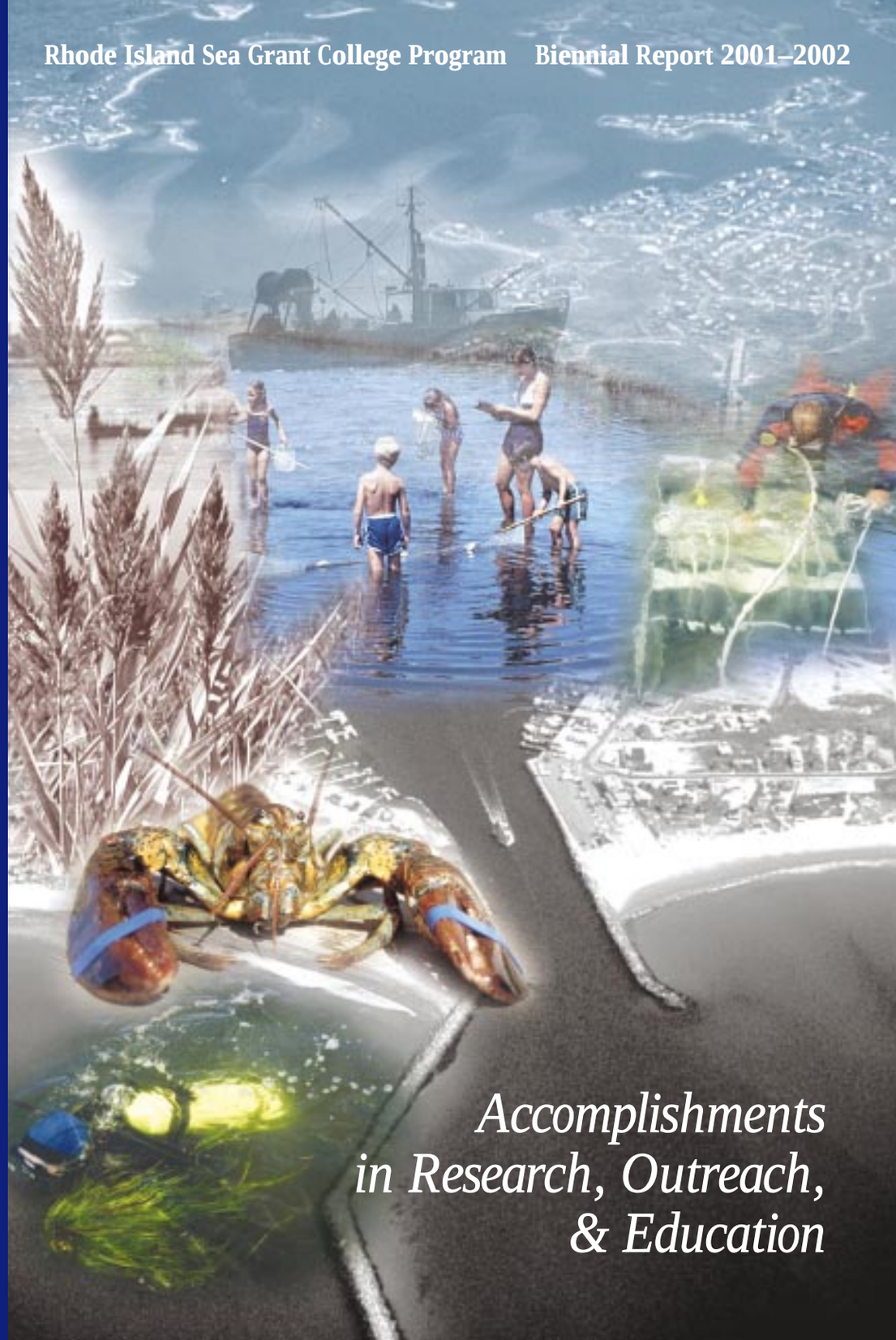
Sea Grant
Rhode Island



Accomplishments in Research, Outreach, & Education

The Rhode Island Sea Grant College Program is a federal-state partnership, based at the University of Rhode Island, that works to promote the wise use and conservation of marine resources for the public benefit through research, outreach, and education. Funding comes primarily from federal sources, with matching funds provided by states and private-sector groups. For more information about Rhode Island Sea Grant's research and outreach programs, publications, and news, please visit the Rhode Island Sea Grant Web site at: http://seagrant.gso.uri.edu.

Additional copies of this publication are available from the Rhode Island Sea Grant Communications Office, University of Rhode Island Bay Campus, Narragansett, RI 02882-1197. Order P1655.

Loan copies of this publication are available from the National Sea Grant Library, Pell Library Building, University of Rhode Island Bay Campus, Narragansett, RI 02882-1197. Order RIU-Q-02-001.

This publication is sponsored by Rhode Island Sea Grant, under NOAA Grant No. NA86RG0076. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

This document should be referenced as:
Rhode Island Sea Grant. 2003. *Rhode Island Sea Grant College Program Biennial Report 2001–2002: Accomplishments in Research, Outreach, and Education*. Rhode Island Sea Grant, Narragansett, R.I. 40pp.

Rhode Island Sea Grant College Program Biennial Report 2001–2002

Accomplishments in Research, Outreach, & Education

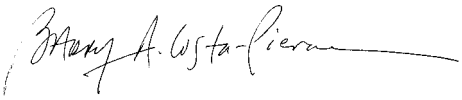
Table of Contents

Rhode Island Sea Grant is committed to the survival of our coasts and coastal heritage.

Letter From the Director

The decades-long migration of Americans to the shore has produced unprecedented alterations to the nation's coastal waters, shorelines, and watersheds. The intensive and continual development of our coastal environments has created a web of urgent social and environmental issues that affect all sectors of the economy and national life. Massive coastal population growth has fundamentally altered the coastal environmental management agenda. At the birth of the U.S. environmental movement in the early 1970s, the culprits were major industrial and municipal point discharges. America responded by investing billions of dollars in wastewater treatment technologies. Today, issues such as nonpoint source pollution, invasive species, freshwater allocation, and watershed management and conservation are the most prominent—issues never anticipated when the Clean Water Act passed in 1972, or when the National Sea Grant College Program was created by Congress in 1965. There is now increasing recognition that we are all responsible for this country's coastal environmental crisis, and that we are all responsible for solving it.

Rhode Island Sea Grant's 2001–2002 biennial report describes the program's successes in addressing the coastal environmental challenges of the 21st century. Our program's strengths lie in its connections to the local, regional, and national champions of our southern New England coast. Working with our strategic partners, Rhode Island Sea Grant is looking for visionary ways to tackle Rhode Island's complex coastal problems to benefit the state's economy, its extraordinary coastal environment, and the unique qualities of life it offers residents and visitors. Rhode Island Sea Grant is committed to the survival of our coasts and coastal heritage, and will continue to partner and leverage our assets and skills for the benefit of Rhode Island, the region, and beyond.



Barry A. Costa-Pierce

Director, Rhode Island Sea Grant College Program

The Rhode Island Sea Grant College Program is part of a national network of 31 Sea Grant College and institutional programs based at flagship universities throughout the United States. Rhode Island Sea Grant is housed at the University of Rhode Island (URI) Graduate School of Oceanography (GSO) on URI's Narragansett Bay Campus. GSO, according to a 2002 Science Watch *survey, ranks fifth among research institutions in the world in terms of the influence and quality of its geosciences research.*

As a Sea Grant College Program, Rhode Island Sea Grant fosters the wise use and conservation of coastal and marine resources through research, outreach, and education investments and programming. Over the past two years, Rhode Island Sea Grant has invested in two overarching thematic areas: maintaining the quality of the coastal environment and achieving sustainable seafood production.

Maintaining the Quality of the Coastal Environment

Sustainable Marine Ecosystems and Habitats

Over the past several decades, Rhode Island's modernized water pollution control facilities have substantially reduced major pollutants, such as heavy metals, and biological oxygen demand in Rhode Island's riverine and estuarine water bodies and watersheds. Nevertheless, much remains to be accomplished. Significant concerns remain regarding the state's ability to protect and maintain the health of Rhode Island's coastal waters. To address these challenges, Rhode Island Sea Grant continued to fund research in coastal habitats and ecosystems, focusing especially on the ecosystems of Narragansett Bay and Rhode Island south shore coastal lagoons, locally called salt ponds.

