

# Research Bulletin

## NWT Cumulative Impact Monitoring Program

### Warming Trends in Lake Temperatures in the North Slave Region

#### Summary

The Northwest Territories is known for its pristine freshwater lakes and rivers, yet is experiencing a notable increase in lake temperatures. This is largely caused by global climate change, which has led to rising temperatures and altered weather patterns. This project looked at temperature dynamics of 535 lakes in the North Slave Region to help understand the patterns of temperature change. Over the past four decades, the surface temperatures of most lakes has increased, with freeze-up happening later and break-up happening earlier.

#### Why is This Important?

The warming of lakes can have many impacts including changes to aquatic ecosystems, impacts on water quality, a reduction in lake ice cover duration impacting transportation infrastructure, and potential disruption of the traditional way of life and well-being of local Indigenous communities. It is crucial to monitor and understand these warming trends to better inform decision-making around ice safety and mitigation strategies.

#### What Did We Do?

We developed an algorithm (system) to determine lake surface temperatures utilizing thermal satellite data obtained from Landsat satellites for 535 lakes in the North Slave Region. This resulted in a lake surface temperatures dataset, which can be used for various research purposes. We analyzed the data to investigate the warming trends and distribution patterns of lake surface temperatures over four decades. We then developed a web interface (scan the QR code) on lake surface temperature mapping for use by northern communities and the public.

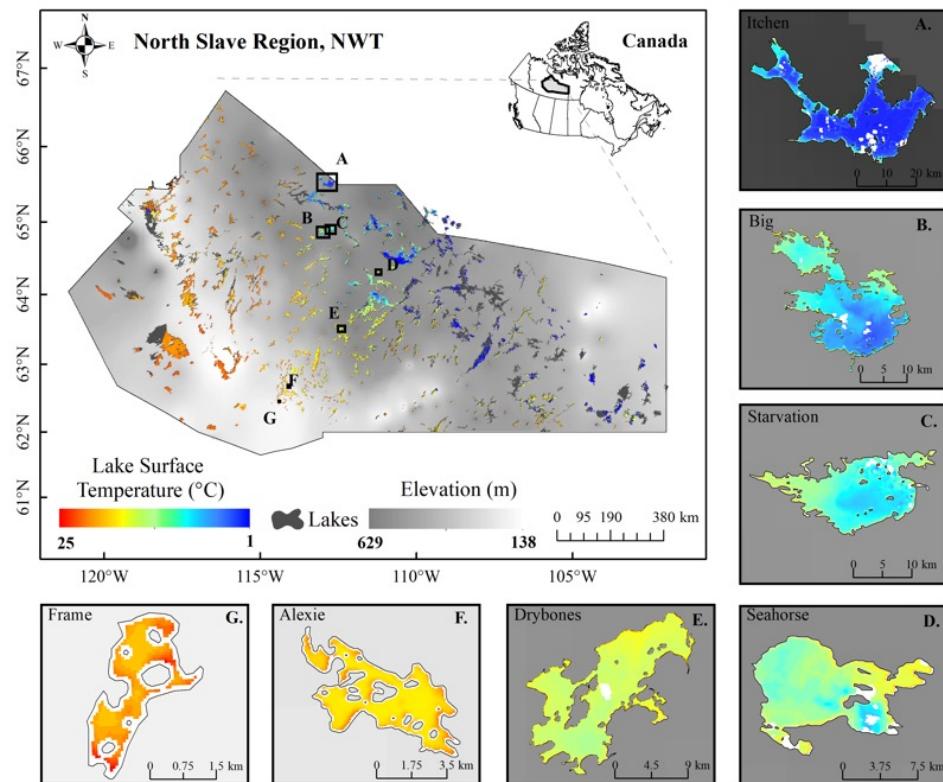
#### What Did We Find?

- Using Landsat satellite data from 1984-2021, up to 92% of lakes showed significantly increasing lake surface temperatures trends.
- For the majority of lakes, the most pronounced temperature increases were observed in the month of October with an average of 0.13 °C per year.
- Lake surface temperature is influenced by both altitude and geographical location.
- Lakes are freezing later (0.2 day/year or about a week later over the study period), and ice break-up is occurring earlier (-0.17 day/year or about 6 days earlier over the study period) across the North Slave Region, indicating a changing climate pattern.



## What Does This Mean?

- The observed pattern of later lake freeze-up shows that conditions vary from year to year which has many implications. It affects transportation, traditional activities, and the timing of ecological processes.
- Understanding increased lake surface temperatures can help assess potential consequences for aquatic ecosystems. This includes changes in the biotic community, timing of fish reproduction, nutrient cycling, and overall lake productivity.
- This knowledge can help inform ice safety and resource management decisions and shape climate change adaptation strategies.



*Distribution of lake surface temperature across the North Slave Region, NWT and on selected lakes, excluding Great Slave Lake.*

## Data visualization website for lake water temperatures:

ReSEC Map (Monitoring and Analysis Platform) is a public web application to communicate the lake surface temperature data for northern communities. Its goal is to disseminate information on lake temperature and compare the changes over time  
<https://resecmap.ca/>



## For More Information

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Attiah, G., Kheyrollah Pour, H., & Scott, K. A. (2023). *Lake surface temperature retrieved from Landsat satellite series (1984 to 2021) for the North Slave Region*. *Earth System Science Data*, 15(3), 1329–1355. <https://doi.org/10.5194/essd-15-1329-2023>

Attiah, G., Kheyrollah Pour, H., & Scott, K. A. (2023). *Four decades of lake surface temperature in the Northwest Territories, Canada, using a lake-specific satellite-derived dataset*. *Journal of Hydrology: Regional Studies*, 50, 101571. <https://doi.org/10.1016/j.ejrh.2023.101571>

**NWT CIMP** is a source of environmental monitoring and research. The program coordinates, conducts and funds the collection, analysis and reporting of information related to NWT environmental conditions. If you're conducting environmental monitoring and research, consider sharing your information with northern residents and decision-makers in a Bulletin.