

Plain Language Project Description

Title: Changing winters and ecosystem health of Arctic lakes

Applicant: Prof. Isabelle Laurion (CEN, GRIL, INRS)

Summary and objectives

Arctic lakes are central to Inuit well-being, providing nutritious food, supporting cultural practices, and sustaining food security. Communities across Inuit Nunangat have reported changes in lake conditions and fish health, including fish kills, unusual taste and flesh color, and concerns about water safety.

Many of these changes are linked to climate warming, notably during winter. Warmer winters and increased snow cover can reduce light under ice, lower oxygen levels, and disrupt food webs, with effects that extend year-round. These changes may affect not only adult fish using lakes as winter refuge but also egg development and juvenile growth. Despite their importance, winter processes in Arctic freshwater systems remain poorly understood.

Our project is part of the broader FROST research initiative (circumpolar comparison of 12 Arctic lakes) and focuses on Tugaat Lake, a community-identified priority fishing site south of Milne Inlet. Tugaat Lake, with abundant anadromous Arctic char, will be compared with Bylot Island Lake (Sirmilik Park), which supports resident char. The main objective is to assess how changing winter conditions influence lake ecosystems, food webs, and Arctic char health. Specifically, the project asks:

- How do warming winters and changing ice and snow conditions affect lake habitats?
- How do these changes affect the food web, from plankton to fish?
- What are the implications for Arctic char health, food quality, and safety?

Given Tugaat Lake's proximity to Mary River mine activities, targeted measurements will also evaluate potential metal contamination and turbidity.

Justification

Tugaat Lake was selected in consultation with HTO Mittimatalik for its importance to subsistence fishing and long-standing value to Elders. Community members have raised concerns about fish health, particularly mercury, and the long-term sustainability of this resource near mining activities. Research builds on earlier community-led work, documented in the film *Ujjirjavut*, and aims to generate knowledge relevant to local food security. This study responds directly to Inuit priorities and supports informed decision-making on fishing practices, resource management, and climate adaptation.

Location and timing

Field work will take place at Tugaat Lake near Mittimatalik. Sampling is planned for 2026 and 2027, with up to three field visits per year. Field timing will follow FROST protocols to capture winter (~one month after ice formation), spring (~two months before ice-breakup), and summer conditions, but will be adjusted based on Inuit expertise, local conditions, and PCSP-related logistical constraints. The project is funded until August 2029.

Methods

This study combines year-round physicochemical measurements of fish habitat (temperature, dissolved oxygen, and light) using an instrument mooring, with modeling and climate data to assess current conditions and project future changes. Food web structure, including plankton and benthic macroinvertebrates, will be characterized, and fatty acids and mercury quantified across trophic levels. No fish will be harvested specifically for research; analyses will use Arctic char caught by Inuit fishers during regular subsistence activities using gillnets or jigging. The study needs 10-30 individuals per visit. Incidental catches of other species will be documented. Measurements include length, weight, gonad size, and otoliths collection for age determination. A small dorsal muscle sample will assess nutritional quality (essential fats) and mercury. Stomach contents and stable isotopes will be analysed to characterize diet and food web connections, and fish will be inspected for parasites. Fish will be returned for consumption after samples are taken.

Sharing of results

Our team has previously engaged with Mittimatalik through outreach, knowledge exchange, and collaborative discussions, including community events, a trilingual Bylot Island ecology website, and Inuktitut-translated posters. The project builds on those relationships and follows the FROST framework, emphasizing collaboration, respect for Inuit knowledge, reciprocal sharing of results, and alignment with the National Inuit Strategy on Research. Community members will be invited to participate in field activities and data interpretation, according to local interests and availability. Results will be shared through annual reports to the NRI, community meetings, and plain-language summaries to support local understanding and informed decision-making. FROST also benefits from a communication officer and a project coordinator from an Inuit-led organization.