EFFECTS OF CLIMATE CHANGE INDUCED DOMINANCE SHIFTS IN ZOOPLANKTON COMMUNITY COMPOSITION ON THE CARBON CYCLE

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Introduction

Zooplankton communities play a vital role in marine ecosystems due to their sheer abundance and their role in ecosystem functioning[1]. Anthropogenically induced global change can shift dominance within these communities leading to potential alterations of the carbon pump in terms of carbon uptake, transport and export[2]. For instance, a potential decrease in zooplankton size could weaken the transport of organic material to the seafloor[3]. The Baltic Sea has been affected by climate change already, including temperature and salinity fluctuations, that most other seas will only experience in the future[4], thus it is important to study the effects of the changes to improve predictions for other seas.

Monitoring

Methods

Zooplankton samples were taken once a month at Tvärminne Storfjärden in the Northeastern Gulf of Finland between 1993 and 2021. The samples were counted microscopically and the most abundant groups were used for analysis.

Fig.1: Sampling site at Tvärminne Storfjärden

Preliminary Results

The preliminary results show a decline in the proportional biomass of the major zooplankton genus the copepod *Acartia* spp. and a concurrent increase of smaller zooplankton species such as the rotifer *Synchaeta* spp. along with an increase in temperature (Fig.2).

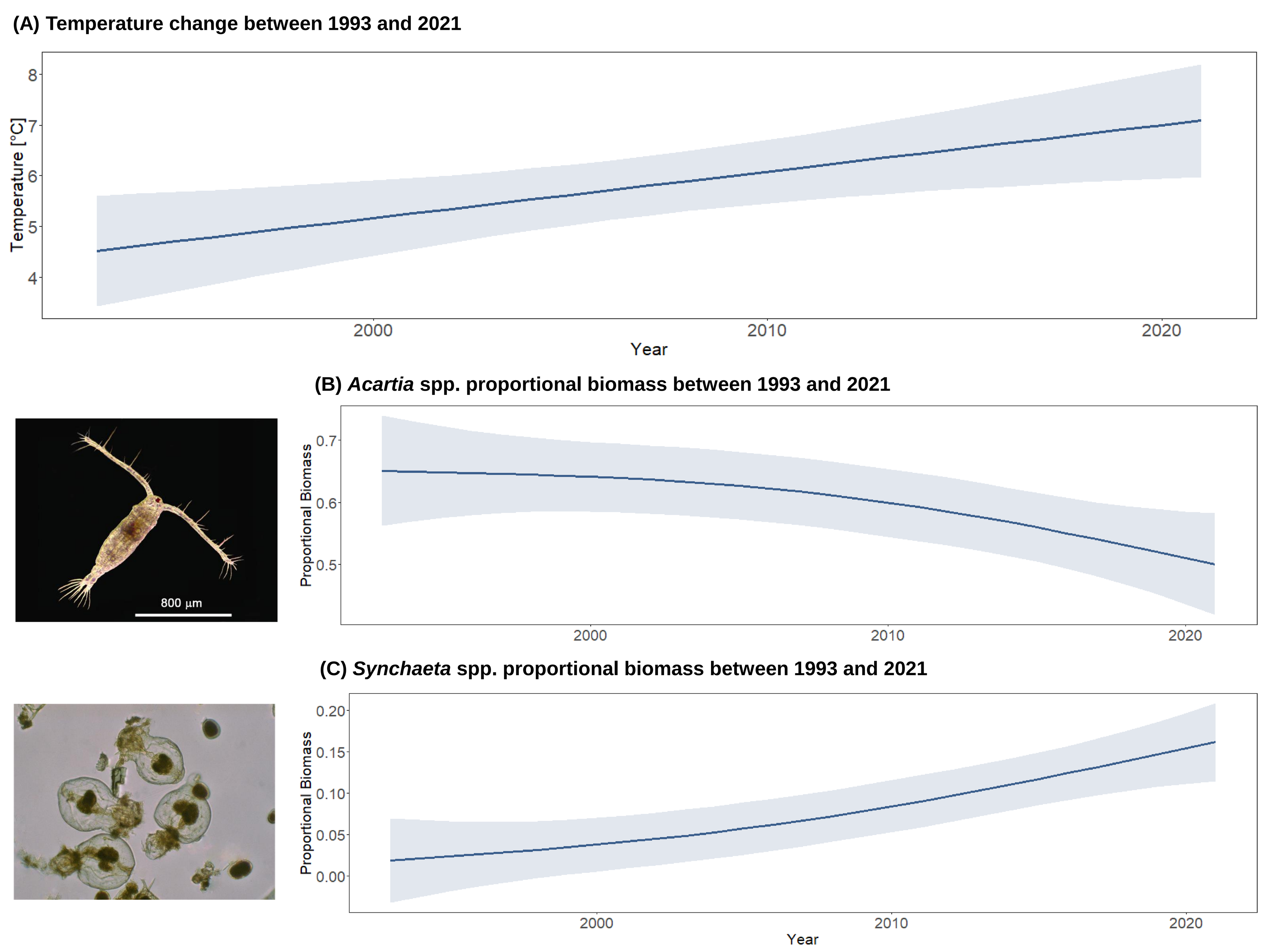

Fig.2: Long term trends of temperature (A) and proportional biomass of the copepod genus *Acartia* spp. (B) and the rotifer genus *Synchaeta* spp. (C) at Tvärminne Storfjärden.