Narragansett Bay Ecosystem

Modeling Circulation and Transport in Narragansett Bay

The Narragansett Bay ecosystem is subjected to diverse natural and human-induced stressors. Wind, runoff, currents, and maritime activities generate physical and chemical impacts on the Bay that potentially lead to harmful algal blooms, pockets of low-oxygen water, fishery habitat-quality declines, and other forms of environmental degradation. To better understand the interactive characteristics of these stressors, Christopher Kincaid, URI oceanography associate professor, and his team developed a circulation and transport model for Narragansett Bay that will serve as a foundation for scientific studies and as a tool for assessing future Bay-specific development scenarios. This state-of-the-art, 3-D, real-time model for Narragansett Bay has a variety of management and scientific applications, such as projecting the impacts of oil spills under varying conditions. Model development will continue in order to augment oil spill response planning and management efforts underway by the U.S. Coast Guard, the state of Rhode Island, and other entities. In addition, other coastal research projects are already applying the current version of this model.

Interaction Between Narragansett Bay and Rhode Island Sound via Vertical Mixing and Horizontal Exchange

Narragansett Bay's diverse and intense uses as a recreational, shipping, and fisheries resource produce environmental stresses that strain the vitality of those uses, the Bay's ecological health and stability, and its natural resources. Continued advancements to our understanding of currents and water exchange processes within Narragansett Bay will improve our ability to predict the

…unless shoreline development is slowed and controlled, natural Rhode Island salt marshes will be entirely lost as they are taken over by dense, single-plant communities of cordgrass and Phragmites...

effects that different stressors have on this ecosystem and will provide fundamental information for devising better ways to protect and restore Narragansett Bay.

David Ullman and Mary-Lynn Dickson, GSO marine scientists, have generated comprehensive data on the flux of water, salt, chlorophyll, and dissolved organic and inorganic nutrients between Narragansett Bay and Rhode Island Sound. These data are essential for clarifying what is happening physically, biologically, and chemically within Narragansett Bay, at the Bay mouth, and in the East and West passages of the Bay during different seasons. Data were collected in late winter-early spring—a time usually characterized by peak plankton blooms in the Bay—and summer. Preliminary results show distinct differences between the East and West passages of Narragansett Bay in the distribution and concentrations of physical and biological parameters.

Influence of Seasonal Range Expansion of the Ctenophore, Mnemiopsis leidyi, *on Ichthyoplankton in Narragansett Bay*

There is growing concern that the warming of Narragansett Bay has contributed to an increased abundance of ctenophores, such as *Mnemiopsis leidyi*, during later spring and early summer, periods of the year critical to larval fish. Given the increasing prevalence of *M. leidyi*, a predator on fish eggs and larvae (ichthyoplankton), it has became important to quantify its predation rates to determine the level of *M. leidyi* population densities likely to have significant impacts on ichthyoplankton populations. Remarkably little information exists for estimating these impacts, especially for fish species prevalent in estuaries of the Northeast. Project investigators Barbara Sullivan and Grace Klein-MacPhee, GSO marine scientists, made field estimates of ingestion and filtration rates of *M. leidyi* preying on ichthyoplankton in Narragansett Bay and found that their rates were significantly different from rates reported in the only other similar study, which was conducted in Chesapeake Bay. The information from their study will be invaluable in predicting when ctenophores reach sufficient numbers to affect survival of ichthyplankton. As an outgrowth of this project, state marine fisheries managers have been trained to measure ctenophore abundance as part of their standard monitoring protocols.

Assessing the Status of Narragansett Bay Salt Marsh Plant Communities

Salt marshes serve as nursery grounds, natural pollutant filters, and shoreline stabilizers. In Rhode Island and elsewhere in the United States, salt marshes are disappearing from infilling, diking, and coastal development. Mark Bertness, Brown University ecology professor, has successfully linked shoreline development patterns with predictable changes in salt marsh plant communities. These findings have important implications for New England resource managers and conservation biologists. Bertness's results reveal that unless shoreline development is slowed and controlled, natural Rhode Island salt marshes will be entirely lost as they are taken over by dense, single-plant communities of cordgrass and *Phragmites*. One of the most important results of this work is the finding that very localized shoreline development around salt marshes can have dramatic consequences on salt marsh community structure. These results highlight the critical importance of local, site-specific means to conserve and manage remaining salt marshes in Rhode Island and along the East Coast.

Rhode Island Coastal Lagoon Ecosystems

Applying Indicators of Nutrient Impact in Coastal Lagoon Ecosystems

The ecological effects of nitrogen enrichment on Rhode Island's coastal lagoons, locally called salt ponds, remains uncertain. But identifying the indicators most valuable as early warning signs of nutrient impact could help coastal resource managers to maintain habitat values of coastal embayments. Scott Nixon, URI oceanography professor, and Betty Buckley and Stephen Granger, GSO researchers, studied eelgrass, *Zostera marina* L., and the major species of macroalgae in Quonochontaug, Ninigret, Green Hill, Potter, and Pt. Judith ponds and have developed a set of indicators of eelgrass health as it responds to nutrient loading and light and temperature stress—insights critical to maintaining and enhancing the habitat value of these coastal lagoons. The indicators included eelgrass shoot production, ratio of new shoot to new root and rhizome production, and leaf length. The results are being used by the R.I. Coastal Resources Management Council (CRMC) and the R.I. Department of Environmental Management (RIDEM) to implement the South Shore Special Area Management Plan and to manage and evaluate salt pond eelgrass restoration efforts.

Radium Isotopes as Tracers of Groundwater Inputs to Rhode Island's Salt Ponds

Groundwater discharge is an important, yet poorly understood, source of freshwater—and dissolved nutrients and contaminants—to coastal waters. In order to more accurately estimate groundwater inputs to Rhode Island's coastal lagoons, Bradley Moran, URI oceanography associate professor, is using naturally occurring radium istopes as groundwater tracers. An important question under investigation is the magnitude of seasonal variations in groundwater nutrient input to such coastal environments. Moran and his team have recently completed a seasonal study of groundwater flow in the Pettaquamscutt River estuary and have begun to extend this approach to Rhode Island's salt ponds. Results from this research provide new independent estimates of groundwater inputs to the coastal ponds of Rhode Island—information critical to constructing hydrological and nutrient budgets for these coastal waters.

Nitrate Removal From Groundwater at Rhode Island's Coastal Margins

Nitrate is the most common groundwater pollutant in the United States and a major cause of eutrophication in coastal marine waters. Denitrification, an anaerobic process whereby bacteria turn nitrate into gaseous nitrogen, is the most important means to remove nitrate from groundwater.

Barbara Nowicki, GSO marine scientist; Arthur Gold, URI natural resources science professor; and James McKenna, Williams College marine science assistant professor, have examined denitrification in the salt marshes and buffers surrounding Rhode Island's coastal waters and suggest that these areas are a huge sink for groundwater nitrate before it reaches coastal waters.

Of the three Rhode Island coastal ponds examined—Quonochontaug, Ninigret, and Green Hill—Green Hill Pond, with the greatest housing density and greatest percentage of shoreline alteration, had the highest ambient groundwater nitrate concentrations. The researchers found that groundwater nitrate concentration was highest where there was no woody or marsh buffer immediately adjoining the pond. The results also provide evidence of denitrification in the pond sediments at Green Hill Pond, and investigators are trying to determine what portion of the groundwater-derived nitrate reaching the pond can be removed during groundwater passage through the pond's sediments.

As housing density along Rhode Island's coastal ponds increases, there is a greater potential for nitrogen enrichment to occur. However, this research indicates that if the shoreline is unaltered and/or vegetated with native plants, nitrogen may be removed in significant quantities from groundwater before it enters the coastal ponds.

Trustom Pond

Sharing Results: The Sea Grant Annual Science Symposium

The Sea Grant Annual Science Symposium brings researchers, interested groups, and the public together to share information about coastal science of importance to Rhode Island and beyond. In 2002, the "Shallow Marine Ecosystems of Southern Rhode Island" were the focus of a two-part symposium that provided participants with a comprehensive overview on the status of research and monitoring efforts underway in Rhode Island's coastal lagoons, including watershed, living resources, and water quality management issues. Sea Grant enjoyed strong attendance and accurate press coverage of the symposium, and, on the basis of this symposium, the Salt Ponds Coalition, a nonprofit advocacy group for Rhode Island's salt ponds, is requesting new management policies and assistance from RIDEM and CRMC.

The seed sled is towed along on the sediment and pumps eelgrass seeds into the estuary bottom.

Marine Technologies to Improve Coastal Environments

Restoring Eelgrass With the Latest Technology

Efforts to restore valuable eelgrass beds by harvesting and transplanting shoots from donor beds have been expensive and have achieved limited success. With funding from the National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute for Coastal and Estuarine Environmental Technology, Rhode Island Sea Grant researchers Scott Nixon, URI oceanography professor, and Stephen Granger, Michael Traber, and Betty Buckley, GSO researchers, have pioneered methods to harvest, prepare, and store large quantities of viable eelgrass seeds. They are currently field-testing their new mechanized underwater seed planter sled, capable of efficiently planting large areas with eelgrass seed, which has been mixed into a gel matrix, to help prevent the seeds from being displaced after planting. The seed sled is towed along on the sediment and pumps eelgrass seeds into the estuary bottom. This seeding technique promises to enable restoration projects to achieve higher germination rates over larger bottom sites.

