

FLSGP-Q-81-001

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The World of Florida Sea Grant Biennial Report 1980-1981



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DIRECTOR AND COORDINATORS

Dr. James C. Cato
(since November 20, 1981)

Dr. Hugh L. Popenoe
(until November 20, 1981)

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DIRECTOR'S STATEMENT

Florida, particularly Central Florida, abounds with "Worlds." Clustered in the Orlando area are such well known attractions as Walt Disney World, Sea World, and Circus World. There is also Laser World, Sheraton World, and further south in Ft. Lauderdale, an Ocean World. Undoubtedly there are other commercial establishments which have also adopted this terminology which by one definition in Webster's New Collegiate Dictionary means "an indefinite multitude or a great quantity or amount." Loosely interpreted, then, and by popular definition, "World" has come to signify a certain state of completeness within a particular area of endeavor.

Although we don't usually refer to it in this way, there is another "World" in Florida - - the World of Florida Sea Grant - - which encompasses the universities in the State University System and several private universities and research laboratories. Their influence extends statewide and even throughout the Southeast and the nation in making impacts on the lives and work of many, residents and visitors alike, who inhabit or visit Florida's coastal zone.

It is this World of Florida Sea Grant which we present to you in this biennial report covering the years of 1980 and 1981. But in a sense it is more than just a biennial report, for in the center section we also take a brief look at some of the most significant accomplishments of the past ten years. Interestingly, several of these were realized during the past two years of this report. This fact, I believe, is indicative of two things - - one, that oftentimes a certain accumulation of experience and data are necessary before successful breakthroughs occur in any area; second - - that the Florida Sea Grant College program has now reached a maturity wherein greater and more significant accomplishments are now possible.

It was in 1972 when the State University System of Florida first joined the national network of other universities in coastal states. At that time, Dr. Hugh Popenoe, Director of International Programs in the Institute of Food and Agricultural Sciences at the University of Florida, was chosen to manage Florida Sea Grant for the Board of Regents, in addition to his other duties. When he assumed the reins, the program was a bi-institutional effort with an annual federal grant of \$250,000. When he resigned in November 1981, the annual federal grant was \$1.6 million with matching state funds of almost the same amount. It is impossible to talk about the first ten years of our program without acknowledging Hugh's many significant contributions.

Sea Grant programs nationally progress through "status levels". The highest level is that of "Sea Grant College" for those institutions which, over a period of time, have demonstrated outstanding leadership in the region they serve and have realized a high level of quality, productivity, and effectiveness of performance in research, education, and advisory services. In 1976, after the minimum waiting period had elapsed, Florida received this designation and is currently one of 16 college-level programs in the 28 states which participate in the national Sea Grant Program.

The tremendous growth of Florida Sea Grant and its designation as a Sea Grant College attests to the leadership Dr. Popenoe brought to the program. That same growth, which demanded more and more time resulted in the need for a full-time director. I was fortunate enough to be chosen as the new director and would like to take this opportunity to personally thank Hugh Popenoe for his efforts during the past ten years. I would also like to explain very briefly to those who may not be familiar with Florida Sea Grant, how we function and the situation as I see it at the present time.

We will continually examine our policies and procedures to ensure that we operate in the best interests of the citizens as we identify problems requiring university-based faculty and advisory service talent. Research projects, which have been quite varied in nature, will continue to cut across many professional disciplines such as economics, coastal engineering, fisheries, biology, law, and environmental sciences to name just a few.

Sea Grant sponsored research will continue to focus on real problems, have scientific merit and affect definite user groups. This requires that problems be identified and an appropriate research response initiated for funding. This identification response procedure requires a communications link between problem solvers --researchers in the universities, and users--those who live and work in coastal areas. One link is the Sea Grant marine advisory program which functions as a component of the Florida Cooperation Extension Service. Another link is the researchers themselves, who can often pinpoint problems from on-going research.

For this system to function effectively, the assistance of many people is required. Marine advisory agents receive assistance from local industry and citizen advisory committees, and a statewide member advisory panel and an agency liaison committee will assist me in determining the direction of our research efforts. Also, at each state

university and participating private institutions, a campus coordinator serves as a contact for Sea Grant. This coordinator assists in determining program direction and in identifying areas of pertinent faculty talent and research needs.

The assistance of these groups and individuals becomes even more important as we enter the time of budget cuts and funding restrictions. Shortages of funds and personnel are seen in other marine-related state agencies as well with oftentimes both long-range and short-range research dollars being in short supply and even in-house research capabilities threatened. Recognizing this we look ahead to joint planning among federal, state, and Sea Grant interests and to fostering interinstitutional efforts to develop and combine faculty talents so that the

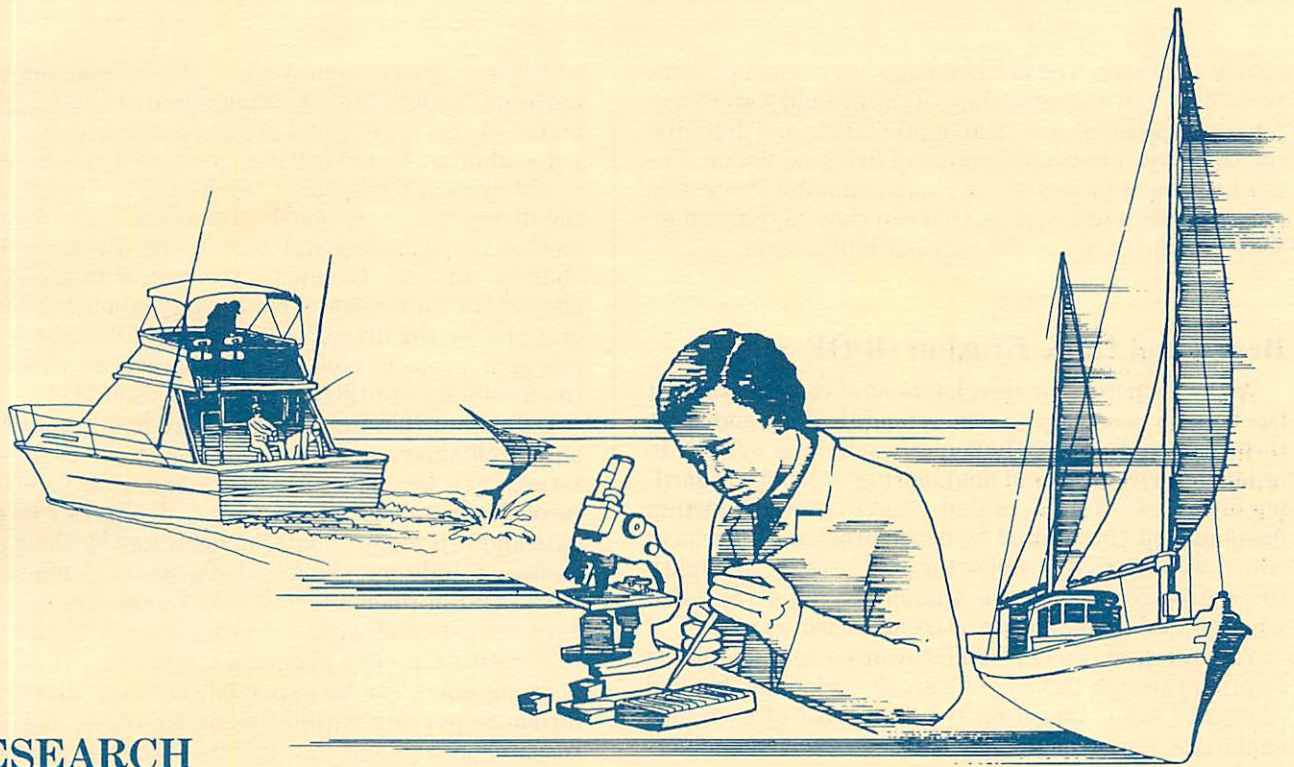
full value is received from every Sea Grant dollar invested.

This, then, is the climate in which we will be operating. That it will be a challenge is quite obvious. But we look forward to it, backed by outstanding professional faculty talent throughout the participating universities, a tireless network of advisory agents in the field, and many volunteers who give their time to serve on advisory committees and panels and in many other ways.

I want to assure everyone within the World of Florida Sea Grant that I intend to make every effort to continue to stimulate the growth of our program as we enter into our second decade of service to the people of Florida.

A handwritten signature in blue ink that reads "James C. Cato". The signature is fluid and cursive, with a long horizontal line extending to the right from the end of the name.

James C. Cato
Director



RESEARCH

Following Sea Grant philosophy, Florida Sea Grant College research is practical research aimed at solving real problems. These problems may be defined by either scientists or laymen, both of whom sometimes collaborate on finding a solution. The two years covered by this report were most strongly characterized by a shift toward a

broader array of ties with planning and development needs in the public and private sectors. While maintaining a base of medium-range studies to characterize ocean and shore processes, the research program also emphasized more work that has built-in delivery of results to users in a short timeframe.

COASTAL PROCESSES AND DEVELOPMENT

Storm Water Runoff (R/EM-15)

Along the north coast of Florida where the land dips down into the Gulf of Mexico before pushing back toward the Georgia border, the Apalachicola River empties into Apalachicola Bay. There, over the years, natural forces have worked to create a system of incredible productivity which forms the basis for a thriving oyster, shrimp, and finfish industry. The nutrient-driven food webs which are responsible for the productivity of the bay are very dependent on the upland drainage system.

Recognizing this, Florida Sea Grant College, for the past 10 years has funded research projects dealing with the ecology and biology of the bay. This most recent research was concerned with detoxifying storm water runoff in order to protect the bay. From previous Sea Grant sponsored research it proved possible to define some biological effects of the humic acid rich runoff waters from the pine plantations into the Apalachicola estuary. A sensitive assay involving the formation of

the bacterial endogenous storage polymer poly beta-hydroxybutyric acid (PHB) by the detrital microbiota in the bay was shown to correlate with the humic acids contained in the water that drained off clearcut forest lands. These compounds apparently stimulated unbalanced growth of microbes. Since the economically important components of the estuarine food web are the animals and plants near the top, an assay of the microbes and estuarine animals was done simultaneously.

These Sea Grant funded studies have enabled the development of a number of methods that have been used to solve problems and to understand the mechanisms of others. The succession on detrital surfaces led to the discovery of the importance of the extracellular polysaccharide polymer films in heat transfer resistance in condenser tubes that are cooled in seawater. The same polymer is of great importance in the sediment stability that is of importance in the placement of devices on the seafloor. There is preliminary evidence that these and bacteria are of great importance in facilitating corro-

sion in seawater. The methodology has made it possible to define a new bacterial flora of the ground water aquifer sediments that are vital in protecting and detoxifying this most important source of drinking water. The methods have provided the Environmental Protection Agency with a test system that can show significant effects of xenobiotics at the part per billion level.

Beach and Dune Erosion (R/OE-8)

With the increasing development of coastal areas, it has become necessary to understand the long and short term behavior of the dynamic beach-dune system in order to arrive at sound engineering decisions regarding future use of these regions, and to protect existing development threatened by beach erosion. One aspect which would greatly assist these efforts is the ability to accurately predict the amount of dune recession which would occur during extreme storm events.

This research was directed toward a semi-empirical solution through the use of a small-scale movable-bed physical model. Based on the principles of hydraulic similitude, a new model law has been derived and verified. The model law was verified with data measured during hurricane Eloise, which struck the Panama City area in September 1975.

Analysis of the experimental data provided a means of calculating the equilibrium barred storm profile in terms of the wave period, breaking wave height, surge level, and profile sediment grain-size. In most instances, the empirical expressions used in determining this profile have physical interpretations in terms of the incoming wave energy flux per unit width.

Finally, a method was developed which corrects the maximum dune recession in cases when equilibrium conditions are not reached.

Acoustic Navigation by Divers (R/OE-12)

Under normal conditions, man makes use of his visual modality for localizing objects and moving from one location to another. Underwater, however, human vision is greatly limited; quite often a diver is functionally blind due to the reduction of his visual ability. Traditionally, the solution to this problem has been the use of an underwater compass with the diver navigating by "dead reckoning." However, it has been found that, for well trained subjects the average performance accuracy was plus or minus 53 feet from the centerline of the measurement array of 3.98 degrees in compass error. In an operational situation when a diver might be engaged in an underwater search task or in accurate placement of underwater sensors, this level of performance would be marginal. An error in navigation of this magnitude would become more crucial, and possibly fatal, for saturated divers. That is, if a saturated diver made this large an error in navigating back to the underwater habitat, he could very easily miss it, and being saturated he would be unable

to surface and reorientate himself. Indeed, under almost any underwater working situation, navigational errors of this type would prove unsatisfactory.

In addition to navigating, a diver depends on his visual system for keeping track of other members of the diving team. Obviously, the need exists for some method of monitoring and locating the position of these "buddy" divers. Besides an increase in work efficiency, such a method would result in much safer operations for the diver. The purpose of this three-year research project, now concluded, was to determine the feasibility of utilizing the diver's sound.

