

Trophic sources and feeding impacts of microzooplankton on phytoplankton community in the Kuroshio

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Background

- ◆ The Kuroshio is a major spawning ground of various forage fishes even under biologically unproductive conditions.
- ◆ Microbial food web is thought to be predominant among the trophodynamics in plankton community in the North Pacific Subtropical Gyre including the Kuroshio.
- ◆ There is limited knowledge on trophic sources and pathways at lower trophic levels of ecosystem in the Kuroshio of the East China Sea (ECS-Kuroshio).

Objectives

- ◆ Measure microzooplankton grazing rates and impacts on phytoplankton community using dilution experiments.
- ◆ Clarify trophic sources and pathways to microzooplankton community.
- ◆ Evaluate importance of microzooplankton for trophodynamics to higher trophic levels.

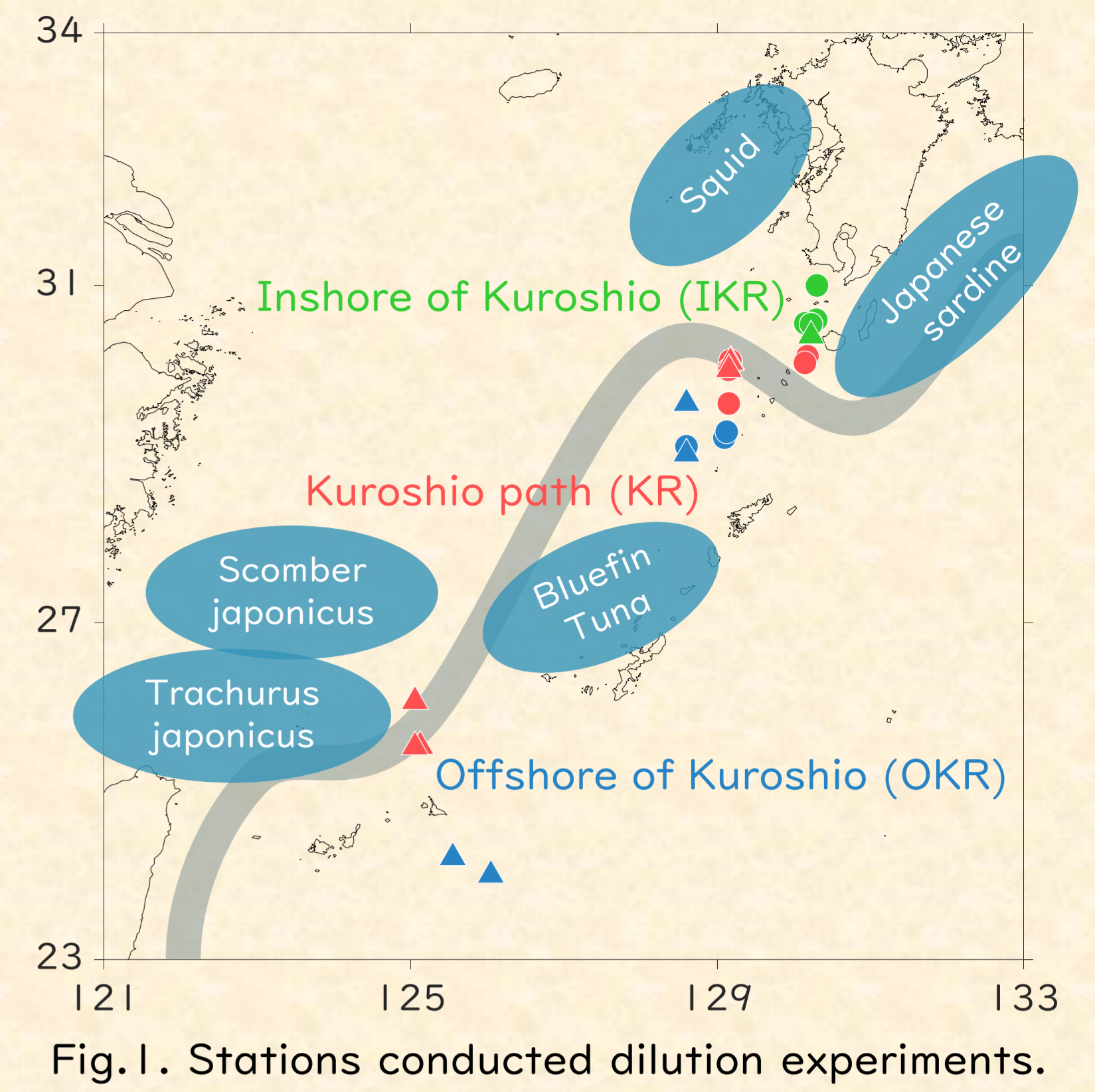


Fig. 1. Stations conducted dilution experiments.

