

# Message From The Director

After 20 years of operation, the National Sea Grant College Program has evolved into a strong and viable partnership between State academic institutions and the Federal Government working together to develop and wisely use our Nation's marine and Great Lakes resources. Twenty-nine Sea Grant Colleges and institutions now serve as the core of the National Sea Grant College Program which operates through a network of over 200 participating university and marine research institutions throughout the nation. During 1986, this network marshalled the intellectual talents and skills of over 3,000 scientists, engineers, educators, extension service agents and students working together to advance knowledge in the marine economic sector. Neither an entitlement

nor an environmental program,

Sea Grant does not "give away" Federal funds to universities to solve parochial problems in their own way. Rather, Sea Grant supports research, education, and marine extension services based upon competitive proposals and their vigorous review. Over one non-Federal dollar from State and industry partners is now invested by the local programs for every two Federal dollars on basic research, technology transfer, and services which promote our national economy.

Most marine-resource problems are multifaceted and, therefore, Sea Grant uses multidisciplinary talent to address identified goals. Successful shrimp aquaculture, for example, requires the applications of biology, microbiology, genetics, engineering, veterinary science, economics, marketing, and food technology. Having entered its third decade in 1986, the National Sea Grant College Program continues to stress the multidisciplinary approach to solving problems and continues to confront the challenges of balancing basic versus applied research, meeting local needs while addressing national objectives, and exercising leadership while still encouraging the inflow of new ideas. The information contained

in this booklet is designed to familiarize you with Sea Grant Program legislation, regulations, and management. If you have any further questions, please call on me or any of the program personnel listed in this booklet.

Ned A. Ostenso

# National Sea Grant College Program:

# In Brief

***********	WHAT IT IS	NHA	WHAT IT DOES
The mission of the National	o Competitive, peer-	0	Supports DOC Goals
Sea Grant College Frogram 1s to increase the understanding,	reviewed program	0	Supports other NOAA
assessment, development, utilization, and conservation	o Managed by technical specialists	1	Services
of the Nation's ocean and coastal resources by providing	o A NOAA Mission	нон	HOW IT OPERATES
assistance to promote a strong educational base, responsive		o	Multidisciplinary
research and training	WHAT IT ISN'T		Teams
activities, and broad and			
<b>—</b>	o An Entitlement Droutene	0	Addresses full Research/Technology
knowledge and reconiques.	L UBLA		Transfer Spectrum
****************	o An Environmental		
	Program		

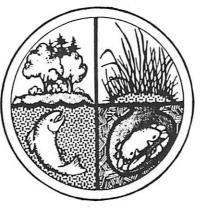
# Department of Commerce Goals

INCREASE AMERICA'S COMPETITIVENESS IN THE WORLD ECONOMY		<ul> <li>Promote the development and growth of oceanic and atmospheric industries</li> </ul>	IMPROVE SERVICE DELIVERY AND INTERNAL MANAGEMENT			
0	Increase U.S. exports of goods and services	MANAGE EFFECTIVELY THE NATION'S OCEANIC AND	<ul> <li>Provide more timely and accurate weather forecasts and warning services to</li> </ul>			
	Increase the number of small and medium sized exporters	ATMOSPHERIC RESOURCES o Improve federal management	the U.S. public o Improve delivery of ocean			
	Increase exports and	of U.S. ocean and coastal resources	information products and services			
	domestic consumption of U.S. fisheries products	o Provide timely environmental data, information and				
STIMULATE PRODUCTIVITY AND ECONOMIC DEVELOPMENT		assessments to U.S. industry				
	Promote private sector capital formation, job creation, and new and expanding industries	o Determine the characteristics and resources of the U.S. 200 mile Exclusive Economic Zone by 1990				
	Promote the development and application of science and technology in U.S. industries	o Increase our understanding of oceanic and atmospheric processes through monitoring and research				

# Sea Grant Legislative Background And Operating Regulations

### Legislation

The Sea Grant Program was established October 15, 1966, by P. L. 89-688, the National Sea Grant College and Program Act of 1966. Its stated purpose was "to provide for the establishment of a program of sea grant colleges, and education, training, and research in the fields of marine science engineering and related disciplines." Until amended by the Sea Grant Improvement Act of October 8, 1976 (P. L. 94-461), it was reauthorized three times without substantive change. The amendment strengthened the basic program of the original Act and provided for the establishment of a Fellowship Program and a National Review Panel. It also authorized separate appropriations for a National Projects Program and an International Program.



Congressional intent, as stated in each of the two Public Laws and in numerous hearing reports, is that the nation needed enhanced efforts on developing and using the resources of the oceans and the Great Lakes, and that utilizing the talents of the nation's academic institutions was one of the best ways of accomplishing this purpose. The Improvement Act has since been reauthorized four times, the only substantive change being to re-insert the word "College" in the title to stress that goals were to be achieved through university programs. Sea Grant was initially assigned to the National Science Foundation and was transferred intact to NOAA in October 1970, when NOAA was created.



