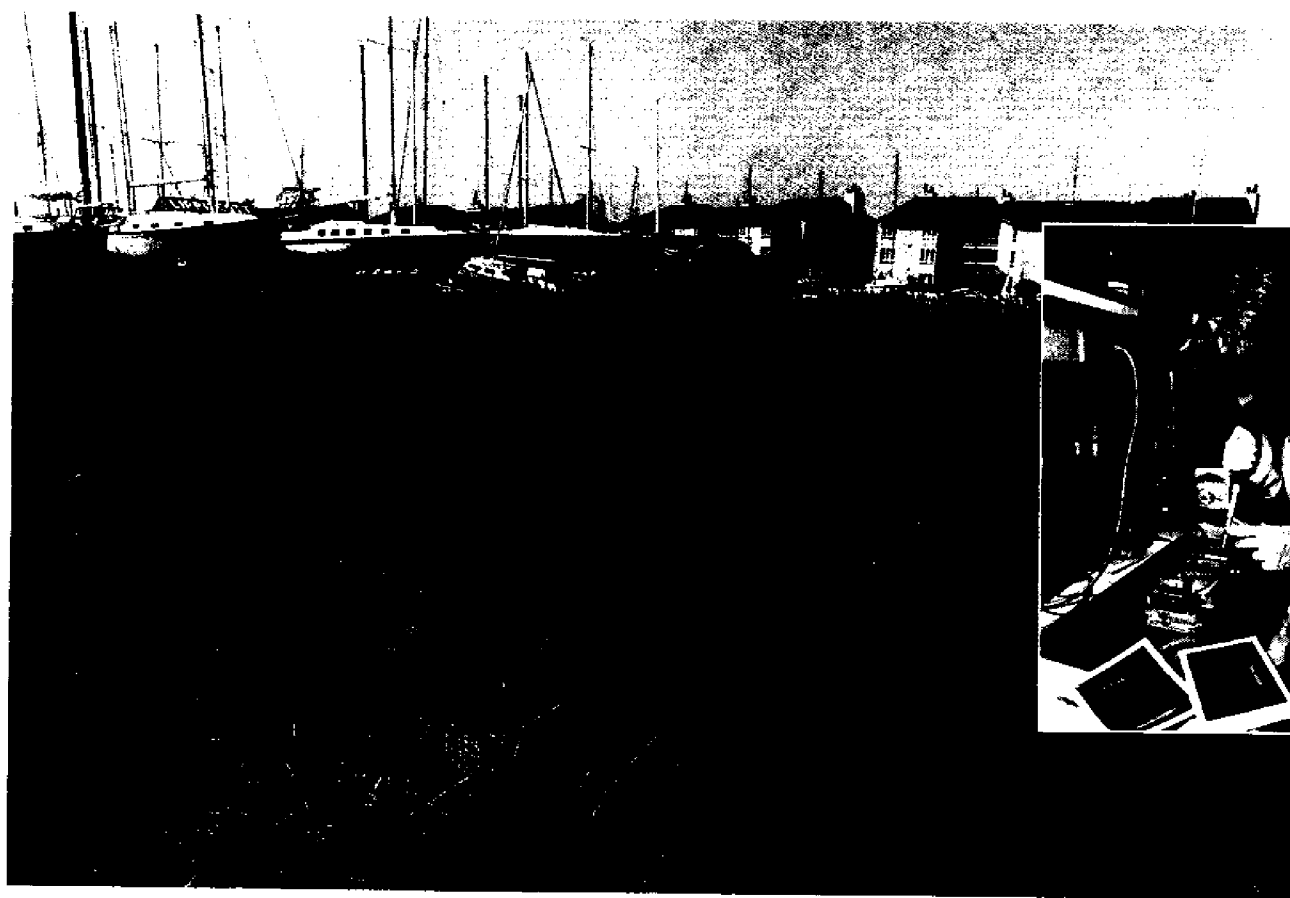


THE NATIONAL SEA GRANT COLLEGE NETWORK

ECONOMIC COMPETITIVENESS AND THE COASTAL ENVIRONMENT

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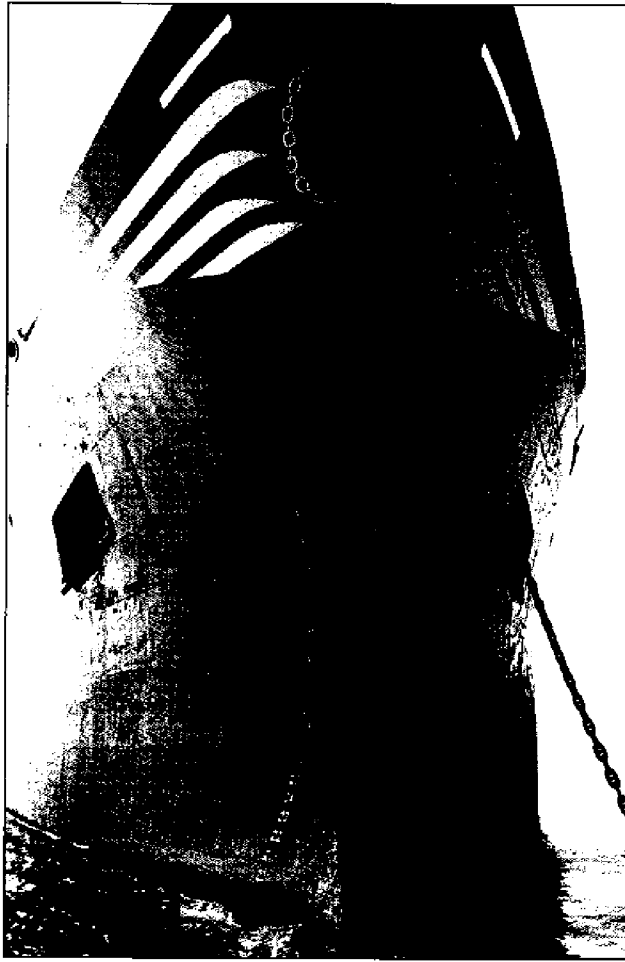
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TOWARDS THE 21ST CENTURY

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Sea Grant, a unique partnership with public and private sectors, combining research, education and technology transfer for public service, is the national network of universities meeting changing environmental and economic needs of people in our coastal, ocean and Great Lakes regions. The National Sea Grant College Program is a component of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.