Data from this first group of studies is considered only preliminary in nature, but a number of generalizations can be made: 1) divers are able to identify "acoustic distances" underwater, 2) divers can navigate and especially "home" underwater by their processing of auditory signals alone, 3) the Underwater Auditory Phi Phenomenon (UAPP) appears to be the most robust of all acoustic procedures evaluated and to constitute a very promising approach, 4) a strong learning effect can be expected, but with divers' performance peaking within five or six trials, and 5) the researchers suggest that low frequency signals (thermal noise and 500 Hz square waves) plus relatively wide transducer separations provide better localization cues than do other signal/source configurations.

Other questions still remain to be answered by re-searching the full nature, boundaries and capabilities of the UAPP approach to diver navigation. How efficient can this procedure be made and what features will enhance efficiency? What is the tradeoff between signal architecture and the downrange power of the technique? How can the signal be made loud enough (or amplified at the diver) so he or she can hear it at distances of 1-2 km? What changes in the procedure are necessary to direct a diver from point A to point B when the sound source is at point C? Experiments designed to answer these and other questions now are being developed and/or carried out.

Corrosion Fatigue of Welded Steel in Sea Water (R/OE-14)

The development of oil and gas production from new and unique offshore locations requires structural systems which retain integrity despite long-term deep water and rough sea exposure. Such structures may be either mobile (jack-up rigs, semi-submersibles, submersibles and drill ships) or fixed. The primary example in the latter category is the jacket or template type structure, as was first employed in the nearshore Gulf of Mexico over thirty years ago. During the relatively brief period numerous design modifications have evolved, first, as a consequence of service experience and data feedback and, second, because of changing requirements. At any rate, fatigue at welded tubular connections has been judged to be critical with regard to integrity of offshore steel structures employed for petroleum production.

The purpose of this research was to develop fatigue data for welded steel under conditions approaching those of actual wave loadings and based upon this, to develop more appropriate design procedures for offshore construction. Variable and constant amplitude fatigue tests upon welded steel plate specimens in sea water with various degrees of cathodic protection and at frequencies as low as eight cycles per minute were conducted. Particular emphasis was placed upon appropriateness of the design S-N curve and the need for developing data in the 10^7 - 10^8 cycles-to-failure regime under realistic conditions of electrochemical potential, frequency, plate thickness and weld profile. Both existing and new data were rationalized within this perspective, and the advantages of a design approach which incorporates both initiation and growth rate criteria were stressed.

The **American Petroleum Institute** contributed matching funds to this project.

Protection of Coastal Aquifers Against Saltwater Intrusion (R/OE-15)

To supply Florida's rapidly growing coastal population with living space and potable water, substantial drainage systems and well fields tapping the Floridan Aquifer and the surface aquifers have been designed and constructed during the last four to five decades. A result of these activities is a lowered potentiometric head, or groundwater table, inviting saltwater intrusion not only from the ocean in the immediate coastal zone but also from the underlying saline aquifers at some distance inland from the coast. Although saltwater intrusion normally is a slow geological process, a substantial mineralization of groundwater is now felt in practically the entire coastal zone.

To know a given site's sensitivity to saltwater intrusion is important to any developer constructing facilities needing potable water and to the agencies regulating such development activities. The present project has addressed that problem by developing a "saltwater intrusion sensitivity index" that will inform the user about the possibility of creating a saltwater intrusion hazard at any given site on the state's coastline. The index, which is a dimensionless number, is based on a numerical analysis of the migration of chlorides in groundwater taking the basic physical laws for migration of fluids and solutes in nonhomogeneous aquifers into consideration. An index value of unity represents the average condition for Florida, while values higher or lower than one indicate that the considered site is less or more likely, respectively, to develop the damaging intrusion.

The value of the index has been mapped along the entire coastline of Florida, from Escambia County in the west to Nassau County in the east and inland in the flat and very fast growing counties of Lee and Collier in southwest Florida.

Detailed information about the theory and aquifer parameters upon which the index is based is given in

Hydraulic Laboratory Report No. 8208, University of Florida, June 1982.

Hurricane-Assisted Sea Severity (R/OE-16)

The prediction of nearshore wave conditions during a hurricane is important for the design of coastal and nearshore structures, especially in the state of Florida since it is more hurricane susceptible than any other state.

Because the sea surface is confused during storm conditions, it is best described by a wave spectra. This permits an evaluation of various items of importance such as extreme wave heights, the presence of wave groups, etc., which may have significant effects on the loading and safety of structures.

A total of 400 wave spectra measured in deep water during hurricanes Camille, Eloise, Belle, Anita, Babe, and Frederic were analyzed. This analysis led to a series of spectral representations characteristic of seas preceding and following the passage of hurricanes.

A series of experiments was then performed to determine how these deep water spectra representations were affected by the passage of the hurricane waves from deep water into shallow water.

Corrosion Cracking in Reinforced Concrete (R/OE-18)

The deterioration of reinforced concrete structures due to the corrosion of the embedded steel strength members may be the leading material degradation problem in Florida. Nationwide it is estimated that one third of the highway bridge decks are seriously deteriorated due to reinforcing steel corrosion and that the cost of this damage is some 6.3 billion dollars. Existing structural inspection methods are incapable of detecting the early stages of corrosion and minor cracking of the concrete. Since the problem is often only recognized after the concrete cracks to the surface, there exists a need to be able to detect, locate and monitor the early stages of concrete cracking due to reinforcing bar corrosion.

The inelastic deformations of the concrete and corrosion product during cracking produce waves or acoustic emissions (AE) in the material. These waves are detectable and through appropriate signal analysis techniques, the location and nature of the sources of the signals may be characterized. Thus, AE offers a new method of inspecting reinforced concrete for its structural integrity and is being employed in this study.

The goal of this research is to adapt AE technology to the task of detecting, locating and monitoring cracking of concrete structures as a result of reinforcing bar corrosion.

The present program, conceived from an initial study in 1978-80, has been extended to large laboratory specimens in order to further characterize the nature of the AE signal itself, to determine additional char-

acteristics of the propagation of AE signals in concrete and to develop location and monitoring methods for use on life size structures.

Information not available before has been developed on the nature of the AE signal, including knowledge of AE signal frequency content, amplitude distributions, propagation losses and time behavior. In addition, this sensitivity of the AE methodology to the severity of the cracking problem has been very good, and the project is now ready to move into the second stage of the effort to select and monitor actual sites of corrosion cracking in the field.

The **Florida Department of Transportation** has assisted in this research.

Bubble Screens for Marina-Generated Pollution (R/OE-19)

Marinas for leisure crafts have long been a picturesque part of the coastal setting in Florida and a major economic factor. They provide the easy access to coastal waters and the ocean desired by the state's rapidly growing permanent population and by its many revenue-generating tourists. Marinas have in many cases, but not always, been built as parts of the extensive systems of residential canals that now occupy a substantial part of the coastal zone in south Florida.

Recent research requested by the Florida Cabinet and development of design rules for environmentally acceptable canal systems have shown that marinas may improve the general flushing characteristics of such systems when they are incorporated in the inland parts of the systems. However, marina-generated pollution, i.e., oil spills, runoff from adjacent parking lots, floating debris, etc., still exist.

Permitting agencies such as the Environmental Protection Agency and Florida's Department of Environmental Regulation are concerned about this source of pollution and require rational designs and firm assurances from the marina developers before permits are issued. At the same time marina owners and developers are seeking design methods and devices that will prevent the accidental pollution of a marina or another part of a canal system from spreading to neighboring waterways.

The bubble screen is a device that not only will prevent this transport but also will help in cleaning up the spills inside the basin without restricting access to the marina.

Bubble screens have been applied earlier by the engineering profession for containment of major oil spills, prevention of ice-formation at power station intakes, wave dampening and of course aeration of water. These are all high energy applications. Contrary to such applications the marina bubble screen considered in this project is a low energy device. It serves as an insurance against degradation of coastal waters by accidental spills. It is not to be considered as a "license to pollute."

Three modes of pollutant transport are being considered in the development of the final design procedure. The first is transport on the water's surface.

Hydrocarbon spills and floating debris are examples of this transport mode. The second is transport of suspended (or dissolved) pollutants such as may originate from sanitary pump-out spills. The third and last transport mechanism considered is rolling and/or jumping (saltation) along the bottom. Larger, heavier than water, particles such as empty beer or soft drink cans, dead animals, etc. are moved in this way.

The design methods are based on a thorough mathematical analysis of the flow phenomena in and around a bubble screen backed up by experimental verification in the Hydraulic Laboratory's research flume. At the present time, most scientific development is completed. The engineering design rules are being developed in cooperation with consulting engineers who will be the future users of the research results. The principal investigator has cooperated with the private branch of the engineering profession as well as with professionals on the county level. Two pilot screens are to be installed on a project in Key Largo this fall for full scale verification.

Snyder Oceanography Service, Inc. has contributed matching funds to this project.

Legal Tools for Local Government (R/CD-2)

Although the focus for management of coastal resources is likely to continue shifting toward local governments, experience has shown that many local governments, particularly in the less populated regions, are unprepared to competently exercise this responsibility. Technical assistance is needed to develop and implement effective management programs.

To assist local governments in improving their capability to manage coastal resources, the Water Law Program of the Center for Governmental Responsibility at the University of Florida is developing two series of technical/legal manuals. One series will consist of annotated bibliographies of selected publications on such subjects as wetlands protection, floodplain use restrictions, stormwater runoff controls and similar topics. The other series of publications will consist of legal memoranda analyzing legal issues that typically arise in developing and implementing resource management regulations. The taking issue, due process, equitable estoppel and similar issues will be researched.

Although benefits from this project have not yet been fully realized, some preliminary assistance has been provided to Resource Planning and Management Committees working with the Charlotte Harbor estuarine system, the Suwannee River valley and to the Southwest Florida Water Management District.

The **Florida Department of Veteran and Community Affairs** assisted in this research program.

Economic Analysis of Recreational Marinas (R/CD-3)

Despite the prominence of marine recreation in Florida, there is little quantitative information about

the actual contribution of marine recreation to the State's labor force and economy. As a result there are no data available to evaluate the consequences of population growth, rising energy prices, or legislative decisions that affect Florida's marine recreation industry. Information about the economic impact of marine recreation would allow policymakers and industry groups such as the Marine Industries Association of Florida to make more informed decisions about the productive use of resources in marine recreation to meet the ever increasing demands of the state's residents and visitors.

Economic activity in the marine recreation industry can be classified into five major sectors:

- Boat Manufacturing — building and repairing small recreational boats, yachts, and miscellaneous craft.
- Marine Manufacturing — production of marine equipment and hardware including electronics, parts, and accessories.
- Marinas and Boatyards — provision of moorage, repair, and marine rental services.
- Marine Trade — wholesale and retail sales of marine equipment and hardware.
- Marine Services — provision of marine insurance, finance, and publishing services.

This project will provide data about the economic impact of marine recreation on the Florida economy with the first year focusing on the marina and boatyard sectors and the second year examining the economic linkages between the five marine recreation sectors and other industries in Florida to determine the overall economic impact of marine recreation in serving the needs of Florida's residents and visitors.

Work is progressing on developing financial operating ratios for Florida marinas and boatyards stratified by assets, sales, and region of the state; determining the primary income and employment characteristics of Florida's marinas; determining the direct and indirect effects of income and employment generated by marinas on other sectors of Florida's economy, and establishing a primary data base that can be used for further research on Florida's marina industry.

Preliminary results from the data analysis have been used by the Marine Industries Association of Florida and various officials of the Florida Department of Natural Resources in recent testimony before the Governor and the Florida Cabinet on the impact of the sovereign lands tax on marinas. A blue ribbon marina committee appointed by the Governor and Cabinet to establish a marina policy for Florida is also utilizing the results of this study.

Legal Aspects of Recreational Marina Operations in Florida (R/CP-7)

This is the second part of a two-phase project undertaken by Florida Sea Grant to assist the recrea-

tional marina industry after marina operators had identified legal issues in the siting and operation of marina facilities as points of major concern.

The first part of the project dealt with legal considerations in the siting of recreational marinas and culminated in the publication of Sea Grant Report No. 36, "Legal Aspects of Recreational Marina Siting in Florida."

In this second phase, legal issues that typically arise in connection with the operation of a recreational marina were analyzed. With this information, marina operators are in a better position to identify potential legal problems and avoid them, thereby saving substantial sums of money. "Legal Aspects of Recreational Marina Operations in Florida," Sea Grant Report No. 46, addresses legal issues in eight major areas. Emphasis is placed on describing how these areas of law affect recreational marinas as opposed to more general businesses. Guidance is given throughout on ways to avoid potential liability.

Southwest Florida Regional Hurricane Evaluation Plan (R/CP-8)

At no time in history has Southwest Florida's population been more hurricane-vulnerable than it is today. Adjacent shallow Gulf of Mexico waters combined with low-laying, densely populated coastal areas produce the potential for large scale loss of life and property. This potential is further amplified by the fact that much of the rapidly growing coastal population consists of elderly people migrating into Southwest Florida who have never before experienced the fury of a hurricane.

Evacuation of those people is the key to avoiding major loss of life in such a situation. Until recently, the amount of time required for such an evacuation was subject to interpretation and guesswork. Recent advances in storm flooding predictions by the National Weather Service show that an accurate measure of the time needed for an evacuation would be a valuable tool for decision-makers in the event that an evacuation must be ordered.

