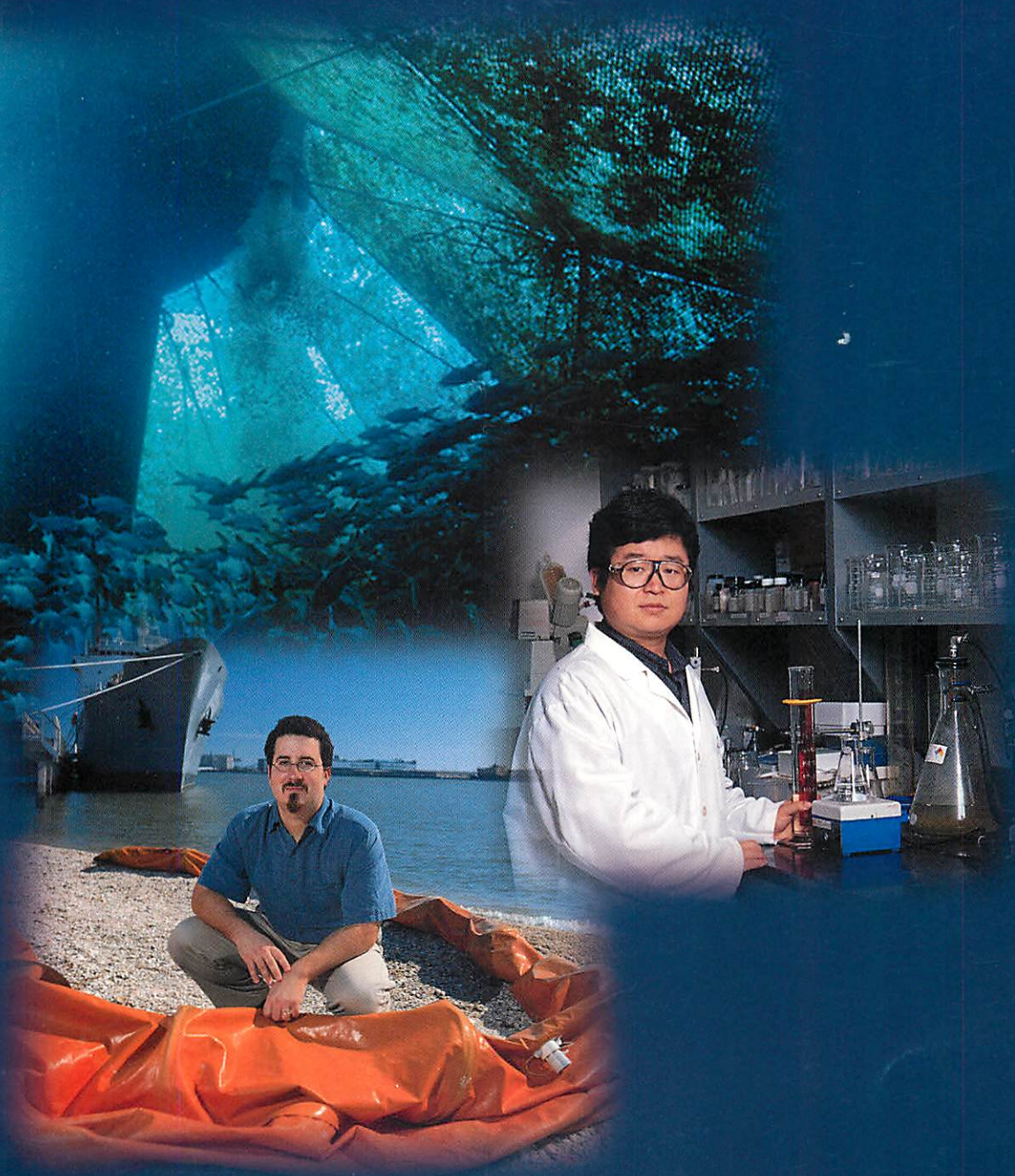


NSGO-Q-01-001

National Sea Grant College Program  
Biennial Report  
2000–2001





# National Sea Grant College Program Biennial Report 2000–2001

U.S. Department of Commerce  
Donald Evans, Secretary

National Oceanic and Atmospheric Administration (NOAA)  
Vice Admiral Conrad C. Lautenbacher, Jr., Under Secretary

Office of Oceanic and Atmospheric Research (OAR)  
David L. Evans, Assistant Administrator

This publication, issued September 2002, was produced in cooperation with the South Carolina Sea Grant Consortium under NOAA Cooperative Agreement No. NA87RG0544. The National Sea Grant College Program is a partnership of academia, government and industry, focusing on coastal, ocean, and Great Lakes resources. The program operates through a university-based network to enhance the Nation's resource management capabilities through programs of research, education and outreach.

Managing Editor: Amy Painter, OAR/Sea Grant

Contributing Editors: Karen Ricker, Ohio Sea Grant, Aquatic Nuisance Species  
Christina Johnson, California Sea Grant, Industry Fellows  
Tim Reid, Mississippi-Alabama Sea Grant Consortium, Aquaculture

Art Director: Linda Blackwell, S.C. Sea Grant Consortium

Front Cover Photos: Sea Cage, *Hawaii Sea Grant*  
Haejo Hwang, *Roger Legel*  
Chris Patterson, *Jim Lincoln*

Back Cover Photos: OAC research cage, *Tim Reid*  
Purple Loosetrife, *Nancy Balcom*  
Moi, *Aquaculture Development Program*  
Zebra Mussel, *Lloyd Lemmerman*



## TABLE OF CONTENTS

<b>Message From The Director</b> .....	2
<b>Review Panel</b> .....	6
<b>Aquatic Nuisance Species</b> .....	8
<b>The Industry Fellowship Program</b> .....	14
<b>Aquaculture</b> .....	20
<b>Financial Report</b> .....	26
<b>Sea Grant Program Directors</b> .....	34

## Message from the Director

### TO OUR CONSTITUENTS:

**As we confront in earnest the considerable challenges that society faces in this new century, we should all take heart from the events of September 11, 2001, in demonstrating, yet again, how this great Nation of ours comes together in the face of adversity.**

**O**ur institutions of governance will be called upon in full measure in the coming years to address a multitude of issues, including coastal environments that continue to experience unprecedented growth and development. In the last decade of the 20<sup>th</sup> century, the U.S. added 33 million people to its population, with over half of this growth occurring in just seven coastal states. Of the U.S.'s 20 most populous states, 17 have coastal counties. What this means is that NOAA, as a mission agency, must enhance its capability to effectively address coastal issues. Sea Grant, as NOAA's principal liaison with universities on coastal matters, will be called on as never before to provide geographically-explicit research and access to new ideas and technologies; to engage constituents; and to develop critical human resources. Research, education and the ability to rapidly synthesize and transfer new knowledge relevant to public policy and

economic well being—all Sea Grant strengths—will be key elements in the future sustainable development and prosperity of our ever-expanding coasts.

To position ourselves for the demands that explosive growth and development will make on resource management policy and practice, Sea Grant has over the past four years made significant changes in its grants management and program accountability procedures. This enterprise has created a dynamic, proactive, innovative organiza-

tion that can effectively confront tomorrow's problems. Most of these organizational changes, the subject of previous biennial reports, have enabled Sea Grant to become more effective and responsive. This

organization's ability to mobilize resources, reorganize priorities, and redefine itself in order to better serve its constituents is no accident, but an eloquent testimony to the many dedicated individuals, stakeholders and partners who make up this diverse, remarkable network known as Sea Grant. To all of you who make good things happen and to the many constituencies who support us and whom we



*Ronald C. Baird*



serve, our sincere thanks for your continued confidence in Sea Grant.

Having already addressed the corporate and cultural imperatives that have positioned us well as an organization for future growth, the 2000-2001 biennium has seen our emphasis change to one of **long-range planning and strategic positioning**.

Three major events occurred during this period that will significantly affect Sea Grant and the Nation's future ocean and coastal agenda. They are: 1) the transition to a new Administration; 2) the convening of the President's Ocean Policy Commission; 3) the reauthorization of the Sea Grant Act. With this as background, the Sea Grant community undertook a number of critical planning exercises that collectively represent a historic first for Sea Grant. These exercises spawned a collective vision for Sea Grant; critical focus areas; reviews of our extension service; a better-defined role and performance evaluation protocols for the national office; and completion of performance reviews for our 30 Sea Grant programs. Such comprehensive planning and review is a first in our 33-year history. Coupled with the management changes already in place, we believe these strategic measures will strengthen our organization enormously.

#### **HIGHLIGHTS OF 2000 AND 2001 INCLUDE:**

1. Congressional appropriations of \$59.25 in FY 2000 and \$62.25 in FY 2001, an increase of about 12% over the last biennium (1998-99).
2. Funds under management, from all sources, totaled \$112.3 million in FY 2001. This is the first time in our history that total funds managed by NOAA's National Sea Grant Office have exceeded \$100 million.
3. The first-ever Sea Grant planning retreat, held in the summer of 2000, drew participants from the National Sea Grant Office, Sea Grant Colleges and the National Sea Grant Review Panel. The outcome was a common vision and plan of action to position Sea Grant for the 21<sup>st</sup> century.
4. Sea Grant commissioned, under the leadership of Dr. John Byrne, past president of Oregon State University, a blue ribbon committee that reviewed Sea Grant Extension, the first such study in our history. The recommendations in the committee's report, *A Mandate to Engage Coastal Users*, are making major impacts on our extension enterprise.
5. Nine thematic teams representing issues of major concern to coastal environments have been designated. Each issue is consistent with NOAA's mission *and* one in which Sea Grant can make a difference in the next decade. The teams have been charged with articulating the research and outreach needs in their respective areas. This represents a major change in strategic thinking and approach in the Sea Grant network.
6. All Sea Grant Programs completed their first four-year performance reviews by outside reviewers in 2001. Of 29 programs evaluated, 23 scored "excellent" in the "producing significant results" category, a fitting testimony to Sea Grant's effectiveness in engaging our Nation's finest universities in resource management issues.
7. Two "blue ribbon" panels under the leadership of Dr. John Toll, ex-chancellor of the University of Maryland, and Dr. Robert



Duce, professor of oceanography at Texas A&M University, were convened. The Toll panel has completed a thorough review of our performance evaluation protocol, while the Duce panel is completing a review of NOAA's National Sea Grant Office and its future role in enhancing Sea Grant's effectiveness and efficiency. An important objective of these reviews is to increase Sea Grant's overall coordination and integration within NOAA.

## NEW INITIATIVES

Our year of intensive long-range planning led to the identification of the following thematic areas: mariculture, marine biotechnology, coastal communities and economies, coastal hazards, ecosystems and habitats, education and human resources, fisheries, seafood science and the urban coast. In addition, Sea Grant has initiated five exciting new programs that respond to needs in each area.

### 1. LAW CENTER

The Sea Grant Law Center was founded to disseminate information about marine laws and policies, coordinate ocean and coastal law researchers, and provide the Sea Grant College Program and its constituents a source of critical analysis of marine laws and policies. One of its primary focuses is contributing to the legal analysis by the U.S. Commission on Ocean Policy of the laws that affect the Nation's oceans and coasts (as mandated by Congress in the Oceans Act of 2000). Other research includes



*Sculpture  
at NOAA  
Headquarters*

fisheries law, marine habitat conservation, non-indigenous species and current issues in wetlands law and policy. To learn more, visit the center's website at: <http://www.olemiss.edu/orgs/SGLC/>

### 2. PORTS & HARBORS

Sea Grant will hire a ports and harbors specialist through Texas A&M University, to serve as a focal coordinating point for expanding Sea Grant College Program activities on state and national ports and harbors, and related marine transportation issues. This position will lead overall efforts in ports and harbors issues, coordinate with individuals within the Sea Grant network on specific matters, and promote the growth and development of Sea Grant leadership in ports and harbors issues at the national level.



