Tagish River and Nares River Least Cisco Assessment (Year 3)

Prepared For
Yukon Fish & Wildlife Enhancement Trust Fund
PO Box 31022
Whitehorse, YT Y1A 5P7

Prepared By
EDI Environmental Dynamics Inc.
2195 -2nd Avenue
Whitehorse, YT   Y1A 3T8

EDI Contact
Ben Schonewille, Fish and Wildlife Biologist
867.393.4882

EDI Project
18Y0362
March 2019

EDI
ENVIRONMENTAL DYNAMICS INC.
Down to Earth Biology

This page is intentionally blank.

EXECUTIVE SUMMARY

Least cisco are a widespread species of whitefish found throughout the Southern Lakes including Marsh Lake, Tagish Lake, Bennett Lake and the rivers and wetlands which connect these waterbodies. There is a local subsistence fishery for the species particularly in the vicinity of the communities of Carcross and Tagish. Cisco are a food source for predatory fish species of interest in the region, including lake trout, northern pike and burbot. In response to a long-standing interest from local citizens, the Carcross/Tagish Renewable Resources Council initiated a project during 2016 and 2017 to gather information on life history of least cisco in the Southern Lakes, to determine seasonal distribution and abundance in the Tagish and Nares rivers and to document potential spawning areas in these locations. This project continued during 2018 with the following objectives: (1) collect a sample of up to 300 least cisco from the Carcross area to compile life history information and conduct sampling for young-of-the-year cisco in both the Carcross and Tagish areas, (2) conduct fall spawning assessments in the Carcross and Tagish areas to better document spawning areas (3) conduct genetic analysis on samples collected from spawning cisco in the Carcross and Tagish areas during 2017 and 2018, and (4) carry out data analysis of existing lake trout diet information from the Southern Lakes to determine the importance of least cisco as a prey item.

The methods used for sampling least cisco primarily involved the use of small mesh gillnets of various sizes but also involved the use of beach seining to specifically target small young-of-the-year juveniles. Sampling was completed in the Carcross area and Tagish areas during the summer and fall months. All fish captured were identified to species with a variety of biological information collected including length, weight, maturity and sex. Genetic samples were collected from all cisco along with ageing structures (otoliths) from retained individuals which were analyzed to determine the age of individual fish.

A total of 477 least cisco were captured during the 2018 sampling effort with 251 captured during the summer and 226 captured during the fall. The biological information collected to date indicates that least cisco in the Southern Lakes mature quickly with most fish spawning for the first time at age 2 and do not have a long lifespan with just a few fish reaching an age of 4, 5 or 6. This is in contrast to other fish species in the system such as lake trout and lake whitefish which grow/mature slowly and have longer lifespans (up to 40+ years).

The sampling conducted during the fall months provided new information on the timing and location of least cisco spawning in the Southern Lakes. Spawning fish were captured in both the Tagish River, Nares River and the outlet of Bennett Lake on September 20 and 26, 2018. In all areas, the preferred spawning habitat appears to be relatively shallow areas (1.3 to 3.0 m) comprised of a clean, sandy bottom free of aquatic plants.

Beach seining conducted in the Carcross area during 2018 captured a variety of fish species with Artic grayling and round whitefish being the most common. Very low numbers of young-of-the-year least cisco were captured using this method despite suitable sampling site characteristics.

Genetic analysis was completed on a subsample of spawning least cisco in the Carcross and Tagish areas during 2017 and 2018. This analysis indicated there was a low to moderate level of genetic diversity among sampled individuals. No evidence of population subdivision was found between the two areas. A small number of samples from the homogenous Southern Lakes samples in the Carcross and Tagish areas were

found to be more similar to samples from the outgroup samples from other Yukon lakes which may indicate the presence of rare genotypes in the Southern Lakes population or that in-migration may be occurring.

The analysis of available lake trout stomach content data from the Southern Lakes as provided by Environment Yukon show that least cisco is the most common identifiable fish species found in lake trout stomachs. This illustrates the importance of least cisco to the important lake trout fishery in the Southern Lakes.

This project was carried out collaboratively by EDI, the Carcross Tagish Renewable Resources Council, and the Carcross Tagish First Nation. Funding was provided by the Yukon Fish and Wildlife Enhancement Trust, the Renewable Resources Council Surplus Fund (administered by the Council of Yukon First Nations), and the Carcross Tagish Renewable Resource Council.

ACKNOWLEDGEMENTS

Funding for this project was provided by the Yukon Fish & Wildlife Enhancement Trust Fund, the Carcross Tagish Renewable Resources Council, and the Renewable Resource Council Surplus Fund as administered by the Council of Yukon First Nations (CYFN). Don Toews of the Carcross Tagish Renewable Resources Council provided input on the field component and reviewed a draft version of this report. Karlie Knight (Carcross Tagish First Nation) assisted with the coordination of local field assistants and was an asset to the completion of the field program and fish processing along with William Twardek and Connor Reid of Carleton University. Oliver Barker (Environment Yukon – Fisheries Unit) provided least cisco genetic samples from other Yukon lakes and lake trout diet information from the Southern Lakes.

AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. Staff who contributed to this project include:

Ben Schonewille, B.Sc., R.P. Bio. (BC).. Primary Author

Jonathan Lowey, B.Sc., BIT (BC).. Section Author

Scott Cavasin.. Section Author

Hannah Gray, B.Sc. .... GIS Mapping

Pat Tobler, B.Sc., R.P. Bio. (BC).. Senior Review

The fieldwork component of this project was led by Ben Schonewille of EDI with assistance from Scott Cavasin. Additional field assistants included Karlie Knight and Rita Johns (Carcross Tagish First Nation), Don Toews (Carcross Tagish RRC), and William Twardek and Connor Reid (Carleton University).

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

ACRONYMS AND UNITS

ASL .... Age, sex, length

CPUE .... Catch per unit effort

CTFN .... Carcross Tagish First Nation

CTRRC .... Carcross Tagish Renewable Resource Counsel

EDI .... Environmental Dynamics Inc.

UTM .... Universal Transverse Mercator

YOY .... Young of the year

SYMBOLS

°C .... degrees Celsius

fish/m .... fish per metre

fish/100 m/hr .... fish per 100 metre net per hour

in .... inches

m .... metres

mm .... millilitres

m^2 .... metres square

1 INTRODUCTION

Least cisco (*Coregonus sardinella*) are members of the whitefish family and are found in large lakes and rivers throughout much of the Canadian north. Across their range, they adopt a wide variety of life histories including strategies such as anadromous or residing exclusively in large rivers (McPhail 2007, McPhail and Lindsey 1970). In the Southern Lakes, cisco can be found in large lakes (Marsh, Tagish, Bennett and Atlin; Map 1), as well as the rivers connected to the lakes including Tagish and Nares rivers. There is a considerable base of traditional knowledge and local information about cisco migration into and throughout the Tagish and Nares rivers during the early summer. During this period cisco are visible from bridges over the rivers and the migration appears to coincide with a large migration of adult lake trout.

Least cisco form the basis of a fishery in the Southern Lakes and are an important prey item to predatory fish species in the system, particularly lake trout (*Salvelinus namaycush*; Larsen 2004). Cisco were historically and continue to be harvested by local First Nations as a subsistence food source. There is a long history of cisco snagging from the Tagish and Carcross railway bridges by anglers and in earlier years for subsistence and sale to mink and fox farms in the area. A special permit was instituted in 2004 to legalize the snagging of cisco by licenced anglers for bait from the Tagish River Bridge and the Carcross Foot Bridge (Nares River) with a daily limit of five fish including a harvest report (Environment Yukon 2017). Since 1993, cisco have also been harvested by a small-scale commercial fishery (quota of 25 to 50 kg) by the marina operator at Tagish to provide bait to local lake trout anglers. This fishery has not been active in recent years and the allocation of cisco to commercial use is currently under review by the Yukon Government.

For many decades, Carcross Tagish First Nation (CTFN) elders and citizens in addition to other local residents have expressed concerns about a possible decline of cisco in the Tagish and Carcross areas. According to First Nation traditional and local knowledge, this decline was first recognized in the 1960's. Elders and knowledgeable local individuals say the decline was most pronounced in the Nares River at Carcross and coincided with a tailings pond failure and spills from the Arctic Gold and Silver Mine near Carcross in 1964 (Toews 2017). Prior to this event, the Nares River contained high numbers of cisco all year round and could be snagged in sufficient quantities to supply mink farms in the area. Populations of cisco in the Tagish River are also thought to have declined although this decline appears to be less pronounced. Large schools of cisco were commonly observed at the base of the old wooden bridge which allowed for easy snagging at Tagish prior to its replacement in 1978 according to elders and knowledgeable local residents (Toews 2017).

Relatively little is known about least cisco populations in the Southern Lakes other than widespread distribution throughout the system and their importance as a prey species for lake trout. In response to concerns about the decline of cisco from CTFN elders, citizens and other locals, Larsen (2004) collected initial information on cisco in the Southern Lakes. This study highlighted that the abundance of cisco was highest at the north end of the Tagish River (near the Tagish River Bridge) and that a mixture of mature, maturing and immature individuals were present in the river during the summer months; however, limitations of this study were that sampling effort was limited to the summer months of July and August and gill net gear was not appropriately sized to capture all individuals within the population. In addition, aging was not a component of the cisco captured during 2004.

1.1 SUMMARY OF 2016 AND 2017 FIELD STUDIES

During 2016, EDI collaborated with the Carcross Tagish Renewable Resources Council to undertake field studies aimed at improving the understanding of least cisco life history in the Southern Lakes. Least cisco were captured in the Tagish River during June, July and August with the highest capture rate during July (EDI 2017). A limited amount of sampling was conducted in Nares River and Nares Lake with cisco captured in July only. The information collected on length, age and maturity indicate that least cisco in the Southern Lakes have a relatively low longevity, particularly when compared with other, slow growing fish species in the system such as lake trout and lake whitefish. The vast majority of least cisco captured were 1 or 2 years old and the maximum recorded age was 5 years. Evidence of short lifespans and high natural mortality (few individuals present older than 3 years), indicates a rapid rate of maturation with many fish becoming sexually mature by the end of the second growing season; nearly all fish were found to be sexually mature at 3 years or older.

Information on temporal changes in cisco relative abundance were also documented in the Tagish River during 2016. The overall capture rate of cisco was highest in July, followed by August and June. Overall cisco populations in the Tagish River appeared to be relatively abundant throughout the summer period and relatively healthy based on the representation of all year classes. However, no young of the year juveniles were captured, likely due to the lack of smaller mesh sizes used. The proportion of larger individuals (3-year olds) was highest during June, the higher overall capture rate during July was due to a large number of 1- year olds captured. While sampling in the Nares River at Carcross was more limited, cisco were only captured in one net set over the course of the summer comprised mainly of larger, mature age 3+ fish. No younger year classes or juveniles were captured.

The 2017 field program had similar results to the 2016 field program (EDI 2018). Least cisco were captured in three out of the four summer sampling events in the Tagish area. Despite significant sampling effort over a wide range of habitats none were captured during the May 24, 2017 sampling event which is consistent with 2016 results when none we captured on May 31, 2016. Similar to 2016, 1+ and 2+ fish were most frequently captured, with 5+being the oldest captured. In 2017, least cisco were only captured during the August sampling event in the Carcross area . They were captured in 3 of 9 sets. Fish captured in the Carcross area were also dominated by 1+ and 2+ fish and there were no fish captured from the 4+ and 5+ age classes.

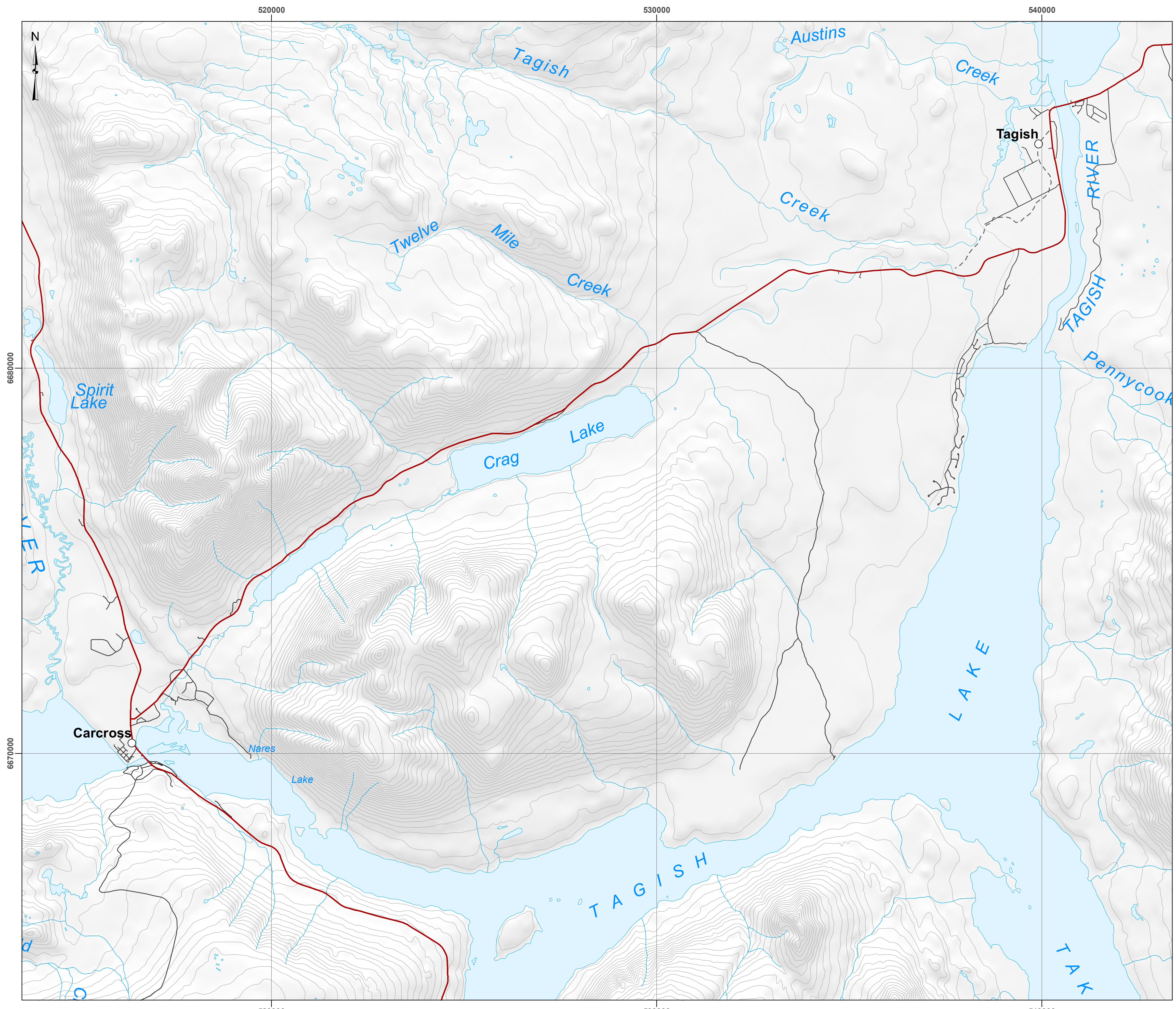
The 2017 program was important in that it was the first year spawning cisco were located and documented. Spawning fish were captured in both the Tagish and Nares rivers on September 28, 2017. A total of 32 least cisco were captured in the Tagish area and 23 in the Carcross area. Least cisco were captured at 9 sites during the fall spawning assessments. In the Tagish River, spawning cisco were captured exclusively in the middle and upstream portion of the river and were absent from the area near the Tagish bridge/Tagish Creek confluence where they were consistently captured during the spring and summer of 2016 and 2017. In the Carcross area, a large group of spawning/spent cisco were captured in the large deep pool on the north riverbank directly downstream of the railway bridge. The water was turbid at the time of sampling; however, past observations of this area indicate that it had a substrate dominated by sand.

1.2 OBJECTIVES OF THE 2018 PROJECT

The purpose of this report is to present the findings of field assessments conducted during the summer and fall of 2018 which were intended to build on existing information of cisco in the Southern Lakes with a focus on the Tagish and Nares rivers (Tagish and Carcross areas). The goal of the project was to collect additional information on the relative abundance and distribution of cisco in both areas during the summer months, to further document spawning areas, and to collect genetic samples from spawning cisco for population genetic analysis.

The specific objectives of the project included:

- Collect a sample of up to 300 least cisco from the Carcross area to collect life history information including age, maturity, fork length and weight, diet, and longevity.
- Conduct sampling for young-of-the-year least cisco in the Tagish and Carcross areas to provide an indication of spawning areas.
- Conduct fall spawning assessments for least cisco in the Carcross and Tagish areas to further document spawning areas.
- Conduct population genetic analysis using samples collected from spawning least cisco in the Carcross and Tagish areas.
- Conduct analysis of lake trout diet data from the Southern Lakes system to determine the importance of least cisco as a prey item.



Map 1. Southern Lakes Least Cisco Assessment Overview

Legend

- Settlement/Community
- Highway
- Secondary road

0 1 2 3 4 5
Kilometres

Map Scale = 1:100,000 (printed on 11 x 17)
Map Projection: NAD 1983 UTM Zone 8N

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

Drawn: HG	Checked: BSc	Date: 2019-01-17

2 METHODS

2.1 GILLNETTING

In the Tagish area, gillnetting was primarily located in the Tagish River with a limited amount of effort at the south end (inlet) of Marsh Lake and the north end (outlet) of Tagish Lake. Sampling in the Carcross area was largely focused in the Nares River and Nares Lake with a small number of sets in the outlet of Bennett Lake.

Sampling in the Tagish and Carcross areas took place on two occasions during the summer of 2018; July 11 and August 30, and two occasions during fall (spawning) on September 20 and September 26. Three different gangs of nets were used, each with two to four panels of varying mesh sizes (Table 1). The very small mesh sizes included in net gang C were used on a trial basis in an attempt to capture young-of-the-year least cisco in the Tagish area during the August sampling event only.

Table 1. Summary of net gangs and mesh sizes used during 2018 least cisco targeted small mesh netting.

Net Gang	Number of Panels	Mesh Sizes and Order (mm)	TOTAL NUMBER OF SETS	Notes
A	3	25/32/38	2	Used during July sampling only.
B	4	25/32/38/44	40	Primary net gang used during July and September.
C	2	13/19	11	Used during August to target YOY only.
		TOTAL SETS	53	-

Gillnetting sites were initially selected during each sampling event to cover a variety of habitat types and depths; however, subsequent sets were located in areas where least cisco were captured to achieve the sampling target. Sets during the spawning period targeted habitat types (sand, limited aquatic plants) where spawning individuals were captured during 2017 (EDI 2018).

The majority of gillnet sets were benthic (set on the bottom) and when in flowing water, were set parallel or angled to the water flow with large anchors on either end to keep the net in position within the current; net sets not in flowing water had random orientations including perpendicular to the shoreline. Three floating net sets were also used in Nares Lake during the July 11 sampling event to test the feasibility of such methods to capture least cisco.

Information collected for each gillnet set included: date, GPS co-ordinates at each end of the net, water depth at each end of the net, mesh size orientation, time set/pulled and weather conditions. All sampling was completed during daylight hours (8:00-17:00); however, a portion of the sets in September were conducted in the evening hours (until 20:00) to document spawning activity at dusk.

All fish captured were given a unique identification number and assigned to the mesh size within which they were captured. During fish processing, all fish were identified to species, measured to fork length (mm) and weighed (g) where possible. During the summer sampling, all least cisco captured were retained for ageing structure collection and during the fall spawning sampling, only incidental mortalities were retained. Otoliths were collected from all least cisco mortalities and scale samples were collected from released individuals and a subset of the retained fish. Sex and maturity were determined for all fish mortalities and included the following classification: immature, maturing (will not spawn this year), mature (will spawn this year), ripe (running eggs/milt) or spent (empty body cavity, recently spawned). All other fish species captured in good condition where released; ageing structures (i.e., otoliths) were collected from all incidental mortalities. Fish were placed in an aerated livewell prior to being measured and promptly released. Genetic samples were collected from all least cisco captured (all samples remain at the EDI office in Whitehorse, Yukon).

All ageing structures collected were sent to North/South Consultants Inc. in Winnipeg for analysis. As was the case during 2016 and 2017, all otolith samples were read by the lab as is with no sample preparation. A subset of the otoliths were also aged through the use of the crack and toast method to verify the results of the as is age reading. An additional subset of the otoliths were further processed through sectioning and slide mounting to provide the most reliable age possible.

Least cisco capture numbers were converted to a measure of CPUE (catch-per-unit-effort) by standardizing the number of fish captured by net length and set duration. The CPUE value used was the number of fish captured per 100 m of net per hour.

Box plots were used to display the variability in small mesh netting CPUE. The thick horizontal line in the middle of the box is the median value with the box showing the interquartile range. The vertical lines show values within 1.5 times the interquartile range. The dots are the outliers, which are more than 1.5 times the interquartile range.

2.1.1 SUMMER SAMPLING

A total of 23 small mesh gillnetting sets were completed during the summer sampling events. The July sampling event was confined to the Carcross area; however, the August sampling event included both the Tagish and Carcross areas (Table 2; Map 2, Map 3). The duration of gillnet sets averaged 1.0 hrs and ranged from 0.35 to 1.8 hours.

Table 2. Summary of targeted small mesh gillnets for least cisco by sampling area during the summer of 2018.

Sample Area	Sampling Location	Number of Gillnet Sets		
		July 11	August 30	ALL EVENTS COMBINED
Carcross Area	Nares River	5	2	7
	Nares Lake	7	2	9
Tagish Area	Tagish River	-	7	7
ALL EVENTS COMBINED		12	11	23

2.1.2 FALL SPAWNING ASSESSMENTS

A total of 30 small mesh gillnetting sets were completed during the fall spawning assessment. A total of 13 net sets were completed in the Carcross area and 17 in the Tagish area over the two sampling events (Table 3; Map 4, Map 5). The duration of gillnet sets averaged 0.7 hours and ranged from 0.5 to 0.9 hours.

Table 3. Summary of targeted small mesh gillnets for least cisco by sampling area during the fall of 2018.

Sampling Area	Sampling Location	Number of Gillnet Sets		
		Sep 20	Sep 26	ALL EVENTS COMBINED
Carcross Area	Bennett Lake	-	3	3
	Nares River	8	2	10
Tagish Area	Tagish River	10	7	17
ALL EVENTS COMBINED		18	12	30

2.2 BEACH SEINING

Beach seining was conducted to target YOY least cisco in the Carcross area on July 11 and August 29, 2018. The sites sampled during 2018 were chosen largely based upon suitable areas for beach seining which are somewhat limited in Nares Lake/Nares River. A total of five hauls were completed on July 11 and seven hauls on August 29. Two different beach seines were used during sampling, one was 10 m long by 1.5 m deep with 5 mm mesh, the other was 30 m long by 1.5 m deep with 5 mm mesh. The length of shoreline sampled was determined by the shoreline characteristics; however, a minimum of 50 m was sampled where conditions allowed (Photo 1).

All fish captured were identified to species and subsamples of each species/life stage were measured for fork length and all least cisco captured were sampled for genetics. Information collected at each site included: UTM coordinates, date and time, weather conditions, photo documentation, bed material type, water temperature, dissolved oxygen and sample area dimensions (length, width, depth). For analysis purposes, beach seining capture data was converted to a measure of CPUE in fish caught per 100 m^2 sampled (length multiplied by width). CPUE is calculated by dividing the total number of fish captured at each site by the dimensions of the area sampled (i.e., sampling effort).

Photo 1. Beach seining for YOY least cisco on the shoreline of Nares Lake, July 11, 2018 (photo provided by Karlie Knight, Carcross Tagish First Nation).

2.3 GENETICS ANALYSIS

A subsample of the genetic samples collected from spawning least cisco in the Carcross and Tagish areas during 2017 and 2018 were analyzed to investigate levels of genetic diversity and differentiation of population structuring between the two areas. A number of least cisco samples from other Yukon lakes were also analyzed as an outgroup to provide perspective for the results. The genetics analysis was completed by Dr. Allan Costello of ABC and Associates in Prince George, BC; for a detailed description of the genetics analysis methods, refer to APPENDIX A.

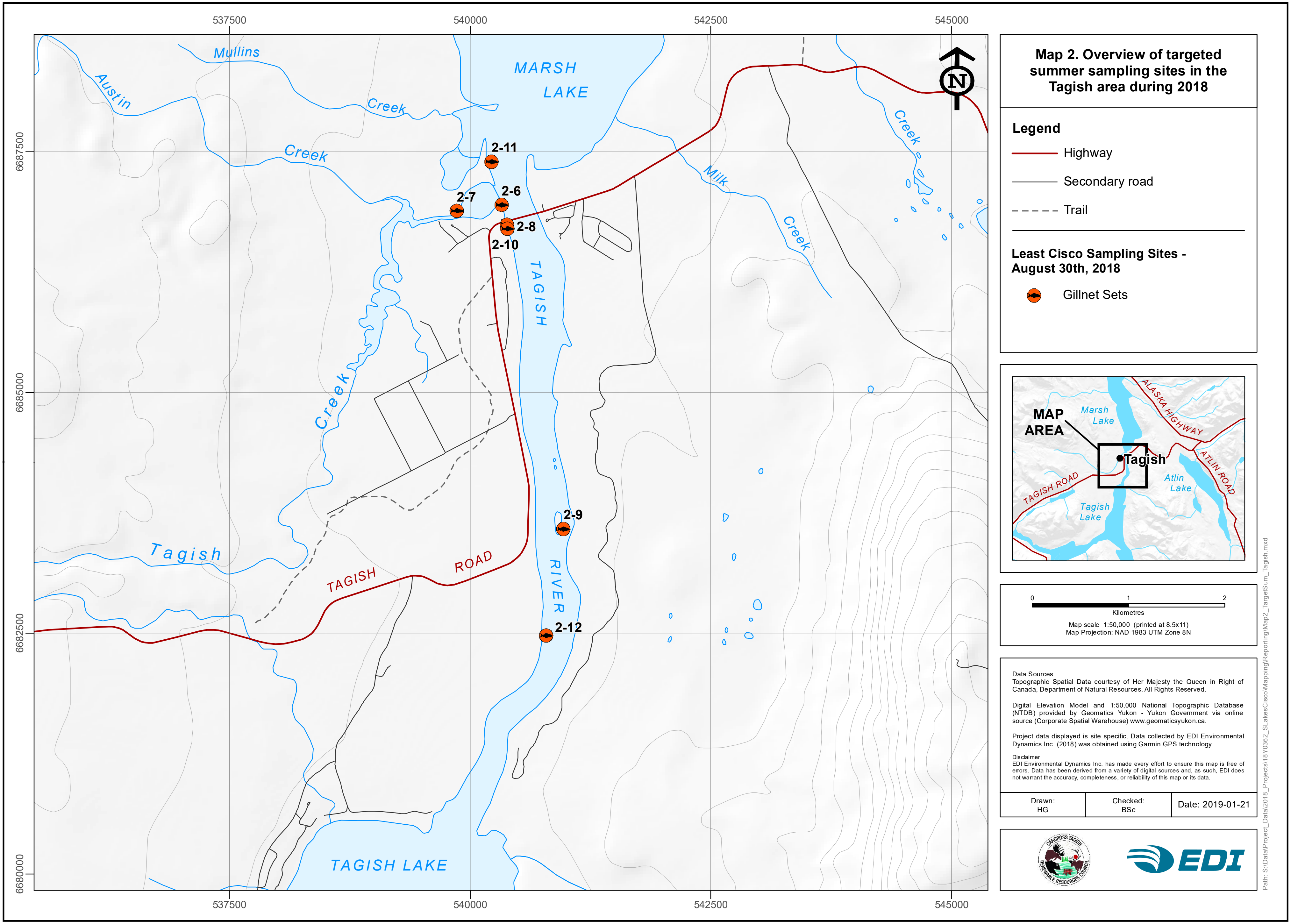
2.4 LAKE TROUT DIET ANALYSIS

Lake trout stomach content data was provided by the Environment Yukon (Fisheries Unit). This included stomach content data collected during 1993, 1998, 2002, 2003, 2007, 2009, and 2014-2017 creel surveys, 1993 index netting surveys, and 2014 and 2015 SPIN surveys conducted in the Southern Lakes (Bennett, Tagish and Marsh lakes in addition to adjoining rivers). The surveys divided the lakes into four areas, Bennett Lake, Marsh Lake, Tagish Lake, and Tagish/Six Mile River. The stomach contents from a single individual collected at Nares Lake during a 2014 creel survey was removed from analysis due to a low sample size (stomach contents were 70% least cisco and 30% Unidentified fish). Food items were grouped into 16 categories from an initial 36 categories as outlined in Table 4. Data was grouped into these simplified categories to focus the analysis on the composition of the different fish species in the stomach contents of lake trout.

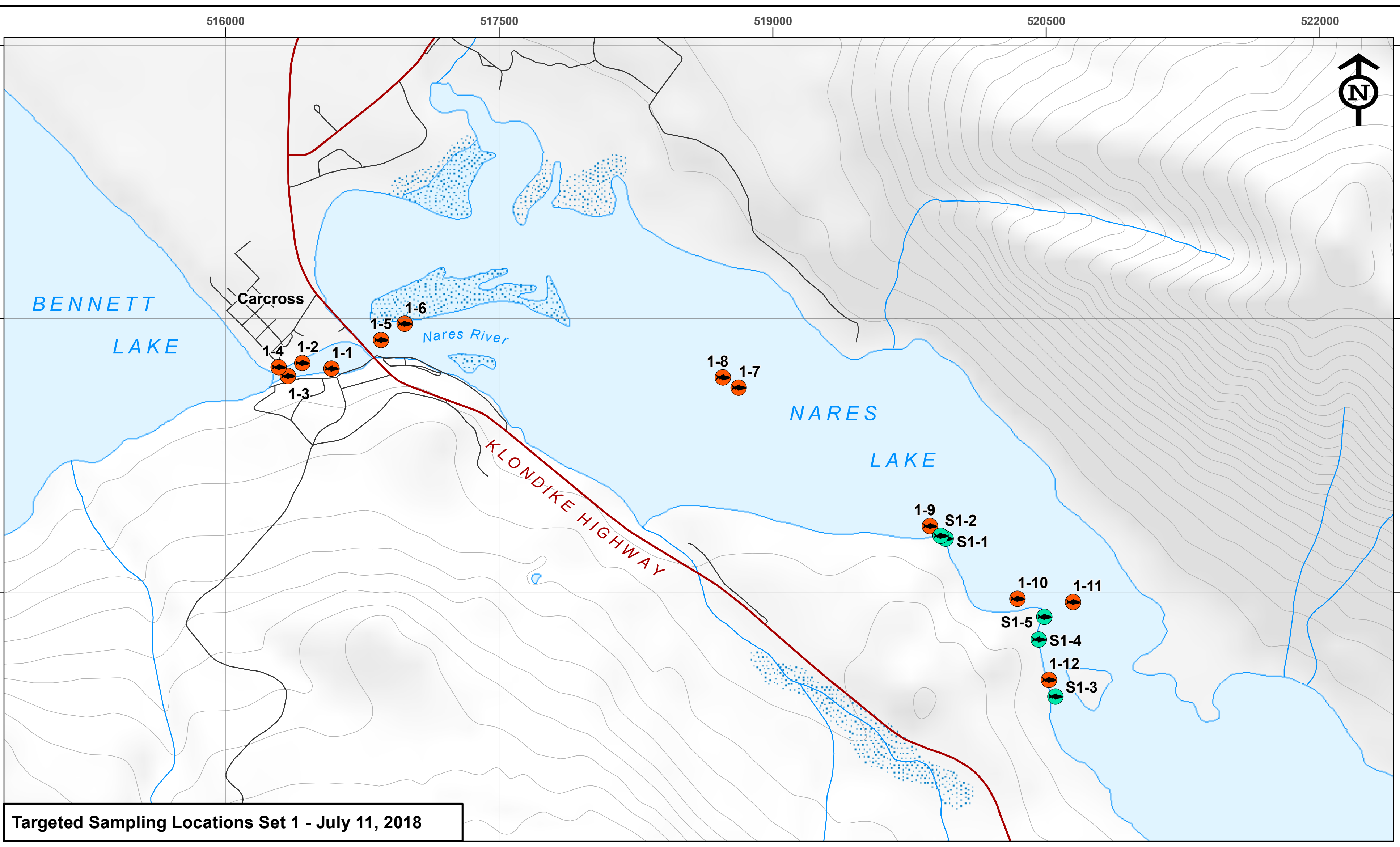
The frequency of occurrence of food items in the lake trout stomachs was calculated over all lake trout stomach samples collected from each area. This analysis shows the percent of samples with the diet item present compared to all the fish sampled from the area. Percent volume of lake trout stomach contents was also calculated over all samples collected from an area. The percent volume of stomach contents shows the percent volume of different diet items occupied over all stomach contents and indicates the importance of different food items in the diet of lake trout. Data on stomach fullness was not available so the percent volume stomach content data only shows the percent of volume different food items comprised of all stomach contents and not the percent of total stomach volume occupied by the food items.

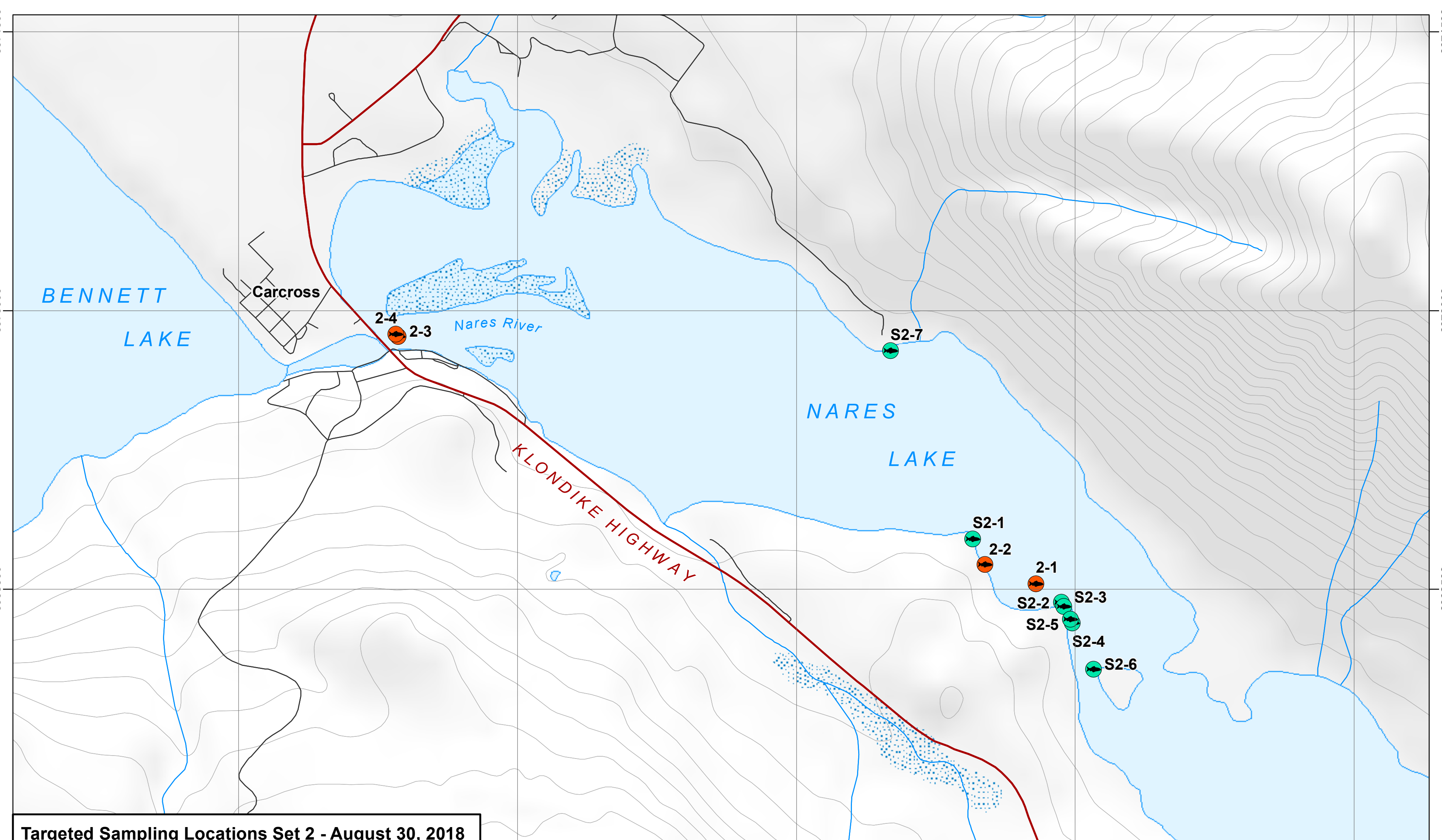
Table 4. Concordance table showing the food taxon groups and the simplified food groups used for the analysis.

