LOUISIANA SEA GRANT PROGRAM BIENNIAL REPORT 1975-77

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Cover: A water lily, a common plant in shallow freshwater lakes and bayous.

This biennial report is a compendium of the activities in the Louisiana Sea Grant Program during the years 1975 to 1977 It is published under the requirements of the National Sea Grant Program, U.S. Department of Commerce National Oceanic and Atmospheric Administration.

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WETLANDS IN FOCUS

LOUISIANA SEA GRANT PROGRAM BIENNIAL REPORT 1975-77

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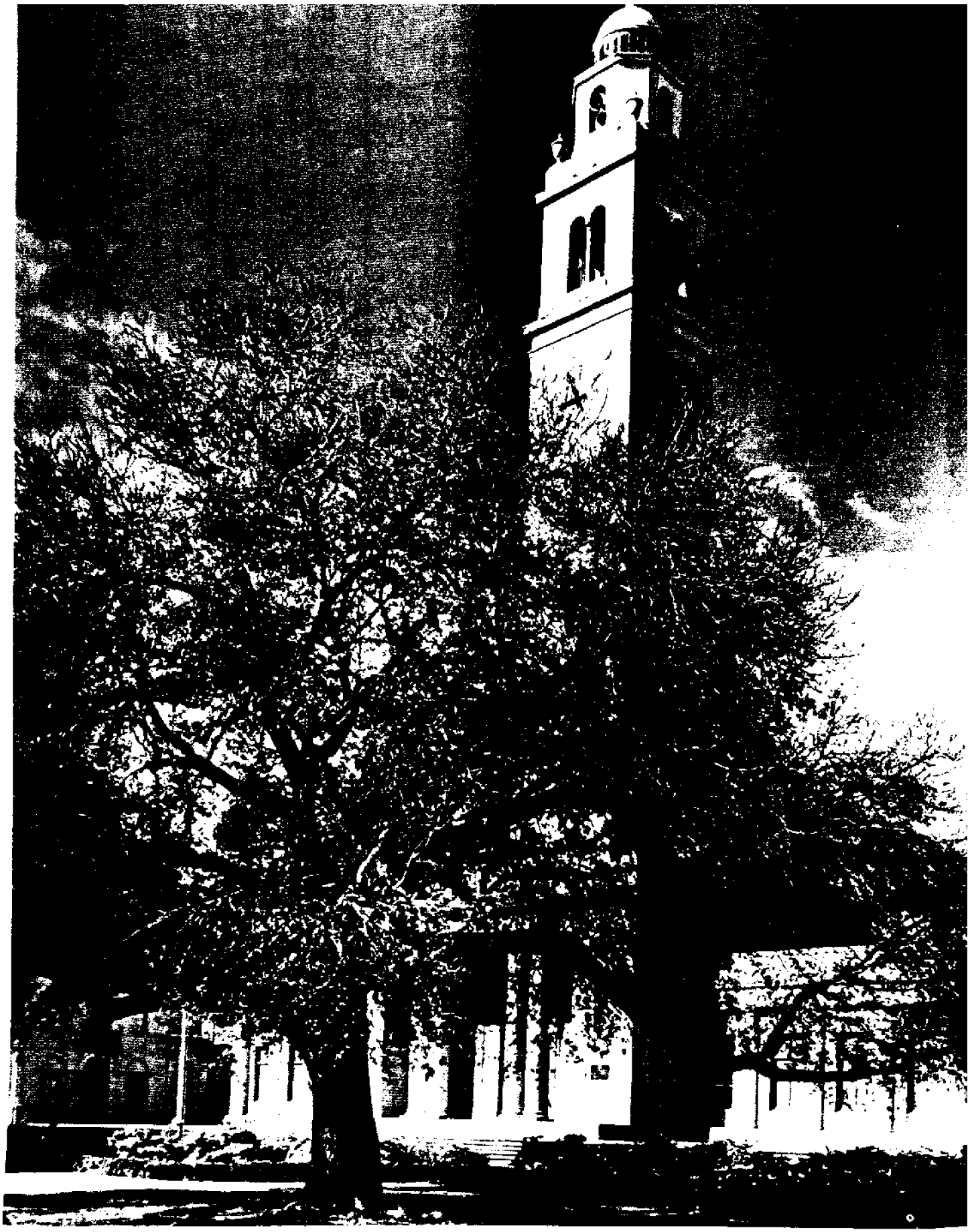


Program Administration

Growing Out and In

It sounds like a contradiction in terms, but Louisiana Sea Grant activities grew both out and in during the two years reported in these pages.

Growing out from the Baton Rouge campus of Louisiana State University, the program included three other state universities. Research on using crawfish wastes for fertilizers was begun at the University of Southwestern Louisiana in Lafayette. Two geography professors from Nicholls State University in Thibodaux completed an inventory of recreational camps in the state's coastal marsh lands. At the University of New Orleans research concerned the chemical behavior of toxic paints used to keep marine vessels free of barnacles and other marine organisms. Meanwhile, about 25 projects were carried out at LSU in Baton Rouge.

The growing out reached beyond universities. The marine advisory field staff—marine agents in coastal parishes working with fishermen and other users of wetland resources—expanded fivefold. Until 1975, only one agent worked for the program, and his territory covered half the state's coastal zone. Four more agents were hired, each was assigned to two or three coastal parishes, and assistance to users of the coastal zone—Sea Grant's most important clientele—was greatly improved.

A vocational-technical high school in Houma also took part in the program. At the Terrebonne Vocational-Technical High School, students training for entry level positions in the offshore oil- and gas-related industries were part of a Sea Grant educational project.

The growing in came on the LSU campus. The university's long-term commitment to Sea Grant was manifested in 13,000 square feet of additional space assigned to the Center for Wetland Resources for offices, laboratories, classrooms, and support services; refurbishing the facility cost more than $300,000. The building is the home of Sea Grant administrative offices, including that of the Director, Jack R. Van Lopik, who is also Dean of the Center for Wetland Resources. The Center was organized in 1970 to serve as the administrative base for the Sea Grant Program, the Department of Marine Sciences, and the Coastal Studies Institute.

The director's job is to pick winners. Success depends on staying abreast of all the state's coastal and marine issues, selecting well-defined problems, and involving productive researchers with appropriate qualifications. Projects can't be too big, too long, or too esoteric; the Sea Grant program favors down-to-earth, low-cost efforts with early payoff in practical results. Such projects often serve as stepping stones to institutional involvement in larger, longer programs funded by other agencies.

Ecological studies in Barataria Bay have been winners because they produced information needed to evaluate environmental impact of the giant LOOP (Louisiana Offshore Oil Port) facilities. They also furnished information needed to launch state coastal zone management efforts. Crawfish production and processing research are winners too; Louisiana's love affair with *l'ecrevisse* assures a long and prosperous future for crawfish growers in the state.

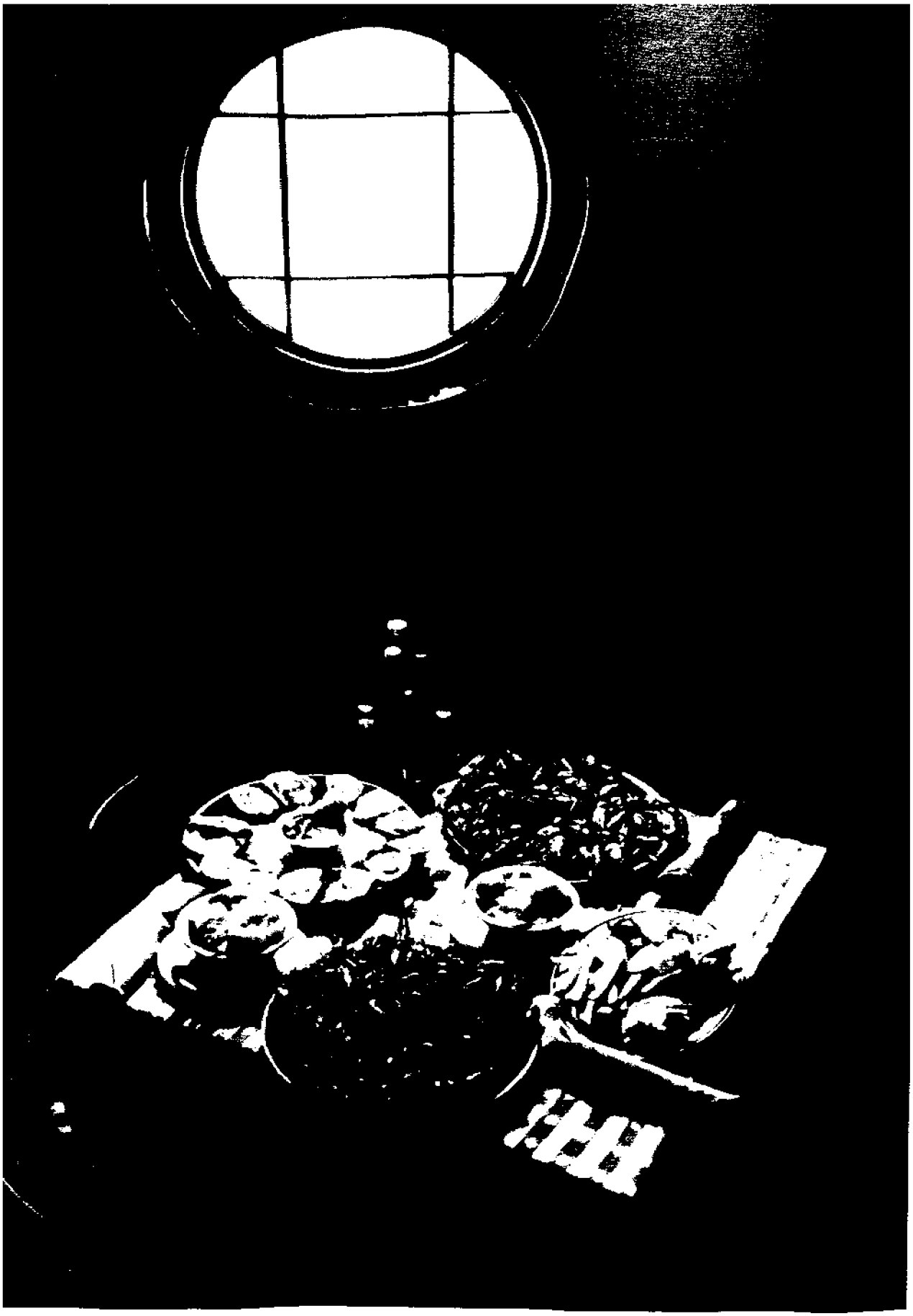
Louisiana Sea Grant is just one of 26 university-based Sea Grant programs that receive institutional support through the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. They share information and coordinate research with each other, creating a nationwide marine research network.

This report is a compendium of two years' work in the program, the eighth and ninth of its operation. Program activities touch nearly every aspect of life in the coastal zone: water, vegetation, aquaculture, law, recreation, economics, and education. The report describes the projects, their results, and the publications generated by the researchers during the years 1975–77.

M/A–1, 1968–77
Jack R. Van Lopik
Center for Wetland Resources
Louisiana State University

M/L–1, 1968–77
Rodney D. Adams
Center for Wetland Resources
Louisiana State University

Memorial Tower at Louisiana State University. The Louisiana Sea Grant Program offices are in the Center for Wetland Resources on the LSU campus.



Fisheries and Seafood Technology

Using Crawfish Wastes for Fertilizer

For every ton of peeled crawfish meat produced at processing plants there are six tons of waste left over. Consider the 25 processing plants located within a 20 mile radius of Breaux Bridge, Louisiana. Together they produce 17 million pounds of waste a year—waste that is physically difficult to haul away and that creates enormous sanitary problems at plant sites, local dumps, streams, and lakes. Coping with these wastes is a research challenge.