### 3. EARTH GRANT

Because of common goals related to improved environmental decision-making, the NSGO has initiated discussions with senior administrators from NASA's Space Grant and USDA's Cooperative State Research Education and Extension Service. The partnership, dubbed "Earth Grant," has led to a cooperative funding arrangement to establish a geospatial extension specialist position located at the University of Connecticut. The specialist provides NASA geospatial information to the national network of Sea Grant coastal community development specialists.

### 4. COASTAL COMMUNITY DEVELOPMENT PROGRAM

This new Sea Grant program element focuses on the critical importance of community planning and growth management in coastal areas. The initiative will provide services to coastal communities to aid in efforts to protect their environmental amenities, strengthen their economies and improve their quality of life. The goal of the Community Development Program investment is to realize a significant step-up in Sea Grant's engagement at the coastal community decision-making level (municipalities, counties, state agencies, watershed management districts, etc.) by providing the enhanced science-based support needed to balance environmental, social and economic considerations.

### 5. EDUCATION WITH CORE (CONSORTIUM FOR OCEANOGRAPHIC RESEARCH AND EDUCATION)

Sea Grant programs throughout the network and the national office have been engaged in substantive collaborative education

efforts with CORE for several years. One such collaboration that has benefited thousands of high school students and their coaches (teachers) is the annual Ocean Sciences Bowl, a series of regional and national competitions. Sea Grant programs are leaders in conducting the regional competitions. The winner of each then competes at the national competition, which is supported in part by the National Sea Grant Office. In addition, as CORE has developed its vision for education, Sea Grant educators have been instrumental in informing the development of an education white paper and priorities for CORE to promote.

We believe our planning and these programmatic changes will enable Sea Grant to better perform in a fast changing world. Our emphasis on management-critical and geographically-specific research, coupled with a sound management paradigm, allows NOAA to engage universities through nationwide focus on critical issues while maintaining local and regional implementation.

In closing, Sea Grant continues its process of constructive change and, as a result, is having greater impact on this Nation's coastal agenda. More than ever, it's an excellent investment of public funds.

Thanks again to our many friends, partners, supporters and constituents.



Ronald C. Baird  
Director, National Sea Grant College Program

## Review Panel

### SEA GRANT WELCOMES THREE NEW PANEL MEMBERS

**Three experts in the marine sciences are appointed to the National Sea Grant Review Panel.**

In 2001, Department of Commerce Secretary Donald Evans appointed three new members to the National Sea Grant Review Panel.

Appointed to the panel are: G. Ross Heath, professor of oceanography and dean emeritus of the College of Ocean and Fishery Sciences at

the University of Washington; Manuel L. Hernandez Avila, former professor and chair of the Department of Marine Sciences at the University of Puerto Rico, Mayaguez; and Jerry R. Schubel, past president and chief executive officer of the New England Aquarium.

Comprised of 15 individuals with diverse backgrounds in marine affairs, the panel advises NOAA's secretary, the undersecretary for oceans and atmosphere, and the director of the National Sea Grant Program on scientific and administrative policy. Members serve three-year terms.





Other panel members include (alphabetically): Robin Alden, former Maine Commissioner of Marine Resources in Augusta; James Arrington, vice president for academic affairs and a professor of biology, South Carolina State University, Orangeburg; Peter Bell (chair), adjunct senior research scientist at the Carnegie Institution of Washington's Geophysical Laboratory and retired vice president and chief scientist of the Norton Company in Worcester, Massachusetts; Robert Duce, professor of oceanography and former dean of the School of Geosciences at Texas A&M University in College Station, Texas; Carlos Fetterolf, Jr., retired executive secretary, Canada-United States Great Lakes Fishery Commission, Ann Arbor, Michigan; Frederick Hutchinson, former president of the University of Maine in Orono; Geraldine Knatz (former chair), managing director for the

Port of Long Beach in California; Frank Kudrna, Jr., chief executive officer of Kudrna & Associates, Ltd., a Chicago engineering consulting firm; Nathaniel Robinson, special assistant to the Secretary of the Wisconsin Department of Administration in Madison and chair of the Great Lakes Commission; Jeffrey Stephan, manager of the United Fishermen's Marketing Association, Inc., Kodiak, Alaska; John Toll, chancellor emeritus of the University of Maryland, College Park, and president of Washington College in Chestertown, Maryland; and Judith Weis, professor of biological sciences at Rutgers University, and president of the American Institute of Biological Sciences.

Dr. Schubel has been voted chair elect. Mr. Robinson has been elected the at-large member of the executive committee.



*First photo on left of page 6:  
National Sea Grant Program Director, Ronald C. Baird with new panel members Manuel L. Hernandez Avila, Jerry R. Schubel and G. Ross Heath, with Scott B. Gudes, NOAA Deputy Undersecretary.*

*Second photo, split on pages 6-7:  
National Sea Grant Program Executive Director, Fritz Schuler with panel member Nathaniel Robinson.*

*Third photo, page 7:  
Former Review Panel Chair, Geraldine Knatz with Scott B. Gudes, Manuel L. Hernandez Avila and current Chair, Peter Bell.*



## Aquatic Nuisance Species

# SEA GRANT TACKLES AMERICA'S MOST UNWANTED: AQUATIC NUISANCE SPECIES

**Nonindigenous species introductions are increasing both in frequency and in the extent of damage they cause to the Nation's environment and economy . . . (Many) nonindigenous species . . . already present in U.S. waters, or that have the potential to invade, . . . may cause significant damage to coastal resources and the economies that depend upon them.**

**W**hether they're called *invasive*, *exotic*, *aquatic nuisance* or *nonindigenous* species, each of these terms describes the same problem—non-native plants and animals that are invading our waterways. In their native habitats, aquatic nuisance species (ANS) may be harmless, but when transplanted to other areas, they compete with indigenous plants

and animals for food and habitat. ANS are causing significant ecological and economic problems throughout much of the United States. These pests may constitute the largest single threat to the biological diversity of the world's coastal waters.

Species such as zebra mussels, European green crabs, Australian jellyfish, purple loosestrife and smooth cordgrass—to name a few—have been introduced into water bodies in many regions of the U.S. Most of the time, humans are responsible for transporting ANS. These exotic pests arrive in the ballast water of transoceanic ships, on the hulls of recreational boats, and are even emptied into water via unwanted bait. From the Great Lakes to the Gulf of Mexico, from the east coast to the west, invasive species can displace native species, drastically alter aquatic ecosystems, and interfere with business and recreational pursuits.

Sea Grant was among the first to respond when zebra mussels invaded the Great Lakes in the 1980s and more recently, when Australian





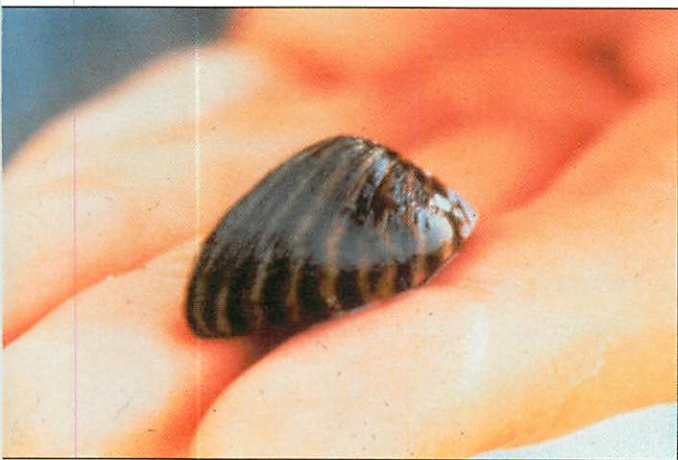
jellyfish raided the Gulf of Mexico. By developing effective methods to control zebra mussels, Sea Grant partnerships have helped industries and drinking water facilities save millions of dollars. Sea Grant has even gone one step further by creating integrated, multi-state research, outreach and education programs, and by increasing public-awareness about ANS through conferences, information clearing-

## THE ZEBRA MUSSEL *DREISSENA POLYMORPHA*

Zebra mussels are small, fingernail-sized freshwater mollusks native to parts of Eurasia. They were introduced to North America through ballast water from transoceanic vessels. First discovered in Lake St. Clair and Lake Erie in 1988, "zebras" have become a problem throughout the Great Lakes region and in an increasing number of inland waterways in the United States and Canada. The zebra mussel, a mollusk known for its hearty appetite, is altering aquatic food webs rather dramatically. The barnacle-like zebra mussel grows quickly on docks, boat hulls, commercial fishing nets, water intake pipes and valves, and along lake bottoms, causing problems for native fish and mussels, and utility companies (by preventing water needed for drinking and supplying electricity from flowing through pipes).

### SEA GRANT RESEARCH: EXPLORING APPLICATIONS FOR HUMAN HEALTH

Research conducted by Delaware Sea Grant has resulted in the first reported protein sequence from the zebra mussel. By determin-



CHARLES RAMCHIRAN

*Zebra Mussel*

houses, newsletters and web sites. These efforts have benefited hundreds of thousands of people in this country and abroad. Now, current research results and educational information is easily accessible to anyone interested in learning about, combating and preventing the spread of ANS.





ing the chemical nature of a special glue that enables the zebra mussel to anchor itself to solid surfaces, researchers may be able to unravel the zebra mussel's mysteries, *and* to explore a variety of other beneficial applications. For instance, a unique waterproof adhesive derived from the glue may have potential applications in dentistry, ophthalmology and other medical fields.

**SEA GRANT OUTREACH:  
CREATING A NATIONAL AWARENESS**

Sea Grant's zebra mussel education and prevention outreach programs are national models. Now, every region of the U.S. has a zebra mussel outreach program—even if the

area has yet to bear an invasion. By taking a proactive role, Sea Grant is reducing the further spread of zebra mussels and helping prevent new infestations. Several national Sea Grant projects include:

**CONFERENCES**

Sea Grant supports a variety of conferences that address zebra mussels. These include the *International Conference on Aquatic Invasive Species* and the *Conference on*

*Marine Bioinvasions*, which include zebra mussels, but also recognize the impact of other invasive species. Both conventions have played

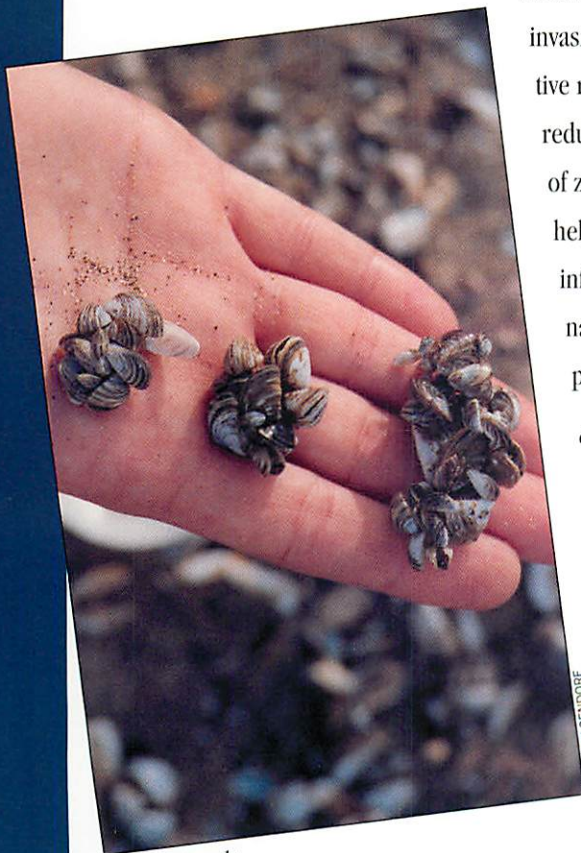
a significant role in fostering the dissemination of research and education program results among various agencies, states, regions and countries.

