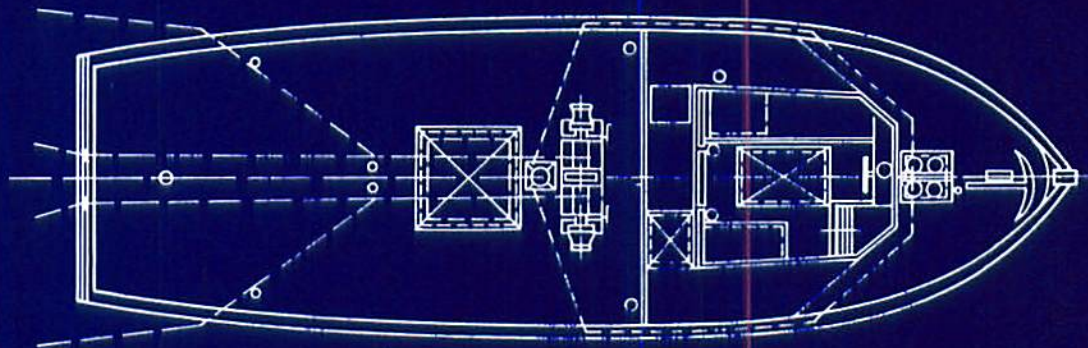
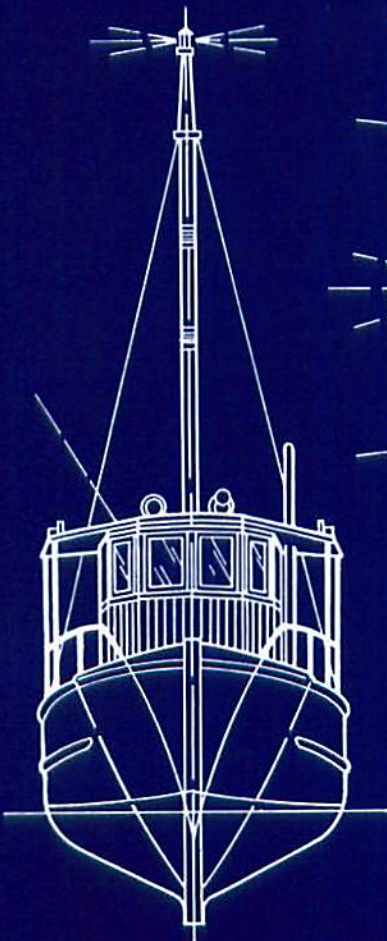
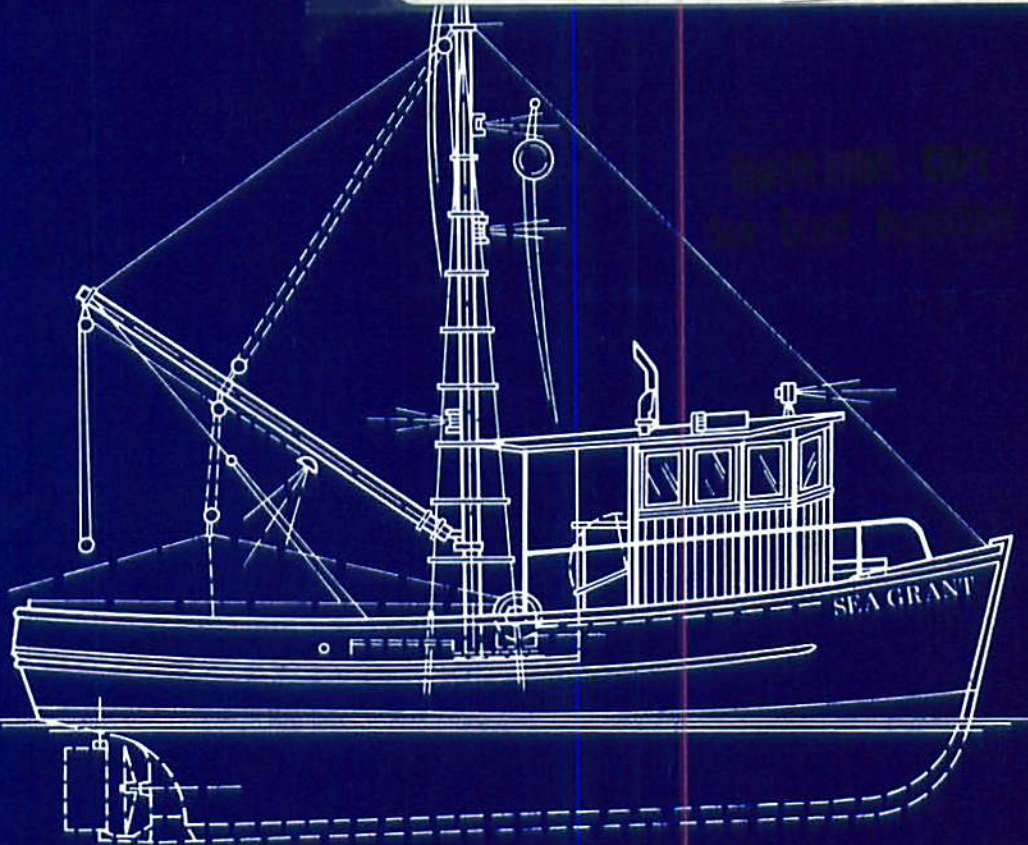
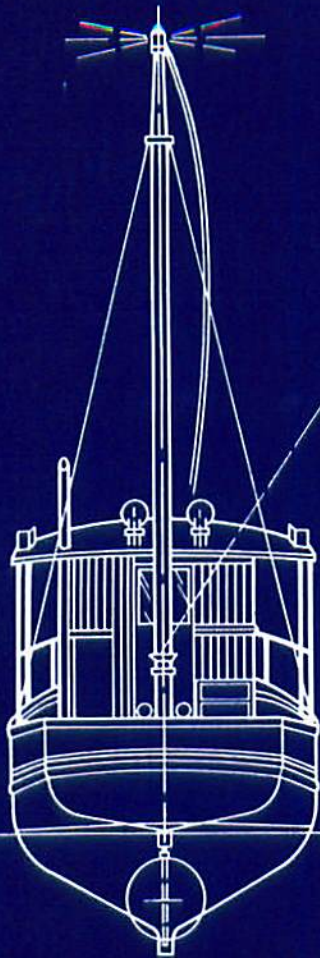


MASGC-Q-78-003



1978 ANNUAL REPORT

*Mississippi - Alabama
Sea Grant Consortium*

JANUARY 1, 1978
to
JUNE 30, 1979

MASGP-79-019

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Mobile, Alabama


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Tuskegee, Alabama

University of Southern Mississippi
Hattiesburg, Mississippi

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**1978 Annual Report
Mississippi-Alabama
Sea Grant Consortium**

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CREW AND CATCH — A crew member from a Pascagoula, Mississippi, boat poses with a snapper from the day's catch. Mississippi has been the leading state in snapper landings in years past. Commercial catches of red snapper totalled 2.3 million pounds in 1972 in Mississippi.



Director's Preface

DR. JAMES I. JONES
Director

The 1978 Mississippi-Alabama Sea Grant Consortium's program, encompassing the period from July 1, 1978, through June 30, 1979, has been a period of significant accomplishment and change. The accomplishment is documented by major programmatic federal funding increases and the elevation of the MASGC Program from Coherent Area to Institutional status. The changes which have developed within the program are those which have been instituted to provide increased response to identified public needs in the marine resource area, and to develop a project and program review mechanism whereby only the finest, most needed research efforts were included within the program. Additionally, significant new efforts were directed toward increasing broadly scoped marine educational opportunities within the bi-state area.

As a result of the changing program emphasis this annual report may be considered transitional to a newly developed programmatic philosophy, in which the primary emphasis of the program will be placed upon the enhancement of mankind's realization of the ocean environment, or to phrase it differently, upon the wise development and utilization of the marine environment for man's needs and activities. Conservation of marine resources is a major theme in this philosophy, with conservation properly defined as "wise utilization." The reader will note that the foregoing emphasizes the **use** of marine resources for man's benefit. This is a fundamental and appropriate role for Sea Grant. Housed as it is within the U.S. Department of Commerce, it deals primarily with users of the ocean resource while developing research programs with a major emphasis and requirement on application of the research product. Thus, within the developing program there is a major emphasis upon the identification and evaluation of marine resources. Living marine resource development activities comprise the bulk of the research program itself, while practically all of the Marine Advisory Service effort lies within this subject area. It need be noted that living marine resources research includes not only those studies and activities relating to the fish or fishery themselves, but also includes any efforts to characterize, better understand or evaluate the habitats essential to the continued

productivity and health of a given living marine resource or ecosystem. This inclusion of habitat as an essential element of living marine resource understanding and management greatly increases the scope of those research and other efforts which may be included within this category.

The increased emphasis upon formal marine educational aspects is exemplified by new efforts of the program to reach the Kindergarten through 12th grade students within the bi-state region and by supplementing existing and new efforts at the college undergraduate and graduate student level.

Finally, during the transition period a number of new initiatives have been developed. These deal primarily within those areas of concern and interest previously described under living marine resource development and broadened educational opportunities and activities. The results of these new initiatives will not be reported until a later year, but the fact of their initiation is important to an understanding of the growth and development of the Mississippi-Alabama Sea Grant Consortium program within this period of transition and change.

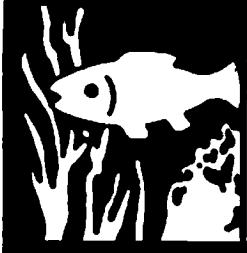
Respectfully,

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 tail.

James I. Jones, Director

Research





Living Resources

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

Wendell J. Lorio
Opal H. Dakin

Mississippi State University
Mississippi State University

SUMMARY: In the second year of this three-year study, data have been collected on finfish catches by commercial and sport fishermen. Aerial censuses of study areas around the barrier islands of coastal Mississippi have been conducted. Aerial trip reports have been supplied regularly to eleven local, state and federal fishery agencies.

Competition for use of the same resource by two different interest groups fuels the age old controversy between recreational and commercial fishermen. The sport fisherman contends that commercial fishermen are depleting the population of sport fish, especially with use of monofilament gill nets. The commercial fisherman's stand is that he is attempting to make a living at fishing and is using the most efficient gear available to do so.

Even though the controversy has been a continuing one, there has been no substantial data base for making scientifically sound decisions on management of this finfish resource. This three-year study is an effort to collect, analyze and disseminate data on the impact of netting and sport fishing on such finfish species as spotted seatrout, red drum and Spanish mackerel. In the 1977 and 1978 effort, the creel census technique has been found to be an effective fish sampling method allowing evaluation of the efforts of both sport and

commercial fishermen. On any given sample day, all fishermen in a selected area around either Cat, Ship, or Horn Islands were counted then interviewed when possible. Interviews covered location of catch, size, species, gear used and fishing time involved. After the interview, each fisherman was given a postcard and asked to provide information about total trip duration and total catch.

Aerial counts around the barrier islands were coordinated with the creel census. Three aerial counts were made monthly, two on weekend days and one on weekdays. Boats were counted and classified as commercial or sport. The number of fishermen per boat was determined when possible. Trip reports of these aerial censuses were provided monthly to eleven local, state, and federal fishery agencies. Creel census information underwent analysis by the Institute of Statistics at North Carolina State University. An overview of 1977 and 1978 data is based on interviews with 933 sport and 25 commercial fishermen in

1977 and 872 sport and 32 commercial fishermen in 1978.

The small number of commercial fishermen interviewed in the study area was attributed in part to the restrictions on gill netting around the barrier islands May 15 through September 15 in 1978. The 1978 estimated commercial catch of 28,624 pounds also reflected the restriction on gill netting during the peak commercial fishing season. In contrast the estimated weight of the 1977 commercial catch was 582,040 pounds.

Sport catch was estimated at 142,696 pounds for 1977 and 136,262 pounds for 1978. The 1977 catch was smaller in numbers but contained larger fish. The 1977 adult fish were excellent reproduction stock that resulted in numerous but smaller fish in the following year's catches. (See Table 1 and 2 for estimated catch by species and weight.)

Fishing pressure was greater on

weekends but harvest was greater on weekdays for both years. Ship Island experienced the most pressure in 1977 and Horn Island in 1978. Sciaenidae (kingfishes, drumfishes, etc.) were more prevalent in catches on the western side of Mississippi Sound and Spanish mackerel more prevalent on the eastern side.

Interviews showed retirees and students comprised 47 and 46 percent of the sports fishing group in 1977 and 1978 respectively. Of sports fishermen interviewed, 91 percent in 1977 and 84 percent in 1978 were Mississippi residents. For both years more than 90 percent spent less than one-fifth of their trip time in Louisiana waters. During the third year of this study, the creel censuses will continue. Experimental gill netting with different mesh sizes will also be conducted to determine species and sizes caught and to collect life history data on sport and commercially important species.

