The role of microzooplankton under future ocean acidification and warming scenarios

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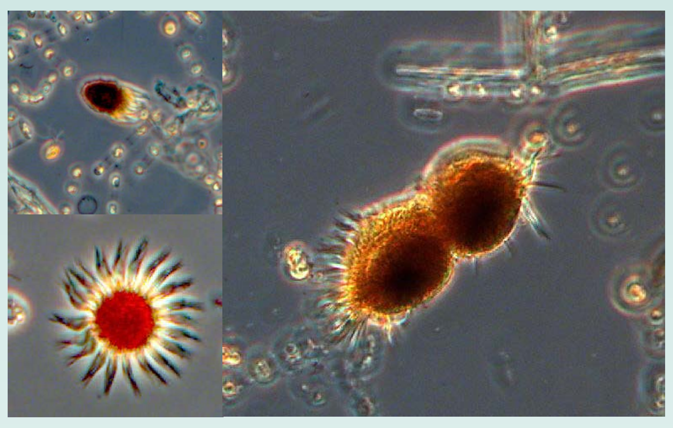
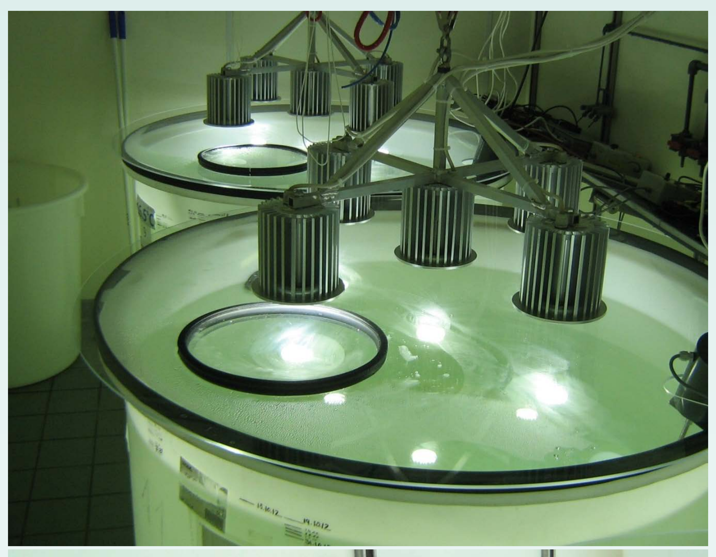


At the interface between microbial loop and higher trophic levels, micro-zooplankton (MZP) can be both buffer against low quality food for larger mesozooplankton as well as a competitor for food. Given the expected decrease in algal food quality with ocean acidification, the former trait may gain in importance. The MZP community was analyzed during the BIOACID summer and autumn experiments in Kiel 2012/2013.

Experimental design

For the indoor mesocosms, CO_2 concentrations of 840 and 2400 ppm with 3 replicates were used in the autumn experiment and a CO_2 gradient ranging from 500 to 3000 ppm was established during the summer experiment. These concentrations were crossed with two temperatures: ambient water temperature and ambient water temperature +3˚C. MZP samples were taken three times a week (Lugol fixation).

Grazing experiments with a 4-step dilution series, mesozooplankton treatment and addition of nutrients were conducted twice in each experiment. Bottles were incubated at ambient conditions using a plankton wheel. Chlorophyll a was measured at start and end point to calculate MZP grazing rates.



First results

The autumn experiment started with very low densities of about 70 ciliates/L and reached up to 5,400 ciliates/L after 22 days (fig.1) with similar growth rates in all treatments (fig.2). The MZP community was dominated by small strobilids (< 30 mm), with *Mesodinium pulex* (cyclotrichids) being second most abundant (fig.3). Variation within treatments was generally high and no large ciliates were present throughout the experiment.

In the summer experiment 2013, first results from the grazing experiments showed higher phytoplankton growth rates and MZP grazing rates at 1500 ppm than at 3000 ppm (tab.1). While rates were lower for 1500 ppm at 22.5˚C compared to 16.5˚C, the high CO_2 treatments showed the opposite trend.