Food Taxon Name	Simplified Food Groups
Ants	Terrestrial Insects
Beetles	Terrestrial Insects
Burbot	Burbot
Caddisflies	Aquatic Invertebrates
Clams, Mussels	Clams and Snails
Copepods	Aquatic Invertebrates
Dragonflies, Damselflies	Terrestrial Insects
Flies (two-winged)	Terrestrial Insects
Grasshoppers	Terrestrial Insects
Gravel	Gravel
Lake Trout	Lake Trout
Lake Whitefish	Lake Whitefish
Least Cisco	Least Cisco
Leeches	Aquatic Invertebrates
May Flies	Terrestrial Insects
Moths and Butterflies	Terrestrial Insects
Non-Biting Midges	Terrestrial Insects
Northern Pike	Northern Pike
Orb Snails	Clams and Snails
Pond Snails	Clams and Snails
Pygmy Whitefish	Pygmy Whitefish
Round Whitefish	Round Whitefish
Scuds, Side swimmers	Aquatic Invertebrates
Slimy Sculpin	Slimy Sculpin
Snails	Clams and Snails
Stoneflies	Aquatic Invertebrates
Unidentified Amphibians	Unidentified Amphibians
Unidentified Fish	Unidentified Fish
Unidentified Invertebrates	Aquatic Invertebrates
Unidentified Vegetation	Unidentified Vegetation
Unidentified Whitefish	Unidentified Fish
Unknown	Unknown
Wasps, Bees	Terrestrial Insects
Water Fleas	Aquatic Invertebrates
Water Mites	Aquatic Invertebrates
Water boatmen	Aquatic Invertebrates



Map 2. Overview of targeted summer sampling sites in the Tagish area during 2018
Legend
Highway
Secondary road
Trail
Least Cisco Sampling Sites - August 30th, 2018
Gillnet Sets
537500
540000
542500
545000
6687500
6685000
6682500
6680000
MARSH LAKE
TAGISH LAKE
TAGISH RIVER
TAGISH ROAD
Mullins Creek
Austin Creek
Creek
Milk Creek
Creek
Tagish
2-6
2-7
2-8
2-9
2-10
2-11
2-12
N
MAP AREA
Marsh Lake
Tagish
Atlin Lake
Tagish Lake
ALASKA HIGHWAY
ATLIN ROAD
TAGISH ROAD
0
1
2
Kilometres
Map scale 1:50,000 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 8N
Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.
Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.
Drawn: HG
Checked: BSc
Date: 2019-01-21
EDI
Path: S:\Data\Project_Data\2018_Projects\18Y0362_SLakesCisco\Mapping\Reporting\Map2_TargetSum_Tagish.mxd





Legend

- Highway
- Secondary road
- Trail

Least Cisco Sampling Sites

- Beach Seine Sets
- Gillnet Sets

Map 3. Overview of targeted summer sampling sites in the Carcross area during 2018

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

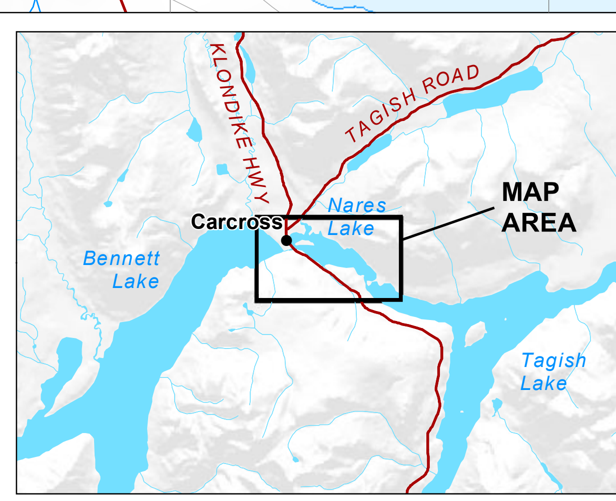
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

0 0.5 1 1.5 2
Kilometres

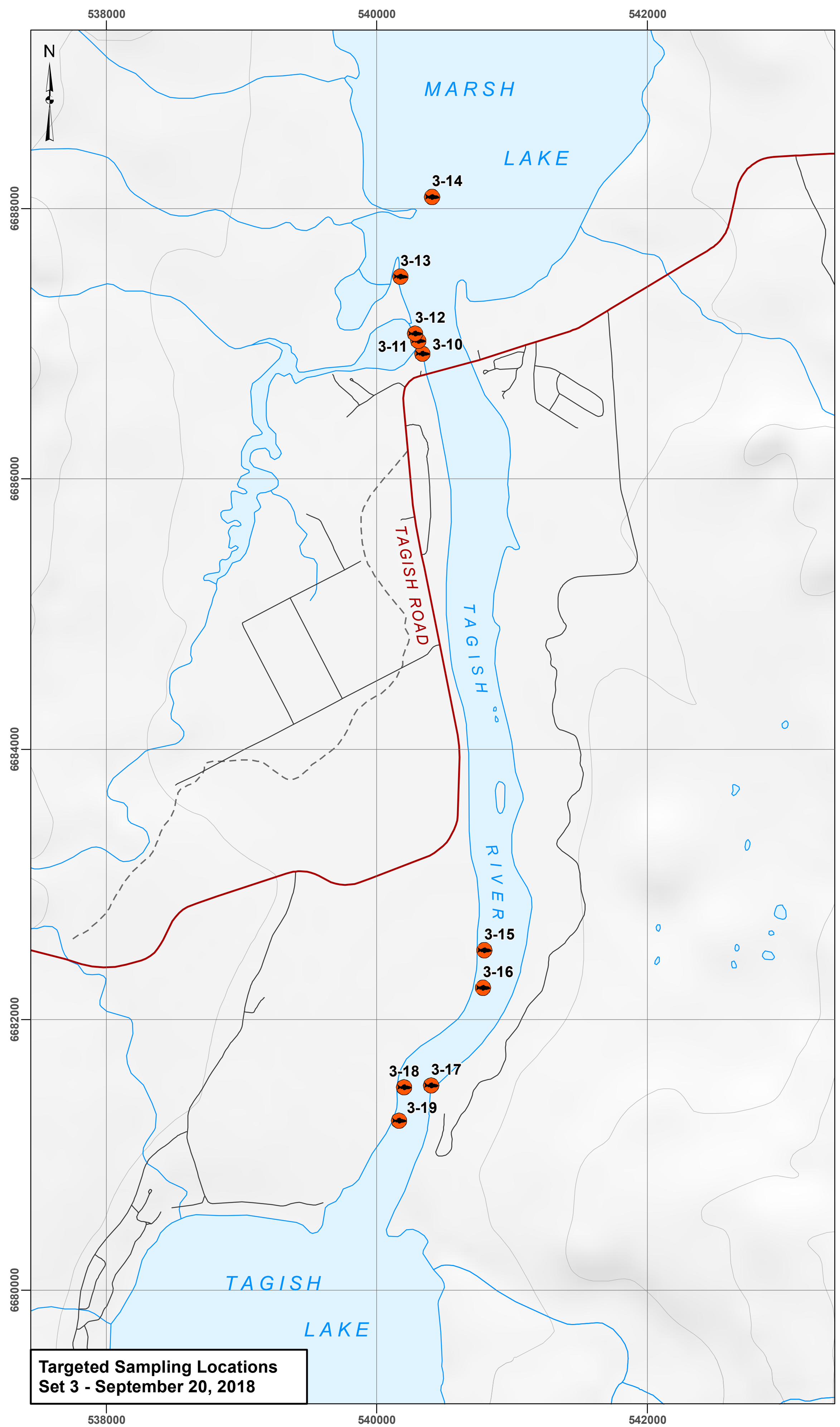
Map Scale 1:30,000 (printed on 11 x 17)
Map Projection: NAD 1983 CSRS UTM Zone 8N

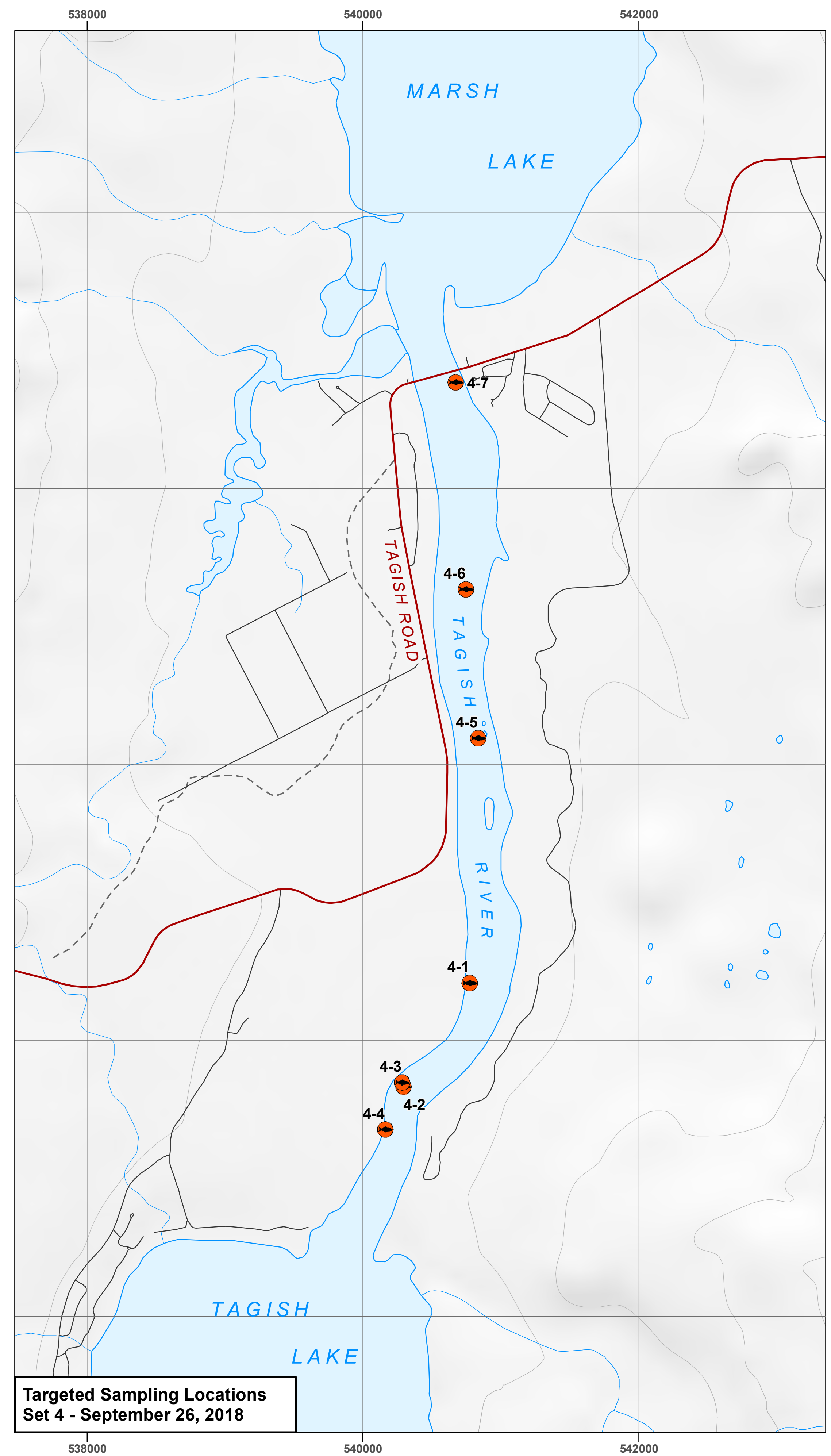
Drawn: HG	Checked: BSc	Date: 2019-04-04



CARCROSS TAGISH RENEWABLE RESOURCES COUNCIL

EDI





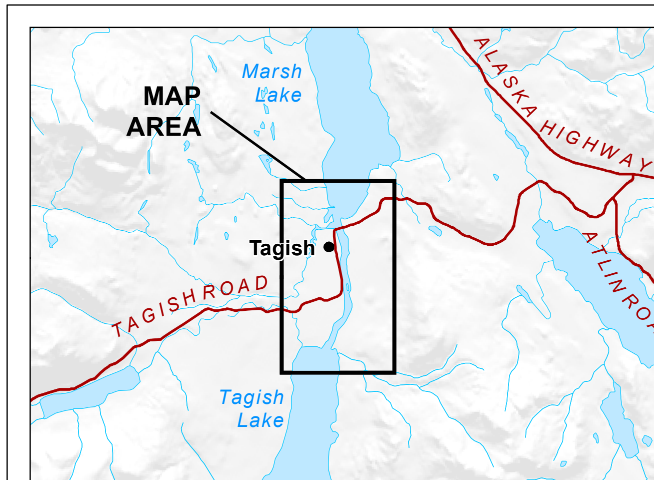
Map 4. Overview of targeted fall (spawning) sampling sites in the Tagish area during 2018

Legend

- Highway
- Secondary road
- Trail

Least Cisco Sampling Sites

- Gillnet Sets



0 0.5 1 1.5 2
Kilometres

Map Scale = 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 UTM Zone 8N

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

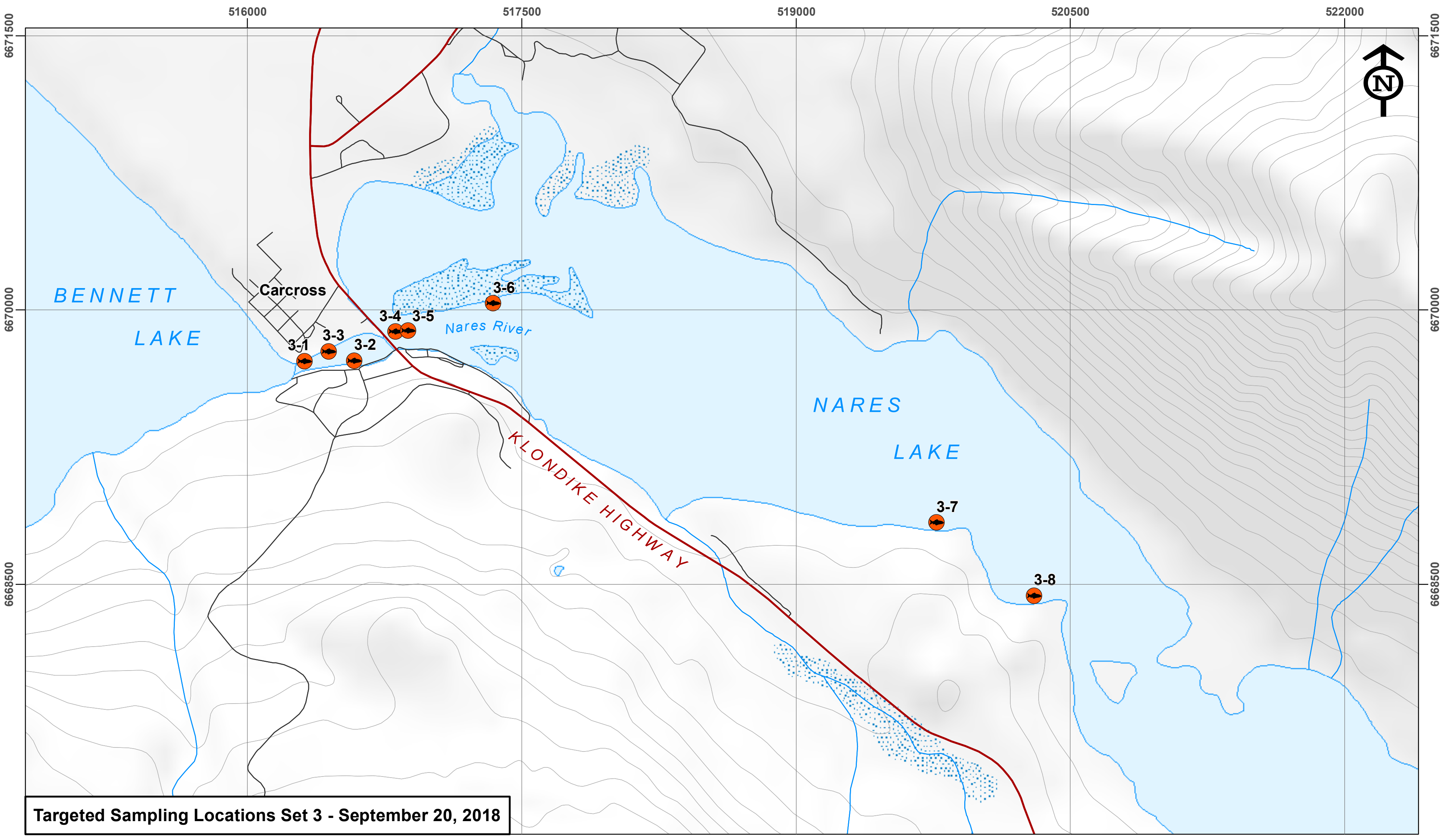
Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

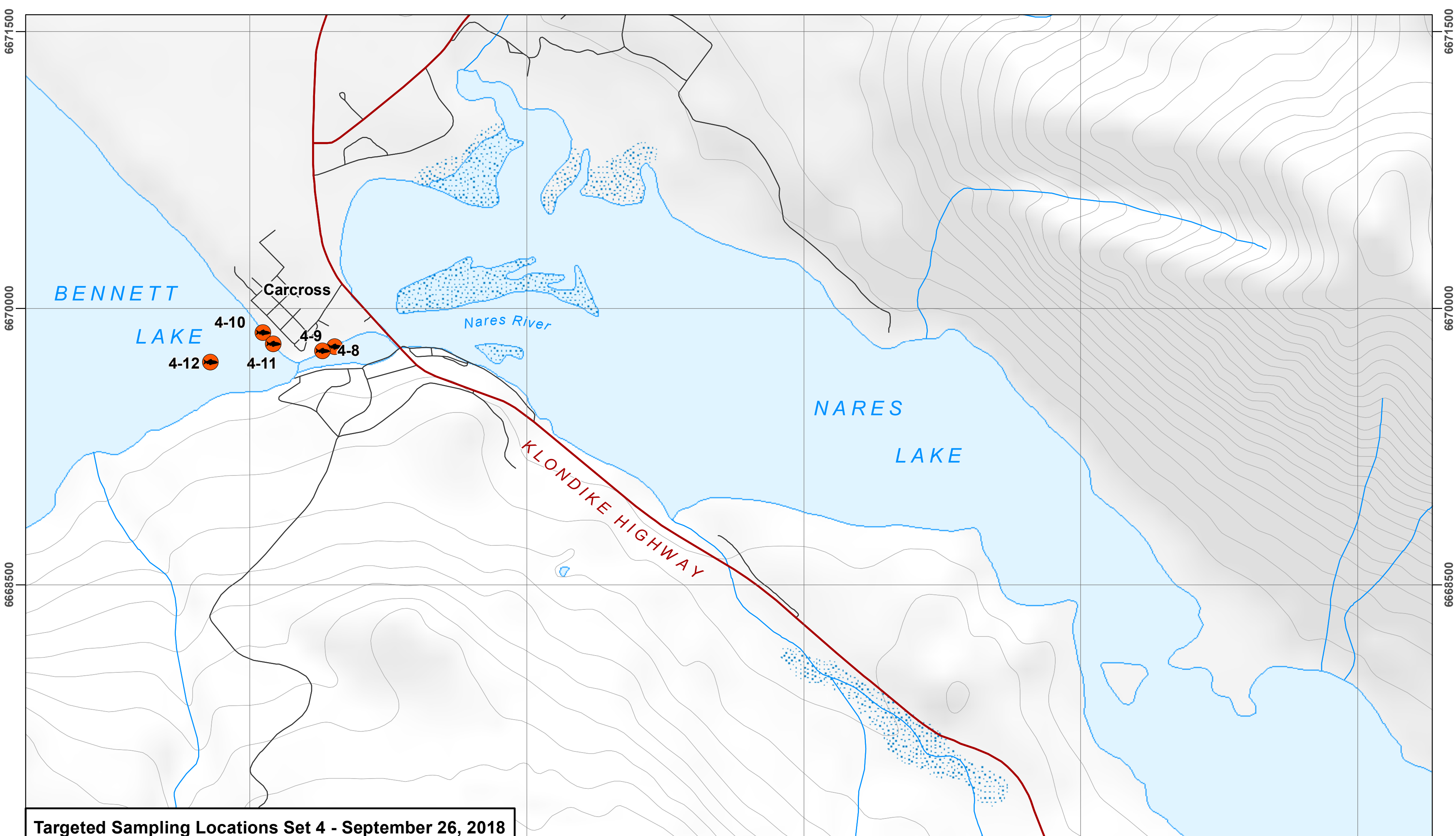
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

Drawn: HG	Checked: BSc	Date: 2019-01-21

Path: S:\Data\Project_Data\2018_Projects\18Y0362_SLakesCisco\Mapping\Reporting\Map4_TargedFall_Tagish.mxd





Legend

- Highway
- Secondary road
- Trail
- Wetlands - 50K - Canvec

Least Cisco Sampling Sites

- Beach Seine Sets
- Gillnet Sets

Map 5. Overview of targeted fall (spawning) sampling sites in the Carcross area during 2018.

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

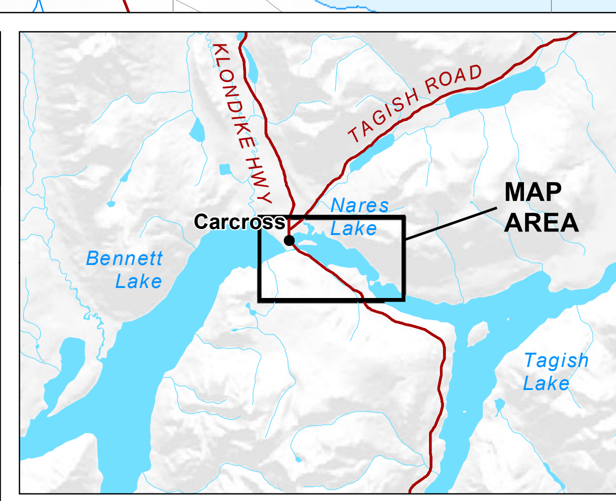
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

0 0.5 1 1.5 2
Kilometres

Map Scale 1:30,000 (printed on 11 x 17)
Map Projection: NAD 1983 CSRS UTM Zone 8N

Drawn: HG	Checked: BSc	Date: 2019-04-04



3 RESULTS AND DISCUSSION

The results of the spring/summer sampling and fall spawning assessments are presented in the following sections.

3.1 GILLNETTING

Gillnetting was completed during the summer and fall (spawning period) 2018. For each sampling period, the results are presented in terms of species composition, capture rates (CPUE), length/age frequencies and maturity (in percent frequency) of different age classes.

3.1.1 SUMMER SAMPLING

3.1.1.1 Species Composition

A total of 24 fish were captured during the two summer sampling events in the Tagish area with round whitefish being the most frequently captured species, accounting for 37.5% of all fish captured (Table 5). Lake whitefish were the second most frequently captured species (33%) followed by least cisco (25%). A single Arctic grayling was also captured. Capture rates were relatively low; however, the sampling gear used was comprised of very small mesh sizes (gang C; 13 and 19 mm) which were used to specifically capture young-of-the-year fish only.

Table 5. Summary of fish captured during targeted small mesh netting for least cisco in the Tagish area during the summer of 2018.

Sampling Event	Species	Retained	Incidental Mortalities		Released/Escaped	TOTAL
			Juveniles	Adults		
August 30	Least Cisco	4	2	-	-	6
	Arctic Grayling	-	-	-	1	1
	Lake Whitefish	-	-	-	8	8
	Round Whitefish	-	-	-	9	9

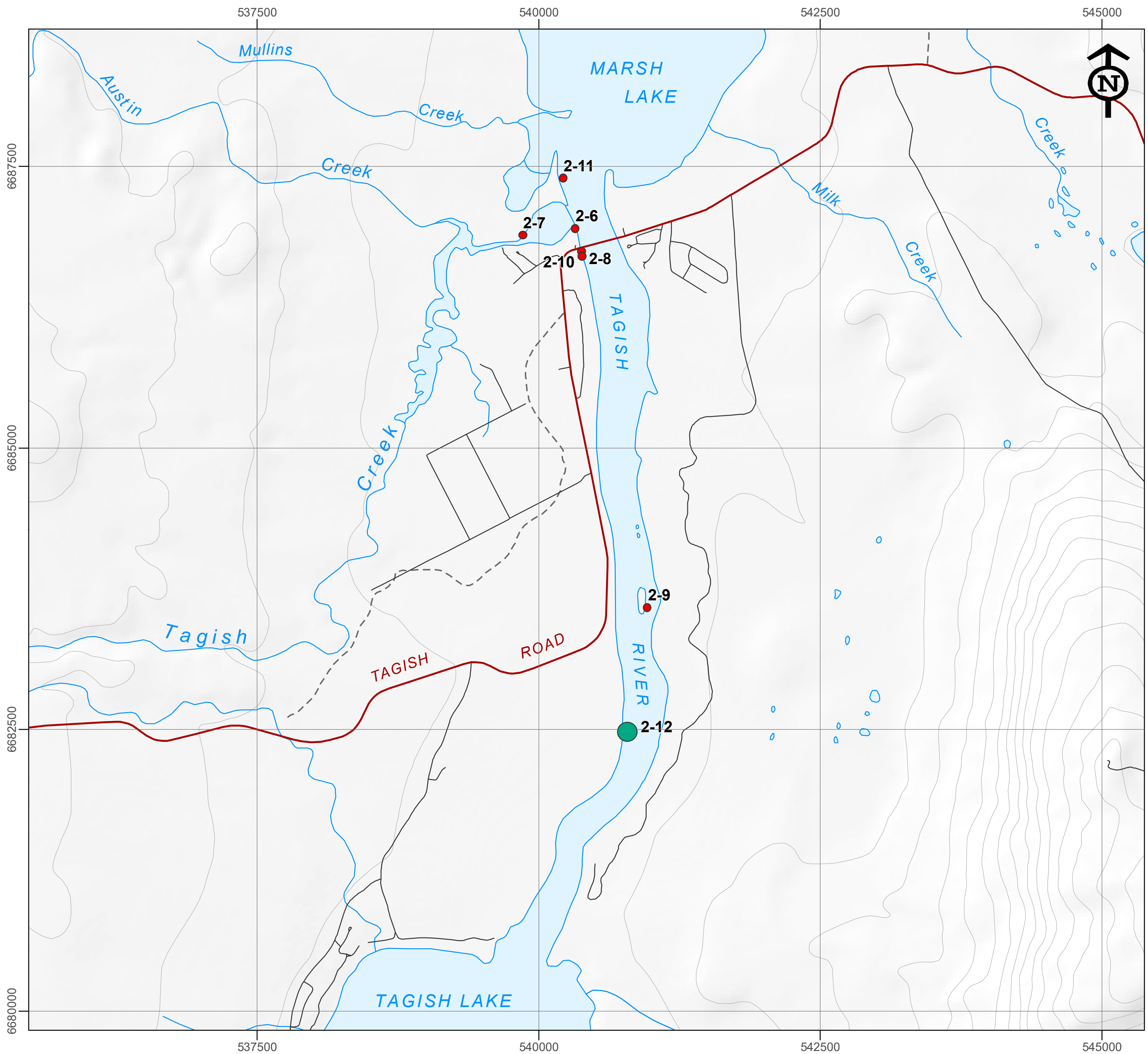
In the Carcross area, the July sampling event utilized sampling gear (mesh sizes) which were conducive to capturing all sizes of least cisco. During July, a total of 370 fish were captured with least cisco dominating the catch (82%), followed by round whitefish (15%; Table 6). The highest numbers of least cisco were captured in Nares Lake, with a single floating net set (1-11) capturing 119 individuals. The floating net set did not capture any other species. The August sampling event in the Carcross area captured small numbers of juvenile fish with only a single least cisco captured (Table 6).

Table 6. Summary of fish captured during targeted small mesh netting for least cisco in the Carcross area during the summer of 2018.

Sampling Event	Species	Retained	Incidental Mortalities		Released/ Escaped	TOTAL
			Juveniles	Adults		
July 11	Least Cisco	71	1	230	-	302
	Arctic Grayling	-	-	-	3	3
	Longnose Sucker	-	-	-	4	4
	Lake Trout	-	-	-	3	3
	Lake Whitefish	-	-	-	1	1
	Northern Pike	-	-	-	1	1
	Round Whitefish	-	14	9	33	56
August 30	Least Cisco	-	-	-	1	1
	Northern Pike	-	1	-	-	1
	Round Whitefish	-	1	-	5	6

3.1.1.2 Least Cisco Capture Rates

A total of 7 sets were completed in the Tagish area during August with least cisco being captured in one set, the CPUE ranged from 0 – 30.6 fish/100 m/hr with a mean CPUE of 4.3 fish/100 m/hr (Map 6). During the July 11 sampling event, a total of 12 net sets were completed in the Carcross area with least cisco being captured in 6 of the 12 sets (Map 7). The CPUE ranged from 0 – 102.4 fish/100 m/hr with a mean CPUE of 22.2 fish/100 m/hr. During the August 30 Carcross sampling event a single least cisco was captured in 1 of 4 net sets.



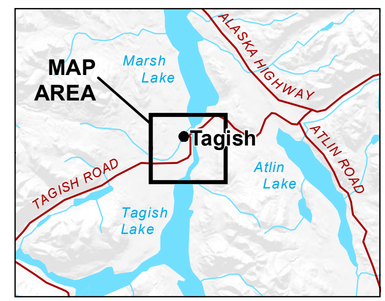
Map 6. Overview of targeted summer sampling results in the Tagish area during 2018

Legend

- Highway
- Secondary road
- Trail

Least Cisco Survey Results - August 30, 2018

- 0 Fish/Hour
- 1- 10 Fish/Hour
- 11 - 15 Fish/Hour
- 16 - 30 Fish/Hour
- > 30 Fish/Hour



0 1 2
Kilometres

Map scale 1:50,000 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 8N

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

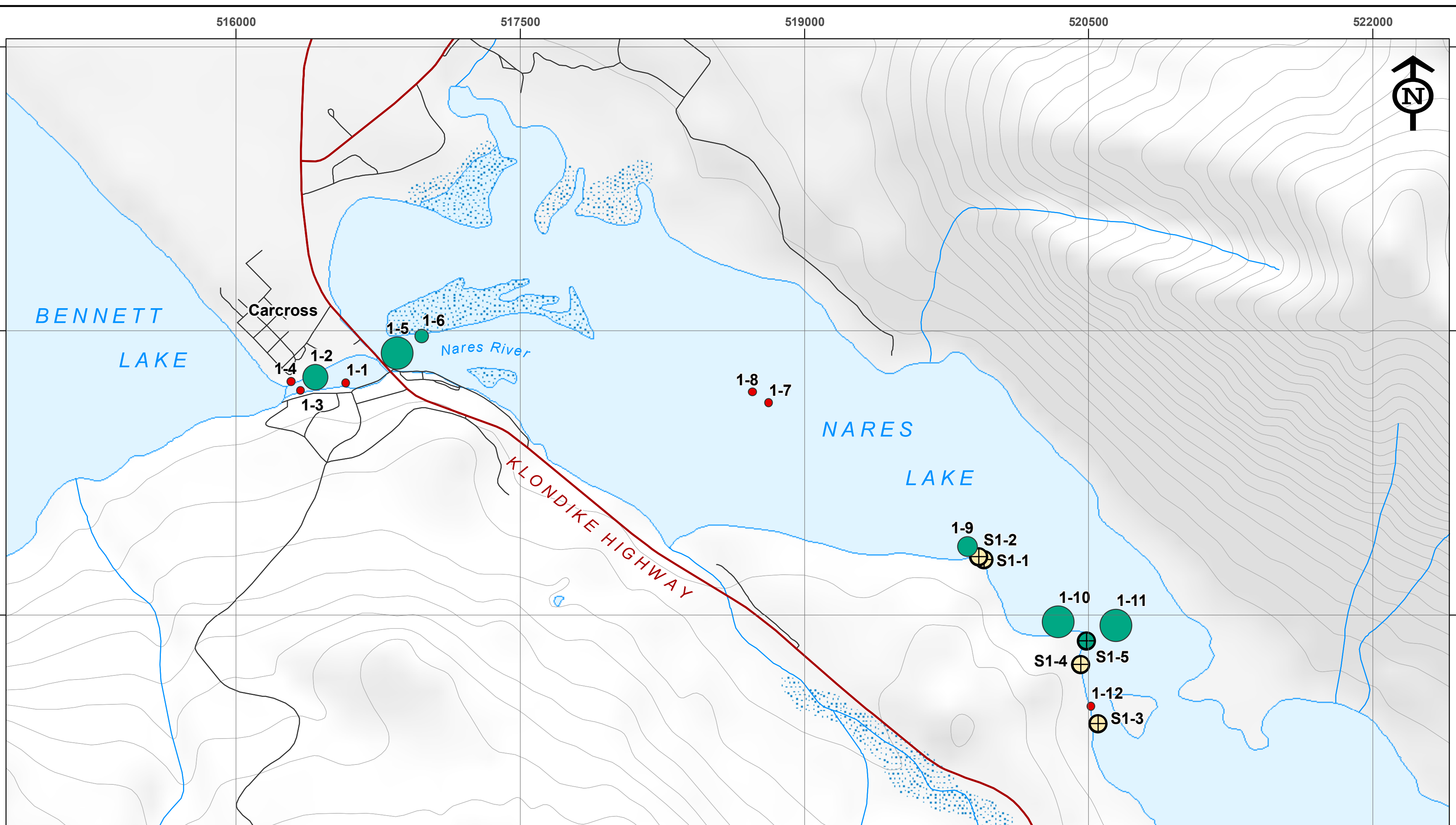
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

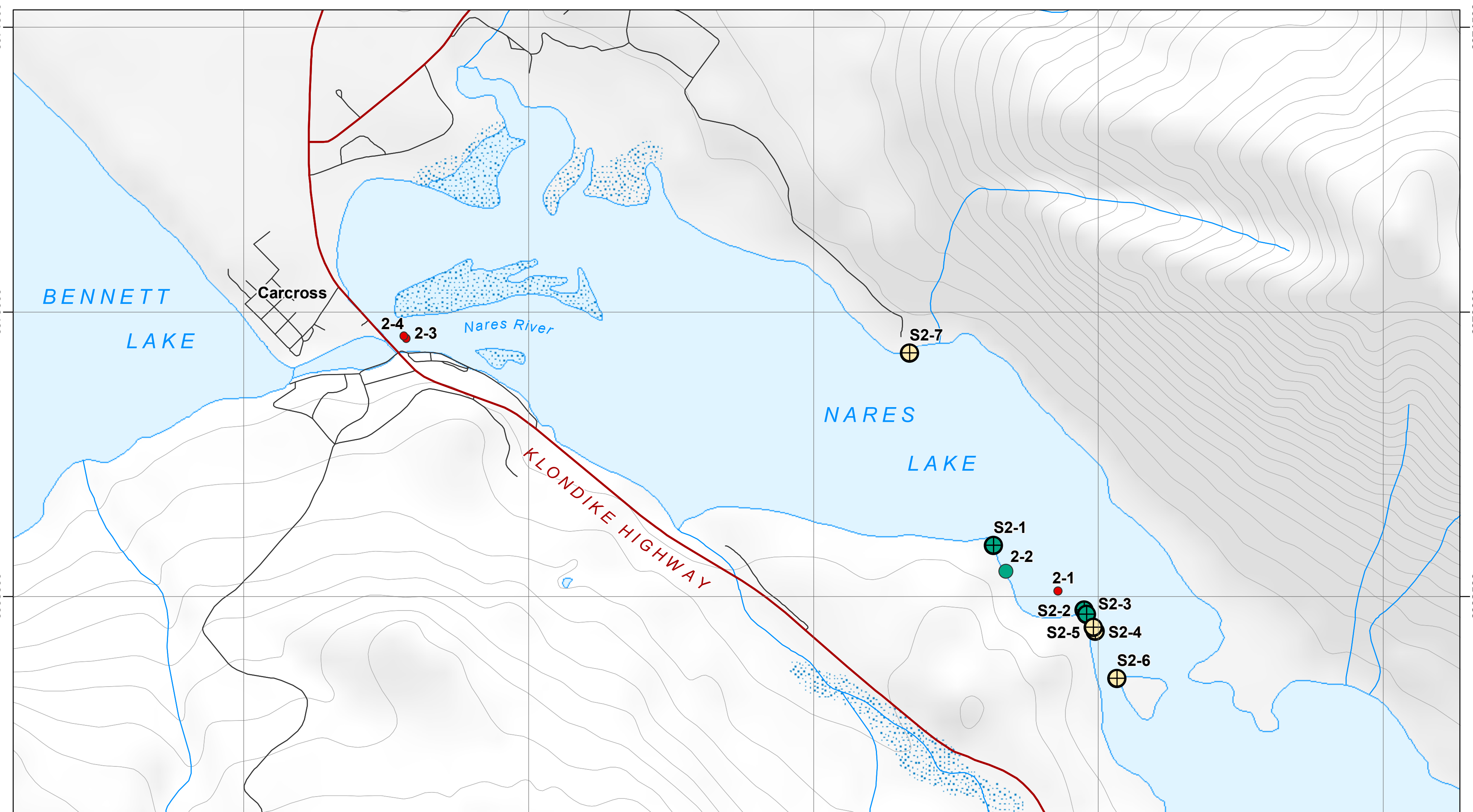
Drawn: HG	Checked: BSc	Date: 2019-01-21

Path: S:\Data\Project_Data\2018_Projects\18Y0362_SLakesCisco\Mapping\Reporting\Map6_TargetSum_Results_Tagish.mxd

Map 7. Overview of targeted summer sampling results in the Carcross area during 2018



Targeted Sampling Locations Set 1 - July 11, 2018



Targeted Sampling Locations Set 2 - August 30, 2018

Legend

- Highway
- Secondary road
- Trail

Least Cisco Gill Netting Results

- 0 Fish/Hour
- 1- 10 Fish/Hour
- 11 - 15 Fish/Hour
- 16 - 30 Fish/Hour
- > 30 Fish/Hour

Least Cisco Beach Seining Results

- Least Cisco
- Other Species

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

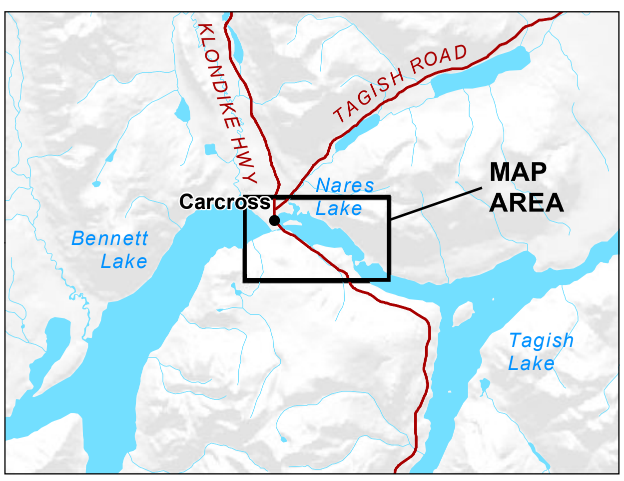
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

0 0.5 1 1.5 2
Kilometres

Map Scale 1:30,000 (printed on 11 x 17)
Map Projection: NAD 1983 CSRS UTM Zone 8N

Drawn: HG	Checked: BSc	Date: 2019-04-04



CARCROSS TAGISH RENEWABLE RESOURCES COUNCIL

EDI

3.1.1.3 Length and Age Frequencies

Least cisco captured via gillnetting in the Carcross area during the July 2018 sampling ranged in length from 123 to 260 mm (Figure 2). Individuals within the range of 160 to 200 mm comprised the majority of the catch and a small number of individuals (3) captured were over 250 mm in length (Photo 2). These represent the largest individuals captured since sampling for least cisco was initiated in the Carcross and Tagish areas during 2016. A total of seven young-of-the-year least cisco were captured via gillnetting during the August 30 sampling (six in Tagish and 1 in Carcross) and ranged in length from 86 to 101 mm with an average length of 91 mm.

