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Trophic pathways through nano-autotrophs and protozoans to support mesozoooplankton community in the Kuroshio

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Background

- ECS-Kuroshio is major spawning grounds of various forage fishes.
- Mesozooplankton is prey to support survival of these fish larvae and known to demonstrate high standing stocks and productivity even under oligotrophic conditions in the ECS-Kuroshio.
- There is less knowledge on trophic source and pathways in plankton food web to support mesozooplankton community.

Objectives

- Measure mesozooplankton grazing rates on phytoplankton and microzooplankton communities based on bottle experiments.
- Clarify trophic sources and pathways to mesozooplankton community.
- Evaluate importance of mesozooplankton for trophodynamics to higher trophic levels.

Study site

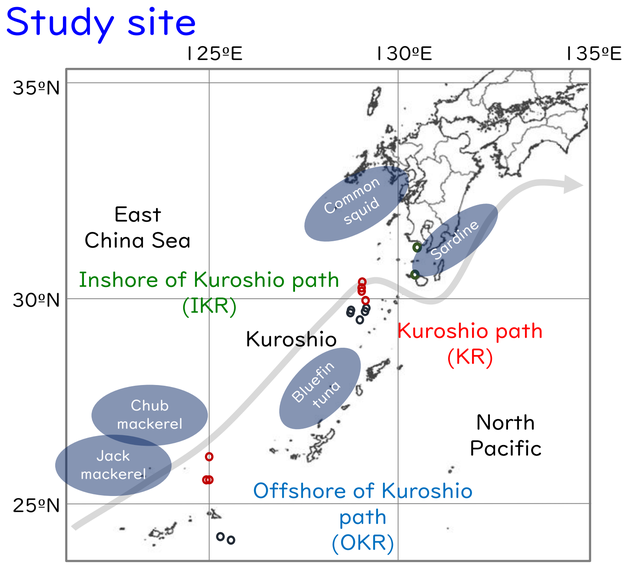


Fig. 1. Stations conducted mesozooplankton feeding experiments.

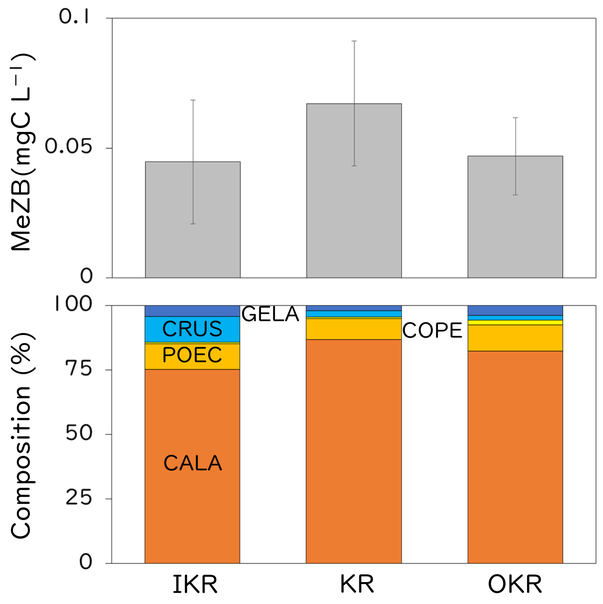


Fig. 2. Mesozooplankton biomass (MeZB) and their taxonomic composition in the incubations.

