Gulf Research Reports

Volume 5 | Issue 2

January 1976

Activities of the Gulf Coast Research Laboratory During Fiscal Year 1975-76: A Summary Report

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DOI: 10.18785/grr.0502.08

Gulf Research Reports, Vol. 5, No. 2, 49–60

ACTIVITIES OF THE GULF COAST RESEARCH LABORATORY DURING FISCAL YEAR 1975–76: A SUMMARY REPORT

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GENERAL

Mississippi's institution of higher learning for research and education in the marine sciences, the Gulf Coast Research Laboratory received an annual general support appropriation of $1,390,318 for the fiscal year 1976 allocated by the 1975 Mississippi Legislature. This support was augmented by self-generated funds, including grants and contracts, in the amount of $508,365.

RESEARCH VESSEL

Construction of an 85-foot oceanographic research vessel for the Gulf Coast Research Laboratory by International Marine Fabricators, Tampa, Florida, under contract with the State Building Commission, continued until February 1976 when all work ceased. At that time, International Marine Fabricators went out of business, leaving the vessel partially constructed. The State Building Commission is currently studying the entire problem and is expected to proceed with the completion of the vessel upon the acquisition of additional funds.

PHYSICAL PLANT

A two-story addition to the Richard L. Caylor Building neared completion as the year ended. The construction was funded in the amount of $172,000 and supervised by the State Building Commission. When completed, the building will provide a lecture hall on the first floor. The second floor will provide 2,400 square feet of space and will house the administrative offices of the Mississippi-Alabama Sea Grant Consortium.

A new water well was constructed to supplement the existing system that had about reached its limit of supply and to provide for the needs of facilities planned for the future. Further, it increased the supply of water available for fire fighting which was previously inadequate. This project was funded in the amount of $16,500 and supervised by the State Building Commission.

The Laboratory, using institutional funds in the amount of $28,318, constructed a 21x62-foot greenhouse and controlled environment chamber for the Botany Section. This facility significantly expands the Laboratory's research capability and enhances current studies of saltmarsh plants and seagrasses.

The Laboratory acquired, at no cost, approximately 52.0 acres of surplus property consisting of about 6.07 acres of marsh island and 45.83 acres of water bottoms from the Department of Health, Education and Welfare on January 30, 1976. This relatively undisturbed estuarine marsh will be used principally as an experimental study area for graduate students pursuing original research, and for ecological studies, including the periodic monitoring of various environmental parameters by Laboratory investigators.

RESEARCH SECTIONS

During the year, the 15 research sections collectively pursued 124 separate investigations, with progress varying from initial probes to completion. A few selected projects for each section are described briefly below:

ANADROMOUS FISHES SECTION

Striped Bass Rearing and Stocking–Mississippi (Funded by National Marine Fisheries Service, U.S. Fish and Wildlife Service and Gulf Coast Research Laboratory): The final segment of this three-year project was carried out during the year. The overall objective was to establish a viable striped bass population in Mississippi coastal waters.

A total of 446,000 2-inch South Carolina striped bass were laboratory reared and released into local waters, along with 30,000 2-inch bass reared from fish known to migrate into the open sea.

A hatchery was established at the Mississippi Game and Fish Commission laboratory on the Ross Barnett Reservoir near Jackson, Mississippi. Ripe male and female striped bass were captured from the tailrace of the dam, taken to the hatchery and spawned, resulting in 5,000 24-hour-old striped bass fry. A total of 2,670 of these fish were reared to 2 inches in length at the Gulf Coast Research Laboratory and then released into local waters. This was the second consecutive year that striped bass fry were produced from Mississippi brood stock. A sampling program is in progress to check for natural reproduction of previously stocked bass and for the occurrence of juvenile striped bass, and to monitor previously stocked striped bass in order to continue assessing the results of all bass stocking programs previously carried out in this area.

Development of Gulf Coast Artificial Reefs (Funded by Mississippi-Alabama Sea Grant Program): The states of Mississippi and Alabama are currently in the process of placing ten surplus Liberty Ship hulls in eight locations off their coast. A total of nine hulls have been placed in the Gulf at eight locations; two have been sunk off the Mississippi coast at each of two locations. The reefs, monitored bi-weekly by personnel from Mississippi and Alabama, are assessed by diver survey and sport fishing methods. Divers are observing the effects of attraction devices such as automobile tire units and multiple arrays of 10-foot

lengths of 2-inch PVC pipe, attached by one end to the sunken hulls.

Artificial Midwater Reef Development Program (Funded by Mississippi Marine Resources Council and Gulf Coast Research Laboratory): Extensive colonization by hydroids and amphipods has occurred on the attractors (enhancement devices). Large aggregations of desirable pelagic and reef fish have been observed and caught over and in the reefs. Observations of the success of the reefs as attractors are being conducted in conjunction with this project.

Bait Fish Rearing (Funded by Mississippi Marine Resources Council and Gulf Coast Research Laboratory): This study, to be initiated on July 1, 1976, will develop and make available methods for rearing bullminnows in controlled ponds to supply the live-bait industry. The bullminnow is a favorite live bait used when available by many coastal sportfishermen. Supplies are quickly depleted in late fall when the spotted seatrout (*Cynoscion nebulosus*) are running. Bullminnows are supplied to the retail market by a few fishermen using traps and/or hook-and-line.

ANALYTICAL CHEMISTRY SECTION

Sediment and Floral Hydrocarbons of the MAFLA Monitoring Program (Funded by Bureau of Land Management, U.S. Department of Interior): The investigation of the distribution of hydrocarbons in benthic sediments and algae was continued through the project. Samples were collected during two seasons from transects extending around the northeastern Gulf, from Pascagoula, Mississippi, to Ft. Myers, Florida, and out to the edge of the continental shelf. In order to monitor the effects of exploratory drilling done in 1974–75, a larger area was sampled and collections were made over a longer period than were those of a baseline study conducted in 1974, prior to exploration. The study also determined seasonal variations at stations beyond the present lease sites.

