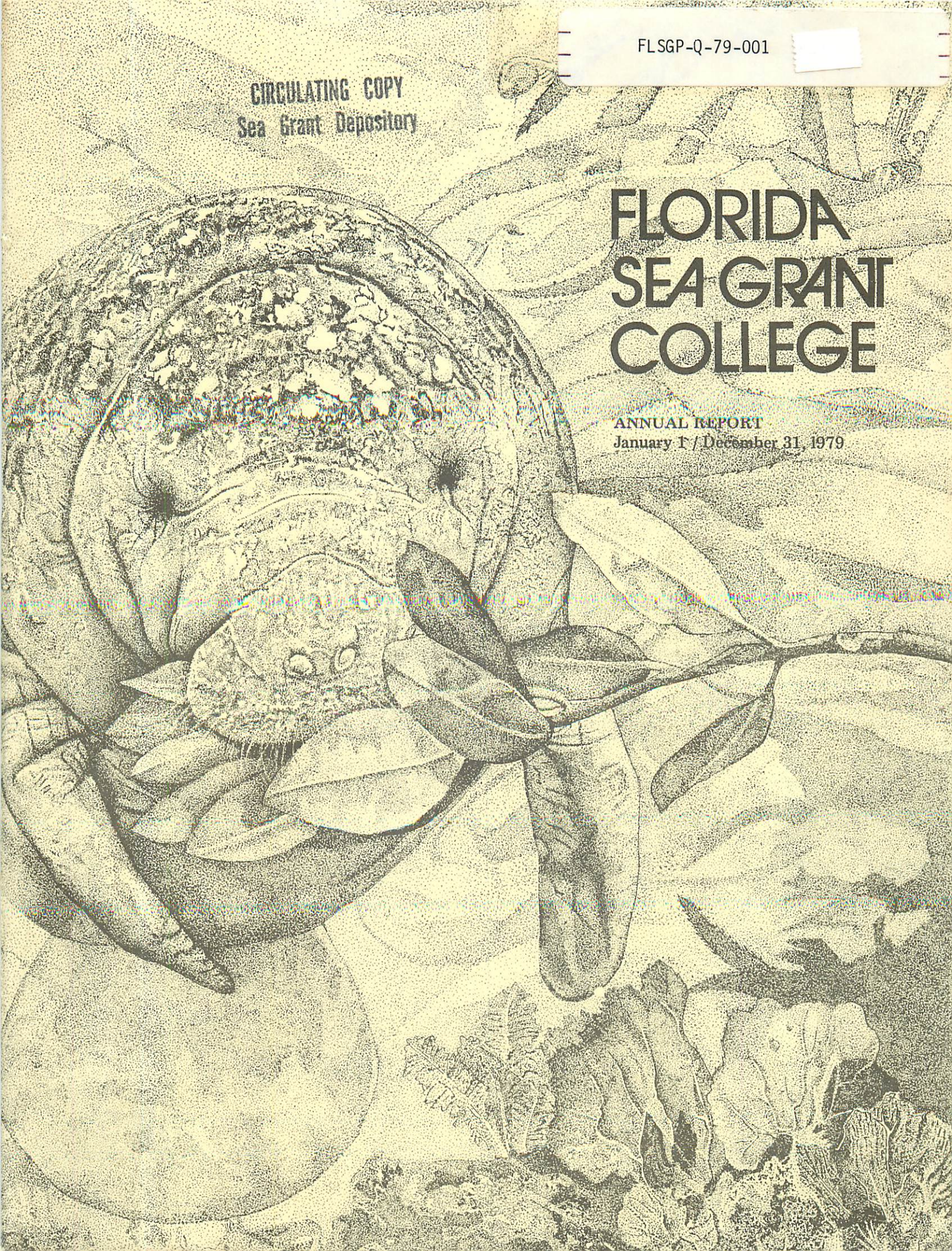

FLORIDA SEA GRANT COLLEGE

ANNUAL REPORT
January 1 / December 31, 1979

FLORIDA SEA GRANT COLLEGE PROGRAM — 1979

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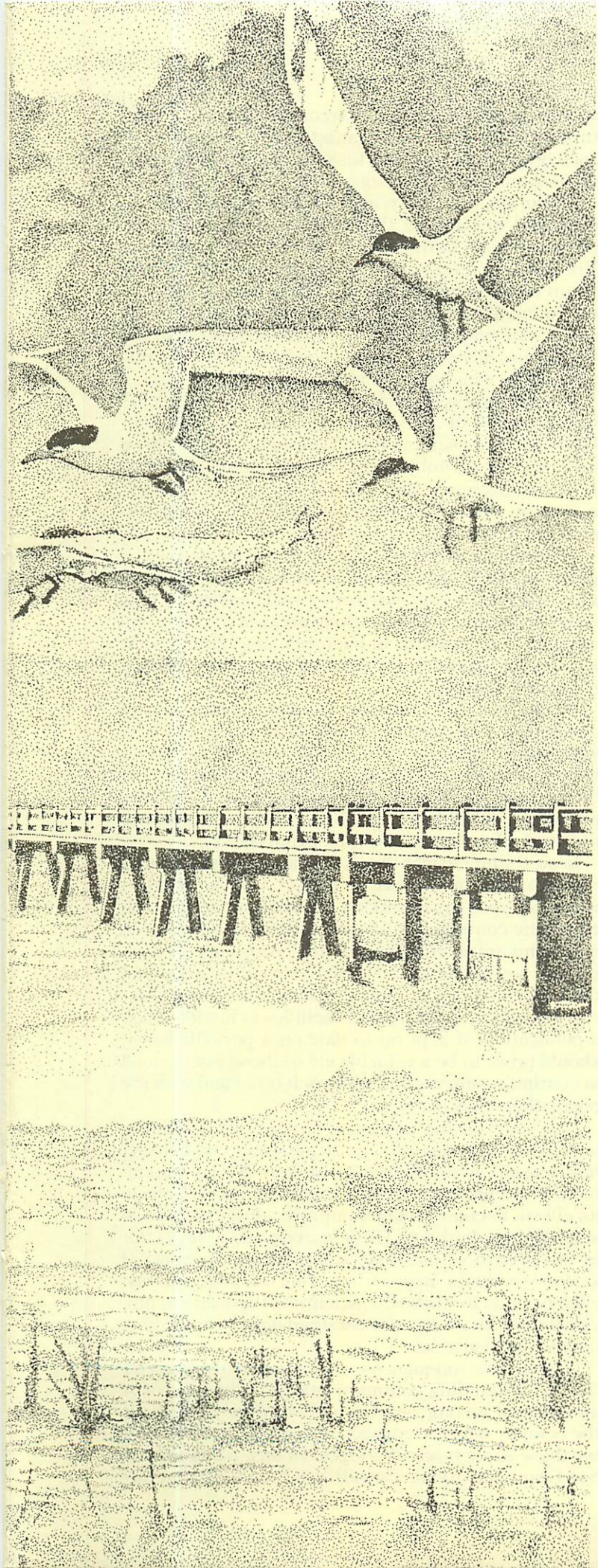


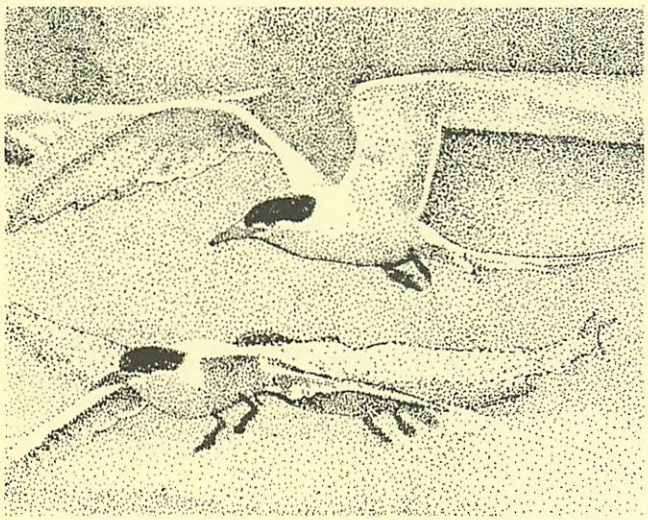
FLORIDA SEA GRANT 1979

"The way to get at the nature of an institution, as of anything else that is alive, is to see how it has grown."
—A. G. Keller

DIRECTOR'S STATEMENT

The year 1979 marks the end of eight years of existence for the State University System of Florida Sea Grant Program. During this period the fledgling program which began with just two of the state universities, Florida State University and the University of Florida participating, has grown to include not only the universities within the State University System but some junior colleges and private educational and research institutions as well. In 1976, just three years after we began, the program received the designation of a Sea Grant College. For 1980, we have scheduled research, educational, and marine advisory programs that, with combined federal and matching funds, total nearly $3,000,000.

During this time also, we have watched Florida's meteoric population growth, primarily concentrated in just 16 of the 38 coastal counties along the peninsula's 1,350 mile coast, and the resulting pressures on the State's saltwater resources. As part of the nationwide network of university Sea Grant programs we have worked to encourage the wise use and development of these resources including conservation, proper management and economic utilization.



Quite obviously, this is a task which no one organization could hope to accomplish alone or without the help of the great number of diverse organizations as well as user groups among the coastal population. Bridges must be built to and between these groups. Obviously, these bridges do not refer to actual steel and concrete structures but to communications bridges. Communication has to be established between Sea Grant and the coastal public, between Sea Grant and other federal agencies such as the National Oceanic and Atmospheric Administration and its branches and laboratories in Florida, to state agencies such as the Department of Natural Resources and Department of Environmental Regulation, their laboratories and personnel, and to the regional Fishery Management Councils. Communications has to be established, also, between Sea Grant and public and private universities, foundations, and other industries and between all of these elements as well, until what we have built is one giant interconnecting web of institutions and people cooperating with and supporting each other in the common task of responsible management of our marine heritage

In Florida, this past year has been a year specifically dedicated to building these bridges and shoring up those already built within our own organization. Bridges were reinforced between my office and the Sea Grant coordinators in the other state universities, between my office and researchers in those universities and private institutions, to the Extension Service, and the Marine Advisory Program coordinator and the marine agents who serve the coastal populations.

Subject area specialists through the marine agents were involved in a continuing communicative effort. Workshops and seminars held throughout the state on such specialized subjects as seafood technology, business management, and coastal zone problems were means by which communications bridges were constructed to the audiences we serve.

To assure a much broader base in considering the pressing needs that should be addressed, we reorganized the Sea Grant advisory panel, enlarging it to eighteen members from various areas of the state and representing expertise in business, community service, conservation, local government, trade associations, and research.

During the past year we also appointed a liaison committee composed of 15 selected Florida and U.S. government agencies both in and out of state. Members of this committee, interacting with members of the advisory panel and with researchers and advisory personnel of the Florida Sea Grant College, can assure the most effective use of our research dollars.

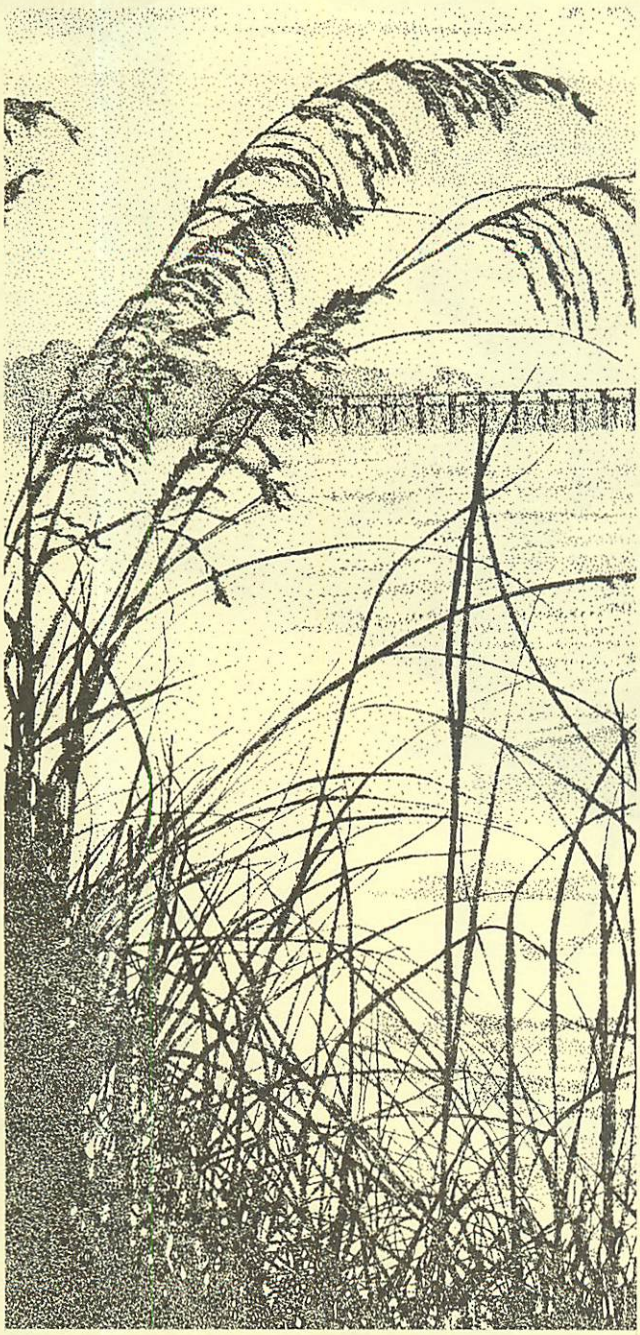
In an attempt to identify all educational and research organizations in Florida, a project was initiated in which all such organizations of which we had knowledge were contacted and requested to complete a brief questionnaire about their activities. Although the project will not be completed until next year we hope that the results will be a comprehensive directory of Marine Education and Research Facilities in Florida. Such a publication, if kept up to date on a periodic basis, should prove to be a valuable aid to those institutions in continuing interaction with each other and with the populations they serve.

Last year, for the first time, Florida Sea Grant, extended its expertise into another country and culture, half a world away. With a grant from NOAA we embarked on a project to assist the government of India in its efforts to construct and improve a large number of small fishing harbors. These harbors are a key factor in the growth of maritime trade including export of seafood products. Researchers from our program travelled to India to work with scientists there and to provide them with the latest coastal and harbor engineering technology available.

Despite the uniqueness of this particular project, the fact of building communications bridges is not at all unusual among Sea Grant Programs throughout the country who are engaged in building and reinforcing these same types of bridges. In fact, a hallmark of Sea Grant activity nationwide has been to help in fur-

thering the interaction of both user groups and service organizations to address applied problems.

In view of the special effort mounted by Florida Sea Grant College during the past year to reinforce our relationships with our counterparts and those we serve, it seemed most appropriate that we should be hosts at the annual meeting in October of the Sea Grant Association, the theme of which we determined would be "Building Bridges."

