

Ihdak'ètì Aquatic Ecosystem Monitoring Project

Final Report



March 31, 2012



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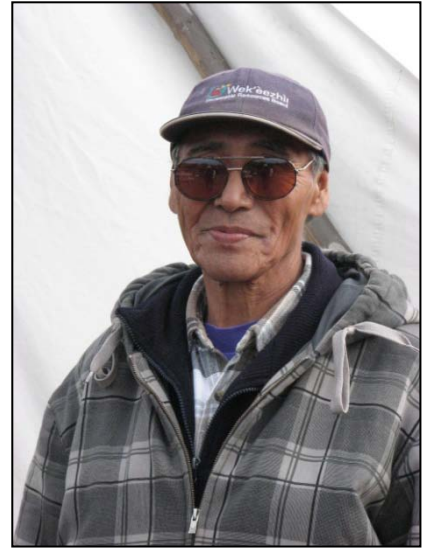
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Dedication

Harry Mantla was a very traditional man who spent his life hunting and trapping on the land. He dedicated his time and shared his valuable knowledge of Tłıchǫ cultural traditions through stories and his experiences with all people. Harry was an outstanding individual that made a difference in the community by teaching the younger generations to keep Tłıchǫ traditions and values alive. His sharing of traditional knowledge, stories and memories will never be forgotten. We would like to thank him and his family for his hard work and dedication to the youth, community, government agencies and this monitoring program. We are very proud to have had Harry Mantla as part of our project and will continue with our work in his memory.



Acknowledgements

This project has been guided by many elders from the community of Behchok̓: Harry Apples, Adele Camille, Eddie Camille, Jonas Football, Nick Football, Robert Mackenzie, Harry Mantla, Elizabeth Michel, Dora Migwi, Bernadette Naskin, Elizabeth Rabesca, Celine Tatzia and Francis Williah. We give many thanks for their dedication to the project and their patience in sharing advice over the past two years.

The Wek'èezhii Renewable Resources Board and Tłıchǫ Government thank those organizations that have provided technical support on this project: Thorpe Consulting Ltd., Fisheries and Ocean Canada (DFO) and Golder Associates. We also thanks those agencies that generously provided financial support: DFO, Aboriginal Affairs and Northern Development (AANDC), Northern Contaminants Program (NCP), Cumulative Impact Monitoring Program (CIMP), Government of Northwest Territories and Tłıchǫ Government

Introduction

There is a scarcity of traditional knowledge and science on the aquatic ecosystems that support subsistence fisheries in the Tłıchq region. As Behchokò is downstream from many historic and proposed developments there is concern in the communities that contamination of downstream aquatic ecosystems may occur or might have already occurred. Therefore, there is need to update baseline information and have ongoing monitoring of the aquatic ecosystem in this region in anticipation of continuing industrial pressures on the watershed.

Our community-driven project, the Jhdak'ètì Aquatic Ecosystem Monitoring Project, was led by Behchokò elders supported by staff from the Tłıchq Government and Wek'èezhìi Renewable Resources Board. It was initiated to draft and test scientific and traditional knowledge protocols for monitoring water quality, sediment quality and fish health at the community level. In this way the two knowledge systems were utilized to develop monitoring protocols for long-term use and contribute to the overall Marian Lake Watershed Stewardship program as it is developed and implemented.

Methods

The project consists of four main phases:

- 1) a planning workshop in Behchokò;
- 2) youth training in film editing and production;
- 3) a monitoring camp in the summer ; and
- 4) traditional indicators workshop.

These activities are discussed in detail below. Simultaneous translation was utilized during all project activities. Appendix 1 lists participants for each activity.

Planning Workshop

The planning workshop provided a forum to discuss the details of the camp and to review the plan to bring together Traditional Knowledge and western science to better understand fish and the aquatic environment in the Russell Lake area. The workshop also introduced the concept of indicators relevant to water quality, sediments and fish health. It was held on August 22, 2011 in Behchokò, (a small Tłıchq community 110 km southwest of Yellowknife) with 20 participants:

- 11 Behchokò elders
- 3 representatives from TG
- one representatives from WRRB
- 4 youth film makers
- 1 videographer

Youth Training in Film Editing and Production

Youth were trained at a series of one-day workshops by a professional videographer in video filming and editing as a method of archiving traditional and scientific knowledge related to monitoring the aquatic environment.

Four youth were selected for participating in the film training and production portions of the project. Training took place in a one-day workshop prior to the Planning Workshop and a one-day editing workshop took place immediately afterward (August 21st and 23rd, 2011 in Behchokò).

Filming was conducted throughout the planning workshop, camp set-up and four-day camp. A one day video planning and visioning workshop based on the footage was then held directly after the camp, with a focus on initiating the editing process. Training, technical support and guidance

continued throughout the project activities. As further support, the Media Studies Teacher at Chief Jimmy Bruneau High School in Edzo provided after school time to help the students on their films.

Monitoring Camp – Russell Lake

A four-day camp was held August 29-September 1, 2011 at a traditional fish harvesting site on an island in Russell Lake (figure 1 at FC5). There were 27 participants:

- 6 elders
- 2 representatives from TG
- 1 representatives from WRRB
- 1 fisheries biologist from Golder
- 1 fisheries biologist from DFO
- 1 water quality specialist from AANDC
- 1 Traditional Knowledge Researcher
- 1 Videographer
- 1 representative from TCSA
- 4 youth
- 2 camp cooks
- 4 camp foreman/workers
- 2 interpreters

Water Quality

Five samples of water were taken two from Slemon Lake and three from Russell Lake (figure 1). Surface water samples were collected by hand from a boat as “grab samples”. GPS coordinates of all sample sites were recorded (table 1). A Campbell scientific Hydrolab™ Datasonde 5 multi-probe was used to record field measurements of temperature, pH, conductivity, turbidity, total dissolved oxygen and total dissolved solids.

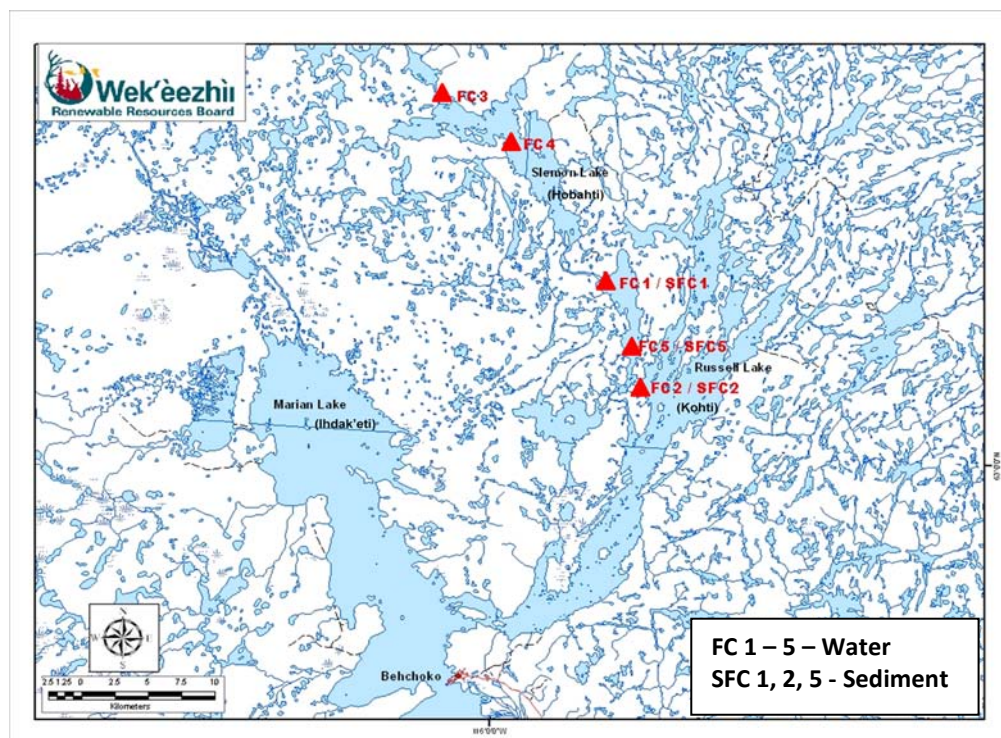


Figure 1 - Water and sediment sample locations

All appropriate QA/QC procedures were followed according to Taiga Environmental Laboratory (Yellowknife) instructions including the analysis of travel and field blanks. Field Staff used fresh

disposable vinyl gloves for each sample collection to minimize the potential for contamination from the sampler's hands. Different sample bottles were used for each laboratory analysis group including: physicals, nutrients, total metals, dissolved metals and microbiological analysis. All bottles were rinsed three times with sample water and lids on before filling. Samples were immediately placed in a cooler with freezer packs to be kept cool.

Table 1 - GPS Coordinates of Water Sampling Sites

Site	Description	Lat/Long hddd mm ss.s
FC1	mouth of channel flowing from Slemon to Russell Lake	N63 07 07.6 W115 53 03.1
FC2	Mouth of channel flowing into Russell Lake first fish net location	N63 02 43.8 W115 48 45.2
FC3	mouth of Snare River flowing into Slemon Lake	N63 14 29.1 W116 07 48.1
FC4	Slemon Lake	N63 12 37.7 W116 01 17.3
FC5	2nd fish net location Russell Lake near camp taken at 14m	N63 05 03.3 W115 49 38.8

Sediment Quality

Sediment samples were taken at four locations using an Ekman grab sampler which is suitable for collecting soft, fine grained sediment that is typically observed throughout the watershed (figure 1 and table 2). Procedures in the CIMP Data Collection Protocol for the Water and Sediment Quality Valued Component¹ and methods outlined in the Metal Mining Guidance Document for Aquatic Effects Monitoring² were followed and analysed for standard physical and chemical properties as well as trace metals at Taiga Lab.

Table 2 - GPS Coordinates of Sediment Sampling Sites

Site	Description	Lat/Long hddd mm ss.s
SFC1	mouth of channel flowing from Slemon to Russell Lake	N63 07 07.6 W115 53 03.1
SFC3	Mouth of Snare River flowing into Slemon Lake	N63 14 29.1 W116 07 48.1
SFC2	fish net location, two distinct layers, lower grey layer	N63 02 43.8 W115 48 45.2
SFC2B	fish net location, two distinct layers, upper brown layer	N63 02 43.8 W115 48 45.2
SFC5	2nd fish net location, grey lower layer	N63 05 03.3 W115 49 38.8
SFC5B	2nd fish net location, upper brown layer	N63 05 03.3 W115 49 38.8

Fish Sampling

Three net sets were completed over the course of the camp on Russell Lake (table 3). A multi-mesh net was used to target multiple sizes of various species of fish whereas 4 and 6-inch nets were used to target larger fish like Lake Whitefish and Northern Pike.

Table 3 - Location, Duration and Characteristics of Net Sets

Net set date	Duration (hrs)	Location	Depth (m)	Mesh size (in)	Dimensions (m)
8/29/2011	15.97	63.04513 N 115.81054 W	1.2-5	6	100x2
8/29/2011	15.68	63.04531 N 115.81054 W	1.2-5	4	100x2
8/31/2011	17.80	63.077369 N 115.816986 W	1.5-2.4	6	100x2
8/31/2011	18.20	63.077369 N 115.816986 W	1.5-2.3	multi	45x2
8/31/2011	14.57	63.085230N 115.828414W	8.0-10.5	6	100x2
8/31/2011	14.42	63.085230N 115.828414W	10.0-10.1	multi	45x2

¹ INAC. 2008. Data Collection Protocol for the Water and Sediment Quality Valued Component. Prepared by KAVIK-AXYS Inc., Yellowknife, NT.

² Environment Canada. 2011. Metal Mining environmental Effects Monitoring Technical Guidance Document

The following standard measurements typical for fish monitoring programs were taken: species identification; length (mm); weight (g); sex, life-stage; reproductive stage; and external and internal health (visual assessment of gross pathology and anomalies). These characteristics can change as a result of changes in water quality and therefore prove to be good indicators. Sagittal otoliths, were processed for aging.

Age estimation was done on otoliths from 19 Lake Whitefish, 12 Northern Pike and 12 Walleye. Figure 2 shows an otolith and how the annual growth rings can be counted to estimate fish age.

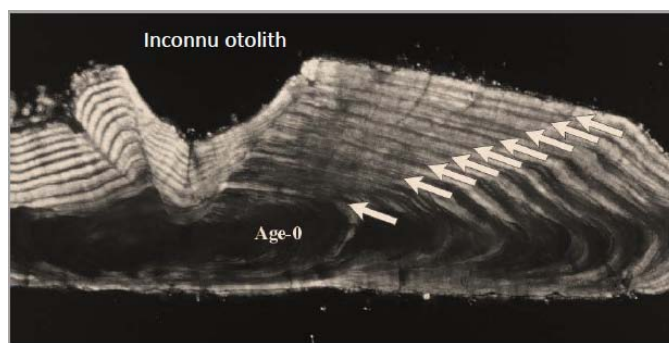


Figure 2 - Example of how otolith layers can be used to age fish³

Fish Tissue Analysis

To determine current levels of contaminants in fishes regularly consumed by local communities, we collected fish tissue samples from two top predators (Walleye and Northern Pike) and an invertebrate feeder (Lake Whitefish). These samples were collected under the guidelines established by Environment Canada for sampling for metals⁴. Ten samples of whitefish tissue, 13 samples of northern pike and 12 samples of Walleye tissue from fish captured in Russell Lake were sent to ALS Environmental (Vancouver) for total metals analysis including mercury, arsenic and copper (wet weight).

Traditional Knowledge Research

Discussions with elders in small groups, were conducted by the Traditional Knowledge Researcher and assistant from the Tłıchǫ Government. These discussions focused on traditional knowledge of aquatic ecosystems and how the health of the ecosystem is assessed and maintained. Discussions were recorded and archived in Tłıchǫ Government, Lands Protection Department files.

Short semi-structured interviews were conducted to explore the following key lines of inquiry:

- Can you tell us about the relationship between fish and the Tłıchǫ?
- Are there stories about the fish in Russell Lake?
- In your lifetime, what sorts of changes have you observed in fish? What about in the lake?
- What types of fish are found in Russell Lake and how were they used and continue to be used by Tłıchǫ?
- How do people tell when a fish is healthy? What do they look for?

Under the guidance of experienced traditional knowledge researchers, youth talked with Elders on these topics, with a vision towards producing a list of Tłıchǫ indicators of a healthy ecosystem. These indicators, derived from Tłıchǫ knowledge, have formed part of a revised data collection form

³ Howland, K., Gendron, M., Tonn, M.T. and R.F. Tallman. 2004. Age determination of a long-lived coregonid from the Canadian North: comparison of otoliths, fin rays and scales in Inconnu (*Stenodus leucichthys*). *Ann. Zool. Fennici* 41: 205-214

⁴ Environment Canada. 2011. Metal Mining Environmental Effects Monitoring Technical Guidance Document

for sampling of fish (the Tłıchǵ Knowledge Aquatic Health Datasheet is part of the Traditional Knowledge Monitoring Protocol in Appendix 10).

Sharing circles were used as a format for group discussions usually in the mornings to plan the day's activities and in the evening to discuss the day's events. A feeding the fire ceremony, led by elder Eddie Camille, was held the last evening of the camp.

Traditional Indicators Workshop

Building on the Traditional Knowledge research done at the camp, a workshop with elders was held on January 13, 2012 in Behchokǵ to verify the information collected at the camp especially with respect to indicators of a healthy ecosystem. The Tłıchǵ Government Traditional Knowledge Researcher went through the notes documented in the semi-structured interviews conducted at the camp. The notes were organized under the following headings:

- How do we know if the water is healthy;
- How do we know if the fish are healthy?
- What changes have we observed on the land and water?

During discussions Elders either corrected or added to what was recorded and reviewed.

Results

Results from each of the project activities are provided below.

Planning Workshop

The Planning Workshop consisted of discussion on elders' interests with respect to changes in the environment they have observed over their lifetimes. Workshop participants identified a range of issues related to changes in water temperature, levels and flows; fish size and abundance; changes in permafrost and landforms; contaminants from industrial development; and, habitat change brought about by the abundance of beavers. These issues form the basis of the rationale for long-term monitoring. The traditional knowledge based protocol was developed in reference to these observations as culturally relevant indicators of environmental change.

With respect to the camp the locations for fish sampling were identified by workshop participants are shown in Figure 3. The final Russell Lake location (Eneko kw'ǵ whela) was altered somewhat from what was initially proposed based on the need to be within a few hours travel of Behchokǵ in case of poor weather. The timing of the camp was set for August 28-Sept 1 based on knowledge that most fish species would be abundant during that time.

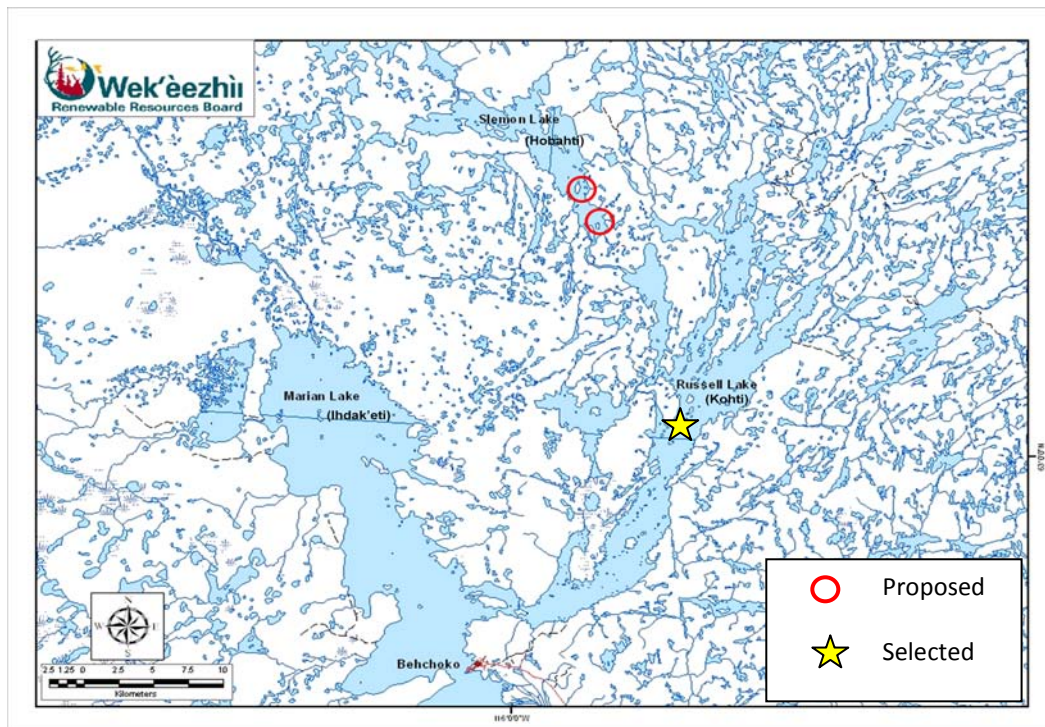


Figure 3 - Areas of interest for monitoring fish as identified in the Planning Workshop, August 22, 2011

Youth Film Editing and Production Training

The basic structure of the workshop was adapted from the Participatory Video workshop method developed by Nick and Chris Lunch and pioneered by Donald Snowdon. Participatory Video is a means of documentation that is lead by individuals with little to no previous video recording experience to document local issues, communications, and activities that are deemed significant to them and by extension, their community.