This study produced such a decision-making tool in the form of a report entitled "Southwest Florida Regional Hurricane Evacuation Plan." This report addresses the anticipated hazards from hurricanes, identifies the areas and people vulnerable to the effects of a hurricane, reviews the ability to shelter the relocated residents on a short-term basis, and considers the impacts of a hurricane on the region as a whole. A guide for evacuation decision-making is included which enumerates several steps officials can take to act upon the information contained in the plan.

In addition to support from Florida Sea Grant College, funding was provided by a grant from the **Office of Coastal Zone Management** and the **Florida Department of Environmental Regulation**.

LIVING MARINE RESOURCES

Fishery and Biology of Swordfish (R/FR-13)

Since 1979, the swordfish fishery has become one of Florida's ten most valuable commercial fisheries. Rapid expansion of the fishery, value of the product, diversity of user groups and the need for data to develop good management plans by Regional Fishery Management Councils led to this study which was originally undertaken by the University of Miami and the Florida Department of Natural Resources.

Catch and effort data from approximately 175 commercial longline vessels and biological data on approximately 450 swordfish including lengths, weight, stomach contents, age, sex, and state of maturation, have been used to determine certain characteristics of the swordfish stock. With this information, predications can be made as to how stock will respond to changes in fishing effort and how much fishing pressure the stock can withstand.

Age and growth studies have enabled the scientists to predict changes in size composition and yields to the fishery with changes in fishing effort. For instance, the mean catch per unit of effort declined 25.6 percent by weight between 1979 and 1980 and from 190.5 Kg/100 hooks to 141.7 Kg/100 hooks. During this period, effective effort increased approximately 93 percent. The tentative conclusion is that any further increase in effort will cause overfishing of females and a decline in total yields.

The U.S. fishery management councils have used the results of this research, in particular the population dynamics and yield per recruit analysis as the basis for managing the swordfish stock within the United States Atlantic, Gulf of Mexico and Caribbean Fishery Conservation Zones.

Matching funds for this project were provided by the **Florida Department of Natural Resources**.

Economic Analysis of Florida's Seafood and Fishing Industries (R/FR-15)

Because Florida's seafood and fishing industries face changing economic and technical conditions, continuous updating of previous economic research is required. This project begins a new series of analysis designed to provide current information. Production techniques and inputs, new products, new markets, and new consumers are among the factors being considered.

Production, costs and returns, and marketing and demand analysis to be provided by this study pertain to spiny lobster, stone crab, blue crab, Gulf of Mexico reef fishes, shrimp, grouper and red snapper.

Objectives of the industry analysis are to address the production and marketing sectors simultaneously while considering questions of economic impacts of management strategies and public policy decisions.

Research results of preliminary dockside demand models specified that spiny lobster prices were affected by Florida landings, imports and income.

The researchers estimated trends in landings and values of the blue crab industry by analyzing the number of vessels, boats, and gear used in resource productivity.

Marsh acreage data incorporated with annual effort and yield data to estimate the effect of marsh acreage on blue crab production on Florida's west coast suggests that a reduction in marsh acreage will reduce blue crab catch.

An overview of the Gulf of Mexico and South Atlantic shrimp fishery reveals that the maximum economic yield of shrimp has been reached and that there is an excess of possibly 4,000 boats and vessels in the Gulf fishery alone. The economists further estimated that a \$.10 per pound increase in shrimp prices to fishermen caused approximately 200 new boats to enter the fishery.

Because individual fishermen acting alone have no influence on market price, any benefits from market research generally accrues through industry-wide activities. Benefits provided by this project include presentation of marketing alternatives, demand studies and over-all economic impact estimates. An example of benefits of specific research results is the lobster demand analysis showing that local supply had little economic effect on prices. A second example is the market expansion studies identifying increased markets for underutilized species.

Economic research also affects the industry indirectly through its influence on management and public policy. For example, after a close look by the shrimp industry at limited entry, it was decided that costs exceeded the benefits. Another example, involving import quotas and tariffs, revealed that a tariff would reduce imports only slightly yet increase consumer prices. On the other hand, export prices would dip slightly while only nominal impacts on fishermen prices could be expected. Consequently, pressures for import tariffs have decreased.

Human Pathogens in Commercially Important Shellfish — Environmental Factors (R/FR-18)

Currently, over 1 million Florida acres have been classified for shellfish harvesting. However, almost 40 percent of these areas are not considered safe, representing a significant loss for economic potential. From the areas considered safe, 3-3.5 million pounds of oysters are harvested annually with 90 percent being taken from Apalachicola Bay. Sporadic cases of "Cholera" associated with oysters from the Bay have further jeopardized the availability of approved shellfish harvesting areas and the economy of the oyster industry.

As a part of a major effort by the Food and Drug Administration and the Florida Department of Natural Resources, this FSG-sponsored study considered the concentrations of human pathogens in Apalachicola Bay and their correlations with fecal coliform standards. The research focused on the sources of these pathogens so that the fishery may be objectively managed and the risk of human illnesses can be minimized.

Researchers collected samples for bacteriological analysis from eight stations located in approved, conditionally approved, or prohibited shellfish harvesting areas in Apalachicola Bay. All four *Vibrio* were found at some time during the study at both approved and prohibited stations. The number of occurrences of non-01 *Vibrio cholerae* at approved stations was only 2.4 percent higher than at prohibited stations. In contrast, the remaining three species of *Vibrio* occurred considerably more frequently at approved stations than prohibited stations.

The results of this study, as well as those of others, suggest that non-01 *Vibrio Cholerae*, may exist as indigenous bacteria and is natural in the environment and not a result of human fecal contamination. This research further demonstrates that the occurrence of *Vibrios* in the marine environment shows little relationship to the activities of man and that, unless *Vibrio Cholerae* which may be related to human feces, is shown to be present, the bacteriological standards used to certify shellfish harvesting areas are not applicable to *Vibrio*-related diseases.

This does not in any way lessen the importance of present bacteriological standards for limiting the transmission of many pathogenic organisms by shellfish. However, the shellfish industry has been and will continue to be in jeopardy as long as "cholera scares" are not put into the proper perspective.

Additional funding was provided by the **Florida Department of Natural Resources**.

Human Pathogens in Commercially Important Shellfish — Storage and Handling (R/FR-19)

As a companion study this project was designed to evaluate the effects of storage and handling procedures on the microbiological quality of oysters and clams and to determine the optimum conditions for preserving the quality of shellfish meats.

Researchers compared and evaluated the effects of storage on unprocessed shellstock at 20, 8, and 2 degrees centigrade for 7, 14, and 21 days. They also examined the interactions between water temperature and salinity of the harvest sites. Of significant importance was the finding that in shellstock stored at 2 degrees centigrade *Vibrio cholerae* increased significantly during the initial seven-day period and continued to increase as storage time or temperature was increased.

However, fewer of the bacteria, *Vibrio cholerae*, were found in oysters shucked, washed, and containerized in a manner similar to the process used in Florida oyster-processing houses.

New information gained from this and other related Sea Grant projects in Louisiana, Maryland and Oregon regarding cholera-causing bacteria is being used by oyster processing houses and other shellfish processing facilities as well as agencies concerned with public health hazards. The laboratory has provided technical assistance to the Center for Disease Control as well as information to the State laboratories. The results will also be incorporated into a set of recommendations to be communicated to the National Shellfish Sanitation Program.

In addition, various regulatory agencies will use the methodology provided by this study for maximum recovery of specific types of microorganisms from shellfish. These agencies include the Florida Department of Natural Resources, the Florida Health and Rehabilitative Services, and the U.S. Food and Drug Administration.

Exploitation of Virgin Deep Water Fish Stocks (R/FR-20)

Although unexploited stocks of the snowy-groupers (*Epinephelus niveatus*) and gray tilefish (*Caulolatilus microps*) still exist in the Florida Keys, can these deep water fish stocks support a sustained fishery if appropriate management strategies are put into motion prior to excessive exploitation?

Both species are potentially targeted for sport and commercial exploitation in the Gulf of Mexico and South Atlantic and biological information on these species-stocks, beyond taxonomy, has been virtually non-existent.

In order to form sound management strategies for these two deep water reef fishes, FSG researchers are making a pre-exploitation assessment of their stocks.

To date, 266 snowy groupers and 39 gray tilefish have been collected for ascertainment of population parameters such as length-weight, sex and age, reproductive characteristics and fishing susceptibility.

Cooperative interactions relative to this project have been developed and maintained with the **National Marine Fisheries Service** and with the **commercial fishing community of the lower Florida Keys**. Also assisting in this project are the **State University System of Florida Institute of Oceanography**, **Monroe County Extension Service**, and the **Venezuelan government**.

Commercial Sailing Fishing Vessels (R/FR-21)

One reason for the decline in fishing vessel construction and operation is the rapid escalation of diesel fuel prices from about 20 cents a gallon several years

ago to \$1.20 per gallon today (Florida west coast prices). Dockside fish prices have not increased at this rate or even at the general inflation rate. The typical snapper-grouper boat operating on the Florida west coast, uses about 14,000 gallons of fuel annually. Half the fuel is used to get to and from the fishing grounds — approximately 200 miles each way. Sailing fishing boats are being built, sold, and operated in the Pacific Northwest but such a trend is not yet apparent in Florida.

Florida Sea Grant is currently funding research with an objective to save fuel and monies spent in operation of fishing vessels by determining ways to retrofit existing craft with sails where feasible. Another part of the research is concerned with developing designs for entirely new fishing vessels optimized for sail propulsion as a primary source of power with auxiliary engine power. Researchers feel that a boat, given the prevailing wind and currents, could sail without engines at all at least 60 percent of the time. It is projected that for snapper-grouper fishing boats, a minimum of 30 percent fuel savings would be realized when retrofitted with sails at an approximate cost of \$10,000 per boat with no change in present fishing patterns.

Test Marketing of Cultured Lugworms (R/A-6)

In recent years, a decline in quantity and size of wild bait worms harvested in Maine and Canada along with difficulties that prevented their culture led to suggestions that other culturable species be used. The lugworm, *Arenicola cristata*, a relative of a popular European bait worm, was proposed as one substitute. In 1976, Florida Sea Grant researchers developed methods to culture the lugworm and reviewed market perspectives.

Nevertheless, potential users of the methodology had reservations about the probable economic success of lugworm hatcheries or farms because no test marketing had been done and retailers and fishermen needed more information on storage, handling, and shipping. More data were also necessary on some aspects of grow-out, especially feeding and harvesting. Providing this information was accomplished with support from the North Carolina Sea Grant Program, Duke Marine Laboratory, North Carolina fishing pier operators, tackle shop operators, and fishermen who participated in the test market, and the Gulf Breeze Environmental Research Laboratory (EPA).

Test marketing was conducted from October 1980 to October 1981. A dealer network was developed from data provided by the North Carolina Marine Resources Center. Selection was based on specific criteria applied during a site visit in April 1980. The researchers selected dealers who had facilities with running sea water and a large concentration of an-

glers. Included were four fishing piers and one tackle shop. Lugworms were shipped to North Carolina by private carrier packaged over ice in insulated containers.

Conclusions were that anglers will accept lugworms as a substitute bait mainly because they can be used to catch the preferred types of fish, especially spot. Dealers will accept lugworms only if handling and storage problems are solved, but if these are not addressed, it is doubtful that commercialization can be considered feasible and a modified marketing strategy was suggested. Data and observations from this study should help potential investors make decisions concerning the profitability of lugworm aquaculture.

Seaweed-Crustacea Polyculture (R/A-7)

Mariculture systems in the United States have not been conspicuous for their success, primarily for economic reasons. Consequently, in recent years, much interest has focused on polyculture systems in which two or more species are grown together. Combined yields of the individual species in such systems commonly exceed those possible from any one species grown alone. Frequently, through mutual benefits, yields of individual species are also higher than those obtained when they are grown alone.

Sea Grant researchers grew the red algal agarophyte, *Gracilaria tikvahiae*, in separate polyculture systems with penaeid shrimp, *Penaeus duorarum* and spiny lobster, *Panulirus argus*. The proposed objective was for mutual benefit, that is, by the crustacea keeping the seaweeds clean of epiphytes, and the seaweed and its epibiota providing food for the shrimp and lobster. Growth of the crustacea in the seaweeds was compared with growth resulting from a diet of artificial prepared feed and combinations of the two sources of nutrition.

The usual filamentous green algal epiphytes did not seriously infect the *Gracilaria* cultures in the experiments, even in the controls without animals, so the study was not a fair evaluation of the epiphyte control ability of the animals. The seaweeds did produce slightly greater yields with the crustacea present than they did without the crustacea.

Spiny lobster culture was unsuccessful in seaweed alone, on pelleted feed alone, and in combination, due to very slow growth and high mortality rate.

Growth of pink shrimp in seaweed alone was equal to or better than that of animals fed the prepared diet alone for the first three months. The prospects were discussed of growing bait shrimp in seaweed with no supplemental feeding at considerable cost saving.

Though the results of preliminary experiments are not conclusive, they show considerable promise of an increase in yields, improvement of quality and reduction of costs when the two are grown together.

SHORT TERM, PILOT, AND DEMONSTRATION PROJECTS (M/PM-2)

While major Sea Grant projects can be scheduled through the regular biennial review process and annual funding cycle, there arise each year opportunities for participation in projects which cannot be anticipated. These needs are met with short term, limited budget, immediate response grants. This has often provided Florida Sea Grant the flexibility to respond to a constituent's needs in a timely fashion, or to conduct a pilot or seed project to determine whether larger, longer term funding was justified.