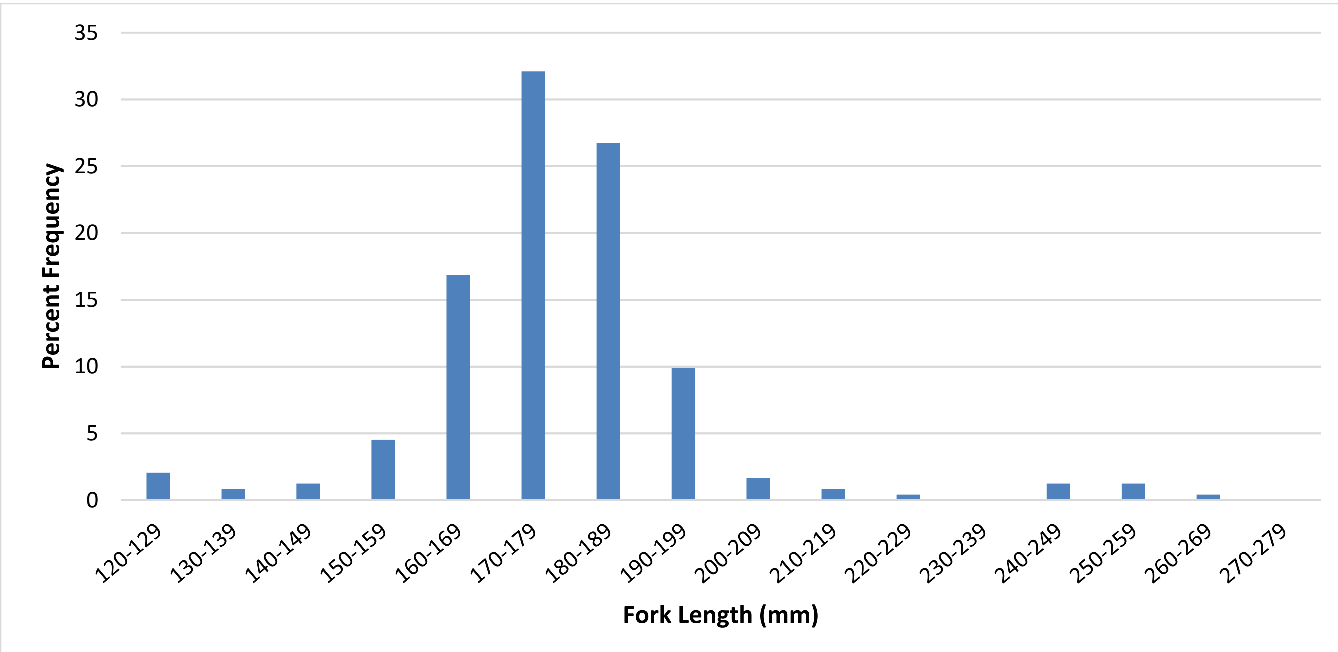


Figure 1. Least cisco length frequency diagram for the July 11, 2018 gillnetting event in the Carcross area.

Photo 2. Large least cisco (260 mm fork length) captured in the Carcross area on July 11, 2018.

A total of 242 least cisco (not including YOY) were aged from the Carcross area and included 1 to 4 year old age classes as based upon the 'read as is' age classification (Figure 2). The 3+age class constituted the largest proportion of the catch (67%) followed by 2+ fish (25%). A subsample of cisco of each age class were re-aged using alternative ageing techniques (crack and toast, and section and mount). It was found that the 'read as is' technique is suitable for younger least cisco (2 year olds), but for the 3+and particularly 4+ cisco, the alternative methods provide a more reliable age with the section and mount being the most preferred (Table 7; Photo 3 - Photo 5). These findings help to explain the lack of 5+ and 6+ cisco in the dataset for the 'read as is' samples shown in Figure 2 and that the proportion of 3+cisco may be overrepresented. Four year olds (4+) likely make up a larger proportion of the samples from 2018; however, this cannot be confirmed without re-aging all of the otoliths using the alternative ageing techniques.

Consistent with the 2016 sampling, the 2017 results indicate a relatively low longevity and high natural mortality rates for the least cisco in Tagish and Carcross areas as indicated by the prevalence of younger fish with relatively few older fish and a maximum age of 4+. Age and length information collected in Tagish and Carcross areas during 2018 sampling is somewhat consistent with the 2016 and 2017 results and historical information from Teslin Lake which contains a similar non-migratory (non-anadromous) population. McPhail and Lindsey (1970) note that the oldest least cisco captured in Teslin Lake was eight years old and measured 249 mm long with the largest fish being 276 mm and aged as a 6 year old.

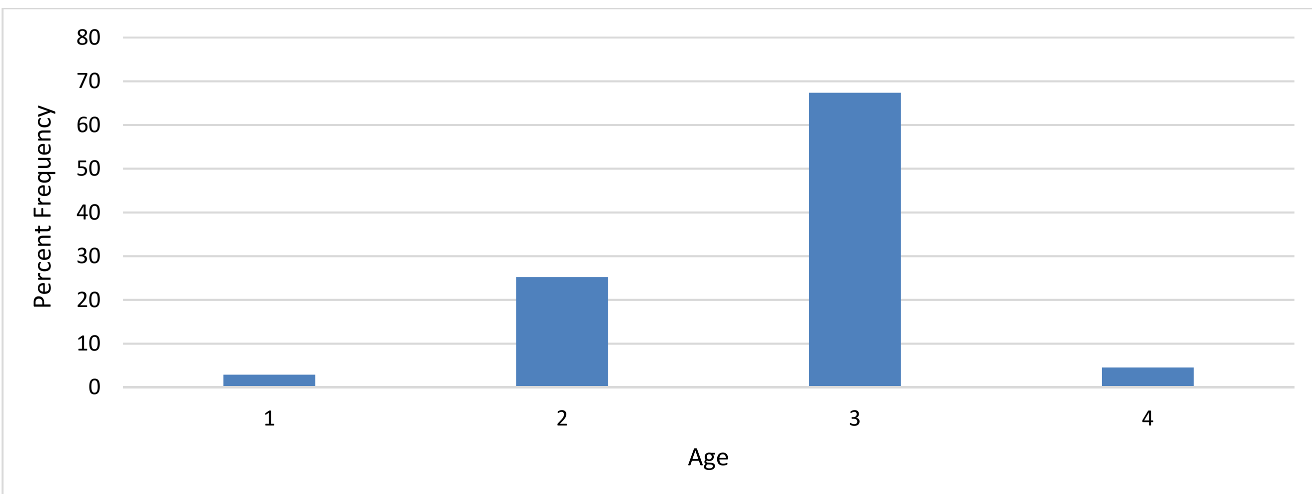


Figure 2. Age frequency of least cisco captured in the Carcross area on July 11, 2018 as determined by the 'read as is' ageing technique.

Table 7. Summary of age verification results for least cisco otoliths.

Age as Determined by 'read as is' Technique	Crack and Toast Technique			Section and Mount Technique		
	Number Aged	Proportion with Agreement (%)	Maximum Age Difference	Number Aged	Proportion with Agreement (%)	Maximum Age Difference
2	0	-	-	15	71	+1
3	0	-	-	15	40	+1
4	10	0	+2	7	57	+1

Photo 3. Sectioned and slide mounted least cisco otolith showing 3 annuli (red dots) indicating a three year old fish (fish ID 45, 191 mm fork length). This individual was aged as 2 years old using the 'read as is' technique.

Photo 4. Sectioned and slide mounted least cisco otolith showing 4 annuli (red dots) indicating a four year old fish (fish ID 25, 208 mm fork length). This individual was aged as 3 years old using the read as is technique.

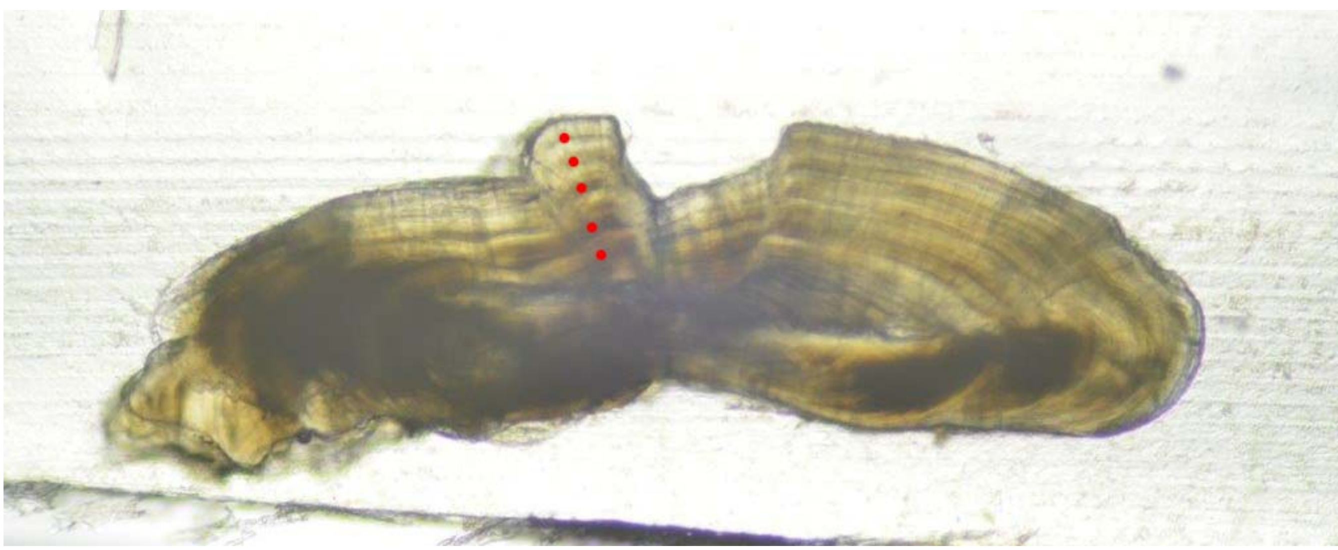


Photo 5. Sectioned and slide mounted least cisco otolith showing 5 annuli (red dots) indicating a five year old fish (fish ID 175, 260 mm fork length). This individual was aged as 4 years old using the 'read as is' technique.

3.1.1.4 Maturity of Least Cisco

Maturity was determined for 242 of the least cisco captured during the July 2018 sampling event in the Carcross area. The vast majority of cisco aged as 2+ or greater (by the 'read as is' technique; Figure 3) were determined to be mature and would have spawned during the fall of 2018.

Collectively, the information compiled on maturity confirms the results from the 2016 and 2017 sampling which indicate rapid maturation of least cisco in the Southern Lakes system with most individuals spawning for the first time at the end of their third growing season (as 2+). A portion of the one year olds may also spawn at the end of their second growing season (as 1+ fish) as indicated by a small proportion of maturing individuals of this age class. This pattern of early maturity is what would be expected for a species that exhibits low longevity due to high natural mortality rates and relatively short effective reproductive life span of 3 to 5 years.

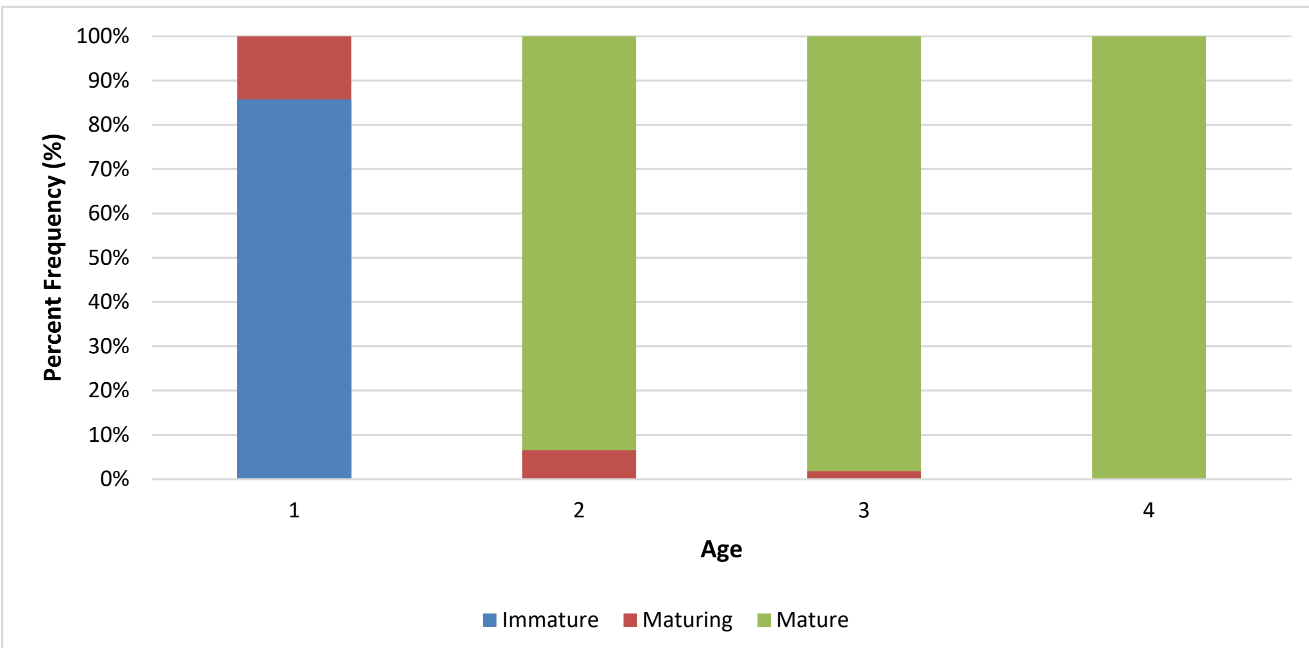


Figure 3. Proportion of immature, maturing, and mature least cisco captured in the Carcross area on July 11, 2018.

3.1.2 FALL SPAWNING ASSESSMENTS

The spawning assessments involved targeted sampling for least cisco at potential spawning locations in the Carcross and Tagish areas on September 20 and 26, 2018. The 2017 fall spawning assessments (EDI 2018) provided the first confirmation of least cisco spawning in these areas and the 2018 sampling was intended to further document these spawning areas while also obtaining additional samples for the analysis of genetic diversity and population structure.

3.1.2.1 Species Composition

A total of 151 fish were captured during the two fall sampling events in the Tagish area with least cisco being the most frequently captured species, accounting for 46% of all fish captured (Table 8). Round whitefish was the second most frequently captured species (44%) followed by lake whitefish (4%). Three lake trout, two longnose sucker, two Arctic grayling and a single northern pike made up the remainder or the fish captured.

Table 8. Summary of fish captured during targeted small mesh netting for least cisco in the Tagish area during the fall of 2018.

Sampling Event	Species	Retained	Incidental Mortalities		Released/Escaped	TOTAL
			Juvenile	Adult		
September 20	Least Cisco	31	-	-	1	32
	Arctic Grayling	-	-	-	1	1
	Longnose Sucker	-	-	-	2	2
	Lake Trout	-	-	-	2	2
	Lake Whitefish	-	-	-	5	5
	Northern Pike	-	-	-	1	1
	Round Whitefish	-	3	-	28	31
September 26	Least Cisco	-	-	13	25	38
	Arctic Grayling	-	-	-	1	1
	Lake Trout	-	-	-	1	1
	Lake Whitefish	-	-	-	1	1
	Round Whitefish	-	3	2	31	36
ALL EVENTS COMBINED	Least Cisco	31	-	13	26	70
	Arctic Grayling	-	-	-	2	2
	Longnose Sucker	-	-	-	2	2
	Lake Trout	-	-	-	3	3
	Lake Whitefish	-	-	-	6	6
	Northern Pike	-	-	-	1	1
	Round Whitefish	-	6	2	59	67

The results from the Carcross area showed a similar result with least cisco accounting for 59% of the 233 fish captured, followed by round whitefish with 36% of all fish caught (Table 8). The remainder of the catch in this sampling area was comprised of nine Arctic grayling and two lake trout.

Table 9. Summary of fish captured during targeted small mesh netting for least cisco in the Carcross area during the fall of 2018.

Sampling Event	Species	Retained	Incidental Mortalities		Released/Escaped	TOTAL
			Juvenile	Adult		
September 20	Least Cisco	-	-	-	1	1
	Arctic Grayling	-	-	-	2	2
	Lake Trout	-	-	-	2	2
	Round Whitefish	-	2	1	51	54
September 26	Least Cisco	-	-	34	102	136
	Arctic Grayling	-	-	-	7	7
	Round Whitefish	-	9	1	21	31
ALL EVENTS COMBINED	Least Cisco	-	-	34	103	137
	Arctic Grayling	-	-	-	9	9
	Lake Trout	-	-	-	2	2
	Round Whitefish		11	2	72	85

3.1.2.2 Least Cisco Capture Rates

Least cisco were captured at 6 sites during the combined 2018 spawning assessments in the Tagish area (Map 8). In the Tagish River, spawning cisco were captured exclusively in the middle and upstream portion of the river and were mostly absent from the area near the Tagish bridge/Tagish Creek confluence where they were consistently found during the summer months. The locations where spawning fish were captured was relatively shallow (< 3 m), along the river margin and in areas with a sand/gravel substrate free of plants. The most notable aggregation of spawning fish was at Set 3-16 on the Tagish River where 31 individuals were captured in a 43 minute set (46.7 fish/100 m/hr). This location was along an inside bend of the river where a large gravel/sand bar extended out into the main channel; water depths ranged from 2.1 to 2.9 m along the length of the set. Nearer to the Tagish Lake outlet, the large sand bar on the west side of the river (sets 4-2, 4-3 and 4-4) also appeared to be a least cisco spawning area and contained a similar substrate (sand) free of aquatic plants.

During the September 26 sampling event, numerous (10+) large schools of apparently adult cisco were observed milling around patches of sand/gravel in the Tagish River between the bridge and the island approximately 3 km upstream. Care was taken to ensure that large schools such as this were not captured; however, a net was set to capture a small number of individuals (Set 4-6) which confirmed that these individuals were indeed ripe and in spawning condition.

Photo 6. Large school of least cisco observed upstream of the Tagish bridge on September 26, 2018.

In the Carcross area, a single cisco (not in spawning condition) was captured on the September 20 sampling event. On September 26, spawning least cisco were captured in three out of the five sampling sets. The largest number of spawning least cisco was captured in Set 4-11 (Map 9) at the outlet of Bennett Lake (250 m upstream of the pedestrian bridge) where 80 cisco were captured in a 31 minute set (166.2 fish/100 m/hr). Set 4-9 in Nares River (directly downstream of the railway bridge) also had large numbers of least cisco captured, where 44 cisco were captured in a 32 minute set (88.2 fish/100 m/hr). Another 12 least cisco were captured in Set 4-12, a 52 minute set (14.9 fish/100 m/hr).

Similar to the observations in the Tagish area, a number (10+) of large schools of presumed adult least cisco were observed milling around the sandy shorelines at the Bennett Lake outlet. Based upon the capture of individuals in sets 4-11 and 4-12, these individuals were ripe and in spawning condition. Calm conditions at the time of sampling allowed these schools to be easily observed while portions of the schools swam near the surface. This activity appeared to increase in the late evening hours and the areas where these schools were milling around were characterized by a clean, sandy bottom free of aquatic plants and depths ranging from approximately 1.3 to 3.0 m.

3.1.2.3 Length and Age Frequencies

Least cisco captured during the September spawning sampling events in the Tagish and Carcross areas had a large range in fork lengths, from 128 – 254 mm (Figure 4). On average, the individuals captured in Carcross were larger than those in Tagish. The average fork length of least cisco captured in Carcross was 182 mm compared to 170 mm in Tagish. One exceptional large individual (254 mm) was captured in Carcross on September 26 and determined to be a ripe male. Ageing structures were only collected from incidental mortalities during the fall sampling event.

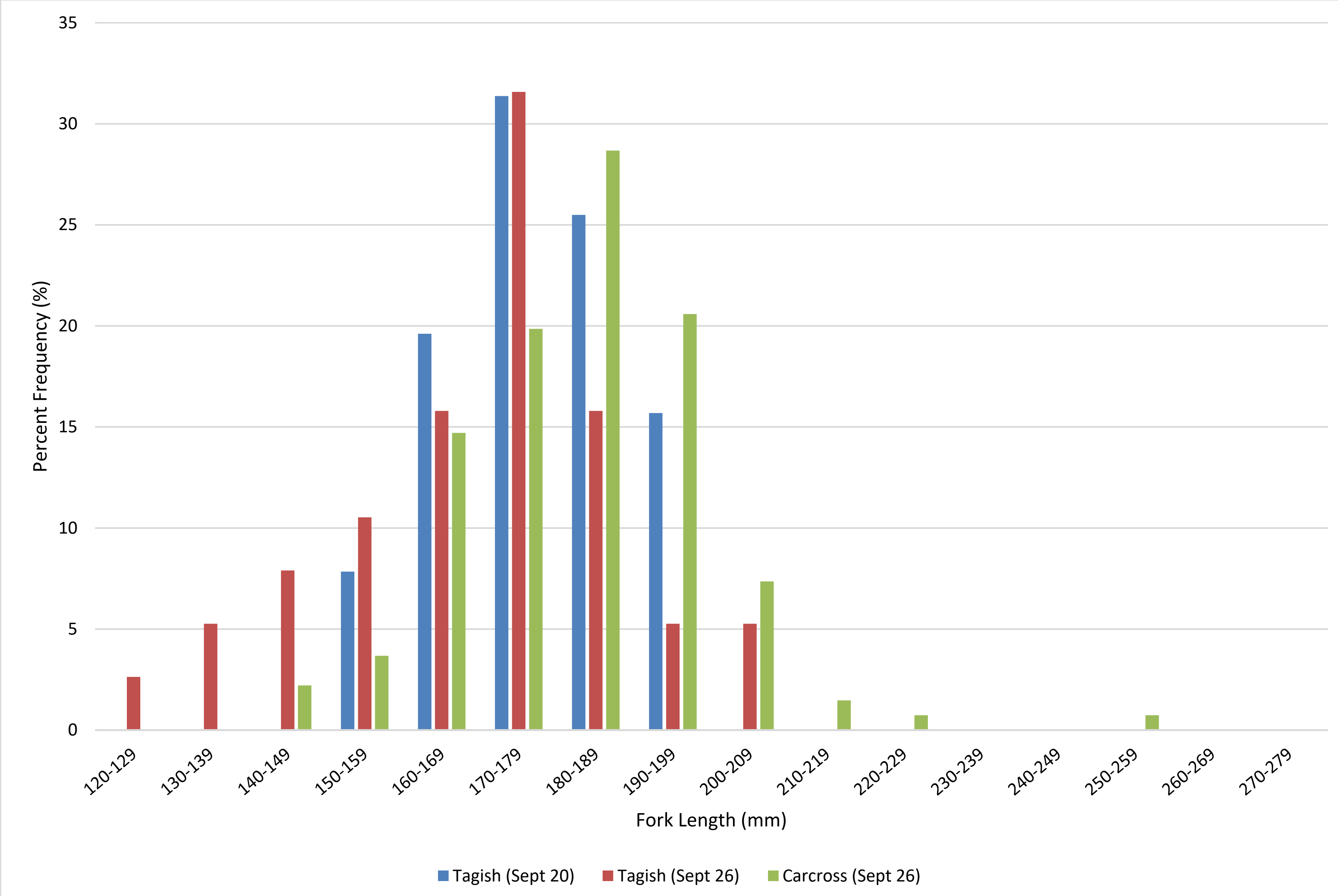
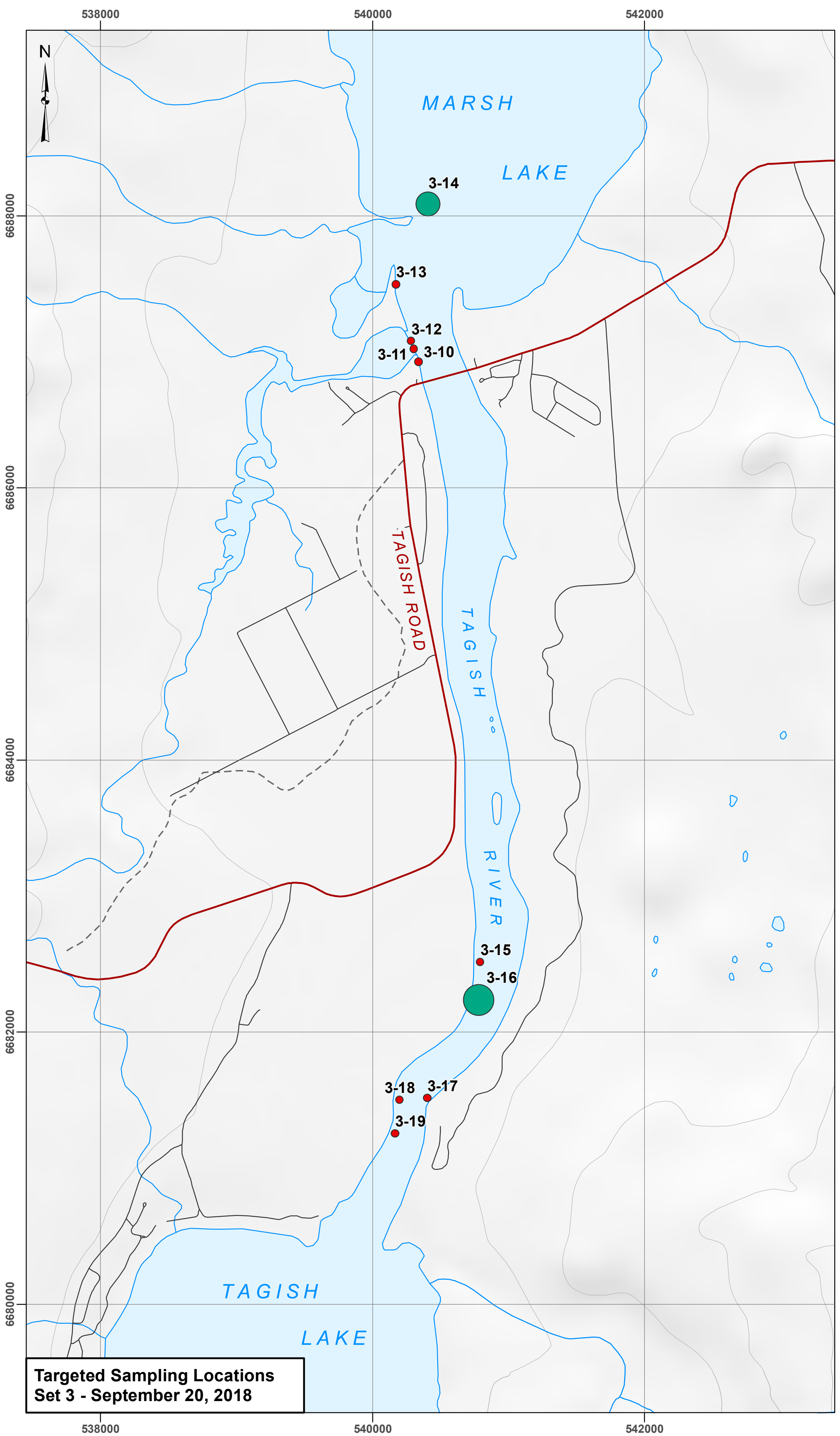
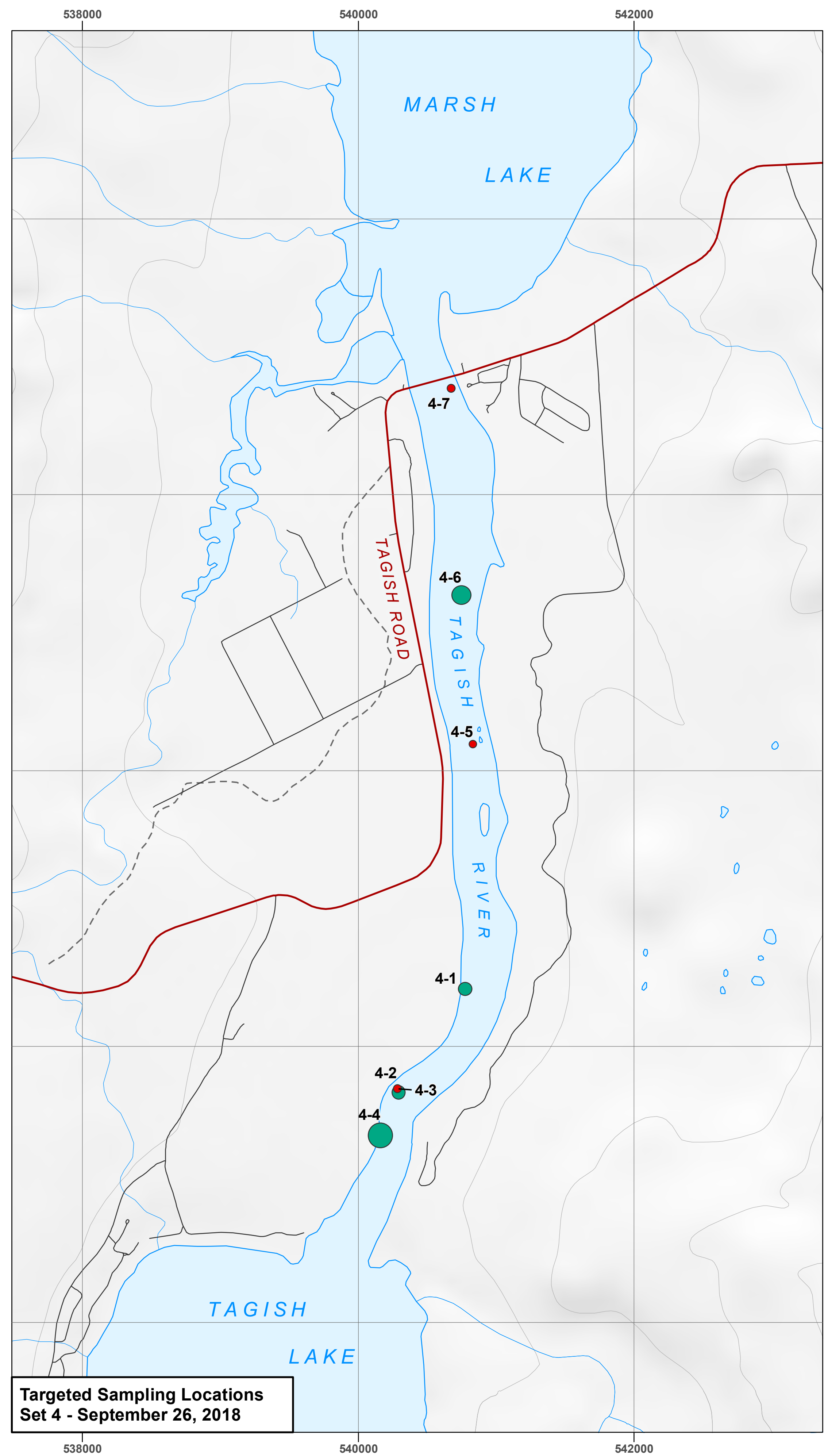


Figure 4. Least cisco length frequency diagram for the fall sampling events in the Tagish and Carcross areas.