The training workshop focused on rapid learning of video techniques through hands-on games and exercises, with a focus on collectively identifying the role of the team in capturing specific events of the upcoming fish camp. Specific technical aspects covered included storyboarding, audio capture, framing and composition, shot types, footage storage and organization, and basic editing skills.

While the youth were supported at Chief Jimmy Bruneau School by the media studies teacher to work on their projects afterschool, none of them successfully completed a video project. There are likely many reasons for this. They may have been busy with other school work, projects and demands on their time. But perhaps it had more to do with the fact they had been paid to attend the training workshops and camp but were not paid to continue with editing and producing a short film. Recommendations for next year include moving away from the approach of paying youth for their participation and aiming to select youth (with advice from educators and elders) that are self-motivated.

Monitoring Camp – Russell Lake

Water Quality

Field quality assurance/quality control (QA/QC) measures carried out for this program consisted of a travel blank and a field blank. These QA/QC samples were incorporated into the study to ensure that no contamination was introduced through the collection, handling, shipping and

analysis of the samples. Interpretation of travel and field blanks analyses is provided in Appendix 2.

Water quality results were compared to the Canadian Council for Ministers of the Environment (CCME) guidelines for the protection of Freshwater Aquatic Life (FAL). The FAL guidelines are based on a thorough review of information on the toxicity of different water quality parameters, and indicate the concentration of a parameter at which no adverse effects are expected. These national guidelines are used in absence of baseline or control data to use as a comparison.

Nutrient and physical parameters were measured at all sample sites and were found to be similar at all sites (Table 4; detailed analytical results in Appendix 3). The results of Slemon and Russell Lake are typical of water originating on the Precambrian Shield and would be classified as an oligotrophic lake.

Table 4 - Selected Nutrient and Physical Parameters of Water Samples

	FC3	FC4	FC1	FC5	FC2
Total P (mg/L)	0.01	0.01	0.01	0.01	0.01
Dissolved P (mg/L)	<0.01	0.02	<0.01	<0.01	0.02
DOC (mg/L)	5.1	5	5	4.8	5
TOC (mg/L)	5	4.9	4.8	4.7	4.8
TSS (mg/L)	<3	<3	6	<3	<3
TDS (mg/L)	<10	<10	<10	<10	10
Hardness (mg/L)	16.3	16.5	16.9	16.6	17.6
Conductivity (µS/cm)	36.8	37.2	38	37.7	37.6
Alkalinity (mg/L)	12.7	12.7	13.7	12.9	13.3
Calcium (mg/L)	4.2	4.3	4.4	4.2	4.5
Magnesium (mg/L)	1.4	1.4	1.5	1.5	1.6
Sulphate (mg/L)	2	2	2	2	2
Chloride (mg/L)	0.8	0.8	0.8	0.8	0.9
Reactive Silica (mg/L)	0.471	0.455	0.406	0.67	0.434
pH	7.37	7.37	7.34	7.18	7.37
Turbidity (NTU)	2.42	3.11	5.79	5.74	6.89

Most metal concentrations in Slemon Lake and Russell Lake were very low with many measuring below Method Detection Limit for lab analytical technique (MDL) (Appendix 4). Mercury levels are low in all samples and below detection limits in all by one sample (FC5). Aluminum is the only metal measuring outside the FAL guidelines of 100µg/L. The total aluminum concentration is the lowest at site FC3 which is the water flowing into Slemon Lake and the concentration of the aluminum increases downstream until the highest level is found at FC2 which is the site furthest downstream that was sampled in 2011 (Figure 4).

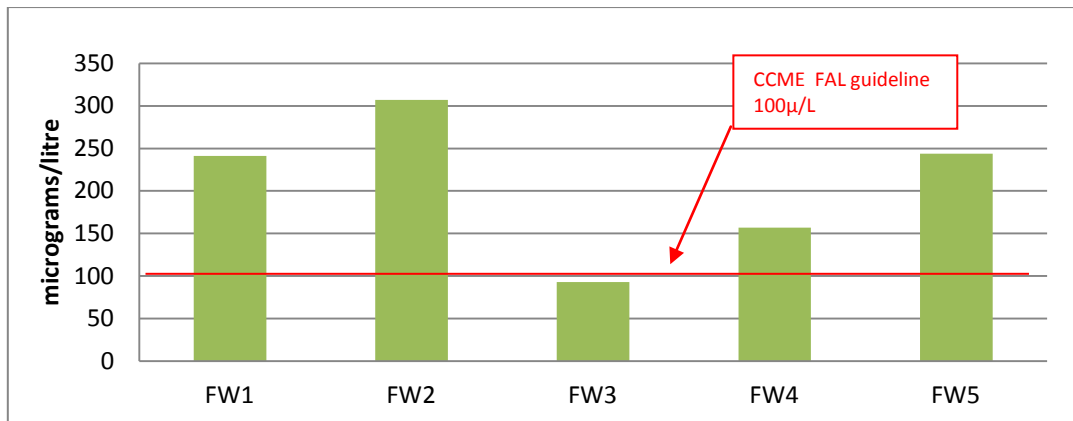


Figure 4 - Aluminum concentrations in water samples

Hydrolab™ measurements were taken at 1-meter intervals from the surface to the bottom of the lake at Site FC5. This site was chosen for the depth profile due to weather conditions and time constraints. This location was close to camp and where the second fish net was set up. Parameters measured included temperature, pH, TDS, turbidity, conductivity and dissolved oxygen..

There was no thermal stratification in September which means that the lake water was mixing throughout the water column. This may be due to the water turning over which commonly occurs in fall equalizing temperature and water quality throughout the water column and/or could also be due to the shallow nature of the area and the wind and wave action. Most parameters were similar at the surface of the water to the bottom of the lake (Table 5) with the exception of the dissolved oxygen and the turbidity.

Table 5 - Field Measurements of Depth Profile at FC5 using the HydroLab

Depth (m)	temperature °C	pH	TDS g/l	turbidity NTU	Dissolved Oxygen %	Specific Conductivity µS/cm
1	14.56	7.3	0.0245	4.4	96.6	38.4
2	14.52	1.19	0.0247	4.9	96.4	38.6
3	14.52	7.29	0.0247	5.4	96	38.6
4	14.5	7.28	0.0249	5	95.9	38.6
5	14.49	7.27	0.0246	5.5	95.7	38.6
6	14.49	7.28	0.0247	5.4	95.6	38.6
7	14.49	7.31	0.0247	5.5	95.3	38.4
8	14.46	7.3	0.0246	5.7	94.9	38.4
9	14.46	7.27	0.0246	5.4	94.5	38.4
10	14.49	7.25	0.0247	5.4	94.2	38.3
11	14.14	7.22	0.0244	6	90.4	38.4
12	13.9	7.12	0.0243	5.9	87.5	38.3
13	13.49	7.01	0.0244	7	79.7	38.2
14	12.4	6.72	0.0242	9.8	59.3	37.9

Sediment Quality

The sediment particle analysis indicated that sediment in lake primarily consists of clay and silt particles. The arsenic concentrations exceeded the CCME Interim Sediment Quality Guidelines (ISQG) of 5.9 µg/g at three of the four locations sampled (SFC1, SFC5, SFC2). The concentrations ranged from 6.3 to 9.5 µg/g. All four of the sample sites exceeded the ISQG for chromium and copper of 37.3 µg/g and 35.7 µg/g respectively while one location (SFC5) also exceeded the ISQG for

lead of 35 µg/g with a concentration of 36.9 µg/g in the lower grey sediment and 40.8 µg/g in the upper brown section of the sediment. Chromium concentrations ranged from 51.3 to 80.4 µg/g and copper concentrations ranged from 45.1 to 67.7 µg/g (Appendix 5). All metal concentrations are below the CCME Probable Effects Level (PEL) criteria. Mercury levels are below detection limits in all sediment samples.

Relatively high amounts of aluminum (figure 5), calcium, iron, magnesium, potassium, sodium and titanium were detected in all sediment samples collected from Slemon and Russell Lake. There are currently no CCME sediment guidelines for these metals.

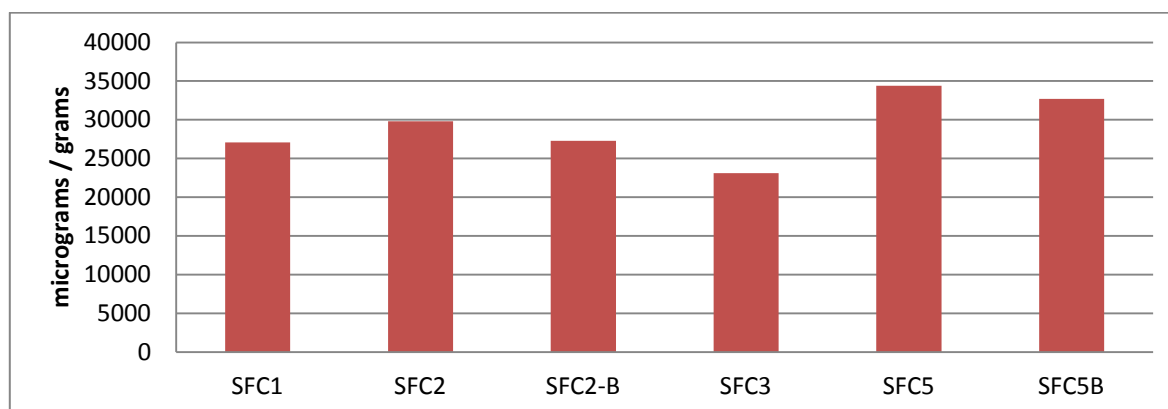


Figure 5 - Aluminum concentrations in lake sediment samples

Fish Species diversity

Eight species of fish were caught on Russell Lake ranging in number from one to 62 (figure 6). Russell Lake supports a variety of fish species similar to that found in other lakes in the region. Northern Pike were abundant since the lake was predominantly shallow and dominated by weedy habitat. Elders were not aware of trout being present at the locations sampled. Inconnu were present in the lake and may represent a distinct Russell Lake stock that spawns in the Lajeunesse River. Cisco were captured in low numbers but were found as part of the stomach content of large predatory species. The small-bodied fish fauna of the lake remains largely unknown and could not be effectively sampled with the gear used. For example, Ninespine stickleback were noted in the stomach contents of predatory fish but none were captured by our multi-mesh gillnets. The complete fish sampling dataset is provided in Appendix 6.

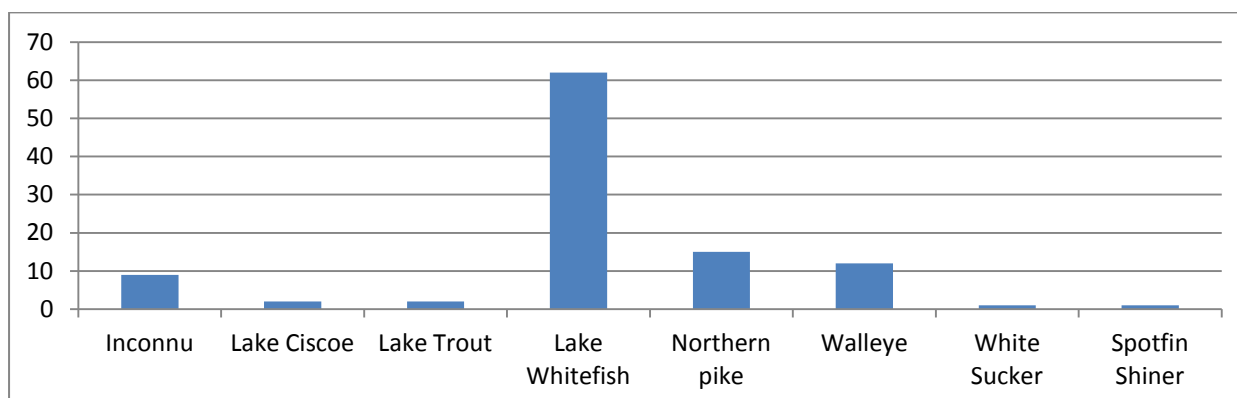


Figure 6 - Species and number of fish captured on Russell Lake

Fish tissue analysis

The full list of metals tested for and results are given in Appendix 3. The larger pike showed mercury levels that exceeded the Health Canada Guidelines for commercial sales of fish for consumption⁵ (figure 7) as did the largest Walleye sampled. All other samples, including all the Lake Whitefish samples, the smaller, younger pike and all other walleye were below the guideline for mercury. Detailed metals analytical results for fish tissue samples are provided in Appendix 7.

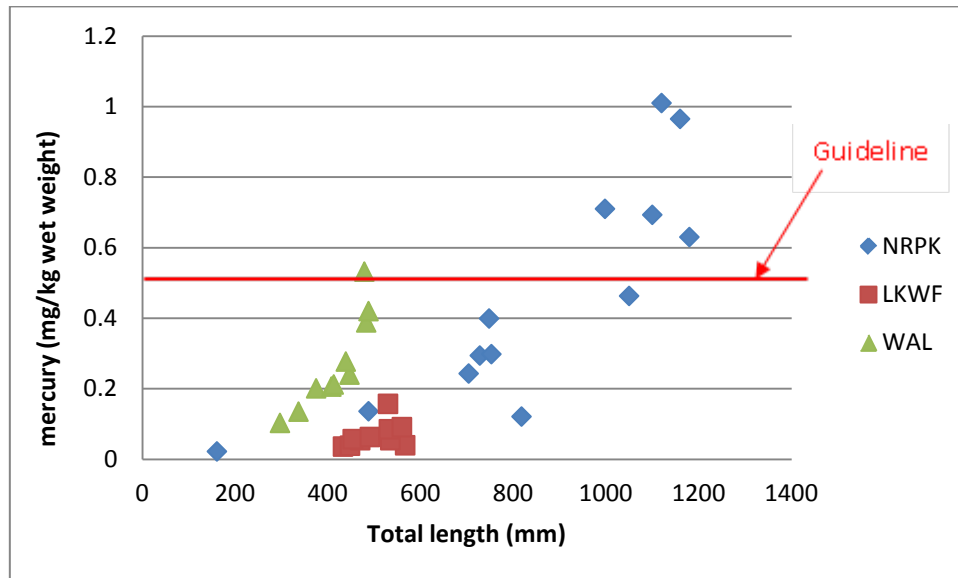


Figure 7 - Mercury levels in Lake Whitefish, Northern Pike and Walleye fish tissue sampled from Russell Lake. Ten samples of Whitefish tissue, 13 Northern Pike and 12 Walleye were analysed.

Fish Age, Size and Maturity

Multiple size classes of the 10 species of fish were captured in Russell Lake. Average size for each species is given in Table 6.

Table 6 - Average Fork Length (mm) of Fish Species Captured in Russell Lake

Species	Average Fork length (mm)
Lake Cisco	121.5
Inconnu	659.2
Lake whitefish	433.7
Northern pike	816.3
Spottail shiner	110
Walleye	372.3
White sucker	404

Lake Whitefish ranged in size from 30 to 68 centimetres and 0 to 21 in age. Lake Whitefish grow quickly in the first few years then more slowly after age 10. (figure 8A). Northern pike ranged in size from 20 to 118 cm and 0 to 21 years in age. Growth rate is slow and steady with not as much change in rate as Lake Whitefish (figure 8B). Walleye ranged in size from 25 to 49 cm and from 5 to 20 years of age. Growth rate is moderate in early years then slows down after age 10 to 12 years (figure 8C). Results from the age estimation from fish otoliths are provided in Appendix 8.

⁵ There are no Health Canada Guidelines for fish caught for recreational or subsistence purposes.

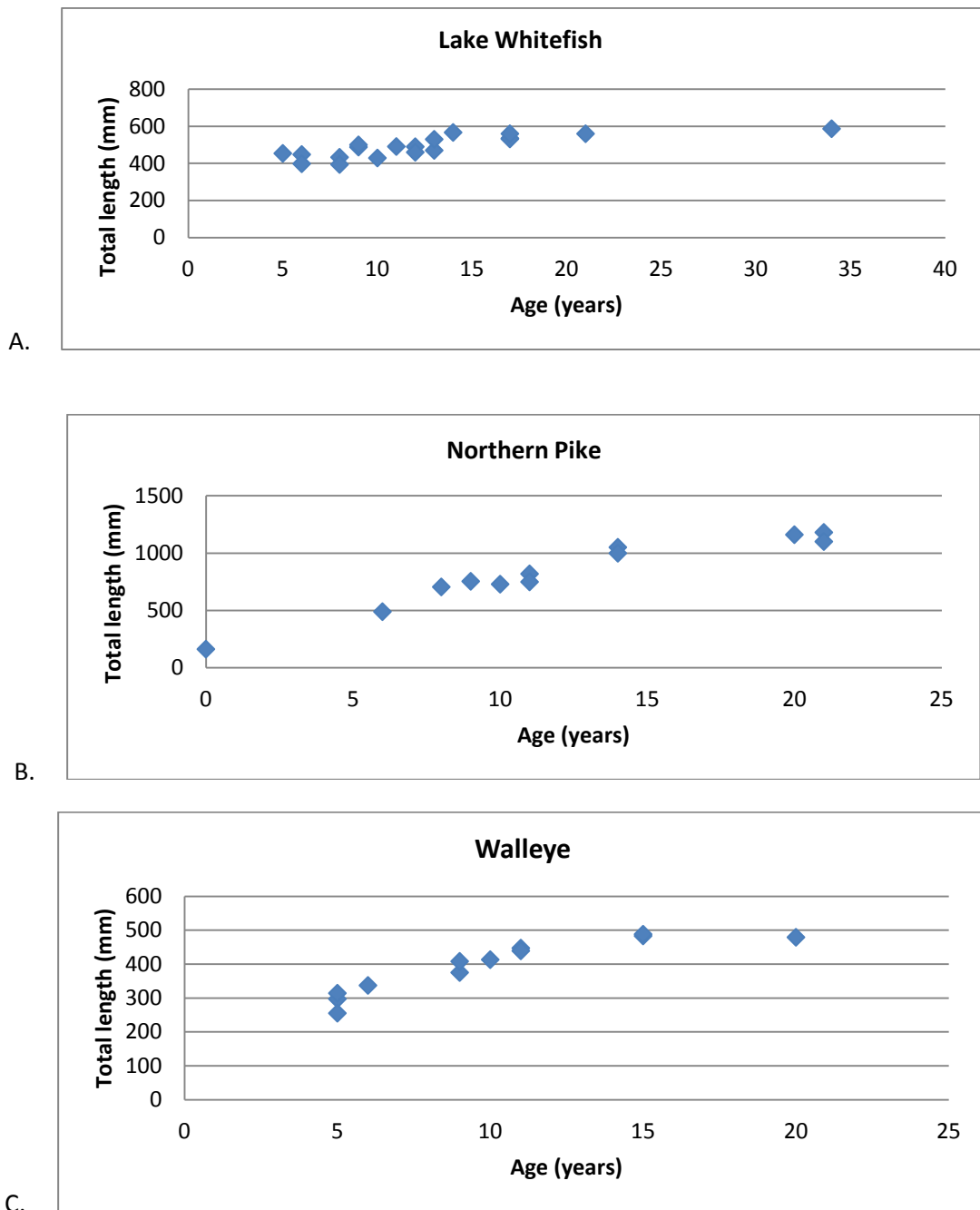


Figure 8 - Length / age relationship in Lake Whitefish (A); Northern Pike (B); and Walleye (C)

Traditional Knowledge Research

Elders have observed many changes in the environment over their lifetimes. They have noticed that water temperatures are warmer than in the past. They say that, as a result, the lake bottom sediments are not freezing and water in the lakes is draining out causing lower water levels. Warmer temperatures are also causing permafrost to melt and the land to slump. This is particularly noticeable between Behchokò and Yellowknife where landforms are subsiding. Warmer temperatures may also be the cause of the lake ice in the winter not being as thick as it used to be making snow machine travel challenging in recent times.