In June 1981 a revised management plan for this program area was implemented which designated various categories of need considered appropriate for an immediate response grant. The primary requirement, of course, continues to be that the opportunity to benefit from the proposed project would be lost before funds could be made available through the regular annual review and fiscal cycle. A small portion of the budget is also earmarked each year for technology transfer demonstrations conducted by marine advisory personnel.

A few of the Immediate Response research projects from the past two years are briefly summarized below with the entire list shown in the Summary section of this report.

Development of the Soft Crab Industry

Through publications and workshops held in crab producing areas marine advisory specialists and agents were instrumental in providing the impetus for a profitable soft crab industry in the state. More details on this project are contained in the center section of this report.

Benthic Studies in Florida Coastal and Estuarine Waters

Benthic biological analyses are pertinent to impact statements and permitting procedures and much data exist in diffuse sources. Compiling those sources into an annotated bibliography has been accomplished and is considered the first step toward a generic summary of Florida's benthic marine communities.

Impact of Toxic Substances on Indian River Fisheries

Inputs of copper from anti-fouling paints presently pose an environmental stress on some restricted embayments of the Indian River Lagoon. This project sought to evaluate these inputs and their fate in the Indian River system. Over an 18-month period, samples of water, suspended matter, sediments, barnacles, clams and crabs from selected sites along the Indian River and one of its tributaries, the Eau Gallie River, have been analyzed for copper. Higher than normal copper concentrations were consistently observed in the water column, sediments, barnacles and

crabs collected from the Eau Gallie Harbor. Point sources of copper could be directly traced to vessel-related activities. From the field data and laboratory experiments on the leaching of copper from anti-fouling paints, an estimated flux of 40 kg/y to Eau Gallie Harbor was calculated. Further estimates suggest that 75 percent of the total copper input to the harbor is retained there. Outside such tributaries along the Indian River from Vero Beach to Melbourne, copper levels were within normal limits.

Dune Management Manual

Beaches and sand dunes confront tremendous energies from storm waves, tides, and winds. They act as shock absorbers to protect the coastal environment and buildings behind them. Dunes can also be looked upon as sand stockpiles, accumulating sand in normal conditions and releasing it to the beach during major storms. This sand reserve helps beaches resist wave energy and provides material to help rebuild the beach after the storm. This manual was prepared as an operating tool for the private property owner or government official to aid them in making good decisions concerning sand dunes. The manual does not focus on beaches generally but on dunes in the pioneer or sea oat zone closest to the waves, since these are the dunes most often damaged or destroyed, and thus most in need of attention.

Economic Impact of Kingfish Tournament

Sport fishing events are becoming an increasingly popular way to attract attention to the fishery stocks of particular coastal areas and are held now in virtually all the states along the Atlantic and Gulf coasts. Despite this fact, little information has been documented on the economic impact on these areas. To collect information about participants' expenditures and socio-economic characteristics in the Greater Jacksonville Kingfish Tournament held in July 1981, FSG researchers surveyed 358 of the 515 captains participating. Results of the survey revealed that approximately \$700,000 to \$800,000 in economic activity was generated. This estimate falls short however, because it was not possible to include all pre-tournament expenditures related to planning, organizing and advertising. Other benefits not quantifiable include good will, public relations improvement and tourist promotion brought about by the tournament.

Small Harbor Engineering — India

This international project, a 10-day Short Course on Small Harbor Engineering held at the Institute of Technology (ITT), Bombay, January 1980, was proposed and coordinated by a FSG researcher who is a native of India. He was aware that the government of

India had a master plan to construct or improve a large number of small fishing harbors circling the entire coast which would call for a cadre of technologically proficient engineers. Fifty people attended the short course which provided a forum for identifying coastal engineering problems and possible solutions related to the design and maintenance of small and intermediate-sized harbors. Cosponsors, in addition to FSG and ITT, were the Dredging Corporation of India, New Delhi; Central Water and Power Research Station, Pune; and the National Institute of Oceanography, Goa.

Florida Smokies: A Market Survey

Florida Smokies, skinless and boneless fish fillets flavored by a cold smoking process, had been developed at the University of Florida, but market survey evidence was required to gain the acceptance of food processing firms. Researchers sampled 402 consumers in Jacksonville and Tampa to determine their sensory reactions and fish fillet use patterns. Mullet fillets which had been frozen for about one month after smoking, were deepfat fried and served to the participants. Based upon the favorable response, several processing firms, in and out of Florida, have production plans pending.

Salted Minced Product From Grouper Frames and Spent Mullet

Because surplus fish and minced flesh from filleting operations were wasted in seafood processing, Florida Sea Grant scientists have developed methods to produce salted minced fish as a by-product. Although no market testing has been undertaken, when the foods were prepared from stored products, a small informal panel found the chowder, fish cakes, and a mixture of mince and vegetables acceptable.

Predator Removal and Reef Fish

This project was based on the theory that larger predator fish prey on the smaller species and that removal of these larger species by spearfishing would allow smaller prey populations to increase. As control reefs, the investigator selected Molasses Reef and French Reef, both located at the Key Largo Coral Reef Marine Sanctuary and protected from spearfishing since 1960. Looe Key Reef, where spearfishing was legal until 1981, was chosen as the experimental reef. Data were collected by observing, counting and measuring individuals of each species. Results showed that on the experimental reef, not only were the largest species rarer but that those remaining were smaller. On the other hand, the reef fishes observed at the control reefs were the larger piscivores species and more numerous. These conclusions can be interpreted as support for the theory that the large fish-eating predators do influence the coral reef community struc-

ture. However, the investigator feels that additional monitoring is necessary for confirmation.

Verifying Freshness of Tournament Fish

Recreational fishing tournaments are increasing in popularity and value, and purses often exceed \$1,000-\$2,000 with individual winnings sometimes ranging as high as \$10,000-\$20,000. With this kind of money at stake, there is a temptation for illegal entries. The most common is a previously caught gamefish that has been properly frozen, then thawed. Although tournament officials often request the assistance of an 'expert' judge, most judgments are based on simple sensory assessments which are limited and confusing. The primary objective of this project was to differentiate fresh and previously frozen fish. Researchers compared samples from fresh catch-of-the-day and previously frozen king mackerel using sensory, Torrymeter, histological and chemical techniques. It was concluded that the Torrymeter can be used to support visual assessments and to verify catch-of-the-day fish in recreational fishing tournaments.

Citizen's Guide to Florida Beaches

To educate Floridians and potential new residents about beach and barrier island systems, a book, "A Citizen's Guide to Florida Beaches," has been prepared. Since geological processes and storm hazards must be considered by users of beach barrier islands in order to make informed personal decisions this layman's guide to Florida's unique barrier system will provide the needed information in a single source.

Artificial Reef Research Diver Training Program

After being established, artificial reefs need to be maintained through regular on-site inspections by qualified divers. To assist reef programs in this, the marine advisory agent for northeast Florida developed and presented diver training courses for sport divers to train them in methods of fish data collection and scientific evaluation of artificial reef sites. The course also offered instruction in methods of presenting this information to reef committees, local government agencies, and the public. Results of the project are already paying off in the development of an artificial reef evaluation manual which was developed as part of the course and which is planned as a publication by Florida Sea Grant College in late 1982 or early 1983. Also, 24 divers who completed the course in 1981 have organized as part of the Jacksonville Artificial Reef, Inc., a non-profit corporation organized by sport fishermen in that area. The divers will assist the corporation in siting, evaluating, and monitoring artificial reefs.

LOOKING BACK — THE LAST DECADE

Ten years of Florida Sea Grant College research has produced many benefits for the state and the region. Some of which can be measured in hard economic terms. Other benefits, however, are less tangible and more difficult to define, but no less important than those which can be accounted for

Artificial Reefs

Prior to 1977, interest in artificial reefs was high but permitting red tape slowed the process of construction. Demand for construction of new reefs has been strong over the past four years and continues to increase. Well over 200 charted artificial and natural fishing and diving reefs exist in Florida. This growing artificial reef population gives Florida a more extensive program than any other state. These alternatives to the natural habitats are popular and productive spots for the state's enormous commercial and resident/tourist sport fishery. In the mid-1970's three government agencies required different permit applications for artificial reef construction. Delays of up to 18 months were not uncommon in the permitting process.

The complicated permitting process for artificial reefs in Florida was addressed in a comprehensive conference on Florida reefs in 1977. Florida Sea Grant organized the conference but involved every major agency, academic and private group having interest in or responsibility for administering artificial reefs in Florida. The Conference resulted in a single inter-agency permitting process. Another accomplishment of the Conference was the establishment of an Artificial Reef Team. The Team was established to assist local communities in artificial reef site selection, permitting, construction, and evaluation. Civic, municipal and special interest groups serve as the catalyst in most projects working through the Marine Advisory Program. Since the establishment of the Artificial Reef Team, the quality of artificial reef construction and stability has increased in Florida. Rarely are properly sited and constructed reef materials washed up on shore. Nearly every community desiring an artificial reef program (more than 20) have worked through the Sea Grant Artificial Reef Team. A very close working relationship has been established with the Florida De-

monetarily. Following are reports on a few of the most significant accomplishments and accompanying benefits as a result of the work of Florida Sea Grant researchers and marine advisory agents and specialists in the past decade.

partment of Natural Resources (DNR) in the permitting and financing of artificial reef projects.

Residential Canal Construction

Thousands of private homes and scores of condominiums line man-made canals and lakes which have been dredged out along the coastline of Florida. Development of this coastal land is complicated for not only does it have a high market value which encourages maximizing the population but it also has a high natural resources value as a breeding ground for marine life, natural pollutant filter, and nutrient recycling ecosystem. This project had as its objective the designing of self-cleaning canals, taking full advantage of both tidal and wind action, and built in such a manner as to be compatible with the physical, chemical and biological characteristics of the site.

As a result of this project and the short courses which followed, engineers, developers, and planners were introduced to modeling procedures which are expected to be widely used by consulting firms and regulating agencies throughout Florida and the Southeast for evaluating both improvement to existing designs and new canal systems. Already, two elaborate canal systems in Palm Beach County have been completed using these procedures and designs. As a result, real estate values of affected property increased approximately four times from an estimated \$25,000 per lot to \$100,000 per lot, creating in one project alone a total value of \$20 million. Also three marina projects with approximately 1,000 boat slips each have been constructed in Dade County and canal/marina projects are underway in Indian River, Martin and Sarasota Counties. Although it is not possible to establish exact monetary benefits from this project, it promises to have a far reaching and favorable effect on future development of Florida's coastal areas as well as areas in other parts of the country.

Beach Dune Walkover Structures

With 210 miles of Florida's 780 miles of beach in a critical state of erosion, the necessity to try to protect the beaches as an economic resource has been very apparent. High priority is given to providing beachgoers with access across sand dunes, a situation which, if uncontrolled, contributes to a breakdown of the dunes and subsequent erosion. In 1976, Florida Sea Grant published a bulletin containing detailed drawings for an acceptable beach dune walkover structure.

Of the over 200 permits requested each year since that time for walkover structures, between $\frac{1}{3}$ to $\frac{1}{2}$ are based on the plans in that Sea Grant marine advisory bulletin. Because these plans are immediately acceptable to the Bureau of Beaches and Shores in the Department of Natural Resources, they are routinely approved, thus saving both time and money for regulatory personnel and those citizens asking to build walkover structures.

Economic Analysis of Commercial Fishing and Seafood Marketing

For ten years Florida Sea Grant has provided to commercial fishermen and seafood processing firms detailed economic data to aid them in making profitable management decisions. The marine economics program has consistently generated research data in the area of production and supply analysis, marketing and demand, and public policy. Over 110 documents and publications have been issued and over 60 workshops of a local, regional, and national scope have been held. A few examples include:

The "optimum" economic position for the Florida spiny lobster industry was determined to be 213 boats each fishing 795 traps in 1973. To reach this solution (many thought too many vessels to be in the fishery) would have required a reduction of 186 boats and an increase of 366 traps per boat for the remaining boats. This reorganization would have caused industry costs to be \$2.4 million. When compared to the political, social and economic costs of displacing 186 boats from the fishery, regulators felt the savings of 14 percent did not warrant this type of regulation.

Florida lobster fishermen were politically displaced from Bahamian waters in 1974. The addition of these 160 boats to the Florida Keys fishery indicated that landings would increase by only 6 percent and catch per trap would decrease from 30.3 pounds to 22.9 pounds due to the already heavily fished nature of the fishery. Increasing traps per firm in the industry by 54 percent to offset the decreases would further reduce catch per trap to 21.7 pounds. The resultant decrease in net returns to the average lobster fisherman's labor, management, and capital was estimated to be \$3,877 which left returns slightly above zero. This analysis provided major input into the awarding of a relocation and training grant of \$2.3 million from the EDA to the displaced fishermen.

During 1977 and 1980 the financial community expressed a desire to learn more about vessel and shoreside facility financing. Two seminars were held for the banking community. One 3½-day seminar in Jacksonville drew over 80 bankers from Florida, Georgia and the Carolina's. Another one-day seminar in Tampa drew 66 bankers from Florida.