**NATIONWIDE ZEBRA MUSSEL  
TRAINING INITIATIVE**

A multi-year training program, this project provided access to resources and informational materials, as well as training on zebra mussels—particularly to individuals in states without Sea Grant programs. This multi-state enterprise, led by the New York, Connecticut, Louisiana, Minnesota and North Carolina Sea Grant programs, sponsored: national teleconferences, a conference that spawned the Western Zebra Mussel Task Force, and the first west coast and Heartland zebra mussel conferences.

**PURPLE LOOSESTRIFE  
*LYTHRUM SALICARIA***

Tall and lush with graceful curved leaves, long stems and clusters of dainty pink or violet flowers, purple loosestrife is as elegant as it is perilous. This striking perennial, which grows up to nine feet tall, arrived in eastern North America in the early 1800s in ballast holds and in the hands of settlers who prized the plant for its ornamental and medicinal value. Since its introduction, purple loosestrife has crept westward where it has taken hold across much of Canada and the United States. This hardy plant dominates wetlands, decreasing habitat for native birds, mammals, plants, fish, amphibians and reptiles that depend on wetland habitats for their survival. Dense stands



Zebra Mussels

MERRAN HILGENDORF





NANCY BALOOM

*Purple Loosestrife*

of loosestrife also impair the recreational use of wetlands and rivers, impede water flow in drainage ditches, and invade right-of-ways, requiring costly management efforts.

**SEA GRANT RESEARCH:  
UNDERSTANDING OPTIMAL  
GROWTH CONDITIONS**

In order to understand how this perennial thrives, a Connecticut Sea Grant researcher identified the environmental conditions that foster purple loosestrife. By examining the dispersal distance of the seeds, optimal germination conditions, and survival and growth rates of the seedlings, the investigator determined how likely purple loosestrife is to

spread from an infested habitat to an adjacent uninfested habitat, *and* which wetlands are most vulnerable to invasion. These findings will help researchers in their efforts to mitigate this troublesome intruder.

**SEA GRANT OUTREACH:  
THE PURPLE  
LOOSESTRIFE PROJECT**

Michigan Sea Grant, in partnership with the Michigan State University (MSU) Department of Entomology, created the *Purple Loosestrife Project*, which seeks to reduce the plant's numbers by integrating citizen stewardship and education with biological control. The project began with a unique loosestrife locator postcard survey that engaged citizens in identifying nearly 500 of the largest wetland infestations in Michigan. Hundreds

of teachers, students, naturalists, property owners and citizen groups now participate in the project, helping to restore Michigan's biodiversity and natural wetland function while learning the key concepts of biological control.

Since the *Purple Loosestrife Project* began in 1997, volunteers have released *Galerucella* leaf-feeding beetles (one of the plant's natural enemies in Europe), across Michigan. The beetles make their homes in stands of purple loosestrife, feasting in heavily infested areas. In addition, Sea Grant assisted teachers in producing a *Cooperators Handbook*, which features 25 outdoor learning activities and

**SEA GRANT  
RESOURCES FOR  
INVASIVE SPECIES  
INFORMATION**

These excellent websites provide timely, reliable scientific information on a variety of marine and freshwater invasive species.

*National Aquatic Nuisance Species Clearinghouse (NANSC)* <http://www.cce.cornell.edu/aquaticinvaders>

NANSC was created to help industry groups and agencies respond efficiently and effectively to the threat posed by freshwater and marine invasive species. NANSC collects and disseminates information about nuisance species' biology, spread, impact and control. With over 5,000 publications, the technical collection is the most extensive of its kind in the world.

*Sea Grant NonIndigenous Species Site (SGNIS)* <http://www.sgnis.org>

SGNIS contains a comprehensive collection of research publications and educational materials produced by Sea Grant programs across the country. Over 1,100 research reports and educational items are currently housed on the site, including newsletters, research findings, conference proceedings, slides, and other information.



classroom experiments, and serves as a comprehensive guide to purple loosestrife biological control.

## S M O O T H   C O R D G R A S S

*SPARTINA ALTERNIFLORA*



Smooth Cordgrass

LISA LEVIN

Although native to the Eastern U.S., smooth cordgrass has migrated to the west coast, particularly California, where it has taken up residence in numerous wetlands. Thought at one time to be beneficial, this coastal salt grass was deliberately introduced into South San Francisco Bay in the mid 1970s. Smooth cordgrass has since become so problematic that if it continues to spread, it could change the intertidal landscape of California by eradicating native cordgrass and encroaching on open mudflats. Large infestations can change water movement and transform wetlands into fields, altering the habitats of birds and other resident species. This ANS also poses a threat to invertebrates, fish and waterfowl, and even to commercial

fish and crab populations. *Spartina alterniflora* has already played a role in flooding in Alameda and Contra Costa counties in California by blocking flood-control channels.

### SEA GRANT RESEARCH: SEEKING SUSTAINABLE PRACTICES AND PARTNERSHIPS

To help eradicate alien cordgrass from California waters, California Sea Grant researchers refined control techniques by reducing the amount of herbicide necessary to

kill cordgrass. The researchers also identified and coordinated with public and private organizations in planning and sharing the costs of a systematic eradication process.

A researcher at the University of California, Davis, funded by California Sea Grant, documented the degree to which invasive and native cordgrasses are hybridizing and spreading through marshlands within the San Francisco Bay and along the northern California coast. This genetic analysis of cordgrasses led to the development of morphological markers that allow resource managers to spot hybrids early.

### SEA GRANT OUTREACH: SHARING THE COSTS OF ERADICATION

As part of an alien cordgrass outreach effort, the researcher conducted workshops and prepared a manual on alien cordgrass control. He also maintains a Spartina website: <http://www-bml.ucdavis.edu/spartina/home.html>

The U.S. Fish and Wildlife Service, the East Bay Regional Parks District, the Alameda Flood Control, U.S. Department of Agriculture, San Francisco Estuary Institute, the California Coastal Commission, California Department of Fish and Game and the San Francisco Bay Area Wetlands Ecosystem Goals Project have been able to use these findings.

### T H E   E U R O P E A N G R E E N   C R A B

*CARCINUS MAENAS*

The European green crab was first discovered near San Francisco Bay in 1989. Nine years later, it was clear that this notorious global invader had reached the Pacific North-



west. The green crab's reputation as a serious threat is well deserved. A voracious predator, it is able to tolerate air exposure, starvation, and wide ranges in temperature and salinity. This scavenger preys on numerous organisms, placing it in direct competition for food with native fish and bird species. When green crabs are abundant, young bivalves, urchins and barnacles cannot establish themselves. If green crabs were to expand their range along the Pacific coast of North America, they could exert a considerable ecological and economic effect.

**SEA GRANT RESEARCH:  
A NATIONAL EFFORT**

In order to understand how to control and mitigate this species, California Sea Grant researchers assessed methods for controlling the European green crab biologically. The researchers then developed mathematical

sessile bivalve (valued commercial species) by direct predation and habitat displacement. In a simultaneous project, the New Hampshire researcher monitored the ongoing range expansion of the green crab along the west coast and estimated the abundance of targeted invertebrate populations known to be reduced by green crab predation. The results of this work will help resource managers, aquaculturists, commercial fishers and other stakeholders anticipate the severity and nature of the crab's colonization, and to identify measures to lessen its impact.

**SEA GRANT OUTREACH:  
DEMISTIFYING THE GREEN CRAB**

The Oregon and Washington Sea Grant programs initiated a major outreach effort focusing on the European green crab. In 1998, the two programs developed the Pacific

Northwest Marine Invasive Species Team (MIST). MIST offers training sessions for growers, biologists, students and volunteers that cover green crab and other ANS identification and life history, potential ecological and economic impacts, mitigation techniques and prevention of further spread. To learn more about MIST, visit: <http://www.seagrant.orst.edu/mist/news.html>

The Oregon Sea Grant program has also published a book titled, *Global Invader: The European Green Crab*, by Sylvia Behrens Yamada, which describes the biology and life history of the European green crab and presents five case studies of green crab invasions. Published by Oregon State University, the book is available online at: <http://seagrant.orst.edu/sgpubs/newpubs.html>

**AN INNOVATIVE  
APPROACH TO  
ANS TRAINING**

To aid the seafood industry in meeting training needs called for by new FDA regulations, Sea Grant spearheaded the formation of the Seafood HACCP (Hazard Analysis Critical Control Point) Alliance, an intergovernmental agency partnership with industry and academia. HACCP programs are estimated to have reached more than 5,000 U.S. processing plants and 6,000 importers, saving as much as \$115 million annually.

The Great Lakes Sea Grant Network has utilized the HACCP approach in preventing the spread of aquatic nuisance species. The 2002 International Conference on Aquatic Invasive Species included an ANS-HACCP (Aquatic Nuisance Species Hazard Analysis Critical Control Point) training workshop to teach participants about the spread of ANS through aquaculture and baitfish harvest. In the next two years, the Network will conduct workshops for state and federal fish hatchery personnel across the U.S. This program has yielded important partnerships between Sea Grant and other governmental agencies as well as with industry.



SYLVIA YAMADA

*European Green Crab*

models for assessing how parasites such as *Sacculina*, which block the reproductive capability of the host, might be used as biological controls.

Washington Sea Grant, in partnership with a New Hampshire Sea Grant researcher, gauged the crab's potential ability to significantly disturb populations of Dungeness crab and



## The Industry Fellowship Program

### SEA GRANT SUPPORTS INNOVATIVE YOUNG SCIENTISTS

**“We’ve had top companies participating because they get a lot for their financial contribution. This is a super model for advancing technologies from academia to the industry setting, for allowing industry to influence academic and Sea Grant priorities, and for exposing students to industry issues.”**

*Vijay Panchang, former Sea Grant Director for Coastal and Technology Programs*

**T**he Industry Fellowship, established in 1995, provides, in cooperation with industry, financial support for graduate students who are pursuing research and development projects on topics of interest to a particular industry or company.

From a project’s inception to its conclusion, students work in close partnership with a faculty advisor, a Sea Grant college or institute and an industry representative. This unique collaboration provides students with hands-on training and experience working with industrial issues. By uniting scientists, engineers and other academicians with their industrial counterparts, the Industry Fellowship promotes long-term partnerships and facilitates information exchange, allowing Sea Grant to engage industry in Sea Grant issues, and industry to influence Sea Grant research priorities.

#### SEVEN SUCCESSFUL YEARS

Now in its seventh year, the program distinguishes itself as one of Sea Grant’s most innovative tools for stimulating the transfer of scientific knowledge relevant to mission





objectives from the laboratory into the workplace. In a 1999 survey, industry and university participants called the Industry Fellowship program an “exceptional opportunity” and “a most efficient use of money.”

A total of 26 fellowships have been awarded since the program began. Former recipients are now working for major companies such as Alden Research Laboratory in Holden, Massachusetts and ONDEO-Nalco in Naperville, Illinois.

#### **INFORMATION EXCHANGE**

Many students work at the businesses’ laboratory facilities where they can experience industry science first hand. The university, in turn, may share patented materials or computer code in addition to intellectual property. Faculty advisors, many of whom are some of the most knowledgeable experts in their fields, are also closely involved with their students and industry scientists.

