A REPORT ON

MISSISSIPPI-ALABAMA SEA GRANT

JANUARY 1, 1974 — JUNE 30, 1975

MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

MASGP-76-001

THE MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

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Gulf Coast Research Laboratory

Mississippi State University

Tuskegee Institute

University of Alabama

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FROM THE DIRECTOR

Much of the 1974 Program of the Mississippi-Alabama Sea Grant Consortium can be characterized by the following observation by Thomas Hardy: "A coral reef which just comes short of the ocean's surface is no more to the horizon than if it had never been begun, and the finishing stroke is what often appears to create an event which has long been an accomplished thing."

Many "finishing strokes" were taken during the 18 months covered by this report (our 1974 grant was extended to cover the period from January 1, 1974 through June 30, 1975). Publications arising from work begun much earlier were produced, and the results of earlier research projects and educational efforts were used by our Marine Advisory Service to the benefit of our coastal constituencies.

Beginning "strokes" were also taken. A Coordinator for Coastal Zone Management Activities was added to our staff, and numerous projects were initiated. The more important of these were the Mississippi and Alabama Governor's Conferences on Coastal Zone Management, and a similar conference where representatives of the five Gulf States met to discuss common interests and to seek possible solutions to coastal zone problems.

In 1974 new procedures were established to determine the needs and priorities of future Programs. These new procedures included a stronger format for proposals and brought together, in planning sessions, Sea Grant investigators, managers, and representatives of those who use the high seas and coastal resources. Needs and priorities were established at these meetings, proposals were reviewed, and the following program areas were defined:

1. Investigation of the basic parameters associated with the existence and alternative uses of coastal resources,
2. Development of systems for using and managing coastal resources,
3. Application of existing knowledge to coastal zone problems.

These areas encompassed all the recommended projects, which were then grouped according to Sea Grant classification. This is the format upon which this report was designed.

The purposes of this process were to:

1. enhance our position within the Sea Grant network,
2. establish a set of clear, broad objectives that could be achieved with adequate funding,
3. produce results that could be used to enhance the well-being of the people in Mississippi, Alabama, and the nation,
4. eliminate the need for excessive federal critique and the elimination by outside reviewers of projects which serve the needs of the people in Mississippi and Alabama,
5. integrate the Mississippi-Alabama Sea Grant Consortium with other marine programs in the two states to avoid conflicts and duplications of effort which are wasteful of time, money, and resources,
6. mesh available expertise with high priority regional needs,
7. continue to develop a program which is the embodyment of the true spirit of Sea Grant —people working with people to improve the quality of our lives.

This process is truly interinstitutional, multidisciplinary, and interstate in scope —and it is working. Our project manager in the Office of Sea Grant, and the review team which visited us in October, recognized our progress. Hence, we received a committment for an approximate 44 percent increase in federal support for 1975. This increase will allow the bond between Misissippi and Alabama to be strengthened through increased participation by member institutions in each state.

Other important events took place in 1974. Approximately 10 percent of the registered participants in the Seventh Annual meeting of the Sea Grant Association held in Seattle, Washington, were from Mississippi or Alabama. Perhaps as a result of this fine showing, I was elected to the Executive Committee, and the Association agreed to hold the Eighth Annual meeting in Biloxi.

I look forward to serving on the Executive Committee of the National Sea Grant Association and am very pleased that people from all across the United States will have the opportunity to visit our coast in 1975. With the help of an extremely capable staff, and with your continued interest and support, I know we will make 1975 our most productive year.

B.W. Mattox

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Mississippi-Alabama Sea Grant Consortium
Dauphin Island Sea Lab

The goal of the Mississippi-Alabama Sea Grant Consortium continues to be that of supporting to the maximum extent possible, through research, education, and advisory services, the needs and interests of the people who live and work within the marine and coastal areas of the two states. The problems associated with such an undertaking cannot be minimized, especially in times of energy shortages, spiraling inflation, unemployment, and pollution. But with the needs of the people foremost in mind, the Mississippi-Alabama Sea Grant Consortium continually reviews each of its projects to insure that stated objectives are attained. If need be, projects are redirected, combined, or new projects are written to explore new avenues to solutions revealed by other research.

The requirement that the Program be responsive to all the people in the marine and coastal areas demands great flexibility to permit rapid response to unforseen situations. Such a program now exists, with active projects within each of the Sea Grant research classifications, in addition to education and advisory services.

A continuing effort has been made to increase the involvement of Alabama's universities in the Sea Grant Program. In close coordination with the Mississippi portion of the Consortium, a program has been designed that revolves around the dynamic interaction of coastal zone resource utilization and the northern Gulf of Mexico. The effectiveness of this program is the result of the concerted effort exhibited by all the participating institutions to share and develop the facilities of the Dauphin Island Sea Lab.

The exceptional hydrographic sampling and research capabilities of the two states are being combined to obtain the best possible working knowledge of the interaction of Mobile Bay, Mississippi Sound, and the Gulf of Mexico. Most of the other satellite projects depend to some extent on this project for data in basic transport phenomena.

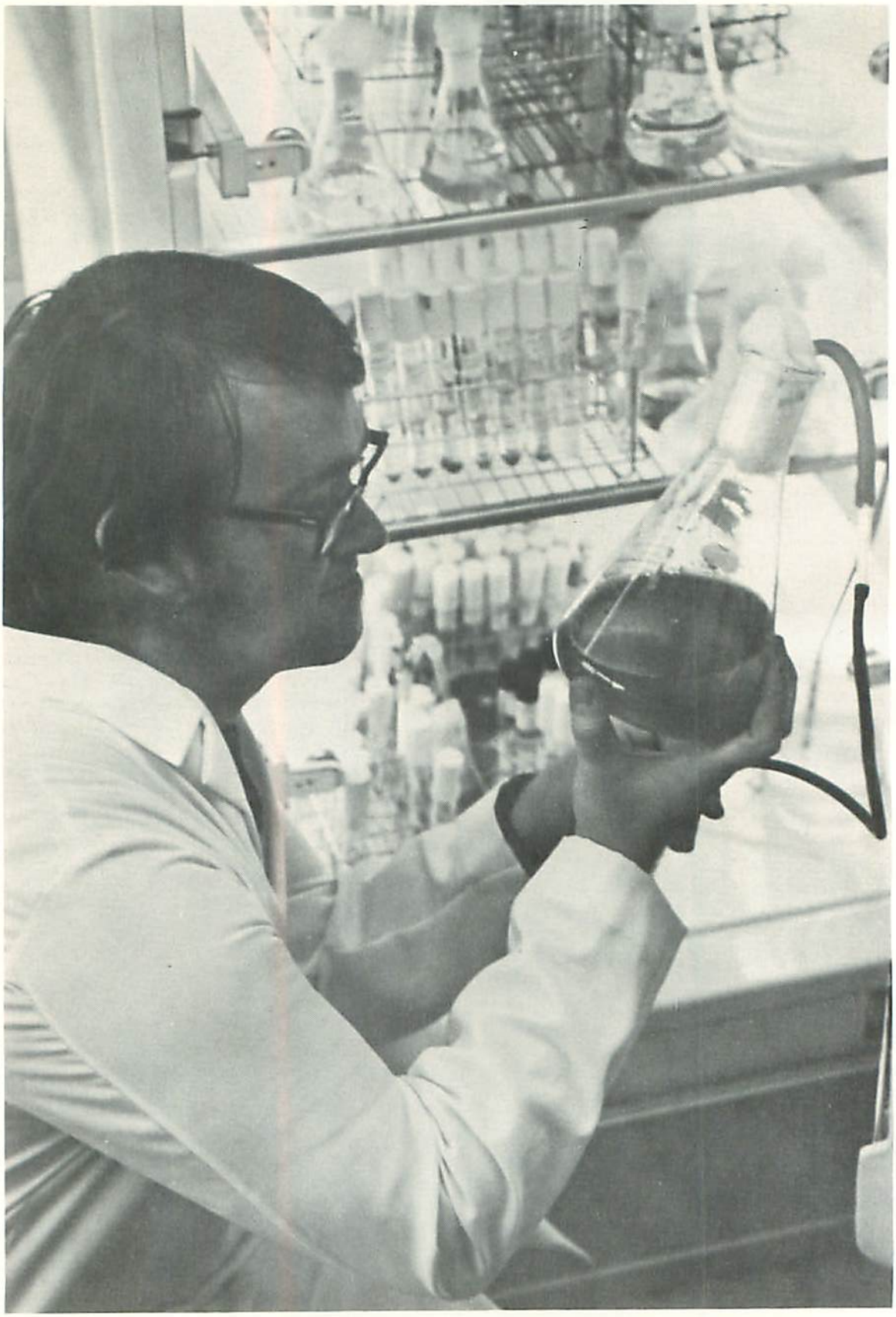
Through an intricate balancing of objectives, the Alabama Program has combined Sea Grant funding with support from the National Aviation and Space Administration, Bureau of Land Management, Environmental Protection Agency, the Russell Foundation, Ameraport Corporation, the Corps of Engineers, and the Marine Science Programs of the University of Alabama at Tuscaloosa and Birmingham. The complete picture represents a composite project studying many aspects of Mobile Bay, Mississippi Sound, and their impact on the Inner Continental Shelf of the Gulf of Mexico.

The use of program development funds has helped to make Tuskegee Institute a full partner in the marine community of the two-state Consortium. This significant achievement has been made possible through two separate approaches. The first of these supports a graduate research education program investigating heavy metal transport in the Mobile Bay - Mississippi Sound system. The other has sought to increase the involvement and interaction of the Tuskegee Staff and students with the marine environment. Student support was provided during the summer of 1974, and a number of workshops and field trips are planned for the future. The initial response to this program is evident in the increased interest by both students and staff in the programs offered at the Sea Lab.

Since the inception of the two-state Program in September of 1972, the Consortium has sought to be a two-state Program in fact as well as name, and to make the most efficient use of the expertise available in the member institutions. Although this effort was hampered initially by funding, it is now moving toward achieving maximum possible integration of projects and a balanced participation by both states.

RESEARCH

MARINE RESOURCES DEVELOPMENT



SELECTIVE ALGAL INHIBITION BY AQUATIC ANGIOSPERMS 05(1)

Robert T. van Aller
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Algal blooms have been recorded throughout history, and at the present time they are causing serious concern in managed ponds and even in the open ocean, as exemplified by the red tides. The factors causing one organism to grow abundantly — or bloom — to the exclusion of others are not well understood. Pollution by nutrient enrichment or by the introduction of toxicants certainly has a bearing on these factors, as does the amount of sunlight and the overall chemistry of the aquatic system. There is also an apparent natural regulatory mechanism that produces different indigenous algal floras in managed and unmanaged ponds with similar measurable characteristics. Some ponds observed in this study were always clear, while others, with similar chemistry and use, routinely pulsed with algal blooms. Typically, the nonblooming ponds supported a dense marginal and submerged growth of the macrophytes *Chara foliolosa* and *Eleocharis microcarpa*.

This research was based on the observation that chemical compounds found in *Chara* and *Eleocharis* in concentrations of less than 10 ppm could inhibit bloom-causing algae. Furthermore, these compounds could be extracted, identified, and, as a future project, synthesized in commercial quantities. The thrust of this project was directed toward a better understanding of plant diversity and the possibility of obtaining naturally occuring compounds which might be used to control algal blooms in managed ecosystems.

Phytoplankton surveys in ponds containing *Chara* and *Eleocharis* revealed a diverse algal flora of low density. These ponds remained clear although nutrient conditions did not differ appreciably from those supporting algal blooms.

Unpurified fractions from both *Chara* and *Eleocharis* were used in bioassays of more than 35 genera of fresh and brackish water algae. It was determined that if a specific alga did not occur where *Chara* and *Eleocharis* grew, the alga would be inhibited in culture by extracts from these plants.

Purification of the extracts required more than 500 pounds of *Chara* and a like amount of *Eleocharis*. More than 100 bands from thin layer chromatography plates were checked by bioassay on algal cultures over a two year period. Although the largest amount of extract was used for chemical characterization, small amounts were used to establish that the inhibiting compounds were selective. They were shown to inhibit certain blue-green algae but did not harm other algal genera.

Many different techniques were evaluated to isolate the inhibiting compounds, and more than 1,200 individual bioassays were conducted to evaluate the results of the experiment. The identity of the compounds was unknown, and their presence was confirmed only by their biocidal effect on the test algae. A separation scheme was developed using selective solvent partitioning, column chromatography, and two different solvent systems in preparative thin layer chromatography.

At least three compounds have been isolated and purified, one from *Chara* and two from *Eleocharis*, which exhibit strong inhibition towards bloom-causing blue-green algae. These compounds are present in concentrations ranging from 2 to 10 ppm/Kg of wet material. Even though the lower limits of biocidal concentrations have not been determined, one ppm has been shown to inhibit growth of blue-green algae.

High resolution mass spectroscopy of two active compounds from *Eleocharis* purified by repeated preparative thin layer chromatography gave molecular weights of 428.3654 and 442.3919. The molecular formulas assigned are $C_{29}H_{48}O_2$ and $C_{29}H_{50}N_2O$ respectively. A computer assisted search of various national mass spectral data files produced a close match of the fragmentation pattern from the $C_{29}H_{48}O_2$ compound with that from 5- *alpha* -stigmastan-3, 6-dion, a rather uncommon plant steroid. This steroid and a closely related steroid, 4-stigmastene-6-*beta*-ol-3-one, were both synthesized in the laboratory but did not show the necessary algacidal activity when tested. There were also some minor differences in chromatographic behavior between these materials and the purified inhibitors. These similarities, coupled with various chemical and spectral information, suggest the $C_{29}H_{48}O_2$ compound is very similar to the synthesized steroids and is probably a 3-keto-steroid with a hydroxyl group in the B or C ring. Research is continuing to further define the structure.

Depending on cost and availability through synthesis, these compounds are expected to have widespread applications for selective control of nuisance algae. Managed systems such as sewage lagoons, mariculture operations, and commercial fish ponds are prime locations where natural algal inhibition could be of inestimable value. Furthermore, the scientific information provided by the project will, hopefully, contribute to a better overall understanding of phytoplankton diversity.

PARASITES IN MARINE ANIMALS IN THE NORTHERN GULF OF MEXICO 08(1)

Robin M. Overstreet

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Many parasites in the northern Gulf of Mexico remain undescribed or poorly understood. Little is known about the biology, ecology, geographical distribution, and effect on hosts of most of the commonly encountered species. Some of these species affect either the sport or commercial fisheries, and others endanger human health. A better understanding of when, where, and how these infections originate will allow the people involved in fisheries or public health to adjust with the circumstances.

Parasites of finfishes and shellfishes, and those that infect or are potentially capable of infecting man, deserve increasing amounts of attention as more people eat seafood and occupy coastal areas. Information is needed concerning infectivity, pathogenicity, and control of selected parasites that infect reared and commercially valuable hosts; the life histories, pathogenicity, and means to treat selected parasites that infect or are potentially capable of infecting man; the seasonality ortolerances towards some environmental parameters of selected parasites that cause human skin rash; and the identification and biology of some parasites infecting marine organisms in and adjacent to the northern Gulf of Mexico.

Microsporidiosis, a readily transmitted disease affecting the economically important blue crab, *Callinectes sapidus*, is caused by the microsporidian *Nosema michaelis*. Most of the muscle tissue of crabs infected by this protozoan is replaced by microscopic spores causing a chalky white appearance and a cottony texture when eaten.

