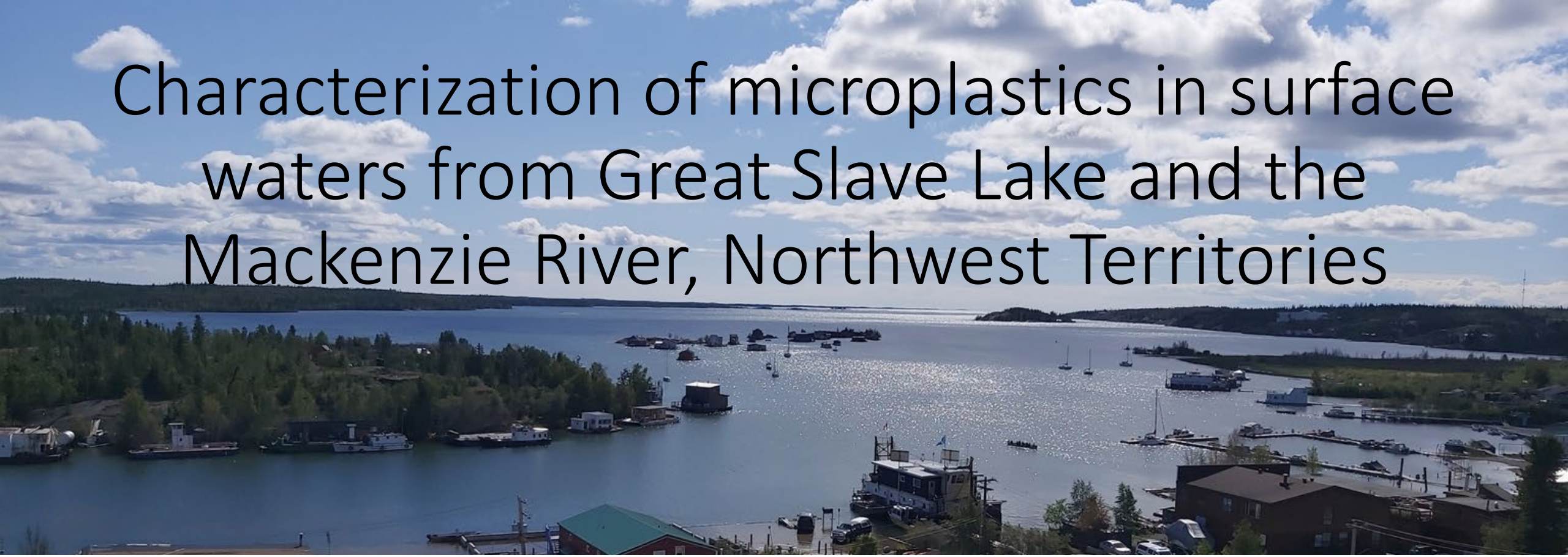
Characterization of microplastics in surface waters from Great Slave Lake and the Mackenzie River, Northwest Territories



Madelaine P.T. Bourdages[1], Jennifer F. Provencher[2], Jesse C. Vermaire[1]

[1] Carleton University; [2] Environment and Climate Change Canada

ISPA – November 22, 2023

AEEC LAB

Environment and Climate Change Canada

Carleton University

- MPs identified in Arctic marine environments, but little is known about Arctic freshwater
- Circumpolar rivers input large amount of water to the Arctic Ocean

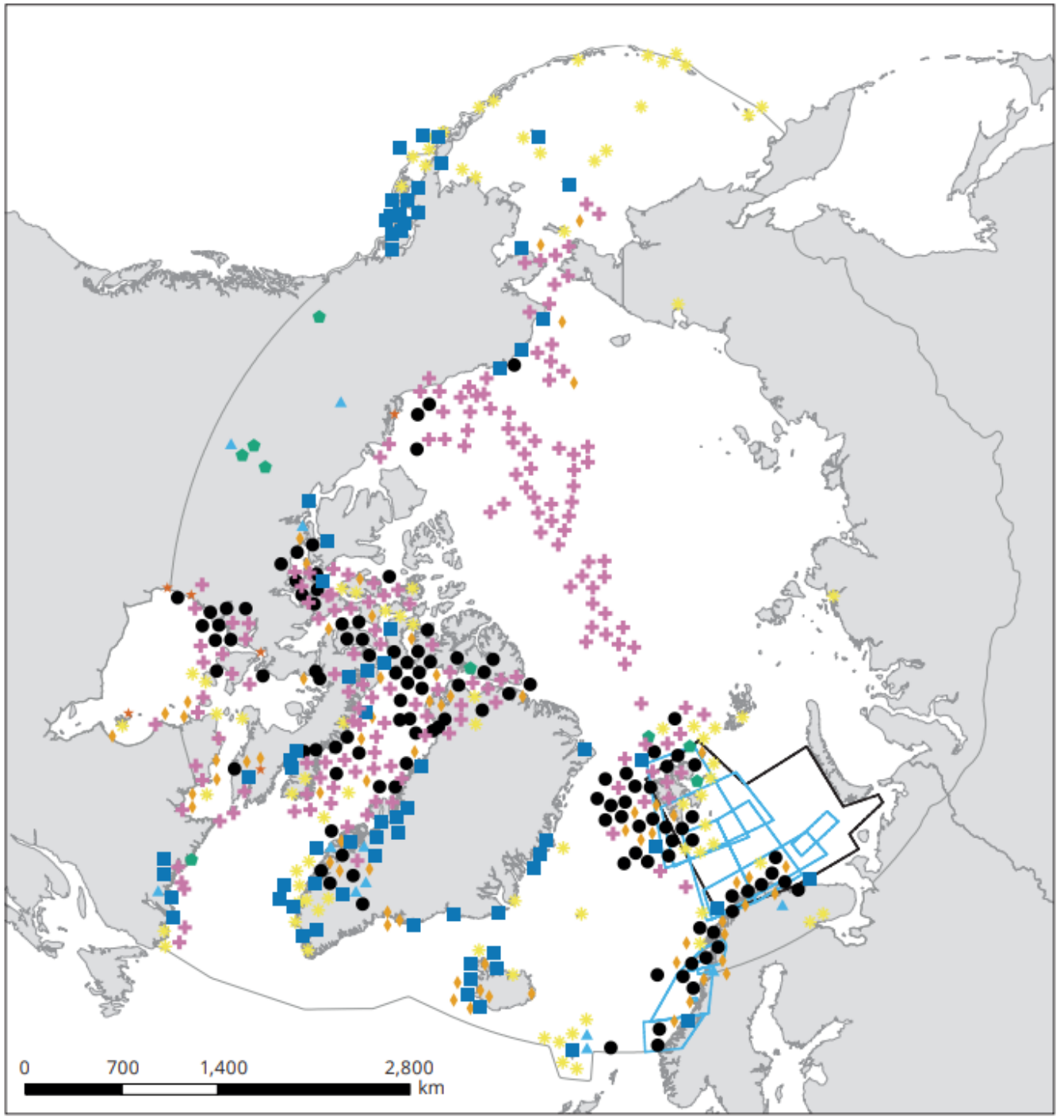
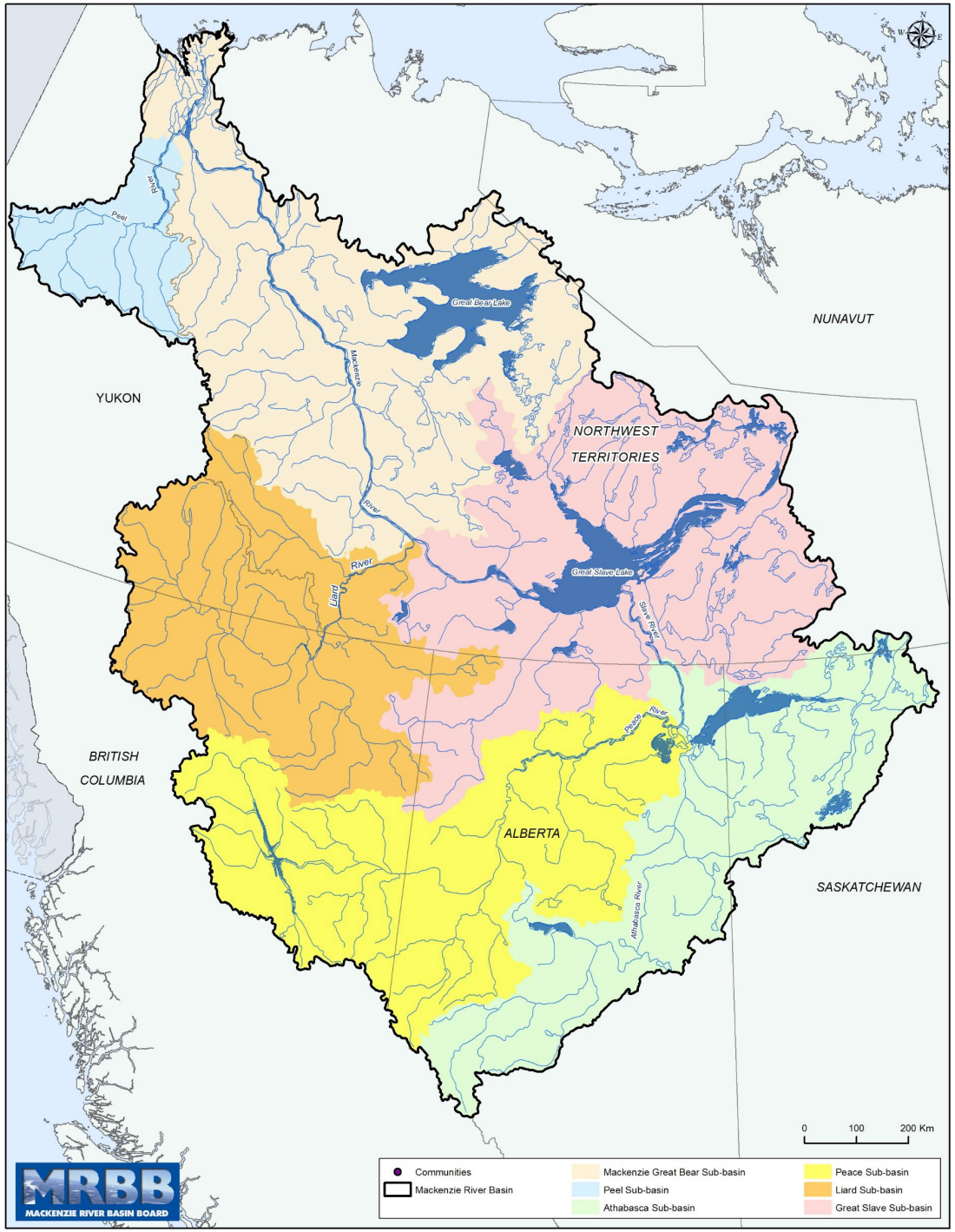


