First Nation-Led Water Quality Monitoring of Salmonid Habitat in the Yukon River Watershed

A water quality workshop

A report prepared by the Yukon River Inter-Tribal Watershed Council for Yukon First Nations

Financial support by:

PACIFIC SALMON FOUNDATION

Community Salmon Program 2014-2015

This document was created by the Science Department of the Yukon River Inter-Tribal Watershed Council: Jody Inkster (JInkster@yritwc.org), Dr. Edda Mutter (EMutter@yritwc.org) and Neil McGrath (NMcgrath@yritwc.org). Please contact us for further information or any question or concerns you may have.

Acknowledgements

The Yukon River Inter-Tribal Watershed Council gratefully acknowledges the support of the Pacific Salmon Foundation's Community Salmon Program.

The Yukon River Inter-Tribal Watershed Council would like to thank the participating First Nations for their support: Carcross/Tagish First Nation, First Nation of Na-Cho Nyak Dun, Taku River Tlingit First Nation, Ta'an Kwäch'än Council, Tr'ondëk Hwëch'in and Teslin Tlingit Council.

We would also like to thank the individuals that participated in the workshop themselves, as well as Bronwyn Benkert from the Yukon Research Centre for her presentation on water isotopes and Al von Finster for sharing his experience on water temperature monitoring.

Table of Contents

Introduction

The Yukon River Inter-Tribal Watershed Council (YRITWC) is an indigenous grassroots organization, consisting of 70 First Nation and Tribes, dedicated to the protection and preservation of the Yukon River watershed. The YRITWC accomplishes this by providing Yukon First Nations and Alaska Tribes in the Yukon River watershed with technical assistance, such as facilitating the development and exchange of information, coordinating efforts between First Nations and Tribes, undertaking research and providing training, education and awareness programs to promote the health of the watershed and its indigenous peoples.

Background

Indigenous Observation Network

The Indigenous Observation Network (ION) is a science-based network consisting of 70 indigenous nations from northern British Columbia, Yukon, and Alaska. This network is facilitated by the YRITWC and has operated for more than 15 years to build capacities of First Nation/Tribal governments in water resources management. The YRITWC accomplished this by collecting water quality and active layer data in conjunction with traditional and environmental observations using citizen science-based methods throughout the Yukon River basin. The information collected aims to improve First Nation governance and understanding of climate change, fish and wildlife habitat, and baseline data sets.

The YRITWC coordinated this water quality workshop “First Nation-led water quality monitoring of salmonid habitat in the Yukon River Watershed” with funds from the Pacific Salmon Foundation. The project entailed (a) to enhance the capacity of participating First Nations to monitor water quality in salmonid habitat; (b) to coordinate a surface water quality monitoring network in the Canadian portion of the Yukon River Watershed; and (c) to share the results with participating First Nations via

community visits and other signatory First Nations in Canada and Tribes in Alaska via the interactive mapping platform, FieldScope, and fact-sheets published to the YRITWC's website.

Water Quality Workshop

Preparation for Workshop

Many activities were carried out in preparation of the workshop. In the preliminary project phase, between November 2014 and January 2015, planning meetings with the Science department and First Nations were held. In addition, invitations were sent out to all First Nations and participants sent registrations to the YRITWC.

To prepare for the fieldwork, the sampling location was selected and tested by YRITWC staff. By March 2015, all respondents for the workshop had been contacted and followed up with.

Workshop Structure

The YRITWC's Science Department facilitated a two-day in-class and field training water quality monitoring workshop in Whitehorse, Yukon on the 3rd and 4th of March, 2015. Representatives from 5 First Nations in Yukon and 1 First Nation in British Columbia attended the workshop. The First Nations were contacted by mail, email, various social media platforms and follow-up phone calls. Members of Lands and Resource Departments, Renewable Resource Councils, water samplers and stewards were invited. Overall, 11 representatives from 6 First Nations participated in the workshop.

