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NWT Cumulative Impact Monitoring Program

Aquatic Ecosystems in the Fort Good Hope Area as Indicators of Environmental Change

Summary

Due to rapid environmental changes, we looked at how aquatic bacteria and their functions are changing due to various landscape pressures in the Sahtù Settlement Area (e.g. permafrost thaw, wildfire, land use). By understanding how environmental variables affect aquatic bacteria under different landscape pressures, our goal was to predict their response to future intense changes. Results showed that local environmental conditions shaped bacterial communities present in lakes and bacteria diversity may reflect landscape-level climate-driven changes (e.g. wildfire, permafrost thaw).

An area impacted by permafrost thaw in Ts'udé Niljné Tuyeta. (Credit: J. Comte)

Why is This Important?

Northern freshwater ecosystems are experiencing rapid environmental changes. These changes can significantly impact the biodiversity and function of these ecosystems. Further, because nutrient availability in arctic lakes are naturally low, aquatic microorganisms, such as bacteria, play critical roles in decomposing dead organisms and making nutrients available to other organisms, water quality and food web dynamics.

What Did We Do?

Samples from waterbodies within the protected area Ts'udé Niljné Tuyeta, were collected in partnership with the local Guardians program. Sites were chosen based on their history of natural disturbance. Bacterial communities were identified and environmental parameters (e.g. temperature, nutrients, dissolved carbon, metals) were measured.

We also conducted an experiment that mimicked the impact of erosion in lakes and measured the difference between aquatic and terrestrial bacteria's ability to respond to the added runoff. The intent was to measure the role of bacteria found in both lake water and runoff samples, and to determine how well the bacteria were able to degrade the addition of organic material (carbon and nutrients).

What Did We Find?

- Bacterial community structure in each waterbody varied in association with nutrients, dissolved organic carbon and oxygen concentrations, and lake depth. These differences may be related to wildfire histories and/or permafrost thaw in this area.
- In the experiment, there was no difference in organic matter degradation between the two treatments (with or without soil bacteria). That is, the lake bacteria were responsible for degrading the soil organic matter that was introduced to the lake water.

K'áhshó Got'ıné Guardians during sampling of Loche lake near Fort Good Hope. (Credit: J. Comte)

What Does This Mean?

Aquatic bacteria are highly sensitive to changes in the environment. Lakes under different landscape pressures showed distinct bacterial communities which affect, and are affected by water quality. Aquatic bacteria play a key role in the fate of soil organic matter in lakes and imported soil bacteria play a lesser role in aquatic ecosystems.

What's Next?

Further research is planned to assess the impacts of higher amounts of organic matter input on lake water quality in the event of continued erosion and sedimentation. Continuing research on sediments, including contaminants, will help identify and predict environmental changes in Ts'udé Niljné Tuyeta lakes.

For More Information

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