

SUSTAINING A SEA BESIDE THE SEA

SEA GRANT'S FOCUS ON THE FUTURE

UNIVERSITY OF MAINE/
UNIVERSITY OF NEW HAMPSHIRE
SEA GRANT COLLEGE PROGRAM

Executive Summary

Overview and Purpose

The joint University of Maine/University of New Hampshire (UM/UNH) Sea Grant College Program is part of a national network of university-based research, education, and advisory (extension) service, whose primary goal is to promote the wise use, conservation, and development of our marine resources. Established 30 years ago by Congress, the National Sea Grant College Program currently represents a \$53 million annual investment in some 300 academic and non-profit institutions around the United States and Puerto Rico that are applying expertise to the important marine issues of our day.

Through a unique partnership involving our two state universities, the federal government (represented by the National Oceanic and Atmospheric Administration), and our various marine clientele, the UM/UNH Sea Grant College Program has had a significant impact on marine resource use, development, and conservation in northern New England since we formally merged the two separate programs in 1976. Realistic planning has evolved as a cornerstone upon which the program is built.

The purpose of this planning document, *Sustaining A Sea Beside the Sea*, is to articulate key marine/coastal issues in the

Gulf of Maine where the academic talents and resources of institutions of higher learning in Maine and New Hampshire may be focused through the Sea Grant College Program. The plan sets a context for our involvement in these areas and helps guide academic interests and resource allocations. Retroactively, it also provides a means for determining the extent of Sea Grant's contribution towards the resolution of important marine problems facing the region and the nation.

In addition to having an issues orientation with a projected five-year life, *Sustaining A Sea Beside the Sea* draws heavily from forward-looking thinkers in our region. Our staff and 22-member Policy Advisory Committee obtained, digested, and integrated input and ideas from dozens of individuals recognized throughout the region for their special knowledge of marine/coastal issues. Additionally, topical reports and documents addressing various aspects of marine/coastal issues were reviewed. Many of these are listed in the section titled "Resources." Thus this final document, resulting from a year-long planning process, reflects to a significant extent the collective wisdom of a broad cross section of our constituents.

Coordination and Approach

Over the past 10 years there has been a remarkable expansion of initiatives, activities, and organizations involving marine-related research and extension throughout northern New England. These include such efforts as the Lobster Institute, the Maine Aquaculture Innovation Center, the Seacoast Science Center, and the Regional Marine Research Program. All of these have developed out of perceived needs and opportunities and have substantive contributions to make to the marine research and extension enterprise. Sea Grant's role in this rapidly evolving, multi-faceted regime is to provide new challenges and opportunities in defining primary, secondary, and shared responsibilities; matching private, state, and federal resources; and developing joint research and extension programs.

Because of the complex processes occurring in the marine environment, many scientific endeavors need to be approached from a systems level. Specifically, our program encourages investigation of the offshore, nearshore, and estuarine systems. These natural systems are very much interrelated and the health, vitality, and functioning of one is heavily dependent upon the others.

The plan contains three major, inter-related areas, which discuss a number of issues that are vitally important to the future use and development of marine resources in northern New England. Not surprisingly, the issues identified as important to this region are also important to much of the nation as well. The three major areas that the reader will find to be highly interrelated are:

- Management and Development of Living Marine Resources
- Coastal Development
- Marine Resources and Environmental Education

Each of the first two major areas contains subsections with a **background** statement, as well as statements on **research opportunities** and **extension/education**

opportunities. The **background** statement briefly outlines the importance of the issue and provides some basis for Sea Grant involvement. The **research opportunities** identify examples of types of research efforts that could make a contribution to the resolution of a specific aspect of the problem. Similarly, the **extension/education opportunities** indicate representative extension and education projects that could have an impact on the particular issue.

The third area, *Marine Resources and Environmental Education*, focuses largely on those aspects of marine science education that are generic to education and have therefore not been addressed in the other two issue-oriented areas. In this marine education section, the single listing of opportunities is devoted largely to non-research types of activities.

Management and Development of Living Marine Resources

1. Scientific Basis for Living Marine Resource Management

A large percentage of the fisheries resources in the Gulf of Maine/Georges Bank region are considered overexploited. According to the 1993 National Marine Fisheries statistics, New England groundfish and anadromous species each currently have 80 percent of their stocks in low abundance. Some, such as cod, haddock, and yellowtail flounder, are at historically low levels.

Extensive changes in species composition have also occurred over the past two decades with major increases in the previously less desirable species (dogfish and skates) and significant declines in the traditional groundfish stocks. Most of these changes in resource abundance can be directly attributed to fishing mortality.

