

Nunavut Research Institute Science License Summary field report - 2011

Project Title

NEIGE (Northern Ellesmere Island in the Global Environment)

Permit Numbers

- Nunavut Research Institute (NRI): **02 125 11N-M**
- Nunavut Impact Review Board (NIRB): **11YN025**
- Parks Canada Agency Research and collection permit: **QUT-2011-8555**
- Polar Continental Shelf Program: **638-11**

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Person nights

The research team left from Resolute Bay to Ward Hunt Island on 27 June 2011 and it came back on 13 July 2011. The team spent 16 nights in Ward Hunt Island in Quttinirpaaq National Park of Canada.

Thus, the total number of person nights for our project in the park was 80 (16 nights x 5 persons) in Ward Hunt Island in Quttinirpaaq National Park of Canada.

Aircraft hours

A Twin Otter chartered by PCSP was used on 27 June 2011 to reach Ward Hunt Island from Resolute Bay. We left Resolute Bay at 9:20 am and we arrived at 1:30 pm after 4h10 of flight.

The same time of flight was necessary on 13 July 2011 to come back to Resolute Bay (departure at 4:30 pm and arrival at 8:40 pm). The Twin Otter stopped en route at Tanquary Fjord for Parks Canada operations before picking us up in Ward Hunt Island.

The helicopter was on site from 4 July 2011 (morning) to 6 July 2011 (noon), giving a total of 2.5 days and 12 hours of flight in place of the 5 days and 15 hours previously planned. We used the helicopter to reach Lake A on 4 July; Milne Fjord on 5 July; and Lake C1 on 6 July 2011.

Fieldwork dates

Our field work took place in Quttinirpaaq National Park (QNP) from 27 June 2011 to 13 July 2011.

Fieldwork location

Our work took place in Quttinirpaaq National Park, at Canada's strategically and scientifically important northernmost coastline, with comparative research on lakes in the Resolute Bay region. The station locations are given in Appendix 1.

Field Activities / Accomplishments

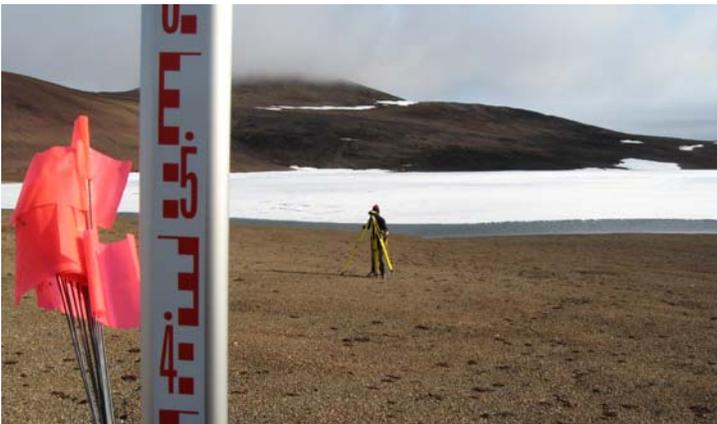


Water was sampled at specific depths in the water columns of Lake C1, Lake A, Milne Fjord and Ward Hunt Lake. These samples were partitioned for several different analyses, including those for pigments, flow cytometry, DNA, and water chemistry variables (DIC, DOC, SRP, TN, TP). We also used water column profilers (Hydrolab and RBR as in photo) to take *in situ* measurements of the specific conductivity, temperature, pH and dissolved oxygen content of our sites. Phytoplankton samples were

collected and preserved for later microscopic analyses of the community composition. Profiles of oxygen and pH were made in microbial mats using microsensors (Unisense) and fluorescence was measured using a PAM 2000. Physico-chemical parameters, specifically, oxygen concentration, salinity, conductivity, temperature and pH, were measured at each sampling site. Small sediment samples were taken from the shorelines of lakes for the analysis of modern communities of biological indicators. Subsamples will be analyzed for algal pigment concentrations, diatom abundance and DNA.

We continued the downloading and servicing of all our automated stations (Ward Hunt Island, Lake A and Lake C1), and this year these systems were upgraded with automated cameras and additional ground and lake thermistors for improved environmental monitoring. These data and imagery may be of interest to Park managers, other researchers and visitors.

We began the mapping of the geomorphology of the Ward Hunt Lake watershed, along with the section between the lake and the lagoon north of the camp. Identification of surface deposits and of periglacial processes and landforms were done around the lake during the first days. The rest of the stay was



focused on the specific mass movement study sites. The work comprised high-resolution mapping of the Ward Hunt Lake watershed using a portable Differential Global Positioning System; transects to profile physiographic features (as in the photo); soil coring for permafrost cryostratigraphy; installation of thermistor cables for permafrost monitoring at the SILA sites; soil profiling and sampling; installation of meters to monitor the permafrost active layer and movement at Ward Hunt Island.

We also sampled microbial mats and lake water (Char Lake) in the Resolute Bay region, as per our NRI Science License.