A total of nine drugs have been studied in an attempt to determine a means to control microsporidiosis, and preliminary evidence suggests that one of the drugs prevents infection in most cases. Additional studies are underway on this and other drugs.

The importance of rearing fish for food, bait, research, or other purposes is becoming more apparent. One protozoan capable of causing mass mortalities among fish in closed systems is the dinoflagellate *Amyloodinium ocellatum*. Continuing research has shown that the majority of the tested fishes from the Mississippi Sound succumbed to the disease in aquaria.

In attempts to control this dinoflagellate, combinations of malachite-green plus formalin did not kill it at the concentrations employed, nor did salinity at levels as high as 44 ppt, nor did Microcide, an oxydizing agent. Only fresh water was effective: experimental fishes survived for over a year after many introductions of infective agents.

Attention also has been given to visible parasites or diseases that affect sport and commercial fisheries. There are several species of tapeworms whose larvae infect the musculature of numerous economically important fishes. The most common, and consequently the most displeasing of these, is *Poecilancistrium caryophyllum*. This worm, typically about 40 mm in length, occured most frequently in the spotted seatrout, *Cynoscion nebulosus*. It is not harmful to man, but infected fish should be cooked, since other worms are potentially dangerous. The possible effects on the host by the worm, the relationship between environmental factors and infections, and other relationships will be investigated following additional sampling. Of 1,231 fish representing nine species related to spotted seatrout, 16 were infected with cestode larva in the musculature. A total of five species, *Cynoscion nebulosus, Cynoscion arenarius, Micropogon undulatus, Pongonias cromis,* and *Sciaenops ocellata*, were infected.

Lymphocystis is another disease that gives fish an aesthetically displeasing appearance. Most fish affected by this disease have numerous solitary tumors, occasionally united to form large conspicuous masses, distributed on the fins and body. In the silver perch, tumors are also present internally. Studies of the ultrastructure of infections in the heart, as well as studies of infections in the eye, meninges of the brain, and optic nerve are being conducted.

A pinfish, *Lagodon rhomboides*, was collected near Ocean Springs, Mississippi, with severely protruding eyes, or exophthalmus. Possibly caused by bacteria, this disease was also associated with hemorrages behind both eyes. Several types of bacteria were isolated on blood-agar media, one of which was hemolytic. This bacterium was cultured, purified, and injected behind an eye and into the abdominal cavity of several pinfish. Two fish later exhibited exophthalmus, and the bacterium was isolated from one.

A schistosome cercaria implicated in swimmers itch was found in a small number of snails from Horn Island, Mississippi, and Sapelo Island, Georgia, but not at Dauphin Island, Alabama, Alligator Harbor, Florida, or Gulf Park Estates, Mississippi. Dermatitis caused by the organisms under study is probably a sensitivity reaction by the host to parasites not normally capable of developing in man.

Other nematodes implicated in causing sensitivity reactions, but which have to be eaten, belong to the ascaridoid group. Investigation revealed that one of two tested species of larval nematodes from local fishes was capable of causing a reaction in white mice. Some individual larvae penetrated through the alimentary tract and then became surrounded with inflamatory cells and died.

Many other parasites are also under study along with methods for their control and prevention.

CIGUATERA FISH POISON 08(2)

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Ciguatera fish poison appears to have been a problem in tropical and subtropical waters since before recorded history. It is the most important marine toxicity problem in the world today, judged by its impact on the health of many people and its inhibition of the development of tropical and subtropical reef fisheries. Ciguatoxic fish have been reported in the Red Sea, Indian Ocean, Pacific Ocean, Caribbean Sea, and Gulf of Mexico. It has been assumed, although never proven, that ciguatera is caused by similar or identical toxins wherever it is observed.

Although fish seem to tolerate the ciguatera toxins, humans who eat ciguatoxic fish become very ill. Toxic symtoms may include abdominal pain, nausea, vomiting, diarrhea, numbness, metallic taste, muscular weakness, muscle aches, reversal of the sensation of hot and cold, and itching. Death sometimes results from the Pacific strain. Recovery is slow and may require weeks or months.

Without exception, fish of ciguatoxic species are toxic in some waters while safe in other. In some cases only a few miles separate toxic and safe fish of a given species. Each of the ciguatoxic species is a bottom feeder or includes bottem feeding species in its diet. This has led to the conclusion that these toxins, or their precursors, originate in reef plant life.

Many reports of ciguatera poisoning in the Caribbean and lower Gulf of Mexico have been documented, and approximately one hundred species of fish have been implicated. More than four hundred species have been implicated worldwide.

To assist in finding a solution to the ciguatera problem, the government of the Cayman Islands has provided a laboratory and living accomodations for researchers from the University of Mississippi at the Mosquito Research and Control Facility on Cayman Brac. These facilities have been of great value in collecting toxic and suspected toxic fish and in accomplishing associated research.

The gut contents of three species of surgeon fish have been collected and examined. These fish, which graze on reef plant life, are suspected of being involved in the ciguatera food chain. In addition, a test device whose sides are covered with copper, brass, or antifouling paint containing copper oxide has been constructed and anchored underwater. Algae growing on or near these surfaces will be collected, identified, and investigated to determine if they are possible sources of ciguatera poison.

Personal interviews have been conducted with medical personnel, fishermen, seamen, cooks, and laymen to gain additional understanding of the ciguatera problem. A significant amount of previously unpublished information has been obtained, including the knowledge of two plants used for treating ciguatera victims in the Cayman Islands and Jamaica. This information will be the subject of a future paper.

Of prime interest is the need for bioassay procedures to detect ciguatera toxins, for there is no suitable chemical assay. The most frequently used methods include feeding suspect fish to a mongoose or cat or injecting extracts into the abdominal cavity of a mouse. Other animals have been used experimentally but were found unsuitable because of cost, size, or lack of sensitivity to ciguatera.

An urgent need exists for simpler and more sensitive tests to determine the origin of ciguatera in the food chain and to identify safe fish and safe fishing waters in the oceans and seas in the ciguatera belt.

A number of potential new bioassays have been explored using extracts of ciguatoxic fish obtained from St. Thomas, Virgin Islands. Three potentially useful procedures have been discovered. One involves injecting a toxic extract into the abdominal cavity of a tadpole. Tadpoles are killed with much smaller doses than mice. A second procedure involves the addition of a small amount of toxic extract to a culture of bacteria capable of emmitting light. Light output is markedly reduced by small amounts of toxic extracts but is unaffected by those of a nontoxic origin.

The third and most promising bioassay involves the use of brine shrimp larvae. This procedure is simple, fast, and more than one thousand times as sensitive as the mouse assay. Studies are now in progress to modify this assay to make it suitable for use in the field.

Toxic fractions from the Pacific were compared with those from fish obtained at St. Thomas. The effects on mice and brine shrimp were similar, and chromatographic behavior, although similar, differs sufficiently to indicate that the Pacific and St. Thomas toxins are not identical but are probably very similar. Five alkaloids were isolated from the St. Thomas fish by thin layer chromatography. They appear to be different from those found in the Pacific. Three of the five were toxic to brine shrimp.

A committment has been obtained from the Century Steel Corporation of Chicago for the construction and basic funding of a marine field laboratory at Virgin Gorda for this ciguatera fish poison study.

DEVELOPMENT OF MARINE FISH TISSUE CULTURE AND ITS APPLICATION TO VIRUS DISEASES OF GULF TELEOSTS AND MAN 08(3)

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Marine cell studies at the University of Southern Mississippi have used the following six step approach to develop viable cell cultures:

1. Initiate tissue explant cultures from Gulf Fish.
2. Find methods to maintain cells which will allow optimum growth.
3. Determine optimum subculture intervals and assay various enzyme subculture techniques to obtain the greatest cell viability.
4. Develop methodology to determine the karyology of each cell line for comparative purposes with known data on the 2n number of the respective fish.
5. Study virus susceptability of each cell culture to a variety of known fish and mammalian viruses.
6. Characterize each cell culture as to the number of lactic dehydrogenase isozymes contained in cells of a pure, uninoculated culture using both polyacrylamide gel electrophoresis and isoelectric focusing.

Prior to the initiation of this project, there was only one marine cell line available from the American Type Culture Collection. Although there have been occasional reports of the development of new fish cell cultures, few reach the status of an established cell line.

Major successes have been achieved with silver perch, speckled trout, and redfish cell culture. Silver perch were studied first, and the knowledge gained by working with this cell line was used as a guide to develop other cultures. The impetus for working with silver perch cells was the isolation of a new strain of lymphocystis virus that appeared along the Mississippi Gulf Coast in 1972 and 1973.

When any cell line is developed the chromosome complement must be investigated so that any genetic changes due to the stress of subsequent subcultivation may be observed. Chromosome analysis of silver perch swim bladder cells was accomplished at passages 9 and 27. At passage 9, cells containing 48 chromosomes were predominant, the same as in the intact fish. By passage 27, the highest frequency of occurrence had risen to 54, indicating a genetic change; but there was no change in appearance. The cell type remained the same and the conditions of growth and subcultivations were identical to those utilized at previous passage levels. A significant finding was that silver perch swim bladder cells lost their susceptibility to lymphocystis at passage 22, and the genetic change previously described also may have occurred as early as passage 22. Stocks of silver perch swim bladder cells at passages 6 through 19 are adequate to continue the studies on lymphocystis.

Studies on silver perch spleen cells from explant cultures revealed that the cells were undifferentiated and grow slowly. This culture seems to have stable characteristics and may be utilized in future lymphocystis studies.

Striped bass fin cells were passed 8 times. These cells were larger than those of silver perch and had an almost transparent cytoplasm. This line had an initially rapid growth rate but at passage 8 the cell line seemed to degrade and no further replication was observed.

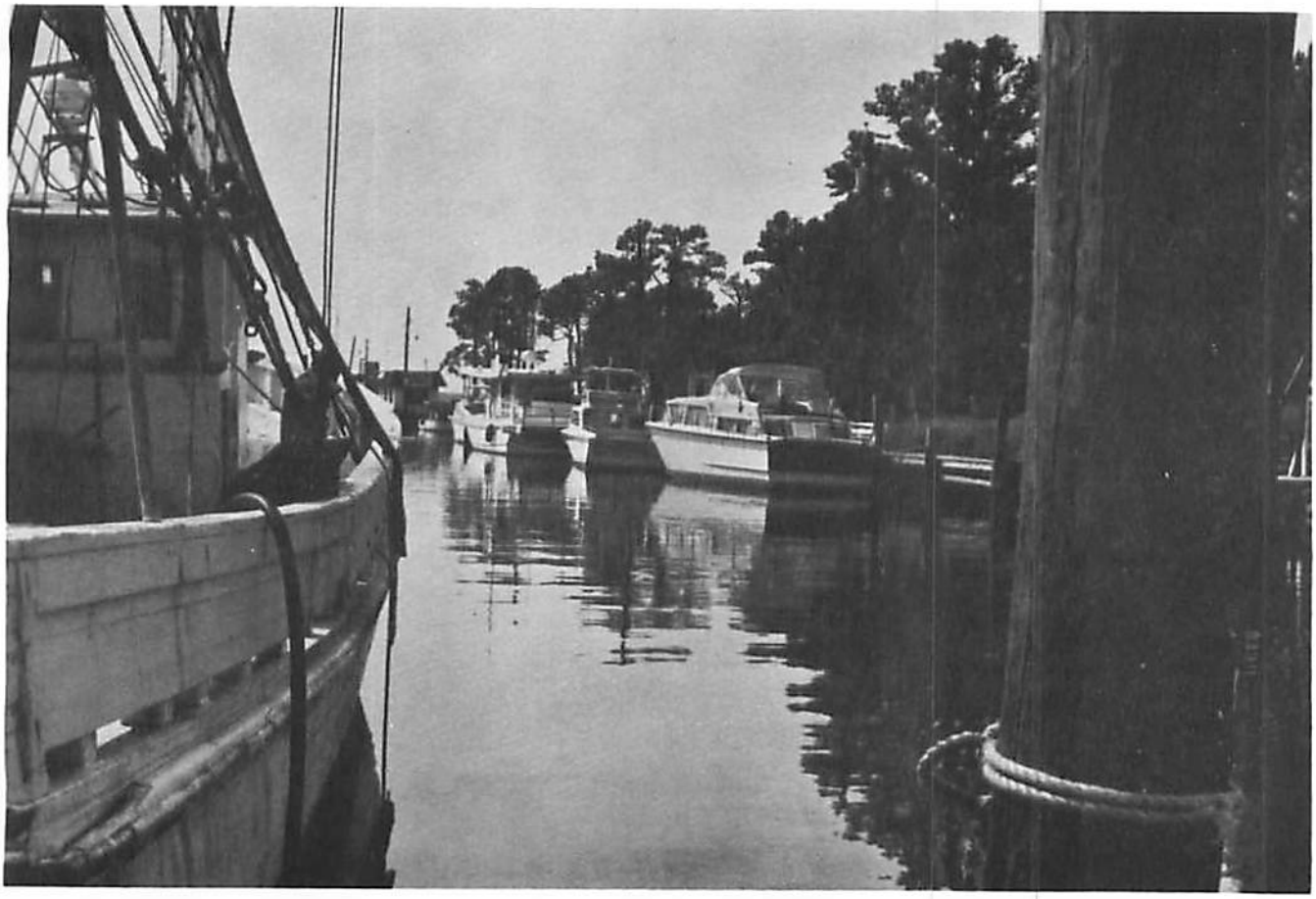
Sheephead fin cell culture reached passage 9. Cells were undifferentiated, hardy, and could be held on maintenance media for up to 2 months.

Redfish muscle cell culture was initiated from explant culture of a chilled fish. Cells were undifferentiated and up to passage 9 formed a whirling pattern. Beginning with passage 10 the cells became smaller, irregular in shape and whirling was not observed, though cells remained undifferentiated. The cell line has reached passage 18, is growing rapidly, and can reach confluency in 24 hours if the flask is seeded with large numbers of cells.

