	shoreline
-124.71264	53.30408	273	night	offshore	shoreline
-124.71242	53.30391	1230	night	nearshore	shoreline
-124.71224	53.30371	85	night	nearshore	shoreline
-124.71209	53.30349	88	night	nearshore	shoreline
-124.71206	53.30328	76	night	nearshore	shoreline
-124.71193	53.30307	577	night	offshore	shoreline
-124.71168	53.30290	588	night	offshore	shoreline
-124.71141	53.30275	0	night	nearshore	shoreline
-124.71116	53.30258	0	night	offshore	shoreline
-124.71087	53.30244	159	night	nearshore	shoreline
-124.71058	53.30231	0	night	nearshore	shoreline
-124.71030	53.30215	0	night	nearshore	shoreline
-124.71000	53.30204	0	night	nearshore	shoreline
-124.70970	53.30189	656	night	nearshore	shoreline
-124.70941	53.30176	583	night	offshore	shoreline
-124.70906	53.30168	341	night	offshore	shoreline
-124.70868	53.30163	0	night	offshore	shoreline
-124.70839	53.30171	1428	night	nearshore	shoreline
-124.70833	53.30199	0	night	nearshore	shoreline
-124.69969	53.29961	0	night	nearshore	shoreline
-124.69957	53.29941	0	night	offshore	shoreline
-124.69922	53.29937	932	night	offshore	shoreline
-124.69885	53.29940	771	night	nearshore	shoreline
-124.69848	53.29940	0	night	nearshore	shoreline
-124.69823	53.29924	727	night	nearshore	shoreline
-124.69804	53.29904	697	night	nearshore	shoreline
-124.69773	53.29893	1352	night	offshore	shoreline
-124.69738	53.29886	1847	night	offshore	shoreline
-124.69704	53.29876	0	night	offshore	shoreline
-124.69668	53.29871	679	night	offshore	shoreline
-124.69631	53.29872	576	night	offshore	shoreline
-124.69593	53.29876	0	night	nearshore	shoreline
-124.69565	53.29864	1391	night	nearshore	shoreline
-124.69543	53.29845	657	night	nearshore	shoreline
-124.69517	53.29830	1809	night	offshore	shoreline
-124.69484	53.29818	137	night	offshore	shoreline
-124.69455	53.29806	1907	night	nearshore	shoreline
-124.69427	53.29791	1994	night	nearshore	shoreline
-124.69405	53.29773	2418	night	nearshore	shoreline
-124.69384	53.29753	2584	night	nearshore	shoreline
-124.69355	53.29741	1386	night	nearshore	shoreline
-124.69328	53.29724	0	night	nearshore	shoreline
-124.69295	53.29722	0	night	nearshore	shoreline
-124.69264	53.29717	0	night	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.68766	53.29295	0	night	nearshore	shoreline
-124.68764	53.29272	834	night	nearshore	shoreline
-124.68758	53.29249	1347	night	offshore	shoreline
-124.68729	53.29247	862	night	offshore	shoreline
-124.68692	53.29253	819	night	offshore	shoreline
-124.68654	53.29255	0	night	nearshore	shoreline
-124.68621	53.29246	1333	night	nearshore	shoreline
-124.68586	53.29237	668	night	nearshore	shoreline
-124.68551	53.29231	664	night	nearshore	shoreline
-124.68517	53.29220	0	night	offshore	shoreline
-124.68489	53.29206	593	night	nearshore	shoreline
-124.68453	53.29199	670	night	nearshore	shoreline
-124.68418	53.29190	0	night	nearshore	shoreline
-124.68407	53.29170	0	night	nearshore	shoreline
-124.68404	53.29148	0	night	nearshore	shoreline
-124.68396	53.29126	0	night	nearshore	shoreline
-124.68381	53.29104	0	night	nearshore	shoreline
-124.68363	53.29085	0	night	offshore	shoreline
-124.68330	53.29078	626	night	nearshore	shoreline
-124.68301	53.29069	0	night	nearshore	shoreline
-124.68285	53.29046	0	night	nearshore	shoreline
-124.68271	53.29025	0	night	nearshore	shoreline
-124.68255	53.29005	0	night	nearshore	shoreline
-124.68233	53.28989	0	night	nearshore	shoreline
-124.68202	53.28992	150	night	nearshore	shoreline
-124.68177	53.29010	189	night	nearshore	shoreline
-124.68155	53.29022	0	night	nearshore	shoreline
-124.67622	53.28562	0	night	nearshore	shoreline
-124.67617	53.28540	0	night	offshore	shoreline
-124.67593	53.28522	649	night	offshore	shoreline
-124.67558	53.28521	575	night	offshore	shoreline
-124.67523	53.28513	99	night	nearshore	shoreline
-124.67498	53.28496	577	night	offshore	shoreline
-124.67476	53.28478	0	night	offshore	shoreline
-124.67442	53.28468	0	night	nearshore	shoreline
-124.67408	53.28460	0	night	nearshore	shoreline
-124.67382	53.28445	0	night	nearshore	shoreline
-124.67377	53.28423	0	night	nearshore	shoreline
-124.67371	53.28400	0	night	offshore	shoreline
-124.67351	53.28382	0	night	nearshore	shoreline
-124.67324	53.28365	0	night	nearshore	shoreline
-124.67310	53.28345	629	night	nearshore	shoreline
-124.67294	53.28324	0	night	offshore	shoreline
-124.67266	53.28311	0	night	nearshore	shoreline
-124.67235	53.28298	0	night	nearshore	shoreline
-124.67214	53.28279	648	night	nearshore	shoreline
-124.67194	53.28260	0	night	nearshore	shoreline
-124.67173	53.28240	0	night	offshore	shoreline
-124.67136	53.28236	0	night	nearshore	shoreline
-124.67111	53.28225	0	night	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.67109	53.28232	0	night	nearshore	shoreline
-124.66237	53.27963	0	night	nearshore	shoreline
-124.66239	53.27938	0	night	nearshore	shoreline
-124.66214	53.27920	0	night	offshore	shoreline
-124.66181	53.27915	0	night	nearshore	shoreline
-124.66151	53.27902	762	night	nearshore	shoreline
-124.66125	53.27887	579	night	offshore	shoreline
-124.66095	53.27874	0	night	nearshore	shoreline
-124.66059	53.27868	0	night	nearshore	shoreline
-124.66035	53.27853	730	night	nearshore	shoreline
-124.66026	53.27831	81	night	offshore	shoreline
-124.66003	53.27815	0	night	offshore	shoreline
-124.65964	53.27815	581	night	offshore	shoreline
-124.65929	53.27811	0	night	nearshore	shoreline
-124.65897	53.27798	5185	night	nearshore	shoreline
-124.65883	53.27778	0	night	nearshore	shoreline
-124.65866	53.27757	580	night	offshore	shoreline
-124.65833	53.27751	578	night	offshore	shoreline
-124.65793	53.27753	134	night	nearshore	shoreline
-124.65762	53.27747	0	night	nearshore	shoreline
-124.65741	53.27727	730	night	nearshore	shoreline
-124.65719	53.27709	1157	night	offshore	shoreline
-124.65686	53.27699	663	night	offshore	shoreline
-124.65657	53.27701	0	night	nearshore	shoreline
-124.65629	53.27717	0	night	nearshore	shoreline
-124.65124	53.27296	0	night	nearshore	shoreline
-124.65113	53.27274	335	night	offshore	shoreline
-124.65076	53.27263	582	night	offshore	shoreline
-124.65040	53.27265	820	night	offshore	shoreline
-124.65005	53.27261	0	night	nearshore	shoreline
-124.64973	53.27248	0	night	offshore	shoreline
-124.64945	53.27237	1375	night	offshore	shoreline
-124.64910	53.27226	114	night	offshore	shoreline
-124.64876	53.27217	0	night	nearshore	shoreline
-124.64849	53.27203	0	night	nearshore	shoreline
-124.64834	53.27183	0	night	nearshore	shoreline
-124.64810	53.27164	713	night	nearshore	shoreline
-124.64793	53.27145	0	night	offshore	shoreline
-124.64761	53.27132	0	night	offshore	shoreline
-124.64728	53.27122	522	night	nearshore	shoreline
-124.64712	53.27103	590	night	offshore	shoreline
-124.64680	53.27091	605	night	nearshore	shoreline
-124.64651	53.27077	720	night	nearshore	shoreline
-124.64634	53.27058	0	night	nearshore	shoreline
-124.64612	53.27039	0	night	offshore	shoreline
-124.64580	53.27028	587	night	nearshore	shoreline
-124.64555	53.27011	0	night	nearshore	shoreline
-124.64529	53.26992	0	night	nearshore	shoreline
-124.64522	53.26973	0	night	nearshore	shoreline
-124.64512	53.26953	1521	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64531	53.26936	73	night	offshore	shoreline
-124.64537	53.26944	576	night	offshore	shoreline
-124.64495	53.26952	925	night	offshore	shoreline
-124.64467	53.26951	0	night	nearshore	shoreline
-124.64425	53.26259	0	night	nearshore	shoreline
-124.64416	53.26236	0	night	nearshore	shoreline
-124.64385	53.26227	2311	night	offshore	shoreline
-124.64348	53.26230	1262	night	offshore	shoreline
-124.64310	53.26232	0	night	nearshore	shoreline
-124.64271	53.26236	0	night	nearshore	shoreline
-124.64239	53.26234	0	night	nearshore	shoreline
-124.64205	53.26224	0	night	nearshore	shoreline
-124.64167	53.26224	0	night	nearshore	shoreline
-124.64134	53.26232	0	night	nearshore	shoreline
-124.64099	53.26228	0	night	nearshore	shoreline
-124.64065	53.26216	1191	night	nearshore	shoreline
-124.64031	53.26210	0	night	nearshore	shoreline
-124.63994	53.26204	0	night	nearshore	shoreline
-124.63958	53.26200	0	night	nearshore	shoreline
-124.63923	53.26197	0	night	nearshore	shoreline
-124.63893	53.26183	1235	night	offshore	shoreline
-124.63860	53.26174	581	night	offshore	shoreline
-124.63824	53.26177	137	night	offshore	shoreline
-124.63788	53.26182	2005	night	offshore	shoreline
-124.63751	53.26182	579	night	offshore	shoreline
-124.63715	53.26173	648	night	offshore	shoreline
-124.63681	53.26165	109	night	nearshore	shoreline
-124.63658	53.26147	0	night	nearshore	shoreline
-124.63636	53.26131	0	night	nearshore	shoreline
-124.63614	53.26113	0	night	nearshore	shoreline
-124.63586	53.26101	0	night	nearshore	shoreline
-124.62830	53.25878	286	night	nearshore	shoreline
-124.62817	53.25853	0	night	nearshore	shoreline
-124.62803	53.25834	0	night	nearshore	shoreline
-124.62788	53.25813	1736	night	offshore	shoreline
-124.62762	53.25798	4160	night	nearshore	shoreline
-124.62733	53.25783	575	night	offshore	shoreline
-124.62703	53.25773	1884	night	offshore	shoreline
-124.62672	53.25763	69	night	offshore	shoreline
-124.62639	53.25751	584	night	offshore	shoreline
-124.62613	53.25734	0	night	nearshore	shoreline
-124.62593	53.25716	1288	night	nearshore	shoreline
-124.62571	53.25697	1209	night	nearshore	shoreline
-124.62542	53.25683	714	night	nearshore	shoreline
-124.62511	53.25672	0	night	nearshore	shoreline
-124.62485	53.25657	1871	night	nearshore	shoreline
-124.62455	53.25644	2959	night	offshore	shoreline
-124.62419	53.25638	1498	night	offshore	shoreline
-124.62383	53.25632	3612	night	offshore	shoreline
-124.62346	53.25628	3682	night	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.62314	53.25617	992	night	nearshore	shoreline
-124.62284	53.25603	797	night	nearshore	shoreline
-124.62254	53.25594	244	night	nearshore	shoreline
-124.62233	53.25581	0	night	nearshore	shoreline
-124.71019	53.29368	79	night	offshore	shoreline
-124.71049	53.29380	81	night	offshore	shoreline
-124.71083	53.29391	136	night	offshore	shoreline
-124.71118	53.29398	204	night	offshore	shoreline
-124.71156	53.29399	70	night	offshore	shoreline
-124.71193	53.29397	622	night	nearshore	shoreline
-124.71224	53.29405	106	night	nearshore	shoreline
-124.71249	53.29424	92	night	offshore	shoreline
-124.71277	53.29437	0	night	offshore	shoreline
-124.71314	53.29437	755	night	offshore	shoreline
-124.71351	53.29441	98	night	offshore	shoreline
-124.71388	53.29444	0	night	nearshore	shoreline
-124.71425	53.29449	242	night	nearshore	shoreline
-124.71450	53.29463	0	night	nearshore	shoreline
-124.71472	53.29483	742	night	offshore	shoreline
-124.71489	53.29502	1077	night	offshore	shoreline
-124.71519	53.29512	69	night	offshore	shoreline
-124.71555	53.29520	391	night	offshore	shoreline
-124.71591	53.29526	0	night	nearshore	shoreline
-124.71612	53.29542	0	night	nearshore	shoreline
-124.71623	53.29563	0	night	nearshore	shoreline
-124.71646	53.29581	0	night	nearshore	shoreline
-124.71670	53.29599	0	night	nearshore	shoreline
-124.71685	53.29619	359	night	nearshore	shoreline
-124.71697	53.29640	0	night	nearshore	shoreline
-124.71710	53.29660	186	night	nearshore	shoreline
-124.71726	53.29682	0	night	nearshore	shoreline
-124.71742	53.29701	0	night	nearshore	shoreline
-124.71753	53.29723	0	night	nearshore	shoreline
-124.71762	53.29744	0	night	nearshore	shoreline
-124.71773	53.29765	102	night	nearshore	shoreline
-124.71792	53.29785	77	night	nearshore	shoreline
-124.71818	53.29798	0	night	nearshore	shoreline
-124.71845	53.29815	0	night	nearshore	shoreline
-124.71860	53.29836	0	night	nearshore	shoreline
-124.71862	53.29858	118	night	nearshore	shoreline
-124.71871	53.29878	131	night	nearshore	shoreline
-124.71879	53.29901	150	night	nearshore	shoreline
-124.71883	53.29923	0	night	nearshore	shoreline
-124.71891	53.29945	0	night	nearshore	shoreline
-124.71901	53.29967	0	night	nearshore	shoreline
-124.71904	53.29989	189	night	nearshore	shoreline
-124.71907	53.30011	193	night	nearshore	shoreline
-124.71915	53.30034	0	night	nearshore	shoreline
-124.71891	53.30073	0	night	nearshore	shoreline
-124.71861	53.30087	102	night	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.71824	53.30092	68	night	nearshore	shoreline
-124.71792	53.30101	204	night	nearshore	shoreline
-124.71757	53.30109	378	night	offshore	shoreline
-124.71719	53.30114	789	night	offshore	shoreline
-124.71686	53.30120	1513	night	offshore	shoreline
-124.68320	53.27914	0	night	offshore	shoreline
-124.68333	53.27935	68	night	offshore	shoreline
-124.68361	53.27949	1452	night	offshore	shoreline
-124.68396	53.27959	1163	night	offshore	shoreline
-124.68428	53.27970	0	night	offshore	shoreline
-124.68460	53.27984	665	night	nearshore	shoreline
-124.68474	53.28003	0	night	nearshore	shoreline
-124.68482	53.28024	0	night	nearshore	shoreline
-124.68489	53.28048	1911	night	nearshore	shoreline
-124.68495	53.28069	601	night	nearshore	shoreline
-124.68502	53.28091	1155	night	offshore	shoreline
-124.68510	53.28113	582	night	offshore	shoreline
-124.68526	53.28133	370	night	offshore	shoreline
-124.68556	53.28147	0	night	offshore	shoreline
-124.68586	53.28160	596	night	nearshore	shoreline
-124.68618	53.28173	205	night	nearshore	shoreline
-124.68637	53.28190	654	night	nearshore	shoreline
-124.68645	53.28213	670	night	offshore	shoreline
-124.68656	53.28235	2318	night	offshore	shoreline
-124.68664	53.28256	886	night	offshore	shoreline
-124.68684	53.28275	1153	night	offshore	shoreline
-124.68693	53.28296	0	night	nearshore	shoreline
-124.68698	53.28318	1433	night	nearshore	shoreline