*The network of
Sea Grant colleges
— forging
partnerships with
business and
industry in the
nation's coastal
and Great Lakes
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ECONOMIC COMPETITIVENESS AND THE COASTAL ENVIRONMENT

COASTAL BUSINESS AND MARINE-BASED INDUSTRIES



Fifty percent of the nation's population now lives within 50 miles of the oceans and the Great Lakes

facturing provided employment, while stimulating the development of other businesses to serve those industries and their workers.

For some years, the structure of coastal industries and businesses has been changing. In many coastal regions, manufacturing, commercial fishing, and seafood processing have declined, while ever-growing numbers of people have continued moving to coastal areas. Fifty percent of the nation's population now lives within 50 miles of the oceans and the Great Lakes. New types of businesses, of course, have grown — among them, recreation, tourism,

To be competitive in the 21st century, the United States must be prepared to take full advantage of its rich coastal resources, while ensuring their protection and long-term productivity. The economic health of the United States has always depended on the development and growth of its coastal regions. Historically, proximity to the coast provided low-cost access to transportation, power generation and natural resources. Industries such as shipping, commercial fishing and manu-

marinas — to meet the needs of this coastal migration and to provide access to the attractions that coastal areas have for both residents and visitors.

The coastal economy directly contributes a sizeable portion to the U.S. gross domestic product, nearly \$100 billion in added value according to one estimate. But these figures mask the vast reach of marine economic activity and the potential for future economic gains that can result from investment in marine-based industries.

Currently, more than 80 percent of the nation's coastal business expansion is provided by the service economy. By creating new jobs and enhancing the balance of U.S. international trade, marine-service enterprises are building economic vitality.

Closures of military bases and downsizing of defense industries will have a significant impact on the economies of a number of coastal regions. However, these areas possess rich natural resources, and economic activity generated by resource-based industries creates more jobs than industries without such a base. Only a quarter of each dollar spent on natural resources stays in the industry; the rest goes to construction, manufacturing, transportation, and the wholesale and retail trade industries.

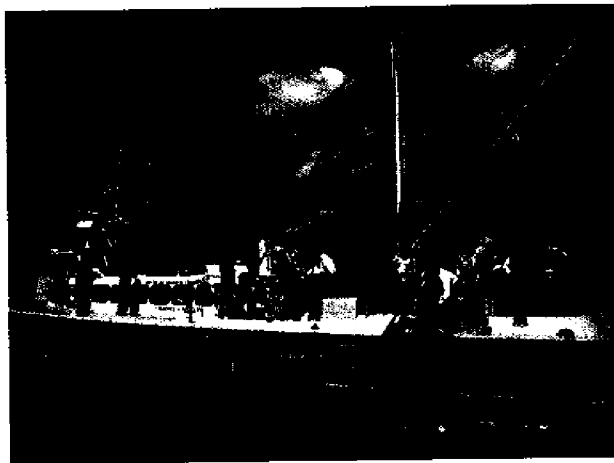
If our natural resources in coastal zones are used on a sustainable basis, if they are used cost effectively, and if aquatic environments can be protected, their potential for increased productivity offers exciting possibilities to add jobs and improve the real income of American workers. *The challenge to the nation is to find ways to maintain or enhance the environmental health and cultural heritage of coastal areas while meeting employment and economic development needs of their communities.*



Coastal areas hold great potential for new business, skilled jobs, and sustainable economic development

SEA GRANT AND COASTAL BUSINESS SUCCESS

For over 25 years, Sea Grant has fostered productive partnerships among business, industry, universities, and government in coastal and Great Lakes regions



The National Sea Grant College Program is a model of federal partnership with the nation's leading universities, state and local governments, and private enterprise. Through matching contributions these institutions annually provide program support nearly equal to the federal investment. For more than 25 years, the network of Sea Grant

programs has been at the forefront of emerging areas, supporting fundamental research and technological development in marine biotechnology, aquaculture, genetics, underwater robotic vehicles, marine instrumentation and sensors, marine natural products, environmental restoration technology, seafood product development and safety, and marine business.

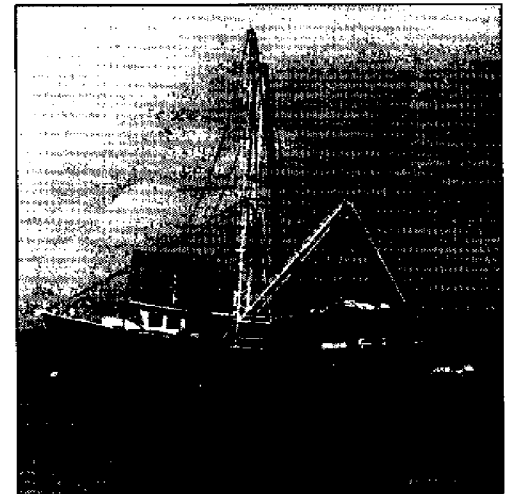
SEA GRANT TRANSFERS TECHNOLOGY

Sea Grant research focuses on enhancing opportunities and solving problems facing marine businesses and industries. One report showed that by stimulating new business opportunities and improving industry productivity, Sea Grant college programs in 29 coastal and Great Lakes states and Puerto Rico helped generate an \$842 million impact on the national economy for a representative year. This is a significant return on the \$40 million annual federal investment. That the economic impact tripled from a decade earlier is a

remarkable achievement, especially with declining program resources throughout the 1980s. Sea Grant-developed technology also has the added benefit of established connections between universities and business. Academic institutions today actively pursue patents and copyrights for promising new technologies and aggressively market licensing agreements to private manufacturers and companies. The regional and national economies are well served by this infusion of new opportunities. Here are some examples of Sea Grant technological advances and their economic impact.

