Sea Grant Program 1991-1992

Woods Hole Oceanographic Institution

Research

WHOI Sea Grant supports 14 concurrent research projects and a number of smaller "new initiative" efforts aimed at taking the first steps into promising new areas. Many of the projects address local and regional needs. A major by-product of this research is publications. Over the years, WHOI Sea Grant has supported more than 600 scientific publications including journal articles, theses, books, and maps. Major areas of research include:

Fisheries Biology and Management

• The growth of **toxic algae** in coastal waters poses an increasing threat to New England fisheries and public health and is becoming a global problem as well. Dense accumulations of microscopic algae (mostly of a group called dinoflagellates) discolor the water and cause what is known as "red tides." WHOI Sea Grant is involved in long-term studies of blooms of toxic dinoflagellates that contaminate shellfish, leading to the risk of Paralytic Shellfish Poisoning (PSP), a food poisoning potentially fatal to humans and other animals. Past studies have focused on the factors determining the distribution and abundance of the red tide organism, the mechanism of toxin production, potential uses of the toxins, the recent "brown tides" and their effects on the bay scallop fishery of New York, and the discovery of domoic acid in New England shellfish. Current research is examining the causes of PSP outbreaks, the recently recognized contamination of offshore shellfish and the possible connection to nearshore blooms, as well as the possible link between dinoflagellates and oyster mortalities in Cape Cod aquaculture operations.

• The harvest of **soft-shell clams** (*Mya arenaria*) contributes as much as $19 million each year to New England's economy. Although much is known about the general life cycle of the species, questions remain about the processes affecting soft-shell clam larvae recruitment into the benthic population. WHOI Sea Grant is supporting work which suggests that the pattern of soft-shell clam recruitment is related to areas of larval "sinks," caused in turn by hydrodynamic processes. The knowledge gained from this study will be beneficial for the management and continued exploitation of this commercially valuable species.

• **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.

Human Impact on the Environment

• Many **coastal ponds** in Massachusetts are suffering from excessive nutrient enrichment as a result of increasing human influences. One WHOI Sea Grant-supported project attempts to construct a nitrogen budget for a local coastal pond. The total nitrogen economy depends on nitrogen loading (through groundwater, runoff, and benthic regeneration) as well as losses of nitrogen to the system (via denitrification and tidal exchange). Before coastal communities can control the short and long-term effects of nutrient loading, it is important that they first understand the nutrient dynamics of their coastal ponds.

• The accurate **measurement of primary production** and oxygen concentration in the water column is essential to long-term environmental monitoring of eutrophic coastal ponds. WHOI Sea Grant researchers are using automated instruments for high-resolution, long-term measurements of productivity. These data will be used in conjunction with studies of nutrient dynamics (see above) to define major physical and biological factors that determine oxygen concentrations in waters of coastal ponds.

• Contamination of marine environments and resources by **organic chemical pollutants** is an area of continuing concern. WHOI Sea Grant is supporting the work of Institution scientists in developing a simple, quick, and inexpensive assay for testing the degree of contamination of marine organisms by toxic organic compounds such as polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), chlorinated dioxins, and chlorinated dibenzofurans, some of which are known carcinogens. The test measures a biomarker - a certain protein - that is produced in increased amounts by organisms exposed to these contaminants. This enzymatic test may be suitable for commercial development for use in effluent monitoring and routine analysis of marine systems.

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.

Coastal Processes

• A series of **sand ridges** has been found on the inner continental shelf along the Middle Atlantic Bight. Improved knowledge of the occurrence and evolution of these seafloor ridges, via WHOI Sea Grant-supported studies of hydrodynamic and sediment transport processes, is important for the discovery of offshore petroleum resources and for the design of marine structures in this area.

• The process of **coastal upwelling**, the vertical transport of coastal water, is one of the mechanisms by which nutrients are brought to the surface from deep water. Upwelling in Cape Cod Bay may significantly impact the biological productivity of the Bay, its fish distributions, and its overall water quality. Studies of this important coastal process are providing information about blooms of toxic dinoflagellates, the behavior of coastal lobster populations, and the health of the shellfishery. Further, studies of upwelling in Cape Cod Bay will provide background information on hydrographic processes that will enable researchers to assess the effects (probable increased nutrient loading) of the new Boston Harbor sewage outfall when it is completed.

International/Policy

• The WHOI Sea Grant Program supports an **International Marine Science Cooperation Program**. This program encourages international cooperation between U.S. and foreign marine scientific communities by increasing opportunities for U.S. marine scientists to work in foreign waters and with foreign scientists, encouraging collaborative research, establishing information exchanges and outreach programs, and assisting with placement and exchange of researchers and students.

• In 1983 the United States proclaimed an Exclusive Economic Zone (EEZ), thereby declaring economic jurisdiction over the oceans within 200 miles of the coast. Among the resources of the EEZ are **strategic marine minerals** such as cobalt, chromium, manganese, and platinum. Economic studies of the potential value of a national marine mining effort are receiving WHOI Sea Grant funding.

Marine Advisory Service

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

Cape Cod and the islands of Martha's Vineyard and Nantucket suffer from the conflicts associated with a growing population requiring multiple uses of coastal lands and waters. In an economy closely tied to tourism and fishing (both finfish and shellfish), the demands of development are contributing to the degradation of the Cape's coastal resources.

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 has sponsored **workshops** on shellfish diseases, the closures of shellfish beds due to bacterial contamination, finfish tag-and-release programs, proper handling of yellowfin tuna catch, the review of local (offshore) oil-spill contingency plans, and many other timely topics.

• Informational talks such as **The All-Cape Coastal Seminars** enhance communication between all researchers concerned with Cape Cod's coastal environment.

• The development of a **Marine Resource Directory** listing the organizations on Cape Cod concerned with coastal resources will help streamline a regional communications system.

• WHOI Sea Grant is supporting **water quality studies** of several coastal ponds in the Town of Falmouth to provide officials with information necessary for taking management actions and assessing the effectiveness of those actions. One study, conducted in cooperation with the Falmouth Planning Office, involves the participation of more than 60 citizen volunteers in pond surveillance and sample collection.

Public Education

A knowledgeable citizenry is imperative for the future well-being of this nation's coastal environment. To this end, WHOI Sea Grant attempts to inform the residents of Massachusetts concerning all aspects of the marine environment and, in so doing, bridge the gap between scientific research and the public.

• WHOI maintains a joint **doctoral program** in oceanography with the Massachusetts Institute of Technology (MIT), and Sea Grant funds have assisted many students.

• Copies of WHOI Sea Grant **publications** are provided free of charge (while supplies last) to researchers, educators, students, fishermen, local officials, and all interested citizens who request them.

• Participation in the production of *Nor'easter*, a regional **Sea Grant magazine**, has enabled this Program to keep the public abreast of Sea Grant research and marine-related issues.

• WHOI Sea Grant sponsors a **lecture series** called "Oceans Alive: Plain Talk on Current Topics in Marine Science Presented for the General Public." The series is designed to introduce the public to the research of selected local marine scientists.

• **Formal and informal links** with other local, regional, and national science education organizations have brought WHOI Sea Grant in contact with teachers as it attempts to meet a growing need and demand for marine-related education and public outreach. This involvement includes work with the National Marine Educators Association, Massachusetts Marine Educators, Network for Environmental Science Education of Southeastern Massachusetts, Cape Cod Environmental Education Resource Center, Waquoit Bay National Estuarine Research Reserve, and the Woods Hole Science and Technology Education Partnership (STEP).

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