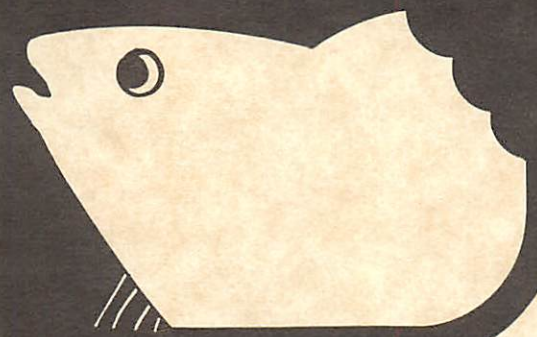
A Report on the University of Rhode Island's Sea Grant Program, July 1976 to June 1977. Marine Memo No. 48

All this happens because Rhode Island is on the ocean.

Because of commercial fishing there is

shipbuilding
water pollution
marine transportation
waterfront construction
marine equipment manufacture & supply
oceanographic research
marine education
fish processing



Because of marine-related industry there is

shipping
shipbuilding
beach erosion
ocean research
water pollution
port development
marine education
marine transportation
waterfront construction
marine equipment manufacture & supply

Because of marine recreation there is

tourism
overcrowding
boatbuilding
ocean research
water pollution
marina operation
waterfront construction
marine equipment manufacture & supply

Because of tourism there is

overcrowding
marina operations
waterfront construction
marine equipment manufacture & supply
ship and boatbuilding
marine recreation
port development

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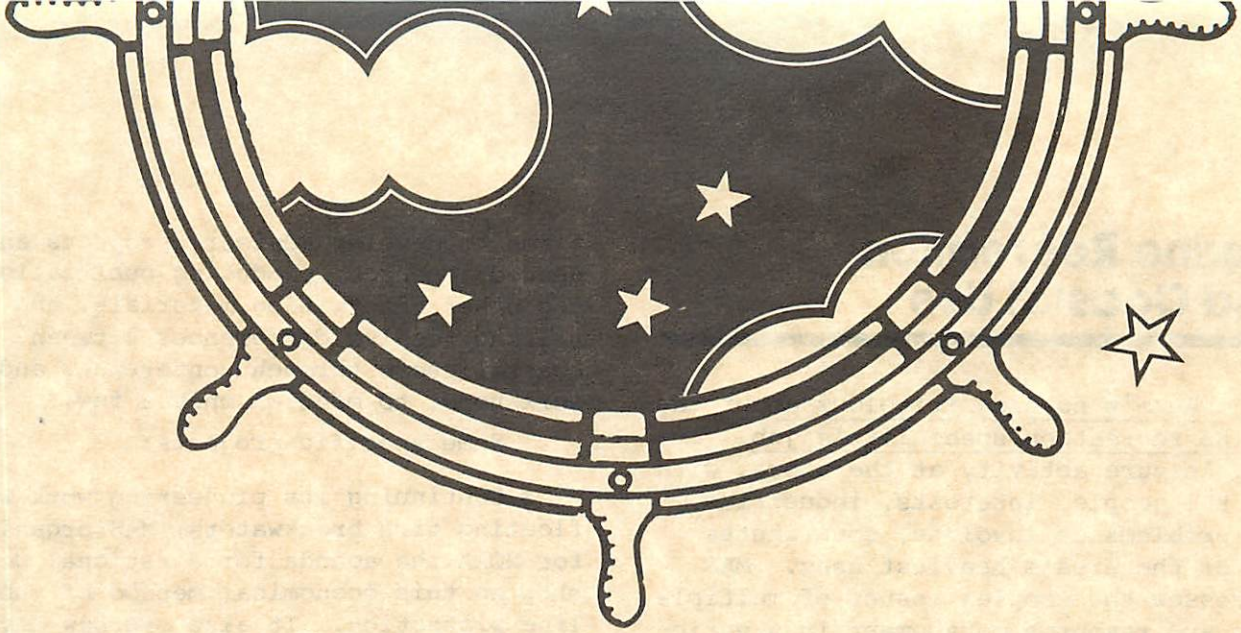
INTRODUCTION

The Sea Grant Program at the University of Rhode Island exists to serve the needs, in marine science and technology of those who depend upon the sea and its environment for work or recreation.



ADVISORY SERVICES

Marine Advisory Service specialists act as conduits. Through them, scientists at the University learn what research is needed by the community, and the public is introduced to the latest information related to their interests. It takes time for such a system to establish itself soundly, and at URI marine advisory services have come of age. Interaction with the marine clientele was higher than ever in the past year, and major projects on which advisory personnel spent much of their time were proving useful far outside Rhode Island's borders. The pioneering of a low-cost breakwater, of a number of trawling techniques, and of a multi-purpose processing plant are only three recent accomplishments that have meaning for the entire region.

Fisheries Development

Fishermen are notably skeptical of helping hands, particularly from outside their own ranks. But in the seven years the commercial fisheries specialist has acted as liaison, the University and MAS have provided enough sustained and useful assistance to forge a strong bond between this particular industry and academia.

Commercial fishing in Rhode Island, so important to New England, has a bright future, but it also has many problems. Fully aware of them, it is turning more and more to URI Sea Grant for help and solutions.

"Except for daily stuff I didn't do much instate last year," the fisheries specialist says. "Daily stuff" includes answering questions, solving fishermen's problems, talking to fishermen on a one-to-one basis, writing a bimonthly newsletter, setting up demonstrations of new techniques or gear, and running the annual Fishermen's Forum.

On a broader geographic level, he also:

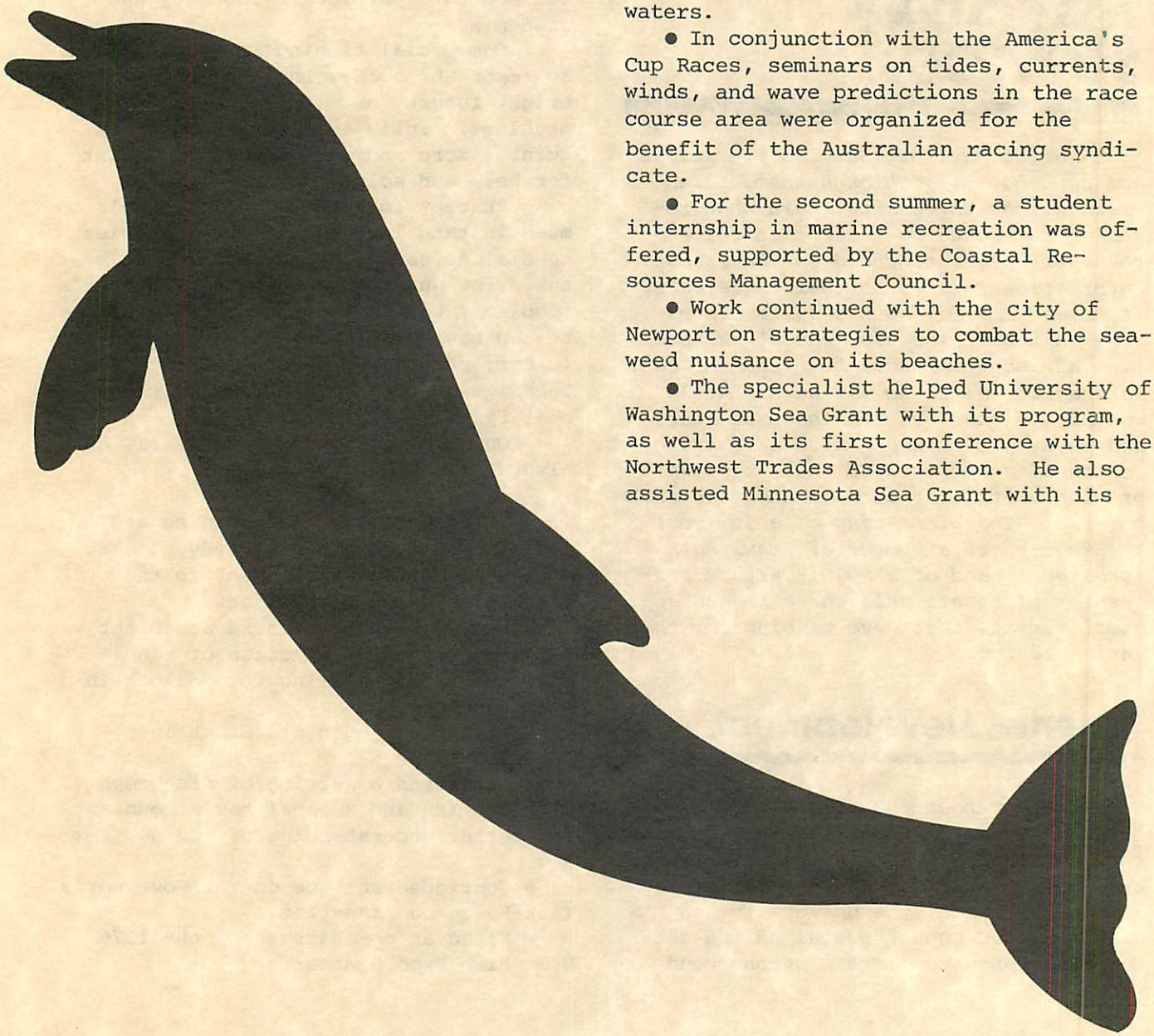
- Introduced Scottish seining and Canadian pair seining, already popular with Rhode Island fishermen, to the Chatham, Massachusetts fleet.
- Worked with the Alaska Sea Grant Program on the introduction of single boat mid-water trawling for pollock in Southeast Alaska.
- Assisted Oregon Sea Grant in a study of Loran C.
- Sponsored a meeting of fishermen with the IRS and a local tax accountant for better understanding of the new tax law.
- Continued service on the Governor's Task Force on Fisheries.
- Acted as co-chairman of the 1976 U.S. Fish Expo Seminar.

Marine Recreation and Coastal Use

There's nothing frivolous about the marine recreation specialist's job. Today, leisure activity at the shore, with all the people, interests, industries, and problems it involves, constitutes one of the area's heaviest uses. MAS addresses the complex issues of multiple uses and resource management in a variety of ways--working directly with business groups, government agencies, environmental organizations and individual firms to develop advisory projects and needed research, producing publications and other information materials, and helping resolve differences between coastal users through conferences and workshops, to mention only a few.

Some specific projects:

- Continuing its pioneering work with floating tire breakwaters, MAS organized for NOAA the agenda for a national workshop on this economical method of shoreline protection. It also oversaw development of a low-cost technique for measuring wave heights, and its specialist was asked by the American Chemical Society to present a paper on tire breakwaters.
- In conjunction with the America's Cup Races, seminars on tides, currents, winds, and wave predictions in the race course area were organized for the benefit of the Australian racing syndicate.
- For the second summer, a student internship in marine recreation was offered, supported by the Coastal Resources Management Council.
- Work continued with the city of Newport on strategies to combat the seaweed nuisance on its beaches.
- The specialist helped University of Washington Sea Grant with its program, as well as its first conference with the Northwest Trades Association. He also assisted Minnesota Sea Grant with its



first trade conference and an assessment of its program's potential.

● A variety of conferences and workshops were organized, including the annual diesel engine repair and electrolysis workshop, the New England Boating Conference, and a marina workshop sponsored by the Coastal Resources Management Council.

