South Carolina Sea Grant

ANNUAL REPORT

1972 - 1973

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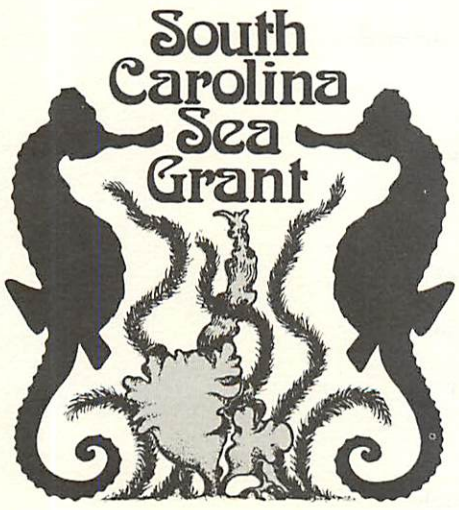
A Report on the South Carolina Coherent Sea Grant Program for July 1, 1972 - June 30, 1973



South Carolina Sea Grant

Director, Dr. Edwin B. Joseph
Assistant Director, Dr. E. A. Laurent

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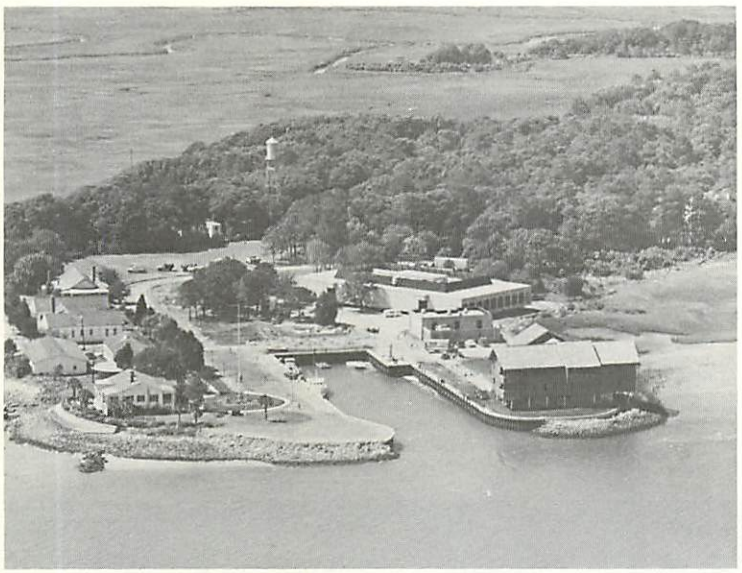
INTRODUCTION

South Carolina's Marine Resources Center in Charleston, S. C.



The South Carolina Sea Grant Program is one of the nation's youngest. We are now entering our second year of research, education and service for the "sea people" of South Carolina.

Because the eight coastal counties comprise about 20 per cent of South Carolina's total land area and population, the sea has long exercized a tremendous influence on the economy and culture of the state and region. Commercial fishing is an $11.2 million industry and tourism, sport fishing and recreational boating, all marine-related activities, are vital elements of the coastal economy.

In response to the mounting pressures on our nation's coastal zones, Sea Grant will continue to provide options and guidance for the orderly development of South Carolina's marine resources. Maintaining the environmental quality of the region is also a prime objective.

During the past fiscal year, twenty-two researchers representing the major institutions of higher learning in the state were engaged in marine research under Sea Grant sponsorship. Although tangible achievements through research are necessarily limited after one year's funding, significant advances have been made in the management of the program and in the area of Advisory Services.