The **primary goal** in this area is to enhance the overall understanding of the factors controlling levels of commercial and

sportfishing stocks in the Gulf of Maine. Specific objectives are to:

- Develop predictive models and tools that will aid in the management of complex, multi-species fisheries such as those found in the Gulf of Maine.
- Develop and aid the adoption of harvesting techniques that increase quality, reduce by-catch of non-targeted species, and increase fisherman safety.
- Identify potential new species suitable for commercial harvest and determine sustainable yields.
- Determine the role of ecosystem and habitat processes as related to fisheries productivity.

2. Production Technologies for Fisheries Enhancement and Aquaculture

Aquaculture has recently experienced widespread and rapid growth in northern New England and nationally. The continued demand by the public for seafood products, the decline in landings of traditional commercial species, and the adoption of new technologies has fueled this rapid expansion. Estimates are that the annual demand for seafood products will increase by 350 million pounds by the year 2000 as a result of population growth alone. With most of the world's fisheries at or above maximum sustainable harvest levels, the increased production of cultured species will have to meet a significant portion of this demand.

The **primary goal** in this area is to provide scientifically based information that will contribute to the development and continuation of effective stock enhancement efforts and a significant, sustainable aquaculture industry in northern New England and the nation. Specific objectives are to:

- Determine the feasibility of offshore, nearshore, and land-based aquaculture for selected finfish and shellfish species.

- Determine the feasibility of large-scale, commercial New England sea weed aquaculture.
- Facilitate the adoption of technologies and techniques that will allow northern New England aquaculture industries to remain competitive in a global market.
- Assess the feasibility and potential impacts of large-scale natural stock enhancement efforts.

3. Social Context of Management

At no time in recent memory have the commercial fisheries of the northeastern United States and Maritime Provinces of Canada, and the coastal communities supported by them, been in such a state of dynamic change and uncertainty. Traditional groundfish stocks such as cod, haddock, and flounder are at record lows, forcing extended closures of vast areas of the Gulf of Maine and severe limitations on the number of days that vessels may fish for affected species. These severe restrictions have led to a redirection of fishing effort onto less restricted species, raising concern that these too may soon become overfished.

Talk of reducing fishing capacity in the groundfish sector by 50 percent, pilot government vessel "buy back" programs, and the potential for implementing a plethora of limited effort/entry schemes for every major fishery in the Northeast has left the entire industry—harvesters, processors, wholesalers, and retailers—reeling from the uncertainty that comes with the inevitable change that will forever reshape the very nature of our region's oldest industry.

The **goal** in this arena is to selectively and effectively apply social science tools and expertise to sustaining the long-term health and viability of the region's fishing and aquaculture industries. Specific objectives are to help:

- Ensure that fishing communities and families will survive the current fish-

eries crisis, and create viable future fisheries with sustainable harvest practices, policies, and appropriate social and economic infrastructures.

- Develop a more dynamic, growing, profitable aquaculture industry in the region through better understanding of socio-economic constraints and their remedies.
- Ensure that all stakeholders (commercial/recreational fishermen, aquaculturists, eco-tourism enterprises, etc.) participate more fully and effectively in the management and policy process by developing mechanisms to reduce user conflict for the mutual benefit of the resource and stakeholders.

Coastal Development

1. Coastal Engineering

The physical infrastructure supporting societal needs in our coastal zone is immense and aging. Much of it was put in place prior to 1950. It is continuously exposed to a dynamic and corrosive environment whose complexities are exacerbated in the Gulf of Maine by harsh winters, great tidal ranges, and a very irregular coastline. These factors, plus a strong environmental dependence and ethos, provides coastal engineering challenges outside the norm.

The goal in this area is to help develop the engineering tools and methods for alleviating these stresses without compromising our quality of life or economic vitality. Specific, long-term objectives are to:

- Develop and apply new engineering approaches and materials for rejuvenating our deteriorating marine infrastructure (harbor, coastal, and off shore structures and pipelines).
- Develop environmentally sound technologies for existing and new applications in our coastal zones.

- Evaluate and predict environmental loadings on coastal and marine structures.

2. Ecosystem Processes

Some stresses and their effects on coastal marine ecosystems are direct and demonstrable, while others are indirect and their impacts uncertain or unknown. What is abundantly clear, however, is that most management issues pertinent to the marine environment seem to ultimately translate into the following fundamental questions: What have been, are, and will be the impacts of human activities on the marine environment? How do we distinguish these impacts from those due to natural variability? What have been, are, and will be the effects of these impacts on our society? And, how do we quantify these environmental impacts and societal effects? All of these at base require that we continually strive to increase our understanding of the structure and functioning of marine ecosystems.

