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Strange Lake project

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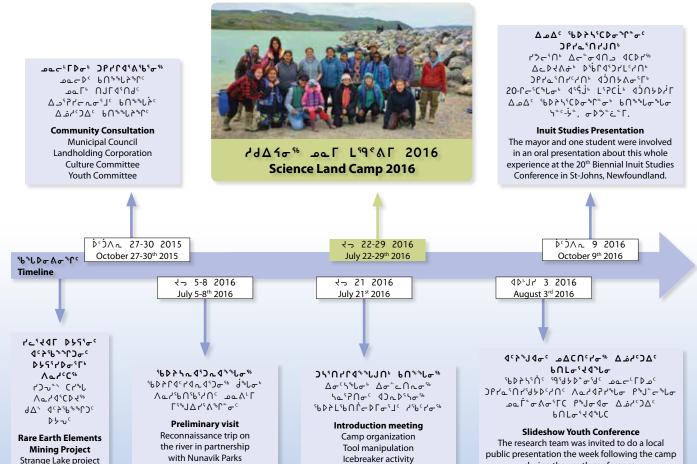
IMALIRIJIIT

Monitoring George River Water Quality

Science Land Camp – Summary report March 2017 Presented to Northern Village of Kangiqsualujjuaq

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.



during the youth conference.

Science Land Camp 2016













イCLDイ⁵ン。 ひら²で20公 Eight youth

ハペレペ Δしi>' Three cooks

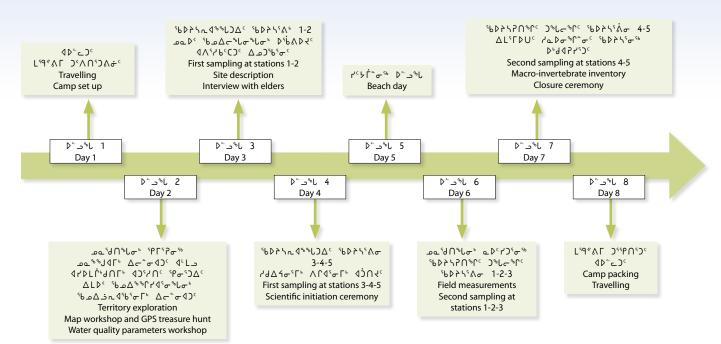
ハ%しと Lધqcハィト
Three guides

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LˁÞ کاوکانهٔ Two elders

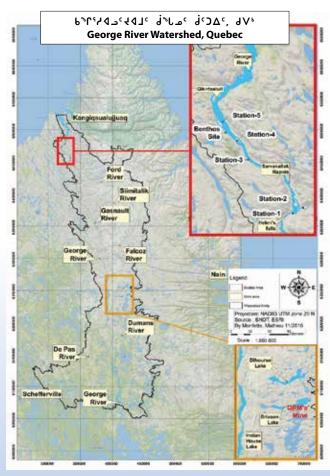
ົ⊂L° 'b▷ትኣ'ሰ' Five researchers

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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.



IMALIRIJIIT: Science activities and training

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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.





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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.

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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.



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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.

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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* (e.g., mayflies), *Plecoptera* (e.g., stoneflies) and *Trichoptera* (e.g., caddisflies), along with *Diptera* (e.g., blackflies, mosquitoes). The first three groups/orders are good indicators of a pristine environment.

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Integration Activities

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

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

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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.

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IMALIRIJIIT: Water Quality Results

⊸مارم مارمیوسی

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.

pH

Δρίτοιτο ph-Jefict Λοιδίσδι δρληπρητών Διδι τίαιδι (Λρίοληπος είδης), βταιδίς (ξαδύπος), ph-Jefict Λοιδίσδι αυστιστιστούς (Διίπου καιδίσους), ph-Jefict Λοιδίσδι αυστιστούς αυσ

рH

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.

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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 the George River are expected to be low, because agricultural areas do not surround the river. 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.

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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 degrees Celsius (°C). To compare, the mean temperature of the surface water of the Koroc River (Nunavik) was 11°C in September 2010.

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Laboratory analyses

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

$V5,D^{e}$, V4, $P^{\Phi}V$, V1, V2, V2, V3, V4, V4,

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. No comparison value is available for chlorophyll in the Koroc River (Nunavik).

4ぐ∩ ℃し 。 Parameter	్⊂ఒ్రాంీ Temperature	рН	ΔLPʹ	イ ハ⋲イL <i>e</i> ~し Hardness
⊅ഛ⁵ኇ°Ր° Units	°C	-	mg/L-∩J ^c mg/L	mg/L-∩J ^c CaCO ₃ mg/L CaCO ₃
ኄ ኮ ኮ ነ ነ ለ	17.8	6.75	10.10	4.58
ኄያንተፈ፣ል፣ 2 / Station 2	13.2	7.06	11.51	3.07
ኘቴኦትኣናል፣ 3 / Station 3	17.7	7.16	10.06	4.49
ኘቴ ቦ ት ነ ናል ፡ 4 / Station 4	16.0	7.11	10.40	4.17
ኄ ኮንት ነናል፦ 5 / Station 5	16.1	7.18	10.80	4.11

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 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 CaCO $_3$ /L). To compare, the mean value of hardness for the Koroc River (Nunavik) was 14 mg CaCO $_3$ /L in 2014.

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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 therefore 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.

CJFD4CDc PP4c44c

Trace Metals

Trace metal analysis included the measurement of 15 Rare Earth Elements (REE), 11 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.

ALD' de'naJn'scibiebl

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.

לפפנ שטארשכ סיאפים שהניספנ לכילטר טאליפני?

- 4°P66-34°P°Dec reftor Dy56e AD49c 4U°aDFb AA204'SU'rN- acac AD4Unac DCDPDec r'P6CD4JC AdLeDPDec, 4aaJC AdLeDPDec, AdLeDPDec, 4aaJC AdLeDPDec, AdLaDPDec, 4aaJC AdLaDPDec,

- 4° ት6- 3° ዮ')ታና ተሬናላለ 0ት5- 3° ና, Δ L'ቮኖ'-3ተበት. 0ት0ት0ት5-0ት6-0

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

- REE make good permanent magnets and are used in many hightech 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 IMALIRIJIIT 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 water bodies.

Δ ረ ^ና σ ື し Turbidity	ለያነጋቀና ለፈቈ የP¬∇ፆﭙ৫ሊፈ«ጋኒር드፥ ULr٦،	Nitrogen-J ರ ೪	Phosphorus-J&GSCS Phosphorus	4 ぐ⋂ [®] しσ Parameter
JTU 6P4° & %Lor 6LJN b JTU	μg/L	Γ⊂dS¹ 1⊂CΓ mg/L/L	۲۵۹۲ ^۱ ۱۵۲۲ mg/L	⊳⊸'σ°° Units
13	0.45	0.145	0.0144	ኘЬ▷ጉԿናል፥ 1 /Station 1
8	0.19	0.084	0.0048	ኄ▷ጉԿˤል፥ 2 / Station 2
10	0.38	0.117	0.0162	ኘЬ ▷ ት Կናል፥ 3 / Station 3
6	0.25	0.122	0.0080	¹⊌▷ጉԿ¹ል፦ 4 / Station 4
6	0.31	0.131	0.0066	¹b

ΔLحگن: Δ۲حا۲۰۰۲ IMALIRIJIIT: Conclusions

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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 Kangiqsualujjuamiut.

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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.

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Acknowledgements

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$V = V_{e}PUD4c$

Partners







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