Effects of dissolved organic carbon on phytoplankton community structure in boreal lakes

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Introduction

- Highly coloured dissolved organic carbon (DOC) tannins from terrestrial plants[1] may result in increased light attenuation[2] and thermocline depths,[3] potentially limiting algal photosynthetic production[4]
- Phytoplankton communities may respond to low light environments by increasing their proportion of species capable of consuming bacteria and DOC (Figure 1) for energy efficiency[5]
- Changes to phytoplankton community structures in low nutrient environments may alter food chain energy transport, species biodiversity, and ecosystems

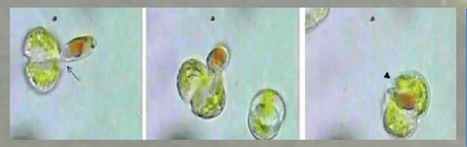

Figure 1.
Sequence showing a cell of *Karlodinium micrum* (mixotroph) feeding on a cryptophyte alga (Stoecker et al. 2006)[6]

Hypothesis & Objectives

- **Objective:** determine the importance of mixotrophs within phytoplankton community structures
- **Hypothesis:** lakes with increasing DOC concentrations will favour mixotrophic phytoplankton species

Methodology

- Phytoplankton taxon and chemistry data from May to September of 2018 were collected on eight lakes across a range of DOC concentrations at the Experimental Lakes Area (ELA)
- Phytoplankton taxa were categorized according to life history consumption strategy (autotrophic, mixotrophic, or heterotrophic), and examined across a range of DOC
- Changes in phytoplankton structure via Principle Regression Curve (PRC) analysis pending

Preliminary Results

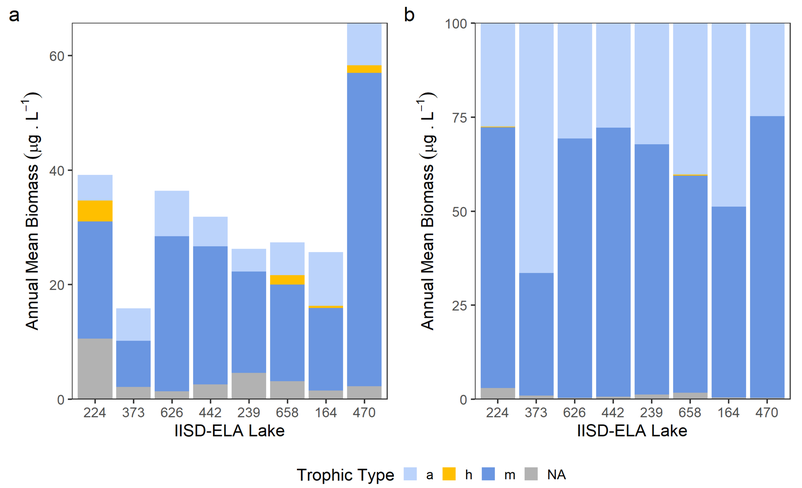

Figure 2. Annual biomass of autotrophic (a), mixotrophic (m), and heterotrophic (h) phytoplankton taxa reported as **(a)** absolute biomass and **(b)** as a proportion of total biomass. Lakes are ordered from lowest to highest annual DOC concentration.

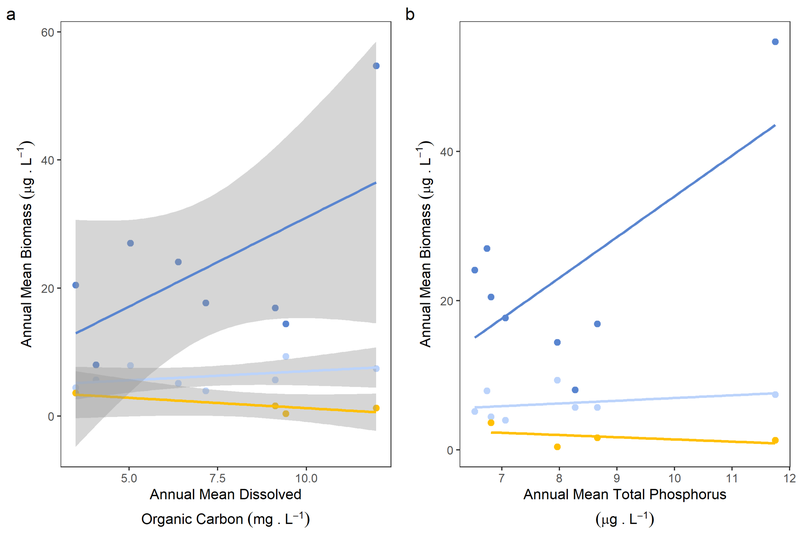

Figure 3. Linear regression of mean annual trophic type biomass (a, m, h) versus **(a)** annual mean DOC and **(b)** annual mean total phosphorus. Trophic type as defined by legend colours in Figure 2.

Discussion

- Phytoplankton community structures are dominated by species capable of mixotrophy (Figure 2a)
- Lakes with high DOC (≥ 9 mg/L) sustained heterotrophic phytoplankton populations
- Mixotrophic species within seven of eight lakes comprise of more than fifty-percent (50.7-71.5%) of the trophic type composition (Figure 2b)
- Trophic type relationships in part driven by a single polymictic lake (L470). No relationships were found with the inclusion of only stratified lakes (Figure 3ab)

Subsequent Steps

- Determine whether DOC drives change in all species taxa, regardless of trophic type via PRC analysis
- Examine whether phytoplankton communities living underneath the epilimnion (low light conditions) retain a similar proportion of mixotrophs

Acknowledgements

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References

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