TABLE 1. The estimated weight (lbs.) of fishes caught by commercial fishermen in the study area during 1977 and 1978.

| SPECIES | TOTAL | |
|-------------------|----------------|---------------|
| | 1977 | 1978 |
| Spotted Seatrout | 8,705 | 1,848 |
| Sand Seatrout | 0 | 145 |
| Atlantic Croaker | 338 | 0 |
| Red Drum | 122,161 | 427 |
| Black Drum | 0 | 0 |
| Southern Flounder | 90 | 27 |
| Sea Catfish | 22,889 | 22,282 |
| Sheepshead | 3,944 | 0 |
| Spanish Mackerel | 86,339 | 2,610 |
| Other Species | 337,574 | 1,285 |
| TOTALS | 582,040 | 28,624 |

TABLE 2. The estimated weight (lbs.) of fishes caught by sport fishermen during 1977 and 1978.

| SPECIES | TOTAL | |
|-------------------|----------------|----------------|
| | 1977 | 1978 |
| Spotted Seatrout | 13,425 | 30,692 |
| Sand Seatrout | 8,283 | 13,207 |
| Atlantic Croaker | 4,388 | 5,887 |
| Red Drum | 14,613 | 7,394 |
| Black Drum | 0 | 1,795 |
| Southern Flounder | 2,743 | 6,071 |
| Sea Catfish | 28,640 | 11,516 |
| Sheepshead | 1,381 | 11,117 |
| Spanish Mackerel | 10,836 | 11,836 |
| Other Species | 58,387 | 36,747 |
| TOTALS | 142,696 | 136,262 |

Seasonal Distributional Patterns of River Shrimp, *Macrobrachium ohione*, In the Pascagoula River Estuary

Gary Anderson

University of Southern Mississippi

SUMMARY: Popular as bait for freshwater and salt water sport fishing, the adult river shrimp, *Macrobrachium ohione*, is important as a source of income to a small number of commercial river shrimp trappers in Jackson County, Mississippi. Habitat preference and movement patterns of river shrimp were studied through systematic trapping, plankton tows and recapture of marked shrimp in this study.

Smallest and most abundant of the four species of *Macrobrachium* reported in Mississippi waters, *Macrobrachium ohione*, or river shrimp, is a popular bait among freshwater and salt water sport fishermen. The species is found in most river systems of the northern Gulf of Mexico west of Mobile, Alabama, and on the eastern seaboard from Virginia to Georgia.

There is a healthy market for these shrimp in the Pascagoula River study area. Fourteen marinas were located which sell this species as bait at prices of 4 to 6 cents each. Sales of river shrimp as bait accounted for an estimated 10 to 20 percent of the income for most fish camp/marina operators in the study area.

Results of this study show that the population of *M. ohione* in the Pascagoula River seems small but adequate to support the present fishery. Adult river shrimp are trapped most successfully in the warmer months in relatively low salinity. Data showed that during the peak summer season, trappers using 20 traps may catch 10 to 30 pounds each day. The study also indicated that populations of river shrimp are most likely recruited from larvae that develop in brackish water, and adult river shrimp travel distances up to one-third mile per day during spring freshet conditions.

Trapping to determine habitat preference involved 47 stations selected at random in approximately 75 miles of the Pascagoula River system north of U.S.

Highway 90 and south of the point where Black Creek enters the river. As traps were retrieved, data on water conditions were recorded. Shrimp abundance was directly correlated to temperature and inversely correlated to salt content. There was no apparent relationship between oxygen content or water depth and shrimp abundance.

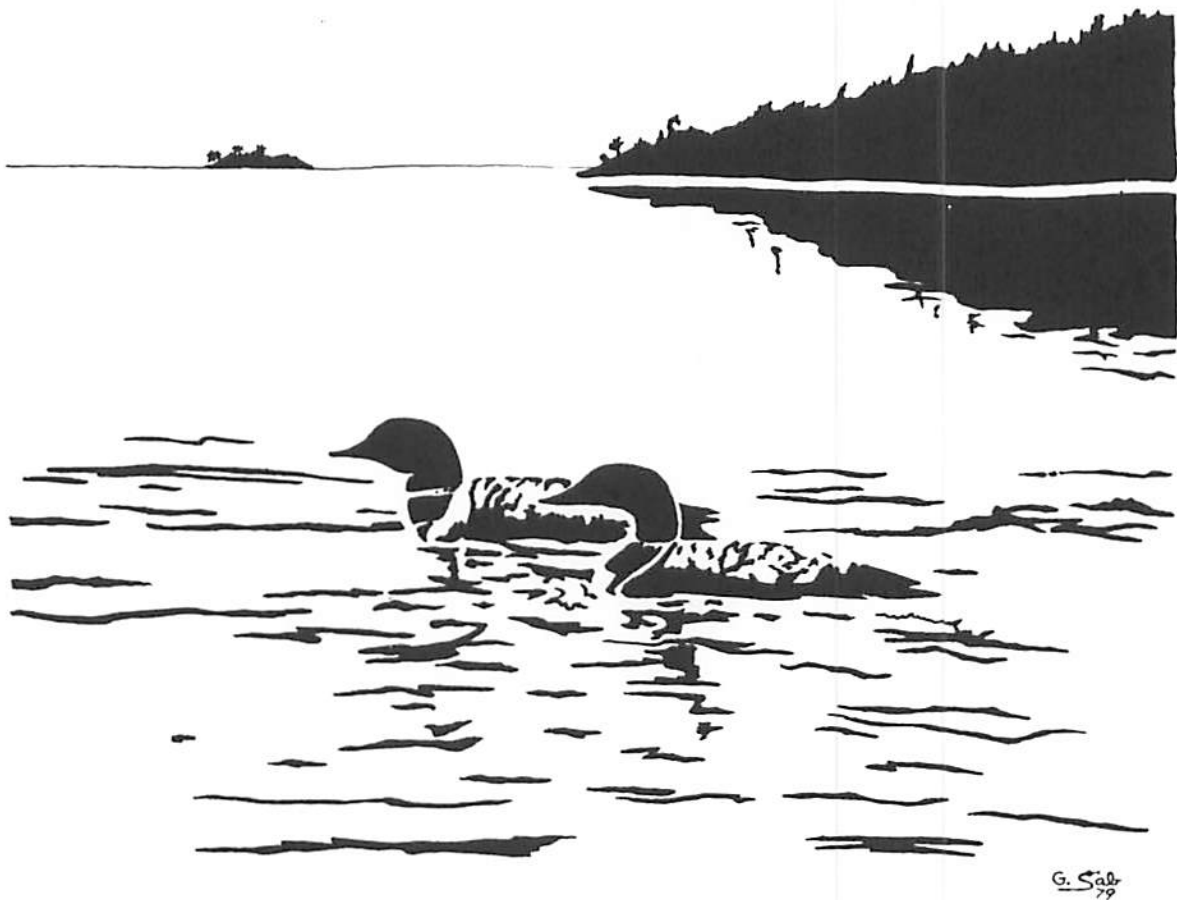
Results of plankton tow population evaluation led to the conclusion that adult female shrimp release larvae that drift passively downstream to develop as planktonic forms in brackish water. Results of laboratory studies suggest that after 36 - 118 days the young shrimp settle to the bottom and swim upstream as they grow to the adult stage.

This upstream movement was examined by the release of 7,455 adult shrimp injected with dye and released on April 12, 1978. All 147 shrimp recaptured prior to August 5 were upstream from the release site, some as far as 11 miles upstream. This phase of the study showed that river shrimp are capable of swimming up to one-third mile upstream per day.

A second mark-recapture study designed to determine population size was affected by bad weather and flooding. Collections of large samples and determination of individual growth rates of shrimp size classes of both sexes need to be made before a rigorous stock assessment and population dynamics analysis can be developed for this species in the Pascagoula River estuary.

Publications

Anderson, Gary and G.A. Fillingame. 1980. "The Occurrence of *Macrobrachium Olfersii* and *Macrobrachium Carcinus* in Southern Mississippi, U.S.A." *Crustaceana*. 39(1): 90-94. MASGP-78-037.



ART AND MARINE EDUCATION — This pen and ink drawing by Gary Sablich, Biloxi High School student, was one of 7,300 prints produced and distributed as part of a program to encourage participation of minorities and disadvantaged students in marine education. (See Page 39)

Slipper Lobster Potential in the Northern Gulf Of Mexico

George F. Crozier
Robert Shipp
James Langdon

University of South Alabama
University of South Alabama
University of South Alabama

SUMMARY: The effort to assess the potential of the slipper lobster as an alternative fishery for the northern Gulf of Mexico has involved trap design and evaluation, trapping activity and underwater observation. Dives with a research submersible have significantly expanded knowledge about the northern ledge of the DeSoto Canyon, an area off the Alabama/Florida coast that has experienced little documented direct observation.

In the second year of this study, concentrations of slipper lobster, *Scyllarides nodifer*, have been located and observed. Further study would be necessary, however, to determine the feasibility of a slipper lobster fishery. Investigation of the potential slipper lobster fishery has been characterized by two phases, direct observation and work with traps.

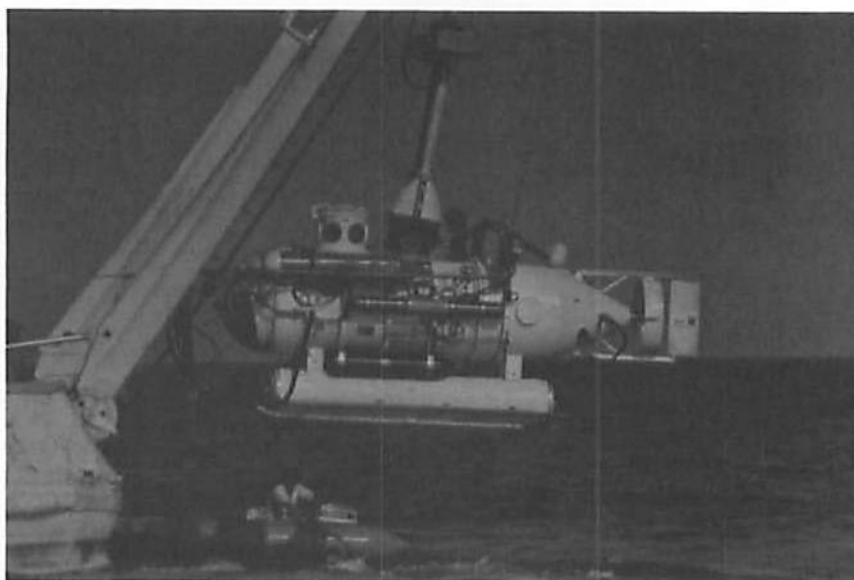
For the first time in this area, a research submersible was used for direct observation. The research submersible *Diaphus* is a five metric ton, battery-powered craft capable of dives to 400 meters and a forward speed of 2 km/hour.

The *Diaphus* carries a pilot and one observer.

Of 27 dives made, 11 were over relatively uniform mud/shell hash areas approximately 50 km SSW of Dauphin Island, Alabama; two were in sand/shell hash areas 20 km SSW of Destin, Florida; and 14 were along the northern rim of the DeSoto Canyon, a high relief area off the Alabama/Florida coast.

Few *S. nodifer* were sighted at the first two dive areas although several had been taken in earlier trawling activity. Trawling had indicated heaviest concentrations of the slipper lobster at the DeSoto Canyon's northern ledge. This area is easily found

UNDERWATER RESEARCH — Use of the research submersible *Diaphus* enabled investigators to make extensive direct observations in the 50-60 meter depths at the DeSoto Canyon's northern ledge.



with a fathometer and extends from about 25 km south of Navarre, Florida, west southwesterly for approximately 25 km.

Day, twilight and night dives of about three hours each were made during a June 27-June 30, 1978, period at the DeSoto Canyon area. Observations of invertebrates were divided according to those found in the sand-shell-coraline-algae slope above and below the Canyon rim's block ridges of limestone and those found in the block ridges. *S. nodifer* was among prominent decapod crustacea inhabiting the blocklike limestone.

Although the area is heavily fished by commercial and sport fishermen, its 50-60 meter depths have precluded extensive direct observations by SCUBA. Neither depth nor duration posed problems for the *Diaphus*, but investigators found that the submersible's lack of maneuverability limited the necessary close range observation of cryptic forms such as the slipper lobster.

Direct observation of the area was especially productive, however, in pro-

viding a preliminary account of deep water reef fishes in their natural environment. Thirty fish species were positively identified and their habitat and abundance observed. In spite of heavy fishing pressure indicated by numerous sightings of lost gear and anchors, red snapper and grouper were among species sighted in abundance.

A second phase of the project involved trapping activities with traps of various designs made from juniper wood or metal. Although no *S. nodifer* was taken in the October 1978 cruise, traps withstood normal use with minimal damage. Later evaluation indicated lobsters avoided the traps that were uncured.

Further laboratory experimentation indicated lobsters actively sought bait on traps and several entered and did not escape. Experimentation indicated improved trap design would increase effectiveness. Entrances larger proportionally to trap size would probably yield a higher success rate.

Publications

Shipp, Robert L. and Thomas S. Hopkins. 1978. Physical and Biological Observations of the Northern Rim of the DeSoto Canyon Made from a Research Submersible. *Northeast Gulf Science*. 2(2): 113-121. MASGP-78-040.

A Survey of Gulf Coast Oysters for Pathogenic Organisms

William E. Hawkins

University of South Alabama

SUMMARY: During this project examination of samples from various Mississippi Sound areas showed no pathogenic organisms in the digestive glands of oysters. Differences in tissue organization existed between oysters from relatively unpolluted areas and oysters from polluted waters, with a potential disease condition occurring in oysters from waters near Point Cadet in Biloxi Bay.

This study was originally designed to determine whether Gulf Coast oysters harbored certain pathogenic organisms in their digestive gland tissues. Such organisms have been found in oysters from other areas in inclusion bodies, structures which are easily recognized with light and electron microscopy.

None of these pathogenic organisms was found in local oysters taken in intermittent sampling during a nine month period. Examination of oyster tissue did reveal a condition tentatively diagnosed as leucocytosis in oysters taken from an area near Point Cadet in Biloxi Bay. The condition is characterized by increased numbers of white blood cells in and around blood vessels and connective tissue of the mantle. In comparison, oysters taken from near Dauphin Island in the Mississippi Sound appeared normal with little or no evidence of leucocytosis.

