Linking traits and ecological niches to predict eco-evolutionary responses of phytoplankton to global change

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Phytoplankton are major primary producers in aquatic ecosystems and are sensitive to various aspects of global environmental change. They can respond through phenotypic plasticity, species sorting, genetic adaptation, or a combination of these processes. I will present conceptual, experimental and theoretical ways to predict different phytoplankton responses to global change. Using phytoplankton ecological niches to predict their responses to multiple environmental stressors is a promising new approach. Functional traits of phytoplankton, such as resource utilization traits and tolerance curves for various environmental factors like temperature, can be used to define niches along major axes. Characterization of pairwise and higher dimension trade-offs among traits should help predict possible niche changes along multiple dimensions simultaneously. The potential for evolutionary responses to global change can be assessed using evolution experiments with individual strains, as well as in communities, because the responses may depend on the presence of competitors, grazers and parasites. The evolutionary pressures induced by multiple stressors may have interactive effects and, thus, should be investigated simultaneously. Novel models of trait evolution in a community context should provide additional insights into potential adaptation trajectories under diverse global change scenarios.