



Woods Hole Oceanographic Institution

# SEA GRANT PROGRAM

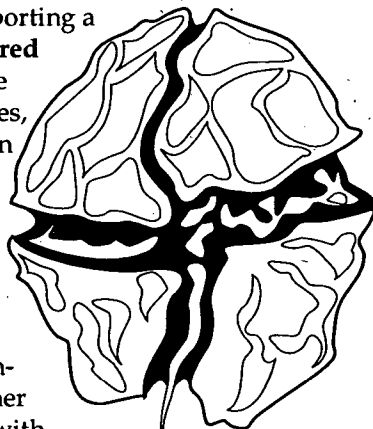
Project Guide: 1992-1994

## Research

During the 1992-1994 funding cycle, WHOI Sea Grant will support 15 concurrent research projects and several smaller "new initiative" efforts aimed at taking the first steps into promising new areas. Many of the projects address local and regional needs while others have national or even global implications. A major by-product of this research is publications. Over the years, WHOI Sea Grant support has resulted in nearly 600 scientific publications including journal articles, theses, books, and maps. Major areas of research include:

### Fisheries Biology and Management

◆ WHOI Sea Grant is supporting a study which investigates the red tide bloom dynamics and the physiology of one toxic species, *Alexandrium tamarense*, within Massachusetts Bay. The study area, also incorporating Cape Cod Bay, has been selected because: it experiences recurrent episodes of Paralytic Shellfish Poisoning (PSP), a food poisoning potentially fatal to humans and other animals; it is poorly studied with respect to bloom dynamics of toxic *A. tamarense* species; and is "upstream" from important shellfish resources on Georges Bank that subject to PSP toxicity. In addition, the location for a proposed (and controversial) sewage outfall that will discharge up to 1.2 billion gallons of effluent per day. Opponents of the outfall have argued that one result of the new discharge of toxic or nuisance algal blooms. This study will attempt to increase our understanding



*tamarense* offshore are now study site is (versial) sewage outfall have discharge of toxic or study will standing

*Alexandrium tamarense*

of red tide bloom dynamics and the physiology of *Alexandrium* blooms in Massachusetts bays sufficient for an informed evaluation of the potential impact of the outfall. (Donald A. Anderson)\*

◆ Many outbreaks of harmful algae in coastal waters have significant economic and public health impacts. During the past several decades, red tide incidents appear to have increased steadily in both species complexity and geographical extent throughout the world. This WHOI Sea Grant-supported study will attempt to estimate economic impacts from harmful algal blooms and red tides by compiling available information and data related to red tide incidents from coastal states and local governments, focusing on the period 1985 to 1990. Anticipated results include the development of an economic model and creation of a national data base. (Yoshiaki Kaoru and Donald A. Anderson)

◆ Winter flounder (*Pseudopleuronectes americanus*), a valuable fisheries resource in the Northeast, might be a likely candidate for commercial aquaculture. Most efforts have failed, however, due to the inability of the larvae to survive past the yolk-sac stage. Pilot experiments suggest that protozoans may be an acceptable and nutritional prey for first-feeding winter flounder larvae. A Sea Grant study is underway to determine whether or not this is true. If successful, the study will provide the information necessary to overcome this major hurdle in flounder culture. (Scott M. Gallager)

