

## Nunavut Research License Report – 2013

**Project Title:** NEIGE (Northern Ellesmere Island in the Global Environment)

**Permit Numbers:**

Nunavut Research Institute (NRI): **02 011 13R-M**

Parks Canada Agency and collection permit: **QUT-2013-13854**

Nunavut Impact Review Board (NIRB) : **11YN025**

Polar Continental Shelf Program: **64113 & 63113**

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**Person Nights**

Michel Paquette & Manuel Verpaelst left from Resolute Bay to Ward Hunt Island on June 1st 2013. They were joined by the remainder of the team on July 15th 2013. Everyone left together on July 23rd 2013. The total number of person nights for our project is calculated as follows:

$$44n \times 2\text{pers} + 8n \times 5\text{pers} = 128$$

All of these nights were spent at the Ward Hunt Island Camp.

**Aircraft Hours**

Twin Otters chartered by PCSP and based in Resolute Bay were used to carry the participants to and from Ward Hunt Island on: 1 June 2013; 15 July 2013; and 23 July 2013, for an estimated total of 27 hours flight time. A PCSP helicopter was on site during the period 16 to 21 July and we flew 7.3 hours.

### **Fieldwork Location**

Most of the work took place at Ward Hunt Island and vicinity in Quttinirpaaq National Park, with side excursions out of the park as far westwards as Milne Fjord. Specific locations are given in Appendix 1.

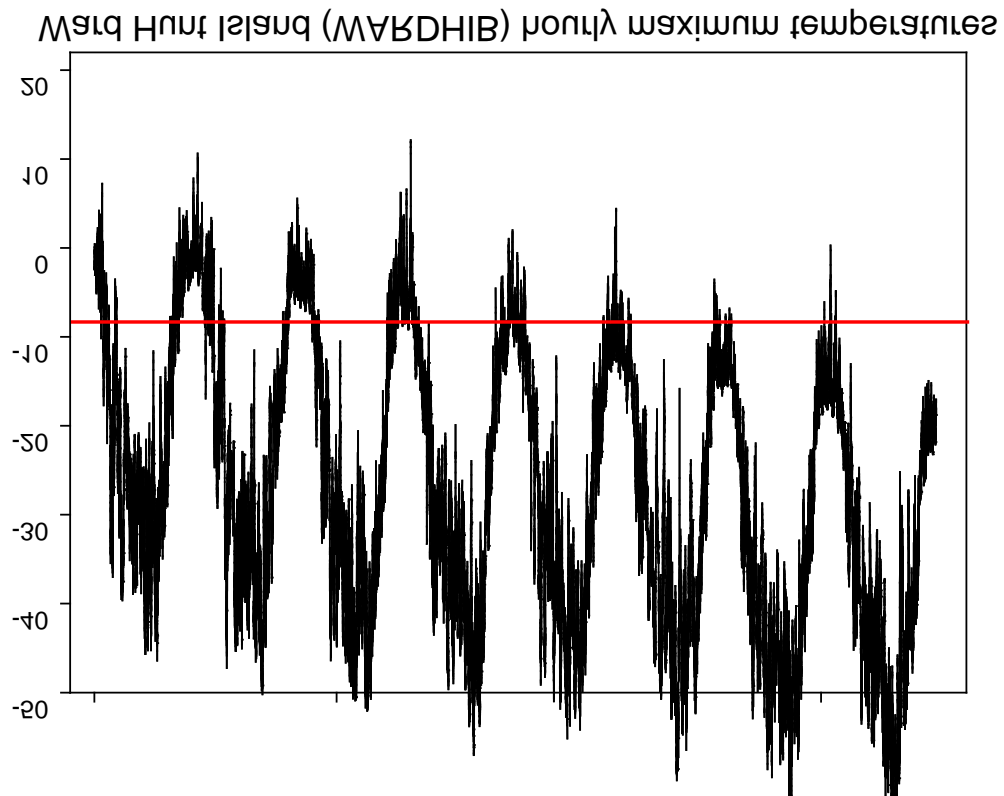
### **Field Activities and Accomplishments**

