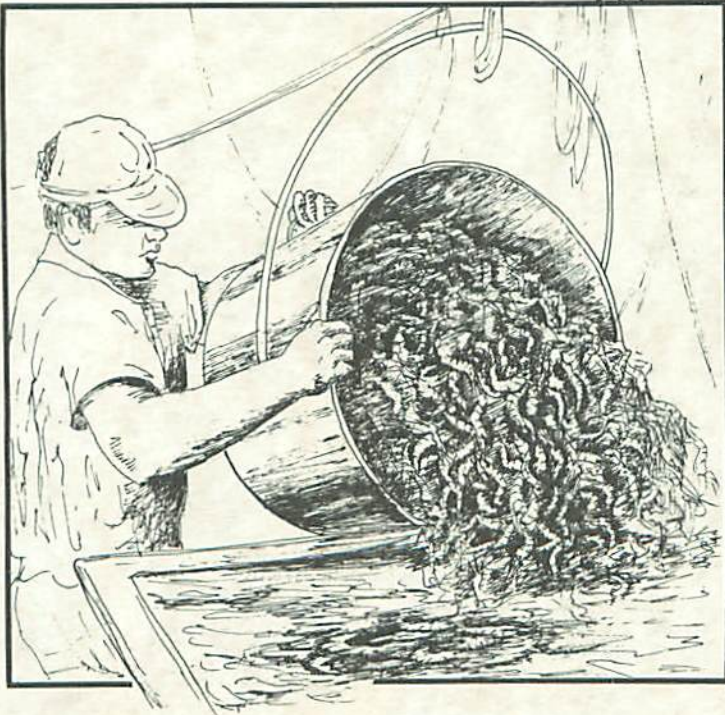
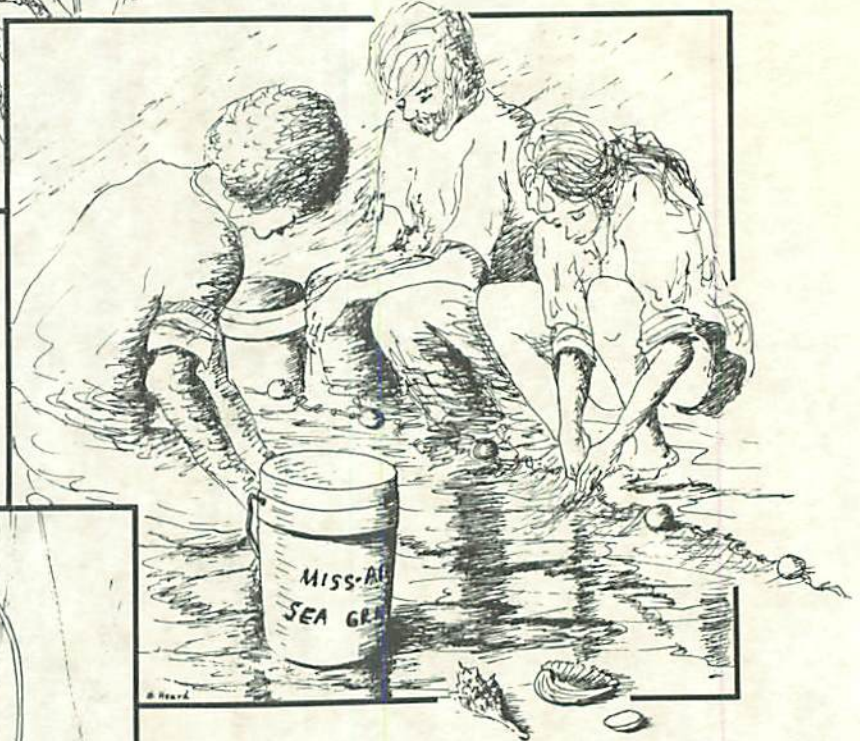


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1979 Annual Report

# Mississippi-Alabama Sea Grant Consortium

January 1, 1979 to June 30, 1980

MASGP-80-019

## **Member Institutions**

*Mississippi-Alabama Sea Grant Consortium is an organization of Mississippi and Alabama institutions of higher learning which participate in the two-state Sea Grant Institutional Program for marine research, education and advisory services.*

*With a common heritage influenced by the Gulf of Mexico, the two states share a Sea Grant program focused on identification and investigation of local, regional and national needs involving the coastal and marine environments.*

*Growing education and advisory programs assist in applying these research results and in promoting an understanding of the nature and value of Mississippi and Alabama's unique estuarine and gulf resources.*

**Auburn University**  
*Auburn, Alabama*

**Gulf Coast Research Laboratory**  
*Ocean Springs, Mississippi*

**Jackson State University**  
*Jackson, Mississippi*

**Mississippi State University**  
*Starkville, Mississippi*

**Tuskegee Institute**  
*Tuskegee, Alabama*

**University of Alabama**  
*Tuscaloosa, Alabama*

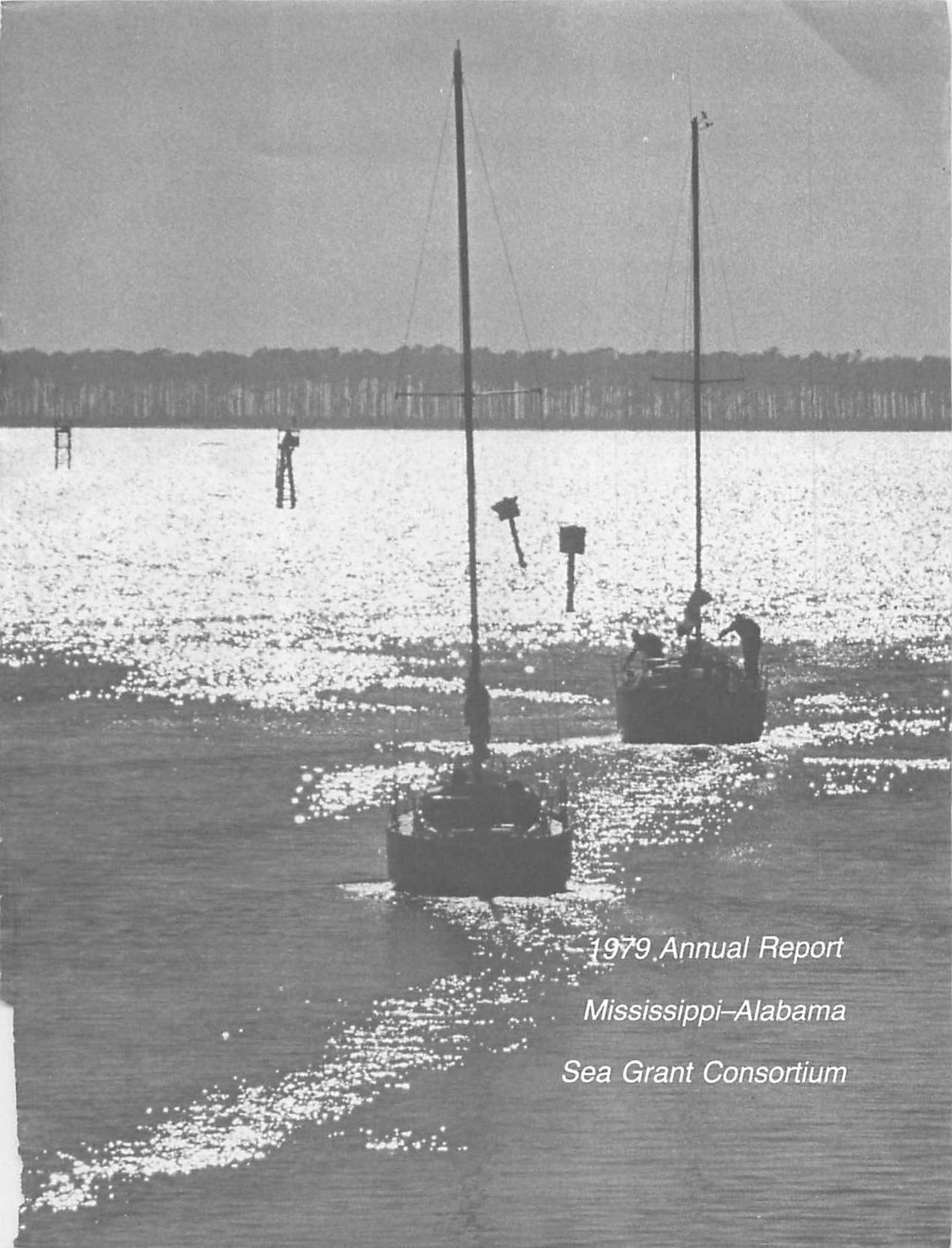
**University of Alabama in Birmingham**  
*Birmingham, Alabama*

**University of Mississippi**  
*Oxford, Mississippi*

**University of South Alabama**  
*Mobile, Alabama*

**University of Southern Mississippi**  
*Hattiesburg, Mississippi*





*1979 Annual Report*  
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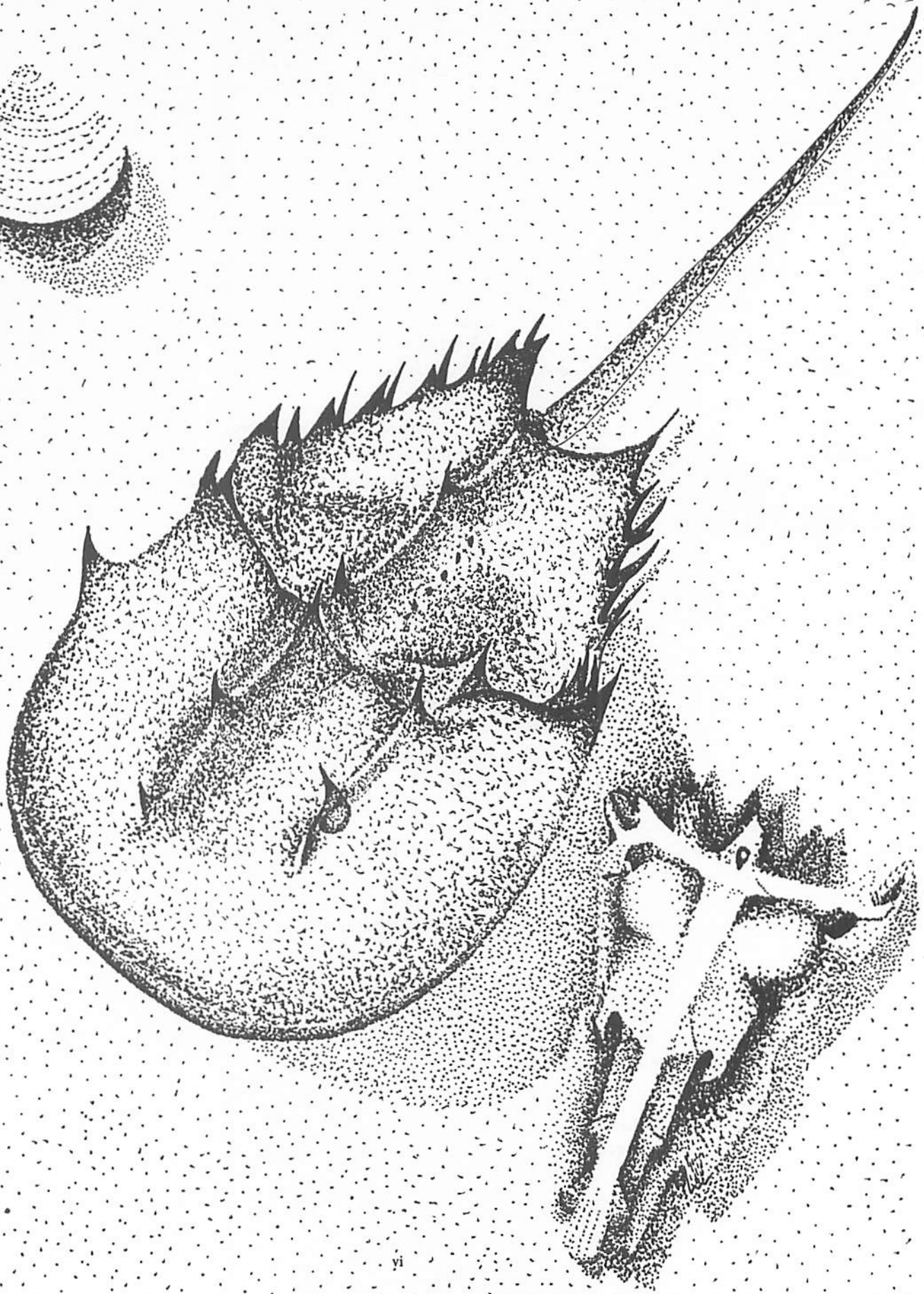
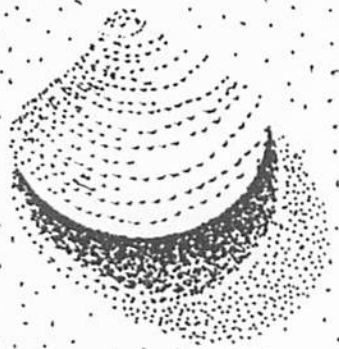


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# Director's Preface

The end of the 1979 fiscal year in July of 1980 marks the completion of the first two full years of the current Directorship of the Mississippi-Alabama Sea Grant Consortium.

During this period sufficient time has elapsed to provide initial assessment of newly developed programs and ongoing projects under the new leadership and to measure progress toward specific goals in program evaluation, development, implementation and effectiveness. This report, therefore, will primarily stress accomplishments of new programs as they relate to this revised developmental initiative.

The program as now developed emphasizes the identification and utilization of available resource entities for the benefit of the populace of the Mississippi-Alabama coastal region, for the benefit of the populations of these states as a whole and, finally, for contributions to programs within the national interest.

Each program element contains portions of what we term the "trinity" of Sea Grant: research, education and application of knowledge for public needs and use. Primary emphasis is upon the acquisition of new knowledge which may be used for mankind's benefit, either from an economic standpoint or as a mechanism to provide higher standards of living and education.

The process leading to this goal is one which normally encompasses *research* to provide the necessary new discoveries or public applications. Secondly, the *education* of individuals provides clearer and more comprehensive understanding for more effective and efficient utilization of coastal resources. Finally, the *Sea Grant Advisory Service's* wide spectrum of

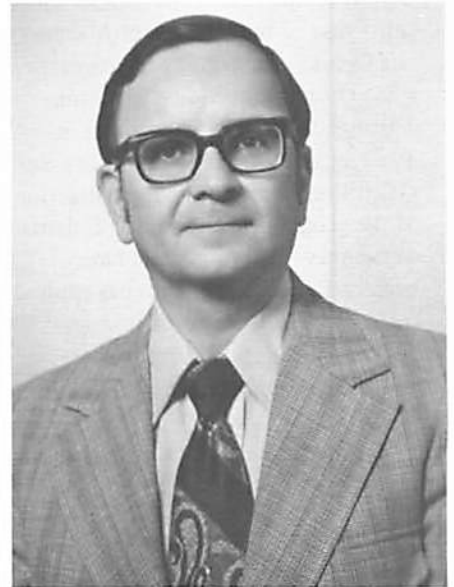
out-reach programs and service to the general public brings research and other knowledge to those to whom it can provide the greatest benefit.

This tripartite approach to problem identification, evaluation, study, solution and dissemination is unique to the marine and coastal community through Sea Grant and works effectively to the maximum benefit of those persons who most need the varied Sea Grant products, whether they be research application, education, or both.

The mechanism used to determine which particular problems and anticipated solutions are most worthy of investigation has proven its effectiveness many times over during the last few years. The research component requires firm direction to function at optimum efficiency for the public benefit. Therefore, an elaborate mechanism has been established to provide the essential "grass roots" input into research prioritization evaluation.

