

BENTHIC MACROINVERTEBRATE COMMUNITIES AND FOOD WEBS OF BEAVER-IMPOUNDED STREAMS IN THE EASTERN CANADIAN ARCTIC

Katelyn Gao¹, Mathilde Lapointe St-Pierre², Jordan Musetta-Lambert³, and Michael Power¹

¹University of Waterloo, Waterloo, ON, Canada; ²Nunavik Research Centre, Kuujuaq, QC, Canada;

³Environment and Climate Change Canada, Saskatoon, SK, Canada

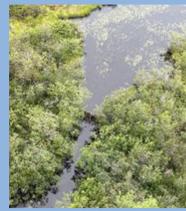


BACKGROUND

- As circumpolar warming facilitates snow cover reduction, permafrost thaw, and shrub growth in low Arctic landscapes, **the range of North American beavers (*Castor canadensis*) has expanded northward into tundra regions** that have not yet been colonised by the species.^{1,2}
- Beavers are ecosystem engineers that modify freshwater streams** by establishing dams that can affect the morphology, chemistry, and hydrology of the aquatic environment.^{3,4}
- Freshwater streams in the Arctic and subarctic provide critical habitat and connectivity** to spawning and overwintering areas for fish.^{5,6}
- The extent to which beaver-induced habitat changes alter freshwater streams supporting Arctic and subarctic fish populations is currently unknown and of concern to Inuit.

QUESTIONS

- Do downstream and upstream **benthic macroinvertebrate assemblages** differ in composition?
- Do downstream and upstream **aquatic food webs** differ in trophic structure and niche space?



FIGS 1 & 2. Aerial photos of beaver dams in Kuujuaq.

FIGS 3 & 4. Aerial photos of beaver dams in Tasiujaq.

STUDY AREA



FIGS 7-10. Close-up photos of beaver dams in Kuujuaq (top) and Tasiujaq (bottom).

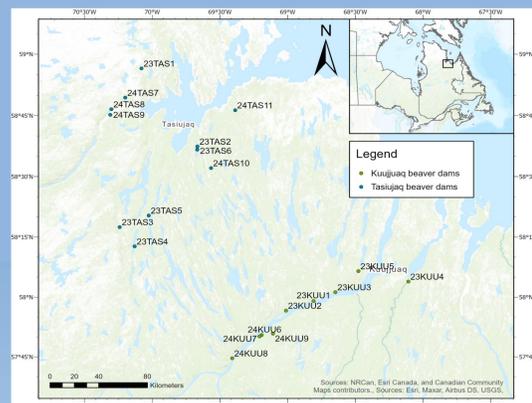


FIG 11. Map of sampling locations in the Nunavik region.

In the **Nunavik** (ᓄᓐᓂᓐ) region of northern Quebec, **20 streams impounded by beaver dams** were sampled in **Kuujuaq** (ᓄᓐᓂᓐ) below the tree line and **Tasiujaq** (ᓄᓐᓂᓐ) above the tree line. Sampling occurred during July and August in 2023 and 2024.

EXPERIMENTAL DESIGN

Environmental measurements and samples were taken immediately **downstream and upstream of impoundments**, at beaver dams **above and below the tree line**.



FIGS 5 & 6. Site photos below tree line in Kuujuaq (left) and above tree line in Tasiujaq (right).

METHODS

Field Methods

- Water quality sampling (e.g., DOC, turbidity)
- Beaver dam and channel measurements
- Canadian Aquatic Biomonitoring Network (CABIN) protocol for kick netting
- Backpack electrofishing

