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Anderson Lab: Research Interests

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The overall focus of research in this laboratory is on toxic or harmful algae - the species responsible for the phenomena commonly called "red tides". Our work spans the spectrum from mesoscale investigations of algal bloom dynamics to studies at the cellular and molecular levels. The "system" we work with the most is the toxic dinoflagellate *Alexandrium*, the genus responsible for poisonous red tides in many countries throughout the world. *Alexandrium* is perhaps the most important of all toxic dinoflagellates, and serves as an excellent model for many other red tide species.

Our field programs are investigating the population dynamics of *Alexandrium* species in various New England habitats, from shallow salt ponds to open coastal waters. We study the biological, chemical, and physical factors which regulate the growth and distribution of *Alexandrium* in each habitat-type. The linkage between toxic dinoflagellate blooms and coastal physics is significant in all habitats studied thus far, and this coupling has been an area of considerable focus. On the physiological front, we are exploring the mechanisms which regulate toxin content and composition of *Alexandrium*, have used toxin "fingerprints" to infer key elements of this organism's population biology, and have delved into the details of the complex life cycle that influences the timing, location, and genetic composition of blooms. At the molecular level, we are investigating the genetic relationships between isolates of *Alexandrium* on regional and global bases. The genetic diversity we have uncovered is remarkable, and bears on issues ranging from "the species concept", to paleo-oceanographic dispersal of organisms, and even to the involvement of human activities in the dispersal of species. Another major molecular effort involves a search for the genes that are responsible for saxitoxin production.

On a more practical side, we have used the sequence information obtained in our biogeographic studies to develop and apply "molecular probes" for toxic *Alexandrium* species from different regions of the world. Another area of active physiological and molecular research involves the search for "indicators" that can be used to rapidly assess the nutritional or metabolic status of our phytoplankton cells.

An important line of practical research involves efforts to develop mitigation or control strategies to reduce the impacts of harmful or toxic blooms. In particular, a program on flocculation and sedimentation of red tide cells using clay shows great promise.

We have also taken a leadership role in the formulation and implementation of national and international programs on harmful algal blooms. These national plans are available on line.

The overall research program is thus very broad, spanning many disciplines and involving basic as well as practical science investigations in both the field and laboratory. Details on specific research projects, relevant publications and links to appropriate web pages are provided here.

Relevant Publications

Anderson, D. M. 1989. Toxic algal blooms and red tides: a global perspective. pp. 11-16. In: T. Okaichi, D. M. Anderson, and T. Nemoto (eds.), *Red Tides: Biology, Environmental Science and Toxicology*. Elsevier.

Anderson, D. M. 1994. Red tides. Scientific American 271: 52-58.

Anderson, D. M., D. M. Kulis, G. J. Doucette, J. C. Gallager and E. Balech. 1994. Biogeography of toxic dinoflagellates in the genus *Alexandrium* from the northeast United States and Canada as determined by morphology, bioluminescence, toxin composition, and mating compatibility. Mar. Biol. 120: 467-478.

Anderson, D. M. 1995. Toxic red tides and harmful algal blooms: A practical challenge in coastal oceanography. U.S. National Report to the IUGG American Geophysical Union, pp. 1189-1200.

ECOHAB, 1995. The Ecology and Oceanography of Harmful Algal Blooms: A National Research Agenda.

HARRNESS, 2005. Harmful Algal Research and Response: A National Environmental Science Strategy 2005-2015.

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