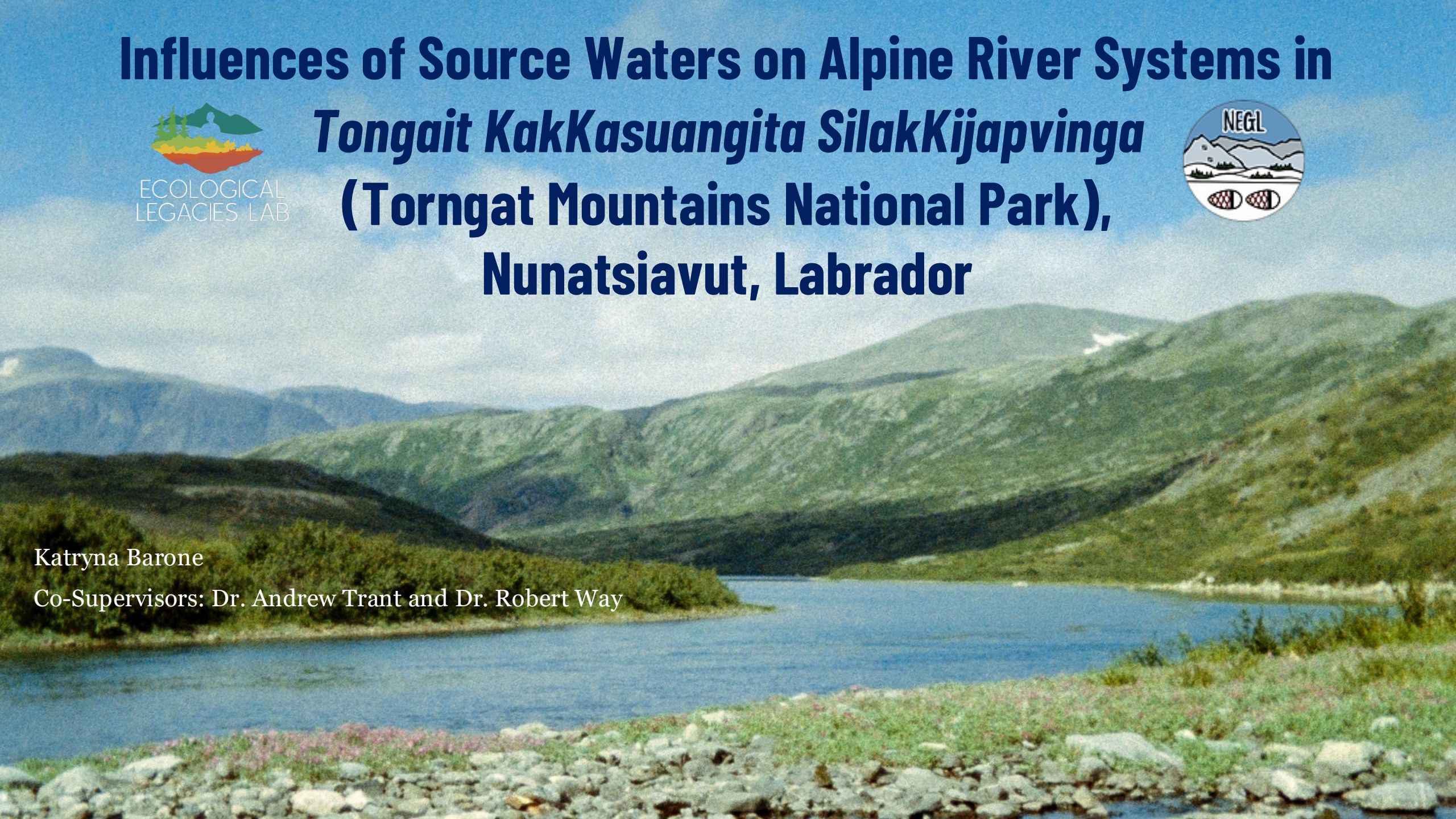
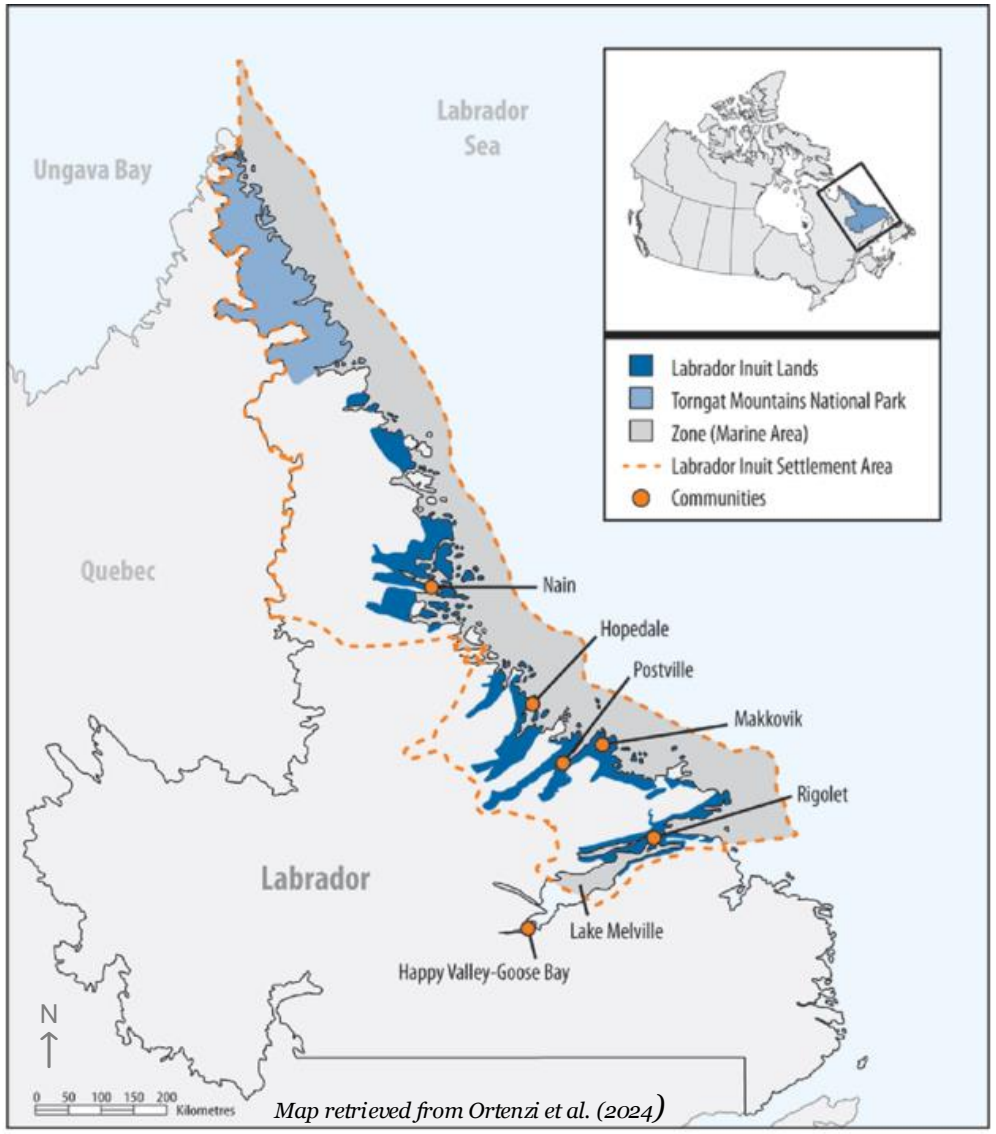
Influences of Source Waters on Alpine River Systems in *Tongait KakKasuangita SilakKijapvinga* (Torngat Mountains National Park), Nunatsiavut, Labrador



