RTG R3

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The role of copepod species change for food-web functioning and ecosystem reversibility

A. Kunzmann°, D. Straile, E. Yohannes & K.-O. Rothhaupt

Limnological Institute, University of Konstanz (Germany)

°alessandra.kunzmann@uni-konstanz.de

Background

Copepods are important components of planktonic food-webs and dominate the crustacean zooplankton biomass especially in oligotrophic lakes[1]. In contrast to ***Daphnia***, their **population regulation and food-web effects are less well known**. Eutrophication in **Lake Constance**, the third-largest lake in Central Europe, resulted in substantial alterations within the crustacean zooplankton community and the species composition changed[2]. With re-oligotrophication, the changes in the relative importance of species were only partially reversed. Hence, **reversibility** of the role of copepods and cladocerans in the food-web depends on whether the identity of different species is **functionally redundant** in respect to **ecosystem functioning**.

Hypotheses

Different zooplankton species are not functionally redundant, but:

- provoke different **cascading trophic interactions**
- differ in their **selective feeding behavior**
- may have **contrasting impacts** on the lake‘s ecosystem

Methods

Field experiments:

- *in situ* bottle grazing experiment (06. – 08. Sep. 17)
- experiment duration: 72 h
- water depth: 2 m
- mean temperature: 19.1°C
- grazer treatments: similar biomasses of 3 copepod species (*Eudiaptomus gracilis*, *Cyclops* sp., *Mesocyclops leuckarti*) and 2 cladoceran species (*Daphnia longispina*, *Daphnia cucullata*) + control treatment without zooplankton
- identification and quantitative evaluation of phytoplankton and ciliates

Data analysis:

- ANOVA, Tukey *post-hoc* test, ANOSIM (Fig. 1 + 2)

Conclusions

- predation on ciliates by copepods (E, Cy, M treatment; Fig. 1) may reduce the feeding pressure on phytoplankton inducing a **trophic cascade effect**
- **biomass reduction** was stronger for ciliates than for phytoplankton
- **community structure differences** between treatments were more pronounced for **phytoplankton** than for ciliates (Fig. 2)
- strong **group-specific** differences in **feeding impact**, but also evidence for **species-specific** differences within groups

Results

- stronger **phytoplankton** biomass reduction by ***Daphnia*** (L, Cu)
- **ciliates** biomass reduction by **copepods** (E, Cy, M)
- significant differences in **prey species composition**