With no evidence of pathogenic organisms, a shift in emphasis developed early in the study. Light and electron microscopical examination was expanded to learn more about oyster cell and tissue response to diseases and varying environmental conditions. Tissue differences were evident in the first samples taken from Point Cadet in Biloxi Bay, an area closed to oystering. Examination showed

infiltration of amoebocytes into connective tissue spaces and congestion of amoebocytes in blood sinuses. Tissue appeared normal in oysters taken in the relatively unpolluted waters near Dauphin Island, Alabama.

Examination of later samples continued to show more amoebocytic infiltration, clotting and parasitic infection in Point Cadet oysters than in Dauphin Island oysters. Fibrous cysts and a possible neoplastic growth (tumor) were also found. These findings were significant because tumors are rare in oysters and those that have been reported were not related to causative factors such as water quality.

In an examination of hearts, inclusions that are often associated with disease processes in mammalian tissues were found in oyster muscle fiber. Mitochondria (sites of energy production in cells) of muscle fibers often contained inclusions in the form of crystals or paracrystalline arrays of mitochondrial contents.

These studies point to the fact that further research is needed on the condition of oyster cells and tissues, the presence of microscopic and submicroscopic parasites and pathogens of oysters, and the cell and tissue differences among oysters from various sites in Gulf coastal waters.

Utilization of Chitin to Control Pesticide Mobility

Charles L. McCormick
Richard H. Pierce

University of Southern Mississippi
University of Southern Mississippi

SUMMARY: This project is an effort to reduce pesticide movement to non-target environments, such as rivers and bays. Research has centered on development of controlled-release systems in which pesticides are chemically attached to biologically degradable polymers such as chitin. In the second year of this study, new syntheses and analytical methods have been developed that have advanced polymer-pesticide research substantially. Polymer herbicide systems have been prepared that show extended effectiveness against weeds in soybeans at reduced application levels. Publications and presentations have generated interest and support in industry as well as the academic community.

Pesticides have generally been accepted as necessary in the production of high yield crops to feed the world's growing population. There is continued concern, however, about the effects of these chemicals on human beings and on harmless or beneficial plants and animals. The object of this study is to combine agricultural pesticides and chitin, a biodegradable polymer available as a waste product of the seafood industry, into controlled-release systems.

Controlled-release technology offers advantages to agriculture pesticides such as longer activity, fewer applications and increased safety. At the same time, controlled-release pesticides create fewer environmental casualties. Pesticides bound to larger "macromolecules" are less likely to filter into runoff water to eventually contaminate water supplies, streams, rivers, oceans and the life these waters support.

There are two categories of polymeric controlled-release systems. In the first the pesticide is physically dissolved, entrapped or dispersed in the polymeric matrix. In the second the pesticide is chemically bound (pendent) to the macromolecular backbone of the polymer. Release depends on the chemical or biological breakdown of the polymer-pesticide bond. The nature of the bond can be varied to provide varied release rates.

In this project, herbicides are bound to pre-formed polymers of naturally occurring polysaccharides such as chitin, cellulose and starch. A barrier to synthesis of polysaccharides with pendent herbicides has been broken with the discovery of a new solvent in which the herbicide-polymer reaction can take place. Most previously reported research with similar systems has encountered problems because bonding occurred only on exposed surfaces of the polymer, failing to result in a homogeneous reaction. The polymers' lack of solubility also interfered with the use of analytical procedures to precisely identify molecular structures. The new solvent, N,N-dimethylacetamide (DMAc) with five percent lithium chloride salt, provides the desired homogeneous reaction. Subsequent analysis by such methods as gel permeation chromatography and infrared, ultraviolet, and nuclear magnetic resonance spectroscopy is also possible with this solvent.

Adaptation of high pressure liquid chromatography has proved to be a significant development in determining release rates and other characteristics of polymer-herbicide systems. The increased speed and accuracy of the chromatographic method is especially important in view of the extensive analysis involved in this research. In this procedure the solvent is

pumped through a chromatography column under high pressure. A sample drawn from a water and polymer-herbicide mixture is injected into the solvent. As the mixture passes through the column, each component passes, or elutes, out at a rate determined by its chemical characteristics. Ultraviolet and refractive index detectors record signals which are used to calculate concentrations of free herbicide and hydrolysis products in the mixture.

Initial results indicate rates of release in water depend on the character of the polymer-to-herbicide bond, the polymer/water interaction, particle size, and the pH value of the solution.

First generation controlled-release herbicides from polyvinyl alcohol have shown good results in greenhouse tests conducted by the United States Department of Agriculture Weed Science Laboratories at Stoneville, Mississippi. Data from the USDA laboratory show that the model system with polyvinyl alcohol and metribuzin, a relatively new herbicide used extensively for weed control in soybeans, exhibits increased potency in contrast

with conventional herbicides.

Second generation controlled-release systems of chitin with 2,4-D (2,4-dichlorophenoxyacetic acid), dalapon and metribuzin have been synthesized. Polymers have been prepared containing from 24 to 80 percent pendent herbicide by weight. Attempts are being made to increase weight ratios of herbicide to polymer. Preliminary syntheses of controlled-release systems with cellulose, amylose and dextran have also been successful.

Presentations at a number of industrial laboratories have generated interest in commercially produced controlled-release systems. Initial economic feasibility studies have begun at Hopkins Chemical Company in Madison, Wisconsin. Pilot facilities are being designed there to produce quantities necessary for small-scale field evaluation of controlled-release herbicides developed through this project. Investigation of second generation polymeric pesticides is continuing with the ultimate goal of large-scale testing, licensing and commercialization.

Publications

- McCormick, Charles L. 1980. Biodegradable Polysaccharides for Controlled Release of Pendent Herbicides. *Polymer Preprints*. 21: 109-110.
- McCormick, Charles L. and D.K. Lichatowich. 1979. Homogeneous Solution Reactions of Cellulose, Chitin, and Other Polysaccharides to Produce Controlled-Activity Pesticide Systems. *Journal of Polymer Science: Polymer Letters Edition*. 17: 479-484. MASGP-78-045.
- McCormick, Charles L., D.K. Lichatowich and M.M. Fooladi. 1978. Synthesis and Characterization of Controlled-Activity Pendent Herbicide Systems Utilizing Chitin and Other Biodegradable Polymers. *Proceedings of the 5th International Symposium on Controlled Release of Bio-active Materials*. 3.6-3.17. MASGP-78-026.
- Savage, K.E., C.L. McCormick and B.H. Hutchinson. 1978. Biological Evaluation of Polymeric Controlled Activity Herbicide Systems Containing Pendent Metribuzin. *Proceedings of the 5th International Symposium on Controlled Release Bio-active Materials*. 3.18-3.28. MASGP-78-027.

Cooperating Organizations

Hopkins Chemical Company
USDA Weed Science Laboratory

Evaluation of the Ecological Role and Techniques for the Management of Tidal Marshes on the Mississippi and Alabama Gulf Coast

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A.A. de la Cruz
M. Susan Ivester
Judy P. Stout
Courtney T. Hackney
Robert W. Landers

Mississippi State University
Mississippi State University
University of Alabama in Birmingham
University of South Alabama
Mississippi State University
University of South Alabama

SUMMARY: In this three year study, fire, harvest and fertilization as management tools for tidal marshes were investigated for their effect on the structure and productivity of vegetation, on decomposition and microbial processes, and on the faunal community on, or in the marsh bottom.

Although the value of tidal marshes in marine ecology has become better understood and accepted, growing coastal populations and potential uses for some marsh vascular plants have placed conflicting demands on the coastal zone and its wetlands. To resolve these conflicts, management techniques must be developed that will maintain the productivity of tidal marshes and their value to both man and wildlife. This study is an effort to evaluate the relative productivity of different types of tidal marshes and to investigate the effects of various management tools on the marshes and their inhabitants. During 1977 and 1978 two marsh communities in St. Louis Bay, Mississippi, and two in Dauphin Island, Alabama, were used to evaluate the effects of fire, fertilizer and simulated harvest. Productivity was examined for aboveground (leaves and stems) and belowground (rhizomes and/or roots) portions of needlerush, *Juncus roemerianus*, smooth cordgrass, *Spartina alterniflora*, and giant cordgrass, *S. cynosuroides*.

Natural communities of the three major species and the minor species of wire grass, *S. patens*, and salt grass, *Distichlis spicata*, were studied for seasonal patterns

of productivity, elemental composition and decomposition. Although the annual aboveground net primary productivity (NPP) was within ranges determined for those species in similar environmental settings, the levels for Mississippi and Alabama marshes were on the low end of the range. The one exception was *S. cynosuroides* which had higher productivity.

Fertilization produced significant increases in annual NPP. For the 1978 growing season, aboveground NPP increased by 59 percent in the Alabama *J. roemerianus*, 76 percent in the Mississippi *J. roemerianus*, 82 percent in *S. alterniflora* and 24 percent in *S. cynosuroides*. Commercial fertilizers were used, and nitrogen in the ammonium form was better used by marsh plants than nitrogen in the NO₃ (nitrate) form. Responses to fertilization varied among different growth forms of the same species such as short and tall *S. alterniflora* and high and low marsh *Juncus*.

Effects of harvesting were also varied. There appeared to be some increase in biomass production with little detrimental effect on productivity. Winter fire stimulated productivity of *Juncus* and *S. cynosuroides* in the growing season that

immediately followed. Results were temporary, however, with productivity returning to natural levels in the second growing season if burning was not repeated.

For the most part, the marsh plants' availability as food depends on decomposition. In the microfloral study of decomposition, plate counts were made on four media for bacteria, molds, yeasts and actinomycetes found in the marshes. Pure cultures of more than 60 representative microorganisms were isolated and studied. In laboratory tests employing cellulose as substrate, only four of 20 isolates demonstrated significant cellulose utilization.

In tests with *J. roemerianus* and *S. alterniflora* as substrates, all pure cultures readily decomposed both plant species, with and without the presence of oxygen. Decomposition rates and end products of decomposition varied widely. Significant in the food chain, protein production in four weeks reached as high as 2.2 mg of protein per gram of substrate in *Juncus* and as high as 2.4 mg of protein/gram of substrate for *Spartina*. This study suggests an effective management technique

would be to foster growth of microorganisms that produce the greatest quantity of protein per unit of marsh grass in the decomposition process.

Examination of macrofauna (forms larger than 1.5 millimeter) and meiofauna (organisms between .063 and 0.5 millimeters) showed only a few highly specialized groups. The abundance of those forms, however, was high. The class Oligochaeta were the dominant organisms among the macrofauna with the majority terrestrial rather than marine in origin. The significant increase within the *Spartina* and the *Juncus* communities of terrestrial oligochetes seems to indicate that these marshes are undergoing change toward a non-marine environment. Nematoda and Copepoda (Harpacticoida) comprised 80 to 95 percent of the meiofauna.

The components of this study have provided knowledge valuable in management and planning decisions on use of Mississippi and Alabama coastal marshes. The scope of experimentation, analysis and evaluation has established a foundation for research on the long range effects of management techniques on the tidal marsh ecosystem.

Publications

- De la Cruz, Armando. 1978. Production and Transport of Detritus in Wetlands. *Wetland Functions and Values: The State of Our Understanding — Proceedings of the National Symposium on Wetlands, American Water Resources Association, Minneapolis, Minn.* 162-174. MASGP-78-039.
- De la Cruz, Armando, Courtney Hackney, Judy Stout. 1980. Aboveground Net Primary Productivity of Three Gulf Coast Marsh Macrophytes in Artificially Fertilized Plots. *Proceedings of the First International Symposium on Nutrient Enrichment in Estuaries.* MASGP-78-047.
- Hackney, C.T. and A.A. de la Cruz. 1979. In Situ Decomposition of Roots and Rhizomes of Two Tidal Marsh Plants. In Press. *Ecology.* MASGP-77-040.
- Parsons, Keith A. and A.A. de la Cruz. 1979. Energy Flow and Grazing Behavior of *Conocephalinae* Grasshoppers In a *Juncus Roemarianus* Marsh. In Press. *Ecology.* MASGP-77-041.
- Stout, Judy. 1978. Evaluation of the Ecological Role and Techniques for the Management of Tidal Marshes on the Mississippi and Alabama Gulf Coast. MASGP-78-044.
- Stout, Judy, A.A. de la Cruz, Courtney C. Hackney. 1978. The Effects of Harvesting on the Productivity of Selected Gulf Coast Marsh Species. *Proceedings of the 5th Biennial International Estuarine Research Conference.*

Longlining Potential Off Mississippi/Alabama

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SUMMARY: The goals of this project were to assess stocks of potential longline fish species from waters near the Mississippi/Alabama coastal areas and to test effectiveness of longlining gear. Sampling results indicated predominant species are sharks. This study provided significant data useful in the current shark management planning program. Data suggested longlining farther offshore would be necessary for billfish catches.

Longlining is a method of high seas fishing used by fishing fleets around the world. Although few United States fishermen use longlining in the Gulf of Mexico, Japanese and Cuban fleets harvested billfish, tuna and shark within the 200 mile Fishery Conservation Zone until restrictions on foreign fishing were imposed pending completion of management plans.

With the foreign interest in longlining in the Gulf and the economic necessity of exploring alternative fisheries, this study's examination of potential longlining species is significant. Data generated by this study is contributing to resource management planning for the Gulf of Mexico and provides potential longlining fishermen with information needed to assess the viability of such a fishing technique in the north central Gulf.