Preliminary results

Limnology

Since our field work took place in July 2011 we are still analyzing our samples (pigments, DNA, ARN, microscopy). However, preliminary graphs of flow cytometry and profiles of water chemistry variables can already be presented. Three different types of lakes were sampled in QNP: a freshwater lake (Ward Hunt Lake), two meromictic lakes (Lake A and C1) and the epishelf lake in Milne Fjord (Figure 1).

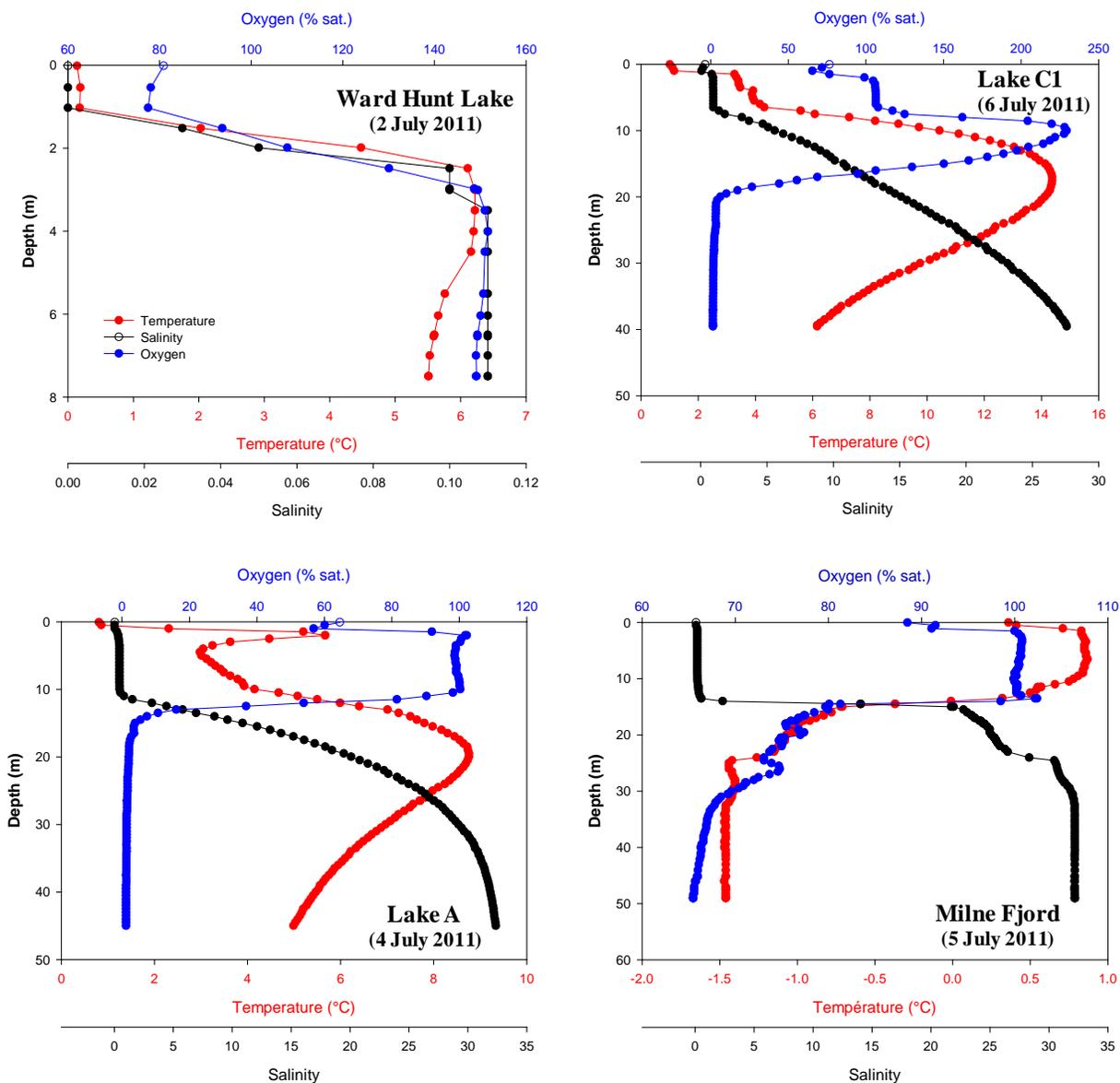


Figure 1: Temperature (°C), salinity and oxygen (% sat.) profiles in Ward Hunt Lake, Lake C1, Lake A and Milne Fjord in July 2011.

Geomorphology

The geomorphological processes on Ward Hunt Island are driven by the thermal state of the active layer and upper permafrost. The hydrology is highly influenced by the thawing of the active layer and the melting of snow banks. Preliminary analysis of 9 temperature loggers inserted in 2005 at a depth of 5cm into the ground in different locations around the watershed has provided an idea of the thermal regime of the active layer. The soil is frozen for 10 months of the year and only undergoes between 5 and 10 freeze-thaw cycles every year (Figure 2).