#### **DIVERSE OPPORTUNITIES AND RESEARCH TOPICS**

Archer Daniels Midland, GlaxoSmithKline, Procter & Gamble, Starkist, Texas Instruments and Weyerhaeuser are several well-known companies that have supported the Industry Fellows program. Research topics, which reflect Sea Grant priorities, have been equally diverse. Past fellows have worked on natural disaster preparedness, discovery of new drugs, aquaculture net pen design, water purification systems, improved seafood canning techniques and waste reduction systems at fish processing plants. These projects are shining examples of what can be accomplished when the quest for scientific knowledge is focused on questions of relevance to business.

In short, Sea Grant’s Industry Fellows program is a vehicle for training bright young scientists *and* for transferring vital technologies from universities to businesses. Everyone wins—student, university, business and the public interest.





## MEET OUR INDUSTRY FELLOWS

### CHRISTOPHER STEVENSON

**“I was in an industry setting where there were enormous resources. People were always available for questions and happy to help overcome any problems I encountered along the way. I now have a better understanding of what is expected of researchers at industrial scientific institutions.”**

*Industry Fellow Christopher Stevenson, who worked for GlaxoSmithKline in Philadelphia, developing a new anti-inflammatory drug isolated from blue-green algae.*

**C**alifornia Sea Grant Industry Fellow Christopher Stevenson worked at a laboratory at GlaxoSmithKline in Philadelphia, studying the biomedical properties of scytonemin, a pigment molecule found in blue-green algae, one of the most primitive photosynthetic organisms on Earth. During his tenure, Stevenson consulted with his thesis adviser, Robert Jacobs, a pharmacologist and Sea Grant researcher at the University of California, Santa Barbara, who was the first to discover the pigment's bioactivity. The fellow also worked closely with company researchers.

“We got together with the common goal of using this marine natural product as an inhibitor of enzymes important in cell proliferation,” said Lisa Marshall, a project director in the oncology department at GlaxoSmithKline.

“The idea was: if we could inhibit cell proliferation, scytonemin could potentially be an interesting new medicine.”

Through his experiments, Stevenson was the first to show that scytonemin inhibits aberrant cell division. He was later able to demonstrate that scytonemin also reduces skin irritations. Stevenson's work lays the groundwork for an exciting new class of medicines for treating skin inflammation, or potentially any disease that involves aberrant cell division.



UNIVERSITY OF CALIFORNIA, SANTA BARBARA

*Christopher Stevenson*

Stevenson's research was awarded a Young Investigator Award at the International Association of Inflammation Society's conference in Edinburgh, Scotland in September 2001. He was also one of five winners at the Inflammation Research Association's national conference in Hot Springs, Virginia. Stevenson is slated to receive his doctoral degree in pharmacology from the University of California, Santa Barbara in 2002.



## KRISTI WEST

**“When students hear what Kristi has been able to do, their mouths drop open.”**

*Shannon Atkinson, thesis adviser for Industry Fellow Kristi West.*

Hawaii Sea Grant Industry Fellow Kristi West, a graduate student at the University of Hawaii in Manoa, has spent the last three years studying dolphins in French Polynesia. Her work may help prevent dolphin shortages predicted at the Nation's zoos and marine parks, and improve the care of captive marine mammals.

West has enjoyed opportunities that most only dream about. She has traveled to exotic South Pacific island paradises, swum with dolphins, and completed research that will help people manage the health of captive newborn calves and dolphin mothers.

For her project, West studied the reproductive physiology of bottlenose dolphins, the most common captive species. Because her industry partner, Dolphin Quest, housed some of the world's only captive rough-toothed dolphins at its facility in Moorea, French Polynesia, West also studied the basic biology of these energetic mammals.

Managing dolphin reproduction is challenging because the animals have such complex hormonal cycles, far more complex than human cycles, West said. Dolphins for instance, do not ovulate at regular intervals,

and, unlike other mammals, lactation does not seem to suppress conception.

Working with Shannon Atkinson, a former professor at the University of Hawaii, and veterinarians at Dolphin Quest, West developed an “at-home pregnancy test” for dolphins. The non-invasive test measures hormone levels in dolphin milk to diagnose pregnancy or the time



CECILE GASPAR / DOLPHIN QUEST

*Kristi West (foreground)*

of ovulation. West also developed methods for measuring hormone levels in blood samples to diagnose potential health problems.

Reflecting the value of West's tests, the Indiana and Minnesota zoos recently sent her blood samples to check the health and reproductive state of their dolphins. In 2001, West won “best student presentation” awards at the World Marine Mammal Science Conference in Monaco and at the Big Island Science Conference in Hawaii. West graduated with a doctorate in biomedical science in the spring of 2002. Atkinson is now science director at the Alaska SeaLife Center in Seward, Alaska.



## CHRIS PATERNOSTRO

**“If I had not had the Industry Fellowship, I would not have this job. My thesis is the reason they hired me.”**

*Industry Fellow Chris Paternostro, who improved an oil spill simulation by modeling the effects of tides on a spreading oil slick.*

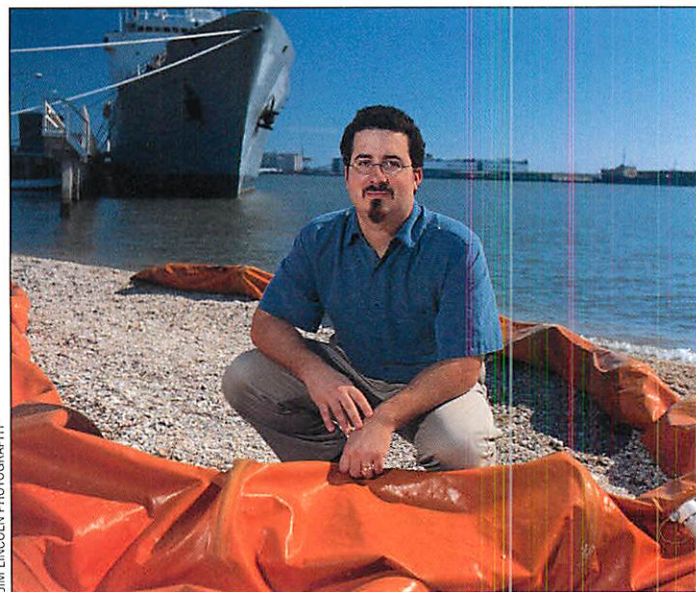
Texas Sea Grant Industry Fellow Chris Paternostro's work will ultimately help companies manage oil spills more quickly and efficiently. Working with Ship Analytics in North Stonington, Connecticut, Paternostro improved an oil spill simulation model used for training emergency planners in the event of a tanker spill or refinery explosion. With guidance from his adviser, Dr. William Seitz, a professor of oceanography at Texas A&M, Paternostro determined how tides would hypothetically spread an oil slick in a given bay or harbor.

Ship Analytics designs, manufactures and operates real-time simulations of oil spills. The models not only simulate the physics of an oil slick, but also the effects of emergency responses, such as applying chemical dispersants. Prior to Paternostro's fellowship, Ship Analytics designed a model that assumed an entirely wind-driven ocean circulation. The student's research advanced this model, making it possible to pattern the effect of tides on water levels and currents in narrow bays and harbors.

Mike Collins, a senior software engineer at Ship Analytics said of Paternostro's work: “His

tidal work was quite important. The more accurate our simulations, the better decisions people are going to make based on the model output. Chris was able to extend a technology that is quite useful to people outside of academia.”

Texas A&M's Center for Marine Training and Safety in Galveston, Texas offered an ideal setting for a collaboration with Ship Analytics. The university has one of the Nation's only “oil spill schools,” where trainees can suit up, jump in a boat and drag containment booms through the surf to contain a mock spill, simulated with lots of floating oranges. The school provides emergency planners with the tools they need to develop strategies for handling a potential crisis. Since graduating in 2001 with a master's



*Chris Paternostro*

in oceanography from Texas A&M, Paternostro has been hired as a hydrologist for the Texas Water Development Board in Austin, a state agency that funds dam construction. He now develops software simulations designed to forecast the environmental consequences of proposed dam projects on water flows in



estuaries and bays in the Gulf of Mexico. Paternostro said of his Industry Fellowship project, "It is satisfying knowing that your work can be applied to help solve present day problems."

## **HAEJO HWANG**

**"My experience as an Industry Fellow opened my mind to pursuing a career in industry. Before, I thought academia was the only option."**

*Haejo Hwang, now a toxicologist with ONDEO-Nalco in Naperville, Illinois.*

Ohio Sea Grant Industry Fellow Haejo Hwang was studying the lingering effects of PCBs on lake and stream ecosystems when, at a science conference, he met Robert Larson, an aquatic toxicologist at Procter & Gamble in Cincinnati. Larson suggested that instead of studying PCBs, which are now banned in the United States, Hwang should focus his research on linear alkylbenzene sulfonates—surfactants added to household and industrial detergents, soaps and cleaners.

His adviser, entomology professor Susan Fisher of Ohio State University, agreed that it would be valuable to study these compounds and their toxicity to invertebrate denizens of Ohio's lakes and streams. Municipal treatment plants remove about 97 percent of linear alkylbenzene sulfonates from wastewater, but concerns remain that the three percent residue may pose a threat to small invertebrates at the base of the freshwater food chain.

One way of studying the toxicity of chemicals is to measure their concentrations in sediments and water. Another way, the one Hwang explored, is to use chemical loads in organisms as indicators of water quality and environmental safety. This monitoring technique is less costly for businesses.

To facilitate research in Fisher's laboratory, Procter & Gamble donated about \$300,000 worth of equipment to Ohio State University.



ROGER LEGEL / AFTER IMAGE MEDIA PRODUCTIONS

*Haejo Hwang*

This equipment made it possible for Hwang to analyze chemical residues in bloodworms and small amphipods at the university. "Haejo's work helped us establish what constitutes a safe concentration (of chemicals) in the organism. We use these concentrations as benchmarks to understand our margin of safety in the environment," said Donald Versteeg, a research scientist at Procter & Gamble.

Hwang received his doctorate from Ohio State University in 2000. He is now employed by ONDEO-Nalco in Naperville, Illinois, where he is working to improve water quality. He said of his fellowship, "If I had not had the Industry Fellowship, there is no way I could have come to industry and felt comfortable."



## Aquaculture

### MOVING AQUACULTURE OFFSHORE: THE PROMISE OF AN OPEN OCEAN

**Imagine for a moment, a farm—only this is no ordinary farm. Its undulating blue pastures are as deep as they are wide and teeming with life. Silvery fish and other sea creatures are corralled in spacious, specially developed mesh cages, which hover just above the ocean floor.**

**J**ust as with traditional agriculture, farmers feed, care for and eventually harvest their ocean-dwelling “livestock.” Sea farming, or marine aquaculture, offers vast potential for feeding millions of people and reducing increasing demands on wild fisheries. Sea Grant is committed to enhancing this budding industry’s development in a socially and environmentally sound manner.

#### THE ISSUE

The U.S. population has increased 85 percent since 1950, swelling from 151 million to 283 million in just fifty years. This burgeoning growth is matched by an unprecedented demand for seafood. According to a recent USDA report, the value of imported shrimp, Atlantic salmon and tilapia alone totaled \$4.6 billion. To put this in perspective, imports of these three aquaculture products in 2000 were worth as much as the combined exports of the U.S. broiler and hog industries.

The Nation’s wild caught fisheries are under extreme stress, leaving commercial fishers unable to meet increasing seafood demands. Presently, more than two-thirds of the seafood consumed in this country is imported, resulting in a more than \$8.1 billion seafood trade deficit. U.S. seafood demand will there-



fore have to be met through increased imports or domestic aquaculture production. Our marine aquaculture industry (which accounts for a mere 15 percent of total domestic aquaculture production) lags far behind its well-developed freshwater aquaculture industry.

