Response of biological communities to a seasonal freshwater gradient in southwestern Hudson Bay, Canada

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Background

- Estuarine systems are important transition zones between freshwater and marine ecosystems
- Under seasonal ice-cover, freshwater plumes from rivers can extend further in the bay than in ice-free conditions[1]
- Increased discharge from regulated rivers in winter arrives in Hudson Bay during annual ice algal spring bloom
- Freshwater can have indirect effects on biological communities by influencing sea ice thermodynamic processes, nutrient transport, turbidity and cell physiology

Objectives

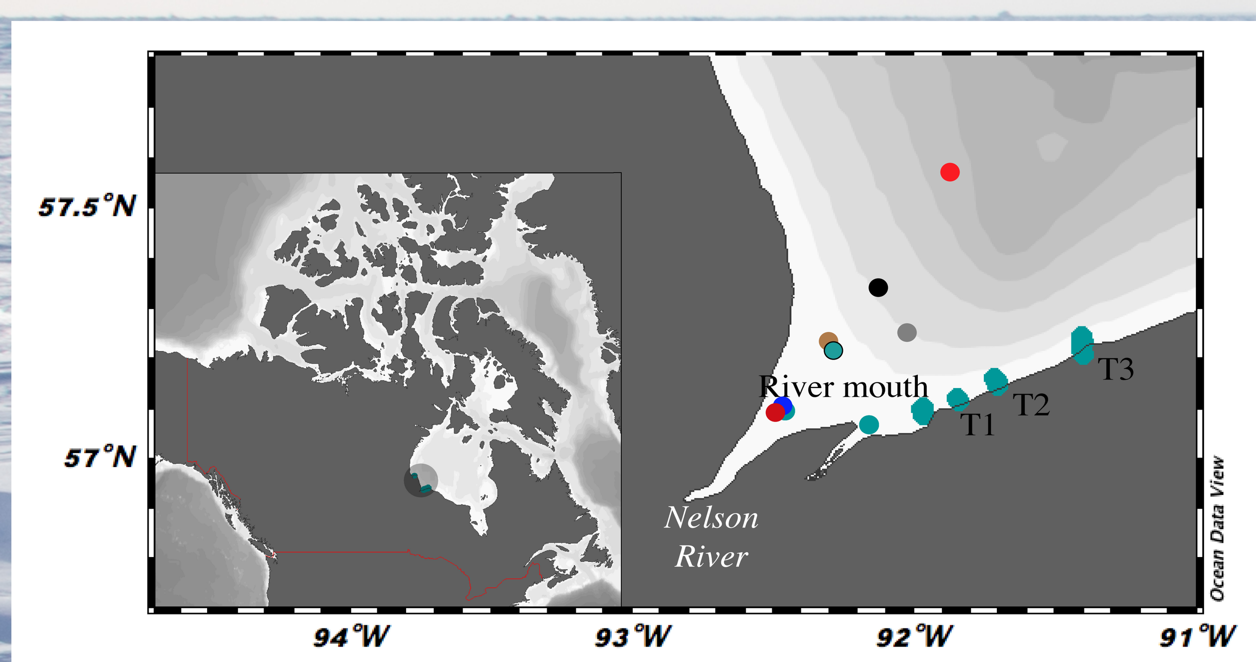
The aim of this study is to examine the role of regulated rivers on bottom ice algal communities and phytoplankton by investigating the following objectives along a salinity gradient:

1. Examine the influence of the river plume on ice algal and phytoplankton production from the estuary to the marine system
2. Examine the variability in ice algal biomass and nutrient availability
3. Investigate the influence of the river output on taxonomic composition

Methods

- Fieldwork executed during the spring bloom in Hudson Bay from 21 March to 8 April, 2017 and 29 June to 1 July, 2018 during BaySys
- Sea ice and water column samples were collected along 3 transects on landfast sea ice and 3 river sites in spring
- Water column samples collected along one transect in spring
- Variables collected and analyzed: snow depth, ice thickness, chlorophyll *a* (via fluorescence), particulate organic carbon and nitrogen (POC/PON), nutrients, pigments, light availability
- Variables to be analyzed: primary production, taxonomy

Location of sample sites in Hudson Bay. Blue and multicolor indicate spring and summer sites, respectively.