Seafood Technology

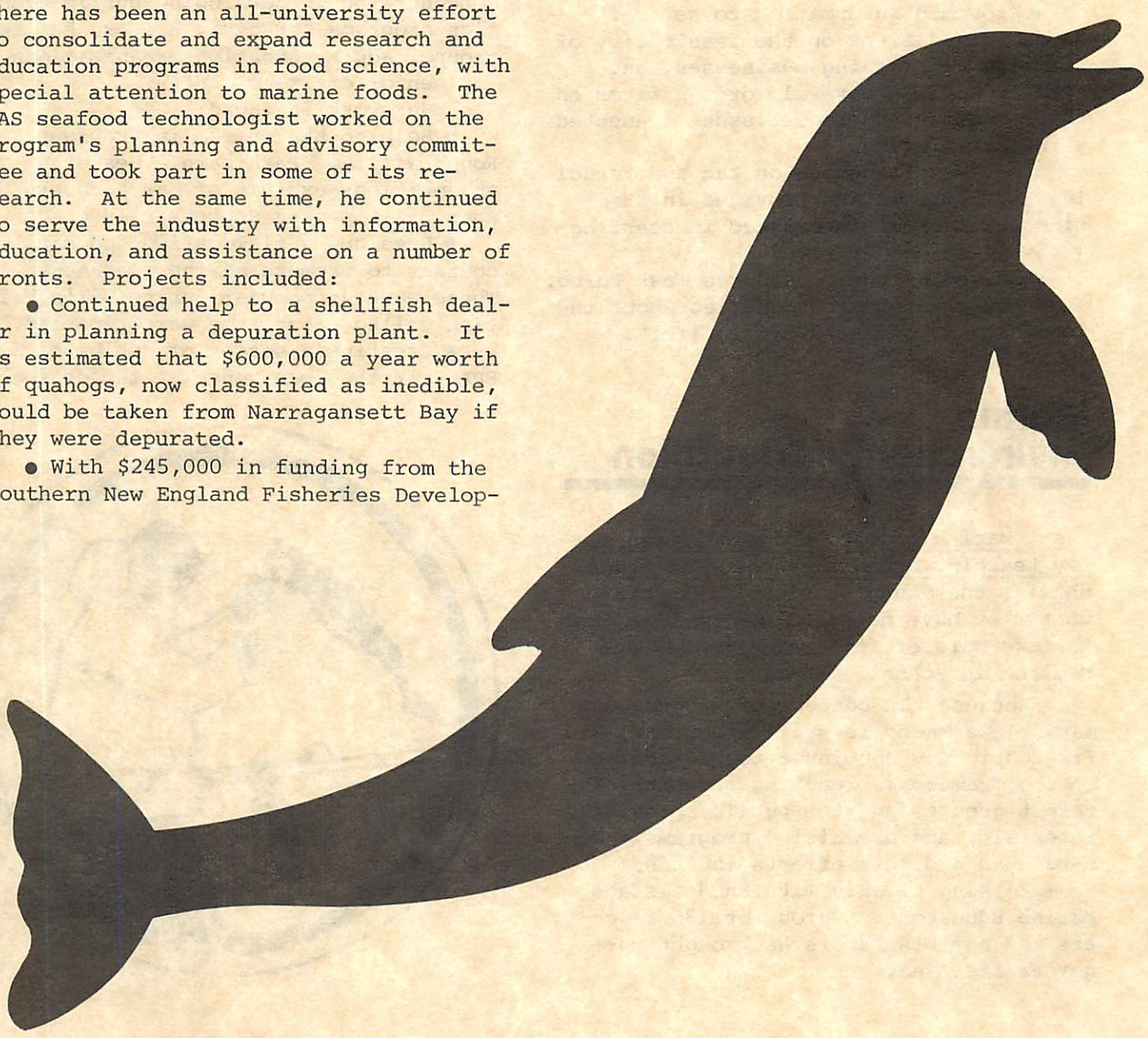
Seafood processing could become a significant industry in Rhode Island, many predict. Anticipating that it will, there has been an all-university effort to consolidate and expand research and education programs in food science, with special attention to marine foods. The MAS seafood technologist worked on the program's planning and advisory committee and took part in some of its research. At the same time, he continued to serve the industry with information, education, and assistance on a number of fronts. Projects included:

● Continued help to a shellfish dealer in planning a depuration plant. It is estimated that $600,000 a year worth of quahogs, now classified as inedible, could be taken from Narragansett Bay if they were depurated.

● With $245,000 in funding from the Southern New England Fisheries Development Program, a seafood company was helped to develop a multi-purpose processing plant, the Rhode Island Seafood Council (started by MAS) was advised and funded for a survey and other promotional activities, and a salmon culture project in a clam processing plant received continued support. Industry representatives approved these projects and voted matching funds of over $500,000.

● The State Department of Economic Development was advised on the potential for a seafood processing park on "excessed" military land.

● The 21st Annual Atlantic Fisheries Technological Conference was held.



Marine Economics

MAS assists the marine community in economic matters through the services of a professor of resource economics. A quarter of his time is devoted to helping fishermen and marine firms adjust to changing federal and state regulations, advising firms, agencies, banks and individuals, and publishing timely reports for the marine community.

During the year, he

- Met with various government and industry representatives to advise them on how to fill their data needs regarding the 200-mile limit.
- Provided information to several Rhode Island firms on the feasibility of starting new fishing businesses, and further advised several foreign firms on the resources and legal issues connected with marketing squid.
- Advised fishermen on tax and vessel leasing problems and provided information for a group interested in starting a shellfish cooperative.
- Served on the Governor's Task Force.
- Answered numerous queries about the implications of the 200-mile limit.

Marine Environmental Education

"Marine education doesn't mean simply teaching ocean sciences. It means showing the young people of this state what they have here and making them want to take care of it," says the MAS specialist in school education.

Because the concept of encouraging marine awareness is still a new one, his first priority continued to be setting up the framework: reaching teachers, interest groups, and the public, providing materials, and organizing programs. Toward this end, his efforts included:

- Working closely with Rhode Island Marine Educators, a group of 135 teachers and administrators he brought together last year.
- Assisting 4-H Marine Awareness Programs to expand statewide.
- Coordinating regional marine education efforts through the New England Marine Advisory Service.
- Developing and teaching courses on coastal awareness in URI's Vacation College.
- Speaking at nearly 40 schools across the state.
- Coordinating, with the State Department of Education, a program called "Experience-Based Career Education," designed to give students a realistic idea of career possibilities in the marine field.

Meanwhile, a part-time specialist concentrated on developing public education programs for civic groups, business groups, adult education organizations, and senior citizens' units.

Her work included:

- Helping the museum in Providence's Roger Williams Park earn a Sea Grant for an ambitious exhibit of Narragansett Bay that will open in September 1978.
- Developing field trips and mini-courses to promote marine awareness. These were so popular during URI's Vacation College that they were repeated.
- Creating a series of exhibits, with EPA, for the open house at the dedica-

tion of its new building in May. The exhibits were also requested for the Narragansett Chamber of Commerce tourist center.

- Helping with a NEMAS publication, "Sea Grant Publications for the Fishing Industry."
- With the Propellor Club of Providence, starting the Adopt-A-Ship Program, designed to interest fourth and fifth graders in marine research and maritime issues.

Information

"Thank you so much for sending the dolphin hydrophone recording," writes a Massachusetts school teacher. "The children who hear these recordings made by University of Rhode Island scientists will be fascinated."

From Maine: "Just a note to thank you for the careful attention you gave our request for information about the U.S. seaweed industry."

From Alabama: "The materials you sent on beaches were invaluable."

These are letters from just three of the 1500 people around the country whose requests were answered by the Information Center during the past year. The Center, which was the first advisory activity in URI's Sea Grant program, continued to serve government, industry, educational institutions, and the general public with answers, literature searches, information packets, and reports.

Supervising the publications distribution program, the Center sent out 38,000 copies of 41 technical reports, marine bulletins, and scientific reprints published by MAS.

Three bimonthly newsletters produced by MAS and distributed by the Information Center showed an increase in circulation. NEMAS Information had slightly over 12,000 readers nationwide, while the Commercial Fisheries Newsletter reached 1800 New England fishermen, and the Marine Advisory Service Newsletter went to 1200 subscribers.

