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# Sea Grant & Your Coasts

1984-85 Biennial Report

Mississippi-Alabama Sea Grant Consortium

MASGP-86-080

S. Weidie



**ABOUT THE COVER:**

The cover is an original watercolor batik by Ocean Springs, Mississippi, artist Suzanne Deuel Weidie.

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# SEA GRANT & YOUR COASTS

**A Biennial Report  
of the  
Mississippi-Alabama  
Sea Grant Consortium  
for  
January 1, 1984 - March 31, 1986**

MASGP-86-080

# SEA GRANT

***Sea Grant's mission is to promote the wise use, development and conservation of United States ocean and Great Lakes resources through marine research, education and advisory service activities.***

***In Mississippi and Alabama, efforts to accomplish that mission are administered through the Mississippi-Alabama Sea Grant Consortium, an organization of universities and research institutions in the two states.***

***Federal, state and local governments as well as private industry participate in efforts to accomplish Sea Grant goals. Federal support comes through the National Sea Grant College Program of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.***



# MISSISSIPPI-ALABAMA

# SEA GRANT

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1984-1985

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# F R O M T H E D I R E C T O R

The mission of the National Sea Grant College Program (NSGCP) is to strengthen the understanding, use and conservation of our nation's ocean and Great Lakes resources through research, education and public outreach. The Mississippi-Alabama Sea Grant Consortium (MASGC) was organized in 1972 to carry out that mission through Mississippi and Alabama institutions of higher learning working in concert with government and private enterprise.

During the period that has ensued since its founding, MASGC efforts have followed a pattern that demonstrates a particular strength characteristic to Sea Grant. Projects have evolved by identifying and investigating problems, puzzles, and opportunities involving marine and coastal resources. This has been accomplished by utilizing a tightly woven, interactive network of research, education and public service entities unique to Sea Grant. Thus, the MASGC has crossed the traditional boundaries of scientific disciplines, governments, agency or institutional affiliation, private enterprise and custom to bring together the necessary expertise to effectively address mutual problems and achieve common goals.

This report, for 1984 and 1985, encompasses a period of fiscal austerity and programmatic retrenchment. While the scope and size of the MASGC program has remained relatively constant, the overall quality of the individual projects has improved, due primarily to increased competition for limited fiscal resources. Administrative costs have been significantly reduced, thereby making proportionally larger resources available for project support. These actions were chosen in order to maintain the desired levels of research and other programmatic activities while experiencing a static budget, increased personnel and other costs, and inflationary impacts. These and other modifications, continued into 1986 and beyond, were

necessary for continued program enhancement.

Although a number of worthwhile projects have unfortunately been precluded by limited fiscal resources, the caliber of those remaining has demonstrated significantly increased professional excellence. Thus, the severe fiscal constraints which have been imposed upon this program have resulted in a higher quality research, education and advisory service effort and a leaner and more efficient administrative component. It is appropriate to reemphasize that this has been achieved in spite of an essentially constant level of federal support both prior to and coincident with this reporting period.

During this period researchers have essentially completed the remaining elements of a comprehensive, five-year multidisciplinary effort to explore, document and define Mississippi and Alabama nearshore resources and processes. As this program looks to the future, Sea Grant veteran researchers and newcomers are launching innovative studies in marine engineering, bio-technology, and fisheries and estuarine processes. Facets of this research are already stirring a broad interest with their potential for worldwide application. This report documents those 1984-85 efforts in brief on pages 28-29. For a more comprehensive view of Sea Grant's mission and the contributions which the Mississippi-Alabama Sea Grant Consortium makes through the work and concerns of its personnel, I invite you to read the articles and study the illustrations contained in this report.



Dr. James I. Jones, Director





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# C O A S T S :

## Sea Grant Targets Processes and Problems Where Sea, Land and People Mix

Food from the sea, transportation, recreation and the sheer drama and beauty of the environment have long invited man to live, work and play on coastlines. But man brings change, often to the very things that drew him to the sea's edge.

Understanding nature's processes, man's impact and the interaction of the two are essential if coastal resources are to remain available for man's use and enjoyment. Sea Grant is working toward that understanding in the northern Gulf of Mexico.

### **ESTUARINE FOOD WEB**

Michael Sullivan, Mississippi State University botanist, is chasing down the role of algae in the food web of nutrient rich estuaries. For some time now he has been studying the structure and function of edaphic algae communities—algae that live in or on soil—in Mississippi salt marshes.

"For years scientists have overlooked the importance of algae. In the case of salt marshes we look at vascular plants—the grasses, sedges and rushes—and say that's what is feeding the animals, but recent research has shown that this is not the case," Sullivan says. "Most of the decomposed marsh grass material is staying in the marsh."

In contrast, the single-celled edaphic diatoms that are the dominant algal species in Mississippi salt marshes are virtually indestructible and available as food for organisms in the marsh system as well as in adjacent waters.

"We are looking at the base of the food web," Sullivan says.

Through analysis of soil samples in-

jected with radioactive carbon isotopes and incubated in filtered marsh water at the collection site, Sullivan has recorded estimates of productivity for edaphic algae growing in each of five different marsh grass communities. He is also identifying diatom species and running statistical analyses to find out how selected environmental factors correlate with productivity.

"The first year we measured the functioning of algae, how much carbon is produced," Sullivan says. "But just because the plants are producing material doesn't mean the animals are eating it. There is evidence that they are, but we don't know for sure in the Gulf yet. That is what we are looking at next—the importance in the food chain."

### **ESTUARINE POLLUTION**

For Jeffrey Evans and Robert Taylor, understanding means refining standard measures of pollution. The University of Southern Mississippi researchers are working on a new method for determining the source of coliforms, bacteria that are found in the intestinal tracts of almost all warm-blooded animals and are standard indicators of fecal pollution.

There is currently no method for pinpointing whether coliforms in water samples are the result of pollution from improperly or untreated sewage or are the result of runoff from areas inhabited by domestic animals, pets or wildlife. Knowing the difference could make a difference in judging the safety of the waters and in potential solutions to pollution problems.

Evans and Taylor's experiments with

plasmids may hold the key. Plasmids are minute chunks of DNA (deoxyribonucleic acid) that are independent of the chromosomal DNA that contains an organism's hereditary code. Most species of bacteria, including coliforms, contain plasmids.

The researchers isolate coliforms from human and non-human sources and use procedures to break down the bacterial cell walls, extract plasmid DNA and separate plasmids according to molecular weight.

In their first year of research, the investigators found that coliforms from human sources contain plasmids relatively high and low in molecular weight. Plasmids from coliforms of other warm-blooded animals generally fall into intermediate molecular weights.

### ***OYSTERS AS MONITORS***

Ken R. Marion and the late Robert L. Settine of the University of Alabama at Birmingham took a different approach to organic pollution. The researchers used oysters and clams to monitor chemical pollution in the highly industrialized Mobile Bay region.

They successfully developed methods for extracting traces of organic pollutants from oyster and clam tissue so that the compounds could be identified and their quantity measured.

They found compounds identified with insecticides, industrial solvents, plasticizers, plastic derivatives, intermediary compounds, coal tars, fossil fuels and combustion products. Concentrations of most individual organic contaminants were in the low parts per billion range.

"Overall pollutant levels in bivalves of Mobile Bay are below what we consider to be very high or critical levels," Marion says. "Their combined effects and interactions, however, are unknown and potentially significant.

"Data gathered through this study serves as a signal of change in the estuary and as a baseline for evaluating the future course of Mobile Bay's condition."

### ***TOOLS FOR THE FUTURE***

Sea Grant research also uses other tools for predicting and evaluating change. University of Mississippi mechanical engineer Sam S.Y. Wang has experimented with developing two-dimensional and three-dimensional mathematical models to simulate basic

estuarine processes of water and sediment movement.

The development of mathematical models allows engineers to explore questions of design and safety while projects are still in the planning stage. They can look at such factors as maintenance requirements for new or deepened channels, the fate of dredged material deposited at selected locations or the stability of bridges and bulkheads.

Wang's modeling has successfully simulated the discharge of river sediments into a bay and the scouring and deposition of bed materials as the result of tidal flows in a bay.

More than 240 scientists, engineers and scholars who share Wang's interest

in sedimentation gathered for the Third International Symposium on River Sedimentation in 1986 in Jackson, Mississippi. Sea Grant and the University of Mississippi sponsored the conference held for the first time outside the People's Republic of China. Wang was organizing committee chairman.

With a focus on coastal and estuarine sedimentation, general and technical sessions featured leaders in sedimentation research from 25 nations.

### ***COOPERATING FOR ANSWERS***

Mathematical modeling by Sea Grant researchers also helped the Mobile District of the U.S. Army Corps of Engineers look at the potential impact of



Botanist Michael Sullivan (left) and research assistant Cindy Moncreiff conduct experiments with algae in the soil of a Mississippi salt marsh to find out how wetlands contribute to the food cycles of marine species.



dredging and other construction in Apalachicola Bay, an oyster-rich estuarine system in Florida's panhandle.

In a cooperative Sea Grant-Corps study, Donald C. Raney of the University of Alabama developed mathematical models to simulate the effects of wind, tides, river flow and other environmental factors on water movement and salinity in the bay.

Through Continental Shelf Associates, Inc., of Tequesta, Florida, Sea Grant conducted a sampling program that provided information on water speed and direction throughout the bay. Raney used the extensive data for calibrating and verifying the accuracy of his models.

The sampling program also provided 90 two-meter sediment cores and 10 ten-meter cores for University of South Alabama researcher Wayne C. Isphording's study of the discharge of sediments by rivers emptying into the bay and sedimentation processes and distribution in the estuary.

In a comparison of sediment strata, Isphording found silt a dominant com-

ponent of older sediments but scarce in present day sediments. He relates the difference to changes in river sediment regimens, possibly caused by dam construction, or to short-term violent events such as hurricanes that could bury or remove major sediment components in the bay, or to a combination of both factors.