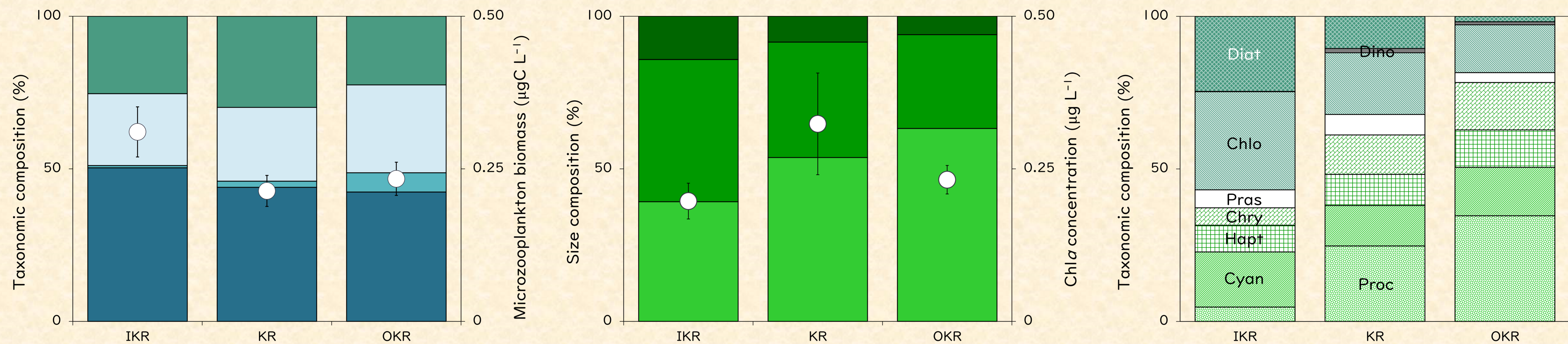


Fig. 2. Microzooplankton biomass and their taxonomic compositions (left), chlorophyll *a* concentrations and their size fraction (middle), and taxonomic composition of phytoplankton community (right) in the three regions. IKR: inshore of Kuroshio path. KR: Kuroshio path. OKR: offshore of Kuroshio path. NC: naked ciliates. TC: tintinnids. CN: copepod nauplii. Micro: > 1 µm. Nano: 2-1 µm. Pico: < 2 µm. Proc: *Prochlorococcus*. Cyan: cyanobacteria. Hapt: haptophytes. Chry: chrysophytes. Pras: prasinophytes. Chlo: chlorophytes. Dino: dinoflagellates. Diat: diatoms.

Results

- ◆ Naked ciliates composed more than half of microzooplankton biomass throughout the stations, indicating a major grazer.
- ◆ Pico to nano-autotrophs were predominated over the three regions and the relative contributions of pico-autotrophs increased IKR to OKR.
- ◆ *Prochlorococcus* and chlorophytes (\cong *Prochlorococcus*) were predominant groups.
- ◆ Toward the OKR, the relative contribution increased for *Prochlorococcus* but declined for diatom.