Elders mentioned that there used to be a lot of Coney in the area but they disappeared. In the past, Coney used to be shared and highly valued among the Tłıchǫ people. Interestingly elders mention that there are two types of Coney in the area that were captured in the past that are different from the one today. It appears Coney may be recovering in numbers recently.

Elders say that fish are not as tasty as they used to be perhaps because they are not as fat; they seem to be bigger in size but skinnier. Whitefish, in particular, are not as fat and some fish have worms. With more industrial development in their region elders have noticed changes in the taste and the texture of the fish. The flesh of the fish is sometimes “gummy”. Nets are not set in the areas near the old RayRock mine because of fears of contamination (Rayrock was a uranium mine that operated from 1957 to 1959). With development there can be increased traffic on the winter road. Elders have expressed concern over contamination of water from use of the ice road. Large equipment and trucks are often parked on the ice before portages. They sometimes dump debris or leak oils or fuels that affect water quality and fish health in the area.

In the 1950’s government introduced beaver in the area around Behchokǫ. ⁶ Elders have noticed many changes in the water quality and quantity resulting from the transplanted beavers and their proliferation. Beaver dams are influencing water levels and flows resulting in changes to fish habitat. Tłıchǫ people used to travel on the river and see fish eggs right along the shore, it is felt that beaver dams and changing water flows are responsible for disrupting fish use of these near-shore areas for spawning. In James Lake, adjacent to Marian Lake, the fish are no longer good to eat and people have not used the area for a number of years. Many of the small rivers are blocked off around Marian Lake by beavers. Further the winter kill of large numbers of northern pike in Russell Lake may have been caused by beaver damming the lake tributaries. Elders explain that fish nets are set in different places now because of changes in fish habitat.

Lastly, elders recall in earlier times there being more birds in the past than now; they used to hear many different types of bird songs. The presence of birds and other wildlife is seen as an indicator of ecosystem health. It seems it recent years that the types and numbers of birds have declined.

Traditional Indicators Workshop

Traditional Knowledge Research conducted at the monitoring camp and at the Traditional Indicators Workshop was used to develop the Tłıchǫ Knowledge Monitoring Protocol and Aquatic Health Datasheet (Appendix 10). Brief discussions of water quality and fish health that were recorded are provided below.

Water quality

Water is considered healthy if it is clear and smells fresh and clean. Rivers coming from the barren lands or the Horn Plateau is good water and can be drunk right out of the boat. The taste of the water in Russell Lake is much better than that of Behchokǫ. It is felt that the community dump and sewage lagoon are too close to the water intake and may be affecting water quality in the community.

It is a good sign if there are lots of birds and other animals around. If there are beaver around, however the water is considered not good. Beavers affect the flow and levels of water and can change the habitat surrounding the areas in which it lives. It also has a strong smell. Further, with the reintroduction of beaver into the area around Behchokǫ in the 1950s, elders have noticed many

⁶ Radvanyi, A. 1954. Prince Albert National Park - Fort Rae beaver transplant, Phase I and II. Canadian Wildlife Service, Edmonton. 10pp

changes. When the water levels and flows change they can affect fish passage between water bodies and change fish spawning habitat.

Fish Health

Fish are considered healthy if they are fat, the texture of the flesh is firm and the flavour is good. Fish health depends on the lake where the fish was caught. Elders will visually assess fish as they remove them from the net and prepare them for drying or cooking. Fish found in cool, deep water have a nice firm texture and fish found in warm, shallow water have softer flesh.

If the flesh is soft and rips easily it is not good to eat. The gills should be red or pink and vibrant (versus white) indicating they are fresh and have not drowned in the net. There should be no visible worms or parasites on the skin or in the flesh and the fish should not be deformed. Where there is concern of contamination, elders say to open guts to make sure the fish is healthy and then you cook it. Fat, healthy fish were kept for human consumption whereas skinnier fish were fed to the dogs. The shape and colour of the scales can indicate disease if they are irregular.

An alternate method of the typical dryfish preparation was demonstrated for when people were in a hurry or if men wanted to preserve fish for a short time period. This type of dryfish would not last as long and remained slightly soft (figure 9).



Figure 9 - Quick preparation of Lake Whitefish for drying

Discussion

The traditional knowledge forms an invaluable baseline against which we can measure change. Behchok̓ elders have observed many changes in water quality, temperature, flow and levels as well as changes in fish texture, size, shape and taste. Their observations have also included indications of changing landforms due to permafrost melting, slumping and fish habitat changes due to the proliferation of beavers in the area.

Russell Lake is a 41 km shallow, turbid inland lake that drains into Marian Lake which in turn, flows into the North Arm of Great Slave Lake. The water and sediment quality sampling results show that Russell Lake is typical of other lakes in the area; low levels of nutrients, dissolved metals and moderate suspended sediment. The levels of most metals were low except aluminum and iron which are common in the surrounding geology. These elements also adhere to suspended sediments and therefore are prone to being suspended in the water column through wind and wave

action. Mercury levels are low in both lakes and below detection limits in sediment samples and all but one water sample.

Russell Lake supports a variety of fish species similar to that found in other lakes in the region. Interestingly it seems to support resident populations of what are typically considered warm (e.g. walleye and pike) and cold water species (eg. lake trout and whitefish). Elders were not aware of trout being present at the locations sampled. Inconnu were present in the lake and may represent a distinct Russell Lake stock that spawns in the Lajeunesse River.

The fish tissue analysis showed that mercury levels are relatively low except in very large and very old individuals of walleye and northern pike. Pike and walleye are predatory fish and as such bioaccumulate mercury as they consume prey. Small to moderate sized pike and walleye were within Health Canada guidelines and do not pose a health risk. All samples of Lake Whitefish tissue had very low amounts of mercury.

Annual implementation of the program through the consistent use of the monitoring protocols developed this year and will be key in achieving the main goals of long-term monitoring: detecting change over time and space.

Conclusions and Next Steps

The bringing together of Tłjchq elders, youth and scientists provides a unique opportunity to share traditional and modern ways of understanding and learning about the environment and the changes that are occurring. Understanding how these changes might be related and what we can expect going into the future will benefit from collaborative projects such as this that bring together science and traditional knowledge in a way that can educate us all on environmental issues.

The 2011 Jhdak'ètì Aquatic Ecosystem Monitoring Program was a success in many ways. In particular participants felt that the camp was a success because:

1. The setting brought together youth and Elders in a location selected by the Elders as being an important fishing and camping area.
2. Sharing and relationship building took place between fisheries biologists, water quality scientists, traditional knowledge researchers, resource managers, Elders and youth.
3. Video documentary techniques were an innovative approach to documenting traditional knowledge and 'keeping Elders alive' through a visual medium.

The production of scientific and Tłjchq knowledge based protocols along with the Tłjchq Aquatic Ecosystem Health Datasheet will enable the implementation of the program in each of the four Tłjchq communities into the future (Appendices 10 and 11). The lessons learned in this year's program provide guidance for continued improvement (see Appendix 9).

After two successful years of developing an aquatic ecosystem monitoring program based on science and Tłjchq knowledge it is hoped that we can continue to implement the program in each of the Tłjchq communities on a rotating basis. We will establish background conditions in water and sediment quality, fish species diversity and relative abundance as well as fish tissue metal concentrations. Proposals were submitted to Northern Contaminants Program and the Cumulative Impact Monitoring Program for this ongoing community-based monitoring program. At this point, there has been no confirmation of funding.

Appendix 1 – Project Participants

Planning Workshop Participants

Elders from Behchokò

- Celine Tatzia
- Bernadette Nasken
- Elizabeth Rabesca
- Dora Migwi
- Elizabeth Michel
- Francis Williah
- Jonas Football
- Harry Apple
- Robert Mackenzie
- Edward Camille
- Nick Football

Tłıchǫ Lands Protection Division

- Georgina Chocolate
- Albertine Eyakfwo

- Joline Huskey

Wek'èezhìi Renewable Resources Board

- Karin Clark

Thorpe Consulting Ltd.

- Natasha Thorpe

Golder Associates

- Beth Keats

Youth

- Charlene Rabesca
- Ketrick Whane
- Avery Huskey
- Dallas Black

Translators

- Marie Rose Blackduck
- James Rabesca

Fish Camp Participants

Elders from Behchokò

- Harry Apple
- Robert Mackenzie
- Edward Camille
- Adele Camille
- Nick Football
- Harry Mantla

Camp Cook/Workers

- Therese Lafferty
- Joey Eyakfwo
- John Quitte
- Bobby Wanazah
- Harry Rabesca
- Sam Leoulle

Tłıchǫ Lands Protection Division

- Joline Huskey
- Albertine Eyakfwo

Wek'èezhìi Renewable Resources Board

- Karin Clark

Department of Fisheries and Oceans

- Deanna Leonard

Golder Associates

- Paul Vecsei
- Beth Keats

AANDC

- Nicole Dion

Translators (3)

- Jonas Lafferty
- James Rabesca

TCSA

- Lucy Lafferty

Youth

- Charlene Rabesca
- Ketrick Whane
- Avery Huskey
- Dallas Black

Traditional Indicators Workshop Participants

Elders from Behchokò

- Bernadette Nasken
- Adele Camille
- Harry Apples
- Robert Mackenzie
- Edward Camille
- Harry Mantla

Tłıchǫ Lands Protection Division

- Georgina Chocolate
- Albertine Eyakfwo

- Joline Huskey

TCSA

- Rosa Mantla
- Lucy Lafferty

Wek'èezhìi Renewable Resources Board

- Karin Clark

Translators

- Jonas Lafferty
- James Rabesca

Appendix 2 – Results from Water Quality Travel and Field Blanks

Travel blanks were prepared by Taiga and field blanks were prepared on site, using Type 1 water provided by Taiga. The blanks were carried, preserved and analyzed the same as samples which were collected on site.

When there is a measured concentration that is higher in the dissolved metals sample than the total metals sample this could be indicative of contamination occurring during the filtering process. The field blank had one metal, manganese and the travel blank had manganese, mercury and silver metals which measured concentrations that were higher in the dissolved metals sample than the total metals sample (Table 1). Potential sources of contamination may include airborne dust and dirt, the paper filters used or improper cleaning of the filtration apparatus.

The presence of measureable levels of total metals in the field blank samples, i.e., concentrations above the method detection limit (MDL), may be indicative of contamination occurring during sample preparation in the field while measurable levels of total metals in the travel blank may be indicative of contamination occurring during sample preparation in the lab.

The majority of the metals were less than method detection limits (MDL). The total metal concentrations which measured above MDL included antimony, barium, iron, manganese, silver titanium and vanadium (Table 1). The presence of the majority of these elements in the blanks was sufficiently low such that it did not affect interpretation of field sample results. The presence of total silver in the travel blank presented some concern. The CCME FAL guideline for silver is 0.1 µg/L, therefore the concentration of 0.2 µg/L in the dissolved fragment and the 0.1 µg/L in the total fragment of the Travel Blank did affect interpretation of results for that element. Essentially, if silver was found at detectable levels in the field results, the probability of outside contamination was considered in the interpretation.

Table 1

Total and Dissolved Metals					
		Field Blank (µg/L)		Travel Blank (µg/L)	
	MDL	Diss.	Tot.	Diss.	Tot
Aluminum	0.6, 5	<0.6	<5	<0.6	<0.1
Antimony	0.1	<0.1	0.3	<0.1	<0.1
Arsenic	0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.1	<0.1	0.3	<0.1	<0.1
Beryllium	0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.05, 1	<0.05	<0.1	<0.05	<0.1
Cesium	0.1	<0.1	<0.1	<0.1	<0.1
Chromium	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	0.1	<0.1	<0.1	<0.1	<0.1
Copper	0.2	<0.2	<0.2	<0.2	<0.2
Iron	5	<5	6	<5	<5
Lead	0.1	<0.1	<0.1	<0.1	<0.1
Lithium	0.2	<0.2	<0.2	<0.2	<0.2
Manganese	0.1	0.1	<0.1	0.3*	0.2
Mercury	0.01	<0.01	<0.01	0.02*	<0.01
Molybdenum	0.1	<0.1	<0.1	<0.1	<0.1
Nickel	0.1	<0.1	<0.1	<0.1	<0.1
Rubidium	0.1	<0.1	<0.1	<0.1	<0.1
Selenium	0.3	<0.3	<0.3	<0.3	<0.3
Silver	0.1	<0.1	<0.1	0.2*	0.1
Strontium	0.1	<0.1	<0.1	<0.1	<0.1
Thallium	0.1	<0.1	<0.1	<0.1	<0.1

Titanium	0.1	<0.1	0.2	<0.1	<0.1
Uranium	0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	0.1	<0.1	0.4	<0.1	<0.1
Zinc	0.4	<0.4	<0.4	<0.4	<0.4

Yellow highlighted cells are measurable amounts. Turquoise highlighted cells are results measured at detection limit. *Dissolved concentration is higher than the total concentration

The majority of the physical and chemical parameters were less than MDL (Table 2). There were measurable amounts of calcium in both field and travel blanks. This was reflected in the hardness (measured as mg of CaCO₃ per liter) of the travel blank but the alkalinity (the neutralizing capacity of water, largely due to the presence of carbonate or bicarbonate ions) was not affected.

Table 2. Physical and chemical parameters measured in field and travel blank.

	MDL	Units	Travel Blank		Field Blank	
Ammonia as Nitrogen	0.01	mg/L	<	0.01	<	0.01
Nitrate+Nitrite as Nitrogen	0.01	mg/L	<	0.01	<	0.01
Nitrogen, Dissolved	0.06	mg/L	<	0.06	<	0.06
Nitrogen, Total	0.06	mg/L	<	0.06	<	0.06
Organic Carbon, Dissolved	0.5		<	0.5	<	0.5
Organic Carbon, Total	0.5		<	0.5	<	0.5
Ortho-Phosphate as Phosphorus	0.002	mg/L	<	0.002	<	0.002
Phosphorous, Dissolved	0.01	mg/L	<	0.01	<	0.01
Phosphorous, Total	0.01	mg/L	<	0.01	<	0.01
Alkalinity, Total (as CaCO ₃)	0.4	mg/L	<	0.4	<	0.4
Conductivity, Specific (@ 25°C)	0.4	µS/cm		2.1		2.3
pH		pH units		5.72		5.54
Solids, Total Dissolved	10	mg/L	<	10	<	10
Solids, Total Suspended	3	mg/L	<	3	<	3
Turbidity	0.05			0.06		0.2
Calcium	0.1			0.3		0.2
Chloride	0.7	mg/l	<	0.7	<	0.7
Fluoride	0.1	mg/l	<	0.1	<	0.1
Hardness	0.7	mg/L		1	<	0.7
Magnesium	0.1	mg/l	<	0.1	<	0.1
Nitrate as Nitrogen	0.01	mg/l	<	0.01	<	0.01
Nitrite as Nitrogen	0.01	mg/l	<	0.01	<	0.01
Potassium	0.1	mg/l	<	0.1	<	0.1
Silica	0.025	mg/L	<	0.025	<	0.025
Sodium	0.1	mg/l	<	0.1	<	0.1
Sulphate	1	mg/l	<	1	<	1

Appendix 3 – Surface Water Physical and Nutrient Analysis Results

Appendix 4 – Surface Water Metal Analysis Results

Appendix 5 – Sediment Metals Analysis Results

Appendix 6 – Fish species diversity, length and weight

Appendix 7 – Metals analysis for fish tissue samples

Appendix 8 – Age analysis for fish otolith samples

Appendix 9 - Recommendations

Feedback from participants has been positive in the desire to keep working together and improving on the program. Some recommendations for improvement include:

- The camp should be longer. The TK component of the work was limited, in part, due to the short duration of the camp. The first and last days were for travel and the two short days in between were thus the first and last days of the camp. The short timeframe meant that sometimes the TK collection was ‘forced’ rather than allowed to evolve according to traditional timelines or ways.
- There should be more youth participants. They were sometimes more busy filming the water quality sampling and fish sampling activities carried out by the scientists than being able to participate in the activities.
- Youth need to be better trained to respect their elders prior to going out to the camp. There was a frustration expressed by elders that youth were not asking enough questions or appeared disinterested. Perhaps a half-day cultural rules lesson delivered by a Tłjchq educator could be incorporated into the future program.
- Youth participants must independently and voluntarily apply to participate, and must have a clear understanding of what they will be learning and their role in the camp, and a personal interest in the subject being taught. They should be selected by elders rather than appointed by TG, WRRB or other agencies.
- Youth should not be paid for this highly educational opportunity. It was sometimes felt that the youth devalued the process because they were paid to participate (i.e. it was not a privilege to attend) and may have influenced their motivation to enrol in the program.
- Youth indicated that they would have liked more training time prior to the camp, and would have liked to have had more prior notice of their involvement in the workshop and camp as well as more information about what they were signing up for.
- Opportunities to integrate lessons from the camp with school curriculum should be explored.
- Elders expressed a desire to teach the youth about traditional trails and “fish” lakes. This should be incorporated into the camp programs.
- Both male and female elders should be involved in all aspects of the project. It was unfortunate that a death in the community meant that several of the women scheduled to attend that camp had to cancel at the last minute. As a result, most of the TK documented came from the male perspective. In the future, it is recommended that particular efforts be made to include more women so that both the male and female TK can be recorded.
- Measuring, sampling and preparing fish should be shared among participants rather than the majority of the work falling to the hands of the biologists.
- A cultural liaison capable of bridging two disparate ways of knowing is critical to successful communication between Tłjchq and non- Tłjchq participants. The Tłjchq participants would have benefited from a better understanding of the non- Tłjchq ways of communicating, planning, scheduling and doing things in the same way that the non- Tłjchq participants would have benefitted from this same insight into Tłjchq worlds.
- Elder participants should be selected by elders, should be familiar with the area in which the camp is taking place and should be invited from other Tłjchq communities.