Table 1. First Nation Participants

First Nation	Number of Workshop Participants
Carcross/Tagish	2
Na-Cho Nyak Dun	5
Taku River Tlingit	1
Teslin Tlingit Council	1
Ta'an Kwäch'än Council	1
Tr'ondëk Hwëch'in	1

For the first day of the workshop the YRITWC introduced the Active Layer Network and ION initiatives regarding water quality and salmonid habitat monitoring. A short ION video was also shown to participants at the start of the workshop. It can be found on YouTube at https://youtu.be/Fg3XQGl9_xo. Followed by the YRITWC Science staff familiarizing participants on water quality parameters (i.e., ions, dissolved organic carbons, metals, hydrocarbon, dissolved oxygen, pH levels, water temperature, and conductivity) and how they related to river water chemistry and aquatic life. Surface water sampling methodologies and sampling process protocols were demonstrated as well as recording environmental observations on field sheets.

During the workshop, data interpretation (historical and current data) was explained in greater detail using graphs depicting trends. In addition, water quality laboratory protocols and indicator contaminants were discussed with regards to their importance to aquatic organisms' and salmonid

habitat. During the first day of the workshop, hands-on training allowed participants to practice calibrating YSI meters with meters provided by the YRITWC.

Furthermore, the YRITWC staff informed participants about FieldScope, an online platform and app developed by National Geographic specifically for the Yukon River water quality monitoring. FieldScope allows direct uploading of field data and environmental observations into the program that can be shared between First Nations and Alaska Tribes throughout the Yukon River watershed.

Participants calibrating YSI meters

The second day of the workshop, the YRITWC science staff reported on the Health Canada Project that involved many of the participants at a previous workshop. Feedback and additions from participants were added to the Health Canada report. The YRITWC Science staff discussed another surface water sampling methodology the passive filter-sampling program. The benefits and drawbacks of using passive filter samplers were explained to participants as well as the areas the YRITWC had already implemented them. Several passive filter samplers were deployed across Yukon and preliminary results were shared during the workshop. The sampling results can be found in the *Passive Sampling Results* report by the YRITWC's website.

Yukon Research Centre's Bronwyn Benkert, regarding isotopic hydrology and the tracing of water through isotopes, also made a presentation. The results of the isotopic analysis can be found on the YRITWC's website.

After the classroom portion of the workshop, participants moved outside to the sampling site at the confluence of the Takhini and Yukon Rivers, one of the sites used for ION. For the field training ice-holes were drilled with an auger, and the thickness of the ice was measured. When ice holes were drilled, participants split into groups to take YSI measurements from the river water for all field parameters (i.e. dissolved oxygen, pH, water temperature and conductivity). The field measurements and observations were recorded on the field sheets. After documenting the field parameters, participants collected a surface water sample and returned to the parking lot, where their water samples were processed and prepared for laboratory analysis. Surface water samples were filtered using syringes with 3.5 μm filters attached to fill individual sample bottles for anions, cations, dissolved organic carbon, nutrients and isotopes. With the field training being completed participants received their workshop certificates and filled out feedback forms.

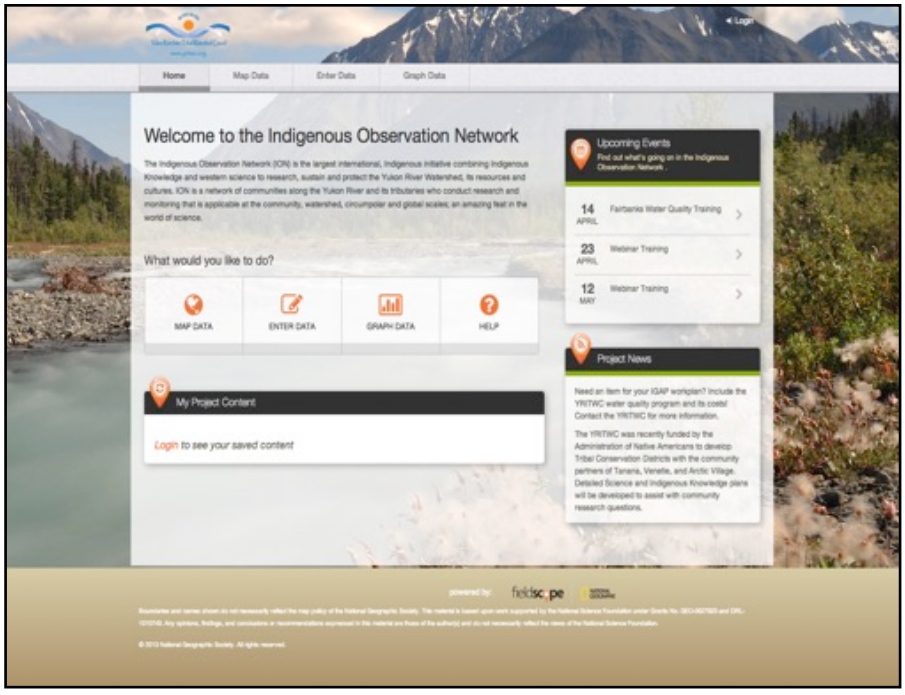
Recording field parameters using the YSI meters