Finally, the research results must be transmitted in a form easily obtained, understood and used by the target population or the whole system has failed. Thus, the primary purpose of the Sea Grant Advisory Service is to take the research results, put them in a form readily understood by and applicable to those persons with the "need to know," and then disseminate this information broadly so that all persons who can benefit from use of the information have been well informed.

This is the Sea Grant concept from start to finish. Overlying all elements is the absolute requirement for a firm and reasonable management structure. This final role, accomplished by the Director and his staff, ensures



James I. Jones, Director



that no single element suffers from undue emphasis placed upon any of the other elements and guarantees that the research, education and information dissemination activities function at the highest possible degree of efficiency and economy.

In conclusion, it is appropriate to note that this year, 1981, marks the third year of the Mississippi-Alabama Sea Grant Consortium's tenure as a Sea Grant Institutional Program. Through this tenure it becomes, in 1982, eligible for designation as a Sea Grant College. With the new direction of the program, the accomplishments of the preceding four years have been such that the Director has applied for, and is confident of receiving, Sea Grant College status for the Mississippi-Alabama Program in 1982 or 1983.

The maturation of this program has

at times been difficult, but the Administrative Council of the Consortium and the college boards of the States have worked closely and cooperatively with the Director to bring the program to its present milestone. In this light, the accomplishments of the program must be viewed as a shared endeavor, an endeavor in which the Director is personally and exceptionally proud to have played a role.

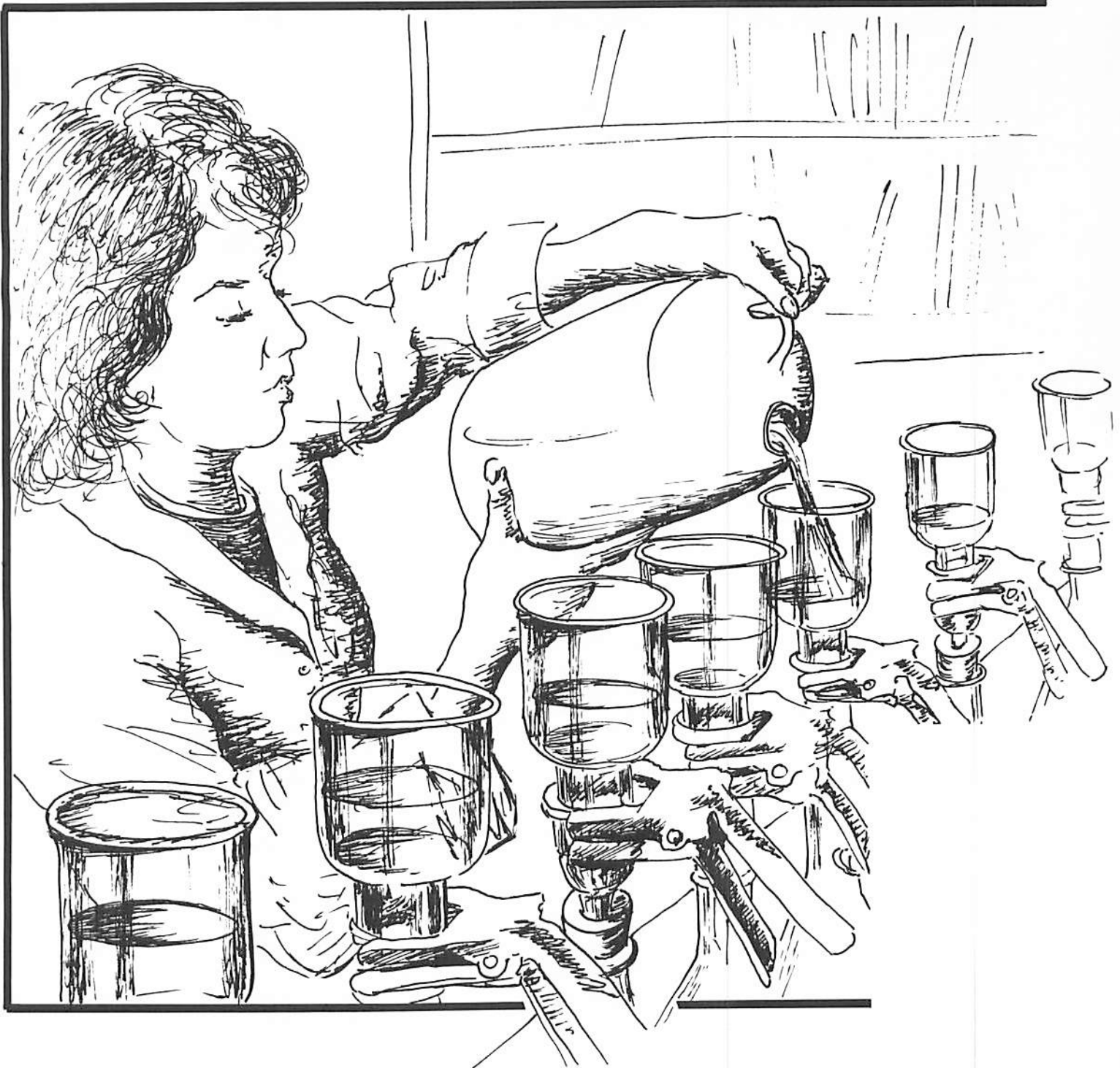
He feels, justifiably, that the future of the Mississippi-Alabama Sea Grant program may be viewed with optimism in that its further development in the identification, evaluation and development of marine and coastal resources for the benefit of the public will continue to be accomplished at a high degree of research and educational capability and at a high rate of management effectiveness.

Yours sincerely,

A handwritten signature in black ink that reads "James I. Jones". The signature is written in a cursive style with a large, stylized "J" at the beginning and a long, sweeping underline.

James I. Jones, Director

# Research





# Living Resources

## The Relative Impact of Netting and Sport Fishing on Economically Important Estuarine Species

Wendell J. Lorio, Opal Dakin and Wade S. Stevens  
Mississippi State University

**SUMMARY:** *The overall objective of this study was to determine the relative impact of commercial netting and sport fishing on spotted seatrout, red drum, and Spanish mackerel. The catch was estimated by a creel census-roving clerk technique. The statistical analysis performed on the data was conducted at the Institute of Statistics, North Carolina State University.*

An intense controversy exists along the coasts of Mississippi and Louisiana over the catching of sport fish by commercial fishermen using 1,000 and 2,000 feet of nylon and monofilament gill and trammel nets.

This issue is probably one of the most critical problems facing resource managers of the northern Gulf of Mexico. The controversy in Mississippi revolves around three principal species of fish: spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellata*) and Spanish mackerel (*Scomberomorus maculatus*).

The sport fishermen contend that nets now in use, especially the monofilament gill nets, are depleting sport fish populations. Neither side of this emotionally charged issue has had necessary facts to support its opinions.

The equitable allocation of the finfish resource is dependent upon knowledge of fishing pressure and harvest by the two groups involved, information that was nonexistent prior

to this study. Through this three-year study, that information was gathered by a statistically designed creel survey conducted at the Mississippi barrier islands (Figure 1). To support data gathered by interviews with sport and commercial fishermen in the field, aerial counts were made of all boats around Horn Island, Ship Island and Cat Island. These flights were coordinated with the roving clerk schedule in order to estimate total fishing pressure and fishing success in the study areas.

The aerial counts proved to be the more reliable indicator of fishing pressure. Interview data, for example, indicated fishing pressure dropped significantly in 1979. Aerial counts indicated a slight increase over 1978. The difference reflected the loss of survey days due to rough seas and outboard motor breakdowns. Flight days were seldom lost due to weather.

The three islands studied represented three slightly different habitats with

salinities and turbidities generally increasing from west to east. Waters around Horn Island were more marine. Cat Island waters were more brackish. Spotted seatrout were more numerous at Cat Island; Spanish mackerel and large spotted seatrout at Horn Island; and red drum at Ship Island.

Fishing effort at the three barrier islands was almost equally divided. Most fishermen fished the island nearest their homes. The heavier fishing pressure that occurred on weekends appeared to disrupt fish schools, reducing the harvest. Weekday fishing activity was less, but harvests were greater. Most fishermen interviewed were residents of Mississippi.

Commercial activities dropped drastically during this study when the study area was closed to commercial gill netting May 15–September 15 in 1978 and 1979. The catch from 1977, the latest year that the area was open to commercial fishing in the peak season, was 582,040 pounds of fish. The sport catch was estimated at 142,696 pounds.

Fifty-eight percent of the commercial catch was tabulated as "other species" and consisted primarily of mullet (*Mugil cephalus*). Red drum, Spanish mackerel, and spotted seatrout comprised 21 percent, 15 percent, and



1 percent, respectively, of the remaining 42 percent.

Before this project began, reports suggested fishing was extremely poor in the study area. The fish contributing to the fishery would have belonged to year classes 1973 and 1974, two years characterized by heavy flooding along the northern Gulf of Mexico. Flooding reduced reproductive success and survival, almost eliminating the 1973 and 1974 year classes of numerous important species such as spotted seatrout.

Larger numbers and smaller sizes of fish harvested in 1978 and 1979 indicated that reproductive success increased during 1976 and 1977. Fishing improved because young fish were entering the fishery. Unfortunately, the improvement occurred during the

same time that netting restrictions were levied against commercial fishing. The results of this study support the conclusion that the improvement should be attributed to environmental conditions rather than netting restrictions.

Another facet of this study was experimental netting conducted at Cat Island. Three 600-foot monofilament gill nets were used, one each of 1 1/2-inch, 1 7/8-inch, and 2 1/2-inch bar mesh size. The nets were set out in a closed circle with fish retained inside. Nets were also set out perpendicular to the shoreline. Resulting data suggest that the smallest mesh size would impact the spotted seatrout population because of the numbers caught. A 2-inch or 2 1/4-inch mesh size allows most smaller fish to go through and harvests spotted seatrout

of 16 inches average size.

Recommendations based on combined data are that commercial fishermen should be allowed to fish the barrier islands from sunrise on Monday through noon on Thursday with one 600-foot gill net of a 2-inch or greater bar mesh size. Such a regulation would reduce sport-commercial conflict and allow both factions to use the resource.

Efforts to maintain viable populations of finfish for as long as habitat quality is maintained should include continued monitoring of sport and commercial fishing pressure by interview and aerial counts along the Mississippi barrier islands. Mississippi has no saltwater fishing license. Legislation to create such a license could provide funds to continue management-oriented research.

## Publications

Lorio, Wendell J., T. Heaton and O. Dakin. 1981. The Relative Impact of Netting and Sport Fishing on Economically Important Estuarine Species. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-025.

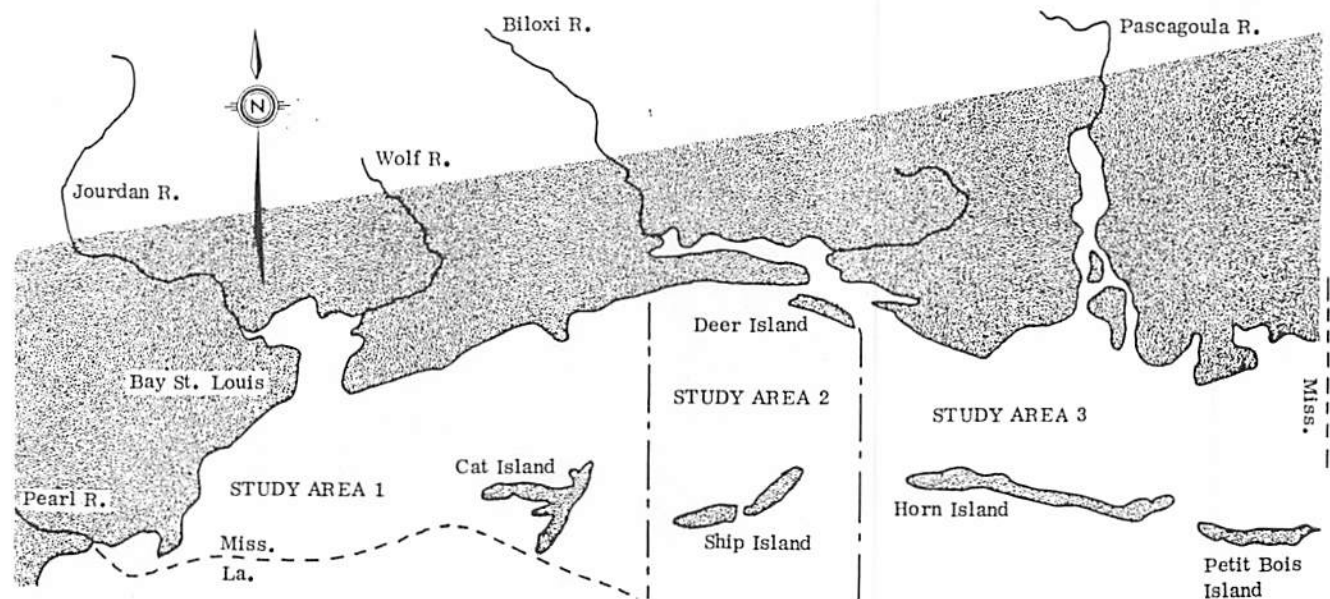


Figure 1. This map of Mississippi Sound shows the study area used to determine the effectiveness of commercial gill netting on sport and commercial estuarine fish species.

# The Role of Mississippi Sound in Recruitment to Sport and Commercial Fish Stocks

Sally L. Richardson  
Gulf Coast Research Laboratory

**SUMMARY:** *In the first year of this three-year evaluation of the Mississippi Sound as a spawning and larval fish nursery, the principal investigator completed a survey of related literature and current research, continued building a reference file of identified larval fish of the northern Gulf of Mexico, and designed and implemented a large-scale sampling program.*

The Mississippi Sound is unique among Gulf of Mexico estuaries in its expanse, shallowness, barrier island protection and location at the mouth of several major drainage systems within what is commonly called the Gulf's "Fertile Fisheries Crescent." Increased population pressures, oil exploration, shipping and dredging also make it one of the most threatened estuarine areas in the Gulf.

Data are not yet available, however, to define the relationships involved or how alteration of the coastal system might affect species dependent on the estuarine environment for survival. Mississippi Sound is considered important to fisheries resources, but little is known of its circulation patterns, fish reproduction and recruitment. This study is designed to fill that need with a broad scale examination of the distribution, abundance and transport of early pelagic stages of fish in the Sound.

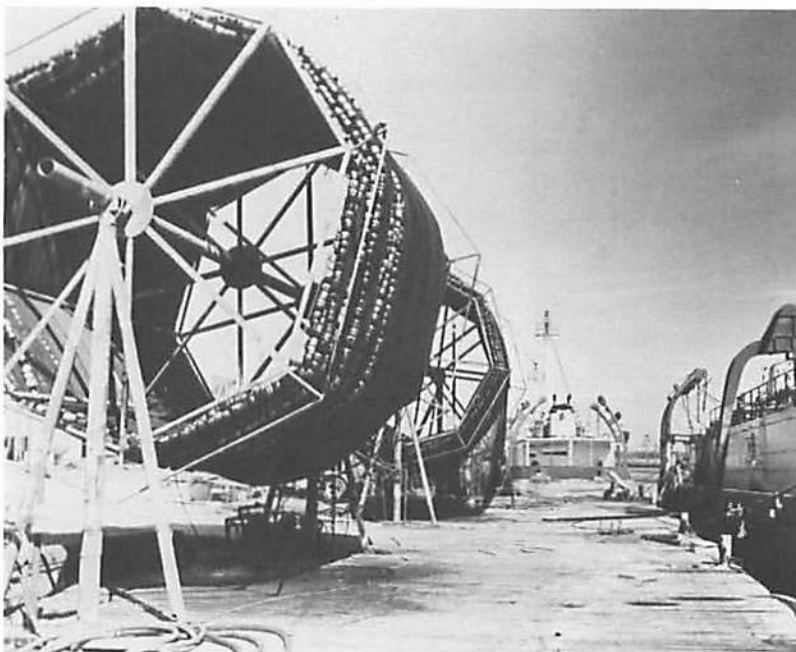
During this initial year, a sampling scheme was developed to accommodate the shallow depths of the estuarine Sound. Monthly sampling began in November 1979 at 22 stations located throughout the Sound between Lake Borgne and Mobile Bay. In conjunction with plankton tows at each station, temperature, salinity and dissolved oxygen are monitored at the surface and bottom of the water column.

