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NWT Cumulative Impact Monitoring Program

Murky Waters: Following Mercury from Peat Soils, Through Beaver Ponds into Streams and Rivers

Summary

Mercury naturally exists in aquatic systems in several forms. A common type of organic mercury is methylmercury which is produced by microorganisms in soil and water. Mercury, especially in the methylmercury form, can build up in fish and are a toxin to aquatic life and humans at higher concentrations. It is important to note that concentrations of methylmercury observed in this study were all below the guidelines for protection of aquatic life.

This project found that permafrost thaw leads to an increased production of methylmercury in peatlands (muskegs). Also, methylmercury concentrations were influenced by beaver ponds, as water leaving the ponds had lower levels than inflow sources. Streams and rivers south of the discontinuous permafrost boundary in Alberta had significantly higher concentrations of methylmercury than rivers in the Dehcho and South Slave regions. This suggests that climate change and continued permafrost thaw may lead to increases in river methylmercury.

Drone photo of a beaver pond near Sambaa Deh Falls Territorial Park. (Credit: D. Olefeldt)

Why is This Important?

Northern soils and aquatic ecosystems store considerable amounts of mercury which under specific conditions can be transformed into methylmercury. With climate change, it is important to understand what controls the production and downstream transport of methylmercury, as it may have implications for monitoring and management of fish.

What Did We Do?

Working with the Dehcho and Katl'odeeche First Nations, we sampled 93 streams and rivers several times in summer in the Dehcho, South Slave and Hay River regions to study the production of methylmercury in peatlands and the role of beaver ponds in downstream transport.

What Did We Find?

Permafrost thaw in peatlands increased the potential rate of methylmercury production, especially in more nutrient-rich fens. Beaver ponds were found to act as sinks for methylmercury, as concentrations of methylmercury were lower downstream than upstream of the pond. Concentrations of methylmercury and dissolved organic carbon (which gives streams a darker color) were higher in streams south of the discontinuous permafrost boundary (in the Hay River watersheds in Alberta).

What Does This Mean?

Our results suggest that continued climate warming and permafrost thaw is likely to increase the production of methylmercury and its downstream transport in the Dehcho and South Slave regions. Our study has provided key insights into how climate change and beaver activity can influence the delivery of methylmercury from peatlands into aquatic food webs and accumulation in fish.

What's Next?

Along with local organizations, we will continue to collect samples for water quality analysis through a newly NWT CIMP-funded project. This project focuses on the impacts of the recent wildfires on mercury and methylmercury levels in northern streams. Stay tuned to results of this project (CIMP249) in 2027.

For More Information

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NWT Cumulative Impact Monitoring Program (CIMP223)

Sampling the Petitot River. L-R: Renae Shewan, Jessica Lagroix, Kate Marouelli and Robbie Potts. (Credit: D. Olefeldt)