## P O L I C Y

In 1999, the U.S. Department of Commerce (DOC) approved an Aquaculture Policy that envisions this U.S. industry growing to \$5 billion by 2025, nearly five times its current value. In addition, policy objectives include increasing aquaculture employment opportunities, increasing U.S. exports, developing a code of conduct for responsible aquaculture and enhancing depleted wild fish stocks through aquaculture. The DOC aquaculture mission is to create sustainable economic opportunities while remaining environmentally sound and consistent with applicable laws and policies.

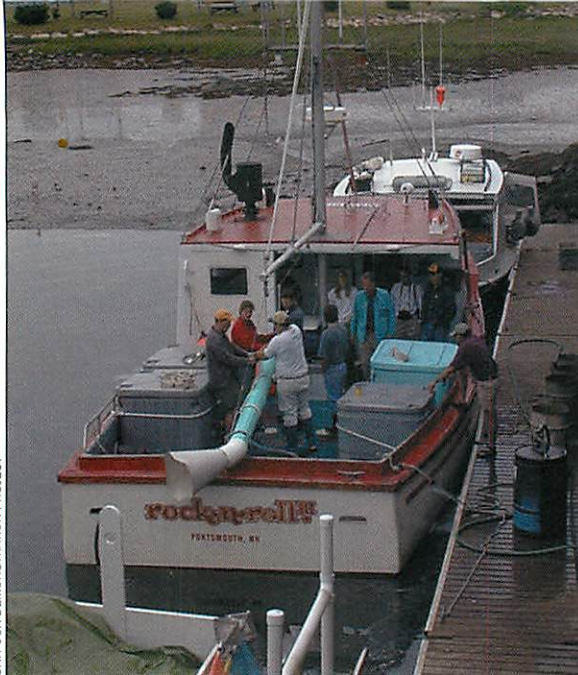
However, coastal aquaculture expansion is limited due to the rapid growth of the Nation's coastal population (creating increased human-

induced pollution and stress on the marine environment), and increasing user conflicts between existing industries and recreational groups. As a result, an open ocean environment has been recognized as an appropriate option for expansion of U.S. aquaculture production.

## S E A   G R A N T A Q U A C U L T U R E I N I T I A T I V E S

Through its long-standing leadership in aquaculture and its partnership with university-based researchers, policymakers, environmental advocates, professionals and coastal communities, Sea Grant is poised to help develop the U.S. aquaculture industry. Sea Grant has funded aquaculture research for more than 30 years and is committed to studying the feasibility of creating a sustainable offshore industry. The New Hampshire, Hawaii and Mississippi Sea Grant Programs have initiated groundbreaking open ocean aquaculture projects.





*E/V Rock-n-Roll III*

THE  
NEW HAMPSHIRE  
OPEN OCEAN  
AQUACULTURE  
DEMONSTRATION  
PROJECT

Sea Grant's first open ocean aquaculture research began in 1997 with the University of New Hampshire's Open Ocean Aquaculture Demonstration Project (OOADP). OOADP was established to realize four goals: 1) to facilitate regulatory and permitting processes that now impede commercial expansion of aquaculture; 2) to demonstrate reliable culture techniques to raise marketable products; 3) to provide focus in ocean engineering for cage design, evaluation, and development; 4) to provide economic data for risk assessment for capital investors and insurance companies.

In 1998, the project established a 36-acre commercial lease site approximately eight-and-a-half miles off the shore of Portsmouth, New Hampshire. By the next summer, two submersible Sea Station sea cages (developed by Ocean Spar Technologies) were deployed in the leased

area, as well as two 394-foot long submerged longlines for shellfish culture.

During the summers of 1999 and 2000, researchers raised summer flounder in the sea cages. Over the course of the study, the researchers developed both an automated feeding system that attached to the cages, and new transportation methods to reduce fish stress. In 2001, cod and Atlantic halibut were successfully grown in offshore cages for the first time in North America. Researchers are now raising haddock.

Results from the shellfish culture demonstrated that each longline could produce up to eight tons of market size mussels in less than



*Elizabeth Fairchild: Assessing flounder stock enhancement*

one year. The growth rates and production cycle compared favorably with those reported for inshore culture in the Northeast U.S. and Atlantic Canada, indicating excellent potential for commercial offshore production.



## THE HAWAII OFFSHORE AQUACULTURE RESEARCH PROJECT

Just four miles west of Honolulu International Airport, researchers are raising thousands of fish on a 28-acre patch of ocean.



OCEANIC INSTITUTE

*Divers check the sea cage.*

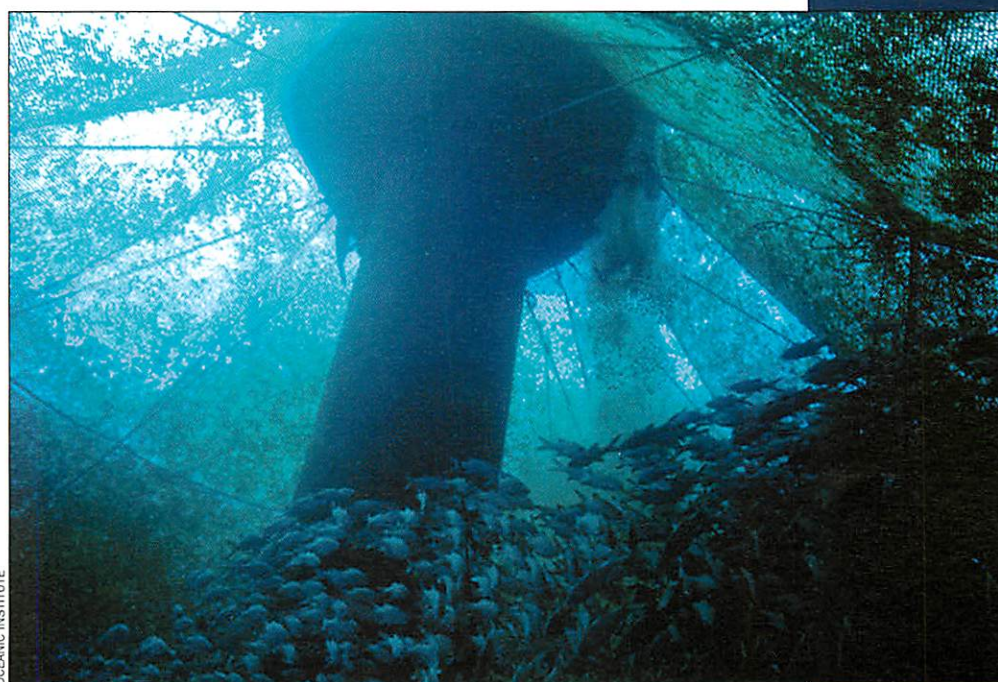
Scientists at the University of Hawaii Sea Grant College Program, partnering with the Oceanic Institute, have been working with government and private organizations in Hawaii to examine the biological, environmental and economic feasibility of offshore aquaculture in the Pacific region. Under the NOAA-funded Hawaii Offshore Aquaculture Research Project (HOARP), these efforts have led to this Nation's first

successful demonstration of offshore culture of a tropical marine fish species in a single, commercial-sized cage.

The cage used in this project is the same design used by the OOADP. However, Hawaii's cage is five times larger, measuring 80 feet wide and 50 feet tall. The cage features a four-point mooring system and is submerged about 40 feet below the surface of the water.

The Hawaii researchers chose to grow Pacific threadfin (moi) because this species has always been highly regarded by Hawaiians, but is currently depleted in local waters. Moi also grows well in captivity and reaches market size in only six to eight months. At the end of the first season, HOARP researchers harvested more than 19 tons of moi. The second year, in which the stocking density of the fish was doubled, the project produced a harvest of nearly 34-and-a-half tons.

As a result of its success, the project is now a commercial venture. The research cage has



OCEANIC INSTITUTE

*Sea cage: NASA-developed mesh designed to withstand 25-foot waves.*

## AQUACULTURE RESEARCH SYMPOSIUMS

Sea Grant coordinated a series of four research symposiums, each highlighting the latest developments in offshore aquaculture from around the world. The latest symposium, *Open Ocean Aquaculture IV* was held June 17-20, 2001 in St. Andrews, New Brunswick, Canada. Speakers from 13 countries made more than three-dozen presentations to the 130 attendees.



been leased to Cates International, Inc, a commercial firm that participated in Phases I and II of the research process. This company

has established the first fully permitted open ocean aquaculture site in the U.S. Under a 15-year lease with Hawaii, Cates International may install a total of four cages and could harvest from 1.2 million to 2

million pounds of fish per year.

According to the Department of Agriculture's Aquaculture Development Program, aquaculture has been growing steadily in Hawaii, from \$6.9 million in 1991 to \$22.2 million in 2000. Offshore fish farming could boost those figures substantially. Researchers hope that offshore aquaculture will elevate the wild moi population while meeting consumer demand for the fish.

## THE GULF OF MEXICO OFFSHORE AQUACULTURE CONSORTIUM

The Gulf of Mexico Offshore Aquaculture Consortium (OAC) was formed as a collaborative, Gulf-wide, university-based interdisciplinary research program with industry partnerships and broad public input. Its research is focused on the development of an environmen-

tally-friendly and economically feasible offshore aquaculture industry in the Gulf of Mexico.

The OAC started in February 2000 with a Gulf-wide workshop hosted by the Texas Sea Grant College Program. From the workshop and on-going collaborations with partners in all five Gulf states and across the country, the OAC developed and implemented a multidisciplinary research plan that included legal regulatory review, grow-out trials, engineering design, environmental and genetics research, development of offshore aquaculture operations, marketing/economic studies, disease monitoring, and public education and outreach.

One year later, a Sea Station cage (measuring 21,000 cubic feet) was deployed 25 miles south of Pascagoula, Mississippi, near a Chevron U.S.A. Production Company gas platform. Researchers selected red drum fish, a species native to Gulf waters. Trials are slated to begin in 2002. The red drum will be fed using a unique automated feeding device designed by MIT Sea Grant, called the "Robofeeder." The feeder holds 500 pounds of fish food and is attached to the top of the cage. Feedings, which are regulated by an internal timer, are dispensed using gravity. The fish will be sampled monthly to track growth rate, food conversion rate and stress responses.

The OAC project will be used to analyze the marketing/economic aspects of creating a commercial-scale offshore aquaculture operation. This will include studying the costs of capital investment, labor, fish and feed, maintenance and fish loss, as well as income from fish sales and rate of return for the investor. The results will determine the



Moi

AQUACULTURE DEVELOPMENT PROGRAM



economic viability of such a venture and create a Model Business Plan for offshore aquaculture. The OAC also will educate the Gulf-wide public and fisheries communities about

offshore aquaculture via public education displays for marine education centers in the region, workshops, and an Internet site: <http://www-org.usm.edu/~ooa/index.htm>





## Financial Report Federal Appropriations

In FY 2000, the total program expenditures for the National Sea Grant College Program were \$100.9 million. Approximately 58 percent of these funds came from federal appropriations after a congressionally mandated rescission. Matching funds from state partners accounted for about 33 percent of the total. Passthrough funds coming from NOAA and other agencies and carryover funds from FY 1999 accounted for the remaining 9 percent of the total.

In FY 2001, the total funds under management for the National Sea Grant College Program were \$112.3 million. Approximately 55 percent of these funds came from federal appropriations after congressionally mandated rescissions. Matching funds from state partners accounted for about 33 percent of the total. Passthrough funds coming from NOAA and other agencies and carryover funds from FY 2000 accounted for approximately 12 percent of the total.