Katryna Barone

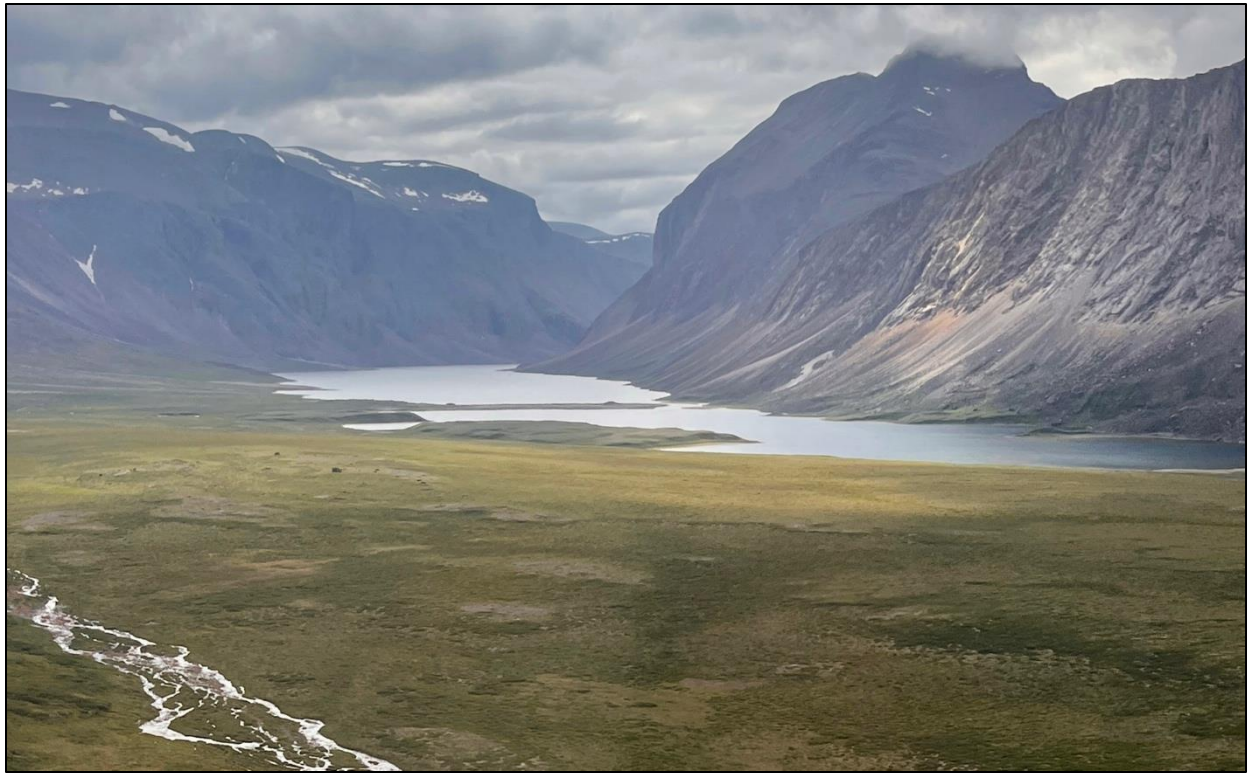
Co-Supervisors: Dr. Andrew Trant and Dr. Robert Way

Tongait KakKasuangita SilakKijapvinga (Torngat Mountains National Park)



Map retrieved from Ortenzi et al. (2024)

Covering 9700km² of northern Labrador this region encompasses the southernmost limit of the Arctic Cordillera in Canada



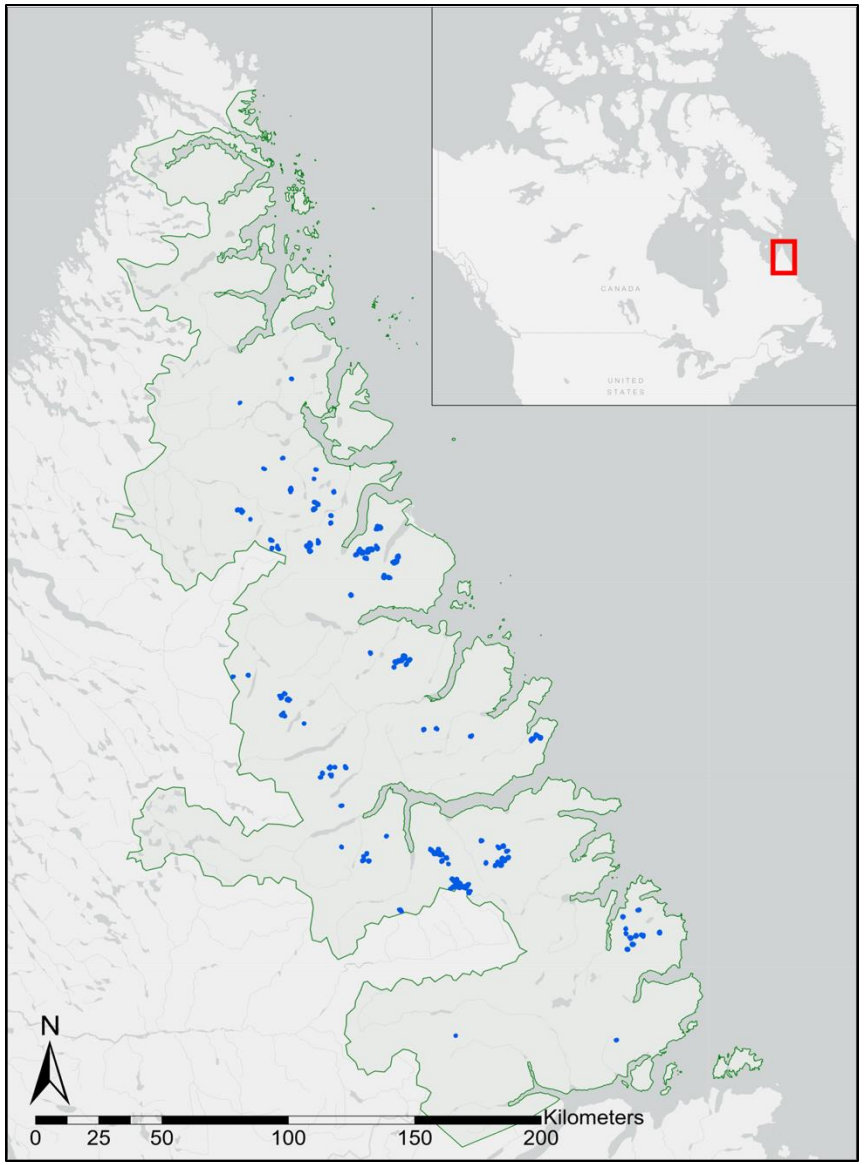
The Glaciers of the Torngat Mountains

This region's proximity to the coast, mild summer conditions, and steep topography have allowed for the preservation of **105** small mountain glaciers