Sediment and Floral Hydrocarbons of the MAFLA Rig Monitoring Program (Funded by Bureau of Land Management, U.S. Department of Interior): Twenty-five stations located off Port Aransas, Texas, were sampled before, during, and after the construction of a rig to determine the detrimental effects of rig use. Although the analyses are incomplete, it appears that no pollution effects are discernible. The major advantage of this study was to provide a means of testing the reproducibility of sampling and analysis for sedimentary hydrocarbons.

BOTANY SECTION

A Study of Salt Marsh in Mississippi by Remote Sensing (Funded by Mississippi Marine Resources Council and Gulf Coast Research Laboratory): This project was designed to obtain ground truth data on the vegetation of salt marshes of Mississippi. Surveys were conducted and 40-acre vegetatively homogeneous tracts were selected to be utilized in developing remotely sensed electronic signatures from satellite flights. Small tracts, ranging in size from a fraction of an acre to an acre or more, were selected for low-altitude aircraft flights provided by the National Aeronautics and Space Administration. These flights provided detailed information on the vegetational and ecological aspects of Mississippi salt marshes. This information will ultimately be used to prepare vegetational maps of Mississippi's wetlands.

The Population Dynamics of Juncus roemerianus (Funded by Gulf Coast Research Laboratory): This study was initiated during the year. *Juncus* dominates the marshes of Mississippi and a better understanding of its genetics and productivity are major objectives of the study.

A Phytosociological Study of Horn and Petit Bois Islands, Mississippi (Funded by U.S. National Park Service): This two-year project is scheduled to begin on July 1, 1976. The first year's work will consist of a general survey to locate areas from which to obtain detailed floristic and ecological information during the second year. The study will determine the presence and abundance of each species, define and map habitats, and deal with their ecology.

ECOLOGY SECTION

Three environmental impact statements were drafted during this fiscal year. The first of these was requested by the Jackson County Board of Supervisors for the Ocean Springs, Mississippi, Beach Renewal project. This project called for the dredging of 30,000 cubic yards of sand to replenish 2,800 feet of front beach in Ocean Springs. The other two impact statements were written for the Laboratory. One of these was for the widening and deepening of the docking facilities at Point Cadet, Biloxi, to provide docking space for the new research vessel. The other was necessary in order for the Laboratory to obtain a marsh island in Back Bay of Biloxi from the federal government. A similar document was also prepared on the value of Marsh Point as a natural unaltered marsh area.

Environmental Affairs Committee: The activity of this Committee, composed of the senior scientific staff, is coordinated by the Ecology Section. The Committee coordinates the Laboratory expertise to provide an interdisciplinary focus on environmental problems, impact statements and permit requests for work proposed in the wetlands and estuaries. The latter is a service to the Mississippi Marine Resources Council, which partially funds this work.

Many permit requests were reviewed throughout the year. In addition, an environmental evaluation of dredging operations in the Pascagoula River by Technical Sands, Inc., Moss Point, Mississippi, was conducted from December 3, 1975 through April 9, 1976 for the Mississippi Marine Resources Council.

ENVIRONMENTAL CHEMISTRY SECTION

The Fate and Effect of Oil Pollution in the Marine Environment (Funded by Environmental Protection Agency): The final year of this three-year study, jointly conducted by Mississippi State University, University of Southern Mississippi and the Gulf Coast Research Laboratory, was completed in February of 1976. During the summer months of 1975, the focus of research was four test ponds located at the National Space Technology Laboratory near Bay St.

Louis, Mississippi. Three new crude oils were tested for toxic effects on shrimp, mullet and oysters in these ponds. Both hydrocarbon distributions and concentrations were determined periodically on sediments, water column and plant tissue. A final report has been submitted to the primary contractor, Mississippi State University.

Sediment and Floral Hydrocarbons of the MAFLA Monitoring Program, and Sediment and Floral Hydrocarbons of the MAFLA Rig Monitoring Program (Funded by Bureau of Land Management, U.S. Department of Interior): The Environmental Chemistry Section participated jointly with the Analytical Chemistry Section (see) in these studies.

FISHERIES MANAGEMENT SECTION

Liberty Ship Artificial Reef (Funded by the Mississippi Marine Conservation Commission and Gulf Coast Research Laboratory): During the year two more Liberty Ship hulls were sunk offshore, one of which was located 4 ½ miles south (3HO 35921-3HI 1900) of Horn Island and the other, 12 ½ miles south (3HO 3577-3HI 1907) of Horn Island. The section worked jointly with the Anadromous Section (see) on the artificial reef study. This project is expected to improve recreational fishing in the area for the benefit of the general public.

A Survey of Oyster Reef Populations in Biloxi and Pascagoula Bays (Funded by Gulf Coast Research Laboratory): These reefs have historically produced large quantities of oysters. However, in the 1960's, both areas were closed because of high coliform counts caused primarily by septic tank seepage and improperly operating sewage treatment facilities. In their present locations, the oysters are a liability to the State in that the areas must be patrolled on a 24-hour basis to prevent their illegal removal and use. They also constitute a lost resource unless they can be removed to clean waters where they cleanse themselves by depuration and then can be harvested.

The objectives of the survey included the assessment of the present oyster population on the major closed reefs in order to determine the size range and abundance of the oysters and the locating of a suitable bottom for relaying and subsequent depuration of the oysters. The survey showed that 100 barrels of large oysters were available on the two major closed reefs. It was further determined that, with proper management, an oyster population of this magnitude could be sustained annually. Another aspect of the reef survey revealed in excess of 710 acres of bottom suitable for oyster relaying and depuration.

FISHERIES RESEARCH AND DEVELOPMENT SECTION

Fisheries Resources Assessment and Monitoring, Mississippi (Funded by National Marine Fisheries Service and Gulf Coast Research Laboratory): An extensive sampling program employing trawls, seines, plankton nets and nekton nets has provided data for assessment and monitoring of Mississippi's fishery resources. Monthly reports, published in *Marine Briefs,* have provided real-time information on resource populations. Appropriate segments of this work have been closely coordinated with the National Marine Fisheries Service's research in Gulf waters. Data have been provided to the Mississippi Marine Conservation Commission, Mississippi Marine Resources Council, Mississippi-Alabama Sea Grant Consortium, and to numerous other State and federal agencies and many private entities.