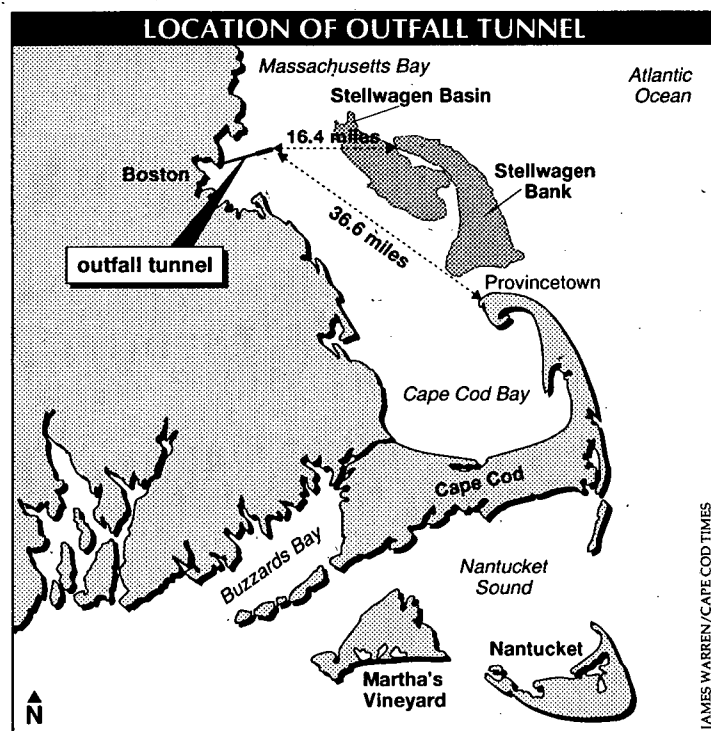
### Human Impact on the Environment

◆ Coastal communities are facing ever increasing demands to increase their level of sewage treatment prior to discharging into harbors and bays. To meet judicial mandates for improved sewage disposal and treatment in the Boston area, the local government water authority has begun construction of a new sewage treatment plant and a new outfall to be located in Massachusetts Bay at

The Woods Hole Oceanographic Institution (WHOI) Sea Grant Program supports research, education, and advisory projects to promote wise use and understanding of ocean and coastal resources for the public benefit. It is part of the National Sea Grant College Program of the National Oceanic and Atmospheric Administration (NOAA), a network of 30 individual programs located in each of the coastal and Great Lakes states to foster cooperation among government, academia, and industry.

Since 1973, WHOI Sea Grant has channeled the expertise of Institution scientists toward meeting the research and information needs of users of the marine environment, especially in Massachusetts.

a water depth of 32 m. Improved sewage treatment, cessation of sludge discharge, prevention of combined sewer overflow, and moving the wastewater discharge from within the confines of Boston Harbor are expected to result in a significant improvement in water and sediment quality within the Boston Harbor area. WHOI Sea Grant is supporting a study that will attempt to predict the effect that changing nitrogen inputs or changing sewage treatment strategies will have on nitrogen budgets and trophic status of coastal waters. In doing so, this study will also collect baseline data in the Boston Harbor and Massachusetts Bay area before the current outfall is moved, and will attempt to predict the effects of sewage diversion throughout Massachusetts and Cape Cod Bays. (Anne E. Giblin and Charles S. Hopkinson, Jr.)\*



◆ The layer between the warmer, near-surface ocean waters and the colder, more dense waters below the surface, is known as the thermocline. Like many deep bays, Massachusetts Bay has a strong thermocline that acts as a partial barrier to the vertical transport of nutrients which support phytoplankton growth and are thus important for primary production. This WHOI Sea Grant-supported project will attempt to determine the rate of vertical mixing across the thermocline in Massachusetts Bay by releasing and tracking a controlled dye substance. The results of this study will be particularly useful for calibrating numerical models of the hydrodynamics and nutrient dynamics of coastal environments such as Massachusetts Bay. The results will be used by environmental managers and engineers to assess the impact of the future sewage effluent in Massachusetts Bay. (Wayne R. Geyer, James R. Ledwell, Graham S. Giese)\*

◆ Increasing industrial and human activities have resulted in an increase in the flux of wastewater effluent and concentration of toxic chemicals in coastal waters (e.g. Boston Harbor). The accurate prediction of the fate of such pollutants depends critically on knowing their physico-chemical state. One WHOI Sea Grant-supported project will study the role of colloidal matter in the transport of reactive chemicals in coastal waters. The results will be useful both to the scientific community and public officials requiring technical data relating to the effective management of coastal waters. (S. Bradley Moran)

◆ Contamination of edible marine resources by polychlorinated biphenyls (PCBs) and chlorinated dioxins is a longstanding problem. WHOI Sea Grant is supporting the development of a novel assay system employing cultured cells for analysis of contamination of marine resources, including finfish and shellfish. The assay measures a sensitive biochemical change in cells exposed to fish and shellfish extracts containing these contaminants. The proposed method provides several improvements over existing techniques, including increased speed and efficiency, reduced hazard, and decreased cost. The assay would be of use to (i) state or federal regulatory agencies charged with assuring the safety of edible marine resources, (ii) commercial fishing or seafood concerns, and (iii) scientists interested in a model system with which to study mechanisms of chemical effects. (John J. Stegeman and Mark E. Hahn)