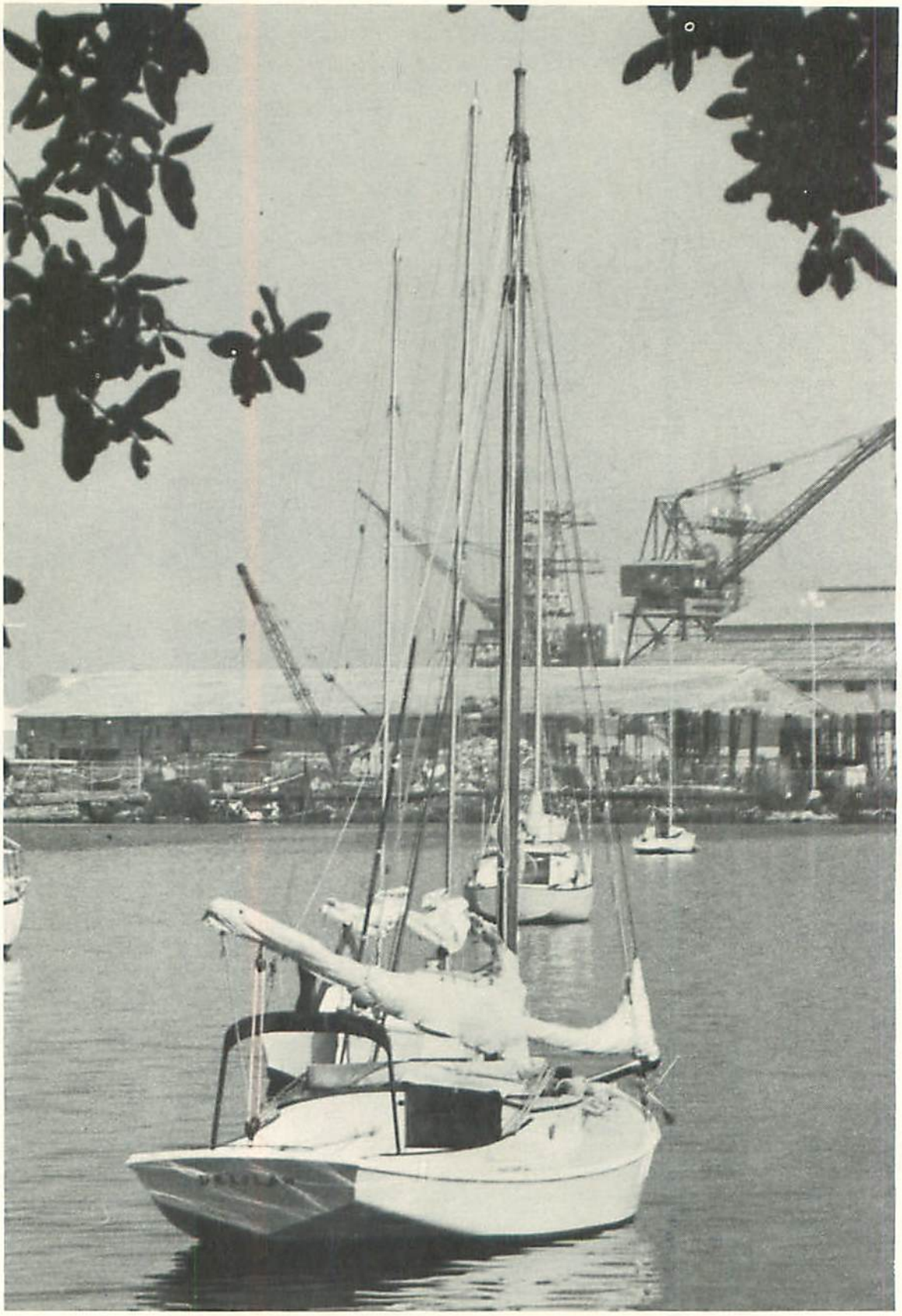
White trout fin cell culture was initiated from a live fish using explant culture. Cells are undifferentiated, somewhat elongated, produce a whirling pattern, grow well, and reach confluency in 3 to 4 days. The cells are currently in passage 18 and no problems have been observed.

Two human pathogens were introduced into silver perch swim bladder cells: vaccinia (cowpox) and poliovirus type 1. Neither was shown to replicate. Presently, attempts are being made to infect silver perch swim bladder cells with vesicular stomatitis virus, eastern equine encephalitis, and measels virus. Lymphocystis virus isolated from silver perch did replicate and produce enlarged cells in silver perch swim bladder monolayers; however, homogenized lymphocystis tumors from croaker failed to produce a similar infection.

A distinct possibility exists that several of the developing cell lines will become established and can be submitted to the American Type Culture Collection. By doing this, other investigators will have additional tools to study the cytology of fish cells or to isolate and further characterize animal viruses. In addition, a research base had been developed which will support other research efforts in the future.



SOCIO-ECONOMIC AND LEGAL STUDIES



LEGAL PROBLEMS OF THE GULF COAST REGION 15(1)

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The Sea Grant Legal Program has continued to provide legal advice and research into the problems that affect the rapidly developing Gulf Coast region. The extensive resources of the School of Law at the University of Mississippi have been utilized to the fullest to keep the Mississippi-Alabama Sea Grant Consortium aware of both federal and state laws that could affect the direction and development of the marine and coastal area.

Exhaustive research has been conducted into all Mississippi laws, regulations, and ordinances which affect the coastal areas. The results of this research have been published in a form readily understandable by the layman, lawyer, and the lawmaker. The information was arranged by category to enable the user to identify easily those laws which affect or govern a particular activity. These articles were divided into eight functional categories containing 1,194 pages.

These categories are: Property Laws, Living Resources, Mineral Resources, Recreational Activities, Industrial and Agricultural Activities, Environmental Control, Navigation, General Administration and Management of the Marine and Coastal Zone.

These publications were disseminated to coastal leaders, scientists, administrators, economists, and representatives of other disciplines whose expertise would be needed in planning for the development of the coastal area.

The written conclusions of those leaders and experts were compiled and incorporated into the material previously published. The final draft of these volumes was prepared and distributed to those leaders who were best equipped to effect the maximum utilization of resources in the development of the coastal zone. In addition, a supplemental volume was prepared containing the laws passed by the Mississippi Legislature during its 1974 session, bringing the previously compiled material up to date. This procedure will be followed after every session of the legislature.

A thorough and comprehensive annotated bibliography is being prepared for all federal laws and regulations, federal and state cases, governmental publications, and law journal articles that might have a bearing on the development of the coastal zone. These materials were analyzed and assigned key words to specifically identify the important issues of the particular item. These key words have been arranged alphabetically to provide an easy reference for the researcher.

Particular emphasis has been given to those laws and cases that specifically deal with the Gulf Coast states. Those subject areas that have been researched include:

Weather, Oceans, Coastal Zone, Wildlife, Conservation, Waste Disposal, Recreation, Economic Development, Land, Water, Air, Oil, Seafood.

When completed, the index should contain between 300 to 500 pages of annotated bibliography listed under approximately 750 key words. This will in turn be reproduced and distributed to those state leaders who are concerned with the development of the coastal zone.

Legislation that the Sea Grant Legal Program originated authorizing the reorganization of the Mississippi Marine Conservation Commission was passed during the 1974 session of the Mississippi Legislature and is now an integral part of the laws of the state. This legislation provides a uniform basis for more equitable regulation of the Mississippi seafood industry.

The Sea Grant Legal Program has expanded its work with the Advisory Service and provides a broader base for the dissemination of legal information to those persons on the coast who would benefit most from such information. Papers that have been prepared by the Sea Grant Legal Program include:

1. Information on proposed federal regulations requiring marine sanitation devices on all vessels equipped with toilet facilities, and for holding tanks and disposal facilities at marinas.
2. Information on both Mississippi and federal truth-in-lending laws setting out loan interest rates.
3. Information on Mississippi and federal loan agencies designated specifically for use by commercial fishermen.
4. Information on the changing responsibilities of fishing boat owners to the individual fisherman for witholding income tax and social security, and their duty to carry workman compensation insurance.
5. Information on the liability of state and local governments and private parties to oyster fishermen for the pollution of oyster beds.

The Sea Grant Legal Program will continue to research specific topics for coastal leaders and government officials and will be available to provide basic legal research into proposed legislation that would affect the coastal zone.

ANALYSIS OF COASTAL MISSISSIPPI SPORT FISHING 18(1)

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It has been known for many years that an irregularity on the bottom of a body of water tends to attract fish. This happens whether the irregularity is artificial or accidental. The excellent fishing reported over ship wrecks and oyster beds illustrates this fact. The idea of creating artificial irregularities on the bottom and in the waters of the Gulf to enhance fishing is not new. Old car bodies, tires, sunken barges and ships have been used and proposed for developing artificial reefs. However, only recently has there been a widepread research effort in this area.

Mississippi Gulf Fishing Banks, Inc., is a publicly funded nonprofit organization chartered for the purpose of providing, generating, and encouraging sport fishing on the Mississippi Gulf Coast. A major goal of this organization is the development of artificial fishing reefs. However, due to a lack of data their efforts have been severely hampered because there were no answers to questions such as:

Where should artificial reefs be located?
Will artificial reefs be of benefit to the economy of the area?
What materials make the best artificial reefs?
What are the legal and institutional problems involved in constructing artificial reefs?
What will be the fishing pressure on the artificial reefs?

A unique approach was used in gathering data for this study. In previous years, boat surveys were used to determine fishing pressure, but aerial surveys were used this year, in conjunction with surface counts. The use of aircraft allowed the survey to include sites within a much broader area than would otherwise have been possible. Approximately 300 square miles of water, containing 12 natural and artificial reefs, plus two control areas, were surveyed during the months of April through December 1974. Estimates of the total fishing pressure were made in terms of the number of fishermen days at each site, based on boat counts developed from these aerial surveys. Monthly estimates reflected seasonal influences, and relationships between estimates for the same period reflect the influence of location, type of reef, the extent of knowledge of its existence among fishermen, and fish concentration. The relationship between reef pressure and control area fishing pressure provided an indication of the potential drawing power of new artificial reefs.

Economic analysis of potential benefits of artificial reefs of the type planned for the Mississippi Sound revealed that gains are likely to be small unless the reef development is publicized well enough to attract additional fishermen from outside this area. This is a significant conclusion because it calls attention to the prime condition necessary for artificial reefs to be economically feasible.

The 1974 fishing season got off to a slow start because of heavy rains and generally poor weather conditions. The weather improved in the late spring, and the fishing pressure increased steadily through the summer and peaked in October. An estimated 15,008 fishermen spent 32,264 hours fishing and caught 76,568 pounds of fish. Approximately 6,253 boats were used in that fishing effort. As in previous years, the number of rental boats increased late in the season as the fish moved into the upper bays and bayous. The most popular bait was shrimp, either dead or alive, and it was used extensively in combination with all other types of baits. Still fishing was the most popular method, followed by trolling and artificial bait casting.

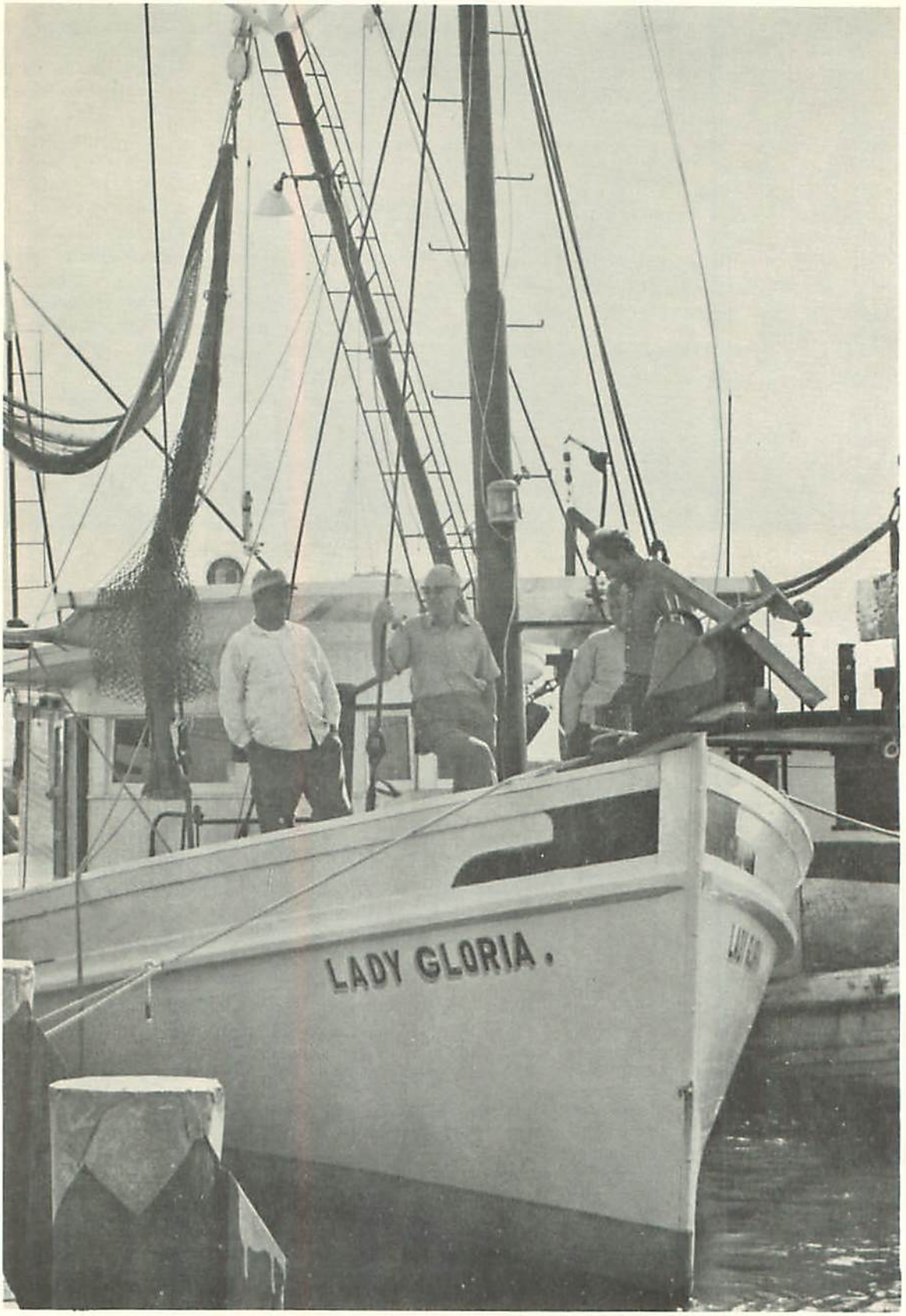
Eighty-five percent of the people interviewed in the study were from Mississippi coastal counties. The remainder were from other counties or out of state.

The data gathered during this study indicate that the Mississippi sport fishery is in a healthy condition and is quite valuable economically to the Gulf Coast. The sport fishery is an excellent but underadvertized drawing card for the state tourist industry, and measures should be taken to capitalize on this important natural resource.

The biological and economic data gathered during this study will provide the base from which further conclusions may be drawn as the fishery is exposed to increased fishing pressure and other environmental and economic stresses.