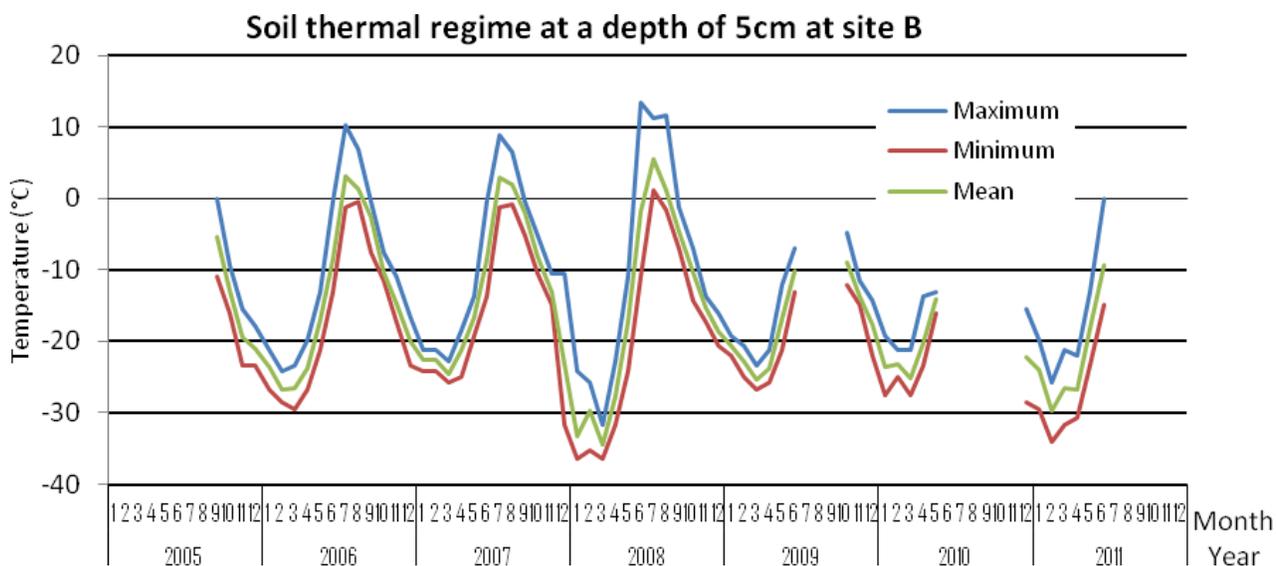


Figure 2: The thermal regime at a depth of 5cm under a vegetated section of sorted stripes at site B, from 2005 to 2011.

Community Consultation and Involvement

Quttinirpaaq National Park is situated far from any village and it is difficult to include local people in the field work. However we are preparing a well-illustrated synthesis article on all our work at Ward Hunt Island and vicinity which could be of broad interest for QNP Park management and Nunavut residents. We will send this to Parks Canada and HTAs at Resolute and Grise Fjord as soon as it is published.

Challenges

The remote nature of this site makes logistics always a challenge. Although weather delayed us by several days, we were able to complete all our highest priority work. The extreme expense of the logistics is also a challenge for us. We appreciated the upgrades to the camp made by Parks Canada.

Plans for next season:

These will follow the plans as described in our permit application. We will continue the monitoring on Quttinirpaaq National Park's lakes and vicinity. We will determine the diversity of microbial life in ice shelf and other shallow pond communities using state of the art molecular techniques, characterize the physical characteristics and processes within northern Ellesmere Island's meromictic lakes, and define the structure and function of microbial food webs within Lake A, C1, Ward Hunt and Milne Fjord using HPLC and flow cytometry analyses at Laval University. Our climate stations will continue to provide long-term air and soil monitoring data for this globally important site. We will also continue our study of the Ward Hunt Lake watershed and of the mass movements on the slopes of the lake. We will measure snow thickness in the watershed and collect snow samples. We will sample the frozen active layer on the western and south-eastern sites of the water shed and will determine the water saturation of the soil during the melting season.

Appendix 1

NEIGE is a multi-year project and all sites sampled were as listed in the Permit Application number QUT-2011-8555. In 2011 the following stations were sampled:

- Lake A climate station (83°00.10'N 77°23.09'W),
- Lake A (83°00.112'N 77°25.034'W),
- Ward Hunt Island lake, 6 stations (around 83°05.30'N 74°08.09'W),
- Ward Hunt Island site A (83°5'16" N 74°10'31"W),
- Ward Hunt Island site B (83°4'53"N 74°10'22"W),
- Ward Hunt Island site C (83°5'24"N 74°10'7"W),
- Ward Hunt Island climate station: Station SILA (83°4'53"N 74°7'51"W),
- Milne Fjord (82° 35.479'N; 80°35.824'W),
- Lake C1 (82° 51.087'N; 78°08 545'W).