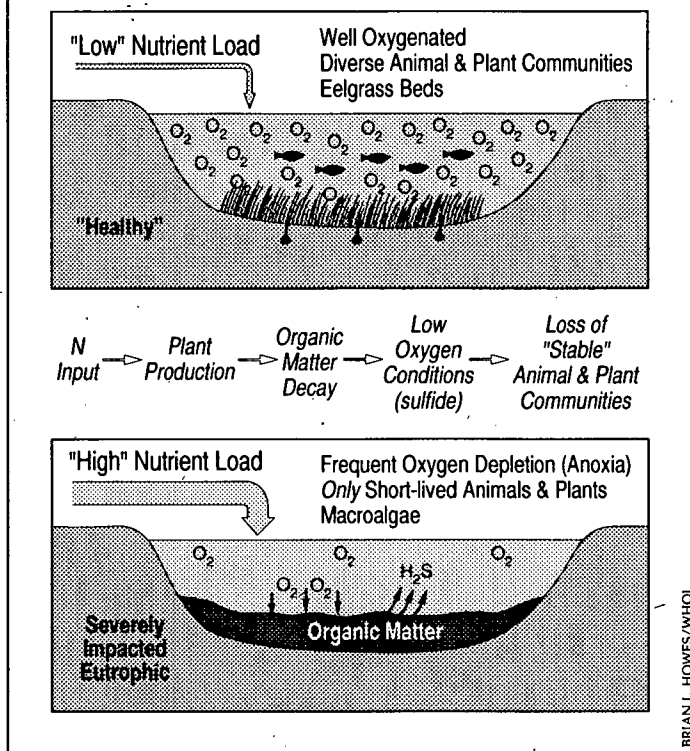
## Coastal Processes

◆ Concern over the potential deterioration of water quality in near-shore coastal salt ponds led to the development and implementation of a water quality monitoring program in Falmouth, Massachusetts in 1988. The core of the project involves the active participation of citizen volunteers who conduct water quality sampling in five coastal ponds and one harbor. The Falmouth Pond Watchers Program represents a unique partnership between scientists from WHOI, local citizens, and town government: scientific information, generated through the efforts of citizen volunteers under the guidance of WHOI scientists, is applied directly and immediately to planning decisions and management objectives for the town. (Brian L. Howes and Dale D. Goehring)

◆ A WHOI Sea Grant-supported study conducted on the island of Nantucket, off Cape Cod, represents a new approach to coastal water quality management in that it seeks to manage coastal waters as whole ecosystems. Nantucket's harbor system, though relatively pristine overall, has recently begun to show signs of nutrient-related stresses in some of its associated smaller water

\*For more information on projects relating to research in Massachusetts and Cape Cod Bays and the Boston Harbor Outfall Project, request WHOI Sea Grant Fact Sheet - WHOI-A-93-001.

## Eutrophication: Coastal Salt Pond



BRIAN L. HOWES/WHOI

bodies. Only by understanding the processes of nutrient dynamics, circulation, and effect on biotic communities can scientists predict how changing nutrient inputs or altered circulation, natural or anthropogenic, will affect the **ecological health of coastal water bodies**. It is hoped that this study, by integrated measure of all of the dominant ecological parameters, will serve as a model for other coastal areas concerned with nutrient pollution and help to redirect environmental management approaches at local, state, and federal levels. In addition, the project incorporates education and outreach on many levels to increase public understanding and awareness of the processes and potential human impacts to our valuable coastal resources. (Brian L. Howes and Dale D. Goehringer)

◆ While designing quantitative studies of coastal environments which correlate development activity, resultant impacts upon ecosystem nutrient dynamics, and subsequent effects upon oxygen status, it became clear to investigators Taylor and Howes that there was a need for new analytical approaches that adequately incorporate the logistical capabilities of the investigators and yield the sampling frequency required by the environment. This WHOI Sea Grant-supported project will attempt to develop an automated and accurate technique for improving the quantity and quality of data necessary for predictive and environmental management purposes. The

investigators will develop a new chemical technique for **high-resolution time series measurement of oxygen in coastal ecosystems** by using standard procedures for measuring chemical reaction rates. When the new method has been optimized for autonomous field implementation, seasonal in situ time series oxygen measurements will be made at hourly intervals using an automated continuous flow analyzer recently developed by the investigators. (Craig D. Taylor and Brian L. Howes)

## International/Policy

◆ The WHOI Sea Grant Program supports an International Marine Science Cooperation Program. This program encourages cooperation between U.S. and foreign marine scientists by developing databases, reports, and maps on the international jurisdiction over marine scientific research, by distributing information on funding sources for marine scientists to do international research, and by fostering binational and regional programs with developing countries to exchange marine science expertise (such as current and future programs in Portugal and Central America). (David A. Ross and Judith Fenwick)