Map 8. Overview of targeted fall (spawning) sampling results in the Tagish area during 2018



Targeted Sampling Locations
Set 3 - September 20, 2018



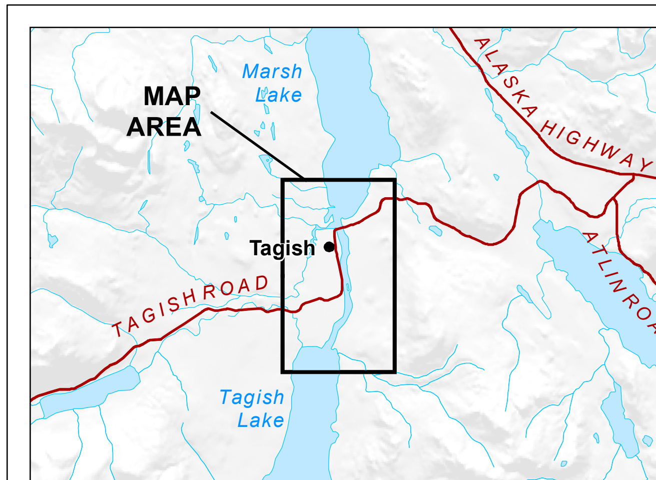
Targeted Sampling Locations
Set 4 - September 26, 2018

Legend

- Highway
- Secondary road
- Trail

Least Cisco Gill Netting Results

- 0 Fish/Hour
- 1- 10 Fish/Hour
- 11 - 15 Fish/Hour
- 16 - 30 Fish/Hour
- > 30 Fish/Hour



0 0.5 1 1.5 2
Kilometres

Map Scale = 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 UTM Zone 8N

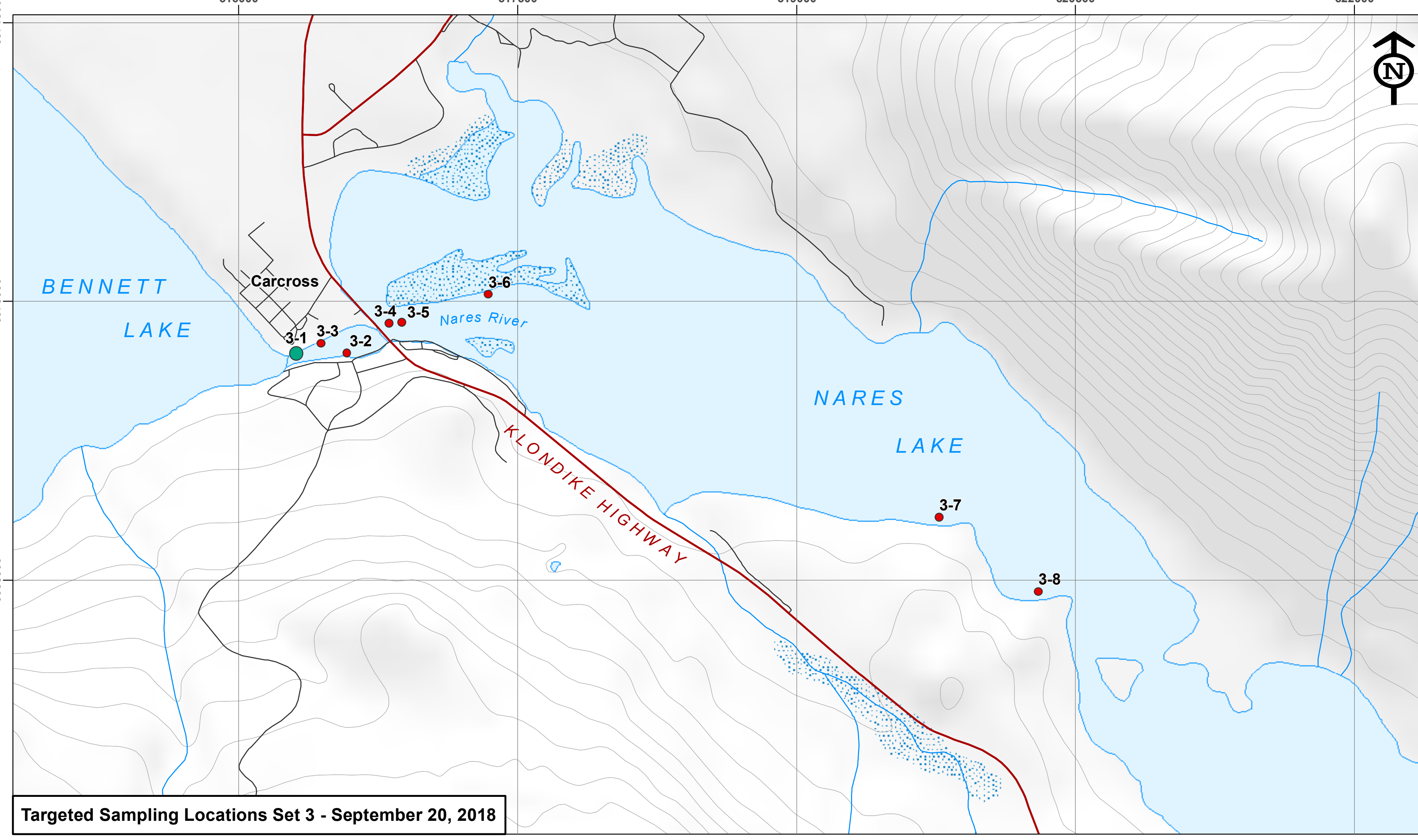
Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

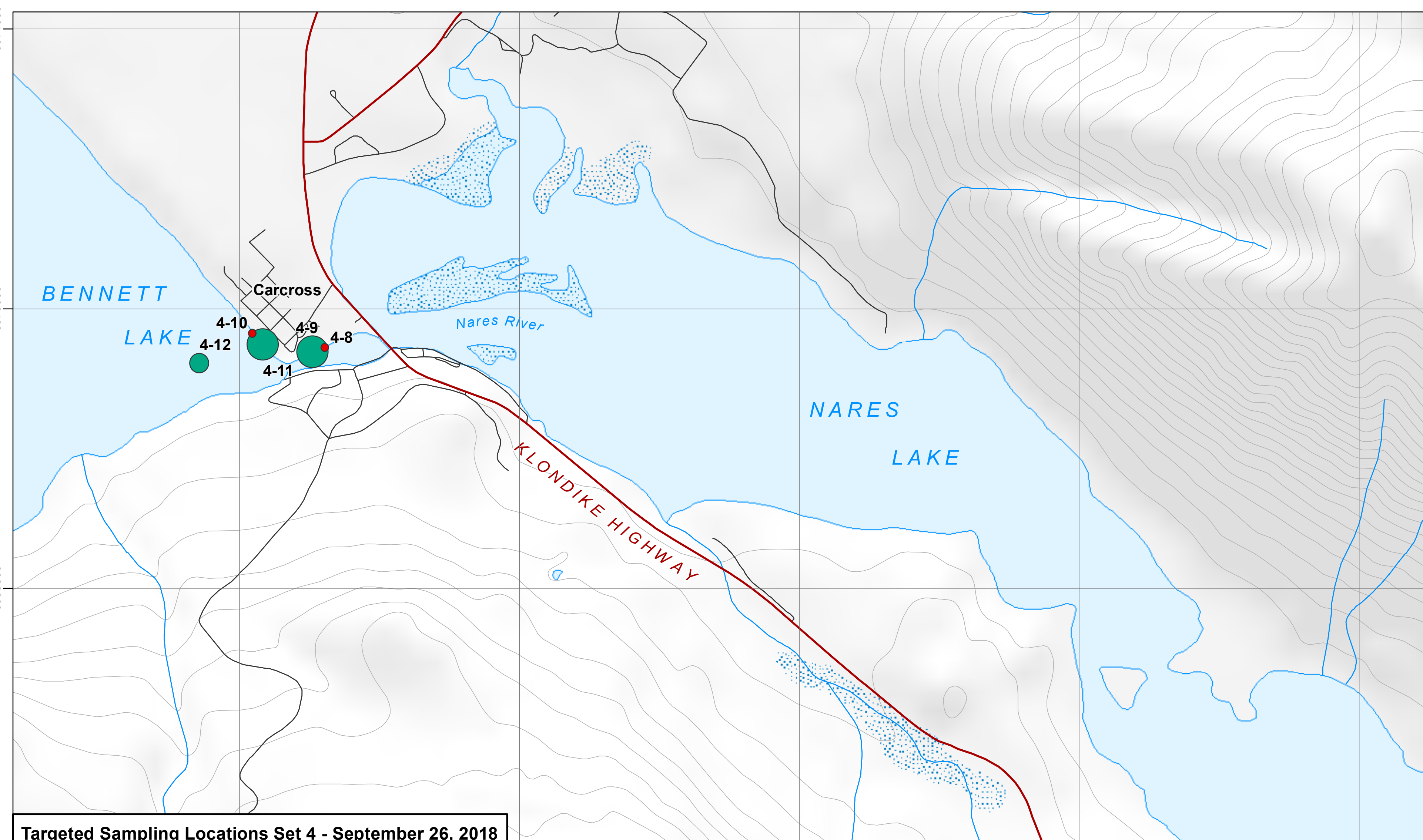
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

Drawn: HG	Checked: BSc	Date: 2019-01-21



Targeted Sampling Locations Set 3 - September 20, 2018



Targeted Sampling Locations Set 4 - September 26, 2018

Legend

- Highway
- Secondary road
- Trail

Least Cisco Gill Netting Results

- 0 Fish/Hour
- 1- 10 Fish/Hour
- 11 - 15 Fish/Hour
- 16 - 30 Fish/Hour
- > 30 Fish/Hour

Map 9. Overview of targeted fall (spawning) sampling results in the Carcross area during 2018

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

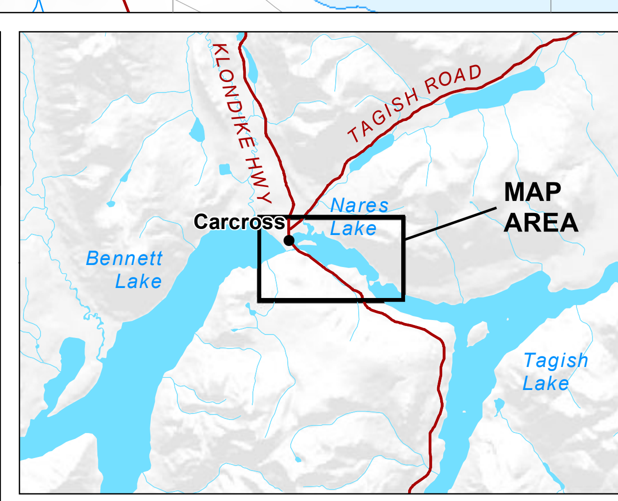
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2018) was obtained using Garmin GPS technology.

Disclaimer
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

0 0.5 1 1.5 2
Kilometres

Map Scale 1:30,000 (printed on 11 x 17)
Map Projection: NAD 1983 CSRS UTM Zone 8N

Drawn: HG	Checked: BSc	Date: 2019-04-04



CARCROSS TAGISH RENEWABLE RESOURCES COUNCIL

EDI

3.1.2.4 Maturity of Least Cisco

Maturity was successfully determined for 57 of the least cisco captured during the spawning sampling events from both the Carcross and Tagish areas and was limited to incidental mortalities or individuals which were ripe (spawning indication) as indicated by running eggs or milt. Many of the individuals classified as unknown maturity were likely ripe but not extruding eggs/milt as indicated by an apparently full body cavity and in some cases, an extruding ovipositor.

Across both areas and sampling events, the majority (95%) of individuals assessed for maturity were determined to be ripe and in spawning condition. These results, combined with the low number of spent individuals captured, suggests that the timing of sampling coincided with the start of the least cisco spawning period. Mean surface water temperatures during these sampling events ranged from 9.2 °C in the Tagish area on September 20 to 8.1 °C and 8.5 °C in the Tagish and Carcross areas on September 26.

Table 10. Summary of least cisco maturity data collected in the Tagish and Carcross areas during September 2018.

Location/Date	Total Individuals	Unknown	Maturing		Ripe		Spent	
			Male	Female	Male	Female	Male	Female
Tagish – Sept 20	51	2			19	31		
Tagish – Sept 26	38	9			11	18		
Carcross – Sept 26	136	6	1		41	86		2

3.2 BEACH SEINING

A total of 534 fish were captured during the two summer beach seining events in the Carcross area with Arctic grayling being the most frequently captured species, accounting for 64% of all fish captured (Table 11; Map 7). Round whitefish were the second most frequently captured species (22%). Small numbers of least cisco, longnose sucker, lake trout, lake whitefish, burbot, and pygmy whitefish were also captured. A total of four hauls were successful in catching cisco. One haul during the July 11 sampling event captured one adult least cisco measuring 165 mm. During the August 29 trip, three seine hauls were successful in capturing five YOY least cisco. Fork lengths for the YOY least cisco ranged from 72 -89 mm with an average of 62 mm. The results of the 2018 sampling indicated limited success of capturing cisco via beach seining. However, the use of a considerably longer (and deeper) seine which may partially towed by a boat similar to a purse seine, could be a method worth attempting in the future.

Table 11. Summary of fish captured during beach seining for YOY least cisco in the Carcross area during the summer of 2018.

Sampling Event	Species	Retained	Incidental Mortalities		Released/ Escaped	TOTAL
			Juveniles	Adults		
July 11	Slimy Sculpin	-	-	-	12	12
	Least Cisco	1	-	-	-	1
	Arctic Grayling	-	9	-	318	327
	Longnose Sucker	-	-	-	3	3
	Lake Trout	-	-	-	5	5
	Lake Whitefish	-	-	-	3	3
	Round Whitefish	-	3	-	60	63
August 30	Burbot	-	-	-	11	11
	Slimy Sculpin	-	-	-	1	1
	Least Cisco	5	-	-	-	5
	Arctic Grayling	-	-	-	23	23
	Longnose Sucker	-	-	-	7	7
	Lake Whitefish	-	-	-	3	3
	Pigmy Whitefish	-	-	-	11	11
	Round Whitefish	-	-	-	59	59
All Events Combined	Burbot	-	-	-	11	11
	Slimy Sculpin	-	-	-	13	13
	Least Cisco	6	9	-	-	15
	Arctic Grayling	-	-	-	341	341
	Longnose Sucker	-	-	-	10	10
	Lake Trout	-	-	-	5	5
	Lake Whitefish	-	-	-	6	6
	Pigmy Whitefish	-	-	-	11	11
	Round Whitefish	-	3	-	119	122

3.3 GENETICS ANALYSIS

A total of 170 least cisco genetic samples were examined from spawning individuals captured in the Carcross and Tagish areas during 2017 and 2018; samples were investigated for genetic variation at 10 microsatellite markers. Genetic analysis of Carcross and Tagish samples suggest individuals from these locations act as one population unit, that is there was no evidence of reproductive isolation between sites at this geographic scale (~50km). Southern Lakes least cisco appear to have moderate to low genetic diversity based upon the subset of samples analyzed. Some Southern Lakes samples show affinities to some outgroup samples from other Yukon lakes (Teslin/Kusawa). This could be evidence for some amount of in-migration and long-distance migration occurring from outside the area or the presence of rare genotypes in the Carcross and Tagish areas. For a detailed explanation of the results of the genetic analysis please refer to APPENDIX A.

3.4 LAKE TROUT DIET ANALYSIS

Unidentified fish make up the largest proportion of lake trout stomach contents in all areas, comprising 43%–63% of lake trout stomach contents by volume (Figure 5; Table 12, Table 13). If all fish species including unidentified ones are combined, fish comprise 57%–75% of stomach contents depending on area. Stomach contents identifiable as least cisco are the most common identifiable fish species and comprise 3%, 6%, 7%, and 9% of volume of lake trout stomach contents (7.8% overall) in Bennett, Marsh, Tagish Six Mile, and Tagish respectively. In comparison slimy sculpin, is the next most common identifiable fish species, comprised 1%–6% of stomach volume (2.3% overall).

Currently it is unknown what proportion of fish in the unidentified fish stomach contents category may be comprised of least cisco. However, because least cisco comprises the largest proportion of identifiable fish stomach contents from all lake areas, it is expected that the percent volume of lake trout stomach contents comprised of least cisco is likely larger than the values reported here. Analysis is currently being completed by Environment Yukon using genetics to help identify what proportion of different species comprise the large unidentified fish stomach contents category.

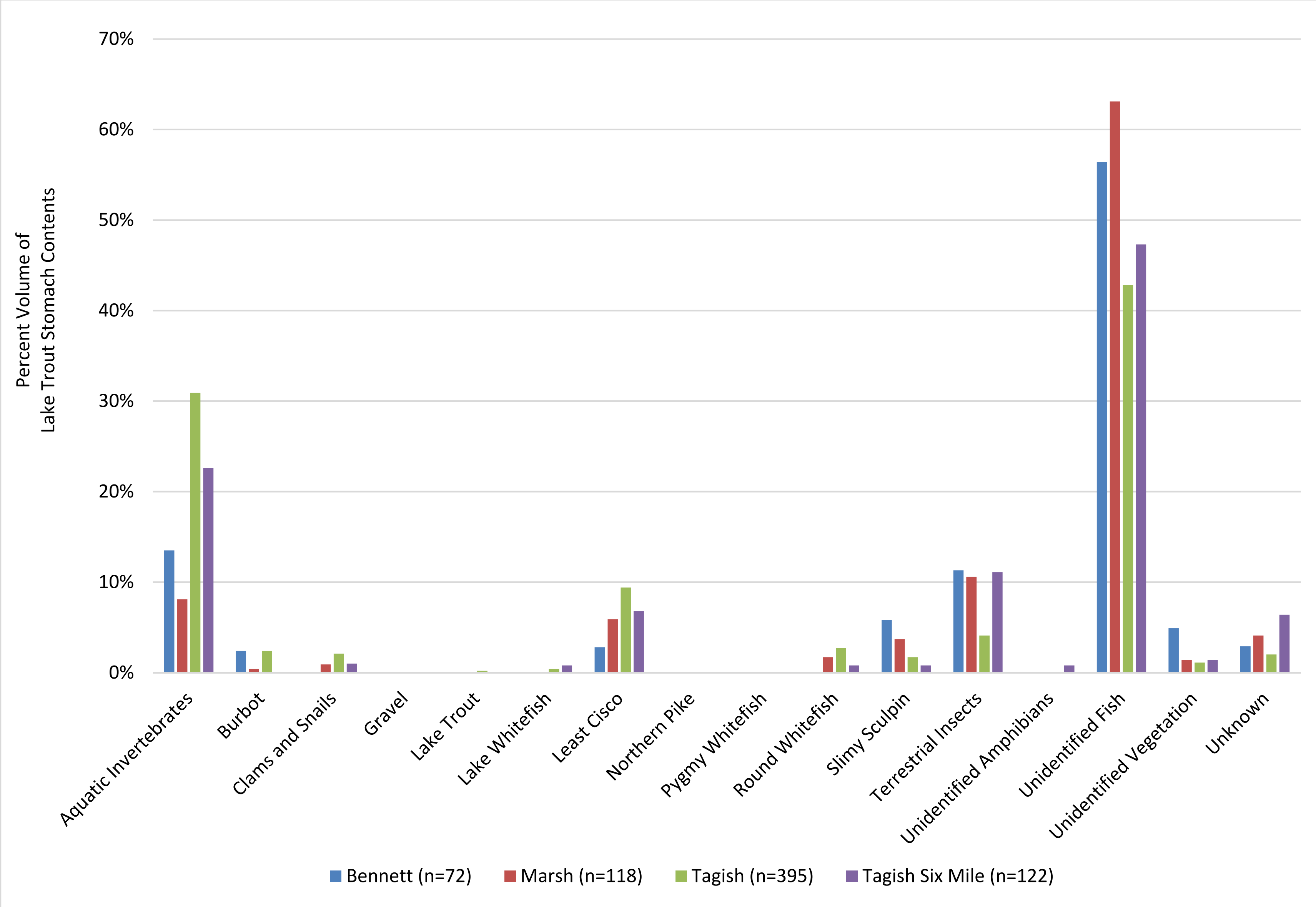


Figure 5. The percent volume of stomach contents by food item group from sampled lake trout stomachs based on simplified grouping (presented in Table 4 in Section 2.4).

Table 12. Summary of lake trout stomach contents (frequency of occurrence) from the Southern Lakes.

Food Items	Frequency of Occurrence in Sampled Lake Trout Stomachs			
	Bennett (n=72)	Marsh (n=118)	Tagish (n=395)	Tagish Six Mile (n=122)
Aquatic Invertebrates	18.1 %	13.6 %	46.1 %	48.4 %
Burbot	2.8 %	0.8 %	2.8 %	
Clams and Snails		2.5 %	5.6 %	2.5 %
Gravel				0.8 %
Lake Trout			0.3 %	
Lake Whitefish			0.5 %	0.8 %
Least Cisco	2.8 %	8.5 %	10.4 %	7.4 %
Northern Pike			0.3 %	
Pygmy Whitefish		0.8 %		
Round Whitefish		1.7 %	2.8 %	0.8 %
Slimy Sculpin	6.9 %	6.8 %	2.5 %	0.8 %
Terrestrial Insects	27.8 %	16.1 %	7.6 %	27.9 %
Unidentified Amphibians				0.8 %
Unidentified Fish	63.9 %	83.1 %	48.1 %	59.0 %
Unidentified Vegetation	6.9 %	3.4 %	2.8 %	4.1 %
Unknown	4.2 %	5.1 %	3.5 %	8.2 %

Table 13. Summary of lake trout stomach contents (percent volume) from the Southern Lakes.

Food Items	Percent Volume of Sampled Lake Trout Stomach Contents			
	Bennett (n=72)	Marsh (n=118)	Tagish (n=395)	Tagish Six Mile(n=122)
Aquatic Invertebrates	13.5 %	8.1 %	30.9 %	22.6 %
Burbot	2.4 %	0.4 %	2.4 %	
Clams and Snails		0.9 %	2.1 %	1.0 %
Gravel				0.1 %
Lake Trout			0.2 %	
Lake Whitefish			0.4 %	0.8 %
Least Cisco	2.8 %	5.9 %	9.4 %	6.8 %
Northern Pike			0.1 %	
Pygmy Whitefish		0.1 %		
Round Whitefish		1.7 %	2.7 %	0.8 %
Slimy Sculpin	5.8 %	3.7 %	1.7 %	0.8 %
Terrestrial Insects	11.3 %	10.6 %	4.1 %	11.1 %
Unidentified Amphibians				0.8 %
Unidentified Fish	56.4 %	63.1 %	42.8 %	47.3 %
Unidentified Vegetation	4.9 %	1.4 %	1.1 %	1.4 %
Unknown	2.9 %	4.1 %	2.0 %	6.4 %

4 CONCLUSIONS

The 2018 least cisco assessments and associated data analysis confirmed the following key findings:

- Summer sampling in the Carcross area documented high numbers of least cisco with ages, lengths, maturities similar to data collected in the Carcross and Tagish areas during the summers of 2016 and 2017.

- Beach seining was found to have limited effectiveness for capturing juvenile young of the year (YOY) least cisco.

- All sampling during the spawning period provided additional documentation of least cisco spawning in the Tagish River, the outlet of Tagish Lake, the Nares River, and the outlet of Bennett Lake. The preferred spawning habitat appears to be characterized by a sand covered bottom free of aquatic plants in relatively shallow water (1.5-3.0 m).

- Genetic analysis of spawning least cisco from the Carcross and Tagish areas found low to moderate levels of genetic diversity. No evidence of population subdivision was found between the two areas which appear to be a single population unit. A small number of samples from the homogenous Southern Lakes population (limited population structuring between Carcross and Tagish) were found to be more similar to samples from the outgroup samples from other Yukon lakes.

- Analysis of available lake trout stomach content data from the Southern Lakes as provided by Environment Yukon show that least cisco is the most common identifiable fish species found in lake trout stomachs.

5 LITERATURE CITED

EDI Environmental Dynamics Inc. 2017. Tagish River and Nares River least cisco assessment. Prepared for Carcross Tagish Renewable Resources Council, Whitehorse Yukon. 51 pp.

EDI Environmental Dynamics Inc. 2018. Tagish River and Nares River least cisco assessment. Prepared for the Carcross Tagish Renewable Resources Council. Whitehorse, Yukon.

Environment Yukon. 2017. Yukon fishing regulations summary (2017-2018). (http://www.env.gov.yk.ca/publications-maps/documents/Fishing-Regs-17-18.pdf). Accessed February 2, 2018

Larsen, M. 2004. Basic life history of cisco (Coregonus sardinella) within Marsh/Tagish lakes. Whitehorse Yukon. 57 pp.

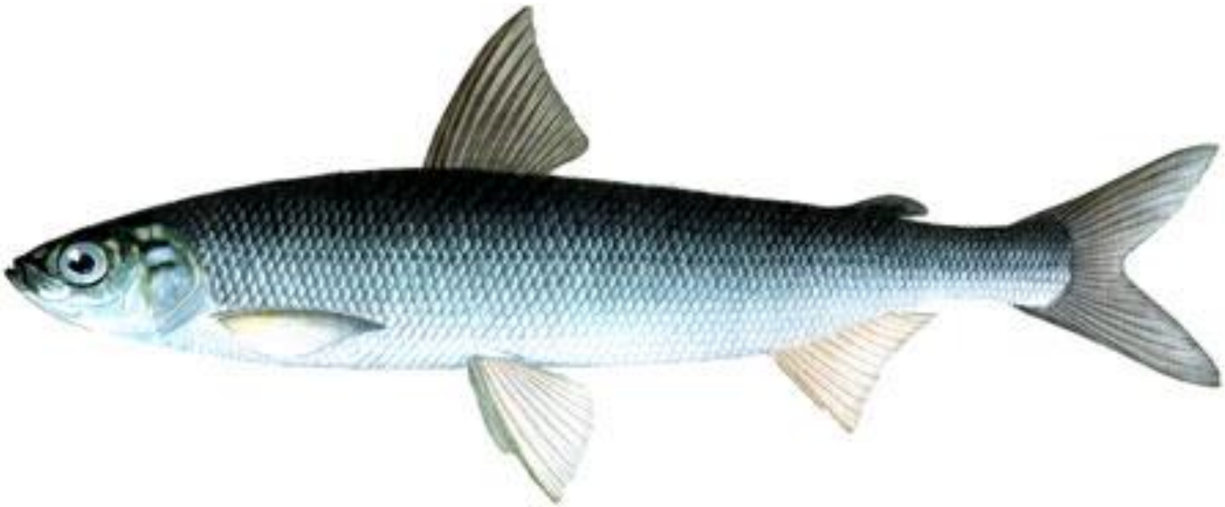
McPhail, J.D. 2007. The Freshwater Fishes of British Columbia. University of Alberta, Edmonton, Alberta.

McPhail, J.D. and Lindsey, C.C. 1970. Freshwater fishes of northwestern Canada and Alaska. Fisheries Research Board of Canada Bulletin 173. Queen's Printer for Canada, Ottawa, Ontario.

Toews, D. 2017. Local knowledge of least cisco in the Southern Lakes. January 23, 2017 email.

APPENDIX A. GENETICS ANALYSIS REPORT

This page is intentionally blank.



SOUTHERN LAKES LEAST CISCO GENETICS

Population Structure and Levels of Genetic Diversity in the Bennett, Nares, and Tagish Systems

Prepared for:
Carcross Tagish Renewable Resources Council
PO Box 70
Tagish, YT Y0B 1T0

Prepared by:
Dr. Allan B. Costello
ABC and Associates
Prince George, BC V2N 6J5
Contact: allan.b.costello@gmail.com

March 2019

EXECUTIVE SUMMARY

In the Southern Lakes, least cisco (*Coregonus sardinella*) are an important whitefish species. They support a subsistence fishery and also appear to form the basis of the popular lake trout fishery in the region. While information is limited on the distribution and health of the area's cisco populations, there is anecdotal evidence of a long-term decline in cisco numbers within the Southern Lakes. Efforts are underway to better define the distribution and abundance of cisco in this very large system as well as determine important life history parameters for typical spawning populations. This report summarizes genetic data collected from putative spawning aggregations in the system to help determine levels of genetic diversity and the distribution of distinct population units for least cisco in the Southern Lakes.

We examined 170 samples collected from the Southern Lakes in 2017 and 2018 for genetic variation at 10 microsatellite markers. The analysis was performed for two main sampling areas: Carcross (including sites at the outlet of Bennett Lake and in Nares Lake/River) and Tagish (sites in the Tagish River between the outlet of Tagish Lake and the inlet of Marsh Lake). Least cisco from these areas were found to contain low to moderate levels of genetic diversity, with an average of 7.4 alleles per marker and expected heterozygosity of 0.52. Evidence was mixed as to whether populations have experienced a recent population decline, though the Nares Lake/River samples do appear to have reduced allelic diversity and effective population size relative to Bennett Lake and Tagish River.

No population subdivision was evident in the Southern Lakes at the spatial scales involved here (analyzed samples were collected within 50 km of each other). In fact, multiple lines of inquiry suggest that the Carcross and Tagish samples analyzed here belong to the same population unit. To provide additional context for the levels of genetic diversity and relationships observed in Southern Lakes least cisco, we analyzed an additional 42 least cisco samples from elsewhere in the upper Yukon drainage. Though outgroups sampling was limited, combined analyses suggest a total of five distinct groups: Southern Lakes (Bennett, Nares, and Tagish), Kusawa and Teslin lakes, Braeburn and Twin lakes, 10 Mile Lake, and Mandana Lake. Interestingly, there were a few fish among the otherwise homogenous Southern Lakes samples that show affinities to outgroup populations. The reasons for this are not known, but could suggest some level of up river immigration into the Southern Lakes or the presence of rare genotypes among Southern Lakes cisco. Additional cisco sampling could perhaps target larger spatial scales to determine the geographic extent of population structuring in these very large systems. As well, it might be informative to perform genetic sampling of least cisco aggregations during different seasons to provide information on the timing and nature of possible population admixture. These types of information would be required for future conservation and management efforts targeting least cisco in the Southern Lakes.

BACKGROUND

Least cisco (*Coregonus sardinella*) are a member of the whitefish family that are common in lakes and rivers throughout the north. In many areas, least cisco represent an important baitfish and prey item for predatory fish species such as lake trout. In the Southern Lakes, least cisco support a subsistence fishery and appear to form the basis of the popular lake trout fishery in the region. While information is limited on the distribution and health of cisco populations, there is anecdotal evidence of a long-term decline in cisco numbers within the Tagish River and particularly so in the Nares River, where a tailings pond failure in 1964 at the Arctic Mine may have impacted local populations. To address these data gaps and persistent conservation concerns about Southern Lakes least cisco, a collaboration between the Carcross Tagish Renewable Resources Council (CTRRC), Carcross Tagish First Nation (CTFN), and Environmental Dynamics Inc. (EDI) is currently attempting to build on existing information to better delineate the distribution and abundance of cisco in this very large system, as well as determine important life history parameters on the size and age structure of typical spawning populations. As part of that larger study, this report summarizes genetic data collected from putative spawning aggregations to determine the existence and distribution of distinct population units in a portion of the Southern Lakes. The two main objectives of the genetic component are, therefore, to:

1. Determine if distinct subpopulations of least cisco exist in the Southern Lakes, and specifically whether spawner samples collected in two different sampling areas (Carcross vs Tagish) differ genetically.
2. Estimate levels of genetic diversity and effective population size in spawner samples to determine if there is evidence for recent population declines in those areas.

This information will be used to inform future conservation and management efforts targeting Southern Lakes least cisco.

MATERIALS AND METHODS

Southern Lakes samples

In 2017 and 2018, targeted small mesh gillnetting for least cisco was undertaken by EDI, CTRRC, and CTFN staff in two main sampling areas:

1. **Carcross** - including sites at the outlet of Bennett Lake and in Nares Lake/River.
2. **Tagish** – including sites in the Tagish River between the outlet of Tagish Lake and the inlet of Marsh Lake directly downstream of the Tagish bridge.

A large number of least cisco samples were collected in these areas throughout the summer and fall (particularly in 2018) with samples containing a mixture of mature, maturing and immature individuals (EDI, 2018). To specifically target spawning populations which would ultimately form the basis of any possible subpopulations, we limited genetic analysis to ripe and spent fish captured during the spawning period (September) and avoided individuals identified as having "hard" bellies (which may not spawn in the collection year or were undergoing migration to other areas when captured). Furthermore, to reduce the initial number of samples analyzed, we randomly subsampled from the larger 2018 collections, ensuring inclusion of multiple cohorts based on aged samples and size at age data. With the exception of Bennett Lake, sufficient samples sizes exist for all waterbodies to allow for comparison of waterbodies between sampling years. A total of 170 Southern Lakes samples were genetically analyzed (Table 1).

Table 1. Sample sizes and locations of Southern Lakes least cisco analyzed as part of this study.

Sampling Area	Waterbody	Sample Site IDs	2017	2018	Site Totals
Carcross	Bennett Lake	**2018**: 4-11,4-12	-	50	**50**
	Nares Lake/ River	**2017**: 5-1, 5-6, 5-9 **2018**: 4-9	18	14	**32**
Tagish	Tagish River	**2017**: 5-12,5-13, 5-14, 5-17 **2018**: 3-14, 3-16, 4-1, 4-2, 4-6	28	60	**88**
Year Totals			**46**	**124**	**170**

Outgroup samples

To provide additional context for the levels of genetic diversity and relationships observed in Southern Lakes least cisco, we analyzed least cisco samples from outside the immediate area, including 34 samples from lakes north of Whitehorse (Laberge, Braeburn, Twin, Mandana, and 10 Mile) as well as a few others nearer the Southern Lakes (Kusawa, 1 sample from Tagish Lake). These “outgroup” samples were kindly provided by Oliver Barker at Environment Yukon, Fish and Wildlife Branch. Five others samples from Teslin Lake were provided by EDI for a total of 42 outgroup samples (see also Table 3). Note that sample sizes from individual outgroup lakes are generally quite low (n < 10) meaning that these 42 samples were combined for certain analyses.

DNA extraction and Development of Microsatellite Panels

Genomic DNA was extracted from selected least cisco tissue samples using Qiagen DNeasy extraction kits (Qiagen Inc.) according to the manufacturer’s instructions. Since no previous microsatellite data existed for least cisco in the upper Yukon, we tested 16 microsatellite markers known to work in other whitefish species. During development in a test sample, three of these markers did not vary and were dropped (Cisco-157, Cla005, Cocl-Lav27); three others were dropped because of poor or inconsistent amplification (Ssa85, Ssa197, ClaTet13). The remaining 10 microsatellite markers were developed into two multiplex panels: CS1 (Sfo8, Aut139, Cla008, Cla010, Cocl-Lav4) and CS2 (BWF2, ClaTet6, ClaTet9, Cocl-Lav6, Cocl-Lav10; Table 2).

Multiplex PCRs were carried out in 10 µL volumes containing 1 µL of template DNA, 2 µL of 5X Q-Solution, 5 µL of 2X Qiagen multiplex PCR master mix (final concentration of 3 mM $MgCl_2$), with dye-labelled primer concentrations given in Table 2. Thermal cycling conditions were as follows: initial denaturation at 95°C/15 min, followed by 29 cycles of denaturation at 95°C/30 sec, annealing at 57°C/90 sec, primer extension at 72°C/60 sec, and a final extension of 60°C/20 min. Following PCR, capillary electrophoresis was conducted on Applied Biosystems 3730S 48-capillary DNA Analyzers (Applied Biosystems Inc., Foster City, CA) following the manufacturer's protocols. Allele binning and base calling were performed using the internal GS500 LIZ size standard and the program GeneMarker v2.6.4 (SoftGenetics, LLC). Approximately 10% of all samples were rerun as a quality control and all GeneMarker calls were reviewed and manually verified.

Table 2. Microsatellite markers used to assess population structure and levels of genetic variation in Southern Lakes least cisco.

Panel	Microsatellite Marker	Label	[Primer uM]	Source
CS1	Aut139	VIC	0.05	Ramey *et al.* (2008)
	Cla008	NED	0.04	Russ (2015)
	Cla010	PET	0.10	Russ (2015)
	Cocl-Lav4	PET	0.05	Rogers *et al.* (2004)
	Sfo8	FAM	0.50	Angers *et al.* (1995)
CS2	BWF2	FAM	0.15	Patton *et al.* (1997)
	ClaTet6	PET	0.04	Winkler and Weiss (2008)
	ClaTet9	NED	0.03	Winkler and Weiss (2008)
	Cocl-Lav6	VIC	0.05	Rogers *et al.* (2004)
	Cocl-Lav10	FAM	0.03	Rogers *et al.* (2004)
Markers dropped	Cisco-157	NED	-	Turgeon *et al.* (1999)
	Cla005	FAM	-	Russ (2015)
	ClaTet13	VIC	-	Winkler and Weiss (2008)
	Cocl-Lav27	FAM	-	Rogers *et al.* (2004)
	Ssa85	NED	-	O'Reilly *et al.* (1996)
	Ssa197	PET	-	O'Reilly *et al.* (1996)

Levels of Genetic Diversity and Effective Population Size

Basic genetic diversity indices

Basic descriptive statistics of the genetic variation present at microsatellite markers and within sample collections were compiled using either Genepop (Rousset 2008) or the Genalex v.6.5.3 add-in for Excel (Peakall & Smouse 2012). Basic metrics included the number of alleles (A), as well as observed (H_o) and expected heterozygosities (H_e) at each marker. Tests for deviations from Hardy-Weinberg equilibrium (HWE, a genetic property expected for distinct populations) and linkage disequilibrium (non-random association among markers) were performed using Genepop. Sequential Bonferroni corrections (Rice 1989) were applied to these calculations to maintain a nominal table wide alpha of 0.05. These tests were not performed for outgroup samples because of the low sample sizes for individual lakes.

Given anecdotal evidence of population declines in Southern Lakes least cisco, we compared levels of allelic diversity (the number of different alleles) and heterozygosity among sample areas as well as waterbodies for Bennett, Nares, and Tagish samples. We also performed specific testing for evidence of a genetic bottleneck using the program Bottleneck (Piry *et al.* 1999). Populations that have experienced a recent reduction in population size tend to exhibit corresponding reductions in the amount of genetic diversity they possess. Since allelic diversity is reduced faster than heterozygosity (with rare alleles disappearing quickly), genetic bottlenecks result in a characteristic mode shift in allele frequency distribution (as rare alleles disappear) and an excess of heterozygosity in a population.

Determination of effective population size (N_e)

Genetic data can provide of estimates of effective population size (N_e) when other data is lacking (reviewed by Luikart *et al.* 2010; Wang 2016). Effective population size represents the subset of the census or total population that effectively contribute to reproduction in a given generation. Here we use the program NeEstimator v2.1 (Do *et al.* 2014) to make estimates of N_e using the linkage disequilibrium method, estimating population size based on the random linkage disequilibrium between markers that occurs in finite populations.

Delineation of Population Structure in Southern Lakes Least Cisco

Tests for population differentiation

To determine whether least cisco collected in different spawning areas are genetically distinct and could be considered distinct population units, we tested for differences in microsatellite allele frequency data between sampling areas. These tests were performed for each marker and over all markers combined using the contingency methods of Raymond and Rousset (1995) as implemented in Genepop with significance determined using Fisher's combined probability. Sequential Bonferroni corrections (Rice 1989) were applied to these calculations to maintain a nominal table-wide alpha of 0.05. Pairwise tests for genetic differentiation were also performed for individual waterbodies within sampling areas, for all collection sites with $n > 15$, as well as between collection years (2017 vs 2018) to test for temporal stability of the genetic signature in spawning areas.

Individual based genetic clustering analyses

To further examine the nature of population subdivision in Southern Lakes least cisco, we used a number of analytical approaches that use individuals (rather than groups of individuals) as the basic sampling unit. Our primary method of investigation was Bayesian genetic clustering which treats allele frequencies and the number of distinct groups (K) as random variables which can be modeled in a Bayesian framework. We used the program STRUCTURE (Pritchard *et al.* 2000) to identify the most likely number of distinct groups among the samples under a series of genetic models from K = 1 – 10 that incorporate information on sampling location (LOCPRIOR). Five replicate runs were performed for each K value with a burn-in period of 100,000 followed by 250,000 iterations of data collection. For the most likely value of K, each of the five individual STRUCTURE runs were then combined into a single output, providing an overall inferred ancestry coefficient (q) for each individual using the program CLUMPAK (Kopelman *et al.* 2015).

To complement Bayesian analyses, we used discriminant analysis of principal components (DAPC), which is a form of multi-dimensional scaling/ data reduction. The ordination plots individuals so individuals that are genetically similar group near each other, and individuals that are genetically different group distantly from each other. DAPC further partitions sample variance to both maximize the discrimination between groups and minimize variation within them. We used the *adegenet* package (Jombart *et al.* 2010) for R (v3.5.3) to perform this analysis; first to illustrate the relationships between Southern Lakes least cisco and outgroup samples, and then to illustrate the relationships between spawning areas in the Southern Lakes.