During the year the public was kept informed of Sea Grant projects at URI through news releases, feature articles, and radio and TV spots. The MAS newswriter also helped arrange TV interviews with Sea Grant investigators, as well as exhibits at Fish Expo in Boston and at the Graduate School of Oceanography's Open House and christening of its new research vessel, Endeavor.

In May, a regional information center was established by the New England Marine Advisory Service to give coastal planners quick access to a wide range of data. Based at URI, it will draw on the existing Sea Grant network of professional marine resources in the Northeast, using information capabilities of marine advisory programs at the universities of Maine and New Hampshire, MIT, UMass, UConn and the New York Sea Grant Service. It is a prototype for a system of similar facilities in other coastal regions.

In March, the MAS information specialist assumed responsibility for the National Sea Grant Depository. Housed in Pell Library on the Bay Campus of URI, the Depository collects all publications prepared with Sea Grant support, provides subject and bibliographic access to them, advertises their availability, and helps the public obtain needed materials.

The Coastal Resources Center

The Center's primary responsibility was to complete the state's Coastal Resources Management Program, the document that will be used by the Coastal Resources Management Council to guide development in Rhode Island's coastal area. This was done in early summer, after 13 public workshops had been held around the state in the first six months of the year as part of an effort to solicit the public's interests and participation.

Funded by Sea Grant, the Office of Coastal Zone Management, and the state, the Coastal Resources Center does more

than merely pull together data needed by the Council and other planning groups in the state. Analyzing management alternatives and recommending guidelines are also part of its job. Thus it studied, at the request of the New England Regional Commission, possibilities for conflict between commercial fishing and offshore oil development and offered ways to avoid it. An environmental assessment of a proposed LNG center was prepared for the governor, as was an analysis of various offshore oil development proposals.

Most recently, the Center completed an environmental assessment of "surplussed" Navy lands at Quonset/Davisville for the Department of Economic Development. The 200-page report contains recommendations for minimizing damage to the site, environmental information, and a determination of the environmental effects of proposed development.

As it does every year, the Center, in cooperation with the Coastal Council, held a number of timely workshops for planners, government agencies and others.

Center for Ocean Management Studies

Management of the coastal belt is a complex task. What happens in one segment of it can affect all the others, but a coherent management policy that recognizes this has never been developed. To promote more effective coastal and ocean management, the Center for Ocean Management Studies was established with Sea Grant support in the fall of 1976.

The Center represents a continuation of the University's longtime assistance to government and industry in analyzing marine-related problems. Its contributions include identifying ocean management issues, holding workshops and conferences, and developing short-term research programs--in short, providing a forum for interdisciplinary communication and education. Although its initial focus has been on problems of particular concern in New England, its scope is already becoming more national and international.

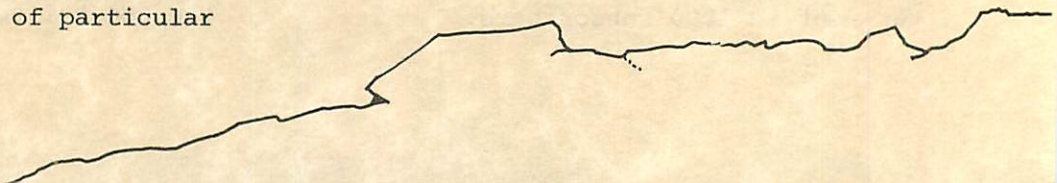
In the spring of 1977, the Center organized, for the International Decade of Ocean Exploration (IDOE), a series of five workshops on opportunities for large-scale oceanographic research in the 1980s. It has held numerous other workshops for various groups and the first in a series of annual conferences.

Law of the Sea Institute

The Law of the Sea Institute produced information used by thousands of decision-makers in its ten years at the University of Rhode Island. Besides sponsoring annual conferences, workshops, and publications, the Institute answered approximately 1000 requests a year from the general public for information on some aspect of the law of the sea. In September 1976, it was decided by the Institute Board and URI to move to the University of Hawaii, a move subsequently carried out.

Special Project

To make scuba diving safer, URI safety researchers analyzed 1200 diving accidents in their files, identifying a variety of factors that lead to underwater fatalities. The information they turned up on common problems in various underwater environments, as well as on possible weaknesses in equipment, were made available to instructors, divers, and manufacturers. The 1200 cases were taken from seven years of data on U.S. diving fatalities compiled by the URI team and provided yearly to the diving industry.



EDUCATION

Urgently needed in the public sector: understanding of the marine and coastal environment, much specialized training, a variety of marine-related skills. Answering this need, URI continued to broaden the scope of its Sea Grant supported educational programs, some of which are available nowhere else in the nation.

Responding to the growing demand for training in marine resources management, the Marine Affairs Program and the Department of Geography instituted a two-year Master of Arts in Marine Affairs course, which was begun in September of 1977 with 19 students. The new program was created for otherwise qualified students who lack the graduate degree or equivalent ocean-related experience required by the one-year Master of Marine Affairs Program. It fills a need that has been obvious for several years.