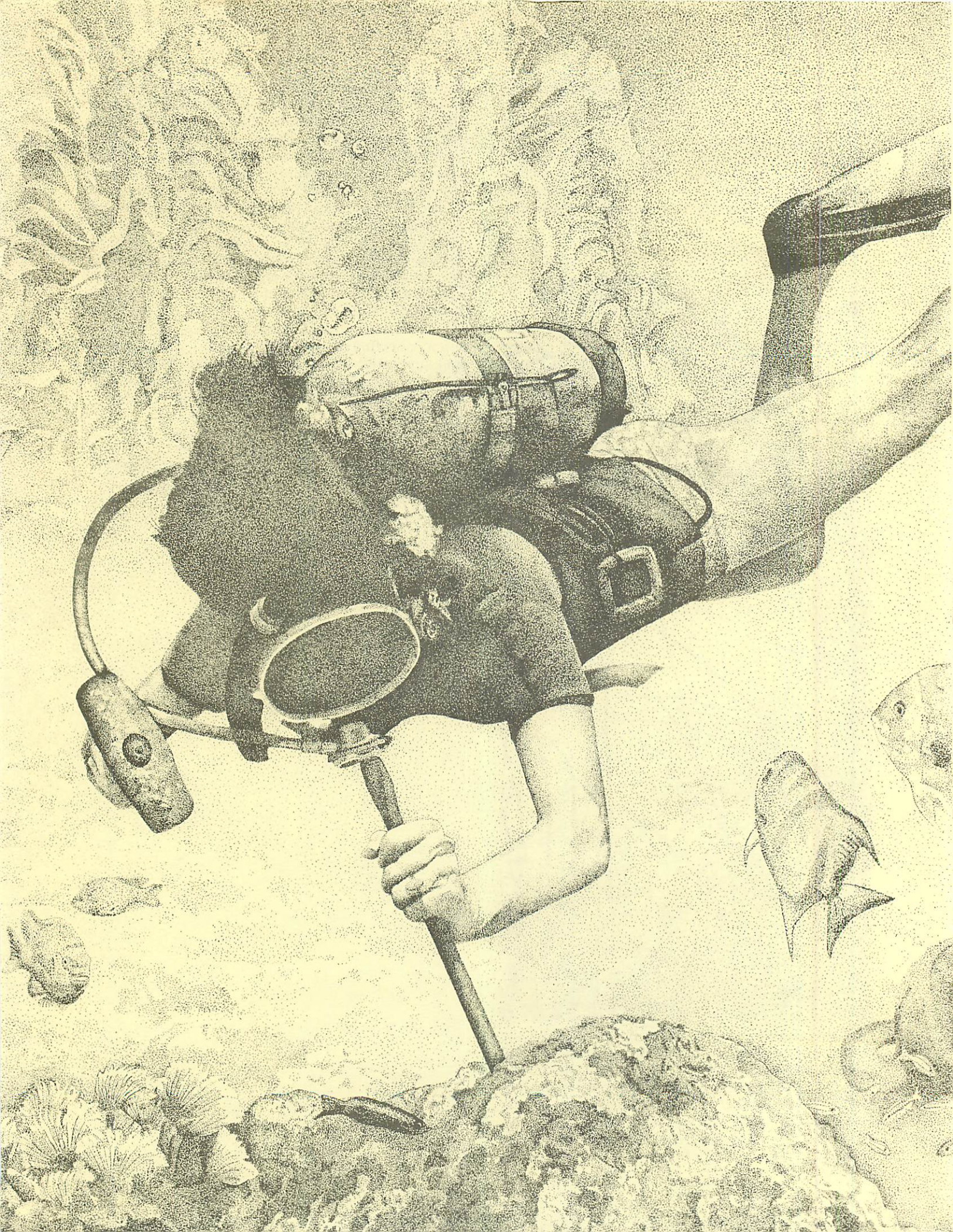


At that meeting we were priviliged to hear from many outstanding individuals in government, academia, and industry including Dr. E.T. York, Chancellor of the State University System of Florida, who through years of work in agriculture is intimately familiar with the Land Grant Program which precede Sea Grant by over 100 years. Russell C. McGregor from the National Association of State Universities and Land Grant Colleges provided an excellent blueprint for the future of Sea Grant through a detailed look at the experiences of the Land Grant Program which has many parallels to the Sea Grant concept. The conference was appropriately climaxed with an address by Congressman Don Fuqua (D. Fla.), chairman of the Science and Technology Committee in the House of Representatives, who focused the attention of the group on the future through a "bridge to new horizons."

But just as a chain is no stronger than its weakest link, so it is with organizations and people. As we enter the decade of the 80's we intend to continue to cooperate with other federal, state, and local agencies and institutions and to channel the energies and talents in the Florida Sea Grant College in such a way that this interconnecting network of bridges will remain strong and supportive as we continue to address the many problems concerned with the utilization and conservation of our state's coastal and marine resources.

Hugh Popenoe

Hugh Popenoe
Director



RESEARCH

"I felt as though I was standing in an immense amphitheater of blue. It looked hauntingly like pictures you see of the moon, but better because it's alive."

—Sylvia A. Earle,
"Exploring the Deep Frontier"

RESEARCH

Florida Sea Grant researchers are "bridge builders," too, although they probably don't think of themselves as such. The principal investigators and their assistants who are conducting research for the Florida Sea Grant College rarely work in isolation. While there may be some projects which, of necessity, confine the researcher to his laboratory or library for a major part of the research, most of them are in contact with coastal user groups either personally, or indirectly through marine agents.

In fact, there are many projects in which contact with constituent groups is actually a necessity for success of the project. Examples of this are previous research projects which studied blue crab migration and the biology of the Florida spiny lobster. Without the help of fishermen and others who helped to obtain the animals used in these experiments and who reported the taking of tagged animals later on, it would not have been possible to compile the data which are proving valuable in reaching management decisions on these fisheries.

The list of sponsors in the summary section of this report is some indication of the cooperation experienced by Sea Grant researchers but it is only part of the story. Not listed are hundreds of unsung "helpers" among the coastal public who through participation in local meetings, serving on county marine advisory committees, or simply working with marine agents and researchers involved in some specific research project in the area where they live, have contributed to the overall success of the Florida Sea Grant Program.

Florida Sea Grant principal investigators are continually reaching out to involve this vast group in their work, thus reinforcing the communications "bridge" to those whom the Sea Grant College seeks to serve.

COASTAL PROCESSES

Research in Coastal Processes embodies environmental factors and seeks to adapt or harness natural processes in acceptable ways. Included in this category is research in such areas as runoff, corrosion, saltwater intrusion, erosion, storms, and man-made pollution.

Specifically, research in this area during the past program year has included completion of several estuarine studies on Apalachicola and Hillsborough Bays, transplant of seagrass, beach and dune erosion, tidal inlets, fatigue of welded steel in sea water, salt tolerance of common ornamental plants, and hurricane evacuation problems.

Apalachicola Bay (R/EM 12, 13, and 14)

Apalachicola Bay represents one of the first areas of research funded by the Florida Sea Grant Program. Work has been conducted in the area for the past eight years beginning with a study on the impact of the pesticide Mirex when washed into the river upstream and its effect on fish populations in the bay.

These current projects, which are scheduled to end in 1980, concern coastal forestry practices and estuarine productivity with the goal of preparing guidelines for development of coastal drainage basins which create only minimum or no adverse impact on the surrounding aquatic ecosystem.

The results of an 8-year field program concerning background variation of physico-chemical (water quality) and biological factors in the lower Apalachicola drainage system have been completed and entered on computer tapes for analysis. These data include changes in water quality and various biological values such as macrophyte associations, detrital assemblages, benthic infauna, and benthic epifauna. Models are being developed to explain area-specific reactions of the Apalachicola estuary to forestry-related activities. These models will be integrated with engineering models so that an understanding of the hydrodynamics of the system can be applied to the biological impact analysis. Background climatological models have been developed which will be applied to the short-and long-term changes observed in the field. A series of ecological experiments with detritus-associated organisms has been completed and will form the basic background for the laboratory experimental program carried out over the past two years.

A series of laboratory experiments was completed to determine the effects of pH on the adenylate nucleotide pool and activity behavior of the Gulf killfish, *Fundulus grandis,* a common inhabitant of upland marshes surrounding the East Bay area of the Apalachicola estuary. The results indicated dose-specified (pH-related) changes in both the physiological and behavioral actions of this organism. Together with past laboratory studies, these data confirm the importance of changes in ambient pH in the upper bay to local aquatic populations. The impact analysis, when applied to the pH models and runoff water quality characteristics for the past 8 years, will allow an evaluation

of the impact of forestry activities in the upper East Bay drainage system (Tate's Hell Swamp) on individual populations and the community structure of aquatic assemblages in East Bay.

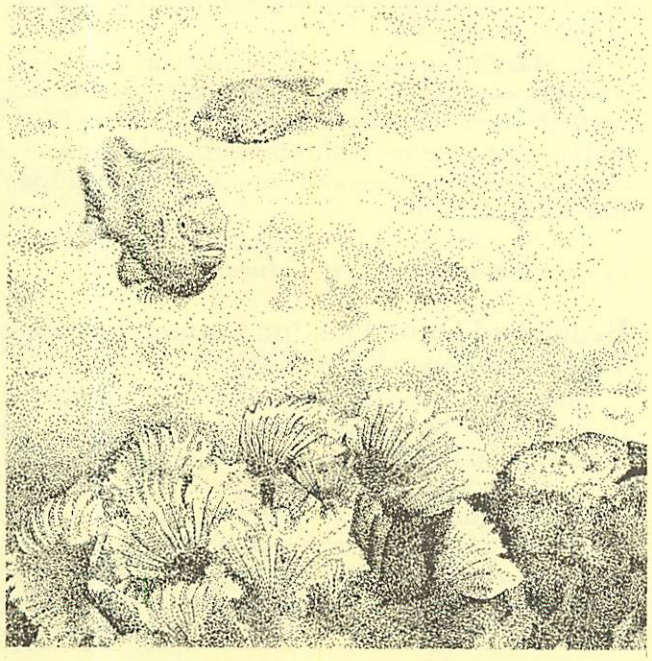
A series of experiments was completed to determine the response of microcosms of detritus-associated organisms to swamp-water runoff. Once again, a dose-specific relationship was established between such organisms and levels of upland runoff. These experiments are currently being compared with the results of the 4-year field experimental program in the Apalachicola estuary so that the final integration of the biological and hydrological models can be achieved. With the completion of these integrated models during 1980, the data can then be integrated into current economic studies by Sea Grant investigators.

During the summer of 1980, a final run will be made concerning system-wide productivity features of the system. Such analysis will add another dimension to the final product of these completed Sea Grant Projects, and will be part of a broad approach to the management of seafood resources in the Big Bend area.

In September 1979, the Apalachicola River and Bay Estuarine Sanctuary was established with a six-member advisory board appointed to serve sanctuary activities.

The results of this total research effort, together with the critical habitat assessment, will be integrated with a statewide effort to develop a local management plan for the area. These data will also serve as the scientific basis for an ambitious new program that will involve various local, state, and federal interests in the Apalachicola River and Bay Estuarine Sanctuary.

The final Sea Grant Report based on this project will be used both as an impact assessment for local forestry activities in the Apalachicola drainage system and as the basis for the development of a major management program as outlined in the projected plans of the Apalachicola River and Bay Estuarine Sanctuary. It is anticipated that the immediate user benefits in the Big Bend area of north Florida will be extended to nation-wide programs which will integrate scientific research and management initiatives through the Estuarine Sanctuary Program.



Hillsborough Bay (R/EM-7)

This year marked the completion of detailed studies regarding the effect on Hillsborough Bay of the introduction of an advanced (tertiary) wastewater treatment (AWT) plant in Tampa. The study has been concerned with identifying any definite changes in the estuarine environment of the bay as a result of the removal of a major point source of pollution.

Continuous pre-AWT data on water quality and bottom-dwelling infaunal invertebrates has been documented and any changes noted since the full tertiary operation was started in September 1978.

Data from this study have been given to the U.S. Environmental Protection Agency for use in their environmental report on the Facilities Planning Process on the City of Tampa and Hillsborough county's wastewater disposal problems. Information has also been given to the Tampa Port Authority, Army Corps of Engineers, Southwest Florida Water Management District, and the Tampa Bay Regional Planning Council.

Matching funds, data and personnel for this long-term project have been provided by the **City of Tampa** and the **Hillsborough County Environmental Protection Commission.**

Landscaping With Salt Tolerant Plants

In a project related to Salt Tolerant Plants (R/CP-4), Florida Sea Grant College funded publication of a report, "Salt Tolerant Plants for Florida Landscapes" (Sea Grant Report 28). This publication discusses the environmental stresses which threaten plants in the coastal zone, most hazardous of which is related to soil salinity.

The author points out that the expanding urbanization of Florida's coastal areas during the past decade greatly increased the construction of homes, condominiums and commercial establishments and created a subsequent need for landscaping to solve both aesthetic and functional problems. But the coastal environment is not always kind to the many varieties of plant materials with the result that often plants never live to perform the function intended.

To overcome this problem, the report recommends using ornamentals that are salt tolerant. The publication contains pictures and descriptions of 67 of the more common salt tolerant ornamentals as well as a list of hundreds of species of trees, palms, shrubs, dwarf shrubs, vines and ground covers along with their salt tolerance level, type of soil and drainage needed, and the climate zone where they are best grown.

Salt Tolerant Plants (R/CP-4)

To study and identify the salt tolerance of the most commonly grown turfgrasses and foliage plants, turfgrasses were grown in sand and supplied varying levels of salt at every irrigation. A solution culture

technique was used to access the salt tolerance of foliage plants.

Salinity levels for foliage plants and turfgrasses were provided by sodium chloride or artificial sea salts. Reduction in plant growth measured by changes in plant height or dry weight and plant visual quality grades at experimental termination were related to increased salinity levels.

Of the turfgrasses, St. Augustine and Bermuda were found to be the most salt tolerant. The plants produced reduced growth and dead shoots at the highest salt levels but were not killed. Bahia and Centipede, however, were sensitive to salt with Bahia being killed at the middle salt levels. Centipede was slightly more tolerant of increased salt.

Foliage plants exhibited similar symptoms of salt stress beginning with a general plant stunting. Gray-green leaves, increased succulence and death were further signs of stress. Most salt tolerant was the Chinese evergreen, followed by the Boston Fern, Dragon tree, Pothos, Philodendron, Ti Plant, Norfolk Island Pine, Weeping Fig and Zebra Plant.

Final data are being analyzed and reports of the results have already been presented at national meetings of the American Society for Horticulture Science and the American Association of Agronomists.

Matching funds for this project were provided by **W.R. Grace Company, Mid-Florida Mining Company,** and **Verlite Company.**

Glossaries of Tidal Inlets in Florida (R/OE-11)

The sixty odd inlets connecting Florida's inner waters to the Atlantic Ocean and the Gulf of Mexico are important from consideration of recreational and commercial vessel traffic and also because they provide small boats access to safe refuge during unexpected severe weather and waves. In addition, inlets act as flushing agents, providing renewal of bay waters by exchange with outer continental shelf waters.

Unfortunately, inlets also contribute significantly to the serious beach erosion problems prevalent along most of Florida's shoreline. These factors, along with the interesting historical role that inlets have played in the early development of Florida have resulted in considerable but scattered documentation pertaining to the major inlets of the state.

The objective of the study was to compile information on six commercially important and problematic tidal inlets in Florida, and to publish the information as a series of "Glossaries of Inlets" reports. The purpose of this series is to provide for each inlet a summary of the more significant available information and to list known documentation in order to yield an improved understanding of the overall effect of the inlet on the economics, recreation, water quality and shoreline stability of the surrounding area.