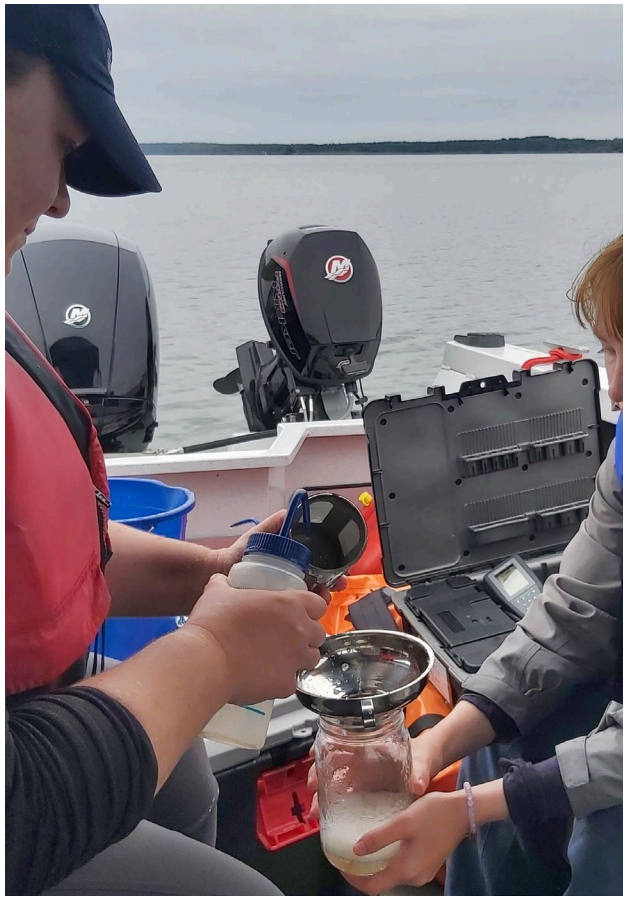
Figure 1. A sub-set of the distribution of the types and locations of existing data on litter and microplastics in the AMAP region. Data are from national reports, as well as the peer-reviewed literature. Points are jittered to prevent overlap and make the symbols visible to demonstrate the spread of the data. See the AMAP *Litter and Microplastics Monitoring Guidelines* for more detailed information on each environmental compartment.

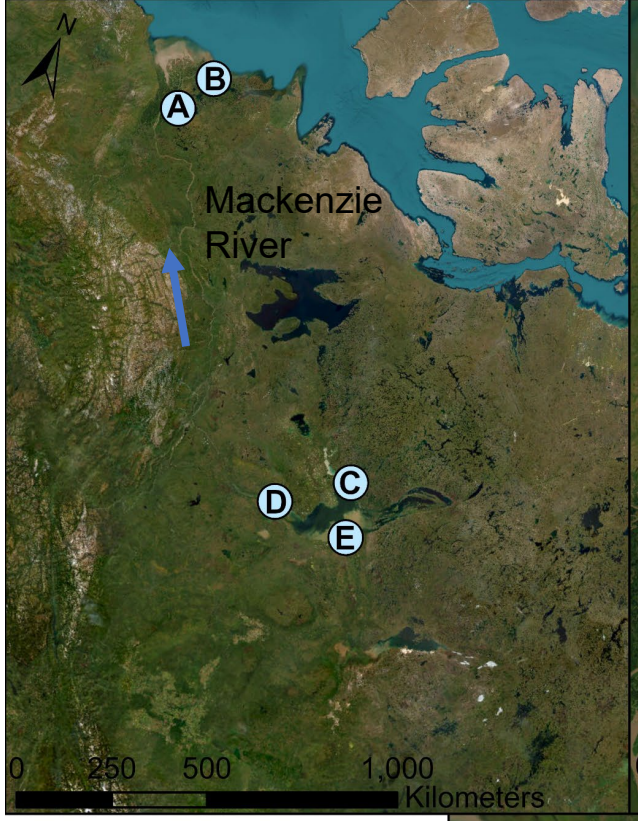
(AMAP, 2021)