There were four aspects to our research:

1. Environmental monitoring. We continued our long term measurements from climate stations, permafrost monitoring and automated cameras. We are making these data available to all stakeholders including northern communities by publication in the online, open access data report series: Nordicana D ([www.cen.ulaval.ca/nordicanad/](http://www.cen.ulaval.ca/nordicanad/)). This is now up to date for all CEN climate data from these sites, including our station downloads from Ward Hunt Island in July 2013.
2. Lake and fjord profiling. We continued our measurements tracking water column change in the lakes and fjords along the northern Ellesmere Island coastline. Specifically we profiled: Markham Fjord, Disraeli Fjord, Lake A, Ward Hunt Lake, Lake A, Lake B, and Milne Fjord. These data will be added to those already available through Polar Data Catalogue.
3. Microbiological research. We continued our studies on the microbial communities and processes in the lakes and fjords of Ward Hunt Island and vicinity. Dr. Velazquez (guest scientists from Spain) ran experiments to examine carbon cycling in cyanobacterial mat communities, and Dr. Vincent took plankton samples from the surface waters of the lakes and fjords for analysis of microbial diversity and activity.
4. Geomorphological and hydrological research (GEO-NEIGE). This work was exclusively conducted in the Ward Hunt Lake watershed, to generate information on snow distribution, flow pathways, water quality, sediment movement and the timing of delivery. This research also contributed to our project “Arctic Development and Adaptation to Permafrost in Transition” (ADAPT).

### **Preliminary Results**

This was a cooler year than previous seasons, and full loss of ice of Ward Hunt Lake seemed unlikely. The large year-to-year variation in climate is seen from the following graph, updated to July 2013, for maximum air temperature at our SILA station:



**The following observations were also of interest to our long term monitoring of this northern Ellesmere environment:**

There were high densities of lemmings on Ward Hunt Island, higher than we have observed in the past, and the lemmings were large and in excellent body condition:



Lemming photographed on Ward Hunt Island, July 2013 (photo: Denis Sarrazin).

Our automated camera (2 images per day) captured the final break out of Ward Hunt Ice Shelf in August 2012. Disraeli Fjord at that time became fully open to the Arctic Ocean, perhaps for the first time in millennia:

**10 July 2012**

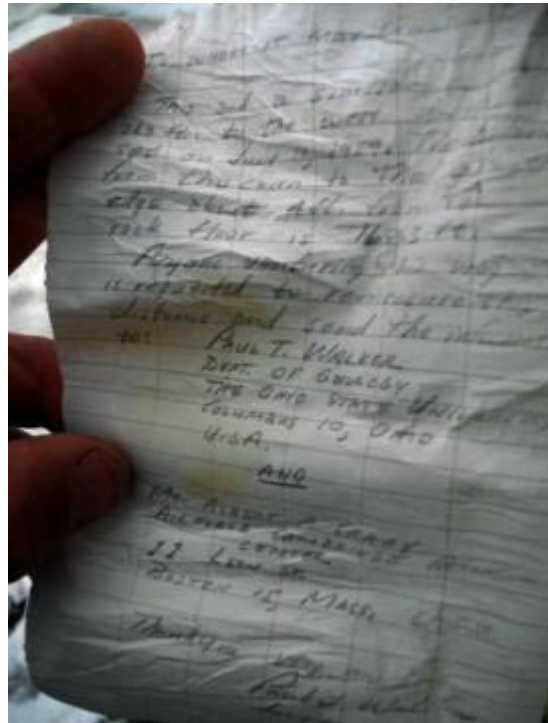


**28 August 2012**



Details of the automated camera: Harbortronics time-lapse camera system modified for cold environments. It uses a Digisnap controller with external battery and solar panel enclosed in a fiberglass box. The Digisnap controls a Canon EOS Digital Rebel XS camera that has a CMOS sensor of 10.1 megapixels. The dimensions of the photos are 3888 x 2592 (pixels). Focal stop of F/14, exposure time of 1/320 sec and focal length of 28 mm. Images were programmed to be taken twice per day, 14h45 and 16h45.

