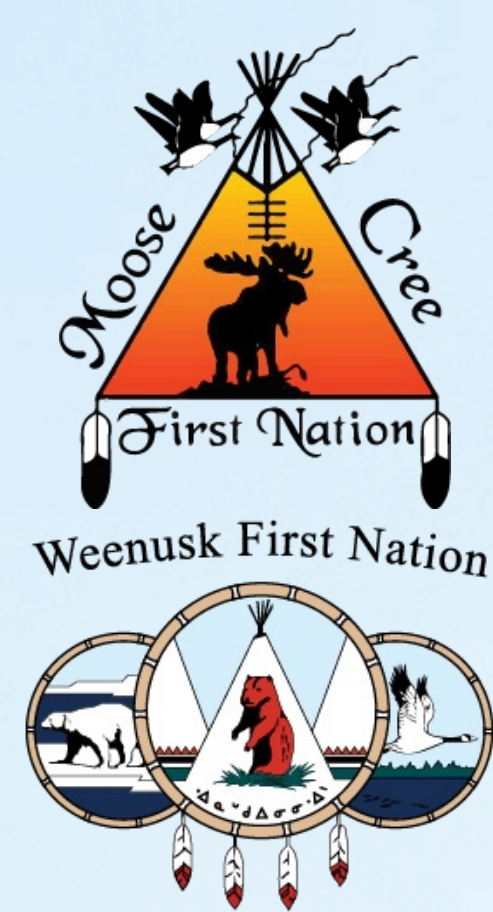


# Community-partnered monitoring of riverine and coastal ecosystems in the Hudson Bay and James Bay Lowlands

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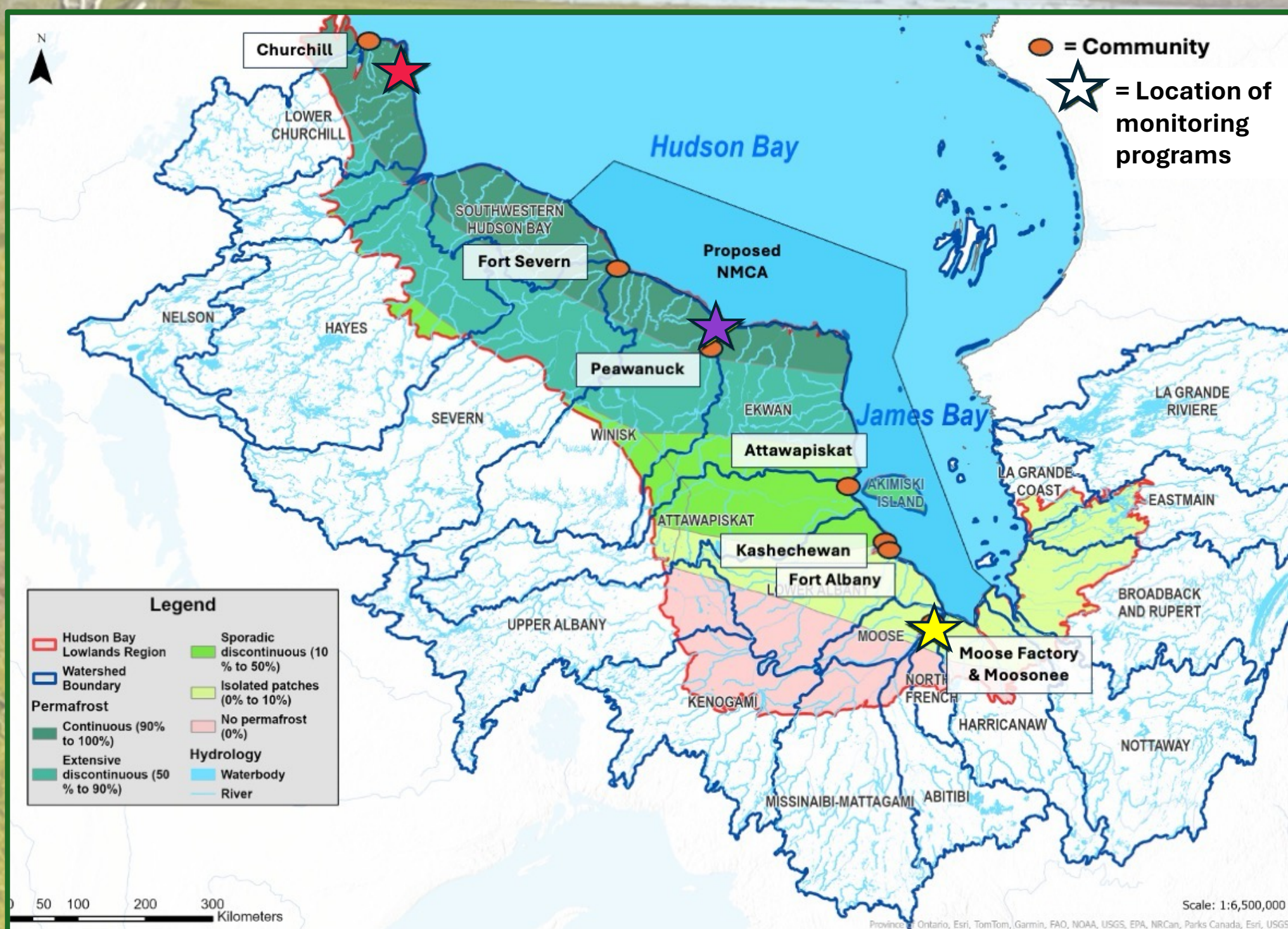
1. University of Manitoba, CEOS; 2. Parks Canada; 3. Weenusk First Nation; 4. Moose Cree First Nation; 5. Mushkegowuk Council