- Since the 1990s winter temperatures have increased by ~2°C per decade and summer temperatures by 0.5°C per decade

- A regional glacier loss of 27% was recorded from 1950 to 2005

Above: a cirque glacier in the Blow Me Down Mountains (August 2025)
Right: map of TMNP glaciers (in blue)



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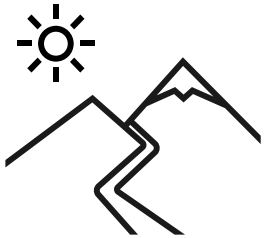
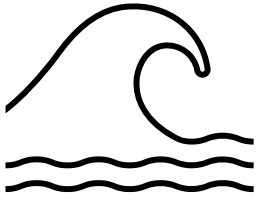
Alpine River Systems and the Cryosphere

- Glaciers and snowfields are important water reservoirs, feeding alpine river systems and providing various ecosystems services:

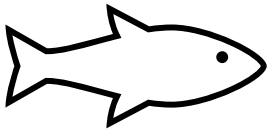
Providing long-term storage and release of water



Transporting nutrients, sediment, and species



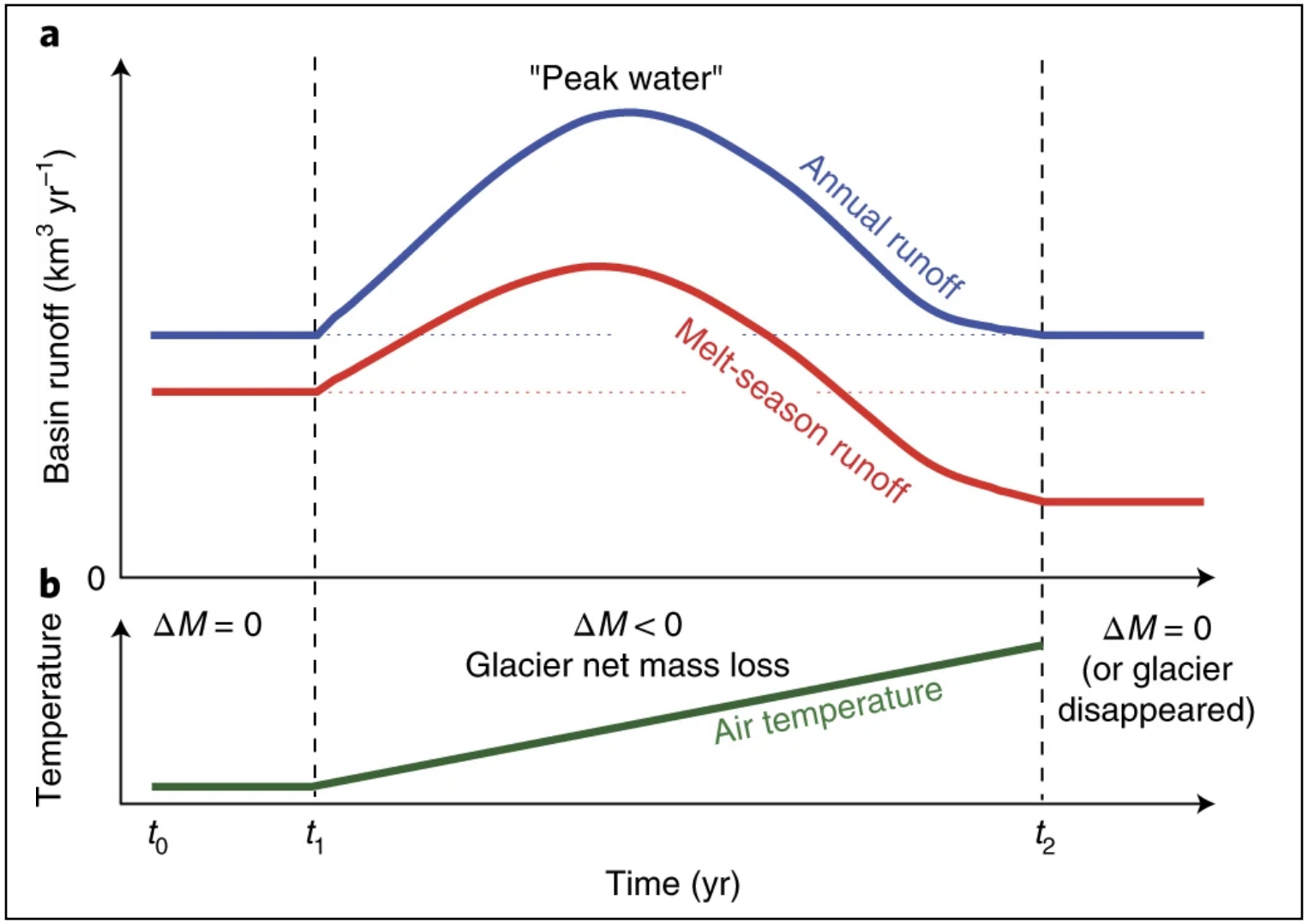
Maintaining streamflow in the drier, warmer months



Providing habitat for cold-water species

- As the effects of climate change are increasingly felt, the ability of glaciers and snowpacks to continue supplying stream networks and their dependent ecosystems is at risk

The Concept of "Peak Water"



Schematic illustration retrieved from Huss & Hock (2018)

"Peak Water": the point when glacier shrinkage results in a surface area too small for the glacier to sustain its meltwater contributions