"The overall study was one of the most comprehensive ever attempted in Apalachicola Bay," Max Flandorfer, Sea Grant project coordinator, said. "Not only was the geographical coverage extensive, the quality control was exceptional."

"Where data were gathered, exactly how information was gathered and the conditions under which it was collected—all are thoroughly documented. Years from now, other scientists or government planners will be able to come back, look at the documentation and know exactly what these data mean."

#### **INFORMATION PLEASE**

Sea Grant's aptitude for turning research into information that can make

a difference in the decisions of government and private enterprise is no accident. It is a primary objective.

An example is the comprehensive set of profiles on sediments and the pollutants they trap in Mississippi Sound and its adjacent water systems. The profiles emerged from a four-year study by Julia S. and Thomas F. Lytle, Gulf Coast Research Laboratory chemists.

Regular maintenance dredging, spoil disposal and new development increase the potential for stirring up polluted sediments in the estuarine system that forms Mississippi's southern border, and people involved in decisions related to the estuary are rarely trained chemists.

With those facts in mind the Lytles summarized volumes of data on more than 120 sediment samples, records of geological characteristics and tests for contaminants, leachability, suspension properties and toxicity. The formats they devised provide easy access to and quick use of their findings.

Sea Grant published the 124-page volume *Pollutant Transport in Mississippi Sound* as a reference for general infor-



Sea Grant Director James I. Jones (standing) welcomes more than 240 participants from 25 different countries in opening ceremonies of the Third International Symposium on River Sedimentation held in Jackson, Mississippi, in 1986. Sea Grant's 1983-85 support of University of Mississippi Sam S.Y. Wang's organizational efforts culminated in the symposium focusing on coastal and estuarine processes.



mation on pollution levels in Mississippi Sound as well as for detailed information on specific sites.

Both amateur and professional birding enthusiasts are waiting for the presses to roll on another Sea Grant publication—*Birds and Birding on the Mississippi Coast*.

Authors Judith Toups and Jerome Jackson have compiled a detailed account of species of Mississippi's coastal region along with precise directions for finding locations where each species can usually be spotted.

Demand has also been high for information from a Sea Grant analysis of the past 10 years of winds and tides in coastal Alabama.

When William W. Schroeder of the University of Alabama started the analysis, hourly observations of winds and tides were available, but no one had thoroughly sifted data to find patterns.

Schroeder used wind data gathered by the Dauphin Island Sea Lab and tide data gathered through the National Oceanic and Atmospheric Administration's National Ocean Survey.

"The usefulness of such a statistical base can range from helping set up contingency plans for such things as oil spills to providing information to the coastal landowner who wants to build a house that takes advantage of seasonal breezes," Schroeder says. "This research is useful to anyone who wants to have some idea of the speed and direction of winds and/or tidal elevations at different times of the year along the Alabama coast."

### LEGAL PERSPECTIVE

Mixing man's activities and nature's processes in the coastal zone has another dimension—the tangle of federal and state statutes, judicial decisions, conflicting goals and lifelong loyalties surrounding the use of marine and coastal resources.

Through the years the Sea Grant legal program, operating through the Mississippi Law Research Institute at the Law Center of the University of Mississippi, has demonstrated an ability to pierce those complexities. Now Sea Grant attorneys experience an annual stream of requests for help and information on specific marine-related issues from state and federal officials and legislators, Sea Grant Advisory Service personnel, Sea Grant principal investigators and law school faculty.



University of Southern Mississippi graduate research assistant Cherrng-zee Chuang prepares plasmid DNA for electrophoresis tests in a Sea Grant study to find methods for identifying sources of fecal pollution in estuaries.

The Sea Grant quarterly legal reporter *Water Log* regularly supplies background and current information about marine and coastal law and policy from regional and national perspectives. *Water Log* also provides research and writing experience for future leaders in coastal and marine affairs. Catherine Mills, a former Sea Grant student research associate, cited her work on *Water Log* as excellent preparation for an internship with NACOA (National Advisory Committee on Oceans and Atmosphere).

Mills was one of 15 graduate students chosen as national Sea Grant Fellows for 1984. Selected on the basis of expertise in marine affairs, the students worked for a year with Washington agencies and organizations involved with marine policy. Mills is now with the Office of Estuarine Programs, National Oceanic and Atmospheric Administration.

The Sea Grant legal staff also recognizes issues of law and policy that are vital to marine and coastal affairs but have never been researched and

presented in a form useable for coastal managers, planners and resource users.

In 1984-85, for example, Sea Grant attorneys explored how federal statutes and regulations surrounding transport and disposal of hazardous wastes apply to waterborne transport.

"The study grew out of the development of the Tennessee-Tombigbee Waterway and the lack of any comprehensive handbook available to local governments," Casey Jarman, legal program director, says.

The resulting handbook for city and county officials covers legal obligations, help in planning for emergencies and sources for more information.

"Coastal and ocean areas of the United States contain a wealth of living and non-living resources held in trust for the people of the United States," Jarman says. "The legal program shares with Sea Grant researchers, advisory service specialists and educators the goal of building a foundation for informed decisions about those resources." □





# SEA HARVEST:

## Sorting Fact from Fiction about Northern Gulf of Mexico Resources

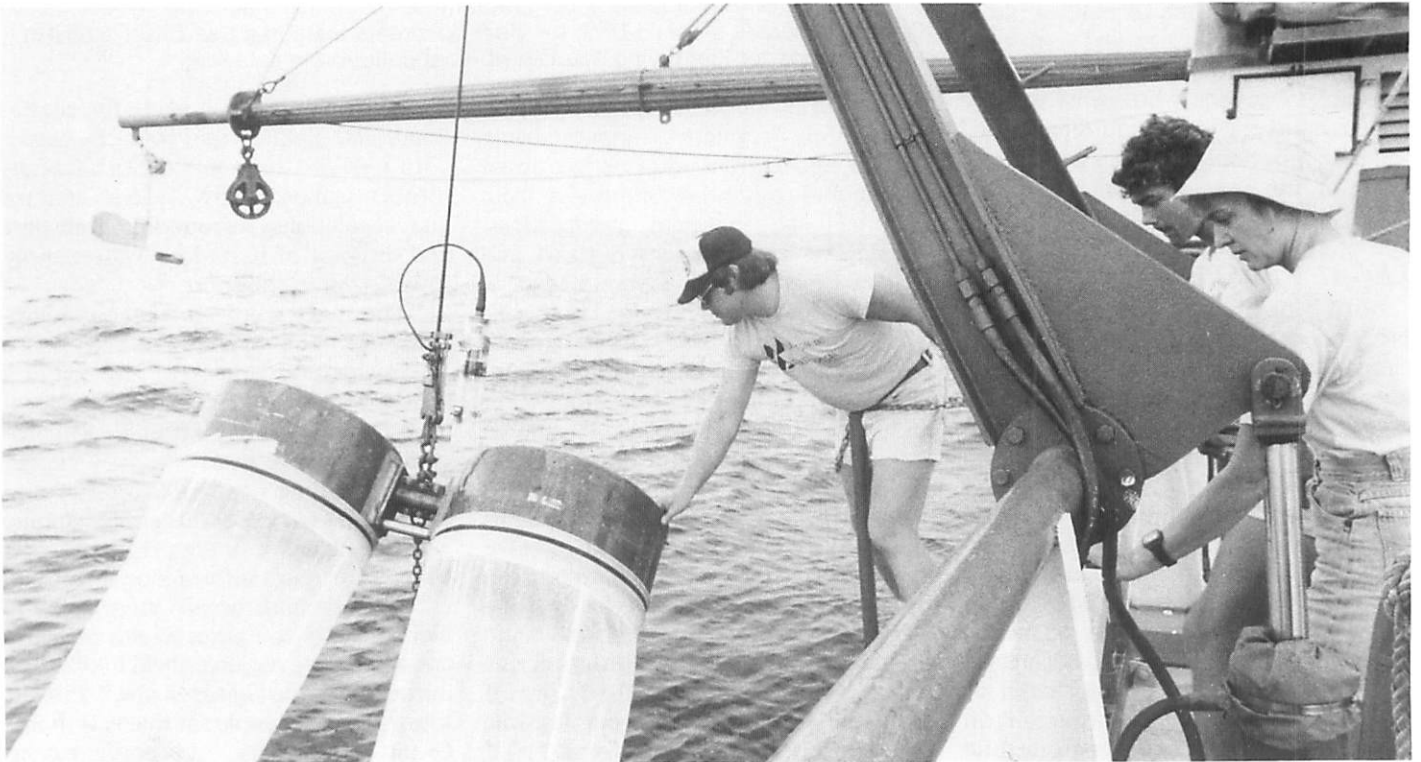
When the cajun dish blackened redfish rocketed into popularity in restaurants around the nation, commercial redfish landings in the Gulf of Mexico jumped from 1.6 million pounds annually to 5.4 million pounds in 1985. Conflict between commercial and sport fishermen about who gets a share of the resource boiled over into emergency quotas in 1986, and research projects proliferated to fill gaps in scientific information needed for management decisions about the resource.

Sea Grant researchers Joanne Shultz and John Steen of the Gulf Coast

Research Laboratory had already recognized the need for information on redfish, also termed red drum. They were well into a study of factors that affect survival of fresh-from-the-egg red drum in the Gulf of Mexico.

"We are looking at larvae barely discernible to the naked eye. They aren't the size fish that interest sport and commercial fishermen, but their survival affects the numbers of fish that live to grow into catchable redfish," Shultz says.