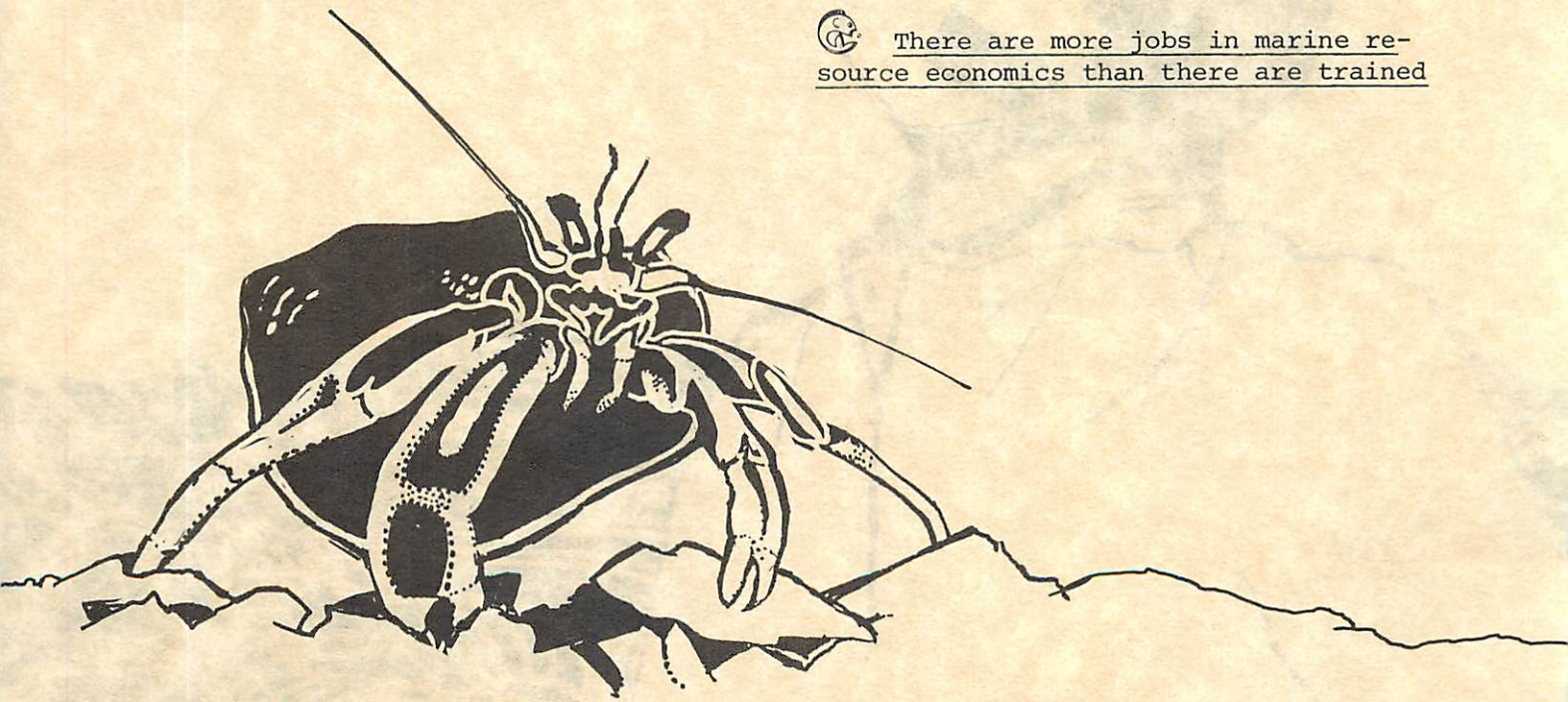
The eight-year-old Master of Marine Affairs Program provides specialists in various marine disciplines with a broad, overall perspective on ocean management not found in any other academic setting. To date 155 men and women have completed the program, entering or returning to responsible jobs both here and abroad.

An undergraduate major in Marine Environmental Policy was also offered for the first time in 1977, by the merged departments of Geography and Marine Affairs. The fourth Marine Affairs Journal was published and distributed nationwide.

Engineers trained to work in the marine environment have no trouble finding jobs. URI's graduate program in Ocean Engineering enrolls more students and receives more enquiries from government and industry every year. Total enrollment for 1976-77 was 113 graduate students and 41 undergraduates. Of 13 who graduated with M.S. degrees, all but one, who is a Ph.D. candidate, found immediate employment. Among undergraduates, the joint B.S. degree in Mechanical and Ocean Engineering attracts increasing interest. The department's curriculum has been broadened to give honor students special-problem courses.

Research and teaching facilities were enlarged, and the practical end-products of two Sea Grant funded research projects have been made available to the public by URI's Marine Advisory Service.

There are more jobs in marine resource economics than there are trained



people to fill them. URI is trying to meet the national and international need with a doctoral program in the subject. Since the Sea Grant funded program began in 1970, 11 students have earned their Ph.D.s in economics-marine resources and have gone on to important positions in government and academia.

The two-year associate degree program in fisheries and marine technology, established in 1967, had the highest enrollment in the history of its course. Questionnaires sent to 108 program graduates revealed that 70 percent believe their URI experience gave them a three to five-year headstart over people entering the fishing industry without formal training.

Responding to requests from industry and government agencies, the department took first steps toward a new program: training observers to serve aboard foreign vessels fishing within the 200-mile limit.

RESEARCH

Sea Grant research at the University of Rhode Island is in four general areas where there are immediate problems or there is an obvious need for better management. The four are coastal resources, the state's most important asset; fisheries, full of potential for the region and the nation but with need to improve efficiency and profitability; aquaculture, foreseeably a vital food supplement but with a long way to go technologically; and underexploited marine food and drugs.

The approach taken here crosses departmental and college lines, a strength made possible by the University's pronounced marine orientation. Besides the broad capabilities of the Graduate School of Oceanography, Sea Grant research can tap expertise in such colleges as Engineering, Business, Resource Development, and even Arts and Sciences.

A project aimed at increasing the economic efficiency of salmon culture, for instance, has involved efforts of an animal scientist, a botanist, a fish pathologist, and an economist. This was one of 21 projects Sea Grant sponsored during 1976-77. Nine were completed at fiscal year's end, having in many cases been undertaken to answer real and current needs in the state or region.

Coastal Resources

If keeping chemicals out of our water is impossible, the only course is to perfect ways of identifying them and removing the dangerous ones. After having monitored hydrocarbons in Narragansett Bay since 1974, a team of chemists concluded their Sea Grant funded study and reported that the largest number of pollutants found in a pleasure craft harbor were pthalic acid esters, which are used in making plastics and are also found in petroleum. The level of these chemicals, listed as hazardous by the Coast Guard, has been increasing yearly, the team found. Results of their study were sent to state and federal regulatory agencies.

Identification techniques were also considerably refined during the year. Laser-raman spectroscopy, which permits identification of hazardous chemicals without having to remove them from water, was extended to the 10-100 pbb range, and a continuous flow-through detection system was developed. The project ended in June 1977.