-124.68722	53.28336	1258	night	nearshore	shoreline
-124.68754	53.28347	737	night	nearshore	shoreline
-124.68789	53.28358	0	night	nearshore	shoreline
-124.68803	53.28377	1622	night	offshore	shoreline
-124.68837	53.28384	1162	night	offshore	shoreline
-124.68874	53.28387	784	night	offshore	shoreline
-124.68912	53.28388	251	night	offshore	shoreline
-124.68951	53.28393	127	night	nearshore	shoreline
-124.68986	53.28402	0	night	nearshore	shoreline
-124.69000	53.28420	626	night	nearshore	shoreline
-124.69010	53.28441	2266	night	offshore	shoreline
-124.69028	53.28460	577	night	offshore	shoreline
-124.69056	53.28476	1156	night	offshore	shoreline
-124.69078	53.28492	1734	night	offshore	shoreline
-124.69100	53.28512	1163	night	offshore	shoreline
-124.69133	53.28519	580	night	offshore	shoreline
-124.69172	53.28514	1452	night	offshore	shoreline
-124.69206	53.28505	620	night	nearshore	shoreline
-124.69240	53.28509	674	night	nearshore	shoreline
-124.69276	53.28517	607	night	nearshore	shoreline
-124.69300	53.28535	643	night	offshore	shoreline
-124.69331	53.28541	2023	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.69369	53.28546	1367	night	offshore	shoreline
-124.69407	53.28545	441	night	offshore	shoreline
-124.69446	53.28545	577	night	offshore	shoreline
-124.69482	53.28549	715	night	nearshore	shoreline
-124.69518	53.28553	745	night	nearshore	shoreline
-124.69550	53.28562	786	night	nearshore	shoreline
-124.69572	53.28581	153	night	nearshore	shoreline
-124.69588	53.28601	605	night	nearshore	shoreline
-124.69610	53.28619	580	night	offshore	shoreline
-124.69645	53.28627	0	night	offshore	shoreline
-124.69682	53.28632	737	night	nearshore	shoreline
-124.69718	53.28636	949	night	nearshore	shoreline
-124.69751	53.28645	687	night	nearshore	shoreline
-124.69768	53.28665	1228	night	offshore	shoreline
-124.69790	53.28684	1014	night	offshore	shoreline
-124.69824	53.28687	574	night	offshore	shoreline
-124.69863	53.28688	1157	night	offshore	shoreline
-124.69899	53.28687	635	night	nearshore	shoreline
-124.69938	53.28687	217	night	nearshore	shoreline
-124.69976	53.28685	0	night	nearshore	shoreline
-124.70005	53.28694	0	night	nearshore	shoreline
-124.70025	53.28712	178	night	nearshore	shoreline
-124.70040	53.28734	1222	night	offshore	shoreline
-124.70054	53.28754	2339	night	offshore	shoreline
-124.70076	53.28771	942	night	offshore	shoreline
-124.70110	53.28782	1737	night	offshore	shoreline
-124.70144	53.28787	1223	night	offshore	shoreline
-124.70180	53.28794	0	night	offshore	shoreline
-124.70198	53.28813	0	night	nearshore	shoreline
-124.70210	53.28833	1999	night	nearshore	shoreline
-124.70217	53.28856	1155	night	offshore	shoreline
-124.70231	53.28876	366	night	offshore	shoreline
-124.70259	53.28891	1156	night	offshore	shoreline
-124.70290	53.28906	1280	night	nearshore	shoreline
-124.70319	53.28918	0	night	nearshore	shoreline
-124.70338	53.28937	675	night	nearshore	shoreline
-124.70358	53.28956	1765	night	offshore	shoreline
-124.70385	53.28972	68	night	offshore	shoreline
-124.70420	53.28978	577	night	offshore	shoreline
-124.70456	53.28986	1162	night	offshore	shoreline
-124.70489	53.28995	598	night	nearshore	shoreline
-124.70522	53.29005	0	night	nearshore	shoreline
-124.70550	53.29021	0	night	nearshore	shoreline
-124.70567	53.29040	660	night	offshore	shoreline
-124.70593	53.29055	220	night	offshore	shoreline
-124.70628	53.29063	584	night	offshore	shoreline
-124.70662	53.29073	774	night	nearshore	shoreline
-124.70686	53.29088	567	night	nearshore	shoreline
-124.70702	53.29107	0	night	nearshore	shoreline
-124.70720	53.29129	107	night	nearshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.70742	53.29146	592	night	nearshore	shoreline
-124.70767	53.29163	595	night	nearshore	shoreline
-124.70795	53.29179	1305	night	nearshore	shoreline
-124.70818	53.29194	0	night	nearshore	shoreline
-124.70828	53.29217	0	night	offshore	shoreline
-124.70839	53.29238	463	night	offshore	shoreline
-124.70865	53.29254	1754	night	offshore	shoreline
-124.70895	53.29267	0	night	nearshore	shoreline
-124.70923	53.29281	0	night	nearshore	shoreline
-124.70939	53.29302	0	night	nearshore	shoreline
-124.70956	53.29321	0	night	nearshore	shoreline
-124.70979	53.29340	584	night	offshore	shoreline
-124.70996	53.29354	364	night	offshore	shoreline
-124.65670	53.26369	68	night	offshore	shoreline
-124.65684	53.26390	0	night	offshore	shoreline
-124.65699	53.26411	579	night	offshore	shoreline
-124.65719	53.26430	0	night	offshore	shoreline
-124.65749	53.26444	1456	night	offshore	shoreline
-124.65782	53.26451	2034	night	offshore	shoreline
-124.65818	53.26459	1504	night	offshore	shoreline
-124.65853	53.26466	1155	night	offshore	shoreline
-124.65888	53.26474	0	night	nearshore	shoreline
-124.65922	53.26484	1365	night	nearshore	shoreline
-124.65957	53.26492	0	night	nearshore	shoreline
-124.65989	53.26503	0	night	nearshore	shoreline
-124.65998	53.26524	0	night	nearshore	shoreline
-124.66002	53.26547	721	night	nearshore	shoreline
-124.66008	53.26569	137	night	offshore	shoreline
-124.66012	53.26592	1165	night	offshore	shoreline
-124.66026	53.26612	0	night	offshore	shoreline
-124.66051	53.26628	0	night	offshore	shoreline
-124.66083	53.26641	580	night	offshore	shoreline
-124.66114	53.26653	68	night	offshore	shoreline
-124.66147	53.26664	578	night	offshore	shoreline
-124.66179	53.26676	953	night	nearshore	shoreline
-124.66212	53.26687	0	night	nearshore	shoreline
-124.66244	53.26698	1191	night	nearshore	shoreline
-124.66279	53.26707	613	night	nearshore	shoreline
-124.66314	53.26714	665	night	nearshore	shoreline
-124.66350	53.26722	0	night	nearshore	shoreline
-124.66377	53.26736	0	night	nearshore	shoreline
-124.66383	53.26758	0	night	nearshore	shoreline
-124.66395	53.26779	659	night	nearshore	shoreline
-124.66411	53.26800	0	night	nearshore	shoreline
-124.66424	53.26821	0	night	nearshore	shoreline
-124.66431	53.26843	0	night	nearshore	shoreline
-124.66437	53.26865	0	night	nearshore	shoreline
-124.66443	53.26887	0	night	offshore	shoreline
-124.66456	53.26907	323	night	offshore	shoreline
-124.66472	53.26928	0	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.66491	53.26947	322	night	offshore	shoreline
-124.66515	53.26964	328	night	offshore	shoreline
-124.66536	53.26983	578	night	offshore	shoreline
-124.66550	53.27004	324	night	offshore	shoreline
-124.66578	53.27018	334	night	offshore	shoreline
-124.66611	53.27028	337	night	offshore	shoreline
-124.66649	53.27031	0	night	offshore	shoreline
-124.66686	53.27035	0	night	nearshore	shoreline
-124.66723	53.27040	0	night	nearshore	shoreline
-124.66740	53.27058	0	night	nearshore	shoreline
-124.66754	53.27079	0	night	nearshore	shoreline
-124.66768	53.27101	0	night	nearshore	shoreline
-124.66779	53.27122	577	night	offshore	shoreline
-124.66788	53.27144	580	night	offshore	shoreline
-124.66818	53.27152	71	night	offshore	shoreline
-124.66851	53.27163	105	night	offshore	shoreline
-124.66883	53.27174	435	night	offshore	shoreline
-124.66919	53.27181	1158	night	offshore	shoreline
-124.66952	53.27190	685	night	offshore	shoreline
-124.66985	53.27202	917	night	offshore	shoreline
-124.67016	53.27216	576	night	offshore	shoreline
-124.67046	53.27228	1225	night	offshore	shoreline
-124.67080	53.27239	1336	night	nearshore	shoreline
-124.67110	53.27251	75	night	nearshore	shoreline
-124.67143	53.27262	717	night	offshore	shoreline
-124.67176	53.27274	0	night	nearshore	shoreline
-124.67211	53.27283	0	night	nearshore	shoreline
-124.67229	53.27300	0	night	nearshore	shoreline
-124.67240	53.27322	203	night	nearshore	shoreline
-124.67247	53.27345	1522	night	nearshore	shoreline
-124.67258	53.27365	0	night	nearshore	shoreline
-124.67276	53.27386	0	night	nearshore	shoreline
-124.67287	53.27407	94	night	nearshore	shoreline
-124.67295	53.27429	605	night	nearshore	shoreline
-124.67307	53.27450	960	night	offshore	shoreline
-124.67326	53.27469	0	night	offshore	shoreline
-124.67354	53.27483	1487	night	offshore	shoreline
-124.67385	53.27497	314	night	offshore	shoreline
-124.67413	53.27512	0	night	offshore	shoreline
-124.67439	53.27528	0	night	nearshore	shoreline
-124.67461	53.27546	594	night	nearshore	shoreline
-124.67482	53.27565	674	night	offshore	shoreline
-124.67512	53.27578	0	night	offshore	shoreline
-124.67547	53.27586	2442	night	nearshore	shoreline
-124.67584	53.27590	0	night	offshore	shoreline
-124.67621	53.27589	629	night	nearshore	shoreline
-124.67658	53.27588	195	night	nearshore	shoreline
-124.67686	53.27602	584	night	offshore	shoreline
-124.67713	53.27616	68	night	offshore	shoreline
-124.67750	53.27621	408	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.67786	53.27624	149	night	offshore	shoreline
-124.67824	53.27625	0	night	nearshore	shoreline
-124.67862	53.27630	746	night	nearshore	shoreline
-124.67887	53.27642	645	night	nearshore	shoreline
-124.67903	53.27664	1226	night	offshore	shoreline
-124.67921	53.27684	0	night	offshore	shoreline
-124.67940	53.27704	580	night	offshore	shoreline
-124.67971	53.27712	1221	night	offshore	shoreline
-124.68006	53.27721	68	night	offshore	shoreline
-124.68042	53.27726	1185	night	offshore	shoreline
-124.68077	53.27734	360	night	nearshore	shoreline
-124.68093	53.27753	602	night	offshore	shoreline
-124.68115	53.27772	0	night	offshore	shoreline
-124.68148	53.27780	0	night	offshore	shoreline
-124.68182	53.27788	0	night	offshore	shoreline
-124.68218	53.27796	635	night	nearshore	shoreline
-124.68252	53.27806	0	night	nearshore	shoreline
-124.68265	53.27827	689	night	nearshore	shoreline
-124.68279	53.27847	0	night	nearshore	shoreline
-124.68291	53.27868	0	night	offshore	shoreline
-124.68306	53.27888	0	night	nearshore	shoreline
-124.63533	53.24584	0	night	nearshore	shoreline
-124.63571	53.24580	0	night	nearshore	shoreline
-124.63592	53.24593	0	night	nearshore	shoreline
-124.63598	53.24615	0	night	nearshore	shoreline
-124.63603	53.24638	594	night	nearshore	shoreline
-124.63617	53.24659	400	night	offshore	shoreline
-124.63632	53.24680	649	night	offshore	shoreline
-124.63653	53.24698	1489	night	offshore	shoreline
-124.63674	53.24717	2039	night	offshore	shoreline
-124.63701	53.24730	1697	night	offshore	shoreline
-124.63726	53.24747	1748	night	offshore	shoreline
-124.63744	53.24767	866	night	offshore	shoreline
-124.63759	53.24788	300	night	offshore	shoreline
-124.63774	53.24809	2471	night	offshore	shoreline
-124.63782	53.24831	0	night	nearshore	shoreline
-124.63778	53.24852	618	night	nearshore	shoreline
-124.63778	53.24875	2702	night	offshore	shoreline
-124.63788	53.24895	1010	night	offshore	shoreline
-124.63809	53.24914	389	night	offshore	shoreline
-124.63833	53.24934	0	night	nearshore	shoreline
-124.63831	53.24952	0	night	nearshore	shoreline
-124.63827	53.24975	1186	night	offshore	shoreline
-124.63853	53.24989	643	night	offshore	shoreline
-124.63890	53.24992	1453	night	offshore	shoreline
-124.63926	53.24996	0	night	nearshore	shoreline
-124.63961	53.25005	0	night	nearshore	shoreline
-124.63990	53.25019	873	night	nearshore	shoreline
-124.64015	53.25035	0	night	offshore	shoreline
-124.64051	53.25038	308	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64089	53.25035	580	night	offshore	shoreline
-124.64126	53.25034	638	night	nearshore	shoreline
-124.64152	53.25046	0	night	nearshore	shoreline
-124.64164	53.25069	0	night	nearshore	shoreline
-124.64176	53.25090	579	night	offshore	shoreline
-124.64193	53.25110	69	night	offshore	shoreline
-124.64218	53.25126	650	night	offshore	shoreline
-124.64242	53.25144	0	night	offshore	shoreline
-124.64265	53.25162	584	night	nearshore	shoreline
-124.64283	53.25181	582	night	offshore	shoreline
-124.64298	53.25202	576	night	offshore	shoreline
-124.64313	53.25222	916	night	offshore	shoreline
-124.64327	53.25243	0	night	nearshore	shoreline
-124.64331	53.25266	0	night	nearshore	shoreline
-124.64329	53.25288	234	night	nearshore	shoreline
-124.64328	53.25311	0	night	nearshore	shoreline
-124.64334	53.25332	0	night	nearshore	shoreline
-124.64334	53.25355	1335	night	nearshore	shoreline
-124.64342	53.25377	649	night	nearshore	shoreline
-124.64354	53.25398	703	night	nearshore	shoreline
-124.64366	53.25419	185	night	nearshore	shoreline
-124.64375	53.25441	0	night	nearshore	shoreline
-124.64374	53.25464	659	night	nearshore	shoreline
-124.64376	53.25486	0	night	nearshore	shoreline
-124.64387	53.25507	0	night	nearshore	shoreline
-124.64395	53.25529	0	night	nearshore	shoreline
-124.64399	53.25551	0	night	nearshore	shoreline
-124.64406	53.25574	580	night	offshore	shoreline
-124.64424	53.25593	0	night	offshore	shoreline
-124.64446	53.25612	407	night	offshore	shoreline
-124.64466	53.25631	768	night	offshore	shoreline
-124.64489	53.25648	0	night	nearshore	shoreline
-124.64508	53.25667	699	night	offshore	shoreline
-124.64529	53.25686	0	night	offshore	shoreline
-124.64545	53.25706	0	night	offshore	shoreline
-124.64569	53.25723	0	night	offshore	shoreline
-124.64596	53.25740	200	night	nearshore	shoreline
-124.64617	53.25758	268	night	nearshore	shoreline
-124.64632	53.25778	0	night	nearshore	shoreline
-124.64649	53.25798	0	night	offshore	shoreline
-124.64671	53.25816	0	night	offshore	shoreline
-124.64699	53.25831	0	night	nearshore	shoreline
-124.64727	53.25845	0	night	nearshore	shoreline
-124.64763	53.25853	697	night	nearshore	shoreline
-124.64793	53.25864	0	night	nearshore	shoreline
-124.64818	53.25881	1163	night	offshore	shoreline
-124.64831	53.25902	579	night	offshore	shoreline
-124.64848	53.25922	1735	night	offshore	shoreline
-124.64870	53.25941	643	night	offshore	shoreline
-124.64894	53.25958	895	night	offshore	shoreline