SUNBOWN
BILOXI

MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT



REMOTE UNDERWATER FISHERIES ASSESSMENT SYSTEM (RUFAS II) 23(1)

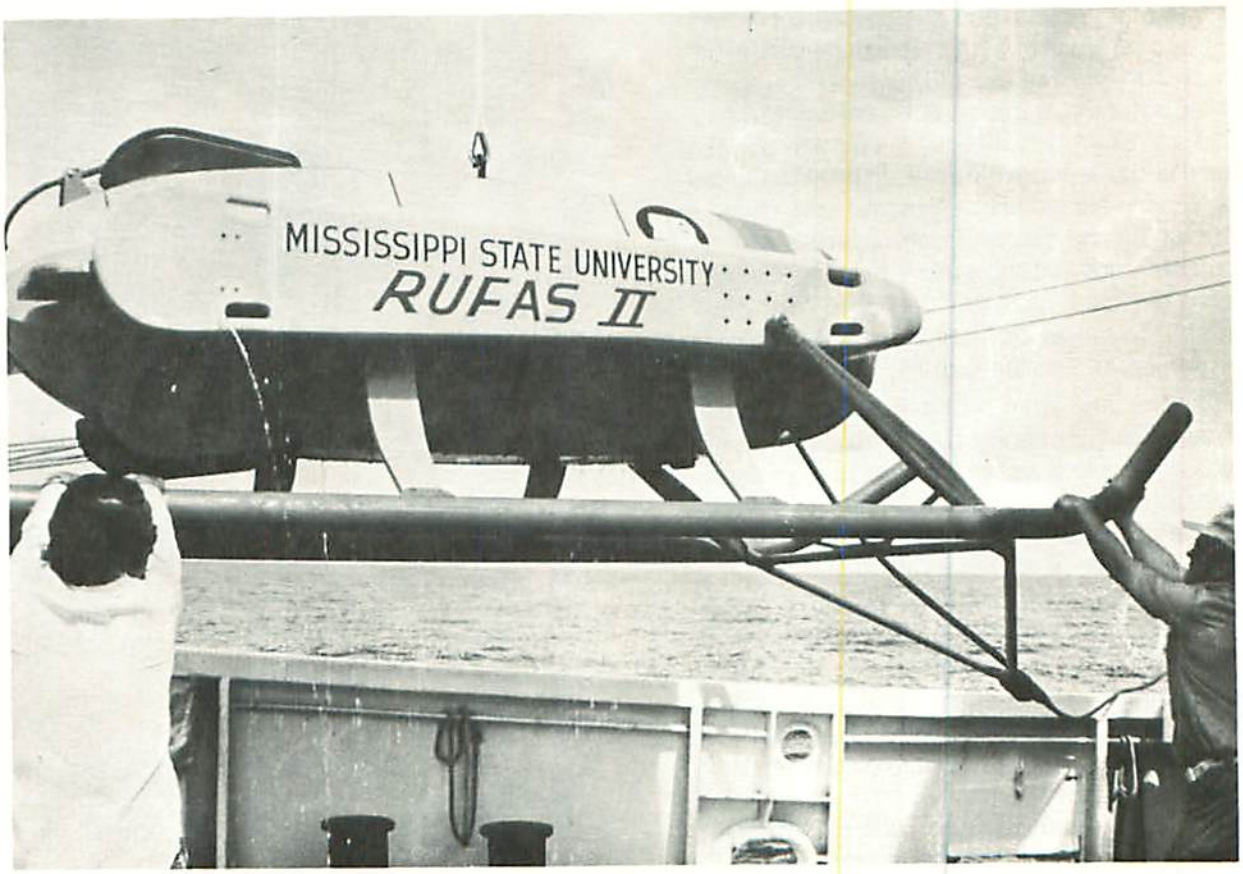
J.E. Thomas — Mississippi State University
Richard D. Benton — Mississippi State University
Glenn D. Bryant — Mississippi State University
Martin F. Jue — Mississippi State University
Wilber R. Seidel — National Marine Fisheries Service

RUFAS II was successfully demonstrated in the Gulf of Mexico in August of 1973 and delivered to the National Marine Fisheries Service in Pascagoula, Mississippi, later that year.

The system is a towed, unmanned, controlled, underwater vehicle for rapid bottom and midwater resource survey. It is used to collect pictoral data on midwater and ocean bottom conditions and resources down to 2,400 feet. At towing speeds up to 4 knots, the system allows rapid surveys of relatively large ocean areas.

Control of the vehicle and its equipment is accomplished over a down-link telemetry system from the operator's console. Information, except the television picture from the sled, is transmitted to the console over an up-link telemetry system. The televison picture and telemetry signals move over a single coaxial cable. A redundant phase-lock-loop telemetry system over hardwire assures continuity of the control commands. The capacity of the telemetry systems can be expanded to accomodate the control of other instrumentation that might be added for other missions.

The last phase of this project, which is now complete, was the writing and publishing of the final report. This unique document (MASGP-74-011), in addition to serving as the project final report, contains complete data on operation and maintenance of the vehicle, and a complete set of engineering drawings.



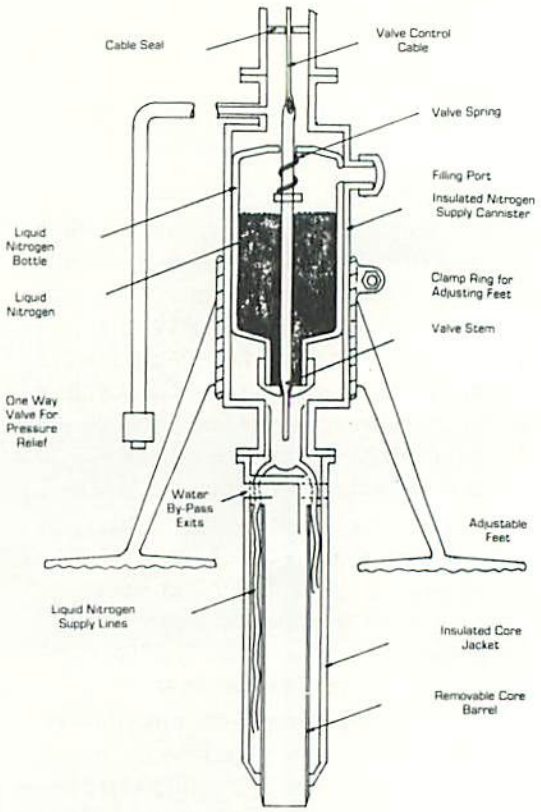
DEVELOPMENT OF A CRYOGENIC PROBE TO STUDY THE SOFT SEDIMENTS 24(1)

Lewis R. Brown — Mississippi State University
Graham Wells — Mississippi State University
Thomas W. Lins — Mississippi State University
Eugene B. Grimley III — Mississippi State University

The need for more sophisticated equipment became apparent when detailed studies were planned to determine the long-range effects of polluted sediments in rivers and estuarine areas. The core sampling devices then in existence for underwater use were generally adequate, but the need for additional accuracy demanded something better. The main problems with these mechanical probes were the compression and mixing of the soft samples. This distortion in many cases rendered a sample worthless for all but simple chemical, geological, and biological purposes. In response to this need for accuracy, a cryogenic probe has been developed to study the soft marine sediments.

This cryogenic probe is unique in that it uses liquid nitrogen to stabilize the sample. It freezes the core with a minimum of vertical and horizontal displacement, and upon removal of a sample in its solid form there is no distortion. The use of this technique prevents further diffusion of substances, including ions, through the sample after collection. The water column and the suspended material at the sediment-water interface is frozen and is recoverable, thus making studies on the exchange of materials between the sediments and the water column possible. The sampling device is generally operated from the surface in shallow water but can be modified to obtain core samples of varying sizes.

The need for this cryogenic probe is emphasized by the fact that adsorbtion and other methods of removal of pollutants from water columns can occur at the interface and within bottom sediments. These phenomena can take place for a period of time without a noticable increase of these toxins in the overlying water. Toxic materials such as copper and lead could be discharged or released into the marine environment by a change in industrial effluents. With information on rates and types of metal ions absorbed by bottom sediments typical of coastal regions, it would be desirable to be able to predict the effect of the various discharges into the marine environment as to the absorption or release of heavy metals. Long-range alterations of marine waters could be affected by new industrial plants moving into coastal areas and introducing effluents containing metal ions into the ecosystems. These metal ions could then release toxic heavy metals already absorbed on the clay sediments, thus, causing an unexpected high concentration of metal ions with no apparent new source of discharge.



Cryogenic Core-Sampling Probe

DEVELOPMENT OF A MATHEMATICAL MODEL FOR THE HYDRODYNAMICS OF A BONGO PLANKTON SAMPLING SYSTEM 28(1)

W. Steve Shepard

Mississippi State University

The three performance characteristics of a plankton sampling system of special significance to the biologist are filtration efficiency, extrusion, and avoidance. These characteristics are influenced directly by the hydrodynamics of the complete plankton sampling system.

The fluid flow associated with a plankton sampling system can be divided into five basic fields:

External flow around the sampler body
Internal flow through the sampler body
Internal flow through the net
External flow around the net
Flow across the net

The mathematical investigation of any one of these flow fields would be fairly simple if the flow field could be isolated. Unfortunately this is impossible, since the boundary conditions of one flow field are determined by one or more of the other flow fields. For example, the pressure in the outlet plane of the sampler body greatly influences the internal flow through the sampler body, and its outlet pressure is determined by flow interaction with the other four flow fields.

The initial research on this project concentrated only on the flow over and through a constant area sampler body without the net attached. Solutions were readily obtained for the external flow since the pressure gradient is zero, or very nearly zero. However, this is not true for the internal flow.

A literature survey has been made for solutions of boundary layer and laminar entrance flows in a pipe. Numerical and series solutions of the boundary layer equations with curvature terms and infinite difference solutions are available but are in general directed toward calculations of the entry length. No literature was found on the solution of a short section of pipe or a short section of a variable area pipe.

A complete solution could not be found for the equation for the ring without a net. Such a solution would have to be obtained for each ring. The addition of a net would highly complicate such a solution even further. However, a solution of a nondimensionalized form of the transformed boundary layer equations would give a solution for each successive nondimensional coordinate once and for all. This solution is independent of upstream and downstream conditions, whereas the physical variables are actually not independent. In this work it was assumed that the addition of a net does change the nondimensional boundary layer model for the ring. Appropriate conditions at the exit plane, obtained by either mathematical, empirical, or physical relations, could specify the solution in physical variables. The entire flow field around the ring, and such parameters as filtration efficiency and mass flow rate, would be specified.

The transformed nondimensional boundary layer equations with curvature term for the inside and outside of the ring were approximated by a system of ordinary differential equations. Solutions for both the inside and outside of the ring were obtained readily at the point or points desired independently, since the pressure gradient is assumed to be zero for the boundary layer. For the inside of the ring, the solution depends on a nondimensional pressure gradient parameter and the assumption of a nonviscous core. The parameter was solved for as the solution was stepped from the leading edge. The method to solve for the pressure gradient parameter consisted of checking conservation of mass at each cross section and setting up a variable secant interaction.

DESIGN & DEVELOPMENT OF A HIGH PERFORMANCE, MINIMUM COST OCEANOGRAPHIC DATA GATHERING SYSTEM 28(2)

Martin F. Jue

Mississippi State University

The design and development of an oceanographic data gathering system for use in the expanding field of ocean and estuarine research requires a thorough study of present techniques and equipment available before making any design commitments. A study of the present methods of oceanographic data gathering techniques was made, in particular those techniques used by the Physical Oceanography Section at the Gulf Coast Research Laboratory and the Dauphin Island Sea Lab, with the intent of applying the information to the development of a data gathering system.

Presently, the Physical Oceanography Section of the Gulf Coast Research Laboratory is using a portable system to monitor water quality at approximately 120 stations over a 65 mile area in the Mississippi Sound. These data are taken every two weeks at each collection point by boat, giving a time lag of approximately eight hours between the first and last measuring points. Eventually, a subset of 6 stations will be selected to project an entire picture of the Mississippi Sound.

The Dauphin Island Sea Lab inherited from the NASA Marshall Space Flight Center a sophisticated buoy system designed for use in fresh water. This system includes 2 buoys, a ground receiving station, signal processing equipment including magnetic and strip chart recorders, and facilities and personnel to modify and maintain the system.

There are 3 modes of operation. The buoys transmit information by satellite to the Goddard Space Flight Center where it is stored on magnetic tape, computer processed, and delivered to the Sea Lab. Information also can be received directly at the Sea Lab from the buoys, stored on magnetic tape, and sent to the Huntsville branch of the University of Alabama for computer processing. At the present time,information received from the buoys can be processed and displayed on strip chart recorders at the Sea Lab. Data is transmitted from the buoys every three minutes with approximately four to five minutes of information sent every fifteen minutes.

The buoys are powered by nickle cadmium batteries providing about 9 months of operation between charging. Beacon lamps are powered by two 12 volt automobile batteries on the hull of the buoy. These are exchanged every two weeks and recharged.

The data gathering system within the buoys consists of a Hydro Lab Surveyor, a water quality monitoring system, and an Inter Ocean Model 1.5 Current Meter with associated submerged sensors. The analog outputs of these units are digitally encoded and transmitted. Refined, portable oceanographic data gathering systems, including water quality monitors, are available from several manufacturers.

The National Oceanographic Instrumentation Center performs laboratory and field testing of oceanographic instruments and periodically publishes the Instrument Fact Sheet series on instrument performance.

The preliminary investigations necessary for this project are approaching completion, and the information gained will be used to establish the highest positive correlation of efficiency commensurate with research needs and minimum cost.

UTILIZATION OF SHRIMP AND FOOD FISH FLEET DISCARDS 30(1)

J. William Cliburn

University of Southern Mississippi

Areas fished by shrimp and finfish fleets in the Gulf of Mexico continue to overlap. The increasing capture and discard of trash fish by the shrimp fleet is of great concern to the fishing industry and to coastal communities. The soaring value of shrimp in recent years has promoted shrimping in areas of high finfish density and has justified the increased costs of sorting out the trash fish.

These high density finfish areas are the basis for a rapidly growing pet food industry which uses large numbers of spot, croaker, trout, and similar fish of the Sciaenidae family. From five to 25 pounds of fish are caught for each pound of shrimp, and approximately 75 percent of the fish are sciaenids. These fish are considered trash by the shrimpers and are discarded with total mortality.

The capture of trash fish by the shrimper is of concern for several reasons. Labor costs are increased, serious handling problems are created for a small operator, and the discarded fish are lost to the finfish industry. The loss of potential protein to the world food supply is tremendous. It is estimated that the Gulf of Mexico shrimp fleet annually discards from 250,000 to one million tons of finfish and shellfish. Increasing discards on the fishing grounds have led to reports of large accumulations of dead and decaying material on the bottom. Catches of the groundfish fleet containing such material are unfit for human consumption or pet food. In addition, these discards have sometimes created accumulations of dead fish along public beaches, in recreational areas, and on private property.

The Gulf of Mexico shrimp fleet consists of approximately 4,000 vessels of over five net tons, and some 10,000 motorboats of smaller size. Mississippi and Alabama are the least important of the Gulf fishing states, but they contribute substantially to the total effort, and have a commanding role in the industrial fisheries.