Nineteen longlining cruises were made between March 14, 1978, and June 1, 1979, to determine composition of larger offshore fish species. Shark species dominated catches in near shore waters to 100 fathoms, and few other species were noted. No billfish were taken in near shore waters, indicating that longlining farther offshore is necessary for any significant billfish catches. This project provides a base for evaluating species composition, seasonal occurrence and population sizes of various shark species. Bait preference (or lack of preference), percent success,

and percent hook strike for various seasons and locality are also available through this study. This data is especially important in view of the rapidly expanding recreational shark fishery in the Gulf of Mexico and the developing interest in a large-scale commercial shark fishery.

Environmental Science and Engineering, Inc., the contractor preparing the Gulf of Mexico Fishery Management Council's Management Plan for Sharks, has been supplied with research reports from this project.

The second goal of this study was to test longlining gear. Equipment for commercial swordfish catches was used.

Summary of experimental longlining activity in the north central Gulf of Mexico March 1978 - June 1979.

| | |
|---|--------|
| Number times longline set | 51 |
| Number hooks (range) | 18-185 |
| Total number hooks set | 4,324 |
| Total number fish caught | 229 |
| Average number hooks per set | 83.02 |
| Average number fish per set | 4.49 |
| Fish per hook | 0.054 |
| Hooks per fish | 18.49 |

Specifically designed to avoid handling sharks unnecessarily, the gear allowed hooked sharks to cut leaders and escape. That sharks comprised the majority of specimens caught was evident early in the study, and experimentation with gear was begun to determine what species of sharks were being lost due to equipment design.

Hook loss stopped and larger shark species began appearing in catch records when leaders of 3/32" 7x7 soft lay wire cable were used. Should a shark fishery develop, use of this type cable is

recommended over chain leaders used by the 1940's Florida shark fishery.

Also related to gear effectiveness was the high percentage of bait loss in waters less than 40 meters. With many hooks set on bottom, bait loss was assumed to result from feeding by crabs, catfish, and small sharks unable to swallow large hooks.

Sampling using longlining techniques in areas beyond 100 fathoms is continuing through the support of Dauphin Island Sea Lab in-house funding.

Cooperative Billfish Study

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SUMMARY: Although billfishes are important in sport and commercial fisheries in the Gulf of Mexico, little is known of their life history. Identification of billfish larvae could provide an important tool in assessing stock sizes. This project provided preliminary work setting up a cooperative study with National Marine Fisheries Service (NMFS). Known data were assembled, specimens examined and problems connected with identifying billfish larvae defined.

The Mississippi-Alabama Sea Grant Consortium provided necessary seed money to initiate a study on larval billfishes of the western Atlantic and Gulf of Mexico in cooperation with the National Marine Fisheries Service. The primary research goal is to establish identification of all billfish species in the Gulf of Mexico and adjacent waters in the Atlantic. Once larvae can be positively identified, they can serve as useful tools for resource assessment.

Species involved are Atlantic sailfish, *Istiophorus platypterus*, longbill spearfish, *Tetrapterus pfluegeri*, white marlin, *Tetrapterus albidus*, and Atlantic blue marlin, *Makaira nigricans*. The longbill spearfish larvae can be identified due to a winter spawning period and a characteristic pigment on the gill membrane. Current knowledge provides little assistance in positively identifying larvae of the other three species.

Examination of more than 1,200 specimens of billfish larvae received from the NMFS Miami Laboratory has posed significant questions. Two kinds of larvae have been distinguished on the basis of amount

of lower jaw pigment and relative snout length. These two groups are tentatively identified as sailfish and blue marlin. No white marlin have been identified although the relative abundance of adults in the collection area would seem to indicate larvae should also be present.

If white marlin larvae are present in the samples, three distinct kinds of larvae should be present. Since only two kinds are apparent and those two are similar, questions are raised as to the validity of the three species (sailfish, blue marlin and white marlin) and their placement in three different genera. Another possibility is that if white marlin larvae are actually missing from samples, their early life history is different. Knowledge of such a difference could be vital in management of the resource.

Future research with NMFS co-investigator Dr. William Richards to resolve these identification problems will include fine measurements of various larval body parts, examination of head spine angles on specimens, osteological comparisons using stained material and possibly scanning electron microscopy.



Coastal Policy Studies

A Mississippi Marine Finfish (Selected) Fishery Management Plan

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SUMMARY: Coastal population growth, a rising demand for seafood and the growing number of recreational fishermen have increased pressure on finfish resources in the Gulf of Mexico. The overall goal for development of this plan is management of the Gulf of Mexico marine finfish resources in Mississippi's territorial and internal waters for the greatest sustained yield. The proposed plan was adopted by the Mississippi Marine Conservation Commission on June 27, 1979.

The finfish of Mississippi coastal waters have traditionally been regarded as an unlimited resource. Now, however, greater percentages of an increasing population fish Mississippi waters. At the same time, growth and development of the coastal area directly or indirectly cause changes in finfish habitats. To maintain best benefits for Mississippi, the other Gulf states and the nation, intelligent management is required.

Such management demands an understanding of the life cycles of the different finfish species, their habitats at each developmental stage, monitoring on a continuing basis and a system for examining alternatives, taking action and communicating with persons and institutions concerned with these living resources.

The Mississippi Marine Conservation Commission selected 10 finfish species for inclusion in this plan. They are spotted seatrout, sand seatrout, red drum,

flounder, menhaden, southern kingfish, croaker, mullet, sheepshead, and black drum.

The management plan developed provides a framework for attacking problems, includes all known data about the 10 species, identifies gaps in technical data and sets up a five-year management action program. The management model is complementary with plans being formulated by area fishery councils for the Fishery Conservation Zone (FCZ, the 200-mile limit) to be administered by the federal government.

Included in the plan is a Management Action Program Summary which outlines biological, economic, environmental and administrative functions of the fishery management. The summary also charts funds needed, possible funding sources and suggested institutions or agencies to effect various objectives in the five-year program.

A top priority is collection and dissem-

ination of catch statistics required for optimum yield management. Catch statistics for Mississippi's recreational fishery were found to be limited and failed to provide an adequate data base for rational management. All available reports indicate the recreational catch of favored target species generally exceeds reported commercial landings.

Examination of commercial catch records for 1968-77 indicated that industrial finfish (menhaden and bottom fish) accounted for 98.0 percent of the finfish volume reported and for 84.2 percent of the value. Reported commercial landings of foodfish composed 2 percent of the volume and 15.8 percent of the value. Foodfish catch included numerous species harvested by both commercial and recreational fishermen.

Also among high priority tasks cited in the management action summary are coordination among data gathering and analysis programs, implementing agencies, and user groups; development and implementation of effective communication among management and user groups; and monitoring and assessment of all life history stages of the selected

species.

Other high priorities are evaluation of benefits from finfish resources harvested by recreational and commercial fisheries; a review of Mississippi statutory regulations and assessment of their effect on finfish management; development of a management plan for all marine fishery resources in Mississippi; identification of jurisdictional constraints on Mississippi finfish management; and support of controlled introduction of fresh water into Mississippi estuarine areas as feasible.

Representatives of Gulf Coast Research Laboratory, Mississippi Marine Conservation Commission, University of Southern Mississippi and Mississippi-Alabama Sea Grant Advisory Service composed the working group which developed the plan. Providing additional discussion and review were members of an advisory group drawn from commercial fishermen, recreational fishermen, seafood processors and consumers of Jackson, Harrison and Hancock counties. Advisory group members participated in two workshops and reviewed drafts of all material used.

Publications

Etzold, David J., and J.Y. Christmas (editors). 1979. A Mississippi Marine Finfish Management Plan. MASGP-78-046.

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

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SUMMARY: During the second year of this three-year study, data were assembled, analyzed and published on the magnitude of air, water and solid waste pollution generated by economic activities in the Mississippi coastal region. The environmental model prepared is a necessary step for linkage of economic and environmental factors. Investigators also collaborated on preparation of an economic input-output analysis for the Mississippi-Alabama coastal counties.

Air and water have traditionally been considered "free goods" by private producers in the development of this nation. The fact that there have been no social or economic charges for use of these publicly owned resources has been a major cause of degradation of the environment.

Economic research can help define the relationships between various "producers" and undesirable effects on the environment. Linkage of economic sectors and the environment will provide decision-makers with a useful tool for attributing responsibility for existing air and water quality and for evaluating the pressure prospective industries or development will put on the environment.

The objective of the second year of this study has been to determine the magnitude of air, water and solid waste pollution generated by economic activities of Mississippi's coastal region. This information and the previous year's economic analysis will form the data base for linking the economy and environment.

The Mississippi Air and Water Pollution Control Commission (MAWPCC) was the primary information source on pollutants, although regional data in usable form was often unavailable. Investigators gathered information from other agencies, unpublished reports and interviews for a

more comprehensive report. As a result, estimates are included in this report that are often absent from similar regional studies.

The matrix developed includes 29 rows representing the economic producing sectors of coastal Mississippi. The thirtieth row is "households," representing pollutants by non-producers. The 30 columns represent waste water and various effluents, air emissions and solid wastes going into the environment. Assembled data indicate that in 1977 approximately 16,000 tons of water pollutants, 114,000 tons of air emissions and 407,000 tons of solid waste were dumped into the environment. An additional 369 billion gallons of waste water (partially or untreated water) were discharged into coastal waters. Ph, temperature and fecal coliform counts were also recorded.

Analysis of data provided a ranking of economic sectors according to the volume of pollutants discharged, a comparison of the volume of pollutants generated for every \$10,000 in sales, and percentages of pollutants produced by the top five sectors in each pollutant category.

Investigators associated with the Department of Agricultural Economics and Rural Sociology of Auburn University are conducting a similar study for Alabama coastal counties. The Mississippi

and Alabama study groups are cooperating on combining the two separate models to reflect the two-state coastal region as a single unit.

Development of an input-output model for the region has been completed as the

first step. Subsequent steps are identification and quantification of individual wastes from production sectors and linkage of the economic and environmental factors.

Publications

Nissan, Edward, Donnie Daniel, D.C. Williams, and Trellis Green. 1978. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi — Part I — Input-Output Model. MASGP-78-017.

Nissan, Edward, D.C. Williams, Jr., Trellis Green, W.E. Hardy and R.G. Nelson. 1978. An Economic Input-Output Analysis for Mississippi-Alabama Coastal Counties. MASGP-78-029.

Nissan, Edward, D.C. Williams, Jr., and Trellis Green. 1978. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi — Part II: Environmental Model. MASGP-78-041.

Williams, D.C. 1980. The Economic Structure of Mississippi Coastal Region. Midsouth Academy of Economists Seventh Annual Conference.

Williams, D.C. 1980. Effects of Hurricane Camille on the Economy of Harrison County. Third International Conference on Hurricanes and Coastal Storms.

Williams, D.C., Edward Nissan, Bill M. Brister, Robert G. Nelson and William Hardy. 1978. Waste Disposal Inventory — Mississippi, Alabama Coastal Counties. MASGP-78-051.

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

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SUMMARY: Work during this three-year project's second year has involved analysis of economic data collected and integrated into an input-output matrix during the previous year. Adjustments for greater accuracy have been made on the economic model developed. A combined model for both Alabama and Mississippi coastal counties has been constructed. Collection of data on water, air and solid waste pollutants was begun in preparation for analyzing the relationships of economic activities and environmental consequences.

The Alabama coastal region's diversity and productivity make an understanding of this valuable environment imperative. This project attempts to provide a base for such understanding with a description of man's economic activities and the relationship of these activities to the environment.

During the first year's study, data on output of goods and services and on employment in each of thirty producing sectors were integrated into an input-output matrix. The matrix traced flow of sales and purchases by each sector to and from each other sector. The second year's work has included analysis of the interactions represented through the matrix. Adjustments to the economic model have been made for greater accuracy.

The model, a formalized collection of variables influencing economic activity, can be used to evaluate the relative contributions individual sectors make to the economy of the region. An example is the construction of a table of income and employment changes based on a hypothetical \$1 million change in sales as it filters through the economy and affects the other sectors (Table 1).

Through use of the economic model, calculations can also be made to analyze

comparative costs and benefits of individual enterprises wishing to locate in the region. Total income and employment resulting throughout the economic sectors from a new industry can be projected and compared with alternatives. Information generated through use of the economic model has been used informally by Mobile county and city planning agencies and through the Alabama Sea Grant/Cooperative Extension Service. Reaction has been favorable. Data and analysis are now in press.

A similar economic model for the combined Mississippi and Alabama coastal counties was constructed and published in cooperation with the University of Southern Mississippi's Bureau of Business Research. The Alabama study group constructed and verified the model with the Mississippi group completing the analysis and write up.

Another facet of the second year's effort has been collection of data on air, water and solid waste pollutants in the Alabama coastal area. These data will be used in the final year's study to extend the analytical capabilities of the model to other aspects of regional growth such as pollution and depletion of natural resources.

Table 1. Changes in income and employment resulting from a \$1 million change in sales to final demand are shown here for 10 of 30 economic sectors included in the table constructed in this study.

| Sector | Direct Change In Income (\$)' | Direct Change In Employment (Persons)' | Type II Income Multiplier | Type II Employment Multiplier | Total Change In Income (\$) | Total Change In Employment (Persons) |
|---|----------------------------------|--|---------------------------------|-------------------------------------|-----------------------------------|--|
| Fishery Products | 416,910 | 85 | 3.54 | 2.23 | 1,475,861 | 190 |
| Fresh or Frozen | | | | | | |
| Packaged Fish | 206,490 | 32 | 6.87 | 5.41 | 1,418,586 | 173 |
| Livestock | 206,450 | 31 | 6.98 | 5.58 | 1,441,021 | 173 |
| Crops | 318,000 | 66 | 4.27 | 2.62 | 1,358,244 | 173 |
| Greenhouse and Nursery | 462,850 | 72 | 3.04 | 2.36 | 1,407,064 | 170 |
| Forestry Products | 439,940 | 12 | 3.50 | 10.57 | 1,539,790 | 127 |
| Agriculture, Forestry and Fishery Services | 428,710 | 68 | 3.11 | 2.47 | 1,333,288 | 168 |
| Petroleum and Natural Gas | 308,770 | 5 | 2.89 | 12.72 | 892,345 | 64 |
| Sand and Gravel Mining | 325,410 | 5 | 3.02 | 14.77 | 982,738 | 74 |
| Construction | 305,480 | 24 | 3.42 | 4.12 | 1,044,742 | 99 |

'Figures rounded to the nearest whole number.