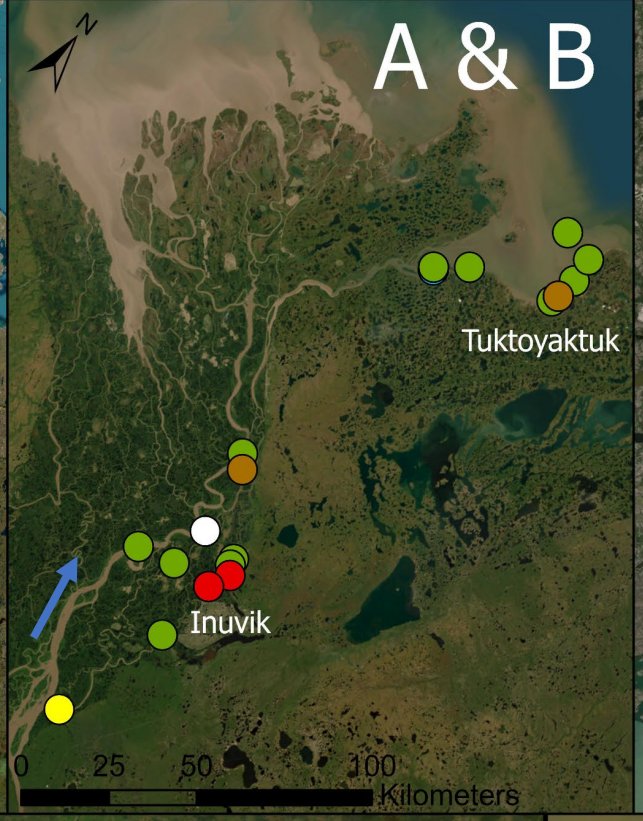
Mackenzie River Basin

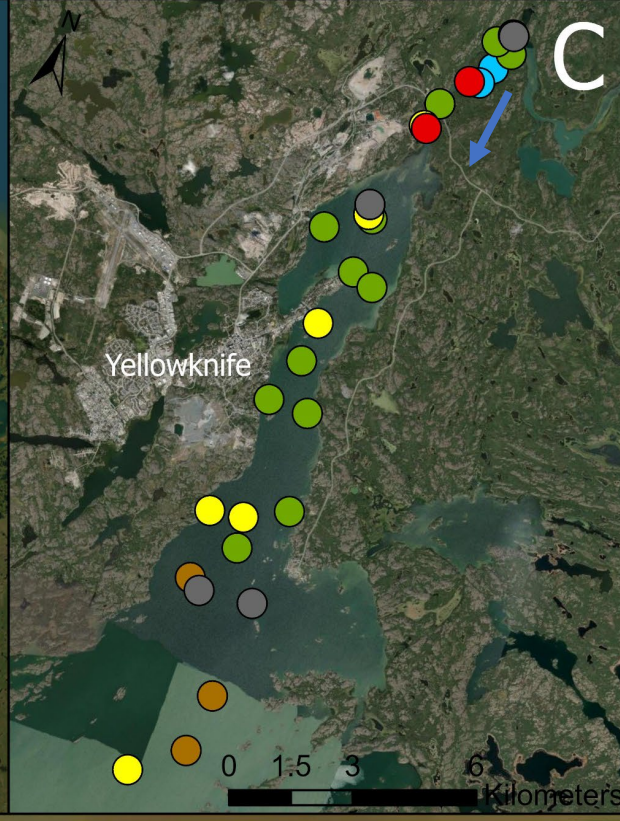
- Great Slave Lake:
  - Second largest lake in the NWT & deepest in Canada
  - Yellowknife: second largest community in Northern Canada (Pop: ~20,000)
  - Slave River: ~75% inflow to Great Slave Lake
    - Transports runoff from the Peace-Athabasca Basins
- Mackenzie River:
  - Flows from Great Slave Lake to the Beaufort Sea
  - Largest northern river in the Western Hemisphere
  - Fourth largest system contributing to the Arctic Ocean





