R3 – Responses to biotic and abiotic changes, Resilience and Reversibility of lake ecosystems

Universität Konstanz

B3: The role of copepod species change for food-web functioning and ecosystem reversibility

Alessandra Kunzmann, Dietmar Straile, Elizabeth Yohannes & Karl-Otto Rothhaupt

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**. Furthermore, differences in ecosystem effects between closely related and morphologically similar copepods have been demonstrated[2]. Eutrophication in Lake Constance resulted in substantial alterations in the relative importance of the copepods in the crustacean zooplankton community and the species composition changed: in the 1950s, the calanoid copepod *Heterocope borealis* went extinct due to intra-guild predation by the invasive cyclopoid copepod *C. vicinus*. With re-oligotrophication, the changes in relative importance were only partially reversed. Hence, **reversibility** of the role of copepods in the food web depends on whether the identity of different species is **functionally redundant**.

Project idea

This project aims to explore to which extent zooplankton species identity is functionally important, i.e. whether copepod or cladoceran diversity in the lake is redundant in respect to ecosystem functioning.

Key questions:

- Which biotic factors (**functional traits**) influence **prey selection** in crustacean zooplankton?
- How does **selective feeding** in zooplankton affect the planktonic food-web?
- What are the **seasonal impacts** of different zooplankton on lake food-web functioning?

Hypotheses:

Different zooplankton species are not functionally redundant, but:

- differ in their **size-selective** feeding behaviour
- provoke different **cascading trophic interactions**
- differentially prey upon nauplii, i.e. impact other copepod population dynamics via **intra-guild interactions**

Methods

Field experiments:

- bimonthly *in situ* bottle grazing experiments (Fig. 1)
- grazer treatments: 3 copepod species, 2 cladoceran species + control treatment without zooplankton
- identification and quantitative evaluation of nauplii, rotifers, ciliates, phytoplankton, and bacteria
- chlorophyll a extraction and spectrophotometric measurements as proxy for total phytoplankton biomass

Data analysis:

- biomass changes, treatment effects (Fig. 2 + 3)
- functional trait estimation
- seasonal variance

Planned: molecular approaches

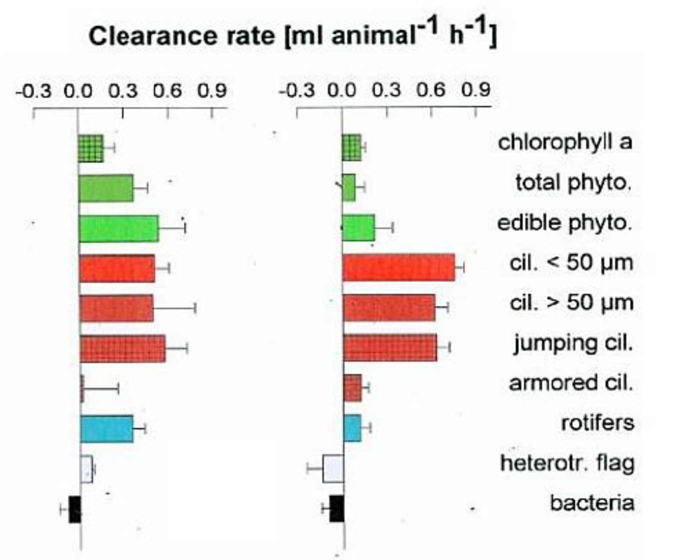

Figure 1: Preliminary results for food web effects of *Eudiaptomus gracilis*. Clearance rates obtained from *in-situ* bottle grazing experiments (2L-bottles, filled with lake water <200µm, incubation time 3 days. Ehret 2000).