## Introduction

The Hudson Bay and James Bay Lowlands (HBJBL), which span an area of 474,000 km<sup>2</sup>, is the second largest contiguous peatland in the world (1, 2). These peatlands are known to be a rich carbon sink, and much of this carbon is locked within the permafrost (3), however climate change (4) and development are threatening ecosystem changes that could alter carbon storage and how it's transported. The watersheds that drain the HBJBL, extend further inland (Fig. 1), where areas such as the “Ring of Fire” have been of increasing interest to mining and extraction companies, and may have implications downstream that are not well understood, if research and knowledge sharing are not prioritized.

## Study Area

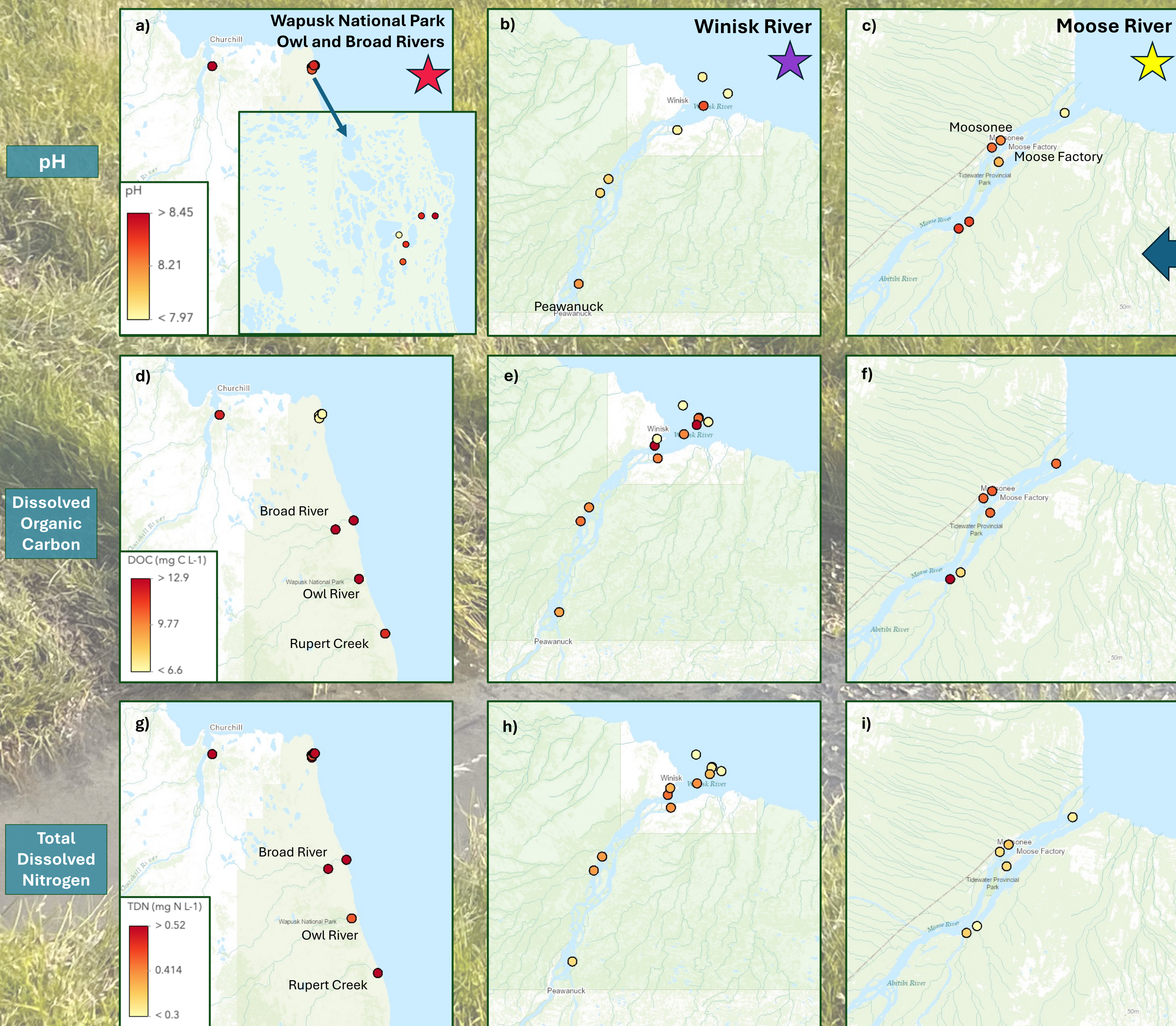


**Figure 1.** Map of study area with watersheds relevant to study area (dark blue outline). Permafrost categories mapped across the Hudson Bay Lowlands area (red outline). Proposed National Marine Conservation Area led by Mushkegowuk Council shaded in blue within the Bays. Stars indicate locations of monitoring programs. See corresponding star colours in Figure 2. Figure adapted from A. Regehr.