RESULTS AND DISCUSSION

Levels of genetic diversity at individual markers and in Southern Lakes sampling areas

Levels of genetic diversity at the 10 microsatellite markers varied considerably across all samples with the number of different alleles ranging from 3 (Aut139, Cla008, Cocl-Lav4) to 37 (Cla010) and an average of 8 alleles per marker. Observed heterozygosity (H_o) across all samples ranged from 0.13 (Cocl-Lav10) to 0.89 (Cla010) and averaged 0.49, while expected heterozygosity (H_e) ranged from 0.19 to 0.94, averaging 0.55. All loci were in HWE with no signs of LD in 135 pairwise tests between markers. Looking specifically at the Southern Lakes, cisco samples were found to contain low to moderate levels of genetic diversity, with an average of 7.4 alleles per marker and H_o and H_e of 0.51 and 0.52, respectively (Table 3). Within sampling areas and individual waterbodies, all loci were in HWE with no signs of LD between markers.

Because of sample size limitations in the outgroup, we are unable to compare these diversity metrics directly to other Yukon populations. There is, however, limited data on microsatellite diversity for least cisco on the North Slope of Alaska. Padula (2013) looked at mitochondrial and microsatellite variation in seven inland lakes on the Arctic Coastal Plain (44 – 360 ha in size, separated by 1 – 50 km). Four microsatellite markers were shared between Padula (2013) and this study: Aut139, BWF2, CLC4/Cla008, and CLB129/Cla010. Considering just those four markers, similar levels of diversity occur in both datasets: approximately 12 alleles/marker, H_o = 0.50, H_e = 0.60 in Padula's Alaskan lakes; 13 alleles/marker, H_o = 0.57, H_e = 0.59 in the Southern Lakes. Such similar levels of diversity between the two datasets is surprising given their location and the physiogeographic differences between lakes. The Southern Lakes, for example, are huge systems (Tagish 5583 ha, Bennett Lake 9680 ha) where surface areas are 15 – 200 times greater than the lakes examined by Padula (2013). In reality, these similarities reflect many factors including the trade-offs associated with dispersal distance from Beringia during post-glacial recolonization (which tends to reduce levels of genetic variation) and the positive influence of lake/population size in promoting the retention of genetic variation (e.g., McPhail & Lindsey 1986; Bernatchez & Wilson 1998; Wilson & Hebert 1998).

Interestingly, the mean number of alleles was significantly different between the Nares, Bennett, and Tagish waterbodies based on ANOVA testing (6.7 vs 7.5 and 7.9, respectively; $F = 3.6259$, $p = 0.048$). Nares River samples, in fact, had fewer alleles (than one or both other Southern Lakes waterbodies) at 8 of 10 markers. Mean H_e was somewhat higher among Nares samples ($H_e = 0.54$ vs 0.51 for Bennett and Tagish), though not significantly so. This pattern is consistent with idea of a population bottleneck in the Nares River (reduced allelic diversity, excess of heterozygotes). Specific evidence for a population bottleneck, however, is mixed. The Bottleneck program, for example, found only weak evidence for excess heterozygosity in Nares and Bennett samples ($p = 0.06$) and less so for the Tagish samples ($p = 0.21$). Furthermore, the expected allele frequency mode shift was not evident in any of the three Southern Lakes waterbodies.

It is possible that with additional samples, more alleles would be found in Nares system. While the methods we have used here are unlikely to mistakenly identify a non-bottlenecked population as a bottlenecked one, the amount of genetic data we have collected (10 markers) provide only a 80% probability (power) of detecting a "severe" historical bottleneck of less that 20 individuals (e.g., Luikart & Cornuet 1998). Mixed support for a population bottleneck in the Nares River may, therefore, suggest that any historical population crashes in the Southern Lakes were not severe (i.e., it is not very likely that cisco populations in the Southern Lakes ever crashed to less than 50 individuals). Furthermore, the effects of a population bottleneck are generally transient in a population (persisting for a few dozen generations), with allelic diversity recovering faster than heterozygosity. If the Arctic Mine spill did negatively impact least cisco, it is entirely possible that enough generations have passed since 1964 (55 years ago) that much of the lost genetic variation has since been recovered. The average age of least cisco spawners in the Southern Lakes appears to be about two years of age, meaning the mine spill occurred approximately 27 generations ago.

Evidence for a population bottleneck in the Nares River, however, may be further bolstered by N_e estimates. By sampling area, N_e estimates for Carcross averaged ~1000 (95% confidence intervals = 206 - ∞) while the value for Tagish was undefined as "∞" (95% confidence intervals = 829 - ∞). Note that the "∞" value does not indicate an infinite population size, only that the population is sufficiently large (i.e., 1000s) so as not to be affected by genetic drift. In these cases, it is often useful to look at the lower bound of the 95% confidence intervals to gauge minimum plausible population sizes (which vary by about 4-fold between Carcross and Tagish samples). Considering individual waterbodies, it is interesting that both Bennett Lake ($N_e = \infty$, 95% CI = 467 - ∞) and the Tagish River ($N_e = \infty$, 95% CI = 829 - ∞) estimates greatly exceed the estimate for the Nares River ($N_e = 267$, 95% CI = 62 - ∞). The lower bound of the 95% CIs is approximately 7-13x less for Nares samples than elsewhere in the Southern Lakes.

Table 3. Summary of genetic diversity parameters for least cisco samples included in this study. Sample size (n), number of alleles (A), observed heterozygosity (H_o), and expected heterozygosity (H_e) for microsatellite markers is provided by waterbody.

	System		Microsatellite Marker										
			Sfo8	Aut 139	Cla 008	Cocl-Lav4	Cla 010	BWF2	Cocl-Lav10	Cocl-Lav6	Cla Tet9	Cla Tet6	AVG
Southern Lakes	Bennett	n	50	50	50	50	50	50	50	50	50	50	
		A	3	3	2	2	23	11	2	6	16	7	**7.5**
		H_o	0.44	0.38	0.32	0.32	0.94	0.66	0.02	0.60	0.86	0.54	**0.51**
		H_e	0.39	0.38	0.30	0.30	0.91	0.65	0.02	0.64	0.91	0.63	**0.51**
	Nares	n	32	32	32	32	32	32	32	32	32	32	
		A	2	2	2	2	19	11	3	5	15	6	**6.7**
		H_o	0.38	0.34	0.25	0.28	0.91	0.75	0.06	0.72	0.94	0.63	**0.53**
		H_e	0.38	0.39	0.38	0.36	0.91	0.77	0.06	0.64	0.91	0.63	**0.54**
	Tagish	n	88	88	88	88	88	88	88	88	88	88	
		A	4	3	2	2	24	13	4	4	17	6	**7.9**
		H_o	0.31	0.45	0.22	0.23	0.89	0.69	0.10	0.57	0.91	0.58	**0.49**
		H_e	0.34	0.45	0.26	0.27	0.92	0.70	0.10	0.57	0.92	0.58	**0.51**
Outgroup samples	Tagish	n	1	1	1	1	1	1	1	1	1	1	
		A	1	2	1	1	1	2	2	1	2	2	
		H_o	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	
	Kusawa	n	2	2	2	2	2	2	2	2	2	2	
		A	1	1	2	2	4	1	2	1	3	3	
		H_o	0.00	0.00	0.50	0.50	1.00	0.00	0.50	0.00	1.00	0.50	
	Laberge	n	4	4	4	4	4	4	4	4	4	4	
		A	2	1	2	1	7	3	1	3	4	3	
		H_o	0.25	0.00	0.25	0.00	1.00	0.75	0.00	0.50	0.75	0.75	
	Teslin	n	5	5	5	5	5	5	5	5	5	5	
		A	2	1	2	1	7	6	2	4	6	3	
		H_o	0.60	0.00	0.60	0.00	0.80	1.00	0.40	1.00	1.00	0.40	
	Braeburn	n	10	10	10	10	10	10	10	10	10	10	
		A	2	1	3	2	7	5	2	1	7	1	
		H_o	0.50	0.00	0.40	0.20	0.60	0.40	0.50	0.00	1.00	0.00	
	Twin	n	10	10	10	10	10	10	10	10	10	10	
		A	2	1	2	2	9	4	2	1	7	1	
		H_o	0.60	0.00	0.50	0.20	0.90	0.70	0.40	0.00	0.70	0.00	
	10 Mile	n	3	3	3	3	3	3	3	3	3	3	
		A	2	2	2	1	4	3	1	1	4	1	
		H_o	0.33	0.67	0.33	0.00	1.00	1.00	0.00	0.00	0.67	0.00	
	Mandana	n	7	7	7	7	7	7	7	7	7	7	
		A	1	1	2	1	6	3	2	3	7	2	
		H_o	0.00	0.00	0.14	0.00	1.00	0.71	0.43	0.71	0.86	0.57	

Determination of Population Structure

Tests for population differentiation show that the Carcross and Tagish spawner samples were not significantly differentiated from each other in terms of allele frequencies. This was true for all individual markers as well as for all markers combined (Fisher combined $p = 0.42$). Each was, however, fairly well differentiated from most outgroup samples. This relationship is perhaps best illustrated in the full DAPC ordination (Figure 1). In the figure, there is a high degree of overlap among Southern Lakes and several outgroup samples, but a marked separation of samples from Braeburn, Twin, Teslin, and Mandana lakes. Mandana Lake in particular, appears quite distinct and genetically diverse given its sample size (i.e., fairly large ellipse). Braeburn, Twin and Mandana lakes are known to contain the 'jumbo' form of least cisco, which may partly explain their level of genetic distinction. Teslin Lake samples, however, at least outwardly, appear to be similar to the cisco in the Southern Lakes (Ben Schonewille, pers. com. 2019). Estimates of long-term genetic subdivision between Carcross and Tagish were very low ($F_{st} < 0.001$), but averaged ~0.13 (moderate) between Southern Lakes and outgroup samples. These values are consistent with the single marker F_{st} estimate provided by Padula (2013) for Alaskan least cisco ($F_{st} = 0.006$).

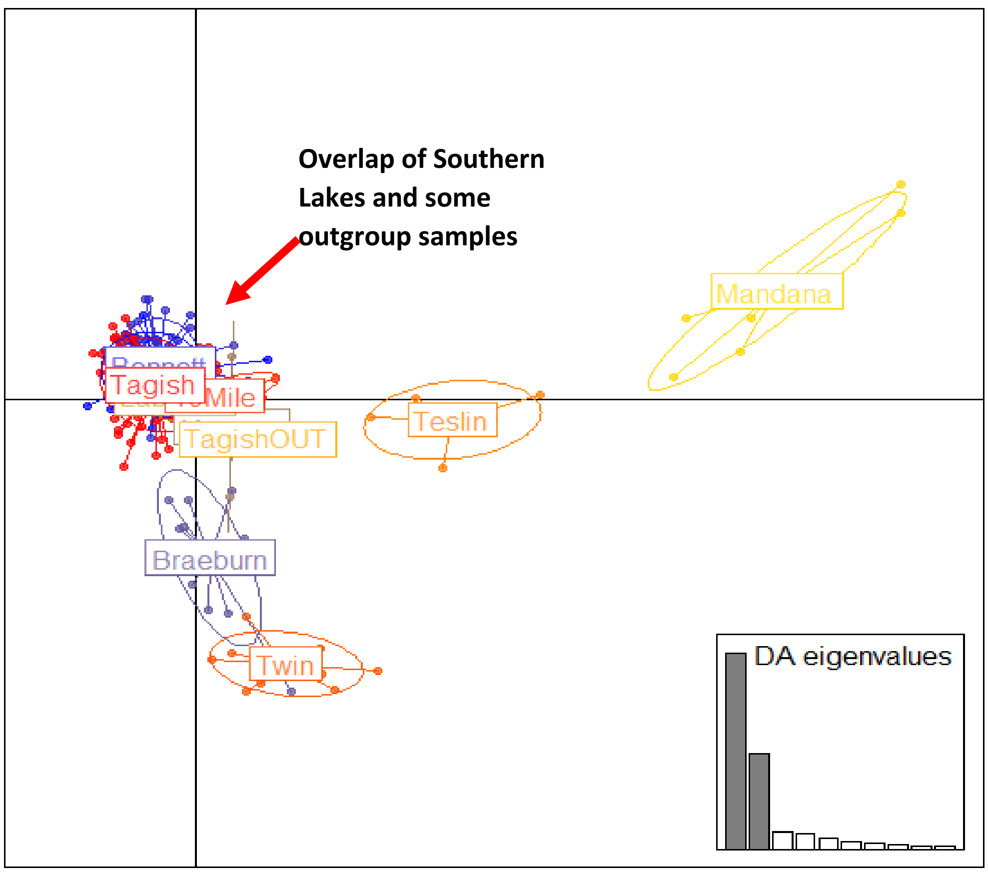


Figure 1. DAPC scatterplot illustrating the genetic relationships between Southern Lakes least cisco and outgroup populations. Individual fish are represented by dots while sample areas are individually colour-coded and bounded by 95% inertia ellipses. Inset are DA eigenvalues (two retained) which together account for 0.94 of the original sample variance.

Focussing on just the Southern Lakes, there is a high degree of genetic similarity among samples from the Bennett, Nares, and Tagish systems (Figure 2). No significant allele frequency differences appear to exist between the analyzed samples (Fisher combined p = 0.58-0.95). No differences appear between 2017 and 2018 sample years in any waterbody (p = 0.13-0.91), nor were there significant differences between individual sample sites with sample sizes of n > 15.

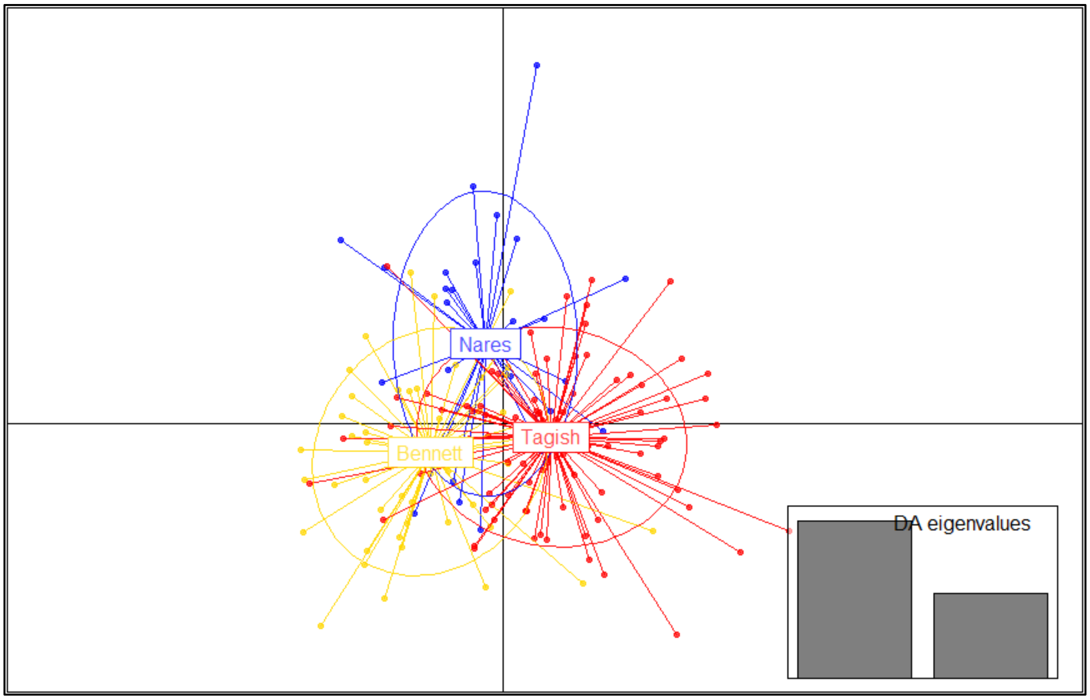


Figure 2. DAPC scatterplot illustrating the genetic relationships among Southern Lakes least cisco. Individual fish are represented by dots while sample areas are individually colour-coded and bounded by 95% inertia ellipses. Inset are DA eigenvalues (two retained) which together account for 0.94 of the original sample variance.

Consistent with DAPC, Bayesian analyses suggest that Southern Lakes cisco represent a single population unit, but that others may exist among outgroup samples (Figure 3). Structure suggests K = 5 as the most likely number of distinct groups:

1. Southern Lakes (Bennett, Nares, and Tagish),
2. Kusawa and Teslin lakes,
3. Braeburn and Twin lakes,
4. 10 Mile Lake, and
5. Mandana Lake.

These findings should be interpreted with caution as sample sizes for individual outgroup lakes are small. Interestingly, Laberge fish appear to represent a mixture or intermediate group with characteristics of Southern Lakes, Teslin, and 10 Mile fish. Similarly, there are a few fish among the otherwise homogenous Southern Lakes samples that show affinities to outgroup populations (individuals in Figure 3 with colored bars that aren't strictly light blue in color). For example, Bennett Lake fish EDI2018DNA394 (the largely purple vertical bar in Bennett Lake) was a 254 mm ripe male that genetically appears more similar to fish from Teslin or Kusawa lakes than other Southern Lakes fish. The same was true of the Tagish Lake outgroup sample provided by Yukon Environment (YG2014DNA1614). That sample was collected ~75 km towards the south end of Tagish Lake near Graham Inlet, but clusters with the Kusawa/ Teslin group rather than other Tagish samples. The reasons for this are not known, but could suggest some level of up river immigration into the Southern Lakes or the presence of rare genotypes among Southern Lakes cisco.

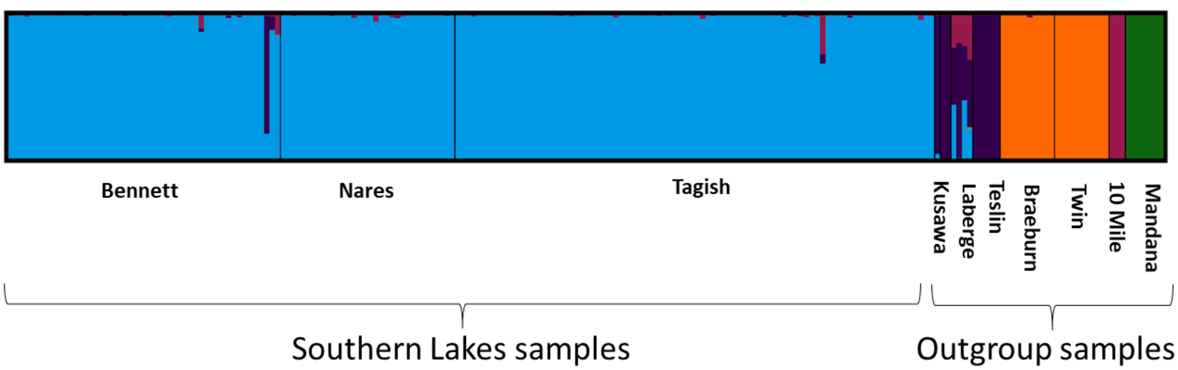


Figure 3. Ancestry q-plot of the K = 5 solution for least cisco included in this study. Different source populations are indicated and separated by black lines. Individual least cisco are represented by a colored vertical lines with estimated ancestral composition denoted by colours that correspond to the five distinct clusters to which they are inferred to belong.

SUMMARY AND RECOMMENDATIONS

This initial genetic survey of Southern Lakes least cisco revealed that samples from spawning aggregations in the Carcross and Tagish systems carry low to moderate levels of genetic variation. While consistent with other least cisco populations in Alaska, these levels are perhaps less than one might expect given the size and potential productivity of Southern Lakes systems. There was, in fact, some genetic support for anecdotal accounts of population decline in the area, particularly in the Nares system. Though evidence is mixed, Nares samples appear to contain significantly fewer alleles and have lower effective population size than elsewhere in the Southern Lakes. Additional sampling of the Nares system could be performed to determine whether the same genetic pattern is observed with a larger sample size.

It is curious that this reduction in allelic diversity would persist given the absence of apparent population structure in the area. Though the spatial scale is small relative to the vast size of these systems (all samples analyzed here were collected within 50 km of each other), no evidence of population subdivision was evident at any of the 10 microsatellite loci. The result is not likely due to any sample size issues nor the number of microsatellites analyzed (though additional markers would certainly increase statistical power to detect population differences). Instead, there appears to be little evidence of consistent natal philopatry or reproductive isolation at this spatial scale. This is perhaps not unexpected given the high mobility of least cisco and the lack of migration barriers in the study area. Rather than returning to natal areas, it may be that mature fish are making opportunistic use of suitable spawning habitats in the general area in accordance with local conditions. Future field work will likely uncover additional information on the nature of habitat use by least cisco, including the factors influencing choice of spawning habitats.

Genetic data collected here may suggest that dispersal processes for least cisco in the Southern Lakes are more complex that expected. The finding of possible "outgroup" genotypes among Southern Lakes fish, for example, may provide evidence for long-distance immigration from systems outside the area. Additional cisco sampling could perhaps target larger spatial scales to determine the geographic extent of population structuring in these very large systems and help define the boundaries of different population units in the Southern Lakes and wider Upper Yukon. As well, it might be informative to perform genetic sampling of least cisco aggregations during different seasons to provide information on the timing and nature of possible population admixture; i.e., whether it occurs early in life (during juvenile dispersal), during summer lake feeding, or coincides with fall spawning events. Finally, interpretation of life history data for Southern Lakes least cisco could certainly benefit from the application of other analytical approaches to extract data on habitat use and migration dynamics, including acoustic telemetry and otolith microchemistry which could provide complementary information to that obtained from field surveys or genetics.

REFERENCES CITED

Angers B, Bernatchez L, Angers A, Desgroseillers L (1995) Specific microsatellite loci for brook charr reveal strong population subdivision on a microgeographic scale. *Journal of Fish Biology* **47**, 177-185.

Bernatchez L, Wilson CC (1998) Comparative phylogeography of nearctic and palearctic fishes. *Molecular Ecology* **7**, 431-452.

Do C, Waples RS, Peel D*, et al.* (2014) NeEstimator v2: re-implementation of software for the estimation of contemporary effective population size (N_e) from genetic data. *Molecular Ecology Resources* **14**, 209-214.

Jombart T, Devillard S, Balloux F (2010) Discriminant analysis of principal components: a new method for the analysis of genetically structured populations. *BMC genetics* **11**, 94.

Kopelman NM, Mayzel J, Jakobsson M, Rosenberg NA, Mayrose I (2015) Clumpak: a program for identifying clustering modes and packaging population structure inferences across K. *Molecular Ecology Resources* **15**, 1179-1191.

Luikart G, Cornuet J (1998) Empirical evaluation of a test for identifying recently bottlenecked populations from allele frequency data. *Conservation Biology* **12**, 228-237.

Luikart G, Ryman N, Tallmon DA, Schwartz MK, Allendorf FW (2010) Estimation of census and effective population sizes: the increasing usefulness of DNA-based approaches. *Conservation Genetics* **11**, 355-373.

McPhail J, Lindsey C (1986) Zoogeography of fishes of the Yukon and Mackenzie basins. In: *The zoogeography of North American freshwater fishes* (eds. Hocutt C, Wiley E), pp. 639-674. John Wiley and Sons, New York.

O'Reilly PT, Hamilton LC, McConnell SK, Wright JM (1996) Rapid analysis of genetic variation in Atlantic salmon (*Salmo salar*) by PCR multiplexing of dinucleotide and tetranucleotide microsatellites. *Canadian Journal of Fisheries and Aquatic Sciences* **53**, 2292-2298.

Padula VM (2013) *The Phylogeography and Population Structure of Least Cisco (Coregonus sardinella) in Alaska* M.Sc., University of Alaska Fairbanks.

Patton JC, Gallaway BJ, Fechhelm RG, Cronin MA (1997) Genetic variation of microsatellite and mitochondrial DNA markers in broad whitefish (*Coregonus nasus*) in the Colville and Sagavanirktok rivers in northern Alaska. *Canadian Journal of Fisheries and Aquatic Sciences* **54**, 1548-1556.

Peakall R, Smouse PE (2012) GenAlEx 6.5: genetic analysis in Excel. Population genetic software for teaching and research—an update. *Bioinformatics* **28**, 2537-2539.

Piry S, Luikart G, Cornuet JM (1999) BOTTLENECK: A computer program for detecting recent reductions in the effective population size using allele frequency data. *Journal of Heredity* **90**, 502-503.

Pritchard J, Stephens M, Donnely P (2000) Inference of population structure using multilocus genotype data. *Genetics* **155**, 945-959.

Ramey A, Grazanio SL, Nielsen JL (2008) Isolation and characterization of microsatellite loci from the Arctic cisco (*Coregonus autumnalis*). *Molecular Ecology Resources* **8**, 357-359.

Raymond M, Rousset F (1995) An exact test for population differentiation. *Evolution* **49**, 1280-1283.

Rice W (1989) Analyzing tables of statistical tests. *Evolution* **43**, 223-225.

Rogers SM, Marchand M-H, Bernatchez L (2004) Isolation, characterization and cross-salmonid amplification of 31 microsatellite loci in the lake whitefish (*Coregonus clupeaformis*, Mitchill). *Molecular Ecology Notes* **4**, 89-92.

Rousset F (2008) genepop’007: a complete re-implementation of the genepop software for Windows and Linux. *Molecular Ecology Resources* **8**, 103-106.

Russ O (2015) *Genetic population structure and dynamics of nearctic Bering cisco and applied mixed-stock analysis of the Yukon River commercial fishery*, University of Alaska Anchorage.

Turgeon J, Estoup A, Bernatchez L (1999) Species flock in the North American Great Lakes: Molecular ecology of Lake Nipigon ciscoes (Teleostei: Coregonidae: *Coregonus*). *Evolution* **53**, 1857-1871.

Wang J (2016) A comparison of single-sample estimators of effective population sizes from genetic marker data. *Molecular Ecology* **25**, 4692-4711.

Wilson CC, Hebert P (1998) Phylogeography and postglacial dispersal of lake trout (*Salvelinus namaycush*) in North America. *Canadian Journal of Fisheries & Aquatic Sciences* **55**, 1010-1024.

Winkler KA, Weiss S (2008) Eighteen new tetranucleotide microsatellite DNA markers for *Coregonus lavaretus* cloned from an alpine lake population. *Molecular Ecology Resources* **8**, 1055-1058.

GLOSSARY

Allele: a variant form of a gene or genetic marker which differs in its DNA sequence or length from other forms of the gene.

Bayesian analysis: branch of statistics that uses a probability distribution of potential outcomes (rather than a specific outcome) and tests which is most likely for a given data set based on a resampling and simulation process.

Bonferroni correction: an adjustment made to outcome of statistical tests when several are being performed simultaneously. To perform a Bonferroni correction, the critical p value for a statistical test (α) is divided by the number of comparisons being made.

Discriminant analysis of principal components (DAPC): a multivariate ordination method designed to identify and describe clusters of genetically related individuals. It essentially combines the methods of principal components analysis and discriminant analysis.

Effective population size (N_e): has various meanings in different contexts, but is essentially an estimate of the size of the population (a subset of the total population) that effectively contributes to reproduction in a given generation.

Expected heterozygosity (H_e): the expected probability or frequency of heterozygotes in a population based on Hardy-Weinberg equilibrium and observed allele frequencies.

Fixation Index (F_{st}): The fixation index (F_{st}) is a measure of long-term population differentiation due to genetic structure. Values range from 0 (no genetic subdivision, panmixia) to 1 (complete genetic isolation). Values from 0.1 to 0.3 are considerate moderate levels of genetic subdivision; below and above that range, are generally considered “weak” and “strong” genetic subdivision, respectively.

Genotype: an individual’s particular combination of alleles at a given genetic marker. Individuals can be homozygotes (have 2 copies of the same allele) or heterozygotes (possess 2 different alleles).

Hardy-Weinberg equilibrium (HWE): Genetic principle that forms the basis for many genetic analyses. It essentially predicts the relationship between allele frequencies and genotypic frequencies and that these will remain constant from generation to generation in the absence of other evolutionary influences.

Linkage disequilibrium (LD): non-random association between alleles at two or more loci in a population. The presence of LD suggests that markers are not inherited independently, violating the assumptions of several genetic tests.

Microsatellite marker: hypervariable DNA markers made up of simple repeat sequences. Different alleles contain different number of repeated units which result in different sized fragments following PCR.

GLOSSARY (cont.)

Observed heterozygosity (H_o): the observed frequency of heterozygotes (individuals with 2 different alleles at a given DNA marker) in a population.

Outgroup: a group of individuals who do not belong to the immediate set of populations being investigated, but which can provide additional context on the scope and nature of variation in the group of interest.

Polymerase chain reaction (PCR): enzymatic reaction facilitated by repeated heating and cooling of DNA that allows a million-fold increase in the quantity of very specific portions of an individual's genome. Think of it as a process to "photocopy" DNA.

Population bottleneck: an event that drastically reduces the size of a population leading to the loss of genetic diversity; allelic diversity being more affected than heterozygosity levels.

APPENDIX: RAW MICROSATELLITE DATA (over)

Year	Waterbody	Sampling Area	Genetic_ID	ABC ID	Sfo8		Aut139		Cla008		Cocl-Lav4		Cla010		BWF2		Cocl-Lav10		Cocl-Lav6		ClaTet9		ClaTet6	
2017	Nares River	Carcross	EDI2017DNA1058	17S-1058	204	204	142	144	150	150	148	148	392	425	202	202	269	269	181	185	203	215	201	206
2017	Nares River	Carcross	EDI2017DNA1059	17S-1059	204	204	144	144	146	150	148	148	434	434	192	202	269	269	179	179	228	228	199	201
2017	Nares River	Carcross	EDI2017DNA1060	17S-1060	200	200	142	144	150	150	148	148	396	404	202	206	269	269	181	183	215	228	199	199
2017	Nares River	Carcross	EDI2017DNA1061	17S-1061	200	204	144	144	150	150	148	148	417	442	204	212	269	269	179	181	203	207	201	201
2017	Nares River	Carcross	EDI2017DNA1062	17S-1062	204	204	144	144	150	150	148	148	380	434	204	204	269	269	181	183	182	211	199	201
2017	Nares River	Carcross	EDI2017DNA1064	17S-1064	204	204	144	144	150	150	148	148	425	450	202	206	269	269	181	181	194	242	201	201
2017	Nares River	Carcross	EDI2017DNA1065	17S-1065	204	204	142	144	146	150	145	145	404	434	192	206	269	269	179	181	190	203	201	206
2017	Nares River	Carcross	EDI2017DNA1066	17S-1066	200	204	144	144	146	150	148	148	425	429	190	202	269	269	179	181	190	194	201	206
2017	Nares River	Carcross	EDI2017DNA1068	17S-1068	200	204	142	144	150	150	148	148	417	429	204	204	269	269	179	183	198	203	199	208
2017	Nares River	Carcross	EDI2017DNA1070	17S-1070	204	204	142	142	146	150	148	148	434	442	202	204	269	269	181	181	190	207	201	201
2017	Nares River	Carcross	EDI2017DNA1072	17S-1072	204	204	144	144	150	150	145	148	396	434	202	204	269	269	179	181	190	228	199	201
2017	Nares River	Carcross	EDI2017DNA1073	17S-1073	204	204	144	144	150	150	148	148	417	429	186	204	269	269	181	185	207	237	201	201
2017	Nares River	Carcross	EDI2017DNA1074	17S-1074	204	204	144	144	150	150	145	148	425	450	202	206	269	269	179	181	190	203	199	201
2017	Nares River	Carcross	EDI2017DNA1076	17S-1076	204	204	142	144	150	150	145	148	376	425	186	208	269	269	179	183	203	220	199	204
2017	Nares River	Carcross	EDI2017DNA1077	17S-1077	200	200	142	144	146	150	148	148	404	438	206	206	269	269	181	181	194	228	201	206
2017	Nares River	Carcross	EDI2017DNA1079	17S-1079	200	204	144	144	150	150	148	148	429	434	202	202	269	269	181	183	203	220	199	206
2017	Nares River	Carcross	EDI2017DNA1080	17S-1080	204	204	144	144	146	150	148	148	408	425	202	202	269	269	181	183	190	207	199	206
2017	Tagish River	Tagish	EDI2017DNA1081	17S-1081	204	204	142	144	146	150	145	148	408	425	202	202	269	269	181	181	211	220	201	201
2017	Tagish River	Tagish	EDI2017DNA1082	17S-1082	204	204	142	142	150	150	148	148	417	442	202	202	269	269	179	183	203	225	199	212
2017	Tagish River	Tagish	EDI2017DNA1083	17S-1083	204	204	142	144	150	150	148	148	396	417	202	202	269	269	179	179	203	203	199	201
2017	Tagish River	Tagish	EDI2017DNA1084	17S-1084	204	204	142	144	146	150	148	148	417	434	192	202	269	269	179	181	215	254	201	201
2017	Tagish River	Tagish	EDI2017DNA1085	17S-1085	204	204	142	144	150	150	145	148	404	408	192	202	269	269	181	181	207	211	199	201
2017	Tagish River	Tagish	EDI2017DNA1086	17S-1086	204	204	142	144	150	150	148	148	392	417	194	202	269	269	181	181	215	233	201	201
2017	Tagish River	Tagish	EDI2017DNA1087	17S-1087	204	204	142	144	150	150	145	148	412	417	204	206	269	269	181	181	233	242	199	199
2017	Nares River	Carcross	EDI2017DNA1088	17S-1088	200	204	144	144	146	146	145	148	372	412	204	208	269	269	179	181	225	228	201	201
2017	Tagish River	Tagish	EDI2017DNA1089	17S-1089	204	204	142	144	150	150	145	148	434	434	202	204	269	269	179	179	186	220	201	201
2017	Tagish River	Tagish	EDI2017DNA1090	17S-1090	204	204	142	144	150	150	148	148	412	417	186	204	269	269	179	181	215	225	201	201
2017	Tagish River	Tagish	EDI2017DNA1091	17S-1091	204	204	142	144	150	150	148	148	408	429	202	206	269	273	177	181	203	228	201	201
2017	Tagish River	Tagish	EDI2017DNA1092	17S-1092	204	204	144	144	150	150	148	148	421	429	186	204	269	269	179	181	207	246	206	206
2017	Tagish River	Tagish	EDI2017DNA1093	17S-1093	204	204	144	144	146	150	148	148	421	429	202	202	269	269	181	183	225	228	201	201
2017	Tagish River	Tagish	EDI2017DNA1094	17S-1094	204	204	144	144	146	150	148	148	429	446	202	204	269	269	179	179	194	228	201	201
2017	Tagish River	Tagish	EDI2017DNA1095	17S-1095	200	204	144	144	150	150	145	148	408	442	202	204	269	269	181	183	203	207	201	204
2017	Tagish River	Tagish	EDI2017DNA1097	17S-1097	204	204	142	144	150	150	148	148	412	442	202	204	269	269	181	181	242	242	199	201
2017	Tagish River	Tagish	EDI2017DNA1555	17S-1555	204	204	144	144	150	150	148	148	388	425	186	186	269	269	179	183	207	228	201	201
2017	Tagish River	Tagish	EDI2017DNA1556	17S-1556	204	204	142	144	150	150	148	148	434	438	190	206	269	269	179	181	207	233	199	206
2017	Tagish River	Tagish	EDI2017DNA1557	17S-1557	200	204	144	144	150	150	145	148	408	417	188	202	269	269	181	181	203	233	201	204
2017	Tagish River	Tagish	EDI2017DNA1559	17S-1559	200	204	144	144	146	150	148	148	368	425	202	202	269	269	179	181	207	215	201	212
2017	Tagish River	Tagish	EDI2017DNA1560	17S-1560	204	208	142	142	150	150	145	148	421	438	186	202	269	269	179	181	186	225	201	201
2017	Tagish River	Tagish	EDI2017DNA1561	17S-1561	204	204	142	144	150	150	145	145	400	421	198	202	269	269	179	181	220	228	201	206
2017	Tagish River	Tagish	EDI2017DNA1562	17S-1562	200	204	142	142	150	150	148	148	404	421	202	206	269	269	181	183	207	228	199	201
2017	Tagish River	Tagish	EDI2017DNA1563	17S-1563	200	204	144	144	150	150	148	148	349	446	202	204	269	269	181	181	190	207	199	201
2017	Tagish River	Tagish	EDI2017DNA1564	17S-1564	204	204	144	144	150	150	145	148	344	434	194	202	269	269	181	181	186	215	199	201
2017	Tagish River	Tagish	EDI2017DNA1566	17S-1566	204	204	144	144	150	150	148	148	429	429	192	202	269	269	181	181	207	207	201	201
2017	Tagish River	Tagish	EDI2017DNA1567	17S-1567	200	204	144	144	150	150	145	148	438	446	202	202	269	269	181	181	186	225	201	201
2017	Tagish River	Tagish	EDI2017DNA1568	17S-1568	204	204	144	144	150	150	145	148	408	425	204	204	269	269	179	181	194	215	201	201
2017	Tagish River	Tagish	EDI2017DNA1569	17S-1569	204	204	144	146	150	150	148	148	425	446	202	206	269	273	179	181	198	225	201	206
2018	Bennett Lake	Carcross	EDI2018DNA312	18S-312	204	204	144	144	150	150	148	148	412	417	188	202	269	269	181	181	194	198	195	201
2018	Bennett Lake	Carcross	EDI2018DNA313	18S-313	204	204	144	144	146	150	145	148	421	425	202	204	269	269	181	181	198	225	201	201
2018	Bennett Lake	Carcross	EDI2018DNA314	18S-314	204	204	142	144	150	150	148	148	421	429	204	212	269	269	179	181	207	237	199	206
2018	Bennett Lake	Carcross	EDI2018DNA315	18S-315	204	204	144	144	146	150	148	148	353	425	202	208	269	269	181	181	186	233	199	201
2018	Bennett Lake	Carcross	EDI2018DNA316	18S-316	200	204	142	144	150	150	148	148	412	434	202	202	269	269	181	183	207	225	201	201
2018	Bennett Lake	Carcross	EDI2018DNA317	18S-317	200	204	144	144	146	150	145	148	429	434	202	206	269	269	179	179	220	225	201	201
2018	Bennett Lake	Carcross	EDI2018DNA318	18S-318	204	204	144	144	150	150	148	148	425	434	202	202	269	269	181	181	186	207	201	201
2018	Bennett Lake	Carcross	EDI2018DNA319	18S-319	204	208	142	144	150	150	148	148	417	429	198	202	269	269	179	181	242	242	206	206