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64919	53.25975	599	night	offshore	shoreline
-124.64950	53.25986	1846	night	offshore	shoreline
-124.64978	53.26001	576	night	offshore	shoreline
-124.65008	53.26014	2080	night	offshore	shoreline
-124.65037	53.26029	72	night	nearshore	shoreline
-124.65054	53.26047	0	night	nearshore	shoreline
-124.65072	53.26067	580	night	offshore	shoreline
-124.65099	53.26083	0	night	nearshore	shoreline
-124.65123	53.26100	0	night	offshore	shoreline
-124.65144	53.26119	320	night	offshore	shoreline
-124.65166	53.26137	1215	night	offshore	shoreline
-124.65190	53.26153	590	night	offshore	shoreline
-124.65222	53.26165	676	night	offshore	shoreline
-124.65255	53.26177	298	night	offshore	shoreline
-124.65286	53.26189	298	night	offshore	shoreline
-124.65321	53.26195	0	night	offshore	shoreline
-124.65359	53.26191	579	night	offshore	shoreline
-124.65396	53.26193	1846	night	offshore	shoreline
-124.65431	53.26200	1152	night	offshore	shoreline
-124.65467	53.26207	68	night	nearshore	shoreline
-124.65503	53.26212	625	night	nearshore	shoreline
-124.65542	53.26214	87	night	nearshore	shoreline
-124.65566	53.26230	0	night	nearshore	shoreline
-124.65581	53.26251	676	night	nearshore	shoreline
-124.65588	53.26273	592	night	nearshore	shoreline
-124.65612	53.26290	586	night	nearshore	shoreline
-124.65626	53.26310	0	night	offshore	shoreline
-124.65642	53.26330	578	night	offshore	shoreline
-124.65655	53.26348	743	night	offshore	shoreline
-124.71801	53.30268	0	night	nearshore	Crosslake
-124.71772	53.30282	75	night	nearshore	Crosslake
-124.71740	53.30296	584	night	offshore	Crosslake
-124.71713	53.30312	1058	night	offshore	Crosslake
-124.71694	53.30328	1224	night	offshore	Crosslake
-124.71664	53.30344	203	night	offshore	Crosslake
-124.71642	53.30361	518	night	offshore	Crosslake
-124.71618	53.30378	1361	night	offshore	Crosslake
-124.71586	53.30390	2760	night	offshore	Crosslake
-124.71559	53.30405	956	night	offshore	Crosslake
-124.71527	53.30418	3476	night	offshore	Crosslake
-124.71506	53.30436	690	night	offshore	Crosslake
-124.71476	53.30449	1426	night	offshore	Crosslake
-124.71444	53.30462	2332	night	offshore	Crosslake
-124.71426	53.30481	1294	night	offshore	Crosslake
-124.71394	53.30493	4250	night	offshore	Crosslake
-124.71362	53.30506	1247	night	offshore	Crosslake
-124.71330	53.30516	0	night	nearshore	Crosslake
-124.71299	53.30528	0	night	nearshore	Crosslake
-124.70833	53.30185	181	night	nearshore	Crosslake
-124.70864	53.30171	0	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.70876	53.30152	259	night	offshore	Crosslake
-124.70910	53.30140	1562	night	offshore	Crosslake
-124.70941	53.30130	943	night	offshore	Crosslake
-124.70971	53.30115	717	night	offshore	Crosslake
-124.70999	53.30100	138	night	offshore	Crosslake
-124.71016	53.30081	0	night	offshore	Crosslake
-124.71037	53.30063	205	night	offshore	Crosslake
-124.71057	53.30042	479	night	offshore	Crosslake
-124.71068	53.30022	204	night	offshore	Crosslake
-124.71073	53.29999	645	night	offshore	Crosslake
-124.71107	53.29997	136	night	offshore	Crosslake
-124.71139	53.29997	186	night	offshore	Crosslake
-124.71155	53.29978	204	night	offshore	Crosslake
-124.71189	53.29983	68	night	offshore	Crosslake
-124.71224	53.29980	578	night	offshore	Crosslake
-124.71225	53.29957	1151	night	offshore	Crosslake
-124.71238	53.29937	137	night	offshore	Crosslake
-124.71264	53.29921	0	night	offshore	Crosslake
-124.71285	53.29902	718	night	offshore	Crosslake
-124.71306	53.29883	714	night	offshore	Crosslake
-124.71325	53.29865	0	night	offshore	Crosslake
-124.71344	53.29845	136	night	offshore	Crosslake
-124.71360	53.29825	68	night	offshore	Crosslake
-124.71377	53.29806	717	night	offshore	Crosslake
-124.71408	53.29792	136	night	offshore	Crosslake
-124.71437	53.29777	1296	night	offshore	Crosslake
-124.71469	53.29765	68	night	offshore	Crosslake
-124.71497	53.29751	69	night	offshore	Crosslake
-124.71526	53.29737	136	night	offshore	Crosslake
-124.71555	53.29722	0	night	offshore	Crosslake
-124.71586	53.29710	477	night	offshore	Crosslake
-124.71618	53.29698	68	night	offshore	Crosslake
-124.71649	53.29685	342	night	offshore	Crosslake
-124.71680	53.29672	376	night	offshore	Crosslake
-124.71709	53.29658	68	night	nearshore	Crosslake
-124.71736	53.29640	0	night	nearshore	Crosslake
-124.71046	53.29334	0	night	nearshore	Crosslake
-124.71011	53.29341	68	night	offshore	Crosslake
-124.70975	53.29350	68	night	offshore	Crosslake
-124.70946	53.29362	0	night	offshore	Crosslake
-124.70915	53.29375	136	night	offshore	Crosslake
-124.70891	53.29393	136	night	offshore	Crosslake
-124.70864	53.29407	137	night	offshore	Crosslake
-124.70842	53.29426	0	night	offshore	Crosslake
-124.70813	53.29442	0	night	offshore	Crosslake
-124.70786	53.29456	136	night	offshore	Crosslake
-124.70760	53.29470	851	night	offshore	Crosslake
-124.70732	53.29486	68	night	offshore	Crosslake
-124.70703	53.29499	1162	night	offshore	Crosslake
-124.70678	53.29517	1453	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.70654	53.29533	847	night	offshore	Crosslake
-124.70633	53.29552	648	night	offshore	Crosslake
-124.70609	53.29568	226	night	offshore	Crosslake
-124.70580	53.29583	1498	night	offshore	Crosslake
-124.70549	53.29596	0	night	offshore	Crosslake
-124.70526	53.29613	0	night	offshore	Crosslake
-124.70501	53.29629	136	night	offshore	Crosslake
-124.70474	53.29646	0	night	offshore	Crosslake
-124.70451	53.29663	136	night	offshore	Crosslake
-124.70425	53.29678	68	night	offshore	Crosslake
-124.70403	53.29697	1852	night	offshore	Crosslake
-124.70381	53.29714	68	night	offshore	Crosslake
-124.70358	53.29732	646	night	offshore	Crosslake
-124.70332	53.29748	1158	night	offshore	Crosslake
-124.70305	53.29765	1076	night	offshore	Crosslake
-124.70284	53.29782	1255	night	offshore	Crosslake
-124.70259	53.29799	646	night	offshore	Crosslake
-124.70233	53.29815	203	night	offshore	Crosslake
-124.70210	53.29833	2467	night	offshore	Crosslake
-124.70184	53.29849	852	night	offshore	Crosslake
-124.70159	53.29866	716	night	offshore	Crosslake
-124.70133	53.29883	69	night	offshore	Crosslake
-124.70108	53.29899	581	night	offshore	Crosslake
-124.70080	53.29915	137	night	offshore	Crosslake
-124.70059	53.29932	580	night	offshore	Crosslake
-124.70033	53.29950	0	night	offshore	Crosslake
-124.70006	53.29965	92	night	offshore	Crosslake
-124.69980	53.29982	0	night	nearshore	Crosslake
-124.69967	53.29989	0	night	nearshore	Crosslake
-124.69299	53.29705	397	night	nearshore	Crosslake
-124.69337	53.29703	3185	night	nearshore	Crosslake
-124.69354	53.29686	725	night	offshore	Crosslake
-124.69374	53.29664	851	night	offshore	Crosslake
-124.69389	53.29646	786	night	offshore	Crosslake
-124.69411	53.29627	1295	night	offshore	Crosslake
-124.69430	53.29609	1163	night	offshore	Crosslake
-124.69452	53.29590	849	night	offshore	Crosslake
-124.69476	53.29572	715	night	offshore	Crosslake
-124.69496	53.29554	719	night	offshore	Crosslake
-124.69518	53.29535	860	night	offshore	Crosslake
-124.69540	53.29517	68	night	offshore	Crosslake
-124.69564	53.29500	581	night	offshore	Crosslake
-124.69591	53.29484	714	night	offshore	Crosslake
-124.69617	53.29467	718	night	offshore	Crosslake
-124.69643	53.29452	138	night	offshore	Crosslake
-124.69671	53.29437	0	night	offshore	Crosslake
-124.69698	53.29421	949	night	offshore	Crosslake
-124.69722	53.29404	353	night	offshore	Crosslake
-124.69751	53.29390	331	night	offshore	Crosslake
-124.69778	53.29375	583	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.69804	53.29358	645	night	offshore	Crosslake
-124.69830	53.29341	1364	night	offshore	Crosslake
-124.69857	53.29326	581	night	offshore	Crosslake
-124.69883	53.29310	1244	night	offshore	Crosslake
-124.69909	53.29294	1722	night	offshore	Crosslake
-124.69937	53.29280	879	night	offshore	Crosslake
-124.69965	53.29264	578	night	offshore	Crosslake
-124.69991	53.29248	1533	night	offshore	Crosslake
-124.70017	53.29232	68	night	offshore	Crosslake
-124.70044	53.29216	581	night	offshore	Crosslake
-124.70072	53.29201	1364	night	offshore	Crosslake
-124.70097	53.29184	1451	night	offshore	Crosslake
-124.70122	53.29168	0	night	offshore	Crosslake
-124.70144	53.29149	581	night	offshore	Crosslake
-124.70166	53.29131	1147	night	offshore	Crosslake
-124.70193	53.29115	72	night	offshore	Crosslake
-124.70223	53.29103	578	night	offshore	Crosslake
-124.70254	53.29090	1231	night	offshore	Crosslake
-124.70284	53.29077	1151	night	offshore	Crosslake
-124.70315	53.29063	366	night	offshore	Crosslake
-124.70349	53.29054	1153	night	offshore	Crosslake
-124.70374	53.29039	1744	night	offshore	Crosslake
-124.70400	53.29022	365	night	offshore	Crosslake
-124.70421	53.29003	136	night	offshore	Crosslake
-124.70440	53.28984	508	night	offshore	Crosslake
-124.70456	53.28962	702	night	offshore	Crosslake
-124.70464	53.28952	0	night	nearshore	Crosslake
-124.69815	53.28647	0	night	nearshore	Crosslake
-124.69784	53.28659	68	night	offshore	Crosslake
-124.69749	53.28667	68	night	offshore	Crosslake
-124.69713	53.28674	579	night	offshore	Crosslake
-124.69683	53.28686	2600	night	offshore	Crosslake
-124.69655	53.28702	298	night	offshore	Crosslake
-124.69628	53.28717	1824	night	offshore	Crosslake
-124.69600	53.28732	2316	night	offshore	Crosslake
-124.69576	53.28749	1743	night	offshore	Crosslake
-124.69550	53.28765	128	night	offshore	Crosslake
-124.69524	53.28782	2308	night	offshore	Crosslake
-124.69498	53.28798	0	night	offshore	Crosslake
-124.69471	53.28814	1153	night	offshore	Crosslake
-124.69446	53.28830	1160	night	offshore	Crosslake
-124.69420	53.28847	0	night	offshore	Crosslake
-124.69395	53.28862	742	night	offshore	Crosslake
-124.69367	53.28878	297	night	offshore	Crosslake
-124.69340	53.28894	4641	night	offshore	Crosslake
-124.69312	53.28910	3752	night	offshore	Crosslake
-124.69295	53.28928	2909	night	offshore	Crosslake
-124.69269	53.28945	3813	night	offshore	Crosslake
-124.69245	53.28962	3337	night	offshore	Crosslake
-124.69220	53.28979	1941	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.69195	53.28996	2391	night	offshore	Crosslake
-124.69171	53.29013	1824	night	offshore	Crosslake
-124.69146	53.29029	874	night	offshore	Crosslake
-124.69116	53.29044	3207	night	offshore	Crosslake
-124.69088	53.29059	870	night	offshore	Crosslake
-124.69059	53.29073	2622	night	offshore	Crosslake
-124.69032	53.29088	871	night	offshore	Crosslake
-124.69005	53.29103	68	night	offshore	Crosslake
-124.68977	53.29120	2692	night	offshore	Crosslake
-124.68957	53.29137	2415	night	offshore	Crosslake
-124.68933	53.29155	1311	night	offshore	Crosslake
-124.68912	53.29174	1289	night	offshore	Crosslake
-124.68894	53.29191	2891	night	offshore	Crosslake
-124.68874	53.29212	2128	night	offshore	Crosslake
-124.68855	53.29230	2456	night	offshore	Crosslake
-124.68833	53.29249	275	night	offshore	Crosslake
-124.68813	53.29268	137	night	nearshore	Crosslake
-124.68793	53.29287	117	night	nearshore	Crosslake
-124.68768	53.29305	0	night	nearshore	Crosslake
-124.68754	53.29314	0	night	nearshore	Crosslake
-124.68121	53.28992	0	night	nearshore	Crosslake
-124.68142	53.28978	0	night	nearshore	Crosslake
-124.68170	53.28963	686	night	nearshore	Crosslake
-124.68194	53.28945	0	night	nearshore	Crosslake
-124.68212	53.28925	0	night	offshore	Crosslake
-124.68226	53.28904	577	night	offshore	Crosslake
-124.68248	53.28887	0	night	offshore	Crosslake
-124.68271	53.28869	1159	night	offshore	Crosslake
-124.68296	53.28853	0	night	offshore	Crosslake
-124.68327	53.28839	578	night	offshore	Crosslake
-124.68362	53.28830	2317	night	offshore	Crosslake
-124.68391	53.28818	298	night	offshore	Crosslake
-124.68418	53.28802	877	night	offshore	Crosslake
-124.68442	53.28785	582	night	offshore	Crosslake
-124.68467	53.28768	2753	night	offshore	Crosslake
-124.68491	53.28751	593	night	offshore	Crosslake
-124.68515	53.28734	69	night	offshore	Crosslake
-124.68541	53.28717	1157	night	offshore	Crosslake
-124.68567	53.28701	2339	night	offshore	Crosslake
-124.68588	53.28683	0	night	offshore	Crosslake
-124.68611	53.28664	297	night	offshore	Crosslake
-124.68631	53.28645	580	night	offshore	Crosslake
-124.68653	53.28627	1237	night	offshore	Crosslake
-124.68678	53.28610	1225	night	offshore	Crosslake
-124.68705	53.28594	1760	night	offshore	Crosslake
-124.68731	53.28579	1157	night	offshore	Crosslake
-124.68759	53.28563	780	night	offshore	Crosslake
-124.68787	53.28548	1235	night	offshore	Crosslake
-124.68816	53.28534	1154	night	offshore	Crosslake
-124.68841	53.28518	872	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.68868	53.28501	2320	night	offshore	Crosslake
-124.68892	53.28485	0	night	offshore	Crosslake
-124.68918	53.28469	577	night	offshore	Crosslake
-124.68945	53.28452	148	night	offshore	Crosslake
-124.68965	53.28434	1158	night	offshore	Crosslake
-124.68986	53.28413	165	night	offshore	Crosslake
-124.68999	53.28394	111	night	nearshore	Crosslake
-124.68505	53.28036	0	night	nearshore	Crosslake
-124.68483	53.28058	1832	night	offshore	Crosslake
-124.68452	53.28066	0	night	offshore	Crosslake
-124.68414	53.28067	579	night	offshore	Crosslake
-124.68385	53.28075	655	night	offshore	Crosslake
-124.68376	53.28097	2905	night	offshore	Crosslake
-124.68350	53.28112	872	night	offshore	Crosslake
-124.68319	53.28124	204	night	offshore	Crosslake
-124.68289	53.28134	576	night	offshore	Crosslake
-124.68256	53.28145	1739	night	offshore	Crosslake
-124.68234	53.28163	580	night	offshore	Crosslake
-124.68216	53.28183	298	night	offshore	Crosslake
-124.68192	53.28200	580	night	offshore	Crosslake
-124.68167	53.28217	1156	night	offshore	Crosslake
-124.68143	53.28234	713	night	offshore	Crosslake
-124.68118	53.28251	1111	night	offshore	Crosslake
-124.68094	53.28268	1152	night	offshore	Crosslake
-124.68070	53.28285	1799	night	offshore	Crosslake
-124.68044	53.28302	581	night	offshore	Crosslake
-124.68019	53.28318	580	night	offshore	Crosslake
-124.67993	53.28335	0	night	offshore	Crosslake
-124.67968	53.28352	1166	night	offshore	Crosslake
-124.67945	53.28368	295	night	offshore	Crosslake
-124.67919	53.28385	1739	night	offshore	Crosslake
-124.67894	53.28402	854	night	offshore	Crosslake
-124.67870	53.28419	0	night	offshore	Crosslake
-124.67842	53.28435	574	night	offshore	Crosslake
-124.67815	53.28450	881	night	offshore	Crosslake
-124.67789	53.28466	782	night	offshore	Crosslake
-124.67762	53.28481	365	night	offshore	Crosslake
-124.67736	53.28498	1452	night	offshore	Crosslake
-124.67709	53.28514	1156	night	offshore	Crosslake
-124.67678	53.28527	1736	night	offshore	Crosslake
-124.67656	53.28543	0	night	offshore	Crosslake
-124.67632	53.28561	82	night	offshore	Crosslake
-124.67609	53.28576	0	night	nearshore	Crosslake
-124.67141	53.28211	653	night	offshore	Crosslake
-124.67151	53.28194	1750	night	offshore	Crosslake
-124.67183	53.28179	1155	night	offshore	Crosslake
-124.67198	53.28161	95	night	offshore	Crosslake
-124.67229	53.28146	1168	night	offshore	Crosslake
-124.67260	53.28132	1804	night	offshore	Crosslake
-124.67286	53.28117	1032	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.67319	53.28106	1156	night	offshore	Crosslake
-124.67348	53.28092	1232	night	offshore	Crosslake
-124.67368	53.28075	0	night	offshore	Crosslake
-124.67380	53.28053	774	night	offshore	Crosslake
-124.67390	53.28031	1812	night	offshore	Crosslake
-124.67405	53.28011	577	night	offshore	Crosslake
-124.67428	53.27993	1746	night	offshore	Crosslake
-124.67453	53.27977	574	night	offshore	Crosslake
-124.67480	53.27960	1169	night	offshore	Crosslake
-124.67505	53.27943	878	night	offshore	Crosslake
-124.67530	53.27926	1155	night	offshore	Crosslake
-124.67554	53.27908	1157	night	offshore	Crosslake
-124.67575	53.27891	713	night	offshore	Crosslake
-124.67600	53.27873	581	night	offshore	Crosslake
-124.67624	53.27856	1175	night	offshore	Crosslake
-124.67646	53.27839	205	night	offshore	Crosslake
-124.67670	53.27820	1160	night	offshore	Crosslake
-124.67693	53.27804	1156	night	offshore	Crosslake
-124.67716	53.27786	1220	night	offshore	Crosslake
-124.67737	53.27767	1754	night	offshore	Crosslake
-124.67758	53.27749	1160	night	offshore	Crosslake
-124.67778	53.27730	580	night	offshore	Crosslake
-124.67800	53.27711	1149	night	offshore	Crosslake
-124.67821	53.27693	582	night	offshore	Crosslake
-124.67847	53.27676	733	night	offshore	Crosslake
-124.67871	53.27659	0	night	offshore	Crosslake
-124.67892	53.27641	636	night	offshore	Crosslake
-124.67912	53.27622	364	night	nearshore	Crosslake