### Features Of The Law

- o The Secretary of Commerce is authorized to make grants and contracts for programs that will:
  - Undertake research, education, training, and dissemination of information relating to development of ocean and coastal resources, and
  - Be responsive to the needs or problems of individual states and regions.
- Except for specified special grants, grants and contracts must be matched with non-Federal funds on a 2/3 (Federal), 1/3 (non-Federal) basis.

o Up to 1 percent of appropriated funds may be

granted without matching for the purposes of implementing the program's objectives.

- A fellowship program is authorized but limited to 5 percent of appropriations.
- o The law directs the establishment of a National Review Panel to advise the Secretary on:
  - Proposals.
  - The Fellowship Program.
  - Designation and operation of Sea Grant colleges and programs.
  - Formulation of guidelines and priorities.

and authorizes separate appropriations for a National Projects Program (limited to 10% of appropriations) to address these needs with grants and contracts that do not require matching funds.

- The law directs the Secretary to consult with the State Department on applications for International Program grants. It also authorizes separate appropriations (\$5,000,000 in 1983) for the program whose purpose is to:
- Enhance the capabilities of developing foreign nations to address their marine resource problems and opportunities.
   Promote international
- o The law directs the exchange of information ercent of Secretary to identify relating to marine ercent funds may be specific national needs. resource development.
- 5

International Program grants are made to U.S. universities and are not subject to the matching provision of the basic program.



o The law further:

- Declares the Federal Government's commitment to and involvement in a continuing partnership with State and local governments.
- Requires the preparation of a biennial report and its evaluation by the Office of Management and

Budget and the Office of Science and Technology Policy.

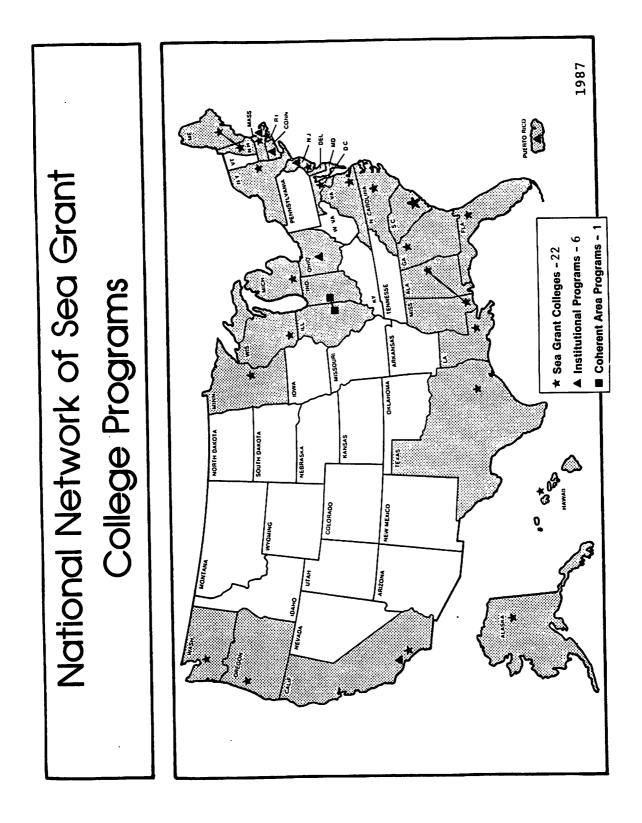
- Calls for continued and increased Federal support of Sea Grant programs.
- Directs the establishment of regulations and guidelines relating to designation, activities, and responsibilities of Sea Grant Colleges and Sea Grant Regional Consortia.

### **Formal Regulations**

- o Currently-in-effect DOC regulations and guidelines (called for by the law) that govern operation of the program include:
  - Regulations for the basic matched funding program covering the

three categories of support:

- 1. Projects
- 2. Coherent Area Programs
- 3. Institutional Programs
- Regulations for the nonmatch National Projects Program along with a listing of identified national needs.
- Regulations for the nonmatch International Program for cooperative assistance to foreign developing nations.
- Guidelines for the Fellowship Program.
- Guidelines for Sea Grant Colleges and Consortia-their designation, duration, and responsibilities.



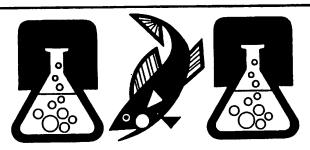
# Managing The National Sea Grant College Program

### Introduction

Although the National Sea Grant College Program operates under its own organic act, passed by Congress and signed by the President on October 15, 1966, and has undergone several subsequent reauthorizations without significant change, there is a pervasive misunderstanding about the purpose and management of the program. This section summarizes the process used in administering the program within the guidelines of its legislative mandate.

Administrative procedures have been developed to balance the competing interest of:

- o Basic versus applied
  research.
- o Meeting local needs while addressing



national objectives.