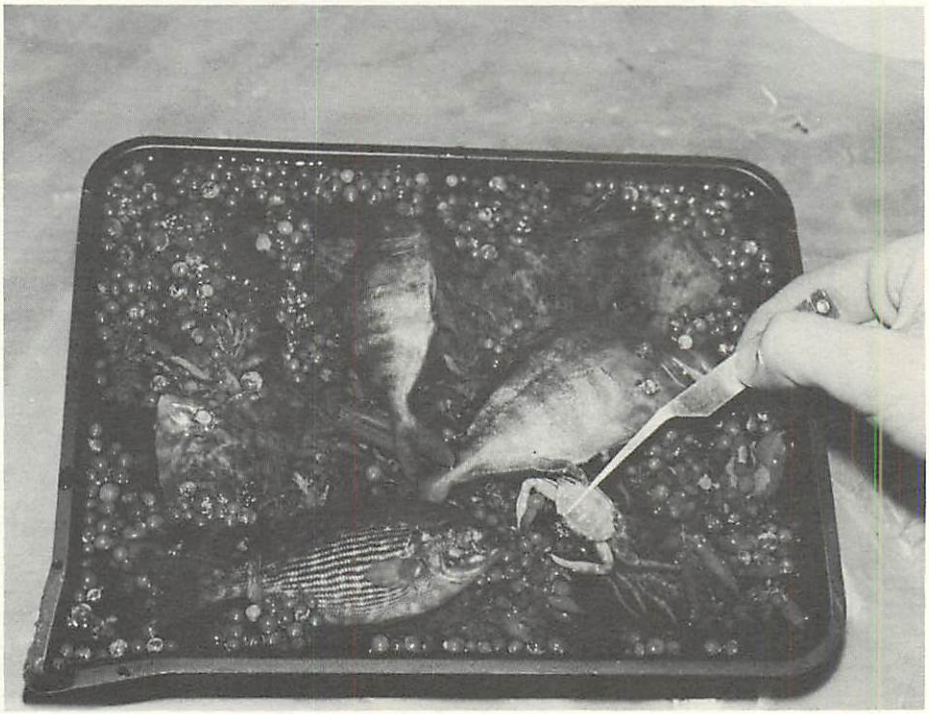
The Sea Grant Program in South Carolina is a unique and dynamic multi-institutional effort, administered by the Director on the advice and counsel of the Steering Committee, which is composed of representatives of each of the five participating institutions. Throughout the ground-breaking first year, this structure proved to be an effective mechanism for strong program management.

This first Annual Report, then is merely an introduction to the Sea Grant Program. We are confident that we will come to know, and to be known by, South Carolina's marine community more fully in the years to come.

Dr. Edwin B. Joseph,
Sea Grant Director

Finding Out What We Have

Realizing that proper management and economic development of marine resources is impossible without a thorough knowledge of the resource itself, an early Sea Grant objective was to spearhead statewide efforts to document and assess the marine resources of the state. Dr. Edwin B. Joseph, Sea Grant Director, was chosen to coordinate a commit-



Pete Laurie

tee of representatives of the various state agencies already engaged in specific small-scale assessment projects.

Part of the first year was spent in identifying needed but unavailable data on South Carolina's marine resources. As a result of this survey, the Sea Grant resource assessment project was divided into sub-projects, each dealing with one vital area of needed research.

One sub-project which emerged is a comprehensive estuarine base line study sponsored jointly by the Coastal Plains Regional Commission and the State of South Carolina. This project has begun identifying the state's most productive wetland environments by estimating the relative year class strength of fishes and crustaceans which contribute to the commercial or recreational fisheries of South Carolina. Although not financially a Sea Grant project, the estuarine study will provide biological and hydrographic data as a contribution to the integrated Sea Grant Resource Assessment Program.

Economists from the University of South Carolina's Bureau of Business and Economic research have initiated an economic base analysis of two coastal counties in their sub-project to assess the coast's economic resources.

The factors which cause economic growth in the two counties have been indentified. The researchers also have determined which of these factors is dependent, and to what extent it is dependent, on the coastal location. For instance, in one county industrial manufacturing is the dominant economic factor, while tourism dominates the economy of the sister county. However, each economic activity depends on the ocean — one for aesthetics and recreation, the other for transportation.

The economists' goal is to estimate the aggregate economic impact of the ocean. This information will help planners direct growth and land use by projecting future economic activity.

In a companion sub-project, Clemson University researchers have completed work documenting land use activities in the same coastal counties. Data derived from this project will match the economic base analysis and become a part of the computerized South Carolina Land Use Information System.