Sorting of samples taken in November, a month of low larval fish abundance, provided a preview of the kinds

of data to be expected from a year's sampling. The 44 samples yielded 299 fish larvae, 177 from surface tows and 122 from bottom tows. Tentative identification of the larvae showed the most abundant were sciaenids. Of the 145 sciaenids, 136 were croaker. The second largest group was the clupeids, and 20 were identified as menhaden with a strong probability that the remainder are also menhaden. Engraulids were third in abundance.

The largest catches were at the three stations offshore of the barrier islands, and were primarily young croaker resulting from recent offshore spawning. A moderate catch of slightly larger croaker larvae was made at one station inside the Sound, indicating they had been spawned earlier.

The assembly of a reference file of identified larval fish from the northern Gulf of Mexico was also begun in 1979. An essential element in analyzing data obtained in the sampling program, the file includes 126 species in 40 families to date. Work on the file included compiling a list of approximately 800 species in 130 families occurring in the northern Gulf of Mexico. Meristics, such as counts of fin rays,



**Menhaden nets** — *The Mississippi Sound menhaden fishery supports fish meal and oil industries. Menhaden larvae have shown up in abundance in Richardson's sampling for a study of the Sound as a larval fish nursery.*

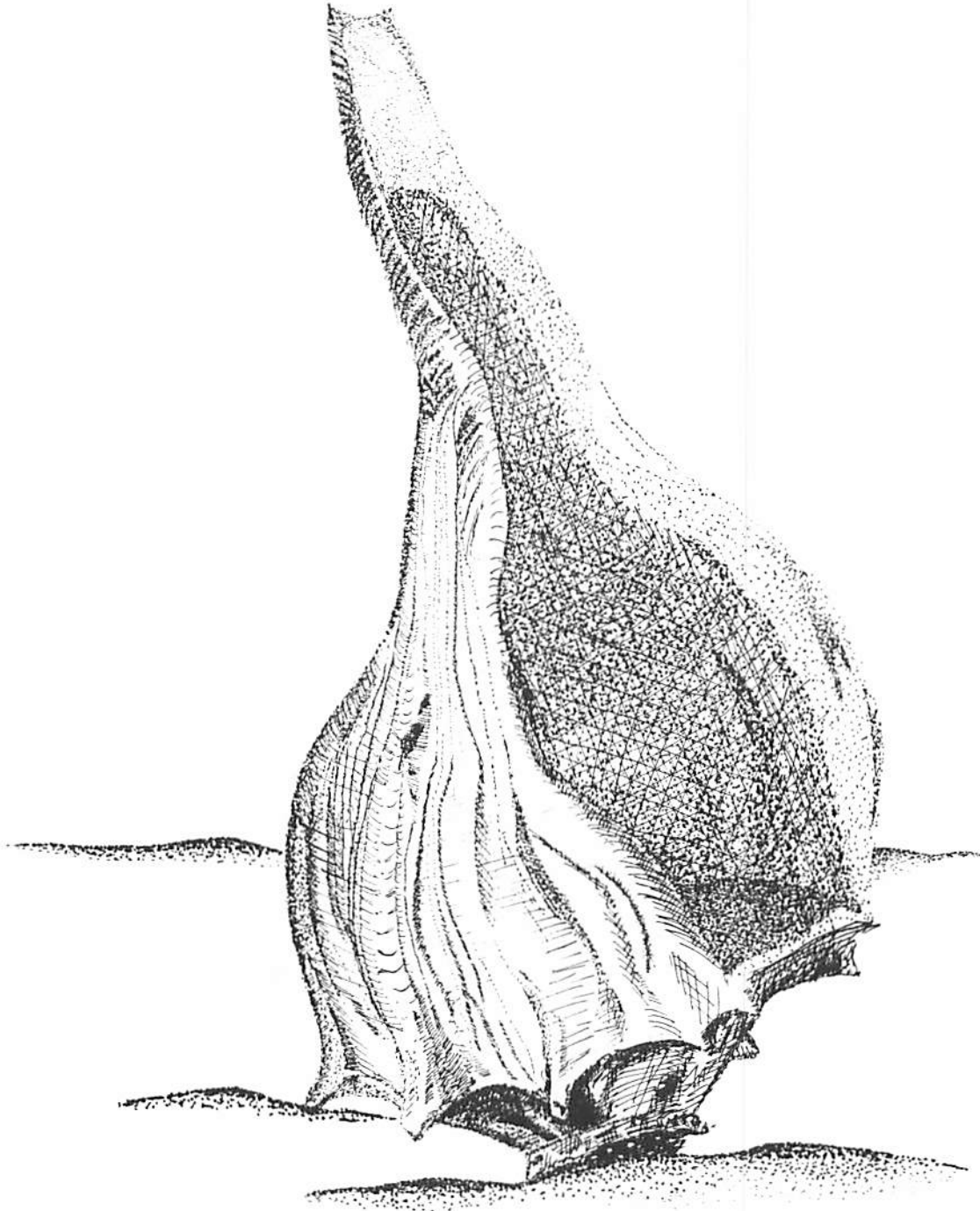
vertebrae and gill rakers, have been tabulated for 480 species. Larval fish specimens were obtained through visits to Texas A&M University, the University of West Florida, National Marine Fisheries Service (NMFS) Panama City Laboratory, NMFS Miami Laboratory and Gulf Coast Research

Laboratory.

A survey of information on past and on-going research involving ichthyoplankton in Mississippi Sound and adjacent areas was compiled and summarized. Several current research efforts will assist in the Mississippi Sound evaluation by providing useful

comparative data on larval fishes in freshwater reaches of rivers, in the surf zone of barrier islands and in Mobile Bay.

In the second year of this study the sampling program will be completed and work continued on sorting and identifying larvae.



*Student art — Vietnamese marine education student Tuan Vu produced this pen and ink drawing as part of a Sea Grant educational program. Another drawing by Vu appears on page vi.*



# Optimum Time Interval in the Application of Controlled Burning and Harvesting as Tools in the Management of Marshes

Armando A. de la Cruz and Courtney T. Hackney  
Mississippi State University

**SUMMARY:** *This study examined the effects of winter fire and harvest on the productivity and structure of vegetation in Mississippi marshes over a three-year period. Data show that annual harvesting or burning is not harmful to *Spartina cynosuroides* marshes. Marshes dominated by *Juncus roemerianus*, however, require three to four years between fire or harvest.*

Federal, state and local agencies are beginning to question how best to manage coastal marshlands without decreasing the marshes' productivity or damaging their ecological value to man and to wildlife.

In this project, investigators studied the effects that winter fire and harvest as management tools have on the net primary productivity and vegetational structures of *S. cynosuroides* and *J. roemerianus* marsh communities. Fire and harvesting have been man's primary methods for altering marshes in the past. Winter fires are still used to promote habitats for waterfowl and pelt mammals in low marshes and to clear high marsh areas for agricultural use. Harvest of "marsh hay" for forage or compost was also once a common practice along coastal wetlands.

Although there is no harvest of marsh plants of significant economic impact in the United States today, the potential for harvesting marshlands on a regular basis exists if extraction of chemical derivatives, cellulose, pulp and other marsh plant by-products

ever proved profitable.

For this project, burn, harvest and control plots were laid out in a study area established on a bar-built island on the western side of St. Louis Bay in Hancock County, Mississippi. Data were collected for 1977, 1978 and 1979.

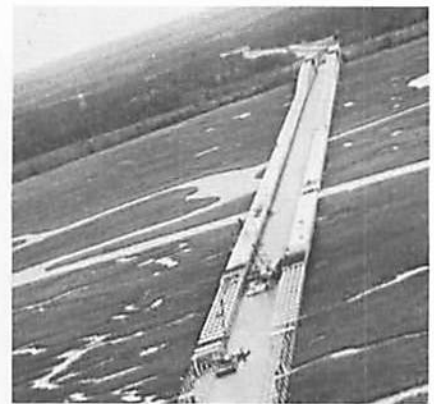
The two types of marsh communities responded differently to treatments. *Juncus roemerianus*, which retains living aboveground tissue during winter, increased primary productivity by 21 to 48 percent during the growing season following harvest and fire. The general vigor of the plants decreased, however, and required more than three years to return to pretreatment condition.

Aboveground tissue dies back in the winter in *S. cynosuroides*. Removal of the dead material enhanced growth of the plants. Net primary productivity of burned and harvested plots increased by 12 to 24 percent over the control and maintained a higher productivity value after two or three successive annual winter fires.

Continued removal of the aboveground tissues increased the distribu-

tion of minor species in the *Juncus* marsh but had little effect on the *Spartina* marsh. Early flowering and a greater number of culms with inflorescences also occurred in burned and harvested plots. Examination of the treated areas in 1980 confirmed that increased flowering occurred only during the first year of treatment. All areas resembled the control area after that first year.

Evidence from this study indicates that the use of fire and harvest in the management of *J. roemerianus* marshes should be limited to once every three or four years. Annual fire and harvest can be used on *S. cynosuroides* marshes without harming the plant community.



**Man and marsh** — Interstate 10 pushed across east Mississippi coastal marshes in 1979.

## Publications

de la Cruz, Armando and Courtney T. Hackney. 1980. The Effects of Winter Fire and Harvest on the Vegetational Structure and Primary Productivity of Two Tidal Marsh Communities in Mississippi. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-80-013.

# Histopathological Studies on Gulf Coast Oysters

William E. Hawkins  
University of South Alabama

**SUMMARY:** *Histopathological examination of oysters taken from various sites in Mississippi Sound during 1979 indicates a potential disease condition occurring in oysters from waters near Point Cadet in Biloxi Bay. Tentatively diagnosed as leucocytosis, this condition is characterized by increased numbers of white blood cells in and around blood vessels and connective tissues.*

The study of lesions in the tissues of Gulf Coast oysters has evolved from a survey of oysters for inclusion bodies known to harbor microorganisms pathogenic to higher organisms, including man.

Oysters examined in this study were collected from reefs in Mississippi Sound and selected sites in Florida and Louisiana. All the areas were closed to commercial harvesting except a Dauphin Island, Alabama, reef.

Light and electron microscopical examination revealed no inclusion bodies in the oysters' digestive glands, but histopathological lesions were evident. The lesions appear to be cellular responses to poor water quality. Involving principally leucocytes, or white blood cells, the abnormalities range from simple inflammation to a type of neoplasm or cancer.

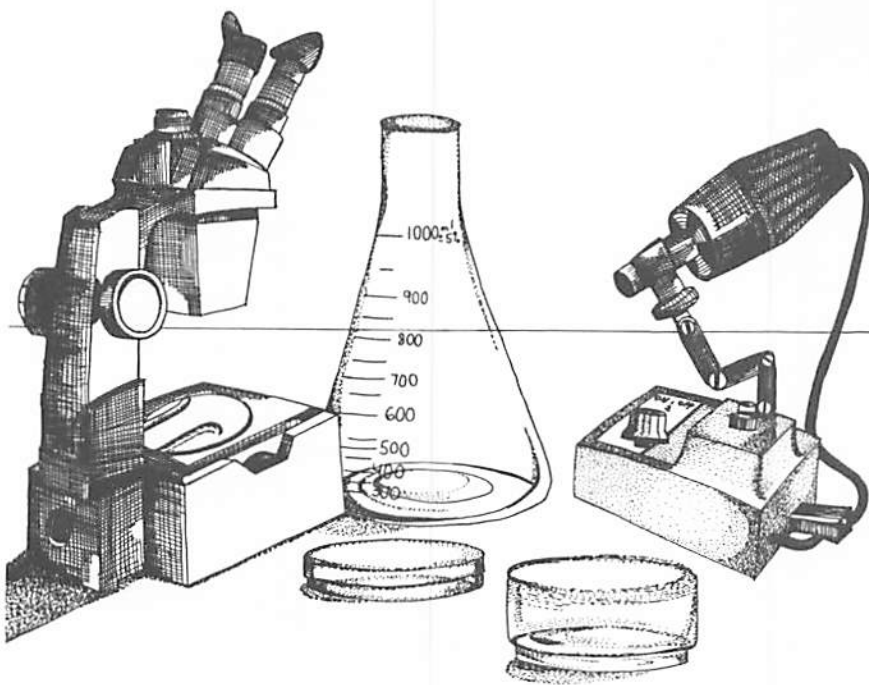
Efforts continue toward classification of the lesions in oysters collected to date. A large percentage of oysters taken from Mississippi Sound off Point Cadet in Biloxi, Mississippi, have the condition tentatively diagnosed as leucocytosis. In these oysters the numbers of leucocytes were greater than normal in and around blood vessels. Numerous leucocytes had also infiltrated the connective tissue of the mantle.

The cause of leucocytosis has not

been determined. In some cases it may be a reaction to parasitism. One Point Cadet oyster examined had extensive leucocytosis coincident with a heavy trematode infection. A non-specific reaction to waterborne chemicals, a spontaneous increase in leuco-

cyte production preceding a cancerous condition, or a combination of such factors could cause the disease.

Future research will focus on the possible relationship of leucocytic abnormalities to parasitic infection and to developmental processes. Studies are also planned to determine whether mature, healthy oysters will develop similar lesions when relocated to one of the closed reefs and whether, conversely, oysters with lesions can recover when moved to the cleaner water of open reefs.



*Art and science – This drawing by secondary marine education student Steve Britt reflects an interdisciplinary strategy for involving minority, handicapped and disadvantaged students in marine education (see page 24).*

## Publications

Hawkins, William E., Harold D. Howse, and Carolyn A. Foster. 1980. Prismatic Cristae and Paracrystalline Inclusions in Mitochondria of Myocardial Cells of the Oyster *Crassostrea virginica* Gmelin. *Cell and Tissue Research*. 209:87-94. MASGP-79-021.



# Coastal Policy Studies

## The Status and Relation of the Coastal Zone to Alabama's Economy

William E. Hardy, Jr. and Robert Nelson  
Auburn University

**SUMMARY:** *The final year of this three-year study encompassed analysis of the economy's interaction with environmental factors in Alabama's coastal counties. Data on the production of air, water and land pollution and on the use of natural resources were analyzed and organized into an economic-environmental model. The model should provide regional planners with a tool for assessing the effects of alternative growth strategies on both the economy and the environment of the Alabama coastal region.*

The coastal areas of Alabama offer a bounty of natural resources that beckon industrial, commercial and residential development. At the same time, individuals, groups and agencies seek to preserve the unique characteristics of an environment where land meets sea. The satisfactory coexistence of both economic and environmental interests requires an understanding of man's economic activity and its ecological effects.

Through this study an input-output model has been developed that will further such understanding for the Alabama coastal zone, an area located in Baldwin and Mobile counties. The model will enable regional planners to define the relationships between specific economic development and changes in the environment.

With this model, comparative costs and benefits of proposed enterprises can be calculated along with projections

of the total effects on income and employment throughout the economy's producing sectors. Extension of the model to include environmental factors allows assessment of the depletion of natural resources and the production of air, water and land pollution by proposed developments.

