

# Research Bulletin

## NWT Cumulative Impact Monitoring Program

### Understanding Great Slave Lake Productivity and Food-web Dynamics

#### Summary

Fisheries and Oceans Canada has been working with local communities to study Great Slave Lake (GSL) since 2011. Water, invertebrate, and fish samples have been collected to understand how cumulative impacts such as those from mining, climate change, fisheries, and regulation of water flow upstream can affect the structure and function of the GSL ecosystem. This information is key to understanding how potential changes could impact the sustainability of the largest freshwater fishery in western Canada.

#### Why is This Important?

GSL is a vulnerable freshwater ecosystem because of its depth, high latitude, and longer slow-growing season. Little is known about the current conditions and this project assesses the potential for acclimation and sustainability of culturally and ecologically important fish species impacted by a changing hydroclimate and habitats. Continuing long-term monitoring allows for changes from the 'usual' (baseline) environmental conditions to be detected and is needed for decision-makers to be able to manage and protect GSL fisheries.

#### What Did We Do?

Working with local community members from K'at'l'odeeche, West Point, Deninu K'ue First Nations, and NWT Metis Nation, we collected information about:

- Lake depth, temperature, and water quality
- Zooplankton and benthic invertebrates (aquatic bugs)
- Fish species

Each fish was sampled for biological information including length, weight, and maturity. As well, tissue samples and ear bones (otoliths) were taken and analyzed to determine what the fish ate and its age.



*K'at'l'odeeche First Nation Field Technician keeping watch in the western basin of Great Slave Lake, summer 2022. (Credit: L. Alsip)*

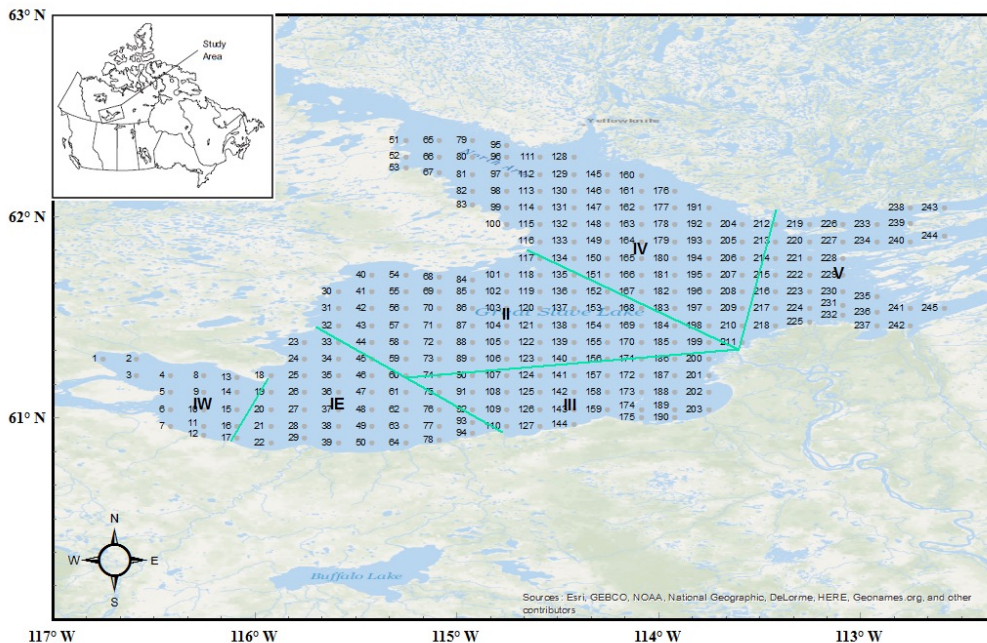


## What Did We Find?

We found that:

- During the summer, most of the lake has warm water ( $>5^{\circ}\text{C}$ ) to depths of 10-15 meters and cool water ( $<5^{\circ}\text{C}$ ) below.
- The amount of invertebrates varied over time, depth, and lake bottom types. This is due to variations in nutrient availability and predator-prey relationships across GSL.
- Fish of 24 different species were collected, including Lake Whitefish, Lake Trout and Inconnu, which are all culturally and economically important.

A food-web dynamics model was built to understand predator-prey relationships in GSL. Based on the variety of connections among species in the food web, Lake Trout, Inconnu, and Walleye are top predators, while Lake Whitefish is a mid-level predator.



Map of Great Slave Lake showing fishery management areas and approximate sampling grid locations. (Credit: X. Zhu)

## What Does This Mean?

The lake conditions and the relationships among fish, water quality, and invertebrates all have an impact on the diversity of fish communities and fisheries production across GSL. Future monitoring plans include expanding sampling sites around the lake to develop stock-specific reference points and support baseline information. Continued monitoring will help to identify and describe environmental changes to GSL from cumulative impacts. This information will affect decision-makers' actions to implement policy changes and develop management, mitigation and adaptation plans.

## For More Information

Dr. Xinhua Zhu, Fisheries and Oceans Canada (DFO) [Xinhua.Zhu@dfo-mpo.gc.ca](mailto:Xinhua.Zhu@dfo-mpo.gc.ca)

NWT Cumulative Impact Monitoring Program (CIMP132)

Zhu, X., Johnson, T.B., Leonard, D.L., Howland, K.L., Podemski, C., Evans, M., and Tallman, R.F. 2014. Ecotrophic modeling of anthropogenic cumulative impacts on the sustainability of fisheries productions: comparison of Lake Erie and Great Slave Lake ecosystems, p. 132-134. In: Steenbeek, J., Piroddi, C., Coll, M., Heymans, J. J., Villasante, S., Christensen, V. (eds.), *Ecopath 30 Years Conference Proceedings: Extended Abstracts*, pp. 132. Fisheries Centre Research Reports 22(3). Fisheries Centre, University of British Columbia [ISSN 1198-6727]. 237 p.

Zhu, X., Chapelsky, A., Carmichael, T.J., Leonard, D.L., Lea, E., Tallman, R.F., Evans, M., Podemski, C., & Low, G. 2017. Establishment of baseline metrics for integrated ecomonitoring cumulative impacts on Great Slave Lake fisheries ecosystem. *Canadian Technical Report of Fisheries and Aquatic Science*, 3223, ix + 58 p ([https://publications.gc.ca/collections/collection\\_2017/mpo-dfo/Fs97-6-3223-eng.pdf](https://publications.gc.ca/collections/collection_2017/mpo-dfo/Fs97-6-3223-eng.pdf)).

**NWT CIMP** is a source of environmental monitoring and research. The program coordinates, conducts and funds the collection, analysis and reporting of information related to NWT environmental conditions. If you're conducting environmental monitoring and research, consider sharing your information with northern residents and decision-makers in a Bulletin.