Led by J. R. Barry, a professor of horticulture at the University of Southwestern Louisiana (USL), a team of researchers undertook a three-year Sea Grant study of this problem. In addition to Barry, a vegetable horticulturist, the group included an agronomic soils specialist, an ornamental plant pathology specialist, an agricultural engineer, and a forage specialist. They had the support of several groups who were concerned with the waste problem, including the city government of Breaux Bridge, where much of the state's crawfish harvest is processed. "From January through June of each year our rivers and our bayous as well as our roads and drainage ditches are seriously polluted with the crawfish waste," Mayor Fred H. Mills wrote in support of the research. "This condition poses a health hazard and is unsightly. We feel that the development of an economical method of reclaiming the crawfish shells will greatly benefit both the industry and the general public."

Crawfish shells and associated waste materials have many elements essential for plant growth, some of which, like calcium and nitrogen, are commonly lacking in south Louisiana soils. A logical use for large quantities of this waste material would be as fertilizer for vegetables, nursery plants, pastures, and agronomic crops.

During the three years of this study, data are being collected on the short- and long-term influence of crawfish waste applications upon crop yields and quality and upon the biological, physical, and chemical properties of the soil. Crawfish wastes are being composted at various rates with such organic materials as rice hulls, sugarcane bagasse, and bagasse ash. Plants produced will be rated according to growth, vigor, and attractiveness. Studies of trade acceptance and the economics of production and marketing will be conducted in the last year of the project. The research will also investigate improvements in collecting, sorting, and handling crawfish wastes.

R/SST–4, 1976–77
Joseph R. Barry
Department of Plant Industry
University of Southwestern Louisiana
Lafayette, LA

Bullfrogs: Amphibious White Mice

About fifteen LSU microbiologists, food scientists, zoologists, and their graduate students are trying to develop what project leader Dudley Culley calls "the white mouse among amphibians." They are culturing the bullfrog, an animal that has been used for years in research on major human diseases like heart disease, cancer, and epilepsy. Twenty million bullfrogs are used for such purposes each year, and they all come from wild stocks. Until recently all were caught domestically, but with land clearing, channelization, and urban development, U.S. supplies have dwindled. Now 90 percent of all frogs used in research in the U.S. are imported, most of them from Mexico.

The change from domestic to foreign supplies has created problems, according to Culley, an associate professor of forestry and wildlife management at LSU. "The imported frogs are different physiologically from the frogs that have been used in this country over a period of years," he says. "The backlog of information generated by one kind of frog does not necessarily apply to the animals now being used in the laboratory." And that is not the only problem. Wild stocks are not hearty enough to withstand transportation, and about half of them die before reaching the laboratory.

In 1970 the National Institute of Health (NIH) provided funds for LSU scientists to learn how to manage these amphibians as laboratory animals. The Sea Grant program added some support in 1976, and significant progress has been made. Rearing systems for the aquatic and terrestrial life stages of the bullfrog have been tested and released for commercial development. Techniques for disease control and selective breeding are other areas of investigation.

Sea Grant has supported development of nutritionally adequate foods. Culturing frogs is not easy because frogs have specific—and expensive—tastes. At the tadpole stage they will eat non-living ra-

From water to table: research in the Sea Grant Program is product oriented. It is designed to solve practical problems of fishermen, pond owners, and processors.

tions similar to those manufactured for catfish, trout, and salmon. At the frog stage, however, they require living food, preferably small crawfish. The expense of maintaining such a food supply has been the major obstacle to commercial bullfrog culture.

One aspect of the Sea Grant study is understanding how diet affects disease in the animal. Researcher Robert Amborski finds he can alter the types and numbers of pathogenic bacteria in the tadpole's intestines by altering the diet. Dietary changes can totally change the intestinal bacterial community, and in turn affect the individual amino acids of proteins in the intestine. They can elevate pathogenic bacteria or wipe them out. In the long run, this information will lead to better disease control. Although such research is not new, it has not been done previously with aquatic animal feeds, according to Culley.

A second aspect of diet research involves developing manufactured foods for the frog stage—a nonliving diet rather than the living food they prefer. This has proven to be a tough job, Culley says, because frogs just do not accept artificial food, probably because of taste, texture, the absence of chemical signals from the living food, or a combination of factors. Culley and his colleagues suspect that they will have to conduct a selective breeding program to suppress genetic characteristics of the frog's digestive system that cause them to accept only live food. If the scientists are successful in altering the diet of the frog, they will have made a major contribution to culturing this important laboratory animal.

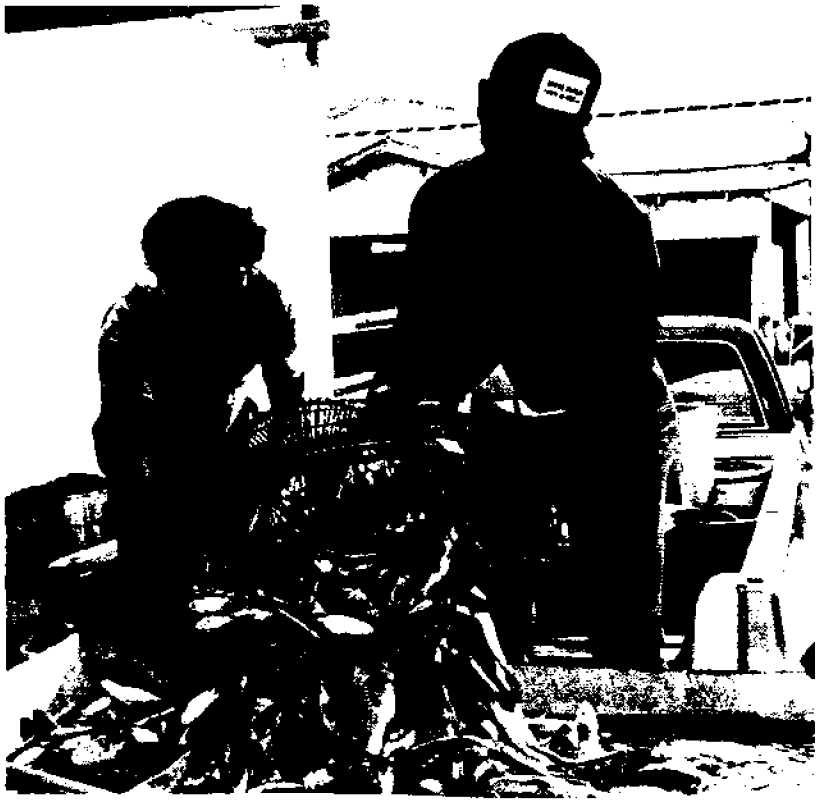
R/A–7, 1976–77
Dudley D. Culley, Jr.
School of Forestry and
Wildlife Management
Louisiana State University

Turtles Make a Comeback

Baby green turtles may be on their way back to the nation's pet stores. After banning the sale of green turtles as pets in this country, the Food and Drug Administration (FDA) is now reconsidering its position, and the Sea Grant program has played a part in the process.

Baby green turtles were banned in the late 1960s because they are suspected carriers of salmonosis, an infection that causes headache, chills, abdominal pain, nausea, and fever. For Louisiana, that decision had considerable economic impact. With only foreign markets to do business with, the $3 million a year turtle industry plummeted to less than a half million dollars by 1972.

When the ban was imposed, the FDA commissioner said that if a salmonella-free turtle could be produced and maintained, he would recommend lifting the ban. It was on the first part of that order—producing disease-free turtles—that Sea Grant efforts were focused. In a three-year project begun in 1974, Ron Siebeling, a microbiologist at LSU, developed a



method for treating turtle eggs to eliminate the infection-causing bacteria, *Salmonella Arizona*. The procedure calls for dipping the eggs in a Terramycin solution and incubating them in sterile, air-tight plastic bags. Egg treatment tests have been successful in eliminating all traces of salmonella from hatching turtles, and turtle farmers in the state have been quick to adopt the method. Other scientific gains made in the project include developing a more sensitive salmonella assay procedure and compiling evidence concerning ecology of the salmonella organisms as they relate to turtle population density and pond water depth.

Another concern of the FDA commissioner—maintaining salmonella-free turtles once they are hatched—has been tackled by the turtle industry. Growers got together and contracted with a pet wholesaler to develop a method for packaging the turtles in individual plastic containers for shipment and sale. The method should maintain disease-free turtles, but in the event a salmonella problem is discovered, the wholesaler's records will show where the turtle originated. Until this procedure was adopted, tracing an individual baby green turtle to a turtle farmer in Louisiana was almost impossible.

The FDA process of reconsidering its ban will take about a year; the fate of baby green turtles as pets in this country should be resolved during 1980.

R/GT–1, 1974–77
Ronald J. Siebeling
Department of Microbiology
Louisiana State University

Getting More From Shrimp Waste

Shrimp wastes need not be wastes at all. As shrimp go through the canning process, shells are removed by mechanical peeling and washing. The wastes—including shells, meat particles, and nutrients dissolved in the water—can be recovered and converted to shrimp meal, used as food for poultry, livestock, zoo animals, and aquatic animals.

Use of the shrimp processing industry's by-products has been an area of concern in the Sea Grant program since 1969 when Sam Meyers, professor of food science, began to develop rations for shrimp aquaculture. Since that time, Meyers has established nutritional requirements for shrimp and developed water-stable rations that are being produced commercially.

In 1976–77, Meyers began a two-year project to measure and analyze the characteristics of waste discharges from commercial processing facilities. The research is being conducted with the cooperation of three shrimp canneries in the greater New Orleans area, which provide repetitive samples from various parts of the canning process.

On the basis of tests conducted on these samples, Meyers and his fellow researchers have shown that even though usable solid material is already being recovered from the wastes, more can be recovered economically. Inventorying this material is one part of this project; the other aspect is to find additional ways of using shrimp wastes, such as developing shrimp flavor concentrates, pigment concentrates, and fabricated shrimp.

R/SST–5, 1976–77 and A/GSI–2, 1975–76
Samuel P. Meyers
Department of Food Science
Louisiana State University

Building a Better Crawfish

Some people call it the largest crawfish research facility in the world, but then there really aren't that many crawfish research facilities around. Suffice it to say that the extensive system of crawfish ponds at the LSU Agricultural Experiment Station's Ben Hur Farm is large and that the work there has contributed enormously to developing the crawfish industry in Louisiana.

Sea Grant-sponsored research on crawfish culture is directed by Jim Avault, professor of forestry and wildlife management. His project is organized as a collection of tasks that address specific problems of concern to crawfish farmers, with each task assigned to a graduate research assistant as a thesis topic. The overall objective is to develop a profitable, large-scale industry based on scientific principles of crawfish husbandry and management. In the years described in this report, Avault's staff investigated better traps and harvesting techniques, the use of agricultural by-products for supplemental food, the role of crawfish in pond systems with several cultured fish species, the feasibility of culturing crawfish intensively in tanks, and double cropping rice and crawfish. All this, plus they responded to hundreds of questions and problems of growers, producers, and sellers of crawfish.

Contributions have been made to many aspects of the crawfish industry, and crawfish farming is ex-

panding in Louisiana. In 1969, a total of 12,000 acres were devoted to crawfish farming; the figure rose to 25,000 acres in 1970, 40,000 in 1972, and to 45,000 in 1977. Just to cite one example of a direct contribution to the industry, early research indicated that production of crawfish in waters where soils are acid could be increased significantly by the addition of lime to the pond. Today, liming is a common practice on farms with those conditions.

R/A–4, 1972–77
James W. Avault, Jr.
School of Forestry and
Wildlife Management
Louisiana State University

How Does the Croaker Grow

The Atlantic croaker is often mentioned as an under-fished species that could complement or supplement the catch of the more valuable penaeid shrimp. To develop and manage croaker fisheries, regulatory agencies need data about how the croaker utilizes the coastal marsh: how long do juveniles remain in a marsh nursery zone, what is their growth rate, and how are these factors influenced by the date they enter the marsh. A three-year project headed by William Herke, assistant leader of the Louisiana Fishery Research Unit at LSU, is seeking answers to these questions.