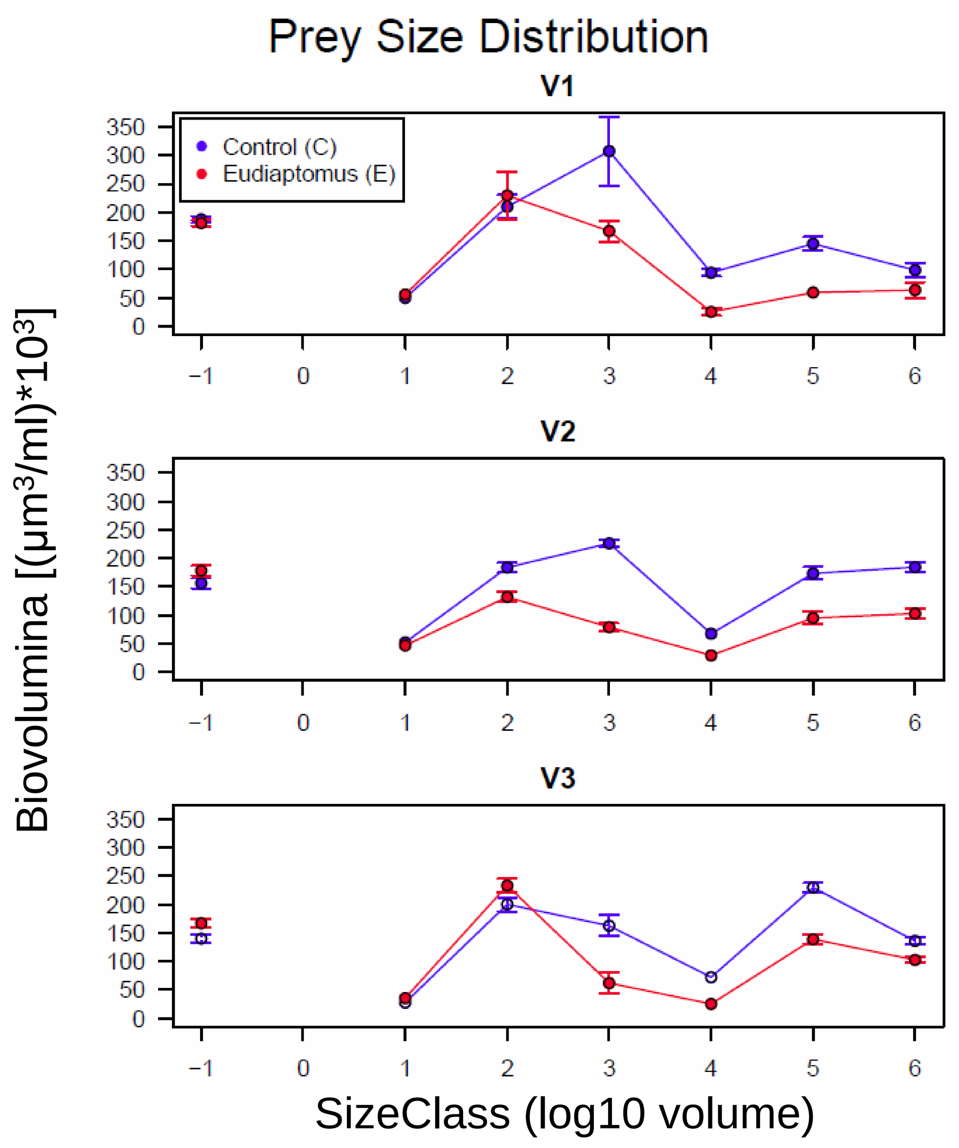

Figure 2: Influence of *Eudiaptomus gracilis* on prey size distribution. –1: heterotrophic zooflagellates and bacteria; 1 – 6: phytoplankton, ciliates, and rotifers (data from Ehret 2000).