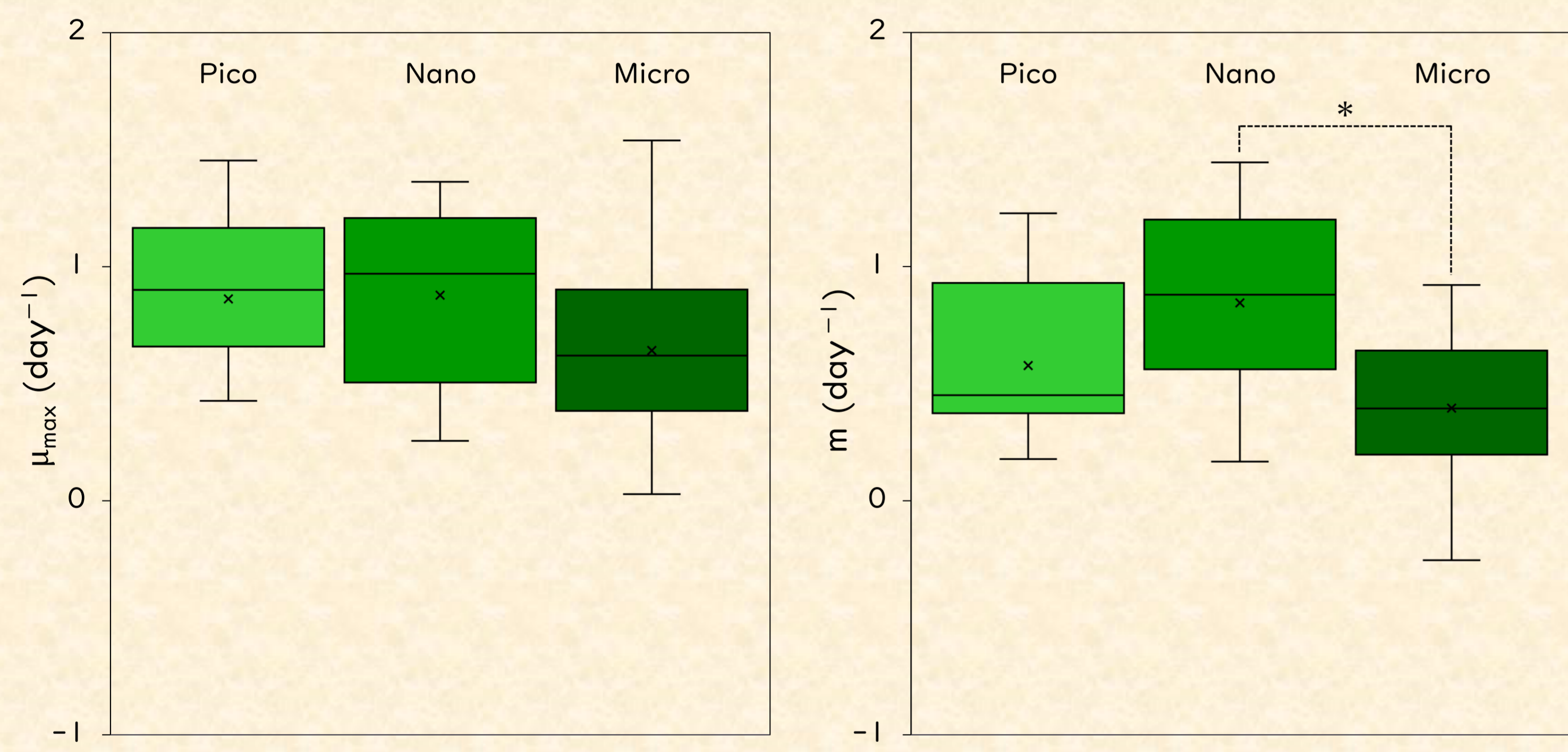


Fig. 3. Maximum phytoplankton growth rates (μ_{max} : left) and microzooplankton grazing rates (m : right) of size-fractionated chlorophyll *a* based on dilution experiments.

