Impact of copepod grazing on developmental dynamics of an iron-induced phytoplankton bloom (EisenEx)

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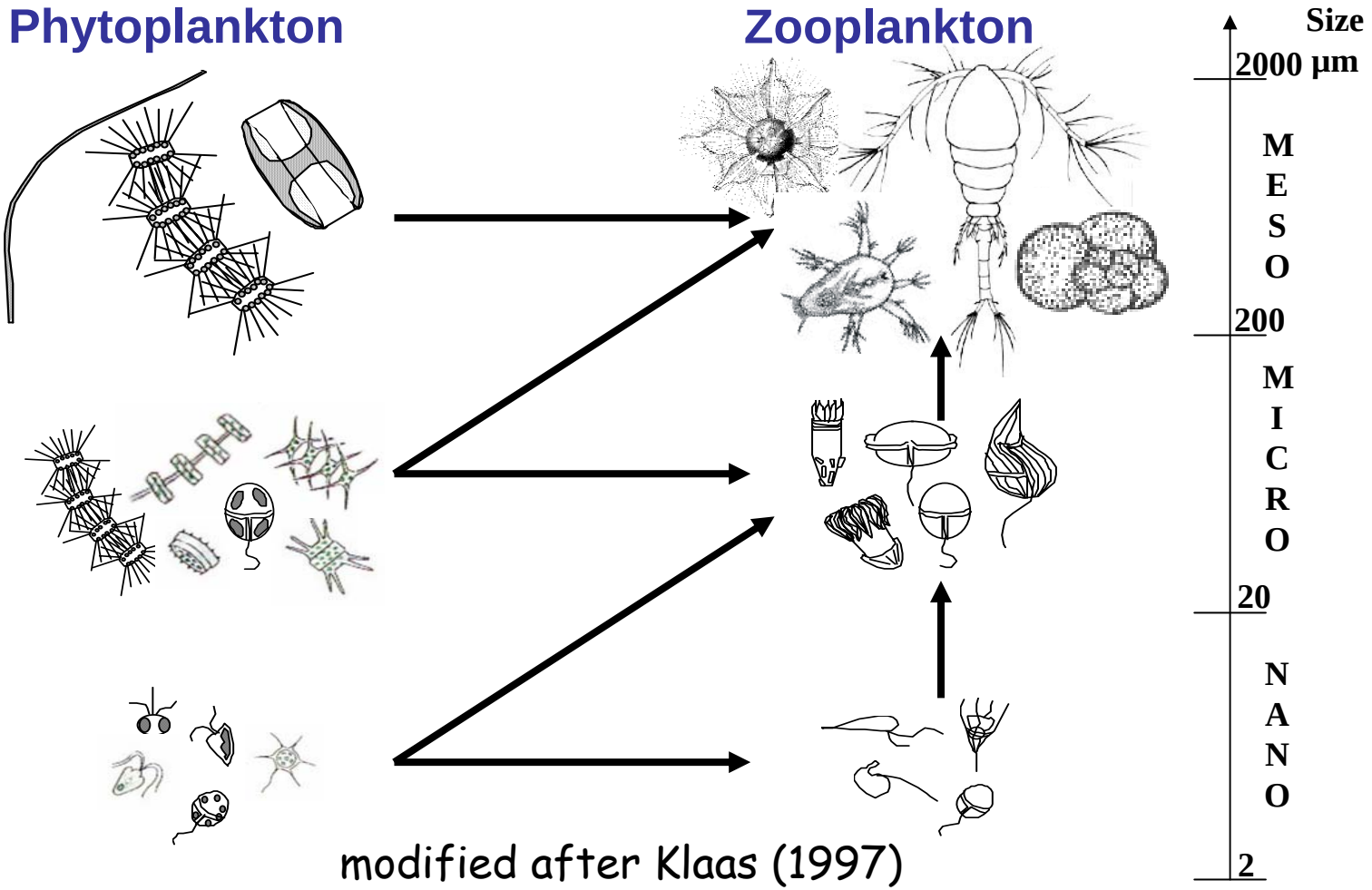
Food web dynamics



Potential role of small pelagic copepods in the ecosystem of the Southern Ocean

(Dubischar *et al.* 2002)

- Small copepods (e.g. *Oithona*, *Ctenocalanus*, *Oncaea*) show high abundances and account for a significant amount of the zooplankton biomass