Herke designed a croaker trap system and placed it in operation to collect samples. Results indicate that past estimates of nursery time for the croaker were too long. The fish moves in and out of the marsh faster than was once believed. Herke's data also show that past growth rates for the croaker have been underestimated. At one time a three-year-old croaker was estimated to be about ten inches long; Herke's research shows that the croaker actually grows to ten inches in about one year. Because the fish grow faster than once believed, harvest potential is even greater.

R/E–4, 1973–76
W. H. Herke
Cooperative Fishery Research Unit,
U.S. Fish and Wildlife Services
Louisiana State University

Stabilizing Hot Sauce

Finding a way to stabilize hot sauce to prevent separation is a problem, especially in Louisiana where so much hot sauce is produced. In 1976, Jim Rutledge, associate professor of food science, began a new line of research on thickeners and gelling agents that might be used in high acid food products like hot sauce and barbecue sauce.

Rutledge successfully prepared two complexes from chitin, a substance found in the exoskeleton of crustaceans, and demonstrated that these solutions—deacetylated chitin and hydroxypropylchitosan— have considerably higher viscosities than those encountered in commercial products. He points out that while there are numerous thickening agents on the market, there are relatively few gelling agents available to the food technologist. He recommends that the gelling capabilities of various chitin products be studied further.

R/SST–3, 1976–77
J. E. Rutledge
Department of Food Science
Louisiana State University

Coastal Information

Where the Camps Are

The ten thousand camps in Louisiana's coastal zone come in all shapes and sizes. Some have just one room, some are simple bungalows, some are elaborate second homes, and some can lodge 50 guests comfortably. Some are built on pilings above the marsh, others on slabs anchored to natural levees, and some on beaches. Some are accessible by water, some by roads. Wherever they are and whatever their size and situation, odds are they have been mapped in the detailed inventory of camps in the Louisiana coastal zone carried out by two Nicholls State University geographers, Don Gary and Donald Davis.

The inventory was made for several reasons. It provides a measure of recreational use of the coastal waters and wetlands. It gives the exact location of camps to planners and decision makers charged with managing the resources of the coastal zone, an area that has long been popular with state residents for outdoor recreation. It shows where utilities such as power, water supply, and sewage may be needed, and pinpoints areas that may be prone to health hazards if such services are not provided. And it serves as a base for parish officials to plan security controls, fire protection, and other infrastructural services.

The inventory has been compiled in a technical report and a set of 29 maps showing the exact location of camps in the coastal parishes. The technical report, "Recreational Dwellings in the Louisiana Coastal Marsh," explains camp geographical distribution, historical development, occupancy, recreational use, and construction. The maps can be reproduced upon request for users desiring information about a single parish or locality.

R/MPE–4, 1975–77
Don L. Gary
Donald W. Davis
Department of Earth Science
Nicholls State University
Thibodaux, LA 70301

How Does the Water Flow

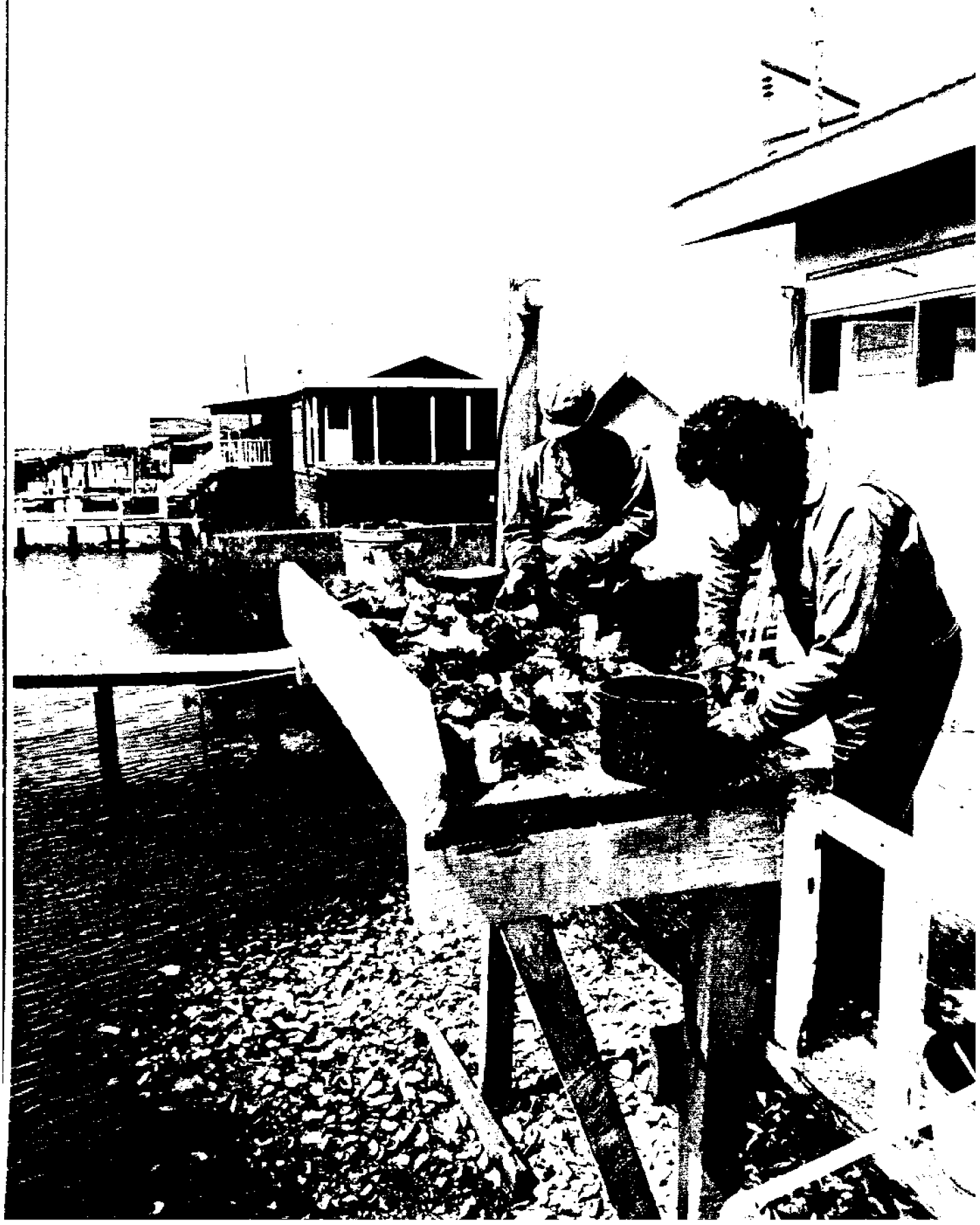
One manifestation of public concern for coastal environments has been a requirement to predict the impact major public works will have on natural systems. This has presented new challenges to environmental scientists concerned with wetlands and estuaries.

Various distributive properties can be sampled, measured, and described as biological, chemical, topographic, and hydrographic subsystems, but there is also a need to functionally characterize the interactions among them. Hydraulic modeling and simulation offer the most promising and realistic approaches to this problem. Subject to limitations imposed by computer size and speed, hydraulic models afford the ability to study the dynamic response of coastal water bodies to changing tides and sea, winds and weather, climate and season. Changes in model boundary geometry and bottom topography will affect calculated currents and circulation just as prototype changes disrupt natural flow patterns. Mathematical solutions exist to predict water mixing, dispersion of nutrients, planktonic forms of plants and animals, and a host of other natural phenomena.

While the theoretical possibilities for computer simulation of hydraulic systems are limitless, practical considerations of computer cost and time impose severe constraints on university researchers. The continuum of a real water system must be approximated by a finite geometric grid of discrete points. Then, computations that represent the response of real systems to prescribed changes in properties of interest are carried stepwise point to point from some specified central point. Irregular boundaries and interconnected systems require a fine mesh of points to accurately reproduce changes, and the repetitive arithmetic operations may easily run into the billions, even for simulated systems with rather uncomplicated boundaries.

The Louisiana estuaries are, moreover, notoriously complicated in physical aspects. So for Barataria Bay, modellers Linc Smith and Gerald McHugh implemented a compromise strategy involving a high-resolution (fine mesh) model nested within a low-resolution (coarse mesh) model. They can thus analyze the general circulation throughout the estuary as a function of measured driving conditions at tidal passes entering the bay, and then superimpose details of circulation associated with smaller features of interest in the basin interior. Such strategy offers a cost-effective approach to both regional and detailed analysis of effects related to canal and channel dredging, spoil banks, storm tides, oil spills, and other conditions of interest to environmental scientists and managers.

R/MPE–2, 1974–77
B. L. Smith
Center for Wetland Resources
Louisiana State University



What Price Oil

Oil production in Louisiana's coastal zone began with the historic discovery at Jennings, Louisiana, in 1901. Now nearly 80 years and 15,000 wells later, people are having second thoughts about the environmental impact of oil exploration, drilling, and extraction activities on Louisiana's wetlands.

Objective evaluation requires basic scientific knowledge of wetland environmental chemistry, food chain relationships, and natural productivity, both in the presence and absence of petroleum activities. Five Sea Grant projects were initiated in 1975 and 1976 to provide that basic knowledge and to assess the changes. And whereas much previous research has examined the effects of acute spillage, the LSU researchers concentrated on the effects of petroleum-related activity on sediment, plants, phytoplankton, and macrofauna in an oil field actively exploited since the early 1930s. The projects were interrelated: techniques developed for one were used in another; information collected for one project was used in another; staff researchers may have worked on related aspects of several projects. All were concerned with understanding the natural functions of the area in order to quantify man-made changes in it.

In a study of long-term crude oil contamination of Louisiana marshes, researchers measured and characterized the hydrocarbons and dissolved organic carbon content in the water and sediments associated with two oil fields and two control sites. They established sublethal levels of contamination and found that microbial processes eventually break down dissolved organo-carbon fractions derived from petroleum.

Organic contamination of sediments was another topic of study in this group of projects. This study was undertaken to ascertain the effect of oil contamination not only on sediments, but also on shellfish in areas where chronic contamination occurs.

Do oil-recovery operations affect plant productivity in the coastal marshes? Researchers William Patrick and Ron DeLaune investigated the effect of crude oil on nutrient chemistry by measuring uptake of plant nutrients by *Spartina alterniflora*, a highly productive marsh grass. Also studied were the effect of oil treatment on the various components of the nitrogen cycle and on sediment oxidation-reduction processes. Early results showed that mature *Spartina* can tolerate up to 1 liter of oil per square meter without an obvious harmful effect. *Spartina* is also being grown in the greenhouse for controlled studies using the oil treatment.

In a study of long-term oil-induced stresses on phytoplankton and macrophyte production, preliminary results indicate that plants in the oil field are shorter, thinner, and of lower density than in the natural marsh. A small proportion of this difference is statistically associated with changes in the land-water ratio related to canal density. An analysis of the data does not refute the hypothesis that the presence of oil-recovery operations, not the associated canals, results in lower plant production.

The final project in this group of five projects investigated the effects of chronic oil pollution on marsh macroconsumers, especially juvenile fish and benthic invertebrates, in terms of species diversity and population density. Resident finfish populations in these wetland areas of differing salinity were analyzed. Benthic invertebrate populations were compared in salt marsh areas with and without chronic oil seepage, and zooplankton populations in two saline marsh areas were studied.

During the early part of the research covered by this report, field work sampling sites and collecting techniques were developed in all three research areas.