Construction of the economic model

involved assembling data on output of goods and services and on employment in each of thirty producing sectors in the coastal economy. Data were integrated into an input-output matrix with one row for each sector's sales and one column representing its purchases. To extend the model's analytical capabilities to environmental quality, data were compiled on pollutants and resource use for each sector. All data are for 1972 with the percentages and relationships generally accepted to apply for a 5- to 10-year range depending on changes in technology and economic diversification in the area.

Data on 76 environmental factors

**Table 1. This comparison of a pet food plant and a resort complex shows the effects of construction and one year's operation on the coastal zone economy and environment. Figures for income, resource use and pollution represent the direct effects combined with indirect effects from operation of sectors which provide supporting goods and services.**

Comparison Factor	Pet Food Plant	Resort Complex
Total cost	\$4,655,593.00	\$7,007,684.00
\$1.00 income per \$1.00 cost	1.28	1.07
Employment per \$mil cost	153.79	99.46
Tons BOD-5 per \$mil cost	5.57	1.89
Tons particulates per \$mil cost	15.76	12.93
Tons solid waste per \$mil cost	606.71	464.50
MGal process water per \$mil cost	32.57	14.30
Thousand KWH electricity per \$mil cost	53,365.03	40,713.33
Acres land per \$mil cost	2,814.35	1,753.14
Technicians required per \$mil cost	2.25	1.98



were tabulated under three broad groups for pollutants (water quality, air quality and solid wastes) and four categories of resource use (water use, land use, fuel use and occupations). Pollutant and resource use information was then organized into a formalized collection of variables that can be used to calculate the impact which changes in output would have on the production of pollution and the consumption of resources.

An example of the model's use is the comparison of two proposed developments—a pet food plant and a resort complex. Generated through use of the model, figures in Table 1 show that the pet food plant gives higher economic returns in terms of income and employment. At the same time it produces higher waste loads and resource uses in all seven environmental categories.

Environmental and economic

analysis together provide estimates of trade-offs between environmental quality and economic growth that would not be apparent through economic analysis alone. The model's capability to provide this balanced assessment of economic and environmental changes makes it an effective tool for regional planners facing decisions on the future growth patterns of Alabama's coastal zone.

## Publications

- Nelson, Robert G. and William E. Hardy. 1980. *The Economic and Environmental Structure of Alabama's Coastal Region—Part I: Economic Structure*. Auburn University, Auburn, Alabama. MASGP-79-016.
- Nelson, Robert G., William E. Hardy and John B. Flynn. 1980. *The Economic and Environmental Structure of Alabama's Coastal Region—Part II: Environmental Structure*. Auburn University, Auburn, Alabama. MASGP-79-017.

# Mississippi-Alabama Combined Coastal Zone Study

Edward Nissan and D. C. Williams, Jr., University of Southern Mississippi  
William E. Hardy, Jr. and Robert Nelson, Auburn University

An outgrowth of the separate Alabama and Mississippi environmental-economic studies is an economic-ecologic model for the two-state coastal region. Development of a method for assessing environmental consequences of economic growth for the five counties—Mobile and Baldwin in Alabama; and Jackson, Harrison and Hancock in Mississippi—is especially important since the two states share as a common resource the northeastern Gulf of Mexico.

Coordination of research efforts to produce such a tool for evaluating economic growth and related pollution was a primary goal for both the Mississippi and Alabama study groups. The theoretical and computational developments were undertaken jointly by researchers at the Bureau of Business Research at the University of Southern Mississippi and the Department of

Agricultural Economics and Rural Sociology at Auburn University.

Collaboration on methodology for the separate state studies ensured an accurate combination. The three developmental stages used in the Mississippi and Alabama studies were followed for the combined report. Modifications to the final economic-ecologic model made possible the application to a small region where standardized data were not always available.

For regional planners and other decision-makers, the development of the two-state model makes information available for evaluating economic alternatives on a broader scope. Decisions on what degree of environmental degradation is acceptable in view of economic growth can be considered from a sound analysis of both economic and environmental factors.



*Resources — Mississippi and Alabama share common marine and coastal resources and similar problems with management of those resources.*

## Publication

- Nissan, Edward, D. C. Williams, Jr., William E. Hardy, and Robert Nelson. 1981. *Economic-Ecologic Model for Mississippi-Alabama Coastal Counties*. University of Southern Mississippi, Hattiesburg, Mississippi. MASGP-79-029.

# Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi

Edward Nissan and D. C. Williams, Jr.  
University of Southern Mississippi

**SUMMARY:** *Through this study a procedure for quantifying the effects of economic activity on the Mississippi coastal region's environment has been developed. This economic-ecologic model is the culmination of a three-year effort to assemble, analyze, and organize data on sales, purchases and production of wastes by the coastal economy's economic sections. Information generated through this study should give decision-makers a method to estimate pollution and economic growth that will accompany proposed industrial, commercial, and residential development.*

The evidence that intense economic activity is linked to degradation of the environment has resulted in legislation regulating treatment and discharge of industrial, commercial and residential wastes. For the benefit of both the economy and the environmental quality, knowledge of economic/ecological consequences is essential in application of existing regulations and in influencing the direction of economic growth.

This three-year study was designed primarily to examine the production of pollutants by economic activities in the Mississippi coastal region of Jackson, Harrison, and Hancock counties. Work on linking the specific industrial and commercial producing sectors with the resulting pollution proceeded in three phases. In Phase I, data on purchases by and from each of 30 sectors of the coastal economy were assembled and organized into an input-output model. In the second phase, data on air, water, and solid pollutants were compiled for each of the 29 producing sectors and for the nonproducing sector "Households."

Phase III, completed in this final year, quantifies factors involved in the interaction of the economy and the environment. Specific pollutants for each of the 30 sectors are tabulated and computed for \$1,000 in sales. Environmental impact is examined as direct,

indirect, and induced effects. Direct effects result from pollution discharged by a sector through its own particular production process. Indirect effects reflect pollution produced by inter-industry sales and services necessary to support a sector's operations. Induced

effects take into account the Households sector's contribution to pollution.

Use of the economic-ecologic model establishes a foundation for assessing the effect on the environment of such proposals as expansion of the region's exports, new industries, and establishing self-sufficiency in related industries. Table 1, for example, indicates the induced effects caused by the move to self-sufficiency in the Food Processing, Lumber and Wood, Chemical/Petroleum, and Primary/Fabricated Metals sectors. All imports of the products from those industries would be replaced by local production, totals of \$40,408,000, \$4,572,000,

**Table 1. Induced environmental impact of increased output for self-sufficiency—Type II selected sectors, Mississippi coastal region (waste water in million gallons per year [MGY]; all other factors in tons).**

Environmental Factors	Food Processing	Lumber and Wood	Chemical/Petroleum	Primary/Fabricated Metals
Waste water	4,362.609	141.750	7,634.043	971.350
Chlorine	2.384	0.046	1.075	0.654
Nitrogen	116.335	4.924	97.009	13.510
Sulfides				
Fluoride				
Phosphate				
Heavy metals			6.668	
Zinc				0.428
Cadmium			0.323	0.704
Iron	0.040		0.876	1.384
Chromium			0.323	0.210
Aluminum	0.040			3.522
Copper				0.377
Nickel				0.830
Lead				
Fecal coliform				
BOD	242.246	16.688	200.902	22.667
COD	0.202	0.018	341.468	0.151
Suspended solids	532.779	40.352	0.416	121.085
Settleable solids	189.635	0.219	4.840	1.182
Oil and grease	108.940	4.165	98.300	18.768
Phenols		0.050	0.215	
Organic carbon			27.102	
Nitrogen oxide	0.871	22.567	2,261.971	169.691
Sulfur oxide	1,262.992	104.090	3,547.826	721.230
Carbon monoxide	638.042	85.204	1,916.631	545.878
Particulates	246.974	229.354	372.657	235.076
Aldehydes	6.102	0.521	15.810	4.554
Hydrocarbons	92.575	11.649	355.470	74.870
Solid wastes	31,466.194	1,767.480	22,988.491	24,184.084

\$107,549,000, and \$2,515,800, respectively.

This study draws no conclusions on the desirability of encouraging or discouraging further industrial development on the basis of pollution levels.

Available data fail to define the degree of pollution which the Mississippi coastal environment can tolerate naturally. This research does, however, provide significant assistance to individuals and agencies responsible for

evaluating economic growth alternatives for the region. It has also established a sound data base and effective methods for any future effort to update the model as more complete environmental data become available.

## Publications

Nissan, Edward, and D. C. Williams, Jr. 1979. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi—Part III: Non-technical Summary. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-023.

Williams, D. C., Jr. 1979. Effects of Hurricane Camille on the Economy of Harrison County. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-024.

Williams, D. C., Jr., Ed Nissan, and Trellis Green. 1980. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi—Part III: Final Report. University of Southern Mississippi, Hattiesburg, Mississippi. MASGP-79-014.

*Water — Large volumes of water are necessary for processing seafood. This study of the relationship between the economy and the environment calculates the direct contribution a particular industry such as seafood processing makes to waste water volume. The indirect contribution of supporting industries and households is also included through the mathematical model developed.*





# Seafood Processing

## Viral Evaluation of Prohibited Oyster Growing Waters

R. D. Ellender and B. L. Middlebrooks, University of Southern Mississippi  
David W. Cook and Edwin Cake, Gulf Coast Research Laboratory

**SUMMARY:** Numerous viruses that reproduce in the intestinal tract of man find their way into the estuarine environment in sewage and land runoff. The presence of such viruses in tissues of oysters collected from approved and prohibited Mississippi shellfish growing waters was examined in this two-year study. The resulting conclusions and recommendations address the direction of public health policy and future research.

As the population of the Mississippi Gulf Coast has grown, more effluent from sewage systems has been discharged into estuarine areas. Available clean shellfish growing waters have decreased, and oysters in areas adjacent to habitation are often contaminated. The health hazard they pose has resulted in strict regulation of oyster collection and distribution.

Although the degree of contamination at a given location has been determined since the 1940's by the use of bacterial indicators of fecal pollution, more recent research has shown that the number of fecal coliforms found in shellfish growing waters is rarely consistent with viral pollution of the same waters. Knowledge of such pollution is significant since viruses shed from the gastrointestinal tract of man are culprits in human diseases that range from hepatitis to numerous unpleasant but subclinical intestinal ailments.

This study was focused on viral pollution of oysters collected on the Mississippi Gulf Coast and was designed to isolate, enumerate and identify oysters from both approved and prohibited waters and to relate these findings to bacterial indicators used by the State Board of Health for reef classification.

Study areas examined were Graveline Bayou southwest of Pascagoula, Mississippi, and a reef south of Pass Christian, Mississippi. Graveline Bayou receives quantities of untreated and partially treated sewage and has been closed to oystering since 1975. The Pass Christian reef is an approved site located in an open area of the Mississippi Sound not subject to rapid environmental change.

Bacteriological studies showed that both study areas conformed to their classification. The figures for fecal coliform in water, a key element in reef classification, did not correlate,

however, with the fecal coliform and virus levels found in oyster tissues in 1978 or in 1979. The discrepancy is attributed to physical factors responsible for distribution of microorganisms in the estuarine environment and to the fact that oysters concentrate microorganisms during feeding.

The number of viruses found in approved oysters remained relatively constant over the two-year period. The 17 confirmed virus isolates in 1978 and 10 in 1979 indicate the site is not severely contaminated. In contrast, the number of virus isolations for Graveline Bayou were 2.4 times higher in 1978 than in 1979. Virus isolates processed from Graveline Bayou samples numbered 146 in 1978 and 51 in 1979. It is not presently understood whether this change was a result of physical alterations in the environment or whether less fecal pollution was placed in the oysters' environment in the second year. The fecal coliform data does not indicate that less fecal material entered the system.

The majority of isolates identified for both areas were poliovirus types 1 and 2, evidence in accord with the common health practice of oral polio vaccination. Of the 51 confirmed



isolates from 1979 Graveline Bayou samples, the Echovirus type 24 was identified on three occasions; coxsackievirus types A-9 and B-3 were isolated once; five isolates could not be identified by the immunological methods used; and the remainder were poliovirus types 1 and 2.

Virus isolations were higher from the prohibited sampling site than from the approved site in both 1978 and 1979, a trend attributed to the large volume of sewage which enters Graveline Bayou and to the fact that water in the bayou is not mixed well by tidal flushing.

The wide fluctuations observed in fecal coliform and virus counts during 1979 were expected but not predictable. When data from the 24-month period are examined statistically, they demonstrate the lack of correlation between indicator bacteria and other physical and biological factors, including virus levels. The fecal coliform counts in water samples should reflect a pattern of bacteria and virus isolations in oyster tissue. Investigation did not, however, indicate any positive relationship.

Although isolation of viruses from approved oysters has been reported in the past for other areas, this study has provided the first research isolating viruses from approved oysters from Mississippi waters. The findings of this study add to the body of evidence opening to criticism the use of indicator

bacteria to assess the potential health hazard of any oyster population. Especially critical is the determination of virus content of the approved oyster which is more likely to be collected and distributed for human consumption than the prohibited oyster. If a suitable shellfish viral extraction method with universal appeal were eventually found, it should be used to supplement bacteriological testing of oyster growing waters.

During the second year of this study experiments were also conducted using HAVAB (Hepatitis A virus antibody) radioimmunological procedures to quantitate Hepatitis A antigen in oyster tissue.

Procedure modifications were necessary since the system was designed to detect Hepatitis A antigen in sera rather than in oyster tissue. The procedure developed was able to

detect virus antigen in seeded oyster homogenates with some loss of sensitivity. When the procedure was tested with naturally contaminated oysters, sample extraction procedures designed for enterovirus detection were not found suitable. The antigen is thought to bind to proteins in the homogenate and is not released by pH adjustment.

The results of this study show that viruses commonly found in the gastrointestinal tract of man can be found in the marine environment. Procedures for evaluating naturally occurring viral contamination in oysters have been adapted and refined through this effort. Data on indicator bacteria and enteroviruses clearly indicate the need for a routine measure of viral contamination to supplement sanitary surveys for classification of oyster growing waters.



## Publications

- Ellender, R. D. 1979. Enterovirus Evaluation of Mississippi Oysters. Abstract. *Journal of Mississippi Academy of Sciences*. 24:63.
- Ellender, R. D. and David W. Cook. 1980. Viral Evaluation of Prohibited Oyster Growing Waters—Final Report. University of Southern Mississippi, Hattiesburg, Mississippi, and Gulf Coast Research Laboratory, Ocean Springs, Mississippi. MASGP-79-022.
- Ellender, R. D., D. W. Cook, V. L. Sheladia and R. A. Johnson. 1980. Enterovirus and Bacterial Evaluation of Mississippi Oysters. *Gulf Research Reports*. 6(4):371-376. MASGP-79-028.
- Ellender, R. D., J. B. Mapp, B. L. Middlebrooks, D. W. Cook and E. W. Cake. 1980. Natural Enterovirus and Fecal Coliform Contamination of Gulf Coast Oysters. *Journal of Food Protection*. 43(2):105-110.

# Oyster Depuration Facility: Economic Assessment

D. C. Williams, Jr., David J. Etzold and Edward Nissan  
University of Southern Mississippi

**SUMMARY:** *The third phase of this project examined the economic feasibility of an oyster depuration facility for the Mississippi-Alabama coastal area. Phases I and II were legal, environmental, management and engineering assessments. The economic assessment is based on the plant design developed in Phase II.*

Mississippi and Alabama waters contain highly productive oyster reefs closed to oystering because of pollution. In Mississippi the oysters on prohibited reefs represent \$3 million lost in renewable resources annually.

The search for effective, economical methods of cleansing and harvesting these oysters has included transferring oysters to clean waters by the State and by private interests. After self-cleansing, the oysters are harvested.

If water quality degradation continues, sites for transplanting oysters will decrease. An onshore oyster depuration plant could provide an alternative for a threatened oyster industry.