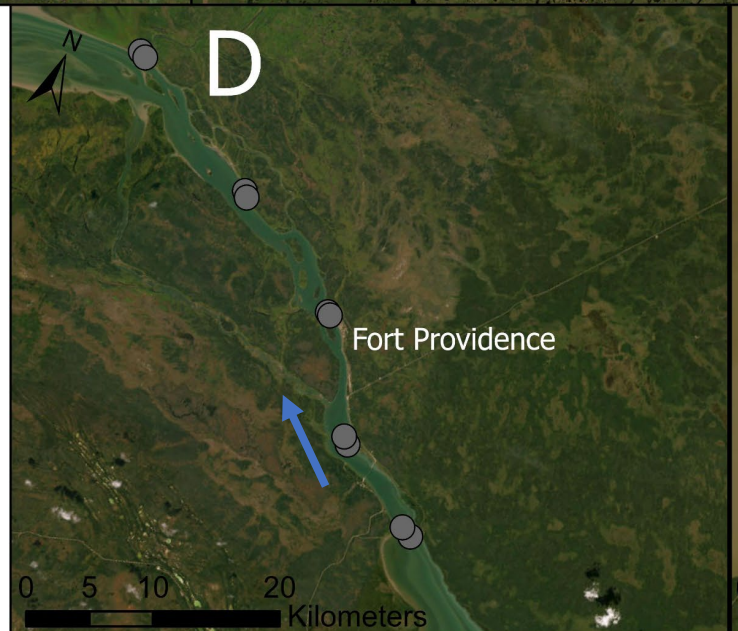


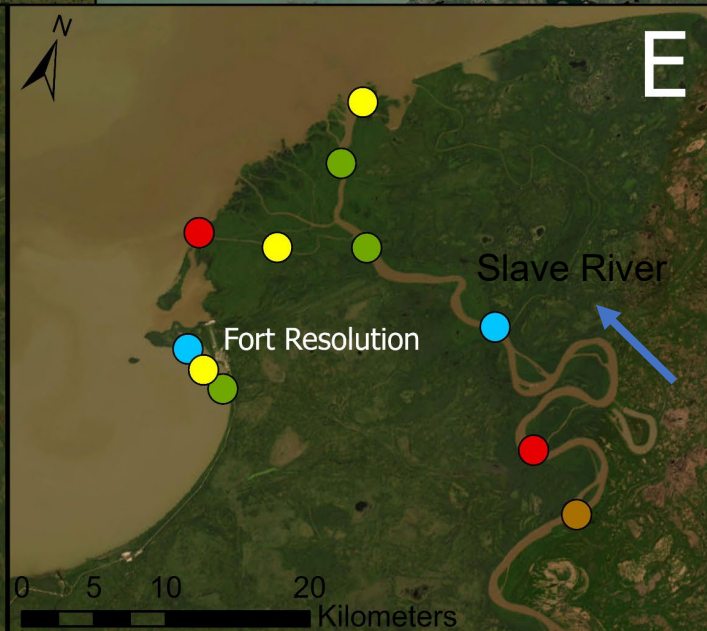




MPs/m³

- NA
- >1.0
- 0.6-0.9
- 0.3-0.59
- 0.1-0.29
- 0.01-0.09
- 0



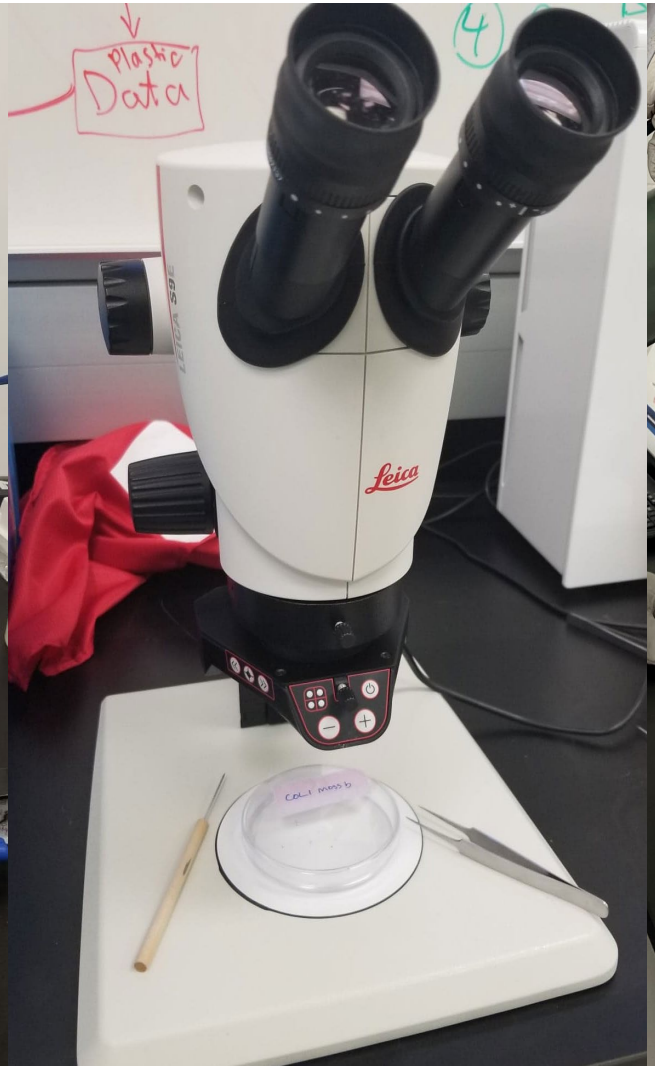


Sample processing

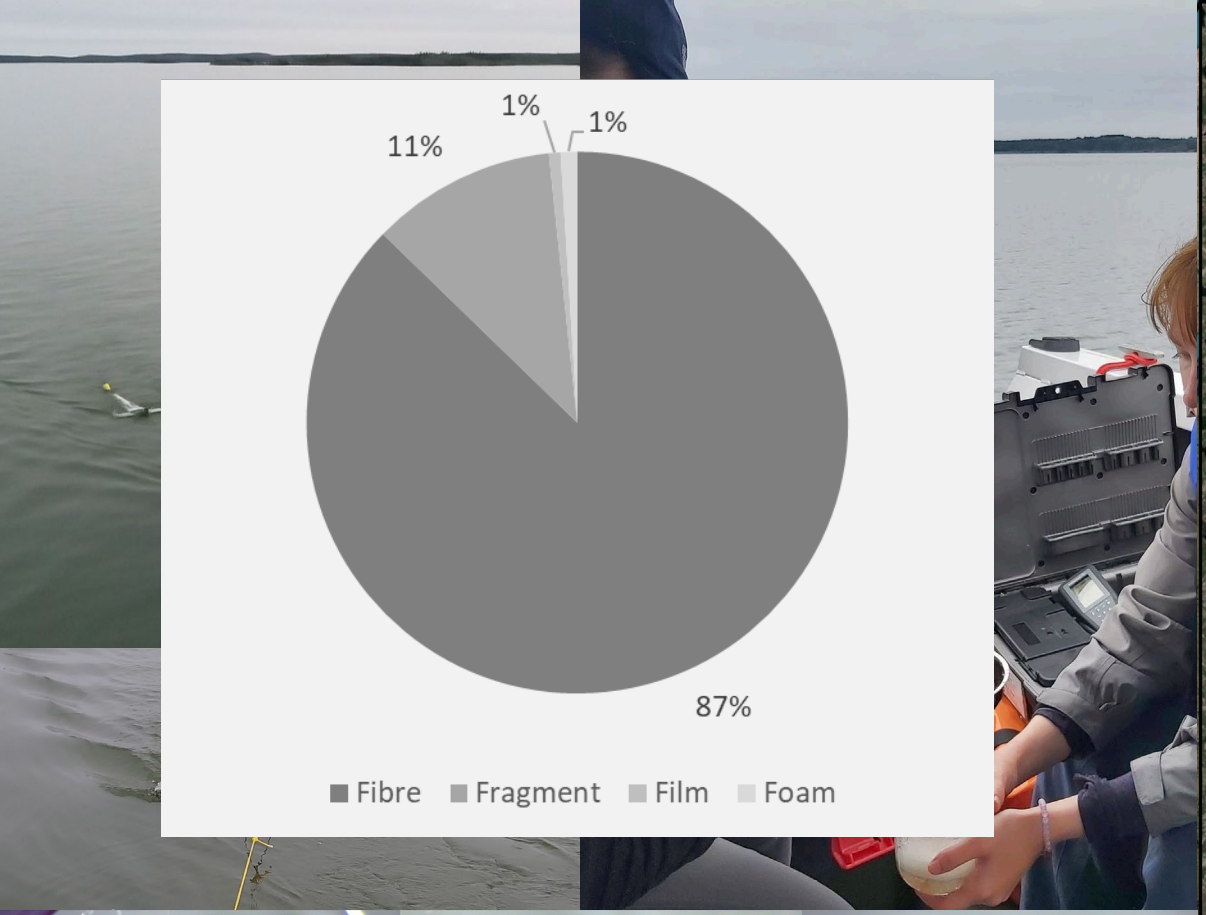
1. Chemical Digestion

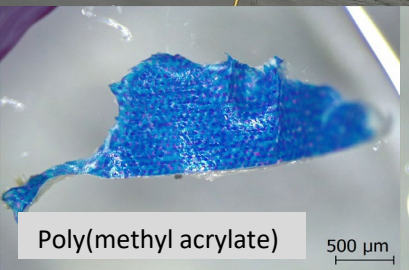
2. Filtration

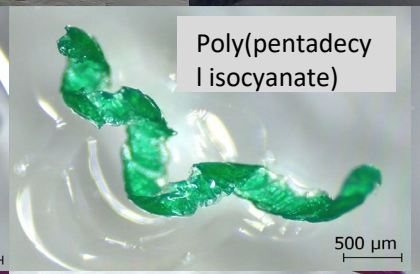
3. Microscopy

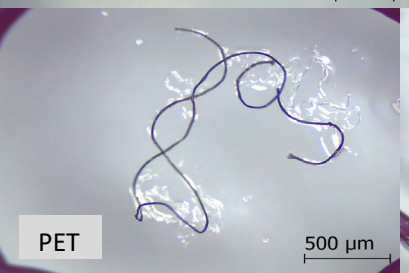