- Sea Grant research on the marine polymer chitin and its derivative chitosan, made from shrimp and crab exoskeletons, has been instrumental in the commercial development of the polymer. A stream of new applications for chitosan in medicine, water quality, and food processing has a potential U.S. market estimate in excess of \$300 million.
- Sea Grant scientists have recently developed the piezocone and piezo-lateral stress cell, two new instruments that measure the shear strength of marine soils and stresses as well as pore pressures acting on pile shafts. These instruments, in combination with new techniques that predict soil disturbances caused by installing structures in the ground, have resulted in millions of dollars of savings to the offshore construction industry.
- Sea Grant researchers developed the science and technology for controlled farming of seaweeds that produce industrial polymers. One such polymer, carrageenan, is the basis for millions of dollars worth of industrial products annually. For example, carrageenan is used as a stabilizer in many food and pharmaceutical products; in McDonald's McLean hamburgers, it replaces fat for juiciness.

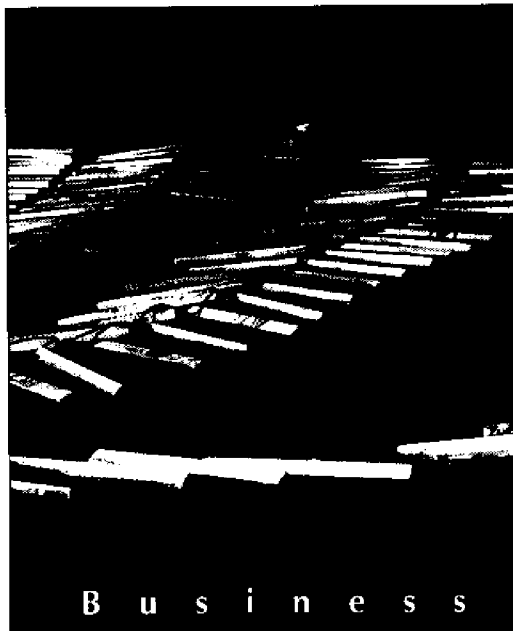
According to one report, the Sea Grant college programs in 29 coastal and Great Lakes states and Puerto Rico helped generate an \$842 million impact in one year on the national economy



Sea Grant funds cutting-edge research and, through advisory assistance programs, publications, and training videos, puts technology to work serving coastal businesses

SEA GRANT BUILDS PARTNERSHIPS

Sea Grant's broad experience in working closely with private industry and government to bring directed marine research to the marketplace will continue to serve the nation. Many challenges are ahead of us — in identifying critical technological needs, in working to improve science education in our schools and training for marine-related careers, in assisting businesses to innovate and meet new environmental and public health requirements. Sea Grant can — and should — play a vital role in meeting these new challenges.



■ ■ *Marine Science and Advanced Technology*

Improving and sustaining the economic health of the nation will depend, in part, on the continuing development of science and technology. Faced with increasing international competition, U.S. businesses must be able to commercialize scientific breakthroughs quickly; and they must be able to rapidly use technological innovation, both to improve and market their products, processes, and services. These needs are especially strong for the nation's 355,000 small manufacturers, which account for some 90 percent of the manufacturing enterprises in the country and employ approximately 40 percent of the country's manufacturing workers.

The network of Sea Grant colleges has been working closely with private industry for 25 years to bring research results to the marketplace. These working partnerships have meant recognizing critical marine technologies early on, engaging scientific and engineering talent, and propelling research results from the laboratory or field to marine industries.

In the last decade, science and technology research has led to significant increases in production of fish and shellfish, development of new pharmaceuticals, design of anti-corrosion coatings, the cleanup of industrial wastes, and new remediation techniques for damaged ecosystems. A major factor in these contributions is the direct transfer of fundamental scientific and technical knowledge to businesses both large and small through the Sea Grant research and advisory programs. The ability to transfer scientific findings to entrepreneurs and ensure innovation in the production of goods and services is critical to the creation of high-wage jobs in America.





■ ■ *A Competitive Workforce*

More than ever before, the creation of jobs that carry with them satisfying living standards will depend on how well American workers are able to adapt to increasingly sophisticated technology. As the economy continues along the technology path, the need for a higher skilled workforce will intensify. For that need to be satisfied we must strongly encourage scientific and technological literacy to ensure that employees will learn the rapidly changing skills the workplace now demands. Workers and managers must become more knowledgeable about environmental and business concepts and their relationships with sustainable economic develop-

ment — a failure to do so will impact the nation's position in the world and, equally important, the quality of life of our citizens.

Scientific, environmental, and business literacy begins in our elementary schools, continues through high school and college, and grows with on-the-job experience. As a nation we must commit ourselves to investing in quality science-related education. For years, Sea Grant colleges across the nation have been working to develop hands-on programs to enhance public school education in the marine sciences, to bring new technologies and processes to those in marine industries, and to cross-fertilize these efforts.

A national vision of quality education means investing in well-educated teachers; it means sustaining the natural curiosity of young people; it means encouraging further education and training not only for economic advancement but as satisfying ends in themselves.