The shrimp sampling program has provided accurate predictions of the commercial fishery production and a scientific basis for management of the shrimp fishery. Estimates based on data from previous years show that the 1975 brown shrimp crop in Mississippi waters was worth approximately $1,000,000 more in dockside value than could have been expected from the same potential in prior years. The June 1976 harvest, according to preliminary reports, probably set a new high record for value and volume. Similar production rates are expected to continue through the season.

Fisheries Planning (Funded by Gulf Coast Research Laboratory): Active participation by the Laboratory provided for the effective input of Mississippi's position in practically all Gulf of Mexico fishery planning activities. These activities involved cooperation with such agencies as the National Marine Fisheries Service, Gulf States Marine Fisheries Commission, the Commission's Technical Coordinating Committee and sub-committees, Gulf State-Federal Fishery Management Board, Sea Grant Association, Mississippi Marine Resources Council, Mississippi Marine Conservation Commission and several professional societies.

The Gulf Coast Research Laboratory was selected to develop management plans for Gulf shrimp and Gulf menhaden and, subsequently, was awarded federal grants totaling $100,000 to develop these plans.

Cooperative efforts with Sea Grant personnel and fishing industries resulted in acceptance by the U.S. Army Corps of Engineers and congressional delegations from the Gulf states of a proposal to study the feasibility of controlled fresh water introduction to estuaries east of the Mississippi River delta.

Fishery Assistance Services (Funded by the Gulf Coast Research Laboratory): Technical assistance was provided in response to numerous calls from local fishing industries, especially bait and crab fishermen, and from the Mississippi Marine Conservation Commission. Up-to-date information on fishery technological problems, regulations, and pertinent pending legislation has been made available to fishermen and the fishing industry.

Statistics on Subsistence Fishing in Coastal Counties of Mississippi (Funded by National Marine Fisheries Service and Gulf Coast Research Laboratory): Investigations continued to determine the level of subsistence fishing in the coastal counties of Mississippi. This study was designed to give an equal amount of attention to all commercially important species and gear types presently managed by the Mississippi Marine Conservation Commission. It is unlike previous surveys of this nature in other states, generally listed as "recreational shrimping" that deal only with one major gear type and usually three common species of shrimp (*Penaeus aztecus, Penaeus setiferus,* and *Penaeus duorarum*).

Subsistence fishermen utilize part or all of their catch as a direct food source, thus supplementing the family

income. In instances where the catcher has to travel great distances or use high-powered gasoline engines, the cost per pound of seafood may be high. Preliminary determinations in this investigation indicate the cost per pound in the Mississippi subsistence shrimp fishery to be $1.37. The cost per pound is decreased due to the number of commercial fishermen involved in this study and their use of larger gear and diesel engines and the close proximity of the inhabitants in the coastal counties of Mississippi to the resource.

The commercial shrimp catch from the inside waters of Mississippi is not known precisely, because the statistical areas used by the National Marine Fisheries Service in reporting shrimp landings (*Gulf Coast Shrimp Data*) include portions of Louisiana and Alabama with Mississippi. Total figures for the commercial catch have not been published to date for 1975. Preliminary figures published in Mississippi Landings, indicate a 24-percent drop from 1974 to 1975 for shrimp. Shrimp taken by subsistence fishermen declined 15 percent from 1974 to 1975 (166,667 pounds to 141,757 pounds).

Development of a Fishery Management Plan for Gulf Shrimp (Funded by National Marine Fisheries Service, Gulf States Marine Fisheries Commission, and the five Gulf states): The Gulf of Mexico shrimp fishery, harvesting at least seven species, extending to all parts of the United States Gulf coast, utilizing an extremely diverse fleet of boats and vessels, employing many thousands of people and producing the highest dollar value of any Gulf fishery, is extremely complex. Current management is entirely under State jurisdiction and is limited to territorial waters. Development of an acceptable Gulf-wide management plan, designed to accomplish and maintain optimum sustainable yield from these resources, is essential.

The Gulf States Shrimp Management Plan will contain a clear statement of mission and objectives, utilizing the "Management by Objectives" technique. Problem identification will focus on profile work already completed; i.e., the discussion paper on shrimp fishery management, National Marine Fisheries Service. Problems will be identified by type (administrative, legal, institutional, legislative, biological, technical, economic, social, environmental, etc.), by degree, and homogeneous area (state, international, range of stock, or section of Gulf). Problems will be analyzed, and potential alternative solutions will be developed, which will in turn reflect needs for problem solution. An action program will then be developed to delineate and prioritize the most feasible actions necessary to meet the established mission and objectives.

Funds necessary to implement the proposed actions will be estimated, the appropriate funding source will be identified, as will the responsibility for taking the necessary actions and the potential benefits that may accrue to the fishery if the funds are spent. Priorities for action will be scheduled, as required, for task(s) accomplishment.

A recommended approach for coordinating the management program will be outlined, including the responsibilities for assuring implementation of the plan. A system for monitoring and evaluating the effectiveness of the management program will be designed.

The Gulf Coast Research Laboratory, with the aid of representatives from the Gulf states (Florida Department of Natural Resources, Alabama Department of Natural Resources, Mississippi Marine Conservation Commission, Louisiana Wild Life and Fisheries Commission and Texas Parks and Wildlife Department), National Marine Fisheries Service laboratories and other agencies as appropriate, will develop from existing secondary data and necessary interview data, a concise description of the Gulf shrimp fishery.

Development of a Fishery Management Plan for Gulf Menhaden (Funded by National Marine Fisheries Service, Gulf States Marine Fisheries Commission and the five Gulf states): The Gulf of Mexico menhaden fishery, using a relatively homogenous fleet of large vessels owned and operated by only five companies, harvests the largest volume taken in any U.S. fishery, almost entirely from one species located in the north central Gulf of Mexico. Consequently, development of an acceptable management plan with all companies participating is not expected to be extremely complex. However, there are strong indications that the maximum sustainable yield is already achieved in this fishery and management plan development is urgent.