Appendix 10 – Aquatic Ecosystem - Traditional Knowledge Monitoring Protocol

Tłıchǫ Aquatic Ecosystem Monitoring Project

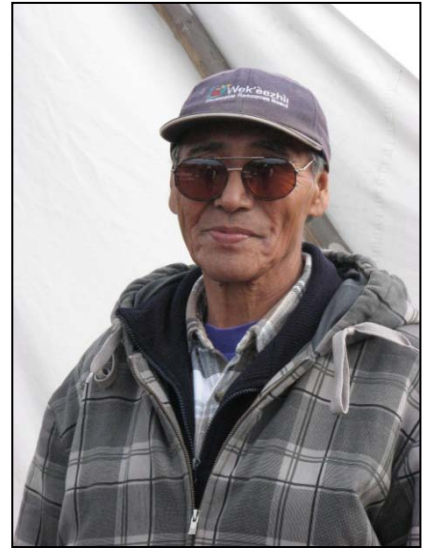


Traditional Knowledge Monitoring Protocol

March 31, 2012

Dedication

Harry Mantla was a very traditional man who spent his life hunting and trapping on the land. He dedicated his time and shared his valuable knowledge of Tłıchǫ cultural traditions through stories and his experiences with all people. Harry was an outstanding individual that made a difference in the community by teaching the younger generations to keep Tłıchǫ traditions and values alive. His sharing of traditional knowledge, stories and memories will never be forgotten. We would like to thank him and his family for his hard work and dedication to the youth, community, government agencies and this monitoring program. We are very proud to have had Harry Mantla as part of our project and will continue with our work in his memory.



Acknowledgements

Thanks to the elders of Behchokò for their patient advice and knowledge shared over the past two years of this project: Harry Apples, Adele Camille, Eddie Camille, Jonas Football, Nick Football, Robert Mackenzie, Harry Mantla, Elizabeth Michel, Dora Migwi , Bernadette Naskin, Elizabeth Rabesca, Celine Tatzia and Francis Williah of Behchokò. Thank you to Georgina Chocolate and Albertine Eyakfwo for their guidance in all aspects of the project. Thanks also to Rosa Mantla, Tammy Steinwand, Mary Seimens and Lucy Lafferty with Tłjchq Community Services Agency for their review and comment on the Tłjchq Knowledge Aquatic Ecosystem Health Datasheet.

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Introduction

You don't need to be an elder to observe the land. Even when you're young you need to watch the land at all times. After 10 or 20 years you notice what is changing. (Bernadette Nasken 2012-01-13)



Figure 1 - Students working on journals at the Monitoring Camp

Tłıchǵ Elders and community members have, in recent years, expressed concern over fish health, consumption of fish and the associated long term effects on people. The purpose of the Tłıchǵ Aquatic Ecosystem Monitoring Project is to develop and implement a monitoring program that meets the needs of the Tłıchǵ people in determining how and if fish health, water and sediment quality is changing over time and whether fish and water remain safe to consume. The program is led by Wek'èezhii Renewable Resources Board, Wek'èezhii Land and Water Board and Tłıchǵ Government with technical support provided by Thorpe Consulting Ltd. , Fisheries and Ocean Canada (DFO) and Golder Associates. Financial support has been provided by DFO, Aboriginal Affairs and Northern Development (AANDC) , Northern Contaminants Program (NCP), Cumulative Impact Monitoring Program (CIMP), Government of Northwest Territories and Tłıchǵ Government

The project engages local community members to collect samples and record a standard set of observations using both Tłıchǵ and western scientific knowledge to address the question “are the fish and water safe to consume?” on an annual basis. The program will rotate community-based fish, water and sediment sampling through the four Tłıchǵ communities such that any one location will be sampled once every four years. Elders stress the importance of teaching their youth the traditional trails and the “fish lakes” (where fish can be caught for food). And thus, involving and educating youth is an integral part of the program.

This is one of several protocols developed for the program and comprises the traditional knowledge based protocol for monitoring the aquatic ecosystem.

Getting started

The only way to have healthy fish is for us to maintain our traditional roles
(Adele Camille 2011-08-30)



Figure 2 - Adele Camille at the cook tent

The annual monitoring program is conducted in collaboration with community representatives including Community Directors, Community Council members, elders, youth and fishers. Several preparatory, planning and training meetings are held prior to heading out to a monitoring camp which is usually held in late August. A location for sampling fish, water and sediment is chosen based on the advice from community representatives including elders who are knowledgeable of the particular region. The location is usually at a traditional campsite where people camped and fished in the past. The site may also be influenced by concerns that elders have about water quality and fish health in areas that may have been affected by industry (i.e. downstream from a mine). A balanced number of male and female elders participate in the monitoring camps as they contribute different types of knowledge; men are traditionally the harvesters while women are the preparers of the food.

A common language

Even though fish don't have trails to follow, they come to us . (Eddie Camille 2011-08-30)



Figure 3 - Fish prepared for drying

A main purpose of the project is to share science and Tłıchǫ knowledge in monitoring and understanding the aquatic ecosystem. While scientists share their knowledge in English and sometimes latin in the case of scientific names, elders and fishers do the same in the Tłıchǫ language. Using the Tłıchǫ language at the camp is one way of demonstrating commitment to and value of Tłıchǫ culture and way of life. In this way, youth are exposed to both ways of knowing and sharing knowledge.

Tłıchǫ words for fish species and fish anatomy can often provide insight into fish biology that may not be captured in an English term. Youth are encouraged to speak Tłıchǫ with their elders; translators are at hand to facilitate discussion when necessary. The following tables list Tłıchǫ and English names for the commonly found fish in Wek'èezhìi (Table 1) and fish anatomy (Table 2).

Figure 4 shows the anatomy of a fish with the parts labelled in Tłıchǫ.

Table 1 - Tłıchǫ, English and Scientific names for fish species common in Wek'èezhìi

Tłıchǫ	English	Scientific (latin)
wille	Inconnu	<i>Stenodus leucichthys</i>
eẖts'è̱	Walleye	<i>Sander vitreus</i>
łẖdaa	Northern Pike	<i>Esox lucius</i>
łiẖtsoa	Lake Cisco	<i>Coregonus sp.</i>
łiẖ	Lake whitefish	<i>Coregonus clupeaformis</i>
łwe̱zǫ̱	Lake Trout	<i>Salvelinus namaycush</i>
nǫ̱hkwè̱e	Burbot (loche)	<i>Lota lota</i>
Dehdoo	Longnose sucker	<i>Catostomus catostomus</i>
kw̱ie̱zhii	White sucker	<i>Catostomus commersonii</i>
	Spottail shiner	<i>Notropis hudsonius</i>
	Ninspine stickleback	<i>Punigtius pungitius</i>

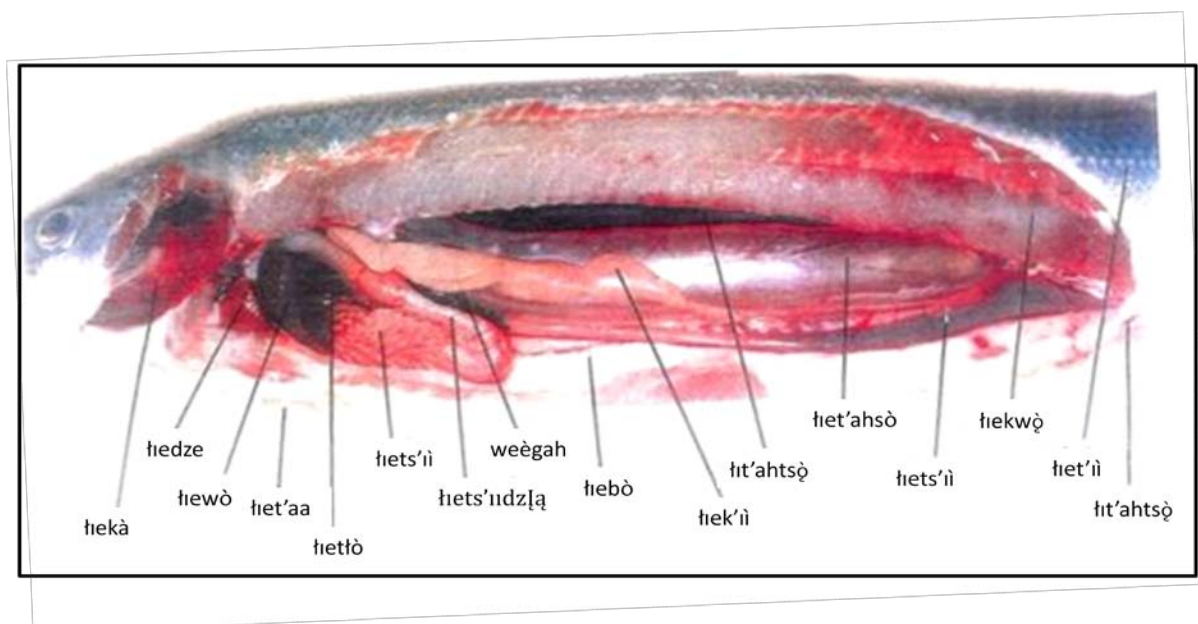


Figure 4 - Fish anatomy in Tłıchǫ

Table 2 - Fish anatomy in Tłjchq and English

Tłjchq	English
łiekà	Gills in gill cavity
łedze	Heart
łewò	Liver
łet'aa	Fin
łetłò	Gall bladder
łets'ìì	Pylorus
łets'ıdzłà	Stomach
weègah	Spleen
łebò	Wall of body cavity
łek'ìì	Sex organ or gonad (male testis)
łt'ahtsò	kidney
łet'ahsò	Swim bladder
łets'ìì	Intestine
łekwò	Muscle
łet'ìì	Skin
łt'ahtsò	anus

Respecting the land and water

Animals are generous; they give their life to us. We treat fish well so they will come to the net. (Harry Apples 2011-08-30)



Figure 5 - Fish delicacies – heads (łiekwi), pipe(łets'ıtsia) and eggs(łek'łł)

Respect is the centre of the Tłjchq way of life: respecting the land, water and demonstrating “proper” behaviour is key to being safe and successful when on the land. A leader or k'òowo should be selected by community elders at one of the first planning meetings. The k'òowo will lead the camp participants in the prayers and provide overall leadership during the camp. Making prayers to the water (paying the water) should be the first step in travelling on the water and settling into a

campsite. Morning and evening prayers, in many cases the rosary, start and finish the day for all participants. Feeding the fire is often a ceremony held at the end of the camp.

Respectful behaviour

People should not talk against each other. We have to work very well together. Saying good morning to each other is a positive way to start (Eddie Camille 2012-01-13)



Figure 6 - Harry Apples describing the parts of the fish

Proper behaviour is the keystone to maintaining a healthy environment. Tłıchǫ have rules for behaviour when handling fish and fishing gear that must be followed such that the fish will continue to give themselves to people.

People must have respect for themselves and others during their day-to-day lives and at the camp (i.e. they do not abuse alcohol or drugs or other people). Further, people should watch their language and not talk directly about animals but only in stories. Women's behaviour around fish, fish guts and blood and gear is particularly sensitive. Women should not step over the blood or guts of fish or fish nets.

One way of showing respect to fish is to be knowledgeable about them and their life cycles. Fish should be handled slowly and deliberately and not made to suffer; they should be killed as soon as the net is brought in. It is very respectful to place bear fat in the mouth of the fish which is traditional practice thought to make the fish fat and keep them healthy.

Blood from other wildlife should not be exposed to fish (i.e. during harvesting and fixing of meat). Also blood from other wildlife should not touch the nets or other fishing gear. Moose hides should not be put in a lake where you are fishing or the lake will cut you off.

Understanding water

Our ancestors reminded us of how healthy the land would be if we took care of it. (Harry Apples 2012-01-13)



Figure 7 - Eddie Camille in his boat

Water is considered healthy if it is clear and smells fresh and clean. Rivers coming from the barren lands or the Horn Plateau is good water and you could always drink it right out of the boat. Fish with nice firm texture like cool, deep water and fish with softer flesh are found in warm, shallow water. Lots of fish come into an area with the fresh melt water in the spring.

It is a good sign if there are lots of birds and other animals around. If there are beaver around, however the water is considered not good. Beavers affect the flow and levels of water and can change the habitat surrounding the areas in which it lives. It also has a strong smell.

Snow water was traditionally used for cooking and making tea. It would be gathered by youth, tasted by elders and used to predict the future; if the water was tasty it was said you would live long. Snow water was made from the snow crystals deep in the snow pack. If you picked up the wrong snow you would get the wrong answer from the elders.

Harry Apples (2012-01-13)

Further, with the reintroduction of beaver into the area around Behchokò in the 1950s, elders have noticed many changes. When the water levels and flows change they can affect fish passage between water bodies and change fish spawning habitat.

Understanding fish

When boiled, if the fish is not fat, the scales stick to the skin and it is not so healthy. If the scales puff up then it is healthy. Also whenever you cook a fish over the fire it won't burn if it is healthy and fat. (Harry Mantla 2012-01-13)



Figure 8 - Cooking fish on the fire

Fish are considered healthy if they are fat, the texture of the flesh is firm and the flavour is good. Fish health depends on the lake where the fish was caught. Elders will visually assess fish as they remove them from the net and prepare them for drying or cooking. If the flesh is soft and rips easily it is not good to eat. The gills should be red/pink and vibrant (versus white) indicating they are fresh and have not drowned in the net. There should be no visible worms or parasites on the skin or in the flesh and the fish should not be deformed. Where there is concern of contamination, elders say to open guts to make sure the fish is healthy and then you cook it. Fat, healthy fish were kept for human consumption whereas skinnier fish were fed to the dogs. The shape and colour of the scales can indicate disease if they are irregular. In the winter, scales get rough while in the summer fish scales are smooth.

Observed changes in the ecosystem

In the spring, muskrat and other animals used to entertain you. The birds were so lively. The land would keep you entertained.

(Harry Apples 2012-01-13)



Figure 9 - A view of Russell Lake from camp

Elders have observed many changes in the environment over their lifetimes. They have noticed that water temperatures are warmer than in the past. They say that, as a result, the lake bottom sediments are not freezing and water in the lakes is draining out causing lower water levels. Warmer temperatures are also causing permafrost to melt and the land to slump. Warmer temperatures may also be the cause of the lake ice in the winter not being as thick as it used to be making snow machine travel challenging in recent times.

Elders mentioned that there used to be a lot of Coney in the area but they disappeared. In the past, Coney used to be shared and highly valued among the Tłıchǫ people. Interestingly elders mention that there are two types of Coney in the area that were captured in the past that are different from the one today. It appears Coney may be recovering in numbers recently.

Elders say that fish are not as tasty as they used to be perhaps because they are not as fat; they seem to be bigger in size but skinnier. Whitefish, in particular, are not as fat and some fish have worms. With more industrial development in their region elders have noticed changes in the taste and the texture of the fish. The flesh of the fish is sometimes “gummy”. Human developments can increase traffic on the winter road. Elders have expressed concern over contamination of water from use of the ice road. Large equipment and trucks are often parked on the ice before portages. They sometimes dump debris or leak oils or fuels that affect water quality and fish health in the area.

Elders have noticed many changes in the water quality and quantity resulting from the transplanted beavers and their proliferation. Beaver dams are influencing water levels and flows resulting in changes to fish habitat. Tłıchǫ people used to travel on the river and see fish eggs right along the shore and it is felt that beaver dams and changing water flows are responsible for disrupting fish use of these near-shore areas for spawning. Elders explain that fish nets are set in different places now because of changes in fish habitat.

Lastly, elders recall in earlier times there being more birds in the past than now; they used to hear many different types of bird songs. The presence of birds and other wildlife is seen as an indicator of ecosystem health. It seems in recent years that the types and numbers of birds have declined.

Appendix A - Tł̥ch̥ Knowledge Aquatic Ecosystem Health Datasheet

These datasheets are to be used by the youth participants at the Monitoring Camp. Youth will need to discuss many of the questions with their elders at the camp before answering. In particular Sections A and B are for youth to ask their elders; Sections C and D are for youth to fill out themselves.

Section A - Assessing the Health of the Aquatic Ecosystem (Youth to ask their elders)

1. Has water temperature changed?

☐ Yes ☐ No

In what way has it changed and why? _____

2. Has the taste of the water changed?

☐ Yes ☐ No

In what way has it changed and why? _____

3. Have the water flow and levels changed?

☐ Yes ☐ No

In what way has it changed? _____

4. Are there other birds, animals and plants around that didn't used to be here?

☐ Yes ☐ No

What are they? What can they tell us about the aquatic ecosystem? _____

5. Are there birds, animals and plants that used to be here that aren't anymore?

☐ Yes ☐ No

What are they? What can they tell us about the aquatic ecosystem? _____

6. What species of fish did you catch? How many of each?

#	Tłıchǫ	English
	wıile	Inconnu
	ehts'èǵ	Walleye
	łhdaa	Northern Pike
	łıhtsoa	Lake Cisco
	łih	Lake whitefish
	łıwezǵǵ	Lake Trout
	nǵhkwèe	Burbot (loche)
	Dehdoo	Longnose sucker
	kwıezhìi	White sucker

7. Have the kinds of fish caught changed?

☐ Yes ☐ No

How? _____

8. What are the sizes of fish caught?

Tłıchǫ	English	%small	%med	%large
nǵhkwèe	Burbot (loche)			
wıile	Inconnu			
łıhtsoa	Lake Cisco			
łih	Lake whitefish			
łıwezǵǵ	Lake Trout			
Dehdoo	Longnose sucker			
łhdaa	Northern Pike			
	Ninespine stickleback			
	Spottail shiner			
ehts'èǵ	Walleye			
kwıezhìi	White sucker			

9. Are there fish in this area that you no longer eat?

☐ Yes ☐ No

Why/Why Not? _____

10. Is flavour and taste of fish good?

☐ Yes ☐ No

What makes fish taste good? Is it better in different seasons? _____

Section B - Assessing the Health of the Fish (Youth to ask their elders)

1. Is this fish the right shape? Is it deformed in any way?

Yes ☐ No ☐

How is it deformed? _____

2. Are scales the shape and colour you are used to seeing?

Yes ☐ No ☐

Why/Why not? _____

3. What colour are the gills?

Red ☐ Pink ☐ White ☐

What causes the gills to be a certain colour? _____

4. Do you consider this fish fat?

Fat ☐ Good ☐ Not so Fat ☐ Skinny ☐

Where is the fat located? Are there times of year when the fish are fatter or skinnier?
When? _____

5. What is the texture of the fish flesh?

Firm ☐ Moderately Firm ☐ Soft ☐ Rips apart easily ☐

Are there environmental conditions that make the flesh firm or soft? What are they? _____

6. Are there visible worms or parasites on the outside of the fish? In the flesh?

Yes ☐ No ☐

Where and what do they look like? _____

Section C - Tłı̨chǫ Rules: Showing Respect for each other (Youth to ask themselves)

1. Do you enjoy going out on the land?

☐ Yes ☐ No

2. How many times a year do you go out on the land?

3. Who do you connect with most when you are out on the land? _____

Why? _____

4. Are you and the other youth at camp listening and showing respect to their elders?

☐ Yes ☐ No

What are some ways you show respect? _____

5. Have you thanked those who caught the fish? Those who cleaned the fish? Those who cook the fish?

☐ Yes ☐ No

6. Have you made use of all the fish you've caught and shared it with others?

☐ Yes ☐ No

How have you used the fish? _____

7. Do people watch their language and talk about animals only in stories?

☐ Yes ☐ No

Why is this important? _____

8. Has a Kàowo been identified for the camp?

☐ Yes ☐ No

How is a Kàowo identified and how does it influence the camp? _____

9. Have you paid the water and land for its many uses?

☐ Yes ☐ No

Why is this done? _____

10. Do you say prayers in the morning and night during the camp?

☐ Yes ☐ No

Why is this important? _____

Section D - Tłıchǫ Rules: Showing Respect to Animals and the Environment (Youth to ask themselves)

1. Are nets and gear kept away from other animals and treated properly?

☐ Yes ☐ No

What does it mean to handle nets and gear properly? _____

2. Is the blood and meat of fish kept separate from the blood and meat of other wildlife?

☐ Yes ☐ No

Why is this necessary? _____

3. Are fish handled properly so they don't suffer?

☐ Yes ☐ No

What does handling fish properly mean to you? _____

4. Are fish respected by putting bear fat in their mouth and releasing them back into the water?

☐ Yes ☐ No

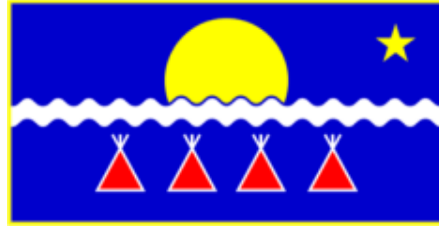
Why is this done? _____

5. Are women avoiding stepping over nets, gear, and fish parts?

☐ Yes ☐ No

Why is this done? _____

Appendix 11 – Aquatic Ecosystem - Scientific Monitoring Protocol



Tłıchǫ

Aquatic Environmental Sampling Protocols

DRAFT FOR REVIEW

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1 INTRODUCTION

The Wek'èezhì Renewable Resource Board and Tłıchǵ Government is undertaking community-based environmental monitoring of lakes in the Tłıchǵ area. The objective of the monitoring is to document the current conditions of basic environmental parameters in lakes used for subsistence fishing near the four Tłıchǵ communities.