From late 1983 through 1985 Shultz and Steen conducted intensive sampling



A computerized monitoring system put together with the help of Sea Grant, National Marine Fisheries Service, NAVOCEANO (the Naval Oceanographic Office) and Gulf Coast Research Laboratory personnel supplies data on salinity, temperature and depth every 15 seconds whenever these bongo nets or other sampling nets are in use and provides researchers with more information on factors that affect the survival of redfish larvae in the Gulf of Mexico.



cruises in federal and state waters off Alabama, Mississippi and Louisiana. They used special equipment that allowed them to stay with one water mass and its accompanying group of larvae and the organisms available as prey for the larvae. They found that movement into estuarine nursery areas was more complex than expected.

"We were operating on the hypothesis that after red drum spawn, currents bring the larvae into estuarine nursery areas fairly directly. By following one water mass, we found that currents are likely to meander in circular loops, carrying the larvae with them before moving inshore."

In the laboratory the researchers use techniques for examining growth rings on otoliths—ear bones in fish—to determine age and growth history. They also correlate data they have collected on weight, prey available, prey actually consumed and environmental and weather information.

Early results show that growth of red drum larvae in the field is almost twice as fast as previously reported growth rates under laboratory conditions. Finding such patterns will contribute both to management decisions and to the development of aquaculture systems, Shultz notes.

### **SHRIMP AND SHRIMPERS**

Changes in the shrimp fishery had Mississippi and Alabama Sea Grant Advisory Service personnel pulling together a variety of people and agencies in 1984-85 to help gather facts and supply information to people who needed it.

Mississippi advisory personnel began investigating a fishing method new to most Gulf of Mexico shrimpers—the pusherhead or "chopsticks" trawl. The state marine resources agency used advisory service information about efficiency, net spread, pole length and finfish bycatch in decisions concerning regulation of the method.

Brought to the United States by Vietnamese fishermen, the chopsticks method uses two large utility or telephone poles to push a trawl in front of a vessel. The poles extend at an angle from the boat to the floor of the estuary and frame and spread the net.

"A major difference," says marine resource assistant Ron Lukens, "is that chopsticks rigs allow bycatch to survive and be returned to the water alive, a phenomenon that almost never occurs



Researchers and technicians wash down a tucker trawl used during around the clock sampling for a Sea Grant study of redfish (red drum) eggs and larvae in state and federal waters off the coasts of Louisiana, Mississippi and Alabama.

with trawling methods traditionally used in this area."

Through fisheries specialist Dave Burrage's study of the Vietnamese language, the advisory service also eliminated a major barrier to working with the large numbers of Vietnamese entering the Mississippi shrimping industry.

"I'm not fluent, but speaking the language even a little helps," he says. "I can walk down to the docks, and guys I know ask questions or introduce me to someone else who needs help with gear adjustment or some other problem."

Also high on the advisory service list in both states has been introduction of TED, a device developed by the National Marine Fisheries Service to allow endangered sea turtles to escape shrimpers' nets unharmed. Although use was voluntary at the time, mandatory use was on the horizon.

In Alabama, advisory personnel used a grant from Saltonstall-Kennedy funds to introduce technology for the manufacture of TED into local net shops. Local shrimpers then were able to incorporate TED into their shrimping operations and evaluate TED's performance

for themselves.

"We found that fishermen can't use TEDs unless they are available, and net-makers won't make them unless fishermen are using them," Alabama fisheries specialist Rick Wallace says. "This project incorporated the whole economic cycle in the fishing community."

In Mississippi, advisory personnel provided information on TED's performance and use through commercial fishing symposiums. In follow-up surveys, more than 80 shrimpers reported that they gave the TED a tryout after attending a symposium.

Bringing rave reviews in both states was an underwater film showing various trawls in use, how they work and rigging details that make them work better. Sea Grant advisory service programs in southeastern states produced the film cooperatively with the National Marine Fisheries Service, gear manufacturers and fishing industry organizations. Technical data excerpted and published by the Alabama advisory service was used with the film throughout the southeastern states.

### STONE CRABS MISSISSIPPI STYLE

Mississippi crabbers set Gulf Coast Research Laboratory biologist Harriet Perry on the trail of another resource in the northern Gulf of Mexico—the stone crab.

Stone crabs had always shown up in the blue crab fishery; but when numbers jumped dramatically, crab fishermen saw the potential for developing a new fishery.

Perry and Kenneth Stuck of the Gulf Coast Research Laboratory launched a two-year Sea Grant study, logging data on seasonal and geographical distribution and the ecological requirements of larval, juvenile and adult stone crabs.

"We learned that stone crabs reproduce and complete their development from larvae to adults in the lower Mississippi Sound and adjacent offshore waters," Stuck notes. "Salinity appears to be an important controlling factor in larval and juvenile occurrence, distribution and survival."

Although they initially cited *Menippe mercenaria* as the subject of their study, Perry and Stuck almost immediately encountered controversy about the identity of Mississippi's stone crab. Differences in color and ecological requirements pointed to the possibility of a new

species.

A short term Sea Grant project using isoelectric focusing, a sophisticated technique that capitalizes on differences in electrical charge and pH to distinguish proteins, supported the possibility of a new species. Biochemist George B. Cline of the University of Alabama at Birmingham found that Mississippi Sound stone crabs are genetically different from stone crabs collected from south Florida and Apalachicola Bay.

Perry and Stuck also supplied specimens and data to other researchers who have since described the Western Gulf form of *Menippe* as a new species, *Menippe adina*.

"There is still much we don't know," Perry says. "What, for example, contributes to those population surges that we see. We have gathered the pioneer information on the larvae, juveniles and adults, and we have the opportunity to collect even more information on an unexploited, virgin population."

### MINERAL INVENTORY

Sea Grant efforts are not limited to the living and the edible among marine resources. University of Mississippi geologists James R. Woolsey and William R. Reynolds targeted industrial minerals in a two-year study of regional resources.

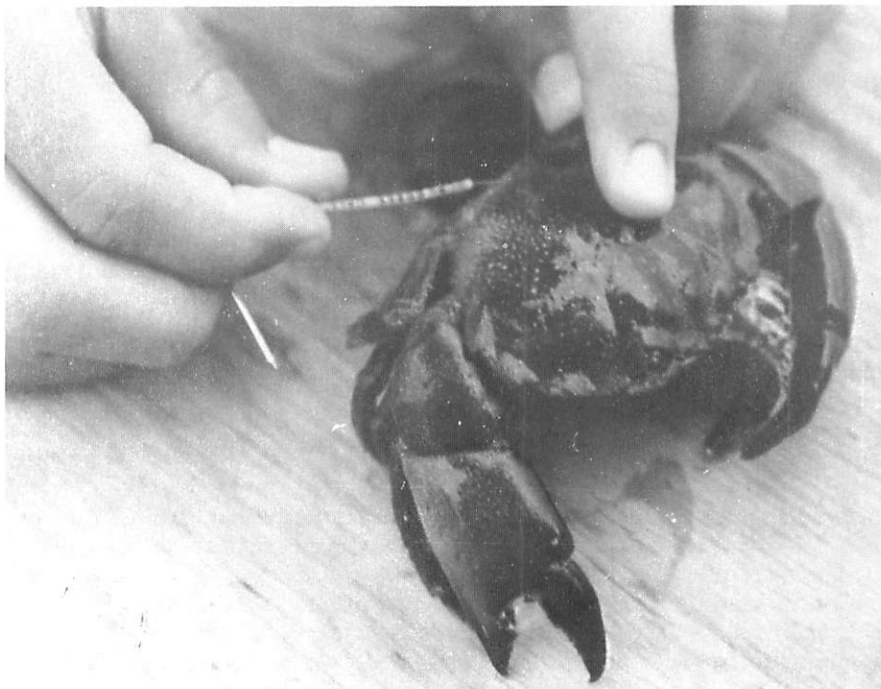
Their reconnaissance work revealed the possibility that oyster shell concen-

trations exist in state and federal waters offshore Mississippi and Alabama in economically valuable quantities. Shell is commonly used in poultry feed as aggregate and as a source of calcium carbonate for industrial use.

They found that heavy minerals and specialty sands do exist in the study area. In most cases quantities were insufficient to warrant further exploration for commercial development with the open water mining technology presently available. Several areas of interest in federal and eastern Louisiana waters, however, are being considered for further investigation as an outgrowth of the original project.

The survey provided an opportunity to expand the limits of mining technology by testing and refining innovative exploration techniques and equipment. With the help of a gamma ray spectrometer sled and a technical team headed by John Noakes from the Center for Applied Isotope Studies of the University of Georgia, Woolsey investigated with favorable results the effectiveness of locating industrial heavy minerals by locating associated species of minerals that emit low levels of radioactivity.

He also used and refined a vibrallift drill he designed. The vibrallift effectively sampled densely packed offshore sands that had hampered sampling efforts with conventional vibracoring equipment. □



Tagging adult stone crabs was one phase of a Sea Grant investigation of a potential new stone crab fishery in northern Gulf waters.



# FROM BOAT TO PLATE

*There's no getting around it. Before seafood winds up in a mouth-watering dish, somebody has to clean, shuck, pick, pack, shed, transport or cook it.*

Sea Grant scientists and advisory service specialists are working on the trip from boat to plate to make seafood safer, tastier and more profitable for the fisherman, the processor and the consumer.

For the growing industry surrounding the soft-shelled crab, that means finding enough pre-molt "peeler" blue crabs to keep crab shedding businesses operating and their customers happy.

"With the exception of the bushline fishery in Louisiana's Barataria estuary, a pre-molt crab fishery has never developed in the Gulf region," Gulf Coast Research Laboratory biologist Harriet Perry says. "Operators of crab shedding systems have to rely on the incidental catch of peelers in the hard crab fishery."

Perry worked with a Mississippi crabber in the 1970s to set up the first successful closed recirculating crab shedding system. Since 1982 she has been a guiding force in the cooperative efforts of Mississippi-Alabama and Louisiana Sea Grant programs to streamline and test the limits of those early systems and to establish guidelines for efficient and economical operation.

## **"PEELER" PROMISE**

With that technology now widely available, Perry is working on the peeler supply problem. She and University of South Alabama biologist John Freeman

are studying the use of hormones to push intermolt crabs into pre-molt stages.