R/HSE–1, 1973–77
Thomas Whelan
Department of Marine Sciences
and Coastal Studies Institute
Louisiana State University

R/HSE–2, 1976–77
Clara Ho
Department of Marine Sciences
Louisiana State University

R/HSE–3, 1976–77
William H. Patrick, Jr.
Department of Marine Sciences
and Laboratory for Wetland Soils and Sediments
Louisiana State University

R/HSE–4, 1975–77
R. Eugene Turner
Department of Marine Sciences
and Coastal Ecology Laboratory
Louisiana State University

R/HSE–6, 1976–77
Leonard M. Bahr Jr.
Department of Marine Sciences
and Coastal Ecology Laboratory
Louisiana State University

Shucking oysters at a camp on Grand Isle. Ten thousand camps in the Louisiana Coastal Zone have been recorded on maps useful to resource managers.

Systems Ecology

Beginning in the Basin

The St. James Canal, a three- or four-mile-long canal west of New Orleans in the Barataria Basin, was dredged to provide better drainage for the sugarcane fields on the natural levee of the Mississippi River. That it has done well, but there have also been some unanticipated negative results. Under natural conditions the runoff water would percolate slowly through the backswamp and gradually purge itself of agricultural fertilizers and wastes. The canal, however, shunts the water directly into the tributary bayous that feed Lac des Allemands, which has consequently become extremely eutrophic.

Understanding the effects of such man-induced changes on the wetlands, and recommending management practices to ameliorate these effects, is the work of Systems Ecology researchers associated with the Sea Grant Program. This program, which dates from 1968, shifted emphasis from the coastal salt marshes to interior freshwater environments in 1976–77 in order to complete a comprehensive, holistic study of the entire Barataria Basin from one end to the other. Generally speaking, the goal of the research is to provide enough accurate scientific data about the life cycle of the basin so that informed decisions can be made when major changes in the hydrology of the basin are proposed. One way this is accomplished is by passing on research findings to the State Coastal Zone Management Program, which will be responsible for writing permits that govern changes in the flow of water in the basin.

There were two projects in the first year of basin-wide studies. In one project, a natural swamp, a crawfish farm, and an impounded swamp were examined for the effects of changes on the flow of water: changes such as canal dredging, spoil bank impoundment, and the introduction of agricultural nutrients. Researchers found that in the impounded swamp where the water no longer moves, there are no new seedlings of cypress or tupelo gum in evidence. Timber production from the area will obviously decline; the impounded condition is detrimental for aquatic growth as well. To reverse this action, impoundments will have to be broken so that water can flow freely, a recommendation that has been made to the State Coastal Management program.

The second project is examining the chemistry of larger water bodies in Barataria Basin—Lac des Allemands, Lake Salvador, Lake Cataouatche, Little Lake, and Barataria Bay—lakes that are recipients of the enriched water being fed directly by man-made canals. Some degree of nutrient enrichment can be beneficial to wetland and aquatic systems, but just how much has to be established. In the project, researchers have begun to study chemical nutrient cycling in the altered areas, monitor basin water quality, and determine the practicable limits of a saline marsh's capacity to absorb nutrients.

Indications of this study are that nitrate and phosphate levels in Barataria Bay are significantly higher than those measured earlier in Caminada Bay. (The latter is in the southwestern corner of Barataria Basin and not directly affected by nutrient inputs from the upper basin.) Nutrient levels in the mid-basin around Lake Salvador and Little Lake are excessive. First-year data indicate that Lac des Allemands, Bayou des Allemands, Lake Cataouatche, and parts of Bayou Barataria are highly eutrophic. As sampling stations ranged away from the urban area of New Orleans, levels of eutrophication decreased. Both of these projects in the basin-wide studies are to continue into 1980 and beyond.

R/E–12, 1976–77
Rolando T. Parrondo
Department of Botany
Louisiana State University

R/E–13, 1976–77
John W. Day Jr.
Department of Marine Sciences
Louisiana State University

Nitrogen in the Salt Marsh

Nitrogen is the primary limiting factor in a salt marsh. Its presence (or absence) controls productivity of emergent vegetation and also microbial and other trophic levels of the estuarine system. That much was made clear by earlier research in the Sea Grant program, but further study was needed to determine how nitrogen is gained or lost by the marsh soil-plant system. To find out, LSU Boyd Professor William H. Patrick and Professor James G. Gosselink constructed a working model of nitrogen in a plant-soil system. The model they developed includes measured or estimated values for nitrogen fixation, nitrogen input from sediments, nitrogen added by rainfall,

Spartina, the most productive plant in Louisiana brackish and salt water marshes.

Changes in the wetland system can affect the bird population, although the sea gull, a notorious scavenger, could adapt better than most birds.

nitrogen loss through detrital export, plant uptake, mineralization of soil organic nitrogen, and denitrification losses.

Patrick, Gosselink, and their associates found that salt marshes are nitrogen deficient. Adding inorganic nitrogen compounds to the marshes increases the growth of marsh grasses, especially *Spartina alterniflora*, thereby improving the overall productivity of the estuary. It is difficult to imagine circumstances that would justify large-scale application of commercial fertilizer to stimulate plant growth, but the finding has valuable economic implications for coastal cities and industries that must dispose of nitrogen-rich effluents. The study provides the impetus for considering the possibility of using agricultural or domestic effluents as a way of fertilizing wetlands. A number of landowners and managers of Louisiana wetland areas have consulted with the Sea Grant program on this subject, as it holds important implications for them: a fertile marsh yields more plant life which yields more fish and wildlife.

R/E–1, 1973–75
William H. Patrick Jr.
Department of Marine Sciences
Louisiana State University

Understanding the Familiar

The year 1976 saw completion of a six-year study on how the plentiful marsh grass *Spartina alterniflora* is converted into detritus, an initial process in plant-dominated estuarine ecosystems. Sam Meyers, an LSU food scientist, led the project, which included field and laboratory studies on just how this marsh grass becomes available to higher trophic levels.

The breakdown and enrichment of marsh grass by microbial activity has been elucidated, as has the degradation and release of nutrients in chitin comprising the exoskeletons of shellfish, and the microbial role in conversion of foodstuffs by shrimp. Meyers and other food scientists working on the project determined the biomass and species composition of the microscopic communities that occupy the *Spartina* stems and root zone (rhizosphere). They found that high populations and a relatively small number of species were present, indicating the rhizosphere as an extremely selective habitat. They also found that cellulolytic bacteria share the initial task of plant tissue breakdown with filamentous fungi. They measured the microbial biomass on *Spartina* in various stages of degradation. The study of such transformation rates and baseline microbial activity allows a more accurate assessment of stressed estuarine habitats compared with their pristine counterparts.

R/E–2, 1969–76
Samuel P. Meyers
Department of Food Science
Louisiana State University

Leaf Litter in the Cypress Swamp

Lac des Allemands in the upper Barataria Basin is a rich cypress swamp that supports timber production, commercial catfish and crawfish fisheries, as well as sports fishing and hunting. In a three-year project researchers studied the productivity and nutrient chemistry of the swamp and why it is changing. In the last ten years algal blooms have appeared in the once clear, brown-water swamp lake.

In the study, researchers measured leaf litter fall to the swamp floor and determined amounts of dissolved and particulate carbon, nitrogen, and phosphorus exported. Comparisons were then made between swamps with natural drainage and those with altered drainage.

The water quality surveys conducted in conjunction with this project indicated that eutrophication is a pressing problem in the area and that man-made changes in the area's hydrology were the cause—subjects that are to occupy systems ecology researchers in the coming years.

Techniques developed for measuring the chemistry and primary

productivity of this swamp ecosystem were subsequently used for U.S. Environmental Protection Agency study of the effects of pesticides from agricultural runoff on swamp ecosystems.

R/E–8, 1973–76
John W. Day Jr.
Department of Marine Sciences
Louisiana State University

Energy and the City

As fossil fuel has become more expensive—and scarce—both artificially manipulated and highly productive natural systems must be considered as possible renewable energy resources, but their energy and nutrient flows must be understood in order to utilize them. In the case of one Sea Grant project, the natural system of the city of New Orleans was the subject of study. Socio-economic and thermodynamic data on the city was collected, so that researchers could estimate how much energy New Orleans uses. They examined ways that the city receives an energy subsidy from its proximity to the coast and the influence of natural coastal processes on the city. Effects, both positive and negative, of urban processes on energy flows through the coastal ecosystem of southeastern Louisiana were estimated. The project produced a seminar series involving students and faculty from the University of New Orleans and the LSU Center for Wetland Resources.

R/E–11, 1974–76
John W. Day Jr.
Department of Marine Sciences
Louisiana State University

Moving Offshore

The continental shelf off the coast of Louisiana supplies a third of the country's fish landings and supports a considerable portion of the coastal economy of southern Louisiana. In 1974, the Sea Grant program began a study that would determine the major environmental forces influencing the regional and seasonal differences in biological productivity. Phytoplankton populations and nutrient concentrations in the waters offshore are being measured in an effort to understand the effects of Mississippi River discharge on these important coastal fishing areas. Among other things, the research should indicate why catches vary from season to season and year to year.

R/E–5, 1974–77
R. Eugene Turner
Department of Marine Sciences
Louisiana State University

Ocean Engineering

Paints that Keep Boats Clean

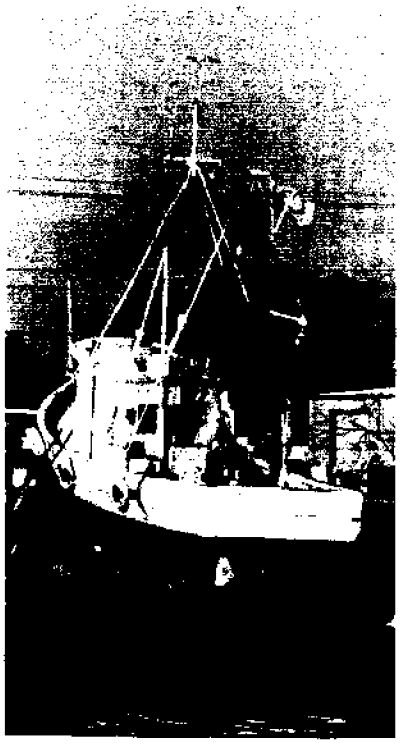
Six months' accumulation of marine organisms on the bottom of a boat can reduce its speed by 10 percent, fuel efficiency by 40 percent, and even damage the hull itself. This accumulation is called marine fouling—the algae, slime, molluscs, marine borers, and barnacles that accumulate on the bottoms of boats used in salt or brackish waters. What to do about this accumulation has long been a concern of boatowners—from shrimpers with 60-foot shrimp boats to the United States Navy with a fleet of ships. It has also become a concern of the Louisiana Sea Grant program.

The most realistic way to deal with the fouling problem is to paint the bottom of a boat with a toxic coating of antifouling paint. The most widely used toxicant has been cuprous oxide, although various compounds of arsenic, mercury, and lead coatings have been used. The cuprous oxide coatings are good fouling inhibitors, but they have rather short effective lifetimes. The arsenic, mercury, and lead coatings have severe toxic effects on fish and have either been restricted or completely removed from the commercial market. That leaves tin-containing coatings as the only reasonable alternative.

In 1976, the Sea Grant program funded a project to investigate the characteristics of these organotin toxicants. Leading the project were two chemists, Lydia Frenzel and Mary Good, who at the time were in the Department of Chemistry at the University of New Orleans. The project will further scientific knowledge of the behavior of organotins used in antifouling coatings. The research is to determine the chemical form of the toxicant in the bulk and on the surface of the coating and the associated surface release mechanisms. Leach rates and surface characteristics for these materials have not been adequately determined, nor has the minimum leach rate necessary for effective antifouling activity.

The project is expected to last three years, and marks the beginning of the Louisiana Sea Grant program's participation in ocean engineering research.

R/MTR-1, 1976–77
Mary L. Good and Lydia M. Frenzel
Department of Chemistry
University of New Orleans



Fighting the accumulation of marine organisms with a coat of antifouling paint. Sea Grant research is trying to find longer lasting and more effective paints.