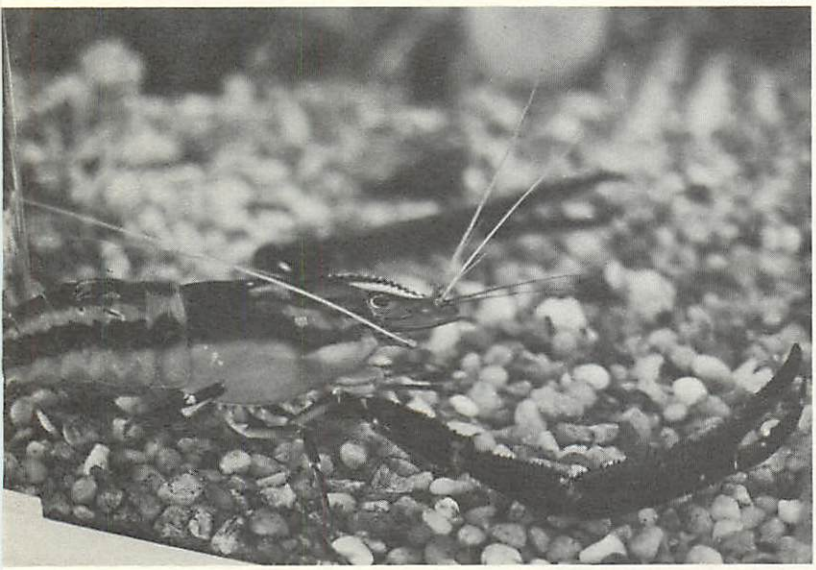
These two studies contribute jointly to a better understanding of the impact of marine resources on the economy and development of the South Carolina coast. The estuarine survey will point out critical areas of environmental importance in the tidal belt, and all will provide data to help the state's newly formed Coastal Zone Planning and Management Council in making its decisions on wetlands and coastal zone management.

In the future, the Sea Grant Resource Assessment Program will include further economic research into labor resources of the coastal zone, and a social study on public attitudes toward the management and conservation of marine resources, particularly tidal wetlands.

Food and Drugs From the Sea

South Carolina became a major center of U.S. mariculture research in the past year. Sea Grant supported a project by Wildlife and Marine Resources Department scientists to investigate the potential for raising fresh/brackish water prawns of the genus *Macrobrachium* in the state's many abandonded rice fields. The Sea Grant project was designed as a part of the state's broad crustacean mariculture program.

Pete Laurie

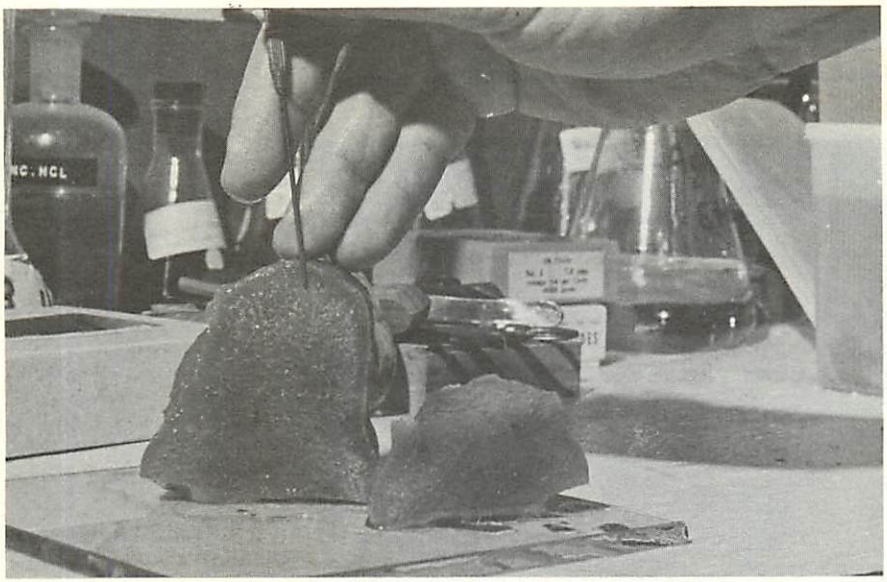


A giant fresh-brackish water prawn of the genus Macrobrachium.

