Ship mediated non-indigenous mesozooplankton: are they in canadian Arctic ports yet ?

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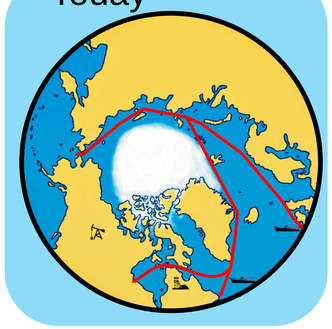
1. CONTEXT

Today



- Sea ice ↘
- New seaways ↗
- Shipping season ↗
- Oil & ore ↗

↗ Shipping traffic[2]

Futur[1]

Ships ↗ risks of biointroduction of non-indigenous species (NIS) by ballast tanks and hull[3]

To understand future impacts on communities, we need to know the present community of mesozooplankton (MZP).

2. MAIN OBJECTIVES

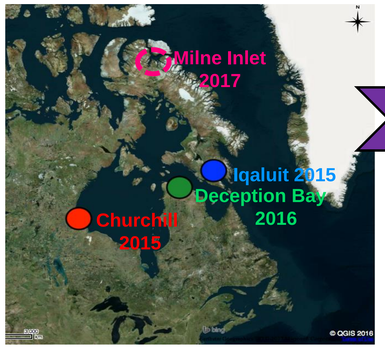
Establish a comprehensive baseline of mesozooplankton biodiversity

1. To determine and to compare diversity patterns within and among three of the most active canadian Arctic ports[3], in relation to environmental parameters.

2. To evaluate if non-indigenous species are already present and to compare with NIS arriving in ballast water.

3. MATERIAL & METHODS

3 Canadian Arctic ports

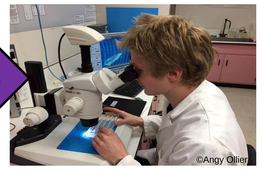


AUGUST SAMPLING

10 stations per port

LAB

Taxonomy and statistical analyses (PRIMER)



CTD + Two nets : Oblique 250µm / Vertical 80µm

Acknowledgment and references

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1 Smith, L.C. & Stephenson, S.R. (2013). New Trans-Arctic shipping routes navigable by midcentury.
2 Gavrilchuk, K. et Lesage, V. (2014). *Canadian Technical Report of Fisheries and Aquatic Sciences*.
3 Chan *et al.,* (2012). *Fisheries and Oceans Canada.*

4. RESULTS

Objective 1 : Biodiversity of the 3 ports

1 - Mesozooplankton density

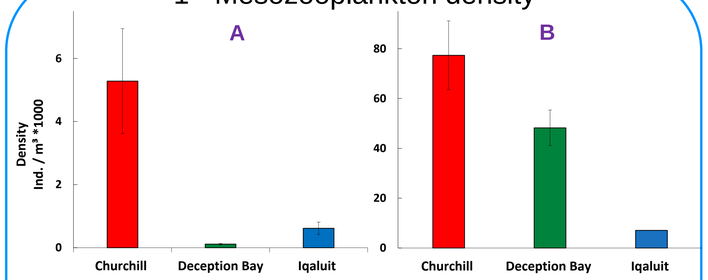

Fig. 1 : Mean mesozooplankton density at each port (ind. m^{-3}) of the **250µm net**. All significantly different ($P < 0.05$). **Nets : A = 250µm & B = 80µm.**

- **Highest abundance in Churchill, lowest in Deception Bay (250µm) or Iqaluit (80µm) (Fig.1).**

2 - Biodiversity

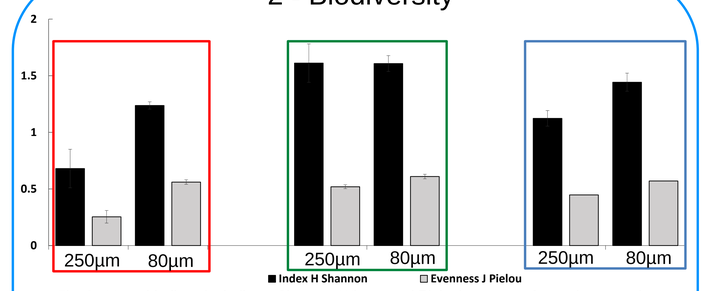

Fig. 2 : Mean biodiversity indices, Shannon-Wiener and Pielou's eveness for each port and each net type.