In spring, the Project Working Group on the advice of elders choose a lake to study. In the summer, a field crew consisting of elders, youth and scientists travel to the lake to record traditional knowledge about the lake as well as collect scientific measurements of lake depth, water quality, sediment quality, and fish in the lake. One lake near one Tłıchǵ community is studied each summer. The program will rotate through the four Tłıchǵ communities such that any one location is monitored every four years to check if the conditions are the same or if they have changed.

This document contains a description of the methods used to measure the lake depth, water and sediment quality and fish in the lake. Each year the same methods will be used so the program is standardized and organized. The methods are consistent with best scientific practice and Northwest Territories monitoring guidance such as the Cumulative Impact Monitoring Program monitoring protocols. A summary of the types of protocols to on each lake is listed in Table 1-1.

Table 1-1 Summary of the Types of Scientific Samples to be Collected at each Lake

Type	Number of samples	Purpose
Lake Depth	Several measurements along four to five transects of the lake	Obtain preliminary understanding of depth of the lake and shallow and deep areas
Water	Collect five surface samples from around the lake in shallow and deep areas	To document water quality for drinking water quality and presence of contaminants
Sediment	Collect five grab samples from around the lake in shallow and deep areas	To document the sediment type and quality and possible presence of contaminants
Fish	Set one gill net in a shallow area of the lake and second gill net in the deep area of the lake; Collect 20 large-bodied fish.	Document the species of fish present in the lake on the basis of limited overnight gill net set and document tissue chemistry from large-bodied fish that are commonly eaten by community member.



2 LAKE DEPTH

2.1 WHY IS LAKE DEPTH IMPORTANT?

Lake depth is the measurement of how deep the water is around different areas of the lake. Measuring the depth of a lake is important because it helps to monitor changes to a lake over time. Knowing the water depth can help you determine where to set nets for fishing. It also helps to determine how well a lake can support animal life. For example, fish could not survive overwinter in a shallow lake that freezes to the bottom. Finally, it also helps identify hazards such as shallow rocky areas that would be dangerous to boaters.

2.2 HOW DO WE MEASURE LAKE DEPTH?

There are several methods that can be used to measure lake depth. Some methods use electronic meters attached to boats and some involve simple measurements with a stick or a rope.

The protocol outlined here uses a standard electronic fish finder and a handheld GPS unit. Depth measurements are taken at numerous places around the lake to find the shallow and deep areas. A handheld GPS unit is used to record the UTM coordinates at the same place where the depth measurements are taken. The measurements are written down on a map of the lake to make a map showing the lake depths in different areas; this is called a 'bathymetry map'.

The steps involved in preparing for the field work as well as the methods for measuring lake depth using this method are provided below.

2.3 USEFUL TERMS TO KNOW

The scientific words that are useful to know when measuring lake depth are:

- Bathymetry – measurement of water depth and shape of the bottom of the lake;
- Transect – straight lines across a lake where lake depth stations will be placed to measure depth in an organized way;
- Lake depth station – the place where to measure lake depth along a transect; and,
- Datasheet – a piece of paper that will be brought to the lake and where the measured lake depths and other information will be written.



2.4 INSTRUCTIONS FOR THE FIELD WORK

2.4.1 Before Going to the Lake

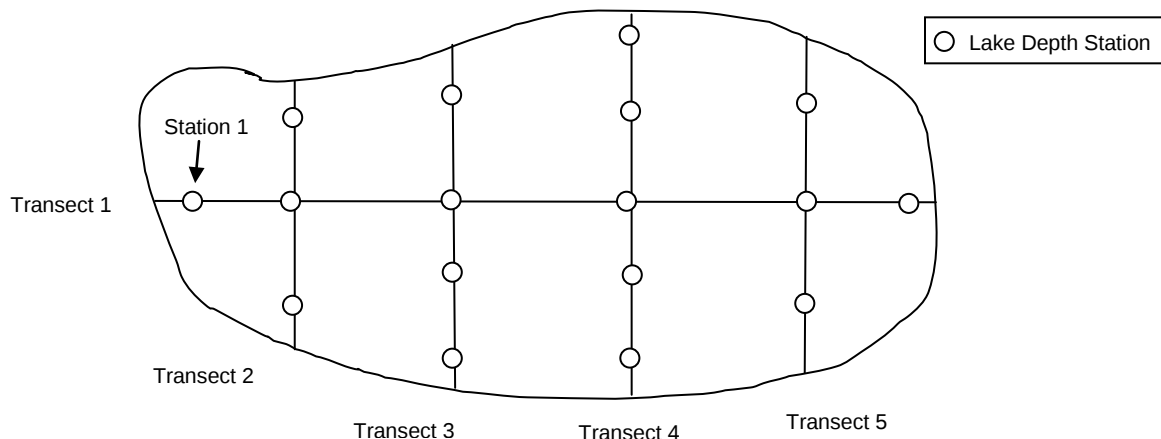
You must prepare a map of the lake, a datasheet, and your equipment before you go to the lake. You must also prepare a health and safety plan for your crew.

Preparing the Map and Datasheet

Get a map of the lake

- Discuss the purpose of the lake depth measurements with the team that is going to do the work (field crew)
- Take the map, and draw lines across the map (See Figure 1). Each line is called a transect. Give each transect a number. The number of transects will depend on the size of the lake; four to six transects is a reasonable number for a medium sized lake like Slemon Lake.
- Along each transect, draw a few spots on the map spreading them evenly across each transect (see Figure 1). Three to five spots on each transect is a reasonable number, but more spots may be needed if the transect is very long. At each spot you will measure lake depth. Each spot is called the lake depth station.
- The depth from each station will be written down on a datasheet. Give each sample station a number.
- Make two to three copies of the map onto paper; water proof paper is preferred.
- Make two to three copies of the datasheet below onto waterproof paper.

Figure 2-1 Example of Transects and Lake Depth Stations on a Lake





Preparing and Packing the Equipment

Pack the equipment listed on the Equipment Checklist (Table 2-1). This is a suggested list of equipment. Discuss with your field crew any other equipment that may be needed.

Table 2-1 Field Equipment Checklist

Packed	Equipment Needed
Boat	
	boat (if inflatable make sure all the parts are included)
	motor with gas tank and hose
	tool box
	boat safety kit (bailer, throw bags, flares)
	paddles
	anchors (preferably two)
	rope to tie the anchors
Lake Depth	
	electronic fish finder
	handheld GPS
	camera
	field maps showing transects and lake depth stations
	datasheets and clipboard to hold datasheets
	pencils and permanent markers (Sharpies)
Safety	
	Lifejackets for each member of the field crew
	first aid kit
	survival kit
	cell phone or satellite phone if there is no cellular reception.
	bear spray and bear bangers
	Rain jacket and pants
	Backpack with spare warm clothes
	bug jacket
	insect repellent

Prepare the Health and Safety Plan

- Discuss and document potential hazards, emergency procedures and who to contact if there is an emergency.
- Check that all field crew members have this information with them when in the field.



2.4.2 At the Lake

- Pack your equipment and your map and datasheets in the boat.
- Have a Health and Safety meeting at the lake before getting in the boat including talking about potential hazards, weather concerns and what to do if something goes wrong.
- Decide which person will drive the boat and read the fish finder, which person will use the GPS, and which person will write down the depths and UTM coordinates on the datasheet.
- The instructions for measuring the lake depths for the field crew are listed below. There are instructions for the boat driver, the person using the GPS and the person writing down the depth and UTM coordinates at each lake depth station.

If you are the boat driver:

- Drive the boat to first lake depth station of Transect 1.
- Stop the boat, anchor the boat if it is windy.
- Read the water depth off the fish finder and allow the other crew members to record the UTM coordinates on the GPS and write down the depth and UTM coordinates on the datasheet.
- Drive to the next station on the transect.
- Once you have finished the first transect, drive the boat to the start of the second transect; repeat until all the transects are complete.

If you are the person using the GPS:

- Once the boat is at the first lake depth station mark the waypoint on the GPS. The GPS will automatically assign a number to this waypoint.
- Read the UTM coordinates to the person writing down the information on the datasheet.
- Repeat this procedure at each lake depth station on each the transect until all stations and transects have been measured.

If you are the person writing down the information:

- Write the name of the lake, the names of the crew, the date, the time of start and finish and a description of the area in the top of the datasheet. At the bottom of the datasheet, write down your name in the line called 'Recorder'; this means you are the person writing all the information on the datasheet.
- Write down the number of the transect and the number of the lake depth station.
- At the lake depth station, write down the UTM coordinates of the lake depth station (Easting and Northing) on the datasheet.
- Write down the depth at each station.



- When you are finished the measurements, check the datasheet to be sure it is filled in and no information is missing. This is called a quality control/quality assurance check or a QA/QC check. It is best if a different person from the person who wrote down the information completes this QA/QC check. This is because a new person might see something that the first person missed like a blank space or a number that is unusual. For example, someone might write 300 meter depth instead of 30 meter depth by mistake.
- Write the name of the person who did the QA/QC check in the bottom of the datasheet,
- It is important to do this QA/QC check while at the lake. If something is missing or looks incorrect, try to go back on the lake to re-measure the depth.
- If you are working on a large lake and cannot sample all the stations in one day, return the next day and continue where you left off.

2.4.3 Back in the Office

Unpack and dry equipment.

Submit the datasheets to appropriate person who looks after this information. They will enter the data into a computer and scan the datasheet so there is an electronic copy of the datasheet.



LAKE DEPTH DATASHEET

Page ____ of ____

PROJECT AND SITE DATA						
Lake Name.			Project Name		Start Time:	
Date (yyyy/mm/dd)			Field Crew		End Time:	
Description of Area					NAD and Zone:	
LAKE DEPTH DATA						
Transect #	Lake Depth Station #	Waypoint Number	Easting	Northing	Water Depth (m)	Comments

Recorder _____
 Field sheet QA by: _____
 Data entry by: _____
 Data entry QA by: _____

Comments:



3 WATER QUALITY

3.1 WHY IS WATER QUALITY IMPORTANT?

Water quality is the physical (temperature, pH, turbidity), chemical (metals, salts) and biological (bacteria and biological oxygen demand) characteristics of water. Natural conditions and human activities can affect water quality, which can ultimately have an effect on fish, wildlife and human health. Water quality sampling helps to document existing conditions in a lake and allows monitoring for changes over time.

3.2 HOW DO WE MEASURE WATER QUALITY?

This information is gathered by collecting water samples and submitting them to an analytical laboratory for analysis. Water quality samples can be collected from the surface of a lake as well as from deeper in the water. The simplest method is to grab water from the surface of the lake because it does not require any special sampling equipment.

In addition to the water quality grab samples, field meters can be used to measure certain water quality parameters, including water temperature, pH, conductivity, dissolved oxygen and turbidity. The field meters have probes that can be lowered into the water column to collect measurements at different depths. This is called water profile data.

This protocol is for collecting five surface water samples around a study lake. These will be the same stations that sediment is sampled, but are different from where lake depths were measured. The steps involved in preparing for the field work as well as the methods for collecting surface water samples and water profile data are provided below.

3.3 USEFUL TERMS TO KNOW

The scientific words that are useful to know when measuring water quality are:

- Water temperature – how warm or cold is the water.
- Conductivity – the measure of the ability of water to conduct an electrical current and depends on the concentration of charged particles or ions in the water.
- pH – how acidic or alkaline is the water. Pure water is neutral, with a pH close to 7. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Vinegar, for example, is acidic and bleach is basic or alkaline.
- Dissolved oxygen – how much oxygen is in the water for fish and other organisms to breathe.



- Total dissolved solids – a measure of the total ions or charged particles in the water.
- Turbidity – the amount of solid material suspended in the water or how clear is the water.

3.4 INSTRUCTIONS FOR THE FIELD WORK

3.4.1 Before Going to the Lake

- Order and pickup your sample bottles from the lab a week before you plan to go to the lake
- Prepare a map of the lake and choose the approximate locations of your five sampling stations ahead of time, try to have some stations be in shallow water and some in deep water. These will be the same stations that you will sample for sediment quality but are not the same stations where lake depth was previously measured. Note that water quality samples have to be taken before sediment quality samples because you do not want sediment in your water.
- Make photocopies of your datasheets on waterproof paper. Note that the same datasheet is used for both water and sediment quality sampling.
- Prepare your equipment before you go to the lake.
- Prepare a Health and Safety Plan for your crew and make enough copies of this for each crew member as well as for all the emergency contact people.

Ordering the Sample Bottles

Order sample bottles from Taiga Environmental Laboratory (Taiga) in Yellowknife at least one week before the sampling date to make sure that all of the bottles, preservatives, and blanks are received before sampling begins.

To place a bottle order with Taiga, a "Bottle Order Form" must be filled out and submitted by e-mail to Taiga. A "Bottle Order Form" (see Figure 3-1) can be downloaded from the Taiga website at: http://nwt-tno.inac-ainc.gc.ca/taiga/fms_e.htm.



Figure 3-1: Example of Taiga Bottle Order Form

TAIGA ENVIRONMENTAL LABORATORY Bottle &/or Preservative Order Form						
Date Ordered: 12-20-2011		Date Required: 01-01-2012				
Name: ABC		Company: WLWB		Project name or Location: Slemon Lake		
Address: Example Shipping Address						
Phone: #		Fax: #				
Pick up: ☐ Yes ☒ No		Ship by Air: ☒ Yes ☐ No		Pack as TDG: ☒ Yes ☐ No		Cooler required: ☒ Yes ☐ No
Date Filled: 200				Filled By:		

NOTE: Bottles and preservatives are provided free of charge for analysis carried out at Taiga. Bottles, preservatives and laboratory supplies for other use, may be subject to additional charges. Unused bottles and preservative cannot be returned to the laboratory for reuse.

Parameter Type	No. of Field Blanks	No. of Travel Blanks	No. of Bottles for Samples	QC Batch # of Bottles Sent	Number of Preservatives	QC Batch # of Pres. Sent
Routine (Green)	1	1	8		Not Required	
Nutrients (Black)	1	1	8		Not Required	
Bacti (Sterile sealed)	Not Required	Not Required			Not Required	
BOD (Purple)	Not Required	Not Required			Not Required	
Total Metals (Red)	1	1	8		8	
Dissolved Metals (Red) see note 1						
Arsenic Speciation Bottle	Not Required	Not Required			Not Required	
Cyanide (Blue)						
Thiocyanate (Orange)						
Hexane Extractable Material (Oil & Grease) (Brown glass, wide or narrow mouth)						
Phenol (Brown glass, narrow mouth)						
Sulphide	1	1	8		8	
Radioisotope						
Chlorophyll A (1L brown plastic bottle)	Not Required	Not Required			Not Required	
Extractable Hydrocarbons (Brown glass) see note 2					Not Required	
BTEX/Purgeable HC see note 2					Not Required	
THM (Glass vial 40ml)					Not Required	
Metals or Hydrocarbons in sediment (300ml jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (1250ml jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (1250ml jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (100ml jar or Whirl Pak Bag)	Not Required	Not Required			Not Required	
Other:						

Other Field Supplies: (e.g. Type I UV⁺ water)

Notes:
 1- Dissolved metals bottles will be preserved at the laboratory if the sample is not filtered in the field. The filtering and addition of preservative is \$20.00/sample.
 2- For TPH requests, both the extractable hydrocarbons (brown glass bottle) and the BTEX/Purgeable HC (40ml vial) have to be submitted.

Shaded areas are for laboratory use only.

Taiga Environmental Laboratory
Bottle/Preservative Order Form
Revision 2 Effective Date 15-Jan-07

Page ____ of ____
Form ID: FQR 0001 File ID: 351.4.4.1
FQR 0001 - Bottle/Preservative Order Form

Note: The Taiga Bottle Order Form example is filled out for five Sample Stations, one Field Blank, one Travel Blank, one Duplicate, and one extra sets of bottles and preservatives.



A total of ten sets of sample bottles and preservatives (each set consists of four different sample bottles and two different preservatives as per Table 3-1) should be ordered from Taiga. One of these sets will be filled at each of the five water quality sampling stations. An extra set (duplicate) of sample bottles will be filled at one sampling station for quality assurance/quality control (QA/QC). The QA/QC samples are explained in more detail below. The two extra sets of bottles have to be ordered in case samples spill or bottles get lost in the field. You will also need to order a set of bottles for the Trip Blank (these will be filled and preserved by the lab and should travel with you to and from the lake) and a set of bottles for the Field Blank (these are empty bottles that you will fill and preserve with special water that is deionized). You will also need to ask the lab for enough deionized water to fill the Field Blank bottles.

To help with preparing the sample bottles, a photograph of an example set of bottles and preservatives that are required is presented in Photograph 3-1. A summary of bottle type, bottle size, and preservative information is presented in Table 3-1.

