

IMALIRIJIIT: CONCLUSIONS

Preliminary results highlight the **high water quality of the George River** including neutral pH, very soft water, and low nutrient and metal levels. Complete data analysis and interpretation will be provided in a detailed scientific report.

The **2016 Science Land Camp** was a very successful first edition of the **IMALIRIJIIT project** from the perspective of researchers, guides, elders, students and Kangiqsualujjumiut.

Participating in scientific measurements with committed local adults and elders as well as researchers had an important positive impact on the Youth. First observations showed that being on the land, camping together, doing hands-on activities, mixing scientific work with other activities and sharing between generations and cultures contributed to:

- **A different perception of science for the Youth and local participants;**
- **A better link between the community and researchers;**
- **A greater local capacity in the protection and monitoring of its environment.**

Plan for 2017: Working at watershed scale using innovative tools: remote sensing and interactive mapping.

ACKNOWLEDGEMENTS

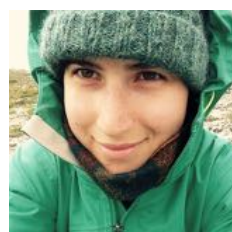
Very special thanks to the Northern Village of Kangiqsualujjuaq, particularly to Hilda Snowball for her trust and involvement, the Youth Committee, the Landholding Corporation, the Recreation Committee, Makivik Corporation, Kativik Regional Government, OHMi Nunavik, Labex DRIIHM, the Centre d'études nordiques and ArcticNet for their financial support, to Parks Nunavik for their logistical support and for welcoming us in their space. Very warmful thanks also to all camp participants: Tim Anaviapik Soucie, the two elders Mary Elisabeth Annanack and Minnie Mae Annanack, the guides Paulosee Jararuse, Alex Noah Morgan, Joe Etok, and Joshua Annanack, the cooks Louisa Minnie Etok with Qipita, Mary Annanack and Julianne Imbeault, and especially the Youth Lise Morgan, Vanessa Snowball, Vanita Weetaltuk, Clara Unatweenuk, Sarah Unatweenuk, Eli Annanack, Morgan Annanack and Rupert Annanack. We really enjoyed this journey with you and we hope it will continue!



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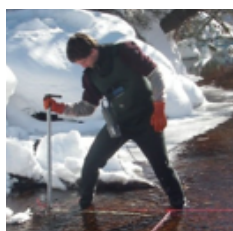
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IMALIRIJIIT Monitoring George River Water Quality Science Land Camp – Summary report

March 2017



Presented to
**NORTHERN VILLAGE
OF KANGIQUALLUJJUAQ**



PARTNERS



Université du Québec
à Trois-Rivières



CENTRE D'ÉTUDES NORDIQUES
CEN Centre for Northern Studies



Environment
Canada



Université
de Montréal

IMALIRIJIT: Monitoring George River Water Quality



Community consultation

Municipal Council
Landholding Corporation
Culture Committee
Youth Committee

Project objectives

To put in place a long-term community-based environmental monitoring program of the George River water quality.

To foster local capacity in biological sampling, data management and analysis and interactive mapping.

To create interest for environmental sciences among Youth while addressing local environmental issues.



Science Land Camp 2016

Inuit Studies Presentation

The mayor and one student were involved in an oral presentation about this whole experience at the 20th Biennial Inuit Studies Conference in St-Johns, Newfoundland.

TIMELINE

October 27-30th 2015

July 5-8th 2016

July 21st 2016

August 3rd 2016

July 22-29th 2016

October 9th 2016

Rare Earth Elements Mining Project

Strange Lake project
Quest Rare Minerals



Introduction meeting

Camp organisation
Tool manipulation
Icebreaker activity



Preliminary visit

Reconnaissance trip on the river in partnership with Nunavik Parks



Slideshow Youth Conference

The research team was invited to do a local public presentation the week following the camp during the Youth Conference.