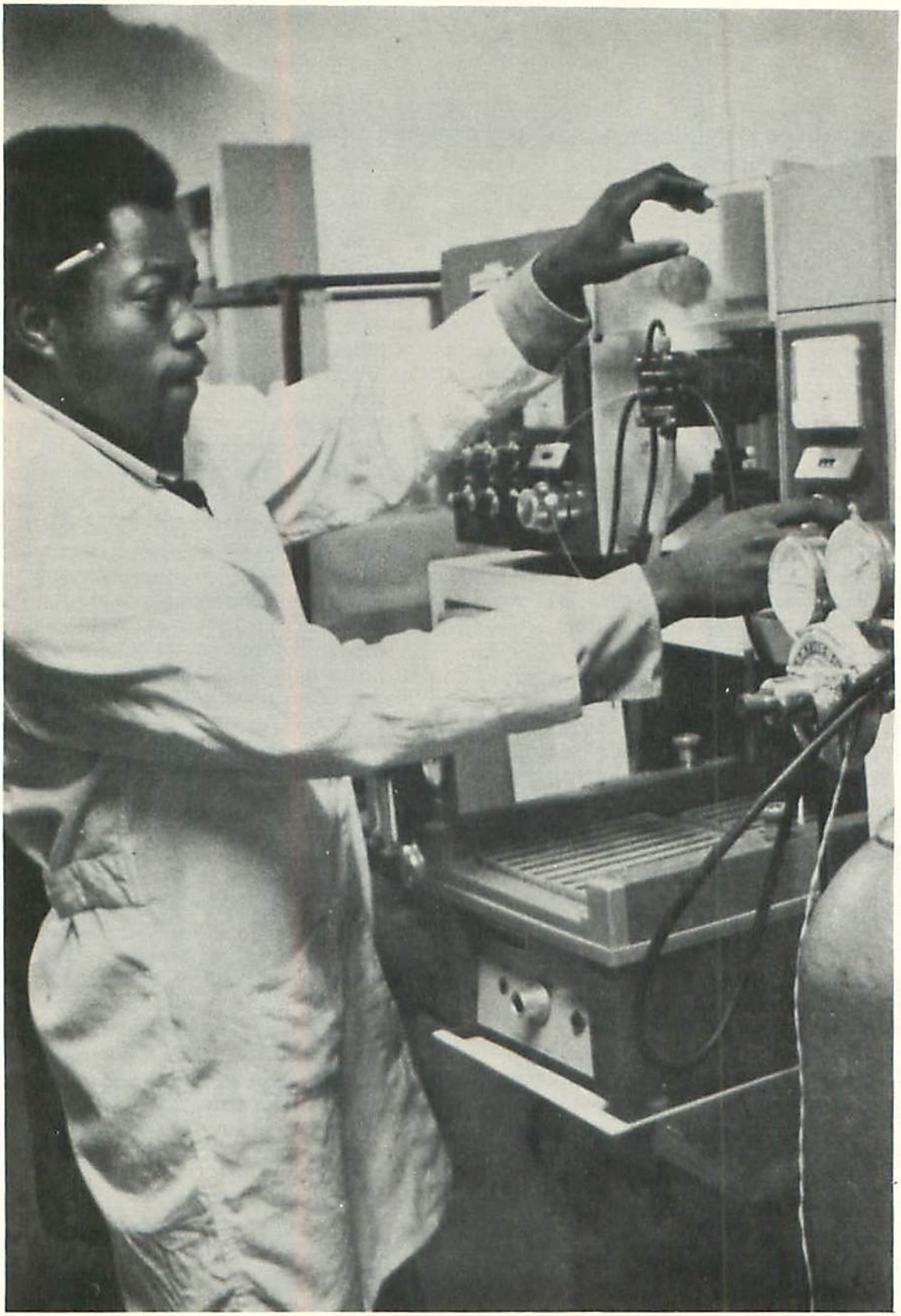
The Gulf groundfish industry can be expected to grow as the demand for fish protein increases in both foreign and domestic markets, and as new products are developed for using these resources. Growth of this industry no doubt will result in strained relations with the shrimpers and an increase in problems. Improved technology must be introduced into the shrimping industry. New techniques must be developed to reduce the capture of groundfish, and to use more effectively those that are captured.

No statistics are available on food fish trawl discards, but fishermen have reported up to 50 percent of the catch is discarded. These discards do not approach those of the shrimp fleet, but they contribute to the total annual discard volume. The collection of data concerning discards from both shrimp and food fish fleets will lead to increased utilization of seafood resources that are presently wasted.

A research team has been formed and approved by the University of Southern Mississippi. Preliminary negotiations have been made with the National Marine Fisheries Laboratory at Pascagoula, Mississippi. Laboratory personnel have agreed to coordinate field work by making the necessary arrangements with boat operators to permit research personnel to participate in actual fishing operations. Laboratory personnel also have given instructions to field workers in fish indentification and in the proper use of data forms for easy computer filing. Further instruction of workers is currently scheduled on a weekly basis at the University of Southern Mississippi.

No field work has yet been accomplished, as data collection and associated research must await the resumption of fishing and shrimping activities.

MARINE ENVIRONMENTAL RESEARCH



AN ANALYSIS OF DEMOGRAPHIC COMPOSITION AND GROWTH COMPONENTS OF THE COASTAL REGION OF MISSISSIPPI 38(2)

John E. Burrus — University of Southern Mississippi
Max W. Williams — University of Mississippi
Ellen S. Bryant — Mississippi State University
Carlton R. Sollie — Mississippi State University

Two of the most immediate and pressing problems of urban areas today are urban renewal and expressway construction. The problems of dislocation resulting from these two processes are of a type and magnitude which have been largely unknown to urban areas in the past.

Of equal importance is a population pile-up resulting from rapid industrialization. The impact of this phenomenon is seen in pressures exerted on housing, schools, transportation, and service facilities such as hospitals, water and waste disposal systems, police and fire protection, to mention a few. Regional planning to relieve existing pressures and to erect structures and processes which will promote balanced growth must be based on accurate inventories of existing conditions and trends. Planning, of course, ultimately is for people and must be carried out with knowledge about the target populations. This knowledge consists of facts pertaining to population composition, dynamics, and projections.

The most pronounced population growth in the United States is occurring around the seacoasts and the Great Lakes. The total population of the three coastal counties in Mississippi, for example, increased more than 25 percent from 1960 to 1970. Growth of this magnitude could lead to the destruction of marine and coastal resources. When this danger is added to the list of identified problems, it becomes even more apparent that the compilation and interpretation of demographic data for use by development planners is a very important activity.

Data of this type provides planners with detailed information to serve as a basis for problem definition and action program planning. It also enables analysts to gauge the state of the system in terms of its composition and dynamics. The objective of this study was to provide the data for use in this planning.

To achieve this objective, three levels of analysis were proposed: Total county areas, Standard Metropolitan Statistical Area census tracts, and Enumeration Districts and non-SMSA cities in areas peripheral to Harrison County. The purpose was to gather, process, display and interpret the data on age, sex, race, residence, education, and migration of the population of the region.

The first level of analysis gave an overall regional perspective. The second level focused on the spatial and human ecology patterns of the Gulfport-Biloxi Standard Metropolitan Statistical Area. This level of analysis was especially pertinent because the 1970 Census of Population was the first in which the Gulfport-Biloxi area was delineated as a SMSA. The level of analytical detail possible with use of SMSA tract data made this part of the overall study especially useful for planning purposes. The third level of analysis, that focusing on Enumeration Districts and non- SMSA cities, was especially useful because it focused on the smallest areas for which population census data are tabulated outside of tracted areas. The increase in urban population on the coast did not result from increased densities in built-up areas, but from suburban growth and annexation. In as much as future growth in the region probably will be an extension of this pattern of peripheral growth, study of the ED's and non-SMSA cities was accomplished in detail.

For each level of analysis the basic source of data was Summary Tapes of the 1970 Census (First through Fourth Counts). Included in the analysis were data on age, sex, and racial composition; detailed housing characteristics; and occupational, educational, and income structure. Material was graphically and cartographically presented to the maximum extent possible. Computer facilities at Mississippi State University and the University of Mississippi were used to interpret these data.

Detailed results of this research project are contained in four publications:

Burrus, J.N. 1975. *Composition of the population of the coastal counties: An analysis of the population of Jackson, Harrision, and Hancock Counties, Mississippi by age, sex, race, and residence.* Mississippi-Alabama Sea Grant Consortium. MASGP-75-002.

Bryant, E.S., and Sollie, C.R. 1975. *Demographic composition and growth components of the coastal region of Mississippi: A study of its peripheral nonmetropolitan areas - Analysis and maps.* Mississippi-Alabama Sea Grant Consortium MASGP-75-003.

Bryant, E.S., and Sollie, C.R. 1975. *Demographic composition and growth components of the coastal region of Mississippi: A study of its perpherial nonmetropolitan areas - Appendix: Tables.* Mississippi-Alabama Sea Grant Consortium. MASGP-75-003A.

Williams, M.W. 1975. *Urban social indicators: A comparative study of census tracts in the Biloxi-Gulfport Standard Metropolitan Statistical Area, 1970.* Mississippi-Alabama Sea Grant Consortium. MASGP-75-004.

COASTAL LEADERS PROGRAM 38(3)

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David J. Etzold University of Southern Mississippi
Charles P. Cartee University of Southern Mississippi

The Coastal Leaders Program is a unique project designed to assist people in the coastal area in identifying and solving local problems. The distinctive feature of this program is the task force, or committee, approach which brings to bear the combined talents of those persons who have an interest in a specific problem or problem area. Representation on these committees includes local industry, public officials, planning organizations, and private citizens.

Sea Grant personnel act as a catalyst by providing a nonpolitical forum where coastal leaders can meet and identify the various pressing problems and organize themselves into committees to seek solutions. The Coastal Leaders Program has been primarily concerned with problems facing the seafood and tourism and recreation industries. The committees that have been formed to help solve these problems have received widespread support from their respective industries and have undertaken a number of projects of concern to the local community. The tourism and recreation committee has received support from hotels, motels, restaurants, municipal and county governments, Chambers of Commerce, and planning groups. The committee is concerned with the orderly development of tourism and recreation on the Gulf Coast. The seafood committee has received support from the seafood industry, Gulf States Marine Fisheries Commission, National Marine Fisheries Service, Mississippi Marine Resources Council, and the Mississippi Marine Conservation Commission.

Significant accomplishments of the tourism and recreation committee include the formation of a forum for the interchange of ideas and information among the various facets of the tourist industry, thus reducing the time involved to accomplish a specific task. Great interest has been shown in a quarterly tourism report that is being prepared and published by the Bureau of Business Research at the University of Southern Mississippi. This report provides data and other information on a continuing basis to assist in gauging the trends of the tourist industry on the coast. With the projected opening of Interstate 10, legislation has been drafted and filed in the House and Senate to designate coastal Highway 90 as a scenic route. Sketches for comfort stations along the sand beach have been prepared and presented to city and county officials with recommendations for their installation. Funds were obtained from private sources to place additional oases on the sand beach. Contacts have been made with the University of Southern Mississippi Arts Department and theater groups on the coast relative to outdoor drama presentations. A summer program is proposed for an informal performing arts center in which academic credit will be granted.

The major problems undertaken by the seafood committee included methods for disposing of solid and liquid wastes from seafood processing plants. This particular problem is the subject of two separate Sea Grant research projects. The largest and most complex problem attacked by this committee is that of supplemental fresh water diverted into the Mississippi Sound on a periodic and controlled basis. It has been known for a number of years that the periodic introduction of fresh water into the Mississippi Sound, usually to relieve a flood threat to New Orleans, produces a bumper crop of seafood during the following years. The problem is that the spillways are opened only to prevent possible flooding, and these flood stages do not occur in completely predictable cycles. It is sometimes years between openings. The anticipated results of the diversion, enhanced seafood and wildlife productivity, were discussed with various agencies and included in a presentation at the Gulf States Marine Fisheries Commission Technical Coordinating Committee to gain support for using Bonnet Carre Spillway as a source of fresh water. At the request of the committee, the United States Army Corps of Engineers, Lower Mississippi River Valley Division, has prepared a resolution to be presented to Congress by the seafood industry committee. This resolution requests that a feasibility study be made for exploring ways and means of introducing supplemental fresh water into the Mississippi Sound.

A total of 12 organizations in Mississippi and Louisiana have pledged their support, and the Bonnet Carre Spillway water flow characteristics have been thoroughly reviewed by the Army Corps of Engineers.

A document has been prepared by the seafood industry to be presented to appropriate members of the Congress of the United States, requesting the Army Corps of Engineers to conduct a feasibility study to determine ways and means of obtaining supplemental controlled fresh water into the Mississippi Sound and adjacent estuarine areas.

THE PREDICTION OF ECOLOGICAL ALTERATIONS CAUSED BY POLLUTANTS 40(1)

Charles R. Brent — University of Southern Mississippi
David W. Cook — Gulf Coast Research Laboratory
Billy J. Grantham — University of Southern Mississippi
Jerome L. Mahloch — Mississippi State University
George F. Pessoney, III — University of Southern Mississippi

The successful management of estuarine water resources requires the acquisition, interpretation, and dissemination of data for use in planning and regulatory purposes. Unless proper data management is employed, the information gained will be minimal. Additionally, collected data is of great use for formulating mathematical models, which may be applied to predict changes in the estuarine environment. A first step in formulating such a model is the examination of available data for interrelationships compatible with modeling concepts. Data management and interpretation is far from a complete solution to estuarine water prolems, but it can provide a useful supplement to any ongoing effort.

The data for this study were collected at four stations in the Bay of St. Louis, Mississippi, and were intended to provide an ecological and environmental description of base line conditions. The collected data were also to serve as a guide for a model describing the fate of pollutants in the Bay.

The objectives of this project were twofold: First, to catalogue the ecological data on the Bay of St. Louis; and second, to conduct a thorough statistical analysis of the data. Cataloguing the data was designed to make it compatible with computer handling and retrieval techniques. Statistical analysis was to include techniques to investigate interrelationships, spatial differences, reduction in data dimensionality, and temporal effects on the data.

The data were obtained from the various investigators and organized to be keypunched on data cards. During this process some editing was done to eliminate incomplete observations and variables. These data formed individual data bases coded by station, date of collection, depth of sample collection, and data type. These data were transferred to peripheral mass storage on the UNIVAC 1160 Computer system for handling and retrieval. Individual files were combined and sorted to obtain a master data file.

The combined data set included 126 variables which were measured in the Bay of St. Louis area. The individual data sets were coded and are currently available and ordered by date for selective retrieval of any particular data variable. An algorithm to search this master file was programmed to give the simultaneous occurence of any of the data files with respect to sampling time. This program also allows the printing of the matched data for any combination of data files. A supplementary program also exists for determining the number of non-zero entries for each variable in a data set, which allows the investigator to determine the possible significance of a variable for subsequent processing. This system allows an interactive querying of the data base for selected variables and pairwise plotting of any combination. This system is currently implemented and the results of any query to the data base or master file may be furnished.

The results of the statistical analysis of these data sets are essentially complete. The interpretation and organization of the results will be completed during the ensuing months, with consultation by respective principle investigators responsible for the data.

The results of this research will encompass two main areas of application and use. First, the data will be available in a logical, computer oriented fashion for other investigators or interested personnel. The retrieval and organization of output from the various data management programs will provide relatively easy access to the complete data base. The versatility of the data management system will allow satisfaction of almost any query made upon the system. Second, the interpretation of the data through statistical analysis will provide a comprehensive picture of the data and its meaning in this sense. The application of statistical analysis towards interpretation of estuarine ecosystem data will also have a teaching benefit for other investigators seeking to analyze similar data structures. This project is designed to achieve results not only in the management and interpretation of a selected data set, but also in the application of the statistical methodology utilized.

THE IMPACT OF MARINAS AND HARBORS IN THE COASTAL ZONE 40(2)

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Charles R. Brent — University of Southern Mississippi
Billy Joe Grantham — University of Southern Mississippi
Billy George Bufkin — University of Southern Mississippi
Peter K. Stocks — University of Southern Mississippi

This project involved a diversified study to determine the impact of marinas and harbors on the coastal zone. The primary objective was to determine the number of pleasure boats stored at these sites. Information was also gained as to the method of storage, services available, percentage of available space utilized, and other data pertinent to boaters and fishermen. Water quality was also determined in the marinas and harbors surveyed.

Data were gathered in nine marinas, and a complete aerial survey was made of all the docking facilities on the coast. A questionnaire was developed and a list of the sales and service facilities available to pleasure boaters was compiled. The biological and chemical investigations were conducted in three harbors of different classifications. Microbiological investigations were conducted on a weekly basis at seven sites, including stations located in the Mississippi Sound and inside the marinas.

It is evident from the aerial and on-site surveys that the majority of the marinas, harbors, and fish camps along the coast are full. This is particularly true on the western side of the state where the typical marina is small and of limited access. Some vacant space was found on the eastern side of the state along the Pascagoula River.