- Exercising leadership without stifling the inflow of fresh new ideas.
- Bringing multidisciplinary talent to focus on specific goals when university structures, professional loyalties, and most other Federal research sponsors function along disciplinary lines.
- o Satisfying the diverse public and private

constituencies which have legitimate interests in the program, some through provision of matching funds.

The managerial structures that have evolved to balance these competing needs and interests are described in the categories below. The operating procedures of the program are formalized in a reference ("The Green Book") used by all national and university administrators in the program. This book is updated regularly.

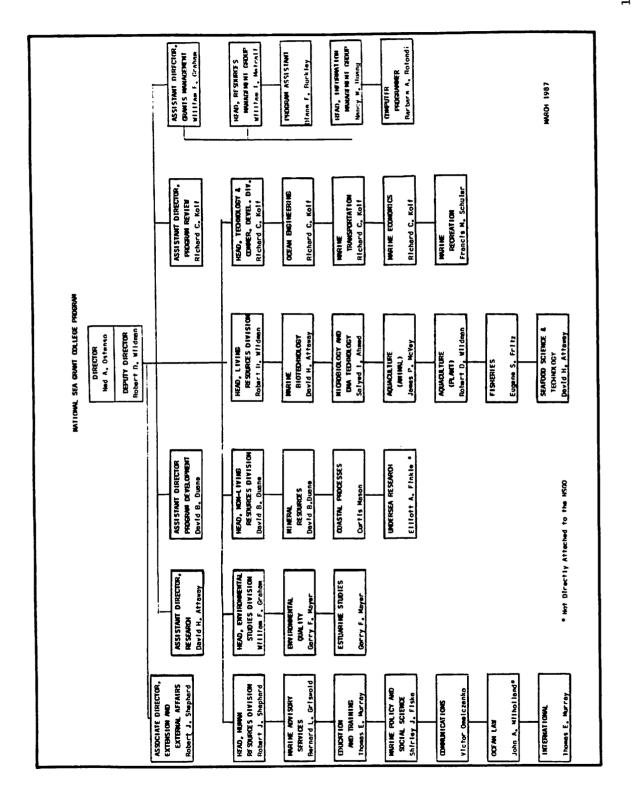
### **Federal Level**

- o The Sea Grant enabling legislation dictates that there shall be a review panel of 15 members and specifies the constituencies from which panel members will be selected. The panelists are individuals of mature experience and provide guidance on administrative and scientific policy.
  - The panel meets with the National Sea Grant College Program Office at least twice a year and with university Sea Grant Directors at least once a year.
  - At least one panelist participates in every onsite review of a university or regional program's progress and plans.

- The panelists serve on ad hoc committees to address specific problems and represent Sea Grant in meetings of other organizations.
- The National Sea Grant
   College Program Office
   annually reviews its entire
   program.
  - An internal annual report is prepared for this review. This report contains critical analyses of each subject area, and a listing of projects in these areas with principal investigators and their institutional affiliations.
  - Representatives from other NOAA organizations, including the National Marine Fisheries Service (NMFS), Congressional Affairs (CA), Public

Affairs (PA), Policy & Planning (PP), and the General Counsel (GC) participate in these reviews.

- In 1978, the NOAA National Sea Grant College Program Office reorganized itself along major "program lines" such as aquaculture, fisheries, and engineering.
  - Members of the technical staff serve as monitors of university and regional programs and as directors of subject areas or "program lines."
  - In subject areas where a full-time professional cannot be justified, the National Office draws on expertise in other parts of NOAA. For example, the General Counsel provides part-time



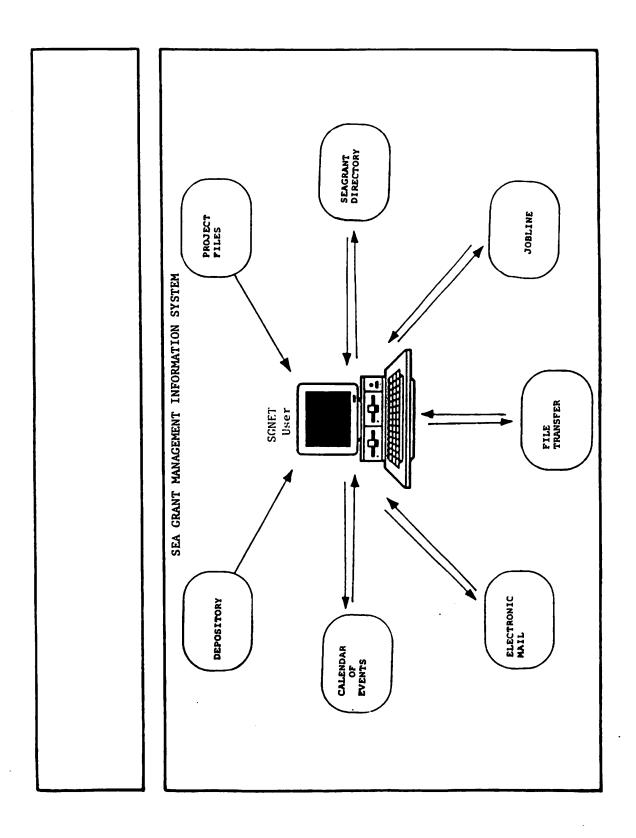
assistance for oversight in marine law.