Analysis of costs and revenue indicates, however, that the depuration facility as designed is not economically feasible at current prices and at interest rates of 10 or 12 percent. The design for the 96-bushel capacity facility specifies eight tanks which accommodate four trays holding three bushels

of oysters each. The plant could be operated as an open, flow-through system or as a closed system, recirculating the water used in depuration. With three days allowed for depuration, the facility could be operated so that depuration of one-third of the capacity would be completed and the oysters replaced each day. Such an operation would minimize labor requirements.

Costs and revenue estimates were based on 1978-79 prices. Both initial costs and operation costs were estimated for an open and a closed system using ozone water treatment for depuration. Supplemental information was also obtained to allow analysis of the open and closed systems using ultraviolet water treatment. Estimated annual operating costs covered the cost of oysters, electrical consumption, salaries for a supervisor, secretary, and three laborers, maintenance costs, telephone expense, and water and sewage.

Initial cost estimates ranged from \$137,000 for the facility operated as an open system using ultraviolet water treatment to \$210,000 for a closed system using ozone treatment. Annual operating costs ranged from about \$95,000 to \$102,000 depending upon the system and water treatment used.

Operating at full capacity, the facility could depurate 8,736 bushels of oysters during the oyster season. With an expected three percent mortality and a market price of \$7.50 per bushel, revenue would be \$63,555 per year. No estimates were made of likely shutdowns during the season, but loss of revenue per day would be approximately \$233.

To analyze costs and revenue on a comparable basis, the present worth equivalent annual cost method was used. At 10 percent interest rate the annual cost for the open ultraviolet system would be \$109,997. Using \$63,555 as the estimated annual benefits at full capacity, the benefit-cost ratio would be 0.58. The closed ozone system's annual cost would range up to \$126,186, yielding a benefit-cost ratio of 0.50.

## Publications

Williams, D. C., D. Etzold and E. Nissan. 1980. Oyster Depuration Facility: Economic Assessment. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-011.

# Utilization of Chitin to Control Pesticide Mobility

Charles L. McCormick, III  
University of Southern Mississippi

**SUMMARY:** *The second year of this five-year study focused on developing and characterizing model systems of chitin and other marine-produced polysaccharides in combination with aromatic amines. Work with the model systems provided an understanding of chemical reactivity and characteristic release rates necessary for eventual development of a controlled-release herbicide system for practical use.*

In recent years an important national and regional priority has been reducing and monitoring adverse environmental effects of industrial and agricultural chemicals. Of major concern to the southern United States is agricultural pesticides leaching into drainage waters and subsequent transport to municipal water supplies and to estuaries.

Chitin, chitosan and other polysaccharides derived from marine resources offer potential for development of commercially marketable controlled-release (CR) systems to reduce pesticide mobility. Chemically attaching small, mobile herbicide molecules to relatively large chitin macromolecules significantly diminishes movement of the herbicide from the area of application.

Environmental hydrolysis of the chemical bond linking herbicide to polymer yields a slow, continuous release of herbicide. Longer periods of control and fewer applications of herbicide result. Chitin also offers the advantages of being an inexpensive, biodegradable, abundant resource available from the 310 million pounds of

seafood waste generated annually.

Earlier phases of this project used soil-thin-layer-chromatography and greenhouse bioassays to demonstrate the feasibility of CR herbicide systems. Further work was necessary, however, to determine the factors influencing herbicide release rates, an understanding necessary to achieve finer control of the polymers' biological activity.

To study factors affecting the amount of herbicide that attaches chemically to the macromolecule and how that herbicide is released, model systems were synthesized and characterized using natural polymers in combination with aromatic amines. Use of the amines as representative compounds established a basis for predicting reactivity and release characteristics of specific herbicide systems. Additional general effects were demonstrated that analysis of specific systems would not reveal.

Techniques developed earlier in this project for homogeneous solution reactions of polysaccharides were used to prepare the model CR systems. The amount of aromatic amine chemically

attached (pendent) to the polymer was determined through ultraviolet spectroscopy. From 0.2 to 1.7 aromatic amine molecules were attached per repeating unit of the chitin polymer, depending on synthesis conditions used. This ability to vary the amount of pendent herbicide should contribute to accurate control of the duration of effectiveness of the polymer/herbicide combination.

Controlled hydrolysis studies under laboratory conditions and analysis by liquid chromatography supplied data on the concentration of the model compound released from samples.

Major conclusions were that hydrolysis was faster in a basic medium than in either neutral or acidic solutions; the delivery rate was higher in systems containing more pendent model compounds; the smallest sized chitin particles released compounds fastest, and uniform particle size was essential for reproducible results.

Preliminary work also indicates that release rates may be strongly dependent on the degree and rate of the system's interaction with water and on the polysaccharide's secondary structure—how the polymer chains are physically packed together to form the solid material.

Information and insights accumulated in the 1979 research effort will be used to further refine the polymer/herbicide systems toward the major objective of producing a commercially marketable controlled-release herbicide.

## Publications

- McCormick, Charles L. and M. M. Fooladi. 1980. Controlled Activity Polymers with Labile Bonds to Pendent Metribuzin. *Controlled Release of Bioactive Materials*. 317–330. MASGP-79-027.
- McCormick, C. L., D. K. Lichatowich, J. A. Pelezo and K. W. Anderson. 1980. Homogeneous Solution Reactions of Cellulose, Chitin, and Other Polysaccharides. *Modification of Polymers*. 371–380. MASGP-79-026.



# Environmental Studies

## Production of a Hydrographical–Meteorological Atlas of Mississippi Sound

Charles K. Eleuterius and Sheree Beaugez  
Gulf Coast Research Laboratory

**SUMMARY:** *The purpose of this project was to search for, collect, evaluate, analyze, edit, and publish available hydrographic and climatic data for the Mississippi Sound area. The atlas published through this effort serves as a single, convenient reference for hydrographic and climatic information for Mississippi Sound.*

Studies by individual academic investigators and at least ten different state and federal agencies have included some type of hydrologic or meteorologic measurements in Mississippi Sound.

The use of these data by other investigators, industry or private groups involves a time-consuming and costly process of literature search. In the production of this atlas, these scattered data were systematically assembled, reviewed, analyzed, edited and presented in a usable form under one cover.

The atlas provides statistical parameters of minimum, maximum, mean, median and coefficient of variation for water temperature, salinity, density, pH and dissolved oxygen for surface waters and depths of 5 feet, 10 feet and near bottom. The same statistical information is included for nitrite-nitrogen, nitrate-nitrogen, orthophosphate and total phosphate. Monetary constraints on the original studies that collected data have limited information

on these chemical components primarily to surface waters.

These physical and chemical variables are presented through 480 isopleth charts produced by plotting each hydrographic variable for each statistical parameter using the SYMAP (symbolic mapping) program developed by Harvard University. The computer-generated charts were reduced photo-mechanically and redrawn by illustrators for publishable quality.

Information is also graphically presented on tides, hurricanes, bathymetry, wave climate, weather patterns, river flow, air temperature, photic period, monthly wind force and direction, and cross-sectional areas of the barrier island passes. The text of the atlas explains data displayed in the 538 illustrations and charts and provides supplemental information on the dynamic nature of Mississippi Sound.

The scope and presentation of the atlas were designed to serve diverse groups of users involved in planning for future scientific studies, manage-

ment of marine resources, assessing environmental factors for industrial plant design, siting or operation, and informing the general public about the environment of the Sound.

The need for such an atlas has been demonstrated by the steady flow of requests for information during preparation of the atlas and in its use since publication. The hydrographic information was used in selecting sites for new oyster reefs. The Corps of Engineers, Mobile District, used the information to help plan a study of the Mississippi Sound benthos as well as other geological, biological and chemical studies. The U.S. Army Corps of Engineers Waterways Experiment Station has used it in planning data acquisition for mathematical modeling of Mississippi Sound. Portions of the data have also been used to assess the feasibility of locating an industry dependent upon specific seasonal water characteristics.

This atlas presents the current knowledge of Mississippi Sound hydrography and climate in condensed form. To continue its usefulness, ongoing and future research should add to and, in some cases, modify what has been presented.

(Turn to page 34 for Publications)



# Modern and Ancient Sedimentary Process and Response Within the Mississippi-Alabama Linear-Barrier-Coastal System

Frederick H. Manley, Albert C. Staheli, William R. Reynolds and Ray L. Frederking  
University of Mississippi

**SUMMARY:** *The purpose of this four-year study is to determine response patterns produced by normal geologic processes along the Mississippi-Alabama coast. Understanding of such patterns will increase accuracy in evaluating, as well as predicting, the effects of catastrophic geologic occurrences and allow evaluation of man's effect on normal processes. In the initial year of this project, data have been collected, analyzed and evaluated in an inventory of the physical and chemical sedimentation processes of the bi-state coastal area.*

The discharge of industrial and domestic wastes, both treated and untreated, into Mississippi streams and rivers has been a common practice. Although sediments from natural processes and man's involvement move with the river systems that eventually empty into the Mississippi Sound, no previous comprehensive study has been made of such movement into the coastal system.

The objective of this study is to provide an understanding of the patterns produced by such geologic processes along the Mississippi-Alabama coast and to construct a predictive sedimentary process-response model based on that understanding. The model can be used to predict movement of pollutants from various sources, the effects of natural processes and the interaction of the two.

Toward that end, the first year of this study focused on collection of up-to-date and first-time data of appropriate spatial coverage and quality. This effort provided the first basic inventory to date on the physical, chemical and biological sedimentation processes in operation in the bi-state coastal system. Examination of the

accompanying evolution of land forms and changes in distribution of land and water was also begun along with related study of similar response patterns that evolved throughout a maximum of the past 50,000 years.

In the study of the geochemistry of Mississippi Sound bottom sediments, organic carbon distribution was mapped from grab samples located on a random grid. Of more than 200 bottom samples collected, 100 selected samples were analyzed for pH, textural characteristics and carbon content. The distribution of organic carbon and other sediment characteristics indicated a general orbital circulation pattern throughout the Sound. Standard use of high organic content as a signal of possible pollution made the presence of organic carbon concentrations behind the barrier islands significant. The semicircular array is shaped by tidal and water currents through the barrier island passes, by wind action and by combinations of these factors.

A second facet of this project involved development and use of a three-dimensional graphical display for study of coastal topography. Through the program used to plot the display,

the computer can tilt and print out any segment of topography for viewing at whatever direction and elevation the investigator indicates. An example of the program's capabilities would be the printout of a view looking up a river valley instead of the standard aerial type representation.

A study of the region surrounding Bayou Portage near the mouth of Wolf River in southwestern Harrison County, Mississippi, revealed two major northeast-oriented landforms at 25-foot elevations. These features were dissected by a series of drainages, almost parallel, suggesting a beach ridge origin. Cores and samples taken on the major linear ridges contained clean, white, fine-grained quartzose sand. The associated swales and drainages contained abundant grey, clay-sized material.

These older northeastern geomorphic features resemble ancient high energy offshore barrier bars, rather than a low energy interior portion of a barrier system similar to the modern coastal features of the study area. The interior lagoon-sound portion of this older system lies farther inland to the northwest and west of the major beach ridge-like features.

Investigation of the relationship of sediment buildup in marshes to the entrainment of sediments by various marsh grass species was begun for Mississippi salt marshes of eastern St. Louis Bay. Salt marsh subenvironments were defined through substrate-structures, industrial X-ray of sediment cores and examination of root types. Compared to Atlantic Coast marshes,

the Mississippi marshes had fewer distinctive subenvironments and were smaller and more poorly developed, all features characteristic of youthful stages of marsh maturation. The scarcity of subenvironments was attributed to lower tidal amplitude, low elevation and relief, low salinity and constant freshwater flooding from upland watershed. The fluvial system

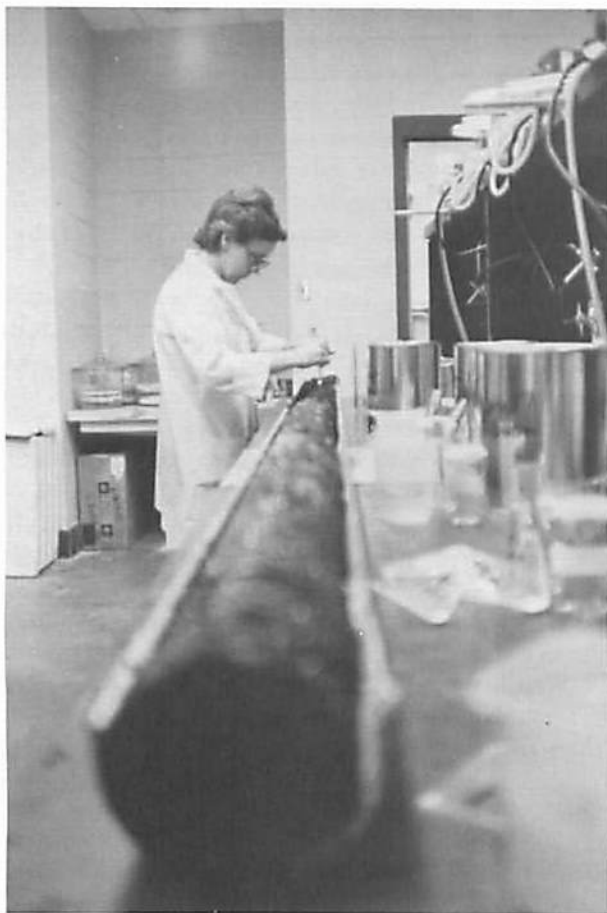
also accounted for sediment changes within substrate types.

Another aspect of this project was the use of color infrared photography (CIR) to map sediments. Analysis performed to determine the effect of sediments on the colors of CIR transparencies showed that sediment compaction or density had a greater effect on colors than did composition. CIR

photography can also be useful in mapping groups of species and upland boundaries of Mississippi marshes. CIR and microdensitometry have been used to characterize some Atlantic Coast marshes for legal considerations. Similar mapping should be done for all Mississippi coastal wetlands before they are altered further by urban and industrial development.

## Publications

Yeagan, Mary E. and Frederick H. Manley. 1979. Reconnaissance Remote Sensing in Atypical Wetlands, Coastal Mississippi. *Geological Society of America, Abstracts with Programs*, 1979. 11(7):545.



*Sediment core — Technician Faye Mallette sections a relatively homogeneous core of Mississippi Sound sediments for analysis at Gulf Coast Research Laboratory in Ocean Springs.*

# Pollutant Transport in Mississippi Sound

Thomas F. Lytle and Julia S. Lytle  
Gulf Coast Research Laboratory

**SUMMARY:** *With little scientific data available, the status of pollution in coastal Mississippi has remained essentially unknown. This study was conceived to characterize the pollutants of Mississippi Sound, clarify those processes responsible for pollutant movement and develop criteria that will be required for more responsible coastal management than that used in the past. Study in the first year of this four-year project focused on the region in the eastern Mississippi Sound influenced by the Pascagoula River.*

Recent legislative approval of a "superfund" to rehabilitate communities devastated by chemical wastes reflects the concern and knowledge shown now by both government and the public concerning pollution throughout the United States.

Pollution in the coastal areas of Mississippi has received minimal attention in the past and has been tolerated as a necessary by-product of progressive growth. This study was initiated to investigate the presence, movement and fate of pollutants within the Mississippi coastal system.

In 1979, sampling and analysis were aimed primarily at sediments collected as surface and core samples. Sediments show tremendous tenacity for the majority of estuarine pollutants and tend to trap them. Sediments also reflect averaged levels of pollution in contrast to water and biota which retain only an instantaneous image of pollution in the area.