As with any project, the opening months of the shrimp study faced many problems, not the least of which was obtaining the larvae with which to begin work. Through good working relations with other Sea Grant *Macrobrachium* researchers, the South Carolinians were able to obtain the shrimp, and to establish successful breeding colonies for several species. They also have identified many of the major problem areas in rearing the shrimp through the critically sensitive larval stage.

The next phase of work involves establishing a pilot hatchery project to demonstrate the technical feasibility of breeding and rearing the shrimp to commercial size. The *Macrobrachium* is a big animal, up to nine inches long for some species. In size and commercial value, it is much more closely akin to the lobster than the brown or white shrimp familiar to most South Carolinians. It could become a profitable industry in a state where shrimp have always been the largest commercial fishery. The ultimate aim of Sea Grant mariculture research is to provide a viable adjunct industry to current hunting and harvesting operations for shrimp.

This program will be expanded in the coming year by involving mechanical engineers from Clemson University in the design and construction of ideal tanks for cultivating shrimp larvae.



A colony of the marine organism Amaroucium, which may someday be used in cancer treatment.

Another researcher at the Marine Center is investigating the naturally occurring cultch-free oyster found in South Carolina's Wando River as a commercial source of seed oysters. Currently, the most important commercial oyster product in the state is the intertidal, clustering variety of the American oyster, *Crassostrea virginica.* Because of the large clusters, this variety is difficult to harvest by hand, and almost impossible to harvest mechanically. The Sea Grant scientists hope to develop the Wando beds as seed areas for the non-clustering, subtidal variety of the oyster.

Intensive monitoring has produced data on oyster strike timing, intensity and survival, as well as information on growth and mortality of Wando seed transplanted to other areas. As a result of this study, South Carolina oystermen will be able to determine the feasibility of cultivating subtidal oysters.

This project has had several unforeseen benefits. For example, the hydrographic and biological data generated by the study is being used to assess the environmental impact of proposed expansion of the Charleston port facilities into the Wando River.

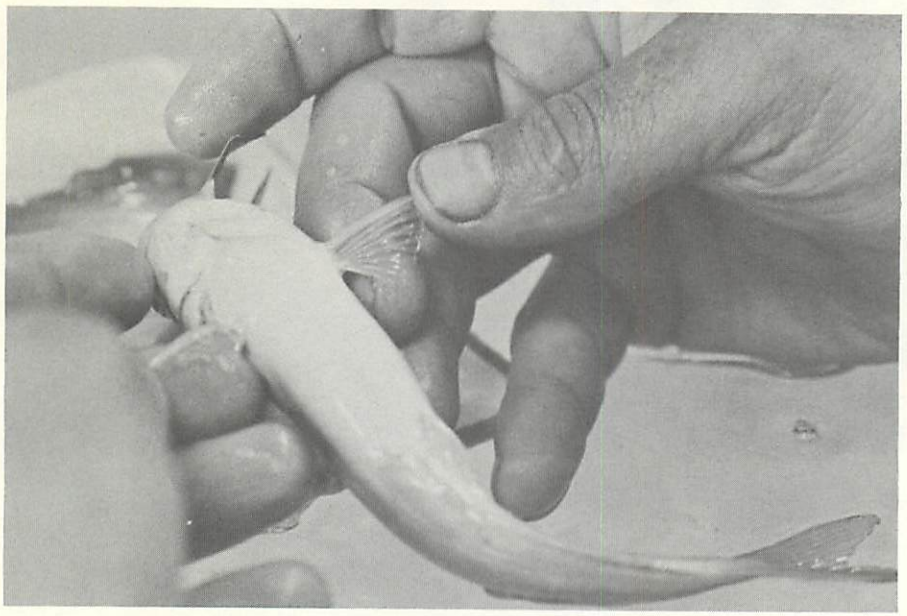
Researchers at Clemson University are experimenting with artificial spawning of red drum, *Sciaenops ocellata.* Red drum are an excellent sport fish and eventually may be raised in impoundments for commercial or recreational purposes. Although this project will not be supported by Sea Grant in the future, it is being continued under funding from other sources.