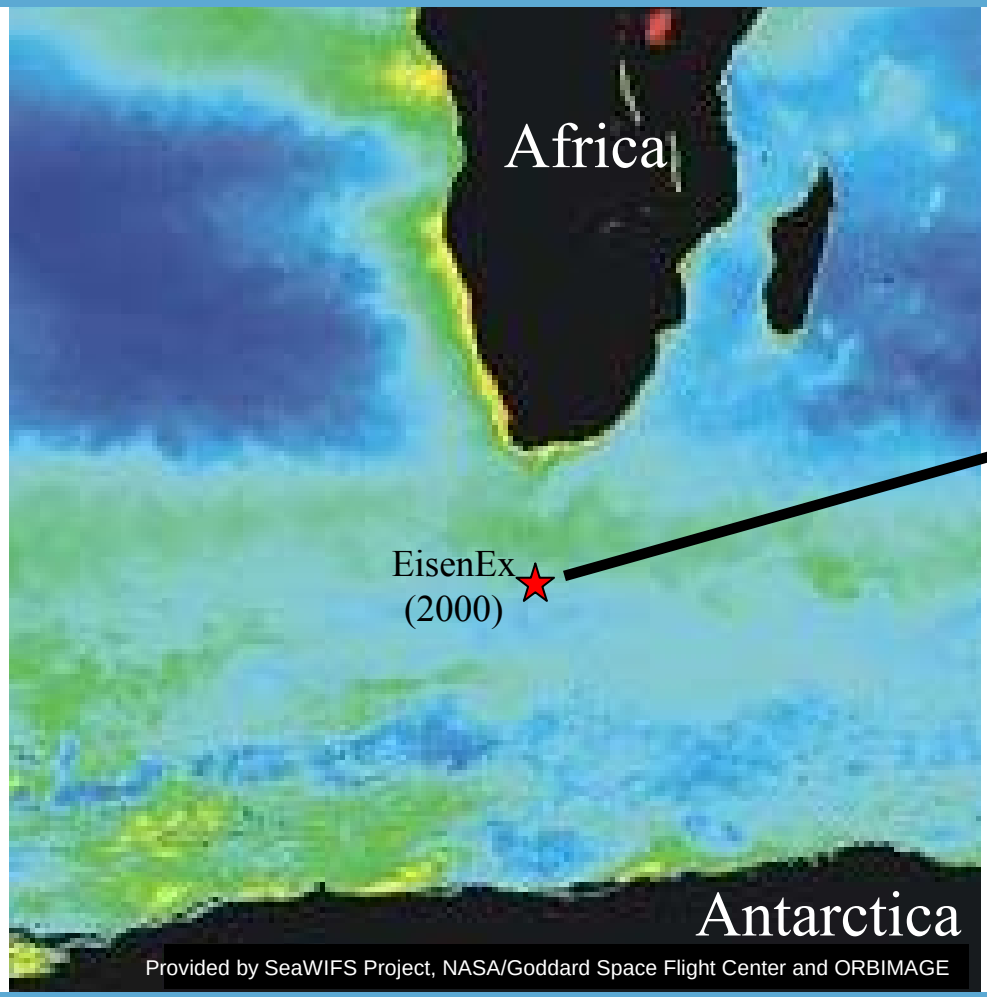
- Intensive grazing pressure on phytoplankton, protozoa, detritus and faecal pellets in the euphotic zone

  + turnover rate of organic material → regeneration of macronutrients

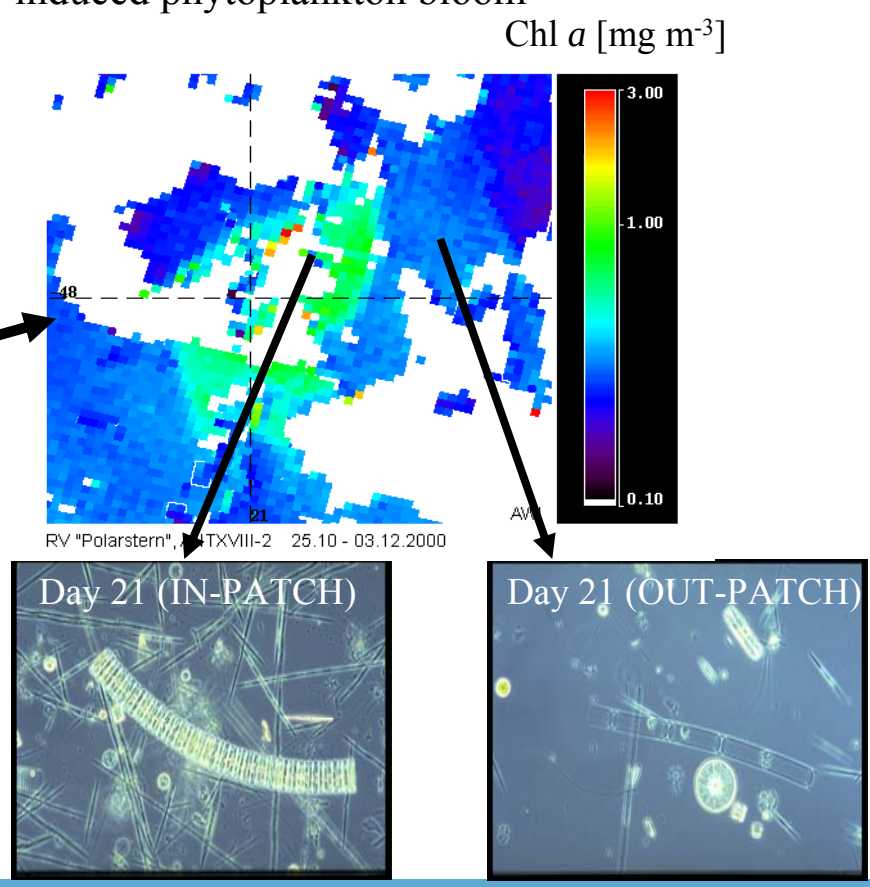
  – vertical particle fluxes

- Food source for many large pelagic predators

Cruise track and area of fertilization



SeaWIFS satellite image of the Fe-induced phytoplankton bloom



Methods

- 200 ml water samples (microprotozoa)
- concentrated water samples (metazooplankton)

10 µm gauze

- 7 discrete depth between 10 and 150 m

(temporal trend: 80 m depth-integrated abundance and biomass)

Statistical data analysis:

Differences between IN- and OUT-STATIONS:

UNPAIRED T-TEST

Correlation between vertical distribution of individual parameters:

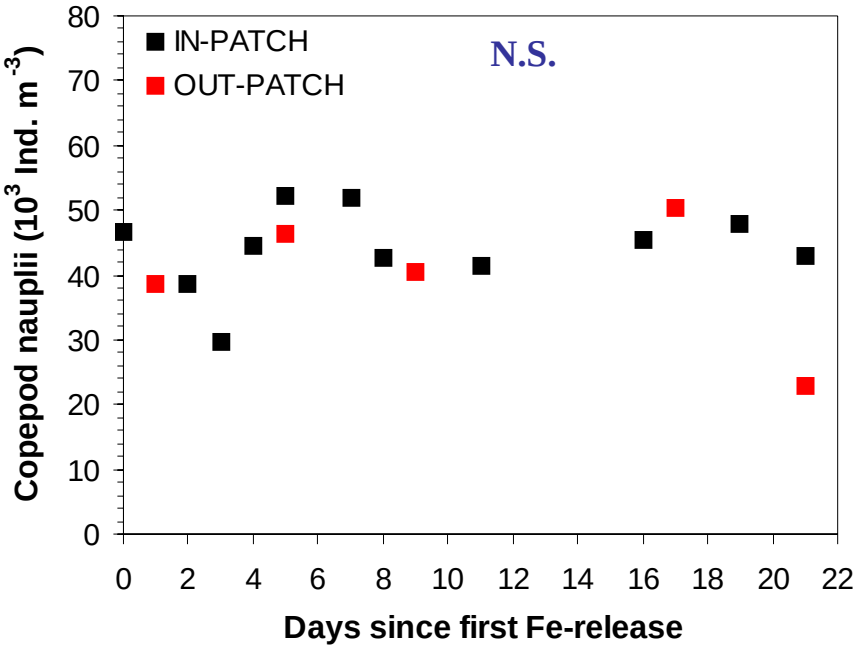
PARTIAL CORRELATION ANALYSIS

Objectives

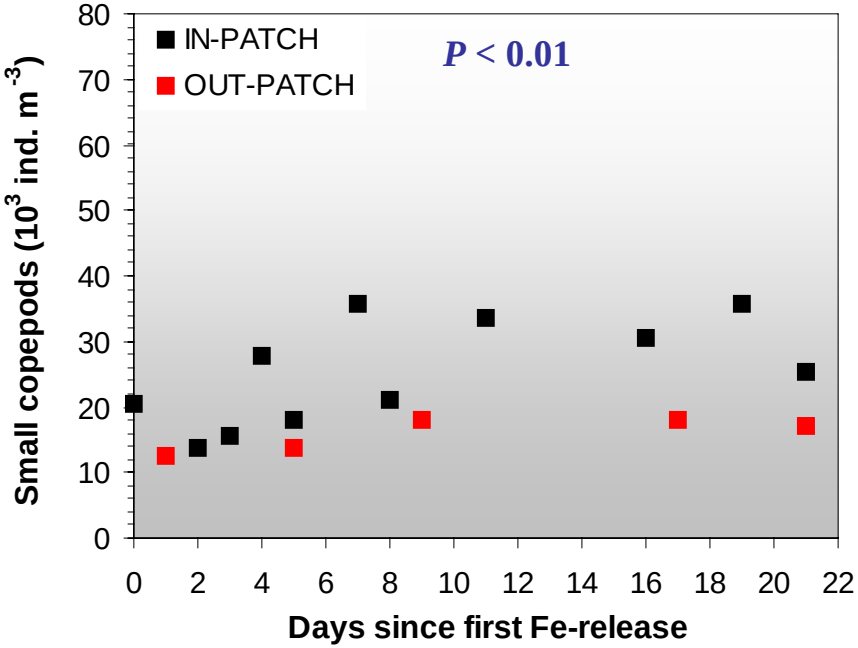
- What is the response of the small copepod community during the experiment?
- How does grazing impact of copepods affect the temporal development of the microprotozoan groups?
- How does this affect microprotozoan grazing on the phytoplankton bloom?

Temporal development of small copepods

Copepod nauplii



Copepodites and adults of small species (<1.5 mm)