- Other NOAA offices routinely assist in review and evaluation of specific projects and proposals.
- Derivative from the National Sea Grant College Program Office's annual review, and its interaction with other elements of NOAA and the scientific community, an annual letter of guidance on research and education priorities goes to all the Sea Grant programs. This letter serves as the intellectual basis for proposal review and action.
- The senior staff of the National Sea Grant College Program Office meets twice annually with the senior managers in the Office of

Oceanic and Atmospheric Research (OAR) in NOAA to discuss programs and establish priorities.

- o Over the years, the NOAA National Sea Grant College Program Office has entered into agreements of cooperation with other agencies (Navy, USGS, F&WS, etc.) and with other NOAA components--NESDIS, NWS, NOS, etc.
- o One individual in NMFS serves as a liaison to Sea Grant. This individual attends Sea Grant staff meetings, solicits written reviews of all Sea Grant proposals in fisheries from experts in NMFS, and schedules NMFS representation at all site reviews.
- A computer system for managing information within the National Sea Grant

College Program is maintained within the National Office. This system is accessible to all university and regional directors and other NOAA organizations. For example, they can quickly get a listing of past and current Sea Grant projects by institution or subject. The system is used frequently when Sea Grant directors are formulating proposals for continuing their programs. They can, thereby, avoid undesirable duplication and establish linkages between their candidate investigators and investigators in other programs and related fields. The system is also used by subject area specialists within the National Office to prevent duplication and coordinate research conducted at



different institutions and Federal laboratories. The information system contains:

- A project file that includes all the general information about projects, including principal investigator, current and past expenditures, and keywords; statements of the projects' objectives, their rationale, methodology, and recent accomplishments; and reports on completed projects.
- An electronic mail system that provides for instantaneous networkwide communications.
- An events calendar that keeps all parties informed of upcoming activities.
- The information system is electronically linked to the National Sea Grant Depository at the Univer-

sity of Rhode Island where copies of all Sea Grant publications and reports are on file and available for lending.

o Proposals for Sea Grant projects undergo a vigorous peer review process to ensure that only outstanding projects are ultimately supported. Most university Sea Grant programs use two levels of review; the first is to screen proposed projects and the second to peer review those selected. Successful projects are then included in the university's institutional proposal that is submitted to the National Sea Grant College Program Office, where all projects undergo further review by outside experts.

 The renewal of each university or region's program is preceded by an on-site review by representatives of the National Sea Grant College Program Office, NMFS, the review panel, and experts from other agencies or universities.

o The final disposition of institutional proposals is done through a collegial process involving the assembled program specialists of the National Office, each of whom speaks to those projects relevant to his/her area of responsibility. Each project is graded on its scientific or professional merit, rationale, and relationship to potential users of the results. NMFS, GC, and OAR are represented at these meetings which conclude with a recommendation for composition and funding of the renewal grants.

### Joint Federal/University

### **Functions**

o The National Sea Grant College Program Office meets with the Council of Sea Grant Directors at least twice and usually three times a year to discuss administrative and programmatic issues. One of those meetings, designated as "Sea Grant Week," has broad representation including financial officers, communicators, extension service leaders, legal researchers, and others to address common problems and establish mutual priorities.

 On a case-by-case basis, the National Office with aid from experts within the Sea Grant network, produces documents which provide a foundation and intellectual framework for setting research priorities within program areas. These documents assist in formulating the National Office's annual letter of guidance on research priorities and in helping to meet Department of Commerce goals. In addition, they are important tools used by university Sea Grant directors in putting their programs together and by National Office staff in evaluating programs and making decisions. The development of these formal strategies is a continuing process and involves relevant expertise inside and outside of NOAA.

# <u>Table I.</u>

# Procedures Involved in Selecting

Major Research Areas

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### Explanatory Notes with Specific Examples for Table I.