Publications

Nelson, Robert and William E. Hardy, Jr. The Economy of Alabama's Coastal Counties. *Highlights of Agricultural Research, Alabama Agricultural Experiment Station.* 26(2): 16.

Nissan, Edward, D.C. Williams, Jr., Trellis Green, W.E. Hardy and R.G. Nelson. 1978. An Economic Input-Output Analysis for Mississippi-Alabama Coastal Counties. MASGP-78-029.

Marine Resources Law

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SUMMARY: Research on legal aspects of ocean pollution and dumping within the United States was completed and published through the 1978 legal program. Laws enacted by the 1978 Mississippi Legislature and affecting coastal resources were analyzed, summarized, and published. Update of a marine resources law library continued along with preparation to revise "Law of the Coastal Zone" course materials. Advisory services were extended to individuals and agencies.

The Sea Grant Legal Program for 1978 was a comprehensive effort encompassing research, education and advisory services.

Research

A publication on legal remedies to ocean pollution and dumping within the United States was completed. Major statutes and the international convention were reviewed for their potential in protecting the marine environment. Special emphasis centered on an analysis of the federal Water Pollution Control Act and its water quality standards, effluent limitations, national standards of performance, National Pollutant Discharge Elimination Systems (NPDES) permit process and other specific provisions.

Also reviewed were the Marine Protection, Research and Sanctuaries Act, the Resource Conservation and Recovery Act and the Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter.

A second research project completed was analysis and summarization of laws enacted by the 1978 Mississippi Legislature that affect coastal resource use, management or protection. This condensed form is a reference that can be used quickly and easily.

Education

A review was completed of "Law of the Coastal Zone" course materials. The materials were compiled earlier under the

Sea Grant Program. Revision of materials for use within the next few years is scheduled. Publications from the updated marine resources law library were made available to students, professors and other interested individuals.

Advisory Services

Legal research assistance was provided in the following instances:

- A public official requested information on legal mechanisms available for forcing a sand and gravel company to conserve water. The company was removing sand and gravel from an area and in the process dumping fresh water into a bay.
- Steps for preventing the dumping of raw sewage into a wild and unpolluted stream were outlined for the Sea Grant Advisory Service. The problem arose when two sewage lagoons behind a school were ordered removed to comply with Mississippi state health department regulations. School officials complied by draining sewage into a basically unpolluted stream. Administrative and judicial action on state and federal levels was detailed in an indepth legal memo.
- An analysis of laws and regulations of Mississippi city, county and state ports was begun for the Sea Grant Advisory Service. Statutes concerning ports are scattered throughout

the Mississippi Code and contain contradictory provisions. Suggestions on wording to eliminate contradictions were noted and the laws compiled into a usable, indexed form. Upon completion of the project, the legal program will work with Sea Grant Advisory Services and port commissions on suggestions for statutory changes.

- Mississippi Marine Conservation Commission ordinances were reviewed with suggestions for wording changes to eliminate contradiction among ordinances and statutes relating to the commission. Ordinances about specific licenses were analyzed, compiled and summarized for use when a license is issued.
- Mississippi Marine Resources Council received periodic research assistance on drafting coastal zone management legislation.
- A review of state statutes that would affect oyster farming in Mississippi was provided to the Sea Grant Ad-

visory Service. A study of corporations versus partnerships for use by oyster farmers was also made. Many oyster farmers have expressed interest in forming a cooperative working unit.

- The Sea Grant Advisory Service was supplied with a study on how to legally prevent shrimpers from trolling on lands leased for oyster farming.
- Mississippi statutes, cases and regulations that would affect the building and operation of an oyster depuration plant were reviewed for Dr. David Cook of the Gulf Coast Research Laboratory. Massachusetts, Maine and Florida statutes were also analyzed. The State's liability in operation of such a plant was researched. (An engineering assessment of a depuration plant was part of the 1978 Sea Grant Program.) The legal program continues to coordinate legal research efforts with Sea Grant scientific projects.

Publications

University of Mississippi Law Center. 1978. The Problem of Ocean Pollution — Legal Remedies Available. MASGP-78-032.



Seafood Processing

Viral Evaluation of Prohibited Oyster Growing Waters

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SUMMARY: During this study numerous confirmed viruses were found in Gulf Coast waters closed to oyster harvesting. No correlation could be found, however, to indicate a relationship with the fecal coliform count on a month to month basis. Neither was there a correlation between fecal coliforms in the water and fecal coliforms in oyster tissue. Data indicate that the current method for classification of water quality according to the presence of fecal coliforms does not adequately indicate the level of viral contamination of shellfish or their surrounding waters.

Shellfish, when eaten raw or improperly cooked, can transmit disease organisms to man. Of the many types of microorganisms transmitted by shellfish, viruses have often been overlooked because of the difficulty and expense of isolation or the lack of information about their disease potential.

An understanding of hepatitis virus and its transmission by shellfish has developed, but the majority of other virus types and their ability to contaminate shellfish have not experienced close examination. Enteroviruses (intestinal viruses) can cause acute or chronic disease. Paralysis, meningitis, pneumonia, pericarditis, hepatitis and diarrhea are among illnesses that can result from eating shellfish contaminated by viruses.

The first year of this two-year study was an effort to quantitatively compare viruses from natural approved and prohibited oyster populations. Water and oyster

samples from two areas were analyzed during 1978 for fecal coliform. Virus contamination was studied only in oyster samples. The two locations for sampling contrasted ecologically, topographically and bacteriologically. The prohibited reef area was Graveline Bayou southwest of Pascagoula, Mississippi. An area closed to oyster harvesting since 1975, Graveline receives large volumes of untreated or partially treated sewage. It is influenced by local rainfall and tidal flushing and may change rapidly. The approved reef south of Pass Christian, Mississippi, is in open waters of the Mississippi Sound and is not readily influenced by rapid environmental change.

Water samples were taken at Graveline Bayou on the three days prior to oyster collection and on the day of collection. Samples were taken at Pass Christian on the day of oyster collection only. Fluctuation was great in the fecal coliform counts

of Graveline, sometimes even within the four-day period. The median fecal coliform values from all samples were 410 for Graveline and 78 for Pass Christian. There appeared to be little relationship between coliform counts in the water and those in oysters collected at the same time.

The approved and restricted shellfish were also widely separated in the degree of viral contamination observed. Virus isolates numbered 12 (350 oysters) for the Pass Christian reef with eight identified as poliovirus type 1 and four that could not be typed. Prohibited oysters (1,327) contained 146 viruses. The majority identified were poliovirus type 1; however, echovirus type 24 and coxsackievirus B-3 were isolated in small numbers.

Although bacterial and viral levels reflected water quality, statistically significant correlations between these levels were not observed. Data for three months in 1978 illustrate the variation of fecal coliforms, plaque-like isolates and confirmed viruses isolated from Graveline Bayou oysters. (Examined as part of standard laboratory procedure, plaques are "holes" in cell sheets caused by growth of a virus, some other microorganism or an irregular-

ity in container preparation.)

In March the number of fecal coliforms rose while plaque-like and confirmed virus isolates decreased or remained constant. In May, plaque-like and confirmed virus isolates increased but did not correlate with the decreasing number of fecal coliforms. Both fecal coliforms and plaque-like isolates increased in August, but confirmed virus isolates remained at approximately the previous month's level.

The first year's study supports re-examination of the concept of indicator organisms in relation to viruses in shellfish. Improvement of the quality of virological examination over the next few years may alleviate problems with indicator organisms. New developments maximizing the process of recovering viruses from shellfish meats would allow viruses shed from the human gastrointestinal tract to be used as indicators. Less expensive but sensitive assay methods could be developed for environmental samples.

Other estuarine relationships such as the level of enteric viruses and fecal coliforms in sediments also should be examined for their connection with shellfish contamination.

Publications

- Ellender, R.D. 1979. Enterovirus Evaluation of Mississippi Oysters. *Journal of the Mississippi Academy of Sciences*. 23:76.
- Ellender, R.D. and J. Baker. 1978. Virus Recovery from Contaminated Oysters. *Journal of the Mississippi Academy of Sciences*. 23:78.
- 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. MASGP-78-042.
- Law, W.M., R.D. Ellender, J.H. Wharton, and B.L. Middlebrooks. 1978. Fish Cell Culture: Properties of a Cell Line from the Sheepshead, *Archosargus probatocephalus*. *Journal of the Fisheries Research Board of Canada*. 35(4):470-473. MASGP-78-022.
- Stout, Debra and B.L. Middlebrooks. 1979. Comparison of Tissue Culture Lines of *Cynoscion Arenarius*. 1979 Abstracts. *Journal of the Mississippi Academy of Science*. 24:89.

Oyster Depuration Facility: An Engineering Assessment

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Dennis D. Truax
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SUMMARY: As domestic pollution encroaches on areas that foster oyster growth, examination of methods for purification of shellfish for human consumption becomes increasingly important. Through this project, experimentation with model onshore depuration facilities showed that solids generated by oysters in their self-cleansing process can be removed readily by gravitational techniques and that the use of ozone provides adequate disinfection and maintains a high level of water quality that requires little waste water treatment. This study provided evidence that a system using recirculating water can be operated for an extended period without significant problems. Plans were also drawn for a 100-bushel capacity depuration facility.

An estimated \$2,500,000 in renewable resources is being lost yearly in Mississippi. Biologists give that dollar value to oysters on state reefs now closed due to domestic pollution. Oysters from polluted waters can be used, however, if they are cleansed first.

The U.S. Food and Drug Administration accepts two cleansing methods for making oysters safe for human consumption — relaying and depuration. Relaying involves harvesting oysters, transplanting them to unpolluted waters and then reharvesting after at least 14 days. At present relaying is the more economical method.

Should clean water areas continue to decrease, however, this project's study of the onshore depuration process would provide an alternative for the oyster industry. In the depuration process, self-cleansing occurs as water treated by ozonation or ultraviolet irradiation flows through tanks containing oysters. From 48 to 72 hours are required for self-cleansing.

To acquire engineering data for a large scale plant, two pilot depuration plants of one-bushel capacity each were set up. One plant was a closed system that recirculated water used in depuration. The

other was an open, flow through system. The plants were identical except for a reservoir tank at the head of the open system and a reservoir containing water for recirculation at the end of the closed system. Other components were an aeration tank, depuration tank, sedimentation tank (clarifier) and pumps. The depuration tank bottom sloped toward the outlet end, allowing wastes generated by the oysters to sink to the bottom. Solids were washed down daily into the sedimentation tank.

Water from both open and closed systems was acceptable for discharging into natural waters or sewage system. Components credited with maintaining water quality were the sedimentation tank and ozone disinfection system.

Oysters produce great quantities of wastes, both fecal material (from ingested substances) and pseudofecal material (substances not ingested but taken into the oyster's mantle, strung together with mucous then expelled). The sedimentation tank allowed these solids to settle out of the system. The benefit was twofold: removal of solids that would hinder the depuration process in a closed system and elimination or reduction of solids that

would otherwise require treatment before discharge of process water.

Through National Pollutant Discharge Elimination Systems (NPDES) permits, the Mississippi Bureau of Pollution Control restricts the concentration of solids that can be released into state waters or sewage systems. In the small pilot plants, quantities of solids were not a problem. On a larger scale, the settling tank would be vital in meeting standards for a NPDES permit for plant operation and in keeping recirculating water at an acceptable quality level.

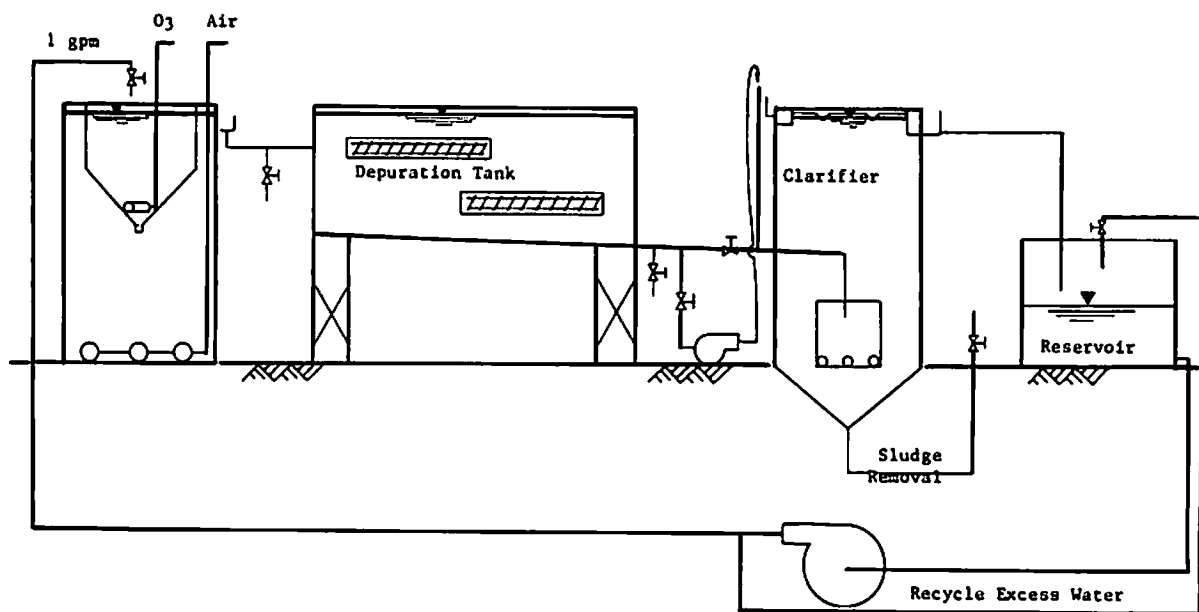
The ozone treatment system's contribution was also twofold. Ozone is a powerful oxidant when used to eliminate bacteria

and viruses. Its efficiency as a disinfectant rivals ultraviolet irradiation, although ozone treatment costs more. Ozone's maintenance of water quality more than offset the cost, however. Especially significant for a closed system was the oxidation of ammonia, a by-product of oyster metabolism. Through the ozone treatment, ammonia was oxidized to the less toxic nitrites and nitrates.