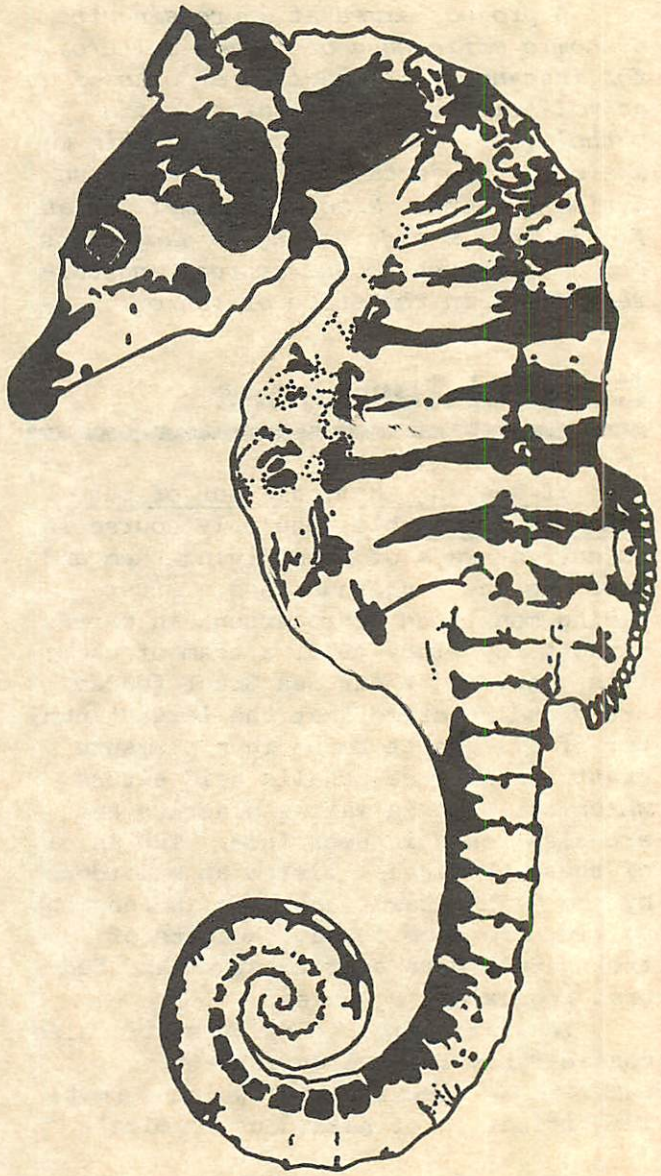
A building material that may have many marine uses is being extensively tested by ocean engineers. If not too susceptible to corrosion, fibrous concrete could be valuable for submerged breakwaters or oil tanks, for low-cost fishing-boat and barge hulls, and for small floating marina components. Besides learning under what conditions it can be used in the ocean environment, the engineering team is working on mix and design standards to make it last longer in water.

After monitoring the interaction of sport and commercial fish in Narragansett Bay over a two-year period, biologists concluded that striped bass and bluefish populations are not threatened by commercial fishing of menhaden, their principal food source. The study was undertaken to help settle a longstanding dispute between sport and commercial fishermen. Information gathered in the study will be used by the state's Department of Environmental Management to regulate both sport and commercial fisheries.

A major change in the dynamics of phytoplankton bloom in Narragansett Bay was verified after several years of observation by scientists in the Graduate School of Oceanography. They are continuing to try to find the cause. However, a similar unusual bloom along the Eastern seaboard suggests that large-scale regional events affect phytoplankton bloom dynamics in Narragansett Bay beyond their response to local events.

The suitability of individual Rhode Island beach areas for development can in the future be objectively determined, thanks to a photogrammatic survey begun this year of the rate of beach erosion and accretion. Basic data being used by geologists in this two-year Sea Grant project are aerial photos of the state's coastline taken over the past 36 years. The major change is found to be erosion at the rate of 0.2m/yr. Techniques developed here can be applied all along the New England coastline where information is needed to plan for housing, nuclear power plant siting, and recreational beach use.

The ability to predict how winds and tides will move coastal waters can be enormously useful for a number of reasons. An obvious one would be to help crews cleaning up spilled oil or other contaminants in Rhode Island waters. A three-dimensional numerical



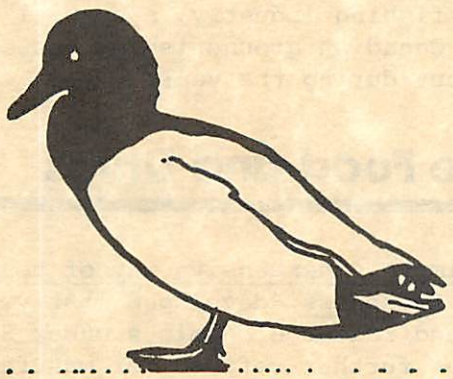
model with this prediction ability has been developed in the Department of Ocean Engineering. This year, the second of the three-year project, the model was successfully tested for a variety of coastal areas and flow conditions in Block Island Sound. It was also adapted to Long Island Sound, Rhode Island Sound and Buzzards Bay. Recent modifications of the model reduced computer run time and storage space by 50 percent.

A study of marine-oriented activities in southern New England, initiated

this year, will provide an economic profile of each marine industry, its impact on the economy and, most important to planners, an empirical framework that can be used to evaluate the effect of potential ocean-related development. The first year of the two-year study was devoted to developing and administering an extensive questionnaire.

How many petroleum hydrocarbons are being discharged into Narragansett Bay? A two-year survey of hydrocarbons in sediment cores was begun this year to provide a basis for decisions about present and future uses of the Bay. It includes measuring input, determining transportation mechanisms, and investigating the distribution in sediment cores of the organic compound found in petroleum, coal and natural gas. This information is urgently needed to evaluate the impact on the Bay of various petroleum-related activities--recreational boating, sewage treatment, tanker and refinery operations--that take place on or near it.

There is a large gap in our knowledge of the coastal marine environment --what happens in the benthic, or bottom community and how processes there are linked with life higher up in the water. Until that gap is closed, it's impossible to predict how bottom communities will react to such disruptions as oil sludge, dumping, and lack of oxygen.



As an outgrowth of their work in numerical modeling and systems analysis of Narragansett Bay, researchers in the Graduate School of Oceanography began a three-year project to take knowledge of benthic ecology beyond its present "descriptive natural history" level. Specifically, they began amassing quantitative data on the nature, mechanisms and rates by which subtidal, heterotrophic bottom communities convert organic material from the pelagic community into animal biomass or carbon dioxide on the bottom.

Numerical simulation models exist for a number of specific marine ecosystems, but they can be used only for that particular system. This is unfortunate because they are time-consuming and costly tools to develop and are increasingly needed for coastal planning.

A model for Narragansett Bay, developed in the Graduate School of Oceanography over a number of years and believed by its creators to be general enough in structure to be useful in any system (with minor changes), was refined and tested for its applicability to other coastal and offshore Atlantic ecosystems. As part of the one-year project, nutrient budgets for nitrogen, phosphorus and silica in Narragansett Bay were developed in order to evaluate the relative importance of sewage in the water. This information was needed by the State Department of Health in order to decide on the possible relocation of sewage outfalls in the Bay. The project ended in June 1977.

Planners for the Bay system in Rhode Island and southern Massachusetts require a much more basic understanding of the Bay floor than presently exists. Specifically, they need to know whether it is suitable for heavy construction, since much can be foreseen in the form of support activities for offshore oil development, new channels, cable crossings and pipeline routes, to mention only a few. The modern estuarine depos-

it in the Bay appears to be easy to dredge and trench but it may be completely unsuitable as a foundation for heavy construction. To find out the extent, thickness, form and gross composition of these estuarine sediments, a three-dimensional study using high resolution seismic profiling was begun in the Graduate School of Oceanography this year. Some 200 miles of the Bay system bottom were surveyed, with a more detailed inspection given to areas where industrial development might be expected soonest.