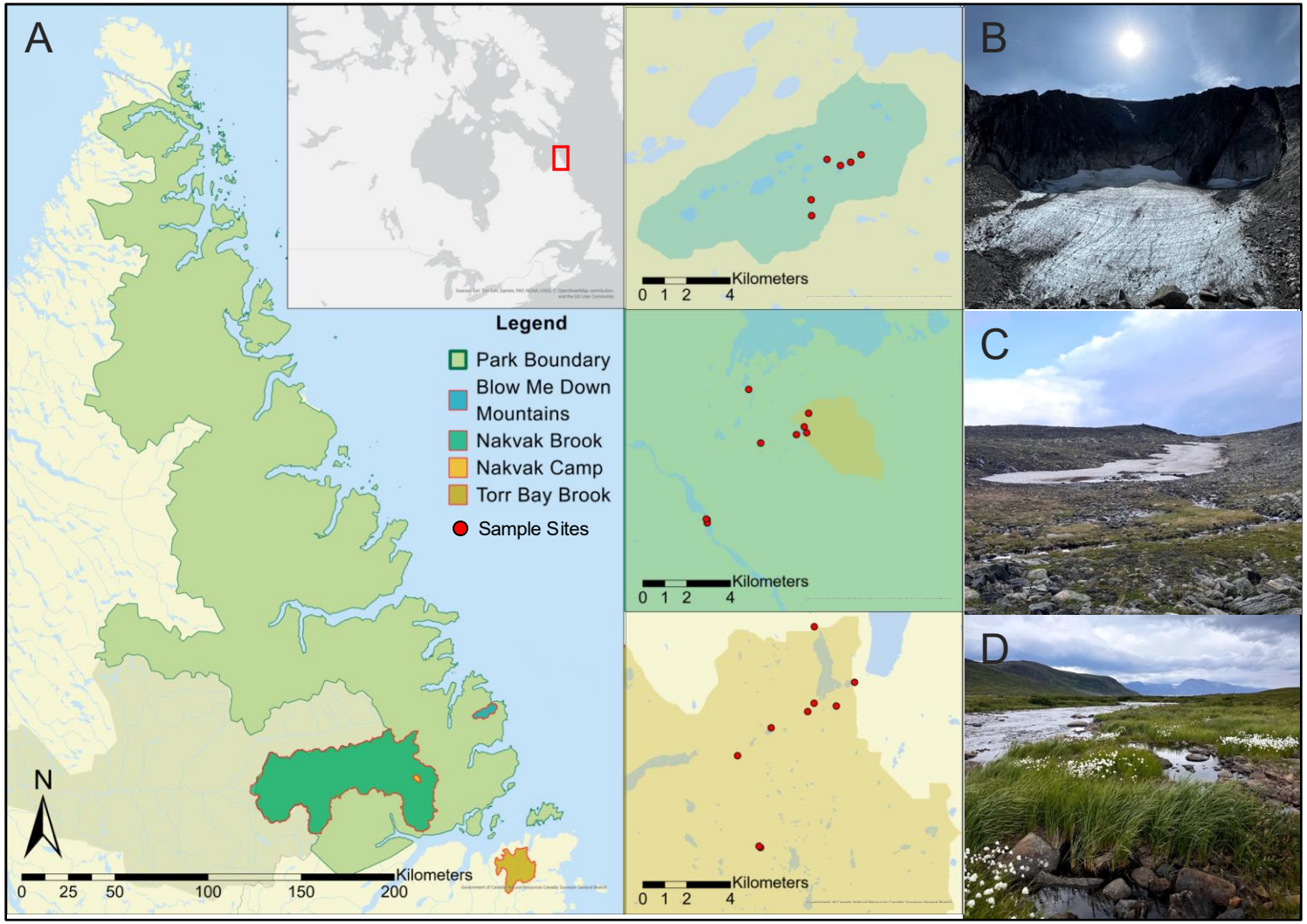
- Before "peak water" water and material supply will increase as glacier melt increases
- After "peak water" water supply will steadily decline as annual runoff decreases until it eventually ceases altogether

Research Objectives

To explore the influences of source waters on Arctic Cordilleran river systems by:

1. Assessing differences in stream composition between glacial and non-glacial watersheds
2. Examining the influence various contributions of source water have throughout a watershed

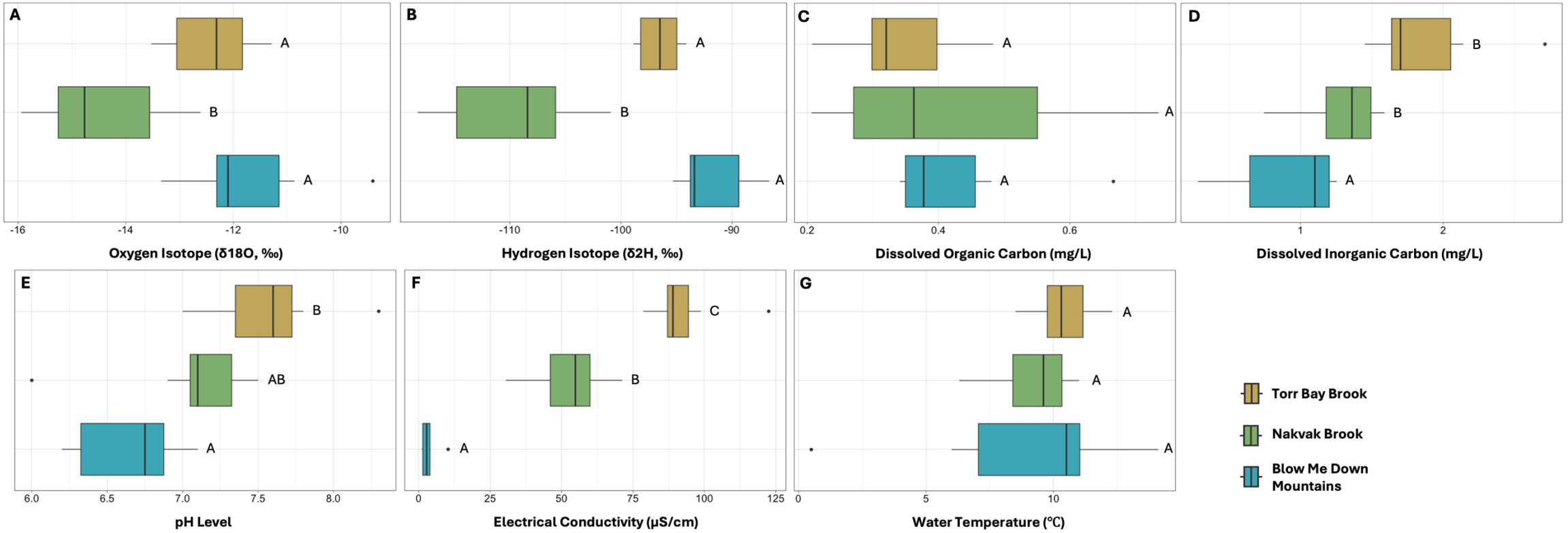
Study Area: August 2024



- Blow Me Down Mountains (BMD)
  - Glacier fed
  - 58.8°N, 62.9°W
  - 15km²
- Nakvak Brook (NVB)
  - Snow fed
  - 58.6°N, 63.3°W
  - 850km²
- Torr Bay Brook (TBB)
  - Rain/groundwater fed
  - 58.4°N, 62.8°W
  - 82km²