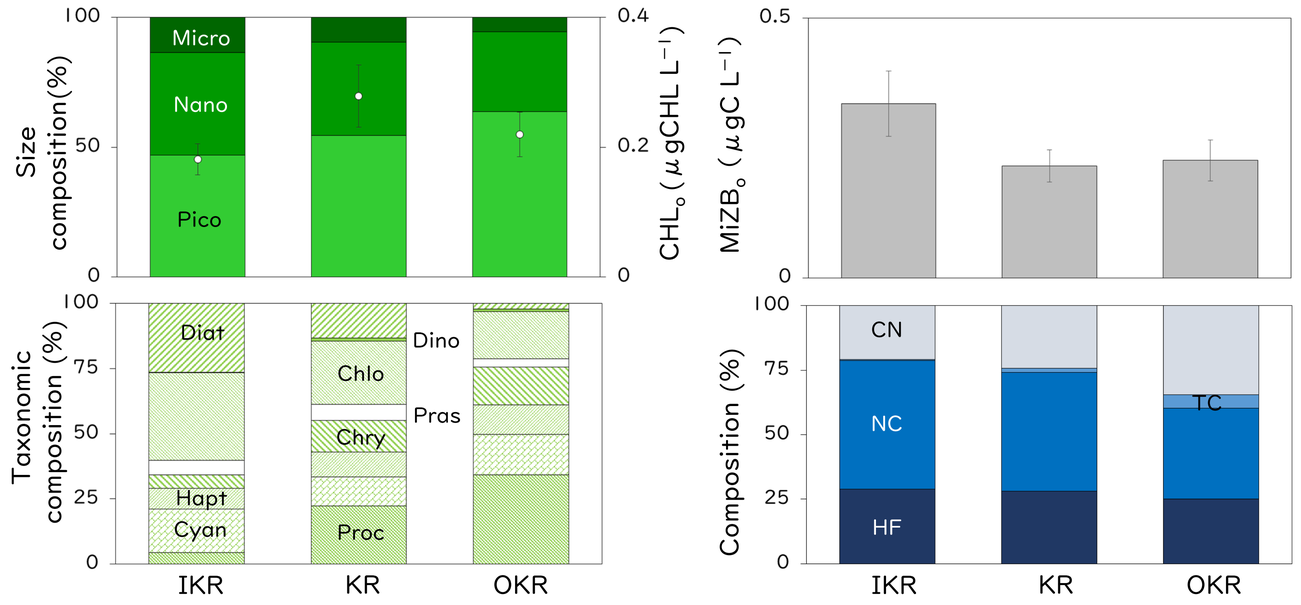


Fig. 3. Mesozooplankton potential prey (Chlorophyll: CHL_o, Microzooplankton: $MiZB_o$) biomass and its composition at the beginning of the incubations.

Results: Community structure

- Copepods (mostly calanoids) were the predominant component of mesozooplankton biomass in the ECS-Kuroshio.
- Pico- (i.e., *Prochlorococcus*) to nano-fractions (i.e., haptophytes and chrysophytes) dominated phytoplankton biomass.
- Naked ciliates and heterotrophic dinoflagellates contributed to microzooplankton biomass.