Their initial work with 20-hydroxyecdysone and other natural hormones indicates that hormone dosages can speed up the changes which the crab's own hormones stimulate at a slower pace. Successful dosage depends on administering the right amount of hormone during a receptive stage in the crab's molt cycle.

Standard procedures for identifying those stages involve taking tissue samples. Since keeping crabs alive and healthy is essential to shedding success, Freeman looked for and found external changes in the cuticle of the crab's fifth leg that identify important stages within the intermolt phase. Now Freeman and Perry are experimenting to determine the most effective dosages and techniques for administering the hormones.

They have also found that low-calcium seawater stops or slows the hardening process once a crab has shed its old shell, and they are working to establish guidelines for the use of low-calcium seawater in commercial systems.

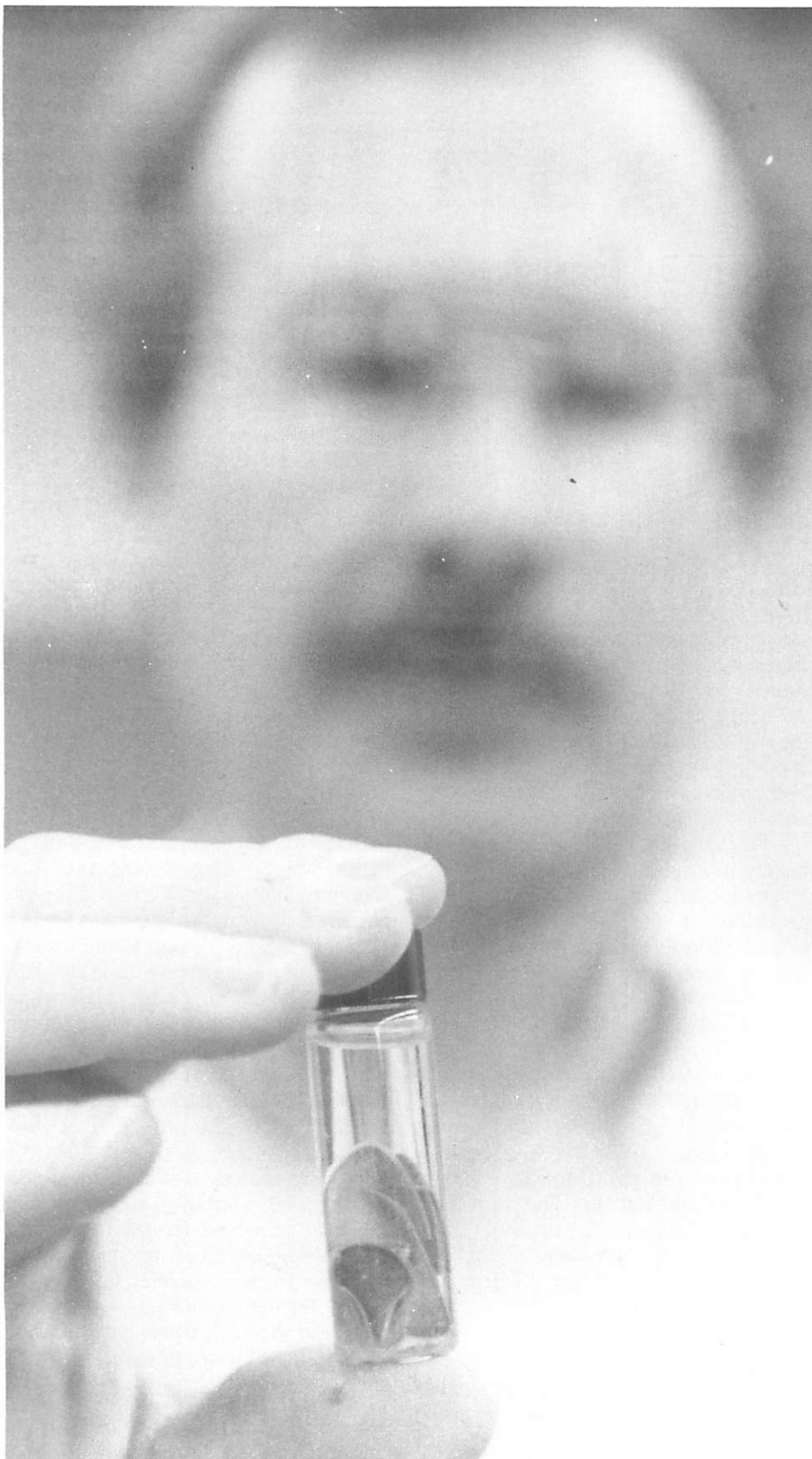
"Low-calcium seawater has a lot of appeal for minimizing the work load involved in shedding crabs, particularly in small, family-run operations where someone has to check shedding tanks throughout the day and night," Freeman says.

With the surge of interest in crab shedding in southeastern and mid-Atlantic states, scientists and advisory personnel have responded with new research directions and prompt communication of research results and problems surfacing



University of South Alabama senior Dianne Laurendeau checks a blue crab that has received experimental doses of natural hormones.





Sea Grant researchers have found that the edges of crab paddles, whether on the living crab or in a jar, offer visual evidence of a blue crab's progress through the molt cycle.

in the industry.

"Cooperation has been tremendous," Perry says. With Bill Hosking of the Alabama advisory service, Perry coordinated a two-day symposium on the soft-shelled blue crab fishery in 1985. More than 100 scientists, advisory specialists and industry representatives gathered for an overview of current work at the Biloxi, Mississippi, conference hosted by Mississippi-Alabama and Louisiana Sea Grant programs and sponsored by southeast and mid-Atlantic Sea Grant advisory networks. Perry also co-edited the symposium proceedings.

### **OYSTER QUALITY**

The Sea Grant research of David Cook and Angela Dicharry Ruple of the Gulf Coast Research Laboratory is determining what fecal coliforms and other indicator organisms really indicate about product quality and safety in the oyster industry.

"The interpretation is that if you find more than the recommended level, the oysters have been harvested from, handled or processed under unsanitary conditions," Cook notes. "But that may not be an accurate assumption."

Through a study of the effects of time, temperature and storage practices on unshucked oysters termed "shellstock" by the industry, the researchers found that fecal coliforms may multiply in oysters after the shellfish have been harvested from approved "safe" waters.

Cook and Ruple documented multiplication of the bacteria in both commercially handled and experimentally handled oysters. Increased coliform levels correlated with higher temperatures as well as the salinity of waters in the harvest area.

They are also looking at bacteria of the genus *Vibrio*, microorganisms that occur naturally in estuarine waters and include species that are pathogenic.

Tests to identify vibrios are time consuming and costly, and Cook and Ruple have been working closely with the Sea Grant project of Louisiana State University researchers who are investigating quick and effective methods for identifying vibrios.

"We're finding many more vibrios than we expected on the basis of our review of past research," Ruple says. "We're sorting out four species that have been known to cause problems in fish and sometimes food poisoning in people. Then we can determine numbers

and whether or not they are multiplying after harvest.”

### FROM WASTE TO PROFIT

For processors, seafood's trip from boat to plate also includes the problem of getting rid of what's left after the edible parts have been removed. In 1984, the Alabama Sea Grant Advisory Service began working with firms interested in turning seafood solid waste into dried meal products.

A plant opened in July of 1985, producing meal for poultry feed and offering Bayou La Batre, Alabama, seafood processors an alternative to the 100-mile round trip to a permitted landfill.

Residents displeased with odors the plant emitted, however, filed suit. The judge ruled that the plant institute measures described by advisory service seafood technologist Brian Perkins in his testimony as an expert witness.

Operators installed new equipment; residents are breathing more freely; and the plant reports a 60 percent increase in efficiency.

Advisory service personnel in Alabama also helped institute a pasteurization process that extends the shelf life of processed crab meat from approximately two to six weeks; bridged language barriers through sanitation posters in Vietnamese for seafood plant workers; and organized a workshop for processors interested in entering foreign markets.

For the consumer, seafood preparation workshops and demonstrations, television programs highlighting the health benefits of seafood, and recipe cards have proved effective.

“One thing we are trying to do is to interest consumers in species that are just as tasty and nutritious as traditional species, but are something they haven't been used to eating,” Hosking comments.

“The most important thing is to have the information at hand when a specific species is available. Then a relatively minor investment of time and resources yields good returns in consumer satisfaction, knowledge and seafood sales.” □



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Telephone: 305/681-3000  
MSADSP 88-001

Alabama Sea Grant Consortium - A Sea Grant College

Sea Grant poster promotes communication.



Microbiologist Angela Dicharry Ruple performs one of a series of tests to identify bacteria isolated from Gulf Coast oysters for a study on the effects of temperature and storage time.



# I N N O V A T I O N :

## Sea Grant Researchers Mix and Match Old and New for Creative Solutions

The slimy coating that helps fish slide through the water with the greatest of ease may one day perform the same function for ships, according to University of Southern Mississippi investigators Charles L. McCormick and Roger D. Hester.

McCormick and Hester are Sea Grant innovators, a cadre of researchers mixing and matching the old, the new, the known and the unknown in exciting, useful ways.

McCormick, Hester and their team of graduate students are developing and testing polymer coatings that reduce drag and increase the fuel efficiency of marine vessels.

Past research has shown that a variety of synthetic materials as well as natural secretions on fish and some mammals reduce drag. But so far no one has found out exactly how the drag reduction

phenomenon works or how to apply it economically to boats.

The USM team is working on both questions. During the first year of Sea Grant research, they have developed "model" water soluble polymers with a range of known physical and chemical characteristics. They have also adapted and developed a device for measuring drag reduction. They use the device in combination with laser technology to study each new polymer's effectiveness and its interaction with water.

In the final stages of the investigation they plan to test polymers that have proved effective as drag reducers and that can be grafted on to vessel surfaces as a permanent coating.