Photograph 3-1 Example of a Full Set of Sample Bottles and Preservatives

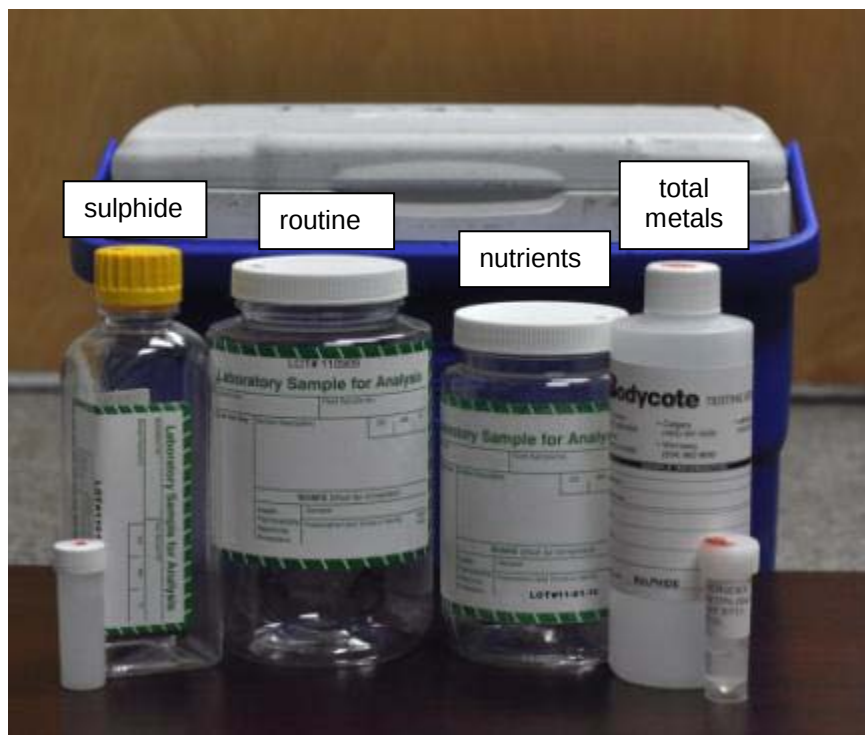




Table 3-1: Water Quality Sample Bottle Types, Parameters, and Preservatives

Type of Bottle and Analyses Requested	Parameters included in Analyses	Bottle Size and Type	Preservative
Total Metals	Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Cesium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Mercury, Molybdenum, Nickel, Rubidium, Selenium, Silver, Strontium, Thallium, Tin, Titanium, Uranium, Vanadium, and Zinc.	250 mL Plastic (clear)	Nitric Acid (Red dot)
Nutrients	Ortho-Phosphate, Dissolved Phosphorus, Total Phosphorus, Nitrate + Nitrite, Nitrate, Nitrite, Total Organic Carbon, Dissolved Organic Carbon, Reactive Silica.	500 mL Plastic (clear)	None
Physical/Major Ions	Alkalinity, Conductivity, pH, Turbidity, Total Dissolved Solids, Total Suspended Solids, Calcium, Chloride, Total Hardness, Magnesium, Potassium, Sodium, and Sulphate.	1L Plastic (clear)	None
Sulphide	Sulphide	250 mL Plastic (opaque)	Zinc Acetate (Orange dot)

mL = millilitre, L = litre.

Quality Assurance/Quality Control Samples

The QA/QC samples will include one Duplicate set of sample bottles, one Field Blank set of sample bottles, and one Travel Blank set of sample bottles. The Field and Travel Blank sample bottles should be included in the “Bottle Order Form” while placing an order with Taiga. The Duplicate sample bottles will be ordered as an extra bottle set.

Duplicate Sample: The duplicate water sample is collected by filling up an additional (duplicate) set of water bottles at one sample station (chosen randomly). It is collected to check variability introduced during sample collection, sample handling, and laboratory analytical procedures. Do not forget to write down at which station the duplicate was taken.

Field Blank: The field blank sample is collected by filling up sample bottles in the field with deionized (purified) water provided by Taiga laboratory. Field Blanks are used to assess potential contamination during sample collection.

- **Travel Blank:** The travel blank sample is a set of sample bottles that Taiga will provide that are already filled with deionized water. It is important **not** to open the travel blanks at any time. The travel blanks are supposed to travel with all of the other samples and are used to determine if any contamination may have occurred during transportation, storage, or analysis.



Label the Sample Bottles

Sample bottles from Taiga should come with a waterproof label. These labels can be completed in advance and should include the following information:

- client name: Wek'èezhii Renewable Resource Board;
- lake name (e.g., Slemon Lake)
- sample station name (e.g., Station 1);
- sampling date (e.g., June 01, 2012);
- analysis required (e.g., total metals); and
- initial of the person taking the sample.

Field Equipment

Pack the equipment listed on the Equipment Checklist (Table 3-2) the day before going to the lake. Put the bottles into a cooler with icepacks so that the samples do not warm up too much. Sampling should commence first thing in the morning. Taiga has committed to filtering and preserving samples within three hours of receipt. This means samples must be delivered to the laboratory as soon as possible after they are collected.



Table 3-2 Field Equipment Checklist

Packed	Equipment Needed
Boat	
	boat (if inflatable make sure all the parts are included)
	motor with gas tank and hose
	tool box
	boat safety kit (bailer, throw bags, flares)
	paddles
	anchors (preferably two)
	spare rope
Water Quality	
	pre-labelled sample bottles
	preservatives
	deionized water
	non-powdered latex or nitrile gloves
	coolers
	ice packs
	Chain-of-Custody forms and shipping labels (if required)
	Hatch Hydrolab Datasonde 5 multiprobe (calibrated)
	GPS
	camera
	field maps with sampling locations
	datasheets and clipboard
	pencils and Sharpie markers
	packing tape
Safety	
	Health and Safety Plan
	certified personal flotation devices
	first aid kit
	survival kit (if in a remote area)
	cell phone or satellite phone
	bear spray
	bug jacket
	insect repellent

Calibrate the Water Meter

Calibrate the water meter (Hatch Hydrolab™ Datasonde 5 multiprobe) the day before going to the lake. To calibrate, follow the directions outlined in the equipment manufacturer's manuals.



Following the manufacturer's instructions, calibrate the pH, conductivity, dissolved oxygen, total dissolved solids, and turbidity (temperature does not need to be calibrated).

If the meter calibrated successfully (if not, refer to the trouble shooting guide in the meter instruction manual).

Prepare the Health and Safety Plan

Before leaving for the field, set up a Health and Safety Plan that includes the following information:

- check-in contacts (person or people who the field crew will contact when they return from the field);
- when the field work will occur (i.e., start and end dates and times);
- where field work will occur (e.g., GPS coordinates, maps);
- personal contact information for each of the field crew (e.g., phone numbers and names);
- emergency phone numbers (e.g., search and rescue, nearest hospital).

Review the Health and Safety Plan with the field crew and have each member sign it. Make sure that the check-in contact people know they are being listed and know what their role will be if an emergency happens. Also, make sure to provide the check-in people with a copy of the Health and Safety Plan so they have all the information they might need.

3.4.2 At the Lake

Pack your equipment, the map and datasheets in the boat.

Have a Health and Safety meeting at the lake before getting in the boat. This meeting should talk about potential hazards, weather concerns and what to do in case of emergency.

Decide which person will drive the boat, which person will collect the water profile measurements and water samples, and which person will write on the datasheet and use the GPS.

Drive to the first sampling station. Stop and anchor the boat (you may need two anchors, one at the bow and one at the stern if it is windy). Collect the water profile measurements and fill the sample bottles. Repeat until all the sampling stations have been sampled.



Water Profile Measurements

Water profile measurements are collected at each sampling stations using the Hach Hydrolab Datasonde 5 multiprobe. The following parameters are measured and recorded on the datasheet:

- water temperature (C°);
- conductivity (µS/cm);
- pH;
- dissolved oxygen (in mg/L);
- total dissolved solids (mg/L); and
- turbidity (NTU).

Turn on the Hatch Hydrolab™ Datasonde 5 multiprobe. Make sure the display box is held securely and will not slip into the water.

Put the probe directly into the lake water making sure that all of the probes are fully submerged. Allow the probe readings on the screen to stabilize by holding the probe in the water for a minimum of one minute (or until the readings have stopped changing for a minimum of ten seconds).

Calibrate the depth so that the surface reading is 0 m.

Record the field measurements on the datasheet.

Lower the probe to a depth of 1 m, allow the readings to stabilize and record the measurements on the datasheet.

Continue until the sonde hits the bottom and the reading start being abnormal (very low DO)

When you bring the probe back to the water surface, make sure to gently rinse it in the lake water to make sure there is no dirt from the bottom of the lake on it. You can do this by moving it back and forth in the water and looking at it to make sure it's clean.

Surface Water Grab Sample

See Table 2-1 and Photograph 2-1 for the type and volume of sample bottles as well as the preservation requirements for each type of sample.

Use non-powdered latex or nitrile gloves for all sample collection. This helps to keep anything that might be on your hands from getting into the bottle. The gloves also help protect your hands from the preservatives that might spill and burn your skin.

Be as clean as possible when handling bottles. Only use clean bottles provided by the laboratory and do not touch the inside of the bottle caps or the mouth of the bottles

Rinse all bottles and caps three times by filling up with lake water, shaking gently so that the water touches all sides of the bottle and cap, then dump this water out of the bottle in an area



away from where you are going to collect the water sample. For example, you can collect the water on one side of the boat and dump the rinse water on the other side of the boat.

After triple rinsing the sample bottles, fill the sample bottles by submerging them approximately 50 cm below the water surface. If no preservative is required, fill the sample bottle completely. If a preservative is required, leave just enough room in the bottle for the preservative.

Preserve the sample bottles that need preservatives immediately after the samples are collected. You can mark the bottle (on the cap or label) once they have been preserved. This makes it easier to keep track of what has and has not been preserved when you do a final check on the samples before returning home.

Keep samples cool and in the dark by storing them in coolers with ice packs.

Chain of Custody Forms

Chain-Of-Custody (COC) forms are official forms that document what stations were sampled, date and time of sampling, who was involved in collecting and transporting the samples, who received the samples at the lab, and what parameters are required to be analyzed (Figure 2-2). If there are special things that the samples need (e.g., filtering, rush order) these must be clearly identified on the COC form. COC forms can be downloaded from Taiga Environmental Lab's website: http://nwt-tno.inac-ainc.gc.ca/taiga/fms_e.htm and then clicking on the "Taiga Field Sheet" link.

- Fill out the COC form carefully. This is a legal document and you should be very careful not to make any mistakes.
- Make sure that the person or people listed to receive the Invoice and Results are correct (e.g., Wek'èezhìi Renewable Resource Board).
- Make sure to record the sample name. This will be your station name (e.g., Station 1, Station 2).
- Check that the parameters requested for every sample being analyzed in each column of the form.
- Sign and date the COC form and make a photocopy.
- Place the original signed COC form inside a large Ziploc bag and place inside one of the coolers with the samples. Keep the other copy for your file records.



Figure 3-2 Example of Taiga Chain-Of-Custody Form for Water Quality

TAIGA ENVIRONMENTAL LABORATORY LABORATOIRE ENVIRONNEMENTAL TAIGA 4601 - 52 Avenue, P.O. Box 1500, Yellowknife, NT, X1A 2R3 Tel: (867) 669-2788 • Fax: (867) 669-2718 www.taiga.gc.ca		Batch No.: T-123456789					
Send Results & Invoice to: (Please notify if results or invoice are to be sent to different locations) Company/Agency: <u>WLWB</u> Address: <u>#1-4905, 48th St.</u> City/Town: <u>YK</u> Province/Territory: <u>NT</u> Postal Code: <u>X1A 8S3</u> Phone: <u>867 765 4592</u> Fax: <u>867 765 4593</u> E-mail: <u>example@wlwb.com</u> Signature: <u>[Signature]</u>		Client Project No: <u>123</u> Date collected: <u>01-01-2012</u> Time collected: <u>08:00</u> Sampler: <u>ABC</u> Location: <u>Slemon Lake</u> Rush Required: ☐ Yes ☒ No (Surcharge applies, please check with Laboratory for price and availability.) Note: Analysis may be subcontracted without prior notice. Date Received: _____ Received By: _____ Comments: _____ (Laboratory use only)					
-WATER SAMPLES-							
Sample Type (check one, sewage, wastewater, portable, groundwater, surface water only)		<u>Fresh Water</u>					
Client Sample ID (As it should appear on final report)		<u>Slemon LK - Stn. 1</u>					
Taiga Sample ID (Laboratory use only)							
[X] PLEASE CHECK PARAMETERS REQUESTED BELOW:							
Physical/Chemical pH, Conductivity, Alkalinity Individual Anions: Sulfate ☒ Total Nitrite (NO ₂ -N) + Nitrate (NO ₃ -N) ☒ Individual Cations: Suite ☒ Hardness (Calculated) Reactive Silica Color Laboratory use only	☒ pH ☒ Cond ☒ Alk ☒ SO ₄ ☒ NO ₂ -N ☒ NO ₃ -N ☒ Ca ☒ Mg ☒ Na ☒ K ☒ Hardness ☒ Silica ☒ Color Received: Y N T °C Sample container: Y N	☒ pH ☒ Cond ☒ Alk ☒ SO ₄ ☒ NO ₂ -N ☒ NO ₃ -N ☒ Ca ☒ Mg ☒ Na ☒ K ☒ Hardness ☒ Silica ☒ Color Received: Y N T °C Sample container: Y N	☒ pH ☒ Cond ☒ Alk ☒ SO ₄ ☒ NO ₂ -N ☒ NO ₃ -N ☒ Ca ☒ Mg ☒ Na ☒ K ☒ Hardness ☒ Silica ☒ Color Received: Y N T °C Sample container: Y N				
	Nutrients Chemical Oxygen Demand Nitrogen: Total, Dissolved Turbidity Total Suspended Solids, Dissolved Solids Ammonia Phosphorus: Total, Dissolved, Ortho Carbon: Total, Dissolved Chlorine: Total, Residual Visible Oil and Grease Laboratory use only	☒ COD ☒ TN ☒ DN ☒ Turbidity ☒ TSS ☒ TDS ☒ NH ₃ -N ☒ TP ☒ OP ☒ TOC ☒ DOC ☒ T-Cl ☒ R-Cl Received: Y N T °C Sample container: Y N	☒ COD ☒ TN ☒ DN ☒ Turbidity ☒ TSS ☒ TDS ☒ NH ₃ -N ☒ TP ☒ OP ☒ TOC ☒ DOC ☒ T-Cl ☒ R-Cl Received: Y N T °C Sample container: Y N	☒ COD ☒ TN ☒ DN ☒ Turbidity ☒ TSS ☒ TDS ☒ NH ₃ -N ☒ TP ☒ OP ☒ TOC ☒ DOC ☒ T-Cl ☒ R-Cl Received: Y N T °C Sample container: Y N			
		Microbiology Fecal Coliforms (FC) Total Coliforms (TC), E. Coli (EC) Fecal Streptococcus (FS) Laboratory use only Biological Oxygen Demand Laboratory use only	☒ FC ☒ TC ☒ EC ☒ FS Received: Y N T °C Sample container: Y N	☒ FC ☒ TC ☒ EC ☒ FS Received: Y N T °C Sample container: Y N	☒ FC ☒ TC ☒ EC ☒ FS Received: Y N T °C Sample container: Y N		
			Metals Please indicate if sample is preserved and/or filtered ICP-MS(1): Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe ICP-MS(2): <u>Aluminum and Arsenic As</u> (not included: B, Br, Hg, Se) Individual Metals by ICP-MS (please specify each metal): Ag, Al, As, B, Ba, Be, Bi, Br, Ca, Cd, Co, Cr, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Si, Sn, Sr, Ta, Te, Ti, U, V, Zn Laboratory use only Hexane Extractable Material (HEM) Laboratory use only	☒ Pres ☒ Filtr ☒ Pres ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved Received: Y N T °C Sample container: Y N	☒ Pres ☒ Filtr ☒ Pres ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved Received: Y N T °C Sample container: Y N	☒ Pres ☒ Filtr ☒ Pres ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved ☒ Total ☒ Dissolved Received: Y N T °C Sample container: Y N	
				BTX, Purgeable HC (40ml x 2 vials) Extractable HC (H. amber glass bottle) Trihalomethanes (40ml x 2 vials) Laboratory use only Other: <u>see special request form</u> For safety purposes, please disclose any contaminants (e.g. heavy metals, cyanide, etc.) that may be present at high levels and pose a risk to human health:	☒ BTX ☒ Purg HC ☒ Ext HC ☒ THM Received: Y N T °C Sample container: Y N	☒ BTX ☒ Purg HC ☒ Ext HC ☒ THM Received: Y N T °C Sample container: Y N	☒ BTX ☒ Purg HC ☒ Ext HC ☒ THM Received: Y N T °C Sample container: Y N

Note: The Taiga Chain-Of-Custody Form example is filled out for one sample station (four bottles = physical/major ions, nutrients, total metals, and sulphide).



3.4.3 Back at the Office

- Take the water samples and COC form to Taiga. Have Taiga sign the form. Get a photocopy of the signed COC to take with you.
- Unpack and dry equipment.
- Submit the datasheets to the appropriate person who looks after this information. They will enter the data into a computer and scan the datasheet so there is an electronic copy of the datasheet.



WATER AND SEDIMENT DATASHEET						Page _____ of _____
Lake Name: _____			Project Name: _____			
Sampling Station: _____			UTM Coordinates: _____			
Date: _____			Field Crew: _____			
Water sample collected: YES / NO Sample Name: _____						
Sediment sample collected: YES / NO Sample Name: _____						
					Sediment sample depth: _____ m	
Water Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)	Comment
Comments						Recorder: _____
						Field sheet QA by: _____
						Data entry by: _____
						Data entry QA by: _____



4 SEDIMENT QUALITY

4.1 WHY IS SEDIMENT QUALITY IMPORTANT?

Sediment quality is the physical (sand, silt or clay) and chemical (metals, salts) characteristics of the mud (called sediment) at the bottom of a lake. Natural conditions and human activities can affect sediment quality, which can ultimately have an effect on fish, wildlife and human health. Sediment quality sampling helps to document existing conditions in a lake and allows monitoring for changes over time.

4.2 HOW DO WE MEASURE SEDIMENT QUALITY?

This information is gathered by collecting sediment samples and submitting them to an analytical laboratory for analysis. There are several methods for collecting sediment samples. One of the simplest methods is to use a piece of equipment that grabs the sample underwater; this is called an Ekman grab sampler (Photograph 4-1). The Ekman is attached to a rope and is lowered to the bottom of the lake. An Ekman has spring-hinged jaws that snap closed when hit by a heavy messenger that travels down the rope and grab a sediment sample.

This protocol is for collecting five sediment samples around a study lake. These will be the same stations that water quality is sampled, but are different from where lake depths were measured. The steps involved in preparing for the field work as well as the methods for collecting sediment samples are provided below.

4.3 USEFUL TERMS TO KNOW

Ekman grab sampler – a metal box with spring-hinged jaws that snap closed and “grab” a sediment sample.