One additional outcome of this work was the publication of a how-to manual for this seed collection, processing, and storage technique. Produced by Sea Grant Communications, the manual is being used locally and as far away as the Netherlands, Spain, and Australia.

Building Profitable Partnerships: The National Sea Grant Industry Fellowship Program

The National Sea Grant Industry Fellowship, established in 1995, provides, in cooperation with specific companies, support for graduate students who are pursuing research and development projects of interest to a particular industry/company. In 2002, Rhode Island's first two Industry Fellows received their awards for projects aimed at reducing bacterial threats to human health. Kenneth La Valley, URI Ph.D. student in fisheries science and director of quality assurance at Spinney Creek Shellfish, Inc., in Maine, received a fellowship to work with Spinney Creek Shellfish to address a deadly bacterial contamination found in shellfish. Heather Saffert, URI Ph.D. student in marine biology, received a fellowship to work with SubChem Systems, Inc., of Jamestown, R.I., to help develop and test an automated device, BioAnalyzer, to detect fecal contamination in marine waters.

Sustainable Coastal Development

Burgeoning Rhode Island shoreline populations have intensified the demand for, and the socioeconomic value of, shoreline access, coastal and marine recreation, coastal waters of the highest quality, and pristine environmental aesthetics. At the same time, major urban centers in upper Narragansett Bay are struggling to retain core populations and rebuild their public infrastructures—factors critical to the state's economic future.

Building Sustainable Coastal Communities on Aquidneck Island and in Washington County

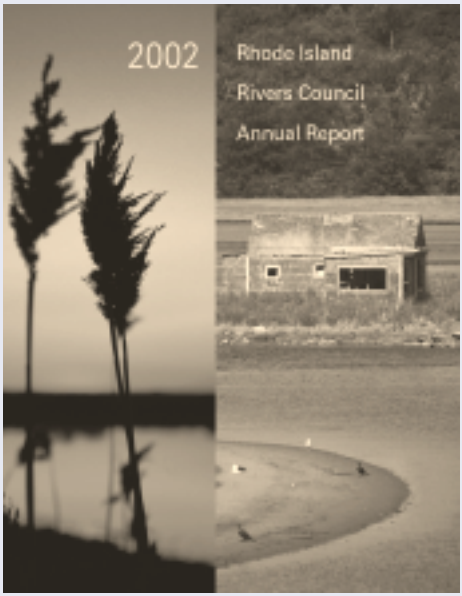
During the last two years, the Sea Grant Sustainable Coastal Communities and Environments (SCCE) Extension Program, under the leadership of Virginia Lee, continued to focus its efforts in two regions of Rhode Island—Aquidneck Island and Washington County (also known as South County) in an effort to bolster the effectiveness of the regional planning commissions. With Sea Grant assistance, the Aquidneck Island Planning Commission (AIPC) and the Washington County Regional Planning Council have, for the first time, enjoyed the services of professional staff,

student assistants, and enabling legislation. Regular meetings are now conducted with the appropriate Rhode Island legislators, and annual workplans are developed and circulated among town officials and the general public, with both councils now seeking full funding for staff resources from their member towns.

Recently, the AIPC partnered with local, state, and federal officials to engage the public in the creation of the Aquidneck Island West Side Master Plan—a sustainable development plan that will foster responsible, balanced land use on a large portion of the island's western coast. An important outcome of Sea Grant's work with the AIPC was the appropriation of $600,000 by Congress in 2003 to support master plan development.

For Washington County, James Opaluch, URI environmental and natural resource economics professor; Peter August, URI natural resources science professor; and Lee worked to develop an interactive computer simulation decision-support system to help users, such as coastal managers and land-use planners, better visualize and comprehend the complex environmental, economic, ecological, and fiscal impacts of local development policies and decisions. Their project combines computer simulation models with technology-based tools to create an interactive decision environment that allows consideration of alternative growth management policies. For example, a 3-D virtual tour of a potential development to replace an existing farm has been constructed. Applying land-use planning models through this particular scenario has allowed land-use planners and others to pre-test the feasibility of the development with impacts to groundwater quality and other parameters. At the same time, these tools allow the researchers to observe decisions made by program users to identify acceptable tradeoffs between environmental, social, and economic outcomes, thereby extending frontiers for integrating science and local decision making.

Burgeoning Rhode Island shoreline populations have intensified the demand for, and the socioeconomic value of, shoreline access, coastal and marine recreation, coastal waters of the highest quality, and pristine environmental aesthetics.

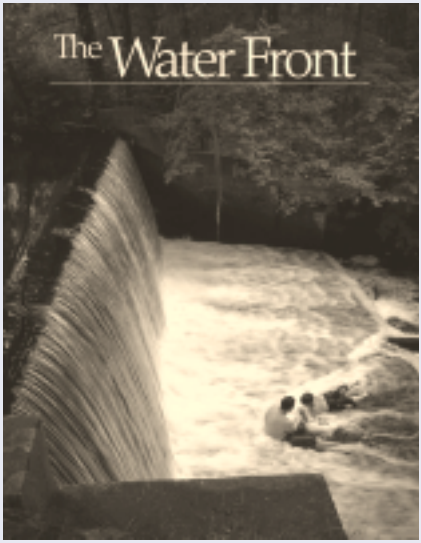


Taking a Holistic Approach to Rhode Island's Watersheds

Sea Grant serves on the state watershed coordinating council and staffs the Rhode Island Rivers Council, which is a part of the statewide planning program. The Rivers Council works to enhance and protect Rhode Island's rivers and to encourage their use. Thanks to Sea Grant efforts, the Rivers Council obtained a legislative grant for the first time in 2001 to support recognized watershed councils. In 2002, the watershed councils used the second $50,000 legislative grant to leverage over $400,000.

SCCE Extension organized and hosted a workshop in May 2002 titled "Do We Have Enough Water?" that brought municipal officials, watershed organizations, and state decision makers together to address the emerging issue of water quantity in Rhode Island. Participants received critical information and insights on the connections between fresh water and coastal quality and on water allocation issues in the face of increasing development. The workshop was videotaped and aired on Cox cable, Rhode Island's primary cable television service.

Sea Grant
Rhode Island



In early 2003, Sea Grant issued *The Water Front*, a special publication dedicated to public education on the issues surrounding growing freshwater scarcities and allocation policies. Starting with some of the information presented at the May 2002 workshop, Sea Grant staff designed and wrote the publication. Demand has been high for the publication, and a second issue is scheduled for release in late 2003.

Ensuring Access to the Rhode Island Coast

In 1993, Rhode Island Sea Grant published the first *Public Access to the Rhode Island Coast* guide. This popular guide catalogued selected sites that offered public access to the shore. A lot has changed in 10 years, and Sea Grant is in the process of updating the guide with funding from CRMC, which is responsible for "discovering," or verifying, and marking rights-of-way to the coast. The guide includes not only these officially designated rights-of-way, but also parks, public beaches, wildlife refuges, historical sites, boat ramps, and the like. When completed, the guide will include descriptions of sites from Westerly to Pawtucket along with maps to help readers discover some of the hidden and not-so-hidden treasures that dot Rhode Island's shoreline.

In 2002, at the request of the R.I. Attorney General, SCCE staff compiled 20 years' worth of tidal wetlands research as technical substance for the state's argument for the U.S. Supreme Court case of *Palazzolo vs. Rhode Island* regarding the filling of tidal wetlands. At the request of the Georgetown University Law Center and the Vermont Law Center, Sea Grant provided a quality and breadth of scientific research that was referenced in the national science amicus brief. The case has been remanded back to the Rhode Island Supreme Court and Rhode Island Sea Grant continues to respond to information requests by the attorney general's office.

Rhode Island Sea Grant's investment in fisheries and aquaculture has resulted in the development of better management practices and policies contributing to long-term sustainability of these important businesses.

Achieving Sustainable Seafood Production

Rhode Island's commercial and recreational marine fisheries continue to grapple with an evolving regulatory, management, and economic landscape. Major issues include seafood quality and safety, overfishing, federal requirements to reduce bycatch and marine mammal interactions, essential fish habitat, habitat alterations from fishing activities, tensions between recreational and commercial fisheries, codes of ethics, and the potential for sustainable fishery certifications for particular fisheries and fishing regions. Rhode Island Sea Grant's investment in fisheries and aquaculture has resulted in the development of better management practices and policies contributing to long-term sustainability of these important businesses.

