Title: ECOHAB: Climate change impacts on the physiology and trophic dynamics of harmful algal species from Delaware's inland bays.

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Abstract: Global climate change is expected to have profound impacts on biogeochemistry, nutrient cycling and biological process in the ocean, and species inhabiting coastal ecosystems are among the most vulnerable to these changes. Examining the effects of climate change on isolated species, however, will not adequately portray the extent of these impacts on complex biological communities. Previous research shows that elevated temperature and/or CO_2 alters toxicity for some HAB species, but the consequences of altered toxicity on community dynamics and trophic interactions have not been investigated. Likewise, prior ECOHAB-funded research by Warner and Coyne investigating the effects of climate change on growth, physiology and expression of enzymes involved in C and N metabolism for local HAB species show species- and strain-specific responses to changes in temperature and/or CO_2. Results of this investigation also indicate substantial changes in nutrient quotas and partitioning of carbon biomass for some HAB species, even when no changes in growth rate were observed. Such shifts will likely alter the nutritional quality and mass transfer efficiency to grazers in a species-specific manner, possibly impacting zooplankton survival, growth and production rates.

The goals of this project are to investigate the effects of climate change on HAB species and the consequences of altered toxicity and nutritional quality of HAB species on micro- and mesozooplankton grazers. The interactive effects of temperature and CO_2 on metabolism, resource partitioning, and toxicity in two raphidophytes (*Heterosigma akashiwo* and *Chattonella subsalsa*) and a dinoflagellate species (*Karlodinium veneficum*) will be examined under nutrient-replete or nutrient-limited conditions. Responses of the cultured micrograzers *Oxyrrhis marina*, *Favella* sp., and *Strombidinopsis acuminatum*, and the model copepod, *Acartia tonsa*, to climate change conditions will also be assessed. Once acclimated to CO_2 and temperature levels expected at the end of this century, their ability to graze the target HAB species compared to non-harmful species cultured under the same conditions will be examined. The relative effects of toxicity, starvation and possible changes in algal fatty acid content on micrograzers and copepod grazing and egg production will be evaluated under both ambient and climate change-driven growth conditions. Behavioral changes and other sub-lethal effects on zooplankton reproductive output as a result of either toxicity or starvation will be evaluated. The possibility for direct and indirect trophic interactions between a target alga, micro- and mesograzer exposed to the same conditions will also be evaluated. Results of this project will lead to a better understanding of how changes in growth, toxicity and nutritional quality of HAB species will impact competitive interactions and trophic dynamics in coastal ecosystems of the future.