Previously, glossaries were published for St. Lucie, Fort Pierce, Sebastian, Ponce de Leon, and Matanzas Inlets and for Johns Pass and Blind Pass. Each of these glossaries summarizes known documentation on the inlets in a specific format and has chapters on the geological setting, climate and storm history, history of the inlet including engineering works, morphological changes, hydraulics and sedimentary characteristics. The glossaries are produced and distributed by Florida Sea Grant College and are also available through the Coastal Engineering Archives, University of Florida.

Inlets included in the present project and for which glossaries are in various stages of preparation are:

Sikes Cut — This is a small man-made inlet connecting the Gulf of Mexico to Apalachicola Bay in Florida's panhandle. It is utilized heavily by shrimp trawlers. Data from the Sikes Cut study are being analyzed to help calibrate a mathematical model of Apalachicola Bay.

Fort George Inlet — This entrance occurs immediately north of the St. Johns River Entrance on the Atlantic Coast and connects the ocean to the Fort George River. In recent years there has been a severe erosion problem along the northern bank of this inlet. Information in this study has been used by the Corps of Engineers in the design of a protective measure against further erosion of a road on Little Talbot Island.

Canaveral Harbor Entrance — This entrance occurs south of Cape Canaveral. Its commercial importance arises out of its role as a part of the navigation channel to Port Canaveral and the naval base. This study is expected to familiarize engineers and geologists with the shoaling problem in the channel.

Big Hickory Pass, New Pass, and Big Carlos Pass — These three contiguous inlets occur on the lower Gulf coast of Florida. Big Hickory Pass is now closed. This has resulted in a water quality problem in the waterways behind the inlet due to reduced flow circulation. The three inlets have been studied together because of their proximity to each other and because the coastal environments in which they exist are similar. This study has been used by engineers to determine the effect on Estero Bay caused by the recent closure of Big Hickory Pass.

St. Mary's Entrance — This inlet on the northern Atlantic coast of Florida is a large tidal inlet which connects the ocean to the tidal waterways both in Florida and Georgia. Interest in this inlet arises because of recent expansion of the naval submarine base in King's Bay north of the inlet.

Matching funds for this project have been provided by the **Florida State Legislature.**

Beach and Dune Erosion Caused by Storm Tides and Waves (R/OE-8)

This is the second year of a study designed to develop the capability of predicting the magnitude of beach-dune erosion under a specific surge elevation caused by a storm. The main factors involved in the highly complex nature of erosion processes are the dynamic factors which include increased water level and wave activities along with the existing physical factors of beach-dune elevation, foreshore and offshore slopes, beach width, and beach-dune material composition.

profiles before and after a storm, with the field data employed as a basis for verifying or refining the results deduced from analysis and experiments.

The project has involved a combination of laboratory experiments and field measurements of beach-dune

Final results from this project, which is scheduled to be completed in 1980, will be of direct benefit to the state of Florida in implementing the Coastal Construction Control Line. The accumulated data will also be important for beach nourishment projects, for coastal zone management and for education.

Seagrass Transplant (R/EM-10)

Seagrass transplants can be used to manage estuaries in the same way that forest management involves transplanting trees. However, the normal agricultural techniques do not apply and new techniques designed to overcome problems created by underwater environment must be followed.

Objectives of this study, which was completed this program year, were to test methods for transplanting the seagrass, *Ruppia maritima,* determining the most suitable time of year for transplanting, and correlating physical and chemical environmental factors with transplant results. The growth rate of natural *Ruppia* beds, and the physical and chemical environment of these beds were also to be determined and culture techniques developed.

Accumulated data indicate that *Ruppia* can be transplanted with plantings made in March, April and May. It has also been learned that addition of nutrient pellets to the substrate below the transplants does not increase growth or improve the rate of success.

The development of transplant techniques and information about environmental conditions will assist agencies managing the estuarine ecosystem.

Fatigue of Welded Structural Steel in Sea Water

Fatigue at welded tubular joints has been determined to be critical with regard to the strength of offshore structures in deep water or rough sea. As a result, numerous ocean structures will experience periods of high stress during their design lifetime.

Most experimental data developed to date is in the lower stress cycles. The purpose of this research has been to develop sea water fatigue data in the high cycles and thereby contribute to improved design of marine structures.

The fatigue tests have been performed on relatively large, welded plate specimens. All of the variables were selected to approximate as closely as possible the conditions which exist at welded joints of offshore structures. As a consequence, data has been developed which extends from one to two orders of magnitude greater stress cycles than what was previously available. These data are consistent with the appropriateness of the AWS-X Modified Design curve for mitigation of fatigue failure under freely corroding conditions in the high cycle range and indicate that the AWS-X curve is an appropriate design criterion for mitigation of high cycle fatigue failure but may not be appropriate for the freely corroding conditions.

Also, limited data suggested that relatively small undercutting at the weld toe causes failure in fewer cycles than predicted by the AWS-X design curve. However, AWS-X Modified curve is still appropriate for fatigue design with undercutting of this size.

COASTAL DEVELOPMENT

Coastal Development projects are primarily technological and commercial aimed at enhancing marine economic productivity, developing commerce and industry, promoting new business, and solving coastal development problems. For example, included in this category is research on coastal construction, ships, reefs, canals, marinas, seawalls, groins, housing, and Florida's burgeoning tourist industry which directly influences construction in coastal areas.

Specifically, research in this area during the past program year includes two marine studies — a legal analysis concerning siting of recreational marinas and engineering design criteria for small craft recreational marinas in Florida. Commercial and economic studies involved an analysis of the Apalachicola Bay coastal area economy, a study of economic change in Florida's coastal counties, and an assessment of Florida marine trades law and standards. Another study investigated the possibility of divers navigating acoustically if they suddenly become functionally blind while underwater.

Legal Aspects of Recreational Marina Siting (R/CP-6)

With nearly 500,000 boats of all types registered with the Florida Marine Patrol, and at least 600 marinas, the boating industry represents a tremendous economic factor to the state of Florida. The practicality of owning and operating a pleasure boat, however, is often dependent upon the availability of the essential services provided by a local recreational marina. As a result, the demand for marinas in Florida is probably greater than in any other state.

To reconcile the state's need for adequate marina services with the ever-growing concern for the environmental impacts of coastal development, the siting and construction of recreational marina facilities must be accomplished in a well-planned manner that does not indiscriminately sacrifice valuable coastal resources.

In this project an overview of the existing laws applicable to current marina developments in Florida and how they are administered was accomplished and the statutory framework evaluated as to its actual and potential effectiveness in balancing the need for more recreational marinas with environmental imperatives.

Along with this, coastal zone management planning efforts to date in Florida have been examined and compared with coastal planning in other states with regard to recreational marina siting considerations. The guidelines and policies recommended in the final report can serve as one component of a comprehensive coastal zone management plan for use by coastal communities.

Also addressed in this project are such related topics as the leasing of State submerged lands and marinas on artificial waterbodies. The project has compiled in one report much of the information required by local legislators, planners and regulators to understand the applicable law and management alternatives for the siting of recreational marinas. While the report focuses on Florida law, it is anticipated that it will be useful to management personnel in the other coastal states as well.

Information developed in this report will be incorporated in the recommendations of the governor's Charlotte Harbor Resource Planning and Management Committee which has been appointed to study the land use and environmental problems facing Sarasota, Charlotte and Lee counties in Southwest Florida.

Small Craft Recreational Marinas in Florida

This study, which is programmed for one year, has two components, a coastal engineering data base and an environmental data base.

Data for the coastal engineering data base study are being carried out in two stages, the first to establish a comprehensive data base to develop an overall picture of the kinds of marinas in Florida and their available facilities and the second to identify the major engineering problems of coastal marinas. Questionnaires were used in both stages of the data collection.

The questionnaire used in the data base survey was designed to provide information on marina characteristics such as location, size, type of ownership, and available services. It was mailed to 633 marina and boatyard addresses and after two mailings 282 responses were received. A third attempt is being made to contact non-respondents personally through marine advisory agents.

The questionnaire for the survey of engineering problems which was designed to provide information on such items as tide and wake activities, materials used for dock construction, and problems due to siltation, and construction materials was mailed to a random sample of 109 marina operators. The sample was selected by stratifying (according to the region of the state) the 282 respondents to the first two mailings of the data base questionnaire. Only coastal marinas with wet slips were included in the sample.

Response to the first mailing of the engineering questionnaire was about 40%. Percentage of the second mailing of the questionnaire along with an attempt to directly contact the non-respondents by the marine agents is unknown at present.

Even though the two surveys are not completed, a preliminary analysis of the data base survey shows several interesting results. For example, while 88% of the marinas have wet slips, the corresponding percentage for dry stack slips is only 37%. More than 90% of all the marinas have a maximum vessel ft. capacity of less than 100 ft. A majority (72%) of marinas are on a bay or river and are privately owned and operated (88%).

Some marina problems identified from the engineering survey are as follows: 1) Materials deterioration and construction, 90%; 2) Siltation, 75%; 3) Boat wake damage, 45%; 4) Storm inundation, 35%.

Materials and construction problems included: 1) Deterioration of pilings (timber and concrete), 70%; 2) Seawall deterioration, 35%; 3) Obtaining permits,

30%; 4) Deterioration of docks, 15%; 5) Floating dock problems, 10%; 6) Electrical equipment and wiring, 10%; 7) Corrosion of pipes, hardware and buildings, 10%.

Several user groups have expressed interest in the work. Among these are the Department of Environmental Regulation of the State of Florida, the Florida State Committee on Natural Resources and Conservation, the Tidewater Administration of the Department of Natural Resources of Maryland and the Cooperative Extension Service of the Marine Advisory Program in Alaska.

Outside financial assistance for this project has been received from the **Marine Industries Association of Florida, Inc.** and the **Florida State Legislature.**

Assessment of Florida Marine Trades Law and Standards

The primary purpose of this project was to develop an inventory of the laws of the State of Florida relating to the marine trades and secondarily to survey members of selected marine trades to obtain their perceptions concerning the adequacy of the standards expressed in the state laws.

Initially, it was envisioned that the selected marine trades would be those of vessel design, vessel construction, and vessel surveying. At the conclusion of the compilation of marine trade laws of the State, it was determined that Florida did not have any statutes addressing the professional standards of vessel design, construction, or surveying.

The U.S. Coast Guard regulates design and construction and is responsible for the development, publication, and enforcement of vessel manufacturing standards. Within the industry, there is also a nonprofit organization that develops voluntary standards and guidelines. Founded in 1954, the American Boat and Yacht Council developed safety standards and recommended practices for designing, building, equipping and maintaining small craft, both pleasure and commercial. Their standards are published in five major categories — hull, machinery, electrical, equipment, and engineering, and are considered by many in the boating industry as the criteria in the field.

Vessel surveying to determine if a given vessel is suitable for the purpose intended is currently not regulated although there is a national Association of Marine Surveyors which requires the passing of a written examination and at least five years of surveying experience to become a member. Some Florida vessel surveyors are members of the association and others are not.

Also selected for study, because the inventory of marine trades laws revealed the existence of statutes or regulations affecting these groups, were harbor pilots, harbor masters, boat dealers, and stevedores.

Harbor pilots were divided on questions of the adequacy of the State Board of Pilot Commissioners, half of those responding feel the board was functioning well, the other half feel that pilots should be under local control. Some harbor masters contacted also expressed a desire for the harbor pilots to be placed back under control of the local port authority to give the port authority control over the charges and hence the attractiveness of its port and because the local authority is more familiar with the requirements to pilot a ship into its port.

Many stevedore companies are now doing a great deal more than loading and unloading cargo, the study revealed. Some indicated this was necessary to expand their operation in order to stay in business.

Boat dealers surveyed in general felt the standards for boat construction and safety equipment were adequate.

The researchers conclude that: 1) the development of the inventory of state and federal statutes and regulations related to the marine industry should provide considerable assistance to those trades which need a guide to the laws that affect them; 2) that further study is needed in the area of Special Acts Legislation, for example, many rules and regulations governing commercial fishermen and other trades are enacted by local communities under authority delegated to them by the legislature by Special Acts Legislation with the result that no uniform or coherent policy exists throughout the state; and 3) that although the U.S. Coast Guard does have some regulatory responsibility in the area of design and construction, it appears that there needs to be some additional regulation to protect the consumer at the point of sale which would include surveying the vessel. The most immediate need, in the opinion of the researcher, is for a meaningful yacht and ship broker regulation which would provide the consumer some protection while the matter of a possible marine surveyor regulation is examined. 4) that a further study of pilotage rates at various ports be made since requirements vary considerably from port to port and it may be more desirable to allow the rates charged to be established at the local level by the port authority or its counterpart.

Acoustic Navigation by Divers (R/OE-15)

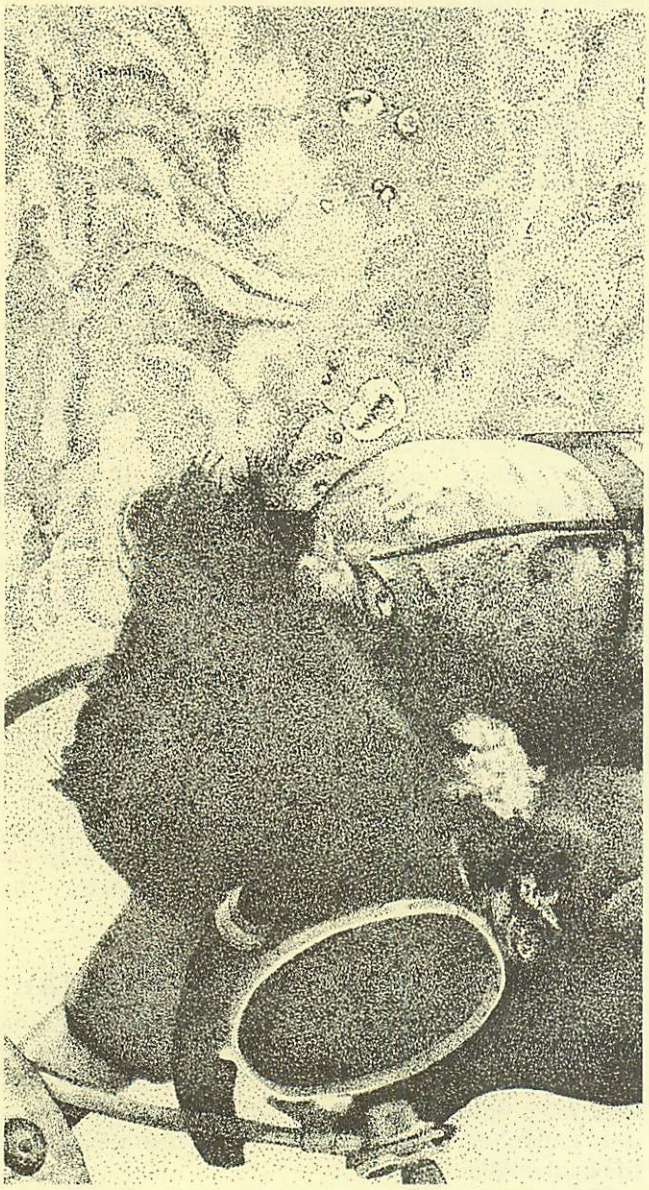
A diver depends on his visual system for navigating and keeping in touch with other members of the diving team. However, quite often a diver is functionally blind and relies on an underwater compass to navigate by dead reckoning — a method that has sometimes proven to be unsatisfactory.