- A. l. : more than 30 operating in the network
  - 4. : operated at MIT for, and cooperatively with, the network
  - 5. : held annually since 1968
  - 6. : Southeast Region National Marine Fisheries Service and Sea Grant Program Directors
  - 7. : Estuarine Research and Management; Smaller Maritime Ports; Extended Jurisdiction.
- C. 2. : published in Federal Register at intervals
  - 3. : individual programs develop long range plans

- 6. : Sea Grant Strategy for Fisheries Research; a Research Agenda for Smaller Maritime Ports
- 7. : Brief statements pertaining to specific issues, Sea Grant capabilities, and needs for research
- D. 2. : reviews provided by both peer and user groups
  - 3. : team composed of both peer and user groups
  - 4. : evaluation of project rationale, quality of science, and relationship to user community

### **University Level**

- o Although details vary among universities, most programs are served by two advisory committees--one made up of representatives of relevant academic institutions and departments, the other composed of representatives of state government, the private sector, and citizens' groups.
- Sea Grant directors solicit proposals on subjects of high priority and search out expertise essential for proper development of their programs.
- Based on guidelines within a university or region and the continuing dialog with his/her monitor in the National Office, the Sea Grant director submits an omnibus proposal to the National Office. All projects have undergone peer review by technical experts.

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 University programs in most regions have formal consortia which enable them to address problems and issues of common interest and to share talent, especially in extension services. In some cases, programs geographically separated establish informal consortia for collaborative research on a topic of common interest. For example, the Maryland, North Carolina, Connecticut, and New York Sea Grant Programs have collaborated on an economic analysis of the striped bass fishery on the Atlantic Coast.

 Sea Grant programs are now producing 5-year plans that are updated on a rolling schedule.

### Accountability

- Fiscal auditing is handled by auditors outside of the National Sea Grant College Program Office.
- Programmatic accountability is achieved by several means.
  - Review of completion reports required for each project.
  - Review of refereed professional papers and technical reports which are expected as part of the output of most projects.
  - Evaluation of progress reported orally and in poster sessions at on-site

reviews of Sea Grant Programs.

Participation in specialized workshops and symposia at which Sea Grant investigators report and discuss accomplishments.

Recertification at 6year intervals of each program which has been designated a Sea Grant College Program by the Secretary of Commerce in order to ascertain compliance with statutory criteria and to judge quality of performance.

# Sea Grant Subject Areas And Economic Benefits

The National Sea Grant College Program Office supports projects in a wide array of marine-related subjects through its five divisions: Living Resources, Non-Living Resources, Technology and Commercial Development, Environmental Studies, and Human Resources. In addition, a Grants Management Division handles the processing of grants and the managing of the Sea Grant network's computerized information system. Office professionals are assigned to one or more subject areas in their division. Names and phone numbers (area code 301 in all instances) are listed here. Afterwards, descriptions are provided of Sea Grant subject areas and recent accomplishments that are aiding the nation's marine economic sector.

DIRECTOR Ned Ostenso, (301) 443-8923

Deputy Director Robert Wildman, 443-8925

Associate Director Extension & External Affairs Robert Shephard, 443-8886

Assistant Director Program Development David Duane, 443-8894

Assistant Director Program Review Richard Kolf, 443-8977

Assistant Director Grants Management William Graham, 443-8926

Assistant Director Research David Attaway, 443-5940

### LIVING RESOURCES DIVISION

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Aguaculture (animal) James McVey, 443-5940

Fisheries Eugene Fritz, 443-5940

Marine Biotechnology, Seafood Science & Technology David Attaway, 443-5940

Microbiology & DNA Technology Saiyed Ahmed, 443-8290

### NON-LIVING RESOURCES DIVISION

Head and Mineral Resources David Duane, 443-8894

Coastal Processes Curtis Mason, 443-8894 Diving Physiology & Safety Elliott Finkle, 443-8391

### TECHNOLOGY & COMMERCIAL DEVELOPMENT DIVISION

Head and Marine Transportation & Ocean Engineering Richard Kolf, 443-8977

Marine Economics, Marine Recreation & Tourism Francis Schuler, 443-8977

ENVIRONMENTAL STUDIES DIVISION

Head, William Graham, 443-8926

Environmental Quality & Estuarine Studies Garry Mayer, 443-8926

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Head, Robert Shephard, 443-8886

Communications Victor Omelczenko, 443-8888

Education and Training Thomas Murray, 443-8888

Marine Advisory Services Bernard Griswold, 443-8886

Marine Policy & Social Sciences Shirley Fiske, 443-8886

Ocean Law John Milholland, 443-8886

### GRANTS MANAGEMENT DIVISION

Assistant Director William Graham, 443-8926

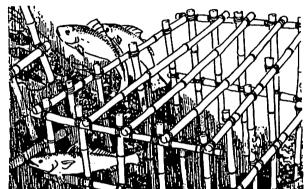
Head, Resources Management Group William Metcalf, 443-8290

Grants Assistant Dee Dee Buckley, 443-8923

Head, Information Management Resources Group Nancy Huang, 443-8290

Computer Programmer Barbara Rotondi, 443-8290

### Living Resources



### Aquaculture

Sea Grant has a lead role in the development of aquaculture for marine, estuarine, and Great Lakes species as mandated by the National Aquaculture Act of 1980. The coho salmon, for example, is the first instance of a truly domesticated marine species; the importance of this development is that we may

soon see the day when such fish become as domesticated as cows and chickens are now. Such salmon currently are being raised in net pens in Puget Sound, and Sea Grant research into salmon genetics, feeding, and improved growth rates has aided this development. Several companies in the Pacific Northwest have gone into commercial production using a net-pen fishery for coho salmon. For example, DomSea Farms, now a subsidiary of Campbell Soup, is harvesting over \$3,000,000 worth of salmon per year.