-124.67311	53.27341	0	night	nearshore	Crosslake
-124.67282	53.27352	0	night	nearshore	Crosslake
-124.67246	53.27358	0	night	nearshore	Crosslake
-124.67216	53.27372	0	night	offshore	Crosslake
-124.67193	53.27390	1158	night	offshore	Crosslake
-124.67169	53.27407	236	night	offshore	Crosslake
-124.67143	53.27423	872	night	offshore	Crosslake
-124.67116	53.27439	0	night	offshore	Crosslake
-124.67091	53.27455	585	night	offshore	Crosslake
-124.67067	53.27473	0	night	offshore	Crosslake
-124.67041	53.27490	870	night	offshore	Crosslake
-124.67018	53.27507	1164	night	offshore	Crosslake
-124.66993	53.27524	0	night	offshore	Crosslake
-124.66969	53.27541	576	night	offshore	Crosslake
-124.66943	53.27557	2908	night	offshore	Crosslake
-124.66919	53.27575	578	night	offshore	Crosslake
-124.66893	53.27591	577	night	offshore	Crosslake
-124.66872	53.27609	1162	night	offshore	Crosslake
-124.66849	53.27627	878	night	offshore	Crosslake
-124.66831	53.27646	2399	night	offshore	Crosslake
-124.66816	53.27666	0	night	offshore	Crosslake
-124.66799	53.27686	1155	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.66779	53.27707	501	night	offshore	Crosslake
-124.66760	53.27724	875	night	offshore	Crosslake
-124.66732	53.27740	1290	night	offshore	Crosslake
-124.66704	53.27756	583	night	offshore	Crosslake
-124.66681	53.27773	0	night	offshore	Crosslake
-124.66660	53.27791	1224	night	offshore	Crosslake
-124.66635	53.27808	1732	night	offshore	Crosslake
-124.66606	53.27823	140	night	offshore	Crosslake
-124.66577	53.27836	0	night	offshore	Crosslake
-124.66544	53.27847	408	night	offshore	Crosslake
-124.66509	53.27853	1231	night	offshore	Crosslake
-124.66473	53.27859	225	night	offshore	Crosslake
-124.66436	53.27867	806	night	offshore	Crosslake
-124.66406	53.27878	1831	night	offshore	Crosslake
-124.66376	53.27893	69	night	offshore	Crosslake
-124.66347	53.27907	951	night	offshore	Crosslake
-124.66317	53.27921	1741	night	offshore	Crosslake
-124.66289	53.27936	0	night	offshore	Crosslake
-124.66259	53.27951	0	night	offshore	Crosslake
-124.66235	53.27966	0	night	nearshore	Crosslake
-124.65638	53.27698	0	night	nearshore	Crosslake
-124.65664	53.27681	0	night	offshore	Crosslake
-124.65674	53.27659	579	night	offshore	Crosslake
-124.65689	53.27640	1830	night	offshore	Crosslake
-124.65719	53.27626	647	night	offshore	Crosslake
-124.65743	53.27609	575	night	offshore	Crosslake
-124.65767	53.27593	1630	night	offshore	Crosslake
-124.65793	53.27576	1232	night	offshore	Crosslake
-124.65816	53.27558	784	night	offshore	Crosslake
-124.65838	53.27540	430	night	offshore	Crosslake
-124.65859	53.27522	1453	night	offshore	Crosslake
-124.65883	53.27504	585	night	offshore	Crosslake
-124.65907	53.27487	0	night	offshore	Crosslake
-124.65932	53.27470	68	night	offshore	Crosslake
-124.65953	53.27452	577	night	offshore	Crosslake
-124.65975	53.27433	0	night	offshore	Crosslake
-124.66001	53.27417	0	night	offshore	Crosslake
-124.66029	53.27403	851	night	offshore	Crosslake
-124.66054	53.27386	1301	night	offshore	Crosslake
-124.66079	53.27369	578	night	offshore	Crosslake
-124.66104	53.27352	577	night	offshore	Crosslake
-124.66133	53.27339	1165	night	offshore	Crosslake
-124.66165	53.27328	1165	night	offshore	Crosslake
-124.66194	53.27314	0	night	offshore	Crosslake
-124.66220	53.27298	2934	night	offshore	Crosslake
-124.66248	53.27283	593	night	offshore	Crosslake
-124.66278	53.27268	1158	night	offshore	Crosslake
-124.66303	53.27253	873	night	offshore	Crosslake
-124.66333	53.27239	591	night	offshore	Crosslake
-124.66359	53.27223	1747	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.66385	53.27207	0	night	offshore	Crosslake
-124.66408	53.27189	593	night	offshore	Crosslake
-124.66428	53.27171	578	night	offshore	Crosslake
-124.66455	53.27155	1742	night	offshore	Crosslake
-124.66485	53.27139	1516	night	offshore	Crosslake
-124.66508	53.27123	1343	night	offshore	Crosslake
-124.66538	53.27108	1290	night	offshore	Crosslake
-124.66558	53.27091	2459	night	offshore	Crosslake
-124.66577	53.27071	881	night	offshore	Crosslake
-124.66602	53.27054	575	night	offshore	Crosslake
-124.66628	53.27037	68	night	offshore	Crosslake
-124.66650	53.27020	0	night	offshore	Crosslake
-124.66676	53.27002	0	night	nearshore	Crosslake
-124.66695	53.26984	0	night	nearshore	Crosslake
-124.66717	53.26959	0	night	nearshore	Crosslake
-124.66201	53.26619	243	night	nearshore	Crosslake
-124.66169	53.26634	0	night	nearshore	Crosslake
-124.66138	53.26646	0	night	offshore	Crosslake
-124.66108	53.26660	0	night	offshore	Crosslake
-124.66076	53.26672	884	night	offshore	Crosslake
-124.66046	53.26687	1149	night	offshore	Crosslake
-124.66015	53.26700	1375	night	offshore	Crosslake
-124.65986	53.26712	0	night	offshore	Crosslake
-124.65957	53.26728	1166	night	offshore	Crosslake
-124.65929	53.26742	0	night	offshore	Crosslake
-124.65903	53.26758	1321	night	offshore	Crosslake
-124.65879	53.26775	2308	night	offshore	Crosslake
-124.65853	53.26791	582	night	offshore	Crosslake
-124.65827	53.26807	581	night	offshore	Crosslake
-124.65804	53.26825	69	night	offshore	Crosslake
-124.65779	53.26842	650	night	offshore	Crosslake
-124.65756	53.26859	1663	night	offshore	Crosslake
-124.65730	53.26876	363	night	offshore	Crosslake
-124.65708	53.26894	583	night	offshore	Crosslake
-124.65685	53.26912	296	night	offshore	Crosslake
-124.65661	53.26929	1312	night	offshore	Crosslake
-124.65643	53.26948	583	night	offshore	Crosslake
-124.65622	53.26967	939	night	offshore	Crosslake
-124.65596	53.26984	0	night	offshore	Crosslake
-124.65570	53.26999	1870	night	offshore	Crosslake
-124.65545	53.27017	295	night	offshore	Crosslake
-124.65522	53.27035	880	night	offshore	Crosslake
-124.65501	53.27053	2036	night	offshore	Crosslake
-124.65481	53.27071	1446	night	offshore	Crosslake
-124.65460	53.27090	1464	night	offshore	Crosslake
-124.65427	53.27100	0	night	offshore	Crosslake
-124.65400	53.27116	2107	night	offshore	Crosslake
-124.65373	53.27132	944	night	offshore	Crosslake
-124.65344	53.27146	1169	night	offshore	Crosslake
-124.65319	53.27163	574	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65296	53.27181	878	night	offshore	Crosslake
-124.65271	53.27199	1808	night	offshore	Crosslake
-124.65248	53.27215	73	night	offshore	Crosslake
-124.65225	53.27232	0	night	offshore	Crosslake
-124.65201	53.27249	0	night	offshore	Crosslake
-124.65173	53.27265	577	night	offshore	Crosslake
-124.65149	53.27282	678	night	offshore	Crosslake
-124.65123	53.27300	0	night	nearshore	Crosslake
-124.64465	53.26942	638	night	offshore	Crosslake
-124.64502	53.26930	583	night	offshore	Crosslake
-124.64533	53.26918	574	night	offshore	Crosslake
-124.64564	53.26907	0	night	offshore	Crosslake
-124.64593	53.26891	1079	night	offshore	Crosslake
-124.64621	53.26876	75	night	offshore	Crosslake
-124.64646	53.26860	1858	night	offshore	Crosslake
-124.64667	53.26841	1242	night	offshore	Crosslake
-124.64693	53.26825	1164	night	offshore	Crosslake
-124.64720	53.26809	0	night	offshore	Crosslake
-124.64746	53.26792	871	night	offshore	Crosslake
-124.64770	53.26775	976	night	offshore	Crosslake
-124.64796	53.26761	1299	night	offshore	Crosslake
-124.64825	53.26746	715	night	offshore	Crosslake
-124.64852	53.26730	1802	night	offshore	Crosslake
-124.64881	53.26716	1616	night	offshore	Crosslake
-124.64910	53.26701	656	night	offshore	Crosslake
-124.64931	53.26683	597	night	offshore	Crosslake
-124.64950	53.26665	0	night	offshore	Crosslake
-124.64970	53.26645	206	night	offshore	Crosslake
-124.64998	53.26630	1889	night	offshore	Crosslake
-124.65029	53.26617	582	night	offshore	Crosslake
-124.65055	53.26602	874	night	offshore	Crosslake
-124.65081	53.26585	574	night	offshore	Crosslake
-124.65106	53.26569	2331	night	offshore	Crosslake
-124.65134	53.26553	1729	night	offshore	Crosslake
-124.65164	53.26540	2379	night	offshore	Crosslake
-124.65197	53.26530	879	night	offshore	Crosslake
-124.65226	53.26518	204	night	offshore	Crosslake
-124.65252	53.26500	2327	night	offshore	Crosslake
-124.65277	53.26483	1102	night	offshore	Crosslake
-124.65301	53.26466	2905	night	offshore	Crosslake
-124.65316	53.26446	2465	night	offshore	Crosslake
-124.65335	53.26426	4910	night	offshore	Crosslake
-124.65355	53.26408	366	night	offshore	Crosslake
-124.65379	53.26390	1465	night	offshore	Crosslake
-124.65396	53.26369	2300	night	offshore	Crosslake
-124.65412	53.26349	646	night	offshore	Crosslake
-124.65432	53.26331	581	night	offshore	Crosslake
-124.65454	53.26312	1463	night	offshore	Crosslake
-124.65476	53.26295	1155	night	offshore	Crosslake
-124.65497	53.26275	579	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.65516	53.26254	0	night	offshore	Crosslake
-124.65533	53.26236	1742	night	offshore	Crosslake
-124.65553	53.26218	68	night	nearshore	Crosslake
-124.65578	53.26199	0	night	nearshore	Crosslake
-124.65590	53.26188	0	night	nearshore	Crosslake
-124.65055	53.25907	0	night	nearshore	Crosslake
-124.65022	53.25923	0	night	nearshore	Crosslake
-124.64993	53.25934	69	night	nearshore	Crosslake
-124.64959	53.25946	619	night	offshore	Crosslake
-124.64933	53.25962	647	night	offshore	Crosslake
-124.64909	53.25978	1161	night	offshore	Crosslake
-124.64884	53.25995	1149	night	offshore	Crosslake
-124.64861	53.26014	1162	night	offshore	Crosslake
-124.64838	53.26032	584	night	offshore	Crosslake
-124.64815	53.26048	295	night	offshore	Crosslake
-124.64791	53.26065	2918	night	offshore	Crosslake
-124.64767	53.26084	1745	night	offshore	Crosslake
-124.64741	53.26098	363	night	offshore	Crosslake
-124.64710	53.26111	882	night	offshore	Crosslake
-124.64682	53.26127	2336	night	offshore	Crosslake
-124.64658	53.26143	0	night	offshore	Crosslake
-124.64634	53.26161	594	night	offshore	Crosslake
-124.64608	53.26177	68	night	offshore	Crosslake
-124.64582	53.26193	582	night	offshore	Crosslake
-124.64555	53.26209	872	night	offshore	Crosslake
-124.64527	53.26223	581	night	offshore	Crosslake
-124.64496	53.26237	0	night	offshore	Crosslake
-124.64468	53.26250	666	night	offshore	Crosslake
-124.64433	53.26264	621	night	offshore	Crosslake
-124.63579	53.26099	0	night	nearshore	Crosslake
-124.63607	53.26078	581	night	offshore	Crosslake
-124.63631	53.26060	2933	night	offshore	Crosslake
-124.63653	53.26043	579	night	offshore	Crosslake
-124.63677	53.26025	2883	night	offshore	Crosslake
-124.63700	53.26007	2967	night	offshore	Crosslake
-124.63720	53.25989	1165	night	offshore	Crosslake
-124.63751	53.25977	580	night	offshore	Crosslake
-124.63781	53.25963	2371	night	offshore	Crosslake
-124.63804	53.25945	3503	night	offshore	Crosslake
-124.63824	53.25926	3614	night	offshore	Crosslake
-124.63844	53.25907	2045	night	offshore	Crosslake
-124.63860	53.25887	2632	night	offshore	Crosslake
-124.63874	53.25866	2435	night	offshore	Crosslake
-124.63887	53.25845	1753	night	offshore	Crosslake
-124.63905	53.25826	1293	night	offshore	Crosslake
-124.63937	53.25813	960	night	offshore	Crosslake
-124.63966	53.25800	0	night	offshore	Crosslake
-124.63994	53.25786	2605	night	offshore	Crosslake
-124.64021	53.25769	1157	night	offshore	Crosslake
-124.64048	53.25753	1455	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.64070	53.25735	2187	night	offshore	Crosslake
-124.64099	53.25723	1774	night	offshore	Crosslake
-124.64129	53.25709	295	night	offshore	Crosslake
-124.64158	53.25694	298	night	offshore	Crosslake
-124.64187	53.25680	1165	night	offshore	Crosslake
-124.64217	53.25667	1157	night	offshore	Crosslake
-124.64247	53.25654	868	night	offshore	Crosslake
-124.64279	53.25641	1458	night	offshore	Crosslake
-124.64311	53.25630	2046	night	offshore	Crosslake
-124.64341	53.25616	3485	night	offshore	Crosslake
-124.64368	53.25602	1367	night	offshore	Crosslake
-124.64395	53.25586	4043	night	offshore	Crosslake
-124.64428	53.25572	1266	night	offshore	Crosslake
-124.64453	53.25562	0	night	nearshore	Crosslake
-124.64167	53.25039	0	night	nearshore	Crosslake
-124.64128	53.25044	136	night	offshore	Crosslake
-124.64092	53.25046	580	night	offshore	Crosslake
-124.64054	53.25050	943	night	offshore	Crosslake
-124.64022	53.25059	785	night	offshore	Crosslake
-124.63990	53.25072	0	night	offshore	Crosslake
-124.63965	53.25089	69	night	offshore	Crosslake
-124.63939	53.25106	2612	night	offshore	Crosslake
-124.63920	53.25125	1745	night	offshore	Crosslake
-124.63905	53.25146	0	night	offshore	Crosslake
-124.63884	53.25163	1232	night	offshore	Crosslake
-124.63856	53.25179	882	night	offshore	Crosslake
-124.63829	53.25193	365	night	offshore	Crosslake
-124.63800	53.25209	894	night	offshore	Crosslake
-124.63773	53.25224	1451	night	offshore	Crosslake
-124.63746	53.25239	592	night	offshore	Crosslake
-124.63717	53.25254	882	night	offshore	Crosslake
-124.63687	53.25268	941	night	offshore	Crosslake
-124.63659	53.25282	295	night	offshore	Crosslake
-124.63631	53.25298	0	night	offshore	Crosslake
-124.63607	53.25315	594	night	offshore	Crosslake
-124.63585	53.25333	1181	night	offshore	Crosslake
-124.63562	53.25350	1771	night	offshore	Crosslake
-124.63536	53.25365	1458	night	offshore	Crosslake
-124.63507	53.25381	887	night	offshore	Crosslake
-124.63481	53.25397	1154	night	offshore	Crosslake
-124.63468	53.25419	68	night	offshore	Crosslake
-124.63445	53.25436	296	night	offshore	Crosslake
-124.63420	53.25451	0	night	offshore	Crosslake
-124.63393	53.25467	581	night	offshore	Crosslake
-124.63365	53.25483	590	night	offshore	Crosslake
-124.63338	53.25498	585	night	offshore	Crosslake
-124.63313	53.25516	1159	night	offshore	Crosslake
-124.63291	53.25533	68	night	offshore	Crosslake
-124.63269	53.25551	1874	night	offshore	Crosslake
-124.63246	53.25568	68	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.63226	53.25587	946	night	offshore	Crosslake
-124.63207	53.25607	1476	night	offshore	Crosslake
-124.63188	53.25626	577	night	offshore	Crosslake
-124.63186	53.25648	1366	night	offshore	Crosslake
-124.63159	53.25663	576	night	offshore	Crosslake
-124.63131	53.25679	885	night	offshore	Crosslake
-124.63103	53.25694	943	night	offshore	Crosslake
-124.63071	53.2570672	462.420785	night	offshore	Crosslake
-124.63041	53.2571983	1156.50565	night	offshore	Crosslake
-124.63016	53.2573431	0	night	offshore	Crosslake
-124.63	53.2575388	1156.78517	night	offshore	Crosslake
-124.62986	53.2577609	1731.77157	night	offshore	Crosslake
-124.62962	53.2579203	581.086679	night	offshore	Crosslake
-124.6294	53.2581033	579.982554	night	offshore	Crosslake
-124.62916	53.2582782	1736.35896	night	offshore	Crosslake
-124.62891	53.2584461	2046.95615	night	offshore	Crosslake
-124.62867	53.2586261	204.759113	night	offshore	Crosslake
-124.62845	53.2587986	0	night	nearshore	Crosslake
-124.62235	53.2556108	0	night	nearshore	Crosslake
-124.62263	53.2554895	0	night	nearshore	Crosslake
-124.62294	53.255395	699.294816	night	nearshore	Crosslake
-124.62314	53.2551839	657.176857	night	offshore	Crosslake
-124.62343	53.2550714	1740.86662	night	offshore	Crosslake
-124.62375	53.2549364	1156.558	night	offshore	Crosslake
-124.62403	53.2548033	327.517324	night	offshore	Crosslake
-124.62428	53.254625	1283.65437	night	offshore	Crosslake
-124.62446	53.2544228	1514.41312	night	offshore	Crosslake
-124.62461	53.2542175	307.075449	night	offshore	Crosslake
-124.62478	53.2540235	972.010124	night	offshore	Crosslake
-124.62501	53.2538455	1533.73213	night	offshore	Crosslake
-124.62524	53.2536617	297.667273	night	offshore	Crosslake
-124.62547	53.2534906	297.896828	night	offshore	Crosslake
-124.6257	53.2533115	1172.42388	night	offshore	Crosslake
-124.62594	53.2531377	1521.85604	night	offshore	Crosslake
-124.62618	53.2529633	658.490908	night	offshore	Crosslake
-124.62645	53.2528149	1754.02599	night	offshore	Crosslake
-124.62671	53.2526439	500.96296	night	offshore	Crosslake
-124.62697	53.2524832	422.848533	night	offshore	Crosslake
-124.62722	53.2523273	1468.98705	night	offshore	Crosslake
-124.62752	53.2521857	1166.56512	night	offshore	Crosslake
-124.62782	53.2520487	365.039387	night	offshore	Crosslake
-124.62811	53.2519033	212.266277	night	offshore	Crosslake
-124.62838	53.2517518	945.748145	night	offshore	Crosslake
-124.62866	53.251599	68.1465367	night	offshore	Crosslake
-124.62895	53.2514523	0	night	offshore	Crosslake
-124.62925	53.2513295	2328.41172	night	offshore	Crosslake
-124.62956	53.2512075	513.400212	night	offshore	Crosslake
-124.62985	53.2510711	71.536137	night	offshore	Crosslake
-124.6301	53.2508971	1156.54713	night	offshore	Crosslake
-124.6303	53.2507075	296.219246	night	offshore	Crosslake