SANKO LINE

Education and Training

Teaching Teachers

Teaching teachers to teach marine science and providing them with the materials to do the job is part of the marine education project of the Sea Grant program. This project began in 1972, and its work has reached from elementary and secondary schools through the college level to workshops for teachers. James P. Schweitzer, associate professor of marine sciences at LSU, has worked with local and state education officials to develop curricula and programs in marine sciences at all these levels.

Schweitzer produced a series of nineteen modules on marine science subjects that are being used as texts in nine Louisiana high schools in Jefferson and East Baton Rouge parishes. He also wrote a series of marine science teaching aids for science teachers in the state.

The work of the project has included organizing a professional group of marine science teachers, the Louisiana Marine Education Association. Teachers and school administrators in the group seek continued operation of marine science programs in the state and develop new programs.

The initial response of teachers in the state to both the modules and the concept of incorporating marine science into science classes has been positive. Schweitzer says that about twelve teachers in the state are offering courses on oceanography and marine biology as a result of their association with the Training and Education program. Part of the interest stems from Sea Grant development of a graduate-level marine science course for teachers and in-service summer institutes in marine and wetland ecology for high school students and science teachers.

E/MS–1, 1974–1977
James P. Schweitzer
Department of Marine Sciences
Louisiana State University

Teaching Students

Since 1974 the Sea Grant program has supported a nautical science education program in Terrebonne Parish to prepare students for jobs in the offshore mineral and oil industry. The program is located at the Terrebonne Vocational-Technical High School in Houma, Louisiana, and draws students from three other high schools in that coastal parish.

The job prospects of students graduating from the program are an indicator of its success. The 27 graduates from the first year of the program had a total of 206 job offers, and the jobs were better than high school graduates could get without completing the course. The training reduces the time a new worker needs to reach the merchant marine status of able-bodied seaman, the first classification above deckhand.

In the two-year program, students study in classrooms and on board ships. They make about eight trips, each lasting from three to five days. Three companies, the Arthur Levi Boat Co., the Lafayette Crew Boat Co., and International Logisties, have made their boats and crews available to be used for the training.

In the classroom students use a text written by the project's director, Capt. Gerald Hoffmann. The book, *Nautical Education for the Offshore Extractive Industry: Transportation* was published by the Louisiana Sea Grant program. When the project was undertaken, a single book was planned, but the information available and instructional needs dictated production of two additional books, *Support Operations and Seamanship* and *Navigation*, both to be published in the coming years by the Sea Grant program.

E/NS–1, 1974–77
Capt. Gerald Hoffmann
Terrebonne Vocational-Technical
High School
Houma, Louisiana

Learning about the wetlands. Sea Grant has education programs for students and teachers.

Advisory Services

Spreading the Word

Who lives in the coastal zone? Not me, answered the majority of 500 south Louisiana residents questioned by pollsters from LSU's Rural Sociology Department. The message gleaned from this and a dozen other questions in the survey was obvious: most Louisiana citizens, including those living in the nation's richest, biologically most productive coastal region, have little appreciation of the area and are indifferent to efforts of planned development and management of its abundant but imperiled resources.

So a first task—one that is vital to success of any future coastal resource management scheme—has to be the creation of a broader environmental consciousness among Louisiana citizens. A Sea Grant project was begun in 1972 to write, edit, and publish information about the coastal zone to try to raise people's awareness of the area they live in. Efforts cover several audiences. Newspaper articles are written with the general public in mind, a newsletter is published for people who have special interests in the wetland area, technical leaflets are produced for fishermen, processors, and boat owners; research reports make results available to scientists and to government agencies whose staffs oversee coastal zone planning and regulation.

What began as a staff of two half-time people to do all this work has grown to a staff of seven including a director, editor, writer, illustrators, and typist. The rapid growth is a result of both an effort to increase awareness of the coastal zone and to keep pace with a burgeoning volume of technical information being generated by a maturing Sea Grant program.

Aquanotes, a bimonthly newsletter, is produced for a non-technical audience. Its subscribers number 8,000. This free publication can be requested from the Center for Wetland Resources, Louisiana State University, Baton Rouge, LA 70803.

Producing technical reports was a major activity of the publications staff in 1975–77. In all, 24 technical reports and 26 journal articles were edited and typed by the staff. Sixteen of the technical reports were part of a series on coastal zone management, which provided background reference material for coastal zone planners and administrators.

A/P–1, 1972–77
Ronald E. Becker
Sea Grant Development
Louisiana State University

One to Five

When Ted Falgout was the only marine advisory agent in the Sea Grant Program, his territory—Lafourche, Terrebonne, and St. Mary parishes—included about half the coastal zone. Sixty percent of the state's shrimp are produced in that area, and Falgout's job was to make fishermen, processors, and anyone else whose livelihood depended on the wetland environment aware of changes in technology, techniques, and laws that would affect that livelihood. Needless to say, that was a tall order. "I spent many days just driving from one place to another," recalls Falgout, now assistant executive director of the Greater Lafourche Port Commission. "I had to rely on communicating with people through the media rather than through individual and group meetings."

All that changed during the years covered in this report, and Falgout's job became a lot easier and his role more effective. Four more agents were hired and more territory was added to the area covered. Coastal parishes were grouped, and each of the five agents was assigned an area. They probably didn't work fewer hours than Falgout did when he was covering half the coastal zone by himself, but their work became more productive.

Falgout saw the change in his own work. With a smaller area to cover he could meet with more groups and individuals. He describes the change as getting the chance to concentrate on educational programs instead of driving from one parish to another. He was also able to develop his newsletter—which all agents have and use effectively—from quarterly to monthly publication, and he saw the response from readers pick up. More people wanted to be on the mailing list, and more readers began to write or call Falgout after receiving an issue. It was proof to him that the newsletter was a good way to communicate with his clientele.

Publishing newsletters is about the only sedentary part of a marine agent's job. Most of the time he is out among fishermen, in shipyards, attending meetings of groups of fishermen, conducting workshops or camps for 4–H club members, or running down solutions to problems brought to him by his clientele. Those solutions may come from the other part of the Sea Grant Advis-

Fishing with a hoop net. Louisiana fishermen of all kinds are helped by Sea Grant marine advisory agents.

ory Services program, the specialists based at LSU.

When Falgout was the lone agent in the field, there was a lone marine advisory specialist at the university: Jim Fowler, an entomologist and director of the advisory program. Since that time, two more specialists have been added to the staff: Mike Moody, a food scientist, and Larry de la Bretonne, a marine scientist whose specialty is crawfish. In addition to finding answers to questions brought to them by the agents their job is to identify research programs that will someday produce results that will help the people in the coastal zone. The specialists also attend meetings and meet people in the coastal zone on a regular basis. The five agents and three specialists represent the Sea Grant Advisory Program to the people of the state.

A/EXT-1, 1971-77
James F. Fowler
Cooperative Extension Service
Louisiana State University

Robbie Juul, above right, marine agent in Lafourche Parish, is one of five agents who live and work in the coastal zone helping solve practical problems. Right, enjoying one of Louisiana's plentiful resources—water.

Law and Socio-Economics

Drawing the Line

It's a full-fledged border dispute between two states—Louisiana and Mississippi—with big money at stake. The question is how the border between the two states should be drawn in the area just offshore: should the line be drawn to give Mississippi or Louisiana more territory. The question is an important one to both states, because the distribution of Coastal Energy Impact funds are involved. Depending on where the line is drawn, one state stands to lose—or gain—funds allocated to states to ameliorate the impact of oil and gas exploration and development.

The dispute is being handled by the Louisiana Attorney General's office, and the Sea Grant Legal Program has provided substantial assistance to the team of lawyers working on the case. This is but one example of the kind of services provided by the Sea Grant legal advisory services program. In addition to assisting those who make and interpret the laws, the Sea Grant Legal Program helps Louisiana residents who want to know exactly how their lives will be affected by coastal zone management regulations and what benefits might be available to them under such programs as the Coastal Energy Impact Program. Letters and calls come in daily both from governmental agency staff people and from individuals who need legal advice.

A bimonthly newsletter, *Louisiana Coastal Law*, is published by this part of the Sea Grant program. It is free and available by writing to the Sea Grant Legal Program, Law Center, Louisiana State University, Baton Rouge, LA 70803.

A/L-1, 1971-77
Joseph T. Bockrath
Law Center
Louisiana State University

A Link to the Fishing Industry

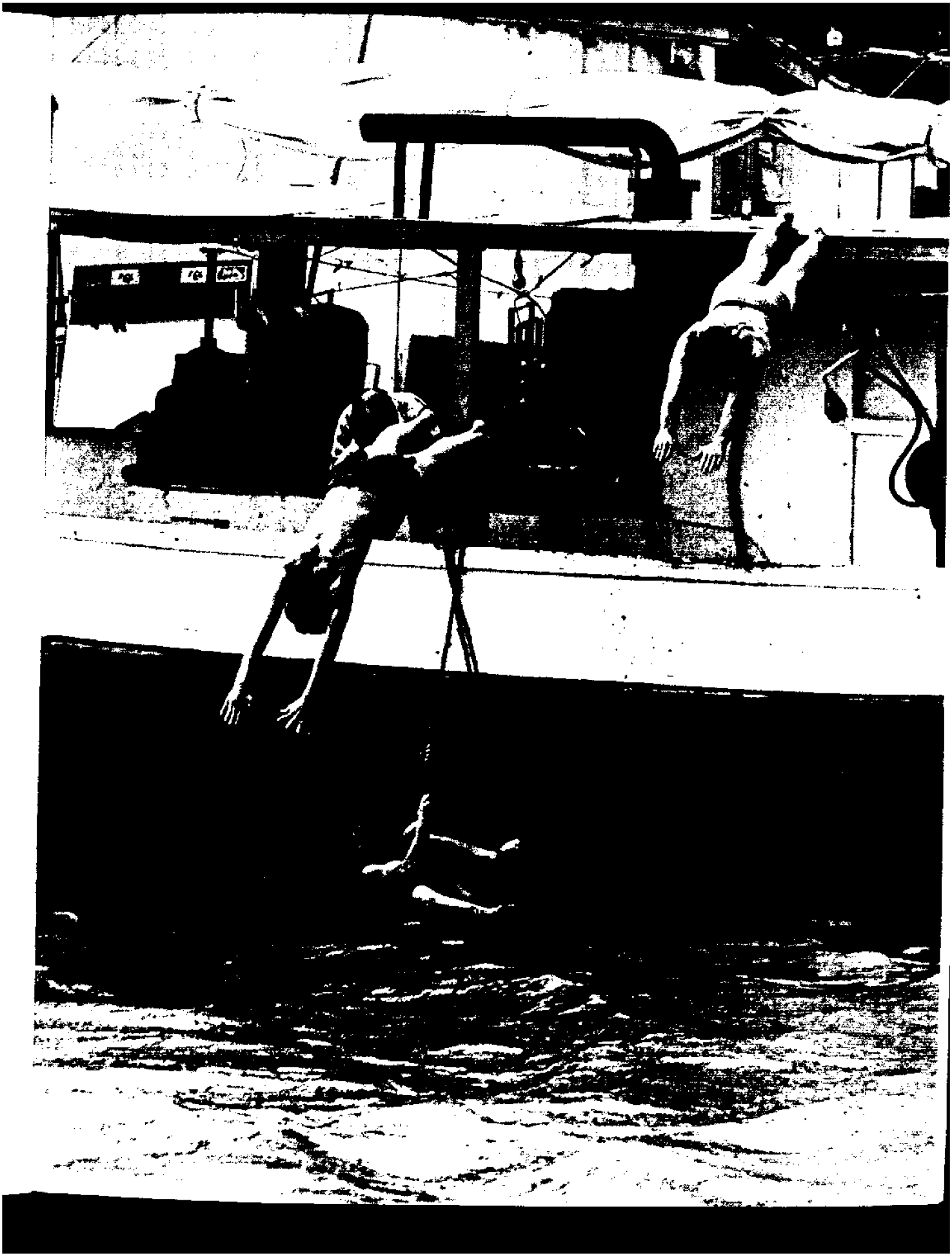
A Sea Grant program cannot succeed in a vacuum. To develop research objectives that will be useful to the fishing industry—both fishermen and processors—administrators of the program have to be aware of the industry's problems and efforts to solve them. A continuing Sea Grant project was begun in 1970 to establish active communication among researchers, government agency officials, and industry leaders so that the research efforts of the program might best be directed toward areas of concern in the fishing industry.