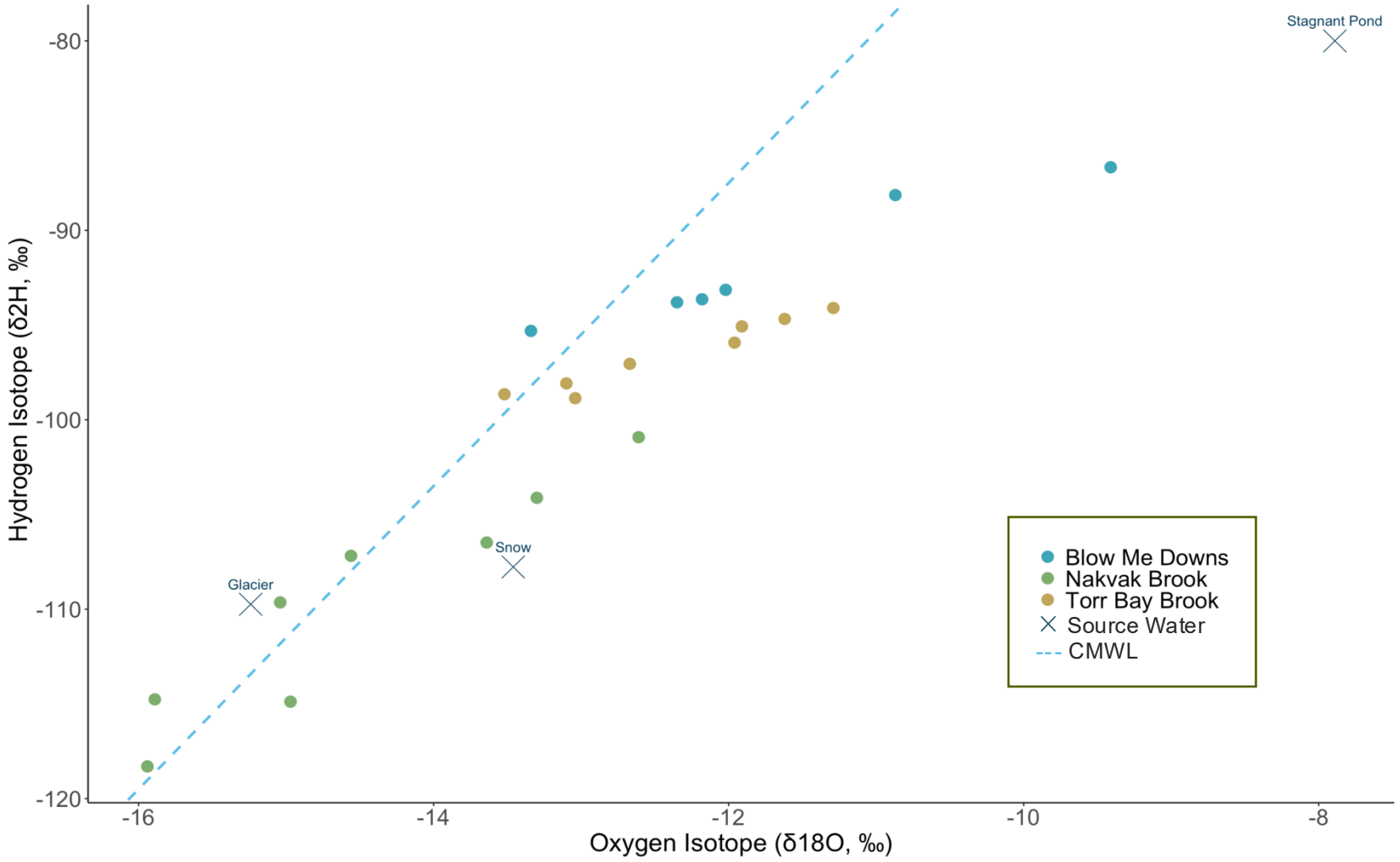
2024 Results: Analysis of Variance Between Watersheds

Objective 1: assess differences in stream composition between glacial and non-glacial watersheds



- Groupings that are not statistically different from each other share the same letters

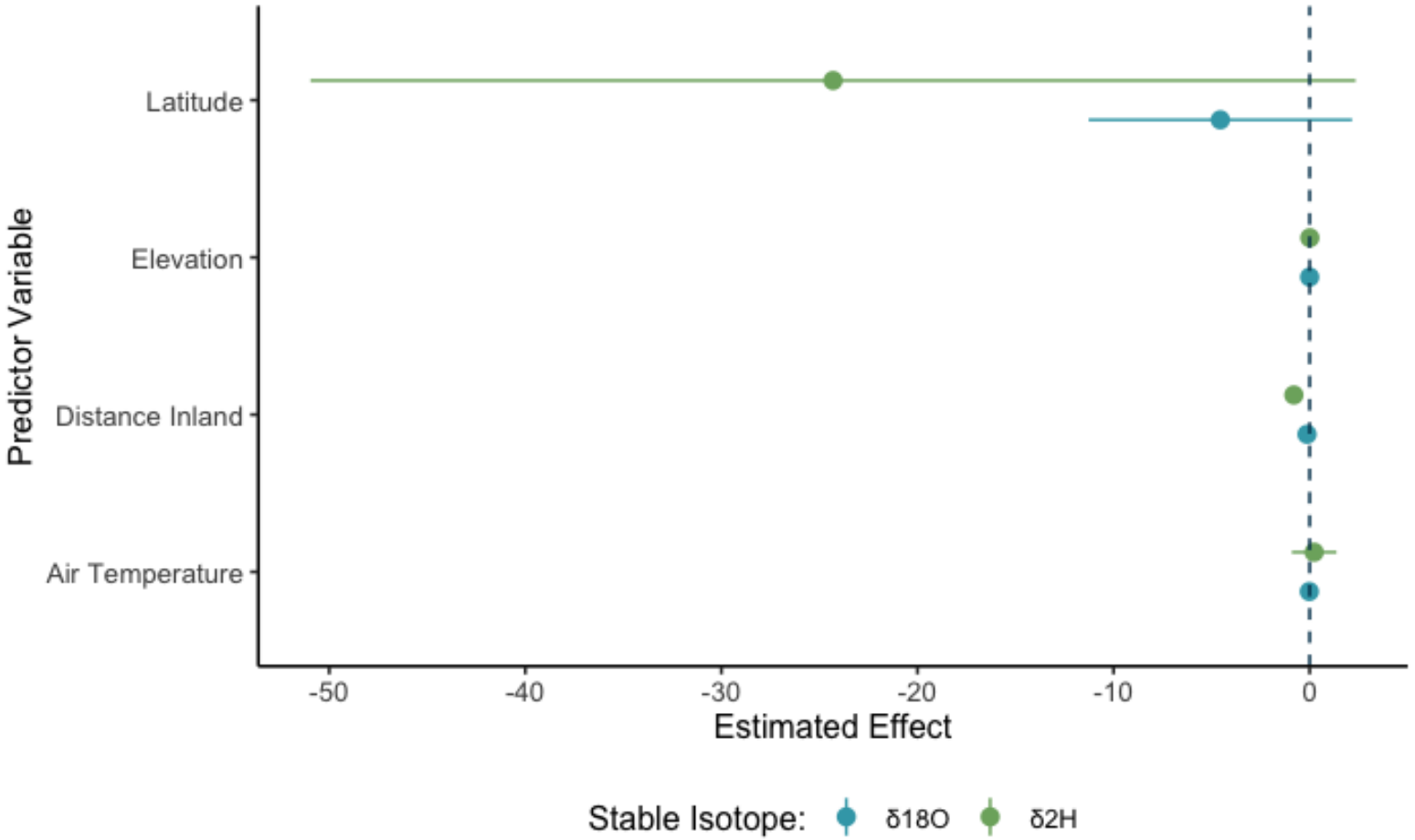
2024 Results: Isospace of δ18O and δ2H Across Watersheds