LON	LAT	FPHA	PERIOD$	HABZONE$	TranType
-124.63048	53.2505087	0	night	offshore	Crosslake
-124.63065	53.2503083	1157.11422	night	offshore	Crosslake
-124.63082	53.2501164	321.407383	night	offshore	Crosslake
-124.63104	53.2499246	0	night	offshore	Crosslake
-124.63121	53.249725	786.226811	night	offshore	Crosslake
-124.63138	53.2495233	1220.95288	night	offshore	Crosslake
-124.63156	53.24933	647.467742	night	offshore	Crosslake
-124.63174	53.2491313	68.3896622	night	offshore	Crosslake
-124.63187	53.2489283	579.378679	night	offshore	Crosslake
-124.63203	53.2487209	648.183061	night	offshore	Crosslake
-124.63227	53.248545	645.347418	night	offshore	Crosslake
-124.63254	53.2483899	651.72081	night	offshore	Crosslake
-124.63282	53.2482417	0	night	offshore	Crosslake
-124.63309	53.2481005	68.8877135	night	offshore	Crosslake
-124.63339	53.2479583	430.813044	night	offshore	Crosslake
-124.6337	53.2478279	288.669679	night	offshore	Crosslake
-124.63401	53.2477104	1153.82509	night	offshore	Crosslake
-124.63433	53.2475833	950.179735	night	offshore	Crosslake
-124.63467	53.2474723	1964.04255	night	offshore	Crosslake
-124.63499	53.2473626	296.979848	night	offshore	Crosslake
-124.63531	53.2472539	216.336933	night	offshore	Crosslake
-124.63563	53.247135	219.061145	night	offshore	Crosslake
-124.63585	53.2469756	1450.81911	night	offshore	Crosslake
-124.63599	53.2467612	1014.60458	night	offshore	Crosslake
-124.63613	53.2465487	1222.86653	night	offshore	Crosslake
-124.63629	53.2463465	0	night	offshore	Crosslake
-124.63644	53.2461358	0	night	nearshore	Crosslake