Vessel cost and return budgets have been developed for spiny lobster, mackerel, snapper, grouper and most of Florida's major commercial fisheries. These budgets have been utilized along with other data in over 60 tax and business management workshops for vessel owners and captains in over 30 Florida fishing communities from Key West to Pensacola. A typical example of the benefits of the workshops is that a vessel owner admitted preparing his own tax returns and not knowing of the

TEN YEARS OF ASSISTANCE

The first and most readily identifiable audience for the Florida Sea Grant Program when it was established in 1972 was the commercial fishing and seafood processing industries. The importance of these industries to Florida can be seen in the latest available statistics which indicate that the Florida seafood industry ranks sixth in terms of value of landings of all states. Dockside landings were

investment tax credit. He benefited that year by \$5,000 in attending.

A survey was conducted during 1977 and 1978 in each Florida coastal county to document the needs in sea port improvement as related to commercial fishing. It was recommended that a major industrial seafood park was not needed (costs would exceed revenues). However, needs in seven north Florida counties were determined with cost estimates ranging from \$.4 to \$3.7 million. Several communities such as Carrabelle actively pursued port improvements.

An analysis of the Gulf of Mexico shrimp industry was made with respect to catch rates, demand for imports, and vessel entry into the fishery in 1980 and 1981. Presentations were made to the Gulf States Marine Fisheries Commission, Gulf of Mexico and South Atlantic Fishery Management Councils, and other industry groups. Proposed import duty legislation was analyzed. The results indicated that an import duty of 30% would raise import price by 37%, domestic price to producers by 9% and decrease quantity imported by 8%. Taxes levied would have helped producers but cause an even more depressed shrimp market than existed in 1980 and 1981 at the retail level which would be harmful in the long run to the industry. These same results were used as the basis for a conference on limited entry in the shrimp fishery held in Jacksonville during 1981 which was attended by 165 commercial shrimpers.

Seafood Waste Management

In conjunction with basic harvesting and processing problems, the seafood industry must contend with complicated regulations and resource conservation, waste management. Florida Sea Grant has responded with numerous programs and individual efforts to assure productivity with more reasonable regulatory requirements. One example is Seafood Waste Management Conference coordinated by the Marine Advisory seafood specialist who concentrated the best expertise from industry, government and the universities to focus on the methods and cost benefits of compliance with numerous regulations. Review of the economic consequences associated with proposed 1984 environmental regulations indicated that the

E TO FLORIDA FISHERIES

valued at \$173 million in 1981. Florida processors handled \$369 million in processed products during 1980. Over 10,500 commercial fishermen and 425 processing and wholesaling firms employ over 6,600 employees to handle the catch. The contribution to Florida's economy is well over one-half billion dollars annually.

Southern shrimp industry would suffer a 30 - 50 percent decrease in productivity with complimentary losses in employment and related business. Based on conservative 1978 figures, 21 percent of the companies in the non-breaded shrimp industry would have to close with a loss of 1,590 jobs and \$38 Million annually. Since this meeting, the respective state and federal regulatory agencies have withdrawn proposed regulations and are reviewing the reasonableness of future regulations.

The Soft Crab Industry Grows

Florida Sea Grant Specialists and advisory agents have simulated the development of soft crab fisheries throughout the Southeast by introducing existing technology from the Chesapeake Bay region to potential Florida producers. Prior to their work, there were two or three soft crab producers in Florida. Beginning in 1979, with technical advice and marketing assistance from a marine agent in the area, three shedding operations were successfully launched in the Big Bend area of Florida's central Gulf coast. At the same time, on the upper beaches of the St. John's River, Florida Sea Grant advisory specialists and the advisory agent for northeast Florida were conducting an economic and feasibility study on soft shell crabs. From that study came a Florida Sea Grant report on the industry and a Marine Advisory Fact Sheet with detailed information on harvesting and identification of peeler crabs. Six workshops were then held in crab producing areas for potential producers.

As a result of the technical and marketing assistance, a number of additional producers entered the business along the Gulf coast. Publicity and marketing efforts were so successful that at one time, two producers in Citrus County each had orders for over 50 dozen soft crabs that they could not fill. All orders were from in-state customers indicating that a large Florida market was developing. The soft crab industry has continued to grow. Now in 1982, over 20 firms are attempting soft crab production in Florida, and the economic potential of this newly developed fishery through Sea Grant inspired technology transfer has been estimated at an annual dockside value in excess of \$1 million.

Oyster Quality Improvement

In Florida a primary concern is oyster processing. A technical assistance project was initiated in 1981 to assure production of safe, top quality oysters in compliance with newly strengthened sanitation requirements which most companies did not meet with existing facilities and practices. Initially six Florida processors under MAP sponsorship visited processing firms in the Chesapeake Bay. Additional work included preparation of a useful operator's manual, on-site recommendations for plants and investigation of an innovative oyster shucking process - steam shucking. Indications are that steam shucking could increase daily oyster production by 30 to 40 percent. This technique does not replace labor but boosts earnings for the processor and his entire labor force. Thus through quick action of the extension service, linked with the State appointed Oyster Task Force Committee, adverse economic impacts were averted and the oyster industry experienced a record banking year of production with a dockside value in excess of \$6 million. Finally, a first ever, "Interstate Meeting with the Florida Oyster Industry" was conducted in Apalachicola, Florida.

Help for the Sponge Fishery

Up until the 1940's, the sponge fishery was one of the most valuable fisheries in Florida. However, a combination of the sponge blights of 1939 and 1946 and the introduction of synthetic sponges reduced the fishery to a fraction of its former importance. In addition, traditional sponging grounds were being depleted and sponges were not reproducing as rapidly as in the past. This situation was brought to the attention of Governor Graham who contacted Florida Sea Grant College to request assistance for the industry. As a result, two Sea Grant Marine Advisory agents embarked on a project to evaluate the situation and try to locate new sponge diving grounds. Partial funding was provided by the Gulf and South Atlantic Fisheries Development Foundation with two boats and diving crews furnished by the Tarpon Springs sponge industry.

In several locations on the Gulf side of the middle and lower Keys the marine agents found sponges in what they felt to be sufficient quantity to support some commercial sponge diving. Sponges cannot be harvested in the area until a Florida Statue is modified and the agents have worked with the Florida Department of Natural Resources and the National Marine Fisheries Service to identify and resolve these legislative restraints. They are also investigating harvesting methods to determine if cutting sponges will permit faster regrowth than the traditional method of hooking and if so, at what level the sponge should be cut for most rapid regrowth.

The Gulf Stream — Locating It Off Florida's Coast

Because of its peculiar characteristics, the Gulf Stream is more difficult to navigate than the surrounding sea and when the wind blows opposite the current, the waves can be twice as high. It is not well-defined and has numerous eddies and counter flows that fluctuate and meander unpredictably. Consequently, timely information related to the location and conditions of the Gulf Stream is crucial to seamen. Although the NOAA Satellite Information Office in Miami provides these data, dissemination to users on a timely, understandable basis has been lacking. The Florida Marine Advisory Program initiated a cooperative project with the NOAA Satellite Information Office and NOAA Weather Radio to identify reference points along the southeast coast of Florida and develop oral descriptions that are easily interpreted by the general public.

Now, up-to-date, usable information is broadcast by NOAA Weather Radio hourly, three days a week for 24 hour periods. Sport and commercial fishermen, and headboat and charter boat operators report the program saves them money, time and energy. By knowing the exact location of the Gulf Stream wall, thermoclines and eddies, swordfish longline fishermen spend less time searching for desired fishing locations along the stream's wall and use less expensive fuel than before. One ocean-going transport company reported saving time, money and energy by being able to locate the Gulf Stream through information received from the Florida Sea Grant/NOAA cooperative project. When traveling in the same direction as the Gulf Stream, and cruising the vessel within the walls of the stream, a vessel's speed can be increased by approximately 2.5 knots. On a bi-weekly basis, this could save 192 hours (8 days per year). An average equipment operating cost of \$15,000 per day represents a savings of \$120,000 annually per vessel. The information provided by this project is vital to the company identified as it has at least 60 vessels in the Caribbean. An on-going fuel conservation program has been enhanced by this weather information with fuel savings of 20-40 percent obtainable when the company's 9000 horsepower tugs are able to reduce rpm by 18 percent, with only small reductions in speed. The company is experiencing up to \$2,000 per day savings per steaming day on seven line haul tugs.

Diver and Mechanic Training

Ever increasing offshore oil exploration and spin-off activities continue to demand skilled, professional divers. The mounting number of powerboats in Florida is greater than the supply of marine mechanics to service outboard and diesel engines.

To help in meeting these needs, Florida Sea Grant provided start-up funds for educational programs at Florida Institute of Technology to train divers and mechanics. These programs which be-

came self-sufficient after two years were also funded in part by members of the Association of Diving Contractors and major engine manufacturers including Outboard Marine Corporation, Evinrude Motors, Johnson Motors, and Mercury Marine.

Since 1976 over 20 divers per year have graduated from the Underwater Technology Program with about 90 percent taking positions with major firms servicing offshore oil operations and the others joining research and development groups or hyperbaric treatment centers. Graduates of the outboard mechanics program which began in 1979 have also readily found employment as factory certified mechanics.

Apalachicola Estuary

The Florida oyster industry is centered in Apalachicola Bay, which provides 85% of the State's \$6 million annual crop. The Bay supports other valuable fisheries dependent on its extensive natural system of shallow estuarine waters, coastal lowlands, and a freshwater drainage that includes much of Georgia and part of Alabama. The overall economy of this region (Northwest Florida) is heavily dependent on natural products (e.g., fisheries, timber).

Increased needs for both agricultural production and urbanization in the Southeastern U.S. have created conflicting demands on the natural resources concentrated in the Apalachicola Bay area. A checklist of recent competing activities includes agricultural pesticide application, dredging for navigation, wastewater discharge, forest harvesting and runoff, barrier island development, and assurance of seafood quality.

Long-term Florida Sea Grant engineering, biological, economic, and technological studies addressed these issues in concert with the Franklin County Commission, Florida Departments of Natural Resources and Environmental Regulation, U.S. Corps of Engineers, Coastal Plains Regional Commission, U.S. Department of Commerce Office of Coastal Zone Management and the Conservation Foundation.

The overall result of these research and advisory projects has been to develop the basis for decisions by (1) the U.S. Environmental Protection Agency and Department of Agriculture, and state agricultural interests to curtail Mirex spraying over Georgia, thereby sustaining major fisheries; (2) timber industry to modify clearcutting practices on thousands of acres to alleviate upland runoff impact on aquatic organisms; (3) the State of Florida and U.S. Department of Commerce to acquire productive lands as the nation's largest National Estuarine Sanctuary; (4) Franklin County government to adopt a land use plan in 1981 incorporating goals to promote maximum productivity of local fisheries while targeting locations for future population growth; (5) the oyster and seafood processing industry to improve practices of concern to regulatory and health officials, and to adopt new technology that could boost production.



TECHNOLOGY TRANSFER AND APPLICATION

While delivery of the results of Sea Grant sponsored research to affected user groups is most often accomplished through extension channels via the marine advisory agents, there are times when it is more expedient and effective for this to be done directly by the principal faculty investigator in ways complimentary to the Extension process. These projects fall into this category.

Florida Canal and Marina Development Seminars

Thousands of private homes and scores of condominiums line man-made canals and lakes which have been dredged out along the coastline of Florida. Development of other coastal land is complicated for not only does it have a high market value which encourages maximizing the population but it also has a high natural resources value as a breeding ground for marine life, natural pollutant filter, and nutrient recycling ecosystem.

Recent research had as its objective the designing of self-cleaning canals, taking full advantage of both tidal and wind action, and built in such a manner as to be compatible with the physical, chemical and biological characteristics of the site. A two-volume canal design manual resulted from this study.

As a means of transferring this technology to the engineering public and regulating agencies, a series of five residential canal short courses was offered by the Hydraulics Laboratory at the University of Florida and the Florida Sea Grant Advisory Program. The courses

dealt with the technical aspects of canal problems, canal design, and numerical methods of the prediction of water quality in canals and marinas. Emphasis was on the development and use of a computer model for numerical modeling of pollutant transport and water quality in canal systems.

These modeling procedures are expected to be widely used by consulting firms and regulating agencies throughout Florida and the Southeast for evaluating both improvement to the existing designs and new canal systems. Already, two elaborate canal systems in Palm Beach County have been completed using these procedures and designs. Three marina projects with approximately 1,000 boat slips each have been constructed in Dade County and canal/marina projects are underway in Indian River, Martin and Sarasota counties.

This project, along with the research which preceded it, promises to have a far reaching and favorable effect on future development of Florida's coastal areas as well as areas in other parts of the country. To make the information developed in this project readily available, an abbreviated version of the canal design manual has been printed and is available for sale to interested parties.

Artificial Reef Resource Team

The year 1981 marked the completion of five years of service by the Florida Sea Grant Artificial Reef Resource Team which was formed to assist municipal and private groups establish an artificial reef building pro-

gram. The team, funded by Florida Sea Grant College, is based in Pinellas County under the leadership of Dr. Heyward Mathews, St. Petersburg Junior College, Clearwater Campus. For the past five years the team has helped interested groups throughout the state with permits, buoy construction, and other problems involved in starting and administering reefs.