Commercial and Recreational Fisheries Science

Fisheries Cooperative Research

The partnering of industry with academia and management for fisheries research is a vital part of the code of conduct for responsible fisheries. The Rhode Island Sea Grant Sustainable Fisheries Extension Program, under the leadership of Kathleen Castro, has undertaken several cooperative research projects in the last few years. In one prime example, the R.I. Commercial Fishermen's Association participated in several at-sea selectivity studies that address the effects of mesh size on the catch of yellowtail and summer flounders. Mesh size has increased by regulatory mandate so that small fish, mostly juveniles, can escape. But fishermen distrusted the numbers that were driving recommendations for a larger mesh. Before conceding to further restrictions on their fishing activity, they wanted to see data that reflected actual, rather than extrapolated, escape and retention rates. RIDEM tapped Rhode Island Sea Grant to conduct a study, which showed a significant difference between what regulators said fell out of the net and what actually did. The industry believes that these data will factor into impending regulations because they represent the most recent and best available science, the acid test for assessing management effectiveness.

Fishing Gear Research and Bycatch Characterization

Rhode Island Sea Grant continues to assist the fishing industry in researching fishing gear and reducing bycatch—the incidental taking of non-targeted or protected species—through developing and modifying gear designs, working on devices that allow undersized or non-targeted species to escape, and developing outreach and training programs to transfer Sea Grant findings to the fishing industry.

In addition to the Sea Grant cooperative research initiative highlighted previously, mapping fishing gear types in Northeast waters is another area of involvement. Mapping who is fishing and where could help fishery managers tailor regulations and simplify management. A project to map areas of North-

east coastal waters according to their use by different fisheries will delineate reference areas that are harvested primarily with fixed gear and those that are fished with mobile gear.

Starting with data obtained from commercial fishermen, the mapping project outlines the boundaries of fishing areas associated with certain gear types. These data will be incorporated into a Geographical Information System (GIS) database and analyzed with statistical and other information to create the map. From this map, managers can begin to assess the impact of different management practices, develop appropriate regimes for protecting essential fish habitat (EFH), identify optimal locations for temporary or permanent area closures, and minimize gear conflicts.

In an example of a recent outreach program, Sea Grant served as a facilitator among fishermen, management agencies, and policy-makers for the Atlantic Whale Fishing Gear Advisory Workshop, which engaged fishermen and fishing gear experts in discussing ways of modifying existing fishing gear to minimize or eliminate serious entanglement of endangered northern right whales. The participants concluded that universal gear modifications were not appropriate because of different fishing practices used in each state, and that more cooperative research was needed.

Fisheries Habitat and Stock Enhancement

Recently, federal and state funds have increased for fisheries research that addresses gaps in scientific knowledge about fisheries habitat. The results of a six-year study to examine the effects of habitat and stock enhancement for American lobster are now in. Led by Castro, this project investigated how placing an artificial reef of quarry rock on a featureless bottom habitat influenced the abundance and distribution of lobster. Castro found that habitat enhancement increased lobster abundance at this site through migration and new settlement, but stock enhancement—addition of post-larval lobsters to the site—did not increase abundance. An important outcome of this work was that the artificial reefs have now been duplicated by the U.S. Navy as part of their restoration efforts at McAlister Point, R.I., and are being examined for use in Mt. Hope Bay, New Bedford, Mass., and New York Harbor.

The Sustainable Fisheries Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Jeremy Collie, URI oceanography professor, is trying to determine the processes by which several fish species select their habitats. Using GIS data to map trawl survey catches, Collie developed a 3-D description of the distribution of Atlantic cod, winter flounder, and yellowtail flounder in the northwest Atlantic. His results showed differences in distribution patterns of the fish during the time period from 1978 to 2001. When complete, results of this project will enable state and federal fisheries managers to base definitions of EFH on habitat characteristics rather than historic geographic location of the stocks.

Fisheries Management and Policy

Adopting the Code of Responsible Fishing

In 1996, the United Nations Food and Agriculture Organization established guidelines for responsible fishing practices, called the Code of Responsible Fishing. Through the efforts of Rhode Island Sea Grant's Sustainable Fisheries Extension Program, Rhode Island was the first and only state in the Northeast to date to have all its fishing associations adopt this code of responsibility.

Restructuring the Commercial Fishing Licensing Process

From 2000 to 2002, the URI Coastal Institute facilitated a fisheries management and license reform process in conjunction with Sea Grant and RIDEM, under the leadership of a group of state executive and legislative leaders. This initiative examined options for commercial fishing license reform and assisted in meeting the legislative mandates designated in the Marine Fisheries Management Modernization Act of 2001. All of Rhode Island's major commercial fishing industry groups participated in the process, which led to a legislative briefing paper and further educational efforts, both developed with Sea Grant assistance. As a direct result of this effort, the Commercial Fisheries Licensing Bill was passed by the Rhode Island State Legislature in June 2002. Implementation of this legislation is under way with support from Sea Grant.

Transboundary Impacts of Fishing Activities Along the Northeast Continental Shelf

Because certain fish stocks are transboundary—meaning they are found simultaneously in waters of multiple jurisdictions—fishing in one country can have a significant effect on the availability and characteristics of the fishery in other countries. Jon Sutinen, URI environmental and natural resource economics professor, is analyzing prospective strategies for cooperative management between the United States and Canada for transboundary stocks and is assessing the biological and economic benefits of cooperative management. Renewed discussions between U.S. and Canadian scientists have culminated in the development of a sharing-allocation proposal for the transboundary resources of cod, haddock, and yellowtail flounder on Georges Bank. The proposal was recommended to administrators of the New England Fishery Management Council in January 2002.

Sutinen has developed a model of the transboundary fishery that can be used to estimate stock density at equilibrium and respective profits associated with differing migration rates. Establishing these relationships will help to determine the data required for more specific analysis.

Fisheries Management Training Program: Better Information for Better Management

Several new fisheries projects are under way as a result of the Rhode Island Sea Grant Sustainable Fisheries Program's success in the National Sea Grant Fisheries Extension Enhancement Initiative. Castro's fisheries educational workshops proposal was selected as one of only 11 funded nationally. The workshops provided a forum to stimulate dialogue among individuals and agencies with a stake in the fisheries and fishery management. The workshops supplemented a two-year-long process, described previously, to restructure the state's commercial licensing system. While that process produced draft legislation for licensing reform, it also identified issues requiring additional attention, such as bycatch as a factor in the harvest of species managed by quota, marine protected areas (MPAs) as a management tool, and property rights in fisheries management. These issues were explored at the educational workshops, which provided access to the most current scientific and technological information on these subjects and reviewed case studies from other areas. Informational materials for each session are available in print and on the Web and are being downloaded frequently.

Marine Aquaculture—An Emerging Industry for Rhode Island

Marine aquaculture is becoming a viable complement to capture fisheries as a source for valued seafood products. Beginning in the 1970s with pioneering investments to develop salmon culture techniques, Rhode Island Sea Grant spearheaded the development of techniques for culturing commercially valuable species in land-based and offshore environments.

Rhode Island Aquaculture Initiative

In the fall of 2001, largely through the efforts of Sen. Jack Reed, Congress appropriated $1.42 million to CRMC to expand and develop Rhode Island's aquaculture industry. CRMC, URI, Roger Williams University, and Rhode Island Sea Grant serve as the core partners in this initiative. Priority topics include improvements in ocean mapping for aquaculture; alternative species, such as marine and freshwater fish, seaweeds, and new shellfish species; novel approaches to shellfish aquaculture in predator protection and new equipment designs; innovative research on shellfish disease monitoring; evaluation of the economic impacts of aquaculture on Rhode Island's economy; and innovative marketing research and product differentiation.

Maximizing Survival of Summer Flounder: The Importance of Synchrony

Summer flounder is a good marine finfish species for aquaculture because it grows quickly and can be spawned in captivity year-round. Flounder have a tendency to cannibalize, however, and Jennifer Specker, URI oceanography professor, and David Bengtson, URI fisheries, animal and veterinary science professor, are working to reduce cannibalism and aggressive behavior that occurs between fish of dissimilar size by synchronizing growth through the manipulation of environmental and endocrine factors.

The team has successfully established a culturing protocol that is highly effective in synchronizing larval settling date, increasing rates of larval settling, and reducing variance in growth and development. The protocol is both inexpensive and easy to apply. It should be a useful first step toward improving survival and reducing the labor costs associated with size-grading of metamorphosing summer flounder.

Seafood Quality and Safety

Training and Education in Support of Controls for Scrombroid Poisoning

Scrombroid fish poisoning is associated with the consumption of a variety of important fish species sought by commercial and recreational fishermen; thus it presents human health as well as economic concerns. According to the Centers for Disease Control and the U.S. Food and Drug Administration, scrombroid fish poisoning is the first or second most common cause of illness from the human consumption of finfish. This project, a collaboration among several Sea Grant programs including Rhode Island Sea Grant, will launch an urgently needed educational program to provide training and guidance to charterboat operators on proven methods for significantly reducing the incidences of scrombroid fish poisoning.

