SEASONAL, INTERANNUAL AND DECADAL VARIATION IN ZOOPLANKTON COMMUNITY STRUCURE AND FUNCTION IN THE NORTH PACIFIC SUBTROPICAL GYRE

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Abstract

Mesozooplankton biomass and abundance in the North Pacific Subtropical Gyre (NPSG), as measured by the Hawaii Ocean Time-series program at Station ALOHA (22.45°N, 158°W), increased significantly from 1994 to 2005. Principal components analysis indicates that the twelve-year trend was driven both by an increase in small (0.2 – 1.0 mm) zooplankton that do not migrate on a diel cycle and larger (0.5 – 2.0 mm) vertically migrating zooplankton. Amino acid- and species-specific stable nitrogen isotope analysis was used to determine if the increase in NPSG zooplankton populations was driven by changes in nitrogen source. These analyses suggest that both the biological fixation of atmospheric nitrogen and entrainment of nitrate from the main thermocline support NPSG zooplankton food webs (approximately 45 and 55 % of zooplankton production, respectively). However the stable nitrogen isotopic composition of the copepod species *Euchaeta rimana*, *Pleuromamma xiphias* and *Neocalanus robustior* increased significantly from 1997 through the winter of 2000, indicating that entrainment of nitrate from the main thermocline was enhanced over this time period. Based on the zooplankton stable nitrogen isotope time-series and the concurrent changes in plankton community structure, it was concluded that enhanced nitrate entrainment, likely driven by climate-induced changes in gyre circulation, water column stability and vertical velocity rates, initiated a NPSG ecosystem regime shift in 1998. The ecosystem regime shift resulted in an increase in phytoplankton pigment biomarkers in the lower euphotic zone and the observed increase in zooplankton abundance and biomass. The effect of this state change on NPSG biogeochemical cycles, for example on the migrant-mediated export of phosphorus from the surface ocean, is discussed.