A useful research tool for simulating complex three-dimensional flow and salinity distribution in estuaries and the coastal zone has been developed by members of the Department of Ocean Engineering. The three-dimensional numerical model is characterized in a resulting Master's thesis as able to describe and predict the combined effects of winds, tides, density gradients and river inflow for a given estuarine area. It is expected to serve as a basis on which water quality and ecological and coastal planning models can be based. Predictive tools of this kind are increasingly relied on by coastal planners in balancing the many conflicting uses of our coastal waters. The project ended in June 1977.

Natural Fisheries

Managing stocks of yellowtail flounder, an important commercial species, depends on an understanding of their decline and recovery over the years. Methods were developed to estimate the annual equilibrium catch, average growth per fish, recruitment and growth coefficients for this species--information already being used by the National Marine Fisheries Service and the New England Regional Fisheries Management Council. Additionally, Sea Grant investigators developed two new concepts expected to have wide application in fishery biology: a delayed recruitment model for application to the lobster fishery and an indirect estimate of natural mortality for the zero year class of a given fishery.

A new type of trawl net was developed in a one-year project, filling a need expressed by East Coast small-boat fishermen. The high opening trawl that can be fished on very rough bottom will be used in areas where the traditional net cannot; it will greatly increase the fishing capability and earning power of low-powered vessels. Information on construction of the net, which has already been tested, will be distributed through URI's Marine Advisory Service.

Extended fisheries jurisdiction will bring important economic changes to the U.S. industry. To ensure best use of the newly available fish stocks, government and industry policy makers need a variety of economic data never collated before. So, in a two-year study ending this year, faculty in the Department of Resource Economics formulated a conceptual approach to the allocation of U.S. fish stocks between the United States and foreign vessels, and mapped the geographical location and structure of the domestic fish processing industry. Additionally, three URI faculty members served as consultants to the Office of Technology Assessment in preparing an analysis for Congress of problems and opportunities resulting from the new legislation.

Because of the critical importance of Canadian competition to expansion of the U.S. fishing industry, a special study of Canadian groundfishing was also carried out during the year.

Marine Food and Drugs

A simple, inexpensive way of testing fish freshness, developed last year by food and resource chemists under Sea Grant, was further refined for manufac-

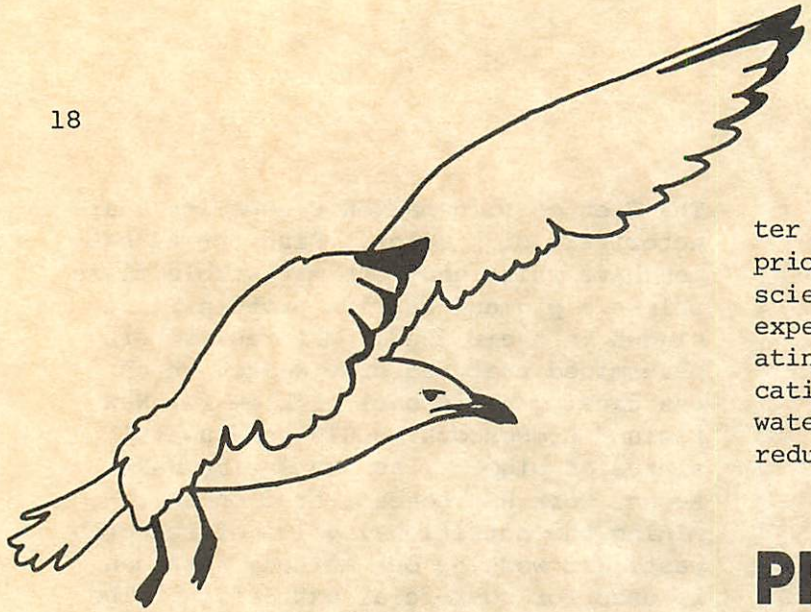
turing purposes. The "strip test" is based on the fact that when an extract of fish that is not absolutely fresh is placed on a dyed and enzyme-coated strip of paper, a chemical interaction occurs turning the paper from blue to pink. Building on this finding, researchers improved the test so it can be used directly on fish flesh, and also developed a second enzyme test to detect spoilage compounds. They hope to combine the two tests to reflect various stages of spoilage. The University has applied for a patent on the results of their work, and three companies have shown interest in manufacturing the strip test. The project ended in June 1977.

Providing a natural source of pigmentation for salmon reared by aquaculture has occupied another team of food and resource chemists for several years. The diet of wild salmon causes its characteristic pink color. Fish-farmed salmon have white and less marketable flesh unless a pigment-bearing protein is included in their feed. URI researchers determined that red crab waste, which was causing a disposal problem for New England processors, could be a useful source of pigment, as can shrimp waste. Recent work has concentrated on determining the nutritional value of red crab waste and working out methods that can be used for commercial extraction. The project ended in June 1977.

A quick test for toxicity in shellfish is the most significant recent accomplishment under Sea Grant of a team in the College of Pharmacy whose research on red tide has become internationally known in the past three years.

Of more than 400 species of unicellular algae whose periodic population explosions give the ocean a reddish tint, only a few are poisonous to man and then only when they have been ingested by shellfish which concentrate their toxins to a dangerous level. The potentially fatal illness is called paralytic shellfish poisoning; in the summer of 1972, scores of New England shellfish eaters were stricken and the seafood industry devastated by the public hysteria which resulted.

Since then, red tides off the coasts of Massachusetts, New Hampshire and Maine have caused frequent closing of shellfish beds, resulting in considerable economic loss to the states, since quarantined beds must remain closed till tests show them to be poison-free. Massachusetts alone has 40 locations to monitor. Until now, the only known test was a cumbersome and time-consuming process. Now pharmacognosists have developed a liquid chromatographic-fluorometric analyzer which uses only a small amount of clam extract to determine in a matter of minutes the approximate toxicity of a clam bed. This tool should do much to shorten quarantines and lighten losses for the seafood industry. The project ended in June 1977.



Aquaculture

The pathology laboratory continued to work closely with lobster and salmon aquaculturists in their attempts to determine how much the environment of cultured animals can be manipulated before pathology results. Work with a fungus destructive to larval crustaceans turned up an agent, the vital stain neutral red, that proved effective in reducing fungus growth and inhibiting spore germination. An inflammatory process in the inner ear of menhaden was pinpointed as the cause of "spinning disease."

