



NWT Cumulative Impact Monitoring Program (NWT CIMP)

A source of environmental monitoring and research in the NWT. The program coordinates, conducts and funds the collection, analysis and reporting of information related to environmental conditions in the NWT.

NWT Environmental Research Bulletin (NERB)

A series of brief plain language summaries of various environmental research findings in the Northwest Territories. If you're conducting environmental research in the NWT, consider sharing your information with northern residents in a bulletin. These research summaries are also of use to northern resource decision-makers.

How will climate warming and permafrost thaw affect fish, bugs, and waterfleas living in Arctic lakes?

Northern lakes and the land surrounding them are warming, leading to increasing water temperatures, shoreline permafrost thaw and changes in water quality. This study looked at how these changes will affect fish and what they eat, such as bugs (macroinvertebrates) and waterfleas (zooplankton).

Why is this research important?

Freshwater ecosystems are an important part of the northern environment. Northern communities depend on lakes for drinking water and food. Climate change is expected to continue to cause warming of lakes and the loss of permafrost, so it is important to understand how these changes might affect these important resources.

What did we do?

We surveyed lakes in the Gwich'in Settlement Area (GSA) and Inuvialuit Settlement Region (ISR) for fish (45 lakes), bugs and waterfleas (37 lakes), and water quality (74 lakes) over three years (2017-2019). We examined how water quality (nutrients, dissolved oxygen, temperature, etc.) affected the abundance (number) and diversity (types) of fish, bugs, and waterfleas in each lake. This information helped to predict how the fish, bugs, and waterfleas might respond to water quality and temperature changes.



Doctoral student Alyssa Murdoch getting ready to release a fish captured as part of our fish surveys. (Credit: M. Teillet)

What did we find?

By comparing information collected across all surveyed lakes, we found that:

- Water quality changes caused by permafrost thaw may lead to increases in the total abundance of waterfleas, but small decreases in the diversity of bugs.
- Indirect climate change effects on water quality, such as increased nutrients, seem more important for fish communities than the direct effect of increasing water temperatures.
- Warming water temperatures may allow lakes to support more types and higher numbers of fish, but changes in water quality due to permafrost thaw might act in the opposite direction, lowering the number and variety of fish that lakes can support.

What does this mean?

Project results suggest that fish diversity and abundance in northern lakes might be sensitive to changes in water quality, caused by climate change and permafrost thaw. However, how fish communities may change is difficult to predict because increases in water temperature and water quality changes may act in opposing directions. Their food, macroinvertebrates and zooplankton, might also change in response.



Environmental monitor Miles Dillon and Masters student Jasmina Vucic getting ready to collect waterfleas and bugs from an Inuvialuit lake. (Credit: D. Gray)

How will climate change affect lakes?

Increases in air temperatures will lead to warmer lake water and increased permafrost thaw. Warming lake water may impact fish that prefer cold water. The materials released when permafrost thaws can lead to changes in lake water quality, including increases in the amount of dissolved salts, how acidic the water is, how clear it is, and how many nutrients there are.

Recommended Reading

Cohen, R.S., Gray, D.K., Vucic, J.M., Murdoch, A.D., Sharma, S. (2020). *Environmental variables associated with littoral macroinvertebrate community composition in Arctic lakes*. Canadian Journal of Fisheries and Aquatic Sciences 78: 110-123. <https://cdnsciencepub.com/doi/abs/10.1139/cjfas-2020-0065?af=R&R>

Vucic, J.M., Gray, D.K., Cohen, R.S., Syed, M., Murdoch, A.D., Sharma, S. (2020). *Changes in water quality related to permafrost thaw may significantly impact zooplankton communities in small Arctic lakes*. Ecological Applications 30: e02186. <https://doi.org/10.1002/ea.2186>

Contacts

Alyssa Murdoch or Sapna Sharma,
York University
alyssamurdoch@gmail.com
sapna.sharma23@gmail.com

Derek Gray, Wilfrid Laurier University
dgray@wlu.ca

NWT Cumulative Impact Monitoring Program (CIMP197)
nwtcimp@gov.nt.ca