Education & Communications

Sea Grant responds to the educational needs of those pursuing professional careers in marine science and policy as well as to the needs of general audiences seeking clarification, explanation, and simplification of scientific results. Through its education, extension, and communications capabilities, Sea Grant brings the latest scientific and technical advances from the academic sector to the public realm.

Educating the Next Generation

Sea Grant has continued to invest in tomorrow's scientists, engineers, and policy makers. Over the past two years, Rhode Island Sea Grant has supported 66 graduate students. In addition, the URI Undergraduate Research

Grant Program offers approximately $6,000 in funding for undergraduate research/creative projects each year. Rhode Island Sea Grant provides financial support each year in the amount of $1,000. This undergraduate grant initiative provides financial assistance to foster research activities by URI undergraduates.

Knauss Fellows

The National Sea Grant College Program's Dean John A. Knauss Marine Policy Fellowship matches highly talented graduate students with hosts in the legislative branch, executive branch, or appropriate associations/institutions in Washington, D.C., to work directly on ocean, coastal, and Great Lakes resources and the national policy decisions affecting those resources. Rhode Island Sea Grant has been proud to support 36 Knauss Fellows since the program was established in 1979. Recent Rhode Island Knauss Fellows are Cynthia Smith, working for Sen. Ron Wyden (D-Ore.) (2001), David Bizot, assigned to NOAA's National Marine Sanctuaries Program (2002), and Catalina Martinez, working in NOAA's Office of Ocean Exploration (2002).

Coastal Fellows

The URI Coastal Fellows Program provides URI undergraduate students with the opportunity to earn a modest stipend and academic credit while becoming involved in the exciting challenges of solving current coastal problems. Coastal Fellows work in research or outreach teams that involve some mix of faculty, research or outreach staff, community professionals, and graduate students. Rhode Island Sea Grant collaborates with the URI Coastal Fellows Program, providing financial support and research opportunities on Sea Grant–sponsored projects. During 2001–2002, Rhode Island Sea Grant sponsored 14 Coastal Fellows.

K–12 and Public Marine Education Programs

The National Ocean Sciences Bowl (NOSB), conducted by the Consortium for Oceanographic Research and Evaluation (CORE), is a core educational program of NOAA. GSO, as a member institution of CORE, hosts the annual Rhode Island-Connecticut Regional Competition where 16 high school teams compete each year. Rhode Island Sea Grant supports this initiative with $5,000 annually to support five scholarships.

Rhode Island Sea Grant also provides financial support to produce the GSO Office of Marine Programs' *Narragansett Bay Classroom* course catalogue that offers a variety of marine and environmental short courses, lectures, tours, field trips, interpretative programs, camps, and training opportunities for people of all ages. Produced twice each year, the catalog is distributed to approximately 4,000 individuals.

Rhode Island Sea Grant also collaborates with the GSO Office of Marine Programs, the R.I. Office of Higher Education, the R.I. Department of Educa-

tion, and the JASON Foundation for Education to provide financial support to bring Rhode Island students to GSO to participate in the JASON Project. Each year, the JASON project offers a week-long comprehensive, multimedia approach to the study of selected ocean and coastal environmental issues designed to engage young people in the practice and joy of science, technology, math, geography, and associated environmental disciplines.

Communicating Cutting-Edge Science

The Rhode Island Sea Grant Communications Program, led by Malia Schwartz-Cromarty, continues to put the results of Sea Grant–sponsored research and outreach activities into the hands of various audiences through its publications, Web sites, videos, and other quality products.

On average, Rhode Island Sea Grant produces 13 new publications/products per year on coastal management, marine research, and fisheries topics. These communications products are made available to the public, as well as to more specialized audiences—all of whom are able to use the information gained to make policy decisions, environmental decisions, to learn something new in school, or to enrich their lives. Sales in 2002 were over $17,500—a $5,000 increase over the previous year. Communications responded to requests for 131,270 Sea Grant products in the past four years, and distributed hundreds more documents free at meetings, lectures, and other events throughout the state where staff also set up the Sea Grant display and interacted with the public.

Sea Grant on the Web

In 2001, Rhode Island Sea Grant improved its Web site's design to make information more easily available by topic and added features to help guide visitors who are "lost." Staff have also continued to post new information in the form of new fact sheets and publications, and have added new sites and sub-pages. The site serves two types of audiences: people who don't necessarily know about Sea Grant but are interested in topics such as the marine food web, sharks, or coastal tourism, and people who know the program and are seeking technical information, such as the Fisheries Educational Workshop Project pages and pdf versions of publications. The Sea Grant Web site received nearly 14,000 user visits per month in 2002, compared with 11,400 per month in 2000, and Web visitors—local, national, and international—request publications and information, letting the program know it reaches a truly interested audience.

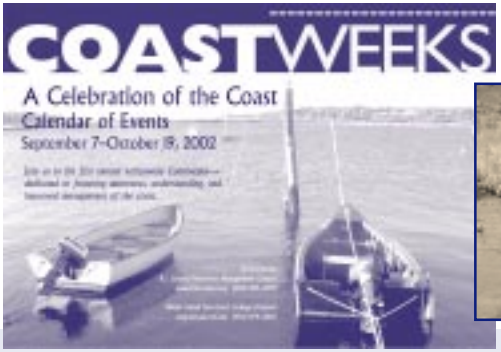
The Sea Grant Web site received nearly 14,000 user visits per month in 2002, compared with 11,400 per month in 2000, and Web visitors—local, national, and international—request publications and information, letting the program know it reaches a truly interested audience.

Forging Partnerships

In response to tightening budgets and the increasing awareness that Sea Grant shares audiences with other organizations and agencies in Rhode Island and beyond, the Communications Program has increased the number and scope of its partnership efforts. Recognizing that the research and outreach on marine resources issues that Sea Grant addresses have increasingly focused on land-based links, such as the effects of development in the coastal zone, Sea Grant sought a partnership with the URI Land Grant Program to create a magazine that examines issues from a land- and sea-based perspective. *41°N*, named for the latitude line running through the state, is the fruit of that partnership. In only two years, it has received recognition from Sen. Lincoln Chafee, and has prompted discussion at the state level of funding for Sea Grant and Land Grant programs at URI. As a further result of this partnership, Land Grant recognized the expertise of the Sea Grant Communications program and initiated a further partnership to create a series of Source Water Assessment Program briefing papers, designed to educate residents about drinking water quality and concerns, edited and produced through Sea Grant Communications.

Communications continues to work with CRMC to produce the annual Coastweeks calendar of events, and to sponsor Coastweeks events. CRMC has also partnered with Sea Grant Communications to update and produce a second edition of the *Public Access to the Rhode Island Coast* guide. This popular guide was much in demand in its first edition, and sales of the second edition are expected to be brisk.

Communications has also provided its publications expertise to the state's aquaculture industry. With funding from the Ocean State Aquaculture Association, the program produced a full-color brochure promoting Rhode Island's cultured shellfish products. The brochure is being distributed to quality restaurants in major cities to encourage their selection of Ocean State cultured shellfish.



Sea Grant in the News

In the newspapers and periodicals Commincations tracks over 120 Sea Grant-related items appeared in 2001 and over 70 in 2002. Many of those stories appeared in the *Providence Journal*, the only statewide newspaper in Rhode Island, with a readership of 477,000, and an on-line readership of 1 million users per month. These clippings are bound together in a "Sea Grant Clippings Book" to demonstrate the impacts of the program.

Sea Grant director pens book advocating 'blue revolution' in aquaculture industry

The aquaculture industry in the United States and around the world will never grow to its full potential unless it radically reforms its practices and produces positive impacts on the environment and society. That's the premise of a landmark new book called Ecological Aquaculture by Barry Costa-Pierce, director of the Rhode Island Sea Grant Program and URI professor of fisheries and aquaculture.

The book details specific new technologies that must be implemented, practices that must be reformed, and policies that must be enacted for the industry to resurrect its reputation and gain the support of its many detractors.

"Environmental groups have done a service to society and the global aquaculture industry by pointing out the ecological and social impacts caused by aquaculture," said Costa-Pierce. "Those concerns are appropriate. Aquaculture does have an impact on the environment, just as agriculture does."

Those impacts include habitat degradation, nutrient discharges from feed and wastes, introduction of diseases and parasites, and the genetic dilution of native wild species from breeding with escapees from aquaculture facilities. In addition, a variety of social inequity issues arise from aquaculture in its present form.

Costa-Pierce defines ecological aquaculture as "an alternative model of aquaculture research and development that brings the technical aspects of ecological principles and ecosystems thinking to aquaculture... [It] internalizes all of nature's and society's costs as part of an entire regional development activity."