Initially, at the start of a project, several team members would meet with the local reef committee and make a rather elaborate presentation followed by a question and answer session and a public discussion as to possible site locations. Later, a slide/tape presentation was produced with copies furnished to each Sea Grant marine advisory agent. This allowed the marine agent, normally the first point of contact for the local reef committee, to make the initial public presentation prior to the visit of the reef team. This procedure reduced the number of team members required for the initial trip and also reduced the time needed for discussion with the reef committee.

Nearly every community desiring an artificial reef program has worked through the Sea Grant Artificial Reef Team and a close relationship has been established with the Florida Department of Natural Resources in the permitting and financing of artificial reef projects.

Economic Analysis for Coastal Zone Recreation Planning

Florida's coastal zone is a unique natural resource that provides a variety of benefits for the 9.0 million residents in the state and for over 30 million annual visitors. With increasing concern by the public about the magnitude of government spending, state and local government units in Florida have been hard pressed to obtain funds for new coastal recreation projects and to maintain existing facilities because recreation facilities are considered secondary activities that are of little economic value. This attitude, however, is fostered by a lack of awareness about the role of recreation in Florida's economy and a lack of knowledge about the methods of economic analysis available to determine the benefits and costs of coastal recreation facilities.

In Florida, coastal recreation planning is coordinated in conjunction with the Department of Natural Resources but primary goals are established by coastal counties through the Local Government Comprehen-

sive Plan process. Regional planning councils participate in the process also. The trend in Florida government has been toward greater decentralization of decisions that affect the coastal zone.

The objectives of this project were to develop an awareness of the use of economic analysis in coastal zone recreation management and to develop the technical skills of local, regional, and state officials to interpret, participate in, and conduct economic analysis of coastal zone projects.

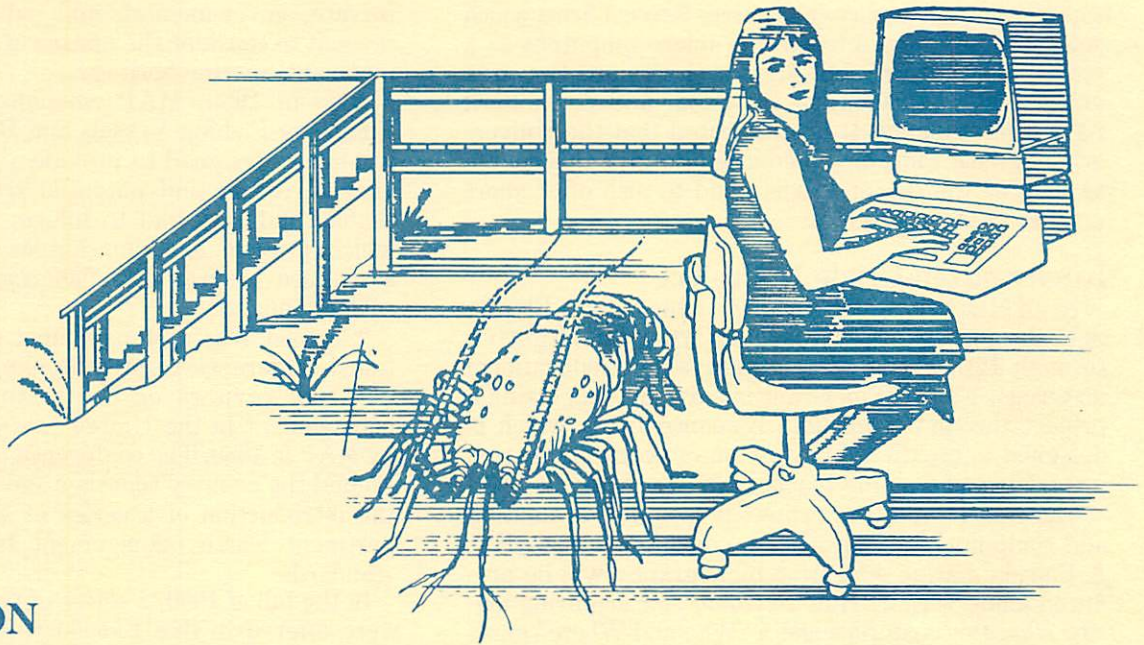
Regional workshops were held in Tampa, Miami, and Jacksonville followed by workshop evaluations to determine the participants' response and further information needs. Also a Florida Sea Grant Report (No. 45) entitled, "A Handbook for Economic Analysis of Coastal Recreation Projects" has been published. Some of the techniques described in the handbook were used by the principal investigator in an applied research project to determine the economic impact of the Greater Jacksonville Kingfish Tournament on the Jacksonville community.

Management Atlas for the Apalachicola Estuarine Sanctuary

The Apalachicola National Estuarine Sanctuary of nearly 200,000 acres is the largest in the United States. The goal of this project is the analysis of nine years of research data and the application of this analysis to sanctuary planning and fishery development.

A review of the atlas outline and formats has been completed and work is progressing on the cartographic work involved. A literature review has been conducted of articles necessary for the development of the atlas. State and local educational officials have been contacted for the development of local environmental education programs. Finally, a video tape based on past television news tapes and films has been prepared for educational purposes in association with the sanctuary program.

It is anticipated that this project, when completed, will provide a scientific basis for management of the Apalachicola River and Bay Estuarine Sanctuary in which numerous federal, state and local interests are involved. A long-term scientific data base will be applied to local problems concerning expansion and development of the highly productive Apalachicola Fisheries resource.



EDUCATION

Florida is an exceptionally fine outdoor marine "classroom" with over 8400 miles of island and inlet shoreline and 1350 miles of Atlantic and Gulf coastline adjacent to over half the state's 67 counties. Since it is a coastal-oriented state with no locality farther than 80 miles from saltwater, most young people grow up with marine experiences as a natural part of their lives and from an early age develop a receptive attitude toward learning about the sea.

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

This factor played a large part in the overwhelming success of the 4-H marine program sponsored in part by Florida Sea Grant College from 1975 to 1980. During that time over 35,000 youth and 6,000 adults were involved in 4-H marine education projects and activities in over two-thirds of the counties in Florida. Presently 7,000 young people are enrolled in 4-H marine activities compared to a zero enrollment in 1974.

Marine Propulsion Systems Training (E/T-3)

This marine/boatyard industry "package" is now on its own with the ending of Florida Sea Grant Support in 1980. The training, which began at Florida Institute of Technology Jensen Beach Campus in 1979 is now supported by the host institution and by industry partners such as **Outboard Marine Corporation, Evirude Motors, Johnson Motors, and Mercury Marine**. The course provides approximately 440 hours of

instruction during the 11 week program with students being certified after successful completion. All graduates of the first few classes have been placed in jobs in that labor-short industry.

Computer-Aided Ship and Yacht Design Course (E/C-2)

Out of the last 5000 years, the world has been without a working sail fleet for only the past 50. Due to the rapid escalation of petroleum-based fuel prices in recent years, many countries are now pursuing investigations into the practicality and economics of commercial sail.

This course, the first comprehensive yacht design course to be offered at a university in the United States, was taught three times at the University of South Florida during 1981 due to demand from within the marine industry.

The Tampa Bay area has probably the largest concentration of yacht manufacturers in the United States and perhaps the world. In addition, a number of power yacht firms are located nearby, and there are a number of commercial vessel companies in the area.

The primary group for this computer-aided ship design course included those already working in the marine field who needed to upgrade their skills. The course places emphasis on the utilization of computers and computer graphics as aids in the design of both power and sail yachts. Students learn to operate computers as part of their instruction.

Engineering seniors and graduate students are also given the opportunity to enroll in their course during the day along with a course in naval architecture.

Student and participating industry reaction to the course has been uniformly positive. Several firms which sent students have invested in microcomputers as a result. Most major yacht firms in the Tampa Bay area and as far as Bradenton, Sarasota, and Avon Park have sent students. It is anticipated that the University of South Florida will continue to give this course as long as the demand exists and to also offer short courses in the subject.

Kindergarten-Grade 12 Project

In an effort to promote marine education in Florida Schools and to assist teachers from kindergarten through 12th grade in locating available educational materials, Florida Sea Grant is partially supporting a project through immediate response funds which is designed to create a dual system of acquiring marine materials and training teachers to use them.

The first step in the project is locating, evaluating and compiling existing marine educational materials. A Florida marine education bibliography will be produced along with a "How to Guide" for acquiring marine education materials and a "Who and Where" guide to resource people and facilities in Florida. The other aim of the program is to develop inservice training workshops for elementary and secondary teachers to familiarize them with the use of marine topics in diverse disciplines.

Marine Education Center

A regional marine education center for northeast Florida was built in cooperation with the Florida Cooperative Extension Service and **Marineland** at Marineland, an oceanarium-research-education complex south of St. Augustine which receives about 500,000 visitors per year. When operational and fully staffed this center will serve northeast Florida school groups and others as part of the Marineland educational effort.

Conferences and Workshops

Within the broad scope of Florida Sea Grant's educational efforts are sponsorship or co-sponsorship and participation in various conference and workshops aimed at information dissemination or technology transfer and application. In some instances such as the annual meetings of the Southeastern Fisheries Association, the Organized Fishermen of Florida and the National Boating Education Seminar, Florida Sea Grant is not a sponsor, but personnel from Sea Grant and the Marine Advisory Program participate.

For the past four years the MAP through FSG has provided assistance to the Marine Industries Association of Florida, Inc. in sponsoring the annual Florida Recreational Marine Industries Conference which brings together all elements of the state's marine industries along with representatives of governmental administrative and regulatory agencies.

In 1980, FSG co-sponsored the Florida Marine Heritage Conference aimed at providing a state overview of maritime preservation needs and exchanging ideas about maritime preservation. Representatives from private, governmental, and industrial sectors were present to consider the matter of preserving Florida's invaluable marine heritage.

Also in 1980, MAP co-sponsored a seminar on Financing Fishing Vessels and Dockside Facilities — a seminar designed to provide expert, up-to-date advice on recent and potential trends in the Florida seafood industry and to inform bankers of agencies which provide loan guarantees and other financial assistance programs to fishermen and those in the seafood industry.

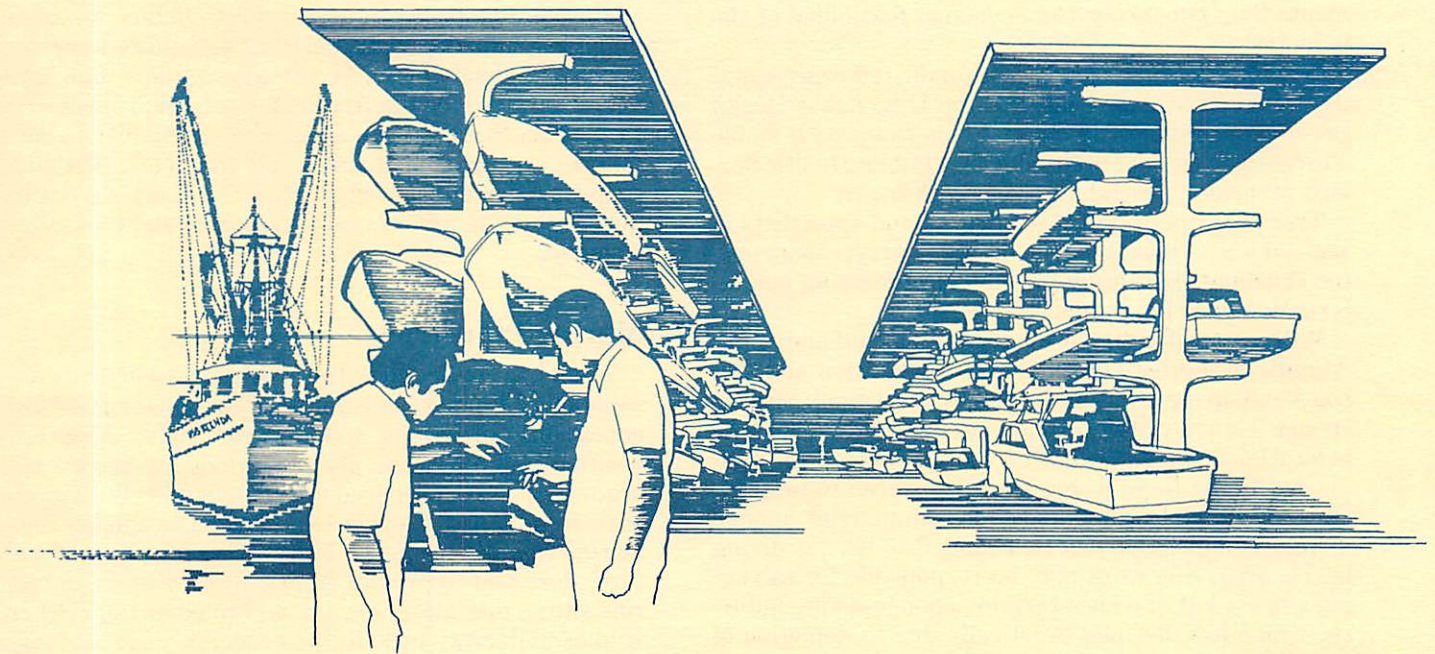
"Seafood Waste Management in the 1980's," a national conference to provide expert, experienced advice and reviews on the status of seafood waste management in the United States, was co-sponsored by MAP in 1980. The conference brought experts from around the country together and had as its objectives the introduction of a series of sessions to introduce pertinent waste management technology and legal standards.