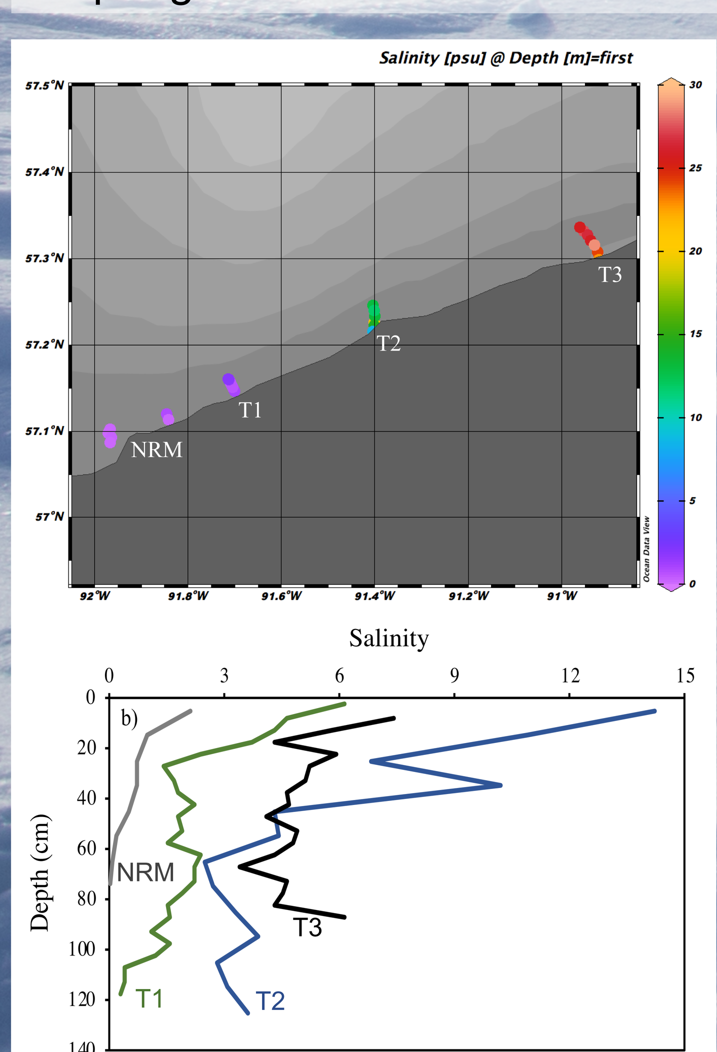


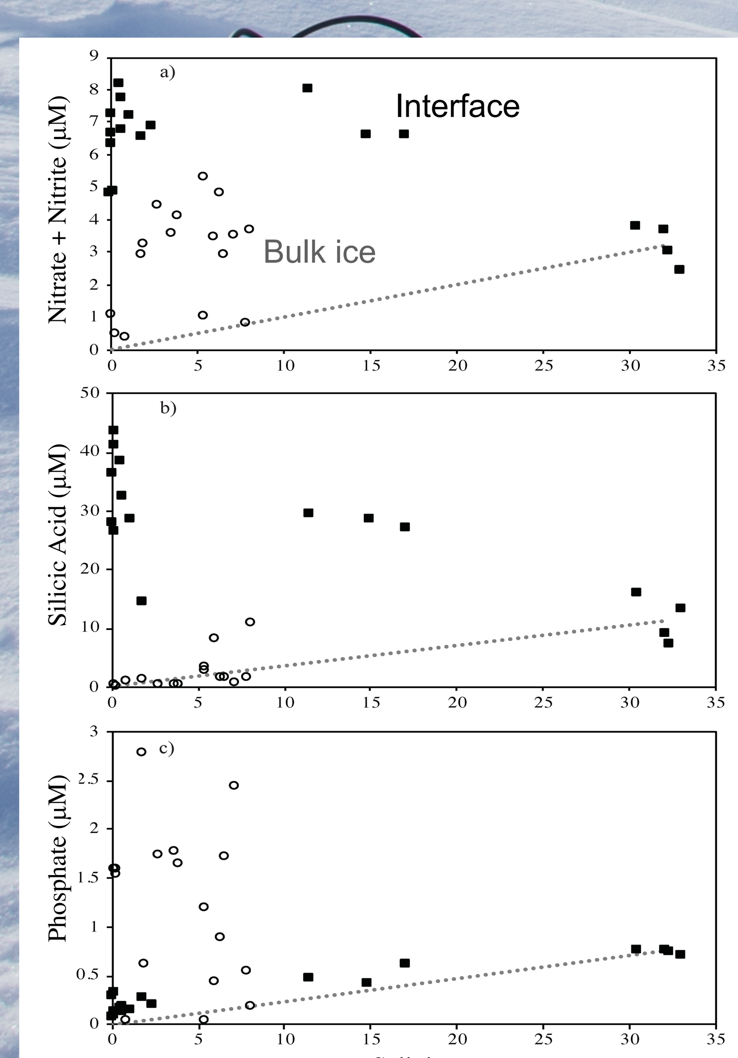
Freshwater **negatively** impacts **ice algae** and **phytoplankton** along a **salinity gradient** from the Nelson River mouth to the marine system.