IMALIRIJIT: Water Quality Results



Hardness

The water hardness is defined by its concentration in mineral salts, calcium and magnesium mainly. A very soft water contains between 0 and 30 milligrams per liter (mg/L) of mineral salts and a very hard water contains over 160 mg/L of mineral salts. The mean value of hardness in our water samples was 4.08 mg/L of calcium carbonate (mg CaCO₃/L). To compare, the mean value of hardness for the Koroc River (Nunavik) was 14 mg CaCO₃/L in 2014.



Dissolved oxygen

As oxygen is an essential gas for most living organisms, the measurement of dissolved oxygen is a crucial parameter. A concentration of oxygen between 7 and 11 milligrams per liter (mg/L) is ideal for most fish species. The mean dissolved oxygen concentration in our water samples was 10.57 mg/L. To compare, the mean concentration of dissolved oxygen in the surface water of the Koroc River (Nunavik) was 8.62 mg/L in 2015.



Turbidity

Turbidity is a measure of the water cloudiness, of how suspended matter in the water allows the light to pass through it. Some waters are completely clear while others are full of particles and so, cloudy. Natural turbidity levels can vary greatly, from less than 1 Jackson Turbidity Unit (JTU) to 50 JTU. Variations are mainly due to the erosion of the river's shoreline and heavy rainfall. The mean turbidity value of our water samples was 8 JTU. To compare, the mean turbidity value for the Koroc River (Nunavik) was 0.2 JTU in 2014.

Turbidity	Chlorophyll	Nitrogen	Phosphorus	Parameter
<i>JTU</i>	<i>µg/L</i>	<i>mg/L</i>	<i>mg/L</i>	<i>Units</i>
13	0.45	0.145	0.0144	Station 1
8	0.19	0.084	0.0048	Station 2
10	0.38	0.117	0.0162	Station 3
6	0.25	0.122	0.0080	Station 4
6	0.31	0.131	0.0066	Station 5



Trace metals

Trace metal analysis included the measurement of 15 Rare Earth Elements (REE), 15 metals and 2 radioactive elements. Measured concentrations for each element will be available in the detailed scientific report.

As the Strange Lake mining project will be extracting REE, those elements must be measured in priority.



What do we know about Rare Earth Elements (REE) ?

- REE make good permanent magnets and are used in many high-tech products such as solar panels, wind turbines, electric vehicles, mobile phones and computers.
- REE were recently discovered, thus, we have a poor understanding of their potential environmental risks.
- There is no water quality criteria for these elements.
- Many research projects are currently underway, trying to understand their mobility in ecosystems and their toxicity for living organisms.
- REE are mostly attached to soils, consequently their mobility is restricted in water. It would be interesting to make analysis of REE in sediments, macro-invertebrates, plants and fish.

Thus, the IMALIRIJIT project is essential to create knowledge on the behaviour of REE in Northern aquatic ecosystems. Measured concentrations must be compared to regional measurements made in similar waterbodies.



IMALIRIJIT: Water Quality Results



Field measurements

Manual kits were used by the students to measure physical and chemical water quality parameters and the results were combined with those obtained with an electronic probe. Field measurements were made twice at each sampling station and results are showing the mean value.

Temperature

Temperature is a variable parameter, changing between day and night, along weeks, months and seasons. It is measured with a thermometer. The mean temperature of our water samples was 16 Celsius degrees (°C). To compare, the mean temperature of the surface water of the Koroc River (Nunavik) was 11°C in September 2010.



pH

Measuring pH allows to determine if the water sample is acid (like a lemon), basic (like bleach) or neutral (like distilled water). pH is measured on a scale of 0 to 14; 7 is the neutral value. The pH of a river water is usually stable and stands between 6 and 8.5. The mean pH of our water samples was 7.05. To compare, the mean pH value of the Koroc River (Nunavik) was 6.60 in 2015.