In the fall of 1980, a series of two-day short courses were offered in five Florida cities on the subject of residential canals and marinas. These courses are discussed in more detail under the Technology Transfer and Application section of this report.

A one-week engineering short course on Groundwater Hydraulics, co-sponsored by FSG and MAP, was held in early spring, 1981. This course dealt with the fundamentals of groundwater flow and modern approaches to mathematical modeling of the flow of water and pollutants in aquifers. At the end of the course, attendees were expected to be able to present in a complete mathematical form any problem of groundwater flow and storage and also any problem of the movement and accumulation of pollutants in aquifers.

In 1981, FSG also co-sponsored two symposia concerned with the ecology of important water systems. One, the Indian River System Information Symposium, was organized by Future of the Indian River System (FIRST) and had as its purpose to bring together investigators who have conducted research in a broad range of disciplines related to the Indian River, Banana River, Mosquito Lagoon, and adjacent fresh water areas. The other, Bay Area Scientific Information Symposium (BASIS), was concerned with the area of Tampa and Hillsborough Bays.

It is apparent from the above that conferences and workshops play a significant role in the total aspect of marine education. Marine education is a broad term, impossible to categorize as solely marine advisory or technology transfer and application or as purely marine education itself. But these conferences and workshops, either as part of a longer term project or funded as an immediate response grant are implemented by personnel in the marine advisory program or principal investigators in the universities, and continue to grow and spread their influence throughout the state.



ADVISORY SERVICES

Much like a circle, the chain reaction of research and advisory functions of Florida Sea Grant College seems to have no end. The identification/response mechanism which combines human interest—commercial, sociological and environmental—with university research continually fosters an awareness of the interrelationships that exist among them.

This is where these human elements come into focus in the persons of the Sea Grant marine advisory agents, members of the Florida Cooperative Extension Service and representatives of Florida Sea Grant College along the coast. The agents, working out of coastal county Extension offices and supported by university-based specialists in seafood science, marine economics, coastal engineering, and communications, serve constituents on a person-to-person basis.

Marine Advisory Program

With the growth of the Florida Sea Grant College program over the past two years the activities of the Marine Advisory Program have also expanded rapidly. The addition of an advisory agent in Charlotte County and another in Lee County brought the total of marine agents in the field to eleven. The addition of these two agents plus a realignment of county responsibilities in the middle and upper Gulf coasts and the Panhandle made possible more concentrated people-to-people efforts in those areas.

In serving their ever expanding constituency along Florida's 1350 mile coastline, these marine agents, with cooperation from university-based specialists, have spread their effort into nearly every conceivable area involving user groups along the coast. There has been a continued effort in the commercial fishing and seafood processing areas along with emphasis on sport fishing and artificial reefs. Greater efforts have been made in the field of marine recreation and education and there has also been an increasing involvement in coastal management matters and matters concerning the quality of the marine environment. Following are brief descriptions of a few of the many activities. In addition, several significant accomplishments of the Marine Advisory Program are covered in more detail in the center section of this report.

Commercial Fishing and Seafood Technology

New and continuing activities include assistance to the mullet roe industry; promotion of use of underutilized species of fish; presentation of workshops in seafood preparation, sanitation, retail marketing, credit channels, and business management; and continued assistance to the Fishery Management Councils.

The softshell crab industry, introduced to Florida by MAP, continued to grow, with market demand continually greater than supply. Efforts have dealt with improving technology for monitoring and implementing the shedding process in a controlled environ-

ment, thus enhancing the economic feasibility of the industry.

MAP has worked closely with industry representatives, insurance companies, and the U.S. Public Health Service to provide commercial fishermen with viable alternatives to benefits under the Public Health Service programs which have been withdrawn.

Training was provided for agents and specialists in seafood waste management, limited entry, steam oyster shucking, sanitation in seafood processing and alternative gear for commercial fishing.

With partial funding provided by the Gulf and South Atlantic Fisheries Development Foundation and two boats and diving crews furnished by the Tarpon Springs sponge industry, two marine agents were successful in locating sponge grounds on the Gulf side of the middle and lower Keys where there appeared to be sufficient sponges to support some commercial sponge diving. If legislation can be changed to permit diving in this area, this work may be responsible for salvaging what is left of a once thriving sponge diving industry which has declined drastically due to depletion of traditional sponge diving grounds.

Through cooperation with the state appointed Oyster Task Force Committee, a technical assistance project was initiated to assure production of safe, top quality oysters in compliance with newly strengthened sanitation requirements. Six Florida processors visited innovative processing firms in the Chesapeake Bay area under MAP sponsorship. An operator's manual was prepared, on-site recommendations for plants were made, and an investigation conducted into a new oyster shucking process — steam shucking. Indications are that steam shucking could increase daily oyster production by 30 to 40 percent.

In the area of seafood waste management, MAP worked to assure effective communication between the seafood industry and pertinent regulatory agencies, relative to the development of new, more stringent regulations. The role of MAP has been technical and economic to assure development of reasonable regulations which provide clean waters but avoid over-regulation. A national Seafood Waste Management Conference in 1980 coordinated by MAP brought together experts from around the country to present papers on this problem. If original proposed regulations requiring installation of expensive, sophisticated waste water treatment systems had been enforced, it is estimated that 30 to 50 percent of the southern shrimp processing firms would have been forced to close.

Recreational Fishing

MAP continued to function as one communications link between commercial and recreational fishermen, bringing the two groups together to discuss differences and mutual concerns. Through MAP, recreational fishermen are able to keep abreast of new developments in management of fishery stocks and new technology affecting recreation fisheries.

Marine agents serve as the first contact for communities or fishing clubs desiring assistance in establishing artificial reefs. At the appropriate time, the agent arranges for the Artificial Reef Team sponsored by Florida Sea Grant to assist the community in permitting, siting, and maintaining the reefs. Training programs have been conducted for sport divers to qualify them to assess reef populations and reef effectiveness.

Marine Industries

Work has continued with the Marine Industries Association of Florida, assisting them in obtaining needed educational programs and research data. A severe weather and hurricane planning guide for marina operators has been prepared and distributed. With guidance from MAP, Florida Sea Grant has funded four marina research projects, legal and engineering in nature, designed to provide information to assist in marine siting, operation, design, and construction. Other studies underway include the economic impact of marinas and boatyards and the use of bubble screens to protect coastal waters from marina-generated pollution. Several problems are being addressed in marine advisory fact sheets.

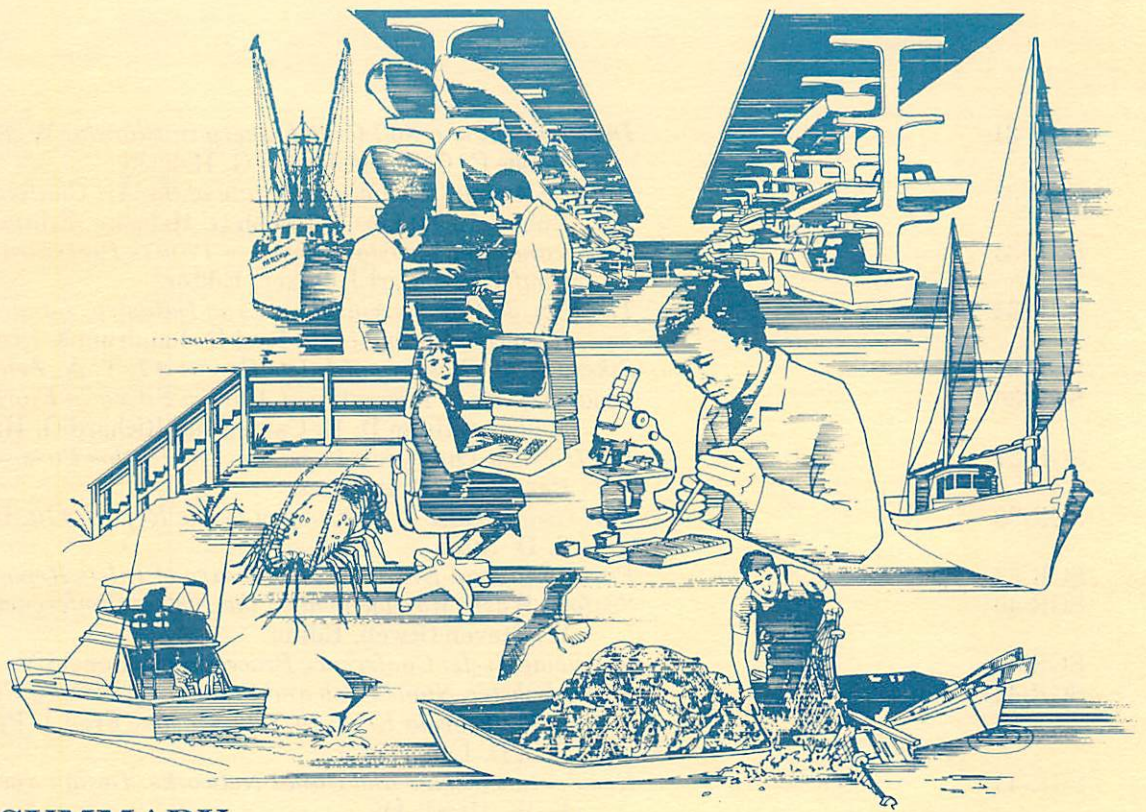
Recreational fishermen, commercial fishermen, sailors, boaters and shippers continue to benefit from a Gulf Stream location program made available through the work of MAP agents. With cooperation of the National Weather Service, the location of the Gulf Stream received by a satellite image is now broadcast regularly over NOAA weather radio. The location is given by use of selected reference points on shore. With such information available on a real-time basis it becomes much more effective.

Coastal Engineering

The coastal engineering specialist worked with the principal investigator and marine agents to organize and present short courses on residential canals and groundwater hydraulics. Approximately 200 engineers and other professionals attended these courses on these two very important issues for Florida's coastal areas. Six coastal engineering seminars were scheduled locally around the state to give Extension personnel an opportunity to become familiar with coastal processes and problems.

Education

MAP continued to provide support for developing and presenting programs for resident and day camps for Florida 4-H. The Marine Education Center was established at Marineland in August 1981 as a cooperative effort with Marineland and the Florida Cooperative Extension Service, but minor construction problems have detained full utilization of the facility to date.



PROGRAM SUMMARY

Publications

MAP-10
MAP-11
MAP-12
MAP-13
MAP-14

MAP-15

MAFS-22

MAFS-23
MAFS-24

MAFS-26

MAFS-27

MAFS-28
MAFS-29

MAFS-30

MAFS-31
MAFS-33

SGR-30

Marine Advisory Bulletins

Florida Sea Grant Publications - 1980.

"Man Meets Coast". Diane Barile.

Hurricane Survival — Family Action Plan.

Florida Sea Grant College Directory - 1980 and 1981.

Florida's Commercial Swordfish Fishery: Longline Gear and Methods.

Steven A. Berkeley, Edwin W. Irby, Jr. and John W. Jolley, Jr.

Small Boat Longlining for Swordfish on Florida's East Coast: An Economic Analysis. James C. Cato and Frank J. Lawlor.

Brochures and Fact Sheets

Fish Facts for Florida Consumers — Oyster. Demonstrates how to select, buy, and prepare oysters.

Fish Facts for Florida Consumers — Conch.

Hurricane and Severe Weather Checklist for Boaters. Safety precautions for boaters and a checklist of steps to take as security measures.

Harvest and Identification of Peeler Crabs. Steven W. Otwell. Provides identification information using color photographs.

Year of the Coast — A Sampler. Listing of coastal publications in keeping with the OCZM program.

Energy Savers for Boats. Jeffrey A. Fisher

Getting Your Feet Wet. Cory Gittner. Answers basic questions about scuba diving.

Diving and Pregnancy. Information concerning the risks related to diving and pregnancy.

Florida Sea Grant College. Update on FSGC program.

Fish Facts for Florida Consumers — Soft Crab.

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An Indexed Bibliography of Snapper (Lutjanidae) and Grouper-Sea Bass (Serranidae) Biology. Stephen A. Bortone, Karen A. Armsby, Mildred B. Bortone, Editors.

- SGR-31 *Development of a Soft Crab Fishery in Florida.* W. Steven Otwell, James C. Cato and Joseph G. Halusky.
- SGR-32 *Aquatic Animal Medicine: A State of the Art Conference Proceedings.* Robert L. Jenkins & Joseph G. Halusky, Editors.
- SGR-33 *Hurricanes and Coastal Storms — Papers Presented at a National Conference.* Earl J. Baker, Editor.
- SGR-34 *The Florida Commercial Blue Crab Industry: Landings, Prices and Resource Productivity.* Paul D. Landrum & Fred J. Prochaska.
- SGR-35 *Sikes Cut — Glossary of Inlets Report #7.* T. A. Zeh.
- SGR-36 *Legal Aspects of Recreational Marina Siting in Florida.* Frank E. Maloney, Bram D. E. Canter and Richard G. Hamann.
- SGR-37 *Big Hickory Pass, New Pass, and Big Carlos Pass — Glossary of Inlets Report #8.* C. P. Jones.
- SGR-38 *Fort George Inlet — Glossary of Inlets Report #10.* H. Kojima and S. D. Hunt
- SGR-39 *Port Canaveral Entrance — Glossary of Inlets Report #9.* S. D. Hunt
- SGR-40 *Seafood Waste Management in the 1980's: Conference Proceedings.* W. Steven Otwell, Editor.
- SGR-41 *Artificial Reefs: Conference Proceedings.* Donald Y. Aska, Editor.
- SGR-42 *Spiny Lobster, Stone Crab and Secondary Fishery Costs and Revenues in the Florida Keys, 1978-79 Season.* Fred J. Prochaska and Paul D. Landrum.
- SGR-43 *Residential Canals and Canal Networks: Design and Evaluation.* F. W. Morris IV.