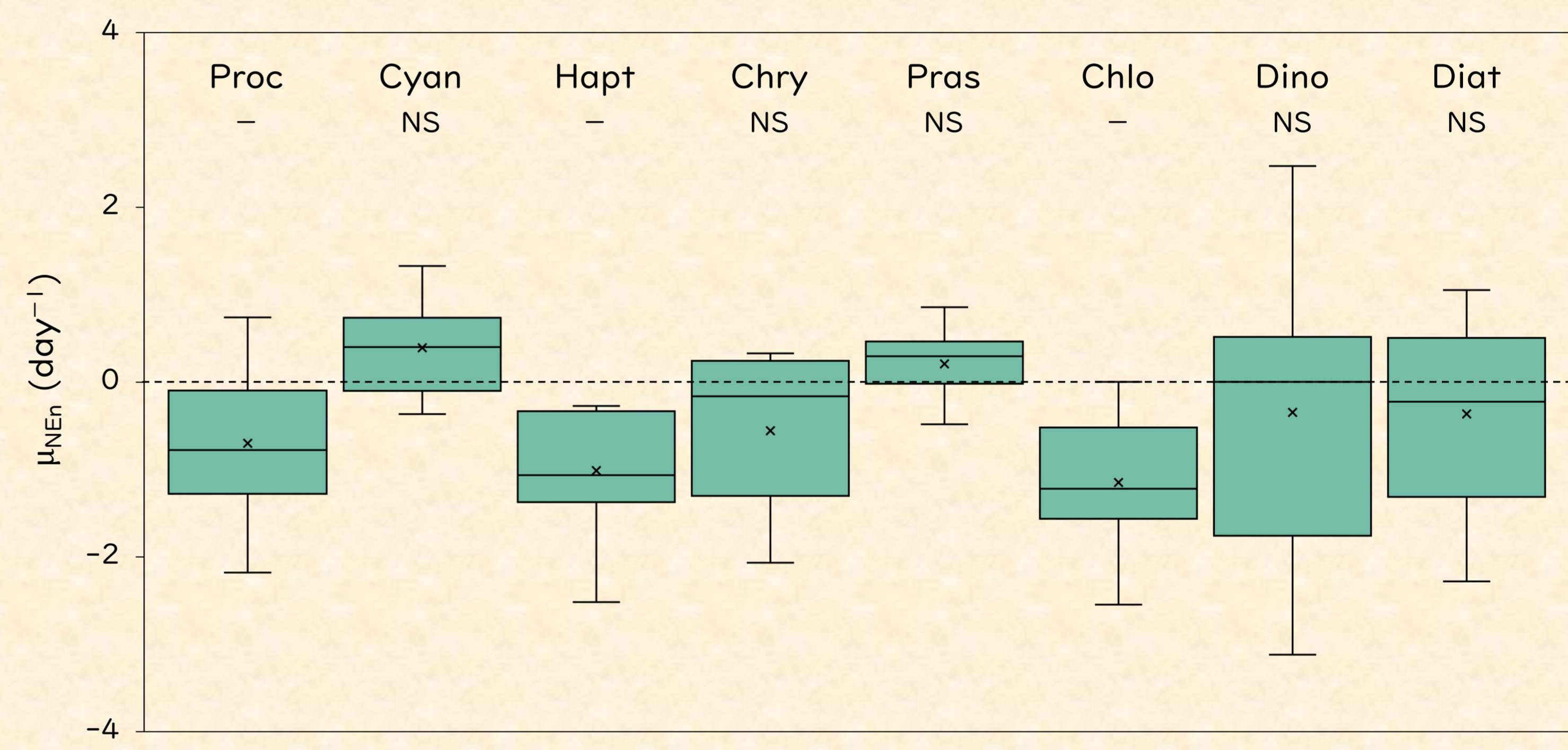


Fig. 4. Apparent growth rates of each phytoplankton taxon in non-diluted bottles without nutrients enrichment (μ_{NE}). -: significantly negative from zero. NS: no difference from zero.

Results

- ◆ Microzooplankton grazing rates were greater for nano-autotrophs, while maximum growth rates were similar among the three groups, implying that nano-autotrophs are consumed by microzooplankton.
- ◆ The apparent growth rates were significantly negative for *Prochlorococcus*, haptophytes and chlorophytes (\cong *Prochlorococcus*), indicating that these taxa are removed by microzooplankton.