The Gulf States Menhaden Management Plan will contain a clear statement of mission and objectives, utilizing the "Management by Objectives" technique. Problem identification will focus on profile work already completed; i.e., the discussion paper on menhaden fishery management, National Marine Fisheries Service. Problems will be analyzed, and potential alternative solutions will be developed, which will in turn reflect needs for problem solution. An action program will then be developed to delineate and prioritize the most feasible actions necessary to meet the established mission and objectives.

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GEOLOGY SECTION

Mississippi Offshore Inventory and Geological Mapping

Project (Funded by Mississippi Marine Resources Council and Gulf Coast Research Laboratory): This project consisted of mapping and describing sediments of the bottom and subbottom of Mississippi Sound. Additionally, the erosional-accumulation conditions on the mainland, several islands and human activities influencing them were studied.

Geological Cross-Sections Under the Sound (Funded by Mississippi Marine Resources Council): A report with illustrations, completed and submitted in January 1976, will be published in offset print by the Mississippi Marine Resources Council.

Gulf of Mexico Bottom Sediment Analysis (Funded by National Marine Fisheries Service): Analyses of 25 bottom sediment samples were made for the National Marine Fisheries Service at Pascagoula, Mississippi, for their use in correlating with fish habitats for sediment texture types.

Offshore Barrier Island Study (Funded by Gulf Coast Research Laboratory): This project addressed the geological history, genetic conditions and present-day state of six Mississippi-Alabama barrier islands. Corehole drilling was completed on Dauphin Island (three coreholes), Petit Bois Island (three coreholes) and Horn Island (five coreholes) through contractors using thread-mounted rotary rigs. The U.S. National Park Service provided barge transportation. Sediment and micropaleontological analyses of the obtained samples are in progress.

Study of Heavy Mineral Content, Distribution and Origin of Miocene Coastal Sedimentary Units (Funded by Gulf Coast Research Laboratory): Formations play an important part in the makeup of the Mississippi coast and as aquifers. The stratigraphic problems involved are being studied in cooperation with Mississippi Geological Survey.

MICROBIOLOGY SECTION

Pollution Indicator Bacteria Studies in Selected Areas of the Mississippi Sound (Funded by Gulf Coast Research Laboratory): Water samples were collected monthly from 63 stations. Stations were located in Biloxi Bay, in four transects across the Mississippi Sound and on the beaches of Horn and Ship Islands. Samples were subjected to bacteriological analysis for coliforms and fecal coliforms.

Microbiology of Crabmeat and Sanitation in Crab Processing Plants (Funded by Gulf Coast Research Laboratory): Several crab processing plants in Mississippi are being visited regularly to make microbiological evaluations of the quality of their products at each step in processing. In addition, a study is being made of the bacteria associated with crabmeat as it undergoes the spoilage process.

Microbiology of Estuarine Sediments (Funded by Gulf Coast Research Laboratory): Currently, studies are being made of the distribution, taxonomy and ecology of bacteria of the genus *Bacillus* in estuarine sediments.

Persistence and Degradation of Insecticides in Estuarine Water and Sediment (Funded by Gulf Coast Research Laboratory): Investigations have continued regarding the degradation of malathion, parathion, methyl parathion, and diazinon in estuarine water and sediment. Emphasis has been on the metabolism of these organophosphorus insecticides by pure culture bacteria indigenous to the sediment of the Mississippi Sound estuary system. Work involving malathion and parathion has essentially been completed, resulting in various publications. Investigations concerned with methyl parathion and diazinon are in progress.

In addition to studies concerning the organophosphate insecticides, an attempt is currently underway to isolate into pure culture a bacterium or fungus capable of degrading mirex, a chlorinated hydrocarbon insecticide. To date, the microbial degradation of mirex has not been demonstrated.

Insecticide Persistence in Natural Seawater as Affected by Salinity, Temperature, and Sterility (Funded by U.S. Environmental Protection Agency): The objective of this research is to determine the effect of salinity, temperature, and sterility on the persistence and degradation of malathion, parathion, methyl parathion, diazinon, and methoxychlor in natural seawater. Three temperatures (10°, 20° and 30°C) and four salinities (0, 10, 20 and 28 ppt) are employed in these investigations. Results to date indicate that abatement of the organophosphate insecticides is directly proportional to salinity and inversely proportional to increasing temperature. Insecticide disappearance appears to be the result of both chemical and biological mechanisms.

MICROSCOPY SECTION

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi (Funded by Gulf Coast Research Laboratory): Studies were initiated on a variety of parasites and pathological processes of commercially important fishery species and are still in progress, in collaboration with the Section of Parasitology (see).

Internal Lymphocystis of the Silver Perch (Funded by Gulf Coast Research Laboratory): This study of lymphocystis disease of various internal organs, with emphasis on cardiac lesions, neared completion by the end of the year.

OYSTER BIOLOGY SECTION

Oyster Spat Monitoring Program, Biloxi Bay and Adjacent Waters (Funded by Gulf Coast Research Laboratory): This project is concerned with basic biological research on settlement and growth of oyster "spat" in various areas of Mississippi Sound.

Cestode Parasites of Oysters and Other Edible Mollusks of the Northeastern Gulf of Mexico (Funded by Gulf Coast Research Laboratory): This study dealt with the effects of oyster predators and pathogens.

Biological and Ecological Studies of the Oyster Boring Clam (Funded by Gulf Coast Research Laboratory): This is a study of the effects of boring clams, including their distribution, abundance, reproduction and their effect on Mississippi Sound oysters.

The section was instrumental in making it possible for the Laboratory to establish the first seed oyster hatchery (see) in the Gulf of Mexico region in cooperation with the Mississippi Marine Resources Council. The section has charge of the hatchery which is now operational and continues to

increase its production of seed oysters for research and development projects in Mississippi.

PARASITOLOGY SECTION

Parasites of Commercially Important Fishes (Funded by National Marine Fisheries Service and Gulf Coast Research Laboratory): This project primarily concerns the use of parasites of Atlantic croaker to indicate migratory and feeding behavior of the fish. Feeding habits of several local finfishes are being investigated. The project also covers aspects of the effects of selected parasites on several different hosts.