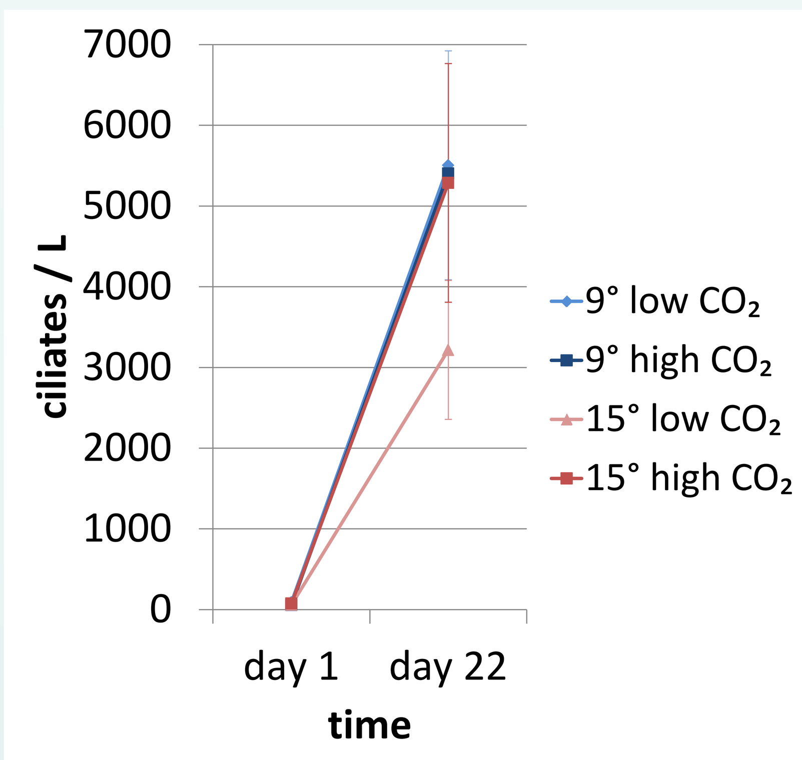


Fig.1: Ciliate abundances on day 1 and day 22 of the BIOACID autumn experiment showed the peak values after the phyto-plankton bloom.

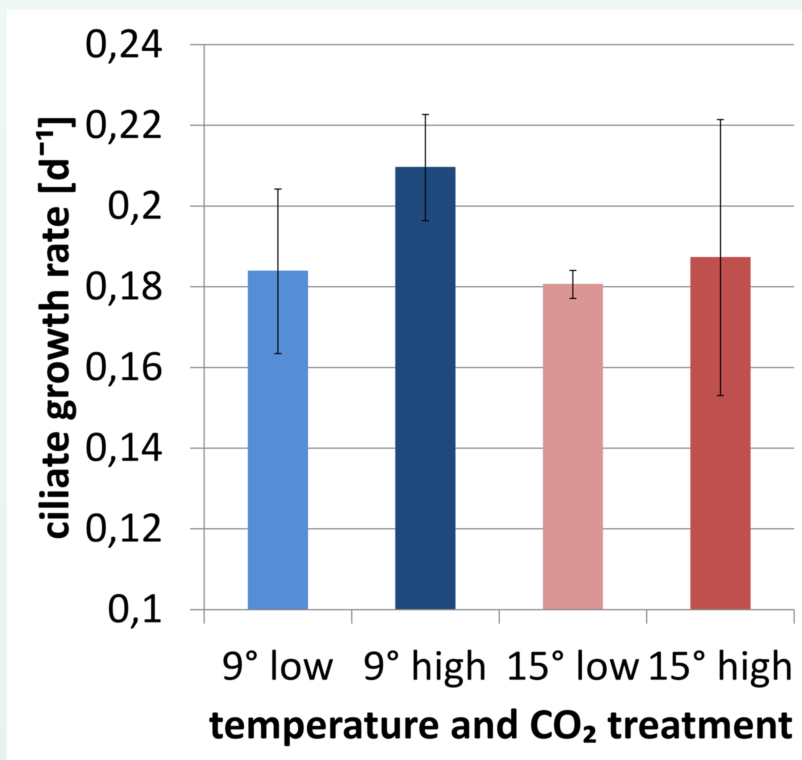


Fig.2: Ciliate growth rates in the BIOACID autumn experiment showed no significant CO_2 or temperature effect.