Objective 2: examine the influence various contributions of source water have

- Isospace plot displayed distinct clusters for each watershed
- Samples below the meteoric water lines (CMWL) are believed to be influenced by processes of evaporation

2024 Results: Influences of Geography



- Stable isotopic compositions can also be influenced by regional geography and weather:
  - Latitude
  - Elevation
  - Distance inland
  - Air temperature
- These variables were tested in a Generalized Linear Model (GLM)

The Dream Team

Inuit Youth Research Technicians collecting water samples in 2024 (above) and 2025 (right)

What's New? 2024 vs 2025

2024

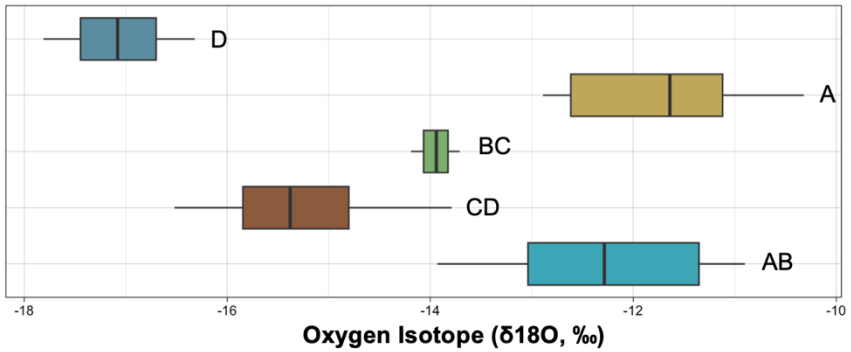
- August 9th to 13th
- 25 water samples
- 3 watersheds
- 8 wet socks

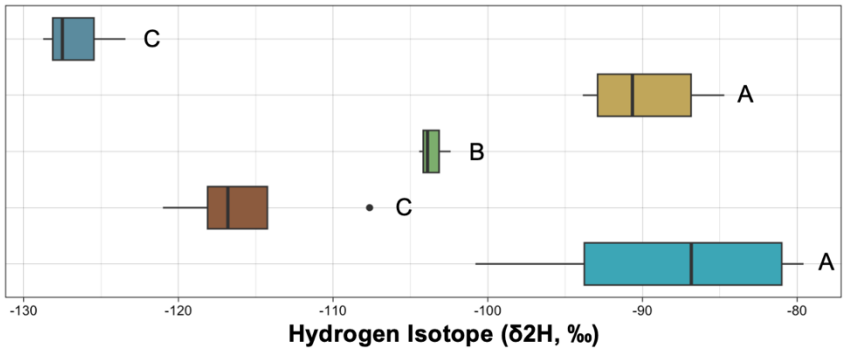
2025

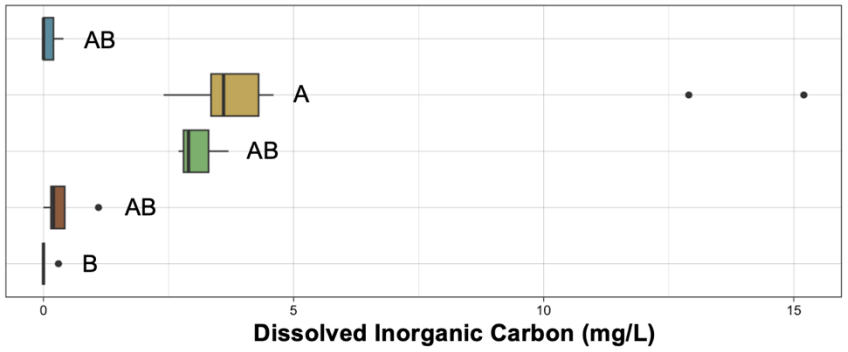
- August 6th to 16th
- 44 water samples
- 10 watersheds
- 5 wet socks

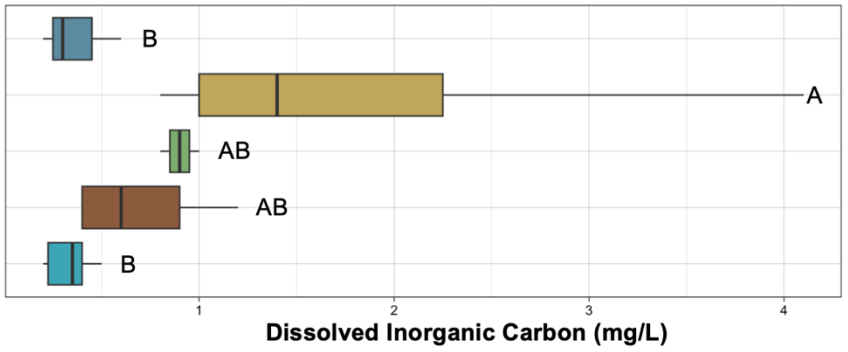
Collecting samples and water quality measurements in Torr Bay Brook (left) and Nakvak Brook (below)

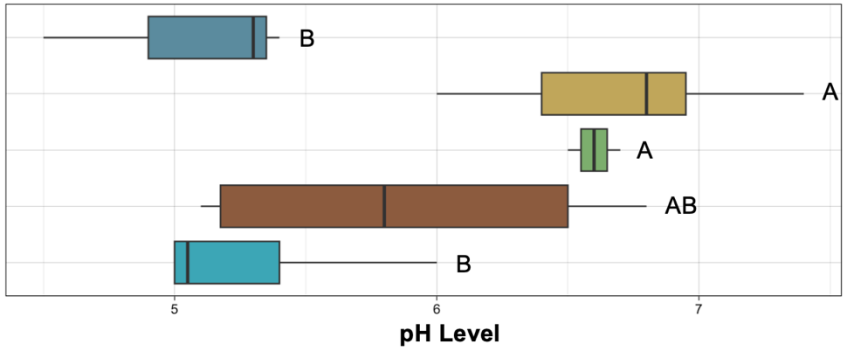
2025 Results: Analysis of Variance Between Watersheds