Parasites of Marine Animals in the Northern Gulf of Mexico (Funded by Mississippi-Alabama Sea Grant Program and Gulf Coast Research Laboratory): This project is divided into studies dealing with parasites infecting finfishes and shellfishes of commercial interest, and those capable of infecting or causing disease in man. The latter studies were concerned with parasites that cause dermatitis and those that can infect or cause disease in man if infected hosts are eaten raw or inadequately prepared.

Studies on Helminths of the Northern Gulf of Mexico Region (Funded by Gulf Coast Research Laboratory): A determination of parasites of hosts was made in this study. It included life histories of the parasites and the relationship between parasites and hosts.

A Study of the Diseases of Fish of Mariculture Potential: Parasites and Parasite-Borne Diseases of Red Sea Mullets (Mugilidae) (Funded by U.S.-Israel Bi-National Foundation): This project was conducted under the auspices of the United States-Israel Bi-National Science Foundation, in collaboration with Dr. Ilan Paperna, Marine Biological Laboratory, The Hebrew University, Elat, Israel.

Because Mediterranean mullets have been maintained successfully in ponds and because disease in those fish is a serious problem, the diseases of Red Sea mullets are being studied to judge their potential in culture. Emphasis also centers around heterophyid infections, since these trematodes can be transmitted to man.

PHYSICAL OCEANOGRAPHY SECTION

Mississippi Sound Hydrographic Study (Funded by Mississippi-Alabama Sea Grant Program and Gulf Coast Research Laboratory): This project has the multiple objectives of: describing the tidal-current patterns; construction of cophase charts; and delineating the distribution of nutrients and salinity. Additionally, much of the tidal and physical constituent data will be employed in the development and calibration of a mathematical model of Mississippi Sound.

Characterization of Tidal Bayou and Development of Statistical Evaluation/Monitoring Techniques (Funded by Gulf Coast Research Laboratory): While much emphasis has been placed on research in open estuarine waters, very little work has been done in the most critical areas, the contributaries—especially the tidal bayous. Data to ascertain the most useful of parametric statistics to characterize the system have been collected for the past two years. In addition to establishing these baseline statistics, statistical techniques are being developed for monitoring the bayous for changes that might ordinarily go unnoticed using the usual methodology.

PHYSIOLOGY SECTION

Studies on the Time Course of Salinity and Temperature Acclimation in Brown Shrimp Penaeus aztecus Ives (Funded by U.S. Army Corps of Engineers): The objective of this study was to determine the rates at which brown shrimp adapt to changing conditions of salinity and temperature. This information was totally lacking and the results are important in basic and applied research, particularly in mariculture. The brown shrimp were tested both by direct transfer from control salinity and temperature conditions and by acclimating them in control salinity maintained at three temperatures. The level of adaptation in different conditions was determined on the basis of attaining a steady state in the regulation of blood osmotic and ionic concentrations and in oxygen consumption rates. In the second phase of this project, a study was made of the effects of deviated ion-ratios in the water media on the survival and behavioral responses of brown shrimp. Also, attempts were made to define the lethal ion-ratio deviations in coastal waters for brown shrimp.

Evaluation of the Nutritional Value of Grass from High Marsh Areas from Brown Shrimp Penaeus aztecus Ives (Funded by Mississippi Marine Resources Council and Gulf Coast Research Laboratory): The objective of this study, to be initiated July 1, 1976 and conducted in conjunction with the Section of Microbiology, is to determine the feasibility of using high marsh grasses as a supplemental feed for young shrimp. Shrimp shell waste from the canning industry will also be evaluated as a nutrient source. Should these experiments provide satisfactory growth rates, it will be possible to prepare food for shrimp and other crustaceans more economically with the available natural ingredients.

Studies on the Molting Frequency of Small Postlarval Brown Shrimp Penaeus aztecus Ives in Relation to Salinity (Funded by Gulf Coast Research Laboratory): The objectives of this study are to determine the role of salinity changes on the molting frequency and resultant growth rates of young brown shrimp. This data will be correlated with behavioral, growth and survival rate data, already obtained from earlier studies, to determine optimal rearing salinities for the various postlarval stages.

SYSTEMATIC ZOOLOGY SECTION

Collections were obtained in the Panama Canal and adjacent areas during January 1976; a trip was made to Belize during April. This work was conducted in cooperation with the Smithsonian Institution.

Systematic and distributional studies continued on the families Microdesmidae, Gobiidae, Dactyloscopidae and Syngnathidae. Reviews of the Indo-Pacific pipefish genera *Corythoichthys* and *Lissocampus* were completed. A large amount of data leading to a synopsis of pipefishes currently

referred to as the genus *Icthyocampus* was accumulated. Work was initiated on studies leading to a review of the Atlantic sand stargazers (Dactyloscopidae). Work continued on the review of Atlantic pipefishes and other long-term projects. In connection with these matters, studies were made on fishes in the collections of the Philadelphia Academy of Sciences and the National Museum of Natural History.

SPECIAL FACILITIES

MARINE EDUCATION CENTER

Visitations to the Marine Education Center have shown a dramatic increase from 13,750 in fiscal year 1975 to 19,675 in fiscal year 1976. With the construction of a larger facility in the future, it is anticipated that the Center will attract in excess of 200,000 visitors annually.

Twenty-one teachers have taken the advanced course, "Advanced Studies in Marine Science for Teachers," offered at the Marine Education Center, and 74 teachers have completed the introductory course, "Basic Techniques in Marine Science for Teachers." A third course, "Marine Science for Elementary Teachers," has been written and approved and is to be offered at a later date.

The Curator of the Center acts as a consultant to Marine Life, Inc., of Gulfport, Mississippi, concerning proper procedures for maintaining local marine animals. In addition, the Curator instituted a research project with a graduate student in an effort to determine the causative agent for "Paisley's Disease" which has infected several of the dolphins owned by Marine Life.

Educational pamphlets for the elementary student have been published concerning the crawfish and the Atlantic bottlenosed dolphin. Future efforts in this area will concentrate on a series treating local game fish.