Leader of this project is Sea Grant Associate Director Ted Ford, who before assuming that post in 1970 worked for many years for the Louisiana Wildlife and Fisheries Commission. In the years covered by this report, Ford served on the Marine Fisheries Advisory Committee, which advises the Secretary of Commerce. He also headed a subcommittee that was responsible for review of the National Fisheries Plan. At the regional level, Ford chaired the Technical Coordinating Committee of the Gulf States Marine Fisheries Commission.

A/WLF-1, 1970-77
Ted B. Ford
Sea Grant Development
Louisiana State University

The Evolving Law of the Sea

How to divide up the ocean and its resources among the nations of the world has been the subject of in-



tense international negotiations in recent years. The United Nations has held several International Law of the Sea Conferences, where negotiators from developing and industrialized nations have met for months at a time to develop a treaty they can all live by. Unfortunately, these international negotiations haven't produced a treaty, and the laws of the sea are evolving in other ways. It is this evolution that has involved H. Gary Knight, Campanile Professor of Marine Resources Law at LSU.

Assuming that an acceptable treaty would *not* be produced by the United Nations Conference on the Law of the Sea, Knight set out to describe the most likely developments in the international law of the sea for the next 10 to 15 years in major areas such as deep seabed mining, economic resource zones, fisheries management, military use of the sea, navigation, scientific research, and protection of the marine environment. The results of this research, which have been published in a number of legal journals, help identify the effects of these evolving laws on U.S. ocean interests.

R/L–3, 1975–77
H. Gary Knight
Law Center
Louisiana State University

Making Way for New Ships

A new generation of ships has taken over in the maritime industry during the past decade, and the resulting impact on port terminals has been enormous. To stay competitive, ports have had to expand and modernize to match the new containerships, large bulk carriers, and roll on/roll off ships they serve. They have also had to cope with increasing legal and institutional regulation by various layers of government. Just how these seemingly conflicting and interrelated issues—economics and social politics—are being dealt with by ports was the subject of a Sea Grant Legal Program study.

In a two-year project, Sea Grant lawyers Kai Midboe and Joe Bockrath analyzed methods that might be used by ports to integrate economic and environmental goals into policies and practices. They observed port development projects in New Orleans, Miami, and Oakland and concluded that the earlier in the planning process environmental considerations can be made, the more successful is the port development.

As a necessary adjunct to environmental planning, the lawyers recommend that ports establish communication with environmental regulatory agencies and other interested public and private groups in the early planning stages of port projects. When possible, ports should be flexible in designing development projects and should incorporate environmental regulations and public expectations in the planning process.

R/L–4, 1975–77
Kai Midboe
Law Center
Louisiana State University

Accidents Offshore: Why They Happen

Lisandro Pérez did not intend to conduct a study of safety in the offshore workplace when he undertook a Sea Grant project on the high rate of turnover among offshore workers, but that's how it turned out.

His goal was to analyze factors that lead to a high turnover rate, but in his interviews with workers, managers, and government officials, he saw the turnover rate was related to a variety of other labor problems, safety among them. Pérez, an associate professor of Sociology at LSU, enlarged the scope of the study to include an analysis of sociological factors that influence safety of offshore work. That analysis is contained in a report, *Working Offshore: A preliminary analysis of social factors associated with safety in the offshore workplace*, published by the Sea Grant program.

While the incidence of accidents is not particularly high in the offshore industry, Pérez found that those that do occur have serious consequences: there is a high rate of fatalities and serious injuries per accident. Contrary to the widely held view in the industry that the current rate of serious injuries and fatalities is inherent in the nature of the workplace, Pérez found that only a small proportion of such accidents occurred in adverse weather conditions, and nearly half of those could be attributed to personal actions or to the mishandling of equipment.

Several factors are identified by Pérez as contributors to these safety problems. A high turnover rate and an absence of formal training keeps the work force inexperienced. Almost all training is done on the job. There is a chronic shortage

of offshore workers, which affects the quality of the labor force. And there is a disproportionately high number of young people among these workers.

Pérez names several sociopsychological factors associated with the incidence of work-related accidents. He points out that the predominant value system among many offshore workers stresses "individualism, independence, defiance of authority and rules, fearlessness, fortitude, and manliness." And he says, "these values may manifest themselves primarily in disregard for safety rules and proper precautions as well as in the taking of unnecessary risks."

One remedial action recommended by Pérez is to establish training programs that will prepare prospective offshore workers for entry-level jobs in the offshore industry. He also suggests actions that could be taken both by the offshore industry and governmental agencies. The report has been made available to industries and governmental agencies with interests in the offshore workplace. Pérez's larger study on labor turnover is continuing.

A fishing party and their catch—king mackeral.

R/S–3, 1975–77
Lisandro Pérez
Department of Sociology
Louisiana State University

Publications

Fisheries and Seafood Technology

Amborski, R. L., G. LoPiccolo, G. F. Amborski, and J. Huner. 1974. A disease affecting the shell and soft tissues of Louisiana crayfish, *Procambarus clarkii*. Pages 229-316 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Avault, J. W. Jr. 1975. Aquaculture research report. The Commercial Fish Farmer and Aquaculture News 1(5):40-51. Sea Grant Publ. No. LSU-R-74-006.

Avault, J. W. Jr. (ed.) 1976. Proc. 2d Inter. Crayfish Symposium, 1974. Louisiana State University Div. of Continuing Education, 676 pp.

Avault, J. W. Jr., L. de la Bretonne, and J. Huner. 1974. Two major problems in culturing crayfish in ponds. Pages 139-144 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Blades, H. C. Jr. 1974. The distribution of south Louisiana crawfish. Pages 621-628 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974.

Brown, R. T., and J. W. Avault Jr. 1974. Toxicity of antimycin to crayfish. Pages 351-370 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Carroll, J. C., R. S. Franz, H. C. Blades Jr., and T. F. Griffin III. 1976. Crawfish test market study, Houston, Tex. The Univ. of Southwestern Louisiana, Office of Instit. Res. Series No. 42. Sea Grant Publ. No. LSU-T-76-007.

Clark, D. F., J. W. Avault, and S. P. Meyers. 1974. Effects of feeding, fertilization, and vegetation on production of red swamp crawfish. Pages 125-138 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Gary, Don L. 1974. The geography of commercial crayfish ponds in south Louisiana. Pages 117-124 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Goyert, J. C., J. W. Avault Jr., J. E. Rutledge, and T. P. Hernandez. 1976. Agricultural by-products as supplemental feed for crawfish. Louisiana Agriculture 19(2):10-11. Sea Grant Publ. No. LSU-R-76-002.

Grodner, R. M., and A. F. Novak. 1975. Microbiological guidelines for freshwater crayfish. Pages 161-172 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Guest, W. C., J. W. Avault Jr., and J. D. Roussel. 1976a. A spermatology study of channel catfish *Ictalurus punctatus*. Trans. of the Amer. Fish. Soc. 105(3):463-468. Sea Grant Publ. No. LSU-R-76-010.

Guest, W. C., J. W. Avault Jr., and J. D. Roussel. 1976b. Preservation of channel catfish sperm. Trans. of the Amer. Fish. Soc. 105(3): 469-474. Sea Grant Publ. No. LSU-R-76-011.

Hall, C. A. S., J. W. Day Jr., and H. T. Odum. 1977. A circuit language for energy and matter. Pages 38-48 in C. A. S. Hall and J. W. Day Jr. (eds.). Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories. John Wiley and Sons, New York. Sea Grant Publ. No. LSU-R-77-009.

Happ, G., J. G. Gosselink, and J. W. Day Jr. 1977. The seasonal distribution of organic carbon in a Louisiana estuary. Estuarine and Coastal Mar. Sci. 5:695-705. Sea Grant Publ. No. LSU-R-77-013.

Huner, J. V. 1976a. Aberrant secondary sexual characteristics in the crawfish *Procambarus clarkii* (Girard) (Decapoda: Cambaridae). Southwestern Naturalist 22(2):269-286. Sea Grant Publ. No. LSU-R-77-007.

Huner, J. V. 1976b. Amphipods and crawfish—a possible commensal relationship? Proc. Louisiana Acad. Sci. 39:7-9. Sea Grant Publ. No. LSU-R-76-021.

Huner, J. V., and J. W. Avault Jr. 1976. Producing crawfish for fish bait. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-TL-76-001.

Huner, J. V., J. W. Avault Jr., and S. P. Meyers. 1974. Response and growth of freshwater crawfish to an extruded, water-stable diet. Pages 149-157 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Jaspers, E. J., J. W. Avault Jr., and J. D. Roussel. 1976. Spermatozoal morphology and ultrastructure of channel catfish *Ictalurus punctatus*. Trans. of the Amer. Fish. Soc. 105(3):475-480. Sea Grant Publ. No. LSU-R-76-012.

Jolly, A. L., J. W. Avault Jr., J. B. Graves, and K. L. Koonce. 1976. Effects of Matadan® on newly hatched and juvenile Louisiana red swamp crawfish, *Procambarus clarkii* (Girard). Pages 389-395 in Freshwater Crayfish: papers from the 3d Inter. Symp. on Freshwater Crayfish, Kuopio, Finland, 1976.

Joseph, J. D., and S. P. Meyers. 1975. Lipid fatty acid composition of shrimp meals and crustacean diets. Feedstuffs 47(35). Sea Grant Publ. No. LSU-R-75-008.

Kilgen, K. D., and R. H. Kilgen. 1975. A study on the natural repopulation of fishes in closed-off brackish water pipeline canals after Rotenone applications. Proc. La. Acad. of Sci. 38:41-45, December 1975. Sea Grant Publ. No. LSU-R-75-018.

Liuzzo, J. A., and A. F. Novak. 1975. Correlation of organoleptic evaluation with chemical and microbiological tests in oysters. Page 57 in Food Product Development, October, 1975. Sea Grant Publ. No. LSU-R-75-005.

Loesch, H. C. 1975. Observations on seabob shrimp *Xiphopenaeus*

kroyeri trapped in a beach trough during a falling tide. Proc. La. Acad. Sci. 38:16-19, December 1975. Sea Grant Publ. No. LSU-R-75-017.

Loesch, H. C., J. Bishop, A. Crowe, P. Wagner, and R. Kuckyr. 1976. Technique for estimating trawl efficiency in catching brown shrimp *(Penaeus aztecus)*, Atlantic croaker *(Micropogon undulatus)*, and Spot *(Leistomus xanthurus)*. Gulf Research Reports 5(2):29-33. Sea Grant Publ. No. LSU-R-76-017.

Melancon, E. J., and J. W. Avault Jr. 1976. Oxygen tolerance of juvenile red swamp crawfish, *Procambarus clarkii* (Girard). Pages 371-380 in Freshwater Crayfish: papers from the 3d Inter. Symp. on Freshwater Crayfish, Kuopio, Finland, 1976.

Meo, M., J. W. Day Jr., and T. B. Ford. 1976. Land treatment of fish processing wastes on dredge spoil sites: Comparative cost evaluations. J. Coastal Zone Management 3(3):307-318. Sea Grant Publ. No. LSU-R-77-005.