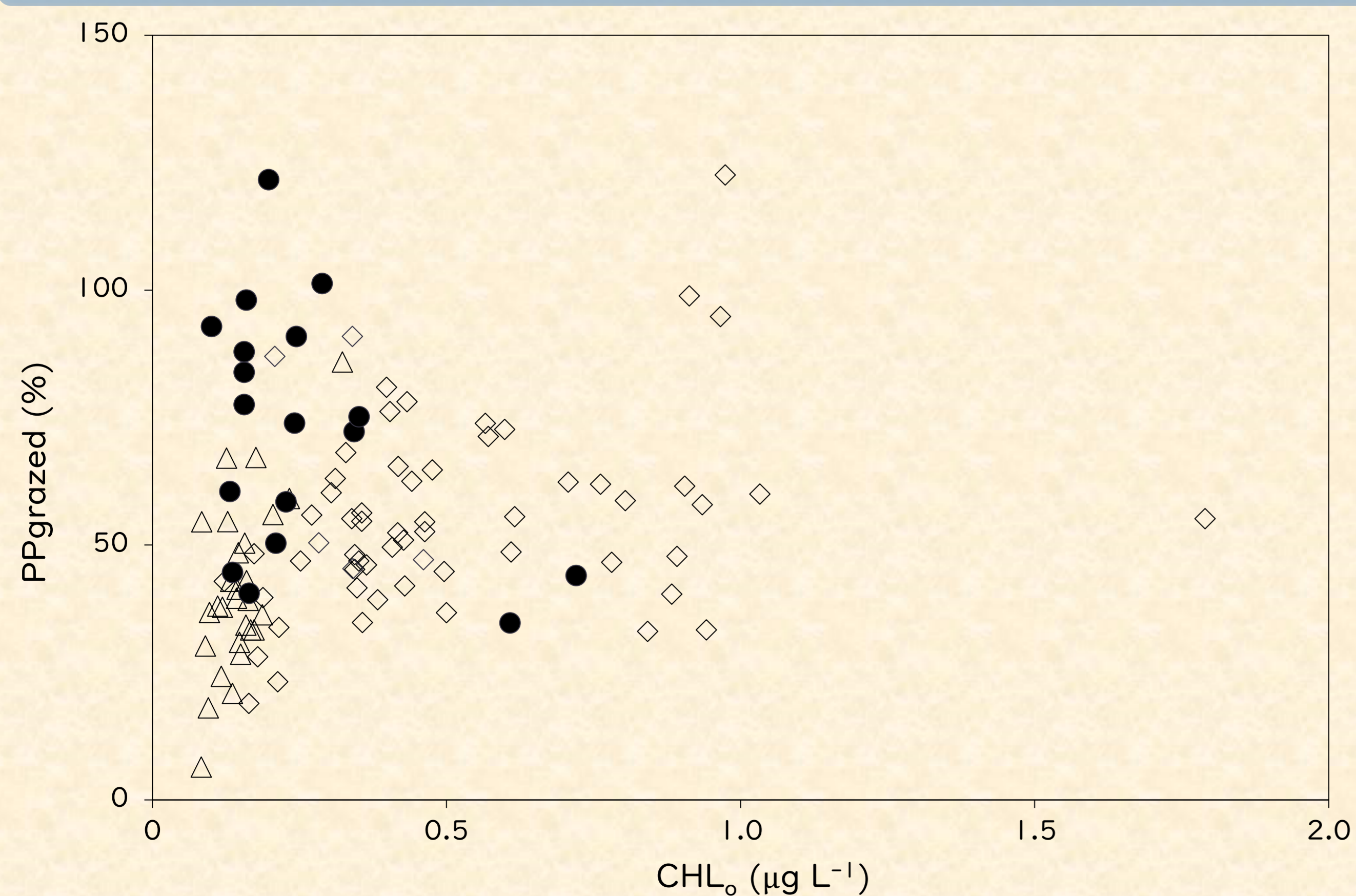


Fig. 5. Microzooplankton grazing impacts on primary production (PP_{grazed}) to ambient chlorophyll *a* concentrations. ●: This study. △: South China Sea (Chen et al., 2009). ◇: Equatorial Pacific (Landry et al., 1995; 1998).

Results

- ◆ Microzooplankton grazing composed more than half of primary production in the ECS-Kuroshio, indicating major grazer on phytoplankton community.
- ◆ Grazing impacts were similar or higher compared with those at the tropical to subtropical sites.

Conclusion

- ◆ Naked ciliates are major grazer of microzooplankton community.
- ◆ A major trophic pathway is haptophytes for nano-autotrophs and *Prochlorococcus* for pico-autotrophs to naked ciliates.
- ◆ Naked ciliates are crucial for trophodynamics integrating microbial production in the ECS-Kuroshio.

Acknowledgements

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