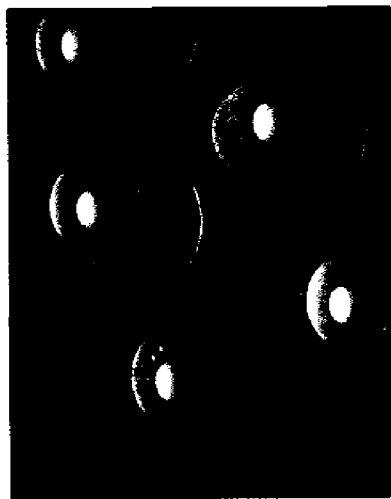
■ ■ *The Business Environment*

Businesses in coastal regions, like businesses throughout the United States, are experiencing rapid changes, among them, new environmental regulations and expanded health and safety requirements. With limited resources to respond to these and other market forces, smaller businesses are especially at risk. Enterprises such as commercial fishing, seafood processing, and recreation or marine trades face growing problems because of dwindling natural resources, regulations aimed at protecting public safety and environmental health, and increased competition. If they are to be socially responsible and economically successful, they must be able to operate efficiently, increase productivity by adopting new technologies and processes, and train a workforce that will produce high-quality goods and services.

Sea Grant's great strength is in its demonstrated capability to form linkages among universities, businesses, and government that maximize the use of research and development results while helping private enterprise adapt to rapid changes in the regulatory and technological climate. A recent Small Business Administration study found that rates of return on research and development dollars in small and large companies with cooperative university relationships were nearly twice that (26 percent to 14 percent) of companies with no such relationships. The Sea Grant experience supports the conclusion that university-industry partnerships can improve the commercialization of research and development results and, moreover, develop environmentally safe ways of doing business that lead to cost savings and increased profits.

In the face of increasing competition from businesses abroad, it is critical that entrepreneurs have access to training and advisory assistance that will help them compete in the marketplace, while meeting our nation's commitment to protecting our environment, public health, and cultural heritage.

CHALLENGE: DEVELOP ADVANCED MARINE TECHNOLOGY



A Sea Grant commitment to innovative, directed research and technology transfer programs has led to advancements in many industries. Sea Grant programs have been at the forefront of emerging areas, supporting fundamental research and technological development in marine biotechnology, marine natural products, underwater robotic vehicles, marine instrumentation and sensors, aquaculture systems, genetics, advanced marine materials, environmental restoration, ocean and coastal remote sensing, next-generation information technologies for marine systems, computer-aided design and manufacturing processes, and deep seabed exploration. Among the successes across the Sea Grant network are the following.

- Sea Grant research is responsible for the derivation of several new products in the pharmaceutical and chemical industries. Among its successes are anti-inflammatory compounds for both disease treatment and skin care. New areas, such as marine-specific fermentation, promise to lead to the development of new industries to exploit untapped marine resources.
- Sea Grant technological research played a major role in developing and expanding the soft-shell crab industry. Sea Grant researchers in Louisiana and Mississippi developed recirculating systems for the industry, which resulted in improved water conditions and higher production. Worth about \$1 million in the 1970s, Louisiana's industry grew to \$5 to \$8 million annually by 1991, with over 75 percent of the production using Sea Grant-developed technology. From Maryland to Florida, the soft-crab industry is now worth some \$40 to \$50 million a year.

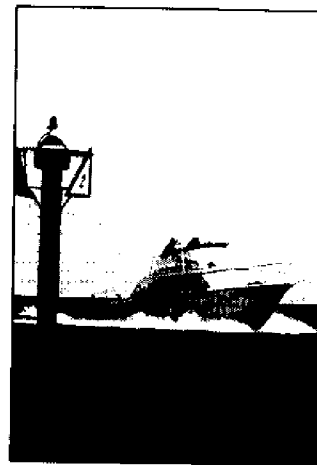
■ Sea Grant has provided vital technical assistance to growing aquaculture industries throughout the United States. For example, research on nutrition, disease, and genetics has helped launch a hybrid striped bass industry on the East Coast which is currently worth \$10 million a year.

Sea Grant programs will continue to support directed research designed to help U.S. businesses compete nationally and internationally. Additional program funding would further support science-based technologies, such as the following, that offer great commercial promise and significant economic productivity.

TECHNOLOGY: WHAT NEEDS TO BE DONE

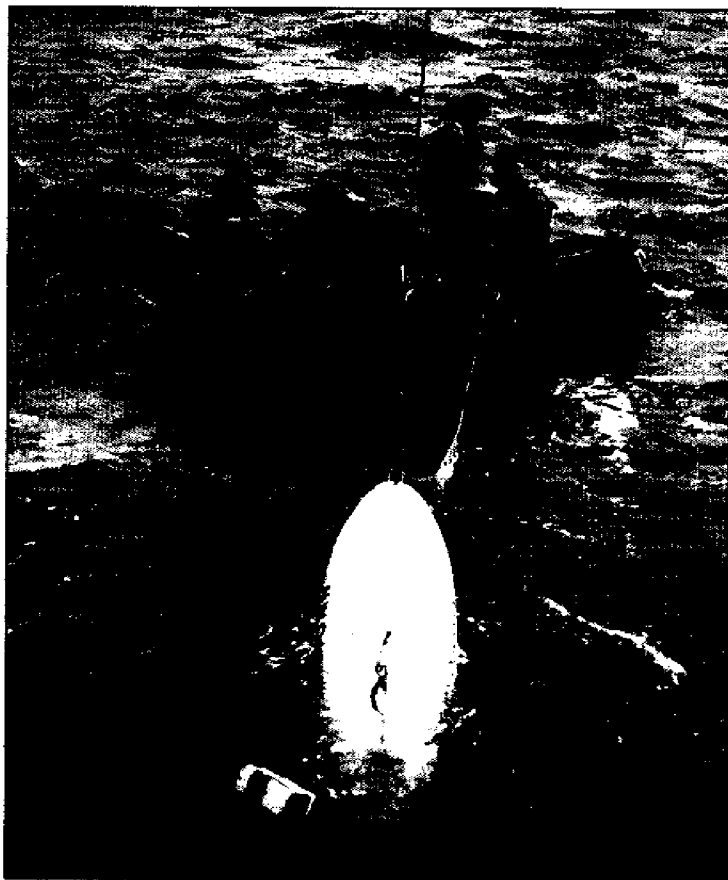
■ *Develop Criteria for Efficient Boat Hull Design*

Recent advances in hydrodynamic research make possible the development of design criteria for small boats that are safer and ride more smoothly. Sea Grant has long supported research at major naval architecture schools on developing Computer-Aided Design and Manufacturing (CAD/CAM) systems that are applicable in the boat industry. Other Sea Grant work has led to industry testing and standards on the use of fiber-reinforced plastic composites in recreational boats. The market for well-designed, safe craft is sizeable: in 1990, the domestic market for small recreational power boats exceeded \$4 billion — U.S. exports were approximately \$800 million, while imports reached \$1 billion. With a market of this size, continued U.S. competitiveness is critical.



