

The Mystery of Lake Tasikallak

"Tasikallak is an excellent spot for Arctic char fishing, especially for spring ice fishing. In the fall, many char return to the lake to spawn and stay there throughout the winter. Arctic char is important to our families: it's nutritious, low-cost, and fishing is a meaningful activity that brings our community together."

I remember the big fish kill in July 2002, when over 3,000 adult char died. Some people have noticed that at times the fish taste unusual or their flesh feels softer. There was also a case where someone felt unwell after eating fish from the lake. We usually discard those, but there are still plenty to catch. Our community is working closely with scientists to understand this mystery, and our knowledge and observations are key to finding answers."

**Fictional testimony inspired by statements shared by community members during the 2023 consultations.*

Exploring what caused the massive fish kill

After the fish kill, residents of Kangiqsualujjuaq quickly took action to clean up the lake, working alongside staff from the Nunavik Research Center in Kuujuaq. They counted and measured the dead fish to estimate the total biomass.

The cause of this massive die-off is still unclear, underscoring the importance of combining local knowledge with scientific research to better understand and respond to such events.



Archive from 2002 report

There is still no clear explanation of this event

To this day, there is still no clear explanation of the event, and **we do not know whether it could happen again**, especially with ongoing climate change.

Could it have been a lack of oxygen?

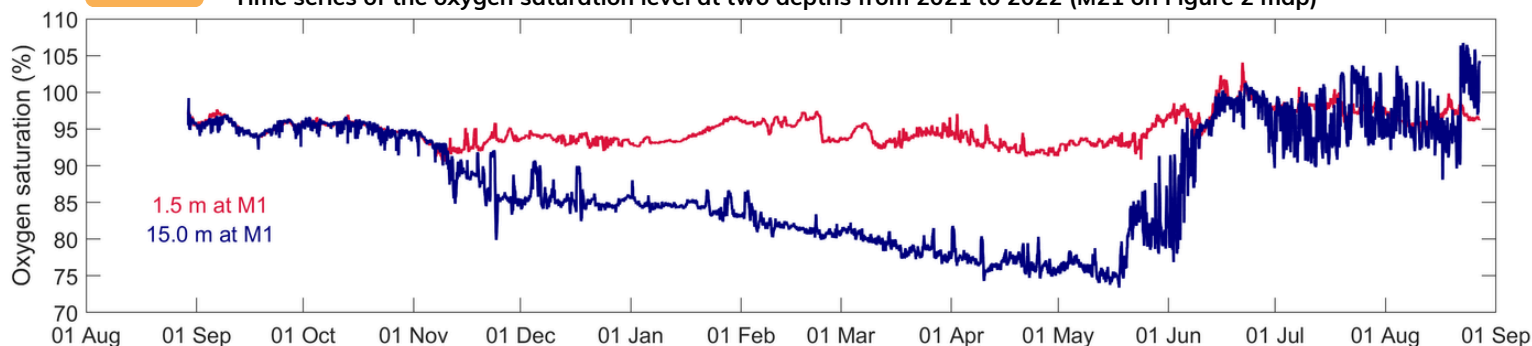
In 2002, scientists first looked for toxins or diseases, but none were found. This led to another possible explanation: maybe the fish had run out of oxygen. But this **does not fit with what we know** about Tasikallak, which is a clear, oligotrophic lake.

Data from 2002 and 2021–2022 showed high oxygen levels (>70%; **Figure 1**), but long-term monitoring is needed since it can vary from year to year. Scientists estimated the minimum oxygen needed for the fish that died, and found there should have been enough. These estimates will be refined with newer data.

The question remains: could hidden processes be at play? With more detailed mapping of water depth and new data, scientists and the community are now working together to find answers.