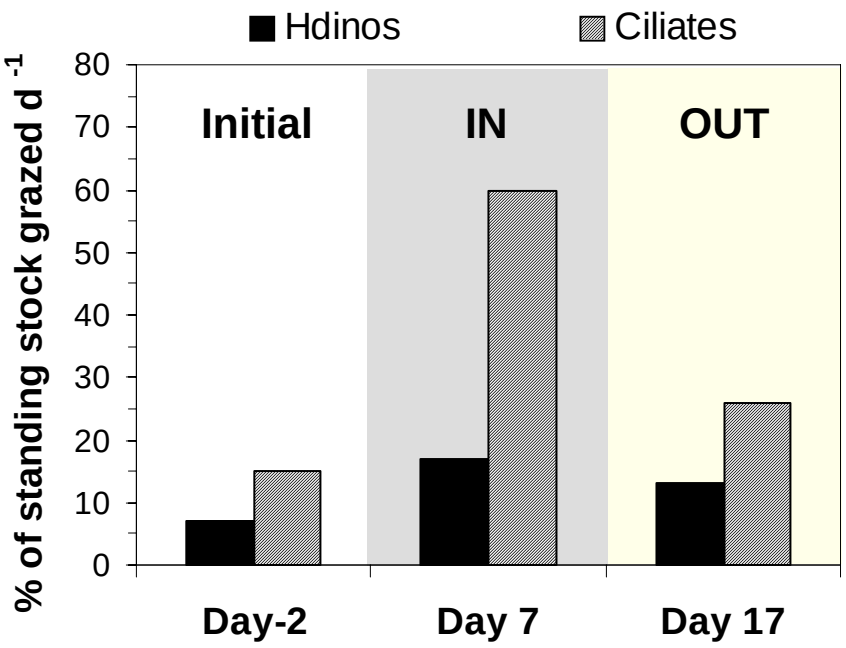


N.S. = not significant

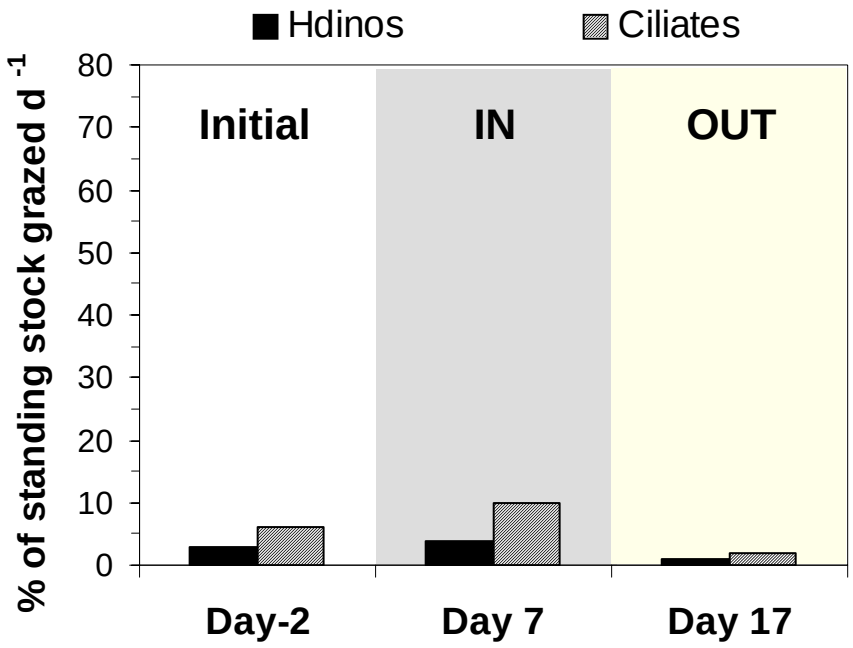
Grazing impact of metazoa

Calculated from clearance rates of Schultes et al. (in prep.)

Small copepods (<1.5 mm)



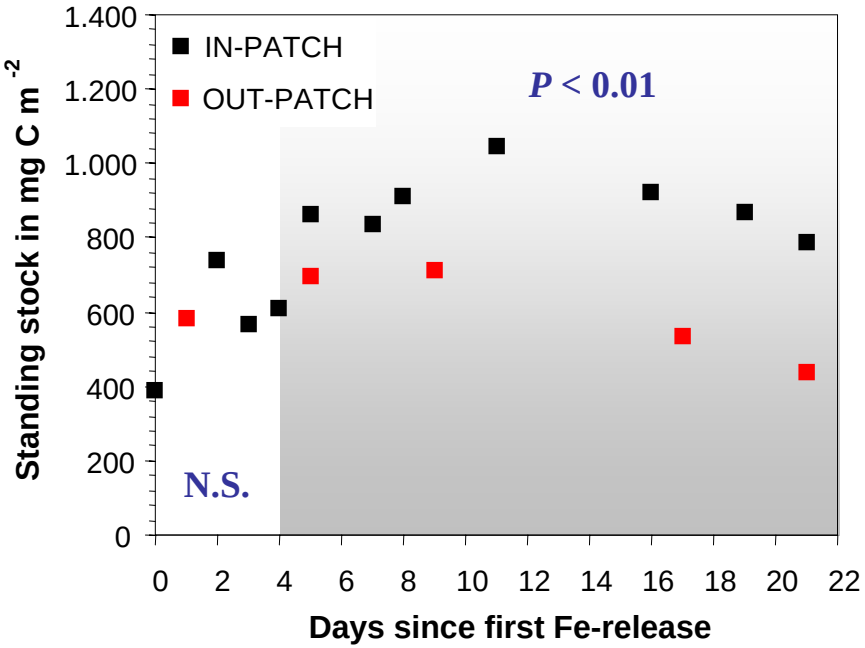
Large copepods (>2 mm)



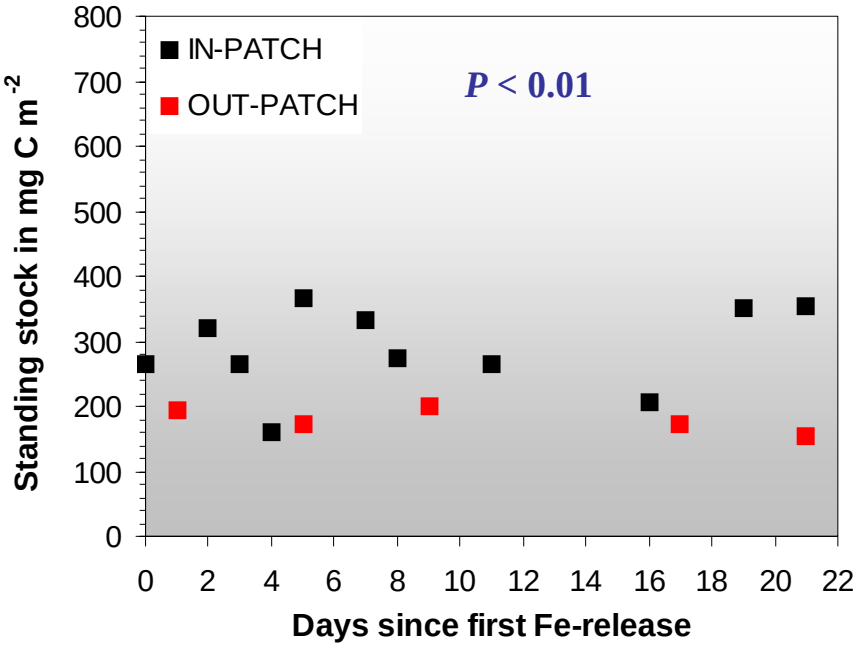
Temporal development of microprotozoa

(integrated over 80 m depth)