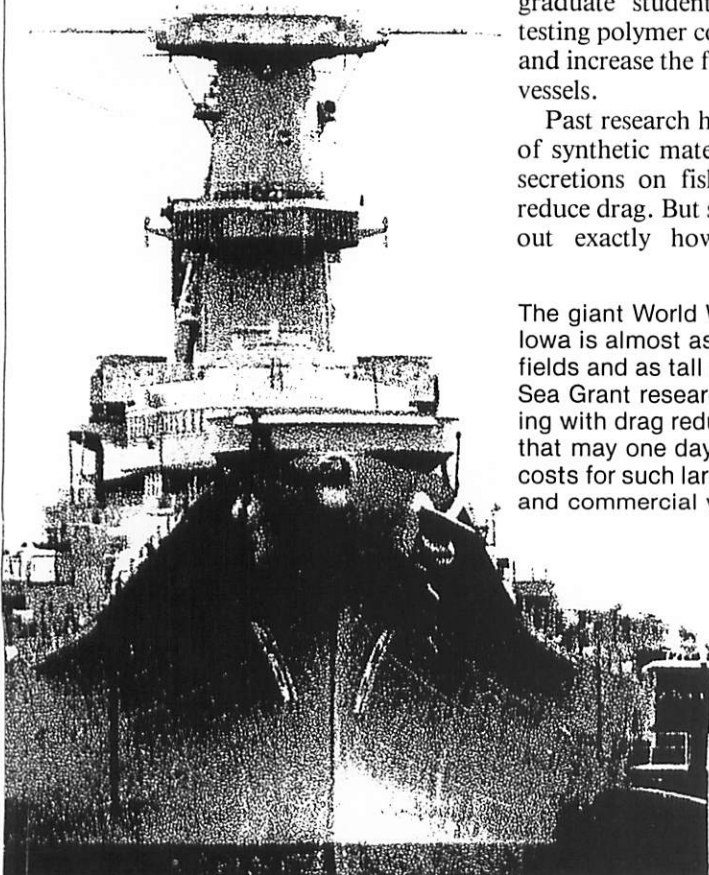
Initial results from the drag reduction studies on the model systems are "greater than any reported in scientific literature previously," McCormick says.

"If we can learn how polymer molecules are responsible for reducing drag, then we can tailor molecules that work much better than the ones we have presently. We can suggest which systems are most viable for commercial development on a large scale."

### **WORLDWIDE PROBLEM**

University of South Alabama biologist C. Steven Sikes is another Sea Grant innovator putting natural and synthetic polymers to work. His specialty is preventing unwanted crystallization.

Nature employs crystallization almost everywhere, and calcium carbonate is particularly widespread. Sikes and fellow scientist Hap Wheeler, now at Clemson University, South Carolina, discovered that organic material termed "matrix" in



The giant World War II battleship USS Iowa is almost as large as three football fields and as tall as an 18-story building. Sea Grant researchers are experimenting with drag reducing polymer coatings that may one day dramatically cut fuel costs for such large ocean-going military and commercial vessels.



oyster shells inhibits growth of calcium carbonate crystals.

Through Sea Grant support and Sikes' fertile imagination, that earlier discovery has spawned a host of useful compounds. He and Wheeler have discovered natural inhibitors in materials from algae, sea urchins and other marine species. They have found synthetic analogs that are as effective or more effective than their natural counterparts.

The result is four patents on the use of non-toxic biodegradable water treatment compounds. The compounds promise to cut water treatment, maintenance and replacement costs for industries plagued with the crystallization of calcium carbonate and other minerals on the inner surfaces of pipes, boilers and water cooling systems.

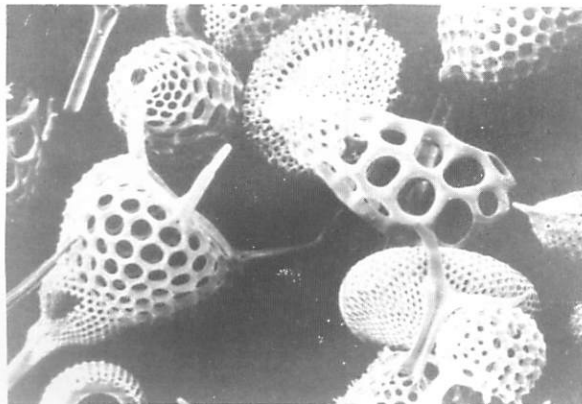
Sikes also has another series of patent applications in preparation. Chemical companies are expressing interest in the opportunity that his work represents, and negotiations for commercial development are under way.

Future uses range from preventing pathological crystallization on artificial heart valves to battling barnacles on boats. While experimenting with such specific applications, Sikes is exploring how and why the inhibitors work so well. He has the answer, he says. Now he is setting out to prove it.

### ***NEW BREED OF BOAT***

In another innovative Sea Grant project, University of Alabama engineers C. Everett Brett and Walter J. Schaetzle have adapted commercially available conversion kits and the technology for storing super cold liquids to the development of a cost-cutting fuel and refrigeration system for commercial shrimp boats.

The new system converts marine diesel engines for dual use of methane in the



Water entering the cooling tower at Mississippi Power Company's Plant Watson (above) is a picture repeated throughout the world. Equally widespread are the high maintenance and replacement costs that result from mineral crystallization on the inner surfaces of industrial pipes, boilers and cooling systems. Sea Grant research involving microscopic radiolarian protozoa (left) and other marine species is developing new chemicals to help combat unwanted crystallization.

form of liquefied natural gas (LNG) plus small amounts of diesel. The LNG also serves as a refrigerant, absorbing heat as it converts from liquid to the gaseous state required for combustion.

A host of public and private sector organizations are cooperatively investing in a new shrimp boat now under construction to test researchers' estimates of up to 45 percent savings on annual operating costs.

"High operating costs and the influx of shrimp imported from South American mariculture operations have hit the domestic shrimping industry especially hard," Brett says. "This pro-

ject will lower operating costs to where shrimpers can be competitive in the international market."

The researchers have also dealt with frequent questions of safety.

"Methane has an undeserved reputation as a dangerous fuel," Brett says. "Methane is extremely difficult to ignite in its gaseous state, and good engineering eliminates the possibility of trapping LNG and creating conditions where an explosion could occur."

Once the new vessel is in operation, the research team will retrofit an existing boat. With about 14,000 shrimp boats in the Gulf and South Atlantic fleets,

retrofitting is where the market is, Brett says. Representatives of other fishing industries have also expressed interest in the conversion system.

### **HELP FOR PORTS**

Another engineering first for Sea Grant is the development of a computer model that port managers can use as a planning tool for expansion.

Assessment of the complex set of variables involved in forecasting, planning, scheduling and resource management of ports is well suited to solution by computer simulation, says Chan S. Park, Auburn University industrial engineer



Left: Sea Grant researcher C. Everett Brett of the University of Alabama examines the heads of specially designed cryogenic tanks for storing super cold LNG (liquefied natural gas) on board a new breed of shrimp boat that could cut 45 percent off Gulf of Mexico shrimpers' annual operating costs. Right: Workers prepare for pouring high density foam mounts for the completed tanks. Below: The larger of the two tanks is installed in the vessel's forepeak.





who developed the computer model.

Managers and planners involved in decision-making can use the model to examine the effects of proposed expansion projects, construction of a new port or for determining the capacities of existing port facilities.

The accompanying documentation along with questions and prompts written into the program make the computer model useable by port administrators familiar with day-to-day port operations.

"They don't have to hire a consultant to run the program, and they can use it over and over as needed," Park says.

The model helps planners answer "What if?" questions about such factors as manpower and physical equipment needed, levels and timing of financial investment, effects on congestion and the amount of time port users' goods are idled waiting for loading or unloading, operating and maintenance costs,

revenues and savings.

### CATFISH PONDS

Other Sea Grant research that is introducing people to new ideas includes projects on the use of food-grade phosphates to improve processed shrimp profits, the development of a new algicide for commercial catfish ponds and algae as a food source in mariculture operations.

Allison Perry of the Gulf Coast Research Laboratory worked with Mississippi seafood processors and a chemical supply company on the use of sodium tripolyphosphate to prevent weight loss in frozen shrimp once they are thawed.

His experiments determined the best ratios for preventing weight loss with the least effect on appearance and flavor of the thawed product. He also found that long soak times recommended in

previous studies are not necessary. A number of Mississippi Gulf Coast processors are now following guidelines Perry's research established.

A new algicide for commercial catfish ponds is slated for the market under the trade name "Solricin 135" as a result of the work of University of Southern Mississippi researchers Robert T. van Aller and George F. Pessoney. Van Aller credits Sea Grant with launching the original research as a three-year project in 1972.

In another Sea Grant project, Jackson State University biologist Charles F. Rhyne experimented with two species of blue-green algae particularly adaptable for use in an integrated mariculture system. In a large-scale system, algae would use nutrients from waste products of the fish *Tilapia*; and the fish would feed on the algae. □

## THE SEA GRANT PAYOFF



C. Steven Sikes, left, continues the Sea Grant tradition of training future scientists. Here he reviews results of tests that University of South Alabama senior Tammy Gunn has run on an experimental inhibitor of calcium phosphate crystallization.

The training of future marine scientists is a Sea Grant mandate that pays off. The research of Sea Grant-trained investigators creates helpful new products, finds new ways to use and conserve resources and provides knowledge that helps us live better, longer and more harmoniously with the world around us.

C. Steven Sikes is a good example of that process. The University of Wisconsin Sea Grant program awarded Sikes a fellowship that supported the final year of research for his doctoral dissertation.

He conducted that research under the direction of pioneer Great Lakes researcher, Alfred M. Beeton, former Michigan Sea Grant director and current director of the Great Lakes and Marine Waters Center at the University of Michigan.