The marine organism *Amaroucium,* commonly known as sea pork, is being studied by Medical University of South Carolina cancer researchers. Extracts of the animal have been shown to act against lymphocytic leukemia, and Sea Grant research is aimed at identifying the chemical agents causing this activity. Preliminary chemical analysis of the freeze-dried material indicates a high protein (20%) and lipid content.

The South Carolina shrimp fleet inadvertently harvests large quantities of sea pork, but considers it a "trash" item. If the organism's medicinal use can be demonstrated, a new source of income for the fishery may be created, in addition to a new and important medical product.

To improve our knowledge of the species which South Carolina fishermen now harvest as cash crops, another Medical University researcher has prepared a histologic survey of healthy tissue samples from oysters, shrimp, clams and crabs. This file will be used by research and management personnel as an aid in identifying abnormal or diseased animals.

Biologists examine a small catfish *for signs of infestation by marine leeches.*



Biologists at the College of Charleston are investigating the blood-sucking marine leech *Calliobdella carolinensis,* which is infesting the Atlantic menhaden of some South Carolina estuaries in epidemic proportions of up to 100% infestation. The anatomy, life cycle, reproductive behavior and ecology of the leech have been studied for the past year. It was discovered that 65-78% of the menhaden caught in Charleston harbor were infested with from 1 to 348 leeches. The leech lays its eggs in March on oyster shells, and the young, which hatch in April, re-infest the schooling menhaden by hanging from the surface of the water in large numbers. Although the leeches do not kill the fish immediately, the possibility that they increase the incidence of fatal blood parasite diseases is being studied.

Research has suggested that increased siltation has led to the current epidemic outbreak by clouding the water and protecting the leeches from the sight of their natural enemies. The presence of the leeches may be used in the future as an indicator of dangerous levels of silt pollution.

Engineering Solutions to the Problems of the Sea

As the focus of our activities in the sea shifts from traditional hunting and gathering to include more aggressive and sophisticated means of utilizing marine resources, modern technology cannot be far behind.

This year, South Carolina Sea Grant sponsored two projects by faculty members in Clemson's Agricultural Engineering Department. The projects are designed to help bring commercial fishing in the state up to the level of technological efficiency enjoyed by the agriculture industry.

One project, a two-part survey, was undertaken to determine what the local oyster industry needs in the way of mechanical equipment. Then a survey of equipment currently in use in other parts of the country was conducted. The researchers will now try to match South Carolina's needs with the right machines, in some cases developing new mechanisms to fit local needs and conditions.

Labor shortages are predicted for this largely hand operated industry, as fewer and fewer young people become oyster pickers and oyster shuckers. It is hoped that, through research such as this, the South Carolina oyster industry can become more productive and meet the demands of a decreasing labor supply.

To provide a coordinated and unified attack on the problems of the oyster industry, this survey will be combined next year with the project on subtidal seed oyster development. These two projects will form the core of a new program titled "Revitalization of the South Carolina Oyster Industry". Future activities involving the oyster industry will be included as sub-projects within this new program area.

A second Clemson effort is aimed at improving product recovery and utilization in seafood processing. The sanitary disposal of processing wastes (such as shrimp heads and crab backs) is a big problem for many South Carolina seafood men. A way must be found to dispose of the waste materials without degrading water quality in nearby estuaries.

The Clemson researchers have already identified some specific waste management problems in several fisheries, and have compared approaches to solutions. Their work may eventually lead to new products made wholly from what was formerly thought of as waste material. The new uses for processing wastes will mean more money for the processor, and less water pollution for the public.

In the realm of ocean engineering and technology, civil engineers from Clemson are studying new methods for compacting and stabilizing diked dredge spoil disposal areas. South Carolina has literally thousands of acres of these unproductive spoil areas which are highly vulnerable to settling and shifting actions, and are therefore unsuitable for many types of construction. As a consequence, good high land is often given over to industrial uses when the land might be more suitable for recreation or conservation purposes.