■ *Develop Processes for Environmental Remediation and Monitoring*

A growing demand for efficient monitoring of ecosystems and natural resource cleanup efforts throughout the world has been stimulating new environmental technologies. Sea Grant research helped seafood processing plants clean up their wastes by developing affordable technologies to turn wastes into marketable products such as animal feeds, flocculents for water purification,

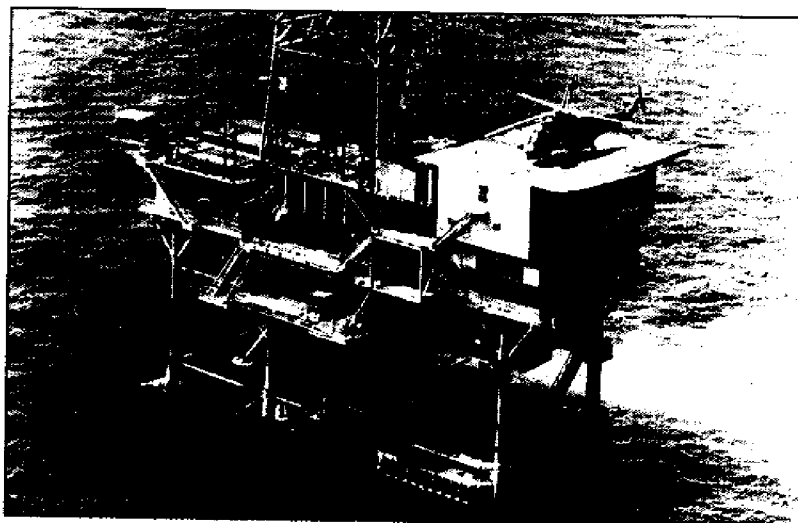


and fungicides for the protection of wheat crops. In 1990, government and industry in the U.S. spent \$115 billion — approximately 2 percent of the gross domestic product (GDP) — to comply with federal, state, and local environmental standards. The Environmental Protection Agency projects that by the year 2000 expenditures will rise to over \$260 billion, or 3 percent of the GDP. Monitoring the health of ocean environments, given the extent of waste disposal and atmospheric deposition of toxic materials, will require increasingly sophisticated technological development. One way to meet this need is through the use of inexpensive robotic submarines that employ very small, low-energy sensors produced with microfabrication technology. With its science and technology base, Sea Grant is well poised to advance new technologies for the expanding business of environmental testing and restoration.

■ *Develop Techniques to Optimize the Continued Use of Offshore Marine Structures*

The United States program of offshore oil drilling is the world's oldest and most active. Numerous oil production platforms in United States waters — there are more than 4,000 of them — have been in service for a number of years and have been subjected to a variety of natural and human-induced stresses. Assessing their integrity and their remaining lifetime is a lengthy and expensive process. However, with advanced computing techniques and artificial intelligence, it is possible to significantly increase the efficiency and reduce the costs of such assessments. Sea Grant has begun working with U.S. industry and regulatory agencies to develop such capabilities.

At the same time, techniques need to be developed for estimating the increased useful life of a platform that will result from specific repairs. Since offshore platforms cost as much as \$1 billion each, the savings from such repairs can be a significant factor in maintaining the U.S. competitive position in this industry.



■ **Develop Profitable Sophisticated Recirculating Aquaculture Systems**

Over the past decade, seafood consumption has risen in the United States from 12.5 pounds per capita in 1981 to 14.9 pounds in 1991. While exports abroad have averaged some \$3 billion

annually, U.S. seafood imports are valued at \$5.7 billion. This \$2.7 billion imbalance makes seafood the second or third largest category in the overall United States trade deficit. While harvests of some wild fish and shellfish species have been on the decline, there are indications that the country could once again become a net exporter of seafood. Intensive aquaculture and more rational management of our wild fisheries are key factors in fulfilling this promise.

Major economic prospects for aquaculture include recirculating systems for raising such fish as striped bass and its hybrids and red drum. With advances in technology, like artificial intelligence for cost-effectively maintaining water quality, intensive fish farming can be conducted apart from farm ponds or coastal waters. The success of recirculating trays in the soft-shell crab industry is an example of how quickly Sea Grant marine advisory agents can deliver appropriate information to aquaculturists.



CHALLENGE: EDUCATE THE WORKFORCE

Sea Grant programs across the nation have made a major commitment to education and training. From K-12 and university science education programs to diverse outreach activities, Sea Grant has worked to provide direct contact between the producers and users of knowledge. Here is a summary of activities.

- *Sea Grant Marine Advisory Service.* Sea Grant's record of moving technical information out of university laboratories and scientific journals and into the hands of those who can use it is based on well-coordinated information transfer programs. These programs are especially important to small and medium-sized coastal businesses that have difficulty tracking new technology and adapting it to their needs.
- *K-12 Science Education.* Numerous studies point to the crisis in scientific and technological literacy in the United States — a crisis that has implications not only for the kinds of work that Americans will do in the future but also for the quality of our lives. Too few U.S. students are pursuing careers in technical fields; comparisons of student achievement worldwide indicate low rankings for American high school students in biology, chemistry, and physics. The National Sea Grant College education network is addressing these issues through programs that stress a hands-on exploration of the marine world, with an emphasis on attracting women and minorities into the marine sciences.

