



Top-down control of phytoplankton biomass and community structure in the monsoonal Arabian Sea

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ABSTRACT: During the 1995 monsoons, phytoplankton biomass was low over large areas of the Arabian Sea in spite of often high concentrations of inorganic nutrients, characteristics typical of high-nutrient, lowchlorophyll (HNLC) areas. The objective of this study, a part of the Arabian Sea U.S. JGOF5 program, was to elucidate controls of phytoplankton biomass and community structure in these areas, using primarily pigment-based methods. Unlike other HNLC areas, phytoplankton biomass and growth rates in the monsoonal Arabian Sea were not likely limited by the availability of trace nutrients but rather controlled by grazers. Evidence for this conclusion is high concentrations of iron, the nutrient likely limiting phytoplankton biomass in other HNLC areas; phytoplankton growth rates clearly not limited by concentrations of inorganic nutrients; blooms during grow-out experiments in the absence of mesozooplankton; rates of microzooplankton and mesozooplankton grazing that approached rates of primary production; and the absence of blooms in situ in spite of persistently high concentrations of inorganic nutrients. A more detailed look at shifts of phytoplankton community structure with increasing levels of phytoplankton biomass, in situ and during grow-out experiments, shows that diatoms were the only group of organisms capable of blooming in the absence of mesozooplankton, i.e., their abundance in situ was likely controlled by mesozooplankton grazing. Changes in the abundance of different picoautotroph taxa with increasing levels of phytoplankton biomass suggest that their biomass was controlled within tight bounds by microzooplankton grazing, rather than by the availability of resources. Thus, these results are consistent with the hypothesis that phytoplankton abundance and community structure in the HNLC areas of the monsoonal Arabian Sea are controlled by top-down forces, grazing, rather than bottom-up forces, availability of resources.

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