The purpose of this project, which is scheduled for three years, is to investigate another type of sensory method, in this case utilizing the diver's sound localization abilities. This research is aimed at determining the most appropriate and powerful acoustical signals and the best mode for their penetration as well as conducting experiments to determine the type of equipment that is most effective especially with respect to a variety of environments.

Work during the first year of the project included gathering data to determine the stimuli/procedures that will provide divers with the optimal acoustic navigation "target." This was accomplished through the testing of three major variables and carrying out a series of procedures to discover those elements within the overall procedure that are most important such as

nature/frequency of the stimulus, configuration of the emitter array, and temporal characteristics of the signal.

It is anticipated that phase two of the project will begin with experiments on signal intensity and band width.



Structural Analysis of the Apalachicola Bay Coastal Area Economy (R/CP-5)

The purpose of this research was to provide economic support for another Florida Sea Grant project concerning coastal forestry practices and estuarine productivity (see Coastal Processes). Objectives were: 1) To analyze historical patterns of economic change in the study area; 2) To analyze existing industry composition, delineating important interindustry relationships, and estimating income, employment, and output multipliers for the major sectors; 3) To determine additional economic value measurements required to accomplish the economic related goals of the other project.

During the year, operational models were developed for use in a six county area around Apalachicola Bay. The first model provided a systematic way of looking at past economic trends while the second provided information on the structure of the local economy. This model also provided detailed employment, output, and income multipliers which may be used in various types of economic impact studies for the area. The details of these modeling procedures and the results obtained are scheduled to be published during 1980.

This work led to efforts in two other areas — a master's thesis to be completed during 1980 dealing with the Apalachicola Bay oyster industry and research dealing with the determination of Apalachicola Bay amenity values from an analysis of area real estate sales. The thesis will update an earlier supply-demand analysis of the oyster industry and attempt to further incorporate biological information into the analysis.

Economic Change in Florida Coastal Counties

The overall objective of this project was to examine historical patterns of economic change in the coastal counties of Florida for the purpose of identifying types of economic activity which are unique to coastal areas. Specifically, the study sought to identify changes over time in industrial composition in each coastal county relative to changes in industrial composition for the state as a whole as well as for the nation and to identify industries in which coastal counties have an apparent comparative advantage.

Data were collected on employment for 80 separate economic activities in each coastal county of Florida for the years 1965, 1970, and 1975. A model was used to systematically compare changes in each type of activity in each county to the state as a whole and to the nation. For purposes of comparison, data were also collected for non-coastal counties.

Detailed results which are scheduled to be released in published form in 1980 will provide researchers, resource management agencies, and public officials with a detailed assessment of the economic performance of counties in Florida relative to state and national averages.

Artificial Reef Resource Team

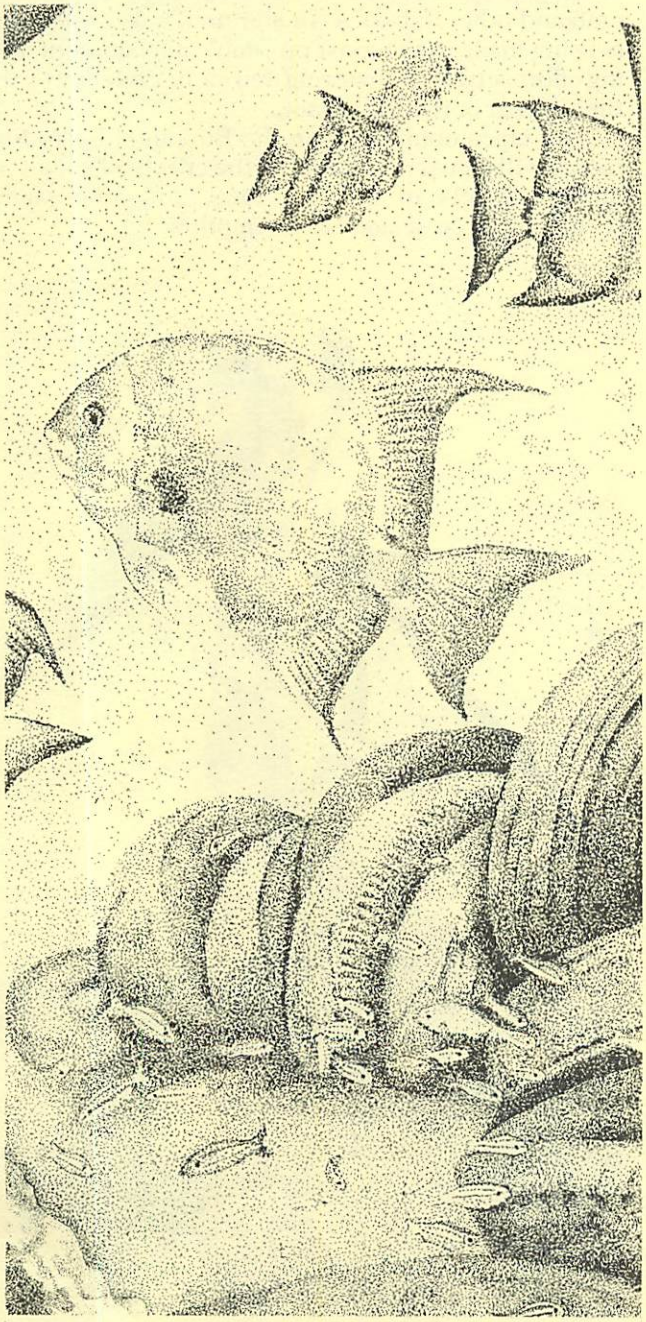
As most fishermen know, one of the big attractants of fish are reefs, the natural ragged bottom structures with heavy grass and coral growth which provide food and habitat for both forage and game fish. The problem is that quite often those natural reefs are located in rather inaccessible places, out of reach to the fishermen with a small boat and an inexpensive compass who can't safely venture too far out.

As a result, an exciting development for sport fishermen in the last decade or so are artificial reefs constructed of discarded automobile tires and bodies, culverts, old concrete structures, sunken ships, and other types of scrap material. Constructed offshore, usually by coastal communities or fishing clubs, these reefs are located so that they do not interfere with large ship navigation or commercial fishing activity, yet are

only a few miles out and well within the reach of the small angler.

To help municipal and private groups establish an artificial reef building program, an Artificial Reef Resource Team is funded by Florida Sea Grant College. The team is based in Pinellas County and has helped interested groups throughout the state with permits, buoy construction, and other problems involved in starting and administering reefs.

During 1979, the team assisted the Hillsborough County Solid Waste Department in selecting several reef sites in Tampa Bay, worked with a local group in Stuart in locating two sites in that area, helped Charlotte County select reef sites off Boca Grande, and selected two prospective reef sites for the middle Keys area. The team also did permit dives at Crystal River but was unable to find a suitable reef site there.



The Reef Resource Team not only assists in site selection, but when a suitable site is located they write the biological reports required by state and federal permitting agencies. Once permits are obtained the team can also assist in design of buoys, evaluation of the fish populations attracted to the reef, evaluation of the overall economic impact of the reef on the local area, and can help with problems that arise in administering the artificial reef program.

Reef Atlas

Although each artifical reef location is marked with a buoy painted in lateral 6-inch wide white and international orange stripes, it is difficult for a fisherman to find a particular buoy out on a broad expanse of water if he doesn't know where to look.

The reef atlas, "Recreational Use Reefs in Florida — Artificial and Natural," published in 1979 by the Marine Advisory Program, goes a long way in helping the fishermen solve this problem.

Shown in the Atlas are the locations of 146 artificial and 185 natural fishing and diving reefs off the Florida Coast. Location is given by longitude-latitude coordinates and distance from the nearest land projectory. Also listed is the depth of the reef and the type of material from which it is composed. To further aid the fisherman, the atlas contains a listing of local information sources around the state and some available local maps which provide even more detailed information about reefs in particular coastal areas.

LIVING MARINE RESOURCES

The Living Marine Resources category is biological in nature, focusing on the use and husbandry of renewable resources and their productivity and the economic and technological processes applied after harvest. Included in this category is research in aquaculture, fish harvest, seafood processing and distribution, economics of the fishing industry, fish populations and biology, and recreational fishing.

Projects under investigation in this area during 1979 were an economic analysis of commercial fishing and seafood marketing, management and biology of the northwest Florida snapper-grouper, tournament angling for swordfish in Southeast Florida, spiny lobster larval recruitment in the Florida Keys, seafood patties from underutilized fisheries and improved fish smoking with a combined solar dryer and smoker.

Short term, pilot and demonstration projects included studies on the development of a soft crab fishery in Florida, trash fish as stone crab bait, commercial fishing port development, heavy metals in selected species of sharks, bibliography of Florida snapper and grouper, and a demonstration of seafood processing equipment.

Spiny Lobster Larval Recruitment in the Florida Keys (R/FR-10)

The principal objective of this project has been to ascertain the patterns of planktonic phyllosome larvae of the spiny lobster, *Panulirus argus.*

From an understanding of larval dispersal, researchers sought to determine if lobsters commercially harvested in Florida waters are part of a self-sustaining closed loop larval recruitment system or part of an open system dependent upon foreign stocks for larval recruitment.

During the past year, the investigators have: 1) collected from several additional adult populations — in particular, Jamaica, Trinidad and the Yucatan Peninsula; 2) collected post larvae at Elliott Key, Florida, and 3) continued biochemical genetic analysis of adult populations. On the latter, significant differences have been established between populations from certain geographic locations. For example, Jamaica and the Virgin Islands are probably not contributing to Florida recruitment. However, similar analysis on the collected post larvae will be necessary to more definitively determine the relative contributions of larvae from non-Florida stocks to the Florida fishery.

Matching funds were provided by the **Academy of Marine Science, Inc.** and **Nova University.**

Commercial Fishing and Seafood Marketing (R/FR-4)

With special emphasis on the blue crab, lobster and stone crab fisheries, Sea Grant and the Florida Experiment Station continued the marine economics studies begun in 1974.

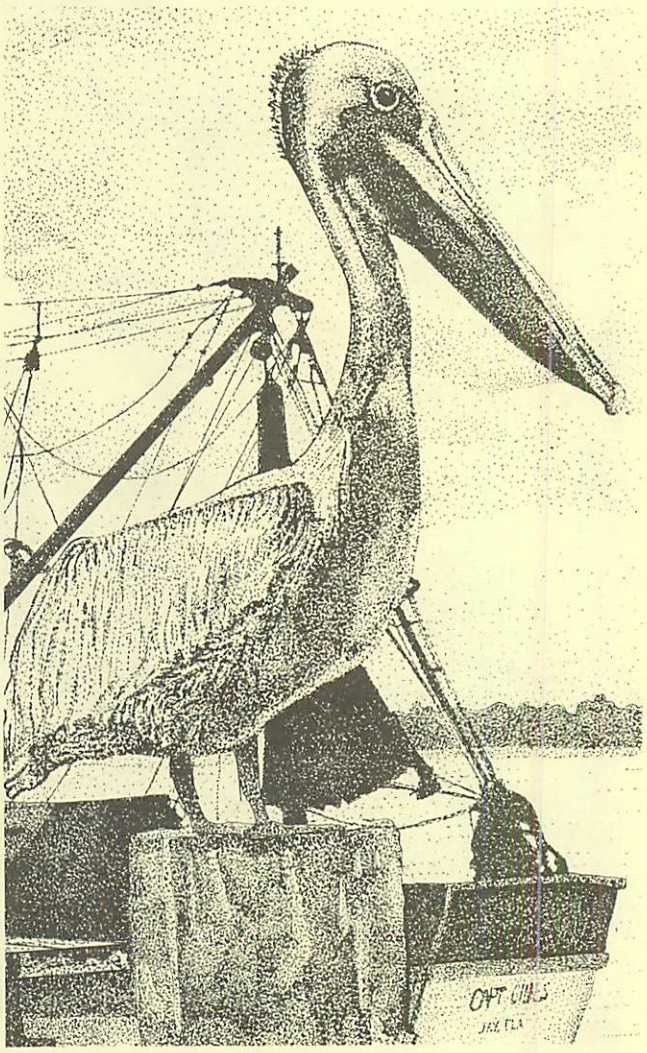
A cyclical and seasonal effort-yield study developed for the Florida West Coast blue crab fishery describes both the recurring and short term effects of environmental and biological factors on production.

Results of an analysis of marsh acreage data suggested a decrease in blue crab harvest where there is a reduction in marsh acreage. Along this line, an estimate of the economic value of a marsh acre in blue crab production was made.

Dockside prices for Florida blue crabs were analyzed for both the east and west coast fisheries. According to the report, fluctuations in consumer income was found to be the most significant factor explaining variations in prices received by fishermen. Values and productivity were estimated from vessels, boats and gear, and trends in landings, values and productivity were estimated.

Using information collected from Florida Keys lobster fishermen, costs and returns budgets are being developed by boat and vessel size for lobster, stone crab and other fisheries. In addition, a determination is being made of the most profitable allocation of fishing effort between lobstering and stone crabbing by the time of year or fishing season.

Data tapes obtained from the Bureau of Labor Statistics will be used to examine the effects of socioeconomic aspects of income, race, and food stamp participation on seafood consumption.



Commercial Fishing Port Development

The Florida commercial seafood industry is characterized by a large number of seafood wholesaling and processing plants. Latest available data indicate 405 operating plants. Although some are large multi-plant firms, the majority are small fish houses that collect, ice, and pack seafood products from commercial fishing vessels. These fish houses provide limited processing services before moving seafood into the distribution channels to terminal markets.

Objectives of this project were to determine needed improvements in shore facilities and services supporting commercial fishing in 17 central and south Florida coastal counties; and to determine other problem areas affecting commercial fishing in these counties, and industry members' suggestions for solutions.

Questionnaires were mailed to 6,114 commercial fishermen and 190 seafood dealers in the 17 counties asking what port facilities and services they used, how they rated those facilities and what improvements might be needed.

Fishermen and dealers identified docking and repair facilities and services as major shore support needs in practically all counties. The most extreme case is in Hillsborough County, where the commercial fishing port was closed by property owners forcing fishermen to dock and land their catch elsewhere. Industry groups are promoting plans to build a new fishing port area near Tampa.

Population growth and waterfront development have put heavy pressure on commercial fishing firms. Existing dealers, catch handling facilities, and docking and repair areas face severe competition for land and for operating rights in several counties. Pressure on fishery resources from sport fishing and environmental damage due to waterfront development concern fishermen and dealers in the study area, particularly on the lower west coast.

Background and experience for this project was provided by a similar study completed in 1978 and funded by the Gulf and South Atlantic Fisheries Development Foundation, Inc. pinpointing north Florida.

Local industry and governmental groups are using reports and findings of that study to support port development efforts and funding requests in the seven north Florida areas.

Additionally county Extension and marine advisory personnel have received copies of all reports which they have distributed to local groups and individuals concerned with improving facilities. Findings were also presented to annual meetings of the Florida Shrimp Association and the Southeastern Fisheries Association.