If we are to excite students about science — and about careers in science, technology, and socially responsible business — effective teaching is essential. A





key factor in improving science education is well-educated science teachers. Sea Grant colleges have a long history of working with teachers through field training programs and workshops, and continue to develop marine science curricula and supporting materials that teachers can bring to their classrooms.

- *University Training.* At the undergraduate and graduate levels, Sea Grant-supported students are participating in research with faculty members representing fields ranging from science and engineering to law and economics. Working at the very fundamental levels of science and technology, often as part of multi-disciplinary teams of researchers, students benefit from Sea Grant's emphasis on transforming scientific findings into commercial applications. Since 1980, more than 6,000 Sea Grant-supported students have received degrees and started careers in business, government and academia.

Highly qualified graduate students also have an opportunity to compete in the Knauss Marine Policy Fellows Program. Those selected work for one year in government on science, technology and environmental policy issues. These highly sought-after educational fellowships have introduced a generation of future leaders to the role of science in public policy development and administration.

- *Public Education.* Sea Grant is the nation's primary marine information program dedicated to creating a scientifically and environmentally informed citizenry. The Sea Grant communications network — through printed material, radio, and video productions — has become increasingly more effective in informing the public about the impact of science on coastal commerce and environmental policy and the responsible use of our national resources.

EDUCATION : WHAT NEEDS TO BE DONE

Sea Grant will continue its ongoing efforts in education and technology transfer through well-established core programs. However, there is a pressing need to build on our success and to expand these efforts so that they will benefit more students, workers and entrepreneurs. Here are opportunities we can augment or initiate immediately.

■ *Improve the skills of workers and business operators in small and medium-sized coastal industries through an expanded Sea Grant marine advisory service focused on the business environment.* Focus attention on the appropriate use of total quality management concepts to improve the quality of products and services, and on the introduction of environmentally enhancing operational procedures for increasing profit margins.

■ *Create jointly with industry a competitive Sea Grant-Industry Fellows Program modeled after the acclaimed Knauss Marine Policy Fellows Program.* This program will give students a greater understanding of the role of science and technology in industries competing in the global marketplace and will better equip them for jobs in such industries.

■ *Expand the Sea Grant Marine Advisory Service's network of research-based specialists in critical technology areas, and increase the number of Sea Grant student research assistantships, targeting critical technologies.* This effort will also focus on increasing the interaction among specialists, faculty, and students to develop



new and innovative technology transfer systems in cooperation with industry. Critical technologies include marine biotechnology, marine natural products, underwater robotic vehicles, marine instrumentation and sensors, aquaculture systems, genetics, advanced marine materials, environmental restoration, ocean and coastal remote sensing, next-generation information technologies for marine systems, computer-aided design and manufacturing processes, and deep seabed exploration.

■ *Expand K-12 marine science programs for students and teachers.* Broaden programs to teach fundamental environmental and business concepts and their significance in economic development. Increase the effort to interest and equip minority and under-represented groups to participate in the sciences and science-related businesses.



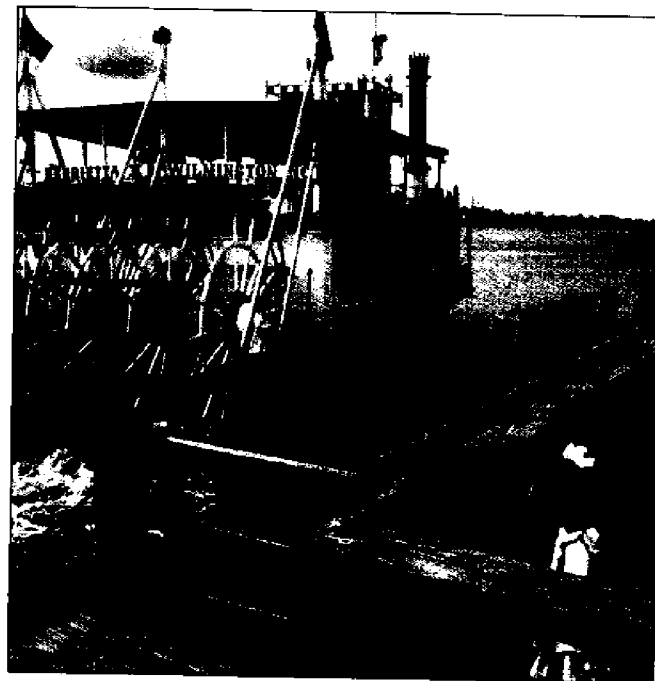
■ *Increase public awareness of scientific concepts pertinent to marine and aquatic systems.* Expand Sea Grant outreach through adoption of new electronic communication and data access methods to raise science and technical literacy of the general public in this area and the related field of global warming.

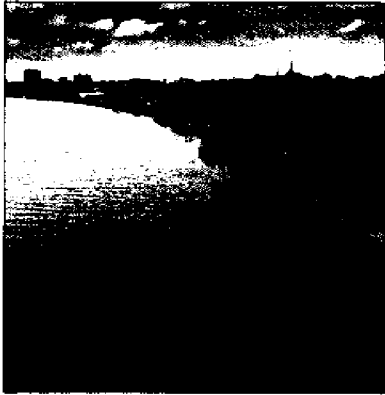
CHALLENGE: BUILD A COMPETITIVE BUSINESS ENVIRONMENT

Sea Grant has been at work in coastal areas, helping businesses and industry plan for sustainable development, while working to improve scientific and technological literacy. Sea Grant programs throughout the nation inform diverse coastal and marine businesses about technological and environmental policy matters that affect their planning and decision-making processes. Moreover, they address problems associated with establishing better ways to measure the economic effects of pollution and of depleting national resources.

Our experience has demonstrated that if businesses are to grow, prosper and compete in international markets, they must be able to respond quickly to changing market conditions; they must be able to adapt to new regulatory requirements; they must be able to apply new technology or processes that become available; and they must be able to evaluate economic options that could mean success or failure.