Heterotrophic dinoflagellates



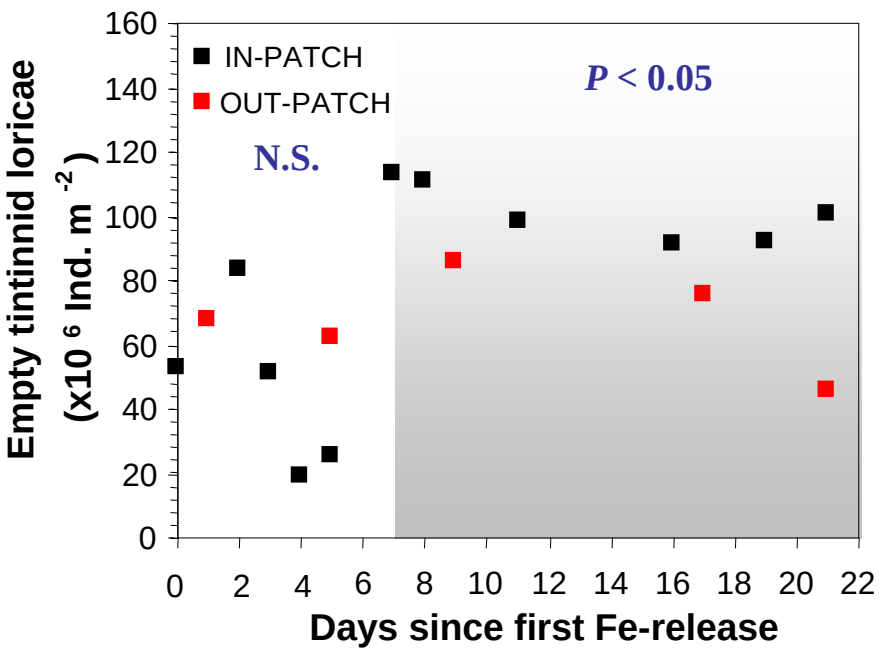
Aloricate + tintinnid ciliates



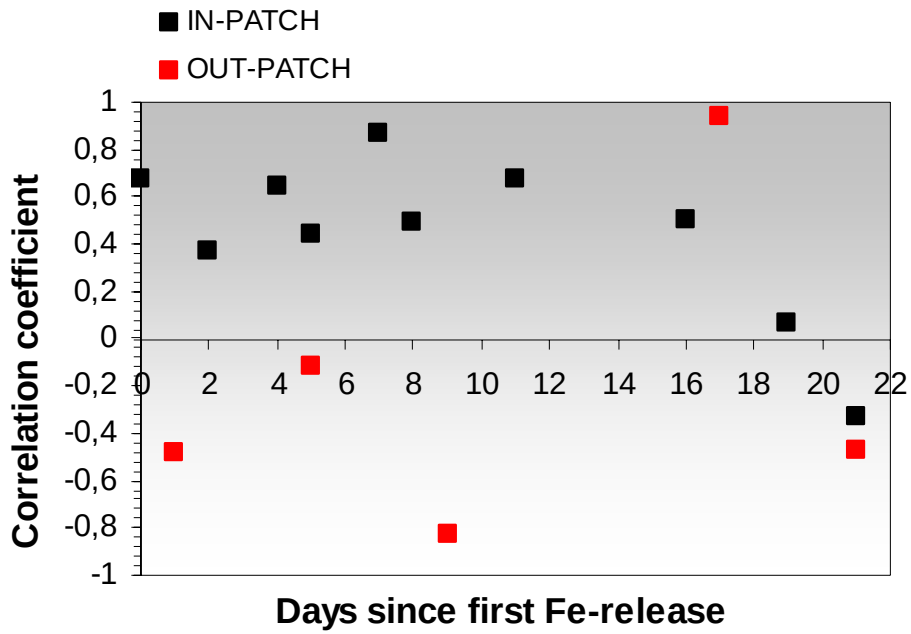
N.S. = not significant

Other indicators for grazing on microprotozoa

Empty tintinnid loricae
(integrated over 150 m depth)



Vertical distribution: Tintinnid ciliates
vs. small copepods (<1.5 mm)