"To make this happen," he said, "we need to get beyond the constant user conflicts between marine fisheries, aquaculturists, coastal zone management, and coastal communities."

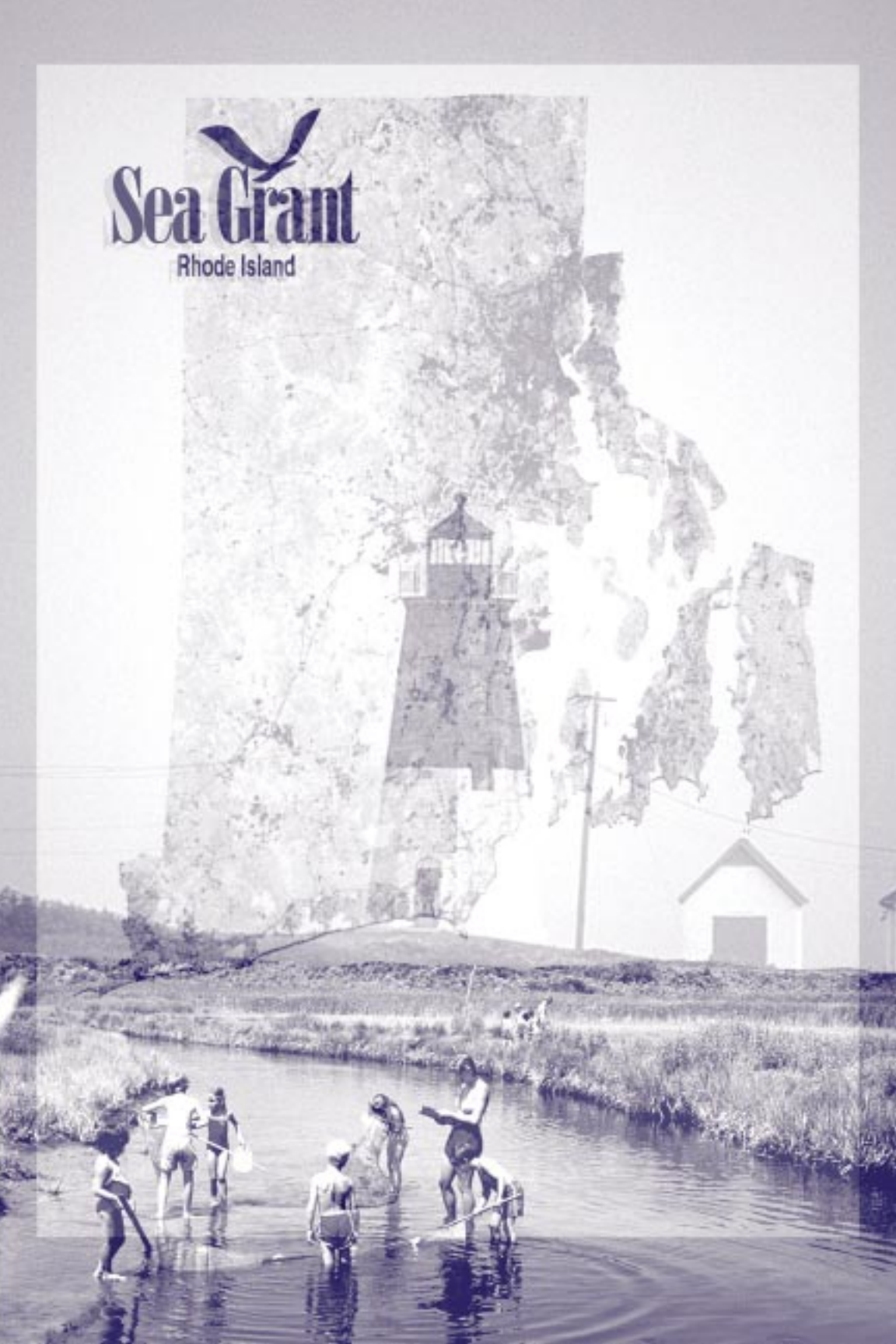
Some aquaculture facilities are already operating as the URI scientist recommends. "There are several facilities that are models of ecological aquaculture," Costa-Pierce said. "They're making good money and producing healthy products for consumers using ecologically sensitive practices."

For example, one finfish facility uses its wastes to grow hydroponic vegetables and animal forages, and both fish and vegetables are certified. Another

■ *Janet Freedman, Rhode Island Coastal Resources Management Council, and Virginia Lee, assistant director of the Rhode Island Sea Grant College Program, point out coastal features during a tour of Misquamicut State Beach in Westerly Friday as part of Connecticut College's Unified Learning Center weekend conference on coastal development issues. Lee is on the left. Below, with Freedman.*

WILL WE BE IN OVER OUR HEADS?

Rising seas, development put pressure on our ever-shrinking shoreline


Sea Grant
Rhode Island

Managing for Success

Keith Stokes, Tom Schumpert, and Barry Costa-Pierce attend the opening of the new American Mussel Harvesters, Inc. facility at Quonset Point.

Program Planning and Management

In September 2001, Barry Costa-Pierce became director of Rhode Island Sea Grant. In the fall of 2001, Costa-Pierce appointed former Interim Director Ames Colt as associate director and outreach program leaders Kathleen Castro, Virginia Lee, and Malia Schwartz-Cromarty as assistant directors.

During this time period, Rhode Island Sea Grant met with its advisory committees to seek information to support strategic programming and to address the needs of its constituents. Costa-Pierce convened an expanded Senior Advisory Council (SAC) in March and October 2002. (SAC current membership listed on page 37.) The SAC provides programmatic advice to Rhode Island Sea Grant and supports the development of management policies and strategic planning documents. Recently, SAC members participated in the Topical Advisory Team on Education convened in November 2002 and helped the management team to establish priorities for the 2004–2006 research competition.

In the summer of 2002, Beverly O'Keefe assumed her current position of program coordinator in the program management office. Her primary duties include fiscal and administrative management. In addition, O'Keefe serves as Rhode Island Sea Grant's education coordinator.

Finally, Rhode Island Sea Grant program management participated in a number of national research and outreach activities. Costa-Pierce cochairs the National Sea Grant Coastal Ecosystems and Habitats Theme Team, which works to position Sea Grant to partner and seek opportunities to build on its expertise in that area. In the fall of 2001, Colt wrote a report to National Sea Grant Director Ron Baird on possible ways to coordinate Sea Grant's Coastal Community Development Program activities and spoke about this and related issues at the Sea Grant Extension Assembly meeting in March 2002. Colt also made a plenary session presentation at the Coastal Society's 2002 biannual conference in Galveston, Texas, on "Coastal Management in a Security Setting" and worked on a national committee convened by the Sea Grant Extension Assembly to articulate opportunities for growth in Sea Grant outreach.

Program Evaluation: Emerging Models

After reviewing a variety of approaches to program self-evaluation, Rhode Island Sea Grant began to apply an "outcome mapping" model to its projects. The model, originally developed by Canada's International Development Research Center, is a methodology for identifying and evaluating behavior changes in key partners that represent fulfillment of the vision and mission of program

initiatives. In May 2002, Rhode Island Sea Grant hosted a workshop during the Northeast Sea Grant regional meeting to introduce this approach to other Sea Grant programs.

Program Development Initiatives

Rhode Island Sea Grant continually seeks new opportunities to support its multi-faceted mission. Opportunities include supporting new projects by promising young researchers, or funding special projects that do not fit into its ongoing research, outreach, and educational programs. Recent initiatives have included pilot research programs, support for a number of graduate and undergraduate students working on projects of particular value to Rhode Island Sea Grant, and travel support for faculty, researchers, students, and others for attending conferences and workshops. The Rhode Island Sea Grant Visual Arts Contest is another such initiative. This competition, run by URI's fine arts department, awards $500 to one or two artists annually whose works explore marine or aquatic themes.