Across the country, Sea Grant research and marine advisory efforts have been assisting small and large businesses — aquaculture operations, seafood processing, pharmaceutical companies, charter boat enterprises and marinas, commercial harvesting, and the tourism and recreation industries. The following examples illustrate these activities.





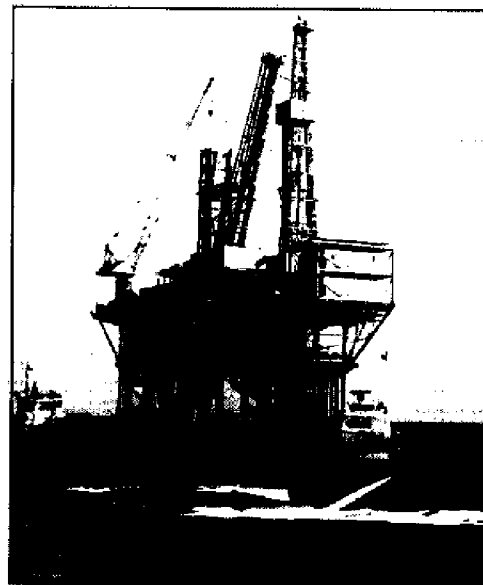
- The Minnesota Sea Grant College Program, with help from the Economic Development Administration, conducted a nationwide training project on tourism development that reached 3,500 people via satellite teleconferencing. Rural tourism operators on four continents have purchased the Minnesota program's training package.
- A team of Sea Grant seafood specialists from California, Florida, Georgia, Louisiana, North Carolina, and Virginia worked with the National Fisheries Institute to develop a nationwide training program for *Hazard Analysis of Critical Control Points*, a food inspection protocol. Their aim is to help the nation's seafood processing firms meet anticipated federally-mandated seafood inspection regulations. The team prepared a training manual, presented a practice workshop to the industry, and is scheduling certification workshops in major U.S. seafood processing centers. Sea Grant extension specialists throughout the country work one-on-one with plant operators to solve quality control problems and introduce new technology.
- Marine advisory personnel throughout the nation have mediated conflicts between competing interests in waterfront redevelopment. Serving as "honest brokers," they have assisted in the resolution of such conflicts by conducting town hall meetings, locating planning expertise, and encouraging broad participation of community interests. As a consequence of this mediation, numerous communities have successfully revitalized waterfronts while retaining traditional establishments and blending old and new functions in ways that attract visitors, diversify economic activity, and enhance community values.

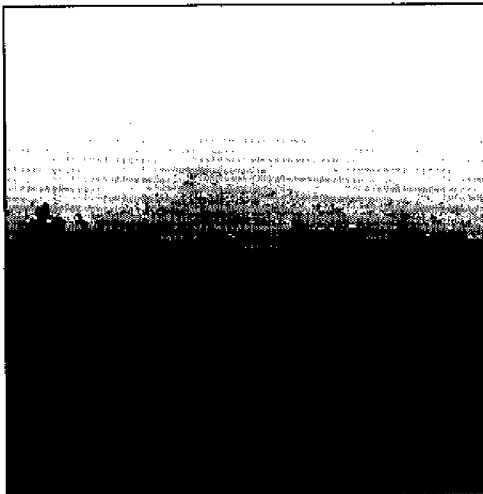
Scientific breakthroughs, technological advances, and productive workers have been major factors in America's business and industrial success. But these factors alone cannot maintain a competitive economy. Also required are private and public investment, a viable manufacturing sector, extensive and well-maintained communications and transportation networks, a healthy natural environment, business leaders who can make informed and innovative decisions across the entire create-make-and-market spectrum of their operations, effective technology transfer mechanisms, and many other tangible and intangible capabilities.

Through its established network and local contacts, Sea Grant's scope can be appropriately broadened to help coastal businesses address more of these issues. Here are examples of activities that can be rapidly implemented.

■ *Develop New Growth Opportunities*

Major areas for potential business growth include environmental monitoring, control, and remediation. High technology coastal and defense industries possess the research, development, and manufacturing expertise to build sophisticated products and systems. In addition, smaller coastal businesses can grow by providing environmental services using such products and systems — if instrumentation needs and acceptable costs can be cooperatively determined. Working together with industry and small businesses, Sea Grant can identify and develop critical technologies that improve the quality and effectiveness of American goods and services.





■ ***Take Advantage of Changing Markets***

The constantly shifting world trade situation requires that business and industry know their markets and, more importantly, what to expect in the marketplace several years in the future. Sea Grant can provide research leadership in analyzing trade and world markets for the products of our coastal businesses and industries. Particularly important are the implications of new trading blocks associated with the North American Trade Agreement and the European Common Market. No less important is an assessment of problems, benefits, and opportunities associated with increasing U.S. service sector exports. U.S. companies that sell services, rather than raw materials or manufactured goods, produced a \$59 billion trade surplus last year — nearly a five-fold increase from 1986. Some of the sales may not be recognized as “exports”; the \$59 billion figure includes about \$19 billion spent by foreign visitors to the U.S. and \$5 billion provided by more than 400,000 international students enrolled in U.S. universities.

■ ***Improve Business Adaptability***

To be successful in the future, business enterprises must be able to adapt to the uncertainties of fast-changing economies abroad and at home, shifting regulatory environments, and a declining resource base. The situation will require dealing and, in many instances, reaching accommodation with various interest groups and government agencies. Sea Grant's traditional role has been to serve as a bridge between disparate groups and as an “honest broker” in conflict resolution. Sea Grant must continue to improve the communication and information networks that coastal businesses need to comply with environmental regulations and to make informed management decisions.