The Hudson Bay marine system has been experiencing change, with rapid sea ice loss and increased warming and occurrences of marine heat waves (5). This means the HBJBL and its coastline, which provides crucial habitat for thousands of birds, fish and mammals, including caribou and polar bears, is facing stressors from both inland and offshore. These species are critically important for sustenance, and local economic development for the communities in the region (Fig. 1). Acknowledging and weaving different forms of knowledge is crucial to improving the overall understanding of these coastal ecosystems to inform decision making for conservation initiatives at the community, regional and national levels.



## Preliminary Results



**Figure 2.** Maps of summer (July-August) pH measurements, dissolved organic carbon (DOC) concentrations, and total dissolved nitrogen (TDN) concentrations, at sampling locations in Wapusk National Park (a, d, g), Winisk River and its estuary, Weenusk Cree Traditional Territory (b, e, h), and Moose River and its tributaries within Moose Cree Traditional Territory (c, f, i).

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## Objectives

- To assess the Hudson Bay and James Bay Lowland carbon system and nutrient conditions along the permafrost gradient and the aquatic continuum, from the land, to the rivers, to the sea, so we may understand and anticipate the impacts of climate change and development on the coastal ecosystems.
- Continue and expand comprehensive and sustainable community-partnered or –led monitoring programs with each community's priority areas in mind.
- Develop standardized methods for riverine and coastal data collection across the region.

## Methods

All work described would not be possible without the established partnerships with Moose Cree First Nation, Weenusk First Nation, Mushkegowuk Council, and Parks Canada.

### Community-partnered water sampling:

- **Moose Cree First Nation:** Seasonal sampling (winter, spring, summer, fall) was conducted in 2023, with additional seasons of sampling in 2024 and 2025.
- **Weenusk First Nation:** Summer water sampling took place in 2023 and 2024, along with short-term mooring deployments that had sensors measuring temperature, salinity, pressure, and recording sounds of belugas.
  - Sediment sampling was also conducted in summer 2023 to assess the carbon content of the mudflats at low tide near the Winisk River.

**Wapusk National Park:** In partnership with Parks Canada, water samples were collected from rivers and ponds within the park in summer 2024.

### Water properties were collected and analyzed for:

- Inorganic carbon (pH, dissolved inorganic carbon (DIC), methane, total alkalinity)
- Dissolved organic carbon (DOC)
- Coloured Dissolved Organic Matter (CDOM)
- Nutrients (nitrate, phosphate, silicate)
- Conductivity / salinity
- Oxygen and carbon stable isotopes



### pH:

- pH varied between the 3 study areas and sampling sites, with values in the Moose River study area having the smallest range (Fig. 2c, 7.99-8.33).

### Dissolved Organic Carbon (DOC):

- DOC varied at the 3 study areas but generally the lowest concentrations were found in lakes/ponds (Fig. 2d, e). The Winisk study area varied in DOC and had the lowest (3.27 mg C L<sup>-1</sup>, lake sample) and highest (14.51 mg C L<sup>-1</sup>) concentrations measured across the 3 study areas.
- The Owl and Broad Rivers had high values whereas the lakes at the north end of the park were relatively low (Fig. 2d)

### Total Dissolved Nitrogen (TDN):

- TDN was highest at all Wapusk sites (Fig. 2g, range of 0.45 – 0.69 mg N L<sup>-1</sup>) with the lowest recorded concentration higher than the maximums observed in the Winisk river and estuary (0.43 mg N L<sup>-1</sup>) and Moose River (0.36 mg N L<sup>-1</sup>).

Sampling within the Moose Cree Traditional Territory occurred in all seasons in 2023 and has shown a distinct difference in DOC/DIC proportions between seasons (Fig. 3) winter and summer show more DIC relative to DOC, whereas spring and fall show the opposite, reinforcing the need for seasonal sampling to understand the carbon story.

## Steps Forward

- Compare results with discharge rates to understand the true carbon and nutrient loads. This is being done with the Moose River and associated tributaries, but hasn't yet been done with the Winisk, Owl and Broad Rivers.
- Community engagement meetings in Peawanuck to assess capacity and move towards a more sustainable community monitoring program
- Ongoing Data analysis and interpretation. Communication products are being developed to share results.
- Expanding sampling with other interested communities with different permafrost conditions, while also addressing community priorities for research and monitoring.

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