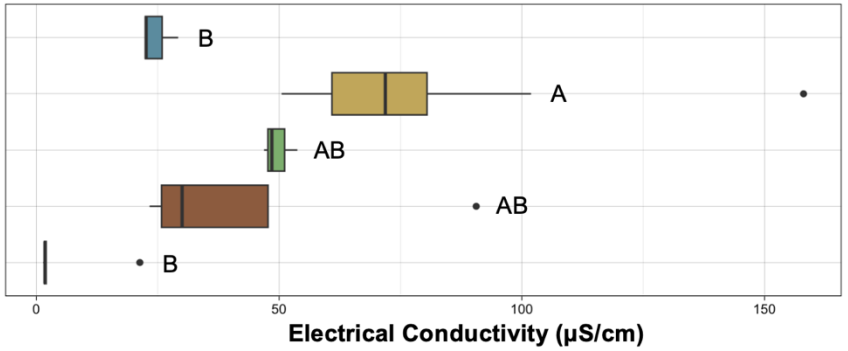












- Statistical differences between watersheds can be seen for all variables
- Groupings that are not statistically different from each other share the same letters

Watershed

Blow Me Downs	*Glacier fed*
Komaktorvik	*Snow fed*
Nakvak Brook	*Snow fed*
Torr Bay Brook	*Rain fed*
Upper Ivitak	*Glacier fed*

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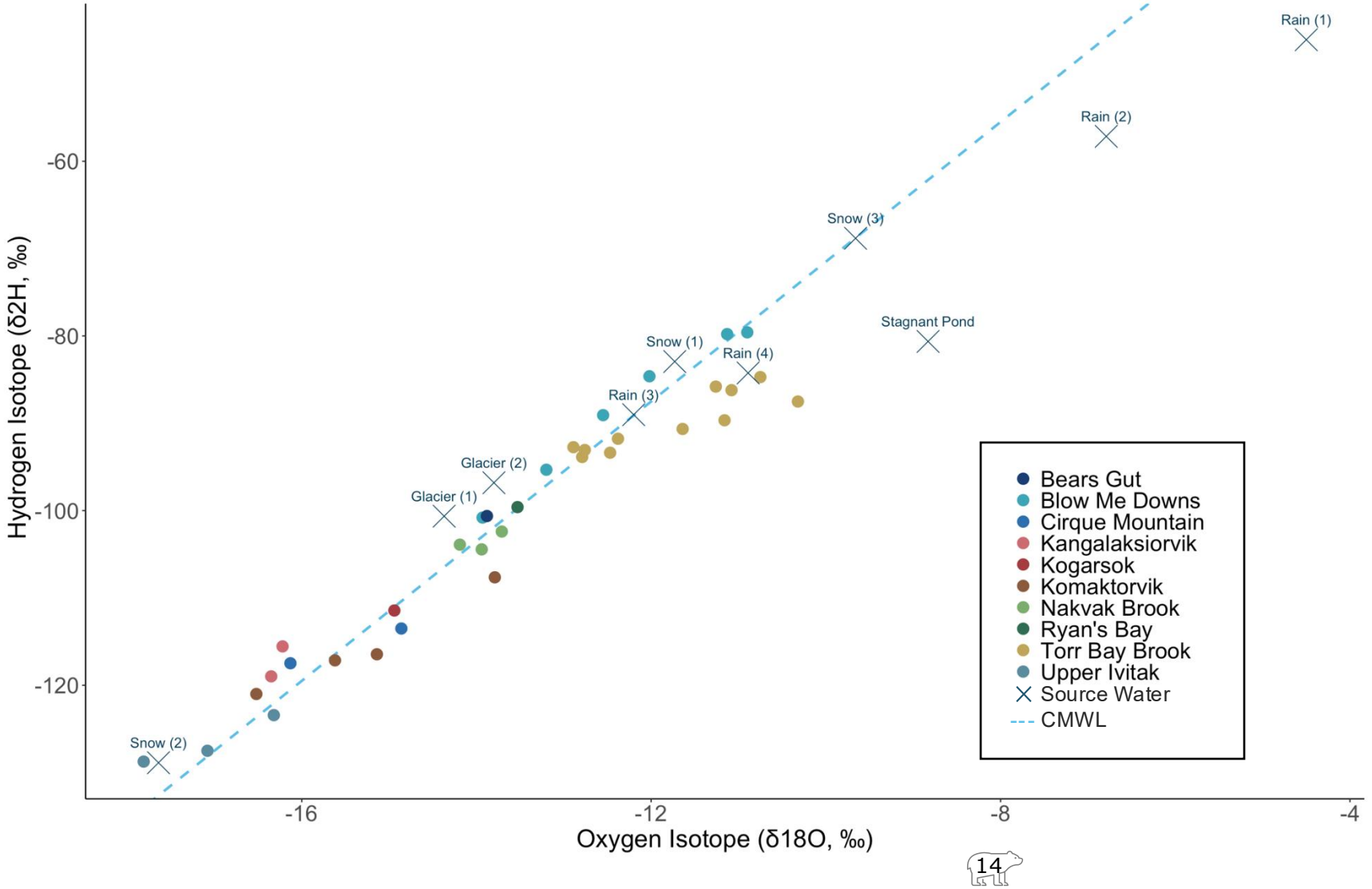
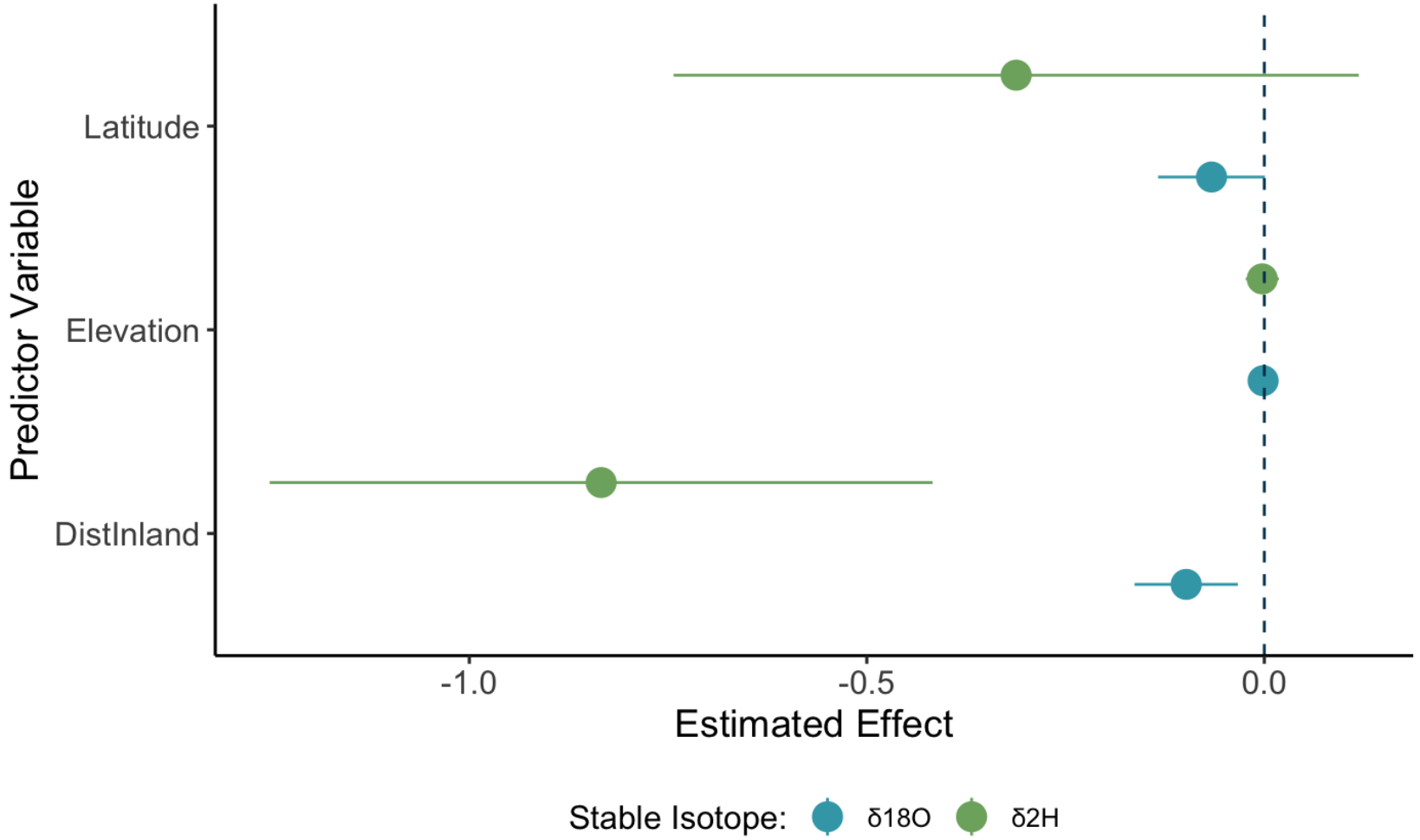
2025 Results: Isospace of δ18O and δ2H Across Watersheds



