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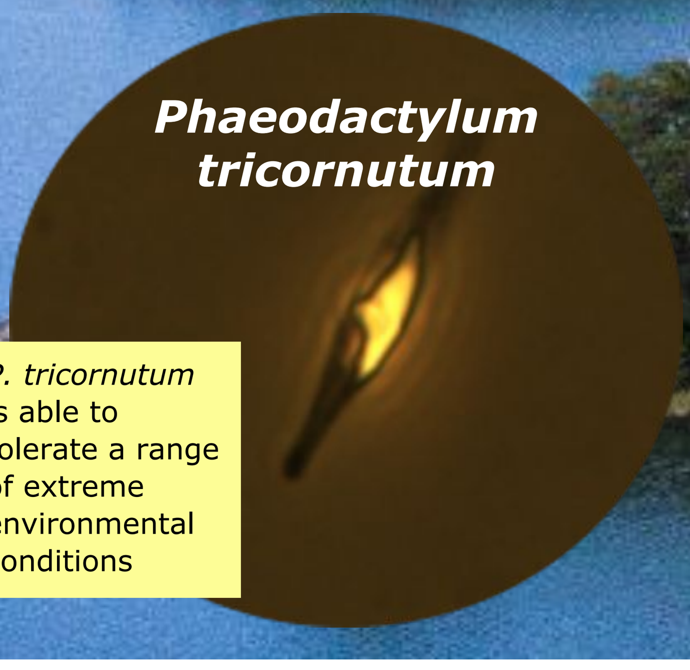
UNIVERSITY OF HELSINKI

WINNERS VS LOSERS

Integrating phenotypic and transcriptomic responses of microalgae to salinity change



P. tricornutum is able to tolerate a range of extreme environmental conditions

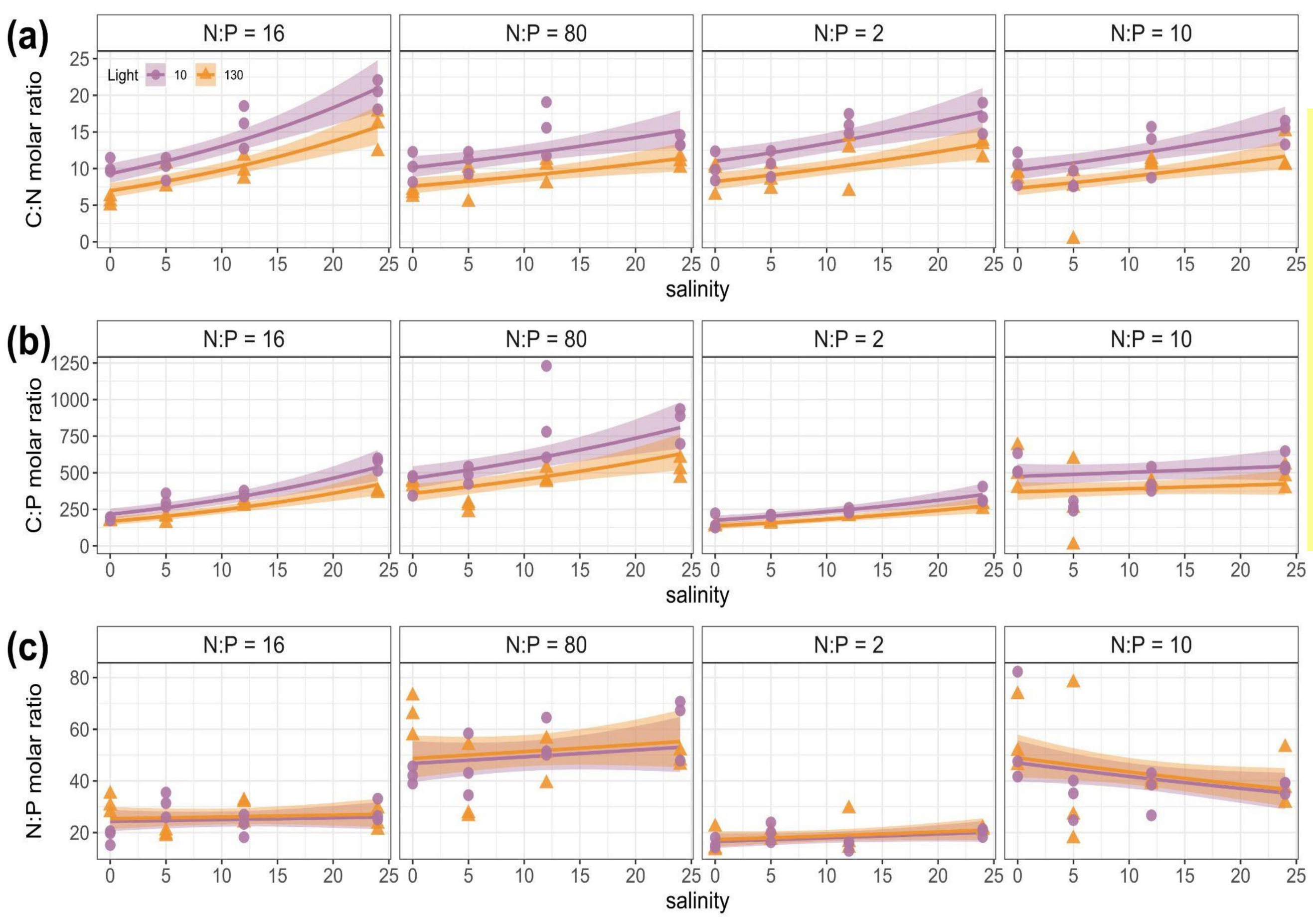
Studies have reported significant declines of cryptophyte algae – generally associated with low temperatures and high salinities – in all areas of the Baltic Sea[4]