This study was not designed to compare ultraviolet light to ozone treatment. Operation of pilot plants clearly indicated that degradation of water is minimal after 44 days if ozone treatment is used. If ultraviolet light is to be used, further study is recommended.

Publications

Bond, M. and Dennis Truax, 1978. Oyster Depuration Facility: Engineering Assessments. MASGP-78-038.



Closed Depuration System

Shrimp Quality: Techniques for the Small Processor

Paul M. Toom

University of Southern Mississippi

SUMMARY: An enzymatic method of measuring ammonia (an indicator of decomposition in shrimp) and ethanol (an indicator of decomposition in a variety of seafood including shrimp) has been developed through this study. Several dye systems have been evaluated for potential use in developing dipsticks for measuring decomposition. One such dye system was selected and used in developing a dipstick to measure ethanol levels.

The Food and Drug Administration is currently moving toward stringent guidelines for seafood processors based on levels of specific components present in decomposition in seafood. Such guidelines push testing for quality into an area of sophisticated equipment and trained personnel unavailable to small processors on a regular basis.

An easy-to-use, inexpensive alternative testing method has been developed through this project. Dipsticks such as those commonly used to measure urine glucose and blood alcohol have been devised for indicating levels of decomposition in seafood. The dipstick method requires no specially trained personnel, no time consuming processes and no expensive equipment. Dipsticks do provide a fast, low-cost test for quality in shrimp and other seafood.

Development of a dipstick through this project depended on devising an enzymatic assay for ammonia and ethanol and coupling it with a proper dye system. The enzyme technique developed proved to be as reliable as gas chromatography and Association of Official Analytical Chemistry (AOAC) methods now in use for measuring ammonia and ethanol respectively.

To measure levels of ammonia, the enzyme glutamic dehydrogenase and co-enzyme NADH (the reduced form of nicotinamide adenine dinucleotide or NAD) are used. The process is based on

the enzyme's reaction with ammonia. The compound formed has a lower absorbancy at 340 nanometers than the enzyme that has not reacted with ammonia. The greater the decomposition, the more ammonia present and the lower absorbance.

The enzyme alcohol dehydrogenase is used to measure ethanol, an indicator of decomposition in seafood in general. The amount of ethanol present is determined in the subsequent chemical process by an increase in absorbance. No correlation could be drawn between concentration of ethanol and degree of decomposition in shrimp, apparently due to washing and leeching actions of the ice in which the shrimp were packed.

Four different dye systems were evaluated for incorporation with the enzyme process into dipsticks. Dye systems that couple with products from the enzyme catalyzed reaction were necessary for development of the dipstick. Dye systems evaluated were irreversible dyes that can be reduced by NADH, reversible dyes that can be reduced by NADH, substrate replacement dyes, and dyes which can be oxidized by H_2O_2 .

Dipsticks that measure ethanol and use an alcohol tetrazole red dye were developed most thoroughly. Others developed were an alcohol tetrazole blue dipstick, an alcohol peroxide brown dipstick and an alcohol oxidase dipstick.

Publications

- Knight, Cindy B. 1980. Enzymatic Analysis of Ammonia. M.S. Thesis. University of Southern Mississippi.
- Knight, Cindy B. and Paul M. Toom. 1980. An Enzymatic Technique for the Analysis of Ammonia in Seafood Products. *Proceedings of the Fifth Annual Tropical and Sub-Tropical Fishery Technology Conference*. MASGP-78-048.
- Stoner, Peter. 1979. Analytical Methods for the Quantitation of Ethyl Alcohol. M.S. Thesis. University of Southern Mississippi.
- Toom, Paul M., Cheryl F. Ward and James R. Webber. 1980. Identification of Fish Species by Isoelectric Focussing. *Proceedings of the Symposium on Seafood Quality, American Chemical Society*. Washington, D.C., October, 1979. MASGP-78-049.



BAYOU CASOTTE — This industrialized area of Pascagoula, Mississippi pictures the variety of Gulf Coast water resource users. Shrimp boat, (foreground), fishing boats in operation (center) and tanker docked in the background range from independent operators to an international corporation.



Environmental Studies

The Assembly, Analysis and Evaluation of Available Existing Atmospheric and Hydrographic Data of Mississippi Sound

**Charles K. Eleuterius
Sheree M. Beaugez**

**Gulf Coast Research Laboratory
Gulf Coast Research Laboratory**

SUMMARY: Through this project, data on the climate and waters of the Mississippi Sound were assembled and processed. Computer programs were designed to provide statistics by season, depth and location in the Sound. Computer-printer maps were used to develop charts of various physical and chemical variables of the Sound.

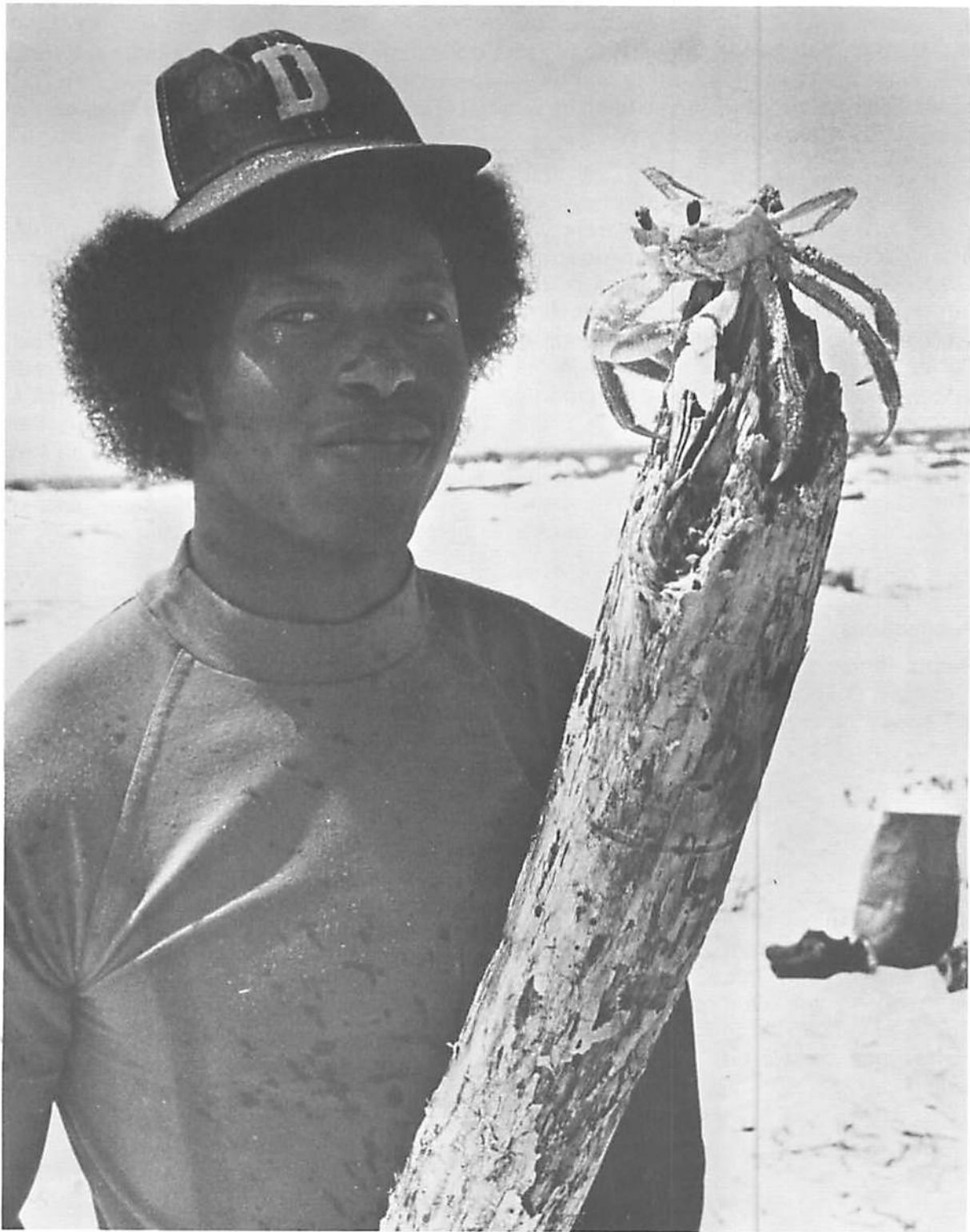
A comprehensive collection and analysis of existing data on the physical and chemical variables of the waters of Mississippi Sound is necessary to provide vital information sought by industrial, recreation and resource management groups. Identifying gaps in knowledge of the Sound will also make planning more effective for future research.

In the first phase of this project, data were assembled and analyzed in preparation for production of an atlas which will summarize under one cover the existing knowledge of the climatic and hydrologic environment of the Mississippi Sound. Computer programs were designed to process data on temperature, salinity, dissolved oxygen, pH, nitrite, nitrate, ortho-phosphate, total phosphate and water density. Climatic data included wind, rain, river flow and air temperature. The statistics that were generated address location, seasonal changes and depth.

Further analysis was effected through use of a sophisticated computer symbolic mapping program (SYMAP). The computer-printer maps from SYMAP were used to develop isopleth charts of the arithmetic mean, median, minimum, maximum, and coefficient of variation of the Sound's physical and chemical variables.

Isopleth charts are similar to contour maps with high and lows representing a particular chemical or physical characteristic such as temperature instead of elevation. They provide easily comprehended information on the nature of the estuarine Sound. The need for an accurate compilation of information on the Sound has been demonstrated by the numerous inquiries received even in the early stages of this study. The second phase of this project will answer that need more completely as work proceeds on the hydrological-meteorological atlas.

Education



Handbook of the Common Marine Salt Marsh Invertebrates of the Northeastern Gulf of Mexico

Richard W. Heard

Gulf Coast Research Laboratory

SUMMARY: This handbook, now ready for publication, is the first scientifically accurate, well-illustrated handbook of the marine salt marsh invertebrates of the northeastern Gulf of Mexico available and can be used by biologists and interested laymen and students not necessarily trained in taxonomy.

The Handbook of Common Marine Salt Marsh Invertebrates of the Northeastern Gulf of Mexico treats 60 species of the larger invertebrates of the northeastern Gulf of Mexico. Such well-known forms as fiddler crabs, blue crabs and periwinkles are included as well as less commonly recognized invertebrates.

The handbook is the first to deal completely with salt marsh invertebrates of the Gulf Coast. A valuable tool for laymen, students, and professionals, the book's

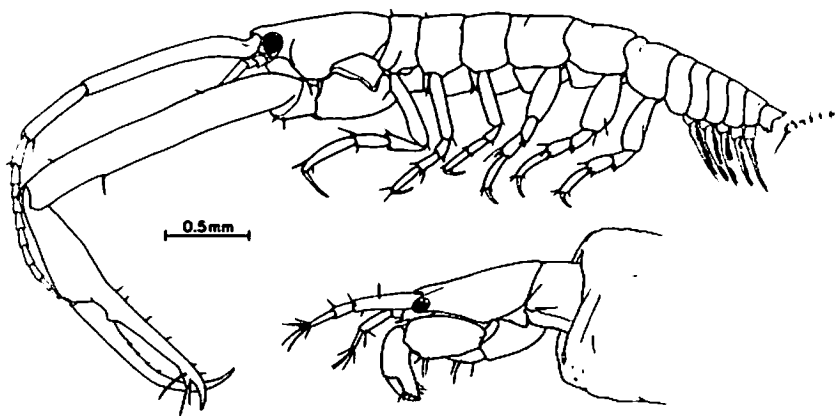
usefulness should extend to the preparation of environmental impact statements, salt marsh productivity studies and other marsh research.

Brief summaries of the ecological importance of each species, accurate illustrations, keys to selected groups and a glossary of terms are included in the book's format. Those not trained in the classification of invertebrates will be aided especially by specific diagrams and a glossary.

Publications

Heard, Richard. 1978. Handbook of the Common Salt Marsh Invertebrates of the Northeastern Gulf of Mexico. In Press. MASGP-79-004.

Hargeria rapax — A small crustacean that occurs in marsh tide pools along the Gulf Coast. Male with large claws and female in tube.



The Development of a Program to Promote a Marine Awareness, Especially Among Minority and Financially Deprived Students and Educators

**Della McCaughan
Gerald Corcoran
Gwendolyn de Marks**

**Biloxi High School
Gulf Coast Research Laboratory
Biloxi High School**

SUMMARY: During the first year of this three-year program, field trips, seminars, and workshops were used successfully to involve minority and disadvantaged secondary students and educators in marine education.