Now, as a Sea Grant investigator in Alabama, Sikes is collaborating with Hap Wheeler of Clemson University—a fellow scientist who has received support from the South Carolina Sea Grant program—on research that has the potential for affecting the health, wealth, work and play of individuals around the world. □





# RECREATION:

## Where Fun and Saltwater Mix

When mom and dad pack the kids in the car, load up the fishing gear and head for Mississippi or Alabama beaches, they join an estimated 18 million people who visit the two states' southern regions each year to sun, golf, swim, fish, dine, explore and spend \$950 million.

Sea Grant's mandate in such a mixture of fun and saltwater is to help keep people and the marine and coastal resources they use safe, healthy and available for future encounters.

One way that the Sea Grant Advisory Services in both Mississippi and Alabama do that is by working with business and government leaders responsible for decisions related to recreation and marine resources.

### *TOURISM SURVEY*

With the help of the Mississippi advisory service, for example, officials in one coastal county conducted a survey of visitors and hotel registration cards over a 30-month period. Information about the Mississippi coast tourist's length of stay, use of resources and money spent is now available for planning and resource management decisions.

"The study supports some things we knew intuitively; tells us some things we didn't know and offers opportunities in new directions," says David Veal, Mississippi advisory service program leader.

In another cooperative project, advisory personnel have monitored Mississippi's artificial fishing reefs and coordinated enhancement efforts, located and determined coordinates of existing reef materials and developed buoys that are less expensive and less susceptible to vandalism and weathering than traditional buoys used to mark reef sites. In a separate project they helped officials of a coastal county plan effective and

economical development of shallow water fishing reefs.

### *WORKSHOPS*

Another effective advisory service tactic is the workshop. Advisory personnel enlist specialists from universities, research laboratories, marine-related businesses and assorted state and federal agencies to volunteer their expertise and experience.

They add opportunities for



A tranquil spring sunrise offers little evidence of sometimes fierce competition for limited marine resources. Sea Grant research and public service programs provide information that is helping individuals and agencies make decisions about the best use of those resources for recreation, commerce and industry.

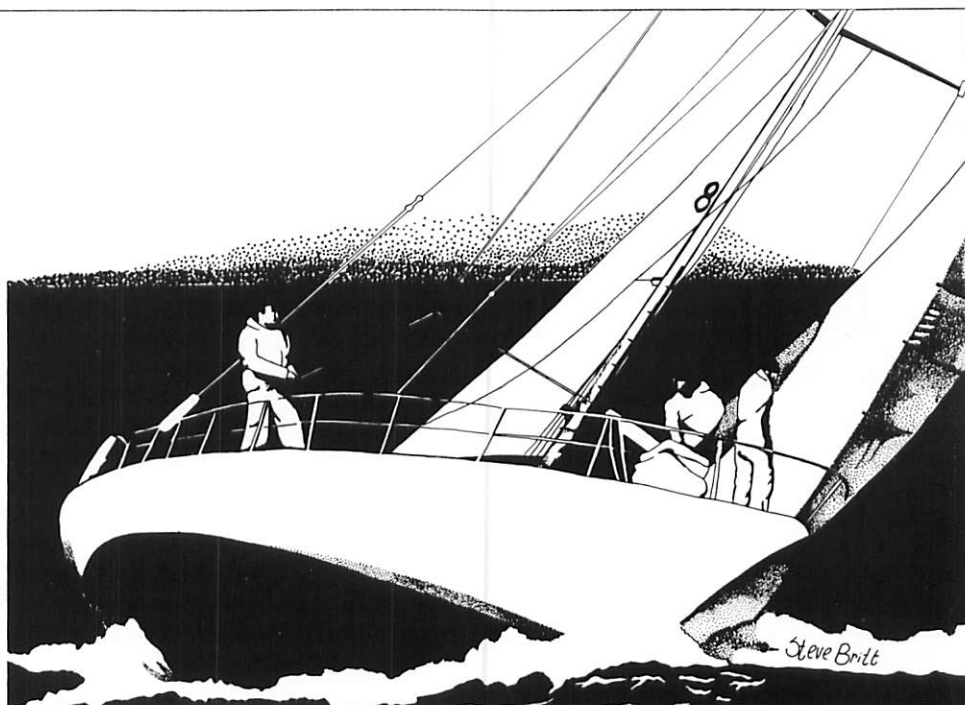
demonstrations, hands-on activities and questions and answers then mix well with an audience ready to learn something about the workshop topic. It works, says Dave Burrage of the Mississippi Sea Grant Advisory Service.

"We've had people drive 350 miles round trip to attend a sportfishing workshop. On call back surveys, we find that most are putting into practice something they learned at our workshops."

Mississippi and Alabama 1984-85 spring workshops focussed on recreational shrimping, saltwater sport fishing and boating safety. Throughout the year advisory service publications such as Mississippi's *Gulf Coast Fisherman* and Alabama's *Sea Harvest News* channel information to more than 8,900 recreational and commercial fishermen.

### CATALYSTS

Advisory service personnel also serve as catalysts, pulling together the people or information necessary to help a group begin or expand a recreational activity. In 1984, for example, the Alabama advisory service helped lay the groundwork for a Labor Day weekend sailboat race as part of the nationwide "Year of the Ocean" observance. Now Alabama sailors are racing for permanent "Year of the Ocean" and Sea Grant" trophies



in the annual race from Dauphin Island, Alabama, to Pascagoula, Mississippi.

A "Year of the Ocean" video based on the race played well at Alabama yacht clubs, introducing members to Sea Grant and its mission to promote wise stewardship of coastal and marine resources.

"Recreation in coastal areas is unique. There are limited resources and greater competition for those resources—boating, commercial fishing, shipping,

industrial development," Veal comments. "The competition for the common property resource is what makes it important that good management principles are applied.

"The Sea Grant advisory service is the only education program that deals almost exclusively with marine and coastal common property resources. That makes our expertise and involvement important." □

## ARTIFICIAL REEFS

Artificial reefs have long been cited as a boon to fishermen, but when it comes to establishing reefs in federal waters, decisions about what to use and where are likely to bog down in questions about what is legal, who will benefit and who is legally liable at different stages of reef construction.

Through a National Marine Fisheries Service grant from Saltonstall-Kennedy funds, Mississippi-Alabama Sea Grant and Continental Shelf Associates, Inc. of Florida put together practical guidelines for answering those and other questions about reef development in the northern Gulf of Mexico.

In the one-year study, investigators gathered existing data from a number of disciplines to incorporate into an overall plan for siting reefs in federal waters of the Gulf of Mexico. Investigators from Sea Grant member institutions assembled information on legal statutes and regulations,

economics and sociological implications.

Continental Shelf investigators looked at biological requirements and effects of reef siting along with operational questions concerning options for reef materials, transport of material and reef configuration.

Investigators applied the general guidelines they developed to three specific sites that serve as models: Biloxi-Gulfport, Mississippi; Mobile-Dauphin Island, Alabama; and Pensacola, Florida.

"One thing we found that was especially important was the use of a local advisory committee and public meetings," James I. Jones, Mississippi-Alabama Sea Grant director, says.

"The advantages of having two levels and sources of local input and evaluation are myriad. The process involves political as well as other factors, and the early routine involve-

ment of competing factions and interests allows for possible identification and resolution of specific problems as they develop."

An advisory committee representing a broad spectrum of organizations and individuals from the public and private sectors met twice during the project to provide direction, critiques of research and evaluations.

Public meetings were held in Biloxi, Mobile and Pensacola with useful ideas and concerns from those meetings incorporated into the final draft of the plan.

A detailed checklist for steps involved in planning and securing permits for artificial reefs, the general siting plan and siting procedures for the three model sites are included in an 840-page Sea Grant publication *A Plan for Siting Artificial Reefs in the Northern Gulf of Mexico.*" □







# FACE OF THE FUTURE

*"We have a responsibility to pass along the technical skills and general knowledge essential to making scientific discoveries and establishing public policy. Our future depends on it."*

—James I. Jones

*Mississippi-Alabama Sea Grant Consortium Director*

Debbie Swift is the face of the future. The University of South Alabama graduate student discovered organic material in sea urchin shells and investigated how the substance inhibits calcium carbonate crystallization.



Debbie Swift

Her research earned national recognition in the 1985 Sea Grant student research awards competition. She is now investigating preventatives for harmful crystallization as she works toward a Ph.D. at Clemson University in South Carolina.

Swift was one of 54 graduate students who worked with Sea Grant projects in 1984 and 1985, exploring uncharted scientific territory under the guidance of established and respected researchers.

"Drawing on the resources of faculty at nine universities and research institutions in two states, Sea Grant projects are producing research of regional, national and global importance. Students are involved in every stage of that research," Jones says.

In 1983 Sea Grant expanded that training opportunity through a competitive program that has awarded fellowships to 13 additional graduate students conducting marine-related research in 1983-85.

"Sea Grant's investment in graduate student training represents minimal dollars that are multiplied many times over through the immediate and future contributions a student makes," Jones says.

"The track record of the MASGC fellowship program illustrates that. All of our recipients are completing advanced degrees or are in positions of responsibility. Five of the six who have already completed degrees are directly involved in marine or environmental science."

Louie Tobias is another face of the future. The Sea Grant undergraduate trainee from Jackson State University (JSU) spent the summer of 1985 calibrating sophisticated instruments for oceanographic research at Virginia Institute of Marine Sciences.



Louie Tobias

The following summer he worked with the numerical modeling division at the Naval Ocean Research and Development Activity (NORDA). The physics major is now completing requirements for his

Sea Grant undergraduate trainee Cynthia Heard (opposite page) of Jackson, Mississippi, works with Virginia Institute of Marine Sciences (VIMS) researchers on aging analysis of fish during a summer intern program at VIMS.

bachelor of science degree through a course of study emphasizing atmospheric science and engineering.