Figure 1

Time series of the oxygen saturation level at two depths from 2021 to 2022 (M21 on Figure 2 map)

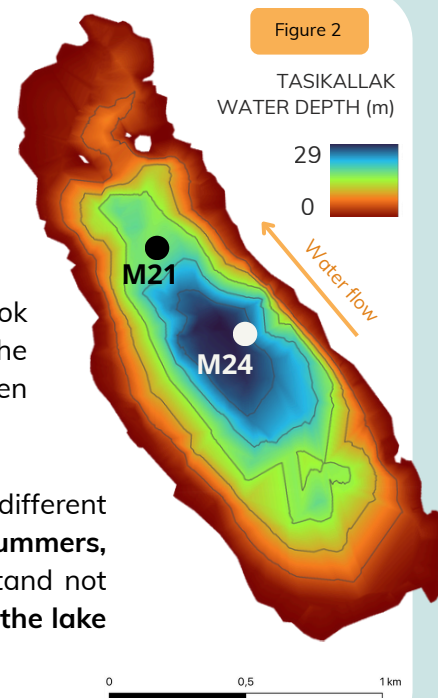


What the lake can tell us about climate

Over the next few years, we will track key signals from the lake: temperature, oxygen, and light (**Figure 2: mooring M24 from 2024-now**). These signals are like the lake's heartbeat, shaping fish habitat (growth, breathing, and vision). By following them over several years, **we can build a model of how the lake lives and breathes through the seasons.**

Once this model is robust enough, we can use it **like a time machine**. It lets us look back and explore **what the lake conditions were like in 2002**, the year of the massive fish kill. We can also ask: have there been other years since then when conditions came close to those of 2002?

But the model also lets us **look forward into the future**. By combining it with different climate scenarios, we can explore how the lake might **respond to warmer summers, shorter winters, and changes in rainfall or snow cover**. This helps us understand not only what happened in the past, but also what might happen again. In this way, **the lake shares both its memory and its warnings.**



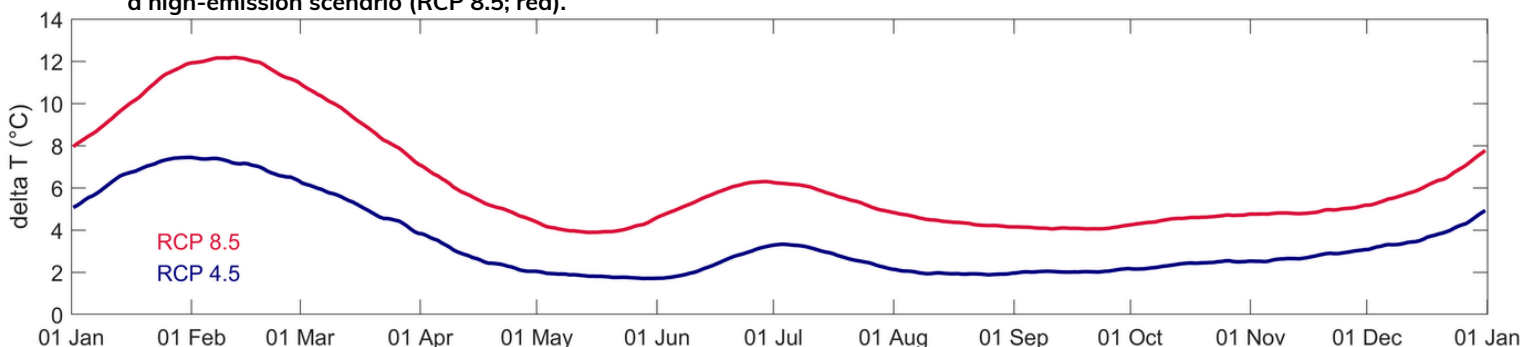
Lake mixing dynamics and climate change projections

Using 2021–2022 mooring data and lake depth mapping, we developed a model that will improve with more data. The current data already describe **the lake's seasonal mixing and stratification**, driven by sunlight and wind. We observed that (1) **winter lasted about 240 days in 2022**, with inverse stratification under the ice (0–4°C), and (2) in summer, **surface water could reach 17°C by late July** in a warm year, while the bottom remained near 4°C. Winter temperature affects adult fish health and egg development, while summer temperature shapes early fish development before migration to saltwater.

Future projections under continued growth in greenhouse gas emissions (RCP 8.5) show strong regional warming, with average air temperatures rising 6°C by 2070–2100 and up to 12°C in winter (**Figure 3**). The model is needed to translate this into water temperatures. Winter precipitation could more than double, reducing light beneath the ice.