In the last year, soil samples from several disposal sites were analyzed by Clemson's Civil Engineering Soils Laboratory, and planning was begun for a field test to compare methods for consolidating and densifying the spoil material.

Beach erosion will come under Clemson's scrutiny next year as researchers try to tackle the problem of serious localized erosion on private beaches.

Exploring the Marine World Around Us

In the field of environmental research, Sea Grant scientists at the University of South Carolina's Belle W. Baruch Coastal Research Institute have found that even sublethal concentrations of heavy metals such as mercury and cadmium can have harmful effects on the early life stages of many marine animals. Larvae of oysters, blue crabs and mud snails were exposed to a complex set of environmental conditions and pollutants, and then studied for changes in three physiological indicators. The indicators looked at were survival rate, metabolism rate and behavior patterns.

In all phases of the study, the pollution levels used were well below those found to have lethal effects on adult populations of the same species, and were within the range of pollution found in certain polluted South Carolina estuaries. Mercury was found to be more toxic than cadmium. Although metabolism and behavior are affected by both metals, the reaction is not necessarily the same.

In one case, the presence of heavy metals in the environment altered a larva's normal swimming pattern by constricting and shortening it. This naturally limited its food gathering range. Although the animal was not killed directly by pollution, its behavior was modified and it starved.

The researchers plan to expand their work into the whole question of genetic impact of heavy metals, in addition to studying the effects of the elements in combination, as they are often found in the natural environment.

In a related project, Baruch Institute biologists studied the decomposition of dead plant material within the salt marsh ecosystem. They were trying to estimate the amount of food material and nutrients supplied to the sea by the marsh.

They began by characterizing the bacterial components of the salt marsh ecosystem. The influence

of several environmental factors on protein degradation by estuarine bacteria also has been determined. The scientists have now mastered the technique of using ATP (a chemical component in the process which converts food energy to usable energy in all living organisms) to measure the amount of living microorganisms — microbial biomass — in an estuary.

Experiments underway now will measure the total flow of particulate organic carbon and living microorganisms in and out of a typical tidal creek. This type of information should help planners determine the long term energy contribution of the salt marsh to the overall natural system.

Also at USC, a pair of related projects deal with sedimentation and stratigraphy in South Carolina's estuarine zone. One study concentrates on the Santee River Delta. This whole system will soon undergo a drastic change when the U.S. Army Corps of Engineers rediverts a major part of the flow of the Cooper River back into the Santee system to prevent silting in Charleston Harbor.

The Sea Grant project on the Santee is producing essential predictive models of anticipated changes in sedimentation patterns, channel stability and other factors. Another geologist is preparing a faunal model of benthic animals and a water quality analysis of the same system. These models will be an invaluable aid in assessing the final environmental impact of the Corps' project.

The second research study is analyzing the bottom sediments of South Carolina's estuaries, marshes and continental shelf from Winyah Bay to the South Edisto River. USC geologists have gathered data on sediment origin, composition and distribution, and will compile all this information in the first bottom charts ever produced for this area. They are also compiling charts of surface and subsurface cross-sections of sediment and rock likely to be found in dredging or construction.

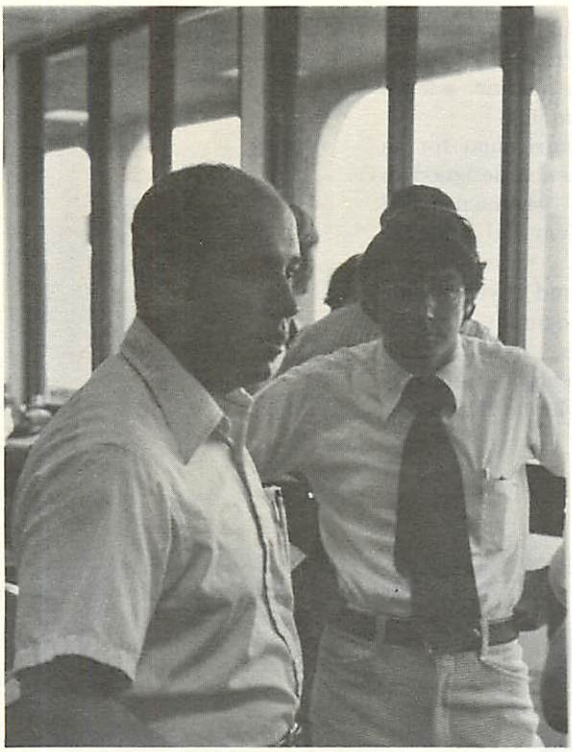
The effects of heavy metal pollution on the respiration of minute larval marine organisms are measured using a Cartesian diver respirometer.