Messenger – a heavy piece of metal that slides down the rope to the Ekman and triggers the jaws to close on the sediment.

Particle size – a measure of how much of the sediment sample is made up of sand, silt, clay or gravel.



Photograph 4-1: Ekman Grab Sampler



4.4 INSTRUCTIONS FOR THE FIELD WORK

4.4.1 Before Going to the Lake

- You must order and pick up either glass sample jars or plastic samples bags from the lab a week before you plan to go to the lake. You could use large Ziploc bags if you cannot obtain containers from the lab.
- You will need two bags for each of the five sediment sample stations (a total of ten bags). Bring a few extra in case something is broken or lost. You need two bags per sample so you can double bag each sample. This is in case one of the bags breaks.
- Prepare a map of the lake and choose the approximate locations of your five sampling stations ahead of time. These will be the same stations that you will sample for water quality. Note that water quality samples have to be taken before sediment quality samples because you do not want sediment in your water.
- Make photocopies of your datasheets on waterproof paper. You can use the same datasheet as the one used for water quality.



- Prepare your equipment before you go to the lake.
- Prepare a health and safety plan for your crew and make enough copies of this for each crew member as well as for all the emergency contact people.
- Label the sediment sample bags or jars.
- If sample bags are being used, make sure you have enough bags to double bag each sample. This keeps the sample from leaking if one of the bags breaks.
- Make a second waterproof label for each sample. This label will be inserted between the two bags and is a back up label in case the first one wears off or gets damaged.

Pack required equipment listed on the Equipment Checklist (Table 3-1) the day before going to the lake. This is a suggested list of equipment and additional equipment may be required.

Table 4-1 Field Equipment Checklist

Packed	Equipment Needed
Boat	
	boat (if inflatable make sure all the parts are included)
	motor with gas tank and hose
	tool box
	boat safety kit (bailer, throw bags, flares)
	paddles
	anchors (preferably two)
	buoy
	sideline
Sediment Quality	
	50 m measured and marked rope
	Ekman grab sampler
	clean bucket
	stainless steel spoons (minimum 2)
	pre-labelled sample jars or bags
	Coolers and icepacks
	GPS
	Chain-of-Custody forms
	field maps showing transects and sampling stations
	datasheets and clipboard
	pencils and Sharpie markers
Safety	
	certified personal flotation devices
	first aid kit



	survival kit (if in a remote area)
	cell phone or satellite phone
	bear spray and bear bangers
	bug jacket
	insect repellent

Prepare the Health and Safety Plan

Before leaving for the field, set up a Health and Safety Plan that includes the following information:

- check-in contacts (person or people who the field crew will contact when they return from the field);
- when the field work will occur (i.e., start and end dates and times);
- where field work will occur (e.g., GPS coordinates, maps);
- personal contact information for each of the field crew (e.g., phone numbers and names);
- emergency phone numbers (e.g., search and rescue, nearest hospital).

Review the Health and Safety Plan with the field crew and have each member sign it. Make sure that the check-in contact people know they are being listed and know what their role will be if an emergency happens. Also, make sure to provide the check-in people with a copy of the Health and Safety Plan so they have all the information they might need.

4.4.2 At the Lake

- Pack your equipment, the map and datasheets in the boat.
- Have a Health and Safety meeting at the lake before getting in the boat. This meeting should talk about potential hazards and weather concerns.
- Decide which person will drive the boat, which person will collect the water profile measurements and water samples, and which person will write on the datasheet and use the GPS.
- Drive to the first sampling station. Stop and anchor the boat (you may need two anchors if it is windy). Collect the water profile measurements and fill the sample bottles. Repeat until all the sampling stations have been sampled.



Sediment Grab Samples

- Travel to the first sampling station and anchor the boat with two anchors (one at the bow and one at the stern).
- Record the water depth, profile the lake and take the water samples as per section 3 – Water Quality.
- Prepare the sample container (bag or jar) and have it ready.
- Have a clean bucket ready to transfer the sample.
- Check that the Ekman is securely tied to the end of the measured rope.
- Set the jaws of the Ekman. CAUTION: Open jaws away from any body parts and keep fingers clear of the opening. If jaws were to suddenly close could it could cause serious injury.
- From the bow of the boat slowly lower the Ekman until it rest on bottom of the lake.
- Pull on rope just enough to tighten but not to lift sampler off the lake bottom.
- Send the messenger down the rope to close the jaws of sampler.
- Slowly pull the Ekman back to the water surface sampler slowly so that no sample is lost.
- If the Ekman jaws did not fully close (see Photograph 4-2), discard the sample and start over.
- If the sampler is fully closed, write down how full the Ekman is (in %), open the jaws and dump the sample into the clean bucket (see Photograph 4-3). Note that there may be water that leaks out of the Ekman into the bucket.
- Use and clean stainless steel spoon to scoop sample into the sample container
- Record observations about the sediment sample (e.g., colour, odour, presence of plants) on the datasheet.
- Store sample in cooler.
- Rinse equipment in ambient water.
- Repeat steps until all the sampling locations are complete.
- Once on shore fill in the COC form and include all samples collected.
- Keep the samples cool and dark by storing them in coolers with ice packs.



Photograph 4-2 Poor Sediment Sample (Ekman Grab Sample with Jaws not fully Closed)





Photograph 4-3 Good Sediment Sample (Ekman Grab Sample with Jaws fully Closed)



Chain of Custody Forms

Chain-Of-Custody (COC) forms are official forms that document what stations were sampled, date and time of sampling, who was involved in collecting and transporting the samples, who received the samples at the lab, and what parameters are required to be analyzed (Figure 4-1). If there are special things that the samples need (e.g., rush order) these must be clearly identified on the COC form.

- Fill out the COC form carefully. This is a legal document and you should be very careful not to make any mistakes.
- Make sure that the person or people listed to receive the Invoice and Results are correct (e.g., Wek'èezhìi Renewable Resource Board).
- Make sure to record the sample name. This will be your station name (e.g., Station 1, Station 2).
- Request analysis for particle size, total metals and major ions.
- Sign and date the COC form and make a photocopy.
- Place the original signed COC form inside a large Ziploc bag and place inside one of the coolers with the samples. Keep the other copy for your file records.



Figure 4-1 Example of Taiga Chain-Of-Custody Form for Sediment Quality



TAIGA
LABORATOIRE ENVIRONNEMENTAL TAIGA
4601 - 52 Avenue, P.O. Box 1500, Yellowknife, NT, X1A 2R3
Tel: (867) 669-2788 • Fax: (867) 669-2718
www.taiga.gc.ca

FIELD SHEET
Batch No. :

Send Results & Invoice to:
(Please notify if results or invoice are to be sent to different locations)
Company/Agency: WRRB
Address: 102A 4504 49th Ave
City/Town: Yellowknife Province/Territory: NT
Postal Code: X1A 1A7
Phone: 867-873-5440 Fax: _____
E-mail: example @ wrrb.ca
Signature: [Signature]

Client Project No: 123
Date collected: 01-01-2012
Time collected: 08:00
Sampler: ABC
Location: SLEMON LAKE
Rush Required: ☐ Yes ☒ No (Surcharge applies, please check with Laboratory for price and availability)
Note: Analysis may be subcontracted without prior notice.
Date Received: _____ Received By: _____
Comments: _____
(Laboratory use only)

-SOIL/SEDIMENT FORM-

Client Sample ID (As it should appear on final report)	<u>SLEMON LK - STN 1</u>		
Taiga Sample ID (Laboratory use only)			

TAIGA
LABORATOIRE ENVIRONNEMENTAL TAIGA
4601 - 52 Avenue, P.O. Box 1500, Yellowknife, NT, X1A 2R3
Tel: (867) 669-2788 • Fax: (867) 669-2718
www.taiga.gc.ca

FIELD SHEET
Batch No. :

Send Results & Invoice to:
(Please notify if results or invoice are to be sent to different locations)
Company/Agency: WRRB
Address: 102A 4504 49th Ave
City/Town: Yellowknife Province/Territory: NT
Postal Code: X1A 1A7
Phone: 867-873-5440 Fax: _____
E-mail: example @ wrrb.ca
Signature: [Signature]

Client Project No: 123
Date collected: 01-01-2012
Time collected: 08:00
Sampler: ABC
Location: SLEMON LAKE
Rush Required: ☐ Yes ☒ No (Surcharge applies, please check with Laboratory for price and availability)
Note: Analysis may be subcontracted without prior notice.
Date Received: _____ Received By: _____
Comments: _____
(Laboratory use only)

-SOIL/SEDIMENT FORM-

Client Sample ID (As it should appear on final report)	<u>SLEMON LK - STN 1</u>		
Taiga Sample ID (Laboratory use only)			

TAIGA
LABORATOIRE ENVIRONNEMENTAL TAIGA
4601 - 52 Avenue, P.O. Box 1500, Yellowknife, NT, X1A 2R3
Tel: (867) 669-2788 • Fax: (867) 669-2718
www.taiga.gc.ca

FIELD SHEET
Batch No. :

Send Results & Invoice to:
(Please notify if results or invoice are to be sent to different locations)
Company/Agency: WRRB
Address: 102A 4504 49th Ave
City/Town: Yellowknife Province/Territory: NT
Postal Code: X1A 1A7
Phone: 867-873-5440 Fax: _____
E-mail: example @ wrrb.ca
Signature: [Signature]

Client Project No: 123
Date collected: 01-01-2012
Time collected: 08:00
Sampler: ABC
Location: SLEMON LAKE
Rush Required: ☐ Yes ☒ No (Surcharge applies, please check with Laboratory for price and availability)
Note: Analysis may be subcontracted without prior notice.
Date Received: _____ Received By: _____
Comments: _____
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Signature: [Signature]

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Postal Code: X1A 1A7
Phone: 867-873-5440 Fax: _____
E-mail: example @ wrrb.ca
Signature: [Signature]



4.4.3 Back at the Office

- Take the sediment samples and COC form to Taiga.
- Unpack and dry all the equipment.
- Submit the datasheets to the appropriate person who looks after this information. They will enter the data into a computer and scan the datasheet so there is an electronic copy of the datasheet.



5 FISH SAMPLING

5.1 WHY IS FISH SAMPLING IMPORTANT?

Fish sampling involves capturing fish from a lake for the purpose of checking which species live in a lake. We also examine fish to see if the fish look healthy or not. By sending fish samples to a laboratory, we can also determine if the fish has a high level of contaminants, such as mercury, and if it is good to eat.

When you catch a fish, you can determine the fish species, the size and weight of the fish, the condition of the fish (does it look healthy on the outside?) and the fish sex/gender. Sometimes, the fish needs to be killed to gather information such as the age, if there are parasites and the gender, and to be able to collect fish tissue to send it to a laboratory for analyses.

The following sections of this protocol explain how to get prepared for the field work, how to collect fish with a gill net and how to collect fish tissue and other fish samples. In this protocol, captured fish will be killed.

5.2 HOW DO WE SAMPLE FISH?

There are many methods to capture fish. Some methods use fishing rods with lures attached to the hook on the line, spears, nets and traps. This protocol explains how to use gill nets. Gill nets are normally set in the evenings and picked up the next morning. If the gill nets are set in the mornings they should be picked up in the evening to avoid hurting and damaging the fish. After picking up the nets, the captured fish are examined by the field crew.

5.3 USEFUL TERMS TO KNOW

- Contaminant: Biological, chemical, physical, or radiological substance which, in sufficient concentration, can adversely affect living organisms through air, water, soil, and/or food.
- Fish tissue: is the fish muscle or the fish liver or kidney.
- Fish parasite: an organism that lives in or on the fish and feeds from the fish body.
- Mesh size: refers how big the holes are in the gill net.
- Fish age structure: a part of a fish, such as a sort of bone in the fish ear (called otolith), or a scale, that is used to determine the age of the fish captured. Age can be determined by counting age rings in the scales or otoliths because every year a new ring is formed.



5.4 INSTRUCTIONS FOR THE FIELD WORK

5.4.1 Before Going to the Lake

Permits

You should apply for two permits to capture fish for scientific purposes. Always carry permits during fishing activities.

- 1) Apply for a License to Fish for Scientific Purposes to be granted by the Department of Fisheries and Oceans (DFO). To apply, you will need to complete a questionnaire and submit it to DFO. You need to know the number of fish you want to capture and what your study lake will be.

Contact information:

NWT Licensing Coordinator
Fisheries and Oceans Canada
Fisheries Management
42043 Mackenzie Highway
Hay River, NT X0E 0R9
Phone: (867) 875-5303
Fax: (867) 874-6922
E-mail: XCA-Inuvikpermit@dfo-mpo.gc.ca

- 2) Apply for an Animal Care Permit to be granted by the Freshwater Institute Science Laboratories Animal Care Committee (FWISL-ACC). To apply, you will need to complete a questionnaire and submit it to the FWISL-ACC. The field staff need to show that they have experience with fish and will respect the fish that are killed for samples.

FWISL-ACC Contact Information:

Environmental Science Division
Central & Arctic
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N6
Phone: 204 983-1327
Fax: 204 984-2403
Email: xca-fwisl-acc@dfo-mpo.gc.ca

Preparing the Map and Datasheets

Get a map of the lake. Also get background information on the lake you plan to set the nets for example the lake depth or fish species present, if available from traditional knowledge or historic scientific studies.

Prepare the datasheet for catching fish and the two datasheets for processing fish and print them on waterproof paper if possible.



Preparing and Packing the Equipment

Pack required equipment; see the attached Equipment Checklist (Table 5-1). Additional equipment may be required. This protocol suggests the use of two gill nets. The nets will have multiple sizes of mesh. Each net should be 45 meters long and 2 meters high.

Table 5-1: Field Equipment Checklist

Packed	Equipment Needed
Boat	
	boat (if inflatable make sure all the parts are included)
	motor with gas tank and hose
	tool box
	boat safety kit (bailer, throw bags, flares)
	paddles
	anchors (preferably two)
	buoys
	sideline
Fish Sampling	
	gill nets (2 multi-mesh size gillnets, 45 meters long and 2 meters high)
	Coolers and icepacks
	Camera
	GPS
	fish collection permits
	field maps showing transects and sampling stations
	datasheets and clipboard
	pencils and Sharpie markers
	Heavy rock to kill the fish with a blow to the head or fish banger (wooden)
General Equipment for Fish Processing	
	collapsible table
	measuring board(s) (various lengths)
	weigh scales or balance
	coolers (with icepacks)
	wax paper
	plastic covering for table and cutting board
	200 plastic bags/Ziploc bags (small, medium and large).
	Fish health datasheets
	Chain-of-Custody forms
	pencils/Sharpie markers
	fish identification book
	camera
	paper towel



	garbage bags
	Special no-metals soap to wash the cutting board
Fish Processing Kit	
	Tote with a lid that seals to store samples after collected and bagged
	ruler and measuring tape
	Plastic cutting boards (at least three)
	Thin scissors
	filleting knife
	small paper envelopes
	callipers
	tweezers
	latex or nitrile gloves
	scalpel and scalper blades
Safety	
	lifejackets
	first aid kit
	survival kit
	cell phone or satellite phone
	bear spray and bear bangers
	bug jacket
	insect repellent

Prepare the Health and Safety Plan

Before leaving for the field, set up a Health and Safety Plan that includes the following information:

- check-in contacts (person or people who the field crew will contact when they return from the field);
- when the field work will occur (i.e., start and end dates and times);
- where field work will occur (e.g., GPS coordinates, maps);
- personal contact information for each of the field crew (e.g., phone numbers and names);
- emergency phone numbers (e.g., search and rescue, nearest hospital).

Review the Health and Safety Plan with the field crew and have each member sign it. Make sure that the check-in contact people know they are being listed and know what their role will be



if an emergency happens. Also, make sure to provide the check-in people with a copy of the Health and Safety Plan so they have all the information they might need.

5.4.2 At the Lake

- Pack the equipment, the map and datasheets in the boat.
- Have a Health and Safety meeting at the field site before getting in the boat: Discuss potential hazards, weather concerns, and emergency procedures.
- Decide which person will drive the boat, which persons will handle the nets and the fish capture and which person will write on the datasheet and use the GPS.
- Later in the afternoon, drive to the first station to set the first gill net.
- Record required information on Fish Datasheet 1 – Gill Net Catch Record.

Setting the Gill Net

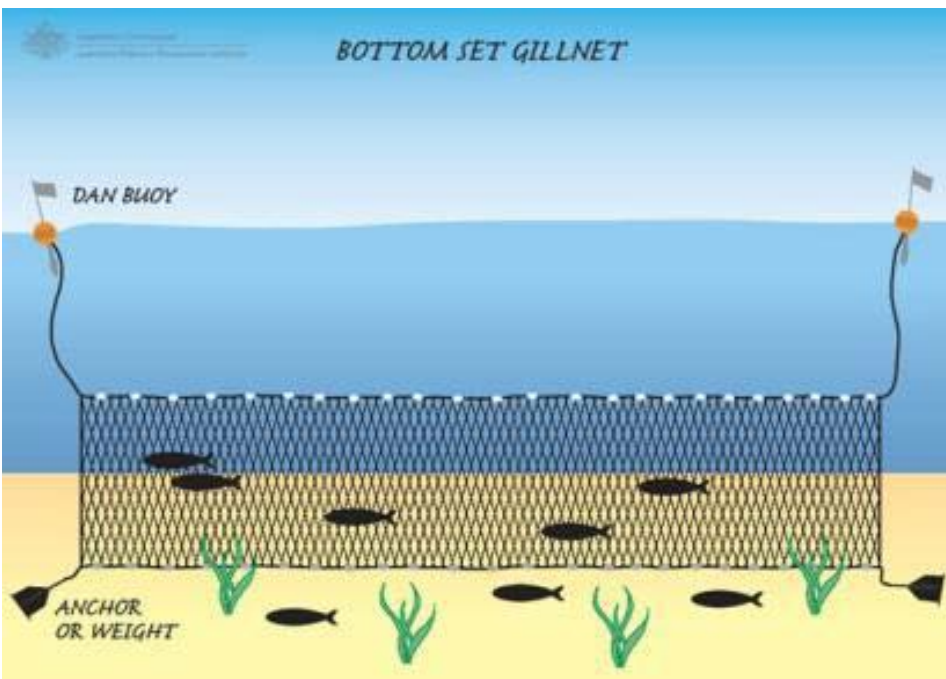
- Once the field crew has checked the lake depth, elders and the field crew, should determine where to set the gill nets. One net will be set in a shallow area and the other in a deeper area. Small mesh should be closer to shore. Avoid net locations along steep gradient drop-offs or very weedy areas. Avoid setting net in areas with underwater obstructions such as sunken trees and wood debris.
- On reaching the first chosen site use a depth sounder (“fish finder”) or a measured and marked rope attached to a rock to verify the station is shallow. Write down the depth of the station.
- Attach a weight on a rope at the bottom of the net at each end, and a floater (buoy) on a rope at the top of the net. See Figure 5-1 below. The floater will prevent the net to collapse at the bottom of the lake and will help you find it when the time comes to pick it up. You can change the length of the rope attached to the buoy depending on the depth of the lake or on the depth you want to sample. Note that if the rope attaching the net to the buoy is too short, the net will not be set deep enough.
- The driver should start slowly backing up the boat. The person responsible to handle the net should throw one of the end of the rope into the water, the side with the buoy first and then the side with the weight. Mark the GPS point as “gillnet start point” and record the net start day and time on the datasheet.
- Continue backing the boat until almost the whole net is underwater. Once the full length of the net is deployed, release the weight attached to the very end of the net. Then use the rope that goes from the net to the buoy to “stretch the net”. Release the buoy once you feel the net is nice and tight. Mark the GPS location as “end of net”
- Some nets almost “set themselves” but lifting the float line to ensure it separates from the rest of the net will ensure a tangle-free set (See Photograph 5-1).
- If you set the net in the afternoon, come back to the lake to pick it up the next day. If you set the net in the morning, you should pick it up in the evening. The field crew and elders



will want fresh fish for eating and to determine the health of the fish. If the weather changes, remove the net earlier or later, as safety dictates.