Project Directory

Core Research Projects

Narragansett Bay Collaborative Projects

R/ES-011 *Modeling of Circulation and Biochemical Transport Within Narragansett Bay*
Christopher Kincaid, URI GSO. $172,349

R/ES-012 *Interaction Between Narragansett Bay and Rhode Island Sound via Vertical Mixing and Horizontal Exchange*
David Ullman and Mary-Lynn Dickson, URI GSO. $193,458

R/EE-011 *Assessing the Status of Narragansett Bay Salt Marsh Plant Communities*
Mark Bertness, Brown University. $213,926

Coastal Lagoons Collaborative Projects

R/CL-011 *Testing and Applying Indicators of Nutrient Impact in Very Shallow Lagoon Ecosystems*
Scott Nixon, Stephen Granger, and Betty Buckley, URI GSO. $264,623

R/CL-012 *Application of ^{223}Ra, ^{224}Ra, ^{226}Ra, and ^{228}Ra to Groundwater Input and Coastal Mixing Dynamics in Southern Rhode Island*
S. Bradley Moran, URI GSO. $158,541

R/CL-013 *Nitrate Removal From Groundwater at Rhode Island's Coastal Margins: Consequences of Coastal Enrichment*
Barbara Nowicki, URI GSO; Art Gold, URI CELS; and James McKenna, Williams College. $274,447

Individual Projects

R/ES-013 *Influence of Seasonal Range Expansion of the Ctenophore,* Mnemiopsis leidyi, *and Low Oxygen on Ichthyoplankton in Narragansett Bay*
Barbara Sullivan and Grace Klein-MacPhee, URI GSO. $114,616

R/SS-011 *A Prototype Decision Support System for Coastal Development in Washington County, Rhode Island*
James Opaluch and Peter August, URI CELS. $179,193

R/SS-012 *Transboundary Impacts of Fishing Activities Along the Northeast Continental Shelf*
Jon Sutinen, URI CELS. $121,457

R/F-011 *A Quantitative Analysis of Essential Fish Habitat: Can We Predict Habitat Use by Fish?*
Jeremy Collie, URI GSO. $116,877

R/A-011 *Maximizing Survival of Summer Flounder: The Importance of Synchrony*
Jennifer Specker, URI GSO, and David Bengtson, URI CELS. $259,476

Rhode Island Aquaculture Initiative

A/F-012 *Collaborative Activities for the Development of Sustainable Aquaculture in New England*
Barry Costa-Pierce, Rhode Island Sea Grant. $35,000

A/I-021 *Rhode Island Aquaculture Initiative—Communications*
Malia Schwartz-Cromarty, Rhode Island Sea Grant. $25,000

A/F-021 *Rhode Island Aquaculture Initiative—URI Cooperative Extension*
David Bengtson, URI CELS. $58,300

R/A-021 *Enhancing the Rhode Island Aquaculture-Fisheries Web Page and Map Server*
Peter August, URI CELS. $149,983

R/A-022 *Competitive Research Support Funds for Aquaculture Research*
Barry Costa-Pierce, Rhode Island Sea Grant. $97,928

National Strategic Investment Projects

National Fisheries Habitat Program

R/F-001 *Fisheries Habitats on Georges Bank: Effects of Disturbance.* $45,464

R/SP-001 *Fish Habitat: Economic Consequences of Protecting/Conserving Fish.* $108,217

Program Development Grants

Research Mini-Grants

M/PD-008 Bengtson, D., *Flounder Synchrony Research*. $2,000

M/PD-009 Lee, C., *Microinjector Prototype Phase II*. $4,000

M/PD-010 Schwartz, M., *Sea Turtle Plasma Laboratory Analysis*. $400

M/PD-011 Specker, J. and J. Rines, *Summer Flounder Research*. $2,032

M/PD-012 Trocki, C., *Coastal Bird Survey Fieldwork.* $1,000

M/PD-013 Wessels, C., *Seafood Eco-Label Awareness Survey*. $3,500

Education and Community Outreach

M/PD-0001 Newport Exploration Center (2001). $4,300

M/PD-0002 Visual Arts Contest (2001). $3,000

M/PD-0003 Northeast Regional Web Site Maintenance. $1,162

M/PD-0004 Bay Day-Endeavor Open House. $500

M/PD-0005 *Maritimes* Catalog. $300

M/PD-0006 Narragansett Bay Classroom Course Catalog (2001). $5,400

M/PD-007 National Ocean Science Bowl. $5,000

URI Coastal Fellows Program (2001). $13,350

Publications

Addy, K., A.J. Gold, B.L. Nowicki, J.H. McKenna, M.H. Stolt. 2001. Groundwater denitrification dynamics in a coastal riparian zone. New England Soil Science Society of America Meeting, June 2001, West Greenwich, R.I.

Bertness, M.D., P. Ewanchuk, and B.R. Silliman. 2002. Anthropogenic modification of New England salt marsh landscapes. *Proceedings of the National Academy of Science* **9(3)**:1395–1398.

Bertness, M.D. and P. Ewanchuk. 2002. Latitudinal and climate-driven variation in the strength and nature of biological interactions. *Oecologia* (In press).

Castro, K., J.S. Cobb, R.A. Wahle, and J. Catena. 2001. Habitat addition and stock enhancement for American lobsters, *Homarus americanus*. *Marine and Freshwater Research* **52(8):**1253–1261.

Castro, K. Articles from *The Fishermens' Call*: Sea Grant (July 2001); Results from the Rock Garden (August-September 2001); Shell Disease (October 2001); The Changing Faces of Extension (November-December 2001).

Castro, K. 2001. The Sea Grant concept: Linking research, education and outreach—Is it for you? *World Fishing*.

Crimmins, D. 2001. Egg eating comb jellies besiege Bay. *The Fisherman's Call* October 2001.

Donnelly, J. and M.D. Bertness. 2001. Rapid shoreward encroachment of salt marsh vegetation in response to sea level rise. *Proceedings of the National Academy of Science* **98**:14218–14223.

Emery, N.C., P.J. Ewanchuk, and M.D. Bertness. 2001. Competition and salt-marsh plant zonation: Stress tolerators may be dominant competitors. *Ecology* **82(9)**:2471–2485.

Gavlik, S., M. Albino, and J.L. Specker. 2002. Metamorphosis in summer flounder: Manipulation of thyroid status to synchronize settling behavior, growth, and development. *Aquaculture* **203:**359–373.

Gómez-Chiarri, M. and P. Muñoz. 2002. Differential gene expression in Eastern oysters, *Crassostrea virginica,* experimentally infected with *Perkinsus marinus. Proceedings of the International Conference on Shellfish Restoration.* Charleston, S.C.

Kelly, R.P. 2001. Radium isotopes as tracers of seasonally variable groundwater input and mixing in the Pettaquamscutt River estuary. M.S. Thesis, Graduate School of Oceanography, University of Rhode Island, Narragansett, R.I. 86pp.

Kelly, R.P. and S.B. Moran. 2002. Radium isotopes as tracers of seasonal changes in groundwater flux in a temperate estuary and implications for coastal nutrient budgets. *Limnology and Oceanography* (In press).

McKenna, J.H., B. Nowicki, A.J. Gold, K. Addy, E. Requintina, and J. Davis. 2001. Understanding groundwater nitrogen and carbon dynamics along estuarine margins: Insights and challenges. *EOS Suppl.* **82(2)**:S152.

Minchinton, T.E. and M.D. Bertness. 2002. Nutrient enrichment, vegetation buffers, and the invasion of coastal marshes by the common reed *Phragmites australis*. *Ecological Applications* (In press).

Muñoz, P. and M. Gómez-Chiarri. 2002. Protease activity in the Eastern oyster, *Crassostrea virginica,* after experimental infection with the protozoan parasite *Perkinsus marinus*. *J. Shellfish Res.* **21(1)**:376.

Muñoz, P. and M. Gómez-Chiarri. 2001. Study of the immune response of the Eastern oyster, *Crassostrea virginica,* to the parasite *Perkinsus marinus. Proceedings of the European Association of Fish Pathologists*, Dublin, Ireland.

National Research Council. 2002. *Effects of Trawling and Dredging on Seafloor Habitat.* National Academy Press, Washington, D.C. 126pp.

Nixon, S.W., B. Buckley, S. Granger, and J. Bintz. 2001. Responses of very shallow marine ecosystems to nutrient enrichment. *Human and Ecological Risk Assessment* **7(5)**:1457–1481.

Opaluch, J., V. Lee, R. Thompson, and R. Johnston. 2001. A decision support system to help manage growth in coastal communities. *Maritimes* **45**:7–9.

Sullivan, B.K. 2001. Evidence for seasonal range expansion by the ctenophore, *Mnemiopsis leidyi,* in northern coastal waters of the United States. Newsletter of the Rhode Island Natural History Survey **8**:2–4.

Sullivan, B. and C. Kincaid. 2001. Modeling circulation and transport in Narragansett Bay. *EOS Suppl.* **82(2)**:S216.

Schwartz, M.L. 2001. Anoxia tolerance and recovery in freshwater and marine turtles. Ph.D. Dissertation, University of Rhode Island, Kingston, R.I. 200pp.

Technical Reports

Kerr, M., V. Lee, and S. Kennedy (Eds.). 2001. *Aquidneck Island Today: Summary Data on Existing Conditions*, Rhode Island Sea Grant, Narragansett, R.I. 154pp.

Rhode Island Sea Grant. 2001. *Rhode Island Sea Grant College Program: Celebrating 30 Years in the Ocean State & 2001–2003 Program Guide.* Rhode Island Sea Grant, Narragansett, R.I. 40pp.