◆ Coastal storms, sea level rise, and erosion represent continuous threats of flood damages to coastal residents. To date, most attention of storm and flood impacts has been devoted to monetary damages to residential and business properties. **Flood risk as perceived by the public** has not been systematically investigated. This Sea Grant project will conduct an economic analysis to evaluate: public perception of flood risk; willingness to pay to insure against future risk; and socioeconomic and risk information factors which influence perceived risk levels. A household survey to a randomly selected sample of residents on Cape Cod, Massachusetts, will be undertaken to collect necessary data. Results will be shared with policy makers who need to acquire information about public perception of flood risk in order to implement effective coastal zone management policies. (Yoshiaki Kaoru and Graham S. Giese)



## Public Education and Outreach

◆ In response to national imperatives to improve science education and to create both students and a work force that are more science-literate, WHOI Sea Grant is supporting a project to create an **interactive demonstration of scientific concepts based on coastal processes** and capitalizing on the romance of the sea. The project will involve WHOI scientists, research associates, and computer programmers who will work together with

skilled science center education staff and classroom teachers to identify the appropriate scientific principles that determine coastal processes, how best to communicate those principles and processes in an interactive program, and translate the principles and processes to computer software. This project will provide new science teaching materials for both formal and informal education, for use by both junior high school and high school classroom teachers and science education centers. (Sallie K. Riggs and Lee Anne Campbell)

◆ The goal of the WHOI Sea Grant Program's communications and outreach effort is effective and active dissemination of Sea Grant information and research. The WHOI Sea Grant communications program reaches out to individuals, agencies, and user groups in need of information about the coastal marine environment, as well as the general public and education sectors in an attempt to answer questions, increase environmental awareness, improve science literacy, and bridge the gap between marine scientific research and public knowledge. Some of the ways that WHOI Sea Grant accomplishes this goal are:

- ◆ WHOI Sea Grant's popular **public lecture series**, "Oceans Alive"
- ◆ Distribution of Sea Grant and other marine-related **publications**
- ◆ Co-sponsorship, along with the Massachusetts Coastal Zone Management office (MCZM), of a **cable television video series** called "SHOREWATCH: A Forum for Coastal Issues and Outreach"
- ◆ **Organizing events** throughout the year such as **annual beach cleanups** during "Coastweeks," **storm drain painting projects** to inform citizens of the dangers associated with dumping chemicals or household hazardous wastes down storm drains, **guided beach and coastal walks**, and articles in *Nor'easter* magazine, a regional Sea Grant publication.
- ◆ Compilation of a **computer database** which catalogs thousands of individual articles, publications, books, and other useful references on literally hundreds of marine-related topics, from aquaculture to zebra mussels.
- ◆ WHOI Sea Grant is an active participant and exhibitor at several educational events throughout the year, such as **local science fairs, conferences, and symposia**.
- ◆ Creation of "**All About Oceanography: A Fun-Filled Activity Book**," co-produced by WHOI Sea Grant and the WHOI Information Office, includes facts and illustrations on various topics in oceanography, including red tide, pollution, coastal erosion, hydrothermal vent communities, the hydrologic cycle, ocean circulation, marine minerals, and oceanography in the early years, to name a few, as well as a glossary defining terms used throughout the book. (Tracey I. Crago)

## Marine Advisory Service

Transferring the results of research and providing general marine-related information are important components of the WHOI Sea Grant Program.

The following examples demonstrate how WHOI Sea Grant's Marine Advisory Service facilitates communication among the users and managers of marine resources including the fishing community, local officials, environmental regulatory agencies, and the public.

◆ WHOI Sea Grant is sponsoring a series of workshops and forums known collectively as the **All-Cape Coastal Science Seminars**. Upcoming topics include a 2-part forum on the role of salt marshes, the use of coastal structures such as dikes and sea walls on gently sloping upland coasts along inner (protected) shorelines, and the fact that these structures may prevent development of new salt marsh in response to relative sea-level rise. Phase II of the forum will focus on the implementation of recommendations, made by participants at Phase I of the forum, for future regulatory actions at the state and local level. Other workshops will deal with coastal erosion and barrier beaches.

◆ The first annual update of the "**Directory of Cape Cod Coastal Outreach Organizations**" was completed and distributed. The Directory lists organizations on Cape Cod concerned with coastal resources and helps to streamline a regional communications system.

◆ A **Coastal Studies Program** is currently underway in two Cape Cod high schools (Chatham and Falmouth). The program involves teachers and their students who, while focusing on a location with a coastal geology problem, conduct field work, data collection, photography, and describe and observe the system and its changes.

◆ WHOI Sea Grant is also a participant in a regional program to develop and implement a proactive education and public outreach program to respond to the potential infestation of **zebra mussels in the Northeast region**. (Graham S. Giese)

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