- **Churchill : lowest Shannon-Wiener and Pielou's evenness => only a few taxa were dominant (e.g. Echinodermata)(Fig.2).**
- **In total 47 species and 18 higher taxa for the 3 Arctic ports.**

3 - Mesozooplankton similarity

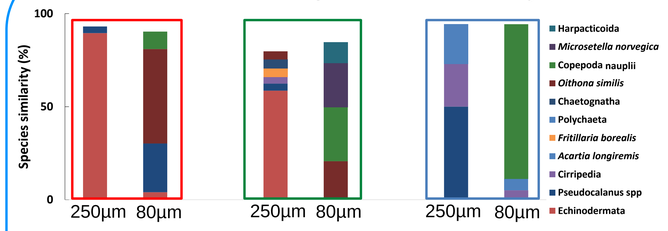

Fig. 3 : Cumulative percentages of species most important to station similarity within each port (SIMPER analysis).

- **Community structure differed largely among these 3 ports (Fig.3).**

4 - Variation in species composition

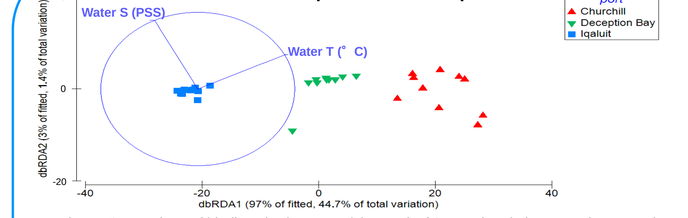

Fig. 4 : Comparison of biodiversity (presence/absence) of 3 ports in relation to environmental parameters (dbRDA).

- **Less variation in species composition within ports than among ports.**
- **Communities are differentiated due to temperature (T) and salinity (S).**
- **Increasing temperature (T) gradient from Iqaluit to Churchill (Fig.4).**

Objective 2 : NIS in ballast water

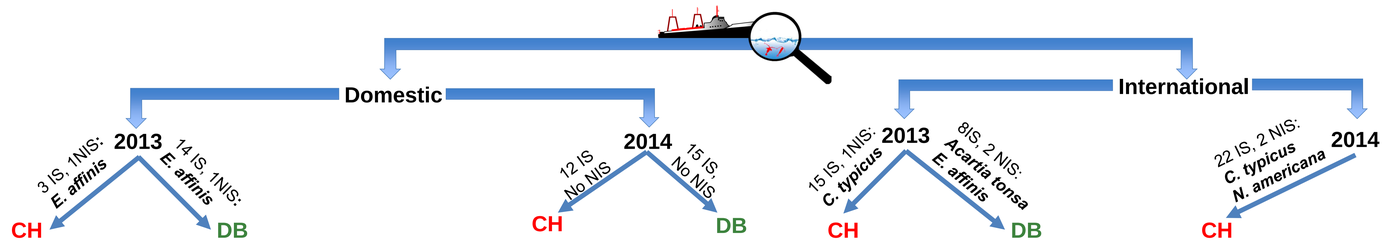

Fig. 5 : Deballasted mesozooplankton (MZP) from domestic and international ships to **Churchill** (**CH**) and **Deception Bay** (**DB**) between 2013 & 2014, with the number of indigenous species (IS) & NIS present in ballast water.

- **4 NIS of MZP found in ballast water discharged in Churchill and Deception Bay but none of these NIS were found (by taxonomy) in port samples at this time (Fig.5).**

5. KEY POINTS & NEXT STEPS

- ✓ **47 species and 18 higher taxa; Community structure differed largely among these 3 ports and nets**
- ✓ **T & S gradients in Churchill create highest variability of community composition among stations, compared to more homogenous community pattern in Deception Bay and Iqaluit**
- ✓ **No NIS of MZP found by taxonomy, but potentially NIS occurrence is rare, thus metabarcoding and eDNA helpful for detection**
- ✓ **Including the data from the last port : Milne Inlet 2017**
- ✓ **Identify jellyfish samples and confirm non-indigenous *Aurelia limbata* (macrozooplankton) in Churchill (DNA barcoding)**