Tobias was one of five undergraduates chosen through a rigorous selection process to participate in a Sea Grant research training program in marine, atmospheric and environmental sciences. Organized by JSU Sea Grant investigator Sylvia Morgan, the program featured training in selected research techniques, field trips and a lecture series that enriched the trainees' academic studies during the 1984-85 school year at the traditionally black university.

The following summer, Sea Grant sponsored the participation of four of the JSU trainees in a Virginia Institute of Marine Sciences/Exxon internship program designed to give qualified minority undergraduates firsthand experience working with marine scientists. Another trainee worked and studied at Duke University Marine Laboratory in North Carolina and has since been recruited to the marine science program there.

"The research conducted by these young people was graduate level work.

They represented Sea Grant and Jackson State exceptionally well," Jones notes.

Sea Grant also sponsored colloquia for Dauphin Island Sea Lab summer school sessions and co-sponsored a unique Mississippi State University honors course that mixed science, art, students and Mississippi coastal and barrier island environments.



Carla Riden

and earned her a 1986 Sea Grant student award at Alabama regional and state science fairs. The award that year included a Sea Grant scholarship to a four week summer marine science course on

an Alabama barrier island.

"That course was what firmed my desire to pursue a career in marine research," Riden says. Now a high school senior, she is working on phase two of her science project and looking forward to undergraduate study in a prestigious marine science program.

There are primary and secondary students who, like Riden, have a brush with Sea Grant and consider marine science as an option for their futures. Of equal importance to the future are those destined for other careers who come away from a Sea Grant experience with greater knowledge of marine environments and a recognition of the possible consequences that future decisions can have for those environments.

### **MARINE LITERACY**

Sea Grant educator-communicator Sharon Walker describes that combination of experience, knowledge and understanding as "marine literacy." Sea Grant began the task of promoting marine literacy at the secondary and primary levels in Mississippi and



High School teacher Bess Moffatt (left) explains the work of shipworms to students on a field trip to a Mississippi beach.



Alabama in 1978.

In 1984 and 1985, marine education efforts had matured to include inter-related and multi-disciplinary projects for teacher training, development of curriculum materials and courses, and projects to encourage minority student involvement in the marine sciences. At every level, whether teacher or student, Sea Grant educators found that "hands-on" experience unlocked a wealth of enthusiasm and learning.

Early in the planning stages for development of Sea Grant's "Man and the Gulf of Mexico" (MGM) marine science curriculum materials, Bobby Irby and his team of researchers at the University of Southern Mississippi found that few science teachers in Mississippi and Alabama felt adequately trained to incorporate marine science topics into existing curricula, even on a limited basis.

### TEACHER WORKSHOPS

To fill that gap, the project incorporated intensive week-long summer workshops to introduce teachers to marine environments and field study techniques, to involve them in development of new curriculum materials and to familiarize them with the "Man and the Gulf of Mexico" series of workbook-texts.

Through 1986, participants included 467 Mississippi and 413 Alabama teachers. Former participants and other science teachers are kept abreast of issues, events and opportunities related to marine education through the *Skimmer*, a bi-annual newsletter initiated in 1984.

The MGM workbook-text series has now been adopted and placed on the Louisiana supplemental textbook list and is under consideration for adoption as an approved marine science text for Mississippi and Alabama. In 1984 Shelia Brown of the University of Southern Mississippi began work on the fifth and final volume, *Coastal Marine Environments*. Field testing and revisions continued through 1985.

"With teaching methodology moving toward inquiry and discovery techniques, use of the "hands-on" experiences available through marine and aquatic studies is growing," Walker notes. "The MGM series includes a wealth of study materials and hands-on exercises and experiences. Teachers are incorporating MGM materials into

related science courses, using the materials as separate units or using the MGM series for a distinct marine science course."

One step beyond hands-on is total immersion, the teaching technique used in a 1985 Sea Grant field course in Bahamian waters for Mississippi and Alabama educators committed to marine education through secondary schools, colleges and adult education programs.

In the water for more than six hours each day for more than two weeks, teachers experienced the interrelationships and productivity of the marine environments that had been part of their studying and teaching through the years.

### YEAR OF THE OCEAN

In 1984 Mississippi-Alabama Sea Grant and the National Marine Fisheries Service sponsored "Year of the Ocean" minority fellowships which were awarded by Sea Grant directors in each of the southeastern states and Puerto Rico. In addition to administering the overall program, MASGC selected Mississippi's fellowship recipient, biology teacher Barbara Ward of Piney Woods Country Life School, a predominantly black private boarding school in rural Mississippi for elementary and secondary students.

After a summer of classroom and field studies at Duke University's Marine Laboratory, Ward was enthusiastic about experiences "in the actual environments where marine organisms live and grow."

With Sea Grant support for equipment, aquaria, textbooks and field trips along with the help of Jackson State University faculty, Ward set up marine and aquatic studies at Piney Woods. Students who had never before been near saltwater were given the opportunity to study marine creatures, identify them in their natural environment and to share their teacher's enthusiasm for learning.

### EXPANDING EXPERIENCES

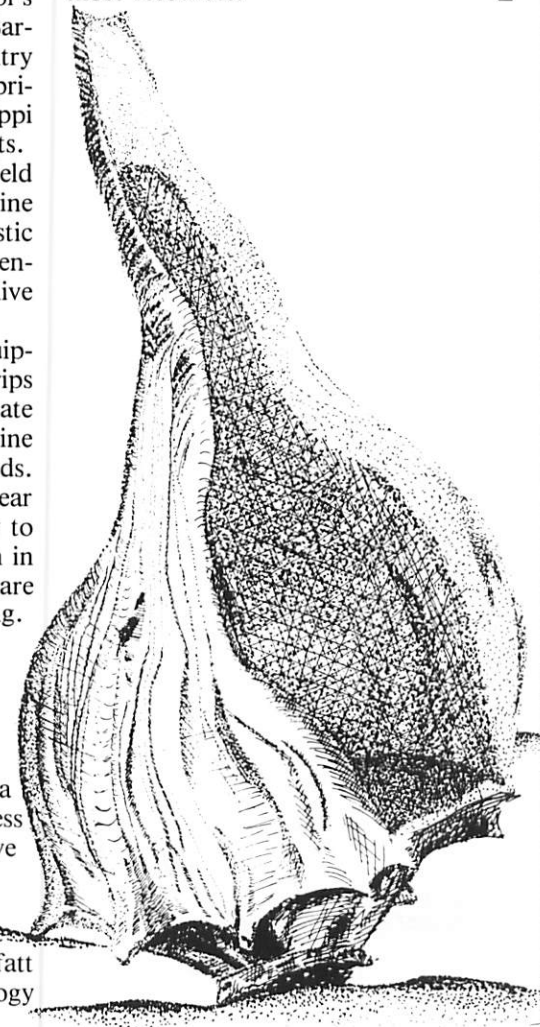
Ward's students were not alone in their unfamiliarity with marine habitats and organisms. In developing a Sea Grant project at Pascagoula (Mississippi) High School, teacher Bess Moffatt found that students who have lived all their lives on the coast may never have been to a barrier island.

Through Sea Grant support, Moffatt expanded an existing marine biology

course to include field trips to barrier islands, beaches and salt marshes along with more in-depth laboratory experiences. Enrollment in the course has doubled. Additional classes have been added, and the administration is committed to maintaining the course once Sea Grant support ends at the conclusion of the 1986-87 school term.

Sea Grant provided similar support for the Mobile County (Alabama) Public School System's environmental studies center. A 150-gallon saltwater aquarium was set up for introducing students to marine organisms of the northern Gulf of Mexico. Teacher in-service, instructional materials, laboratory supplies and field studies were all part of the Sea Grant project SEA OATS (Special Enrichment Activities in Oceanography for Advanced and Talented Students).

"More than 20,000 visitors, mostly students, come through the center each year," Jones says. "They will come into contact with the Sea Grant ethic that our oceans' resources are valuable to each of us and we are responsible for wise use of those resources." □