Filtering the samples into various bottles

Workshop participants. Back row, from right to left: Korey Smith (TTC), Ron Peters (NNDFN), Jay Gagnon (NNDFN), Gestie Tees (NNDFN), Herman Melancon (NNDFN), Donna Geddes (CTFN), Corey Edzerza (CTFN), Anna Schmidt (TRTFN), Neil McGrath (YRITWC). Front Row, right to left: Jody Inkster (YRITWC) and Coralee Johns (TKC). Not pictured: Edda Mutter (YRITWC)

FieldScope

FieldScope is an interactive data mapping system created by National Geographic. The YRITWC uses FieldScope to input its data for the ION. It is an online resource for signatory First Nations and Tribes along the Yukon River to add water quality data they collect in their communities and access all uploaded information. The YRITWC sample sites GPS locations and site descriptions, field parameters (i.e. dissolved oxygen, pH, conductivity and water temperature), and any river observations or changes in the landscape. FieldScope also allows for map creations and data analysis tools to interpret data (e.g., graphs or tables). Furthermore, FieldScope gives a representative idea of the sampling efforts across the Yukon River watershed. The YRITWC oversees the database and insures the data quality.



An example of the FieldScope program from the website

Questions and Comments

There were many great questions asked and comments made in both days of the workshop. Some of the questions and comments are sorted into categories for the purpose of this report.

Data Questions

Q: Is there one database all the water quality information gets put into?
A: Currently, the YRITWC uses the FieldScope application that stores physical parameter data (pH, conductivity, temperature, and dissolved oxygen). First Nations can use this application to create graphs and maps of their water quality data.

C: We are having a really hard time getting good data (there's a temperature sensor device available by Dynamic Aqua Supply that records temperature measurements every hour for 5 years). You need a long-term baseline to capture all temperature changes such as seasonal, water level, etc. Currently, there is not enough data available to conclude water temperature is increasing in the Yukon River watershed. We need to get multi-year baseline data because single points don't give sufficient information.

C: The techniques of collecting data need to be consistent.

Q: Do you put in every individual number into FieldScope?
A: You can, but there is a bulk entry option to allow a faster upload.

Q: Can anyone create a FieldScope account and add inaccurate data?
A: The YRITWC does review data and compare all entered data with the submitted field sheets to ensure data quality.

YRITWC Questions

Q: How many signatory First Nations are on the Yukon side?
A: 16

C: There are lots of opportunities to get funding for northern communities to conduct community-based monitoring. We can collaborate with the

YRITWC to get funding like certain funds specific to NGOs rather than for governments.

Q: Are all the YRITWC baseline sites monitored regularly?
A: It really depends on the capacity of each First Nation. The YRITWC can assist in certain areas.

Q: Is the YRITWC actively testing permafrost?
A: Yes, through the Active Layer Network (ALN) initiative. The Yukon has three sites and nine sites are established in Alaska.

Q: Is there collaboration between the YRITWC and Environment Canada?
A: Yes, Environment Canada supported the passive filter sampling initiative.

Q: Is there a contribution agreement from First Nations? What would that number look like if there were? It seems like the YRITWC is going for outside funding all the time but the First Nations are benefiting.

Q: Is there a community report on Carcross?
A: Yes, all community reports are posted on the YRITWC website and each First Nation received hard copies.

Sampling, Parameters, YSI Meters Questions

Q: Does the YRITWC only monitor upstream from communities? Could monitoring not take place downstream from the community like where the Carcross Venus Mine site is located?
A: The YRITWC can address specific concerns of communities, if they are identified to us.