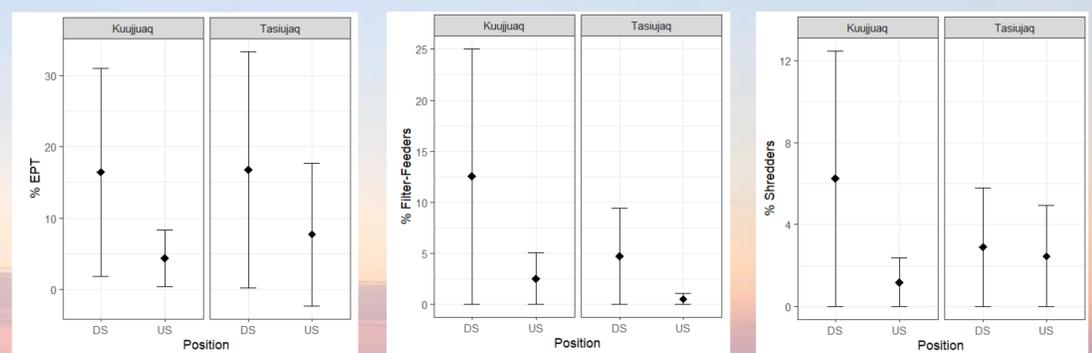
Laboratory Methods

- Water chemistry analysis
- Benthic macroinvertebrate taxonomy
- Stable isotope analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$)



PRELIMINARY RESULTS

- Benthic assemblage composition between downstream and upstream sites was significantly different, and their **dissimilarity was driven by Simuliidae, Baetidae, and other emergent insect families**.
- Proportions of disturbance-sensitive invertebrates (i.e., EPT taxa) and some functional feeding groups (filter-feeders, shredders) were **significantly lower in upstream sites, and attributed to channel morphology characteristics** (e.g., substrate size, depth, flow).
- Resource use was different downstream and upstream for freshwater consumers, particularly below the tree line.



FIGS 12-14. Proportions of EPT, filter-feeder, and shredder invertebrates in standardised CABIN kicknet samples.

NEXT STEPS & SIGNIFICANCE

Completion of trophic niche and overlap estimates in impounded streams will help characterise food web changes and competition induced by beaver dams. This research will help determine whether beaver-transformed tundra streams will affect fish populations and stream food webs, and describe the nature of risks they pose to Inuit food security in Nunavik.

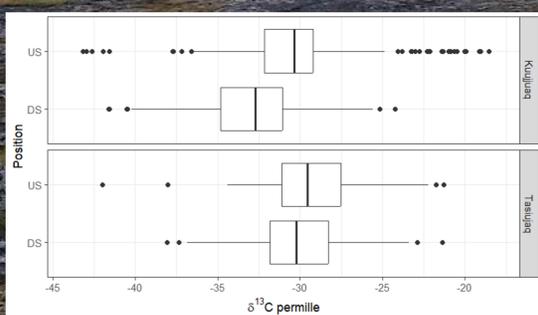


FIG 15. C stable isotopes of benthic macroinvertebrates.

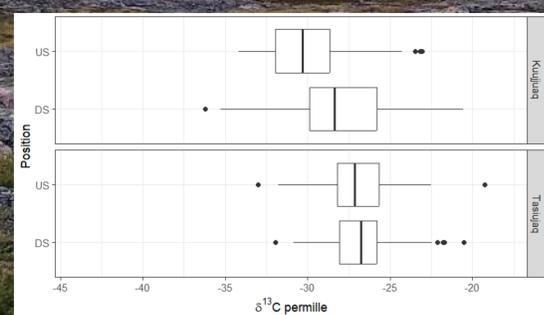


FIG 16. C stable isotopes of freshwater fishes.

ACKNOWLEDGEMENTS

Research for the project is funded by Makivvik, Environment and Climate Change Canada, and the University of Waterloo. We gratefully acknowledge support from the communities in Kuujuaq and Tasiujaq. Thank you to the scientists, technicians, and students at the Nunavik Research Centre, Nunavik Rotors, and Power lab for their participation in beaver dam surveys, fieldwork, and laboratory work.

REFERENCES

- Jones et al. (2020). *Environ Res Lett*. DOI: 10.1088/1748-9326/ab80f1
- Tape et al. (2018). *Glob Change Biol*. DOI: 10.1111/gcb.14332
- Shannon et al. (2023). *J Geophys Res Biogeosci*. DOI: 10.1029/2023JG007408
- Rosell et al. (2005). *Mammal Rev*. DOI: 10.1111/j.1365-2907.2005.00067.x
- Poulin et al. (2025). *Arctic Sci*. DOI: 10.1139/as-2024-0084
- Dubos et al. (2023). *Arctic Sci*. DOI: 10.1139/as-2022-0019