Climate change is predicted to intensify the global water cycle, with salty ocean regions getting saltier compared to the global mean and fresh regions (including parts of the Baltic sea) getting fresher[1]. Salinity shifts in marine ecosystems could produce filtering effects, eliminating species with narrow environmental constraints, and potentially disrupting their ecosystem functions[2]. It is imperative we predict the effects of such changes on organisms to respond accordingly. However, development of robust predictions about biological responses to environmental change is held back by lack of knowledge about the capacity of organisms to respond to new regimes by plasticity and evolution[3].

PRIOR STUDY

AIM: to understand how the tradeoff between plastic response to salinity stress and resource acquisition affects microalgal stoichiometry.

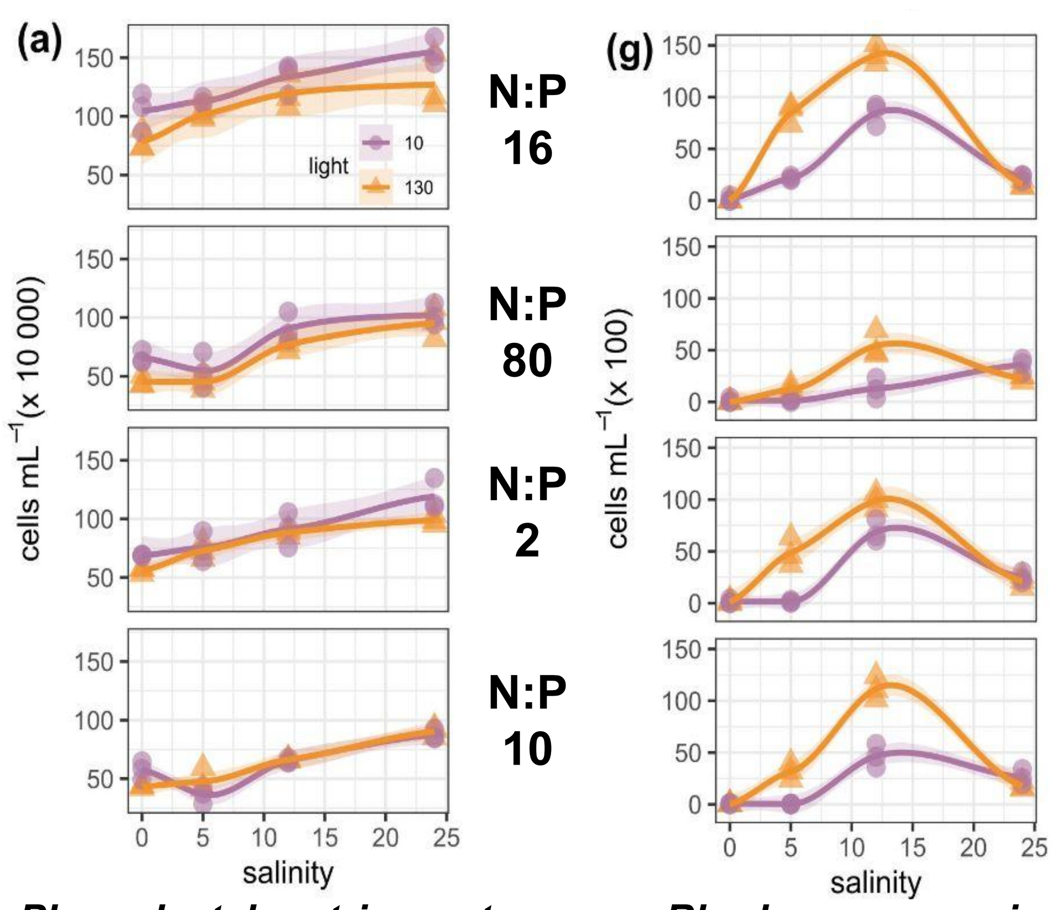
Incubated mixed microalgal cultures of ten species until they reached stationary phase: *Diatoma tenuis, Monoraphidium sp., Levanderina fissa, Synechococcus sp., Diacronema lutheri, Kryptoperidinium foliaceum, Alexandrium ostenfeldii, Skeletonema marinoi,* ***Rhodomonas marina, Phaeodactylum tricornutum***