Solar Assisted Fish Smoker (R/FR-12)

In Florida, smoked mullet has been estimated as a $2-million industry consisting mainly of small businesses usually operated by families who smoke the mullet and sell it locally. Although smoked fish is primarily distributed throughout fish camps and grocery stores, it is also available in some restaurants and may be eaten at home as a dinner entree.

A hot smoking process requires cooking the fish with heat generated by burning sawdust, in a small-scale operation, or by an electrical or gas heating unit on a larger scale commercial operation.

Because of the current worldwide energy shortage there is an increasing awareness of the needs for alternate energy sources. As a result, several devices have been developed to collect solar energy with maximum efficiency at reasonable expense.

This research project was designed to test the potential of using a solar collector in the processing of smoked fish. In the solar-assisted fish smoker, solar energy heats the air before it enters the smoking chamber, thereby replacing either electrical resistance heaters or heat due to sawdust combustion.

Objectives were to develop a combined solar drying and smoking process which can produce an acceptable smoked fish product following FDA's Good Manufacturing Practice. Other objectives included the study of factors affecting product quality during processing and storage and the economical feasibility of the combined process.

A flat plate collector which not only absorbs direct solar energy but also diffuses radiation from the ground and sky was chosen for the experiment rather than the concentrating type of collector which absorbs only direct solar radiation and requires an additional mechanism for tracking the sun, thus increasing the cost.

The prototype system built for the project included a flat plate solar collector and smoking chamber into which air was blown. These were constructed and tested in the field while simulated tests were conducted in the laboratory.

Findings indicated that the efficiency of the solar collector was affected to a large degree by the rate of air flow through the collector and that it performed more efficiently at higher flow rates. Temperature increase also varied with different air flow rates, a lower air flow resulting in a higher temperature increase.

Taste tests conducted revealed no discernible difference between the solar smoked fish and those smoked conventionally.

Seafood Patties (R/FR-11)

Many finfish species landed in Florida are underutilized, for example, croaker, mullet, sheepshead. Also, flesh left on the frame after filleting is often wasted. But by using a mechanical deboner this flesh may be recovered.

The purpose of this project was to examine ways in which the flesh from underexploited species may be made into an acceptable product. Objectives include development of an economical process for preparing seafood patties from these species in combination with other ingredients.

In the basic research phase of the project, it was determined that in washing the deboned minced flesh prior to refrigeration, the optimum washing conditions are one to ten minutes of washing at temperatures of 29-33°C with water:flesh ratio of 23-25.

The product development phase incorporated three studies. In all three, the patties were evaluated by

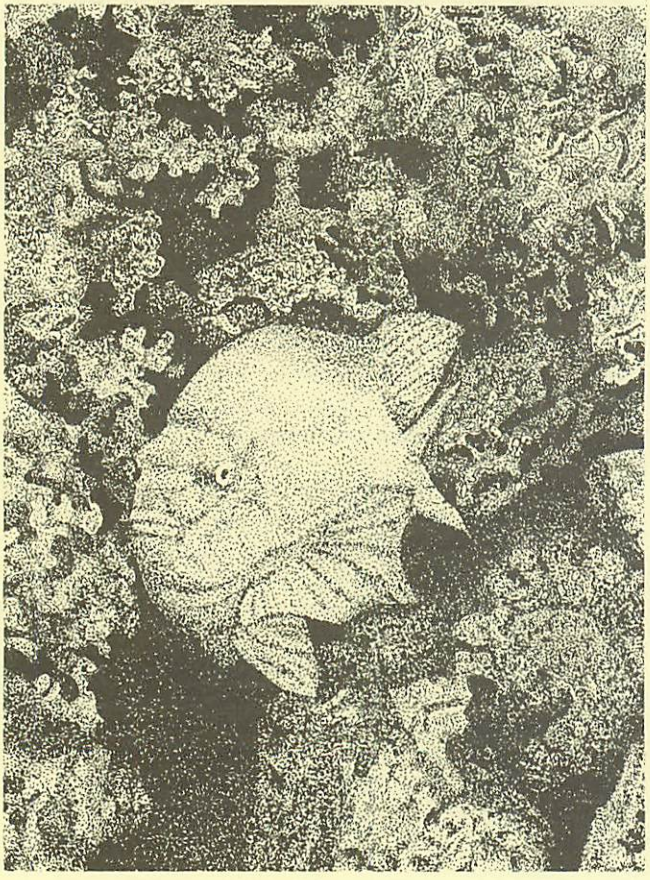
judges for texture-firmness, texture-preference and flavor preference.

In the first study, various combinations of croaker, mullet and sheepshead were mixed with other ingredients. Processing conditions were altered for the different combinations by varying time and/or temperature of deep-fat frying and oven cooking. Generally, it was found that as either the oven temperature or baking time increased, the firmness increased. Many combinations were found to produce acceptable texture and flavor depending upon the processing conditions.

In the second study, minced fish, either croaker or mullet, were mixed with varying levels of potato flour and soy protein. A spice blend formulated in the lab was used to mask the soy flavor. When using minced croaker, the softest patty was obtained at 70 percent croaker to 30 percent potato flour. With the addition of croaker and/or soy protein, an increase in firmness was observed. The same was true of mullet with the firmest patties having a 79 percent mullet to 21 percent soy blend.

In the third study, patties were prepared using 100 percent croaker, mullet or sheepshead in combination with three other factors, salt, sodium tripolyphosphate and sodium alginate, a gel-forming agent. Although the texture and flavor trends for the three species varied, a general trend for all indicated that as the alginate increased, the softness increased until the patties were most unacceptable.

Information concerning this project has been presented at scientific meetings and has been made available to a number of fisheries industries.



Trash Fish as Stone Crab Bait

A 1976 report from the Florida Game and Fresh Water Commission states that about 35 percent of the crab bait market in Florida went unfilled, indicating a potential annual need for 1.8 million pounds of rough fish for crab bait.

This situation is not unusual as the supply of bait for stone crabbers has traditionally been subject to wide fluctuations resulting in unstable input prices during the season. Consequently, the feasibility of using trash fish for bait appeared promising.

Accordingly, the objectives outlined for this study were to utilize a renewable resource that, for the most part was being wasted, and to provide an alternate bait supply for the stone crab fishermen.

With the cooperation of the Game and Fresh Water Commission, 1,000 pounds of gizzard shad obtained from Lake Okeechobee was delivered to Marathan Seafoods and Keys Fisheries, Inc., both of Marathon; and E Fish Company, Cudjoe Key.

These dealers selected what they considered to be good operators to try the bait in designated trap lines so that it could be compared with the more traditional bait.

A follow-up investigation found the response favorable in all cases and one fish house manager immediately placed another order for 15,000 pounds.

Although the experiment was considered successful by all concerned, an unpredicted problem surfaced — a ready supply was not on hand to meet the demands because of the lack of storage at the Lake Okeechobee fish houses.

Upon discussion of the storage problem and marketing opportunities with gizzard shad fishermen and dealers, the concensus was that because of the tentative nature of the rough fish program and no guarantee of a renewal, the local industry could not take the risk of "gearing up" to haul seine the rough fish, nor expand their very small storage capacity.

Nevertheless, the experiment achieved its goal of documenting a marketable use for the Okeechobee rough fish providing a lower priced substitute bait for the Keys' stone crab industry.

As a spinoff, another load of the shad was tried as finfish bait. The bait was fished side by side with squid and herring and reportedly "caught pretty well." However, the boat's mate indicated that the fish handled poorly — oily, scaly and too large.

Another suggested use for the trash fish, however, is to grind the shad and freeze for use as chum. This has met with considerable interest and if proven acceptable to fish and fishermen would provide an even higher price outlet for the rough fish than as stone crab bait.

Heavy Metals in Selected Species of Shark

The industry for processing and marketing of shark meat, particularly for human consumption, is not as fully developed in the United States as in other countries. In some countries, shark meat production is a profitable industry and trends in recent years indicate increased consumer acceptance even in the United States.

But before investing large sums developing this industry, information about its nutritional value and safety is needed. In addition to nutritionally essential elements, Sea Grant scientists were particularly interested in trace elements, such as mercury, lead and cadmium, but little information was available.

The three species chosen for analysis were the Bull, Dusky and Tiger sharks — all caught within four miles of the gulf Coast.

Bull sharks studied were 151 to 238 cm. long; Dusky, 248 to 288 cm.; and Tiger, 164 to 184 cm. (all lengths, front frontal tip to center base of tail fin). Mercury content of Bull shark was positively related to length. Only three of ten Bulls had mercury content below the FDA action level. Tiger samples deviated from this pattern with only one of six Tigers having mercury above 1 ppm. The six Tigers, matched by length to six Bulls, had significantly lower mercury content. In samples of the three species analyzed, cadmium averaged 0.212 to 0.263 ppm. and lead 0.255 to 0.272, with no definite pattern of relation to size.

Ten Bulls and five Duskies were analyzed for other elements. All samples had the biologically more abundant elements such as phosphorus, sulfur, chlorine, potassium, and calcium. In addition, fifty percent or more of the samples contained iron, copper, zinc, arsenic, selenium and bromine.

Results of this investigation and others suggest that length, or age, and the habitat of the specie need to be taken into account in making decisions about the use of shark meat for human consumption. Information obtained from the Fishery Management Council of Florida indicates that if sharks are juvenile, or larger with high salinity habitat, heavy metals such as mercury are likely to be at safe levels.

Considering these facts, it is obvious that the method of measuring length and identifying species and sex should be standardized to enable valid comparisons. Additionally, at this time, it is not known how the harvesting of sharks may influence the shark population or the ecological balance in these waters.

Communications with some members of the Marine Fisheries Program, Fishery Management Council, fishing industries, and the Suncoast Shark Hunters' Association indicate that currently small sharks are commonly caught for consumption.

It was determined that an important need is the identification of additional shark species suitable for human consumption. Such information will be useful in preparing harvesting guidelines for interested fishing industries.

Bibliography of Snapper and Grouper

Snapper *(Lutjanidae)* and grouper-sea bass *(Serranidae)* are important ecological and economic components of reef and reef-like areas throughout the world. This bibliography was prepared so that researchers and others interested in these marine fishes could be made aware of the available information and would also be able to identify areas where information is lacking, thus providing impetus for future studies.

This list of 1,192 references is not intended as a complete systematic or toxonomic reference. However, systematic revisions and important or recent toxonomic references were included to help with species identification and recognition.

Tournament Recreational Angling for Swordfish (R/FR-13)

After summarizing results of various South Florida swordfishing tournaments between June 1977 and July 1979, biologists from the University of Miami, Florida Department of Natural Resources and National Marine Fisheries Services reported a decline in tournament recreational angling for swordfish in 1979.

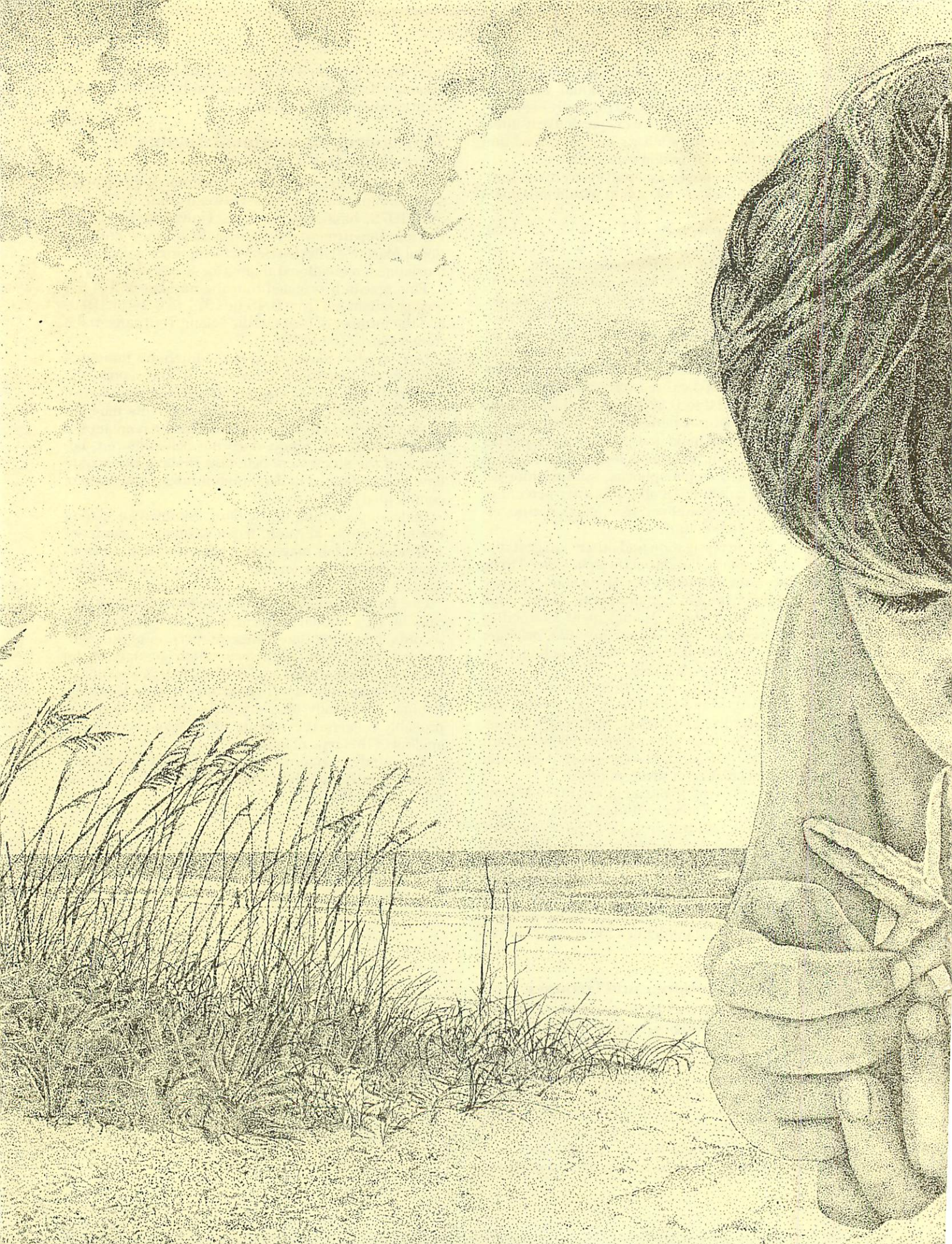
This research revealed that the number of fish per boat per night fell from 0.45 in 1977 to 0.14 in 1979, and the number of boats in the Miami Tournament fell from 44 in 1978 to 22 in 1979.

One possible cause cited is the intensive fishing of commercial longliners. According to the report, the longline fleet has been expanding and large numbers of swordfish have been caught. Although this may appear to have had an effect on the decline in recreational swordfishing, the report does not bear this out, because, if the stock were being overfished, this would have been reflected in declining numbers and sizes of commercial catches as well.

Instead, according to the data, commercial fishing has increased total catch, mean weight and catch per 100 hooks which may reflect improved fishing techniques rather than an increase in swordfish abundance.

One probable explanation for the lack of fishing success by recreational fishermen in 1979 comes from records indicating that a large proportion of the commercial catch was taken over much greater depths where few recreational anglers fished. It is also possible that tournaments were held during periods of slow fishing. The study also suggests that the decrease probably reflects the waning interest of recreational anglers in this type of fishing.