McCann, J., S. Kennedy, and E. Mathews. 2002. *Shaping A Future: Aquidneck Island Achievements 1997–2001*. Rhode Island Sea Grant, Narragansett, R.I. 24pp.

Rhode Island Rivers Council. 2001. *Rhode Island Rivers Council Annual Report.* The Rhode Island Rivers Council, Department of Administration, Providence, R.I.

Newsletters

41°N: A Publication of the Rhode Island Sea Grant and Land Grant Programs at the University of Rhode Island. 2001, **1(2)**; 2002, **1(3).**

Our Shared Future. Washington County Regional Planning Council. August 2001, May 2001.

Brochures

Promoting Sustainable Coastal Communities in Washington County. 2001.

Aquidneck Island Partnership: One Shared Future for One Island Community. 2001.

Working in Partnership with Communities to Protect and Manage Coastal Environments. 2001.

Miscellaneous

Coastweeks Calendar of Events. 2001, 2002.

Rhode Island's Coastal Wildlife Video Program. 2001.

Rhode Island Sea Grant Notecards. 2001.

Program Advisors

Rhode Island Sea Grant Senior Advisory Council
Chair
Paul Scholz
Branch Chief, Coastal Management Services, NOAA Coastal Services Center

Robert Billington
Executive Director, Blackstone Valley Tourism Council

John Boreman
Acting Science and Research Director, National Marine Fisheries Service
Northeast Fisheries Science Center

Darrell Brown
Chief, Environmental Protection Agency Coastal Management Branch

Michael Connor
Executive Director, San Francisco Estuary Institute

Benjamin Cuker
Professor, Hampton University

Linda Deegan
Senior Scientist, Ecosystems Center, Marine Biological Laboratory

John Dunningan
National Marine Fisheries Service, Office of Sustainable Fisheries

Carlos Fetterolf, Jr.
Member, National Sea Grant Review Panel

Peyton Fleming
Communications Director, Environmental Protection Agency, Region 1

James Frye
Executive Director, Marina Operators Association of America

Grover Fugate
Executive Director, R.I. Coastal Resources Management Council

Jack Greer
Assistant Director for Communications and Public Affairs, Maryland Sea Grant

Christine Gault
Reserve Manager, Waquoit Bay National Estuarine Research Reserve

Jan Reitsma
Reserve Manager, R.I. Department of Environmental Management

Lee Schisler
Executive Director, Audubon Society of Rhode Island

Keith Stokes
Executive Director, Newport County Chamber of Commerce
Member, Board of Directors, R.I. Economic Development Corporation

Curt Spalding
Executive Director, Save The Bay

Ex-officio Member
James Murray
National Sea Grant Office Program Officer

University Advisory Committee
Chair
Deborah Grossman-Garber
Director, Undergraduate and Internship Programs
College of the Environment and Life Sciences

Peter August
Director, Coastal Institute

Richard Burroughs
Professor, Department of Marine Affairs

Arthur Gold
Professor, Department of Natural Resources Science

John Merrill
Professor, Graduate School of Oceanography

Stephen B. Olsen
Director, Coastal Resources Center

Richard C. Rhodes, III
Vice Provost for Academic Affairs

Mark Wimbush
Associate Dean, Graduate School of Oceanography

Sea Grant Staff

Program Management

Barry A. Costa-Pierce, Director
Tel.: (401) 874-6802
bcp@gso.uri.edu

Ames B. Colt, Associate Director
Tel.: (401) 874-6805
acolt@gso.uri.edu

Beverly O'Keefe, Program Coordinator and Fiscal Officer
Tel.: (401) 874-6813
beverly@.uri.edu

Dolores Smith, Administrative Assistant
Tel.: (401) 874-6800
dsmith@gso.uri.edu

Alan Desbonnet, Marine Research Associate
Tel.: (401) 874-9343
aquaculture@gso.uri.edu

Communications

Malia Schwartz, Assistant Director and Director of Communications
Tel.: (401) 874-6936
malias@gso.uri.edu

Tony Corey, Communicator
Tel.: (401) 874-6844
tonyc@gso.uri.edu

Monica Allard Cox, Communicator and Webmaster
Tel.: (401) 874-6937
allard@gso.uri.edu

Jean Gallo, Publications Manager
Tel.: (401) 874-6842
jgallo@gso.uri.edu

Sustainable Coastal Communities and Environments Extension Program

Virginia Lee, Assistant Director and Extension Coleader
Tel: (401) 874-6490
vlee@gso.uri.edu

Jennifer McCann, Coastal Management Extension Specialist
Tel: (401) 874-6127
mccann@gso.uri.edu

Meg Kerr, Coastal Management Extension Specialist
Tel.: (401) 874-6522
mkerr@gso.uri.edu

Sue Kennedy, Coastal Management Extension Specialist
Tel.: (401) 874-6107
skennedy@gso.uri.edu

Patty Harrington, Fiscal Assistant
Tel.: (401) 874-6113
pharring@gso.uri.edu

Michelle Moulton, Administrative Assistant
Tel.: (401) 874-6626
moulton@gso.uri.edu

Sustainable Fisheries Extension Program

Kathy Castro, Assistant Director and Extension Coleader
Tel: (401) 874-5063
kcastro@uri.edu

Dave Beutel, Fisheries Extension Specialist
Tel: (401) 874-7152
dbeutel@uri.edu

Laura Skrobe, Fisheries Extension Specialist
Tel: (401) 874-9360
lskrobe@uri.edu

Finances

	2001		2002	
	NOAA	Match	NOAA	Match
I. Core Program				
A. Marine Research				
Coastal Ecosystems	690,631	328,331	687,065	313,125
Sustainable Fisheries	243,655	129,746	252,963	156,297
Integrated Coastal Management	89,229	58,133	89,627	64,000
Total	**1,023,515**	**516,210**	**1,029,655**	**533,422**
B. Marine Advisory Services				
Sustainable Fisheries	225,000	142,670	365,050	115,608
Integrated Coastal Management	230,000	190,602	230,001	179,153
Communications	226,000	4,000	230,000	27,102
Total	**681,000**	**337,272**	**825,051**	**321,863**
C. Program Management & Development	**347,279**	**185,057**	**303,444**	**226,044**
D. John A. Knauss Fellowship Program	**38,000**		**76,000**	
Core Program Total	**2,089,794**	**1,038,539**	**2,234,150**	**1,081,329**
II. National Strategic Initiatives				
NMFS Fisheries Habitats Research	153,681	77,280	160,857	82,141
National Sea Grant Industry Fellowship Program			43,061	32,045
NSI Total	**153,681**	**77,280**	**203,918**	**114,186**
III. Other Activities				
NMFS/NGSO Resource Economics Fellowship	31,667	6,333	31,667	6,333
RI Aquaculture Initiative	35,000		743,767	
Other Total	**66,667**	**6,333**	**775,434**	**6,333**
Grand Total	**2,310,142**	**1,122,152**	**3,213,502**	**1,201,848**

Rhode Island Sea Grant investments supported an integrated approach to addressing priority marine and coastal issues through merit-reviewed research, education, and outreach initiatives. Our core programs drew on the academic talent of our institution and a wider network that included Brown University, Roger Williams University, regional academic institutions and industrial companies, and nonprofit advocacy groups.

	2001 NOAA	Match	2002 NOAA	Match
I. Core Program				
A. Marine Research				
Coastal Ecosystems	690,631	328,331	687,065	313,125
Sustainable Fisheries	243,655	129,746	252,963	156,297
Integrated Coastal Management	89,229	58,133	89,627	64,000
Total	**1,023,515**	**516,210**	**1,029,655**	**533,422**
B. Marine Advisory Services				
Sustainable Fisheries	225,000	142,670	365,050	115,608
Integrated Coastal Management	230,000	190,602	230,001	179,153
Communications	226,000	4,000	230,000	27,102
Total	**681,000**	**337,272**	**825,051**	**321,863**
C. Program Management & Development	**347,279**	**185,057**	**303,444**	**226,044**
D. John A. Knauss Fellowship Program	**38,000**		**76,000**	
Core Program Total	**2,089,794**	**1,038,539**	**2,234,150**	**1,081,329**
II. National Strategic Initiatives				
NMFS Fisheries Habitats Research	153,681	77,280	160,857	82,141
National Sea Grant Industry Fellowship Program			43,061	32,045
NSI Total	**153,681**	**77,280**	**203,918**	**114,186**
III. Other Activities				
NMFS/NGSO Resource Economics Fellowship	31,667	6,333	31,667	6,333
RI Aquaculture Initiative	35,000		743,767	
Other Total	**66,667**	**6,333**	**775,434**	**6,333**
Grand Total	**2,310,142**	**1,122,152**	**3,213,502**	**1,201,848**