MARINE ADVISORY SERVICES:

From the Laboratory to the People

Making the insights gained through marine research known to those who use the state's marine resources is one of the jobs of Sea Grant Advisory Services. In keeping with the multi-institutional character of South Carolina Sea Grant, the Marine Advisory Program is a joint project involving the Clemson University Cooperative Extension Service and the Marine Resources Center of the South Carolina Wildlife and Marine Resources Department.

The Program developed during the first year consists of two components — a marine information program and the person-to-person contact personnified by the Marine Extension Project. South Carolina's marine community serves not only as audience, but also as participant in the Marine Advisory



Program, providing constant input and feedback to aid in the further development of the program.

At mid-year Dr. Kenneth Roberts, a natural resource economist, assumed leadership of the Marine Extension component. A Marine Extension Specialist with Clemson University, his office is located in the Marine Resources Center to provide close contact with the people of the coast and Center personnel. In addition to relaying information to user groups and soliciting feed back, Dr. Roberts has fashioned an agressive program designed to attack the causes of problems confronting mariners (those who use the sea).

Through in-service training of Extension Service county agents, considerable progress has been made in bringing the county agents closer to the marine program. Marine Advisory Committees have been set up in two counties, and plans are underway for an industry-wide seafood conference to be held next year.

During the past year, Advisory Service activities have included seminars and workshops on the financing of commercial fishing vessels, development of income tax information for commercial fishermen, reputational surveys of the attitudes and problems of the marine community, and development of films and displays for sportfishing clinics.

The information arm of the Marine Advisory Program is under the direction of the Sea Grant Editor. Information services include a regular newsletter and periodic Advisory Bulletins. The Sea Grant newsletter "Fathom Line" provides a ready structure for disseminating useful information gained from research to the beneficiaries of that research. The Advisory Bulletin has been used effectively to reach specific audiences on specific subjects, and has provided printed support for extension programs. As results of Sea Grant research come in, a technical report series will also be established.

One of the more important functions of the information program during the early stages of Sea Grant activity was to compile a definitive list of the state's marine resource users. This file also allows for selective mailing to specific groups such as seafood dealers, educators, bankers, sport or commercial fishermen, and is utilized regularly by Sea Grant researchers and state agency personnel.

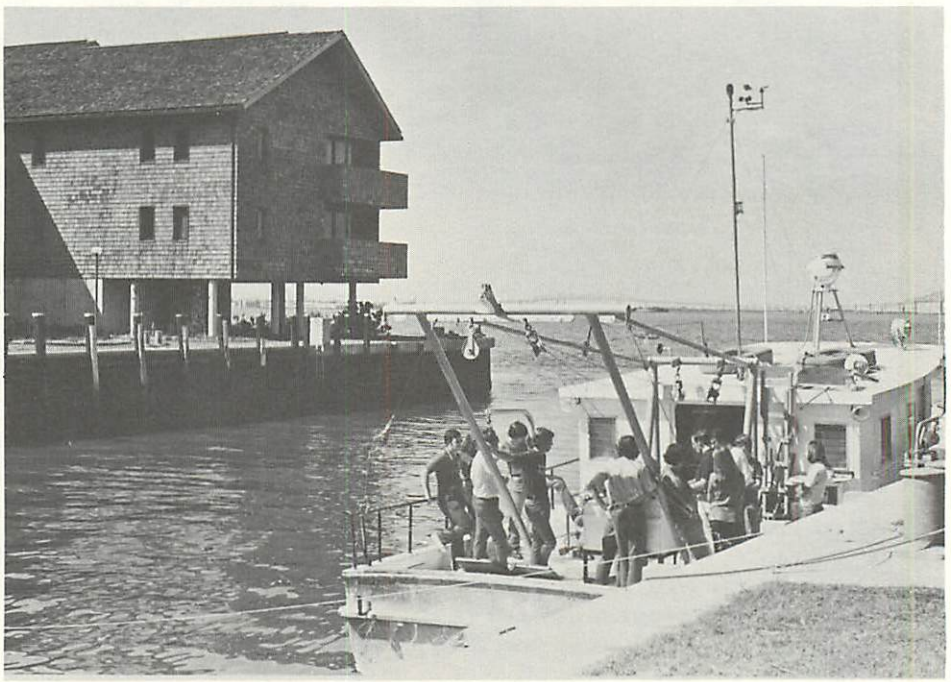
Because the hallmark of the Sea Grant concept is the practical application of knowledge gained through research, Marine Advisory and Information Services will continue to play a vital role in South Carolina Sea Grant.