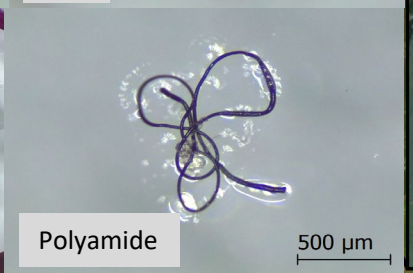
4. Spectroscopy



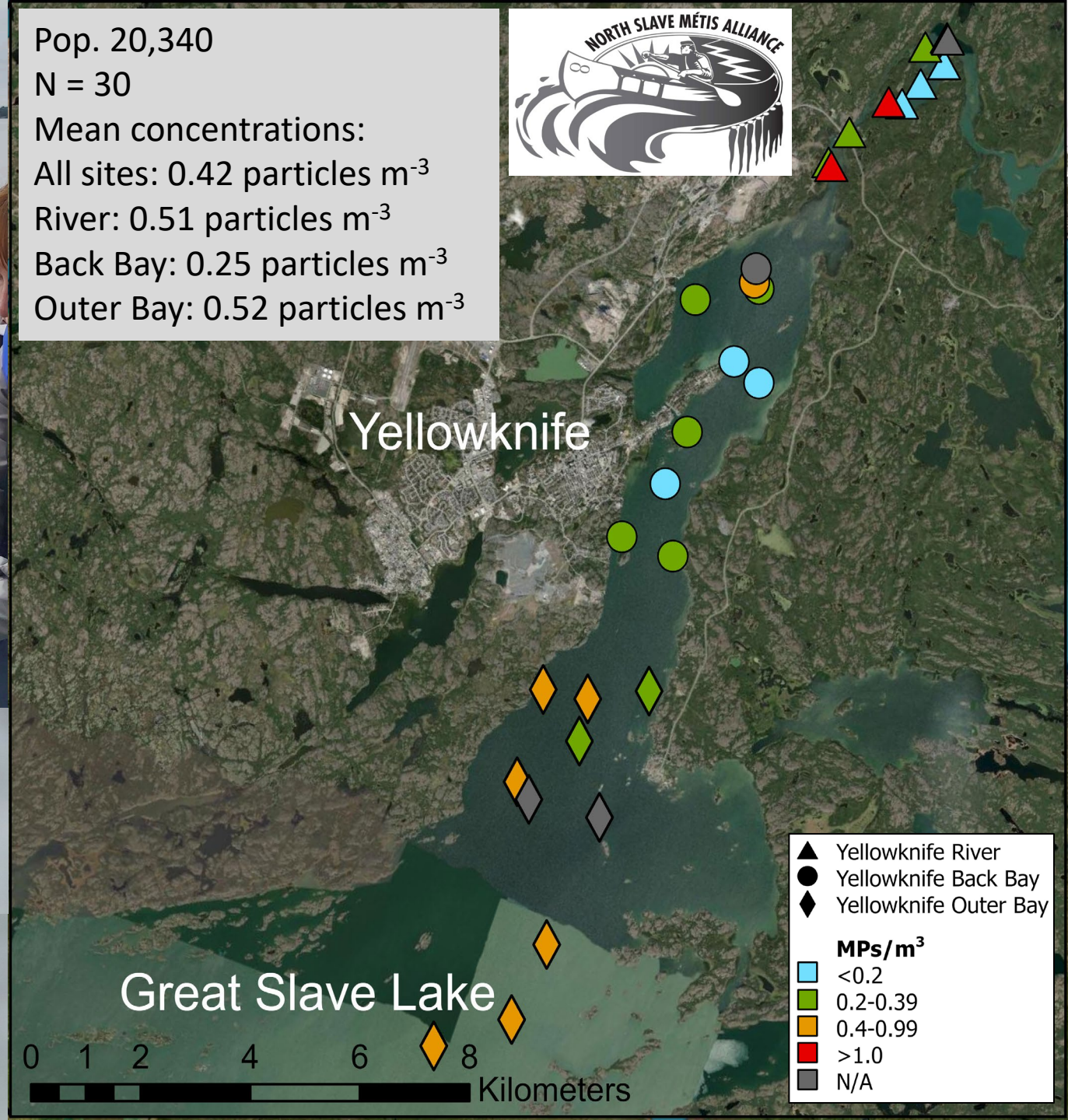


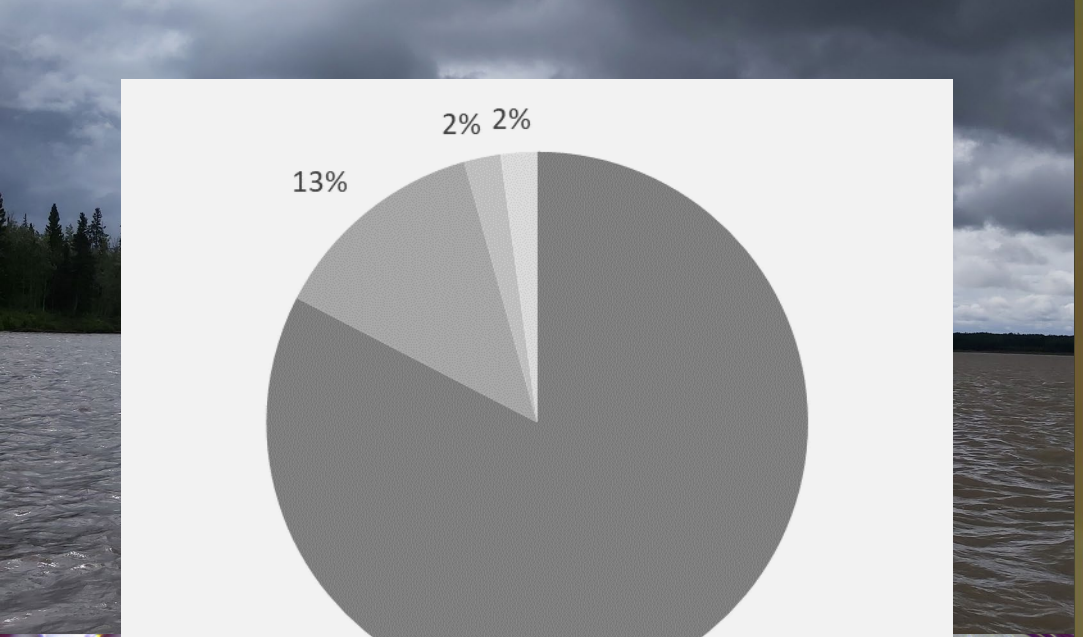


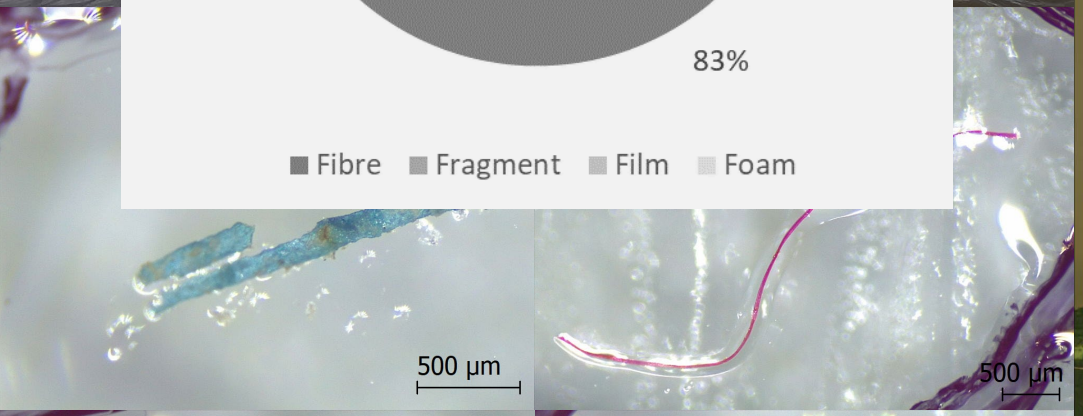


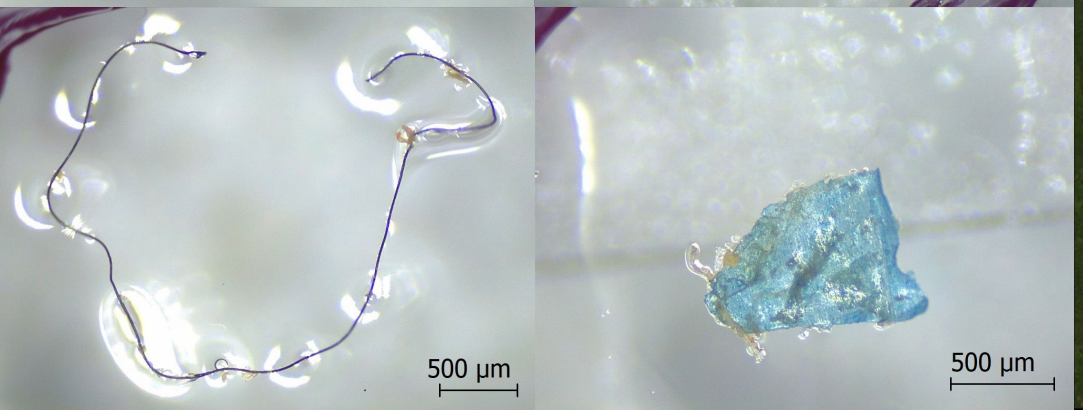


Pop. 20,340
N = 30
Mean concentrations:
All sites: 0.42 particles m^{-3}
River: 0.51 particles m^{-3}
Back Bay: 0.25 particles m^{-3}
Outer Bay: 0.52 particles m^{-3}

