Maximum resiliency as a food web organizing construct: Heterotrophic bacteria and phytoplankton biomass across a trophic gradient

Edward Laws

University of Hawaii, Department of Oceanography, Honolulu, HI 96822, USA, Tel: +1 808-956-9136, Fax: +1 808-956-2751, elaws@hawaii.edu

Application of the principle of maximum resiliency to a pelagic food web model leads to the conclusion that the ratio of heterotrophic bacterial biomass to phytoplankton biomass will be greatest under oligotrophic conditions. This prediction is in accord with the results of several field studies. Under eutrophic conditions, model results indicate that the same ratio will be positively correlated with temperature, and that microbial biomass will be dominated by phytoplankton at low temperatures and high production rates. Heterotrophic bacterial biomasses predicted from information on temperature and phytoplankton biomass or production are in excellent agreement with field data collected among a wide variety of limnetic and marine systems. Export ratios are closely correlated with the ratio of heterotrophic bacterial biomass to phytoplankton biomass. Because of the short generation time of marine microbes, pelagic food web behavior that is determined primarily by the activity of these organisms may tend to display characteristics expected of the mature stages of ecological succession. Maximum resiliency, a characteristic expected of such mature stages, may therefore prove to be a useful construct in modeling the response of pelagic food webs to environmental change.