Annex 5.15-1
Kokanee Spawner Survey Data, 2013

Table 5.15-1A: Kokanee Spawner Surveys in Reach 1 of Davidson Creek, August 2013

Stream:	Davidson Creek		Reach:	1
Date:	08-Aug-13		Crew:	RS, SL, VC
Water Temp ºC:	12		Weather:	Sunny
Start UTM:	384600	5908028	Waypoint:	KODC1S
End UTM:	384297	5907870	Waypoint:	KODC1E
Start Time:	9:30		End Time:	12:57

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	P	2	–	2	–	–	–	2
5	G	10	–	10	–	–	–	2
20	R	2	–	2	–	–	–	–
31	P	12	–	12	–	–	–	–
38	G	1	–	1	–	–	–	2
43	R	0	–	–	–	–	–	–
44	P	9	–	9	–	–	–	1
51	R	8	–	8	–	–	–	2
55	P	11	–	11	–	–	–	–
69	G	17	–	12	5	–	–	2
77	G	19	–	15	4	–	–	–
91	P	7	–	7	–	–	–	–
97	R	1	1	–	–	–	–	–
100	P	8	–	4	4	–	2	–
102	R	1	1	–	–	–	–	2
104	P	31	–	29	2	–	7	5
108	G	16	–	12	4	–	1	4
122	R	23	–	17	6	–	3	4
139	P	10	–	9	–	1	–	1
163	G	10	–	9	1	–	–	1
169	R	10	–	10	–	–	–	2
184	G	16	–	8	8	–	2	–
187	P	6	–	5	1	–	–	1
194	G	7	–	6	–	1	–	2
197	P	12	–	11	1	–	1	2
200	R	7	–	7	–	–	–	–
208	P	0	–	–	–	–	–	3
217	R	21	–	17	4	–	2	–
225	G	16	–	12	4	–	–	–
237	G	19	–	18	1	–	–	1
237	P	19	–	17	2	–	3	1
242	P	3	–	3	–	–	–	3
255	G	1	–	1	–	–	–	–
258	R	5	–	5	–	–	–	–
259	P	1	–	1	–	–	–	4
262	G	1	1	–	–	–	–	4
270	R	4	–	4	–	–	–	–
287	G	11	–	5	6	–	–	2
308	R	26	–	18	8	–	–	3
318	G	33	–	23	10	–	8	5
340	CULVERT START	–	–	–	–	–	–	–
345	CULVERT END	–	–	–	–	–	–	–
345	G	16	–	10	6	–	3	1
355	P	2	–	1		1	–	1
364	G	5	–	3	2	–	1	3
369	R	24	–	10	14	–	7	1
389	P	1	–	1	–	–	–	3
394	R	2	1	1	–	–	5	1
400	G	38	–	32	6	–	5	–
413	R	1	1	–	–	–	–	–
422	G	21	–	21	–	–	2	–
424	P	0	–	–	–	–	–	2
429	R	1	–	–	–	1	–	–
438	G	17	–	17	–	–	2	–
444	P	9	–	9	–	–	–	7
456	G	2	–	2	–	–	–	3
471	P	9	–	7	2	–	–	5
–	R	8	–	8	–	–	–	1
471	G	63	–	43	20	–	13	2
501	R	9	–	9	–	–	–	2
508	G	END	–	–	–	–	–	–
	TOTAL	644	5	514	121	4	67	93