Water column surface salinity (a) and sea ice salinity profiles (b) ↑ with ↑ distance from river mouth in spring.

a)

b)

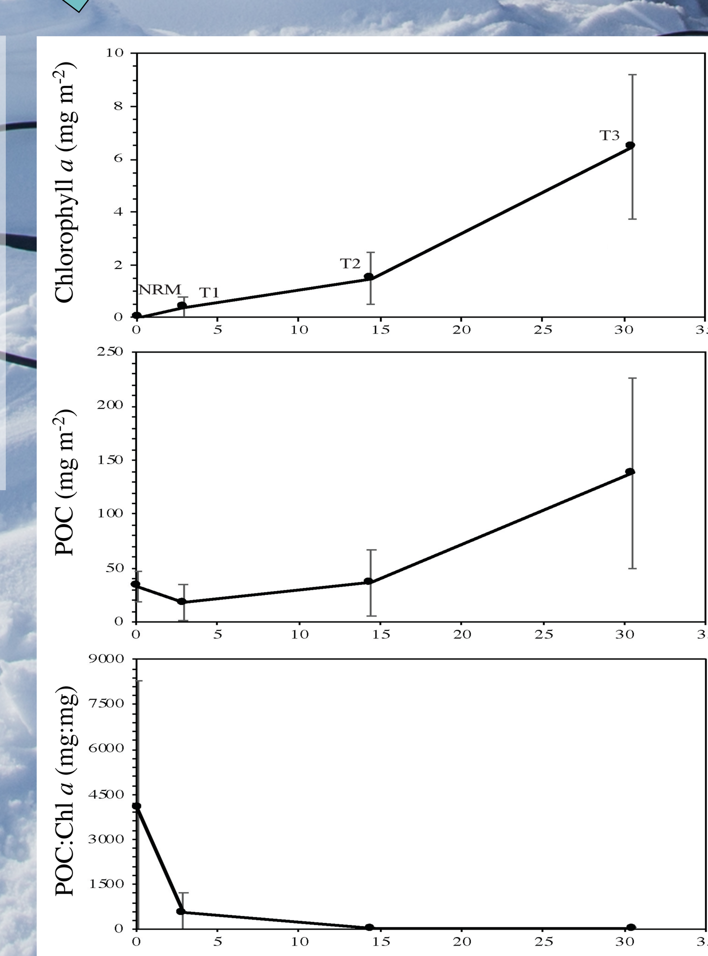




Interface nitrate + nitrite and silicic acid ↓ with ↑ salinity (distance from river mouth). Phosphate is opposite.