The typical marina is a family operation. The average age of the owner is over 60, and more than 80 percent of the marinas visited were for sale. The reason for selling was the age of the operator and the confining nature of the work. Most of the operations were profitable with reported gross annual incomes ranging from $20,000 to $70,000. The majority of this income was derived from sources other than boat storage and maintenance. These accessory services include trailer rental, sale of beverages, groceries, bait, and ice.

The marinas visited remained open the year around, but the majority of the business was between the months of May and October. Most operators had rental skiffs, but they were primarily dependent on regular customers who had their own boats. Often these customers had been with the marinas for more than 20 years. This fact was mentioned by several operators. Most did not encourage additional business, and there was little or no advertising of services available.

The cost of docking and storage was dependent on the types of slips available. Wet storage in an uncovered shed varied from $15.00 to $30.00 per month. Dry storage on trailers was the most common type available, and its price was comparable to that of wet storage. Planned expansion was limited, and the majority of new development consisted of building additional dry storage space.

Most operators launched boats from 15 to 25 feet in length with a hoist. The price for this type of launching was approximately $3.00. Some operators also cleaned and placed boats in storage for the same fee. Ramps were provided for the launching of individual boats, and the fee for using the launch was comparable to that charged for the hoist. There was some concern for the number of new public launching facilities being developed. Most operators were concerned over the scarcity of live shrimp, the principal bait sold. Live shrimp were usually saved for regular customers and those who rented skiffs.

Biological and chemical investigations were carried out in three selected harbors. There were two sampling trips involved in this part of the study. The water quality in the marinas and harbors tested did not differ greatly from that of the adjacent Mississippi Sound. Since these samples were taken at a time when the salinity was high and activity was minimal, it is likely that the conditions might differ during other times of the year.

Bacteriological investigations were carried out weekly. Sampling concentrated on the identification of specific pathogens such as *Salmonella* and *Shigella* rather than total and fecal coliform counts. Additional sampling stations were located in Mississippi Sound, and there were sporatic positive tests for pathogens.

During the months of September, October, and November, when the majority of the interviews were conducted, there was some concern on the part of the operators for obtaining fuel; however, they were most concerned with the Mississippi Coastal Wetlands Protection Act and the trouble anticipated in obtaining dredge permits. Few of the operators had any knowledge or feeling for the 1975 water quality standards. None had any idea of how they would comply with the new laws.

RATE OF CATION EXCHANGE IN RECENT MARINE SEDIMENTS 44(1)

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Recent marine sediments are composed of both organic and inorganic particles. In most marine sedimentary areas, organic fractions seldom exceed ten percent. Inorganic sediments along the Gulf Coast are composed of fine size fractions of sand and very fine size fractions of silt and clay. These fine sands are composed of quartz, feldspar, and minor accessory minerals such as magnetite and zircon. Quartz is the most prevalent mineral, comprising more than 95 percent of the fine sand portion. Silt fractions are also predominately composed of quartz.

The clay size fractions are mostly composed of illite and montmorillonite. These minerals are silicates of aluminum having complex layered structures. Large volumes of sediment within the bays, estuaries, and on the continental shelf are composed of these clay minerals.

The binding characteristics of the elemental composition of clays and their resulting crystal structure produce unique cation exchange properties. All clay minerals readily exchange cations with those of their aqueous environment. Many factors such as organic content, ionic strength, partical size, metal ion concentration, and pH can determine the rates of such cation exchanges. These clays, therefore, can act as a storage bank, releasing or storing cations in response to changes in the aqueous environments. It is well known that concentrations of cations in the immediately overlying water column do not reflect cation concentrations in the bottom sediments.

Within a marine environment absorption and adsorbtion rates of metal ions on clay, and diffusion rates in the pore space of fine sands, are highly critical as to their effect on the ecosystem. Usually metallic ion contamination taken up by bottom sediments returns to the ecosystem through bottom and sub-bottom feeding organisms. It is not known what metallic ions would be released, and at what rate, by the introduction of new metallic contaminants or changes in pH or Eh.

In order to study absorbtion and adsorbtion rates of the bottom sediments, known quantities of heavy metals were to have been introduced into sediments and placed in equilibrium with normal estuarine water salinities. The absorption rate of the water column was then to have been closely monitored. A cryogenic coring device, developed in a separate Sea Grant project, was to have been used to determine the depth of ionic movement and the relationship between sand and clay as to the ionic concentration in each. This was to have been done with various metals.

During the past year several mechanical problems have remained unsolved, and the project was refocused on the continued development and refinement of the cryogenic probe itself rather than on the study of the rate of cation exchange in recent marine sediments, as originally planned.

The main problems were: Venting of gaseous nitrogen prior to the core sample freezing operation; regulating the liquid nitrogen required to freeze a core sample effectively; and a lack of uniform freezing throughout the entire length of the core sample.

Major design changes were required in the liquid nitrogen delivery system. Instead of a pressure forced siphoning system, the liquid nitrogen is now pressure and gravity forced between the removable core barrel and the insulated core jacket. Regulation of the liquid nitrogen flow rate is difficult to control because of the temperature at which the valve stem operates. A seal which can be easily broken and resealed repeatedly without sticking has been developed.

When the apparatus is placed underwater the pressure exerted on the filling port increases with depth. A positive pressure produced by liquid nitrogen boil-off can be obtained. High pressures affect valve stem sealing and present the possibility of an explosion. Therefore, a one way relief valve for pressure control has been installed.

To insure thorough freezing of the core sample, it was necessary to increase the volume of the liquid nitrogen and hence the size of the liquid nitrogen supply canister. Also, the liquid nitrogen supply lines had to be redesigned to insure efficient and uniform cooling along the entire removable core barrel. When the cryogenic probe was submerged, heat transfer from the surrounding water was greater than anticipated, necessitating a larger liquid nitrogen supply canister.

In addition to the other mechanical changes, adjustable feet for bottom definition have been designed. Eight core barrels have been purchased, along with a Linde 30 liter nitrogen storage vessel, sands, clays, and fish tanks. When the mechanical difficulities have been solved and the necessary modifications have been made, research will continue into the nature of cation exchange in recent marine sediments.

EVALUATION OF MICROORGANISMS AS INDICATORS OF ENTERIC PATHOGENS IN ESTUARINE WATERS 45(1)

Thomas W. Feary
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University of Alabama, Birmingham
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Coliform bacteria are predominant members of the fecal flora of all warm-blooded animals and are eliminated in large numbers in fecal wastes from normal, healthy individuals. Consequently, their presence in water has long served as an indication of fecal contamination. Additionally, since a major source of bacterial and viral pathogens in water is the feces of man and animals, the presence of coliform bacteria in water has also served as an indirect indication of the possible presence of human pathogens, *Salmonella* species. However, the current coliform standard is thought to be unrealistic because of increasing reports of high coliform recoveries from nonfecally contaminated environments, in addition to reports of coliform multiplication in some natural environments.

The key to microbiological assessments of water quality is knowledge relative to pathogen presence. The major objective of this project has been to develop new and more effective methodology for pathogen detection in estuarine waters and to relate these findings to the densities of other microbial indicators of enteric pathogens.

Sixty-six water samples have been analyzed quantitatively for *Salmonella* and total and fecal coliform densities by using the Most Probable Number method. Based on a bacteriological sanitary survey, water collection sites have been selected from polluted, semipolluted, and unpolluted areas. These include several sites in Mobile Bay, Mobile River, and a water treatment plant. For each sample, the fecal coliform group has been further analyzed to determine densities of specific organisms such as *Escherichia coli* and *Enterobacter aerogenes*.

In addition, *Salmonella* isolation techniques were performed on each sample by a modified filtration technique. This technique has yielded a higher frequency of *Salmonella* isolations than have previously been obtained by utilization of other methods. So far, 110 *Salmonella* cultures have been isolated. Approximately 80 of these have been confirmed serologically. Since this work has been quantitative rather than qualitative, data are being collected to relate density ratios of *Salmonella* to total and fecal coliforms as well as *Escherichia coli*. Most significantly, there appears to be no direct correlation between total and fecal coliform densities and *Salmonaellae* isolation. Although these pathogens are more frequently isolated from water samples which exhibit high total and fecal coliform densities, they have also been isolated from water samples exhibiting low coliform densities. In the latter case, the water would be safe to drink by coliform standards alone. This emphasized the need for modified pathogen techniques to be used in conjunction with standard total and fecal coliform counts when monitoring waters from shellfish harvesting areas.

UTILIZATION OF SEAFOOD PROCESSING WASTE TO INCREASE PRODUCTIVITY OF THE ESTUARINE AREA 45(2)

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Armando A. de la Cruz — Mississippi State University
William Graham Wells — Mississippi State University
H. Randall Robinette — Mississippi State University
Augustine W. S. Wang — Mississippi State University
Luther A. Knight, Jr. — University of Mississippi

The Mississippi seafood industry is faced with serious problems, especially the shrimping industry. Present methods of extraction, canning, and freezing result in as much as 65 percent solid waste from hand picked shrimp, and 82 percent when machine processed. Shrimp processors in Biloxi estimate that 75 percent of the shrimp is waste, including solid wastes, blood, oil, and dissolved substances.

Processing wastes always have been dumped into waters adjacent to the processing plants. Regulations of the Mississippi Air and Water Pollution Control Commission now require all shrimp processing plants in Mississippi to screen out solid wastes (hulls, viscera, and heads) and to treat waste waters to remove suspended and dissolved materials. Solid wastes are disposed of in landfills, at considerable expense to the processors. The cost burden, especially to marginal operators, is financially prohibitive.

The poor condition of the freshwater channel catfish market in Mississippi was emphasized at the annual meeting of the Mississippi Catfish Growers Association on January 16, 1975. Cheaper imported fish have eroded the market for domestic fish. One of the obvious conclusions for the depressed market is the increasing cost of high quality fish feeds.

An estimated 95 percent of the catfish sold in the United States comes from aquaculture enterprises ranging from small ponds to elaborate fish farm complexes. Approximately 30,000 acres in Mississippi are now used for commercial channel catfish production, and as latent markets are developed more acreage will be put into production. Thus, high quality protein feeds will be required for growth of the industry. Shrimp processing wastes are readily acceptable by certain fish, and experimental evidence suggests that these wastes contain large amounts

of high quality protein. One approach to the utilization of shrimp processing wastes was directed to evaluating its potential as fish feed or as a supplement to the usual list of fish feed constituents.

Channel catfish *(Ictalurus punctatus)* were maintained in the laboratory for 8 to 10 weeks. Diets consisting only of shrimp processing wastes were not sufficient to maintain the fish beyond 6 weeks; normal growth and behavior were obtained when the wastes were combined with other nutrients. Chopped raw shrimp processing wastes produced weight gains of 3.6 g per fish in 6 weeks, which represented a gain of 90 percent and a food conversion ratio of 0.41. The commercial feed was not acceptable by the fingerlings in the laboratory aquaria. In a seperate experiment, bluegill (Lepomis machrochirus) fed cooked shrimp processing waste gained an average of 1.39 g to 9.69 g per fish in 230 days in the laboratory.

Growth of channel catfish fingerlings in experimental ponds was reduced below that which is normally obtained in commercial ponds due to the infrequency of feeding. Fish in the Mississippi State University pond were fed once a week with whole shrimp heads, and in 100 growing days gained from an initial average weight of 5.5 g to a final average of 43.6. Fish in the Game and Fish Commission pond were fed twice a week during the growing season and once a week during the winter. Their total growing season was approximately 235 days. The length ranged from 140 to 300 mm with a mean of 182 mm, and weight varied from 20 g to 296 g with a mean of 51 g. Fish fed at a rate of 5 percent of their body weight per day should gain about 454 g in a 200 to 220 day growing season. Digestive system contents were examined and 55 to 80 percent of the contents were shrimp processing wastes. Further examination revealed that much of the chitinous material was excreted. This no doubt contributed to the low weight gain observed in these fish.

Small ponds at the Education and Research Center were stocked with channel catfish which were about 10 days past the sac fry stage. These were maintained for 100 days, with temperatures on at least 80 days in the range suitable for proper feeding activities. Controls averaged 32 g and 62 mm at the conclusion of the experiment, and the shrimp-fed specimens weighed an average of 25 g and had a length of 54 mm.

An experiment was initiated to determine if there were microorganisms present in the guts of channel catfish which could break down chitin and make the protein available to the fish. A gram-negative rod or coccibacillus and a gram-variable coccus were isolated from the gut contents of the channel catfish. These organisms grow in colonies on agar agar containing chitin. The relationship between the two appeared to be simbiotic, although each could also grow independently of the other on nutrient agar.

Samples from two sources were analyzed for total protein. Wastes from hand-picked shrimp contained 47 percent total protein and 29 percent from processing plants. As shrimp wastes deteriorate total protein is reduced, and the value of 29 percent found in plant processed wastes may have resulted from decomposition loss. Also, soluble proteins and protein in particles of tissue too small to be retained by the screen no doubt lowered the percentage.

One of the major objectives of this project was to measure the effects on water quality and plankton production when materials from a marine organism were introduced into fresh water. Plankton was sparse throughout the experiment in the Mississippi State University pond. No adverse effects were found in plankton communities in either the Game and Fish Commission pond or in the Education and Research Center ponds. Physico-chemical parameters fell well within the acceptable range. Sodium varied with geographical location, but no excessive increases due to the shrimp wastes were found in any of the ponds.

Catfish farming is a major industry in the South and Southwest, and especially in Mississippi. Information from this project should prove useful to fish farmers and fish food processors. Although shrimp processing wastes alone do not contain all the nutrients needed for a complete catfish diet, the high protein content should make these substances valuable sources of protein. Seafood processors will also find this information useful in securing new markets that will result in monetary gains as opposed to the present high cost of disposal.

TREATMENT OF SHRIMP PROCESSING WASTE WATER BY ELECTROLYSIS 45(3)

Richard D. Benton

Mississippi State University

During the summer of 1974 preliminary tests were conducted to determine the applicability of electrolysis as a means of treating shrimp processing waste water. These tests were encouraging. Significant decreases in chemical oxygen demand, biochemical oxygen demand, protein, ammonia, and phosphate were shown to occur.

Initial tests used direct current and platium electrodes, and satisfactory results were obtained with the addition of NaCl. The electrolysis process then produced flocculating bubbles and hypochlorous acid. This is the commercial process sold by Raritan Engineering Company for waste treatment on boats. However, this process alone did not appear to be practical for the large flow rates required by the shrimp processing plants.

It was found that excellent results could be obtained using alternating current and aluminum electrodes. This process can be more accurately named electroflocculation than electrolysis. Electrical stimulation of the aluminum electrodes in the waste water produces free hydrated aluminum hydroxide which carries down organic matter. The stimulation also produces a large quantity of micro bubbles which aid in the flocculation process. Results depend somewhat on pH but compare favorably with what is defined by the Environmental Protection Agency as best available technology. Owing to the quantities used, insufficient data were produced to investigate the energy economics of the process or to determine proper electrode geometry. A decision was made to construct an apparatus to investigate these questions.

Construction began during the summer of 1975. This test unit, which was constructed on a golf cart trailer frame, has two storage tanks with a combined capacity of about 500 gallons. The tanks are insulated by a one-half inch thickness of plywood, a three inch thickness of styrofoam, and a layer of fiberglass. A portable refrigeration unit will be installed to chill the material to about 35 degrees F. for storage and transport. Two pumps are provided to fill the tanks and circulate the liquid. The plumbing system allows single panel control of a large number of functions.