2018	Bennett Lake	Carcross	EDI2018DNA320	18S-320	204	204	144	144	150	150	145	148	429	434	204	204	269	269	181	181	198	211	199	212
2018	Bennett Lake	Carcross	EDI2018DNA321	18S-321	204	204	142	144	146	150	148	148	412	425	202	202	269	269	181	181	211	211	201	201
2018	Bennett Lake	Carcross	EDI2018DNA322	18S-322	204	204	144	144	150	150	145	148	417	421	202	202	269	269	179	181	186	186	199	201
2018	Bennett Lake	Carcross	EDI2018DNA323	18S-323	204	204	142	144	150	150	148	148	412	425	202	202	269	269	181	185	190	203	201	201
2018	Bennett Lake	Carcross	EDI2018DNA324	18S-324	204	204	144	146	150	150	145	148	412	434	202	206	269	269	179	181	182	211	204	206
2018	Bennett Lake	Carcross	EDI2018DNA325	18S-325	200	200	142	144	150	150	145	148	417	438	202	202	269	269	179	183	215	225	199	199
2018	Bennett Lake	Carcross	EDI2018DNA326	18S-326	204	204	142	144	150	150	145	148	412	442	192	204	269	269	177	181	194	198	199	199
2018	Bennett Lake	Carcross	EDI2018DNA327	18S-327	200	204	142	144	150	150	148	148	429	434	202	204	269	269	179	181	207	225	199	206
2018	Bennett Lake	Carcross	EDI2018DNA328	18S-328	204	208	144	144	146	150	148	148	425	434	202	202	269	269	179	181	215	237	201	206
2018	Bennett Lake	Carcross	EDI2018DNA329	18S-329	200	204	144	144	150	150	148	148	417	446	186	202	269	269	181	181	215	220	201	204
2018	Bennett Lake	Carcross	EDI2018DNA330	18S-330	204	204	142	142	150	150	145	148	425	429	202	204	269	269	181	181	228	237	201	212
2018	Bennett Lake	Carcross	EDI2018DNA331	18S-331	204	204	142	144	150	150	145	148	396	417	202	202	269	269	179	181	225	242	201	206
2018	Bennett Lake	Carcross	EDI2018DNA332	18S-332	204	204	142	144	150	150	145	148	434	438	202	204	269	269	179	185	207	228	201	201
2018	Bennett Lake	Carcross	EDI2018DNA334	18S-334	200	204	142	144	150	150	148	148	392	421	202	204	269	269	179	181	228	228	199	201
2018	Bennett Lake	Carcross	EDI2018DNA336	18S-336	200	204	144	144	150	150	148	148	408	417	202	202	269	269	181	183	207	207	199	208
2018	Bennett Lake	Carcross	EDI2018DNA337	18S-337	204	204	144	144	146	150	148	148	368	442	202	204	269	269	177	181	194	207	201	201
2018	Bennett Lake	Carcross	EDI2018DNA338	18S-338	200	204	144	144	146	150	148	148	396	434	202	202	269	269	179	181	203	207	201	201
2018	Bennett Lake	Carcross	EDI2018DNA339	18S-339	204	204	144	144	150	150	148	148	417	429	202	202	269	269	179	179	198	207	201	206
2018	Bennett Lake	Carcross	EDI2018DNA340	18S-340	204	204	144	144	150	150	145	148	442	454	202	206	269	269	181	183	186	228	199	201
2018	Bennett Lake	Carcross	EDI2018DNA341	18S-341	204	204	144	144	146	150	148	148	425	434	186	202	269	269	181	181	198	211	206	206
2018	Bennett Lake	Carcross	EDI2018DNA348	18S-348	200	204	144	144	150	150	145	148	417	434	202	206	269	269	179	181	225	225	199	201
2018	Bennett Lake	Carcross	EDI2018DNA352	18S-352	200	204	142	144	150	150	148	148	417	462	204	204	269	269	181	183	207	242	201	201
2018	Bennett Lake	Carcross	EDI2018DNA353	18S-353	204	204	144	144	150	150	148	148	344	404	194	202	269	269	179	181	207	228	199	201
2018	Bennett Lake	Carcross	EDI2018DNA354	18S-354	200	204	142	144	150	150	145	148	425	429	188	202	269	269	179	183	207	233	201	201
2018	Bennett Lake	Carcross	EDI2018DNA355	18S-355	200	204	144	144	150	150	145	148	400	421	202	202	269	269	181	187	190	203	199	201
2018	Bennett Lake	Carcross	EDI2018DNA363	18S-363	200	204	144	144	150	150	148	148	417	425	202	204	269	269	181	181	211	242	201	201
2018	Bennett Lake	Carcross	EDI2018DNA367	18S-367	200	204	144	144	150	150	148	148	412	412	202	202	269	269	181	183	203	233	201	204
2018	Bennett Lake	Carcross	EDI2018DNA370	18S-370	200	204	142	144	146	150	148	148	372	376	186	202	269	269	177	185	211	225	201	212
2018	Bennett Lake	Carcross	EDI2018DNA372	18S-372	200	204	144	144	146	150	148	148	425	434	194	204	269	269	179	179	198	228	199	201
2018	Bennett Lake	Carcross	EDI2018DNA373	18S-373	204	204	142	144	146	150	145	148	434	450	186	206	269	269	177	179	186	186	201	201
2018	Bennett Lake	Carcross	EDI2018DNA374	18S-374	200	204	142	144	150	150	145	145	429	446	202	202	269	269	179	181	203	228	199	199
2018	Bennett Lake	Carcross	EDI2018DNA378	18S-378	200	200	144	144	146	150	148	148	425	438	202	202	269	269	181	183	194	207	201	206
2018	Bennett Lake	Carcross	EDI2018DNA381	18S-381	204	204	142	144	146	150	148	148	384	438	192	202	269	269	179	179	225	233	201	212
2018	Bennett Lake	Carcross	EDI2018DNA382	18S-382	200	204	144	144	146	150	148	148	404	429	186	206	269	269	181	181	194	203	199	201
2018	Bennett Lake	Carcross	EDI2018DNA385	18S-385	200	204	142	144	146	150	148	148	400	438	202	204	269	269	181	181	215	246	199	201
2018	Bennett Lake	Carcross	EDI2018DNA387	18S-387	204	204	144	144	150	150	145	148	384	438	202	204	269	269	181	181	194	233	201	201
2018	Bennett Lake	Carcross	EDI2018DNA388	18S-388	204	204	144	144	150	150	148	148	417	417	200	204	269	269	179	181	198	237	201	201
2018	Bennett Lake	Carcross	EDI2018DNA391	18S-391	200	204	144	144	150	150	148	148	344	425	186	206	269	269	177	183	225	228	201	206
2018	Bennett Lake	Carcross	EDI2018DNA393	18S-393	204	204	144	144	146	150	148	148	408	434	202	204	269	269	179	179	186	207	201	201
2018	Bennett Lake	Carcross	EDI2018DNA394	18S-394	200	204	142	142	150	150	148	148	434	438	202	206	269	273	179	179	198	215	195	195
2018	Bennett Lake	Carcross	EDI2018DNA395	18S-395	204	204	142	142	150	150	148	148	353	404	186	204	269	269	179	179	194	207	201	201
2018	Bennett Lake	Carcross	EDI2018DNA398	18S-398	204	204	144	144	146	146	148	148	372	372	186	202	269	269	179	181	190	225	199	206
2018	Tagish River	Tagish	EDI2018DNA460	18S-460	204	204	144	144	150	150	148	148	425	425	202	202	267	269	181	183	194	225	201	201
2018	Tagish River	Tagish	EDI2018DNA462	18S-462	204	204	142	142	146	150	148	148	404	421	206	206	269	269	181	181	207	220	201	201
2018	Tagish River	Tagish	EDI2018DNA464	18S-464	200	204	144	144	150	150	145	148	421	434	202	204	269	269	179	181	190	190	201	201
2018	Tagish River	Tagish	EDI2018DNA466	18S-466	200	204	142	144	150	150	148	148	417	417	194	198	269	269	179	183	211	228	199	201
2018	Tagish River	Tagish	EDI2018DNA468	18S-468	204	204	142	144	150	150	145	148	425	425	190	206	269	269	181	181	190	228	199	201
2018	Tagish River	Tagish	EDI2018DNA470	18S-470	200	200	144	144	150	150	148	148	404	421	186	202	269	269	179	183	203	228	199	201
2018	Tagish River	Tagish	EDI2018DNA477	18S-477	200	204	144	144	150	150	148	148	408	469	190	202	269	269	181	181	215	242	199	206
2018	Tagish River	Tagish	EDI2018DNA478	18S-478	200	204	142	144	146	150	148	148	425	442	202	202	269	269	179	179	233	237	199	206
2018	Tagish River	Tagish	EDI2018DNA479	18S-479	204	204	144	144	146	146	145	148	408	438	186	202	269	269	179	181	194	237	199	201
2018	Tagish River	Tagish	EDI2018DNA480	18S-480	204	204	142	144	150	150	148	148	425	438	200	206	267	269	179	181	186	194	201	201
2018	Tagish River	Tagish	EDI2018DNA482	18S-482	204	204	142	144	146	150	148	148	421	442	202	202	269	269	179	181	182	233	199	212
2018	Tagish River	Tagish	EDI2018DNA483	18S-483	204	204	142	144	150	150	148	148	412	450	186	202	269	269	181	181	198	215	201	201
2018	Tagish River	Tagish	EDI2018DNA486	18S-486	204	204	144	144	150	150	148	148	337	421	202	206	269	269	179	179	190	233	206	206

2018	Tagish River	Tagish	EDI2018DNA487	18S-487	204	204	142	144	150	150	145	148	392	396	202	202	269	269	181	181	220	220	199	201
2018	Tagish River	Tagish	EDI2018DNA490	18S-490	204	204	144	144	150	150	148	148	400	434	202	206	269	269	179	181	203	233	201	204
2018	Tagish River	Tagish	EDI2018DNA493	18S-493	200	204	142	144	150	150	148	148	421	434	202	206	269	269	179	181	220	220	199	201
2018	Tagish River	Tagish	EDI2018DNA494	18S-494	200	204	144	144	146	146	145	145	421	425	202	202	269	269	181	181	203	237	199	201
2018	Tagish River	Tagish	EDI2018DNA495	18S-495	200	204	142	144	150	150	148	148	372	425	202	202	269	269	181	181	194	225	199	201
2018	Tagish River	Tagish	EDI2018DNA496	18S-496	200	204	142	144	150	150	145	148	438	438	202	204	269	269	179	181	207	225	199	201
2018	Tagish River	Tagish	EDI2018DNA498	18S-498	200	204	142	142	146	150	148	148	400	421	202	202	269	269	179	181	190	211	199	201
2018	Nares River	Carcross	EDI2018DNA706	18S-706	204	204	144	144	150	150	148	148	421	425	202	210	269	269	179	179	207	233	201	201
2018	Nares River	Carcross	EDI2018DNA707	18S-707	204	204	142	144	150	150	145	148	417	421	200	202	269	269	181	183	186	215	199	201
2018	Nares River	Carcross	EDI2018DNA709	18S-709	200	204	142	144	146	146	145	148	372	434	192	202	269	273	179	181	190	207	201	206
2018	Nares River	Carcross	EDI2018DNA711	18S-711	200	204	144	144	146	150	148	148	341	412	202	202	269	271	179	181	225	233	199	199
2018	Nares River	Carcross	EDI2018DNA712	18S-712	200	204	142	142	146	146	145	145	412	429	202	208	269	269	179	179	190	211	199	206
2018	Nares River	Carcross	EDI2018DNA713	18S-713	200	204	142	144	150	150	145	148	364	429	192	206	269	269	179	181	186	207	199	201
2018	Nares River	Carcross	EDI2018DNA716	18S-716	200	204	144	144	150	150	145	148	400	421	202	202	269	269	179	181	190	225	201	212
2018	Nares River	Carcross	EDI2018DNA718	18S-718	204	204	144	144	146	146	148	148	434	438	202	206	269	269	177	181	203	228	201	201
2018	Nares River	Carcross	EDI2018DNA721	18S-721	200	204	144	144	150	150	148	148	434	434	190	204	269	269	181	181	215	215	199	201
2018	Nares River	Carcross	EDI2018DNA723	18S-723	204	204	144	144	150	150	145	148	425	434	186	202	269	269	177	179	203	225	199	199
2018	Nares River	Carcross	EDI2018DNA728	18S-728	204	204	142	142	146	150	145	145	404	417	186	198	269	269	181	181	186	198	201	206
2018	Nares River	Carcross	EDI2018DNA735	18S-735	204	204	144	144	150	150	148	148	372	438	202	204	269	269	179	181	220	233	201	201
2018	Nares River	Carcross	EDI2018DNA742	18S-742	200	204	142	144	150	150	148	148	421	421	202	204	269	269	181	181	186	198	199	201
2018	Nares River	Carcross	EDI2018DNA743	18S-743	204	204	142	144	150	150	148	148	400	438	204	206	269	269	177	179	211	228	201	201
2018	Tagish River	Tagish	EDI2018DNA749	18S-749	204	204	144	144	150	150	148	148	417	442	202	206	269	273	181	183	186	211	199	201
2018	Tagish River	Tagish	EDI2018DNA750	18S-750	200	204	144	144	150	150	148	148	421	438	186	202	269	269	179	181	190	225	201	201
2018	Tagish River	Tagish	EDI2018DNA751	18S-751	204	204	144	144	146	150	145	148	408	442	202	206	269	269	179	183	198	228	199	212
2018	Tagish River	Tagish	EDI2018DNA753	18S-753	200	208	142	144	150	150	148	148	364	429	202	206	269	269	181	181	211	228	199	201
2018	Tagish River	Tagish	EDI2018DNA755	18S-755	204	204	144	144	146	150	145	145	417	417	202	202	269	269	181	181	211	220	201	206
2018	Tagish River	Tagish	EDI2018DNA760	18S-760	204	204	142	144	146	150	148	148	412	438	202	202	269	269	181	183	190	203	199	201
2018	Tagish River	Tagish	EDI2018DNA761	18S-761	204	204	142	144	150	150	148	148	429	434	202	202	269	269	179	181	194	220	201	201
2018	Tagish River	Tagish	EDI2018DNA763	18S-763	200	204	142	144	150	150	148	148	417	417	202	208	269	269	181	183	186	190	201	206
2018	Tagish River	Tagish	EDI2018DNA764	18S-764	200	200	144	144	150	150	148	148	421	429	202	202	269	269	181	181	190	190	199	201
2018	Tagish River	Tagish	EDI2018DNA765	18S-765	204	204	142	144	146	150	148	148	392	434	202	206	269	269	179	181	203	237	201	206
2018	Tagish River	Tagish	EDI2018DNA766	18S-766	204	204	144	144	150	150	148	148	404	434	202	206	269	269	181	181	203	207	201	201
2018	Tagish River	Tagish	EDI2018DNA767	18S-767	204	204	144	144	150	150	148	148	388	417	202	204	269	269	181	181	190	198	199	201
2018	Tagish River	Tagish	EDI2018DNA768	18S-768	204	204	142	142	150	150	148	148	408	434	186	194	269	273	179	181	194	215	201	201
2018	Tagish River	Tagish	EDI2018DNA769	18S-769	200	200	144	144	150	150	148	148	400	421	202	202	269	269	179	181	211	233	201	201
2018	Tagish River	Tagish	EDI2018DNA770	18S-770	204	204	142	144	150	150	148	148	417	434	202	206	269	269	177	181	220	233	201	201
2018	Tagish River	Tagish	EDI2018DNA771	18S-771	200	204	142	142	150	150	148	148	408	442	202	202	269	269	179	181	198	228	201	201
2018	Tagish River	Tagish	EDI2018DNA772	18S-772	200	204	142	144	146	150	145	148	425	425	186	208	269	273	179	179	211	233	199	201
2018	Tagish River	Tagish	EDI2018DNA773	18S-773	200	204	144	144	150	150	145	148	421	446	202	202	269	269	179	179	211	233	201	201
2018	Tagish River	Tagish	EDI2018DNA774	18S-774	200	200	142	142	150	150	148	148	417	434	202	204	269	269	181	181	211	215	199	201
2018	Tagish River	Tagish	EDI2018DNA775	18S-775	200	206	142	142	146	146	148	148	372	425	204	208	269	269	181	181	207	228	199	201
2018	Tagish River	Tagish	EDI2018DNA776	18S-776	204	208	144	144	150	150	148	148	421	438	202	204	269	269	177	181	194	198	201	201
2018	Tagish River	Tagish	EDI2018DNA777	18S-777	204	204	142	144	150	150	148	148	404	434	204	204	269	273	179	181	190	237	201	201
2018	Tagish River	Tagish	EDI2018DNA778	18S-778	204	204	144	144	150	150	148	148	421	421	202	202	269	269	181	181	190	198	199	201
2018	Tagish River	Tagish	EDI2018DNA781	18S-781	204	204	144	144	150	150	148	148	368	400	186	192	269	269	181	181	186	228	201	206
2018	Tagish River	Tagish	EDI2018DNA782	18S-782	204	204	142	142	146	150	148	148	344	429	202	204	269	269	179	179	211	220	195	206
2018	Tagish River	Tagish	EDI2018DNA783	18S-783	204	204	142	144	146	150	148	148	412	434	192	202	269	269	181	181	228	228	201	206
2018	Tagish River	Tagish	EDI2018DNA784	18S-784	204	204	142	144	150	150	148	148	400	434	186	192	269	269	181	183	225	233	199	199
2018	Tagish River	Tagish	EDI2018DNA785	18S-785	204	204	144	144	146	150	148	148	429	434	186	186	269	269	179	181	203	242	201	201
2018	Tagish River	Tagish	EDI2018DNA786	18S-786	200	204	144	144	150	150	145	148	368	408	202	204	269	269	179	183	186	211	199	206
2018	Tagish River	Tagish	EDI2018DNA787	18S-787	204	204	142	144	150	150	148	148	400	421	202	202	269	269	179	183	198	233	201	201
2018	Tagish River	Tagish	EDI2018DNA788	18S-788	200	204	142	144	150	150	148	148	412	434	202	204	269	269	179	181	211	233	199	201
2018	Tagish River	Tagish	EDI2018DNA789	18S-789	204	204	142	144	150	150	148	148	434	442	190	192	269	269	181	181	207	211	199	201
2018	Tagish River	Tagish	EDI2018DNA790	18S-790	204	204	144	144	150	150	148	148	412	446	202	210	269	269	177	181	190	211	199	212
2018	Tagish River	Tagish	EDI2018DNA791	18S-791	204	204	142	144	146	150	145	148	412	425	202	204	269	269	181	181	182	220	199	201

2018	Tagish River	Tagish	EDI2018DNA792	18S-792	204	204	142	144	150	150	148	148	425	429	198	206	269	269	181	183	190	211	206	212
2018	Tagish River	Tagish	EDI2018DNA794	18S-794	204	204	144	144	150	150	148	148	360	434	202	204	269	269	179	181	182	190	199	199
2018	Tagish River	Tagish	EDI2018DNA795	18S-795	204	204	144	144	150	150	145	145	412	425	186	204	269	269	179	181	198	207	201	201
2018	Tagish River	Tagish	EDI2018DNA796	18S-796	204	204	142	144	146	150	148	148	425	429	180	186	269	269	177	181	225	228	195	201
2018	Tagish River	Tagish	EDI2018DNA797	18S-797	204	204	142	144	150	150	148	148	408	434	194	202	269	269	181	181	190	225	199	199
2018	Tagish River	Tagish	EDI2018DNA798	18S-798	200	204	144	144	146	146	148	148	425	429	186	202	269	271	179	183	203	220	201	212
2016	Braeburn	OUT	YG2018DNA6303	Braeburn6303	200	204	142	142	150	150	148	148	388	388	192	206	269	273	181	181	215	225	201	201
2016	Braeburn	OUT	YG2018DNA6304	Braeburn6304	200	204	142	142	150	150	145	145	417	417	206	216	269	269	181	181	198	215	201	201
2016	Braeburn	OUT	YG2018DNA6305	Braeburn6305	200	204	142	142	146	150	145	148	400	417	192	196	269	269	181	181	215	225	201	201
2016	Braeburn	OUT	YG2018DNA6306	Braeburn6306	200	200	142	142	150	150	145	145	412	412	204	204	269	273	181	181	186	194	201	201
2016	Braeburn	OUT	YG2018DNA6307	Braeburn6307	204	204	142	142	150	150	148	148	388	438	192	192	269	269	181	181	198	237	201	201
2016	Braeburn	OUT	YG2018DNA6308	Braeburn6308	200	204	142	142	150	150	148	148	388	438	204	204	269	269	181	181	215	225	201	201
2016	Braeburn	OUT	YG2018DNA6309	Braeburn6309	200	200	142	142	146	150	145	148	388	417	204	204	269	269	181	181	198	237	201	201
2016	Braeburn	OUT	YG2018DNA6310	Braeburn6310	200	200	142	142	146	154	148	148	412	412	192	192	269	273	181	181	186	215	201	201
2016	Braeburn	OUT	YG2018DNA6311	Braeburn6311	200	204	142	142	150	150	148	148	412	434	204	206	269	273	181	181	198	237	201	201
2014	Braeburn	OUT	YG2018DNA6312	Braeburn6312	204	204	142	142	146	150	148	148	400	442	204	204	269	273	181	181	198	220	201	201
2014	Kusawa	OUT	YG2014DNA0516	Kusawa0516	204	204	142	142	150	150	148	148	388	392	202	202	269	273	179	179	182	207	195	201
2009	Kusawa	OUT	YG2014DNA0752	Kusawa0752	204	204	142	142	146	150	141	148	421	458	202	202	269	269	179	179	182	211	199	199
2009	Laberge	OUT	YG09DNA073	Laberge007	200	200	142	142	150	150	148	148	368	425	202	204	269	269	181	181	186	207	199	199
2009	Laberge	OUT	YG09DNA066	Laberge037	200	204	142	142	150	150	148	148	349	376	202	208	269	269	179	181	207	225	195	201
2009	Laberge	OUT	YG09DNA037	Laberge066	200	200	142	142	150	150	148	148	404	425	202	204	269	269	179	183	207	215	199	201
2009	Laberge	OUT	YG09DNA007	Laberge073	200	200	142	142	146	150	148	148	372	412	202	202	269	269	181	181	215	215	199	201
2013	Mandana	OUT	YGDNA20131004	Mandana1004	204	204	142	142	146	150	148	148	454	477	202	208	269	273	173	181	198	228	201	204
2013	Mandana	OUT	YGDNA20131005	Mandana1005	204	204	142	142	150	150	148	148	421	477	202	208	269	273	173	187	215	228	201	204
2013	Mandana	OUT	YGDNA20131027	Mandana1027	204	204	142	142	150	150	148	148	421	477	200	202	269	273	173	181	215	215	201	204
2013	Mandana	OUT	YGDNA20131045	Mandana1045	204	204	142	142	150	150	148	148	458	477	202	208	273	273	173	187	198	203	201	201
2013	Mandana	OUT	YGDNA20131054	Mandana1054	204	204	142	142	150	150	148	148	466	477	202	202	273	273	181	187	207	225	201	204
2013	Mandana	OUT	YGDNA20131070	Mandana1070	204	204	142	142	150	150	148	148	454	477	202	202	269	269	173	173	207	228	204	204
2013	Mandana	OUT	YGDNA20131076	Mandana1076	204	204	142	142	150	150	148	148	368	477	202	208	269	269	173	173	228	233	204	204
2017	Tagish	OUT	YG2014DNA1614	Tagish1614	204	204	142	144	150	150	148	148	421	421	192	202	269	273	179	179	186	198	195	201
2017	Teslin	OUT	EDI2017DNA1570	Teslin1570	204	204	142	142	146	150	148	148	344	442	192	202	269	269	173	181	194	198	199	199
2017	Teslin	OUT	EDI2017DNA1571	Teslin1571	200	204	142	142	146	150	148	148	341	341	202	206	269	273	166	181	198	211	201	201
2017	Teslin	OUT	EDI2017DNA1572	Teslin1572	200	204	142	142	146	150	148	148	349	438	192	208	273	273	166	181	203	207	199	201
2017	Teslin	OUT	EDI2017DNA1575	Teslin1575	200	204	142	142	146	146	148	148	344	376	202	210	273	273	179	181	207	211	199	204
2017	Teslin	OUT	EDI2017DNA1576	Teslin1576	204	204	142	142	150	150	148	148	349	353	186	192	269	273	166	173	198	215	201	201
2013	Twin E	OUT	YG2013DNA0357	TwinE0357	200	204	142	142	146	150	148	148	388	400	192	202	269	273	181	181	220	220	201	201
2013	Twin E	OUT	YG2013DNA0358	TwinE0358	204	204	142	142	146	150	148	148	388	466	216	216	269	269	181	181	194	225	201	201
2013	Twin E	OUT	YG2013DNA0361	TwinE0361	200	204	142	142	146	150	148	148	400	466	192	216	269	273	181	181	194	220	201	201
2013	Twin E	OUT	YG2013DNA0363	TwinE0363	200	204	142	142	146	150	148	148	388	400	208	216	273	273	181	181	215	215	201	201
2013	Twin E	OUT	YG2013DNA0364	TwinE0364	200	200	142	142	150	150	148	148	408	438	192	192	273	273	181	181	203	225	201	201
2013	Twin E	OUT	YG2013DNA0365	TWINE0365	200	200	142	142	150	150	145	148	384	425	192	192	269	273	181	181	220	228	201	201
2013	Twin E	OUT	YG2013DNA0366	TwinE0366	200	204	142	142	150	150	148	148	400	408	192	216	269	273	181	181	198	228	201	201
2013	Twin W	OUT	YG2013DNA333	TWINW0333	200	204	142	142	150	150	148	148	400	400	192	202	273	273	181	181	215	220	201	201
2013	Twin W	OUT	YG2013DNA334	TwinW0334	200	200	142	142	146	150	145	148	412	421	192	216	273	273	181	181	198	220	201	201
2013	Twin W	OUT	YG2013DNA335	TwinW0335	200	204	142	142	150	150	148	148	400	408	192	216	273	273	181	181	198	198	201	201
2016	10 Mile	OUT	YG2016DNA1179	10Mile1179	200	204	142	142	150	150	148	148	372	462	186	208	269	269	181	181	203	225	201	201
2016	10 Mile	OUT	YG2016DNA1191	10Mile1191	204	204	142	144	146	146	148	148	372	477	208	210	269	269	181	181	190	220	201	201
2016	10 Mile	OUT	YG2016DNA1192	10Mile1192	204	204	142	144	146	150	148	148	372	469	186	210	269	269	181	181	225	225	201	201

APPENDIX B. FISH SAMPLING DATA

This page is intentionally blank.

Table B1. Summer targeted small mesh gillnetting set data.

Waterbody	Date	Set ID	Latitude	Longitude	Time Set	Time Pulled	Duration (hr)	Net Composition	No. of Panels	Net Length (m)	Depth In (m)	Depth Out (m)
Nares River	11-Jul-18	1-1	60.16406	-134.70119	08:56	09:41	0.74	B	4	91.2	1.6	2.8
Nares River	11-Jul-18	1-2	60.16454	-134.69975	09:06	10:00	0.90	B	4	91.2	1.9	2.7
Nares River	11-Jul-18	1-3	60.1638	-134.70549	09:55	10:27	0.53	B	4	91.2	2.1	56
Nares River	11-Jul-18	1-4	60.16407	-134.70401	10:25	11:09	0.73	B	4	91.2	2.8	3.2
Nares River	11-Jul-18	1-5	60.16426	-134.7046	10:42	11:53	1.19	B	4	91.2	1.8	2.9
Nares Lake	11-Jul-18	1-6	60.16628	-134.69394	11:23	12:19	0.93	B	4	91.2	1.8	24
Nares Lake	11-Jul-18	1-7	60.16299	-134.66066	12:52	14:08	1.27	B	4	91.2	10.2	11.5
Nares Lake	11-Jul-18	1-8	60.16357	-134.66259	12:53	14:20	1.45	A	3	68.4	10.2	11.2
Nares Lake	11-Jul-18	1-9	60.16246	-134.66018	12:59	14:27	1.47	B	4	91.2	2.5	8.7
Nares Lake	11-Jul-18	1-10	60.15262	-134.63316	15:00	16:20	1.34	B	4	91.2	0.9	4.6
Nares Lake	11-Jul-18	1-11	60.15285	-134.63489	15:06	16:49	1.72	A	3	68.4	11.1	8
Nares Lake	11-Jul-18	1-12	60.15275	-134.6292	15:13	17:07	1.89	B	4	91.2	2	7.6
Nares Lake	30-Aug-18	2-1	60.14807	-134.62518	10:02	10:51	0.81	C	2	45.6	6.4	5.2
Nares Lake	30-Aug-18	2-2	60.16449	-134.64862	10:55	11:30	0.59	C	2	45.6	18	6.6
Nares River	30-Aug-18	2-3	60.15432	-134.63855	11:05	11:44	0.65	C	2	45.6	1.8	2
Nares River	30-Aug-18	2-4	60.16589	-134.69797	11:09	11:50	0.67	C	2	45.6	1.9	2.8
Tagish River	30-Aug-18	2-6	60.31687	-134.2692	12:55	13:19	0.39	C	2	45.6	1.9	2.6
Tagish River	30-Aug-18	2-7	60.31734	-134.27002	13:01	13:36	0.59	C	2	45.6	1.6	2.4
Tagish River	30-Aug-18	2-8	60.3165	-134.2776	13:07	13:48	0.68	C	2	45.6	1.8	2.9
Tagish River	30-Aug-18	2-9	60.3165	-134.2776	13:27	14:00	0.55	C	2	45.6	3.4	2.4
Tagish River	30-Aug-18	2-10	60.28734	-134.2587	13:46	14:18	0.55	C	2	45.6	2	2
Tagish River	30-Aug-18	2-11	60.32109	-134.27184	14:08	14:31	0.39	C	2	45.6	1.8	3.6
Tagish River	30-Aug-18	2-12	60.26859	-134.2691	14:12	14:38	0.43	C	2	45.6	1.8	1.9
Nares River	20-Sep-18	3-1	60.16503	-134.69957	11:43	12:29	0.76	B	4	91.2	4.5	4
Nares River	20-Sep-18	3-2	60.16422	-134.70454	11:58	12:55	0.94	B	4	91.2	1.5	3.4
Nares River	20-Sep-18	3-3	60.16452	-134.70358	12:52	13:22	0.49	B	4	91.2	1.8	3.4
Nares River	20-Sep-18	3-4	60.16459	-134.70204	13:07	13:39	0.52	B	4	91.2	1.5	3.5
Nares River	20-Sep-18	3-5	60.16554	-134.6959	13:30	13:59	0.49	B	4	91.2	2	2.5
Nares River	20-Sep-18	3-6	60.16686	-134.6875	13:49	14:36	0.79	B	4	91.2	8.7	3.2
Nares River	20-Sep-18	3-7	60.15599	-134.64389	14:11	14:49	0.63	B	4	91.2	2	5.1
Nares River	20-Sep-18	3-8	60.15236	-134.6346	14:44	15:16	0.52	B	4	91.2	2	7.7
Tagish River	20-Sep-18	3-10	60.31683	-134.26935	16:31	17:01	0.50	B	4	91.2	2.3	2.8
Tagish River	20-Sep-18	3-11	60.3192	-134.27097	16:45	17:19	0.57	B	4	91.2	1.2	2.3
Tagish River	20-Sep-18	3-12	60.32269	-134.27182	17:08	17:38	0.51	B	4	91.2	2.4	2.2
Tagish River	20-Sep-18	3-13	60.32201	-134.27264	17:27	18:02	0.59	B	4	91.2	2	2.2
Tagish River	20-Sep-18	3-14	60.32728	-134.26826	17:47	18:29	0.70	B	4	91.2	1.8	2
Tagish River	20-Sep-18	3-15	60.27721	-134.26243	18:16	19:01	0.75	B	4	91.2	0.9	3.1
Tagish River	20-Sep-18	3-16	60.26835	-134.26971	18:41	19:24	0.72	B	4	91.2	1	3.4
Tagish River	20-Sep-18	3-17	60.27716	-134.26186	19:12	20:08	0.93	B	4	91.2	1	3.8
Tagish River	20-Sep-18	3-18	60.26741	-134.27406	19:41	20:23	0.70	B	4	91.2	2	2.9

Waterbody	Date	Set ID	Latitude	Longitude	Time Set	Time Pulled	Duration (hr)	Net Composition	No. of Panels	Net Length (m)	Depth In (m)	Depth Out (m)
Tagish River	20-Sep-18	3-19	60.26582	-134.27409	20:20	20:52	0.54	B	4	91.2	2.8	3

Notes:
Net composition codes as follows: A – 25/32/38 mm mesh, B – 25/32/38/44 mm mesh, C – 13/19mm mesh

Table B2. Fall targeted small mesh gillnetting set data.

Waterbody	Date	Set ID	Latitude	Longitude	Time Set	Time Pulled	Duration (hr)	Net Composition	No. of Panels	Net Length (m)	Depth In (m)	Depth Out (m)
Tagish River	26-Sep-18	4-1	60.31582	-134.26964	12:09	12:47	0.65	B	4	91.2	1.4	3.2
Tagish River	26-Sep-18	4-2	60.26851	-134.26935	12:35	13:14	0.65	B	4	91.2	2.8	3.3
Tagish River	26-Sep-18	4-3	60.26991	-134.27185	13:00	13:46	0.76	B	4	91.2	1.3	3.2
Tagish River	26-Sep-18	4-4	60.2768	-134.26195	13:24	14:10	0.77	B	4	91.2	1.3	3.6
Tagish River	26-Sep-18	4-5	60.29151	-134.26115	14:04	14:52	0.80	B	4	91.2	3.1	2.2
Tagish River	26-Sep-18	4-6	60.26577	-134.27	14:48	15:32	0.73	B	4	91.2	2.8	2.6
Tagish River	26-Sep-18	4-7	60.31534	-134.26373	15:15	16:02	0.79	B	4	91.2	1.8	1.9
Nares River	26-Sep-18	4-8	60.1655	-134.70483	17:10	17:51	0.68	B	4	91.2	13	3.3
Nares River	26-Sep-18	4-9	60.16547	-134.70469	17:21	17:53	0.54	B	4	91.2	4	3.1
Bennett Lake	26-Sep-18	4-10	60.16576	-134.70928	18:18	18:55	0.63	B	4	91.2	2	2
Bennett Lake	26-Sep-18	4-11	60.16591	-134.70903	19:05	19:36	0.53	B	4	91.2	1.9	2
Bennett Lake	26-Sep-18	4-12	60.16329	-134.71329	19:09	20:01	0.87	B	4	91.2	1.8	10.7

Notes:
Net composition codes as follows: A – 25/32/38 mm mesh, B – 25/32/38/44 mm mesh, C – 13/19mm mesh

Table B3. Summer YOY targeted beach seining data.

Waterbody	Date	Time	Haul ID	Latitude	Longitude	Haul Number	Length (m)	Width (m)	Depth (m)	Effort (m^2)
Nares Lake	2018-Jul-10	13:35	S1-1	60.15569	-134.641	1	50	22	1.2	1100
Nares Lake	2018-Jul-10	13:59	S1-2	60.15571	-134.641	1	62	26	1.2	1612
Nares Lake	2018-Jul-10	15:40	S1-3	60.14777	-134.63	1	65	8	1.3	520
Nares Lake	2018-Jul-10	15:57	S1-4	60.15057	-134.632	1	60	6	1.3	360
Nares Lake	2018-Jul-10	16:10	S1-5	60.15171	-134.631	1	68	7	1	476
Nares Lake	2018-Aug-29	7:52	S2-1	60.15539	-134.641	1	60	18	1.2	1080
Nares Lake	2018-Aug-29	8:23	S2-2	60.15231	-134.632	1	65	12	1.5	780
Nares Lake	2018-Aug-29	8:50	S2-3	60.15226	-134.632	1	50	12	1.3	600
Nares Lake	2018-Aug-29	9:09	S2-4	60.15129	-134.631	1	80	6	1.3	480
Nares Lake	2018-Aug-29	9:27	S2-5	60.15135	-134.631	1	75	25	1	1875
Nares Lake	2018-Aug-29	9:50	S2-6	60.14905	-134.629	1	85	28	2.2	2380
Nares Lake	2018-Aug-29	10:42	S2-7	60.1645	-134.649	1	65	25	1.2	1625

Table B4. Spring/summer targeted small mesh gillnetting fish capture data.