Parameter	Temperature	pH	Dissolved oxygen	Hardness
<i>Units</i>	°C	-	mg/L	mg/L CaCO ₃
Station 1	17.8	6.75	10.10	4.58
Station 2	13.2	7.06	11.51	3.07
Station 3	17.7	7.16	10.06	4.49
Station 4	16.0	7.11	10.40	4.17
Station 5	16.1	7.18	10.80	4.11



Laboratory analyses

Water samples were collected and sent to accredited laboratories (Environment Canada and University of Montreal) for nutrient, chlorophyll and trace metal analyses.

Chlorophyll

Essential to capture the energy of the sun, chlorophyll is a pigment found in plants and algae. Chlorophyll concentration can be related to the abundance of phytoplankton and micro-algae living in water. The mean concentration of chlorophyll in our water samples was 0.32 micrograms per liter (µg/L).



Nutrients

The nutrient analyses include the measurement of nitrogen (N) and phosphorus (P) concentrations. In the south, nutrient overload is often caused by fertilizer release in water. Nutrient levels in George River are expected to be low because the river is not surrounded by agricultural areas. The mean concentrations of N and P in our water samples were respectively 0.120 milligrams per liter (mg/L) and 0.0100 mg/L.

IMALIRIJIT: Science Land Camp 2016



8 youths



3 cooks



3 guides



1 assistant



2 elders

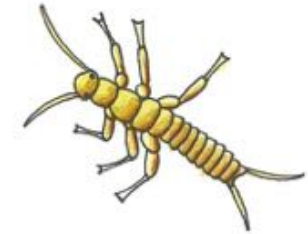


5 researchers

Travelling
Camping set up



Beach day



Second sampling at stations 4-5
Macro-invertebrate inventory
Closure ceremony

First sampling at stations 1-2
Site description
Interview with elders

Day 1

Day 3

Day 5

Day 7

Day 2

Day 4

Day 6

Day 8



First sampling at stations 3-4-5
Scientific initiation ceremony



Camp packing
Travelling



Territory exploration
Map workshop and GPS treasure hunt
Water quality parameters workshop



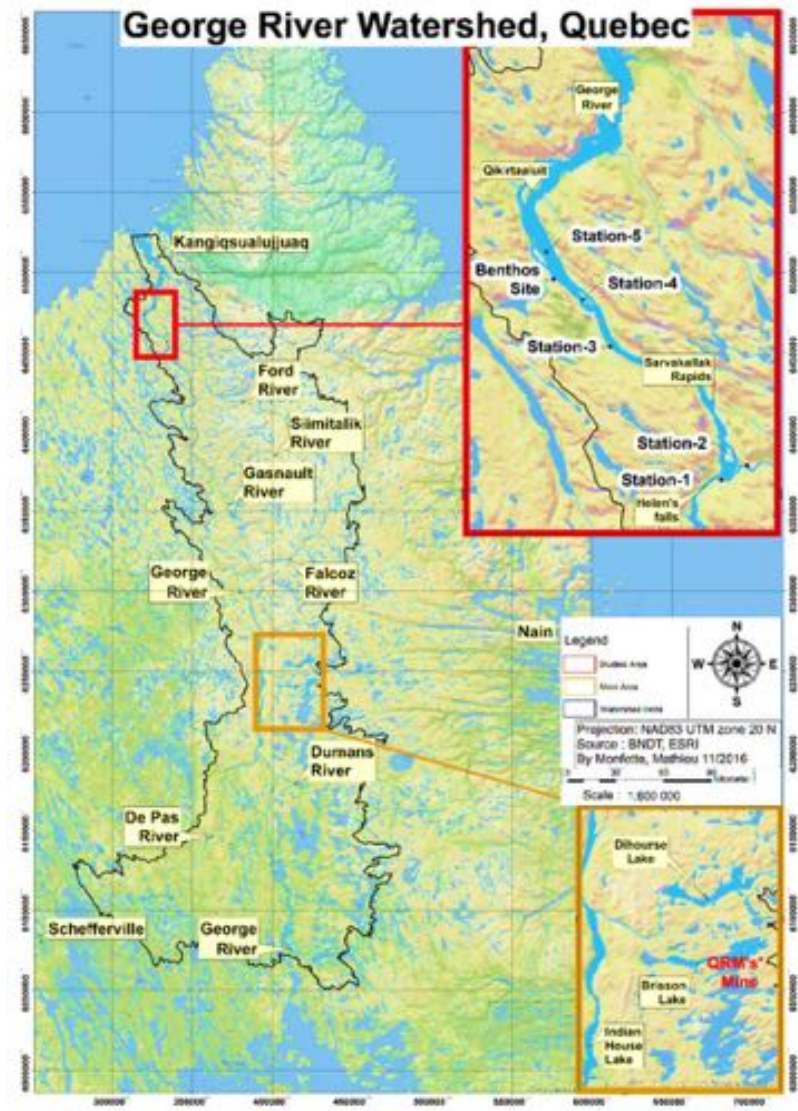
Field measurements
Second sampling at stations 1-2-3