Sampling encompassed a large area of the eastern Mississippi Sound. Fifteen deep sediment cores allowed observation of the history of pollution in the Sound and provided data useful in making dredging impact decisions. Extensive surface sampling supplied data on sediments between the widely spaced core sites.

A vibracorer and specially cleaned aluminum coring tubes were used in the November, 1979, coring operation.

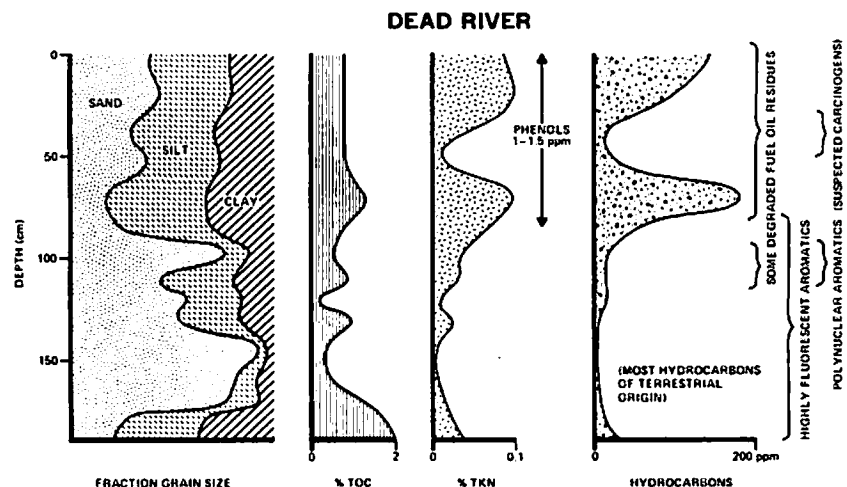
The 10-foot X 4-inch cores were sufficient to reach down into the sediment column to layers deposited prior to industrialization.

Cores were appropriately sectioned and processed to be analyzed for hydrocarbons, priority pollutants—a term applied by the Environmental Protection Agency (EPA) to select types of pollutants that pose the most eminent threat to the environment, phenols, trace metals, organic carbon, organic nitrogen, clay mineralogy, grain size and phenolic aldehydes. The bulk of core analysis was postponed until

1980 since cores were obtained late in the year. Analytical efforts included procedure development, technique refinements and examination of surface sediments of the Escatawpa River, a tributary of the Pascagoula River.

Transport of pollutants associated with a paper mill and other industries on the Escatawpa was of special interest. This heavily industrialized area experienced almost unrestrained waste disposal between 1960 and 1970. A virtual absence of life existed in the lower Escatawpa until the early 1970's, and the EPA has unofficially designated the area as having the highest pollution probability in the Mississippi Sound.

Sixteen surface stations sampled in July and August, 1979, were located along a five-mile stretch extending up and down river from suspected pollutant sources. Initial results of analysis have targeted this area as a prime trouble spot.



**Depth profile** — *Chemists Thomas F. and Julia S. Lytle have devised a practical format for presenting data on sediments to individuals and agencies involved in dredging impact decisions. Instead of volumes of statistics, the depth profile provides a visual comparison of types of sediments with the presence of pollutants at particular depths. Decisions can then be made to avoid dredging in areas that would cause resuspension of toxic chemicals into the water column.*

Investigators also began studies involving tracer compounds in the lower Escatawpa. Sufficiently stable compounds unique to a particular industry's effluent can provide useful data when found in sediments. Tracer compounds can point to the extent and source of certain pollutants, help date core sections and increase understanding of pollutant transport processes.

Phenolic aldehydes, with a characteristic distribution in pinewood, are prime possibilities for tracers. An area paper mill processes predominantly pinewood as did former lumber yards in the study area. Work continues on developing procedures to identify phenolic aldehydes for use as tracers of pollutant movement in the eastern Mississippi Sound. A large pentachlorophenol (PCP) spill in 1980 near the western end of the Sound is also being followed closely using PCP as a possible tracer of sediment transport in that part of the Sound.

Other pertinent facts gathered about pollution in the eastern Mississippi Sound, especially the Pascagoula River, include the following:

- Organic matter in sediments is extremely high—40 percent or more at several locations, even in regions tentatively designated as control sites. A normally organic rich river would average four to five percent organic matter in sediments.

- Phenols, extremely toxic compounds found in effluents from industries processing organics such as wood and coal, were found in surprisingly low concentrations or not at all in the water column near the industrial area. The ease of phenol oxidation to quinones has led the investigators to examination of quinones as possibly

concealing large quantities of phenolic materials in sediments. Even slight environmental changes could cause the compounds to convert back to the more toxic phenolic form.

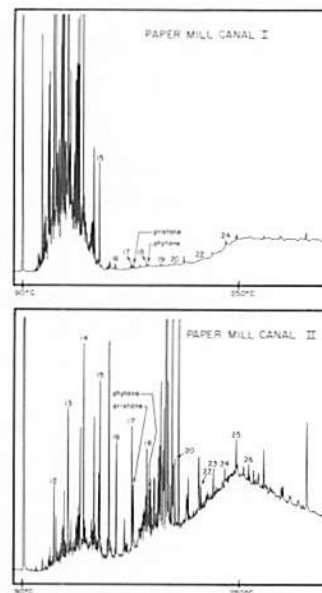
– Aliphatic and aromatic hydrocarbons in sediment samples show abnormally high variability, reflecting the variety of wastes dumped in the region. The high variability also indicates a need to change survey sampling procedures by the U.S. Geological Survey, the EPA and other well-meaning groups which rely heavily on one or two random sediment samples to depict the chemical make-up of a large region. This project's documentation of enormous spatial variability of sediment pollutants makes such a collection scheme invalid.

To provide a broader scope in identifying key pollutant compounds, investigators have established a working agreement with the University of Alabama in Birmingham, to analyze select samples by gas chromatography-mass spectrometry. Investigators have also begun establishing the market necessary for widespread use of this project's data and research findings.

The Corps of Engineers, Mobile District, the EPA Priority Pollutant Program and Mississippi Air and Water Pollution Control Commission are among those soliciting data. Formats have been devised to assure maximum use of this program's results and to generate a feeling of confidence in the efforts to protect the aquatic environment of Mississippi.

Another essential objective has been public education. This objective has been accomplished through talks and slide presentations to civic clubs, high school and college groups and scientific organizations. An April 1980

seminar also outlined research and provided some results to the Biology Department at the University of Southern Mississippi in Hattiesburg. Television and radio interviews have been effective in letting the public know how pollution affects the Mississippi Sound, how this study can help resolve the situation and what private individuals can do to support measures combating pollution.



**Extreme variability** – The gas chromatograms above illustrate the danger inherent in the current practice of depending on one or two sediment samples to define the extent of pollution in a region. Analysis of a sediment sample taken from one end of the paper mill canal (top) shows a high load of low molecular weight hydrocarbons. Analysis of a sample taken less than 200 yards away (bottom) still shows high hydrocarbon concentration. The much wider distribution, however, indicates different types of materials as pollutant sources.

## Publications

Lytle, Thomas F. and Julia S. Lytle. 1981. Interim Technical Report I: Pollutant Transport in Mississippi Sound. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-032.



# Hydrodynamics of Mobile Bay and Mississippi Sound

Gary C. April and Donald C. Raney  
University of Alabama

**SUMMARY:** *The adaptation of numerical models describing the water movement and elevation in Mississippi Sound and Mobile Bay was achieved during the first year of this three-year project. Partial calibration of the model for Mobile Bay was completed using historical field data.*

This nation's streams, rivers, estuaries and bordering oceans are no longer considered finite and unspoiled. That change in viewpoint has in recent years produced measures to protect existing water resources through national and local control.

Hydrodynamic modeling can provide information useful in implementing such control. The application of rapid, accurate mathematical models that describe the physical behavior of streams and estuaries supplies information affecting water resources management, water quality assessment and evaluation of water-related projects.

Based on a computer solution of the governing differential equations, these models can be used to accurately predict hydrodynamic and water quality characteristics as a function of time by specifying only attendant boundary and initial conditions.

In 1979 the first stages were completed on development of a model with such predictive capabilities for the Mobile Bay and Mississippi Sound region. The basic model adapted to Mobile Bay-Mississippi Sound was developed by the U.S. Army Engineer Waterways Experiment Station (WES). The WES Implicit Flooding Model (WIFM II) represents the most sophisticated two-dimensional tidal modeling

currently available.

Flooding capability and variable grid size are important features of this model. The flooding feature provides simulation in specific areas of "flood" or "dry" at various times in the tidal cycle. This flooding capability is valuable for modeling work in the Alabama-Mississippi region characterized by marshes and bayous.

The variable grid size permits use of larger finite difference cells for less critical portions of the waters studied and smaller cells for areas such as channels and passes between barrier islands. The proper grid provides more geometric detail on passes, channels and other areas where great changes in water movement occur.

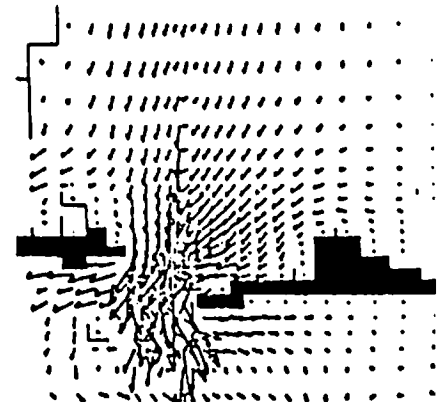
Three separate models were developed for the Mobile Bay-Mississippi Sound system: one for the entire region, one for Mobile Bay and one for Mississippi Sound. The better resolution provided by models of the smaller areas will be particularly desirable for supplying information which is local in nature to specific users. All three models are constructed so that they are compatible at computational boundaries.

Partial calibration of the Mobile Bay system was completed using historical field survey data. Calibra-

tion involves complex adjustment of variables until the model reproduces a set of actual field data with reasonable accuracy. Complete calibration depends upon obtaining additional prototype data for Mobile Bay.

Results from a Sea Grant field survey designed for trend calibration of the Mississippi Sound system should be available in this project's second year. A detailed six-month survey program conducted by the U.S. Corps of Engineers in mid-1980 should be available in late 1981 for comprehensive calibration and verification of all three models.

Preliminary work was initiated during 1979 on the development of material transport models describing salt content in Mobile Bay and Mississippi Sound. This work will provide a starting point from which more detailed material transport studies can proceed during later stages of this project.



Mobile Bay entrance — Simulated tidal flow.

## Publications

April, Gary C., Donald C. Raney, Lih Chern, John P. Jarrell, Der-Jang Lou and Yieng-Chiang Wu. 1980. Hydrodynamics of Mobile Bay and Mississippi Sound—Interim Report. University of Alabama, Tuscaloosa, Alabama. MASGP-79-020.

# Photogeological Survey of Barrier Islands

Ervin G. Otvos

Gulf Coast Research Laboratory

**SUMMARY:** *This aerial photographic survey of selected Mississippi and Alabama barrier islands was initiated in response to the devastation of Hurricane Frederic in September 1979. The survey has provided monitoring of island and sea bottom restoration.*

On September 12, 1979, Hurricane Frederic battered the coasts of Alabama and Mississippi. The same force that wrecked homes and businesses altered barrier islands and sea bottom in the coastal zone.

Fishing, shipping and the recreation industries were affected by elimination

of island segments and emergence of new shoals and islands. The purpose of this project was to observe and document erosive and constructive changes in Sand Island in the Mobile Bay ebb-tidal delta and Dauphin Island and Horn Island in Mississippi Sound.

Dauphin Island was severely over-

washed and four-fifths of Sand Island was washed away. The eastern one kilometer of Horn Island was washed away and reduced to a shallow-water area. Aerial photos and field studies have provided especially detailed documentation of Horseshoe Island, a new island that emerged in that shallow water area.

Monitoring the evolution of the islands may eventually contribute to an understanding of the geologic conditions required for effective artificial island restoration.



*Changes – A photographic survey of barrier island changes contributed to a coordinated 1979 effort that supplied vital insights for users and issues ranging from the family shrimping operation above to national priorities.*

# Education



# Secondary School Minority, Underprivileged and Handicapped Student Exposure to Marine Education

Della M. McCaughan and Gwendolyn N. de Marks, Biloxi High School  
Gerald Corcoran, Gulf Coast Research Laboratory

**SUMMARY:** *Participation in marine education by minority, handicapped and underprivileged students and their teachers has grown significantly through this project. Co-principal investigators and students created an awareness of marine education among students, teachers, parents and the community at large through workshops, seminars, field trips, television programs, newspaper articles and visits to elementary and secondary classrooms.*

Fewer than five minority students were enrolled in marine biology classes at the Biloxi, Mississippi, high school prior to the second semester of the 1977-78 school year. Even fewer participated in field trips.

The Biloxi school situation was representative of formal marine education programs throughout the nation.

Misconception among minority students, a lack of knowledge among parents, absence of experiences in the marine environment, expenses of field trips and deficiencies in educational background have hindered participation in the marine sciences by minorities. This project has developed effective avenues for changing attitudes and opening opportunities for minority involvement in marine education.

By January 1979, 13 blacks and five Caucasians were enrolled in an experimental marine education class at Biloxi High School. The students

became familiar with marine life. They learned how to hold, collect, observe and identify organisms.

One of the most effective innovations that came out of the experimental class was the practice of training students for team teaching. Using their team teaching training, marine education students reached 350 students at five elementary schools and 200 secondary students who visited the marine education classroom for special programs.

Students presented programs that introduced elementary and secondary students to the organisms and ecosystems existing in the aquatic environment. The involvement of the different races in these presentations also reinforced the realization that any child can participate in marine education and marine activities.

Field trips were another major tool used to involve a wide range of students

and teachers in marine education. More than 16 trips were taken to the barrier islands during the 1979 program year with 550 students and teachers participating.

Eight all-day field trips were scheduled for students in marine biology, marine education and other disciplines. On one overnight trip to Ship Island, parents helped teach techniques of night floundering, soft shell crabbing and early morning fishing. Among the minority students were young people who had their first beach camping experiences.

Field trip experiences would not have been possible for numerous students had it not been for Sea Grant. In September of 1979, Hurricane Frederic left in its wake fishermen with boats destroyed and families with homes damaged, often with no insurance coverage. The children of fishermen in such circumstances were among

*Old and new — Drawings by Biloxi High School student Steve Britt contrast a shrimping schooner of the Mississippi Gulf Coast's past (right) with recreational sailing of today (opposite page). Principal investigator and marine sciences teacher Della McCaughan coordinates cooperative efforts with art teacher Kristine McGuire for a wide range of marine-related art as part of the pilot program to encourage awareness of and involvement in marine education among minorities, handicapped and disadvantaged students.*





those given financial assistance for field trips.

The effectiveness of all these programs was multiplied by the popular public interest focused on them. Ten television programs and frequent newspaper articles featured Biloxi High School marine education activities.

An effective project influential statewide was the Marine Education Workshop held March 11–16, 1979. More than 67 graduates and undergraduates and 25 high school students participated in lecture sessions, field trips, tours and marine-related laboratory activities. Participants also received materials which could be used for instructional programs. The majority of the college-level participants were teachers in varying disciplines from throughout Mississippi.

The 34 participants funded by Sea Grant included black teachers and students and two handicapped students. For the first time, there were additional black educators who attended because of personal interest

and were not participating through Sea Grant financial assistance. Through changes in education and attitudes, minorities are closing the gap in the marine sciences.

The 1979 secondary program also included the following:

- An assembly meeting for the 300 Biloxi High School minority students provided information on the marine education workshop, cooperative college programs for minority students and the continuing marine education program.

- All marine biology and marine education classes and students in summer school science, general science, biology, learning disability and art classes of Biloxi High School and other educational and civic groups used Sea Grant seines, nets and equipment.