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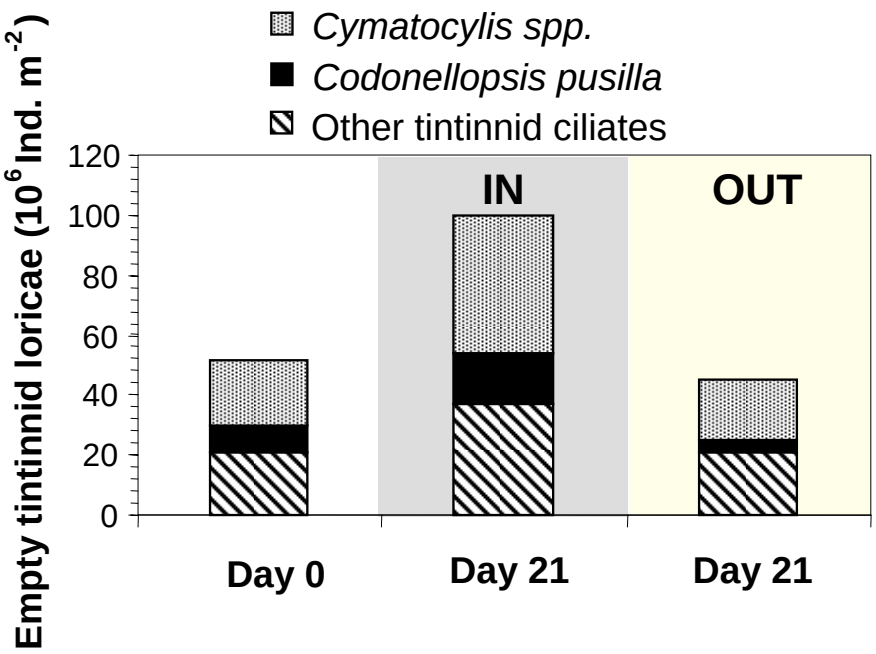
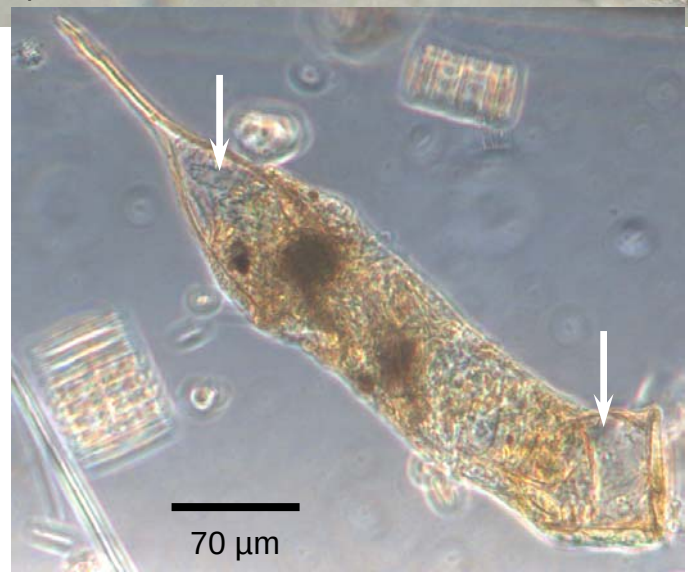
Other indicators for grazing on microprotozoa

