

Annual research report for:

Canadian Wildlife Service multiyear licence NF-NR-2022-NU-002
Nunavut Research Institute licence 02 012 22R-M
Mayor's Office, Sulukvait APMC & HTA, Resolute NU

Project Title: Lake Ice in the Canadian High Arctic

Lake ice is an integral part of the cryosphere, and recent projections suggest a pan-Arctic reduction in ice duration (20 - >100 days) and thickness (0.3 - > 1 m) by the year 2100 [1]. Documented changes in the ice covers of Arctic lakes have already been noted in recent years. On Cornwallis Island (NU), recent modelling work suggests a reduced ice-covered season on Resolute Lake since the 1960s [4], and recent field data has shown a reduction of maximum ice thickness by ~30 cm already on a small High Arctic Lake (Small Lake) compared to the early 1980s. As changes occur, there is a need to understand the implications and response of the water/energy balance and the effects on other areas of research (e.g. ecology, limnology, transportation). Of particular significance in the High Arctic is the effects of changing climate on lake biota (e.g. Char) as reduced ice cover on lakes will affect lake parameters such as available light conditions through the ice, longer open water seasons, and overall water temperature increases. Most ground-based ice observations in Canada ceased by the 1990s, and recent ice cover changes have been primarily noted through modelling and remote sensing. To monitor changes, and validate modelling and satellite imagery, lake ice data in Canada is being collected across a latitudinal gradient from Haliburton, ON (temperate) to Nanuit Itillinga National Wildlife Area and Resolute (High Arctic). The field data is being used to improve the effects of snow cover on modelled ice thickness, to isolate how the duration of the modelled ice break-up season is affected by the shape/size of the lake, and to highlight the differences between northern vs. mid-latitude ice processes.

Permittee name and contact information:

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2022 Research Team:

University of Toronto: Laura Brown, Brianna Lane, Alexis Robinson, Noah Bacal
Team that entered Nanuit Itillinga NWA May 2022: Laura Brown, Debbie Iqaluk, Brianna Lane, Alexis Robinson and Pilots
Team that entered Nanuit Itillinga NWA Aug 2022: Laura Brown, Brianna Lane, Noah Bacal, and Pilot

Date and Duration of research in the NWA:

Our research visits to Nanuit Itillinga National Wildlife Area 2022 took place on May 11(~ 3 hours) and Aug 3 (~ 2 hours).

Transportation and Travel Routes in the NWA:

The exact flight route was not recorded from Resolute (PCSP) to Nanuit Itillinga. In May, we travelled by Twin Otter and landed on Hunting Camp Lake. We used a snowmobile to get to the weather tower at the cabin and walked to the small camera. Aug. 3, we landed beside the cabin to download data and do maintenance on the

weather station, before landing again at the small camera on the shore of Hunting Camp Lake (75.73N, 98.42W) (Figure 1).



Figure 1. Location of landing and work sites in the NWA.

Summaries of Activities:

This year, our field party consisted of 5 members: Laura Brown, Brianna Lane (MSc student, year 1), Alexis Robinson (PhD Student, year 5), Noah Bacal (MSc Student, year 1), and Debbie Iqaluk. Our group spent 12 days (May 8-20) and another 15 days (Jul 31 – Aug. 15) working from PCSP in Resolute, with two brief trips over to Nanuit Itillinga, Bathurst Island for equipment maintenance and snow depth measuring on Hunting Camp Lake.

In May, we measured the snow conditions and ice thickness on Resolute, Small, North and Plateau Lakes near Resolute. We used a small 2” auger attached to a cordless drill to measure the ice thickness and found that the average ice thickness was 2.15 m. We also found some very interesting ice on the south end of Small Lake that had unfrozen water inside the ice which was unexpected and not detected in the early 1980s (from communication with previous researchers). We are hoping to investigate that more next year and see if community members who ice fish in the area have seen this before – perhaps it is common now, but none of the other lakes had this kind of interesting ice where we drilled.