Q: If First Nations collect samples, does the YRITWC take care of the analysis/costs?
A: The YRITWC can receive the samples from the First Nation, process them, and then ship them off to our partner at United States Geological Survey to have the sample analyzed.

Q: Would it make sense to just do one time sampling on the watershed? NNDFN is thinking of doing our own water monitoring, can we collaborate with the YRITWC to create a database? Placer miners are really affecting

the territory; the government doesn't always follow up so we're going to do it ourselves.

C: The Ta'an Kwäch'än Council guidebook set up for long-term monitoring is still available on their website. It starts the planning process to properly identify a site.

C: You can program an YSI meter to take readings periodically in one spot for an extended period of time.

C: The YRITWC makes a calendar for target sample weeks to help with the schedule of sampling.

Q: Why can't First Nations preserve the samples? It might be good to teach samplers in First Nations the preserving techniques.
A: The preservation techniques includes filtration and acidify the samples; some acids used for acidify the samples are toxic so you want to use them in a laboratory environment.

Q: Can you calibrate just once in the morning for all day sampling?
A: Typically yes, unless you notice your readings drastically change or something like a barometric pressure is changing.

C: First Nations would like to have some individual field manuals for reference.

Q: What is the dissolved oxygen threshold, does it come from Yukon or the federal government?
A: It comes from many different research sources, but generally in Canada there are guidelines such as the Guidelines for the Protection of Aquatic Life from the Council of Canadian Ministers of the Environment. The YRITWC is also working on our own water quality standards, the Yukon River Watershed Plan.

Q: How often do you need to check a passive filter sampler in the spring?
A: Depending on the parameter you are measuring but these devices can be deployed two weeks to a month.

Q: What's the difference between dissolved and total metal analysis?
A: Total metals analysis for water samples include the metals content both dissolved in the water and present in the particulates (sediment) in the water. The total metal analysis result should always be greater than or equal to dissolved metals result (a subset of total metals). Typically, dissolved metals analysis of a water sample is performed by removing the particulates with a 0.45m pore size. Dissolved metals are generally considered more mobile and biologically available and used for risk assessment and metal transport studies. In general terms, we are more concerned about dissolved metals in the water system.

Other Questions or Concerns

C: Is there any data collected on First Nation salmon sources? There is a big concern on the water temperature effecting salmon. Want to know where all the salmon is coming from the Yukon River.
A: There are many agencies that collect data on salmon. The YRITWC collect data on their habitat such as water temperature and dissolved oxygen measurements.

Q: Is the YRITWC continuing its initiative in the Peel watershed?
A: If there's a directive from our leadership and community support.

C: The biggest problem in Carcross is the trans-boundary border, nobody is monitoring in northern BC, where the River starts. Maybe we can put a beacon or something like that on that side of the border.

Q: Does volcanic ash affect water makeup?
A: Yes, it contributes to affect the water quality and can be observed by a change of pH. Volcanic ash makes the water more acidic, but the Yukon limestone deposits generally helps to balance the pH.

Q: Is there any further contamination from glaciers?
A: Yes, air pollution greatly contributes to contaminants in glacial water runoff.

Q: Is the ice that is melting positive or negative for contaminants in water?

A: We are trying to achieve a better understanding about the linkage between air pollution, terrestrial and river in terms of contaminants. Contaminants can be trapped in glacier ice and permafrost over time and released through the thawing process into the river system. For example mercury is a contaminant of concern in certain areas where we experience drastic permafrost or glacial thawing due to long-term accumulation. Mercury isn't poisonous to fish but decomposition of mercury to methyl mercury is very toxic. We need to figure out the puzzle, which pieces are coming from where to understand contaminant source and their impacts. For example, the YRITWC's historical data shows an increasing trend of some metals in the water that can contribute to change the quality of the river.

C: There is lots of permafrost thaw in Old Crow that results in lakes draining

Q: NASA funded a project to do a large permafrost study all around Yukon, who monitors the Northern Slope?
A: Think that falls under YESAB and the Inuvialuit Agreement as well as the Arctic Council.