POC and C:nutrients ratio increased significantly with salinity (weaker response under nutrient limitation)

Primary production was highly affected under hypoosmotic conditions

Difference in taxa abundance within mixed cultures point to importance of trait variability for functioning in the microalgal community under stressful environmental conditions.



Phaeodactylum tricornutum **TV335**

Rhodomonas marina **Crypto07-B1**

For more information about this study, please see Sonja Repetti's Master's thesis:

(link is also available at sonjarepetti.weebly.com)

RESEARCH PLAN

AIM: to characterise the microalgal traits underpinning success and failure in responding to changing salinity conditions

Phaeodactylum tricornutum

(1.1) Growth experiment
3 strains
5 salinities (0, 3.5, 5, 20, 35)
6 replicates
200+ generations (~**125** days)
Morphological and physiological traits:
Chlorophyll *a*, Growth rate, POC, PON, POP, Nutrient uptake
Molecular: RNA extraction (DGE analysis)

(1.2) Community growth experiment

(1.3) Bioinformatics:
Gene family evolution (diatom phylogeny)

Incorporating understudied strains from the Baltic and North seas

Rhodomonas marina

(2.1) Growth experiment
3 strains
5 salinities (0, 3.5, 5, 20, 35)
6 replicates
200+ generations (~**160** days)
Morphological and physiological traits:
Chlorophyll *a*, Growth rate, POC, PON, POP, Nutrient uptake
Molecular: RNA extraction (DGE analysis)

(2.2) Bioinformatics:
Transcriptome comparison with freshwater *Cryptomonas sp.* CPCC336

BUT WHAT ABOUT:
gene expression, the longer term, intraspecies effects?

Please provide feedback on this research plan:

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Our project will identify genetic expression changes underpinning key traits implicated in responses of microalgae to longer term changes in salinity, and associated shifts in stoichiometry. This will advance understanding of microalgal responses to environmental change, furthering the integration of plastic and evolutionary responses to better predict changes in functional group distribution in marine ecosystem models and develop robust predictions about biological responses to salinity change.

LUOVA DOCTORAL PROGRAMME IN WILDLIFE BIOLOGY RESEARCH
WIIPURILAISEN OSAKUNNAN STIPENDISÄÄTIÖ
PRO MARE BALTICUM WALTER AND ANDRÉE DE NOTTBECK FOUNDATION SR

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3 Collins, S., Boyd, P.W., Doblin, M.A. 2020. Evolution, microbes, and changing ocean conditions. *Annual Review of Marine Science 12:*181-208.
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