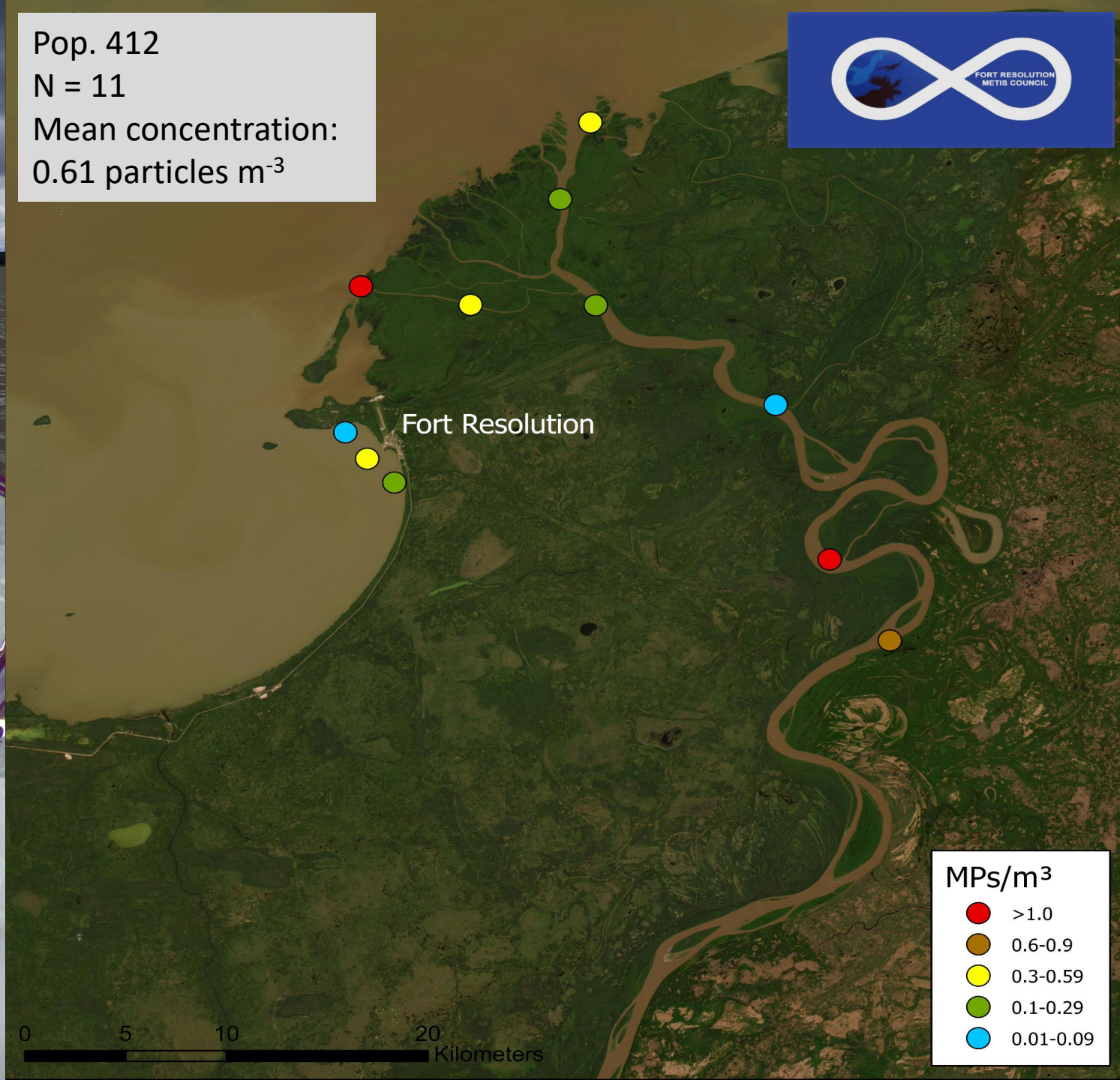


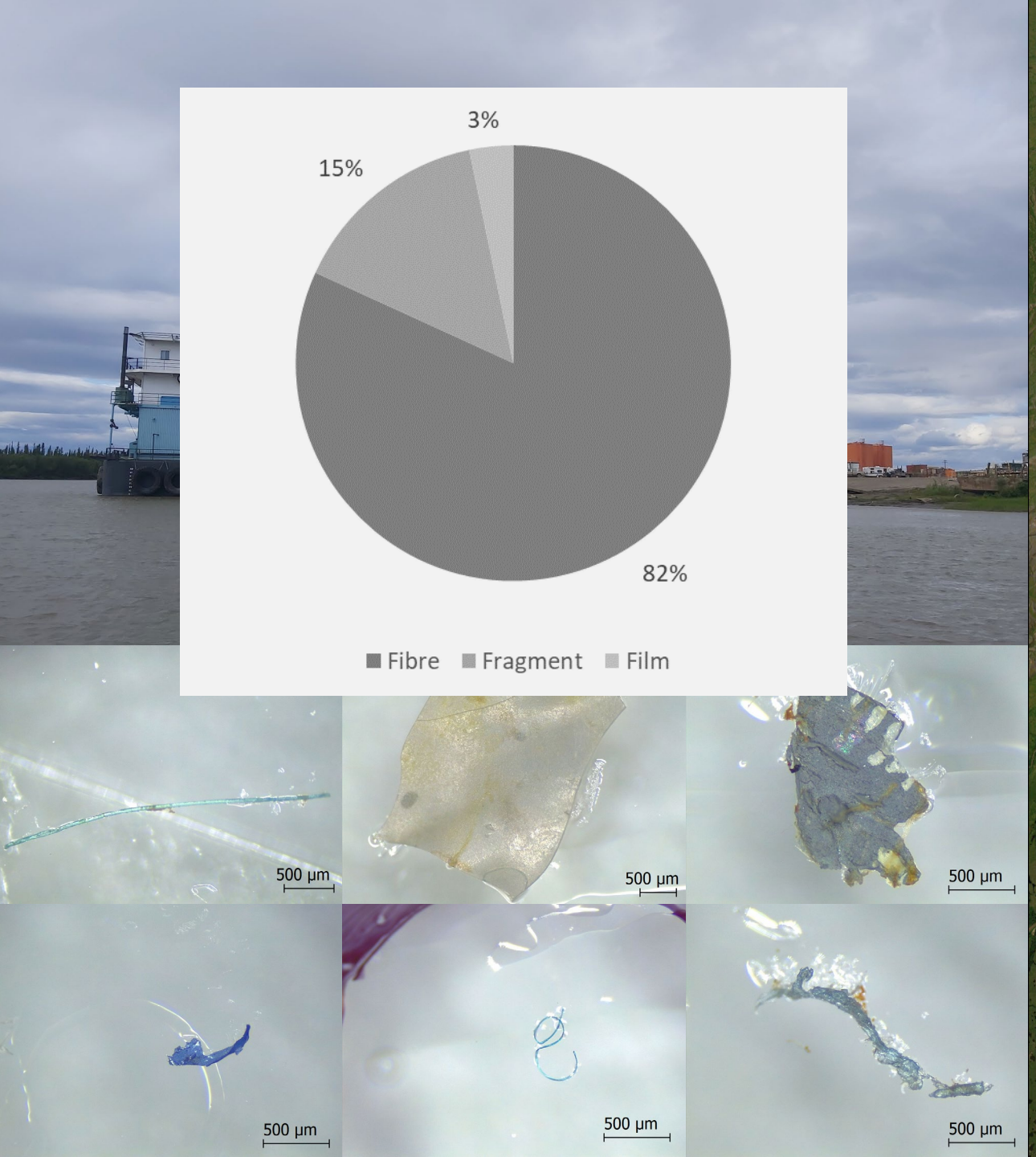






Pop. 412
N = 11
Mean concentration:
0.61 particles m^{-3}





Pop. 3,137
N = 11

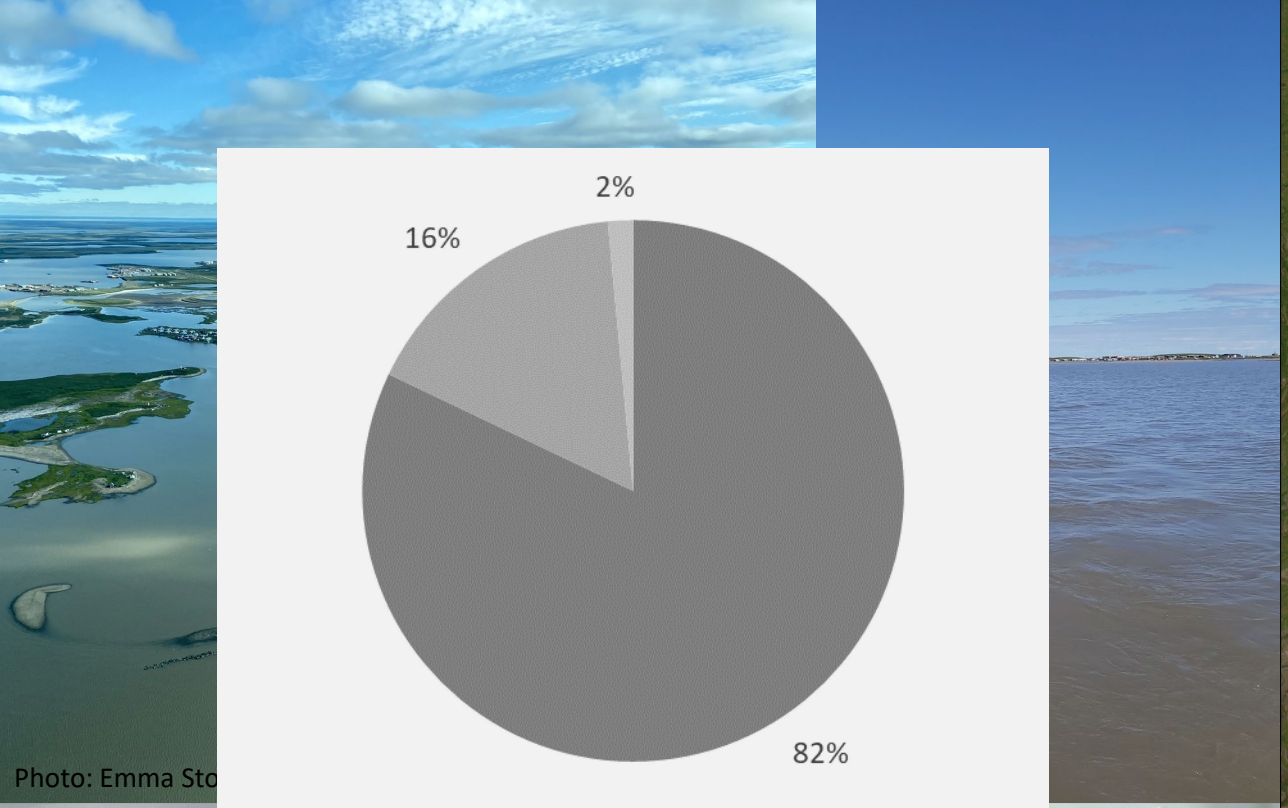
Mean concentration:
Inuvik: 0.49 particles m^{-3}