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1B: Kokanee Spawner Surveys in Reach 2 of in Davidson Creek, August 2013

Stream:	Davidson Creek		Reach:	2
Date:	08-Aug-13		Crew:	RS, SL, VC
Water Temp ºC:	14		Weather:	Sunny
Start UTM:	384074	5907548	Waypoint:	KODC2S
End UTM:	383899	5937316	Waypoint:	KODC2E
Start Time:	13:00		End Time:	15:37

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	G	37	–	37	–	–	7	–
11	G	5	–	4	1	–	–	1
17	P	20	–	20	–	–	–	3
22	G	37	–	26	10	1	5	–
28	P	12	–	12	–	–	–	–
31	R	5	–	5	–	–	–	–
33	G	32	–	32	–	–	6	–
39	G	4	–	4	–	–	–	–
49	G	10	–	6	4	–	–	1
54	P	6	–	6	–	–	–	–
60	G	8	–	8	–	–	1	1
65	R	22	–	22	–	–	–	–
76	G	49	–	38	10	1	7	–
91	P	20	–	19	1	–	–	1
–	R	11	–	11	–	–	–	1
113	R	19	–	13	6	–	–	4
–	G	22	–	18	4	–	2	–
124	R	8	8	–	–	–	–	–
131	G	45	–	20	25	–	–	–
–	G	53	37	2	–	14	10	1
166	R	4	2	–	–	2	–	–
177	R	11	5	2	4	–	4	–
185	R	10	–	10	–	–	–	–
195	P	21	–	21	–	–	–	–
200	R	33	–	25	6	2	–	1
231	G	44	–	24	20	–	13	–
241	R	43	–	43	–	–	5	1
262	G	25	–	21	4	–	2	–
269	P	5	–	5	–	–	–	–
272	R	2	–	2	–	–	–	–
269	G	19	–	19	–	–	–	–
296	R	7	–	3	4	–	–	–
316	P	5	–	5	–	–	–	–
319	R	27	–	17	10	–	8	–
335	R	2	–	2	–	–	–	1
343	G	3	–	3	–	–	–	–
351	R	33	–	33	–	–	6	–
368	G	4	–	4	–	–	–	–
374	R	5	–	3	2	–	–	–
385	G	6	–	6	–	–	1	–
397	P	45	–	19	26	–	3	–
–	P	17	–	17	–	–	–	1
406	R	6	–	6	–	–	–	–
409	G	16	–	16	–	–	–	–
412	P	15	–	13	2	–	–	–
417	R	4	–	4	–	–	–	–
425	G	3	–	1	2	–	–	–
435	P	3	–	3	–	–	–	–
442	P	7	–	7	–	–	3	–
450	P	7	–	7	–	–	–	–
452	R	10	–	9	–	1	–	–
475	G	5	–	3	–	2	3	–
477	P	12	–	–	12	–	–	–
490	R	6	–	–	6	–	–	1
493	G	31	–	23	8	–	5	–
498	P	3	–	3	–	–	–	–
503	R	end	–	–	–	–	–	–
	TOTAL	924	52	682	167	23	91	18

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1C: Kokanee Spawner Surveys in Reach 3 of Davidson Creek, August 2013

Stream:	Davidson Creek		Reach:	3
Date:	10-Aug-13		Crew:	SL, RS, VC
Water Temp ºC:	14		Weather:	Sunny
Start UTM:	383551	5907125	Waypoint:	KODC3S
End UTM:	383310	5907138	Waypoint:	KODC3E
Start Time:	12:23		End Time:	14:00

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	0	–	–	–	–	–	–
2	G	12	–	–	12	–	3	–
15	P	33	–	6	27	–	–	1
21	G	0	–	–	–	–	4	–
23	P	29	–	–	29	–	4	–
30	R	0	–	–	–	–	–	1
34	P	17	–	–	17	–	3	–
45	R	13	–	6	7	–	3	–
58	P	12	–	9	–	3	–	–
78	G	1	–	–	1	–	1	–
83	P	18	–	–	18	–	–	–
89	R	4	4	–	–	–	–	–
99	G	21	–	21	–	–	5	–
109	P	12	–	–	12	–	–	–
115	R	2	2	–	–	–	2	–
119	P	26	–	26	–	–	8	–
127	R	13	13	–	–	–	–	–
140	G	10	–	–	10	–	–	1
152	P	2	–	–	2	–	–	1
156	R	0	–	–	–	–	3	–
161	P	17	–	–	17	–	5	–
167	R	4	–	–	4	–	–	–
173	P	2	–	–	2	–	2	–
179	R	8	8	–	–	–	–	–
193	G	74	–	4	70	–	8	–
208	P	5	–	–	5	–	–	–
216	R	1	1	–	–	–	–	–
229	G	1	–	–	–	1	–	–
231	P	14	–	–	14	–	–	–
239	R	2	–	–	2	–	–	–
246	G	31	–	–	31	–	1	–
263	P	32	–	–	32	–	–	–
268	R	1	–	–	1	–	–	–
272	G	4	–	4	–	–	1	–
280	P	11	–	–	11	–	–	–
292	R	2	–	–	2	–	–	–
329	P	0	–	–	–	–	–	–
338	R	8	–	–	7	1	–	–
368	G	8	–	4	4	–	2	–
383	R	2	–	–	2	–	–	–
412	R	3	–	–	3	–	–	–
427	P	7	–	–	7	–	1	–
431	G	3	–	–	3	–	5	–
441	P	10	–	–	10	–	–	–
445	G	1	–	–	1	–	–	–
447	P	0	–	–	–	–	–	–
448	G	3	–	–	3	–	–	–
459	P	0	–	–	–	–	–	–
462	R	0	–	–	–	–	–	–
466	G	7	–	–	7	–	–	–
480	R	7	–	–	7	–	–	–
487	G	6	–	–	6	–	–	–
495	R	0	–	–	–	–	–	–
503	beaverdam, stream forks at 411.6, and norrows significantly right before beaver dam.							–
	TOTAL	499	28	80	386	5	61	4

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1D: Kokanee Spawner Surveys in Reach 4 of Davidson Creek, August 2013

Stream:	Davidson Creek		Reach:	4
Date:	10-Aug-13		Crew:	RS, SL
Water Temp ºC:	15		Weather:	Sunny
Start UTM:	382995	5905924	Waypoint:	KODC4S
End UTM:	382846	5905970	Waypoint:	KODC4
Start Time:	14:30			16:00

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	G	1	1	–	–	–	–	–
–	G	2	2	–	–	–	–	–
–	G	2	–	2	–	–	–	–
–	P	2	–	2	–	–	–	–
271	G	3	–	3	–	–	–	–
296	G	1	1	–	–	–	–	–
342	G	2	–	2	–	–	–	–
378	P	2	–	2	–	–	–	–
422	R	1	–	1	–	–	–	–
444	G	1	–	–	–	1	–	–
463	G	2	–	2	–	–	–	–
468	R	2	–	2	–	–	–	–
495	G	5	–	5	–	–	–	–
509	G	12	–	10	2	–	1	–
	TOTAL	38	4	31	2	1	1	0

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1E: Kokanee Spawner Surveys in Reach 1 of Creek 661, August 2013

Stream:	Creek 661		Reach:	1
Date:	11-Aug-13		Crew:	RS, SL, VC
Water Temp ºC:	16		Weather:	Sunny
Start UTM:	388707	5899424	Waypoint:	KO661S
End UTM:	388418	5899337	Waypoint:	KO661E
Start Time:	11:11		End Time:	12:30

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	33	11	22	–	–	–	–
29	P	5	–	5	–	–	–	–
32	R	9	–	9	–	–	–	–
59	LOGJAM	3	–	2	–	1	–	–
66	G	64	10	54	–	–	–	–
83	LOGJAM	11	–	11	–	–	–	1
93	R	17	–	13	3	1	–	–
106	LOGJAM	10	–	10	–	–	–	–
112	R	9	–	9	–	–	–	–
123	G	56	–	50	6	–	–	–
131	R	2	2	–	–	–	–	–
139	G	37	–	37	–	–	–	–
143	R	10	–	10	–	–	–	1
173	G	28	–	28	–	–	–	–
178	P	6	–	6	–	–	–	–
184	R	5	–	5	–	–	–	–
203	G	32	–	30	2	–	–	–
209	R	78	10	53	15	–	–	–
225	R	5	5	–	–	–	–	–
244	P	53	–	43	10	–	–	–
255	R	34	–	32	–	2	–	–
275	G	8	–	8	–	–	–	–
278	R	8	4	4	–	–	–	–
285	G	3	–	3	–	–	–	–
292	R	23	–	23	–	–	–	–
318	LOGJAM	27	–	27	–	–	–	–
325	R	36	36	–	–	–	–	1
270	R	2	2	–	–	–	–	–
374	P	23	–	23	–	–	–	–
379	R	4	–	4	–	–	–	–
397	LOGJAM	20	–	20	–	–	–	–
404	G	30	–	30	–	–	–	–
418	R	7	–	7	–	–	–	–
439	G	6	–	6	–	–	–	–
460	R	0	–	–	–	–	–	–
469	G	7	–	5	2	–	–	–
474	R	8	–	8	–	–	–	–
501	G	5	–	5	–	–	–	–
506	R	–	–	–	–	–	–	–
	TOTAL	724	80	602	38	4	0	3

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1F: Kokanee Spawner Surveys in Reach 2 of Creek 661, August 2013

Stream:	Creek 661		Reach:	2
Date:	24-Aug-13		Crew:	RS, SL, VC
Water Temp ºC:	10		Weather:	Overcast
Start UTM:	385981	5898498	Waypoint:	KOR2S
End UTM:	385691	5898446	Waypoint:	KOR2E
Start Time:	9:08		End Time:	10:30

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	4	4	–	–	–	–	–
7	P	6	–	6	–	–	–	–
19	R	9	9	–	–	–	–	–
53	G	26	–	26	–	–	–	–
61	P	9	–	9	–	–	–	–
66	R	1	–	1	–	–	–	–
87	P	4	–	4	–	–	–	–
90	G	23	–	23	–	–	–	–
93	P	0	–	–	–	–	–	–
97	R	12	–	10	2	–	–	–
122	LOGJAM	2	–	2	–	–	–	–
126	G	5	5	–	–	–	–	–
133	R	8	–	8	–	–	–	–
149	G	23	–	23	–	–	–	–
164	R	7	–	7	–	–	–	–
167	P	1	–	1	–	–	–	–
178	R	2	–	1	–	1	–	–
185	G	9	–	9	–	–	–	–
195	R	0	–	–	–	–	–	–
201	P	26	2	24	–	–	–	1
209	R	19	–	19	–	–	–	–
218	G	7	–	7	–	–	–	–
223	P	2	–	2	–	–	–	–
238	G	10	–	10	–	–	–	–
244	P	1	1	–	–	–	–	–
251	R	0	–	–	–	–	–	–
253	G	13	–	9	4	–	–	–
260	P	0	–	–	–	–	–	–
275	R	0	–	–	–	–	–	–
278	P	0	–	–	–	–	–	–
291	R	0	–	–	–	–	–	–
311	P	0	–	–	–	–	–	–
316	P	0	–	–	–	–	–	–
329	G	0	–	–	–	–	–	–
355	P	0	–	–	–	–	–	–
359	G	2	–	2	–	–	–	–
384	P	0	–	–	–	–	–	–
390	R	0	–	–	–	–	–	–
396	P	0	–	–	–	–	–	–
400	R	0	–	–	–	–	–	–
417	P	2	–	2	–	–	–	–
422	G	3	–	3	–	–	–	–
438	P	0	–	–	–	–	–	–
446	R	0	–	–	–	–	–	–
466	P	0	–	–	–	–	–	–
467	G	41	–	41	–	–	–	–
490	P	0	–	–	–	–	–	–
507	R	–	–	–	–	–	–	–
	TOTAL	277	21	249	6	1	0	1

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1G: Kokanee Spawner Surveys in Reach 3 of Creek 661, August 2012