IMALIRIJIT: Science activities and training



Map workshop and GPS treasure hunt

The first activity was a treasure hunt using GPS to initiate and consolidate the use of this tool for every student. GPS is a very important tool to provide a precise location based on satellite positioning in any experimentation.



GPS workshop with Lise, Émilie and Justine



Site characterization with Joshua, Louisa and Alec

The George River flows northerly for 505 kilometers (km) towards Ungava Bay and its watershed spreads over 41 700 km². The George River is a large river, 0,7 to 1,7 km wide at the sampling stations. The water flow was moderate and deep water holes of more than 60 meters (m) were measured near Sarvakallak rapids.



Treasure hunt with Clara, José and Vanita



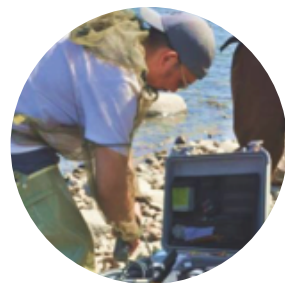
Territory exploration with Morgan, Mathieu and Rupert



Field measurements

In order to assess the water quality of a river, many physical and chemical parameters have to be measured. Manual kits and electronic probe were used to measure water quality parameters such as temperature, pH, hardness, turbidity, and dissolved oxygen concentration. See details on page 6-7.

Tim Anaviapik Soucie, Inuk researcher in water quality from Pond Inlet, Nunavut, was part of the camp team. His presence, teachings and valuable insights were especially inspiring for the Youth and all participants. It also allowed the researchers to gain great cultural insights.



Probe measurements with Tim



Water color determination with Lise



Manual measurement of turbidity with Morgan

IMALIRIJIT: Science activities and training



Sample collection

Several scientific activities and workshops were organized during the week and five sampling stations were established on the George River. In order to separate dissolved and suspended fractions, some samples were filtered. Guides and students participated in the water collection and filtration.



Water sample collection with Justine and Joshua



Water filtration with Vanita



Water sampling for laboratory analyses



Sampling on Ford River



Macro-invertebrate inventory

Macro-invertebrates live in brooks and rivers under rocks, and, depending on the species we find, it tells us the health of the water stream. The dominant macro-invertebrates we identified were *Ephemeroptera*, *Plecoptera* and *Trichoptera*. They are good indicators of a pristine environment.



Macro-invertebrate inventory with Rupert



Joshua, Eli and Mathieu capturing macro-invertebrates



Macro-invertebrates



Collective work



Integration activities

Scientific initiation ceremony, discussions with elders and group activities were organised in order to strengthen the group cohesion.



Initiation activity around the bonfire



Lunch time at station 2



Lise and Vanessa at introduction meeting



Elders' stories about the land

The students rapidly learned the manipulations, were generally engaged and remembered well the protocols. At the end of the camp, they could do the set-up, conduct all the tests and record the data all by themselves.

Interviews and discussions with the elders and guides took place several times to encourage intergenerational knowledge transfer. These activities allowed to document Inuit Knowledge related to the George River and observations of hydrological changes, thus linking Inuit Knowledge and Science.