### Fisheries

By its nature, the fishing industry is

disaggregated, consisting of many small to medium-sized companies. As a result, it underinvests in research and development making it difficult to maintain its competitive edge in international economic markets. Sea Grant has supported innovative research and technology transfer to the fishing industry to assist in improving productivity. For instance, Sea Grant researchers successfully applied acoustic techniques for more accurately estimating populations for the Pacific herring industry. This research helped to set quotas much closer to the maximum sustainable yield.



### Seafood Science And Technology

Sea Grant research in food science is aiding the fishing industry by improving processing technology, products, and methods for assuring safety of seafood. This research is relevant to tapping the enormous potential for expansion of domestic and foreign markets for seafood.



Atlantic and Gulf menhaden, the nation's largest fishery in terms of volume but rather low in value per pound, is currently being evaluated by Sea Grant scientists as a possible candidate for use in surimi, a minced fish product that can be reconstituted into various seafood products. It is possible that menhaden may become the "soybean

of the sea."

### Marine

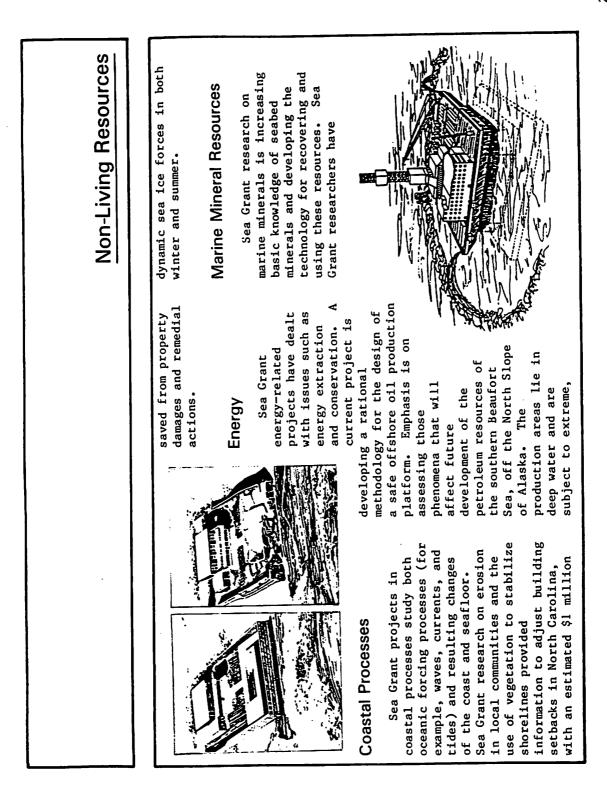
### Biotechnology

Biotechnological development of living marine resources has the potential of introducing valuable new products and services to medicine, the chemical industry, agriculture, and aquaculture. Sea Grant researchers have been testing new pharmacological compounds derived from marine resources.



For example, they have found that winter wheat can be protected against damage by soil fungus with an inexpensive seed treatment that uses chitosan, a structural component of shrimp, crab, and lobster shell. In field trials in an eastern Washington state area where fungus-infected root is common, crop yield from treated seed was up to 20 percent higher than yield from untreated seed. The inexpensive treatment, which

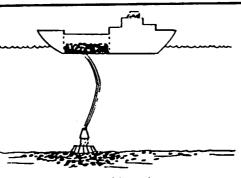
costs about \$20 per 160 acres of wheat, creates a new commercial use for chitosan, a component of shell waste that has created disposal problems for seafood processors in the past. Bioshell Inc., has acquired patent rights to this chitosan wheat seed treatment.



discovered promising accumulations of ilmenite, the source of titanium, and other minerals on the floor of the Gulf of Mexico and off coastal Georgia. Titanium is used in high technology products where its strength, light weight, and resistance to heat are important, as well as in leadfree pigment for consumer paints. U.S. manufacturing plants that use the mineral to produce titanium dioxide currently import their raw material from Australia.