This study, concerned with the biology and fishery for swordfish in South Florida is scheduled to continue until June 1981.



EDUCATION

"The life cycle and the water cycle are inseparable . . . we must save the oceans if we want to save mankind."
—Jacques Yves Cousteau

EDUCATION

"All the water on earth is all the water there is."

That quotation from an unknown source describes perfectly the uniqueness of this planet we call home. Providing the key to life, water covers more than three-fourths of the earth's surface — indication enough that we, as caretakers of the earth's bounty, must actively encourage the wise use and conservation of our water resources.

In this same context, Jacques Cousteau remarked that, "Education is the key to our encounter with the sea."

Florida Sea Grant College, adhering to this philosophy and emphasizing education along with research and advisory services, strives to share with all residents of the state, both coastal and noncoastal, the knowledge and understanding gained from Sea Grant program activities.

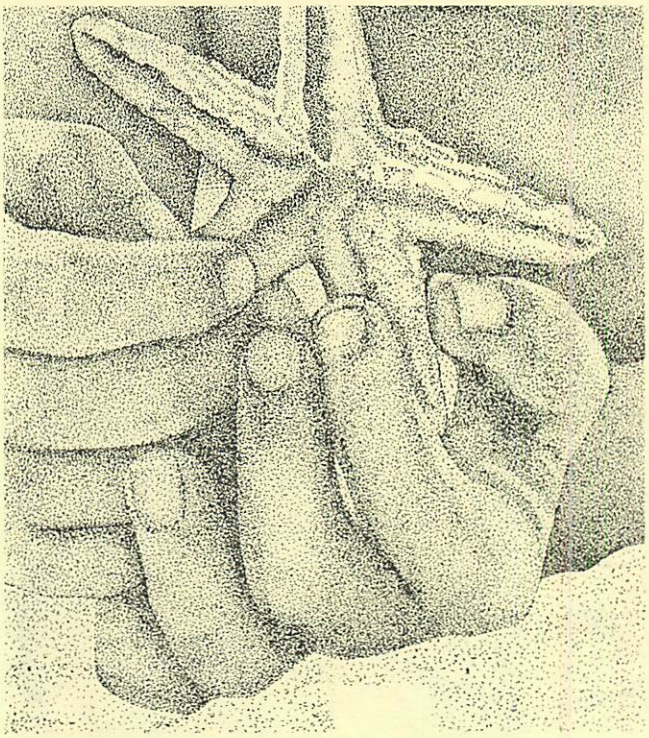
4-H Marine Education (E/Y-2)

Because of the cooperative atmosphere created between the Marine Advisory personnel and the State 4-H Department, 4-H Marine Education continued to enjoy a dynamic program.

It includes all boys and girls in the 8-19 age group, either enrolled in the Florida 4-H Program or youth who are not officially enrolled but exhibit an expressed or implied interest in some facet of the marine discipline.

According to the 4-H marine specialist, probably the most popular activities planned during the year were the 4-H marine camps held at Marineland, Crystal River and 4-H Camp Timpoochee. These encampments focus on marine food webs, natural resource development, ways to improve the environment, and such things as net casting, trap setting and crab cleaning. More than 500 youths participated.

A steady increase has also been seen in marine science demonstrations and exhibits at Florida's 4-H Congress. Previously, marine science and entomology were combined. This year, for the first time, marine education emerged as a separate category with eight districts participating. To date, 46 of Florida's 67 counties are actively involved in some aspect of marine education.



In addition to the numerous educational publications produced, an article, "Young Farmers Go to Sea," appeared in the July-August 1979 issue of *Sea Frontiers.* And, two slide cassette-tape presentations, *The Florida 4-H Marine Program* and *Undersea Life of Florida,* were developed to help promote interest in and public awareness of the marine program.

A bonus connected with the educational resource materials is that they can also be used by other youth organizations needing special program assistance.

Florida 4-H Marine publications include the following titles:

Florida 4-H Marine Science Program, Member's Guide (4-H 314). Neil Crenshaw, editor. Includes sixteen short-term projects on marine science.

Field Study of the Marine Environment, Leader's Guide (4-H 338). Neil Crenshaw. Describes how to conduct a field study of an aquatic environment with youngsters.

Intertidal Zone Project (4-H 362). Neil Crenshaw. Six field activities designed for youngsters between the ages of 12 and 18 years.

Life in the Sea, Member's Guide (4-H 360). Neil Crenshaw and Bill Clifton. Contains seven activities that can be done by visiting an oceanarium or through actual observations in the wild.

Life in the Sea, Leader's Guide (4-H 358). Includes answers to the questions contained in the project record, 4-H 359.

Life in the Sea, Project Record (4-H 359). A manual to be used in conjunction with 4-H 360 and 4-H 358.

Starting and Maintaining a Marine Aquarium (4-H 356). Neil Crenshaw. Explains how to make an aquarium from used glass, and how to maintain a salt water aquarium.

Starting and Maintaining a Marine Aquarium, Project Record (4-H 357). A record book for maintaining a salt water aquarium.

Wetlands (4-H 365). Neil Crenshaw. Covers basic information about salt marshes, swamps, estuaries, and mangrove wetlands.

Wetlands, Project Record (4-H 366). Contains a wetlands crossword puzzle, hidden words puzzle, and activities for youngsters to conduct in the field.

Fins & Scales (4-H 367). Neil Crenshaw. Discusses the various kinds of fins and scales found on fish and how they are used by the fish.

Coastal Awareness and Education Program (E/P-1)

In Florida, the allure of the coast has drawn three quarters of the population to twenty-seven percent of the state's land area. This concentration of rapid population growth has brought immediate and potential problems which threaten the natural resources that frame and support coastal systems.

The purpose of this project was to develop an educational program focusing public awareness on the benefits and vulnerabilities of coastal resources. The audience targeted ranges from school children in grades 5-12 and the 4-H program to adults in the general public. The three educational tools planned to implement this goal represent an integrated program that can be combined in a variety of ways to accommodate various interest groups, age groups or time limitations.

Components of the program include a slide/tape show, "Man Meets Coast," a cartoon booklet by the same title, and a Coastal Zone Game/Simulation, "Big Bay County."

The slide/tape presentation was shown eight times during the year to 365 people. The cartoon booklet, based on the narrative of the slide presentation, includes a directory of agencies and groups involved in coastal management. The coastal zone game/simulation was presented seven times to a total audience of 360 which included school children 10-18 years of age. Adult and teacher groups have also participated in the game.

All the game materials are assembled for use alone, or as a scholastic unit with the "Man Meets Coast" slide/tape presentation and the cartoon booklet.

Products of the coastal awareness program have been used by groups as diverse as 4-H organizations, public schools, Rotary clubs and local chapters of the Southern Building Officials Congress. Presentations were made at 4-H camps and special interest programs, 4-H Leader Environmental Workshops and National Science Foundation teacher training sessions.

Matching funds were provided by **Junior Service League of South Brevard** and the **Florida Department of Environmental Regulation.**

Outboard Mechanics Program

The State of Florida Department of Natural Resources reported 436,348 registered boats in 1976 with Palm Beach-Martin-St. Lucie counties reporting more than 25,000. Qualified marine-oriented personnel needed to service and repair this equipment far exceeds the current supply of qualified personnel. A survey initiated by Florida Institute of Technology (FIT) indicated a projected increase in marine mechanics to exceed 40 percent by 1980.

The employment outlook for marine propulsion systems mechanics is expected to grow faster than the average for all occupations, yet many of the mechanics currently serving these boats have very little, if any, formal training or preparation in marine-oriented services. The most important areas are: 1) outboard training; 2) inboard engines, diesel and gasoline; and 3) inboard-outboard drive gear.

It was the objective of this project to offer a certificate program, endorsed and approved by industry, which provides instruction in the basic skills required for entry-level positions as outboard marine mechanics, and for upgrading existing work skills for those presently employed within the industry.

A pilot program was started on the Jensen Beach Campus of FIT September 1979. The 11-week program revolved around hands-on-training providing approximately 440 hours of instruction. Every student was factory certified by the Outboard Marine Corporation (OMC) and all students were offered outboard mechanic positions in the Stuart area.

Matching funds were supplied by the **Ralph S. Evinrude Foundation, Casa Rio Boat and Motor Sales, Sid Blakes Marine** and **Martin Marine.**

Conferences, Seminars, and Workshops

The line delineating Florida Sea Grant College research, education, and advisory efforts is often a fine or almost indistinguishable one for the end result, however arrived at, is educational in nature. Each year, through combined efforts of researchers, advisory agents, specialists and educators a major thrust of

Florida Sea Grant's educational effort is accomplished through conferences, seminars, and workshops.

Many of these are held locally by agents or specialists while others are state-wide, regional, or national in scope. Whatever the subject or the scope of these meetings, they provide outstanding opportunities for sharing information, answering questions, and building communications bridges with groups throughout the state, the area, and the nation.

During 1979 Florida Sea Grant College and the Marine Advisory Program sponsored or co-sponsored conferences and workshops on such wide ranging topics as marine recreation, seafood processing, aquatic animal medicine, artificial reefs, hurricanes and coastal storms, beach preservation, water resources and the manatee.

Topics ranging from legal and political issues to marketing of related products and research needs were discussed at the **Aquatic Animal Medicine State of the Art** session held in April at Marineland of Florida.

As part of the Tenth Annual Conference of the International Association for Aquatic Animal Medicine (IAAAM), this session was sponsored by the Florida Marine Advisory Program, Florida Cooperative Extension Service and the Florida Sea Grant College.

Participants from the Netherlands, Hong Kong, West Indies and the United States congregated to share knowledge and experience and to promote public awareness, determine future research direction and foster support of aquatic industries.

Presentations included a national and international overview of aquatic animal medicine, business management and economics of related industries, and aquatic animal medicine and the government.

Other discussions were concerned with the culturing and rearing of aquatic animals in confined and natural systems as well as development of equipment, drugs, chemicals and materials used to treat, nourish, handle and contain aquatic animals.

Demonstrations of equipment and products designed for the processing and handling of seafoods were featured at the **4th Annual Tropical and Subtropical Fisheries Technological Conference of the Americas** in Tampa in April. The purpose of the demonstrations, in which companies from Canada, England and the United States participated, was to allow exposure of new equipment and supplies which could be used by Florida's seafood industries and all other southeastern seafood industries.

Among the items shown were edible seafood coatings, a new crab picking machine, refrigeration and freezing equipment, long-distance packaging, vacuum packaging, meter to assess freshness, automated fish skinning and scaling equipment, and smoking units.

Special sessions included a discussion of marketing opportunities in Japan, Egypt, Nigeria and the midwestern United States. According to the report, these markets are open to a variety of seafoods United States fishermen can supply.

An industrial session allowed such seafood representatives as processors, suppliers, wholesalers, retailers, importers and exporters to "tell it like it is" to seanood technologists and researchers.

The conference included an informal advisory meeting with personnel from the National Sea Grant Office, the National Fisheries Institute and the National Food Processors Association who discussed research needs related to the seafood industries in the southeast and better means of cooperative research.

In May, the Marine Advisory Program in cooperation with the Marine Industries Association of Florida, Inc. (MIAF) co-sponsored a **Recreational Marine Industries Conference** attended by more than 200 participants representing 140 marine-related businesses.

One main conference objective was to identify the size of and location of the diversified elements of the state's marine industry, to determine just how big it is, who the members are, and where they are located.

In addition to a number of "how to" presentations on such subjects as merchandising, showroom floor plans, advertising and promotion, legal problems, and financial management, researchers from Florida Sea Grant discussed a planned research project concerning marinas and boatyards and the engineering problems involved.

A new set of by-laws for MIAF was approved by the membership. These provided for the organization of several conferences within MIAF to include marine dealers, marina and boatyard operators, manufacturers, and marine support industries. The result was an organization that could accommodate the many diverse marine interests in the state.

At a three-day national conference on **Hurricanes and Coastal Storms** held in Orlando in May, public officials, scientists, business executives, and private citizens from a number of coastal states, many of them acknowledged experts on the subject of severe storms discussed ways to plan for and cope with the hazards involved.

Although originally planned as a small two-day meeting as part of a Sea Grant research project at Florida State University on hurricane evacuation alternative, the subsequent involvement of the Federal Disaster Assistance Administration (now part of the Federal Emergency Management Agency), the National Oceanic and Atmospheric Administration, the Florida Division of Disaster Preparedness (now the Bureau of Disaster Preparedness) and other state agencies, expanded it into a meeting of national scope.

One message seemed to dominate all other discussions and that was the warning voiced by a number of speakers that a potential catastrophe awaits U.S. coastal communities as the continued explosive development along the coasts puts more Americans at risk than ever before, and that failure to take positive steps toward effective hurricane evacuation plans could result in disaster for many coastal residents. Adding to this was the complacency that has developed among much of the coastal population because of the absence of major coastal storms in the past twenty years.

Since evidence indicates that technical ability to forecast hurricanes is no longer improving but has reached a plateau, emphasis was placed on ways to create awareness of the hazard, improve evacuation procedures, and mitigate damage from the storms. In-

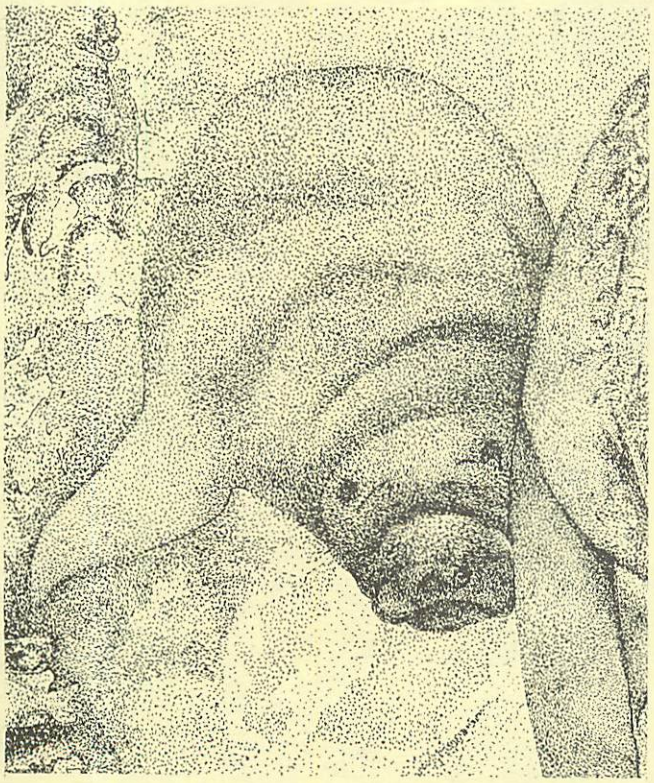
centives, it was pointed out, will have to come from the federal level, causing states and localities to react and thereby gradually improving the ability of all areas to react to severe coastal storms.