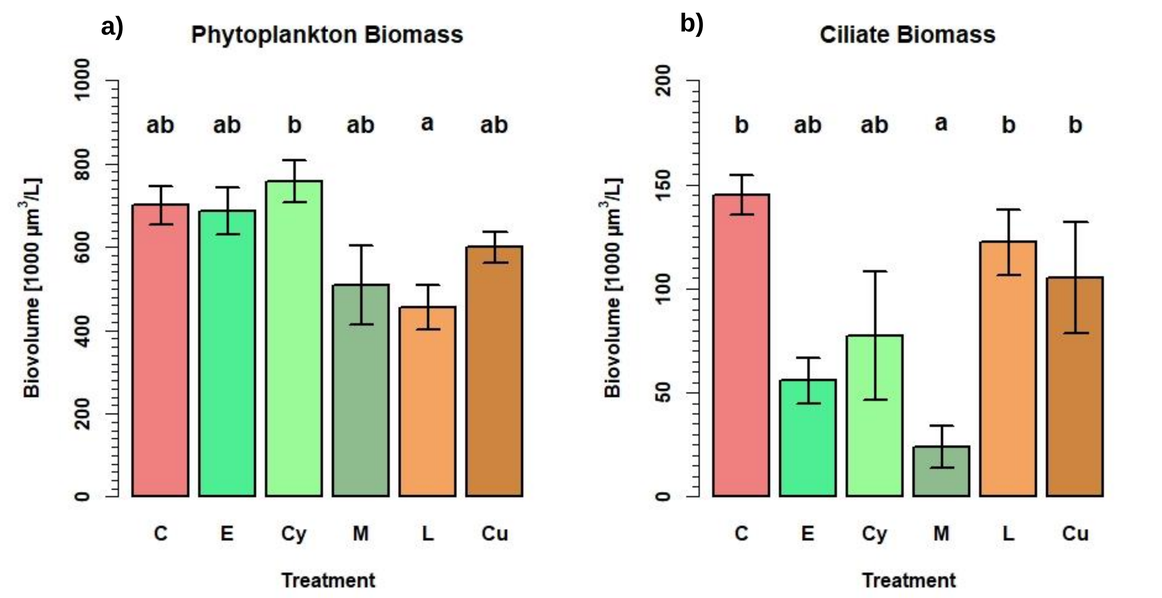

Figure 1:
Mean (+/- SE) phytoplankton (a) and ciliate (b) biomass changes between treatments (n=3).
C: control treatment, E: *E. gracilis*, Cy: *Cyclops* sp., M: *M. leuckarti*, L: *D. longispina*, Cu: *D. cucullata*.

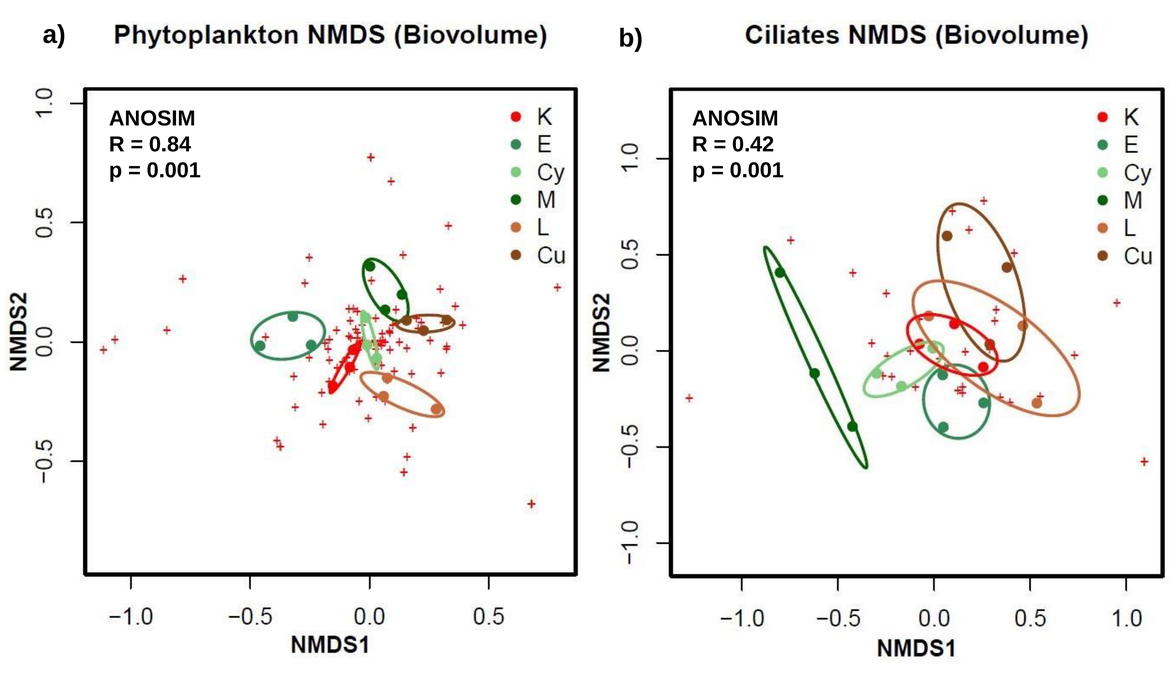

Figure 2:
Non-Metric Multidimensional Scaling (NMDS) plots for a) phytoplankton and b) ciliates. Circles indicate standard errors. C: control treatment, E: *E. gracilis*, Cy: *Cyclops* sp., M: *M. leuckarti*, L: *D. longispina*, Cu: *D. cucullata*.

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[2]Einsle, U. (1988). The long-term dynamics of crustacean communities in Lake Constance (Obersee, 1962-1986). S*wiss Journal of Hydrology*, **50**(2): 136-165.