In years past few blacks have been involved in marine sciences. Marine-related careers were not among traditional avenues of achievement for minority groups, and opportunities that would create an interest in marine sciences were seldom available. At the secondary level few blacks enrolled in marine education courses. There was an obvious educational gap between the blacks who did enroll and Caucasians due to the black students' lack of experiences in marine-related activities.

The emphasis of this program has changed that pattern. Efforts to introduce more blacks to marine education in 1978 were successful locally and influential statewide. As more minorities participate in marine-related activities in coastal and inland areas, educators have begun providing teacher workshops, scholarships and counseling to meet the growing awareness of and interest in the marine sciences.

The model program developed through this project used the field trip experience as the principal method for promoting participation by minority, learning disabled and financially deprived students. Through Sea Grant, field trips were opened to more than 80 minority and disadvantaged students from other classes. A learning disability class of 20 students, an average of 20 minority students and three financially deprived students were among

the 140-150 young people who participated in field trips. The eight all-day trips included four trips to Horn and Ship Islands.

Field trip equipment and supplies provided through the program not only benefited minority and disadvantaged students, but enhanced marine field experiences for Biloxi High School science classes, numerous college classes, the Youth Conservation Corps (YCC), school clubs, a private school and other groups and individuals. In August 1978 the equipment was flown to Adak, Alaska, for use in a three week marine biology program. The seines, shrimp trawls and buckets were used more than 100 times during 1978.

Another facet of the program was a marine education workshop held March 20-24, 1978. One of the most comprehensive held in Mississippi, the workshop drew 90 participants. Scholarships were provided for minority representatives. Four marine education seminars were conducted for secondary students on marine environment, resources and careers. Among the marine professionals who spoke was a black female with the National Marine Fisheries Service. She emphasized that qualified, competent blacks who are willing to work are being sought for marine-related positions.

Among other 1978 activities were the following:

- Organization of a YCC field trip to Ship Island and assistance to the YCC staff in developing a curriculum for their environmental program.
- A public meeting conducted by representatives of the National Science Foundation and the National Park Service concerning barrier islands.
- Promotion of marine awareness through programs in the Afro-American Club and a local church by the co-principal investigator, a black female instructor.
- Invitations to other night students to visit evening marine science courses when guest lecturers, seminars and special programs were scheduled.



- Presentations on teaching techniques and involvement of minorities in marine education at the National Association of Biology Teachers

Convention, the National Science Teachers Association, teacher workshops, civic groups, church groups and other organizations.

- Distribution at local, state and national civic and education meetings of 7,300 reprints of marine art by marine biology students.
- Television exposure for blacks involved in the marine science program as an effort to remedy the absence of black role models in television news and specials on marine subjects and to instill assurance in young black viewers that minorities can be involved in marine sciences.
- Consultation for other marine educators, counselors and administrators.
- Providing resource material and counseling for college students, local citizens, scientific investigators and businesses upon request.
- A program for secondary students to aid elementary teachers in setting up and maintaining salt water aquaria.
- Participation in surveys and personal contacts affecting attitudes on marine education and ocean policy at national levels.

This program has instilled in previously uninvolved minority and disadvantaged students a desire to explore and understand the marine environment. It has also created an awareness that marine education should be and can be made available to all children.

Award Recipient Continues Career In Virology

From oysters to cattle might seem like a big step; but to Janet Baker Mapp, it's just an extension of what she likes doing best — work in the field of virology.

Mrs. Mapp, now chief virologist for the Veterinary Diagnostic Laboratory of the Mississippi Board of Animal Health, was recipient of a 1978 Sea Grant Student Research Award. Her winning abstract was on her studies of "Virus Recovery from Contaminated Shellfish," part of a Sea Grant project directed by her sponsor and advisor, Dr. R.D. Ellender of the University of Southern Mississippi.

"Basically we were developing a method to take viruses from oysters and identify them. There were other procedures for recovery of viruses, but they involved steps too difficult or time consuming to perform in a routine microbiology laboratory.

"We evaluated already published techniques, picked the most promising one and began to modify it. When we ran into problems, we modified our modifications. We were trying to establish a technique that could be run in a laboratory with little difficulty and in a reasonable amount of time." An inexpensive, reliable recovery procedure is especially important to the seafood industry.

The research award, one of seven conferred on selected master's and Ph.D. candidates from throughout the United States, made the hard work worthwhile. Even more important, Mrs. Mapp said, is the role the project played in her current work.

"I feel I owe a lot to Dr. Ellender and to Sea Grant, which made the project possible in the first place. I enjoyed that research and the work has helped me in this position."

As chief virologist, Mrs. Mapp works with one other virologist isolating and identifying viruses, mostly from large animals such as cattle. "This is exactly the kind of work I was looking for. We don't do



AWARD RECIPIENT — Mrs. Janet Mapp (right) and her sponsor and advisor, Dr. R.D. Ellender of the University of Southern Mississippi, share news of her Sea Grant award. Mrs. Mapp is now chief virologist for the Veterinary Diagnostic Laboratory of the Mississippi Animal Board of Health.

the same thing every day. There is always the challenge of isolating viruses. I just enjoy working in virology and working with tissue cultures.

"There is the satisfaction of knowing that our work might alert officials to the need for a specific vaccination program, preventing crippling economic loss for Mississippi livestock producers. Although at the University of Southern Mississippi I was working mostly with human viruses in oysters, the theories and techniques of cell culture I mastered there apply in my work with animals. I didn't know much about animal viruses when I started. I have a lot to learn. This job is an opportunity to keep exploring, learning, growing. That's good."

Advisory Services



Mississippi Sea Grant Advisory Service Program

C. David Veal
J. Dale (Zach) Lea

Mississippi Cooperative Extension Service
Mississippi Cooperative Extension Service

SUMMARY: In 1978, the Mississippi Sea Grant Advisory Service continued a strong program of public education, disseminated technical and legal information to special audiences, helped develop coastal recreational resources and continued to develop seafood products and markets.

The Mississippi Sea Grant Advisory Service is a vital link between marine research, education and policy programs and users and potential users of marine and coastal resources. Through direct contact with sport and commercial fishermen, seafood processors, government groups and others, the Advisory Service helps identify areas that need examination by sea grant programs. At the same time, the Advisor Service channels scientific, economic and legal information in usable form to the general public and specific groups. The operation of the Advisory Service through the Mississippi Cooperative Extension Service (MCES) provides additional support for fulfilling sea grant objectives through the personnel and organization of Mississippi Cooperative Extension Service.

General Public Education

The 1978 program continued creating an awareness of issues and information concerning marine and coastal resources. The print medium was used extensively for articles and newsletters on understanding and protecting the marine environment, recreational opportunities, seafood preparation, health issues and general information. The two-man staff logged more than 10 hours of television air time including local appearances and three programs on the Mississippi Educational Television. Regular beach tours, specially scheduled beach and outdoor programs, in-house presentations and seafood preparation demonstrations were used effectively for public education.

Both specialists served as resource personnel for area schools and for such educational groups as the Mississippi Science Teachers Association. Advisory Service Staff assisted Harrison County Cooperative Extension Service 4-H personnel with marine-related youth programs.

Workshops and seminars effectively provided technical information for specific audiences and fostered identification of problems and needs. A commercial fishermen's symposium was sponsored, as were seminars on seafood retailing, mariculture, commercial fishing techniques and other topics. Eight workshops were held with the Mobile District Corps of Engineers on dredging in the Mississippi Sound and Mobile Bay.

Recreational Resource Development

Efforts in the area of general tourism development materialized when the Charter Boat Captains' Association and local innkeepers put together a promotional package. The package will be sold individually and in combination with the widely-used golf package as a late fall and early spring attraction. Work continued with chambers of commerce, city governments, live bait dealers, the marine sales and service industry and special groups such as SCUBA divers, recreational fishermen, boaters and environmentalists.

Resource Development

Each year the oyster industry and Mississippi lose several million dollars

worth of renewable resources — the oysters on reefs closed because of pollution. A 1977 change in Mississippi law allows private oyster leases and opens the possibility for relaying mature oysters to approved waters for depuration and construction of productive oyster reefs on water bottoms where reefs have not occurred naturally.

The Advisory Service has detailed procedures and regulations on oyster leases in publications and workshops. Preliminary work also has been completed on setting up a demonstration oyster farming project funded by Sea Grant and a private investor. Actual work has been

delayed to the summer of 1979 because of unfavorable weather. The oyster farming project will provide sound economic data for private investors, lending institutions and government agencies involved in the industry.

In other areas of resource development, work continued with the Mississippi State University Food and Fiber Center and Mississippi Cooperative Extension Service on development of additional economic resources including frozen oysters on the half shell; fresh, frozen and breaded croaker; refabricated shrimp; canned herring, sardines and mullet; and other fresh and frozen fish.

Publications

Mississippi Sea Grant Advisory Service. 1978. Gulf Coast Fisherman Newsletter. MASGP-78-035.

Mississippi Sea Grant Advisory Service. 1978 Mississippi Tide Tables. MASGP-78-015.

Mississippi Sea Grant Advisory Service. 1979 Mississippi Tide Tables. MASGP-78-036.

Veal, David C. 1978. *Mississippi Charter Boat Directory*. Mississippi Sea Grant Advisory Service, Mississippi Cooperative Extension Service. MASGP-78-005.

Public Education — *Personal contact was one aspect of the general public education effort in the 1978 Sea Grant Advisory program. Sea Grant Advisory Specialist J. Dale (Zach) Lea (center) answers a Gulf Coast resident's questions and at the same time acquaints him with Mississippi-Alabama Sea Grant Consortium.*



Alabama Sea Grant Advisory Service Program

R. Warren McCord
Mac V. Rawson
William Hosking
Gale R. Trussell

Alabama Cooperative Extension Service
Alabama Cooperative Extension Service
Alabama Cooperative Extension Service
Alabama Cooperative Extension Service

SUMMARY: The 1978 Alabama Sea Grant Advisory program was characterized by expansion into marketing and tourism/recreation, areas of vital importance to the coastal region and the State of Alabama. Public awareness and acceptance of the Sea Grant Advisory Service was strengthened through mass media and public meetings. Contact with the commercial fishing and seafood processing industries increased with greater opportunity for education and dissemination of information through workshops, publications and personal contact.

The 1978 program year for Alabama Sea Grant Advisory Service heralded a major staff expansion to provide comprehensive indepth service for all categories of users of the Alabama coastal environment. The 1978 advisory staff members included Dr. R. Warren McCord, State Leader; Dr. Mac V. Rawson, Marine Resources Development Specialist; Dr. William Hosking, Marine Resource Economics; and Mr. Gale R. Trussell, Coastal Recreation and Tourism Specialist.

The Sea Grant Advisory staff operates within the organizational structure of the Alabama Cooperative Extension Service, Auburn University. This framework provides further support from the resources of Auburn University's teaching and research faculty and the statewide visibility, contacts and personnel of the Cooperative Extension Service.

An important tool for providing advisory and educational assistance has been the organization of seminars, workshops and public meetings. Especially significant was the education program initiated by Alabama Sea Grant Advisory Service on the changeover from Loran-A to Loran-C navigation systems. The Loran-A system is to be phased out by December 30, 1980. By that time every Loran user must have purchased new equipment that costs from \$2,500 to \$7,000. The training program

conducted in cooperation with the U.S. Coast Guard drew Sea Grant personnel from Mississippi, Texas, Georgia and Alabama. The program involved one day's lecture and lab work with Loran-C units and a half day field session using equipment in Mobile Bay.

An extensive mass media education campaign on Loran-C was begun. Two workshops on Loran-C changeover were held for boat owners at Bayou La Batre and Summerdale, Alabama.

The Sea Grant Advisory Service cooperated with the Alabama Coastal Area Board and the U.S. Corps of Engineers on six public affairs meetings and seven problem identification workshops for coastal industrial leaders. The resulting publications, "Issues and Goals for Coastal Alabama" and "Summary Report: Mobile Bay and Mississippi Sound Problem Identification Workshops," have been widely distributed by the cooperating agencies.

A workshop also launched the Sea Grant Advisory Service's program for seafood market development. The workshop for seafood retailers featured Dr. Samuel Gillespie of Texas A&M, a nationally recognized authority on seafood marketing. Twenty percent of local, independent seafood retailers attended. One major food chain represented at the workshop is

establishing a seafood section in its meat department.

The advisory service has begun providing specific information and assistance to industries exploring international markets for seafood. Work also continued on development of a Mobile Seafood Industrial Complex. Advisory specialists worked closely with the Alabama Development office in organizing and accompanying city and state officials on a fact-finding trip to a similar complex in Brownsville, Texas.

Advisory service to commercial fishermen and seafood processors was enhanced by opening a satellite office in Bayou La Batre two days a week. The location of this office in the heart of the State's largest fishing community is especially productive since personal contact has proved the most effective approach to the commercial fishing audience.

Sea Grant specialists have assisted major seafood processors with waste treatment problems. Specialists have secured legal research services through the Sea Grant Law Program, consulted appropriate state and local authorities, and provided information about in-plant

clean-up techniques, development of individual plant treatment facilities and alternative disposal techniques.

An awareness of the availability of assistance in the field of recreation and tourism has been established through advisory service consultation on specific recreational land and water use situations and completion of development plans for private and public recreational areas. The publications, "A Guide to Buying and Developing Coastal Alabama Property" and "Public Boat Launch Sites on the Alabama Gulf Coast" have been widely requested and used.

This facet of the advisory program has also included development of a slide presentation with taped narrative on outdoor recreational opportunities on the Alabama Coast. A video tape version is being made for each Alabama Welcome Center. A Marine Fishing Workshop for Alabama sport fishermen was taught as a three-night course on various fish species explaining when, where and how to catch them. A similar workshop was co-sponsored with the University of South Alabama.