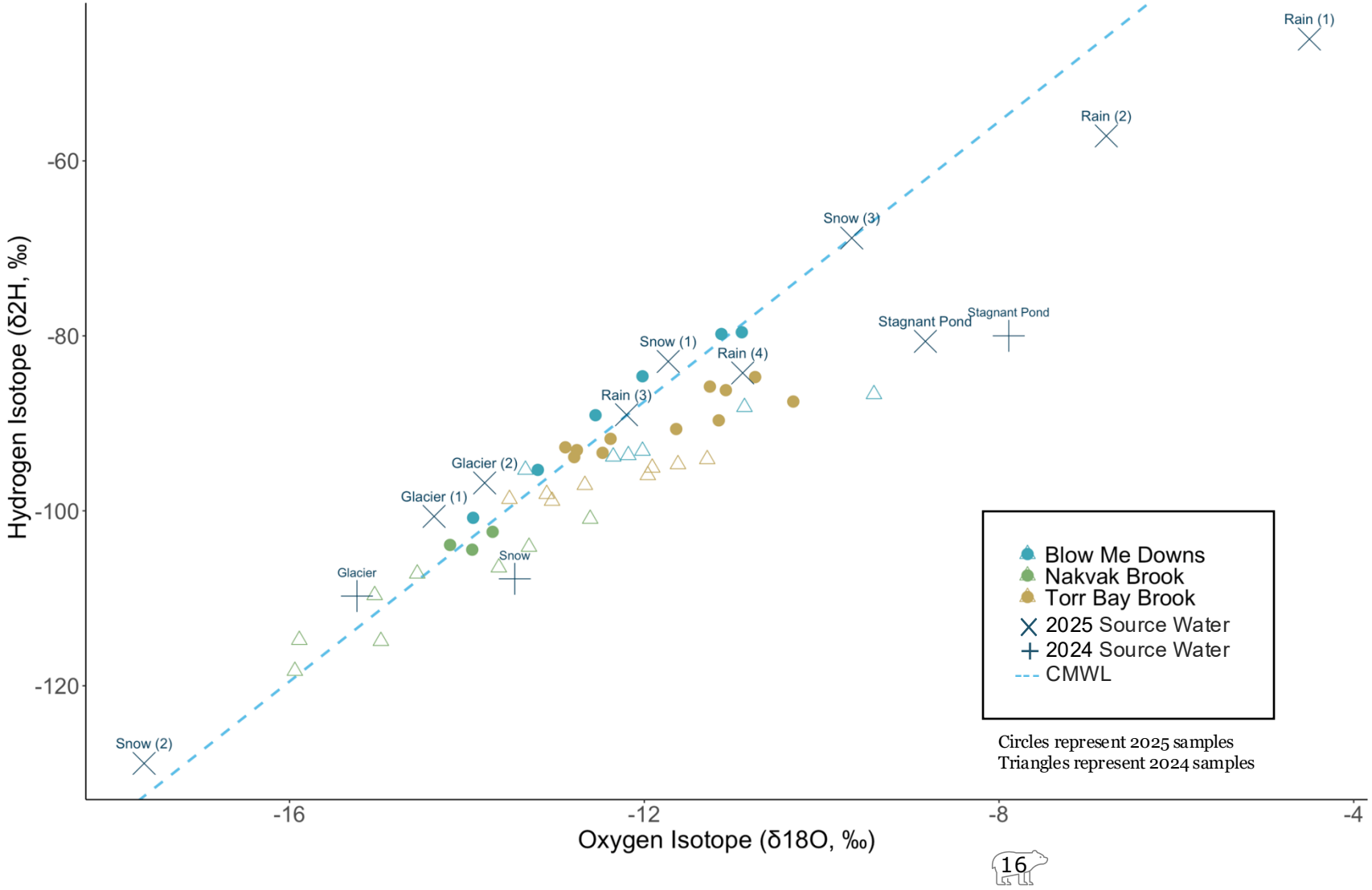
- The 2025 isospace plot also displayed clustering for each watershed
- Evidence of mixing, evaporation, and source water influences can also be found

2025 Results: Influences of Geography



Results of the Generalized Linear Model (GLM) showed *"Distance Inland"* to be significantly correlated with isotopic composition and *"Latitude"* to be marginally correlated

2024 vs. 2025: Stable Isotope Analysis



Results from both years followed similar trends, though 2025 samples were more enriched than 2024 samples

- Recorded rainfall during the 2024 sample period: **0mm**
- Recorded rainfall during the 2025 sample period: **11.2ml**

Limitations and Next Steps

- Continuation of stream water sampling on a broader spatial scale
- Collection of water samples ideally throughout an entire melt season
- Samples collected from additional watersheds and endmembers
- Establishment of a Local Meteoric Water Line
- Opportunities for collaboration with research partners and future Inuit-led hydrological monitoring initiatives

Acknowledgements

The many (many) people who made this project possible…

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- Our Fearless Helicopter Pilots
- The TMBC Staff
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- And so many more…


Thank You!