Stream:	Creek 661		Reach:	3
Date:	16-Aug-13		Crew:	RS, BH
Water Temp ºC:	10		Weather:	overcast
Start UTM:	384774	5898410	Waypoint:	KORECS
End UTM:	384362	5898331	Waypoint:	KORECE
Start Time:	12:29		End Time:	13:38
Observed 30 kokanee of which 6 were spawning pairs, 24 migrating				

Table 5.15-1H: Kokanee Spawner Surveys in Lower Chedakuz Creek, September 2013

Stream:	Chedakuz Creek		Reach:	13
Date:	11-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	14.5		Weather:	Sunny
Start UTM:	382766	5910266	Waypoint:	KOR13S
End UTM:	382986	5910101	Waypoint:	KOR13E
Start Time:	12:03		End Time:	12:54

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	G	1	1	–	–	–	–	15
56	G	–	–	–	–	–	–	7
102	R	–	–	–	–	–	–	1
122	G	–	–	–	–	–	–	3
133	R	1	–	–	–	1	–	2
171	G	2	1	–	–	1	–	16
248	R	1	–	–	–	1	–	10
271	P	1	–	–	–	1	3	20
307	G	1	–	–	–	1	–	2
335	P	–	–	–	–	–	–	4
349	R	–	–	–	–	–	–	3
364	G	2	–	1	–	1	–	4
411	P	–	–	–	–	–	–	2
421	R	–	–	–	–	–	–	6
432	G	3	–	–	2	1	3	8
452	P	–	–	–	–	–	–	2
476	R	–	–	–	–	–	–	–
488	G	1	–	–	–	1	–	1
521	R	–	–	–	–	–	–	–
	TOTAL	13	2	1	2	8	6	106

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1l: Kokanee Spawner Surveys in Lower Chedakuz Creek, September 2013

Stream:	Chedakuz Creek		Reach:	14
Date:	11-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	15.5		Weather:	Sunny
Start UTM:	383368	5909969	Waypoint:	KOR14S
End UTM:	383640	5909594	Waypoint:	KOR14E
Start Time:	13:33		End Time:	14:11

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	–	–	–	–	–	–	–
21	G	2	–	1	–	1	–	28
74	R	–	–	–	–	–	–	1
101	G	5	–	–	2	3	–	22
162	R	–	–	–	–	–	–	2
183	G	4	–	4	–	–	–	12
239	R	–	–	–	–	–	–	–
249	G	–	–	–	–	–	–	3
269	R	–	–	–	–	–	–	2
289	G	1	–	1	–	–	–	6
335	R	–	–	–	–	–	–	–
351	G	–	–	–	–	–	–	5
379	R	–	–	–	–	–	–	2
394	G	36	–	30	6	–	–	15
432	R	1	1	–	–	–	–	3
452	G	31	–	23	8	–	–	3
489	G	34	–	22	12	–	9	2
514	G	–	–	–	–	–	–	–
	TOTAL	114	1	81	28	4	9	106

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1J: Kokanee Spawner Surveys in Lower Chedakuz Creek, September 2013

Stream:	Chedakuz Creek		Reach:	15
Date:	11-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	12.5		Weather:	Sunny
Start UTM:	389933	5909321	Waypoint:	KOR15S
End UTM:	384006	5909380	Waypoint:	KOR15E
Start Time:	8:58		End Time:	10:28

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	3	1	2	–	–	–	2
23	G	43	–	39	4	–	12	2
51	R	6	–	6	–	–	5	0
70	P	5	–	4	–	–	–	6
77	G	22	–	21	–	–		4
112	P	13	–	13	–	–	5	–
120	G	31	–	29	2	–	11	4
136	G	26	–	23	2	1	1	0
164	R	6	–	5	–	1	–	1
176	G	32	–	26	6	–	8	2
201	G	76	–	63	12	1	14	3
246	R	5	1	4	–	–	–	–
258	G	24	24	–	–	–	–	1
278	G	27	–	27	–	–	8	3
305	G	6	1	5	–	–	–	11
340	G	11	–	10	–	1	–	7
410	G	8	4	–	–	4	–	7
440	G	7	6	3	–	1	–	17
500	G	–	–	–	–	–	–	–
	TOTAL	351	37	280	26	9	64	70

Note: G = glide; P = pool; R = riffle; dash indicates no data

Annex 5.15-1K: Kokanee Spawner Surveys in Middle Chedakuz Creek, August 2013

Stream:	Chedakuz Creek		Reach:	19-20
Date:	11-Aug-13		Crew:	RS, SL, VC
Water Temp ºC:	12.5		Weather:	Sunny
Start UTM:	388785	5899649	Waypoint:	KOCHS
End UTM:	388634	5899310	Waypoint:	KOCHE
Start Time:	9:36		End Time:	11:00

Distance	Habitat Type	Total live count	Behaviour				No. redds	Dead count
			Migrating	Holding	Spawning	Spent		
0	R	3	3	–	–	–	–	1
26	G	73	25	43	5	–	–	2
37	R	20	5	14	–	1	–	–
85	R	6	–	6	–	–	–	–
109	G	72	–	–	68	4	–	–
113	P	104	–	84	20	–	–	–
117	G	32	–	10	22	–	–	–
119	P	62	–	52	10	–	–	–
124	R	11	–	11	–	–	–	–
136	LOGJAM	4	–	4	–	–	–	–
161	R	66	2	50	13	1	–	–
207	G	11	–	11	–	–	–	–
215	R	29	–	22	4	3	–	–
246	G	30	–	27	3	–	2	1
252	R	26	–	26	–	–	–	–
279	Confluence with Creek 661		–	Reach 20 from here down		–	–	–
279	R	29	3	26	–	–	–	–
308	G	8	–	5	2	1	–	–
328	G	15	10	5	–	–	–	–
339	P	41	–	41	–	–	–	–
343	R	11	–	11	–	–	–	–
370	LOGJAM	3	3	–	–	–	–	–
378	G	28	–	2	26	–	4	–
385	P	2	–	2	–	–	–	–
396	G	12	–	10	2	–	1	–
404	R	24	–	24	–	–	–	–
434	P	6	–	6	–	–	–	–
448	G	5	–	3	2	–	–	–
479	P	41	–	41	–	–	–	–
481	R	6	3	3	–	–	–	–
501	G	–	–	–	–	–	–	–
Distance	**Total**	780	54	539	177	10	7	4
279	**Total R19**	549	35	360	145	9	2	4
222	**Total R20**	231	19	179	32	1	5	0

Note: G = glide; P = pool; R = riffle; dash indicates no data

Table 5.15-1L: Kokanee Spawner Surveys in Middle Chedakuz Creek, September 2013

Stream:	Chedakuz Creek		Reach:	22
Date:	12-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	10.9		Weather:	Sunny
Start UTM:	389425	5895639	Waypoint:	KOR22S
End UTM:	389585	5895353	Waypoint:	Reach Break
Start Time:	11:00		End Time:	11:30
No live or dead fish observed.				

Stream:	Chedakuz Creek		Reach:	23
Date:	12-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	11.6		Weather:	Sunny
Start UTM:	389585	5895353	Waypoint:	Reach Break
End UTM:	389669	3894976	Waypoint:	KOR23E
Start Time:	11:30		End Time:	12:03
No live or dead fish observed.				

Stream:	Chedakuz Creek		Reach:	26
Date:	12-Sep-13		Crew:	RS, IM, RC
Water Temp ºC:	10.7		Weather:	Sunny
Start UTM:	389749	5893932	Waypoint:	KOR26S
End UTM:	389768	5893387	Waypoint:	KOR26E
Start Time:	9:30		End Time:	10:17
No live or dead fish observed.				

Annex 5.15-2
Density of Kokanee Spawners and Redds in Blackwater LSA, 2011-2013

Table 5.15-2A: Linear Density of Kokanee Spawners in Davidson Creek, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	1.22	0.26	1.27	0.92	0.33
2	0.94	0.69	1.84	1.16	0.35
3	1.81	0.32	0.99	1.04	0.43
4	1.16	0.06	0.03	0.41	0.37
Mean	1.28	0.33	1.03	0.88	0.18
SE	0.19	0.13	0.38		

Note: Linear density = number of fish per metre; n = sample number; SE = standard error

Table 5.15-2B: Linear Density of Kokanee Spawners in Creek 661, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	1.10	1.33	1.43	1.29	0.10
2	0.77	–	0.55	0.66	0.11
3	0.51	–	0.06	0.28	0.22
Mean	0.79	1.33	0.68	0.82	0.19
SE	0.17	–	0.40		

Note: Linear density = number of fish per metre; n = sample number; SE = standard error; dash indicates no data

Table 5.15-2C: Linear Density of Kokanee Spawners in Lower Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
13	–	0.02	0.02	–
14	–	0.22	0.22	–
15	1.99	0.71	1.35	0.64
Mean	1.99	0.32	**0.74**	**0.44**
SE	–	0.20		

Note: Linear density = number of fish per metre; n = sample number; SE = standard error; dash indicates no data

Table 5.15-2D: Linear Density of Kokanee Spawners in Middle Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
17-18	1.51	–	1.51	–
19	–	1.97	1.97	–
20	–	1.04	1.04	–
Mean	1.51	1.50	1.50	0.27
SE	–	0.46		

Note: Linear density = number of fish per metre; n = sample number; SE = standard error; dash indicates no data

Table 5.15-2E: Linear Density of Kokanee Redds in Davidson Creek, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	0.15	0.05	0.13	0.11	0.03
2	0.10	0.08	0.18	0.12	0.03
3	0.10	0.05	0.12	0.09	0.02
4	0.06	0.02	0.00	0.03	0.02
Mean	0.10	0.05	0.11	0.09	0.02
SE	0.02	0.01	0.04		

Note: No. /m = number of fish per metre; n = sample number; SE = standard error

Table 5.15-2F: Linear Density of Kokanee Redds in Creek 661, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	0.19	0.24	0.00	0.14	0.07
2	0.06	–	0.00	0.03	0.03
3	0.00	–	0.00	0.00	0.00
Mean	0.09	0.24	0.00	0.07	0.04
SE	0.06	–	0.00		

Note: No. /m = number of fish per metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2G: Linear Density of Kokanee Redds in Lower Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
13	–	0.01	0.01	–
14	–	0.02	0.02	–
15	0.18	0.12	0.15	0.03
Mean	0.18	0.05	0.08	0.04
SE	–	0.04		

Note: No. /m = number of fish per metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-1: Linear Density of Kokanee Redds in Middle Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
17-19	0.31	–	0.31	–
19	–	0.01	0.01	–
20	–	0.02	0.02	–
Mean	0.31	0.01	0.11	0.10
SE	–	0.01		

Note: No. /m = number of fish per metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2: Areal Density (No. /100 m²) of Kokanee Spawners in Davidson Creek, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	23.01	4.91	23.91	17.28	6.19
2	18.76	13.81	36.62	23.06	6.92
3	41.91	7.44	22.93	24.10	9.97
4	20.40	1.03	0.50	7.31	6.55
Mean	26.02	6.80	20.99	17.94	3.80
SE	5.37	2.68	7.51		

Note: No./100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2J: Areal Density (No. /100 m²) of Kokanee Spawners in Creek 661, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	30.16	36.62	39.33	35.37	2.72
2	19.43	–	13.79	16.61	2.82
3	15.05	–	1.78	8.41	6.64
Mean	21.55	36.62	18.30	22.31	5.14
SE	4.49	–	11.07		

Note: No./100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2K: Areal Density (No. /100 m²) of Kokanee Spawners by Lower Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
14	–	1.52	1.52	–
15	14.93	5.31	10.12	4.81
Mean	14.93	3.42	7.25	3.99
SE	–	1.90		

Note: No./100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2L: Areal Density (No. /100 m²) of Kokanee Redds in Davidson Creek, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	2.88	1.03	2.49	2.13	0.56
2	2.00	1.60	3.61	2.40	0.61
3	2.38	1.06	2.80	2.08	0.53
4	1.10	0.28	0.01	0.47	0.33
Mean	2.09	0.99	2.23	1.77	0.32
SE	0.38	0.27	0.77		

Note: No./100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2M: Areal Density (No. /100 m²) of Kokanee Redds in Creek 661, 2011-2013

Reach	2011	2012	2013	Mean	SE
1	5.35	6.58	0.00	5.97	0.61
2	1.47	–	0.00	1.47	–
3	0.07	–	0.00	0.07	–
Mean	2.30	6.58	–	3.37	1.55
SE	1.58	–	–		

Note: No. /100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data

Table 5.15-2N: Areal Density (No. /100 m²) of Kokanee Redds in Lower Chedakuz Creek, 2012-2013

Reach	2012	2013	Mean	SE
14	–	0.12	0.12	–
15	1.32	0.92	1.12	0.20
Mean	1.32	0.52	0.79	0.35
SE	–	0.40		

Note: No. /100 m² = number of fish per 100 square metre; n = sample number; SE = standard error; dash indicates no applicable data