Publications

Alabama Sea Grant Advisory Service. 1978. *Alabama Charter Boat Directory*. MASGP-78-002.

Alabama Sea Grant Advisory Service. 1978. "Charter Boats Now Eligible for National Marine Fisheries Service Financial Assistance Programs." Newsletter. MASGP-78-006.

Alabama Sea Grant Advisory Service. 1978. "Shrimp Fishing With Twin Trawls." Brochure. MASGP-78-007.

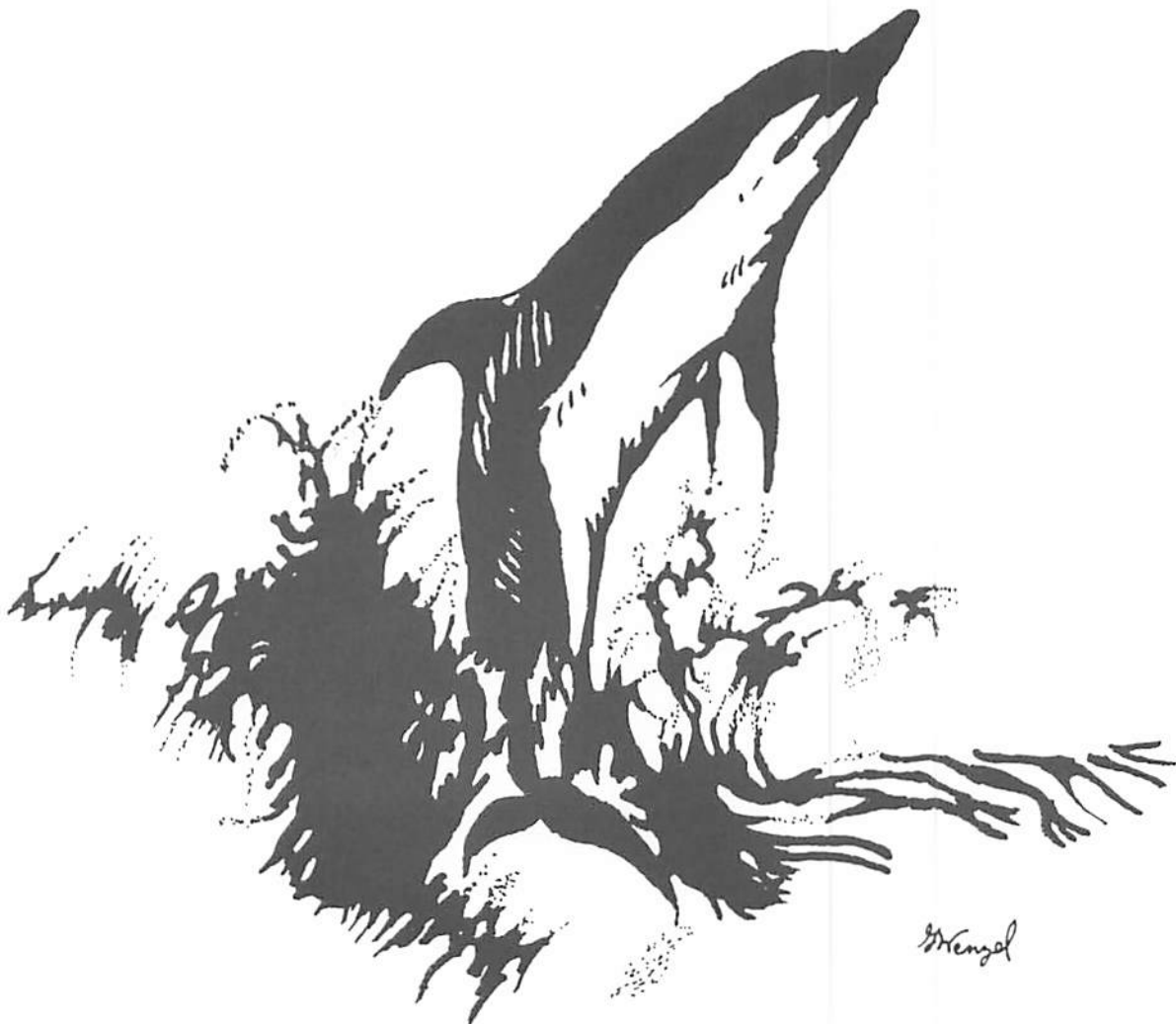
Alabama Sea Grant Advisory Service. 1977. "Public Boat Launching Sites on the Alabama Gulf Coast." Brochure. MASGP-78-019.

Hosking, William, and Mac V. Rawson. 1977. "Issues and Goals for Coastal Alabama — Final Report." Newsletter. MASGP-78-018.

Hosking, William, Mac V. Rawson, and Gale Trussell. 1978. "Mobile Bay and Mississippi Sound Problem Identification Workshops — Summary Report." Newsletter. MASGP-78-023-1

Rawson, Mac V., and John Booker. 1978. "Intertidal Life Along the Northern Gulf." 4-H Program Supplement. MASGP-78-025.

- Rawson, Mac V., and David Harrington. 1978. "Using Twin Trawls for Our Shrimp Fishing." Slides and script. Alabama Sea Grant Advisory Service. MASGP-78-030.
- Rawson, Mac V. and Gale R. Trussell. 1978. "Alabama 4-H Pilot Manual." Alabama Sea Grant Advisory Service. MASGP-78-024.
- Trussell, Gale R. 1978. "Protect Yourself When Buying Coastal Alabama Property." Brochure. Alabama Sea Grant Advisory Service. MASGP-78-033.
- Trussell, Gale R. 1978. "Outdoor Recreation Opportunities on the Alabama Gulf Coast." Slides with narrative on tape. Alabama Sea Grant Advisory Service. MASGP-78-034.



AIR BORNE — *This drawing by a Biloxi, Mississippi high school student, G. Wenzel, was one of 7,300 prints distributed as part of a model program creating an awareness of marine education among and for minorities and handicapped students.*

Appendix

Sea Grant Technical Publications

- Brooks, Daniel R. and Robin M. Overstreet. 1977. Acanthostome Digeneans from the American Alligator in the Southeastern United States. *Proceedings of the Biological Society of Washington*. 90(4): 1016-1029. MASGP-78-011.
- Eleuterius, Charles K. 1977. Location of the Mississippi Sound Oyster Reefs as Related to Salinity of Bottom Waters During 1973-75. *Gulf Research Reports*. 6(1): 17-23. MASGP-78-008.
- Hecker, Stan (ed.) 1978. Summary of Proceedings of an Experimental Dredge Disposal Workshop for Mississippi Sound. MASGP-78-043.
- Hendrix, Sherman and Robin M. Overstreet. 1977. Marine Aspidogastriids (Trematoda) from Fishes in the Northern Gulf of Mexico. *Journal of Parasitology*. 63(5): 810-817. MASGP-78-004.
- McIlwain, J. Baron. 1978. Mississippi-Alabama Sea Grant Consortium Publications Listing 1971-77. Mississippi-Alabama Sea Grant Consortium. MASGP-78-009.
- Mississippi-Alabama Sea Grant Consortium. 1977. Annual Report. MASGP-78-028.
- Overstreet, Robin M. 1977. *Poecilancistrum caryophyllum* and Other Trypanorhynch Cestode Plerocerooids from the Musculature of *Cynoscion nebulosus* and Other Sciaenid Fishes in the Gulf of Mexico. *Journal of Parasitology*. 63(5): 780-789. MASGP-78-003.

Activity Budget Sheet
(Summary Totals by Sea Grant Activities)

| | <u>NOAA Grant Funds</u> | <u>Matching Funds</u> |
|--|---------------------------------|---------------------------|
| RESEARCH | | |
| MARINE RESOURCES DEVELOPMENT | | |
| Living Resources | \$130,349 | \$ 78,098 |
| SOCIO-ECONOMIC & LEGAL STUDIES | | |
| Marine Economics | 40,900 | 27,195 |
| Ocean Law | 30,000 | 13,782 |
| MARINE TECHNOLOGY RESEARCH & DEVELOPMENT | | |
| Resources Recovery & Utilization | 53,100 | 36,780 |
| MARINE ENVIRONMENTAL RESEARCH | | |
| Ecosystems Research | 51,700 | 39,245 |
| Applied Oceanography | 15,000 | 240 |
| TOTAL RESEARCH | <u>321,049</u> | <u>195,340</u> |
| EDUCATION | | |
| MARINE EDUCATION AND TRAINING | | |
| Other Education | 16,700 | 6,738 |
| ADVISORY SERVICES | | |
| ADVISORY SERVICES | | |
| Extension Programs and Other Advisory Services | 111,784 | 61,005 |
| PROGRAM MANAGEMENT | | |
| PROGRAM MANAGEMENT | | |
| Planning, Development and Administration | <u>113,467</u> | <u>107,480</u> |
| TOTALS | <u>\$563,000</u> | <u>\$370,563</u> |

MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

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University of Mississippi

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MASGC, Administrative Council
Associate Director of University
Research
Graduate School**

Auburn University

**Dr. Gene A. Bramlett
Vice President for Extension and
Public Service**

Gulf Coast Research Laboratory

**Dr. Harold D. Howse
Director**

Mississippi State University

**Dr. J. Chester McKee, Jr.
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Tuskegee Institute

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University of South Alabama

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Alabama Marine Environmental
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Dauphin Island Sea Lab**

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Gulf Regional Planning Commission

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Southern Operations

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Mobile Public School System
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Biology Teacher
Biloxi High School

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Mississippi Agricultural and
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Code 110
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Development Activities
Department of the Navy

Dr. J.J. Hayden
President
Gulf Coast Junior College

Mrs. Verda Horne
Alabama Conservancy
League of Women Voters

Mr. L. Willis Hyde
Alabama Development Office
Coastal Area Board Program

Mr. Tom J. Joiner
State Geologist
Geological Survey of Alabama

Mr. Edgar Pullis
Captain Ed's Restaurant

Mr. Charles M. Lyles
Executive Director
Gulf States Marine Fisheries
Commission

The Honorable Ben H. Stone
Mississippi State Senate

Dr. Hugh Swingle, Director
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and Natural Resources

Mr. Joe Moore
Joe Moore Seafood Company, Inc.

Mr. J.R. Nelson
Bon Secour Fisheries

Dr. William E. Powell
Lapeyrose

Mr. J.E. Thomas
Executive Director
Mississippi Marine Resources Council

Mr. Ron Werby, President
Mississippi State Port Authority

PROGRAM SUMMARY

| <u>Project No.</u> | <u>Project Title</u> | <u>Principal Investigator</u> | <u>1978</u> |
|-------------------------------|--|-------------------------------|-------------|
| Living Resources | | | |
| R/LR-1 | The Impact of Netting and Sport Fishing on Economically Important Estuarine Species | Lorio | C |
| R/LR-2 | Seasonal Distributional Patterns of River Shrimp, <i>Macrobrachium ohione</i> , in the Pascagoula River Estuary | Anderson | N/E |
| R/LR-3 | Slipper Lobster Fishery Potential in the North Central Gulf of Mexico | Crozier, et al | E |
| R/LR-4 | A Survey of Gulf Coast Oysters for Pathogenic Organisms | Hawkins | N/E |
| R/LR-5 | Utilization of Chitin to Control Pesticide Mobility | McCormick | C |
| R/LR-6 | Evaluation of the Ecological Role and Techniques for the Management of Tidal Marshes on the Mississippi and Alabama Gulf Coast | Stout, et al | E |
| R/LR-7 | Longline Potential Off Mississippi/Alabama | Shipp | N/E |
| R/LR-8 | Cooperative Billfish Study | Richardson | N/E |
| Coastal Policy Studies | | | |
| R/CP-1 | A Proposed Mississippi Marine Finfish (Selected) Fishery Management Plan | Etzold, et al | N/E |
| R/CP-2 | Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi | Williams, et al | C |
| R/CP-3 | The Status and Relation of the Coastal Zone to Alabama's Economy | Hardy | C |
| R/CP-4 | Marine Resources Law | Criddle, et al | C |
| Seafood Processing | | | |
| R/SP-1 | Viral Evaluation of Prohibited Oyster Growing Waters | Ellender | C |
| R/SP-2 | Oyster Depuration Facility: Engineering Assessment | Cake, et al | C |
| R/SP-3 | Shrimp Quality: New Techniques for the Small Processor | Toom | E |
| Environmental Studies | | | |
| R/ES-1 | The Assembly, Analysis and Evaluation of Available Existing Atmospheric and Hydrographic Data for Mississippi Sound | Eleuterius | N |

Legend

E - Project completed or terminated
 C - Project continued
 R - Project redirected
 N - Project initiated

PROGRAM SUMMARY (continued)

| Project No. | Project Title | Principal Investigator | 1978 |
|---|---|-------------------------------|-------------|
| Education and Training | | | |
| E/LR-1 | Handbook of the Common Marine Salt Marsh Invertebrates of the Northeastern Gulf of Mexico | Heard | N/E |
| E/LR-2 | The Development of a Program to Promote a Marine Awareness, Especially Among Minority and Financially Deprived Students and Educators | McCaughan | N |
| Extension Programs & Other Advisory Services | | | |
| A/EP-1 | Mississippi Sea Grant Advisory Service Program | Veal | C |
| A/EP-2 | Alabama Sea Grant Advisory Service Program | McCord | C |

LEGEND

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Cover: Shrimp boat typical to the Mississippi-Alabama area. Don Watson, artist.

Title Page Photograph: Cast netters at sunset off Biloxi, Mississippi, beach. Art supplied by principal investigators, MASGC staff and Mississippi Press Register photographers Jerry Moulder, Herb Welch and Jon Mitchell.

Linda Skupien
Editor

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