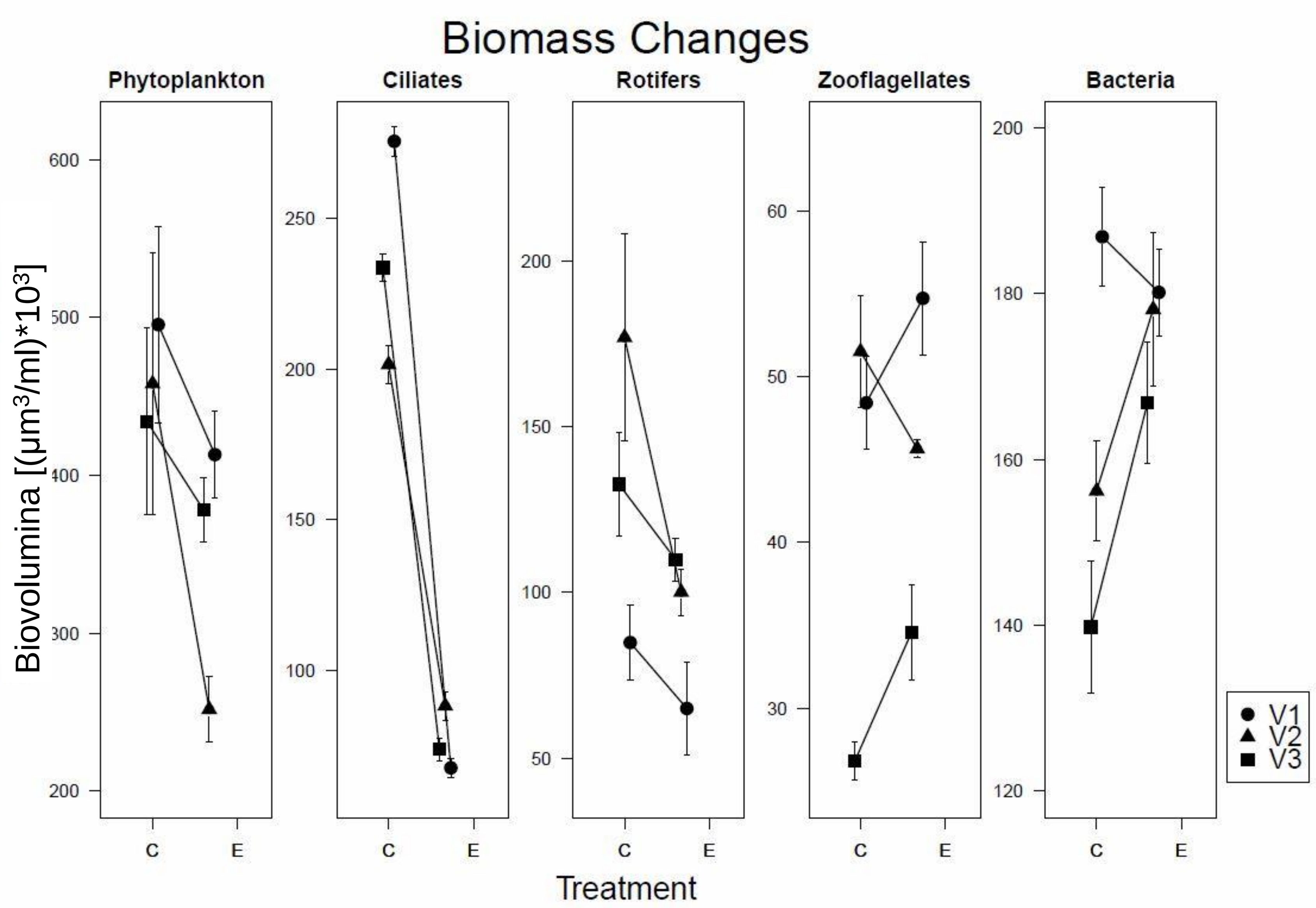

Figure 3: Biomass changes in different prey groups due to predation by *Eudiaptomus gracilis*. C: control treatment, E: copepod treatment. V1: 22.-25.09., V2: 29.09.-02.10., V3: 06.-09.10. (data from Ehret 2000).

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References

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[2]Matthews, B., S. Hausch, C. Winter, C. A. Suttle, and J. B. Shurin. 2011. Contrasting Ecosystem-Effects of Morphologically Similar Copepods. PLoS One **6**: e26700.