C: Each First Nation has a different dynamic, like in C/TFN there aren't a lot of current mines but there are lots of mine reclamation sites, it's hard for the YRITWC to keep up with everything happening along the watershed so it's important to have regularly meeting with our constituents and get directives from our leadership.

Q: If I was to give you a contaminated salmon, could the YRITWC tell where it came from?
A: There is an analysis method available, which allows studying the migration pattern of a salmon (i.e. isotope analysis). However, we still would need a very tight water quality-monitoring network to provide all required contaminant analysis data to be able to identify the source.

C: We need to know where mutated fish are coming from (like the whitefish with holes on their heads in Carcross).

Q: INAC knows the guidelines surrounding the Venus Mine cleanup and they know there's leaching, but they say it will dilute by the time it reaches the water source.
A: That is true, it depends on where the sample is taken, and some places won't pick up the contamination even though it exists.

C: You can see when driving past Venus Mine site that there is snow everywhere other than on top of the tailings pond. Was the road made with contaminated soil? There has to be runoff into the Yukon River headwaters from the mountain there?

Q: What is the Yukon River average temperature? If the water temperature is rising it's inevitable that invasive species will move in and push salmon out.
A: We need more water temperature data throughout the entire Yukon River to understand water temperature trends. It really depends where you are measuring it, whether at the headwaters or the mouth, and the time of year. But, we can say with an increase of vegetation in the water that less oxygen will be available for salmon.

C: The Yukon government tells First Nations to reactively predict and manage fish/wildlife but then introduce territory-wide policies that trump these rights.

C: In the Southern Lakes there are underground spawning streams, wondering how to connect these dots in forest planning. How do you go about protecting and managing these underground streams? It's scary when Yukon Government sends out a regional plan by just ignoring these things locally. First Nations don't have the capacity or resources to address these things. There was the poll/petition around communities about fracking, but the territorial government can't even figure out how a few lakes are connected, can never be sure it's safe.

C: Why are we making strategic plans instead of working on the special management areas that come under the Final Agreements?

C: Water isn't just about drinking for First Nations; Na-Cho Nyak Dun First Nation is working on an environmental policy that will address water rights.

C: Carcross would like to have a sharing agreement like Northern Tutchone Nations have to really collaborate on stewardship and monitoring.

Conclusion

The YRITWC workshop successfully completed the expected result of training 11 First Nation government employees in water quality monitoring. The workshop content provided participants with the information, techniques and tools to initiate their community water quality monitoring to collect data in salmonid habitats and other areas. Participants gained scientific knowledge regarding water quality parameters, sampling protocols, contaminant indicators, YSI meter application, as well as water quality data analysis and interpretation. In addition, participants acquired practical field application taking surface water samples and YSI measurements, learned how to process surface water samples and how to record and store the water quality data. Footage was taken during the workshop and will be compiled into a short video in the couple of weeks to complete all expected project outcomes.

Appendix A: Workshop Agenda

Agenda: First Nations-led Monitoring of Salmonid Habitat and Contaminant Indicators in the Yukon River Watershed
Yukon College
Classroom A2712
500 College Drive, Whitehorse, Yukon Y1A 5K4

March 3rd, 2015

8:30am – 9:00am: Light breakfast and registration

9:00am - 9:30am: Introductions, outline agenda and expected outcomes

9:30am - 12:00pm: Indigenous Observation Network - an explanation of water monitoring equipment and water quality parameters

12:00pm – 1:00pm: Lunch provided by YRITWC

1:00pm –2:45pm: YSI meter calibration demonstration, followed by practice

2:45pm – 3:00pm: Health break

3:00pm – 3:30pm: FieldScope introduction (bring smartphones/tablets)

3:30pm – 4:30pm: Wrap-up, review, and questions

March 4th, 2015

8:30am – 9:00am: Light breakfast

9:00 am: Review agenda and hand out/sign out equipment

9:45 am: YRITWC Science presentations

11:00am – 11:30am: Isotope presentation by Bronwyn Benkert, Yukon Research Centre

11:30am – 1:00pm: Lunch served at venue

1:00 pm – 5:30pm: Afternoon out in the field at the confluence of Yukon River and Takhini River.

Note: Meet near the Takhini River Bridge on the North Klondike Highway/Two Mile Road. Bring warm clothes & your field equipment.