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-1	1	GR	RG	109					
Nares River	11-Jul-18	1-1	2	GR	RG	132					
Nares River	11-Jul-18	1-1	3	GR	RG	127					
Nares River	11-Jul-18	1-2	4	CS	KS	172	49.1	Female	3	3	
Nares River	11-Jul-18	1-2	5	RW	RG	206					
Nares River	11-Jul-18	1-2	6	CS	KS	171	49.1	Female	3	2	
Nares River	11-Jul-18	1-2	7	CS	KS	169	47.8	Female	3	3	
Nares River	11-Jul-18	1-2	8	CS	KS	168	44.4	Male	3	2	
Nares River	11-Jul-18	1-2	9	CS	KD	184	65	Male	3	3	
Nares River	11-Jul-18	1-2	10	CS	KD	183	63.6	Female	3	3	
Nares River	11-Jul-18	1-2	11	CS	KD	189	64.1	Female	3	3	
Nares River	11-Jul-18	1-2	12	CS	KD	168	49.8	Female	3	2	
Nares River	11-Jul-18	1-2	13	CS	KD	190	64.7	Male	3	3	
Nares River	11-Jul-18	1-2	14	CS	KD	176	49.6	Male	3	2	
Nares River	11-Jul-18	1-2	15	CS	KS	246	133	Male	3	4	
Nares River	11-Jul-18	1-2	16	CS	KS	256	158.5	Male	3	4	
Nares River	11-Jul-18	1-2	17	CS	KS	254	158	Female	3	4	
Nares River	11-Jul-18	1-2	18	CS	KS	189	73	Female	3	3	
Nares River	11-Jul-18	1-2	19	CS	KS	188	75.5	Female	3		
Nares River	11-Jul-18	1-2	20	CS	KS	190	69	Female	3	3	
Nares River	11-Jul-18	1-2	21	CS	KS	183	64	Female	3	2	
Nares River	11-Jul-18	1-2	22	CS	KS	196	79.5	Female	3	3	
Nares River	11-Jul-18	1-2	23	CS	KS	184	68.5	Female	3	3	
Nares River	11-Jul-18	1-2	24	CS	KD	206	90	Male	3	3	
Nares River	11-Jul-18	1-2	25	CS	KD	188	72	Female	3	3	
Nares River	11-Jul-18	1-2	26	CS	KD	172	56.5	Female	3	3	
Nares River	11-Jul-18	1-2	27	CS	KD	191	78.5	Male	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-2	28	CS	KD	192	70	Female	3	3	
Nares River	11-Jul-18	1-2	29	CS	KD	184	62.5	Female	3	3	
Nares River	11-Jul-18	1-2	R2	RW	RG	260					
Nares River	11-Jul-18	1-2	R3	RW	RG	336					
Nares River	11-Jul-18	1-3	R1	RW	RG	213					
Nares River	11-Jul-18	1-4	30	RW	KD	324	420	Male	3		
Nares River	11-Jul-18	1-5	31	RW	KD	248	122.5	Male	3		
Nares River	11-Jul-18	1-5	32	RW	KD	208	82.5	Female	3		
Nares River	11-Jul-18	1-5	33	CS	KS	168	46	Female	2	3	
Nares River	11-Jul-18	1-5	34	CS	KS	193	72	Female	3	3	
Nares River	11-Jul-18	1-5	35	CS	KS	181	63	Female	3	3	
Nares River	11-Jul-18	1-5	36	CS	KS	177	61.5	Female	3	3	
Nares River	11-Jul-18	1-5	37	CS	KS	192	72.5	Female	3	3	
Nares River	11-Jul-18	1-5	38	CS	KS	170	46	Female	3	3	
Nares River	11-Jul-18	1-5	39	CS	KS	156	35.5	Male	3	3	
Nares River	11-Jul-18	1-5	40	CS	KS	193	71	Female	3	3	
Nares River	11-Jul-18	1-5	41	CS	KS	172	51	Male	3	3	
Nares River	11-Jul-18	1-5	42	CS	KS	181	56.5	Female	3	3	
Nares River	11-Jul-18	1-5	43	CS	KS	175	54	Male	3	3	
Nares River	11-Jul-18	1-5	44	CS	KS	175	52	Female	3	2	
Nares River	11-Jul-18	1-5	45	CS	KS	191	63.5	Male	3	2	
Nares River	11-Jul-18	1-5	46	CS	KS	189	60.5	Female	3	3	
Nares River	11-Jul-18	1-5	47	CS	KS	166	45	Female	3	3	
Nares River	11-Jul-18	1-5	48	CS	KS	167	48	Female	3	3	
Nares River	11-Jul-18	1-5	49	CS	KD	166	52	Male	3	3	
Nares River	11-Jul-18	1-5	50	CS	KD	176	52.5	Male	2	2	
Nares River	11-Jul-18	1-5	51	CS	KD	160	37.5	Female	3	2	
Nares River	11-Jul-18	1-5	52	CS	KD	179	52.5	Male	2	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-5	53	CS	KD	193	68.5	Male	3	3	
Nares River	11-Jul-18	1-5	54	CS	KD	181	55	Male	3	3	
Nares River	11-Jul-18	1-5	55	CS	KD	189	64.5	Female	3	3	
Nares River	11-Jul-18	1-5	56	CS	KD	176	51	Female	3	3	
Nares River	11-Jul-18	1-5	57	CS	KD	166	47	Female	3	2	
Nares River	11-Jul-18	1-5	58	CS	KD	192	70	Female	3	3	
Nares River	11-Jul-18	1-5	59	CS	KD	192	75.5	Female	3	2	
Nares River	11-Jul-18	1-5	60	CS	KD	172	52	Male	3	3	
Nares River	11-Jul-18	1-5	61	CS	KD	171	53.5	Male	3	3	
Nares River	11-Jul-18	1-5	62	CS	KD	198	71	Female	3	3	
Nares River	11-Jul-18	1-5	63	CS	KD	176	50.5	Male	3	2	
Nares River	11-Jul-18	1-5	64	CS	KD	180	53.5	Male	3	3	
Nares River	11-Jul-18	1-5	65	CS	KD	170	52	Male	3	3	
Nares River	11-Jul-18	1-5	66	CS	KD	180	65.5	Male	3	3	
Nares River	11-Jul-18	1-5	67	CS	KD	174	51	Male	3	2	
Nares River	11-Jul-18	1-5	68	CS	KD	170	50	Female	3	2	
Nares River	11-Jul-18	1-5	69	CS	KD	162	43	Female	3	3	
Nares River	11-Jul-18	1-5	70	CS	KD	181	61.5	Male	2	3	
Nares River	11-Jul-18	1-5	71	CS	KD	183	59	Female	3	3	
Nares River	11-Jul-18	1-5	72	CS	KD	165	45	Female	3	3	
Nares River	11-Jul-18	1-5	73	CS	KD	176	58	Female	3	3	
Nares River	11-Jul-18	1-5	74	CS	KD	173	46	Female	3	3	
Nares River	11-Jul-18	1-5	75	CS	KD	194	79.5	Female	3	4	
Nares River	11-Jul-18	1-5	76	CS	KD	192	71	Male	3	3	
Nares River	11-Jul-18	1-5	77	CS	KD	172	54.5	Female	3	3	
Nares River	11-Jul-18	1-5	78	CS	KD	185	59	Female	3	3	
Nares River	11-Jul-18	1-5	79	CS	KD	185	63.5	Female	3	3	
Nares River	11-Jul-18	1-5	80	CS	KD	179	51	Female	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-5	81	CS	KD	164	65	Female	3	2	
Nares River	11-Jul-18	1-5	82	CS	KD	188	73.5	Female	3	3	
Nares River	11-Jul-18	1-5	83	CS	KD	179	58	Male	3	2	
Nares River	11-Jul-18	1-5	84	CS	KD	171	53.5	Male	3	3	
Nares River	11-Jul-18	1-5	85	CS	KD	168	45.5	Female	3	3	
Nares River	11-Jul-18	1-5	86	CS	KD	177	55.5	Female	3	3	
Nares River	11-Jul-18	1-5	87	CS	KD	181	68.5	Female	3	3	
Nares River	11-Jul-18	1-5	88	CS	KD	175	59	Male	3	3	
Nares River	11-Jul-18	1-5	89	CS	KD	161	36.5	Female	3	2	
Nares River	11-Jul-18	1-5	90	CS	KD						
Nares River	11-Jul-18	1-5	R4	RW	RG	154					
Nares River	11-Jul-18	1-5	r5	RW	RG	204					
Nares River	11-Jul-18	1-5	r6	RW	RG	191					
Nares River	11-Jul-18	1-5	r7	RW	RG	313					
Nares River	11-Jul-18	1-5	r8	LT	RG	498					
Nares River	11-Jul-18	1-5	r9	NP	RG	730					
Nares River	11-Jul-18	1-6	91	CS	KS	150	31.5	Female	3	2	
Nares River	11-Jul-18	1-6	92	CS	KS	126	18.5	Female	1	1	
Nares River	11-Jul-18	1-6	93	CS	KS	128	21.5	Female	1	1	
Nares River	11-Jul-18	1-6	94	CS	KS	131	20	Male	1	1	
Nares River	11-Jul-18	1-6	95	CS	KS	123	19.5	Male	1	1	
Nares River	11-Jul-18	1-6	96	CS	KS	248	126.5	Female	3	4	
Nares River	11-Jul-18	1-6	97	RW	KD	330	347	Male	3		
Nares River	11-Jul-18	1-6	r10	RW	RG	222					
Nares River	11-Jul-18	1-6	r11	RW	RG	243					
Nares River	11-Jul-18	1-7	r12	RW	RP	280					
Nares River	11-Jul-18	1-7	r13	LT	RG	503					
Nares River	11-Jul-18	1-9	98	CS	KS	245	140.5	Female	3	4	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-9	99	CS	KS	188	67.5	Female	3	3	
Nares River	11-Jul-18	1-9	100	CS	KS	176	61.5	Male	3	3	
Nares River	11-Jul-18	1-9	101	CS	KS	181	61.5	Male	3	3	
Nares River	11-Jul-18	1-9	102	CS	KS	186	65.5	Male	3	3	
Nares River	11-Jul-18	1-9	103	CS	KS	199	80	Female	3	3	
Nares River	11-Jul-18	1-9	104	CS	KS	193	63.5	Female	3	3	
Nares River	11-Jul-18	1-9	105	CS	KS	183	59	Female	3	3	
Nares River	11-Jul-18	1-9	106	CS	KS	179	59	Female	3	3	
Nares River	11-Jul-18	1-9	107	CS	KD	187	66.5	Male	3	3	
Nares River	11-Jul-18	1-9	108	CS	KD	201	79.5	Male	3	3	
Nares River	11-Jul-18	1-9	109	CS	KD	177	55	Female	3	3	
Nares River	11-Jul-18	1-9	110	RW	KD	241	118.5	Male	1		
Nares River	11-Jul-18	1-9	111	CS	KS	170	47	Female	3	3	
Nares River	11-Jul-18	1-9	112	CS	KD	178	60.5	Female	3	3	
Nares River	11-Jul-18	1-9	113	CS	KD	180	60	Female	3	3	
Nares River	11-Jul-18	1-9	114	RW	KD	199	66				
Nares River	11-Jul-18	1-9	115	RW	KD	200	70				
Nares River	11-Jul-18	1-9	116	RW	KD	193	62.5				
Nares River	11-Jul-18	1-9	117	RW	KD	182	59.5				
Nares River	11-Jul-18	1-9	118	RW	KD	184	56.5				
Nares River	11-Jul-18	1-9	119	RW	KD	201	72.5				
Nares River	11-Jul-18	1-9	120	RW	KD	196	66				
Nares River	11-Jul-18	1-9	121	RW	KD	190	65				
Nares River	11-Jul-18	1-9	122	RW	KD	216	95	Female	1		
Nares River	11-Jul-18	1-9	123	RW	KD	242	137	Female	1		
Nares River	11-Jul-18	1-9	124	RW	KD	230	109.5	Male	1		
Nares River	11-Jul-18	1-9	r14	RW	RG	209					
Nares River	11-Jul-18	1-9	r15	LW	RP	405					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-9	r16	RW	RG	256					
Nares River	11-Jul-18	1-9	r17	RW	RG	196					
Nares River	11-Jul-18	1-9	R18	LSU	RG	175					
Nares River	11-Jul-18	1-9	R19	RW	RG	330					
Nares River	11-Jul-18	1-9	R20	RW	RG	212					
Nares River	11-Jul-18	1-9	R21	RW	RG	390					
Nares River	11-Jul-18	1-9	R22	RW	RG	235					
Nares River	11-Jul-18	1-9	R23	RW	RP	265					
Nares River	11-Jul-18	1-9	R24	RW	RP	205					
Nares River	11-Jul-18	1-9	R25	RW	RP	215					
Nares River	11-Jul-18	1-9	R26	RW	RP	220					
Nares River	11-Jul-18	1-10	125	CS	KS	156	33.5	Female	3	2	
Nares River	11-Jul-18	1-10	126	CS	KS	176	58.5	Male	3	3	
Nares River	11-Jul-18	1-10	127	CS	KS	171	47.5	Female	3	2	
Nares River	11-Jul-18	1-10	128	CS	KS	170	54	Female	3	3	
Nares River	11-Jul-18	1-10	129	CS	KS	181	62	Female	3	2	
Nares River	11-Jul-18	1-10	130	CS	KS	188	71	Male	3	3	
Nares River	11-Jul-18	1-10	131	CS	KD	260	166	Male	3	4	
Nares River	11-Jul-18	1-10	132	CS	KD	174	50	Male	3	3	
Nares River	11-Jul-18	1-10	133	CS	KD	189	71.5	Male	3	3	
Nares River	11-Jul-18	1-10	134	CS	KD	179	59.5	Male	3	2	
Nares River	11-Jul-18	1-10	135	CS	KD	178	56	Female	3	3	
Nares River	11-Jul-18	1-10	136	CS	KD	171	50.5	Female	3	2	
Nares River	11-Jul-18	1-10	137	CS	KD	171	47	Female	3	2	
Nares River	11-Jul-18	1-10	138	CS	KD	195	79	Female	3	3	
Nares River	11-Jul-18	1-10	139	CS	KD	190	68.5	Female	3	3	
Nares River	11-Jul-18	1-10	140	CS	KD	177	55	Female	3	3	
Nares River	11-Jul-18	1-10	141	CS	KD	173	50	Female	3	2	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-10	142	CS	KD	176	55.5	Female	3	3	
Nares River	11-Jul-18	1-10	143	CS	KD	181	60	Male	3	3	
Nares River	11-Jul-18	1-10	144	CS	KD	176	51	Female	3	3	
Nares River	11-Jul-18	1-10	145	CS	KD	177	60.5	Female	3	3	
Nares River	11-Jul-18	1-10	146	CS	KD	168	48	Female	3	2	
Nares River	11-Jul-18	1-10	147	CS	KD	177	56.5	Male	3	2	
Nares River	11-Jul-18	1-10	148	CS	KD	182	58.5	Female	3	3	
Nares River	11-Jul-18	1-10	149	CS	KD	166	51.5	Female	3	2	
Nares River	11-Jul-18	1-10	150	RW	KD	242	137	Female	1		
Nares River	11-Jul-18	1-10	151	CS	KD	168	45	Female	3	3	
Nares River	11-Jul-18	1-10	152	CS	KD	183	64	Male	3	3	
Nares River	11-Jul-18	1-10	153	CS	KD	164	46	Female	3	2	
Nares River	11-Jul-18	1-10	154	CS	KD	173	49.5	Female	3	3	
Nares River	11-Jul-18	1-10	155	CS	KD	162	42	Female	3	2	
Nares River	11-Jul-18	1-10	156	CS	KD	185	56.5	Female	3	2	
Nares River	11-Jul-18	1-10	157	CS	KD	174	53.5	Female	3	3	
Nares River	11-Jul-18	1-10	158	CS	KD	190	65.5	Female	3	3	
Nares River	11-Jul-18	1-10	159	CS	KD	162	41	Male	3	3	
Nares River	11-Jul-18	1-10	160	CS	KD	185	65.5	Male	3	3	
Nares River	11-Jul-18	1-10	161	CS	KD	179	58	Female	3	3	
Nares River	11-Jul-18	1-10	162	CS	KD	213	81.5	Female	3	3	
Nares River	11-Jul-18	1-10	163	CS	KD	149	33.5	Male	3	2	
Nares River	11-Jul-18	1-10	164	CS	KD	177	54	Female	3	3	
Nares River	11-Jul-18	1-10	165	CS	KD	158	35.5	Male	2	2	
Nares River	11-Jul-18	1-10	166	CS	KD	163	40.5	Female	3	3	
Nares River	11-Jul-18	1-10	167	CS	KD	176	56	Male	3	3	
Nares River	11-Jul-18	1-10	168	CS	KD	190	72	Female	3	3	
Nares River	11-Jul-18	1-10	169	CS	KD	187	62.5	Female	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-10	170	RW	KD	195	63				
Nares River	11-Jul-18	1-10	171	CS	KD	170	40.5	Male	3	3	
Nares River	11-Jul-18	1-10	172	CS	KD	166	48.5	Female	3	3	
Nares River	11-Jul-18	1-10	173	CS	KS	156	35.5	Female	3	2	
Nares River	11-Jul-18	1-10	174	CS	KS	167	50	Female	3	3	
Nares River	11-Jul-18	1-10	175	CS	KS	211	97	Female	3	4	
Nares River	11-Jul-18	1-10	176	CS	KS	177	57.5	Female	3	3	
Nares River	11-Jul-18	1-10	177	CS	KS	173	55	Female	3	3	
Nares River	11-Jul-18	1-10	178	CS	KS	171	52.5	Male	2	2	
Nares River	11-Jul-18	1-10	179	CS	KS	162	39.5	Female	3	2	
Nares River	11-Jul-18	1-10	180	CS	KD	177	57	Male	3	3	
Nares River	11-Jul-18	1-10	181	CS	KD	156	40.5	Male	3	2	
Nares River	11-Jul-18	1-10	182	CS	KD	188	69.5	Female	3	3	
Nares River	11-Jul-18	1-10	183	CS	KD	173	50.5	Male	3	2	
Nares River	11-Jul-18	1-10	184	CS	KD	190	70	Male	3	3	
Nares River	11-Jul-18	1-10	185	CS	KD	166	44	Female	3	3	
Nares River	11-Jul-18	1-10	186	CS	KD	176	62	Male	3	3	
Nares River	11-Jul-18	1-10	187	CS	KD	172	51	Female	3	2	
Nares River	11-Jul-18	1-10	188	CS	KD	169	43	Male	3	3	
Nares River	11-Jul-18	1-10	189	CS	KD	188	66	Male	3	3	
Nares River	11-Jul-18	1-10	190	CS	KD	183	69.5	Male	3	3	
Nares River	11-Jul-18	1-10	191	CS	KD	175	62	Female	3	3	
Nares River	11-Jul-18	1-10	192	CS	KD	183	63.5	Female	3	3	
Nares River	11-Jul-18	1-10	193	CS	KD	189	72	Female	3	3	
Nares River	11-Jul-18	1-10	194	CS	KD	149	33.5	Female	2	2	
Nares River	11-Jul-18	1-10	195	CS	KD	154	35.5	Female	3	2	
Nares River	11-Jul-18	1-10	196	CS	KD	175	51	Female	3	3	
Nares River	11-Jul-18	1-10	197	CS	KD	170	51	Male	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-10	198	CS	KD	172	54.5	Female	3	2	
Nares River	11-Jul-18	1-10	199	CS	KD	165	47.5	Male	3	3	
Nares River	11-Jul-18	1-10	200	CS	KD	184	62	Female	3	2	
Nares River	11-Jul-18	1-10	201	CS	KD	190	72.5	Female	3	3	
Nares River	11-Jul-18	1-10	202	CS	KD	160	44.5	Female	3	2	
Nares River	11-Jul-18	1-10	203	CS	KD	176	56.5	Male	3	3	
Nares River	11-Jul-18	1-10	204	RW	KD	276	198.5	Female	2		
Nares River	11-Jul-18	1-10	R27	RW	RP	120					
Nares River	11-Jul-18	1-10	R28	RW	RG	125					
Nares River	11-Jul-18	1-10	R29	RW	RP	145					
Nares River	11-Jul-18	1-10	R30	RW	RG	135					
Nares River	11-Jul-18	1-10	R31	RW	RG	128					
Nares River	11-Jul-18	1-10	R32	RW	RG	128					
Nares River	11-Jul-18	1-10	R33	RW	RG	210					
Nares River	11-Jul-18	1-10	R34	RW	RG	375					
Nares River	11-Jul-18	1-10	R35	LT	RG	340					
Nares River	11-Jul-18	1-10	R36	LSU	RG	144					
Nares River	11-Jul-18	1-10	R37	RW	RP	208					
Nares River	11-Jul-18	1-11	205	CS	KS	123	17.5	Male	1	1	
Nares River	11-Jul-18	1-11	206	CS	KS	165	50.5	Female	3	2	
Nares River	11-Jul-18	1-11	207	CS	KS	148	33.5	Female	3	2	
Nares River	11-Jul-18	1-11	208	CS	KS	154	33	Male	3	3	
Nares River	11-Jul-18	1-11	209	CS	KD	150	36	Female	3	2	
Nares River	11-Jul-18	1-11	210	CS	KD	128	21.5				
Nares River	11-Jul-18	1-11	211	CS	KD	132	24.5	Male	2	1	
Nares River	11-Jul-18	1-11	212	CS	KD	159	42	Male	3	2	
Nares River	11-Jul-18	1-11	213	CS	KS	166	46	Female	3	2	
Nares River	11-Jul-18	1-11	214	CS	KS	186	69	Male	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-11	215	CS	KS	182	62.5	Male	3	3	
Nares River	11-Jul-18	1-11	216	CS	KS	180	63	Female	3	3	
Nares River	11-Jul-18	1-11	217	CS	KD	179	55	Male	3	2	
Nares River	11-Jul-18	1-11	218	CS	KD	186	66.5	Female	3	3	
Nares River	11-Jul-18	1-11	219	CS	KD	167	48	Female	3	2	
Nares River	11-Jul-18	1-11	220	CS	KD	170	42.5	Male	3	3	
Nares River	11-Jul-18	1-11	221	CS	KD	174	54	Male	3	3	
Nares River	11-Jul-18	1-11	222	CS	KD	185	56	Male	3	3	
Nares River	11-Jul-18	1-11	223	CS	KD	153	33	Female	3	2	
Nares River	11-Jul-18	1-11	224	CS	KD	162	38.5	Male	3	2	
Nares River	11-Jul-18	1-11	225	CS	KD	162	40	Male	3	3	
Nares River	11-Jul-18	1-11	226	CS	KD	179	64.5	Female	3	3	
Nares River	11-Jul-18	1-11	227	CS	KD	169	51.5	Female	3	2	
Nares River	11-Jul-18	1-11	228	CS	KD	186	72	Female	3	3	
Nares River	11-Jul-18	1-11	229	CS	KS	180	59	Female	3	3	
Nares River	11-Jul-18	1-11	230	CS	KS	173	57.5	Male	3	3	
Nares River	11-Jul-18	1-11	231	CS	KS	176	56.5	Female	3	3	
Nares River	11-Jul-18	1-11	232	CS	KS	171	55.5	Female	3	3	
Nares River	11-Jul-18	1-11	233	CS	KS	179	61.5	Female	3	3	
Nares River	11-Jul-18	1-11	234	CS	KD	182	62.5	Female	3	2	
Nares River	11-Jul-18	1-11	235	CS	KD	182	60	Female	3	3	
Nares River	11-Jul-18	1-11	236	CS	KD	251	158.5	Female	3	4	
Nares River	11-Jul-18	1-11	237	CS	KD	229	121.5	Male	3	4	
Nares River	11-Jul-18	1-11	238	CS	KD	164	49.5	Female	3	3	
Nares River	11-Jul-18	1-11	239	CS	KD	180	60	Male	3	3	
Nares River	11-Jul-18	1-11	240	CS	KD	181	63.5	Female	3	3	
Nares River	11-Jul-18	1-11	241	CS	KD	167	50.5	Female	3	2	
Nares River	11-Jul-18	1-11	242	CS	KD	172	51.5	Female	3	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-11	243	CS	KD	180	62.5	Female	3	3	
Nares River	11-Jul-18	1-11	244	CS	KD	163	46.5	Female	3	3	
Nares River	11-Jul-18	1-11	245	CS	KD	170	51.5	Female	3	3	
Nares River	11-Jul-18	1-11	246	CS	KD	172	53	Female	3	3	
Nares River	11-Jul-18	1-11	247	CS	KD	164	45	Female	3	3	
Nares River	11-Jul-18	1-11	248	CS	KD	172	56.5	Male	3	2	
Nares River	11-Jul-18	1-11	249	CS	KD	180	62	Female	3	2	
Nares River	11-Jul-18	1-11	250	CS	KD	186	70	Male	3	3	
Nares River	11-Jul-18	1-11	251	CS	KD	183	65.5	Female	3	3	
Nares River	11-Jul-18	1-11	252	CS	KD	182	63	Female	3	2	
Nares River	11-Jul-18	1-11	253	CS	KD	174	55	Female	3	2	
Nares River	11-Jul-18	1-11	254	CS	KD	172	50	Male	3	2	
Nares River	11-Jul-18	1-11	255	CS	KD	193	66.5	Male	3	3	
Nares River	11-Jul-18	1-11	256	CS	KD	165	46.5	Female	3	3	
Nares River	11-Jul-18	1-11	257	CS	KD	166	42	Female	3	3	
Nares River	11-Jul-18	1-11	258	CS	KD	185	66	Female	3	3	
Nares River	11-Jul-18	1-11	259	CS	KD	185	66.5	Female	3	3	
Nares River	11-Jul-18	1-11	260	CS	KD	185	62	Male	3	3	
Nares River	11-Jul-18	1-11	261	CS	KD	186	64	Female	3	3	
Nares River	11-Jul-18	1-11	262	CS	KD	201	83	Male	3	3	
Nares River	11-Jul-18	1-11	263	CS	KD	177	57	Female	3	3	
Nares River	11-Jul-18	1-11	264	CS	KD	187	71	Female	3	3	
Nares River	11-Jul-18	1-11	265	CS	KD	183	66	Female	3	3	
Nares River	11-Jul-18	1-11	266	CS	KD	166	52	Female	3	3	
Nares River	11-Jul-18	1-11	267	CS	KD	200	68	Male	3	4	
Nares River	11-Jul-18	1-12	268	RW	KD	349	398	Male	3		
Nares River	11-Jul-18	1-12	269	RW	KD	282	227	Female	2		
Nares River	11-Jul-18	1-12	270	RW	KD	264	208	Female	2		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	11-Jul-18	1-12	271	RW	KD	293	237	Female	2		
Nares River	11-Jul-18	1-12	R38	LSU	RG	165					
Nares River	11-Jul-18	1-12	R39	RW	RG	340					
Nares River	11-Jul-18	1-12	R40	LSU	RG	280					
Nares River	11-Jul-18	1-12	R41	RW	RG						
Nares River	30-Aug-18	2-1	272	RW	KD	73					
Nares River	30-Aug-18	2-2	273	RW	KD	71					
Nares River	30-Aug-18	2-2	274	CS	RG	179					
Nares River	30-Aug-18	2-3	277	NP	KD	120					
Nares River	30-Aug-18	2-4	278	RW	RG	75					
Nares River	30-Aug-18	2-4	279	RW	RG	73					
Nares River	30-Aug-18	2-4	280	RW	RG	92					
Nares River	30-Aug-18	2-4	281	RW	RG	104					
Tagish River	30-Aug-18	2-7	282	LW	RG	95					
Tagish River	30-Aug-18	2-7	283	LW	RG	94					
Tagish River	30-Aug-18	2-8	284	RW	RG	229					
Tagish River	30-Aug-18	2-8	285	RW	RG	100					
Tagish River	30-Aug-18	2-8	286	LW	RG	92					
Tagish River	30-Aug-18	2-8	287	RW	RG	101					
Tagish River	30-Aug-18	2-8	288	RW	RG	99					
Tagish River	30-Aug-18	2-8	289	RW	RG	99					
Tagish River	30-Aug-18	2-9	290	RW	RG	96					
Tagish River	30-Aug-18	2-10	291	LW	RG	92					
Tagish River	30-Aug-18	2-10	292	LW	RG	102					
Tagish River	30-Aug-18	2-10	293	LW	RG	98					
Tagish River	30-Aug-18	2-10	294	RW	RG	100					
Tagish River	30-Aug-18	2-10	295	LW	RG	82					
Tagish River	30-Aug-18	2-10	296	LW	RG	91					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	30-Aug-18	2-10	296	RW	RG	99					
Tagish River	30-Aug-18	2-12	298	RW	KD	80					
Tagish River	30-Aug-18	2-12	299	GR	RG	93					
Tagish River	30-Aug-18	2-12	300	CS	KD	95			1		
Tagish River	30-Aug-18	2-12	301	CS	KS	88			1		
Tagish River	30-Aug-18	2-12	302	CS	KS	101			1		
Tagish River	30-Aug-18	2-12	303	CS	KS	90			1		
Tagish River	30-Aug-18	2-12	304	CS	KS	88			1		
Tagish River	30-Aug-18	2-12	305	CS	KS	86			1		
Nares River	30-Aug-18	3-1	300	CS	RP	108					
Nares River	30-Aug-18	3-1	301	RW	KD	170		Male	1		
Nares River	30-Aug-18	3-1	302	RW	KD	315		Male	3		
Nares River	30-Aug-18	3-3	303	RW	KD	163					

Notes:
Fish species codes as follows: CS – least cisco, LSU – longnose sucker, LT – lake trout, LW – lake whitefish, NP – northern pike, RW – round whitefish, GR – Arctic grayling.
Conditions codes as follows: KD – killed (retrieved dead), KS – killed (retrieved alive and sacrificed), RG – released (good), RP – released (poor).
Sex and maturity codes as follows: M – male, F – female, U – unknown; 1 – immature, 2 – mature/resting (will not spawn this year), 3 – mature/spawner (will spawn this year), 4 – ripe, 5 – spent.

Table B5. Fall targeted small mesh gillnetting fish capture data.