The unit is equipped with three combination AC/DC power supplies, which can provide up to 50 amperes each to any number of electrodes in the electrolysis chambers. The electrolysis chambers consist of three plexiglon towers, each 7.5 inches square and 99 inches tall. A floc catch basin is provided at the top of the towers to separate the floc from the waste water. It is expected that this test unit will be completed in August or September 1975. Initial tests will be conducted during the latter part of 1975 to provide data for adjusting the unit prior to the 1976 shrimp season.

DELINEATION OF THE TIDAL CURRENT REGIME OF MISSISSIPPI SOUND 50(1)

Charles K. Eleuterius

Gulf Coast Research Laboratory

Multiple and often conflicting uses are imposed on the fertile estuarine environment of the Mississippi Sound. Knowledge of the current regime and water exchange characteristics of such an estuarine system is essential to the intelligent planning and design of coastal development, navigation, flood control, hurricane protection, and the disposal of municipal and industrial wastes. The problem of pollution, as well as that of water quality, is directly related to the temporal and spatial distribution of the contaminants introduced into the estuary. The mechanism for the dispersal of the contaminants is the natural circulation of the estuarine system. The effective capacity of an estuarine system to dispose of waste material is a function of many factors. The factors considered of greatest importance are the rate of exchange or flushing with the ocean, the type of contaminant, circulation and mixing, salinity, temperature, and the depth of the water. It should be understood that while a single source of effluent added to an estuarine system may not in itself constitute a particular pollution problem, the composite of all wastes may overload the assimilative capacity of the system.

A total of fifty-six hydrographic cruises have been conducted in the mid and western sectors of the Mississippi Sound. An extra sampling station was added to help clarify the circulation pattern in the vicinity of Ship Island Pass. Measurements of water temperature, salinity, pH, and dissolved oxygen were taken at the surface, and in some localities at the bottom, to determine the presence of nitrite, nitrate, orthophosphate, and total phosphate.

These data have been checked, keypunched, verified, and undergone initial processing. Rough isopleth charts of temperature, salinity, pH, dissolved oxygen, nitrite, nitrate, orthophosphate, and total phosphate are almost complete. Planned computerization of most of this task will prevent future backlogs. Six computer programs have been written and tested to process the data. Final renditions of the base charts to be used in the project reports have been completed. These programs permit: Classic processing of hydrographic data; investigation of the influence and effect of surface warming; construction of isopleth worksheets; construction of vertical sections of the water column of selected parameters; and construction of tidal hodographs. In addition, utilization of other dynamic programs will permit computer generation of graphics that will clarify for the scientist and layman alike certain phenomena of Mississippi Sound circulation that should be considered in coastal zone management.

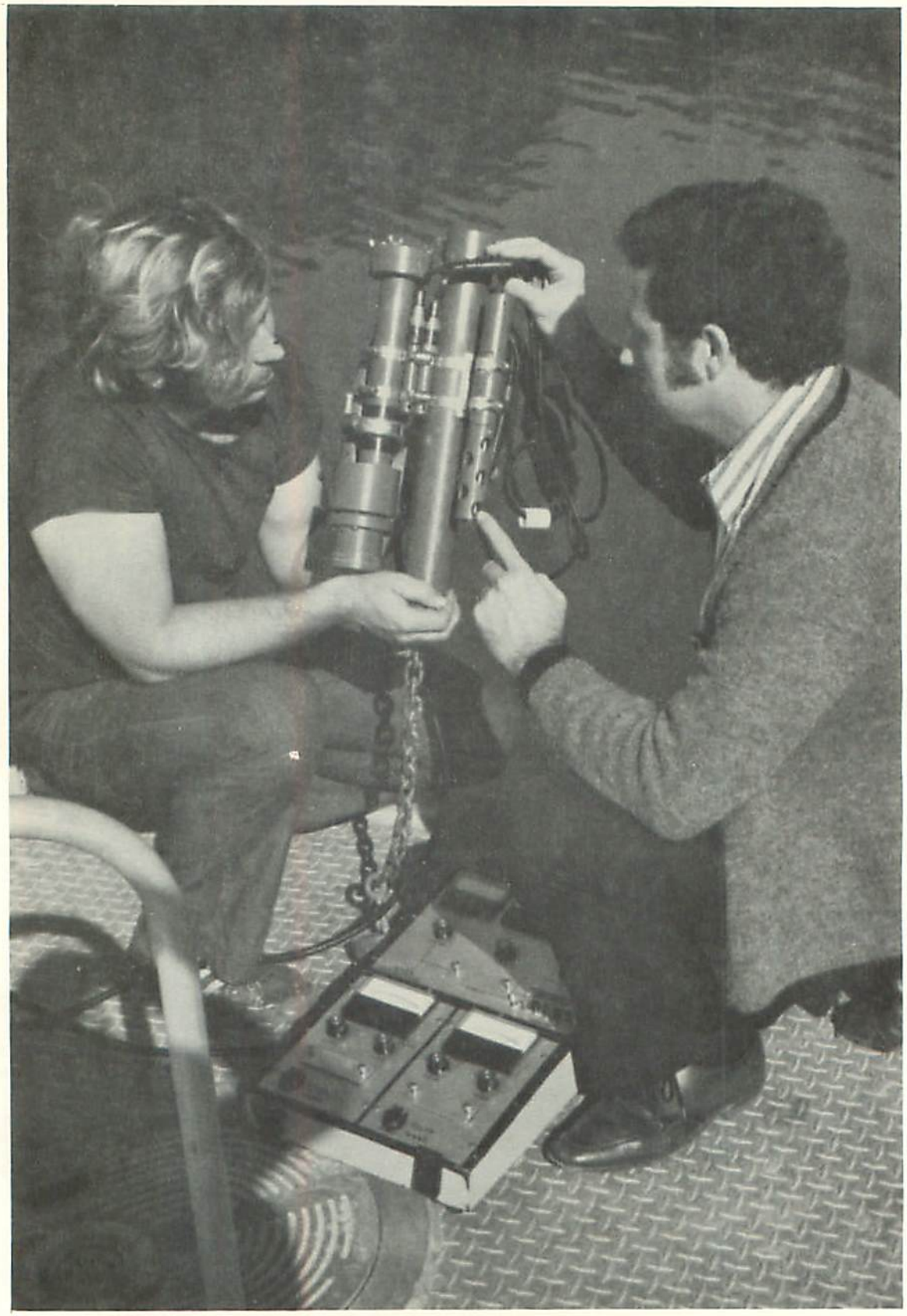
Maintenance of offshore tide gauge stations has continued with the time error in the analog traces now reduced to ± 2.5 minutes per month. The quality of these tide records has been superior, and once reduced they will be used to calibrate a mathematical model of the Sound.

The construction and maintenance of a wind gauge station at Point Cadet, Biloxi, Mississippi, has been a positive asset in acquiring information that will help determine the degree of wind influence on Mississippi Sound circulation.

Interest in this hydrographic investigation of Mississippi Sound has increased considerably over the past year. Inquiries have been received from scientists, industrialists, the Corps of Engineers, the Mississippi Marine Resources Council, civil engineers, and other agencies and individuals.

EDUCATION

MARINE EDUCATION AND TRAINING



LAW OF THE COASTAL ZONE 55(1)

James W. Zirkle — University of Mississippi
Stephen Gorove — University of Mississippi

The increased emphasis being placed on the wetlands, estuaries , and coastal area in general, prompted the School of Law at the University of Mississippi to design a course to acquaint future lawyers with the unique legal requirements of the coastal zone.

The Law of the Coastal Zone has been taught to more than 100 law students, and 1,600 pages of text and course materials have been compiled and are constantly updated. As the course continues to grow and develop, it will become a laboratory where answers will be sought for pressing legal questions, as they arise. This type of realistic exposure to the difficulties encountered in the coastal zone will provide these young lawyers with a far better grasp of the magnitude and complexity of these problems. Further investigation and compilation of statutes and regulations will be used to augment the course materials presently in use. Study of this new material will provide some solutions and identify areas where more research is needed. This constant two-way flow between field and classroom is anticipated to continue as an integral part of the course.

This course, as with all Sea Grant sponsored legal education courses, has progressed to the point where support from outside the University is no longer necessary, thus releasing Sea Grant funds for other purposes.

MARINE LAW AND SCIENCES 55(2)

James W. Zirkle — University of Mississippi
Stephen Gorove — University of Mississippi

As a result of expanded legal and technical information about the coastal zone, the School of Law at the University of Mississippi, working in coordination with the Mississippi-Alabama Sea Grant Consortium, has developed a graduate program leading to the degree of Master of Marine Law and Science. This program, which provides interdisciplinary studies and activities between the School of Law, the Department of Biology of the University of Mississippi and the Gulf Coast Research Laboratory, has been approved by the University and announcements have been mailed to almost 500 American colleges and universities and schools of law. The program provides interdisciplinary study between law and science designed to seek solutions to some of the problems of the marine and coastal zone. It is open to law graduates who have backgrounds in biology, zoology, or some other related scientific discipline.

The inquiry into the feasibility of establishing the Master of Marine Law and Science program was begun in November 1971. The curriculum for the program has been approved by the faculty of the School of Law and is now an integral part of the Graduate Law Program at the University of Mississippi.

INTERDISCIPLINARY STUDIES ON PROBLEMS OF THE COASTAL ZONE 55(3)

James W. Zirkle — University of Mississippi
Stephen Gorove — University of Mississippi

The legal problems that face the Mississippi coastal zone are as complex and varied as the coastal zone itself. The very nature of the area conspires to produce complex problems unknown to those who live in other areas. Some of these problems include curving shoreline boundaries, accretion, reliction, and complecated riparian rights.

Because of these unusual legal problems, it became evident that an interdisciplinary approach was the best avenue to follow to seek solutions to problems of such a varied nature. The School of Law at the University of Mississippi coordinated with other disciplines such as sociology, political science, geology, marine biology, economics, and agriculture to develop such a course. The first joint course was taught on an informal basis between the School of Law and the Department of Geology during the summer session of 1974.

The course was designed to inform future lawyers of the importance of other disciplines in the growth and development of the coastal area. Of particular significance were those disciplines dealing with marine biology, for wetland protection legislation is designed to preserve the habitats and nursery areas of many species of fish, birds, and animals valuable for commercial and sport purposes. A knowledge of these disciplines will be invaluable to lawyers in litigations involving coastal wetlands, zoning ordances, and other complex issues peculiar to the coastal zone.

DEVELOPMENT OF AN OCEANOGRAPHIC INSTRUMENTATION COURSE 62(1)

Richard D. Benton

Mississippi State University

The Institute of Engineering Technology of Mississippi State University offers a program in the areas of Marine Engineering Technology (emphasis on the shipbuilding industry) and Electronic Engineering Technology (emphasis on electronics, computers, and instrumentation). Graduates of these programs are highly skilled technologists with an understanding of engineering fundamentals and a practical, problem-solving approach. But it appears that they would be of more value to oceanographic research teams if they had a basic understanding of oceanographic instrumentation problems. The Electronic Engineering Technology curriculum includes a required course entitled Instrumentation System Technology. This course deals primarily with theory and application of electronic instrumentation, but does not meet the needs of oceanography.

The objective of this project is to modify the Instrumentation System Technology curriculum and make it responsive to the needs of oceanographic research.

During the summer and fall of 1974 data for the course were gathered and compiled. A visit was made to the National Oceanographic Instrumentation Center to gather information on the latest developments in instrumentation. Information was requested from other institutions offering courses on oceanographic or marine instrumentation, and a library search was made for suitable textbooks for the course.

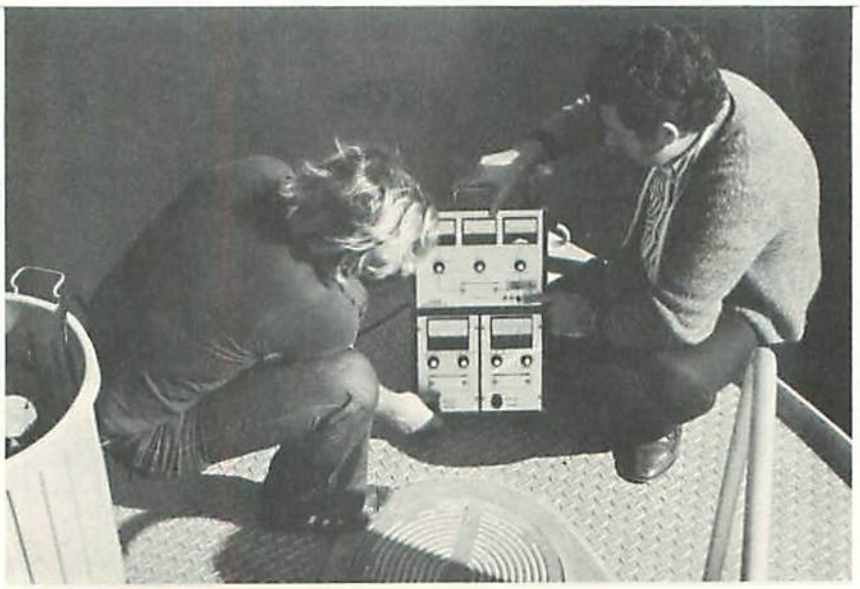
The following is an outline of major topics for the Oceanographic Instrumentation Course:

- Instrument Characteristics
- Errors
- Galvanometers
- D'Arsonval Movement Meters
- Bridges
- Electronic Laboratory Instruments
- Pressure Instruments
- Temperature Measurements
- Salinity Measurements
- Fluid Motion Measurements
- Sound Measurements
- Chemical Measurements
- Wave and Tide Measurements
- Geophysical Measurements
- Instrument Platforms
- Data Transmission and Analysis

In addition, each student will be required to prepare a term paper detailing the solution of an oceanographic instrumentation problem.

This course is being taught for the first time, and a detailed course syllabus is in preparation. Necessary modifications will be made after the first teaching, and the revised notes and syllabus will be expanded and presented as the final report. It is planned that this report will serve as the basis for a textbook in the area of oceanographic instrumentation.

The course will be taught again in the spring of 1976 and each spring semester thereafter at university expense.



DEVELOPMENT OF A GUIDE TO THE MARINE RESOURCES OF MISSISSIPPI 70(1)

Bobby N. Irby — University of Southern Mississippi
Della McCaughan — Biloxi High School

Would you like to know the history of Mississippi's Barrier Islands or how menhaden are caught and processed? Or how about the oceanography and geology of Mississippi's coastal area? Then you aren't alone. Now that mankind is realizing the great importance of estuarine areas in the production of food and energy, agencies and individuals responsible for managing marine resources are being inundated by requests for information. These requests have emphasized the need for an inventory of the total resources within Mississippi's marine and coastal area to enable interested persons to consult one reference to find information to satisfy their requirements. The result of this inventory was the *Guide to the Marine Resources of Mississippi*. Containing 44 chapters and 351 pages, the richly illustrated *Guide* is encyclopedic in scope but is written for all to understand and enjoy.