OYSTER HATCHERY

The Oyster Biology Section completed the design and construction phases of the oyster hatchery in 1975 and it entered an operational testing phase. Hatchery personnel began improving oyster culture techniques, equipment operation and maintenance, technical processes, etc., and integrating them into a functional and operational pilot seed oyster hatchery. Millions of attached and unattached (cultchless) seed oysters are being reared on a continuous basis in the hatchery. The seed oysters being reared now are used for various experimental purposes, including (but not limited to) the following: staff and graduate student field and laboratory experiments, cooperative oyster culture experiments with other state agencies and interested parties, and bioassaying. Excess seed oysters will be used for reef rehabilitation trials.

The seed oyster hatchery is providing evidence that such a culture facility is practically feasible (i.e., is capable of producing millions of attached and cultchless seed oysters) and can play a major role in the development of intensive oyster culture in Mississippi Sound and adjacent waters.

The knowledge gained from the oyster hatchery research will eventually assist the Mississippi Sound oyster industry by increasing production in unpolluted areas or by rejuvenating formerly productive reefs. The hatchery should also demonstrate the commercial potential for private seed oyster hatcheries in Mississippi Sound and the northern Gulf of Mexico. The hatchery's potential as an educational and research facility in the years to come is, perhaps, its greatest value.

THE GUNTER LIBRARY

During the fiscal year, 308 books and 1,212 reprints were accessioned. Numerous back issues of journals were purchased with special Library Improvement Funds appropriated by the Mississippi Legislature. Major gifts from individuals included a personal library valued at $14,000 from Dr. Harry J. Bennett of Louisiana State University, and a collection of 4,500 reprints and separates from Dr. Jean Piatt of the University of Pennsylvania. The personal reprint collection of Dr. Gordon Gunter, Director Emeritus, was placed in the Controlled Circulation section. The reprint cataloging program was revitalized with the assignment of one extra typist and a number of graduate students to the task.

A Library Committee was formed in October 1975 and as a result of their recommendations a six weeks course in Library Science was conducted for the Library assistants and aides. The Committee was also instrumental in the development of modified circulation systems, in acquiring needed equipment, and in setting up the graduate student reprint cataloging program.

ICHTHYOLOGY RESEARCH MUSEUM

The Museum, part of the Systematic Zoology Section, cataloged 1,004 lots of fishes, representing about 10,000 specimens. The total vertebrate holdings now include 14,894 cataloged lots, approximately 140,000 specimens.

A number of loans and exchanges were made with other institutions in the United States and elsewhere. Numerous identifications were made on materials sent by workers in Surinam, Nicaragua, Mexico, Australia, Hawaii, Panama, Samoa and the United States.

Gifts or exchange specimens were received from the National Museum of New Zealand; University of Nicaragua; University of Panama; Western Australian Museum; Zoologische Museum, Kanpur, India; National Museum of Natural History (Smithsonian Institution); California Academy of Sciences and other institutions.

The Museum was designated as one of five major Regional Ichthyological Collections in the final report of the American Society of Ichthyologists and Herpetologists Advisory Committee on collections.

The Gulf Coast Research Laboratory is a member institution of the Association of Systematics Collections.

WATER ANALYSIS LABORATORY

This facility is operated by the Analytical Chemistry

Section. During the year, water analyses were performed for the sections of Physical Oceanography, Botany, Parasitology, Ecology and Anadromous Fishes. In addition, samples were processed for Marine Life of Gulfport, Mississippi. The Mississippi Marine Resources Council contracted for a variety of analyses on waters from the Pascagoula River.

A total of 2,185 separate analyses were conducted, including analyses for nitrate (382), nitrite (358), total phosphorus (382), orthophosphate (382), ammonia (42), salinity (41), chlorophyll (28), phaeophytin (28), DO (4), sulfate (12), total suspended solids (60), pH (53), silicate (24), turbidity (48), alkalinity (29), COD (24), fluoride (24), cyanide (24), Kjeldahl (24), and nine heavy metals (24).

COMPUTER SECTION

The Computer Section underwent an overall streamlining and improvement program, which included the updating of existing data files, development of higher level statistical and graphic programs, production of an ongoing accounting system and the cross-training of all section personnel.

Equipment was acquired to execute, as soon as possible, a tie-in of the Laboratory's IBM 1130 Computer with the Xerox Sigma IX Computer at the University of Southern Mississippi, Hattiesburg.

PUBLIC INFORMATION/PUBLICATIONS SECTION

This Section prepared news releases on a variety of newsworthy subjects and distributed to 50 selected daily and weekly newspapers, television and radio stations, wire services, and special correspondents. Comprehensive articles on the Laboratory were prepared for use in "special editions" of the Mississippi Press (March 1976) and the Sun-Herald (July 1976).

Numerous briefings on the Laboratory and guided tours of the facilities and research projects were provided to an average of one high school science class per week during the school year and to special groups such as junior high school principals, junior college students, and Laboratory summer students.

Gulf Research Reports, Volume 5, Number 1, was the first issue in the new 8 ½ x 11 inch page size and contained 62 pages, which included four technical papers and two short communications. Three of these were authored by Laboratory personnel. In December 1975, about 800 copies of the journal were mailed, including 270 to foreign countries. The *Reports* are exchanged for 102 foreign publications and 58 stateside publications.

Copy editing and manuscript setting for Volume 5, Number 2, began in December 1975. By the end of the fiscal year five technical papers and two short communications had been accepted for publication, set and proofed.

Gulf Research Reports titles are now listed in *Marine Science Contents Tables, Aquatic Sciences and Fisheries* and *Current Contents/Agriculture, Biology and Environmental Sciences.*

The Section also writes, edits, sets, proofs and lays out copy for the Laboratory newsletter, *Marine Briefs,* which is written in non-technical language; it was mailed each month to an average 3,280 recipients. Any organization or individual interested may receive this publication.

Two slide programs with printed and taped narrations were produced on different aspects of the seafood industry and are now available on request. The first program, entitled "The Canning of Shrimp in Mississippi" was made with the cooperation of Southern Shell Fish Company, Biloxi. The second program, entitled "The Packing of Raw Oysters by Mississippi Processors," was made with the cooperation of the E. M. Gollott Company, Biloxi. Copies of the programs have been donated to the Mississippi Museum of Natural Science, Jackson.