### Distribution of Federal Funds (SG Appropriations)

Sea Grant Appropriated Funds Only (In thousands)		
Fiscal Year	2000	2001
Appropriation <sup>1</sup>	59,250	62,250
Rescission	-620	-136
Prior Year Deobligation Assessment	-454	-142
Travel/Administrative Cost Reduction	0	-47
Prior Year Carryover	25	424
Prior Year Re-use of Deobligated Funds	222	61
Available Funding	58,423	62,410
Sea Grant Core Programs	44,091	46,127
National Competitions		
Oyster Research <sup>2</sup>	2,084	2,889
Marine Biotechnology	1,492	1,437
Nonindigenous Species <sup>3</sup>	2,767	2,453
Coastal Technology	947	1,058
Fisheries Habitat	1,400	1,411
HBCU Program	472	52
Total	9,163	9,248
Other Network Activities		
Rapid Response Fund	244	408
Knauss Fellows - Legislative	342	380
Network Communications	444	512
SBIR	752	780
Adjusted Prior Year Grant Obligation	0	31
Total	1,782	2,120
Total Programmatic Activities <sup>4</sup>	55,036	57,505
NSGO Program Management Cost	2,963	2,915
<b>Total Expenditures</b>	<b>\$57,999</b>	<b>\$60,420</b>
Funds Remaining - Carryover to Subsequent Fiscal Year	424	1,990

1. Passthrough funds, which are received from NOAA components and other federal agencies, are not included in these figures. These funds, which were managed by Sea Grant, amounted to an additional \$9,715,000 in FY 2000 and \$14,630,000 in FY 2001.

2. Oyster Disease Research and Gulf of Mexico Oyster Program are combined into Oyster Research. Some projects selected for funding in FY 2001 were carried over until FY 2002.

3. Represents projects funded out of Nonindigenous Species appropriation. Some Nonindigenous Species Projects were funded using core Sea Grant dollars. Some projects selected for funding utilizing the Nonindigenous Species appropriation in FY 2001 were delayed until FY 2002.

4. Programmatic activities include all grants, contracts, cooperative agreements and interagency transfers excluding NSGO administrative costs.



## Financial Report Explanatory Notes

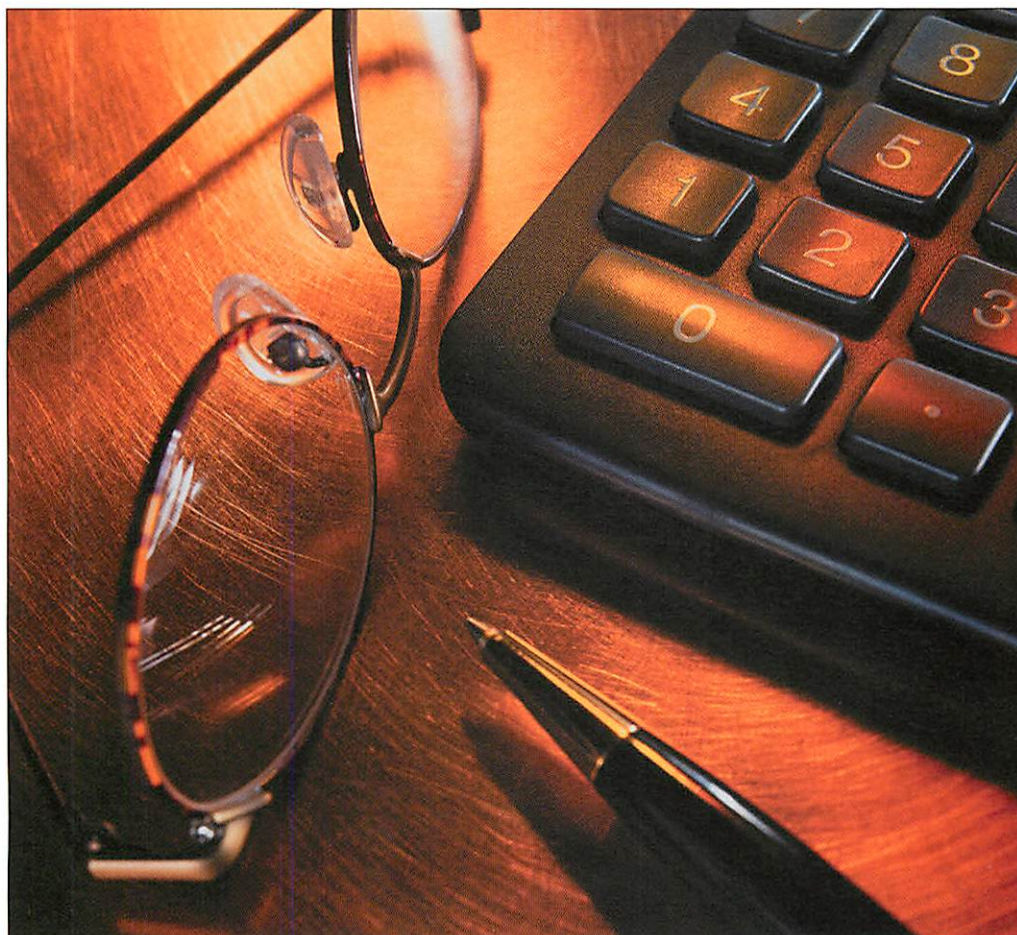
### SEA GRANT CORE PROGRAM

■ Sea Grant invested \$90.2 million in federal funds during FYs 2000 and 2001 in core program activities, primarily in 30 Sea Grant colleges and institutions. Each program is responsible for developing an integrated approach to addressing priority marine and coastal issues through merit-reviewed research, education and outreach activities. The core programs draw upon the academic talent not only in their institutions but also through a wider network that has grown to encompass over 200 participating universities and other marine organizations throughout the nation. Federal oversight of the program is the responsibility of NOAA's National Sea Grant Office.

### NATIONAL STRATEGIC INVESTMENTS

■ The Sea Grant Coastal Technology Program's goal is to foster greater technology development and transfer activities between academia and industry. The federal investment in the program was \$2.0 million during the biennium. Of this, Sea Grant invested \$280,000 in industry fellowships as part of Sea Grant's technology portfolio during FYs 2000 and 2001.

■ Sea Grant invested \$2.8 million in federal funds to support fisheries habitat research. This project's focus is on innovative research, education and outreach projects that address critical and high priority problems related to fisheries habitat in U.S. coastal and Great Lakes waters. These problems reflect critical gaps in





knowledge that exist regarding habitat preferences and requirements of the life stages of many finfish and shellfish species; the role played by various habitats in the fishery production process; and the impact of anthropogenic and natural activities on habitat structure and function.

and aquacultural pathogens, and biotechnology to enhance aquaculture.

■ Sea Grant obligated \$5.2 million through national competitions and core program science investments in FYs 2000 and 2001 to address the problem of nonindigenous species invasions of marine and Great Lakes coastal

ecosystems. The goals of this program

are to prevent new introductions, control the spread of established species, and provide information to mitigate the

damage from established populations.

■ Sea Grant obligated \$5.0 million during FYs 2000 and 2001 to oyster disease research and the Gulf of Mexico Oyster Program to address diseases that have severely impacted the U.S. oyster industry. The goal of the Oyster Disease Program is to promote a better understanding of oyster diseases and to develop new measures to protect the industry from the effects of disease. The Gulf Oyster Industry Program is a competitive grant program providing research and outreach support for work related to Gulf of Mexico oyster industry issues. The primary focus has been on human disease issues associated with oyster consumption, new aquaculture technology, post harvest treatment of oyster products, habitat, and water quality issues.

■ Sea Grant invested \$524,000 in FYs 2000 and 2001 in a competitive grants program in cooperation with several Historically Black Colleges and Universities (HBCUs). The goal of this program is to significantly enhance the ability of the HBCUs to offer education in the marine sciences to their student bodies.

■ Sea Grant's marine biotechnology research totaled \$2.9 million during the biennium with emphasis on the following areas: environmental remediation, marine natural products, seafood





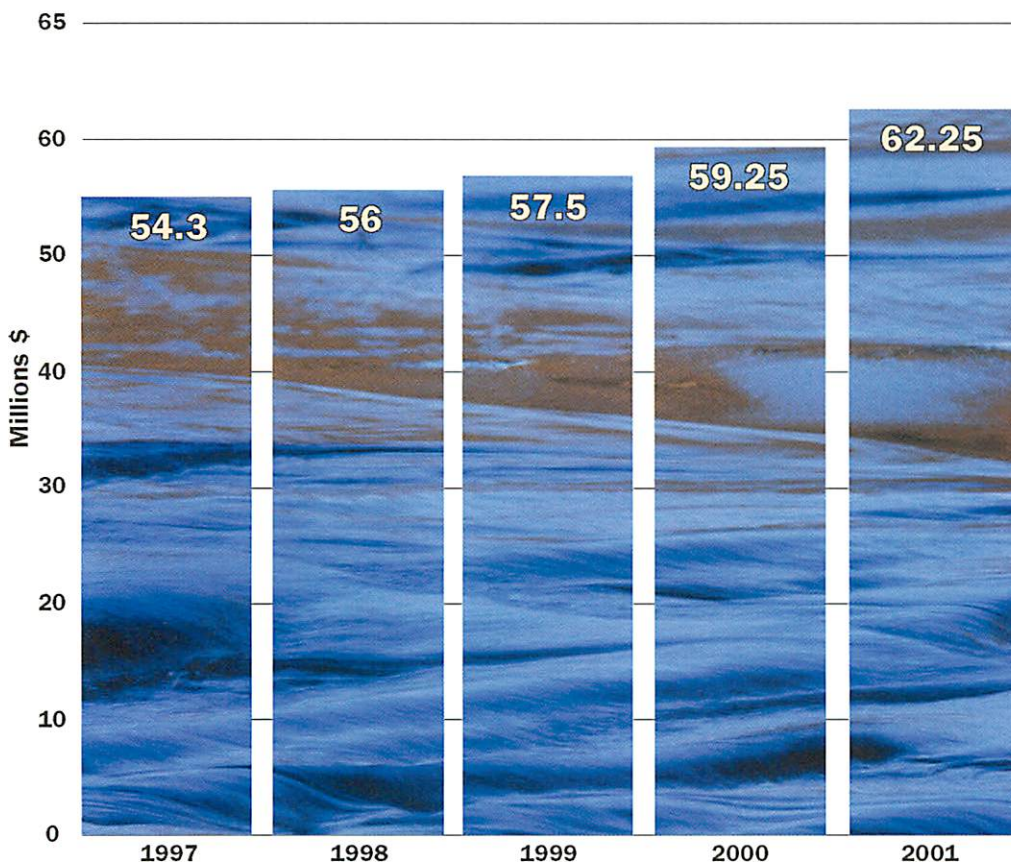
## OTHER NETWORK ACTIVITIES

■ The National Sea Grant Office invested \$652,000 of program development funds during this biennium to develop new initiatives and to respond to opportunities throughout the network.

■ Sea Grant invested \$722,000 in FYs 2000 and 2001 to support the Knauss Fellowship program. This program was established to provide an opportunity for graduate students to work in government agencies and Congress on national policy decisions affecting ocean and Great Lakes resources.

■ Sea Grant invested \$1.5 million during FYs 2000 and 2001 in NOAA's Small Business Innovation Research (SBIR) Program. This Congressionally mandated program provides funding for research projects to assist small businesses in developing commercial products. Principal investments were made in areas such as vaccines for use in aquaculture, aquaculture filter systems and coastal modeling. Earlier projects coming to fruition in the marketplace include an underwater camera and mapping system for autonomous underwater vehicles and development of a feed for shrimp broodstock.