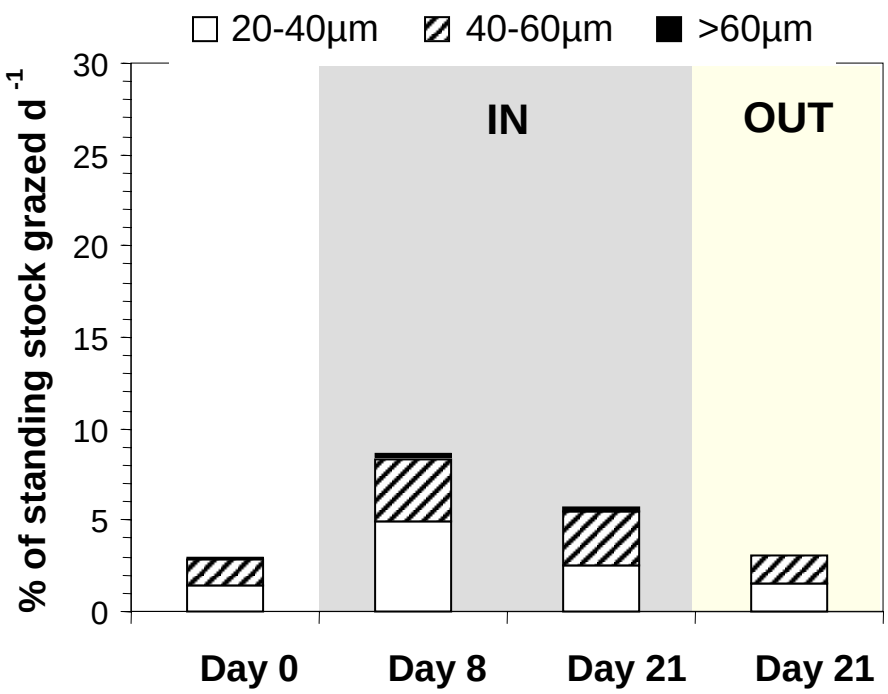




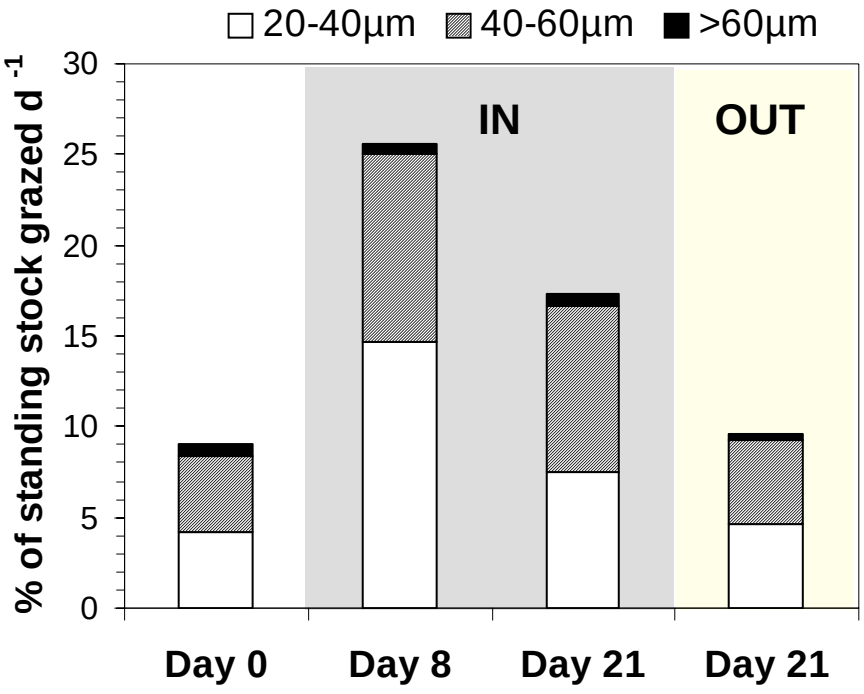
Grazing impact of microprotozoa on the bloom

Calculated from clearance rates of dark incubation experiments

Diatoms



Other phytoplankton



Conclusions

- ☆ Vertical net hauls seriously undersample small copepods in contrast to Niskin bottle sampling
- ☆ Small copepods show a clear increase in the iron-induced bloom indicating that they were food limited
- ☆ Heterotrophic dinoflagellates and aplastidic ciliates stocks are mainly controlled by small copepods
- ☆ Interactions between copepods and microprotozoa facilitated population growth of diatoms within an iron-induced bloom