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	20-Sep-18	3-1	R10	RW	RG	220					
Nares River	20-Sep-18	3-1	R11	RW	RG	232					
Nares River	20-Sep-18	3-1	R12	RW	RG	245					
Nares River	20-Sep-18	3-1	R13	RW	RG	228					
Nares River	20-Sep-18	3-1	R14	RW	RG	208					
Nares River	20-Sep-18	3-1	R15	RW	RG	192					
Nares River	20-Sep-18	3-1	R16	RW	RG	220					
Nares River	20-Sep-18	3-1	R17	RW	RG	223					
Nares River	20-Sep-18	3-1	R18	RW	RG	228					
Nares River	20-Sep-18	3-1	R19	RW	RG	240					
Nares River	20-Sep-18	3-1	R20	RW	RG	188					
Nares River	20-Sep-18	3-1	R21	RW	RG	215					
Nares River	20-Sep-18	3-1	R22	RW	RG	224					
Nares River	20-Sep-18	3-1	R23	RW	RG	340					
Nares River	20-Sep-18	3-1	R24	RW	RG	210					
Nares River	20-Sep-18	3-1	R25	RW	RG	186					
Nares River	20-Sep-18	3-1	R26	RW	RG	225					
Nares River	20-Sep-18	3-1	R27	RW	RG	188					
Nares River	20-Sep-18	3-1	R28	RW	RG	240					
Nares River	20-Sep-18	3-1	R29	RW	RG	193					
Nares River	20-Sep-18	3-1	R30	RW	RG	182					
Nares River	20-Sep-18	3-1	R31	RW	RG	235					
Nares River	20-Sep-18	3-1	R32	RW	RG	204					
Nares River	20-Sep-18	3-1	R33	RW	RG	235					
Nares River	20-Sep-18	3-1	R34	RW	RG	245					
Nares River	20-Sep-18	3-1	R35	RW	RG	182					
Nares River	20-Sep-18	3-1	R36	RW	RG	228					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	20-Sep-18	3-1	R37	RW	RG	177					
Nares River	20-Sep-18	3-1	R38	RW	RG	183					
Nares River	20-Sep-18	3-1	R39	RW	RG	190					
Nares River	20-Sep-18	3-1	R40	RW	RG	172					
Nares River	20-Sep-18	3-1	R41	RW	RG	199					
Nares River	20-Sep-18	3-1	R42	RW	RG	195					
Nares River	20-Sep-18	3-1	R43	RW	RG	240					
Nares River	20-Sep-18	3-1	R44	RW	RG	165					
Nares River	20-Sep-18	3-1	R45	RW	RG	114					
Nares River	20-Sep-18	3-1	R46	RW	RP	348					
Nares River	20-Sep-18	3-2	R47	RW	RG	195					
Nares River	20-Sep-18	3-2	R48	GR	RG	168					
Nares River	20-Sep-18	3-2	R49	GR	RG	180					
Nares River	20-Sep-18	3-2	R50	RW	RG	246					
Nares River	20-Sep-18	3-2	R51	RW	RG	160					
Nares River	20-Sep-18	3-2	R52	RW	RG	188					
Nares River	20-Sep-18	3-2	R53	RW	RG	165					
Nares River	20-Sep-18	3-2	R54	RW	RP	175					
Nares River	20-Sep-18	3-3	R55	RW	RG	344					
Nares River	20-Sep-18	3-3	R56	RW	RG	190					
Nares River	20-Sep-18	3-4	R57	RW	RG	270					
Nares River	20-Sep-18	3-4	R58	RW	RG	295					
Nares River	20-Sep-18	3-5	R59	LT	RG	562					
Nares River	20-Sep-18	3-5	R60	RW	RG	272					
Nares River	20-Sep-18	3-5	R61	RW	RG	315					
Nares River	20-Sep-18	3-5	R62	RW	RG	345					
Nares River	20-Sep-18	3-6	R63	LT	RG	460					
Tagish River	20-Sep-18	3-10	R64	RW	RG	183					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	20-Sep-18	3-11	R65	RW	RG	316					
Tagish River	20-Sep-18	3-11	R66	RW	RP	245					
Tagish River	20-Sep-18	3-12	R67	RW	RG	300					
Tagish River	20-Sep-18	3-14	305	CS	RP	176					
Tagish River	20-Sep-18	3-14	306	CS	RP	188		Female	4		
Tagish River	20-Sep-18	3-14	307	CS	RG	194		Male	4		
Tagish River	20-Sep-18	3-14	308	CS	RG	187		Female	4		
Tagish River	20-Sep-18	3-14	309	CS	RG	161		Male	4		
Tagish River	20-Sep-18	3-14	310	CS	RG	178		Female	4		
Tagish River	20-Sep-18	3-14	311	CS	RG	158		Male	4		
Tagish River	20-Sep-18	3-14	312	CS	RG	194		Female	4		
Tagish River	20-Sep-18	3-14	313	CS	RG	164		Male	4		
Tagish River	20-Sep-18	3-14	314	CS	RG	186		Female	4		
Tagish River	20-Sep-18	3-14	315	CS	RG	171		Male	4		
Tagish River	20-Sep-18	3-14	316	CS	RG	171		Female	4		
Tagish River	20-Sep-18	3-14	317	CS	RG	184		Female	4		
Tagish River	20-Sep-18	3-14	318	CS	RG	182		Female	4		
Tagish River	20-Sep-18	3-14	319	CS	RG	183		Female	4		
Tagish River	20-Sep-18	3-14	320	CS	RG	190		Female	4		
Tagish River	20-Sep-18	3-14	321	CS	RG	191		Female	4		
Tagish River	20-Sep-18	3-14	322	CS	KD	170		Female	4	2	2
Tagish River	20-Sep-18	3-14	323	CS	KD	188		Female	4	3	3
Tagish River	20-Sep-18	3-14	324	CS	KD	188		Female	4	3	3
Tagish River	20-Sep-18	3-14	R68	RW	RG	174					
Tagish River	20-Sep-18	3-15	R69	RW	RP	315					
Tagish River	20-Sep-18	3-15	R70	RW	RG	395					
Tagish River	20-Sep-18	3-16	325	CS	RG	181		Male	4		
Tagish River	20-Sep-18	3-16	326	CS	RG	168		Male	4		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	20-Sep-18	3-16	327	CS	RG	196		Female	4		
Tagish River	20-Sep-18	3-16	328	CS	RG	169		Male	4		
Tagish River	20-Sep-18	3-16	329	CS	RG	181		Male	4		
Tagish River	20-Sep-18	3-16	330	CS	RG	188		Female	4		
Tagish River	20-Sep-18	3-16	331	CS	RG	176		Female	4		
Tagish River	20-Sep-18	3-16	332	CS	RG	177		Male	4		
Tagish River	20-Sep-18	3-16	333	CS	RG	163		Male	4		
Tagish River	20-Sep-18	3-16	334	CS	RG	179		Female	4		
Tagish River	20-Sep-18	3-16	335	CS	RG	191		Female	4		
Tagish River	20-Sep-18	3-16	336	CS	RG	191		Male	4		
Tagish River	20-Sep-18	3-16	337	CS	RG	165		Female	4		
Tagish River	20-Sep-18	3-16	338	CS	RG	172		Female	4		
Tagish River	20-Sep-18	3-16	339	CS	RG	168		Female	4		
Tagish River	20-Sep-18	3-16	340	CS	RG	177		Female	4		
Tagish River	20-Sep-18	3-16	341	CS	RG	150		Male	4		
Tagish River	20-Sep-18	3-16	342	CS	RG	173		Male	4		
Tagish River	20-Sep-18	3-16	343	CS	RG	172		Female	4		
Tagish River	20-Sep-18	3-16	344	CS	RG	180		Male	4		
Tagish River	20-Sep-18	3-16	345	CS	RG	172		Female	4		
Tagish River	20-Sep-18	3-16	346	CS	RG	171		Male	4		
Tagish River	20-Sep-18	3-16	347	CS	RG	163		Female	4		
Tagish River	20-Sep-18	3-16	348	CS	RG	152		Male	4		
Tagish River	20-Sep-18	3-16	349	CS	KD	190		Female	4	3	
Tagish River	20-Sep-18	3-16	350	CS	KD	172		Male	4	2	
Tagish River	20-Sep-18	3-16	351	CS	KD	168		Female	4	2	
Tagish River	20-Sep-18	3-16	352	CS	KD	150		Male	4	1	
Tagish River	20-Sep-18	3-16	353	CS	KD	178		Female	4	3	
Tagish River	20-Sep-18	3-16	354	CS	KD	182		Female	4	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	20-Sep-18	3-16	355	CS	KD	161		Female	4	2	
Tagish River	20-Sep-18	3-16	356	RW	KD	215					
Tagish River	20-Sep-18	3-16	357	RW	KD	212					
Tagish River	20-Sep-18	3-16	R71	RW	RG	324					
Tagish River	20-Sep-18	3-16	R72	RW	RP	340					
Tagish River	20-Sep-18	3-16	R73	RW	RG	180					
Tagish River	20-Sep-18	3-16	R74	GR	RG	174					
Tagish River	20-Sep-18	3-17	358	GR	KD	234					
Tagish River	20-Sep-18	3-17	R75	RW	RG	330					
Tagish River	20-Sep-18	3-17	R76	RW	RG	275					
Tagish River	20-Sep-18	3-17	R77	RW	RG	280					
Tagish River	20-Sep-18	3-17	R78	RW	RG	255					
Tagish River	20-Sep-18	3-17	R79	GR	RG	232					
Tagish River	20-Sep-18	3-17	R80	GR	RG	184					
Tagish River	20-Sep-18	3-18	359	RW	KD	185					
Tagish River	20-Sep-18	3-18	360	RW	KD	180					
Tagish River	20-Sep-18	3-18	R81	RW	RG	183					
Tagish River	20-Sep-18	3-18	R82	LT	RG	495					
Tagish River	20-Sep-18	3-18	R83	RW	RP	170					
Tagish River	20-Sep-18	3-19	R84	RW	RP	315					
Tagish River	26-Sep-18	4-1	400	LT	RG	565					
Tagish River	26-Sep-18	4-1	401	CS	KD	166		Female	4	2	
Tagish River	26-Sep-18	4-1	402	CS	KD	175		Female	4	2	
Tagish River	26-Sep-18	4-1	403	CS	KD	170		Female	4	2	
Tagish River	26-Sep-18	4-1	404	GR	KD	231		Female	1		
Tagish River	26-Sep-18	4-1	405	CS	RG	194		Female	4		
Tagish River	26-Sep-18	4-1	406	CS	RG	200		Female	4		
Tagish River	26-Sep-18	4-1	407	CS	RG	194		Female	4		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	26-Sep-18	4-2	408	CS	RG	128					
Tagish River	26-Sep-18	4-2	409	CS	RG	133		Male	4		
Tagish River	26-Sep-18	4-2	410	CS	RG	130					
Tagish River	26-Sep-18	4-2	411	RW	RP	184					
Tagish River	26-Sep-18	4-4	412	CS	KD	163		Female	4	2	
Tagish River	26-Sep-18	4-4	413	CS	KD	152		Male	4	1	
Tagish River	26-Sep-18	4-4	414	CS	KD	172		Male	4	2	
Tagish River	26-Sep-18	4-4	415	CS	KD	170		Female	4	2	
Tagish River	26-Sep-18	4-4	416	CS	KD	179		Female	4	2	
Tagish River	26-Sep-18	4-4	417	CS	KD	186		Male	4	3	
Tagish River	26-Sep-18	4-4	418	CS	KD	174		Female	4	2	
Tagish River	26-Sep-18	4-4	419	CS	KD	151		Male	4	2	
Tagish River	26-Sep-18	4-4	420	CS	KD	168		Female	4	2	
Tagish River	26-Sep-18	4-4	421	CS	RG	184		Female	4		
Tagish River	26-Sep-18	4-4	422	CS	RG	180		Female	4		
Tagish River	26-Sep-18	4-4	423	CS	RG	141		Male	4		
Tagish River	26-Sep-18	4-4	424	CS	RG	168		Female	4		
Tagish River	26-Sep-18	4-4	425	RW	RG	200					
Tagish River	26-Sep-18	4-4	426	CS	RG	174		Female	4		
Tagish River	26-Sep-18	4-4	427	CS	RG	176		Male	4		
Tagish River	26-Sep-18	4-4	428	CS	RG	150					
Tagish River	26-Sep-18	4-4	429	CS	RG	179		Male	4		
Tagish River	26-Sep-18	4-4	430	CS	RG	140		Male	4		
Tagish River	26-Sep-18	4-5	431	RW	RG	370					
Tagish River	26-Sep-18	4-5	432	RW	RG	239					
Tagish River	26-Sep-18	4-5	433	RW	RG	264					
Tagish River	26-Sep-18	4-5	434	RW	RG	290					
Tagish River	26-Sep-18	4-5	435	RW	RG	322					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	26-Sep-18	4-5	436	RW	RG	315					
Tagish River	26-Sep-18	4-5	437	RW	RG	255					
Tagish River	26-Sep-18	4-5	438	RW	RG	250					
Tagish River	26-Sep-18	4-5	439	RW	RG	344					
Tagish River	26-Sep-18	4-5	440	RW	RG	328					
Tagish River	26-Sep-18	4-5	441	RW	RG	326					
Tagish River	26-Sep-18	4-5	442	RW	RG	255					
Tagish River	26-Sep-18	4-5	443	RW	RG	288					
Tagish River	26-Sep-18	4-5	444	RW	RG	255					
Tagish River	26-Sep-18	4-5	445	RW	RG	295					
Tagish River	26-Sep-18	4-5	446	RW	RG	300					
Tagish River	26-Sep-18	4-5	447	RW	RP	285					
Tagish River	26-Sep-18	4-5	448	RW	RP	302					
Tagish River	26-Sep-18	4-5	449	RW	KD	252		Male	1		
Tagish River	26-Sep-18	4-5	450	RW	KD	339		Female	3		
Tagish River	26-Sep-18	4-5	451	RW	KD	256		Male	3		
Tagish River	26-Sep-18	4-6	452	RW	RG	332					
Tagish River	26-Sep-18	4-6	453	CS	RG	176					
Tagish River	26-Sep-18	4-6	454	CS	RG	200					
Tagish River	26-Sep-18	4-6	455	RW	RG	181					
Tagish River	26-Sep-18	4-6	456	CS	RG	148					
Tagish River	26-Sep-18	4-6	457	CS	RG	185					
Tagish River	26-Sep-18	4-6	458	CS	RG	159		Male	4		
Tagish River	26-Sep-18	4-6	459	RW	RG	185					
Tagish River	26-Sep-18	4-6	460	CS	RG	170					
Tagish River	26-Sep-18	4-6	461	CS	RG	173		Male	4		
Tagish River	26-Sep-18	4-6	462	RW	RG	175					
Tagish River	26-Sep-18	4-6	463	RW	RG	205					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Tagish River	26-Sep-18	4-6	464	RW	RG	205					
Tagish River	26-Sep-18	4-6	465	CS	RG	162					
Tagish River	26-Sep-18	4-6	466	CS	RG	180		Female	4		
Tagish River	26-Sep-18	4-6	467	RW	RG	176					
Tagish River	26-Sep-18	4-6	468	CS	RG	166		Female	4		
Tagish River	26-Sep-18	4-6	469	RW	RG	186					
Tagish River	26-Sep-18	4-6	470	LW	RG	136					
Tagish River	26-Sep-18	4-6	471	CS	KD	188		Female	4		
Tagish River	26-Sep-18	4-7	472	RW	RG	360					
Tagish River	26-Sep-18	4-7	473	RW	RG	250					
Tagish River	26-Sep-18	4-7	474	RW	RG	340					
Tagish River	26-Sep-18	4-7	475	RW	KD	345		Male	2		
Tagish River	26-Sep-18	4-7	476	RW	KD	277		Male	1		
Nares River	26-Sep-18	4-8	477	GR	RG	208					
Nares River	26-Sep-18	4-8	478	RW	KD	353		Male	3		
Nares River	26-Sep-18	4-9	479	RW	KD	174					
Nares River	26-Sep-18	4-9	480	RW	KD	238					
Nares River	26-Sep-18	4-9	481	RW	KD	241		Female	1		
Nares River	26-Sep-18	4-9	482	RW	KD	237			1		
Nares River	26-Sep-18	4-9	483	RW	KD	258		Female	1		
Nares River	26-Sep-18	4-9	484	RW	KD	249		Male	1		
Nares River	26-Sep-18	4-9	485	RW	KD	290		Male	1		
Nares River	26-Sep-18	4-9	486	CS	RG	169		Male	4		
Nares River	26-Sep-18	4-9	487	CS	RG	207		Female	4		
Nares River	26-Sep-18	4-9	488	CS	RG	194		Female	4		
Nares River	26-Sep-18	4-9	489	CS	RG	181		Female	4		
Nares River	26-Sep-18	4-9	490	CS	RG	178		Female	4		
Nares River	26-Sep-18	4-9	491	CS	RG	161		Female	4		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	26-Sep-18	4-9	492	CS	RG	169		Male	4		
Nares River	26-Sep-18	4-9	493	CS	RG	173		Male	4		
Nares River	26-Sep-18	4-9	494	CS	RG	181					
Nares River	26-Sep-18	4-9	495	CS	RG	195		Female	4		
Nares River	26-Sep-18	4-9	496	RW	RG	190					
Nares River	26-Sep-18	4-9	497	CS	RG	194		Female	4		
Nares River	26-Sep-18	4-9	498	CS	RG	171		Male	4		
Nares River	26-Sep-18	4-9	499	CS	RG	149		Female	4		
Nares River	26-Sep-18	4-9	500	CS	RG	180		Female	4		
Nares River	26-Sep-18	4-9	501	RW	RG	243					
Nares River	26-Sep-18	4-9	502	CS	RG	170		Female	4		
Nares River	26-Sep-18	4-9	503	CS	RG	183		Female	4		
Nares River	26-Sep-18	4-9	504	CS	RG	184		Male	4		
Nares River	26-Sep-18	4-9	505	CS	RG	179		Female	4		
Nares River	26-Sep-18	4-9	506	CS	RG	178		Female	4		
Nares River	26-Sep-18	4-9	507	RW	RG	173					
Nares River	26-Sep-18	4-9	508	CS	RG	179		Female	4		
Nares River	26-Sep-18	4-9	509	CS	RG	193		Female	4		
Nares River	26-Sep-18	4-9	510	RW	RG	222					
Nares River	26-Sep-18	4-9	511	GR	RG	191					
Nares River	26-Sep-18	4-9	512	CS	RG	198		Female	4		
Nares River	26-Sep-18	4-9	513	CS	RG	205		Female	4		
Nares River	26-Sep-18	4-9	514	CS	RG	190		Female	4		
Nares River	26-Sep-18	4-9	515	CS	RG	188		Female	4		
Nares River	26-Sep-18	4-9	516	CS	RG	180		Female	4		
Nares River	26-Sep-18	4-9	517	RW	RG	188					
Nares River	26-Sep-18	4-9	518	RW	RG	186					
Nares River	26-Sep-18	4-9	519	CS	RG	191		Female	4		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	26-Sep-18	4-9	520	CS	RG	192		Female	4		
Nares River	26-Sep-18	4-9	521	CS	RG	192		Female	4		
Nares River	26-Sep-18	4-9	522	RW	RG	190					
Nares River	26-Sep-18	4-9	523	CS	RG	185		Female	4		
Nares River	26-Sep-18	4-9	524	RW	RG	230					
Nares River	26-Sep-18	4-9	525	RW	RG	191					
Nares River	26-Sep-18	4-9	526	RW	RG	183					
Nares River	26-Sep-18	4-9	527	RW	RG	195					
Nares River	26-Sep-18	4-9	528	GR	RG	200					
Nares River	26-Sep-18	4-9	529	RW	RG	285					
Nares River	26-Sep-18	4-9	530	RW	RG	340					
Nares River	26-Sep-18	4-9	531	RW	RG	330					
Nares River	26-Sep-18	4-9	532	CS	RG	185		Female	4		
Nares River	26-Sep-18	4-9	533	CS	RG	176		Female	4		
Nares River	26-Sep-18	4-9	534	GR	RG	240					
Nares River	26-Sep-18	4-9	535	RW	RG	220					
Nares River	26-Sep-18	4-9	536	RW	RG	335					
Nares River	26-Sep-18	4-9	537	CS	KD	183		Female	5		
Nares River	26-Sep-18	4-9	538	CS	KD	165		Female	4	2	
Nares River	26-Sep-18	4-9	539	CS	KD	198		Female	4	3	
Nares River	26-Sep-18	4-9	540	CS	KD	183		Female	4	2	
Nares River	26-Sep-18	4-9	541	CS	KD	199		Female	4	2	
Nares River	26-Sep-18	4-9	542	CS	KD	172		Female	4	2	
Nares River	26-Sep-18	4-9	543	CS	KD	161		Male	2	2	
Nares River	26-Sep-18	4-9	544	CS	KD	186		Female	4	2	
Nares River	26-Sep-18	4-9	545	CS	KD	165		Male	4	2	
Nares River	26-Sep-18	4-9	546	CS	KD	165		Male	4	2	
Nares River	26-Sep-18	4-9	547	CS	KD	158		Female	4	2	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares River	26-Sep-18	4-9	548	CS	KD	170		Female	4	2	
Bennett Lake	26-Sep-18	4-11	549	CS	RG	180		Female	4		
Bennett Lake	26-Sep-18	4-11	550	CS	RG	189		Female	4		
Bennett Lake	26-Sep-18	4-11	551	CS	RG	181					
Bennett Lake	26-Sep-18	4-11	552	CS	RG	166		Male	4		
Bennett Lake	26-Sep-18	4-11	553	CS	RG	208		Female	4		
Bennett Lake	26-Sep-18	4-11	554	CS	RG	184		Female	4		
Bennett Lake	26-Sep-18	4-11	555	CS	RG	204		Female	4		
Bennett Lake	26-Sep-18	4-11	556	CS	RG	223		Male	4		
Bennett Lake	26-Sep-18	4-11	557	CS	RG	254		Male	4		
Bennett Lake	26-Sep-18	4-11	558	CS	RG	183		Female	4		
Bennett Lake	26-Sep-18	4-11	559	CS	RG	158		Female	4		
Bennett Lake	26-Sep-18	4-11	560	CS	RG	164		Female	4		
Bennett Lake	26-Sep-18	4-11	561	CS	RG	175		Female	4		
Bennett Lake	26-Sep-18	4-11	562	CS	RG	210		Female	4		
Bennett Lake	26-Sep-18	4-11	563	CS	RG	188		Female	4		
Bennett Lake	26-Sep-18	4-11	564	CS	RG	182		Male	4		
Bennett Lake	26-Sep-18	4-11	565	CS	RG	174		Female	4		
Bennett Lake	26-Sep-18	4-11	566	CS	RG	176		Male	4		
Bennett Lake	26-Sep-18	4-11	567	CS	RG	185					
Bennett Lake	26-Sep-18	4-11	568	CS	RG	199		Female	4		
Bennett Lake	26-Sep-18	4-11	569	CS	RG	184		Female	4		
Bennett Lake	26-Sep-18	4-11	570	CS	RG	183		Male	4		
Bennett Lake	26-Sep-18	4-11	571	CS	RG	214		Female	4		
Bennett Lake	26-Sep-18	4-11	572	CS	RG	172		Male	4		
Bennett Lake	26-Sep-18	4-11	573	CS	RG	188		Female	4		
Bennett Lake	26-Sep-18	4-11	574	CS	RG	170		Male	4		
Bennett Lake	26-Sep-18	4-11	575	CS	RG	169					

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Bennett Lake	26-Sep-18	4-11	576	CS	RG	204		Female	4		
Bennett Lake	26-Sep-18	4-11	577	CS	RG	175		Female	4		
Bennett Lake	26-Sep-18	4-11	578	CS	RG	189		Female	4		
Bennett Lake	26-Sep-18	4-11	579	CS	RG	181		Female	4		
Bennett Lake	26-Sep-18	4-11	580	CS	RG	195		Female	4		
Bennett Lake	26-Sep-18	4-11	581	CS	RG	192		Female	4		
Bennett Lake	26-Sep-18	4-11	582	CS	RG	196		Female	4		
Bennett Lake	26-Sep-18	4-11	583	CS	RG	181		Female	4		
Bennett Lake	26-Sep-18	4-11	584	CS	RG	153		Female	4		
Bennett Lake	26-Sep-18	4-11	585	CS	RG	157		Female	4		
Bennett Lake	26-Sep-18	4-11	586	CS	RG	176		Female	4		
Bennett Lake	26-Sep-18	4-11	587	CS	RG	188		Female	4		
Bennett Lake	26-Sep-18	4-11	588	CS	RG	193		Female	4		
Bennett Lake	26-Sep-18	4-11	589	CS	RG	175		Male	4		
Bennett Lake	26-Sep-18	4-11	590	CS	RG	162		Male	4		
Bennett Lake	26-Sep-18	4-11	591	CS	RG	204		Female	4		
Bennett Lake	26-Sep-18	4-11	592	CS	RG	172		Female	4		
Bennett Lake	26-Sep-18	4-11	593	CS	RG	168		Male	4		
Bennett Lake	26-Sep-18	4-11	594	CS	RG	190					
Bennett Lake	26-Sep-18	4-11	595	RW	RG	190					
Bennett Lake	26-Sep-18	4-11	596	RW	RG	370					
Bennett Lake	26-Sep-18	4-11	597	RW	RG	338					
Bennett Lake	26-Sep-18	4-11	598	GR	RG	362					
Bennett Lake	26-Sep-18	4-11	599	GR	RG	330					
Bennett Lake	26-Sep-18	4-11	600	GR	RG	350					
Bennett Lake	26-Sep-18	4-11	601	RW	RP	180					
Bennett Lake	26-Sep-18	4-11	602	CS	RG	198		Female	4		
Bennett Lake	26-Sep-18	4-11	603	CS	RG	186		Female	4		

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Bennett Lake	26-Sep-18	4-11	604	CS	RG	185		Female	4		
Bennett Lake	26-Sep-18	4-11	605	CS	RG	168		Female	4		
Bennett Lake	26-Sep-18	4-11	606	CS	RG	190		Male	4		
Bennett Lake	26-Sep-18	4-11	607	CS	RG	190		Female	4		
Bennett Lake	26-Sep-18	4-11	608	CS	RG	186		Female	4		
Bennett Lake	26-Sep-18	4-11	609	CS	RG	200					
Bennett Lake	26-Sep-18	4-11	610	CS	RG	202		Female	4		
Bennett Lake	26-Sep-18	4-11	611	CS	RG	163		Male	4		
Bennett Lake	26-Sep-18	4-11	612	CS	RG	183		Female	4		
Bennett Lake	26-Sep-18	4-11	613	CS	RG	168		Male	4		
Bennett Lake	26-Sep-18	4-11	614	CS	RG	187		Female	4		
Bennett Lake	26-Sep-18	4-11	615	CS	RG	179		Female	4		
Bennett Lake	26-Sep-18	4-11	616	CS	RG	193		Female	4		
Bennett Lake	26-Sep-18	4-11	617	CS	RG	179		Male	4		
Bennett Lake	26-Sep-18	4-11	618	CS	RG	154		Male	4		
Bennett Lake	26-Sep-18	4-11	631	RW	KD	180					
Bennett Lake	26-Sep-18	4-11	632	CS	KD	195		Male	4	3	3
Bennett Lake	26-Sep-18	4-11	633	CS	KD	190		Female	4	3	
Bennett Lake	26-Sep-18	4-11	634	CS	KD	182		Female	4	3	
Bennett Lake	26-Sep-18	4-11	635	CS	KD	180		Male	4	2	
Bennett Lake	26-Sep-18	4-11	636	CS	KD	206		Female	5	3	
Bennett Lake	26-Sep-18	4-11	637	CS	KD	162		Male	4	2	
Bennett Lake	26-Sep-18	4-11	638	CS	KD	170		Male	4	2	
Bennett Lake	26-Sep-18	4-11	639	RW	KD	250		Male	1		
Bennett Lake	26-Sep-18	4-11	640	CS	KD	199		Male	4	3	
Bennett Lake	26-Sep-18	4-11	641	CS	KD	140		Male	4	1	
Bennett Lake	26-Sep-18	4-11	642	CS	KD	196		Male	4	4	
Bennett Lake	26-Sep-18	4-11	643	CS	KD	170		Male	4	3	

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Bennett Lake	26-Sep-18	4-11	644	CS	KD	171		Male	4	2	
Bennett Lake	26-Sep-18	4-11	645	CS	KD	188		Female	4	3	
Bennett Lake	26-Sep-18	4-11	646	CS	KD	166		Male	4	2	
Bennett Lake	26-Sep-18	4-11	647	CS	KD	163		Male	4	2	
Bennett Lake	26-Sep-18	4-11	648	CS	KD	190		Male	4	3	
Bennett Lake	26-Sep-18	4-11	649	CS	KD	175		Female	4	2	
Bennett Lake	26-Sep-18	4-11	650	CS	KD	186		Male	4	3	
Bennett Lake	26-Sep-18	4-11	651	RW	KD	195			1		
Bennett Lake	26-Sep-18	4-12	619	CS	RG	168		Female	4		
Bennett Lake	26-Sep-18	4-12	620	CS	RG	142		Male	4		
Bennett Lake	26-Sep-18	4-12	621	CS	RG	189		Male	4		
Bennett Lake	26-Sep-18	4-12	622	CS	RG	162		Female	4		
Bennett Lake	26-Sep-18	4-12	623	CS	RG	182		Male	4		
Bennett Lake	26-Sep-18	4-12	624	CS	RG	174		Female	4		
Bennett Lake	26-Sep-18	4-12	625	CS	RG	189		Female	4		
Bennett Lake	26-Sep-18	4-12	626	RW	RG	195					
Bennett Lake	26-Sep-18	4-12	627	CS	KD	205		Female	4	3	
Bennett Lake	26-Sep-18	4-12	628	CS	KD	171		Male	4	2	2
Bennett Lake	26-Sep-18	4-12	629	CS	KD	198		Female	4	3	2
Bennett Lake	26-Sep-18	4-12	630	CS	KD	193		Male	4	3	3
Bennett Lake	26-Sep-18	4-12	R85	LT	RG	530		Female	4		

Notes:
Fish species codes as follows: CS – least cisco, LSU – longnose sucker, LT – lake trout, LW – lake whitefish, NP – northern pike, RW – round whitefish, GR – Arctic grayling.
Conditions codes as follows: KD – killed (retrieved dead), KS – killed (retrieved alive and sacrificed), RG – released (good), RP – released (poor).
Sex and maturity codes as follows: M – male, F – female, U – unknown; 1 – immature, 2 – mature/resting (will not spawn this year), 3 – mature/spawner (will spawn this year), 4 – ripe, 5 – spent

Table B6. Summer YOY targeted beach seining results.

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	11-Jul-18	S1-1	CCG	45	RG						
Nares Lake	11-Jul-18	S1-1	RW	42	RG						
Nares Lake	11-Jul-18	S1-1	GR	46	RG						
Nares Lake	11-Jul-18	S1-1	GR	35	RG						
Nares Lake	11-Jul-18	S1-1	RW	49	RG						
Nares Lake	11-Jul-18	S1-1	GR	48	RG						
Nares Lake	11-Jul-18	S1-1	GR	36	RG						
Nares Lake	11-Jul-18	S1-1	RW	37	RG						
Nares Lake	11-Jul-18	S1-1	GR	44	RG						
Nares Lake	11-Jul-18	S1-1	GR	51	RG						
Nares Lake	11-Jul-18	S1-1	RW	44	RG						
Nares Lake	11-Jul-18	S1-1	RW	46	RG						
Nares Lake	11-Jul-18	S1-1	RW	30	RG						
Nares Lake	11-Jul-18	S1-1	GR	40	RG						
Nares Lake	11-Jul-18	S1-1	GR	42	RG						
Nares Lake	11-Jul-18	S1-1	GR	42	RG						
Nares Lake	11-Jul-18	S1-1	RW	34	RG						
Nares Lake	11-Jul-18	S1-1	RW	44	RG						
Nares Lake	11-Jul-18	S1-1	RW	36	RG						
Nares Lake	11-Jul-18	S1-1	RW	34	RG						
Nares Lake	11-Jul-18	S1-1	RW	36	RG						
Nares Lake	11-Jul-18	S1-1	RW	34	RG						
Nares Lake	11-Jul-18	S1-1	GR	34	RG						
Nares Lake	11-Jul-18	S1-1	GR	42	RG						
Nares Lake	11-Jul-18	S1-1	RW	34	RG						
Nares Lake	11-Jul-18	S1-2	RW	128	RG						
Nares Lake	11-Jul-18	S1-2	RW	46	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	11-Jul-18	S1-2	GR	41	RG						
Nares Lake	11-Jul-18	S1-2	GR	42	RG						
Nares Lake	11-Jul-18	S1-2	GR	40	RG						
Nares Lake	11-Jul-18	S1-2	LSU	48	RG						
Nares Lake	11-Jul-18	S1-2	GR	47	RG						
Nares Lake	11-Jul-18	S1-2	GR	42	RG						
Nares Lake	11-Jul-18	S1-2	LW	52	RG						
Nares Lake	11-Jul-18	S1-2	GR	33	RG						
Nares Lake	11-Jul-18	S1-2	GR	42	RG						
Nares Lake	11-Jul-18	S1-2	GR	52	RG						
Nares Lake	11-Jul-18	S1-2	RW	29	RG						
Nares Lake	11-Jul-18	S1-2	RW	38	RG						
Nares Lake	11-Jul-18	S1-2	RW	34	RG						
Nares Lake	11-Jul-18	S1-2	GR	46	RG						
Nares Lake	11-Jul-18	S1-2	GR	45	RG						
Nares Lake	11-Jul-18	S1-2	GR	54	RG						
Nares Lake	11-Jul-18	S1-2	GR	38	RG						
Nares Lake	11-Jul-18	S1-3	LW	143	RG						
Nares Lake	11-Jul-18	S1-3	GR	38	RG						
Nares Lake	11-Jul-18	S1-3	GR	48	RG						
Nares Lake	11-Jul-18	S1-3	RW	29	RG						
Nares Lake	11-Jul-18	S1-3	GR	46	RG						
Nares Lake	11-Jul-18	S1-3	GR	41	RG						
Nares Lake	11-Jul-18	S1-3	RW	27	RG						
Nares Lake	11-Jul-18	S1-3	GR	37	RG						
Nares Lake	11-Jul-18	S1-3	GR	42	RG						
Nares Lake	11-Jul-18	S1-3	GR	42	RG						
Nares Lake	11-Jul-18	S1-4	GR	125	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	11-Jul-18	S1-4	RW	148	RG						
Nares Lake	11-Jul-18	S1-4	GR	38	RG						
Nares Lake	11-Jul-18	S1-4	GR	46	RG						
Nares Lake	11-Jul-18	S1-4	GR	49	RG						
Nares Lake	11-Jul-18	S1-4	GR	40	RG						
Nares Lake	11-Jul-18	S1-4	GR	42	RG						
Nares Lake	11-Jul-18	S1-4	GR	43	RG						
Nares Lake	11-Jul-18	S1-4	GR	49	RG						
Nares Lake	11-Jul-18	S1-4	GR	50	RG						
Nares Lake	11-Jul-18	S1-4	GR	53	RG						
Nares Lake	11-Jul-18	S1-4	GR	32	RG						
Nares Lake	11-Jul-18	S1-4	RW	44	RG						
Nares Lake	11-Jul-18	S1-4	GR	31	RG						
Nares Lake	11-Jul-18	S1-4	GR	49	RG						
Nares Lake	11-Jul-18	S1-4	LT	48	RG						
Nares Lake	11-Jul-18	S1-4	GR	48	RG						
Nares Lake	11-Jul-18	S1-4	GR	49	RG						
Nares Lake	11-Jul-18	S1-4	LT	42	RG						
Nares Lake	11-Jul-18	S1-4	LT	41	RG						
Nares Lake	11-Jul-18	S1-5	GR	114	RG						
Nares Lake	11-Jul-18	S1-5	GR	102	RG						
Nares Lake	11-Jul-18	S1-5	RW	33	RG						
Nares Lake	11-Jul-18	S1-5	GR	104	RG						
Nares Lake	11-Jul-18	S1-5	GR	42	RG						
Nares Lake	11-Jul-18	S1-5	GR	42	RG						
Nares Lake	11-Jul-18	S1-5	LT	44	RG						
Nares Lake	11-Jul-18	S1-5	GR	46	RG						
Nares Lake	11-Jul-18	S1-5	GR	45	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	11-Jul-18	S1-5	GR	44	RG						
Nares Lake	11-Jul-18	S1-5	GR	49	RG						
Nares Lake	11-Jul-18	S1-5	GR	44	RG						
Nares Lake	11-Jul-18	S1-5	GR	42	RG						
Nares Lake	11-Jul-18	S1-5	RW	37	RG						
Nares Lake	11-Jul-18	S1-5	RW	128	RG						
Nares Lake	11-Jul-18	S1-5	GR	118	RG						
Nares Lake	11-Jul-18	S1-5	GR	42	RG						
Nares Lake	11-Jul-18	S1-5	LSU	52	RG						
Nares Lake	11-Jul-18	S1-5	LW	59	RG						
Nares Lake	11-Jul-18	S1-5	CS	165	RG						
Nares Lake	29-Aug-18	S2-1	RW	76	RG						
Nares Lake	29-Aug-18	S2-1	RW	85	RG						
Nares Lake	29-Aug-18	S2-1	RW	69	RG						
Nares Lake	29-Aug-18	S2-1	LSU	49	RG						
Nares Lake	29-Aug-18	S2-1	RW	71	RG						
Nares Lake	29-Aug-18	S2-1	RW	78	RG						
Nares Lake	29-Aug-18	S2-1	RW	74	RG						
Nares Lake	29-Aug-18	S2-1	RW	88	RG						
Nares Lake	29-Aug-18	S2-1	RW	76	RG						
Nares Lake	29-Aug-18	S2-1	PW	42	RG						
Nares Lake	29-Aug-18	S2-1	RW	88	RG						
Nares Lake	29-Aug-18	S2-1	RW	52	RG						
Nares Lake	29-Aug-18	S2-1	GR	76	RG						
Nares Lake	29-Aug-18	S2-1	GR	78	RG						
Nares Lake	29-Aug-18	S2-1	LW	86	RG						
Nares Lake	29-Aug-18	S2-1	PW	41	RG						
Nares Lake	29-Aug-18	S2-1	PW	39	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	29-Aug-18	S2-1	PW	36	RG						
Nares Lake	29-Aug-18	S2-1	PW	34	RG						
Nares Lake	29-Aug-18	S2-1	GR	82	RG						
Nares Lake	29-Aug-18	S2-1	CS	84	KS						
Nares Lake	29-Aug-18	S2-1	CS	77	KS						
Nares Lake	29-Aug-18	S2-2	GR	67	RG						
Nares Lake	29-Aug-18	S2-2	RW	97	RG						
Nares Lake	29-Aug-18	S2-2	GR	87	RG						
Nares Lake	29-Aug-18	S2-2	RW	78	RG						
Nares Lake	29-Aug-18	S2-2	RW	82	RG						
Nares Lake	29-Aug-18	S2-2	RW	86	RG						
Nares Lake	29-Aug-18	S2-2	RW	74	RG						
Nares Lake	29-Aug-18	S2-2	GR	75	RG						
Nares Lake	29-Aug-18	S2-2	GR	82	RG						
Nares Lake	29-Aug-18	S2-2	LSU	49	RG						
Nares Lake	29-Aug-18	S2-2	RW	76	RG						
Nares Lake	29-Aug-18	S2-2	LSU	46	RG						
Nares Lake	29-Aug-18	S2-2	RW	53	RG						
Nares Lake	29-Aug-18	S2-2	RW	38	RG						
Nares Lake	29-Aug-18	S2-2	PW	41	RG						
Nares Lake	29-Aug-18	S2-2	PW	38	RG						
Nares Lake	29-Aug-18	S2-2	RW	42	RG						
Nares Lake	29-Aug-18	S2-2	CS	72	KS						
Nares Lake	29-Aug-18	S2-2	CS	78	KS						
Nares Lake	29-Aug-18	S2-3	PW	48	RG						
Nares Lake	29-Aug-18	S2-3	RW	47	RG						
Nares Lake	29-Aug-18	S2-3	RW	39	RG						
Nares Lake	29-Aug-18	S2-3	RW	32	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	29-Aug-18	S2-3	RW	50	RG						
Nares Lake	29-Aug-18	S2-3	LSU	48	RG						
Nares Lake	29-Aug-18	S2-3	LSU	39	RG						
Nares Lake	29-Aug-18	S2-3	LSU	41	RG						
Nares Lake	29-Aug-18	S2-3	CS	89	KS						
Nares Lake	29-Aug-18	S2-4	RW	46	RG						
Nares Lake	29-Aug-18	S2-5	RW	97	RG						
Nares Lake	29-Aug-18	S2-5	LSU	50	RG						
Nares Lake	29-Aug-18	S2-5	CCG	52	RG						
Nares Lake	29-Aug-18	S2-7	GR	98	RG						
Nares Lake	29-Aug-18	S2-7	RW	56	RG						
Nares Lake	29-Aug-18	S2-7	GR	64	RG						
Nares Lake	29-Aug-18	S2-7	RW	91	RG						
Nares Lake	29-Aug-18	S2-7	RW	39	RG						
Nares Lake	29-Aug-18	S2-7	RW	78	RG						
Nares Lake	29-Aug-18	S2-7	RW	82	RG						
Nares Lake	29-Aug-18	S2-7	GR	92	RG						
Nares Lake	29-Aug-18	S2-7	PW	36	RG						
Nares Lake	29-Aug-18	S2-7	GR	102	RG						
Nares Lake	29-Aug-18	S2-7	LW	84	RG						
Nares Lake	29-Aug-18	S2-7	RW	53	RG						
Nares Lake	29-Aug-18	S2-7	GR	82	RG						
Nares Lake	29-Aug-18	S2-7	RW	76	RG						
Nares Lake	29-Aug-18	S2-7	GR	78	RG						
Nares Lake	29-Aug-18	S2-7	GR	96	RG						
Nares Lake	29-Aug-18	S2-7	GR	96	RG						
Nares Lake	29-Aug-18	S2-7	RW	92	RG						
Nares Lake	29-Aug-18	S2-7	LW	82	RG						

Waterbody	Date	Set ID	Fish ID	Species	Condition	Fork Length (mm)	Weight (g)	Sex	Maturity	OT Age	Scale Age
Nares Lake	29-Aug-18	S2-7	GR	92	RG						
Nares Lake	29-Aug-18	S2-7	PW	44	RG						
Nares Lake	29-Aug-18	S2-7	PW	46	RG						
Nares Lake	29-Aug-18	S2-7	GR	64	RG						
Nares Lake	29-Aug-18	S2-7	RW	51	RG						
Nares Lake	29-Aug-18	S2-7	RW	98	RG						
Nares Lake	29-Aug-18	S2-7	RW	72	RG						

Notes:
Fish species codes as follows: CS – least cisco, LSU – longnose sucker, LT – lake trout, LW – lake whitefish, NP – northern pike, RW – round whitefish, GR – Arctic grayling.
Conditions codes as follows: KD – killed (retrieved dead), KS – killed (retrieved alive and sacrificed), RG – released (good), RP – released (poor).
Sex and maturity codes as follows: M – male, F – female, U – unknown; 1 – immature, 2 – mature/resting (will not spawn this year), 3 – mature/spawner (will spawn this year), 4 – ripe, 5 – spent