Research Statement – Michael Chislock **December 1, 2013**

My research focuses on predator-prey interactions across ecological gradients. I am particularly interested in how within-species trait variation influences community dynamics and ecosystem function. Using complementary experimental and observational approaches, I study how ecosystem productivity influences the presence and efficacy of prey defenses and consumer offenses. Prey responses to consumers (e.g., prey defense), including phenotypic plasticity and genetically-fixed adaptations, have been shown to be important in diverse ecosystems. However, fewer studies have examined the consequences of adaptations by consumers to defended prey (consumer offense).

To address these questions, I use a planktonic model system consisting of toxic algae (i.e., cyanobacteria) and a keystone herbivore (i.e., the microcrustacean *Daphnia*) that adapts to the presence of toxic cyanobacteria in its environment. *Daphnia* is well known to have dramatic effects on the total biomass and productivity of primary producers (phytoplankton). While the presence of *Daphnia* is essential for a strong trophic cascade in lakes, my research has shown that: 1) the effect of different *Daphnia* genotypes on ecosystem function is as large as the effect of presence/absence of this species; 2) the effect of *Daphnia* genotypes is mediated by an offensive adaptation; and 3) the mechanism is keyed to the superior numerical response of adapted *Daphnia* genotypes, not a difference in functional response. Thus, my research has demonstrated that *Daphnia* genotype (i.e., consumer offense) can mediate the response of lake ecosystems to nutrient enrichment and food-web manipulations.

Over the next five years, I will use complementary large-scale field experiments and smaller-scale, mechanistic field and laboratory experiments to understand the relative importance of genetically-fixed and inducible traits in phytoplankton and zooplankton for species interactions. This work will enhance general theory of species interactions, will enhance existing phytoplankton defense theory, will incorporate consumer offenses into existing theories, and will provide new insights regarding the strengths and patterns of trophic interactions across productivity. Furthermore, as algal blooms pose one of the most serious biological threats to our surface freshwaters, my research will aid in future water quality management. Through my established collaborations with several state and federal agencies, the results of this work will be shared with water quality managers.

I am passionate about training students of all ages. I will continue to mentor middle and high school students, in addition to undergraduate and graduate students, while also teaching community-based outreach courses. A major goal of mine is to continue to integrate research and education by teaching middle school, high school, undergraduate, and graduate students about the effects of eutrophication on ecosystem structure and function. These experiences will help me to share research results with the next generation of scientists, while also enhancing my teaching, student training, and mentoring skills.