# PROGRAM SUMMARY

		Program Year Begun	Program Year Ending
<b>Resources Development</b>			
R/RD-2	Evaluation of a Closed Recirculating Seawater System for Production of Soft-shelled Crabs	Perry	1982 1984
<b>Living Resources</b>			
R/LR-11	<i>Menippe mercenaria</i> : The Potential for Development of a Fishery	Perry & Stuck	1983 1984
R/LR-12	Trophic Dynamics, Growth and Condition of Red Drum Larvae ( <i>Sciaenops ocellatus</i> ) in Mississippi Coastal Waters	Shultz & Steen	1983 1986
R/LR-13	Analysis of Tissue Isoenzymes of Stone Crabs of the Genus <i>Menippe</i> by Isoelectric Focusing	Cline	1984 1984
R/LR-14	Use of 20-hydroxyecdysone to Initiate Pro-ecdysis in Intermolt Blue Crabs, <i>Callinectes sapidus</i>	Freeman & Perry	1985 1987
R/LR-15	Functional Importance of Algal Productivity in Mississippi Salt Marshes	Sullivan	1985 1986
<b>Socio-Economic &amp; Legal Studies</b>			
R/SL-4	Mississippi-Alabama Sea Grant Legal Program	Jarman	1971 Continuing
<b>Marine Technology Research &amp; Development</b>			
R/MT-6	Prevention of CaCo <sub>3</sub> Fouling of Marine Surfaces by Potent Synthetic Inhibitors of Crystal Growth	Sikes	1983 1985
R/MT-8	Protein Feedstock Production Using an Algae/Seawater/Wastewater System	Rhyne	1983 1984
R/MT-9	Use of Food Grade Phosphates to Benefit the Southern Shrimp Processing Industry	Perry	1984 1984
R/MT-10	Microflora Modification in Temperature Abused Shellstock Oysters	Cook	1985 1986
<b>Engineering Research</b>			
R/EN-2	Finite Element Modeling of Sediment Transport in the Mississippi Sound	Wang	1983 1984
R/EN-3	Port Expansion Simulation Model	Park	1983 1984
R/EN-4	LNG as an Alternative Fuel for Diesel Powered Fishing Vessels	Brett	1984 1986
R/EN-5	Hydrophilic Surface Coatings for Drag Reduction in Marine Propulsion	McCormick & Hester	1984 1988
<b>Marine Environmental Research</b>			
R/ER-2	Pollutant Transport in Mississippi Sound	Lyle & Lyle	1979 1984
R/ER-8	Organic Pollutant Levels in Bivalves of Mobile Bay	Marion & Settine	1981 1984
R/ER-11	Exploration for Industrial Minerals in Mississippi Sound and Adjacent Territories of Mississippi and Alabama	Woolsey	1983 1984
R/ER-13	Hydrodynamic and Water Quality Modeling and Bathymetry and Sediment Characterization of Apalachicola Bay and Adjacent Waters	Jones, Raney & Isphording	1983 1984
R/ER-14	A Synthesis and Quantitative Analysis of the Winds and Water Level Elevations along the Alabama Coast: 1973 to 1983	Schroeder	1984 1984
R/ER-15	Determination of the Origin of Fecal Coliforms Isolated from the Mississippi Sound	Evans & Taylor	1985 1986
<b>Marine Education and Training</b>			
E/O-15	MGM, Dissemination and Implementation—A Comprehensive Plan	Irby	1983 1985
E/O-16	Sea Grant Fellowship Program	Committee	1983 Continuing
E/O-17	A Cooperative Mississippi-Alabama Sea Grant Consortium/Southeast Fisheries Center Fellowship Program	Jones	1984 1984
E/O-18	National Sea Grant Internship Program	Jones	1984 1984
E/O-19	Dauphin Island Sea Lab Colloquium Support	Shipp	1984 1984
E/O-20	An Illustrated Identification Guide to the Predominant Benthic Macroinvertebrates of East Mississippi Sound and Mobile Bay	Hopkins	1984 1984
E/O-21	Minority Student Involvement in Marine and Aquatic Sciences at Piney Woods School through Jackson State University	Morgan & Ward	1984 1987
E/O-23	Marine Biology Curriculum Expansion: A Secondary School Education Course	Moffatt & Corcoran	1984 1987
E/O-24	MGM, Coastal Marine Environments	Brown	1984 1985
E/O-25	Jackson State University Undergraduate Research Training Program in Marine, Atmospheric and Environmental Sciences	Morgan	1985 1985
E/O-26	Field Studies in Marine Science Education: Bahamas	Brown	1985 1985
E/O-27	Birds of the Mississippi Coast, and Where to Find Them—A Guide Book	Corcoran & Touns	1985 1986
E/O-28	Special Enrichment Activities in Oceanography for Advanced and Talented Students: Project SEA OATS	Hosking & Scott	1985 1987
E/O-29	“Sea-Earth-Sky”: An Undergraduate Curriculum Course	Jones & Jackson	1985 1985



			<b>Program Year Begun</b>	<b>Program Year Ending</b>
<b>Advisory and Public Service</b>				
A/O-9	Mississippi-Alabama Sea Grant Advisory Service	Veal & Hosking	1972	Continuing
A/O-12	Mississippi-Alabama Coastal Information Management System	Blancher	1984	1984
A/O-13	Development of International Cooperation on Sedimentation Research	Wang	1983	1986
A/O-14	Symposium on the Soft Crab Fishery of the United States	Perry	1984	1985
<b>Program Administration, Planning &amp; Development</b>				
M/PA-1	Program Management: Administration and Planning	Jones	1971	Continuing



# BUDGET

	<u>1984 PROGRAM</u>		<u>1985 PROGRAM</u>	
	NOAA/ Sea Grant	Grantee Match	NOAA/ Sea Grant	Grantee Match
<b>RESEARCH</b>				
<b>Marine Resources Development</b>				
Aquaculture	21,410	19,255	28,623	19,604
Living Resources	46,094	73,110	51,446	54,897
Mineral Resources	17,600	25,758	—0—	—0—
Marine Biomedicinals & Extracts	39,309	38,772	41,497	69,806
Socio-Economic and Legal Studies	43,353	62,356	51,369	77,457
<b>Marine Technology Research &amp; Development</b>				
Ocean Engineering	49,440	53,402	126,856	165,220
Resources Recovery & Utilization	26,375	78,890	27,405	23,931
Transportation Systems	18,729	13,051	—0—	—0—
<b>Marine Environmental Research</b>				
Ecosystems Research	34,037	17,343	67,182	59,825
Environmental Models	94,449	32,507	—0—	—0—
Applied Oceanography	9,923	31,191	—0—	—0—
Total Research	400,719	445,635	394,378	470,740
<b>EDUCATION</b>				
College Level	—0—	—0—	—0—	4,942
Other Education:				
Fellowships/Internship	91,846	5,556	42,481	28,423
K-12 projects	23,231	27,835	6,692	13,443
Course development	7,307	7,934		13,015
Guidebook development	8,100	6,386		4,103
Total Education	130,484	47,711	49,173	63,926
<b>ADVISORY SERVICES</b>				
Other Advisory Services	196,704	132,756	206,759	176,779
<b>PROGRAM MANAGEMENT</b>				
Administration, Rapid Response Projects and Program Development	259,110	132,089	313,782	85,762
<b>TOTALS</b>	<u>987,017</u>	<u>758,191</u>	<u>964,092</u>	<u>797,207</u>

# PUBLICATIONS

## 1984-1985

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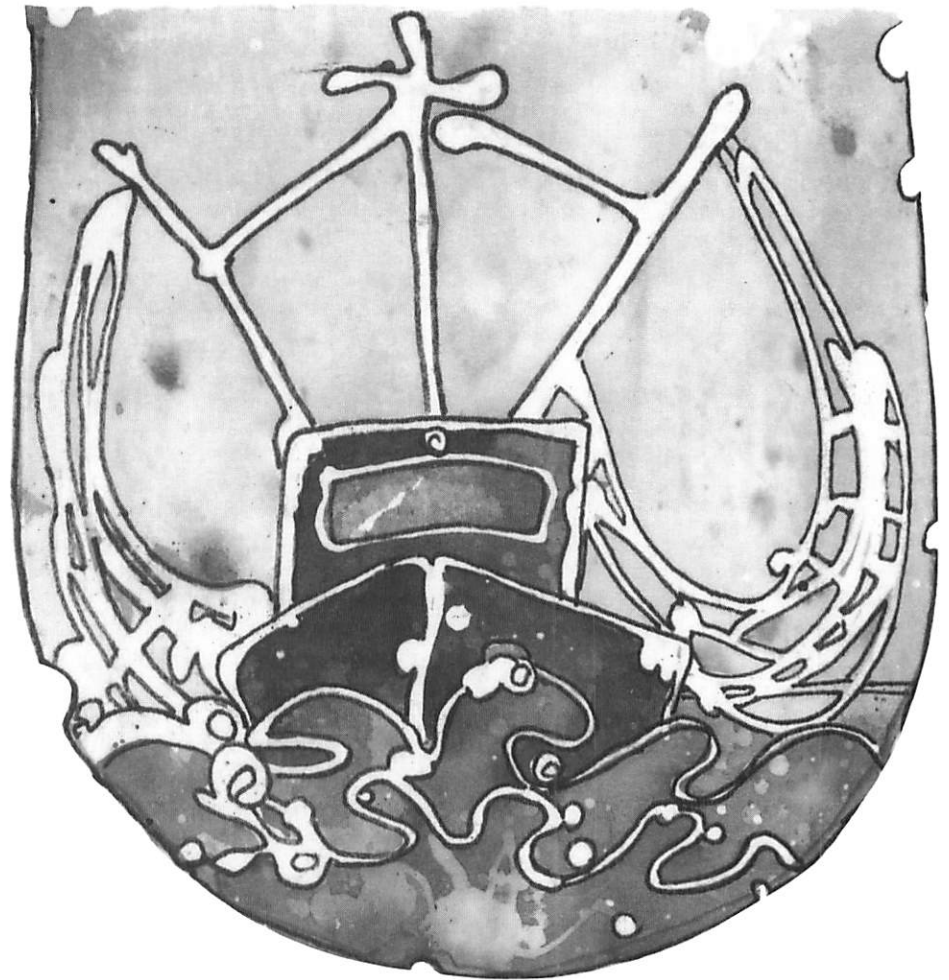
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## **Credits**

### **Writing and Editing**

Linda Skupien

### **Photographs**

Linda Skupien: Pages 9, 10, 11, 12, 13, 14, 15, 16,  
17, 20 (top right, bottom), 21, 22, 26

Ingalls Shipbuilding: Page 18

Mississippi Power Company: Page 19 (right)

C. Steven Sikes: Page 19 (left)

University of Alabama: Page 20 (top left)

Virginia Institute of Marine Sciences: Page 24

### **Line Art**

Students of Mrs. Della McCaughan, Biloxi High  
School: Pages 23, 27

### **Design**

Marie Rogers

### **Typesetting and Layout**

Abbey Commercial Printers

### **Printing**

Reinbold Lithographing and Printing Company



**For more information contact**

Mississippi-Alabama Sea Grant Consortium  
703 East Beach Boulevard  
P.O. Box 7000  
Ocean Springs, MS 39564-7000

Administration--(601) 875-9341  
James I. Jones, Director  
Stanley Hecker, Associate Director for Programs  
Dianne Jones, Assistant Director for Administration  
Sharon Walker, Educator-Communicator  
Nancy Marcellus, Administrative Assistant  
Linda Skupien, Editor

**Sea Grant Advisory Service Offices:**


**In Mississippi**

4646 West Beach Boulevard  
Suite 1-E, Bailey Gateway Plaza  
Biloxi, Mississippi 39531  
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**In Alabama**

3940 Government Boulevard, Suite 5  
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