Warmer summers will stress fish and reduce oxygen. For example, Arctic char needs water well below 20°C and oxygen above 5 mg/L to remain healthy. Shifts in temperature, oxygen, and light also reshape the food web, influencing fish fat and mercury levels. **This study connects past, present, and future lake conditions to better understand how climate change may affect fish health and community resources.**

Figure 3 Projected changes in air temperature (delta T) at Tasikallak, based on averages from 5 regional climate models, comparing the baseline period (1981–2010) with future conditions (2071–2100) under a moderate-emission scenario (RCP 4.5; blue) and a high-emission scenario (RCP 8.5; red).



Could geology be part of the mystery?

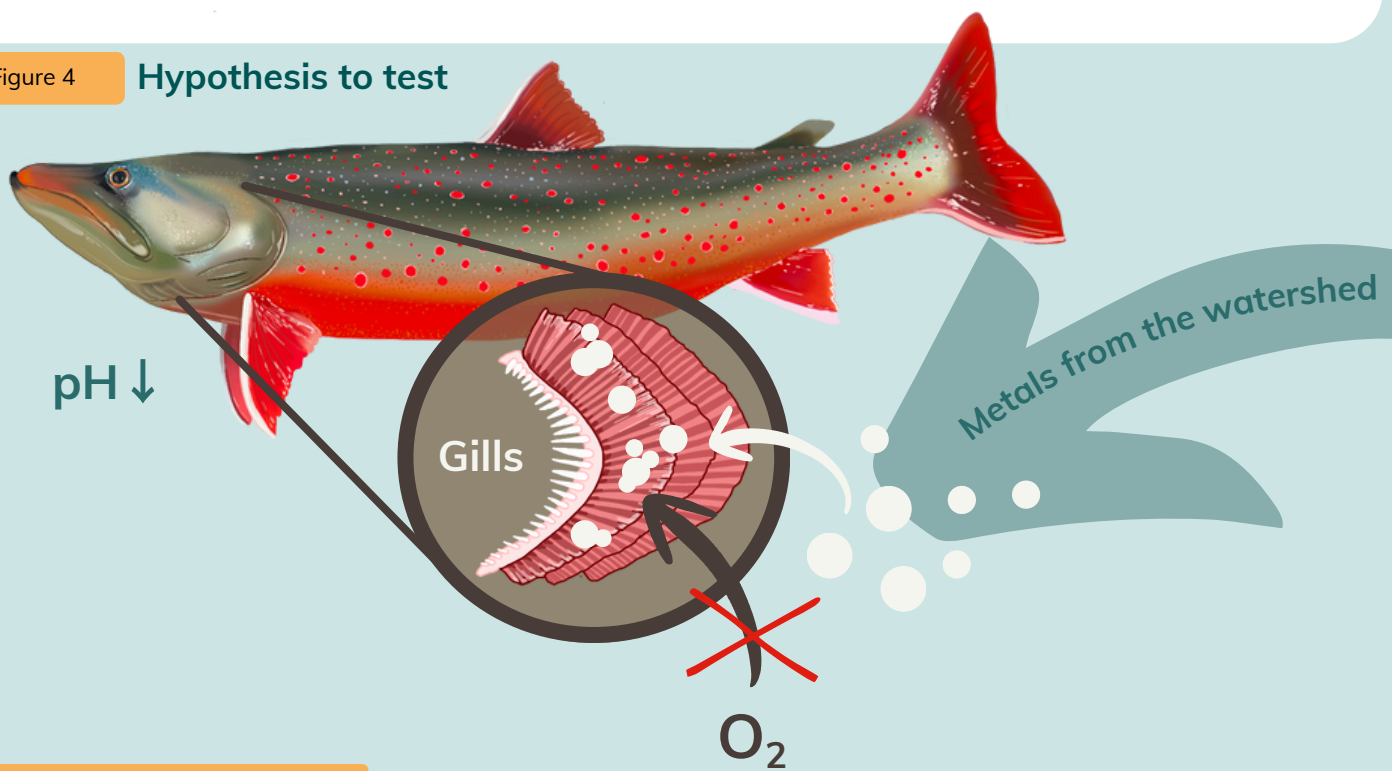
Another possible clue comes from the lake's geology and acidity. In some regions, **certain soils can release metals into lakes** after dry spells followed by heavy rain, **and these metals can harm fish by clumping in their gills**, slowly suffocating them (**Figure 4**).