- Once the net is set, the net should be like a 'fence of netting' along the bottom (see Figure 5-1).
- Now that the first net is set, drive the boat to a deeper location where you will set the second net by repeating the steps above.
-

Figure 5-1 Gill Net Set at the Bottom of a Lake



(Graphic Courtesy XXX. Need reference for graphic from P. Vecsei prior to final report)

Pulling the Gill Net

- Record the date and time when the nets are pulled on datasheet just prior to pulling net.
- Make sure you have a large tote or tub to store the gill net and several coolers with icepacks where the captured fish will be placed after killing them (Photograph 5-1).
- Always start pulling a net at the downwind end of the net; this way you won't drift over the net. Start pulling and pile the net into a tote immediately rather than letting it pile up in the boat.
- It's best to take out fish from the net as they are pulled into the boat. Put fish captured by the first gillnet in a different cooler than the ones captured by the second gillnet. To remember which cooler contains which fish it is good to mark each cooler. For example



the cooler containing fish from the net set in a shallow area could be marked as “shallow net”.

- Write on the Fish Datasheet 2- Fish Catch Record how many fish of each species were captured in each net, if possible; if the weather is poor or you must hurry back to camp, you may write this down at camp.
- Take the fish to the camp to be counted and processed.

Photograph 5-1 Lifting a Gill Net





5.4.3 Before Processing the Fish

- Gather all the fish processing equipment listed in the Table 5-1 and setup a fish processing table.
- Organize your space, set-up the collapsible table; make sure the area is clean (see Photograph 5-2). Cover the table and the cutting board with plastic wrap.

Photograph 5-2 Setting up the Fish Processing Area



- Gather the elders around if they are present. Their initial observations and comments on fish species and fish health will provide valuable information. Record their comments in the comment box of the datasheet.
- Have one person act as the “cutter” and one person as the “recorder” of the information.
- **NOTE:** Take pictures throughout the entire process. You want to document as much as you can. If a fish does not look normal be sure to take photos and notes.

Number of samples

The objective is to obtain approximately twenty tissue samples from two species of fish that are of interest to the elders and are consistent with samples taken on other local lakes. This means the total number of fish tissues samples is 40, with four additional samples taken for QA/QC purposes.



It is best to choose one species that eats fish such as northern pike or lake trout as well as a second species that eats bugs off the bottom of the lakes, such as whitefish. This way, samples are taken from predators that eat other fish and from fish that eat bugs (top predator and a bottom feeder). The species chosen should be fish that community people eat.

Other fish that are captured and that are not used for fish tissue samples should be examined as well. Some fish can be kept for eating. Others should be checked to see what kind of fish they are and if they are healthy and may be kept by community members for community use, such as suckers or small northern pike.

Quality Assurance/Quality Control Samples

The QA/QC samples will include four Duplicate set tissues from four fish. Choose two fish from each species at random and collect extra tissue from these fish. This is a 'double-check' of the fish to be sure the lab result can be trusted.

Duplicate Sample: The duplicate sample is collected by collecting more fish tissue from the fish. The main tissue and the additional tissue (the duplicate) are both sent to the lab. We do this to check if the lab makes a mistake in the analysis or if we made a mistake when cutting the fish. Do not forget to write down the number of the fish that each duplicate was taken (Example: Fish 10, Duplicate).

Fish catch

- Take the tub with the fish from the first net.
- Count how many fish were captured
- Write down on the Fish Datasheet 1 – Gill Net Catch Record how many of each type of fish were captured and estimate if the fish are adult, juvenile or young. This may have been done in the boat if the weather is good and there is time to do this.
- Do this again with the second tub of fish from the second net.
- This documents the total catch of fish from the lake.
- Elders may choose some fish for camp use; fish for fish tissue removal should be set aside. Smaller fish that cannot be used for eating or lab analysis should be set aside for community use as determined at the camp (for example, as dog food).

5.4.4 Processing the Fish

Two datasheets must be filled out when processing fish: the measurements of each fish (Fish Datasheet 2 – Fish Catch Record) and the samples taken from each fish (Fish Datasheet 3 – Fish Biological Data). It is important to measure and count each fish. Fish are numbered from one onward to the total number of fish (Example Fish 1, Fish 2, etc). This numbering is important as the fish tissue samples need to follow this number system.



Fish Recorder

The recorder writes down all the information onto the datasheet (see Datasheet 3 – Fish Biological Data below). The recorder must ensure all data is being collected and written the same way from one fish to another. For example, if the length of the fish #1 is written in millimeters (mm) the length of fish #2 should be also written in millimeters. Communication between cutter and recorder is very important. Before the cutter starts preparing the fish, the recorder needs to fill in general information on the datasheet such as date, name of lake, and name of crew. Everything measured or observed by the cutter or observers needs to be written into the datasheet.

- The recorder will assign a number to every fish prepared by the cutter and write it on the sample bag and on the datasheet.
- The recorder will also prepare a small paper envelope and label it with the name of the age structure(s) collected by the cutter.
- The recorder will also prepare a bag for the fish tissue sample with the sample name and date on the bag.

Fish Cutter

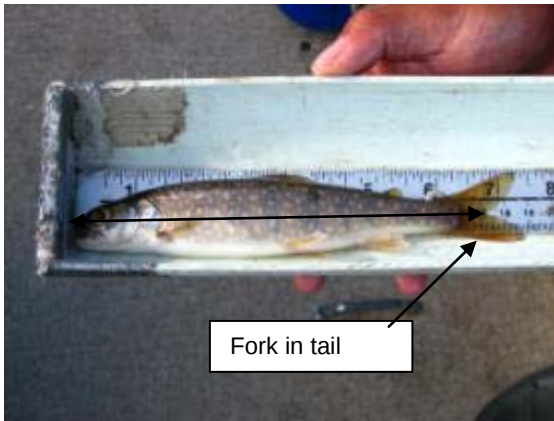
The processor does all the measurements and removes the structures that need to be collected. It is very important that the cutter be consistent with his/her techniques when processing one fish to the next. During the process, the cutter has to tell the recorder what the measurements or observations are.

If you are the fish cutter, follow the following steps:

- Put on disposable latex or nitrile gloves.
- Select a fish.
- Identify the fish species;
- Place the fish on the measuring board so that the nose is snug against the zero end of the length board and the fish is laying flat along the ruler (Figure 5-2).
- Look at the general condition of the fish, if something does not look normal, for example if there are parasites or scars, take photos and record information in comments on the datasheet.
- Measure the fork length (see Table 5-2) and total length (measurement to tip of tail) to the nearest 1 millimetre and record the fish number on the datasheet. Some fish do not have a fork in their tails; record only total length of these fish (See Table 5-2 for fork or total lengths required for certain fish species).



Table 5-2: Measuring the Fork and Total Length of a Fish

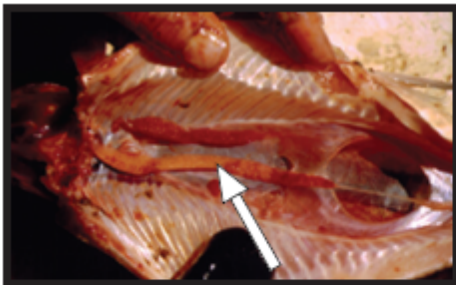
Type of Length	Example	Type of Fish
Fork Length (nose to fork in tail)		Grayling Pike Char Suckers Trout Whitefish Walleye
Total Length (nose to tip of tail)		Sculpins Sticklebacks

- Weigh the fish using a dial scale, a hand held spring-loaded weigh scale or an electronic balance. Ideally, record weight to the nearest 1 gram. Be sure any excess water is removed from fish before weight recorded. **Note: do not forget to zero the balance!**
- Use a filleting knife to cut the fish ventrally from the bum to the mouth. Be careful not to cut the stomach.
- To weigh small parts of the fish, put clean plastic or wax paper on the balance. Tare the balances so that it says zero. Put the tissue on the scale. Record the weight. If there is something unusual about part of a fish, photograph it, and cut it out to send to the lab. Put tissue in a bag and label the bag. Label should include the date, the fish number and the type of tissue.

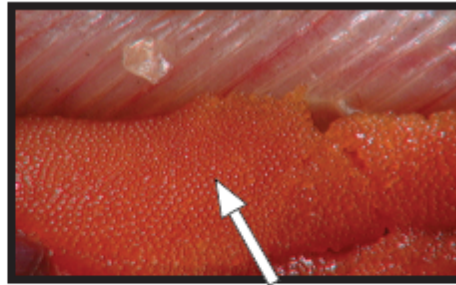


- Note the general condition of the interior of the fish. Do you see any parasites? Do you see any fat? Do you see any eggs? What other things do you see?
- Determine the sex. In females, eggs are small and orange and usually very obvious. In males, the testes are white, smooth organs along the top of the body cavity. When males are not matured the testis may be thin reddish organs (Figure 5-2). Take the eggs or testes out, weigh them and discard.

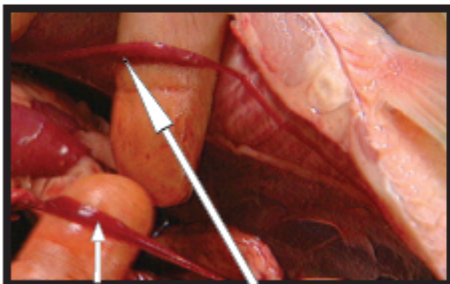
Figure 5-2 Determining the Sex of the Fish



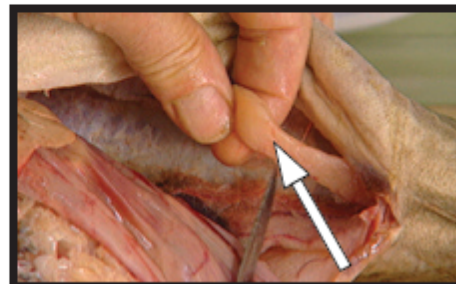
Female has sacs full of orange eggs. The size of the eggs may vary depending on the time of year. (Sex code F2 example)



Female has a sac full of orange eggs. The size of the eggs may vary depending on the time of year. (Sex code F1 example)



A male's testes are sometimes long, thin tubular shaped. (Sex code M4 example)



A male's testes can be a whitish material in long connective tissue. (Sex code M3 example)

- Over the stomach and close to the head you will see the liver. It is a “triangular” soft and pink organ. Cut it at the base, remove it and weight it, then discard.
- Open the stomach and write down what is in it (fish, eggs, plants)
- Look at the liver, and kidneys, and heart and gall bladder and determine if they look normal
- Take the stomach and intestines out, weigh them and put them in a labeled Ziploc bag. Weigh the fish without the internal organs: this is called carcass weight.



- To take a fish muscle sample you have to be careful because you don't want to contaminate it. Change gloves and clean the knife before doing this. Cut a medium piece of the muscle and cut off the skin. Weigh the piece of muscle and put it in a labeled Ziploc bag.
- Collect an age structure. The recorder fills in the information on the age structure envelope (Figure 5-3). The processor places the age structure into it into the envelope and the recorder seals it up. See Table 5-3 for which age structures to collect for each fish species. See Figure 5-4 for otolith removal. If possible, you should collect two aging structures (otolith and scales) in case one gets lost or broken.

Figure 5-3: Information on Age Structure Envelope

Date _____	Sample No. _____	
Area _____	☐ Angling	Type of Gear Used (mark correct box)
Location _____	☐ Net	
Species _____	☐ Trap	
Fork Length _____	Other _____	
Round Wt. _____	Mesh Size _____	
Dressed Wt. _____	☐ Scale	Ageing Structures Taken (mark correct box)
Sex & Mat _____	☐ Otolith	
Stomach _____	Age _____	

Table 5-3: Age Structures to Collect for Specific Fish Species

<i>Fish Species</i>	<i>Age Structure</i>
Walleye (Pickerel)	Otoliths or first 3 dorsal spines
Northern pike	Otoliths or cleithrum
Lake trout, Whitefish and Ciscoes	Otoliths or first four marginal pectoral finrays
Other species	Otoliths



Figure 5-4 Otolith Removal

Otolith Removal



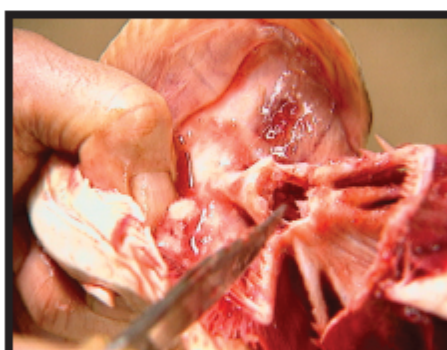
1) Grab the fish by the lower jaw with thumb and index finger.



2) Cut the gill arches and connecting tissue to expose the roof of the mouth.



3) Using a short sturdy knife place it between the 1st and 2nd gill arches.



4) Using downward pressure on the knife and bending the head backwards separate the back bone. Cut only 1/2 way through, then break the rest of the back bone.



5) The otoliths are located at the base of the brain. Using tweezers remove the otoliths located one on each side of the brain.



6) Place the otoliths on the back of your hand and gently clean and remove the sac from the otoliths with your finger.



Chain of Custody Forms

Chain-Of-Custody forms are official forms that document what stations were sampled, date and time of sampling, who was involved in collecting and transporting the samples, who received the samples at the lab, and what parameters are required to be analyzed. ALS Laboratories in Yellowknife could analyze fish tissue if required (Figure 5-5).

- Fill out the COC form carefully. This is a legal document and you should be very careful not to make any mistakes.
- Make sure that the person or people listed to receive the Invoice and Results are correct (e.g., Wek'èezhì Renewable Resource Board).
- Make sure to record the sample name. This will be your fish number (e.g., Fish 10).
- Check that the parameters requested for every sample being analyzed in each column of the form.
- Sign and date the COC form and make a photocopy.
- Place the original signed COC form inside a large Ziploc bag and place inside one of the coolers with the samples. Keep the other copy for your file records.

5.4.5 Back in the Office

- Unpack all the equipment.
- Wash all the equipment that touched the fish with soap and let it dry.
- Envelopes with the age structures in them should be laid out in the office to dry. The dried envelopes should be kept in the office until it is determined who will analyze them. It is possible that DFO will request the structures.
- Submit the datasheets to appropriate person looking after the data entry and creation of the bathymetry map.
- Freeze the fish if you don't think you will prepare the fish samples right away.



Figure 5-5 Example of ALS Environmental Chain-Of-Custody Form for Fish Tissue Metals Analysis

**ALS Environmental**

excellence in analytical testing

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CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM																		PAGE	OF				
CLIENT:				ANALYSIS REQUESTED:																			
ADDRESS:				Total Metals(ICP Low Res) % moisture tissue prep Low Level Mercury																			
CITY:		PROV:	POSTAL CODE																				
CONTACT:		SAMPLER:																					
TELEPHONE:		FAX:	P.O. #:																				
PROJECT NAME / #:		QUOTE #:																					
DATE SUBMITTED:		ALSO CONTACT:																NOTES					
TURN AROUND REQUIRED: ☐ Routine (7 - 10 working days) ☐ Rush * (Specify date: _____) * SURCHARGES MAY APPLY				REPORT FORMAT: ☐ Hard ☐ Fax ☐ E-mail (Specify file type: _____) E-mail Address: _hmarktans@golder.com																			
SPECIAL INSTRUCTIONS (billing details, QC reporting, etc.):																							
SAMPLE IDENTIFICATION				DATE / TIME COLLECTED		MATRIX																	
				YY	MM DD	Time																	
FOR LAB USE ONLY	Fish 123						tissue	x	x	x	x									EXAMPLE			
RELINQUISHED BY:							RECEIVED BY:													FOR LAB USE ONLY			
NAME:				DATE:			NAME:				DATE:				Cooler Seal Intact?								
OF:				TIME:			OF:				TIME:				Yes No N/A								
NAME:				DATE:			NAME:				DATE:				Sample Temp: °C								
OF:				TIME:			OF:				TIME:				Frozen? Yes No								



Fish Datasheet 1 - Gill Net Catch Record					
Lake Name: _____			Page # _____ of _____		
PROJECT TITLE: _____			Trial # _____ of _____		
LOCATION: _____					
SAMPLING DATE: _____					
FIELD CREW: _____					
GPS coordinates (start of net): _____					
GPS coordinates (end of net): _____					
Waypoint Name: _____					
Set Time and Date: _____					
Net checked: _____					
Net checked: _____					
Net checked: _____					
Net checked: _____					
Pull Time and Date: _____					
Total Effort (Time hours:min): _____					
Gill Net Information					
Net Name: _____		Number of Panels: _____	Panel Length (m): _____		
Gill Net Depth (m): _____		Mesh Size: _____	Overall Gill Net Length (m): _____		
Habitat Sampled:					
Water Depth (m) _____					
Substrate Description _____					
Notes _____					
Species Captured	# Fry	# Juvenile	# Adult	# Unknown	TOTAL
Comments: _____					

			Entered by: _____		
			QA/QC'd by: _____		
			Date: _____		



Page ____ of ____

Fish #	Species	Fork Length (mm)	Total Length (mm)	Weight (g)	Gender	Adult or Juvenile or Unknown?	Mature or Immature or Unknown?	Age Structure taken?	Released or kept?	Comments
Red Tincho				0.5 g				April 2012		



	Fish Datasheet 3 - Fish Biological Data							Page _____ of _____		
	Sampling Effort Number: _____					Site Number: _____				
Proj/Task No. _____ Proj. Title _____ Task _____ Personnel _____										
Stream/Waterbody _____										
Date (MM/DD/YY) _____										
Fish No:										
Biomarker No:										
Species										
Total length (mm)										
Fork Length (mm)										
Wet weight (g)										
Adult or Juvenile or Unknown?										
Gender (M/F)										
Mature or Immature or Unknown?										
Released or kept?										
Any deformities or fins problems?										
Parasite present? Describe where?										
Stomach fullness										
Gut contents? (describe)										
Otoliths	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pectoral Fin Rays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pelvic Fin Rays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Scales	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Liver (Histology)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gonad (Histology)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gonad (Fecundity)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Muscle (Metals)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	√ = tissue collected						blank = not collected			
Comment										
Entered into database by: _____ Date: _____ QA/QC _____ Date: _____										