Technical Papers

- TP-17 *Marine Education and Research Organizations in Florida.* Norbert W. O'Hara and Matthew Landau.
- TP-18 *A Survey of Small-Craft Recreational Marinas in Florida.* P. V. Rao, J. J. Einerson, J. A. Einerson and A. J. Mehta.
- TP-19 *Low Temperature Smoked Fish Fillets: A Potential New Product Form for Florida Fish.* W. Steven Otwell, John A. Koburger, and Robert L. Degner.
- TP-20 *Consumer Acceptance of Low Temperature Smoked Fish Fillets.* Robert L. Degner, W. Steven Otwell, and John A. Koburger.

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Project and Investigators

Project	Complete Title	Duration		Investigators and Institution
		Begin	End	
Coastal Processes and Development				
R/EM-13	Criteria for Optimization of Storm Water Runoff Detoxification to Protect Estuaries	1980	1981	D.C. White, FSU
R/OE-8	Beach & Dune Erosion Caused by Storm Tides and Waves	1978	1981	T.Y. Chiu, UF
R/OE-12	Acoustic Navigation by Divers	1979	1981	H.F. Hollien, UF
R/OE-14	Low Frequency and Variable Amplitude Corrosion Fatigue of Welded Steel in Sea Water	1980	1981	W.H. Hartt, FAU
R/OE-15	Coastal Development and Water Needs: Protection of Coastal Aquifers Against Saltwater Intrusion	1980	1981	B.A. Christensen, R.G. Smith, H. Rubin, UF
R/OE-16	Prediction of Hurricane-Associated Sea Severity for Florida Coastal Problems	1980	1981	M.K. Ochi, UF
R/OE-17	Barrier Island Dynamics on a Highly Developed Coast	1980	1981	R.A. Davis, D.F. Belknap, A.C. Hine, USF
R/OE-18	Acoustic Detection of Corrosion Cracking In Reinforced Concrete	1981	1982	S.E. Dum, W.H. Hartt, FAU
R/OE-19	Bubble Screens to Protect Coastal Waters From Marina-Generated Pollution	1981	1982	B.A. Christensen, B.A. Benedict, UF
R/OE-20	Determination of Engineering Needs for Extreme Sea State Information	1981	1981	D.M. Sheppard, UF; B. Le Mehaute, UM
R/CP-5	Structural Analysis of the Apalachicola Bay Coastal Economy (1979 Annual Report)	1979	1980	W.D. Mulkey, J.W. Milon, UF
R/CP-7	Legal Aspects of Operating a Recreational Marina in Florida	1980	1981	R. Hamann, J. Mills, UF
R/CP-8	Southwest Florida Hurricane Evacuation Plan	1980	1980	R.H. Eastwood, W.E. Daltry, SWFRPC
R/CD-2	Managing Coastal Resources: Legal Tools for Local Governments	1981	1982	J. Mills, D. Woodson, R. Hamann, UF
R/CD-3	Economic Analysis of Florida's Recreational Marinas and Boatyards	1981	1982	J.W. Milon, W. Mulkey, J. Gordon, UF
Living Marine Resources				
R/FR-13	Fishery and Biology of Swordfish in Southeast Florida	1978	1981	E. Houde, S. Berkeley, D. de Sylva, UM; E. Irby, DNR, Palm Beach
R/FR-15	Economic Analysis of Florida's Seafood and Fishing Industry	1980	1981	F. Prochaska, J. Cato, UF
R/FR-16	The Economic Value of Saltwater Sport Fishing in Florida	1980	1982	F.W. Bell, B.P. Sorensen, FSU
R/FR-17	The Impact of Fishing on a Small Local Economy	1980	1982	W.D. Stronge, J. Early, FAU
R/FR-18	Concentration of Human Pathogens by Commercially Imported Shellfish. I. As Affected by Environmental Factors	1980	1982	N.J. Blake, G.E. Rodrick, USF
R/FR-19	Concentration of Human Pathogens by Commercially Imported Shellfish. II. Affected by Storage and Handling	1980	1983	M. Hood, F. Singleton, UWF
R/FR-20	A Case Study of the Exploitation of Virgin Deepwater Fish Stocks	1980	1983	R. Labisky, UF
R/FR-21	Engineering Design of Commercial Sailing Vessels	1981	1983	J. Shortall, USF
R/A-6	Test Market of Cultured Lugworms	1980	1981	C. D'Asaro, H.C.K. Chen, UWF
R/A-7	Seaweed-Crustacea Polyculture	1980	1981	J.H. Ryther, UF; L. Williams, B. Falkner, HB
Short Term, Pilot & Demonstration Projects				
M/PM-2	Florida Sea Grant Immediate Response Projects			
	Development of a Soft Crab Fishery in Florida	9/78	8/80	W.S. Otwell, UF
	Economic Change in Florida Coastal Counties: A Shift-Share Analysis (1979 Annual Report)	1/79	6/80	D. Mulkey, UF
	Engineering Planning & Design Criteria for Small Craft Recreational Marinas in Florida. (1979 Annual Report)	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
	Directory of Florida Marine Research and Education	4/79	5/80	N. O'Hara, FIT
	Impact of Toxic Substances on Indian River Fisheries	5/79	2/80	R. Pierce, J. Trefry, FIT
	Salt Minced Product from Grouper Frames and Spent Mullet	6/79	5/80	J. Koburger, UF
	Florida Marine Heritage Conference	9/79	4/80	B. Purdy, UF
	Maritime Agriculture Training Experience	10/79	6/80	M. Estes, Monroe County
	Florida Smokies: A Market Survey	1/80	5/80	W.S. Otwell, J. Koburger, R. Denger, J. Cato, UF
	Small Harbor Engineering	1/80	1/80	A.J. Mehta, UF

Development of Open Water Culture Techniques to Grow Benthic Algae	1/80	12/80	H. Humm, USF
Artificial Reef Research Diver Training Program	1/80	6/80	J. Halusky, UF
People, the Environment, and Development: A Case Study in Estuarine Site Design	4/80	6/80	D. Donelin, D. Ousley, UF
Effects of Predator Removal on Coral Reef Community Structure	7/80	10/80	J.A. Bohnsack, UM
Analysis of the Choctawhatchee Bay	7/80	2/81	S. Collard, UWF
Habitat Requirements of the Benthic Post-Larval Spiny Lobsters.	9/80	12/80	W.F. Herrnkind, S. Andree, FSU
The Effectiveness of the State's Aquatic Preserve Program	12/80	9/81	A. Turnbull, FSU
Analysis of Hillsborough Bay Sewage Pollution Abatement Data	3/81	6/81	S. Bloom
An Investigation of Water Vapor and Aerosol Sulfur Correlation in Florida's Maritime Atmosphere and its Public Health Implications	4/81	8/81	J. Winchester, FSU
Marine Programs of the State University System of Florida	4/81	3/82	F. Snelson,
Assessment of Techniques to Verify the Freshness of Fish Caught During Recreational Fishing Tournaments	5/81	7/81	W.S. Otwell
Educational Needs Assessment of Florida Commercial Fishermen Concerning Fuel Conservation	5/81	9/81	C. Beeman, M. Daire, UF
State of the Art — Wind-powered Workboats and Ships	6/81	6/82	J. Shortall, USF
Citizen's Guide to Living With Florida Beach Barrier Islands	6/81	4/82	L.J. Doyle, et. al., USF
Economic Impact of the Greater Jacksonville King Mackerel Fishing Tournament	7/81	8/81	J.W. Milon, UF
Future of the Indian River System (FIRST)	7/81	12/81	L.T. Johnson, UF
Bay Area Scientific Information Symposium (BASIS)	8/81	6/82	J. Simon, USF
Vibrio Conference	8/81	10/81	M. Hood, UWF
Shark by-Catch in the Florida Swordfish Longline Fishery	8/81	12/81	S. Berkeley, UM
Management Manual for Dune Reconstruction and Restoration	9/81	5/82	J. Salmon, UWF
Florida Marine Education: Matching Educators and Resources	9/81	9/82	R. Iverson, FAU

Technology Transfer and Application

A/E-1	Florida Canal and Marina Development Seminars	1980	1980	B.A. Christensen, F. Morris, UF
A/F-1	Artificial Reef Resource Team	1980	1981	H. Mathews, SPJC
A/F-2	Significance and Occurrence of Ciguatera (Tropical Fish Poisoning) in Florida	1980	1981	D. de Sylva, UM
E/P-2	Economic Analysis of Coastal Zone Recreation Planning	1981	1982	J.W. Milon, R. Carriker, UF
T/P-1	Management Atlas for the Apalachicola Estuarine Sanctuary	1981	1982	R. Livingston

Education

E/Y-2	Florida 4-H Marine Education Program	1978	1980	T. Greenawalt, UF
E/T-3	Marine Propulsion Systems Training Program: Phase I (Outboard)	1979	1980	L. Booth, J.M. Burns, FIT
E/C-2	Computer-Aided Ship and Yacht Design Course	1980	1981	J. Shortall, USF

Advisory Services

A/MAP-1	Marine Advisory Program	Continuous	J.T. Woeste, M.L. Clarke, UF
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Administration

M/PM-1	Administration of the State University System of Florida Sea Grant College	Continuous	J. Cato, H. Popenoe, W. Seaman, UF
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BIENNIAL FLORIDA SEA GRANT BUDGET FOR CALENDAR YEARS 1980 AND 1981

	FUNDING*			
	National Sea Grant		State Matching	
	1980	1981	1980	1981
Aquaculture (04, 05)**	\$ 66,800	\$ 20,000	\$ 44,500	\$ 13,300
Commercial Fisheries-Biology (06)	101,000	80,400	47,700	47,300
Seafood Science and Technology (35)	58,000	77,700	47,000	35,400
Marine Economics (14)	93,000	119,400	90,300	127,800
Coastal Law (15)	35,400	30,000	17,100	23,900
Recreation-Sports Fisheries (18)	49,200	46,500	63,500	41,500
Vehicles, Vessels, and Platforms (23)	—	25,400	—	13,000
Materials and Structures (24)	26,000	51,900	20,000	80,200
Coastal Engineering (25)	108,500	75,400	83,700	55,700
Ocean Engineering (28)	—	44,100	—	37,500
Man-in-the-Sea (34)	34,100	35,900	19,600	17,900
Coastal Management-Social Sciences (38)	—	44,900	—	15,000
Coastal Management-Natural Sciences (39)	79,100	—	46,900	—
Ecosystems Research (40)	29,500	29,500	16,400	16,700
Pollution Studies (45)	38,900	43,300	22,300	21,600
New Applications Development (81)	121,700	139,700	31,300	24,700
Course Development (62)	—	5,000	—	11,200
Technician Training (67)	25,000	—	77,500	—
Extension Agent Services (71)	524,900	585,000	532,900	466,100
Public Education Programs (75)	49,300	8,100	21,400	2,700
Professional Training (77)	15,000	—	8,700	—
Administration	121,700	126,800	31,300	79,900
	\$1,577,100	\$1,585,000	\$1,222,100	\$1,131,400

*Final amounts in official fiscal report may vary.

**Code numbers are according to National Office of Sea Grant classification.

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Florida Board of Regents
Florida State Legislature
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Government of Venezuela
Gulf and South Atlantic Fishery
Development Foundation, Inc.
Individual Fishermen
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Pinellas County
Snyder Oceanography Service, Inc.
Southwest Regional Planning Council
State University System of Florida
Institute of Oceanography
Stuart Marine Center

GRANTEES

Florida Atlantic University, Boca Raton
Florida Institute of Technology, Melbourne and Jensen Beach
Florida State University, Tallahassee
Harbor Branch Foundation, Inc., Fort Pierce
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University of West Florida, Pensacola

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This publication was promulgated at a cost of \$2,421.47, or \$1.21 per copy, to provide a biennial report of the Florida Sea Grant College Program. 9-2M-82

The State University System of Florida Sea Grant College is supported by award of the Office of Sea Grant, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, grant number NA80AA-D-00038, under provisions of the National Sea Grant College and Programs Act of 1966. This information is published by the Marine Advisory Program which functions as a component of the Florida Cooperative Extension Service, John T. Woeste, dean, in conducting Cooperative Extension work in Agriculture, Home Economics, and Marine Sciences, State of Florida, U. S. Department of Agriculture, U. S. Department of Commerce, and Boards of County Commissioners, cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 14, 1914. The Florida Sea Grant College is an Equal Employment Opportunity-Affirmative Action employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, sex, or national origin.