The overall goal in this area is to provide that scientific understanding of our coastal ecosystems that is necessary to the informed management of our coastal zone.

Specific objectives are to:

- Improve our knowledge of ecosystem variability and the causative factors.
- Determine the ecological significance of habitat and life stages critical for maintaining or enhancing stocks of systemically important species.
- Provide the ecological knowledge base for developing a competitive and sustainable aquaculture industry.
- Develop capabilities to credibly monitor and predict the effects of intrinsic and extrinsic perturbations on coastal ecosystems.

3. Water Quality

The Gulf of Maine is often considered by scientists and the public alike as one of the most pristine marine environments on the East Coast. As a result of its water circulation patterns and the combined productivity of its seaweed, salt marsh grasses, and phytoplankton, the Gulf of Maine is also one of the world's most productive water bodies. Pristine as it may be, however, the Gulf of Maine is not without real or potential problems associated with growing populations and changing societies. As coastal land use intensifies, so do the effects of water pollution, both point and non-point. The latter represents a significant threat to the nearshore environment primarily due to its chronic character, its cumulative effects, and the difficulty in detecting, controlling, and abating it.

Within this area, the overall goal is to promote a balance that seeks to minimize public and ecosystem health risks associated with Gulf of Maine water resources and to maximize sustainable development. Specific objectives are to:

- Determine the existing levels, trends, sources, and economic impacts of key toxic compounds found in Gulf of Maine waters, sediments, and seafood.
- Develop capabilities for remedial actions when and where water quality degradation is identified.
- Establish the net costs and effectiveness of remediation efforts.
- Determine the assimilation capability of selected water bodies within the Gulf of Maine.
- Establish the relationships between toxic concentrations, water quality, and ecosystem degradation.
- Assess the status and trends of marine environmental quality by supporting volunteer monitoring of appropriate indicators that will allow identification of early stages of change.

4. Alternative Uses of Coastal Resources

The coastal environment of Maine and New Hampshire faces unprecedented demands for a wide variety of uses. Some of these alternative uses are consistent with one another while many others are not. Although most of the shoreline is in private hands, the public sector continues to have a major influence on which uses will be permitted.

The primary goal in this area is to produce socio-economic information that decision-makers can use effectively to predict future impacts of specific types of development. The objectives are to:

- Determine methods that accurately measure the economic and social benefits derived from alternative uses of coastal resources.
- Develop conceptual models, empirical methods, or alternative valuation techniques for use by coastal zone managers and decision makers.
- Determine more accurately the potential impacts of coastal development.
- Facilitate resolution of access and user conflict issues where possible.

Marine Resources and Environmental Education

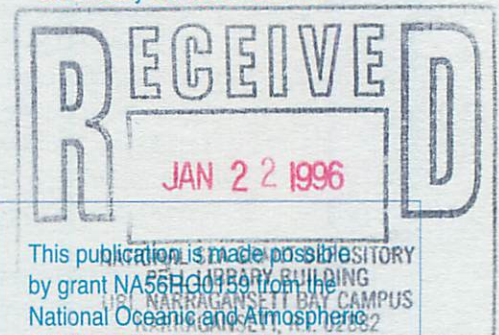
Science education in the U.S. is undergoing fundamental change and reform at all levels. Universities in general, and the marine science academic community in particular, are reassessing the long accepted goals of their undergraduate and graduate programs. And in the K-12 arena, much attention has been focused on developing programs that increase students' knowledge of science, their understanding of the science enterprise, and their engagement with the scientific process.

The goal in this area is to expand the public's understanding of marine resources, the marine environment, and the issues re-

lated to them so that the public and other stakeholder groups are better equipped to make informed decisions related to these issues.

Specific objectives are to:

- Encourage the technical transfer of knowledge in marine sciences to society by supporting graduate and undergraduate training through research projects and by extension/education efforts focused on specific issues related to living resources and coastal development.
- Develop marine/coastal educational programs and materials and disseminate information to produce marine- and coastal-literate citizens who are able to contribute more effectively to a technology-based, information-rich, and resource-limited society.
- Encourage the inclusion of marine and coastal concepts in existing educational programs by providing training for pre-service and practicing teachers in northern New England.
- Enhance marine science education in our school systems and help foster a sense of stewardship of the northern New England coast by encouraging the expansion of water quality monitoring and other hands-on research programs for elementary and secondary school students.



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