**Sea Grant Appropriations  
FYs 1997 - 2001**





## SEA GRANT FUNDING BY STRATEGIC PLAN

The following charts show the level of effort within the Sea Grant network during FYs 2000 and 2001 according to the *Sea Grant Network Plan*. This plan was developed in conjunction with the strategic planning efforts of the Department of Commerce's National Oceanic and Atmospheric Administration. The plan, which identifies priorities and charts the Sea Grant network's direction for the decade 1995-2005, focuses on three broad portfolios: economic leadership; coastal ecosystem health and public safety; and education and human resources. Following are the key focus areas identified within these portfolios:

### ECONOMIC LEADERSHIP:

commercial biotechnology; environmental technology; commercial fisheries; sustainable aquaculture; seafood technology; coastal business development; coastal community development; and revitalizing marine infrastructure.

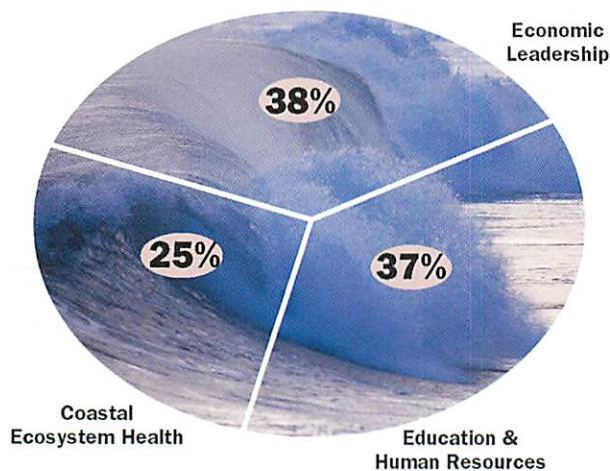
### COASTAL ECOSYSTEM HEALTH AND PUBLIC SAFETY:

coastal ecosystems; coastal and Great Lakes habitats; sustainable development; coastal hazards; and safety at sea.

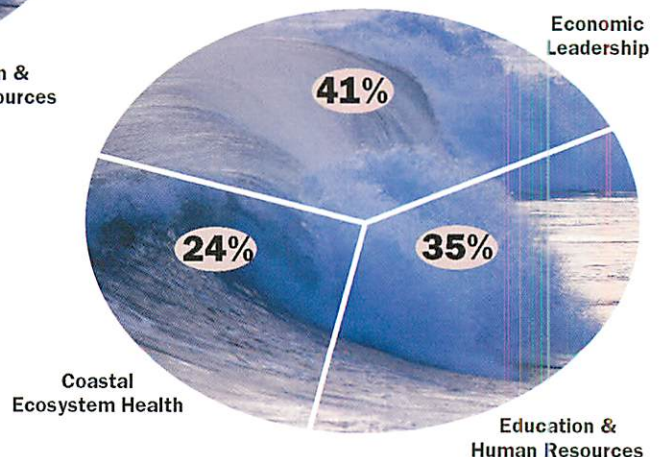
### EDUCATION AND HUMAN RESOURCES:

education of scientists, engineers and resource managers; technical training; precollege education; and informal education (outreach).

**FY 2000**  
Percentage of Invested Funds  
\$97.9M Federal, Match & Passthrough  
by Sea Grant Strategic Plan Category



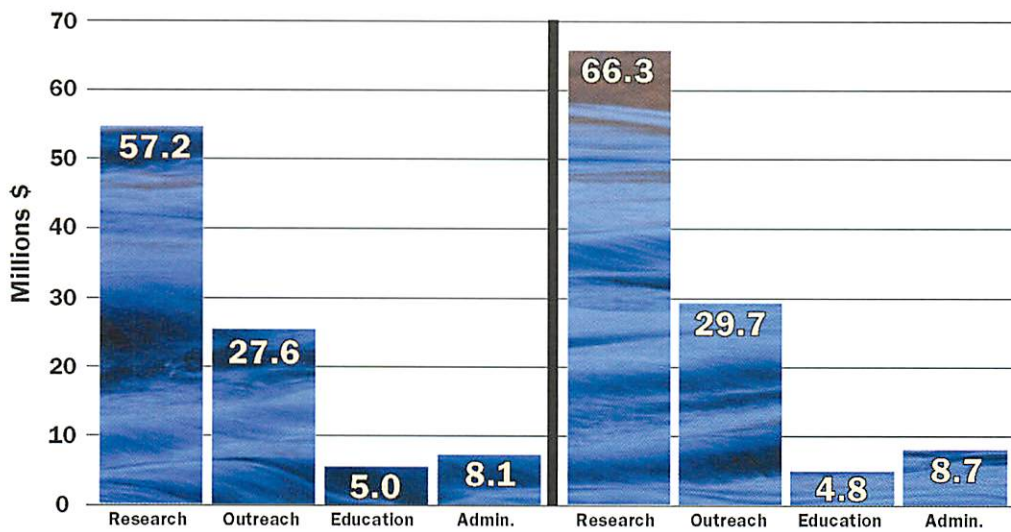
**FY 2001**  
Percentage of Invested Funds  
\$109.4M Federal, Match & Passthrough  
by Sea Grant Strategic Plan Category





**Grant Award Categories\***  
**FY 2000 - \$97.9M Total**

**Grant Award Categories\***  
**FY 2001 - \$109.4M Total**



\*Does not include NOAA administration expenditures.

## SEA GRANT FUNDING FOR RESEARCH, EDUCATION AND OUTREACH

The charts above show Sea Grant's level of investment during FYs 2000 and 2001 in the broad areas of research, education and outreach. In addition, costs of program administration are shown. A few explanatory notes:

■ **Research** in Sea Grant supports over 500 projects per year across the full spectrum of the marine sciences—from aquaculture, biotechnology, coastal processes, and estuarine studies to fisheries, habitat restoration, ocean engineering, seafood technology, and water quality. Also included here are the regional and program development funds that seed research efforts, and support for graduate research assistants.

■ **Education** in Sea Grant includes efforts such as development of precollege curricula, training of K-12 teachers in the marine sciences, fellowship opportunities for policy study in Washington, D.C. and for work with industry, and support for graduate research assistants (except for those cases where such assistants are included in specific research project budgets, as above).

■ **Outreach** in Sea Grant includes both the extension service and the communications activities of the individual Sea Grant programs. These activities facilitate the rapid transfer of scientific information in forms that can be readily understood by coastal clients and other users.

■ **Program Administration** in Sea Grant relies on individual state Sea Grant directors and their staffs who shape and manage programs. Funds in this category also include program development grants.



## Funding Summary

### Funding Summary by Program State

Programs	FY 2000 Sea Grant \$	FY 2000 Passthru \$	FY 2000 Match \$
3897,787 Alaska	1,410,667	505,653	698,251
1 10,142,385 California	5,146,302	76,000	2,849,754
3,849,538 Connecticut	1,092,504	76,000	710,564
3,010,058 Delaware	1,306,758	0	1,440,675
8 5,290,500 Florida	2,284,672	365,944	1,591,580
2,628,550 Georgia	1,294,550	80,000	751,998
10 4,847,390 Hawaii	1,954,308	370,882	1,068,727
2,159,461 Illinois/Indiana	1,208,461	0	720,046
4,067,238 Louisiana	1,972,204	99,667	1,417,170
9 4,878,121 MIT	2,440,470	0	1,616,964
6 5,419,621 Maryland	1,778,071	915,529	1,374,511
2,338,167 Maine	659,202	442,000	596,223
14 4,261,289 Michigan	1,572,264	1,075,000	843,099
2,689,513 Minnesota	1,250,511	72,000	696,788
3,229,328 Mississippi/Alabama	1,214,256	300,177	831,929
13 4,299,941 North Carolina	1,841,413	189,000	894,374
4 6,745,899 New Hampshire	1,174,798	2,382,935	835,073
2,309,951 New Jersey	1,105,637	0	761,488
2 7,583,223 New York	2,707,498	227,730	1,470,184
2,328,067 Ohio	1,126,867	76,000	628,473
7 5,299,321 Oregon	2,451,786	64,166	1,485,778
Other*	858,179	657,962	519,991
Puerto Rico	894,000	380,000	605,944
11 5,009,058 Rhode Island - 400K = 4,609,058	2,557,534	0	1,200,854
12 4,421,355 South Carolina	1,839,831	76,000	944,369
3,969,772 Texas	1,843,250	187,522	1,009,477
University of Southern California	799,000	38,000	384,848
3 6,793,600 Virginia	2,433,251	234,463	1,275,305
5 5,765,746 Washington	2,834,956	68,000	1,511,363
Woods Hole	1,254,577	160,619	881,288
Wisconsin	1,932,987	38,000	1,500,814
Internal Funding Transfers and SBIR ***	795,200	555,800	0
<b>Total Sum of SG \$</b>	<b>55,035,964</b>	<b>9,715,049</b>	<b>33,117,902</b>

\*Funds awarded through universities and institutions not having Sea Grant program status.

\*\*\*Internal Funding Transfers represents funds transferred to other NOAA Line Offices or Federal Laboratories in order to carryout joint research and extension projects. It also includes the Small Business Innovation Research Program and other research contracts.



### Funding Summary by Program State

Programs	FY 2001 Sea Grant \$	FY 2001 Passthru \$	FY 2001 Match \$
Alaska	1,459,667	521,800	729,833
California	4,763,083	157,000	3,341,773
Connecticut	928,000	1,753,034	1,407,750
Delaware	1,290,000	413,300	1,775,935
Florida	2,515,884	124,000	1,291,033
Georgia	1,209,000	45,000	773,830
Hawaii	1,865,000	657,200	964,852
Illinois/Indiana	951,000	0	645,205
Louisiana	1,976,364	19,000	1,314,839
MIT	2,399,651	38,000	1,643,422
Maryland	2,180,296	545,725	1,175,617
Maine	1,208,965	28,000	780,219
Michigan	1,406,025	208,000	828,606
Minnesota	1,333,002	34,000	683,576
Mississippi/Alabama	1,627,020	87,875	1,249,450
North Carolina	2,138,028	131,500	1,076,295
New Hampshire	942,000	2,246,166	471,002
New Jersey	1,134,231	70,083	936,664
New York	3,219,995	1,428,000	2,116,419
Ohio	1,049,200	76,000	569,233
Oregon	2,574,392	208,977	1,514,894
Other*	772,173	2,525,052	813,299
Puerto Rico	890,908	270,003	1,227,333
Rhode Island	2,451,524	54,000	1,118,691
South Carolina	2,069,964	546,200	1,266,582
Texas	1,939,000	0	1,202,577
University of Southern California	826,000	38,000	556,787
Virginia	3,373,678	752,208	2,024,762
Washington	2,805,790	57,000	1,542,398
Woods Hole	1,155,167	68,713	668,181
Wisconsin	2,049,713	97,000	1,611,269
Internal Funding Transfers and SBIR **	1,000,300	1,429,200	0
<b>Total Sum of SG \$</b>	<b>57,505,020</b>	<b>14,630,036</b>	<b>37,322,326</b>

\*Funds awarded through universities and institutions not having Sea Grant program status.

\*\*Internal Funding Transfers represents funds transferred to other NOAA Line Offices or Federal Laboratories in order to carryout joint research and extension projects. It also includes the Small Business Innovation Research Program and other research contracts.