Production of a 15-minute taped radio program called "On Course," began in January 1976. It was accepted by five local stations and is being broadcast on a weekly basis. By the end of June, 23 programs had been aired and they involved 23 members of the Laboratory staff, faculty and students, plus 10 invited guests representing as many other state and federal agencies and political subdivisions.

ACADEMIC PROGRAM

SUMMER SESSION

During the 1975 summer academic session, 102 students registered individually for a total of 145 student courses. Formal courses offered during that session were:

Marine Botany
Salt Marsh Ecology
Marine Chemistry
Physical Marine Geology
Chemical Marine Geology
Introduction to Marine Zoology
Marine Invertebrate Zoology
Marine Vertebrate Zoology
Aquaculture
Marine Ecology
Marine Fisheries Management
Basic Techniques in Marine Science for Teachers
Special Problems in Marine Science

Forty-four students registered through Mississippi schools, 56 through out-of-state affiliates and 2 through nonaffiliated out-of-state institutions. The 1975 session showed a 5 percent increase in students over the 1974 session.

As an adjunct to the academic program, the Laboratory each year provides, at nominal costs, living accommodations, classroom laboratories, and essential services to visiting scientific field trip groups made up of college and university students and their professors. These groups may stay for periods of up to several weeks, live in the dormitories, use Laboratory boats to make collections of marine life from the sea and from the beaches of offshore islands, and study their specimens in the classroom laboratories. There were 44 visiting field trip groups in the past year. Some came as far as 2,000 miles to study marine life in the Gulf of Mexico.

AFFILIATED ACADEMIC INSTITUTIONS

IN-STATE

Alcorn State University, Lorman, MS
Belhaven College, Jackson, MS
Delta State University, Cleveland, MS*
Jackson State University, Jackson, MS*
Millsaps College, Jackson, MS
Mississippi College, Clinton, MS*
Mississippi State University, Mississippi State, MS*
Mississippi University for Women, Columbus, MS*
Mississippi Valley State University, Itta Bena, MS
University of Mississippi, University, MS*
University of Mississippi Medical Center, Jackson, MS*
University of Southern Mississippi, Hattiesburg, MS*
William Carey College, Hattiesburg, MS

OUT-OF-STATE

Auburn University, Auburn, AL*
Arkansas Tech University, Russellville, AR
Hendrix College, Conway, AR
Berry College, Mount Berry, GA
North Central College, Naperville, IL
Iowa State University, Ames, IA*
Wartburg College, Waverly, IA
Westmar College, LeMars, IA
St. Joseph's College, Rensselaer, IN
Louisiana State University, Baton Rouge, LA*
Louisiana State University Medical Center, New Orleans, LA*
McNeese State University, Lake Charles, LA*
Northeast Louisiana University, Monroe, LA*
Southeastern Louisiana University, Hammond, LA*
Central Methodist College, Fayette, MO
Northeast Missouri State University, Kirksville, MO*
Northwest Missouri State University, Maryville, MO*
Southeast Missouri State University, Cape Girardeau, MO*
Southwest Missouri State University, Springfield, MO*
Queens College, Charlotte, NC
Jamestown College, Jamestown, ND
Bowling Green State University, Bowling Green, OH*
Southwestern Oklahoma State University, Weatherford, OK*
Coker College, Hartsville, SC
Presbyterian College, Clinton, SC
Lambuth College, Jackson, TN
Memphis State University, Memphis, TN*
Southwestern at Memphis, Memphis, TN
Tennessee Technological University, Cookeville, TN*
Tennessee Westleyan College, Athens, TN
Union University, Jackson, TN
University of Tennessee at Martin, Martin, TN*
University of Tennessee at Nashville, Nashville, TN
Southern Methodist University, Dallas, TX*
University of Washington, Seattle, WA*

*INSTITUTIONS WITH GRADUATE PROGRAMS

New Affiliates: Louisiana State University Medical Center at New Orleans; the University of Tennessee at Martin; and the University of Washington at Seattle, became affiliated with the Laboratory during this fiscal year.

GRADUATE RESEARCH PROGRAM

During the year, five students were accepted into the Laboratory graduate research program, one student completed his degree and one student withdrew. At present there are in residence seven candidates for the master's degree and six candidates for the doctorate.

Each candidate's name, thesis title, degree sought and home university are listed below according to research sections directing their work:

Ecology Section: Jerry A. McLelland, "The summer vertical distribution of Chaetognatha in the northeastern Gulf of Mexico," M.S., University of Southern Mississippi.

John P. Steen, Jr., "Factors influencing the spacial and temporal distribution of selected crustacean plankton species in Davis Bayou," Ph.D., University of Mississippi.

Environmental Chemistry: Sharon H. Walker, "An environmental survey of fatty acids in the northeastern Gulf of Mexico," M.S., Louisiana State University.

Microbiology Section: John D. DeMond, "Amphipod fouling of an artificial reef in the north central Gulf of Mexico," M.S., University of Southern Mississippi.

Microscopy Section: Carolyn A. Foster, "Ultrastructure of the gill of the brown shrimp, *Penaeus aztecus* Ives in relation to salinity variations," M.S., University of Southern Mississippi.

Oyster Biology Section: David A. Blei, "A successional study of the hydrozoans inhabiting an artificial reef in the north central Gulf of Mexico," M.S., University of Southern Mississippi.

Neil Cave, "Predator-prey relationships involving the American oyster *Crassostrea virginica* Gmelin, and the black drum *Pogonias cromis* Linnaeus, in the Mississippi Sound," M.S., Southeastern Louisiana University.

Alfred P. Chestnut, "Substrate competition between *Crassostrea virginica* Gmelin and associated sessile marine invertebrates," Ph.D., University of Southern Mississippi.

Katherine A. McGraw, "A comparison of the growth and survival rates of hatchery reared and natural oyster spat at selected locations in Mississippi Sound and adjacent waters," Ph.D., University of Washington.

Parasitology Section: Daniel R. Brooks, "Systematic studies on the digenetic trematodes of crocodilians with emphasis on the family Acanthostomidae," Ph.D., University of Mississippi.