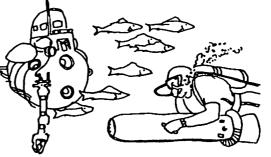
### Diving Physiology and Safety

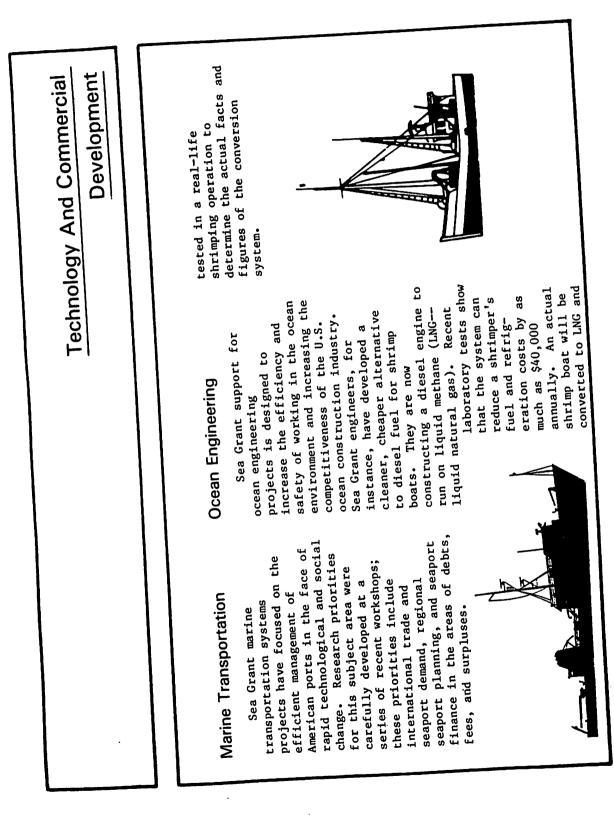
Understanding the fundamental requirements for increasing man's capacity both to perform underwater scientific research and to enjoy the water on a recreational basis is the focus of Sea Grant's efforts in diving physiology and



safety. Mortality is a problem in both commercial and military operations and for recreational divers. Approximately 140 sport scubarelated deaths occur each year in the United States.

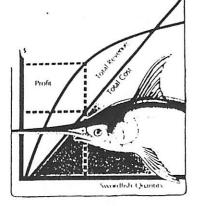
Sea Grant scientists, through new experiments and a recent Survey of diving accidents, have found that the nation's 1.5 million scuba divers face a greater risk of paralysis and death from decompression sickness than was once believed. The scientists found an unexpectedly high incidence of spinal cord injuries caused by the deep, short-duration dives that scuba divers often make. From their experiments, they stress that divers stay well within the diving decompression guidelines that govern the depth and duration of a safe dive. They also advise that scuba diving vacationers rest a day before driving over the mountains or flying to get home.





### **Marine Economics**

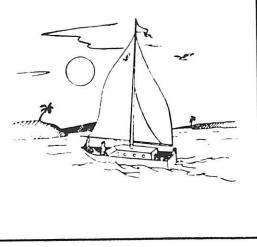
Research in marine economics contributes valuable information about the economic processes at work in delivering a wide mix of goods and services to the world marketplace. Sea Grant projects in this area encompass such fields as fisheries management and development, marine recreation, coastal zone resources, marine minerals, and transportation. A research project on fish markets is now being conducted in Portland, Maine, where a new fish pier has been built and a fish auction has been inaugurated. The research is expected to provide details about the value of fish auctions, especially as they relate to encouraging fishermen to ensure that quality products are brought to shore.



### Marine Recreation And

### Tourism

Recreation and tourism has been cited as the fastest growing industry in the United States, and Sea Grant research in this area recognizes the importance of this sector of the economy. A regional research initiative begun in the Northeast is developing an analytical method to project benefits and impacts from future investments in tourism development. This tool can then be used by municipalities to help make choices about investment in activities ranging from promotional planning to marine or public sector construction of recreation and tourism facilities.



### Environmental Quality And Estuarine Studies

The Sea Grant environmental research program examines major problems and management issues affecting the nation's estuarine, coastal, and oceanic environments. The primary goal is to develop knowledge that fosters multiple uses consistent with the maintenance of strong and healthy natural ecosystems.

Sea Grant environmental studies fall into seven topical areas--environmental characterization, nutrient and carbon dynamics, habitat use and dynamics, toxicants, human health, environmental management, and special projects. Well over half of the projects deal with estuarine issues.

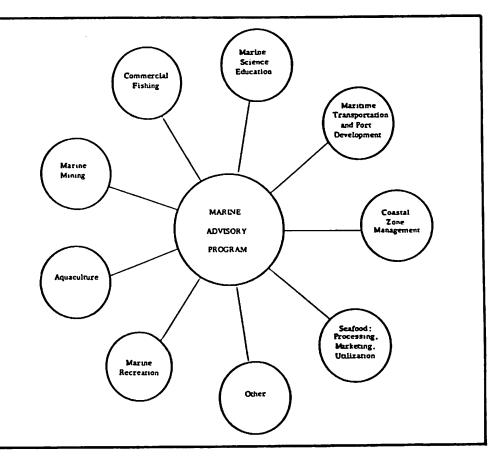
Rhode Island's scenic coastal ponds--high salinity embayments that occur behind barrier beaches along the southwestern shore of the state--have until recently been relatively unaffected by human activities. However, the demand for additional recreational opportunities and the suburbanization of shore areas augur detrimental effects on water quality. declines in traditional fisheries, development of flood and erosion hazards, mounting user conflicts, and the loss of an aesthetically and ecologically valuable pond habitat. Results of Sea Grant studies of coastal pond fisheries and salt pond manangement served as the cornerstone for a Special Area Management Plan for the ponds and their watershed. This plan was adopted by the the Rhode Island Coastal Resources Management Council as a result of on-going, direct interactions with Sea Grant scientists and policy specialists. The partnership continues with the initiation of research on eutrophication in coastal ponds and with the implementation of a citizenbased program to monitor environmental conditions in the ponds.

