

## ABSTRACT

Research Category: ECOHAB: Ecology and Oceanography of Harmful Algal Blooms

Funding Opportunity Number: EPA-G2006-STAR- B1

Title: Identifying regulatory mechanisms for *Heterosigma akashiwo* bloom formation: predation interactions with algal behavior and resource use

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Project period: 9/1/06 to 8/31/09

Project cost: Direct: \$363,651 Indirect: \$135,249 Total: \$498,900

**Project Summary:** We propose an experimental investigation into the regulation of *Heterosigma akashiwo* blooms by protistan predators. *H. akashiwo* causes fish kills yearly in coastal waters of the Pacific. Food web interactions involving *H. akashiwo*, a raphidophyte that may have multiple modes of toxicity, are poorly understood. Our study focuses on the interactions between *H. akashiwo* layer-forming behavior, nutrient use, and susceptibility to predation mortality. Predation and behavioral experiments will utilize heterotrophic protists, the major consumers of phytoplankton in the world's oceans, and will address both toxicity and predator deterrence as phenomena with different implications for bloom formation and maintenance. This is a novel approach that integrates traditionally separate 'bottom up' and 'top down' aspects of HAB ecology. Results will significantly contribute to our understanding of *H. akashiwo* in coastal food webs, as well as to our knowledge of competitive strategies (layer formation, use of organic nutrient sources, deleterious effects on predators) that are employed by a number of HAB taxa.

### Objectives:

1. To determine the relative importance of toxicity versus feeding deterrence in reducing *H. akashiwo* mortality from protist predators.
2. To investigate the role of *H. akashiwo* layer formation in deterring predators and, reciprocally, the role of predators in inducing *H. akashiwo* layer formation.
3. To determine the effect of different nitrogen sources for *H. akashiwo* growth on toxicity and feeding deterrence of *H. akashiwo*.
4. To understand how *H. akashiwo* nitrogen use interacts with *H. akashiwo* toxicity to influence predation.

#### Approach:

We will conduct laboratory experiments with *H. akashiwo* and heterotrophic protist isolates from the coastal northeast Pacific. Regional waters and natural blooms of *H. akashiwo* will be sampled to obtain new isolates of the raphidophyte and of protist predators that both do and do not co-occur with the natural blooms. Work on layer formation and associated *H. akashiwo* and protist predator behavior will be conducted in novel spatially structured laboratory environments, using video and motion analysis techniques to quantify individual- and population-level behavioral effects.

#### Expected Results:

1. An increase in our currently meager knowledge of *H. akashiwo* toxicity effects on protist predators, potentially the major consumers of this HAB species.
2. Determination of the role of predator deterrence in reducing *H. akashiwo* mortality.
3. An understanding of the relationship between layer formation by *H. akashiwo* and the behavior of protist predators.
4. Increased understanding of the potential for organic nutrient use by *H. akashiwo*, and the effects of algal nutrient source on predation.
5. New understanding of the interactions between resource use and behavior of *H. akashiwo* and the response of protist predators to this alga.

#### Supplemental Key Words:

Grazing, DON, microzooplankton, nutrition, trophic, behavior, palatability