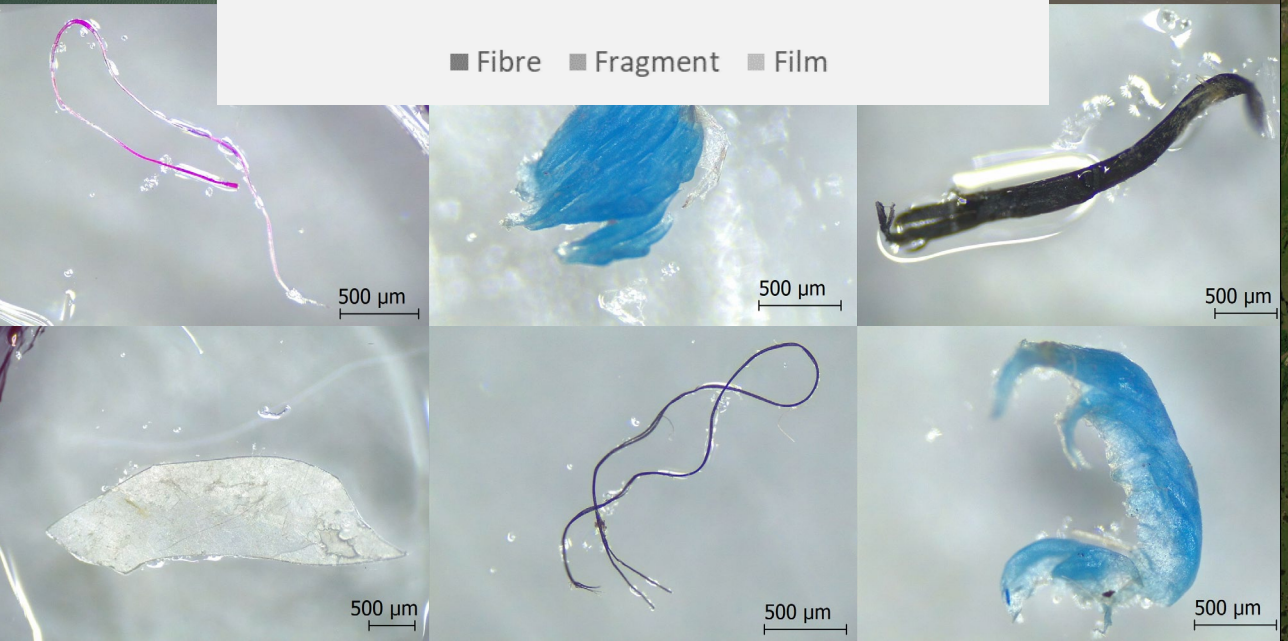
Tuktoyaktuk

Inuvik

MPs/m³
>1.0
0.6-0.9
0.3-0.59
0.1-0.29
0.01-0.09
0

0 25 50 100 Kilometers

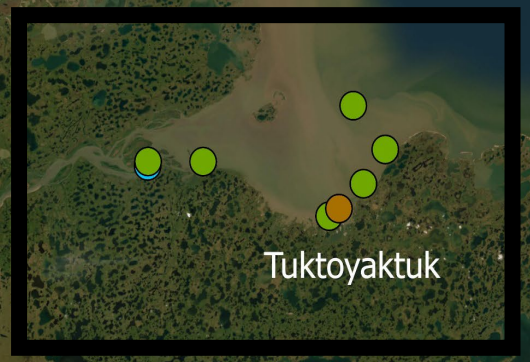




Pop. 937
N = 8

Mean concentration:
Inuvik: 0.49 particles m^{-3}
Tuktoyaktuk: 0.25particles m^{-3}