Meyers, S. P. 1975. Experimental flake diets for fish and crustacea. Prog. Fish Culturist, vol. 37. Sea Grant Publ. No. LSU-R-75-007.

Meyers, S. P. 1976. Development of water stable diets for larval and postlarval crustacea. In Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Meyers, S. P. 1977. Using crustacean meals and carotenoid-fortified diets. Feedstuffs 49(19):26-38.

Roussel, J. E., and R. H. Kilgen. 1975. Food habits of young Atlantic croakers *(Micropogon undulatus)* in brackish-water pipeline canals. Proc. Ann. Meeting La. Acad. Sci., April 1975. Sea Grant Publ. No. LSU-R-76-008.

Sabins, D. S., and F. M. Truesdale. 1974. Diel and seasonal occurrence of immature fishes in a Louisiana tidal pass. Pages 161-171 in Proc. of the 28th Ann. Conf. of the Southeastern Assoc. of Game and Fish Commissioners, 1974. La State Univ. School of Forestry and Wildl. Mgt., Baton Rouge, La. Sea Grant Publ. No. LSU-R-76-004.

Siebeling, R. J., P. M. Neal, and W. D. Granberry. 1975. Treatment of *Salmonella-Arizona*-infected turtle eggs with Terramycin and Chloromycetin by the temperature-differential egg dip method. Applied Microbiology 30(5):791-799. Sea Grant Publ. No. LSU-R-75-009.

Spieler, R., and A. H. Meier. 1976. Short-term serum prolactin concentrations in goldfish *(Carassius auratus)* subjected to serial sampling and restraint. J. Fish. Research Bd. Canada 33(1):183-186. Sea Grant Pub. No. LSU-R-76-001.

Spohrer, M. L., J. L. Williams, and J. W. Avault Jr. 1976. A selected bibliography of the red swamp crayfish, *Procambarus clarkii* (Girard) and the white river crayfish, *Procambarus acutus acutus* (Girard). Pages 637-662 in Freshwater Crayfish: papers from the 2d Inter. Symp. on Freshwater Crayfish, Baton Rouge, La., USA, 1974. Sea Grant Publ. No. LSU-W-74-002.

Stone, J. H. 1976. Environmental factors relating to Louisiana menhaden harvest. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-004.

Toma, R. B., and S. P. Meyers. 1975. Isolation and chemical evaluation of protein from shrimp cannery effluent. Agri. and Food Chem. 23(4): 632-635. Sea Grant Publ. No. LSU-R-75-006.

Williams, J. L., and J. W. Avault Jr. 1976. Acute toxicity of acriflavin, formalin, and potassium permanganate to juvenile red swamp crawfish, *Procambarus clarkii* (Girard). Pages 397-404 in Freshwater Crayfish: papers from the 3d Inter. Symp. on Freshwater Crayfish, Kuopio, Finland, 1976.

Yakupzack, P. M., W. H. Herke, and W. G. Perry. 1977. Imigration of juvenile Atlantic croaker, *Micropogon undulatus*, in a semi-impounded marsh in southwest Louisiana. Trans. of the Amer. Fish. Soc. 106(6):538-544. Sea Grant Publ. No. LSU-R-77-018.

Theses

Chung, Soomi L., 1976. Bio-protein from banana wastes. Ph.D. diss., Louisiana State University, Baton Rouge.

Fey, Michael S. 1976. Supplemental dietary carotenoids in aquatic flake formulations. Ph.D. diss., Louisiana State University, Baton Rouge.

Granberry, William D. 1976. Treatment of *Salmonella-Arizona* infected turtle eggs with gentamicin sulfate by the temperature and pressure differential egg dip methods. Master's thesis, Louisiana State University, Baton Rouge.

Hopkins, William C. 1975. The application of the HACCP concept to the breaded shrimp industry. Ph.D. diss., Louisiana State University, Baton Rouge.

Michael, S. A. 1977. The efficacy of treatment with various concentrations of gentamicin sulfate (Gamsol) for the elimination of *Arizona hinshawii* from artifically infected turtle eggs. Master's thesis, Louisiana State University, Baton Rouge.

Moertle, Randal J. 1976. A trawl and wing net study of the icthyofauna of the Caminada Bay estuarine system, Louisiana. Master's thesis, Louisiana State University, Baton Rouge.

Romaire, R. 1976. Population dynamics of red swamp crawfish in ponds receiving fertilization, and two agricultural forages as supplemental feed. Master's thesis, Louisiana State University, Baton Rouge.

Yakupzack, Paul M. 1976. Use of a tidal trap to direct growth and movement of juvenile Atlantic croaker, *Micropogon undulatus*, in a semi-impounded marsh in southwestern Louisiana. Master's thesis, Louisiana State University, Baton Rouge.

Coastal Information

Adams, R. D., B. B. Barrett, J. H. Blackmon, B. W. Gane, and W. G. McIntire. 1976. Barataria Basin: geologic processes and framework. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-006.

Conner, W. H. 1977. Public administration of Louisiana's coastal wetlands: 1820 to 1976. Sea Grant Publ. No. LSU-T-77-001.

Ho, C. L., and B. B. Barrett. 1977. Distribution of nutrients in Louisiana's coastal waters influenced by the Mississippi River. Estuarine and Coastal Marine Science 5:173-195. Sea Grant Publ. No. LSU-R-77-002.

Hood, M. A., W. S. Bishop Jr., F. W. Bishop, S. P. Meyers, and T. Whelan III. 1975. Microbial indicators of oil-rich salt marsh sediments. Appl. Microbiol. 30(6):982-987. Sea Grant Publ. No. LSU-R-75-010.

Hsu, S. A. 1976. Atmospheric dispersion characteristics in the Louisiana coastal zone. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-R-75-011.

Kupfer, R. L., K. Wallach, and S. Jollissaint. 1977. Comparative coastal zone management: a selective annotated bibliography. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-L-77-001.

McHugh, G. 1976. Development of a two-dimensional hydrodynamic numerical model for use in a shallow well-mixed estuary. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-008.

McIntire, W. G., M. J. Hershman, R. D. Adams, K. D. Midboe, and B. B. Barrett. 1975. A rationale for determining Louisiana's coastal zone. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-75-006.

Muller, R. A. 1977. A synoptic climatology for environmental baseline analysis: New Orleans. J. Appl. Meteorology 16(1):20-33. Sea Grant Publ. No. LSU-R-77-003.

Murray, S. P. 1976. Currents and circulation in the coastal waters of Louisiana. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-003.

Newton, M. B. Jr., and E. St. C. Easterly III. 1977. Louisiana parish boundaries through lakes, bays, and sounds. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-77-002.

Van Sickle, V. R., B. B. Barrett, L. J. Gulick, and T. B. Ford. 1976. Barataria Basin: salinity changes and oyster distribution. La. Wildl. and Fish. Comm. Tech. Bull. No. 20. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-002.

Watt, K. F. 1976. The relationship between resource use and economic growth: the forces determining the future. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Distinguished Lectures in Marine Science. Sea Grant Publ. No. LSU-R-76-008.

Whelan, T., J. T. Ishmael, and W. S. Bishop. 1975. Long-term chemical effects of petroleum in south Louisiana wetlands. Pt. I. Organic carbon in sediments and waters. Mar. Poll. Bull. 7(8):150-155. Sea Grant Publ. LSU-R-76-014.

Systems Ecology

Allen, R. L., R. W. Turner, and L. J. Rouse. 1977. Mississippi Delta Bight Studies 1-5. Hydrographic Data: March 11-27, July 15-24, October 28-November 7, 1975; January 13-February 5, April 27-May 9, 1977. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. Nos. LSU-T-77-003 through 007. Microfiche only.

Bahr, L. M., and J. J. Hebrard. 1976. Barataria Basin: biological characterization. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-005.

Bishop, J. 1976. A continuous recording, differential respirometer for a closed, flowing seawater system. OIKOS 27:127-130. Copenhagen. Sea Grant Publ. No. LSU-R-76-009.

Burke, W. W. III. 1976. Third record of Vioscallia Louisianae (Gastropoda: Hydrobiidae) in Louisiana. Proc. Louisiana Acad. Sci. 39:13-14. Sea Grant Publ. No. LSU-R-76-019.

Conner, W. H., and J. W. Day. 1976. Productivity and composition of a baldcypress-tupelo site and a bottomland hardwood site in a Louisiana swamp. Amer. J. of Botany 63(10):1354-1364. Sea Grant Publ. No. LSU-R-76-018.

Conner, W. H., R. E. Noble, and J. W. Day. 1975. Plant species checklists for the Lac des Allemands swamp area of Louisiana. Louisiana State University School of Forestry and Wildl. Mgt., Forestry Notes: LSU Agr. Exp. Sta. Bull. No. 113, Baton Rouge, La. LSU-R-75-021.

Crowe, A. L. 1975. Population dynamics of two species of commercial shrimp in Caminada Bay, Louisiana. I. Proc. La. Acad. of Sci. 38:86-91. Sea Grant Publ. No. LSU-R-76-006.

Day, J. W., T. J. Butler, and W. H. Conner. 1977. Productivity and nutrient export studies in a cypress swamp and lake system in Louisiana. Pages 255-269 in M. Wiley (ed.), Estuarine Processes, Vol. 2, Circulation, Sediments, and Transfer of Materials in the Estuary. Academic Press, New York. Sea Grant Publ. No. LSU-R-77-001.

Day, J. W. Jr., C. S. Hopkinson Jr., and H. C. Loesch. 1977. Modeling man and nature in southern Louisiana. Pages 282-391 in C. A. S. Hall and J. W. Day Jr. (eds.). Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories. John Wiley and Sons, New York. Sea Grant Publ. No. LSU-R-77-011.

DeLaune, R. D., W. H. Patrick Jr., and J. M. Brannon. 1976. Nutrient transformations in Louisiana salt marsh soils. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-009.

Hall, C. A. S., and J. W. Day Jr. 1977. Systems and models: terms and basic principles. Pages 6-35 in C. A. S. Hall and J. W. Day Jr. (eds.), Ecosystem

Modeling in Theory and Practice: An Introduction with Case Histories. John Wiley and Sons, New York. Sea Grant Publ. No. LSU-R-77-08.

Happ, G., J. G. Gosselink, and J. W. Day Jr. 1977. The seasonal distribution of organic carbon in a Louisiana estuary. Estuarine and Coastal Marine Science 5:695-705. Sea Grant Publ. No. LSU-R-77-013.

Hood, M. A., and S. P. Meyers. 1977. Microbiological and chitinoclastic activities associated with *Penaeus setiferus*. J. Oceanog. Soc. of Japan 33(5):235-241. Sea Grant Publ. No. LSU-R-77-015.

Hood, M. A., and S. P. Meyers. 1977. Rates of chitin degradation in an estuarine environment. J. Oceanog. Soc. of Japan 33(6):328-334. Sea Grant Publ. No. LSU-R-77-017.

Hopkinson, C. S. Jr., and J. W. Day Jr. 1977. A model of the Barataria Bay salt marsh ecosystem. Pages 236-265 in Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories. John Wiley and Sons, New York. Sea Grnt Publ. No. LSU-R-77-010.

Kirby, C. J., and J. G. Gosselink. 1976. Primary production in a Louisiana gulf coast *Spartina alterniflora* marsh. Ecology 57:1052-1059. Sea Grant Publ. No. LSU-R-76-020.

Meo, M., J. W. Day Jr., and T. B. Ford. 1975. Overland flow in the Louisiana coastal zone. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-75-04.

Meo, M., J. W. Day Jr., and T. B. Ford. 1976. Comparative cost evaluations of selected waste water treatments in Louisiana's coastal zone. J. Coastal Zone Mgt. 3(3):307-317. Sea Grant Publ. No. LSU-R-77-005.