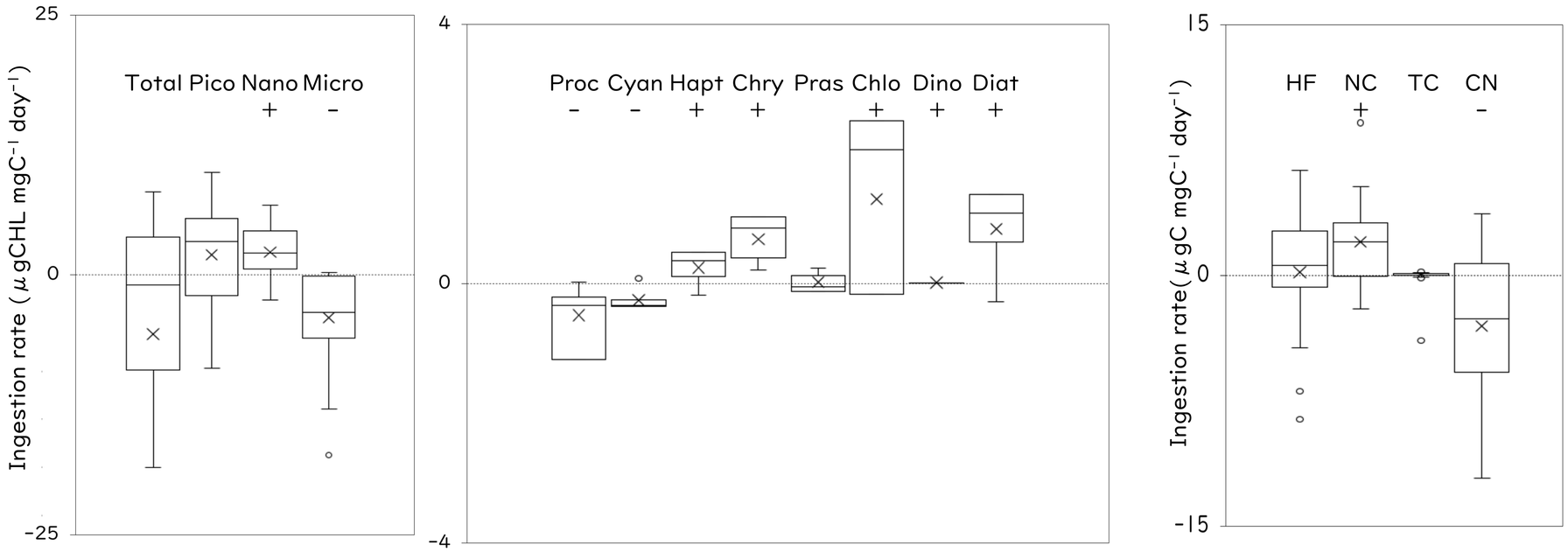
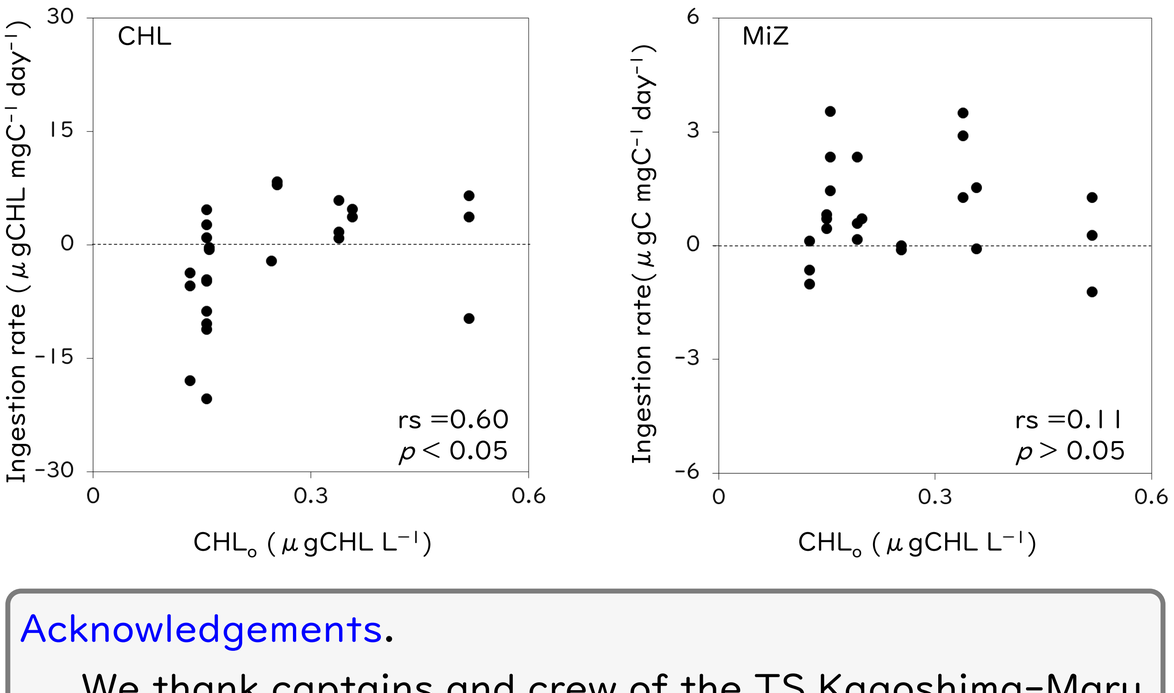


Fig. 4. Mesozooplankton ingestion rates on size-fractionated chlorophyll a (left), phytoplankton groups classified with CHEMTAX analysis (middle) and microzooplankton groups (right). + or −: significantly positive or negative from zero at $p<0.05$ (one sample *t*-test).

Results: Mesozooplankton ingestion

- Mesozooplankton ingestion rates on size-fractionated chlorophyll showed size preference on nano-fractions.
- Autotrophic prey was likely haptophytes, chrysophytes, chlorophytes, dinoflagellates and diatoms.
- Heterotrophic prey was naked ciliates.



Results: Mesozooplankton feeding to ambient chlorophyll

- Mesozooplankton ingestion rates to the ambient chlorophyll exhibited a positive correlation for phytoplankton prey but no correlation for microzooplankton prey.

Fig. 5. Mesozooplankton ingestion rates on chlorophyll *a* concentrations (CHL) and microzooplankton prey (MiZ) to the chlorophyll *a* at the beginning of the bottle incubations (CHL_o).

Conclusions

- Calanoid copepods are major consumer of phytoplankton and microzooplankton communities.
- A major trophic pathway to calanoid copepods is nano-autotrophs like haptophytes and chrysophytes and supplemented by ubiquitous naked ciliates.
- Calanoid copepods and nano-autotrophs are important linkages transferring microbial production to higher trophic levels in the ECS-Kuroshio.

Acknowledgements.

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