- The marine sciences laboratory at Biloxi High School was used for college night classes and special programs.

- Forty-five educators participated in a one-day elementary reading marine

sciences workshop for review and evaluation of Jacques Cousteau films and written materials designed for educational television and classroom work in combination.

- Three students (including a minority student) spoke at a Congressional subcommittee hearing held in New Orleans on the Coastal Zone Management Act.

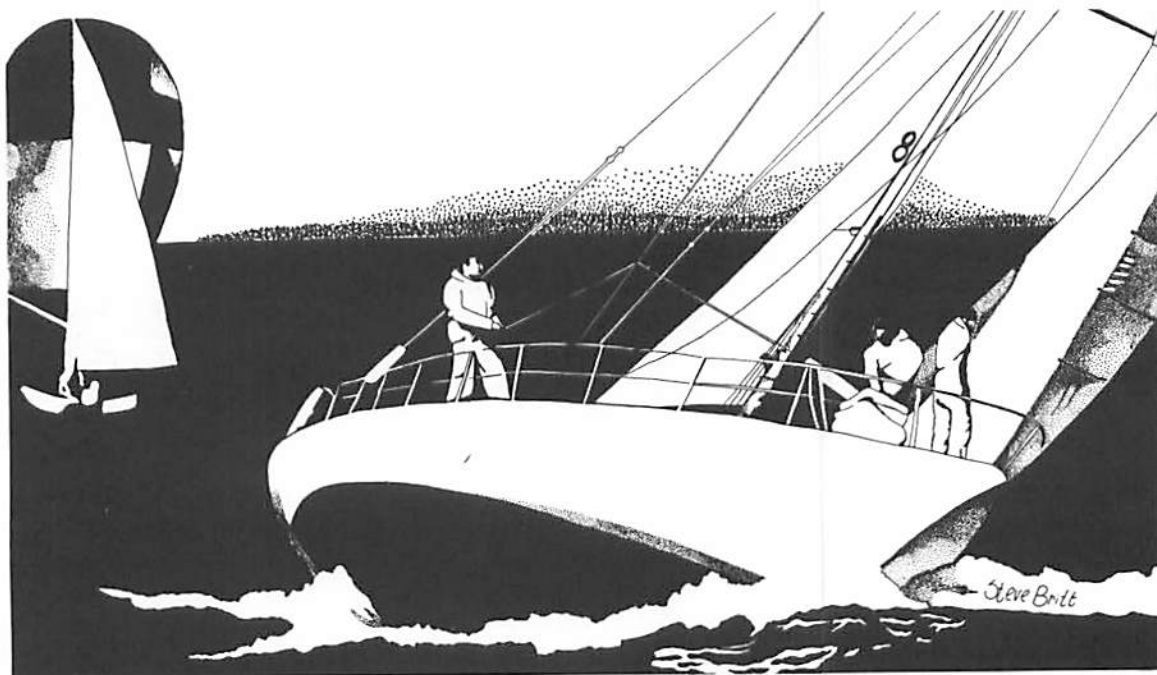
- A Boy Scouts of America Explorers Club was organized in the field of oceanography and marine biology.

- Marine environmental programs and equipment for field trips were provided for the Youth Conservation Corps (YCC). These YCC participants were also provided with marine education guides.

- Marine field experiences were arranged for teachers attending a Tougaloo College science workshop. The teachers also experienced preparation and picking of crabs, shrimp and other seafood during dinners at the home of the co-principal investigator.

## Publications

Milkent, Marlene M., Bobby N. Irby and Della McCaughan. 1980. An Assessment of Differences between White Students' and Black Students' Involvement in Marine Related Activities. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-018.



# Man and the Gulf of Mexico

Bobby N. Irby, Marlene Milkent and Lloyd Story, University of Southern Mississippi  
Elizabeth Martin, University of South Alabama  
Gerald Corcoran, Gulf Coast Research Laboratory

**SUMMARY:** *An appreciation and conservation of the Gulf of Mexico as a valuable resource depends on understanding the nature of the marine environment and its inhabitants. This project is designed to foster such understanding by establishing marine education programs in Mississippi and Alabama schools. The first phase of this project has consisted of curriculum development, teacher in-service training, field testing and revision of materials for Grades 10–12.*

Secondary schools are comprised of a large population of students on the threshold of adulthood. As adults these students will need to make intelligent decisions on the role of the marine environment in their society.

In the initial year of this project, marine educational materials were developed to introduce students to the complexities of the marine environment. The materials are designed for use in schools' existing science curricula or as a separate marine-oriented subject for the secondary level. The work with Grades 10–12 materials is the first step in a broader effort encompassing Kindergarten through Grade 12.

The curriculum consists of six units: *Marine and Estuarine Ecology, Marine Habitats, Diversity of Marine Animals, Diversity of Marine Plants, Physical and Chemical Properties of Water and Food from the Sea.*

The first four units are completed and ready for field testing. Revision of the remaining two continues. Test center schools have been established for the evaluation component of the

project. Test center teachers have received training sessions in use of the materials.

"Man and the Gulf of Mexico" reflects the work of a cross section of disciplines. Individuals from the teaching profession, scientific community and Mississippi and Alabama Departments of Education, as well as professional curricular personnel, have contributed to the development of the instructional materials.

Mississippi and Alabama science teachers helped provide initial direction for the project with participation in a marine science education survey in the Spring of 1979. Responses reinforced the need to include in-service training as an element of the project. Most teachers indicated that they had little or no academic preparation or formal coursework pertaining specifically to the marine sciences and that they felt they lacked adequate knowledge to teach most marine-related topics.

A conference of selected science teachers contributed concrete sugges-

tions on selection of topics for the curriculum. They worked on development of concepts, instructional objectives and teaching strategies to be used with each concept. The participants for the March 30–April 1, 1979, conference were selected from science teachers recommended by the two states' science supervisors.

Twenty-four teachers attended a later conference to read, edit and revise the curriculum materials that had been written. Several of the developed activities were also successfully piloted in a summer marine sciences workshop conducted on the Gulf Park Campus of the University of Southern Mississippi.

Field testing, evaluation and revision of materials are scheduled to make the curriculum available for use in Mississippi and Alabama schools in the 1981–82 school term.



## Publications

- Milkent, Marlene M., Bobby N. Irby and Della McCaughan. 1980. An Assessment of Differences Between White Students' and Black Students' Involvement in Marine Related Activities. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Mississippi. MASGP-79-018.
- Milkent, Marlene M., Bobby N. Irby and Lloyd E. Story. 1979. Teachers and Marine Education—A Survey. University of Southern Mississippi, Hattiesburg, Mississippi. MASGP-79-005.

# Talladega College Marine Sciences Fellowship and Development Program

Arthur L. Bacon and Gladys Mayers, Talladega College  
Robert P. Glaze, University of Alabama in Birmingham

*SUMMARY: Designed to encourage more minorities to pursue careers in the marine sciences, this development project used financial aid, academic courses, seminars and field trips to involve students in the marine sciences.*

Few members of minority races have entered the field of marine sciences in the past. Talladega College's record for successfully channeling its graduates toward higher degrees and areas of achievement make it a prime choice for inaugurating a marine sciences awareness program.

A major element of developing a marine sciences program at Talladega has been selection of undergraduate trainees. During this first year, the program advisory committee selected one freshman, two juniors and one senior to receive various levels of financial support. Additional trainees were selected for the summer program.

Career-oriented seminars provided trainees and other students with exposure to marine science professionals from the Dauphin Island Sea Lab, the

research facility of Alabama's Marine Environmental Sciences Consortium, from the National Marine Fisheries Service and from the National Fisheries Engineering Laboratory of the National Aeronautics and Space Administration. The guest lecturers presented an overview of ongoing work and educational and career opportunities. Visiting marine scientists reviewed their current research during science seminars.

A field trip to Dauphin Island, Alabama, was an effective first-hand introduction to the marine environment for trainees and ecology and botany class members. Students toured Dauphin Island Sea Lab facilities and were taken on a working cruise. Trainees classified and preserved specimens collected on the cruise.

Three trainees later participated in

a summer session at Dauphin Island Sea Lab.

Efforts to create an awareness of the marine sciences among the entire student body included setting up marine aquaria in select locations in the science building, setting up two display cases containing a shell collection and marine organisms, and mounting framed posters of representative organisms of various coastal zones. A collection of marine education reading materials was also begun.

The first Marine Sciences Day was held in October at Talladega College. A brochure, local newspaper articles and an article in the school paper publicized the program.

The Marine Sciences Program opened new areas for exploration by Talladega students in 1979. The program's value will grow as successes continue. Faculty and administration are currently exploring sources of additional funding for expanding the program even further.

## Publications

Marine Sciences Fellowship and Development Program, Talladega College. 1979. Brochure. Talladega College, Talladega, Alabama. MASGP-79-003.

# *Advisory Services*



# Mississippi Sea Grant Advisory Services Program

C. David Veal, John Dale Lea and John R. Kelly  
Mississippi Cooperative Extension Service

Information is the life-blood of the Mississippi Sea Grant Advisory Service. The advisory staff uses resources available through Sea Grant research and education programs and resources available through its affiliation with the Mississippi Cooperative Extension Service to connect marine resource users and potential users with information they need.

In 1979 the role of the Sea Grant Advisory Service in this communication process ranged from simple telephone calls, publications and newsletters to organization of conferences, seminars and workshops. The Advisory Service also transferred insight on local problem areas to investigators involved in research.

With the philosophy that an educated public is a more responsible public, the Advisory Service continued a major public education effort. More than 100,000 publications on Gulf Coast recreational opportunities were distributed through Chambers of Commerce, innkeepers and related agencies. Newspaper articles were published on topics as diverse as seafood preparation, seafood industry trends, marine issue explanation, recreational opportunities and environmental protection and enhancement. Advisory Service staff members accumulated ten hours of air time on educational and commercial television stations for public education on marine-related issues.

Free beach tours begun in 1978 were continued in the spring of 1979. Advi-

sory staff specialists introduced Gulf Coast visitors and local residents to the historical, geological and ecological characteristics of the coastal environment. Activities such as seining involved audiences in marine experiences.

Another effective continuing program was the work with county home extension agents to supply information on seafood to consumers. The home economists regularly demonstrated proper purchasing, preserving and preparing of seafoods available on the Gulf Coast. Efforts to include marine activities in statewide Cooperative Extension Service 4-H programs continued. In other work with young people, specialists presented marine education programs for the Mississippi Education Association and for youth groups along the coast.

Advisory Service staff also invested time and effort with specialized clientele groups during the 1979 program year. More than 30 percent of total staff time was devoted to the harvesting, processing and marketing sectors of Mississippi's seafood industry.

An annual commercial fishermen's symposium explored fuel management, environmental protection, market trends, vessel safety, and Loran A/C conversion. Advisory specialists assisted processors with waste disposal problems, seafood product development and labor procurement.

Specialists continued efforts to help Indo-Chinese and American natives adjust to the movement of Vietnamese

refugees into the fishing industry in Mississippi. Highly experienced in the seafood industry, these individuals proved to be an economic boon to the seafood processing sector. Substantial stress developed, however, around their presence in the seafood harvesting sector. The Advisory Service continues work to alleviate the situation through fostering better communication and understanding.

With an estimated \$3 million worth of oysters in polluted waters closed to harvesting in Mississippi, an Advisory Service educational program aimed at the oyster industry was especially significant. The Advisory Service used workshops, newspaper articles, newsletters and television to inform members of the industry about procedures involved in obtaining and using private leases for transplanting oysters from polluted reefs to clean waters for self-cleansing and eventual harvesting. Thirty-seven private leases have been arranged. A number of firms have sought assistance in developing self-contained systems for use of oysters from polluted reefs, and the State has assumed new interest in management of a valuable resource.

Throughout all these programs involving general public education and special user groups, the Sea Grant Advisory staff has worked toward the ultimate goal of disseminating information to help solve problems of those interested in and involved in marine affairs.

## Publications

- Mississippi Sea Grant Advisory Service. 1979. New Publications from Sea Grant. *Gulf Coast Fisherman*. July 9. MASGP-79-002-1.
- \_\_\_\_\_. 1979. *Fish Holds can be Death Traps*. August 24. MASGP-79-002-2.
- \_\_\_\_\_. 1979. *Shrimping Measures Proposed for the Gulf*. November 30. MASGP-79-002-3.
- \_\_\_\_\_. 1980. *Some Tax News for 1980*. January. MASGP-79-002-4.
- \_\_\_\_\_. 1980. *Dual-Fuel Diesel Engines*. January 7. MASGP-79-002-5.



# Alabama Sea Grant Advisory Services Program

R. Warren McCord, Mac V. Rawson, William Hosking and Gale R. Trussell  
Alabama Cooperative Extension Service

On September 12, 1979, Hurricane Frederic ravaged coastal Alabama and Mississippi. The Alabama Sea Grant Advisory Service's response in the wake of the hurricane's devastation characterizes the "grass roots" philosophy of Sea Grant.

As part of the community, the Advisory Service staff had special insight into the sense of loss and frustration the coastal residents were experiencing. The staff began work immediately bringing those in need of assistance into contact with the federal and state disaster relief officials that could help.

Administration of the Advisory Service as part of the Alabama Cooperative Extension Service's Community Resource Development Program provided flexibility and diversity of resources, knowledge and contacts for assisting coastal communities, industries, and individuals in this major crisis as well as in long-range programs.

## *Hurricane Recovery*

Within 10 days of Hurricane Frederic's landfall, the Advisory Service staff had taped five 5-minute television programs featuring federal and state disaster control officials. At the request of the Federal Emergency Management Administration (FEMA), the staff published a preliminary assessment of the hurricane's \$10.7 million damage to the commercial fishing industry. The Extension Service's in-house rapid response printing permitted prompt publication and dissemination of disaster recovery information ranging from the assessment for FEMA to information sheets on construction of storm-resistant housing.

The Advisory Service helped federal and state legislators contact coastal

and seafood industry leaders on further problems resulting from the storm, set up a meeting with the Small Business Administration attended by more than 100 Bayou La Batre, Alabama, businessmen hit by the hurricane, and brought together state, county and city groups to draw up a plan for redevelopment of Mobile, Alabama's Battleship Parkway as an economical, environmentally sound recreation area.

Stronger channels of communication developed with commercial fishermen and seafood processors in 1979 as a result of both hurricane recovery work and continuing advisory programs. A successful educational program on the change over from Loran A to Loran C navigation systems provided necessary background for fishermen dependent on Loran to locate fishing areas or for avoidance of underwater obstructions during trawling.

The Advisory Service organized meetings between fishermen and personnel administering the National Marine Fisheries Service Fishermen's Contingency Fund, a fund for reimbursement of losses due to specified underwater obstructions. Meetings were also set up for National Ocean Survey and contractual personnel to determine fishermen's preferences on methods to chart bottom obstructions.

An economic crisis in the shrimping industry followed Hurricane Frederic losses. Brought on in part because the Gulf of Mexico shrimp harvest is near maximum sustainable yield, the crisis involved rising fuel costs, rapidly declining prices and reduced catch per boat.

Advisory Service efforts focused on leadership development that involved shrimpers in exploring alternatives,

contacting proper government officials and making decisions. Vessel owners were encouraged to convert to other fisheries in the off-season. Some have already converted to longline operations for tuna and swordfish.

Advisory Service personnel also participated in efforts to adapt the newly developed ferrofoil to replace heavy wooden trawl doors used in shrimping. The lighter weight equipment would reduce fuel consumption and provide a more durable door.

## *Seafood Processors*

Sea Grant Advisory Service personnel worked with seafood processors and various government groups on an acute wastewater treatment problem in Bayou La Batre. The concentration of processing plants in this major commercial fishing center had overloaded the city's wastewater treatment system. Permit violations resulted.