Future Research

Monitoring methods

As monitoring efforts are crucial to identify and investigate changes and effects on the carbon cycle, different monitoring methods will be tested and compared to complement and improve traditional monitoring, such as:

- **eDNA Metabarcoding**
- **Bulk sample Metabarcoding**
- **Automated Imaging**

Experiments

A bottle experiment will be conducted to investigate the impact of changing zooplankton dominance on carbon transport via respiration, excretion and greenhouse gas emissions (Fig. 3).

Fig.3: Experimental set-up to measure respiration, excretion and greenhouse gas emissions of zooplankton mono-cultures.

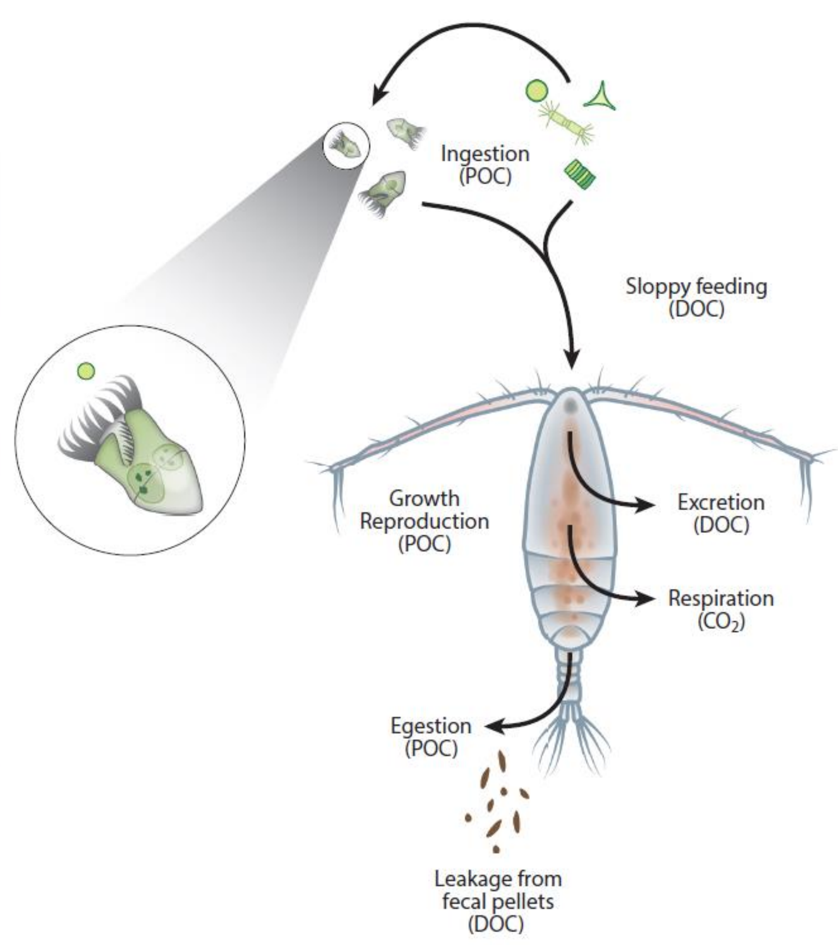

Fig.4: Overview of carbon consumption and metabolism by zooplankton. (Steinberg & Landry, 2017)

Summary

Climate change has been altering marine ecosystems in the Baltic Sea. Hence, this study aims to identify the effects these changes have on the role of zooplankton within the carbon cycle and additionally improve the methodological basis of this approach.

References

[1] Richardson, A. J. (2008). In hot water: zooplankton and climate change. *ICES Journal of Marine Science*, *65*(3), 279–295.

[2] Beaugrand, G., Edwards, M., & Legendre, L. (2010). Marine biodiversity, ecosystem functioning, and carbon cycles. *Proceedings of the National Academy of Sciences*, *107*(22), 10120.

[3] Brun, P. et al. (2019). Climate change has altered zooplankton-fuelled carbon export in the North Atlantic. *Nature Ecology and Evolution*, *3*(3), 416–423.

[4] Reusch, T. B. H. et al. (2018). The Baltic Sea as a time machine for the future coastal ocean. In *Science Advances* (Vol. 4, Issue 5).

[5] Steinberg, D. K., & Landry, M. R. (2017). Zooplankton and the Ocean Carbon Cycle. *Annual Review of Marine Science*, *9*(1), 413–444. (https://doi.org/10.1146/annurev-marine-010814-015924)

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