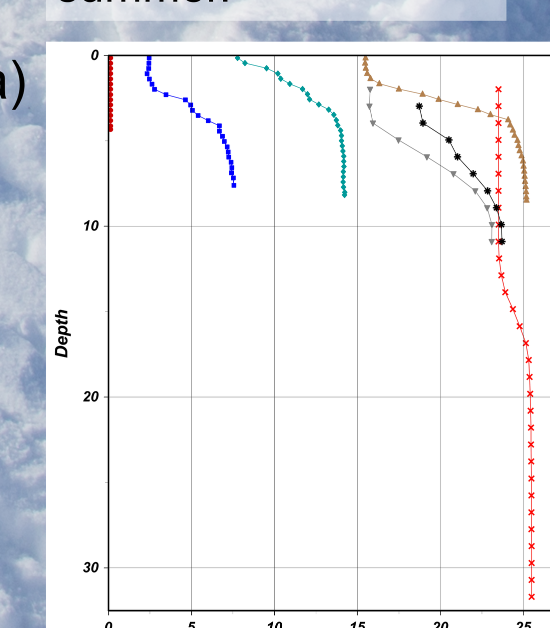
Bulk ice concentrations increase at higher salinity. Potential intracellular storage at high salinity, exclusion process at low salinity.

Chlorophyll *a* and POC increase with ↑ salinity (distance from river mouth). The high POC:Chl *a* at the river mouth can indicate nutrient limitation or other POC sources.



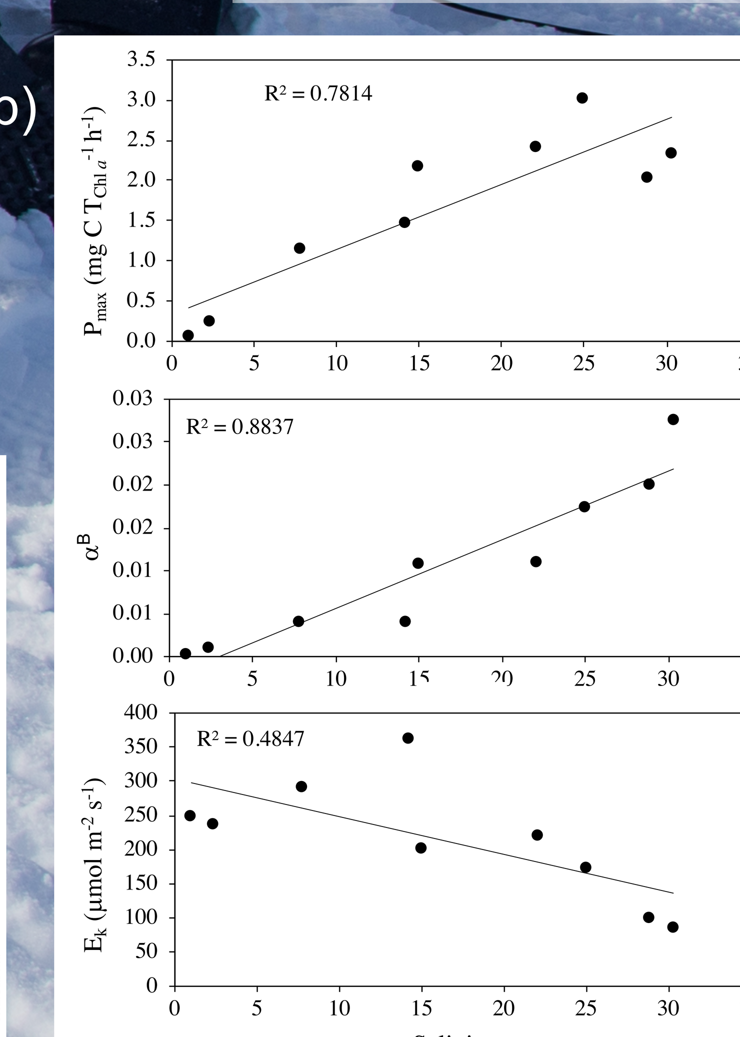
Water column salinity profiles (a) ↑ with ↑ distance from river mouth in summer. Primary production (b) ↑ with ↑ salinity in summer.

a)



Max photosynthetic rate (P_{max}) and photosynthetic efficiency (α^B) ↑ with ↑ increasing salinity. Low salinity communities are adapted to high light conditions in shallow river mouth.

b)



Next Steps: Complete primary production estimates and taxonomic composition analysis. Compare spring and summer data to understand impact of riverine output.

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