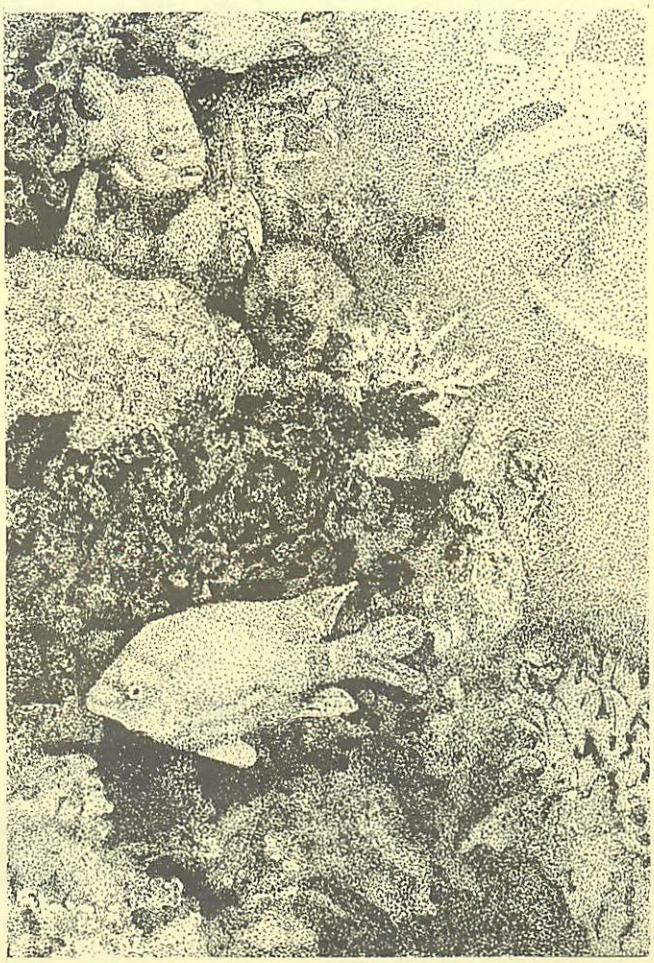
Groundwater supplies, saltwater intrusion, water quality, wetlands, and water resources were the topics of a two-day Sea Grant sponsored conference on **Brevard County Water Resources and the Manatee in Brevard County.** Concurrently with this conference was a conference on manatee management aimed at developing a list of actions or implementation policies which would assist local governments in preserving the endangered manatees and their habitat.

The Water Resources conference addressed the future of water supplies in the county, relationships of marshes and wet hammocks, and the process for obtaining water quality permits, for dredge and fill operations, docks, and seawalls.

The manatee conference discussed manatee behavior, habitat description and human impact, either direct or indirect on the manatees and their habitats. At a workshop which concluded the conference, discussion centered on how local governments could be more effective in enforcing existing state and federal laws, how a manatee awareness program could be incorporated into the local educational system, and what type of controls on land use development would be most beneficial in assuring viable manatee habitats in the future.

Recognizing the ever-increasing demand for saltwater fishing and sport diving and the fixed supply of quality saltwater fish habitats, artificial reef experts met at a regional **Artificial Reef Conference** in Daytona Beach in September to consider all aspects of artificial reef programs. Sponsored by Sea Grant



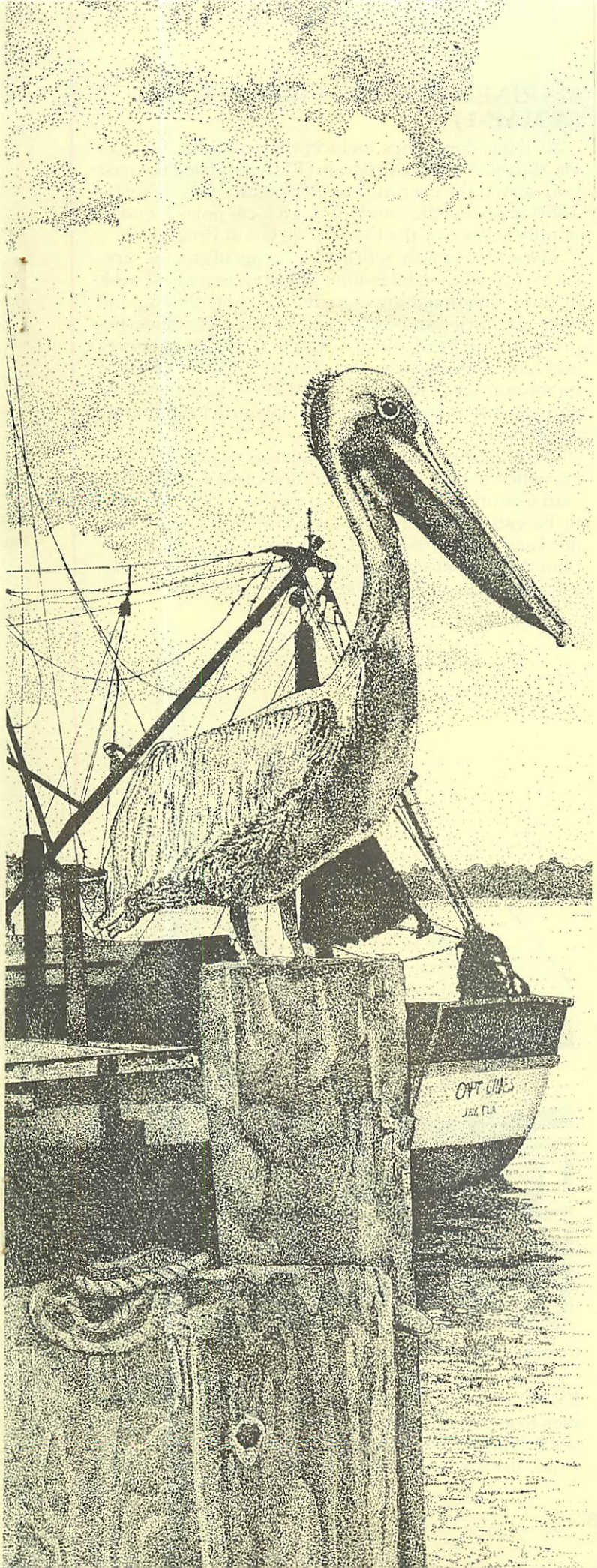


Programs from Virginia to Texas and by numerous local, state, and federal fishery and marine-oriented organizations and agencies, the conference was a geographical and topical expansion of a 1977 statewide conference held in St. Petersburg.

The conference was organized to provide the latest information on artificial reefs to fishermen, divers, boaters, engineers, planners, and administrators as well as other groups associated with the marine industry and covered social, economic, engineering and biological factors. Technical sessions examined in detail the planning, construction, evaluation, and management of artificial reefs including advantages and disadvantages of different construction materials, social and economic assessment of reef use, and liabilities and other legal aspects.

The Florida Sea Grant Marine Advisory Program again joined with the Florida Shore and Beach Preservation Association, the Coastal Plains Center, Wilmington, N.C., and the Coastal & Oceanographic Engineering Department, University of Florida to cosponsor the **annual meeting of the Association** held in October at Bal Harbour.

Experts in the area of coastal zone matters presented papers on a wide range of subjects including the future of Coastal Zone Management, rights of coastal property owners, beach nourishment, barrier islands, and the effects on Florida's shoreline of the federal flood insurance program.



ADVISORY SERVICES

"Mechanical means of communication have their important places; but they are only adjuncts. None of them can take the place of personal man-to-man contact."

—William G. Werner

ADVISORY SERVICES

If Florida Sea Grant College could be compared with an army, the Advisory Services could be likened to the infantry — the troops in the front lines. At the heart of the Advisory Services effort is the Marine Advisory Program and the agents in the field who work daily on a person to person basis with those whose livelihood depends upon the sea.

They could also be likened to the engineers whose job in combat is to build bridges for the troops to cross to keep communications open and link together all of the fighting elements.

For although all in the Sea Grant College build communication bridges, it is the marine agents, who, through more opportunity and as an inherent part of the job, are building these bridges and establishing contact with their constituency as a normal part of each day's routine.

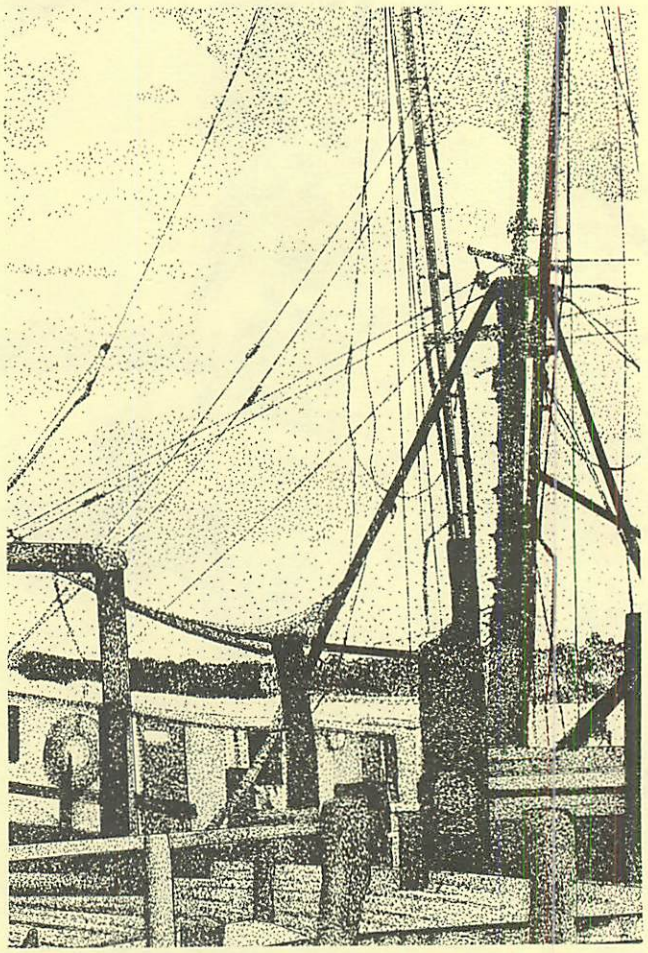
Advisory Services is application of research also, and in 1979, one prime area of research was in the area of artificial reefs. The Artificial Reef Resource Team continued to function in its advisory role to coastal communities on artificial reef matters and a Reef Atlas was published showing the location of all natural and artificial reefs along the Florida coast.

MARINE ADVISORY PROGRAM (A/MAP-1)

As it has done since its inception in 1972, the Florida Marine Advisory Program (FMAP) during the past year served the ever-increasing constituency along its 1350 mile coastline and offered a focal point for community service by the Florida Sea Grant Program.

These efforts were reflected in terms of greater service to the commercial fishing industry, increased work in the recreational areas including sport fishing and marinas, advice and assistance on coastal engineering problems, and a mounting effort in the fields of energy and hazard awareness. In addition, FMAP expanded its awareness in marine education to encompass the entire community from elementary youth to adult populations.

During the year the marine advisory agent staff was expanded to nine with the addition of an agent in Brevard County. Additional agent positions are expected to be established as coastal counties recognize the need and are able to provide joint funding. Much greater than the modest staff expansion however, was the significant expansion in ongoing programs and new areas.



Commercial Fisheries

Commercial fisheries, always a primary focus of FMAP, continued as a major area of assistance. Activities to assist commercial fishermen in 1979 included workshops in product marketing, fishing gear, electronic navigation (LORAN C), tax management, busi-

ness, seafood utilization, and promotion of the soft shell crab industry.

The Gulf of Mexico Council and South Atlantic Fishery Management Councils looked to the marine agents to help provide liaison with local recreational and commercial fishermen. FMAP follows developments that affect fishermen trying to keep them advised of proposed and newly passed regulations.

Educational programs, publicity materials, and demonstration projects also were used in a continuing effort to improve the quality of handling of Florida seafood products. By working with seafood retailers and commercial fishermen, FMAP made progress in developing new markets for seafood products, including international outlets, and in promoting use of underutilized species and new industries such as the soft shell crab.

Members of FMAP served on advisory boards of the Public Health Service to insure workability of programs, emphasizing benefits to fishermen, and also worked with the Federal Intermediate Credit Bank to help fishermen secure loans from the Production Credit Association.

Marine Recreation and Sport Fishing

Work in marine recreation and sport fishing, which had accelerated in 1978, continued throughout 1979. FMAP cooperated with the Marine Industries Association of Florida, Inc. (MIAF) to coordinate a statewide workshop for all marine business interests.

FMAP developed educational programs for marina operators to improve fiscal, personnel, and operational management of Florida's many marinas, an effort that should result in better facilities, more services, and a safer environment for the boating public.

Marine specialists have advised sport fishermen, as well as the commercial fishermen, on proposed management plans being developed by the Fishery Management Councils. They also have prepared and presented programs to selected groups of sport fishermen.

FMAP also has played an important role in the establishment of artificial reefs along the Florida coast, which have been a boon to sport fishing. The marine agent is the principal contact for sportfishing clubs and other civic groups and reef committees that want to build reefs offshore from their communities. The agent meets with the committee and if required, makes arrangements for a visit from the Artificial Reef Resource Team sponsored by Sea Grant to assist in site selection, buoy construction and economic evaluation of the completed reef.

Energy

New energy technology has received high priority as a program element of the Florida Cooperative Extension Service and FMAP. Activities during 1979 included working with fuel allocation officials to insure a voice for the marine industry and commercial fishermen in allocation of energy sources. The availability of fuel to the coastal population in Florida will have an important impact on the success of this industry and the economy of the state.

Emergency Preparedness

The focus on preparedness for hurricanes and other natural disasters continued during 1979 under the direction of the specialist assigned to FMAP from the National Weather Service under provision of the Intergovernmental Personnel Act.

FMAP continued to assist Civil Defense, the National Weather Service, Red Cross, Federal Emergency Management Agency, Sea Grant, Regional Planning Councils, and the U.S. Corps of Engineers in planning and carrying out educational programs and emergency preparedness plans. FMAP also cooperated in a national workshop on hurricanes and coastal storms co-sponsored by other governmental agencies.

Quality Marine Environment

During the past year, FMAP staff participated in technical committees to consider resource management priorities in promoting quality marine environments. It also was instrumental in bringing together various agencies and groups to define problems and consider multiple resource use alternatives.

Education

Florida Department of Education, through its science supervisors and the governor's designee on marine education, has worked with Sea Grant and FMAP in guiding marine education program development in Florida. During the past year FMAP has undertaken experimental programs to develop hazard awareness education materials in public schools.

FMAP continued to provide the primary support for developing and presenting programs for resident and day camps for Florida 4-H, and helped establish migratory child education programs for dependents of commercial fishermen.