A commercially valuable red algae was further tested by Sea Grant researchers for its usefulness in removing nitrogenous wastes from the recirculating water used in closed aquaculture systems. Since the seaweed can later be recovered and sold, the system promises to pay for itself. After experiments with a number of light and temperature regimes, it was found that rates of removal and growth of the algae were higher with natural light in greenhouse facilities than with artificial lights indoors. These results suggest that algae used for ammonia removal in closed fish culture systems would be more effective in shallow ponds or lagoons than in silo culture.

Finding ways to grow salmon more economically in systems that re-use water continued to be the first Sea Grant priority of a professor of animal science. Specifically, efforts included experimenting with cheaper diets, evaluating an alternative method of nitrification to reduce the capital cost of water re-use systems, and attempting to reduce mortality due to disease.

PROGRAM DEVELOPMENT

The Tall Ships' visit to Newport in the summer of '76 was a rare opportunity to amass invaluable information: what is the economic impact on the state of large-scale, short-term tourist events, and how can they best be planned for and managed?

Thanks to URI's Sea Grant fund for program development, the chance was not lost. A quickly organized study, which measured total economic impact at $15.2 million, was able to compare projections with reality, providing planners of similar events with a priceless tool.

Since 1973, the fund has helped the Sea Grant Program at URI do its job--producing results and the application of results faster and better. Promising new ideas in research and advisory services can be investigated to see if they merit full-scale funding, while immediate needs in the community can often be met with short-term research.

One such project in the past year involved experimental drilling for salt water wells on the east side of Narragansett Bay. There are a number of these aquifers in the state and they appear to have considerable potential for both aquaculture and fish processing. Information about their presence and how to locate and make use of them was made available to the industry.

In another project, one of a number of "quick pay-off" projects funded during the year, European seining was introduced to the Newport fishing fleet.

PROJECT STATUS FISCAL YEAR 1977

Project Number and Title		Planned Termination Date	Date Initiated
Advisory Services			
A/AS-3	Marine Advisory Service and New England Marine Resources Information Program	None	1975
A/COM-1	Center for Ocean Management Studies	1983	1977*
A/CR-5	Coastal Resources Center	None	1971
A/L-1	Law of the Sea Institute	1977T	1969
A/SS-3	An Analysis of Variables in Fatal Scuba Accidents	1977C	1976
Education			
E/FT-1	Fisheries & Marine Technology	None	1968
E/M-1	Master of Marine Affairs	1977R	1969
E/ME-1	Marine Resources Economics Option	1977R	1971
E/OE-1	Graduate Program Ocean Engineering	1977T	1971
Coastal Resources			
R/E-8	Identifying and Monitoring Oil Spills	1977C	1974
R/E-9	Remote Sensing Photogrammetric Survey for Long-Term Shoreline Erosion Inventory - R.I. Coast	1978	1976
R/E-11	Relationship Between Menhaden and Sportfish in Narragansett Bay	1978	1976
R/ES-6	Development of an Integrated Three-Dimensional Hydrodynamic, Salinity and Temperature Model	1977C	1974
R/ES-8	Causes of Phytoplankton Blooms in Narragansett Bay	1978	1975
R/ES-9	Analytical Modeling of Coastal Zone Areas	1978	1975
R/ES-10	Distribution of Hydrocarbons in Narragansett Bay Sediments	1978	1976
R/ES-11	Carbonflux in a Coastal Marine Bottom Community	1979	1976
R/ES-12	Testing and Suitability of a Coastal Ecosystem Model	1977C	1976

R/ES-13	Three-Dimensional Study of Modern Estuarine Deposits in the Narragansett Bay System, R.I. and Southern Mass.	1977C	1976
R/ME-1	An Economic Study of Marine-Oriented Activities in the Southern New England Marine Region	1978 1978	1976 1976
R/OE-1	Degradation of Metal-Fiber Reinforced Concrete in a Marine Environment	1978	1976

Fisheries

R/F-16	Regional Fisheries Population Management	1977C	1974
R/F-20	The Economic Impacts of Extended U.S. Fishery Jurisdiction Under Alternative Institutional and Fisheries Management Policies	1977C	1975
R/F-23	Hard Bottom Combination Net	1977C	1976

Aquaculture

R/A-4	Marine Pathology	1978	1970
R/A-9	Potential of Macroalgae in Silo Culture	1978	1975
R/A-11	Production of Salmonids in Closed Systems	1979	1976

Food and Drugs

R/D-5	Pragmatic Facets of Deleterious Dinoflagellate Toxins	1979	1976
R/T-5	Utilization of Red Crab Waste in Salmonid Aquaculture	1977C	1974
R/T-6	Simplified Method of Assessing Marine Food Quality	1977C	1975

Management and Development

M/PM-1	Program Management	None	1971
M/PD-1	Program Development	None	1973

*Initiated with funds remaining in A/L-1, which terminated.
R-indicates revised for year following
C-indicates project was completed in 1977
T-indicates project was terminated in 1977

ACTIVITY BUDGET

	NOAA Grant Funds	University Matching Funds
Marine Resources Development		
Aquaculture	$ 61,177	$ 28,915
Living Resources, other than aquaculture	53,416	6,572
Marine Biomedicinals and Extracts	17,616	3,000
Socio-Economic and Legal Studies		
Marine Economics	94,226	2,000
Ocean Law	31,943	31,763
Marine Technology Research and Development		
Ocean Engineering	26,850	-0-
Resources Recovery and Utilization	77,889	24,913
Marine Environmental Research		
Research and Studies in Direct Support of Coastal Management Decisions	53,092	29,886
Ecosystems Research	92,730	9,590
Pollution Studies	49,746	600
Environmental Models	66,875	71,355
Applied Oceanography	15,260	2,075
Marine Education and Training		
College Level	15,939	181,118
Vocational Marine Technician Training	30,188	114,434
Advisory Services		
Marine Advisory Services	259,710	49,184
Program Management and Development		
Program Management	82,230	5,110
Program Development	92,113	-0-
Total	$1,121,000	$560,515

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Vaughan, D.S. and S. Saila (GSO, URI). "A Method for Determining Mortality Rates Using the Leslie Matrix," *Trans. Am. Fish. Soc.* 105(3)(1976):380-83. P-528.

Wolke, R.E. (Animal Pathology, URI) and R.A. Murchelano (NMFS). "A Case Report of an Epidermal Papilloma in Mustelus canis," *J. Wildlife Diseases* 12(April 1976):167-71. P-508.

Marine Environmental Research

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Hess, K.W. (GSO, URI). "A Three-Dimensional Numerical Model of the Estuary Circulation and Salinity in Narragansett Bay," *Est. and Coast. Mar. Sci.* 4(1976): 325-38. P-515.

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