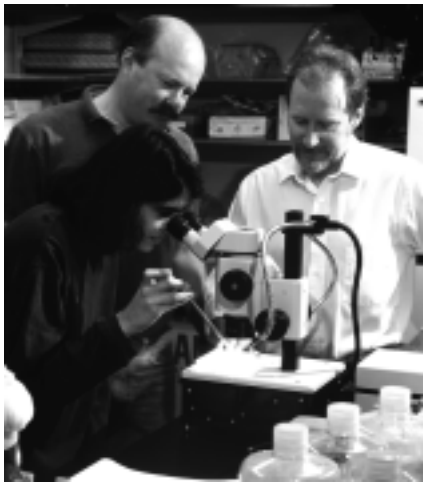
Food Web Studies Strive to Understand the Cause of Brown Tide

Since 1985 the estuarine and coastal waters of Long Island, New York have experienced recurrent harmful algal blooms called brown tides. The causative agent of these events is a minute (2-3 microns) alga named Aureo-coccus anophagefferens. This Latin moniker loosely translates into 'golden cell that causes feeding to stop', a good description of its effect on many benthic organisms such as bivalve molluscs.

Massive outbreaks of this alga during the past 12 years have had devastating effects on some shellfish populations within these ecosystems, and also resulted in habitat loss by causing reductions in the size of eel grass beds. Scallop populations, and the sizable fishery that this species has supported in the past, have been particularly hard hit.

The underlying environmental and biological conditions that lead to brown tides have been enigmatic, but an important role for food web interactions has been implicated for the brown tides alga. Because of its small size, potential grazers for this alga are predominantly single-celled, microbial predators that compose the first few trophic levels of pelagic food webs.



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Mausmi Mehta, Mark Dennett and Dave Caron examine a brown tide culture.

David Caron is investigating the role of these predators in Long Island embayments habitually afflicted by brown tides. Funding from RCRC, New York Sea Grant and the Seaver Institute has enabled Caron and his colleagues to combine experimental and modeling studies to unravel the food web interactions that lead to massive outbreaks of this alga. These studies entail a variety of experiments designed to investigate the structure of the microbial food web prior to, during, and following these algal blooms. The goal is to understand the changes that food webs undergo at the time of bloom initiation, and how they recover when these brown tides eventually wane.

One aspect of this work supported by RCRC funds has been the development of a mathematical model (see Figure, page 3) that incorporates information provided by Caron's food web experiments into a description of trophic dynamics in these coastal bays. This model will provide a means of testing hypotheses involving food web structure and trophic relationships, and how they relate to blooms of this harmful alga.

This article was contributed by Dr. David Caron, a Senior Scientist in the Biology Department at the Woods Hole Oceanographic Institution.

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Conceptual framework for a food web model to examine bloom dynamics of the brown tides alga. The model assumes size-dependent predation within the pelagic food web. The ovals depict major groups of plankton. Trophic relationships among these populations, and nutrient cycling pathways, are shown by the arrows.