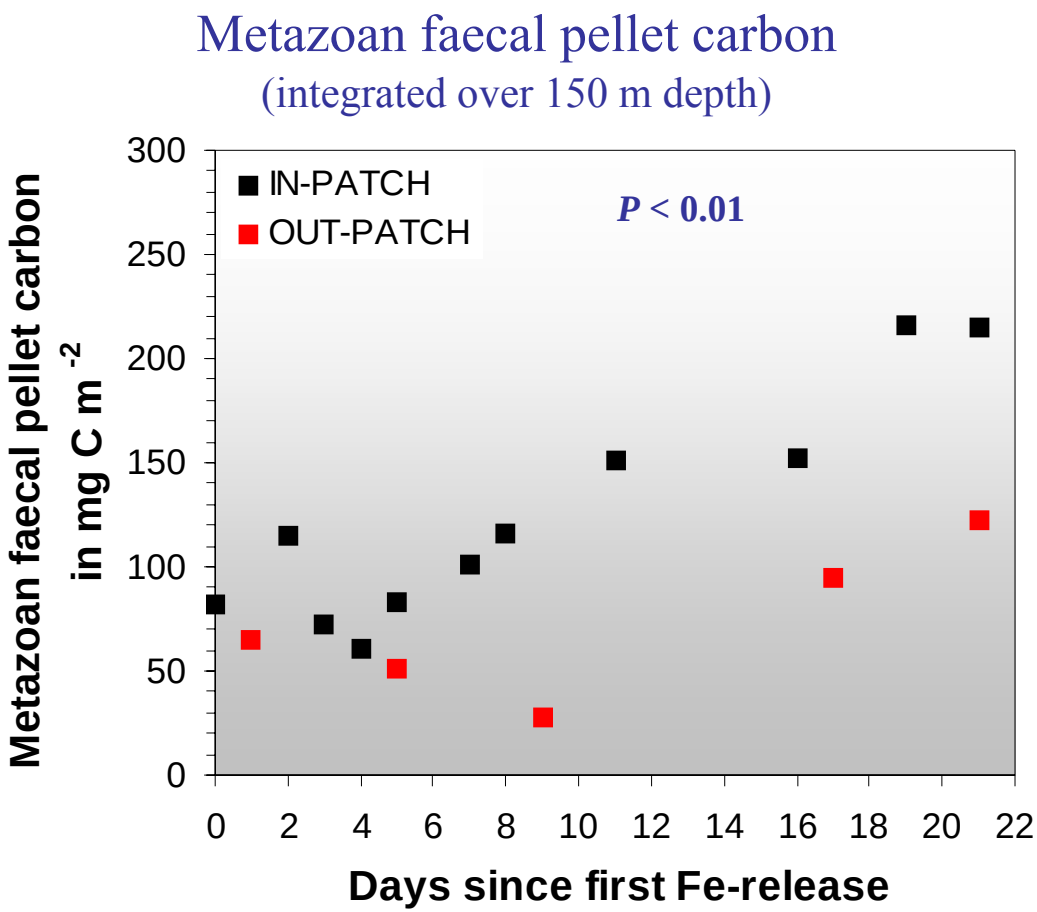
Acknowledgements

Many thanks to

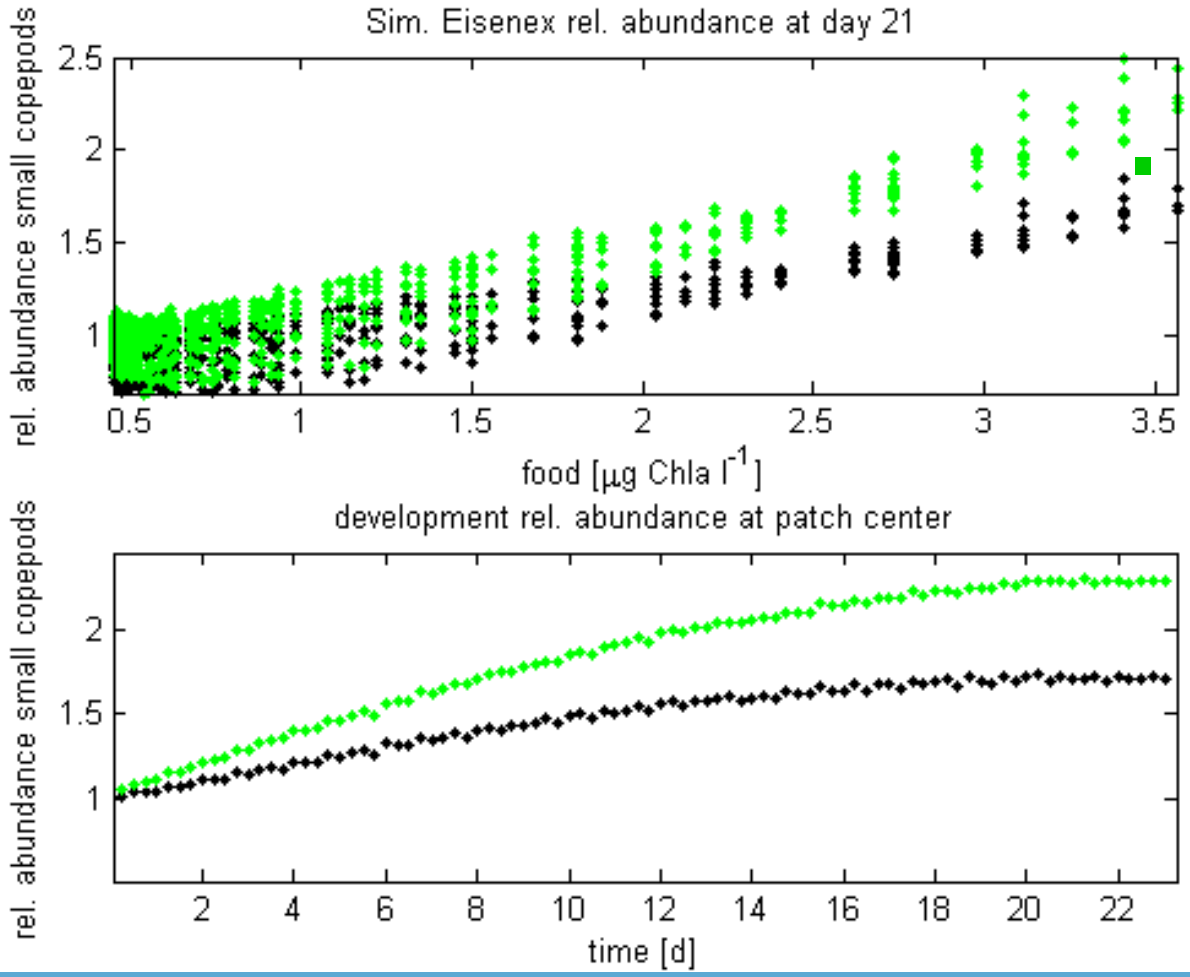
the crew of R.V *Polarstern and participants*

of EisenEx

Grazing impact of metazoa



Mechanism for congragation of small copepods

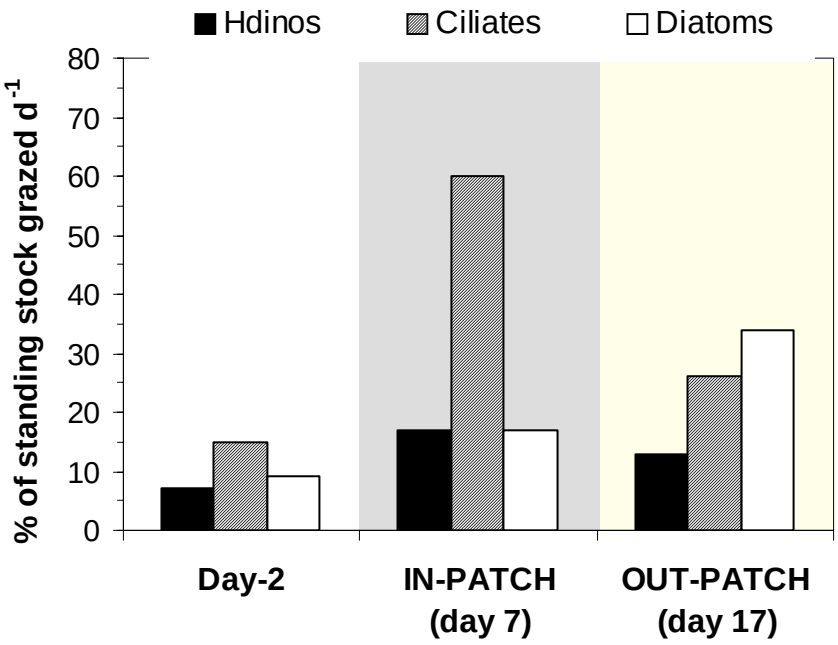


Krägefsky et al. (in prep.)

- mean over 80 m depth
- mean over 160 m depth

Grazing impact on microprotozoa

Small copepods (<2.0 mm)



Calculated from clearance rates of Schultes et al. (in prep.)

Large copepods (>2 mm)