THE FUTURE OF COASTAL BUSINESS: THE NEED TO ACT NOW

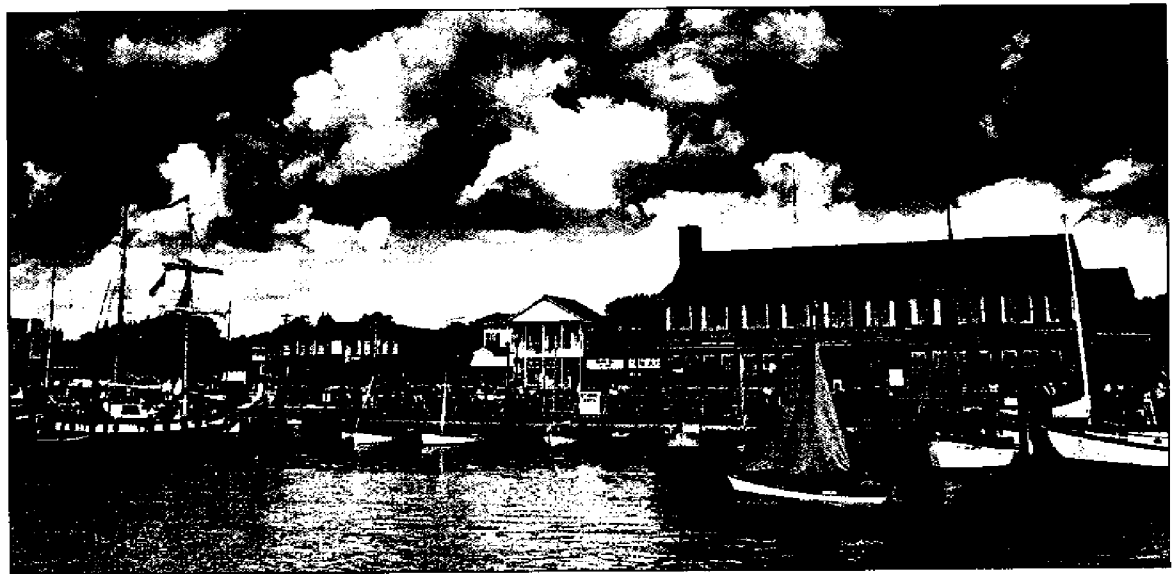
Increasingly, the future competitiveness and economic success of coastal businesses will depend on their access to information — to research results, data concerning environmental health and regulations, and to education or training opportunities — all covering a wide range of technological and socioeconomic subjects. Sea Grant — with ties to over 300 universities, more than 3,000 scientists, engineers, students and extension specialists, and hundreds of people in businesses, citizen's organizations, and governmental units at federal, state, and local levels — comprises a national resource that should be more extensively employed in addressing current business needs. Its demonstrated success and cost effectiveness amply document a capacity to meet this economic challenge.

Created over 25 years ago as a federal partnership with the nation's universities, state and local governments, and private enterprise, the National Sea Grant College Program has proved to be the nation's leader for transferring information and technology on the sustainable use of marine resources, protection of the coastal environment, and economic development in the coastal zone. Sea Grant is more relevant and potentially more significant today than when it was created by Congress in 1966. However, funding constraints over the past 12 years have limited Sea Grant's potential to advance economic development and coastal



environmental protection. The buying power of Sea Grant's FY 1993 appropriation is approximately 40 percent less than the funding peak reached in FY 1978. To implement the new or expanded Sea Grant activities identified in this document — activities that would both create jobs and assure sustainable economic development — would require that present funding be raised to the peak level equivalent. This equivalent would amount to an added investment of less than \$28 million in current dollars above the FY 1993 appropriation.

Today's national needs dictate that if Sea Grant did not exist, it would have to be invented. Fortunately, Sea Grant is here, hard at work, and eager to continue and expand activities to meet America's competitive and environmental challenges. With the requisite investment, we can achieve the vision put forth by Sea Grant's founders for a network of Sea Grant colleges to promote the stewardship and wise economic development of the nation's ocean, coastal, and Great Lakes resources.



SEA GRANT INSTITUTIONS

Alaska Sea Grant College Program
University of Alaska

California Sea Grant College
University of California

University of Southern California
Sea Grant Program
University of Southern California

Connecticut Sea Grant College Program
University of Connecticut

Delaware Sea Grant College Program
University of Delaware

State University System of Florida
Sea Grant College Program
University of Florida (Administrative Office)

Georgia Sea Grant College Program
University of Georgia

Hawaii Sea Grant College Program
University of Hawaii

Illinois-Indiana Sea Grant Program
University of Illinois
Purdue University

Louisiana Sea Grant College Program
Louisiana State University

Maine/New Hampshire Sea Grant
College Program
University of Maine
University of New Hampshire

Maryland Sea Grant College Program
University of Maryland System

MIT Sea Grant College Program
Massachusetts Institute of Technology

Michigan Sea Grant College Program
University of Michigan
Michigan State University

Minnesota Sea Grant College Program
University of Minnesota

Mississippi-Alabama Sea Grant
College Program
Mississippi-Alabama Sea Grant Consortium

New Jersey Sea Grant College Program
New Jersey Marine Sciences Consortium

New York Sea Grant Institute
State University of New York and Cornell
University

North Carolina Sea Grant College Program
University of North Carolina

Ohio Sea Grant College Program
The Ohio State University

Oregon Sea Grant College Program
Oregon State University

Puerto Rico Sea Grant College Program
University of Puerto Rico

Rhode Island Sea Grant College Program
University of Rhode Island

South Carolina Sea Grant College Program
South Carolina Sea Grant Consortium

Texas Sea Grant College Program
Texas A&M University

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For information about the National Sea Grant College Program, contact:

National Sea Grant College Program
NOAA Sea Grant, R/OR-1
1335 East-West Highway
Silver Spring, Maryland 20910-3226

For further information on coastal business, contact your local Sea Grant program or:

Louisiana Sea Grant College Program
Louisiana State University
Baton Rouge, Louisiana 70803
Phone: (504) 388-6451

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