We discovered an excellent site for microbial mat sampling, a shallow inland waterbody (unofficially named Walker Pond, shown below) located near a glacier between Markham and Disraeli Fjords. At that site (lat. 83 00.601'N; long. 72 12.387'W) we discovered a cairn containing a bottle, with a message from Paul T. Walker (as in 'Walker Hill', Ward Hunt Island) dated 10 July 1959. It marked the distance from the cairn to the glacier as 168.3 feet. We re-measured the distance to the glacier and found it to be 401 feet. This large retreat (233 feet) highlights the pronounced warming of the Ward Hunt region over the last half century.



Photos: Warwick F. Vincent

Please note that we carefully replaced the note in the bottle (along with our own) and replaced the rocks, so as to leave the site undisturbed, consistent with our NRI License and Parks Canada Research Permit, and the usual ethics of polar research and exploration. This discovery generated enormous popular interest around the world when we presented it at the ArcticNet meeting in Halifax, December 2013 (including a TV interview with CBC North and an article in the flight magazine 'Up Here').

Our early results in the geomorphological part of our work (GEO-NEIGE) show that water is channeled in the coarse sections of sorted nets that form underneath snow drift. These underground “channels” are similar to soil pipes and they favor nutrient and sediment movement through the landscape and into Ward Hunt Lake. The channeled flow also emerges to form “water tracks”, a type of overland flow whose characteristics have yet to be clearly defined in the literature. One of the effects of these water tracks on the soil is their cooling effect, as the flow of water through them slows down the thawing of the active-layer during early summer. This contrasts with what has been observed in regions of warmer permafrost.

### **Community consultation and Involvement**

Quttinirpaaq National Park and Ward Hunt Island are located in a remote region, far from northern communities. Our interactions are through community consultation, Parks Canada and NRI license applications, interactions with Parks Canada staff (including at Ward Hunt Island this year, and at meetings in Nunavut), and by meetings with Resolute Bay and Grise Fjord residents at workshops and other events. For example, we ran a display and hands-on activities with residents (including many children) of Resolute Bay this July at the PCSP Open House Day event. They enjoyed looking at the amazing microscopic life of Nunavut!

### **Challenges**

Weather and funding continue to be our greatest challenges. Our first group was delayed by more than 2 weeks due to uncertain weather in the Park. Helicopter flying time was reduced because of foggy weather. PCSP’s increasing charges and new cost-recovery policies are a huge challenge for us. We appreciate the upgrades to the camp made by Parks Canada and the CEN-QNP laboratory greatly facilitated our work.

### **Plans for next season**

We would like to return in July-August 2014 to continue each of these projects, including the following activities: 1) Environmental station downloads and replacement of the automated camera, which broke down when air temperatures at the station dropped to -50°C; 2) Ongoing lake and fjord profiling, with measurement of their biogeochemical properties; 3) New microbiological work on processes at the base of the marine and freshwater food webs of this region; 4) Ongoing research on the water tracks that affect land-water interactions in the Arctic; 5) Some comparative work on lakes and ponds in the Resolute Bay area.

## **Appendix 1**

In 2013 the following stations were visited for observations or sampling:

- Ward Hunt Island SS1 (83°05.263'N; 74°10.293'W)
- Ward Hunt Lake and shores (83°05.30'N; 74°08.09'W)
- Ward Hunt Island : SILA station (83°04'53''N; 74°7'51''W)
- Lake A climate station (83°00.10'N; 77°23.09'W)
- Lake A (83°00.112'N; 77°25.034'W),
- Lake B (82°58'00''N; 75°25'59''W),
- Lake C1 (82° 51.087'N; 78°08 545'W),
- Markham Fjord (83°01.90'N; 71°27.15'W),
- Walker Pond (N83° 00.601' N; 72° 12.387' W),
- Disraeli Fjord (82°50.658'N; 74°31.630'W),
- Milne Fjord (82° 35.479'N; 80°35.824'W)