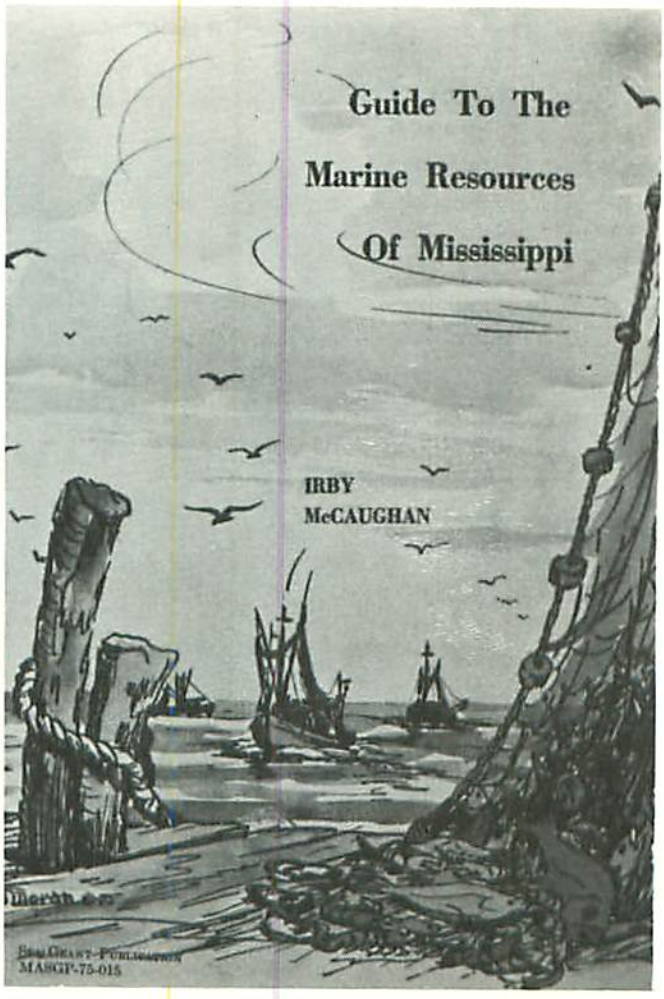
The *Guide* departs from the traditional animal, vegetable, or mineral approach and explores not only natural resources but history, agencies, institutions, and manmade features that have made the coastal area the most productive and economically important region.in the state.

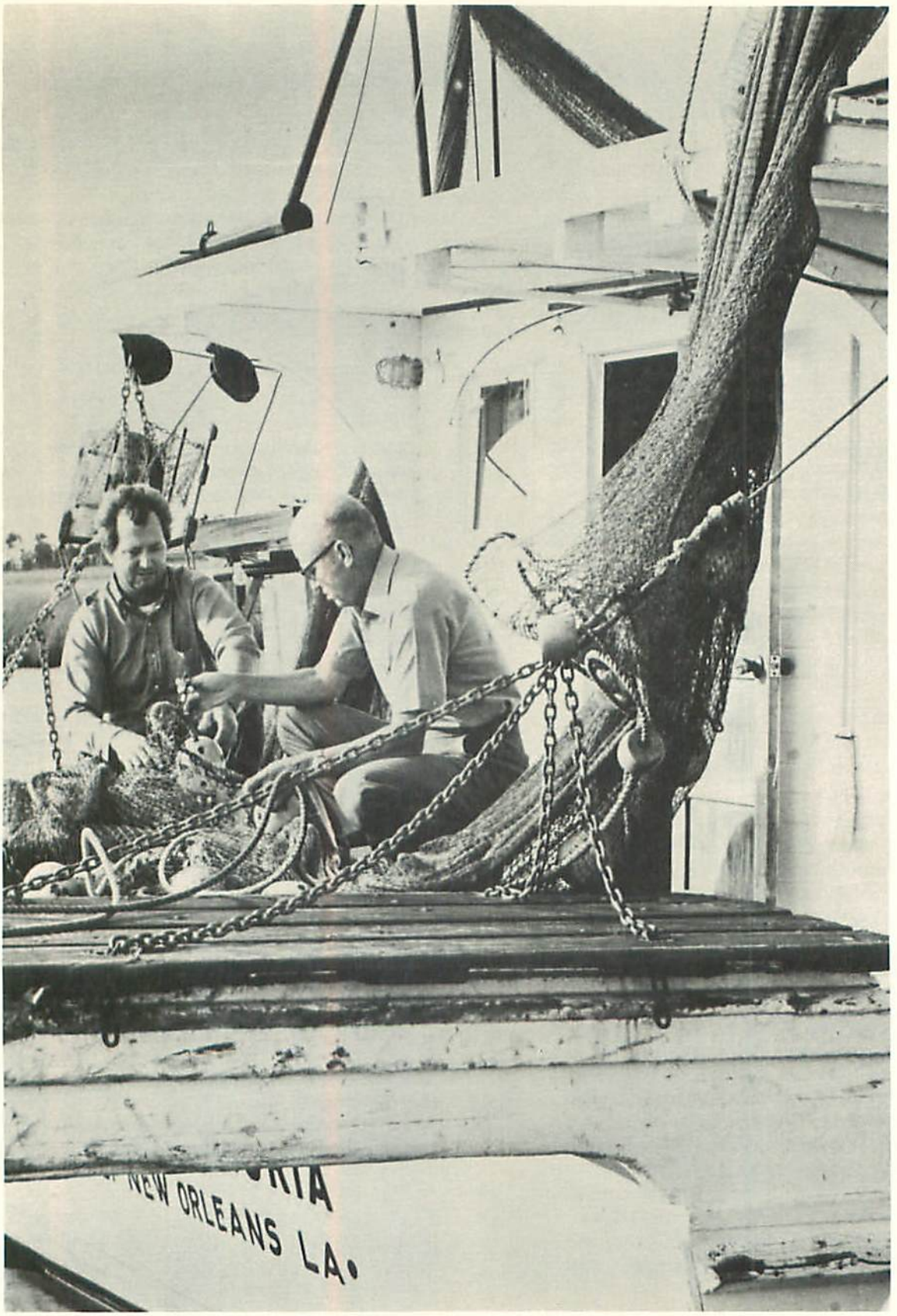
We are given a glimse of the coast as seen by the French Colonists and witness the effects of war, pestilence, and natural disasters. We watch the changing panorama as Indian dugouts are replaced by sails, which are in turn replaced by steam, gasoline, and diesel engines. The coastal marshes and estuaries are examined in depth and a detailed description is given of their irreplaceable functions as nursery areas for most commercial seafood species, buffer areas that attenuate storm surges, and habitats for many species of animals and waterfowl.

The largest portion of the *Guide* is devoted to the sport and commercial fishing industries and to seafood processing. These industries have contributed more to the development of the coast than any other single industry, and they have made a significant impact on the heritage of the area. But now these industries are facing difficult times, and some of the more serious problems are discussed at length.

All coastal regulatory and planning agencies are listed along with their locations, responsibilities, and functions. Industrial activities, both large and small, are included with their various contributions to the economic stability of the coastal area. All of the major ports and harbors are listed, complete with charts and specifications. A description of airports and surface transportation facilities completes the industrial and transportation picture.

No matter what your interests may be, you are certain to find something to satisfy your curiosity in the *Guide to the Marine Resources of Mississippi*.

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MISSISSIPPI MARINE ADVISORY SERVICE PROGRAM 71(1) 75(1) 76(1)

Leon O. Paulette — Mississippi Cooperative Extension Service
C. David Veal — Mississippi Cooperative Extension Service

The primary activities of the Mississippi Advisory Service have been concerned with consulting, educational programs, and special purpose publications. Advisory Service Specialists visited the docks and processing plants frequently to get acquainted with fishermen and processors and to learn first hand of their problems. Many of these problems could be solved or alleviated on the spot by the application of existing knowledge or technology. Some of the more complex problems were referred to Sea Grant researchers, legal experts, or elected officials.

When Governor William L. Waller requested the Mississippi Marine Resources Council to make a detailed study of the ailing seafood industry, Advisory Service Specialists provided information on commercial and sport fishing, marine rules and regulations, and made a number of recommendations to help improve the conditions under which the industry was forced to operate. One result of this effort was increased state support for the Mississippi Marine Conservation Commission and the hiring of a full-time director. Another beneficial change was the addition of representatives of four state agencies to the Board of Directors. This added expertise has improved the stability and efficiency of the Commission.

When fuel became scarce and costly and the price of supplies, equipment, and repairs to fishing boats began to increase, commercial fishermen found themselves in financial difficulty because the price of shrimp failed to follow the general upward trend. The Advisory Service held workshops on business management, social security, withholding and unemployment taxes and benefits, income tax training, fishermen's loans, federal fuel allocations, and fishing gear adjustment. While these activities could not stem the tide of inflation, they helped individual operators establish more efficient business practices to help survive adverse conditions.

In addition, an educational program was conducted to inform the general public, and housewives in particular, of the nutritive value of seafood and the reasonable price of shrimp as compared to other sources of protein. A multistate shrimp promotion campaign was conducted by the Advisory Service in cooperation with the National Marine Fisheries Service and Cooperative Extension Home Economists.

Workshops were conducted on a continuing basis to inform coastal residents of the value of marine resources, their proper use, conservation, and appreciation. Boating safety and fishing clinics were stressed, and a program was inaugurated to help fishing camp operators.

Advisory Service Specialists surveyed the fishing camps in the three coastal counties, and the information obtained was used to revise the Advisory Service publication, "Enjoy Your Leisure - Go Fishing!" In addition, detailed guides were developed for the major inland sport fishing waters in the coastal counties. These eight guides have been in great demand by local residents and visitors alike. Tide tables have been computed and published for the Mississippi Gulf Coast. Tide information is needed by sport and commercial fishermen, not to mention an automobile dealer who uses the information to predict if he will have to move his automobiles to high ground during times of heavy rain and high tides.

The Area Tourist Council approved the Sea Grant Advisory Service four color publication, "Mississippi Beaches," as an official publication to be mailed to people inquiring about the Mississippi Gulf Coast; more than 18,000 have been mailed. Two additional publications, the Sea Grant Newsletter and the Fishermen's Newsletter, are published on a scheduled basis.

Advisory Service Specialists have assisted local fishermen in planning and establishing two separate organizations. The objective of these organizations was to bring to the attention of Governor Waller, and proper authorities in Washington, the seriousness of the economic situation of the fishing industry. Advisory Service Specialists accompanied a delegation to discuss the matter with the Governor, and a representative was sent to Washington to secure support from members of the Legislature. Ultimately, these efforts resulted in the region being declared a disaster area eligible for low interest loans.

Advisory Service Specialists cooperated with other Sea Grant principal investigators and research staff members in arranging meetings on the coast. In particular, they participated directly in the Coastal Leaders Program in the areas of transportation, tourism and recreation, and seafood processing. Numerous contacts and arrangements were made with various seafood processors and fishermen to obtain permission for other Sea Grant personnel to visit and study their operations.

ALABAMA MARINE ADVISORY SERVICE PROGRAM 71(2) 75(2) 76(2)

A. Ray Cavender
Billy E. Powell

Alabama Cooperative Extension Service
Alabama Cooperative Extension Service

The Alabama Advisory Service program became a reality when a Marine Advisory Specialist was located in the coastal region. The first task was to establish a Sea Grant presence among sport and commercial fishermen, seafood processors, coastal leaders, state and federal agencies, and the news media. This presence was established through many personal contacts and a series of news articles and television programs explaining the Sea Grant Program.

The fuel crisis provided an opportunity for the Advisory Service to accomplish a beneficial act for the fishermen and shrimpers. The sharp increase in fuel prices and the drop in shrimp consumption, due to reduced restaurant sales, put many shrimpers in a critical economic situation. In an effort to assist the industry, various legislators and the Small Business Administration were contacted. As a result, shrimp boat owners were declared eligible for the Emergency Energy Short Loan Program. The Advisory Service Specialist then set up a series of meetings along the coast where the Small Business Administration staff held more than 90 interviews with shrimp boat owners interested in applying for loans. A number of loans have been processed, giving some aid to the shrimping community.

The Advisory Services of Mississippi and Alabama joined with the National Marine Fisheries Service and six other Southern states to celebrate "Shrimp Week." Governor George C. Wallace designated December 1 through 8 as "Alabama Shrimp Week." A "Shrimp Day" was proclaimed in Bayou La Batre, capital of Alabama's seafood industry. The Advisory Service Specialist served as State Coordinator and Marketing Specialist for the program. Packets prepared by the National Marine Fisheries Service were mailed to each county Home Economist, and many local and statewide television and radio programs were made to promote shrimp consumption. Newspaper articles featuring shrimp recipes reached more than 600,000 homes in the state.

Contacts with commercial fishermen revealed a real need for assistance with income tax programs. To help alleviate the situation, Mississippi and Alabama Advisory Service Specialists combined their activities and conducted two income tax workshops. Additional workshops have been held in the areas of record keeping and business management.

Sport fishing is big business in Alabama, and like all businesses it can benefit from any exposure to potential customers. The Advisory Service Specialist made numerous contacts with charter boat fishermen and determined that a real need existed for a Charter Boat Directory to inform prospective customers of what services are available and at what cost. The first Alabama Charter Boat Directory has been published and distributed widely in the coastal area.

The Advisory Service also assisted a research staff from the University of Southern Mississippi in conducting a survey of the sport fishing industry. This survey was a comprehensive two-state effort to determine the total magnitude of sport fishing along the Gulf Coast.

The utilization of trash fish and seafood processing plant waste could be a real asset to the fishing community. Disposal of these processing wastes at this time is a real problem, for government regulations prohibit depositing such debris in estuarine waters. The Advisory Service has made contacts with food technologists and industry personnel concerning new products that could be made from these wastes. Close coordination has been maintained with researchers at Mississippi State University who are working to perfect the use of electrolysis to treat shrimp processing wastewater and to increase the productivity of estuarine areas by utilizing pelletized seafood processing waste. Both of these projects show great potential in improving the quality of estuarine waters and in producing a valuable product from noxious wastes.

Alabama has established a Coastal Area Board charged with the development of a Coastal Zone Management Plan. Since any action of this type involves the total community, the Advisory Service has assisted in conducting meetings designed to inform the public of the need for Coastal Zone Management. A statewide Governor's Conference on Coastal Zone Management has been held, and community leaders have been identified in the various areas that will be affected by a total Coastal Zone Management Program.

PUBLICATIONS

MARINE RESOURCES DEVELOPMENT

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BUDGET SUMMARY
ACTIVITY SHEET

1974

	NOAA Grant Funds	Grantee Matching
Program Management and Development		
Program Administration and Development	$75,970	$66,825
Marine Resources Development		
Aquaculture	23,800	24,305
Living Resources, other than Aquaculture	51,784	78,906
Socio-Economics and Legal Studies		
Ocean Law	47,442	26,257
Marine Recreation	22,810	25,471
Marine Technology Research and Development		
Ocean Engineering	5,509	2,483
Resources Recovery & Utilization	9,960	14,625
Marine Environmental Research		
Research and Studies in Direct Support of Coastal Management Decisions	24,954	15,870
Ecosystems Research	435	-0-
Pollution Studies	104,175	51,708
Applied Oceanography	33,940	40,774
Marine Education and Training		
College Level	30,708	31,718
Advisory Services		
Extension Programs and Other Advisory Services	73,377	67,034
TOTAL	$504,864	$445,976

Partial funding from Sea Grant #2-35362 as follows:	NOAA	Matching
Living Resources, other than Aquaculture	$2,942	$1,048
Ocean Engineering	456	557
Program Administration and Development	850	

This summary is only approximate. The official financial report will be submitted to NOAA's Office of Sea Grant Programs in accordance with federal grant requirements.

For Further Information Contact

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