EDUCATION

In addition to the educational and informational activities of the Marine Advisory Project, a College of Charleston biologist headed a marine science education project with Sea Grant funding.

The project involved planning curriculum for an adult evening course in marine science designed to help coastal businessmen, lawyers, fishermen, naval base personnel, and others whose lives and work are allied closely to the sea.

The course will be team taught and cover a wide variety of topics, including oceanography, invertebrate zoology, marine economics, and estuarine biology. The teachers include scientists from area colleges and the Wildlife and Marine Resources Department.



Margaret Pridgen

1972-1973 Sea Grant Program Budget

	NOAA Funds	Matching Funds
I. Administrative Project	$ 1,000	$
II. Advisory Services	25,000	21,230
III. Education	2,000	3,600
IV. Resource Assessment and Documentation	25,900	20,000
V. Marine Resource Utilization	54,300	35,400
VI. Marine Technology	26,000	12,000
VII. Environmental Research	78,600	43,400
TOTAL	$212,800	$135,630

	PROJECT	1972-73	1973-74
1)	Administrative Project	N	C
2)	Marine Advisory Services	N	C
3)	Course Development - General Marine Science	N	C
4)	A Program to Document & Assess the Marine Resources of S. C.	N	R
5)	Marsh Production and the Effects of Environmental Perturbation: The Physiology, Behavior, and Energetics of Larval Zooplankton	N	C
6)	Marsh Production and the Effects of Envirnomental Perturbation: Decomposers and Marsh Microbiology	N	T
7)	Marsh Production and the Effects of Environmental Perturbation: Sedimentation Bedform Analyses & Stratigraphy	N	C
8)	Santee Delta Faunal Model & Water Quality Analyses	N	T
9)	Sedimentary and Chemical Models of the Santee Estuarine-Deltaic Complex	N	C
10)	Utilization of Diked Disposal Areas in South Carolina	N	C
11)	Design & Development of Equipment for Aquacultural Mechanization	N	R
12)	Development of In-Plant Modifications to Improve By-product Recovery and Utilization and to Reduce Waste in Seafood Processing	N	T
13)	An Investigation of the Potential of Naturally Occurring Cultch-free spat of the American Oyster, *Crassostrea virginica*	N	C
14)	The Potential for Culture of Fresh Brackish Water Shrimp, *Macrobrachium*, in South Carolina Rice Fields	N	C
15)	Production of Red Drum *(Sciaenops ocellata)* for Sport Fishing and Food in Coastal Impoundments	N	T
16)	Population dynamics of the Atlantic menhaden, *Brevoortia tyrannus*, with special emphasis on its blood-sucking parasite	N	C
17)	Histologic Survey of Commercially Valuable Marine Organisms of South Carolina: Preparation of a Microscopic Reference Museum	N	T
18)	Isolation and Study of Antitumor Principle of *Amaroucium*	N	C

N - New C - Continuing T - Terminated R - Restructured