STUDIES ON THE ECOLOGY OF *TRICHODESMIUM* SPP. (CYANOPHYCEAE) IN THE CENTRAL NORTH PACIFIC GYRE

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ABSTRACT

The cyanophyte *Trichodesmium* sp., a marine planktonic diazotroph, is considered a potentially important source of nitrogen in oligotrophic marine environments. However, studies on the ecology and physiology of *Trichodesmium* have been biased toward periods when this genus is abundant. As a result little is known on the temporal variability of planktonic communities and biochemical parameters in relation to changes in *Trichodesmium* concentrations in the euphotic zone.

During the first five years of the Hawaii Ocean Time-series (HOT) program, the hydrography, chemistry, and biology of the water column of Sta. ALOHA (22°45'N; 158°00'W) have been characterized at approximately monthly intervals to study biogeochemical processes in the Central North Pacific (CNP) gyre. Simultaneously, *Trichodesmium* samples were collected for physiological studies and to assess the temporal variability in their abundances. The present dissertation focuses on the variability of phytoplankton pigments, photoautotrophic production and the potential role of *Trichodesmium* in temporal patterns of plankton communities at Sta. ALOHA.

During this study, concentrations of chlorophyll *a* (chl *a*) displayed depth dependent seasonal patterns attributed to photoadaptation in the upper euphotic zone,

and increases in phytoplankton biomass in the deep chlorophyll maximum during spring. The major taxa contributing to chl *a* below 75 m were *Prochlorococcus* spp. (39%) and cyanobacteria (24%). Although no measurable changes in the phytoplankton community structure were observed between 1989 and 1992 based on pigment analyses, a significant increase in photosynthetic carbon assimilation efficiency (P^B) was measured between 1989-1990 and 1991-1992. This P^B increase coincides with a decrease in mixed-layer depths and an increase in the N:P molar ratio in suspended particulate matter.

Only 10-12% of total *Trichodesmium* biomass was attributable to colonial morphologies. The remaining fraction was found as naturally occurring single filaments. Aerobic acetylene reduction measured in colonies and single filaments suggests that 60% of *Trichodesmium* potential nitrogenase activity in the water column is attributable to single filaments. An increase in *Trichodesmium* abundances during 1991-1992 relative to 1989-1990 and the positive correlation of these abundances with N:P ratios suggests that nitrogen fixation during periods with decreased frequency in deep mixing events may be the cause of the relative enrichment in particulate nitrogen observed at Sta. ALOHA.