

## **Annual permit report from Brown, UofT, “Lake Ice in the Canadian High Arctic”**

### **TO:**

**Canadian Wildlife Service and Sulukvait ACMC** multiyear licence NUN-NWA-16-03;  
**Nunavut Research Institute** licence 02 033 16N-M (to be renewed spring 2017)

### Project Overview:

Lake ice is an important part of the cryosphere and recent projections suggest a pan-arctic reduction by the end of the century in ice duration (ranging from 20 to >100 days) and thickness (ranging from 30 cm to > 1 m). Since the majority of ground based ice observations in Canada ceased by the 1990s, recent changes in ice regimes have been primarily noted through modelling and remote sensing. Observation data, essential for validating both remote sensing and modelling research, is currently inadequate though some volunteer monitoring efforts have emerged since the decline of Canada's monitoring network and have been utilized for ice research. As changes are noted in ice regimes, we need to fully understand the implications and response in terms of water and energy balance and their effects on other areas of research (e.g. limnology, transportation). To achieve this, in situ data of lake ice in Canada is being collected across a latitudinal gradient (temperate, sub-Arctic, High Arctic). The field data will be used to improve the effects of snow cover on modelled ice thickness, as well as to isolate how the duration of the modelled ice break-up season is affected by the shape/size of the lake. Resolute and Polar Bear Pass provide ideal locations for the High Arctic portion of this study and data collection is underway.

### Summary of 2016 Field Work, May 20 – May 26:

My field party of 3, Myself (UofT), Kathy Young (York), Sarah Ariano (UofT) spent one week setting up research equipment this spring, all but 1 day based out of PCSP in Resolute. We spent approximately 3 hours in Polar Bear Pass National Wildlife Area on May 24 2016. No wildlife was observed during our brief stay (although, plenty of droppings were observed around the cabin). We landed the helicopter beside the cabin and downloaded the data from the existing weather station, and then moved closer to the edge of Hunting Camp Lake with the helicopter to measure snow depths and install an outdoor camera before returning to Resolute.

Following the advice from the Sulukvait ACMC I altered the location for placing the ice thickness sensor as the intended Hunting Camp Lake was likely too shallow. The ice sensor was placed in our other study lake near Resolute instead where the depth is known (3mile / Small Lake, 74.75N, -95.05W). The project will continue to use Hunting Camp Lake as a representative lake for the area in terms of modelling as there is a historical climate record and snow cover data available.

An outdoor digital camera was left in place overlooking Hunting Camp Lake to take pictures of the ice cover (75.73N, -98.42W). The camera is on a hill ridge attached to a short metal frame with solar panel and power, surrounded by rocks to prevent tipping. The wires are all enclosed in tubing to prevent animal chewing. The metal frame is painted white to blend in with the snow cover as best possible (pictures provided below as requested, Figure 1). The camera structure was intact at the end of the summer, kindly checked on by the CWS researchers working from the cabin. I hope to maintain the location of the camera long term as funding allows creating a data set of the spatial variation of ice cover on the lake. Moving forward, I would like to get in contact with anyone who is familiar with the lake and might have some first-hand observations on the timing of when the ice over formed/retreated in previous years.



***Figure 1. Outdoor digital camera and solar panel in place at Polar Bear Pass***

The outdoor camera in place near Resolute at 3 Mile / Small Lake was set up behind an existing barrel on the north end of the lake (Figure 2), however the rebar was installed while the ground was frozen and the camera is likely on the ground after the summer thaw. I am in the processes of trying to hire a local field assistant for some help retrieving the data from that camera and set it up again before the summer lake ice thaw (through the Resolute Hunters and Trappers Association) as I plan to return later in the summer. I hope to also hire a field assistant / guide for the upcoming summer field work season (planned for about 1 week in August).



***Figure 2. Outdoor camera in place at Small Lake and example of the Ice sensor currently on the bottom of the lake, with a rope floating for retrieval.***

#### Overall Project Progress and plans for 2017:

There are no results from the study yet to share as summer 2017 will be the first data download. My new graduate student is currently organizing the previous years of data from the weather station at Polar Bear Pass (provided by K. Young and C. Labine) and we will begin some initial modelling work to assess the lake ice model performance that we plan to use. We aim to return to both Resolute and Polar Bear Pass in 2017 during the summer to download the camera data, the weather tower data and the ice thickness sensor and reprogram all for the next season. If funds allow, we aim for a technician from Campbell Scientific Canada to accompany the field party this year for some maintenance on the existing weather tower. The satellite data portion of this project will begin in late 2017 and we aim to collect suitable imagery of the region to begin compiling a space-based dataset as well. I aim to have the preliminary results from the field campaigns presented at scientific meetings by the end of 2017.