The Advisory Service proposed the alternative of spreading wastewater over a marsh in an overland flow treatment. The marsh acts as a filter, and the decaying organic material becomes fertilizer for the marsh. Marine Environmental Sciences Consortium investigators developed a proposal for the project that is under review by the Environmental Protection Agency.

Demonstrations of new products for seafood processors included assistance in the development of a surimi plant. Surimi is the raw material for kamaboko, a cheese-like product that accounts for 25 percent of fish consumption in Japan. Success of the pilot plan would be significant in development of Gulf of Mexico ground-fish resources.

A workshop on potential fishery resources for the northern Gulf of

Mexico provided an initial step in an Advisory Service educational program. The program familiarizes seafood industry leaders with prospective international markets and appropriate business procedures for selling surplus fish. The workshop was sponsored jointly by the Consortium, Louisiana Sea Grant Program, and Gulf and South Atlantic Fisheries Development Foundation, Inc.

### Recreation

The recreational aspect of the 1979 program emphasized development of recreational facilities that preserve the coastal environment and provide educational and recreational attractions.

The Advisory Service recreation

specialist helped design campgrounds and nature trails in connection with the restoration of Blakeley, site of a town that once rivaled Mobile and was the scene of the last Civil War battle. Advisory Service staff also helped two coastal cities establish park and recreation boards and developed cooperative seminars on sport fishing, camping and marine live bait.

An effective investment for the future wise use and preservation of Alabama coastal resources was the development of a pilot marine 4-H program in 1979. The pilot program included five coastal area counties and a sixth central urban county. The first 4-H Marine Resources Conference at Dauphin Island Sea Lab closed the

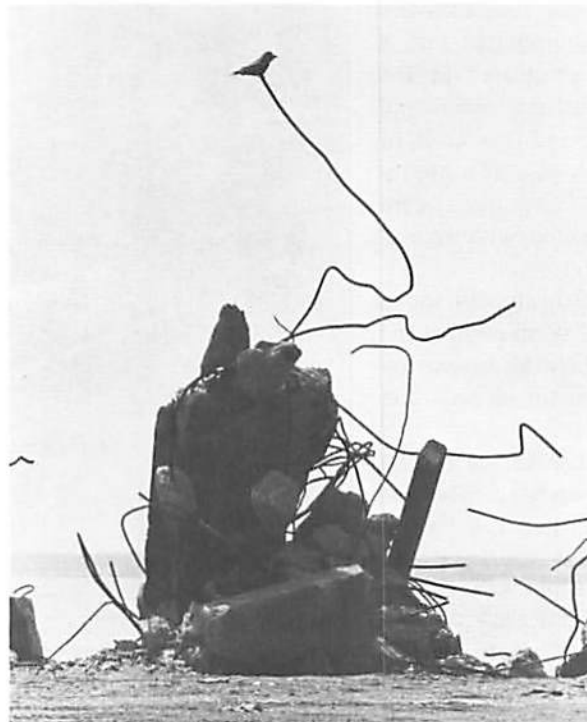
year's program with more than 35 young people and 4-H Extension agents attending. The program expanded statewide for the 1979-80 school year.

In 1979 the Alabama Sea Grant Advisory Service accomplished its goal of meeting the needs of the people, industries and communities of the coastal region through practical, informal educational programs. The Advisory Service has provided a vital link between scientists involved in marine research, government agencies concerned with the marine environment and communities and users dependent on marine and coastal resources.

### Publications

- Alabama Sea Grant Advisory Service. 1979. Brochure. Alabama Sea Grant Advisory Service. MASGP-79-001.
- \_\_\_\_\_. 1979. "Checklist for Building Construction on Shoreline Property." MASGP-79-006-1.
- \_\_\_\_\_. 1979. "Guidelines for Hurricane Resistant Construction." October. MASGP-79-006-2.
- \_\_\_\_\_. 1979. "Trawl Damage." August. MASGP-79-006-3.
- \_\_\_\_\_. 1979. "Emergency Aid." September 21. MASGP-79-006-4.
- \_\_\_\_\_. 1979. "Hurricane Frederic - Preliminary Damage Assessment - Commercial Seafood." October. MASGP-79-006-5.
- \_\_\_\_\_. 1979. "The First 100 Days." December. MASGP-79-006-6.

*Evidence - Twisted steel and broken concrete give silent testimony of Hurricane Frederic's fury of September 12, 1979. Advisory Service personnel were, and are still, involved in the recovery process of the coastal counties.*



# Marine Resources Law

Dixie A. Criddle and William Hooper, Jr.  
University of Mississippi

**SUMMARY:** *The 1979 Sea Grant Legal Program worked closely with other elements of the Sea Grant effort in providing research, education and advisory services to a wide range of marine resource users. The law program contributed significantly to increasing public awareness and understanding of the laws and regulations applicable to the marine and coastal environment.*

During 1979 the legal program instituted a notification service for local and state agencies with responsibility for managing coastal resources. The concerned agencies were informed of changes in federal laws and regulations which affected the Mississippi coastal area. *The Federal Register* and *Environmental Reporter* were reviewed daily, and short summaries of the information contained in those publications relevant to the coastal area were sent to the appropriate agencies.

The law portion of a multidisciplinary course in marine education was assembled in language easily understood by high school students. The material will be incorporated into a publication to be completed at the University of Southern Mississippi through the "Man and the Gulf of Mexico" project (see page 26). Appropriate federal and state laws were analyzed and footnoted with accompanying bibliography.

The principal investigator also spoke at an environmental symposium at the University of Southern Mississippi on the legal mechanisms for oil pollution control.

Materials for a law of the coastal zone course were updated. The Sea Grant Legal Program principal investigator will teach this course at the University of Mississippi Law School in the 1981 Spring Semester.

A primary research effort involved research, analysis and synopsis of gill netting laws of the Atlantic Coast

states for a Sea Grant study on the effects of gill netting versus sport fishing in Mississippi waters. Proposed gill netting laws for Mississippi will be drafted in 1980.

Advisory services included the following:

- State statutes regulating Mississippi ports were compiled and summarized at the request of the Sea Grant Advisory Service. Port author-

ities can use the information in clarifying their powers and duties and in identifying deficiencies under Mississippi statutes.

- Research assistance was provided to the Sea Grant Advisory Service on possible means of compensation to fishermen for damage caused by bottom obstructions.

- The question of whether adding water to packed oysters constitutes adulteration under present law was briefed for the Gulf Coast Research Laboratory.

- Patent and copyright laws were briefed to assist in preparation of a patent and copyright policy for the Consortium.



**Grain elevator** – *The Port of Pascagoula grain elevator handled a record 4,615,951 tons in 1979. Statutes regulating Pascagoula and other Mississippi ports were compiled and summarized by the Marine Resources Law program.*

# Alabama Marine Law Program

Robert L. McCurley, Jr., Penny Davis, Eric Bruggink and Edwin L. Yates  
University of Alabama

**SUMMARY:** *During its initial year, the Alabama Marine Law Program was effectively established and staffed. Its three-fold purpose of research, service and education was effected through publication of monographs, work with agencies on legal questions and providing courses in coastal and environmental law.*

## Service

Two major projects begun in 1979 were assistance with a hearing draft for the Coastal Management Program and establishment of a permit information center. Both projects were undertaken at the request of Alabama's Coastal Area Board. The Marine Law Program staff assisted the Board in preparing portions of the hearing draft, including a complete draft of rules and regulations which would comply with federal and state laws covering coastal and natural resources use.

Establishment of the permit information center involved identification and compilation of regulations and permits required by federal, state and municipal agencies for activities which have an impact on the Alabama coastal area within Mobile and Baldwin counties. A single volume describing all permit procedures was assembled, and a feasibility study on establishing the Coastal Area Board as a unified permit information center was completed through the Marine Law Program.

## Research

Four major research projects were begun in 1979. The staff researched the controversy between federal and state governments over ownership of submerged lands in the Mississippi Sound off the Mississippi-Alabama coastline for the Alabama Conservation Department. An overview of the

litigation and a history of submerged land cases was published as a result of the research.

The Marine Law Program also made a survey of Alabama energy and environmental agencies at the request of Oak Ridge National Laboratory in Oak Ridge, Tennessee. A monograph, published in January 1980 and entitled "Alabama Energy and Environmental Agencies," has provided a quick reference source to all Alabama laws which affect the coastal areas. Copies were sent to all members of the state legislature and to government agencies throughout Alabama and neighboring states.

Research on water use conflicts in Alabama was provided for the Alabama Development Office. The research involved legal issues surrounding withdrawal of groundwater from aquifers in the Alabama coastal region, the interbasin transfer of water in Jefferson County, the rights of riparian owners on the Chatahoochee River and methods for resolution of interstate water conflicts. A monograph entitled "Municipal Water Supplies, Interbasin Transfers and Interstate Water Problems Confronting Alabama" was published in October 1980.

A survey of all federal regulations governing the development of the wetlands was undertaken at the request of the Sea Grant Advisory Service in Mobile. The results were published in a monograph entitled "A Survey of Wetlands Law," published in October 1980.

## Education

"Introduction to Coastal and Environmental Law" was taught for graduate level students once at Dauphin Island Sea Lab and once at the University of Alabama. Course materials and visiting lecturers covered methods of settling disputes in the water pollution context, ownership concepts, coastal zone management, oil pollution control, water pollution control, fisheries regulation and oil exploration.

The Marine Law Program also contributed to the area of education through assistance with an environmental law seminar designed for practicing attorneys and sponsored by the University of Alabama's Continuing Legal Education Program. Plans were made at that Birmingham, Alabama, seminar to develop a forum to inform the business community of environmental requirements, especially those relating to coastal and marine laws.

A result of those plans was publication of nine issues of a newsletter which provided current information on major marine, environmental and energy developments. A chart of Alabama's natural resource related agencies was also developed and distributed to the state's legislature, agencies and marine resource users. Newsletter circulation is more than 200, and demand for the chart was high as well.

## Cooperating Organizations

Alabama Development Office  
State Department of Conservation  
Bay Area Shrimpers Association  
Alabama Coastal Area Board

## **Publications**

Cohen, Harry. 1980. Municipal Water Supplies, Interbasin Transfer and Interstate Water Problems Confronting Alabama. University of Alabama, Tuscaloosa, Alabama. MASGP-79-008-4.

Office of Energy and Environmental Law. 1980. Alabama Energy and Environmental Agencies. University of Alabama, Tuscaloosa, Alabama. MASGP-79-008-2.

\_\_\_\_\_. 1980. State and Federal Claims to Submerged Lands in the Mississippi Sound. University of Alabama, Tuscaloosa, Alabama. MASGP-79-008-1.

Simons, George. 1980. A Survey of Wetlands Law. University of Alabama, Tuscaloosa, Alabama. MASGP-79-008-3.

## **Publications (Continued from page 16)**

Eleuterius, Charles. 1980. Mississippi Sound: A Hydrographic and Climatic Atlas. Gulf Coast Research Laboratory, Ocean Springs, Mississippi. MASGP-79-009.



# Appendix

# Activity Budget Sheet

	<u>NOAA Grant Funds</u>	<u>Matching Funds</u>
<b>RESEARCH</b>		
<b>MARINE RESOURCES DEVELOPMENT</b>		
Living Resources	\$ 87,503	\$ 31,333
Mineral Resources	26,500	11,560
<b>SOCIO-ECONOMIC &amp; LEGAL STUDIES</b>		
Marine Economics	46,453	24,897
Ocean Law	53,952	40,246
<b>MARINE TECHNOLOGY RESEARCH &amp; DEVELOPMENT</b>		
Resources Recovery & Utilization	36,499	22,265
<b>MARINE ENVIRONMENTAL RESEARCH</b>		
Ecosystems Research	5,596	325
. . . Coastal Management Decisions	1,078	612
Environmental Models	131,515	48,948
Applied Oceanography	23,281	18,752
Total Research	412,377	198,938
<b>EDUCATION</b>		
<b>MARINE EDUCATION AND TRAINING</b>		
Other Education	62,263	38,180
<b>ADVISORY SERVICES</b>		
<b>ADVISORY SERVICES</b>		
Extension Programs and Other Advisory Services	168,856	118,160
<b>PROGRAM MANAGEMENT</b>		
<b>PROGRAM MANAGEMENT</b>		
Planning and Development		
Administration		
	141,504	121,783
<b>TOTALS</b>	<b>\$785,000</b>	<b>\$477,061</b>

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Alabama Department of Conservation  
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**Mr. J. E. Thomas**  
Executive Director  
Mississippi Marine Resources Council

**Mr. Ron Werby, President**  
Mississippi State Port Authority

# Program Summary

<u>Project Number</u>	<u>Project Title</u>	<u>Principal Investigator</u>	<u>1979</u>
<b>LIVING RESOURCES</b>			
R/LR-1	The Relative Impact of Netting and Sport Fishing on Economically Important Estuarine Species	Lorio	E
R/LR-9	The Role of Mississippi Sound in Recruitment to Sport and Commercial Fish Stocks	Richardson	N/C
R/LR-6	Optimum Time Interval in the Application of Controlled Burning and Harvesting as Tools in the Management of Marshes	de la Cruz	E
R/LR-4	Histopathological Studies on Gulf Coast Oysters	Hawkins	E
<b>COASTAL POLICY STUDIES</b>			
R/CP-2	Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi	Nissan	E
R/CP-3	The Status and Relation of the Coastal Zone to Alabama's Economy	Hardy	E
<b>SEAFOOD PROCESSING</b>			
R/SP-1	Viral Evaluation of Prohibited Oyster Growing Waters	Ellender	E
R/SP-2	Oyster Depuration Facility: Economic Assessment	Williams	E
R/SP-4	Utilization of Chitin to Control Pesticide Mobility	McCormick	C
<b>ENVIRONMENTAL STUDIES</b>			
R/ES-1	Production of a Hydrographical-Meteorological Atlas of Mississippi Sound	Eleuterius	E
R/ES-2	Modern and Ancient Sedimentary Process and Response Within the Mississippi-Alabama Linear-Barrier-Coastal System	Manley	N/C
R/ES-3	Pollutant Transport in Mississippi Sound	Lytle	N/C
R/ES-4	Hydrodynamics of Mobile Bay and Mississippi Sound	April	N/C
R/ES-5	Photogeological Survey of Barrier Islands	Otvos	N/C
<b>EDUCATION AND TRAINING</b>			
E/O-1	Secondary School Minority, Underprivileged and Handicapped Exposure to Marine Education	McCaughan	C
E/O-2	Man and the Gulf of Mexico	Irby	N/C
E/O-3	Talladega College Marine Sciences Fellowship and Development Program	Bacon	N/C
<b>EXTENSION PROGRAMS AND OTHER ADVISORY SERVICES</b>			
A/EP-1	Mississippi Sea Grant Advisory Services Program	Veal	C
A/EP-2	Alabama Sea Grant Advisory Services Program	McCord	C



<u>Project Number</u>	<u>Project Title</u>	<u>Principal Investigator</u>	<u>1979</u>
A/O-1	Marine Resources Law	Criddle	C
A/O-2	Alabama Marine Law Program	McCurley	N/C
<b>PROGRAM ADMINISTRATION, PLANNING AND DEVELOPMENT</b>			
M/PP-1	Program Management: Administration	Jones	C
M/PA-1	Planning and Development	Jones	C
M/PD-1	Project Initiation and Rapid Response	Jones	C

Legend: E – project completed or terminated  
C – project continued  
R – project redirected  
N – project initiated

## Administrative Staff

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Associate Director for Programs . . . . . Cdr. Stanley Hecker  
Assistant Director for Administration . . . . . Ms. Dianne Jones  
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*Waders — Residents of Mississippi and Alabama salt marsh and shore.*



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Linda Skupien  
Editor



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