Meyers, S. P., and D. G. Ahearn. 1977. Extracellular proteolysis by *Candida lipolytica*. Mycologia 69(3):646-651. Sea Grant Publ. No. LSU-R-77-004.

Patrick, W. H., and R. D. DeLaune. 1976. Nitrogen and phosphorus utilization of *Spartina alterniflora* in a salt marsh in Barataria Bay, La. Estuarine and Coastal Mar. Sci. 4:59-64. Sea Grant Publ. No. LSU-R-76-004.

Spieler, R., A. Meier, and H. C. Loesch. 1976. Seasonal variations in circadian levels of serum prolactin in striped mullet *Mugil cephalus*. General and Comparative Endocrinology 29:156-160. Sea Grant Publ. No. LSU-R-76-007.

Spieler, R., A. H. Meier, and H. C. Loesch. 1976. Photoperiodic effects on salinity selection in the gulf kilifish *Fundulus grandis*. Copeia 3:605-608. Sea Grant Publ. No. LSU-R-76-009.

Thomas, J. D. 1976. A survey of gammarid amphipods of the Barataria Bay, Louisiana, region. Contr. in Mar. Sci. 20:87-100. Sea Grant Publ. No. LSU-R-76-016.

Turner, R. E. 1976. Geographications in salt marsh macrophyte production: a review. Contr. in Mar. Sci. 20:57-68. Sea Grant Publ. LSU-R-76-015.

Turner, R. E. 1977. Intertidal vegetation and commercial yields of Penaeid shrimp. Trans. Amer. Fish. Soc. 106(5):411-416. Sea Grant Publ. No. LSU-R-77-012.

Turner, R. E., J. W. Day Jr., M. Meo, P. M. Payonk, T. B. Ford, and W. G. Smith. 1976. Aspects of land-treated waste application in Louisiana wetlands. Pages 973-975 in Proc. Nat'l Symp. on Freshwater Wetlands and Sewage Effluent, May 1976, Ann Arbor, Mich. Sea Grant Publ. No. LSU-R-76-005.

Turner, R. E., and J. G. Gosselink. 1975. A note on standing crops of *Spartina alterniflora* in Texas and Florida. Contr. Mar. Sci. 19:113-118. Sea Grant Publ. No. LSU-R-75-004.

Theses and Dissertations

Alexander, S. K. 1976. Relationship of macrophyte detritus to the salt marsh periwinkle, *Littorina irrorata* Say. Ph.D. diss., Louisiana State University, Baton Rouge.

Burke, William W. III. 1976. Vertical and horizontal distribution of macroinvertebrates on the cord grass, *Spartina alterniflora*, in a Louisiana salt marsh. Master's thesis, Louisiana State University, Baton Rouge.

Eckenrod, R. M. 1977. Computer simulation of urban-wetland interactions in the New Orleans region. Master's thesis, Louisiana State University, Baton Rouge.

Hinchee, R. E. 1977. Selected aspects of the biology of Lake Pontchartrain, La. Master's thesis, Louisiana State University, Baton Rouge.

Roth, William W. 1975. Purification and characterization of B-glucosidase of *Candida guilliermondii*. Master's thesis, Louisiana State University, Baton Rouge.

Sklar, F. H. 1976. Primary productivity in the Mississippi Delta Bight near a shallow bay estuarine system in Louisiana. Master's thesis, Louisiana State University, Baton Rouge.

Trivedi, Hasitkumar K. 1976. Transport phenomena in bay-marsh systems. Ph.D., Louisiana State University, Baton Rouge.

Education

Hoffman, G. H. 1977. Nautical education for the offshore extractive industries: Transportation. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-B-77-001.

Schweitzer, J. P. 1975. Evolution of the sextant. Louisiana State University Center for Wetland Resources, Marine Science Teaching Aid No. 7. Sea Grant Publ. No. LSU-LI-75-002.

Advisory Services

Aquanotes. Bimonthly. Advisory publication of the Louisiana Sea Grant Program. Louisiana State University Center for Wetland Resources, Baton Rouge, La. 12 issues.

Law and Fish Farming. 1975. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-G-75-001.

Louisiana Coastal Law. Bimonthly. Advisory publication of the Louisiana Sea Grant Legal Program. Louisiana State University Law Center, Baton Rouge, La. 12 issues.

Moody, M. R. 1976. Seafood plant sanitation. Louisiana State University Coop. Ext. Serv. Bull. No. 1879. Sea Grant Publ. No. LSU-R-76-002.

Law and Socio-Economics

Grimes, M. D., and T. K. Pinhey. 1976. Recreational potential of private lands in Louisiana's coastal areas. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-010.

Hershman, M. J. 1975a. Coastal zone management: accommodating competing coastal areas. Geoscience and Man, 12:109-115. Sea Grant Publ. No. LSU-R-75-022.

Hershman, M. J. 1975b. Achieving federal-state coordination in coastal resources management. William and Mary Law Review 16(4):747-772. Sea Grant Publ. No. LSU-SG-75-R2.

Hershman, M. J., and D. R. Fontenot. 1976. Local regulation of pipeline sitings and the doctrines of federal preemption and supremacy. Louisiana Law Review 36(4):929-945. Sea Grant Publ. No. LSU-R-76-013.

Hershman, M. J., and M. Mistric. 1975. Coastal zone management and state-local relations under the Louisiana Constitution of 1974. Loyola Law Review 22(1):273-309.

Knight, H. Gary. 1975. Between Scylla and Charybdis: Part I. Caracas. Common Ground 1(4):93-102. Sea Grant Publ. No. LSU-R-74-007.

Law and Fish Farming. 1975. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-C-75-001.

Lindsey, J. L., K. W. Paterson, and A. L. Bertrand. 1976. Citizen perception of coastal area planning and development: a study of the attitudes and knowledge of Louisianians. Louisiana State University Center for Wetland Resources, Baton Rouge, La. Sea Grant Publ. No. LSU-T-76-001.

Pinhey, T. K., and K. W. Paterson. 1976. Comments: Environmental concern as a factor in coastal zone development: a study of Louisiana citizens. J. Coastal Zone Management. 2(3):297-310. Sea Grant Publ. No. LSU-R-76-005.

Williams, E., F. S. Craig III, and J. W. Avault Jr. 1975. Some legal aspects of catfish and crawfish farming in Louisiana: a case study. La. State Univ. Agr. Exp. Sta. Advisory Leaflet. Sea Grant Publ. No. LSU-TL-75-001.

Thesis

Pinhey, Thomas K. 1975. Environmental concern as a factor in coastal zone development. Master's thesis, Louisiana State University, Baton Rouge.

Projects and People

Program Management

Program Administration (M/A-1)	J. R. Van Lopik	Since 1968
Field Logistics (M/L-1)	R. D. Adams	Since 1968

Fisheries and Seafood Technology

Crawfish Culture (R/A-4)	J. W. Avault	1972–77
Salmonella in the Baby Green Turtle (R/GT-1)	R. J. Siebeling	1974–77
Evaluation of Deacetylated Chitin, Hydroxypropylchitin and Hydroxypropylchitosan in High Acid Food Products (R/SST-3)	J. E. Rutledge	1976–77
Evaluation of Procedures for Handling and Utilizing Crawfish Waste as a Fertilizer Amendment for Horticultural and Agronomic Crops (R/SST-4)	J. R. Barry	1976–77
Shrimp Industry By-Product Recovery and Utilization (R/SST-5)	S. P. Meyers	1976–77
Guidelines for Feeding and Managing Bullfrogs Under Intensive Culture (R/A-7)	D. D. Culley Jr.	1976–77

Coastal Information Program

Marine Fresh Water Exchange and Coupling with Biological and Chemical Systems (R/MPE-2)	B. L. Smith	1975–77
Inventory of Louisiana's Marsh Recreational Dwellings (R/MPE-4)	D. Gary	1975–77
Hydrocarbon Concentration in Food Chains (R/HSE-1)	T. Whelan, III	1975–77
Water and Sediment Chemistry (R/HSE-2)	C. L. Ho	1975–77
Effect of Crude Oil on Nitrogen Flux in Salt Marshes (R/HSE-3)	W. H. Patrick Jr.	1975–77

Hydrocarbon Effects on Estuarine Carbon Flux (R/HSE-4)	R. E. Turner	1975–77
Oil Stresses on Wetland Macrofauna (R/HSE-6)	L. M. Bahr Jr.	1976–77
Systems Ecology		
Nitrogen Transformations in Wetland Soils (R/E-1)	W. H. Patrick Jr.	1975–76
Spartina/Cellulose Transformation Processes (R/E-2)	S. P. Meyers	1975–76
Size and Number of Emigrating Fishes, Shrimp and Crabs (R/E-4)	W. H. Herke	1975–76
Chemical Ecology of a Cypress Swamp (R/E-8)	J. W. Day Jr.	1975–76
Metropolitan Metabolism in a Coastal Setting (R/E-11)	J. W. Day Jr.	1974–76
Offshore Primary Productivity (R/E-5)	R. E. Turner	1974–76
Effects of Current Management Practices on the Primary Productivity of the Barataria Basin (R/E-12)	R. T. Parrondo	1976–77
Effects of Man's Alterations on Wetland and Estuarine Chemistry (R/E-13)	J. W. Day Jr.	1976–77
Ocean Engineering		
Preparation and Investigation of Marine Antifouling Materials (R/MTR-1)	M. L. Good, L. M. Frenzel	1976–77
Architectural Guidelines for the Louisiana Coastal Zone (R/MTR-2)	A. Kaple	1976–77

Education and Training		
Marine Education (E/MS-1)	J. P. Schweitzer	1974–77
Nautical Science Vocational Training (E/NS-1)	G. L. Hoffman	1974–77
Advisory Services		
Publications and Information Dissemination (A/P-1)	R. E. Becker	1971–77
Aquaculture Diet Formulation and Marine Food Studies (A/GSI-2)	S. P. Meyers	1971–76
Marine Extension Service (A/EXT-1)	J. F. Fowler	1971–77
Legal Advisory Services (A/L-1)	J. T. Bockrath	1971–77
Advisory Services to Fisheries Interests (A/WLF-1)	T. B. Ford	1970–77
Law and Socio-Economics		
Post Conference Development of Law of the Sea (R/L-3)	H. G. Knight	1975–77
Site Selection for Port, Waterway, and Pipeline Development in Coastal Louisiana: Legal, Institutional and Policy Aspects (R/L-4)	K. D. Midboe	1975–77
Labor Instability in Louisiana's Maritime Industries (R/S-3)	L. Perez	1975–77

Sea Grant Program Expenditures

	1975-76 NOAA Funds	1975-76 Matching Funds	1976-77 NOAA Funds	1976-77 Matching Funds
Marine Resources Development				
Aquaculture	22,064	7,937	25,310	27,961
Living Resources other than Aquaculture	20,714	13,356	4,920	5,200
Socio-Economic and Legal Studies				
Marine Economics	19,050	5,426	0	0
Ocean Law	38,175	40,441	43,695	30,289
Socio-Political Studies	23,804	18,271	20,697	15,432
Marine Technology Research and Development				
Ocean Engineering	—	—	33,506	15,554
Resources Recovery and Utilization	—	—	57,655	26,792
Marine Environmental Research				
Research and Studies in Direct Support of Coastal Zone Management	65,409	44,307	13,103	4,511
Ecosystems Research	75,064	40,893	77,092	25,605
Pollution Studies	84,422	52,837	59,843	37,154
Environmental Models	—	—	42,707	27,555
Marine Education and Training				
Other Education	28,100	33,674	24,121	35,818
Advisory Services				
Extension Agent Services	59,490	47,124	94,606	52,303
Other Advisory Services	110,558	86,808	101,630	87,935
Program Management and Development				
Program Administration	123,598	211,872	121,115	178,278
Total	**$670,448**	**$602,946**	**$720,000**	**$570,387**