INUVIALUIT REGIONAL CORPORATION



Inuvik

MPs/m³
>1.0
0.6-0.9
0.3-0.59
0.1-0.29
0.01-0.09
0

0 25 50 100 Kilometers

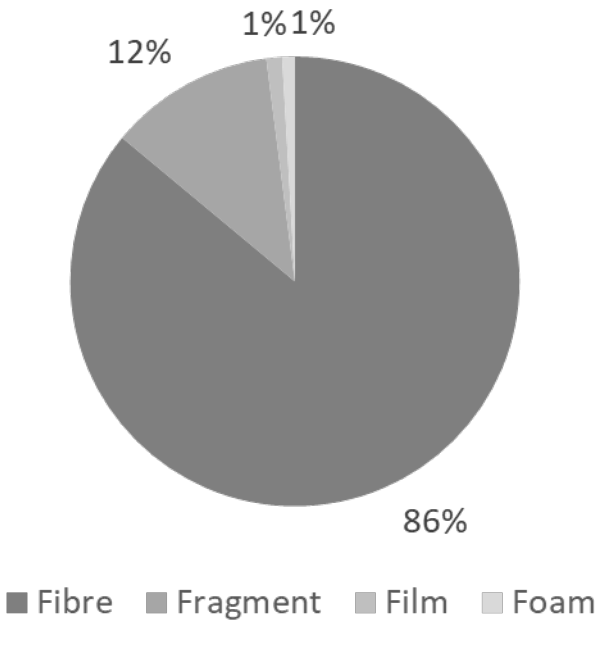
Pop. 618
N = 10

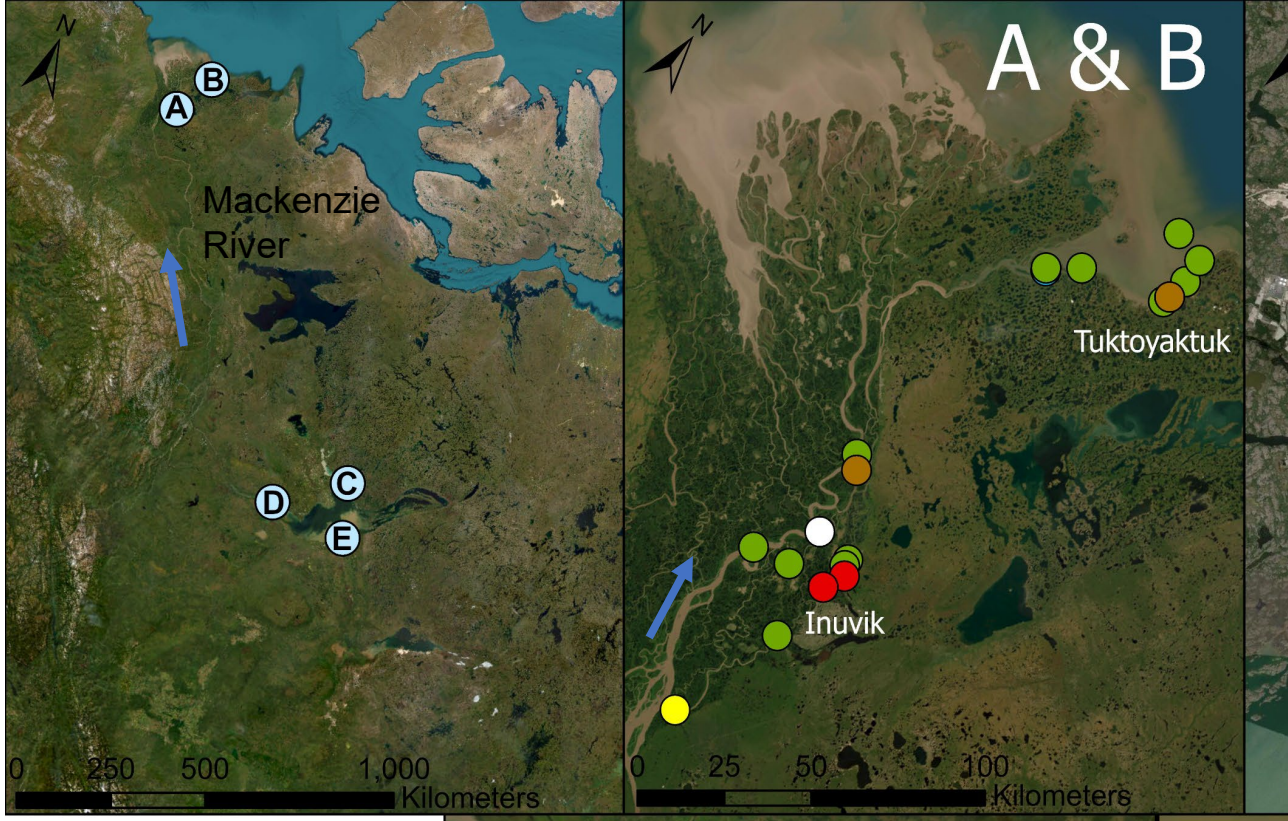
Fort Providence

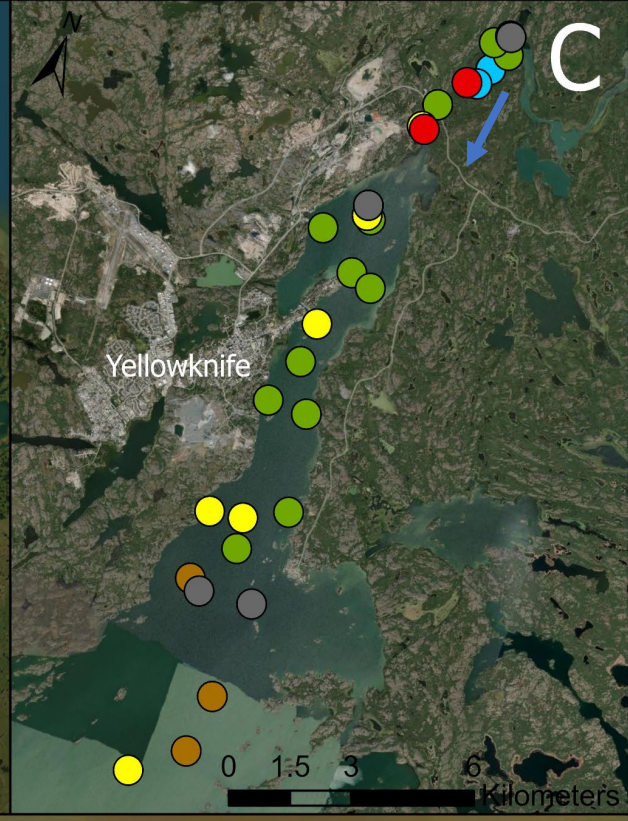
0 5 10 20
Kilometers

N = 70
Mean concentrations (particles m^{-3}):

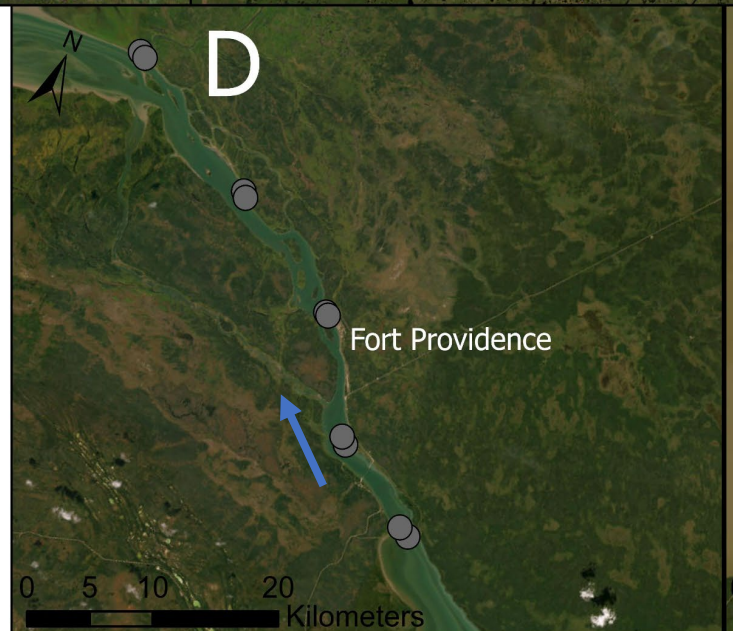
All: 0.45
Yellowknife: 0.42
Fort Resolution: 0.61
Inuvik: 0.49
Tuktoyaktuk: 0.25
Fort Providence: TBD

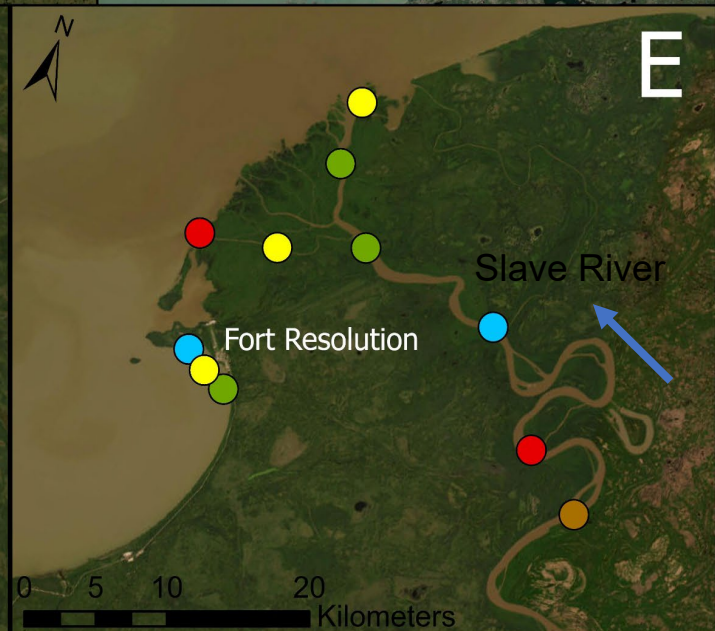






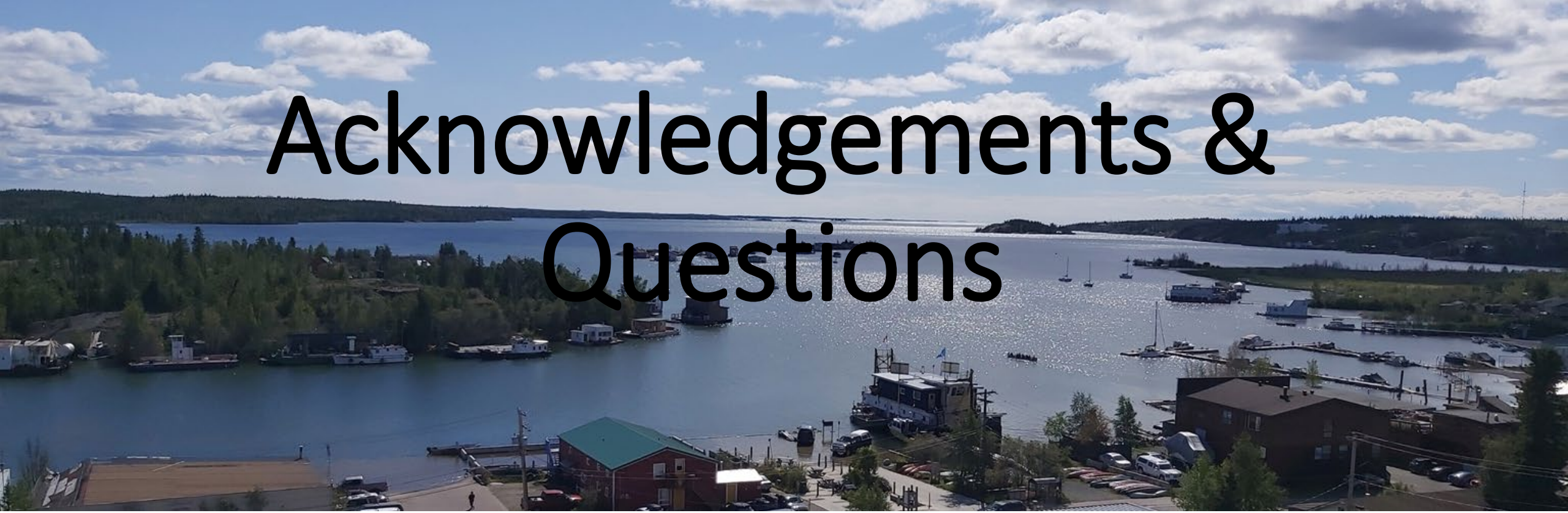
MPs/m³
- NA
- >1.0
- 0.6-0.9
- 0.3-0.59
- 0.1-0.29
- 0.01-0.09
- 0





Conclusions

- MPs found in surface waters from all sampling regions
- Overall mean concentration: 0.45 particles m^{-3}
- Fibres: 86%
- Future work:
  - Finish Fort Providence & 2022 Yellowknife samples
  - ID particles
  - Analyse data further



Acknowledgements & Questions

Carleton University

AEEC LAB

NORTH SLAVE MÉTIS ALLIANCE

Northwest Territory Métis Nation

COLLÈGE AURORA COLLEGE Research Institute Institut de recherche

Environment and Climate Change Canada

NSERC CRSNG

DEHCHO FIRST NATIONS

FORT RESOLUTION METIS COUNCIL

INUVIALUIT REGIONAL CORPORATION

Field crew:
Jessica Hurtubise, Noah Johnson, Jessica Smart, Tanner Arychuk, Joe Lecorne, Steven Nedli, Roger Beck, Sean Mckay, Ryan McLeod, Emma Stockton, Rae Landriau, James Keevik, Dale Panakealok