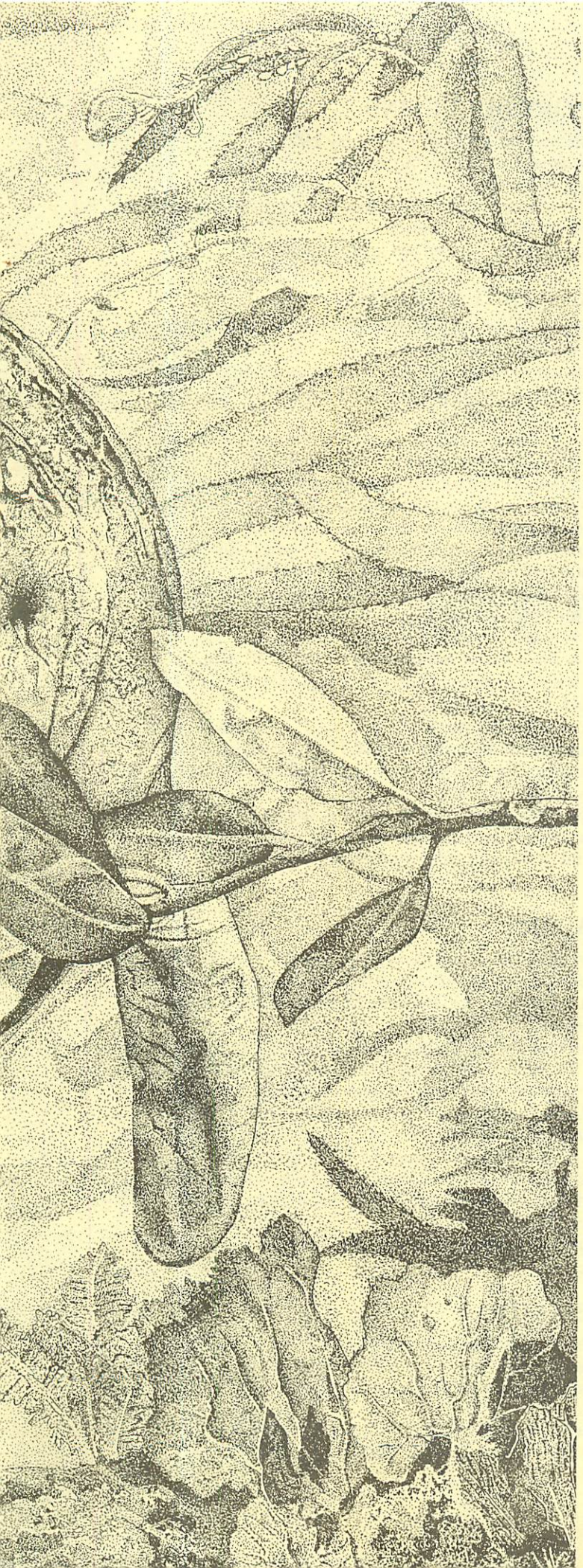
The first Extension marine intern program was worked out in cooperation with the IFAS Agricultural and Extension Education Department. In addition, several students from the University of Florida Department of Geography were used as interns and provided useful materials to FMAP.

Progress continued on the development of a marine education center at Marineland. Indications are that the center will become established in 1980.

Publications

Marine Advisory and Sea Grant publications were distributed in record numbers with 2,403 requests received during the year and 12,034 publications distributed. Bulk quantities of four publications also were requested by official Florida Welcome stations for distribution to state visitors. A bi-monthly newsletter, a regular weekly marine column for newspapers, advisory bulletins and fact sheets, news releases and feature articles, and radio and TV appearances by specialists and marine agents are other ways in which marine information reaches many individuals.

In summary, 1979 was a year marked by greater than ever awareness of marine advisory programs which enabled FMAP to provide an ever-expanding public service to the state's coastal communities.



PROGRAM SUMMARY

Publications

MARINE ADVISORY BULLETINS

MAP-3A — *Florida Sea Grant Publications* — Revised January 1979.

MAP-5 — *Boating Safety — Thunderstorms.* Walter A. Sitarz.

MAP-6 — *Florida Sea Grant Program Directory - 1979.*

MAP-7 — *Local Control Over the Onshore Impacts of Offshore Energy Development in Florida.* R. D. Woodson, John Corbett.

MAP-9 — *Recreational Use Reefs in Florida — Artificial and Natural.*

BROCHURES AND FACT SHEETS

MAFS-4 — *Florida Marine Advisory Program.* A brochure on what the Marine Advisory Program is and what it does.

MAFS-5 — *The Sea and Coast — Motion Picture and Slide Presentations.* Information on motion picture films and slide presentations available from the Marine Advisory Program.

MAFS-6 — *Land Your Catch Fresh.* Quality control guidelines for proper protection of fish harvest by culling, cleaning and chilling. Includes legal requirements for boats used for harvesting and transporting seafood.

MAFS-7 — *Diving and Smoking.* Outlines effects of smoking on individuals who dive and smoke. Gives reasons why divers should not smoke.

MAFS-8 — *Florida Coastal and Environmental Information — A User's Guide.* Lists sources of coastal and environmental information.

MAFS-9 — *Constructing an Artificial Reef Buoy.* Describes artificial reef buoys and provides diagrams for construction.

MAFS-18 — *Coastal History Notes — Venice, Florida.* Todd L. Walton, Jr.

MAFS-19 — *Coastal History Notes — Boca Raton Inlet Vicinity.* Todd L. Walton, Jr. History of high water shorelines and erosion patterns over a period of 100 years for each of these areas.

MAFS-20 — *Artificial Reef Site Selection and Evaluation.* Heyward H. Mathews. Tells how to select a proper site for an artificial reef. Includes information related to the distance and depth offshore, substrate, reef permitting and biological reports.

MAFS-21 — *Florida Sea Grant Artificial Reef Resource Team.* Describes the activities of a Florida Sea Grant funded artificial reef resource team established to aid municipal and private groups interested in artificial reef construction.

TECHNICAL PAPERS

Tech. Paper #11 — *Development of County and Local Ordinances Designed to Protect the Public Interest in Florida's Coastal Beaches.* Frank E. Maloney and Dan Fernandez with Anthony J. O'Donnell, Anthony R. Parrish and James M. Reinders.

Tech. Paper #12 — *Fourth Annual Tropical and Subtropical Fisheries Technological Conference of the Americas.* W. Steven Otwell and John A. Koburger, Editors.

Tech. Paper #13 — *Local Control Over the Onshore Impacts of Offshore Energy Development in Florida.* R. D. Woodson, Marc J. Tannen, and John J. Corbett.

Tech. Paper #14 — *Protecting Coastal Waters: Model Ordinances for Runoff Control and Sewerage Disposal.* Frank E. Maloney and Bram D. E. Canter.

Tech. Paper #15 — *Marine Related Recreation Businesses and Public Facilities in Bay County, Florida.* Edward A. Fernald, Karen Walby, Sarah Jane Miller, and John Paul Jones III.

Tech. Paper #16 — *Papers Presented at Annual Conference on Beaches.* Stan Tait and Thomas Leahy, Editors.

SEA GRANT REPORTS

Report #26 — *Economic Impact of the Processing and Marketing of Commercial Florida Marine Landings.* R. Allen Morris and Fred Prochaska.

Report #27 — *Conference Proceedings: Marina and Boatyard Operators in Florida.* Thomas M. Leahy, Editor.

Report #28 — *Salt Tolerant Plants for Florida Landscapes.* William E. Barrick.

Report #29 — *Seawall Design on the Open Coast.* Todd L. Walton, Jr. and William Sensabaugh.

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Project and Investigators

Project	Complete Title	Duration Begin	Duration End	Investigator and Institution
	Coastal Processes			
R/EM-7	Effects of Sewage Pollution Abatement on Hillsborough Bay	1975	1979*	J. L. Simon, USF
R/EM-10	Culture & Transplant Studies of the Seagrass *Ruppia maritima*	1977	1979*	P. A. Winter, UWF
R/EM-12, 13, 14	Coastal Forestry Practices and Estuarine Productivity: A Case Study, The Apalachicola Bay	1978	1979/* 1980	R. J. Livingston, D. C. White, FSU; B. A. Christensen, UF
R/OE-8	Beach & Dune Erosion caused by Storm Tides and Waves	1978	1980	T. Y. Chiu, UF
R/OE-9	Fatigue of Welded Steel in Sea Water	1978	1979	W. H. Hartt; D. S. Wolf, FAU
R/OE-11	Glossaries of Tidal Inlets in Florida	1978	1979	A. J. Mehta, UF
R/CP-4	Salt Tolerance of Common Ornamental Horticultural Plants	1978	1979	T. A. Nell, A. E. Dudeck, D. B. McConnell, UF
	Coastal Development			
R/OE-15	Acoustic Navigation by Divers	1979	1981	H. F. Hollien, UF
R/CP-5	Structural Analysis of the Apalachicola Bay Coastal Area Economy	1979	1980	D. Mulkey, UF
R/CP-7	Legal Analysis of Marina Siting	1979	1979	F. E. Maloney, B. D. E. Canter, UF

*Extended into early 1980

	Living Marine Resources			
R/FR-4	Economic Analysis of Commercial Fishing and Seafood Marketing	1974	1979	F. J. Prochaska, J. C. Cato, UF
R/FR-9	Management Biology of the Northwest Florida Snapper-Grouper	1977	1979*	S. A. Bortone, UWF
R/FR-10	Spiny Lobster Larval Recruitment in the Florida Keys	1977	1979*	R. A. Menzies, Nova U
R/FR-11	Seafood Patties from Underutilized Fisheries	1978	1979	J. C. Deng, UF
R/FR-12	Improved Fish Smoking with a Combined Solar Dryer and Smoker	1979	1979	J. C. Deng, C. D. Baird, K. V. Chau, UF
R/FR-13	Fishery and Biology of Swordfish in Southeast Florida	1978	1981	E. Houde, D. deSylva, UM
R/FR-14	Economic Benefits and Costs of the Fishery Conservation and Management Act of 1976.	1979	1980	F. W. Bell, FSU
M/PM-2	**Short Term, Pilot & Demonstration Projects**			
	Florida Sea Grant Immediate Response Projects			
	Salt Tolerant Plants for Florida Landscapes	6/77	11/79	W. Barrick, UF
	Heavy Metals in Selected Species of Sharks	10/77	7/79	M. Kessouny, FSU
	Florida Artificial Reef Atlas	3/78	12/79	J. R. Anderson, Jr., FSU
	Artificial Reef Resource Team	3/78	12/79	H. Mathews, SPJC
	Feasibility of a Seafood Industrial Park in Florida	3/78	6/79	K. Mathis, R. Degner, J. Cato, F. Prochaska, UF
	Diving Habits and Obstetric Course of Pregnant Scuba Divers (1978 Annual Report)	3/78	6/79	M. Dougherty, UF
	Future Key — A Floating Research Facility in the Gulf of Mexico (1978 Annual Report)	5/78	9/78	H. Merritt, UF
	Florida Marine Trades Law and Standards Assessment	8/78	5/79	J. E. Pitts, FSU
	Development of a Soft Crab Fishery in Florida	9/78	4/79	W. S. Otwell, UF/MAP
	Solutions to Growing Hurricane Evacuation Problems	10/78	7/79	E. J. Baker, FSU
	Isopods in Florida East Coast Sharks	10/78	11/78	P. Bird, Mote
	Trash Fish as Stone Crab Bait	12/78	6/79	T. Murray, MAP
	Economic Change in Florida Coastal Counties: A shift-Share Analysis	1/79	6/80	D. Mulkey, UF
	Chitinoclastic bacteria	1/79	9/79	M. A. Hood, UWF
	Engineering Planning & Design Criteria for Small Craft Recreational Marinas in Florida	1/79	6/80	A. J. Mehta, UF
	Survey of Benthic Studies in Florida Coastal and Estuarine Waters	2/79	6/80	S. Mahadevan, Mote
	Social Impact of Naval Base Development on a coastal community	3/79	6/80	P. Doughty, UF
	Bibliography of Snapper and Grouper	3/79	2/80	S. A. Bortone, UWF
	Directory of Florida Marine Research and Education	4/79	5/80	N. O'Hara, FIT
	Seafood Processing Equipment and Supply Demonstration	4/79	4/79	W. S. Otwell, UF
	Impact of Toxic Substances on Indian River Fisheries	5/79	2/80	J. Trefry, R. Pierce, FIT
	Salt Minced Product from Grouper Frames and Spent Mullet	6/79	5/80	J. Koburger, UF
	Maritime Agriculture Training Experience	10/79	6/80	M. Estes, Monroe County
	Estreme Sea States Due to Hurricanes	12/79	6/80	B. LeMehaute, UM; M. Sheppard, UF

Project	Complete Title	Duration Begin	End	Investigator and Institution
	Education			
E/Y-2	Florida 4-H Marine Education Program	1978	1980	T. C. Greenawalt, UF
E/P-1	Coastal Awareness and Education Program	1979	1979	D. Barile, FIT
E/T-3	Marine Propulsion Systems Training Program: Phase I (Outboard)	1979	1980	L. Booth, J. M. Burns, FIT
	Advisory Services			
A/MAP-1	Marine Advisory Program	Continuous		J. T. Woeste, M. L. Clarke, UF
	Administration			
M/PM-1	Administration of the State Univ. System of Florida Sea Grant College	Continuous		H. L. Popenoe, W. Seaman, UF

BUDGET, CALENDAR YEAR 1979*

Florida Sea Grant Program Area and Federal Category (with code)	NOAA Sea Grant	Grantees & Sponsors**
COASTAL PROCESSES		
Materials and Structures (II.24)	$ 33,600	$ 17,100
Coastal Engineering (II.25)	43,800	44,000
Coastal Decisions (III.34)	158,500	81,800
Ecosystems Research (III.40)	34,500	18,800
Pollution Studies (III.45)	88,000	94,000
COASTAL DEVELOPMENT		
Marine Economics (II.14)	11,100	4,200
Ocean Law (II.15)	29,100	8,200
Ocean Engineering (II.28)	14,300	7,100
Man-in-the-Sea (II.34)	28,400	16,600
LIVING MARINE RESOURCES		
Living Resources (I.06)	143,800	77,600
Marine Economics (II.14)	46,500	37,000
Seafood Science & Technology (II.35)	45,800	13,900
EDUCATION		
Public (IV.70)	19,600	6,000
Technical (IV.67)	62,000	58,700
Youth (V.75)	34,200	62,100
ADVISORY SERVICES		
Extension (V.71)	451,200	486,800
SHORT TERM AND PILOT STUDIES (VI.81)	111,100	30,600
ADMINISTRATION (VI.79)	128,000	48,000
Totals	$1,483,500	$1,112,500

*Approximate figures subject to final audit
**No Federal funds included

Sponsors

American Petroleum Institute
Academy of Marine Science, Inc., Miami
Board of County Commissioners of Various Coastal Counties (advisory services)
Casa Rio Boat and Motor Sales
Chrysler Outboards
Clearwater, City of
Coastal Plains Center for Marine Development Services, Wilmington, NC
Engineering and Industrial Experimental Station, Florida
Florida Board of Regents
Florida Department of Environmental Regulation
Florida Department of Natural Resources
Florida State Legislature
Ford Foundation
Franklin County Board of County Commissioners
Gulf and South Atlantic Fishery Development Foundation, Inc.
Gulf States Marine Fisheries Commission
Hillsborough County Environmental Protection Commission
Johnson Outboards
Junior Service League of South Brevard County
Martin Marine
Marine Industries of Florida, Inc.
Mercury Outboards
Mid-Florida Mining Co.
National Marine Fisheries Service, U.S. Dept. of Commerce
Ralph S. Evinrude Foundation
Sid Blake's Marine
Tampa, City of
Verlite Co.
W. R. Grace Co.

Grantees

Florida Atlantic University, Boca Raton
Florida Institute of Technology, Melbourne and Jensen Beach
Florida State University, Tallahassee
Monroe County District School Board
Mote Marine Laboratory, Sarasota
Nova University, Ft. Lauderdale
St. Petersburg Junior College, Clearwater Campus
University of Florida, Gainesville
University of Miami
University of North Florida, Jacksonville
University of South Florida, Tampa
University of West Florida, Pensacola

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Marine Research · Education · Advisory Services

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