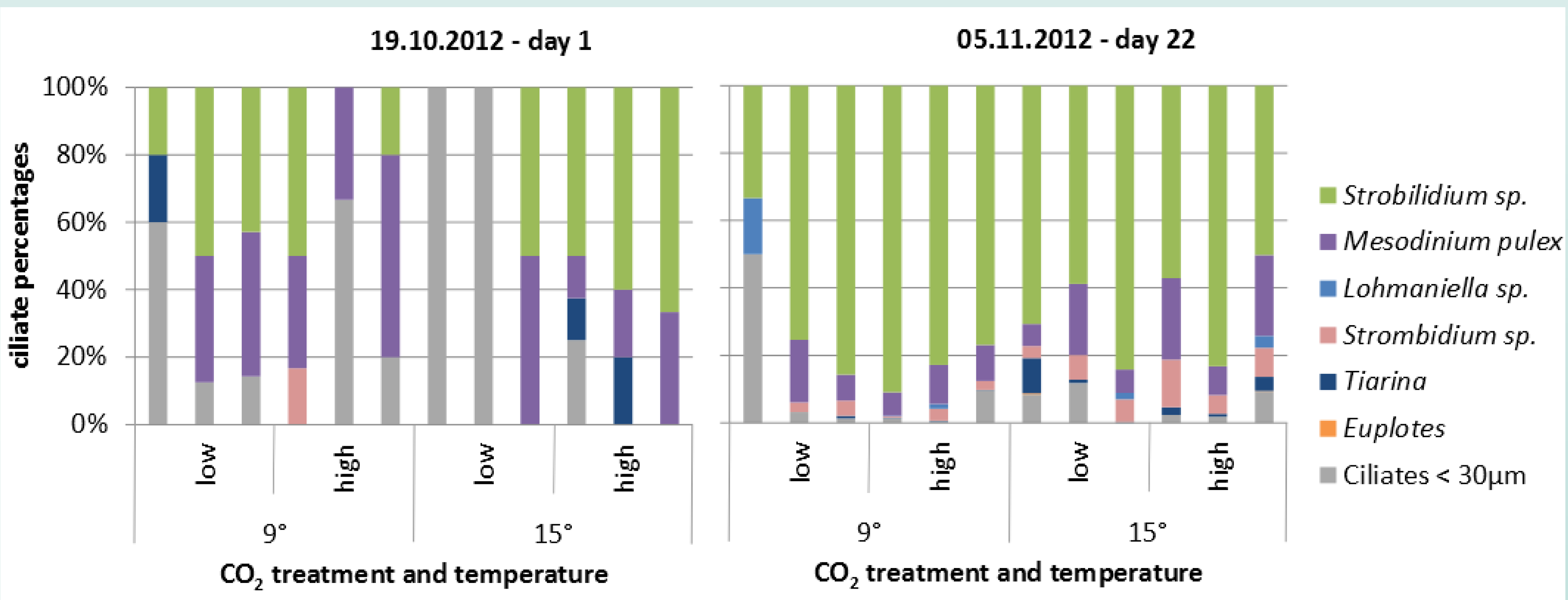


Fig.3: Ciliate species composition in the BIOACID autumn experiment 2012 on day 1 and 22 (bloom phase). While contributing about half of the ciliate population at the start, small strobolids became the most abundant species during the experiment.

Tab.1: Preliminary MZP grazing rates from the BIOACID summer experiment 2013, calculated using linear regressions of apparent phytoplankton growth. To account for higher rates than natural due to nutrient addition, a control without nutrients was included.

treatment	MZP grazing rate d^{-1}	phytoplankton growth rate d^{-1}
22.5°C/500 ppm	-1,57	3,15
22.5°C/1500 ppm	-3,48	4,57
22.5°C/3000 ppm	-0,98	1,34
16.5°C/1500 ppm	-4,69	5,70
16.5°C/3000 ppm	-0,73	0,80

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