Richard W. Heard, "Microphallid trematode metacercariae in fiddler crabs of the genus *Uca* from Mississippi," Ph.D., University of Southern Mississippi.

Tom E. Mattis, "Larval development of two trypanorhynch cestodes from Mississippi Sound," Ph.D., University of Southern Mississippi.

Mobashir Ahmad Solangi, "Pathological changes in some estuarine fishes when challenged by crude oil fractions," Ph.D., University of Southern Mississippi.

SPECIAL AND COMMUNITY SERVICES

PUBLIC SEMINARS

The Gulf Coast Research Laboratory hosts a series of staff seminars throughout the year. These seminars are open to the public and speakers include invited scientists as well as officials from various levels of local, state and federal governments. The central purpose of the seminars is to promote better dissemination, understanding, and use of scientific information at all levels of society. Seminars presented during fiscal year 1976 were as follows:

"Marine Studies in the Ole Miss Pharmacognosy Department" by Dr. Norman J. Doorenbos, Department of Pharmacognosy, University of Mississippi, July 8, 1975.

"Oenology Research at Mississippi State University" by Dr. B. J. Stojanovic, Department of Horticulture, Mississippi State University, August 5, 1975.

"There is More Wealth in an Acre of Sea than in an Acre of Land" by Mr. Edward A. Khayat, President, Jackson County Board of Supervisors, September 9, 1975.

"Requirements for a Fishery Management Program in Mississippi's Marine Fisheries" by Mr. Charles H. Lyles, Director, Mississippi Marine Conservation Commission, October 7, 1975.

"Mississippi Sandhill Crane–Surrender or Survival" by Dr. Robert E. Noble, Department of Forestry and Wildlife Management, Louisiana State University, November 4, 1975.

"Fate of Nitriloacetic Acid (NTA) in Estuarine Waters" by Dr. Al W. Bourquin, U.S. Environmental Protection Agency, Gulf Breeze Environmental Research Laboratory, December 9, 1975.

"Cultural Resource Studies–Continental Shelf–Northern Gulf of Mexico" by Dr. Sherwood Gagliano, Coastal Environments, Inc., January 27, 1976.

"Tornadoes" by Dr. Robert G. Watts, Department of Mechanical Engineering, Tulane University, February 24, 1976.

"The Mississippi Sound's First Seed Oyster Hatchery" by Dr. Edwin W. Cake, Jr., Head, Oyster Biology Section, Gulf Coast Research Laboratory, March 9, 1976.

"Relationship of Law to the Marine Scientist" by Mr. Joel Blass, Attorney, Legal Counselor, Gulf Coast Research Laboratory, March 16, 1976.

"Overview and Future Plans of the Mississippi Park Commission" by Dr. James Meredith, Director, Mississippi Park Commission, April 20, 1976.

"Evolution–What do the Experts Say?" by Mr. Robert Allen, Microscopy Section, Gulf Coast Research Laboratory, May 18, 1976.

SYMPOSIUM ON COASTAL ZONE

The Gulf Coast Research Laboratory convened and sponsored, along with the Mississippi Academy of Sciences, Mississippi-Alabama Sea Grant Consortium, Mississippi Marine Resources Council and the Mississippi Marine Conservation Commission, a Symposium on the Mississippi Coastal Zone Environment in conjunction with the Annual Meeting of the Mississippi Academy of Sciences on March 4, 1976.

The purpose of the symposium was to tell the general public as well as interested scientists about work being done on the management of coastal zone resources, ascertain new problems and possible solutions, and discuss future needs in research and management.

Speakers who took part in the symposium and the titles of their papers are listed below:

"Geological evolution and recent geology of the Mississippi-Alabama Gulf coast" by Dr. Ervin Otvos, Section of Geology, Gulf Coast Research Laboratory.

"An overview of Mississippi Sound hydrography: changes, forces, interactions and implications" by Mr. Charles K. Eleuterius, Section of Physical Oceanography, Gulf Coast Research Laboratory.

"Hydrocarbons in the northeastern Gulf of Mexico" by Drs. Julia and Tom Lytle, Section of Environmental Chemistry, Section of Analytical Chemistry, Gulf Coast Research Laboratory.

"Pesticide levels in the Mississippi coastal zone" by Dr. William W. Walker, Section of Microbiology, Gulf Coast Research Laboratory.

"Distribution of fecal pollution indicator bacteria in waters of the Mississippi Sound" by Dr. David W. Cook, Section of Microbiology, Gulf Coast Research Laboratory.

"Evaluating the value of marshlands" by Dr. Armando A. de la Cruz, Department of Zoology, Mississippi State University.

"The seasonal periodicity of seagrasses and seaweeds in Mississippi waters and their contribution to the marine environment" by Dr. Lionel N. Eleuterius, Section of Botany, Gulf Coast Research Laboratory.

"Food chains in the Mississippi coastal zone" by Dr. Robert A. Woodmansee, Section of Ecology, Gulf Coast Research Laboratory.

"Salt water angling in Mississippi" by Mr. Thomas D. McIlwain, Section of Anadromous Fishes, Gulf Coast Research Laboratory.

"Coastal zone management and marine resources" by Mr. J. E. Thomas, Director, Mississippi Marine Resources Council.

The symposium was co-chaired by Dr. H. D. Howse, Director, and Dr. G. Gunter, Director Emeritus, Gulf Coast Research Laboratory.

These papers will appear in the Journal of the Mississippi Academy of Sciences, Volume XXI, scheduled for publication in the fall of 1976.

SYMPOSIUM ON MISSISSIPPI FISHERIES

In April, Gulf Coast Research Laboratory conducted a one-day symposium on Mississippi fisheries for selected personnel of the Mississippi Research and Development Center.

Members of the Gulf Coast Research Laboratory staff briefed the R&D Center personnel on conditions within the shrimp, bait shrimp, blue crab, oyster, and both commercial and sport finfish fisheries.

Representatives of seafood processors, raw stock seafood wholesale and retail businesses and Sea Grant Advisory Services also participated in the symposium.

STAFF PUBLICATIONS

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