During the 2002 fish kill, **the fisherman who discovered it said the fish looked suffocated** and the water was whitish. Scientists measured low pH (5.3-5.4), and in 2024 it was still low (5.5), showing the lake is acidic and potentially **sensitive to sudden changes**. We will measure alkalinity and other geochemical markers to learn more.

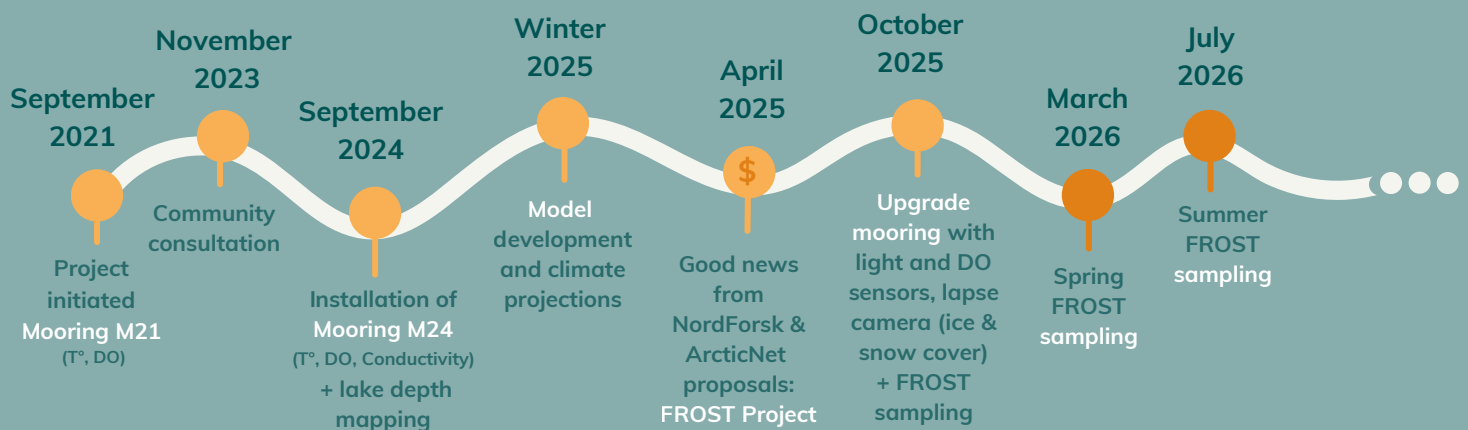
Could this be part of the story at Tasikallak? Upstream blue lakes hint at unusual water chemistry, but further investigation is needed—and the community's observations are key.

Figure 4

Hypothesis to test



Time line and next steps



What FROST funding brings to the community

In brief | FROST is a circumpolar project comparing Lake Tasikallak with 12 other Arctic lakes to understand **how changing winter conditions**—ice cover, snow, water temperature, oxygen, and light—**affect food webs, fish health, food security, and even travel on ice.**

Using a space-for-time approach, FROST links ecosystem processes to fish safety and nutritional value through measures of **mercury, fatty acids, and stable isotopes**. A strong social science component integrates **Inuit observations** on past conditions, fish kills, fish flesh quality, and the cultural importance of ice fishing and winter lake use. By combining natural science with Indigenous knowledge, FROST will **co-develops adaptation strategies and resilience plans** to support local food systems and cultural practices connected to Arctic lakes.



What this means for the community ?

Research on Lake Tasikallak has been **funded for four years**, allowing us to collect new data and solve **the mystery of the 2002 fish kill**. This collaborative work will help us to understand the **conditions under which such events occurred** in the past and may occur again as the Arctic climate changes.

Beyond fish survival, the project will examine whether lake conditions and climate change affect **fish quality (fat and mercury)**, providing critical insights into the health of Indigenous communities who rely on these vital food sources. FROST funding also supports a dedicated Communication Officer to **make the science accessible** and strengthen knowledge sharing.

Ways you can contribute

We invite community members to **share observations** on lakes and fish, **help with fieldwork**, and **join discussions**. Through science, stories, or lending a hand, your involvement is essential for understanding lake changes and supporting community health.

Contact us

Get Involved in Tasikallak
Research

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