MESOSCALE VARIABILITY IN NITROGEN-FIXING BACTERIA AND RATES OF NITROGEN FIXATION IN THE NORTH PACIFIC OCEAN

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By
Allison A. Fong

Thesis Committee:

Matthew J. Church, Chairperson
Grieg F. Steward
David M. Karl

Abstract

The euphotic zone of the North Pacific Subtropical Gyre (NPSG) is nutrient-poor and supports relatively low standing stocks of planktonic organisms. Data collected as part of the Hawaii Ocean Time series (HOT) program indicate upper ocean physical and biogeochemical dynamics of Sta. ALOHA (22° 45' N, 158° 00' W) vary over timescales ranging from diurnal to interannual. Mesoscale processes, including eddies and planetary waves have the potential to influence temporal variability in biogeochemical cycling and planktonic community structure, but the influence of such processes on open ocean ecosystems remain poorly understood, in part due to under-sampling. In July 2005, I sampled a spatially coherent region of elevated chlorophyll that coincided with a decaying anticyclonic eddy. I conducted a transect through the eddy measuring a suite of biogeochemical properties, including nitrogenase (*nifH*) gene abundance and rates of nitrogen fixation. *nifH*-containing plankton were abundant and rates of nitrogen fixation were elevated along the cruise track relative to previous measurements from Sta. ALOHA. Rates of nitrogen fixation were 2-18 times greater than previous rate measurements at Sta. ALOHA. Clone libraries of expressed *nifH* genes prepared by reverse transcription-PCR were dominated by sequences similar to that of *Trichodesmium* spp. Quantitative PCR assays of *nifH* genes indicated substantial increases in the abundance of all targeted *nifH* gene phylotypes within the eddy. More specifically, the *nifH* gene phylotype of the heterocyst-forming cyanobacteria, termed Heterocystous_2, displayed the greatest abundance of all targeted *nifH* phylotypes. My study has shown that physical variability generated by mesoscale anticyclonic eddies can induce shifts in

planktonic community structure, favor the increase of the relative abundances of specific diazotrophs, and elevate rates of nitrogen fixation in open ocean ecosystems.