## Local Program Directors and Addresses

### ALASKA

Dr. Susan Sugai, Acting  
\*Alaska Sea Grant  
University of Alaska  
P.O. Box 755040  
Fairbanks, AK 99775-5040  
Tel: (907) 474-6840  
[www.uaf.edu/seagrant](http://www.uaf.edu/seagrant)

### CALIFORNIA

Dr. Russell A. Moll  
\*California Sea Grant College System  
University of California, San Diego  
9500 Gilman Drive  
La Jolla, CA 92093  
Tel: (858) 534-4440  
<http://www.csgc.ucsd.edu/>

Dr. Linda Duguay  
+University of Southern  
California Sea Grant  
3616 Trousdale Parkway - AHF 209F  
Los Angeles, CA 90089-0373  
Tel: (213) 821-1335  
<http://www.usc.edu/org/seagrant>

### CONNECTICUT

Dr. Edward C. Monahan  
\*Connecticut Sea Grant  
University of Connecticut  
1084 Shennecossett Road  
Groton, CT 06340  
Tel: (860) 405-9128  
<http://www.ucc.uconn.edu>

### DELAWARE

Dr. Carolyn Thoroughgood  
\*Delaware Sea Grant  
University of Delaware  
Graduate College of Marine Studies  
Robinson Hall, Room 111  
Newark, DE 19716  
Tel: (302) 831-2841  
<http://www.ocean.udel.edu>

### FLORIDA

Dr. James C. Cato  
\*Florida Sea Grant  
University of Florida  
P.O. Box 110400  
Gainesville, FL 32611-0400  
Tel: (352) 392-5870  
<http://www.FLSeaGrant.org>

### GEORGIA

Dr. Mac Rawson  
\*Georgia Sea Grant  
University of Georgia  
Marine Sciences Building, Room 220  
Athens, GA 30602-3636  
Tel: (706) 542-5954  
<http://www.marsci.uga.edu/gaseagrant.html>

### HAWAII

Dr. Gordon Grau  
\*Hawaii Sea Grant  
University of Hawaii  
2525 Correa Road, Room 238  
Honolulu, HI 96822  
Tel: (808) 956-7031  
<http://www.soest.hawaii.edu/SEAGRANT>

### ILLINOIS-INDIANA

Dr. Richard Warner  
\*Illinois-Indiana Sea Grant  
University of Illinois, Urbana-  
Champaign  
211 Mumford Hall  
1301 West Gregory Drive  
Urbana, IL 61801  
Tel: (217) 333-5199  
<http://www.iisgcp.org>

### LOUISIANA

Dr. Jack R. Van Lopik  
\*Louisiana Sea Grant  
Louisiana State University  
103 Sea Grant Building  
Baton Rouge, LA 70803-7507  
Tel: (225) 388-6710  
<http://www.laseagrant.org/>

### MAINE

Dr. Paul Anderson  
+Maine Sea Grant  
University of Maine  
5715 Coburn Hall  
Orono, ME 04469-5715  
Tel: (207) 581-1422  
<http://www.seagrant.umaine.edu>

### MARYLAND

Dr. Jonathan Kramer  
\*Maryland Sea Grant  
University System of Maryland  
4321 Hartwick Road, Suite 300  
College Park, MD 20740  
Tel: (301) 403-4220  
<http://www.mdsg.umd.edu>

### MASSACHUSETTS

Dr. Chrysostomos Chrysostomidis  
\*MIT Sea Grant  
Massachusetts Institute of Technology  
Building E38, Room 330  
77 Massachusetts Avenue  
Cambridge, MA 02139  
Tel: (617) 253-7131  
<http://web.mit.edu/seagrant/>

Dr. Judith McDowell  
+WHOI Sea Grant  
Woods Hole Oceanographic Institution  
193 Oyster Pond Road  
M.S. #2  
Woods Hole, MA 02543  
Tel: (508) 289-2557  
<http://www.whoi.edu/seagrant>

### MICHIGAN

Dr. George R. Carignan  
\*Michigan Sea Grant  
University of Michigan  
4107 I.S.T. Building  
2200 Bonisteel Boulevard  
Ann Arbor, MI 48109-2099  
Tel: (734) 615-4084  
<http://www.miseagrant.org>

### MINNESOTA

Dr. Carl Richards  
\*Minnesota Sea Grant  
University of Minnesota  
2305 East 5th Street  
Duluth, MN 55812  
Tel: (218) 726-8710  
<http://www.seagrant.umn.edu>

### MISSISSIPPI-ALABAMA

Dr. LaDon Swann  
\*Mississippi-Alabama Sea Grant  
Consortium  
703 Beach Drive  
P.O. Box 7000  
Ocean Springs, MS 39564-7000  
Tel: (228) 875-9368  
<http://www.masgc.org>

### NEW HAMPSHIRE

Dr. Ann Bucklin  
+New Hampshire Sea Grant  
University of New Hampshire  
Ocean Process Analysis Laboratory  
Durham, NH 03824  
Tel: (603) 862-0122  
<http://www.seagrant.unh.edu/index.html>

### NEW JERSEY

Dr. Michael Weinstein  
\*New Jersey Sea Grant  
New Jersey Marine Science Consortium  
Building No. 22  
Ft. Hancock, NJ 07732  
Tel: (732) 872-1300 Ext. 21  
<http://www.njmssc.org/index.html>

### NEW YORK

Dr. Jack Mattice  
\*New York Sea Grant  
State University of New York  
121 Discovery Hall  
Stony Brook, NY 11794-5001  
Tel: (631) 632-6905  
<http://www.seagrant.sunysb.edu/>

### NORTH CAROLINA

Dr. Ronald G. Hodson  
\*North Carolina Sea Grant  
North Carolina State University  
Box 8605  
Raleigh, NC 27695-8605  
Tel: (919) 515-2454  
<http://www.ncsu.edu/seagrant>



**OHIO**

Dr. Jeffrey M. Reutter  
\*Ohio Sea Grant  
Ohio State University  
1314 Kinnear Road, Rm. 1541  
Columbus, OH 43212  
Tel: (614) 292-8949  
<http://www.sg.ohio-state.edu/>

**OREGON**

Dr. Robert E. Malouf  
\*Oregon Sea Grant  
Oregon State University  
322 Kerr Administrative Bldg.  
Corvallis, OR 97331-2131  
Tel: (541) 737-2714  
<http://seagrant.orst.edu>

**PENNSYLVANIA**

Dr. Robert A. Light  
^Pennsylvania Sea Grant  
Extension Project  
Penn State Erie  
Glennhill Farmhouse  
Station Road  
Erie, PA 16563-0101  
Tel: (814) 898-6160  
<http://www.pserie.psu.edu/seagrant>

**PUERTO RICO**

Dr. Manuel Valdés-Pizzini  
\*Puerto Rico Sea Grant  
University of Puerto Rico  
Department of Marine Science  
P.O. Box 9011  
Mayaguez, PR 00681-9011  
Tel: (787) 832-3585  
<http://gnv.ifas.ufl.edu/~seaweb/homepage/upr.htm>

**RHODE ISLAND**

Dr. Barry A. Costa-Pierce  
\*Rhode Island Sea Grant  
University of Rhode Island  
Graduate School of Oceanography  
129 Coastal Institute Building  
Narragansett, RI 02882-1197  
Tel: (401) 874-6800  
<http://seagrant.gso.uri.edu>

**SOUTH CAROLINA**

Mr. M. Richard DeVoe  
\*South Carolina Sea Grant Consortium  
287 Meeting Street  
Charleston, SC 29401  
Tel: (843) 727-2078  
<http://www.scseagrant.org>

**TEXAS**

Dr. Robert Stickney  
\*Texas Sea Grant  
Texas A&M University  
2700 Earl Rudder Freeway South  
St. 1800  
College Station, TX 77845  
Tel: (979) 845-3854  
<http://texas-sea-grant.tamu.edu>

**VERMONT**

Dr. Jurij Homziak  
^Lake Champlain Sea Grant  
University of Vermont  
317 Aiken Center  
School of Natural Resources  
Burlington, VT 05405-0088  
Tel: (802) 656-0682  
<http://www.snr.uvm.edu/lcseagrant>

**VIRGINIA**

Dr. William L. Rickards  
\*Virginia Sea Grant  
Virginia Graduate Marine Science  
Consortium  
170 Rugby Road  
P.O. Box 400146  
Charlottesville, VA 22904-4146  
Tel: (804) 924-5965  
<http://www.virginia.edu/virginia-sea-grant>

**WASHINGTON**

Mr. Louie Echols  
\*Washington Sea Grant  
University of Washington, Box 355060  
3716 Brooklyn Avenue, N.E.  
Seattle, WA 98105-6716  
Tel: (206) 543-6600  
<http://www.wsg.washington.edu>

**WISCONSIN**

Dr. Anders W. Andren  
\*Wisconsin Sea Grant  
University of Wisconsin-Madison  
Goodnight Hall, 2<sup>nd</sup> Floor  
1975 Willow Drive  
Madison, WI 53706  
Tel: (608) 262-0905  
<http://www.seagrant.wisc.edu/>

**NATIONAL OFFICE**

Dr. Ronald C. Baird  
NOAA Sea Grant  
1315 East-West Highway  
Room 11716  
Silver Spring, MD 20910-3282  
Tel: (301) 713-2448  
<http://www.nsgo.seagrant.org>

\*Sea Grant Colleges (total 26)  
+Sea Grant Institutional Programs  
(total 4)  
^Sea Grant Projects (total 2)





## Regional Web Sites and Other Resources

### LOCATION MAP WITH REGIONAL AND LOCAL PROGRAM HOT LINKS

<http://www.nsgo.seagrant.org/NationalSeaGrant.html>

#### NATIONAL SEA GRANT DEPOSITORY

<http://nsgd.gso.uri.edu/>

#### NATIONAL SEA GRANT NEWS MEDIA CENTER

<http://www.seagrantnews.org>

#### NORTHEAST REGION

<http://web.mit.edu/seagrant/northeast/>

#### MID-ATLANTIC REGION

<http://www.mid-atlantic.seagrant.org>

#### SOUTHEAST ATLANTIC GULF (SEAGUL)

<http://seagul.tamu.edu>

#### GREAT LAKES REGION

<http://www.seagrant.wisc.edu/greatlakes/glnetwork/>

#### PACIFIC REGION

<http://www.wsg.washington.edu/regional/region.html>

#### PENNSYLVANIA SEA GRANT

<http://www.pserie.psu.edu/seagrant/seagindex.htm>

#### OTHER SEA GRANT RESOURCES

AquaNIC (Aquaculture Network Information Center)

<http://aquanic.org>

BRIDGE (Teacher Resource Center)

<http://www.marine-ed.org/>

HazNet (Coastal Hazards)

<http://www.haznet.org>

MarinaNet (A Network Marine Trades Project)

<http://seagrant.orst.edu/crt/>

Marine Science Careers

<http://www.marinecareers.net>

Mississippi-Alabama Sea Grant Legal Program

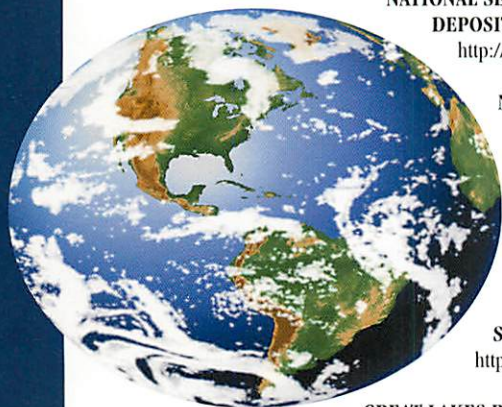
<http://www.olemiss.edu/pubs/waterlog/>

Sea Grant Nonindigenous Species Site (SGNIS)

<http://www.sgnis.org>

National Aquatic Nuisance Species Clearinghouse (NANSC)

<http://www.cce.cornell.edu/aquaticinvaders>



Received  
National Sea Grant Library

JUL 07 2008 From RISB  
CLEANOUT

9 Fish Rd, URI, GSO, 1 Pell  
Narragansett RI 02882 USA