In August we recovered the ice thickness sensor from Small Lake: it recorded most of the season before getting caught in the ice during break-up. We also downloaded and repaired some of the local lake ice cameras so they were ready for the next year. Unfortunately, the camera at Small Lake had been tampered with two days before we arrived to download the images, the weatherproofing seal was removed (and left lying on the ground), and the SD card was taken out and put back in - thankfully no data was lost as this is the most important research lake for us. We would like to remind everyone that there is no motion detection on the cameras, they only take 1 picture of the lake a day.

Four new cameras were placed on lakes across Cornwallis Island, in nearby locations to where other ongoing research takes place (by Derek Muir and Debbie Iqaluk). The cameras are a short walk from the helicopter landing areas on the west ends of Amituk, Sofia, Laura and Eleanor Lakes (Figure 2). The cameras are on the northwest areas of the lakes, aimed to the east to capture the main lake area. As advised, there will be no images captured of the west end of the lakes where people might visit, and they are far enough away from the lake that if anyone was out fishing they would be too small to recognize. Similar to the cameras near Resolute, only 1 image a day at noon is being taken (no motion detection). If anyone does happen to be in the area of the cameras over the winter, it would be much appreciated to know if they are still standing.

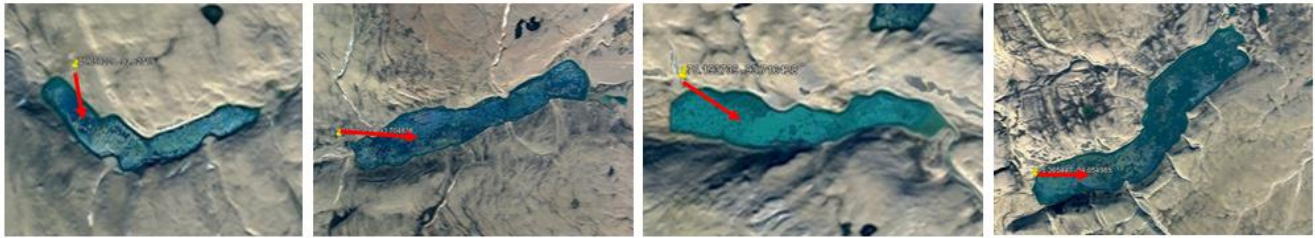


Figure 2. Locations of new cameras.

Near Resolute, we were able to create lake depth maps for more lakes (North and Small) using leased equipment from the Department of Fisheries and Oceans:

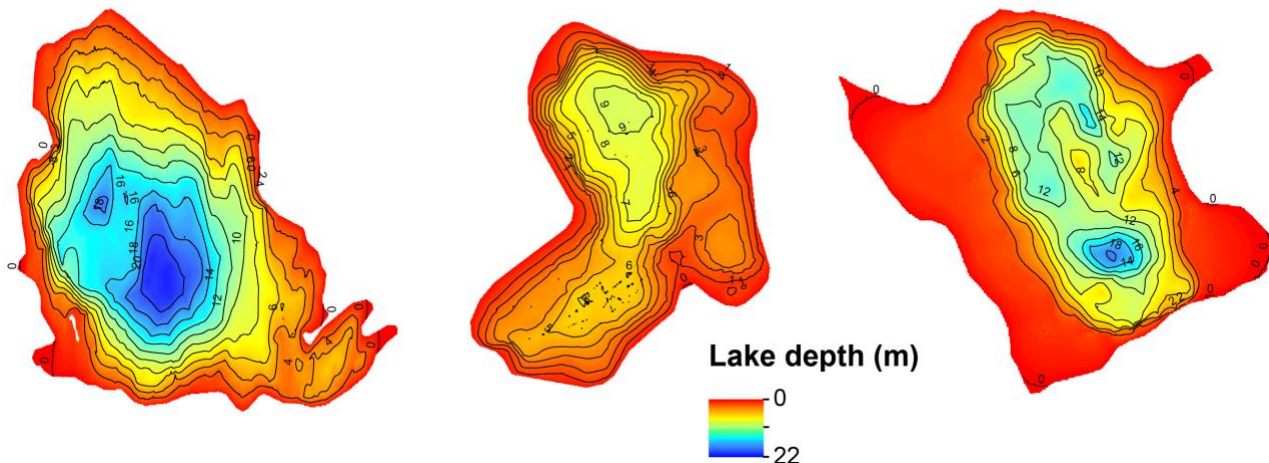


Figure 3. Lake depth maps of Resolute, Small and North Lakes.

At Nanuit Itillinga NWA we were able to download and service the small camera structure on the NE shore of Hunting Camp Lake and happily, all was working well. The weather tower was serviced, and the rain gauge was replaced. I plan to continue to use Hunting Camp Lake as a representative lake for the area in terms of modelling, as there is an existing climate record and snow cover data available. Claude Labine from Campbell Scientific was not with our team this year but is still an active participant with respect to tower maintenance and data records.

Record of Wildlife observed (NWA):

On May 11 we observed ~7 muskox on the southern plateau of the valley. We did not get close enough for an accurate count, but best estimation from a zoomed-in photo was 5 adults and 1 or 2 small ones between them.

On Aug 3 we saw a herd of 20 muskox in the valley behind the CWS Cabin (counted from a zoomed-in picture), and 2 wolves outside of the NWA, to the south.

Community consultation and involvement:

This year we were able to work with Debbie Iqaluk in May (and consult with her in August), who was very much appreciated once again. We really enjoyed being able to chat with people while were out working in both May and August, we met several people this summer and had the chance to tell them about our projects – it was great! My apologies that I forgot to drop off a USB stick with the camera images to the HTA office this year, but I will bring them next season so that all the files are available for use if wanted. I would be very interested if anyone might be travelling to Nanuit Itillinga (or nearby) during the year. It would be very helpful for checking on the weather tower. I have applied for funding for next year to potentially show someone to operate the weather tower to download the data in future years if there is anyone interested in learning about that.

Future Plans within the Protected Area and Overall Project Progress:

Overall project plans are to continue monitoring the lake ice conditions to build a record of annual variability. Within the NWA we hope to continue maintenance of the weather tower and potentially add a satellite modem (depending on costs and functionality of the new Star Link service). Ice formation and melt dates from the camera imagery are all posted on my website: <https://sites.utm.utoronto.ca/brown/content/lake-ice-cover-dates-nunavut>. The climate data from the NWA weather tower and the Resolute weather stations are being used for lake ice modelling work, simulating the ice cover for as far back as the climate records allow.

One publication in collaboration with Kathy Young focused on Nanuit Itillinga data is in review; one northern-based paper on changing summer precipitation is in review, and an overall Arctic lake ice update is scheduled to be released soon:

Brown, L and Duguay C. 2022. Lake Ice [in Arctic Report Card 2022], NOAA, to be released Dec 13 2022.

Two presentations were given this past year using the field data collected, and one more is scheduled for December:

Lane B and Brown LC. Changing Arctic Snow and Ice: in situ monitoring using digital camera imagery. CMOS/CGU/ESC Joint meeting, poster presentation, June 2 2022

Brown, LC. Past, present, and future of lake ice in the central Canadian High Arctic. Invited Talk (Keynote speaker), Northern Research Basins 23rd symposium, Iceland (online), Aug 25, 2022.

Lane B and Brown LC. Changing Arctic Snow and Ice: in situ monitoring using digital camera imagery. Poster Presentation, ArcticNet AMS 2022, Toronto, Dec 2022.

I certify that the information is correct and complete to the best of my knowledge.

Signature of permit holder:



Date (yyyy/mm/dd): 2022/11/15