### **Environmental Studies**

### Human Resources

### Marine Advisory Services

The National Sea Grant Marine Advisory Service (MAS) program is designed to improve the productivity of marine resources and the quality of life for the people who enjoy them, are affected by them, or who depend on them for a living. A network of about 350 agents and specialists, who are affiliated with Sea Grant universities and work in the field, provide an essential link between the people who live and work in coastal areas and the Sea Grant researchers at the universities. These agents and specialists are experts in areas such as seafood technology, marine economics, coastal engineering, commercial fishing, recreation, and communications.



Through workshops, seminars, publications, radio, television, demonstrations and person-to-person contact, they put the results of Sea Grant research into the hands of those persons, such as commercial fishermen and coastal planners, who can use them both to better manage and to realize fully the potential of the oceans and Great Lakes.

The blue crab fishing industry is estimated to be worth \$6.5 million in Virginia and Maryland. Demand has grown for this product, but a great many blue crab shedders still use methods dating back to the earliest days of the industry. Consequently, excessive mortality of crabs occurs during the shedding process, often due to poor water quality. In some cases, mortality can exceed 65-70 percent.

At the request of industry, a project was initiated to increase the production capabilities of the soft shell blue crab industry through information transfer, diagnostic services, and improved shedding facility design and construction. For example, a major crab producer in Virginia, upon the advice of a Sea Grant commercial fisheries specialist, changed his flow-through crab shedding system to a closed recirculating system. The survival rate on crabs, from peeler through soft shell stage, increased from 35 percent to 65 percent in one season.

### **Education And Training**

In the act that set up the National Sea Grant College Program as a cooperative federal-university program, Congress encouraged the universities to develop a skilled labor force--of scientists, engineers and technicians--that can benefit our environment and economy, and transfer knowledge from the university to industry. Since its inception, the National Sea Grant College Program has supported over 7,000 students in research or course work at the undergraduate and graduate levels.

Education and training projects currently supported by Sea Grant cover areas such as: college course development and student projects; research assistantships; non-formal education; technical and vocational training; the Sea Grant Fellowship Program; and Sea Grant interns. Non-formal education projects, for



example, include marine and aquatic education efforts that typically take place at science centers, museums, and aquariums, while the the Sea Grant Fellowship Program provides educational assistance to qualified undergraduate and graduate students of ocean and coastal resources who have been underrepresented in marine fields.

### Marine Policy And Social Sciences

Current issues such as estuarine management, development of aquaculture, and coastal economic development rely on scientific research, but their wise resolution depends on understanding the social and policy context underlying the issues. Sea Grant projects in marine policy and social sciences have addressed issues of federal/state responsibility for managing ocean and coastal resources, have contributed to more efficient port management and planning, helped develop a more flexible waterfront plan for the Seattle harbor, and identified long-term trends in Great Lakes environmental

policy. Most of the projects are interdisciplinary and draw upon many fields to help solve marine problems.

### Ocean Law

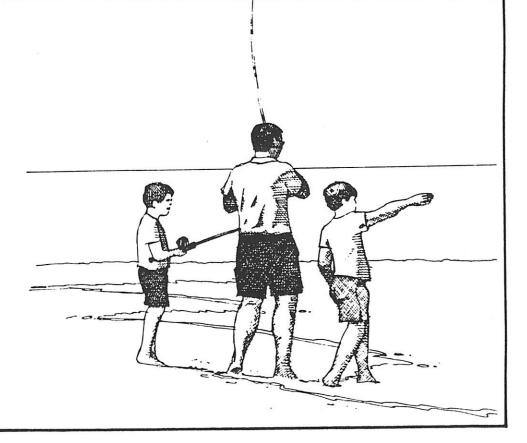
Ocean and coastal law issues are studied in continuing programs of legal research at designated universities and through individual projects supported by Sea Grant. While some continuing programs are broadbased in nature, others focus on particular areas of the law such as international marine law, the coastal zone, and fisheries. Recent individual, non-continuing projects have included a study of legal problems in post-hurricane reconstruction in Florida and a project to evaluate the effects of fisheries laws in California between 1945-1970.

### Communications

Communications projects at Sea Grant institutions disseminate the results of research and promote public awareness and appreciation of ocean and Great Lakes resources and issues. A variety of methods are employed to reach audiences, including publications, media materials, and publicoriented activities such as exhibits and conferences.

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