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Texas A&M University Sea Grant College Program
1974-75



Annual Report

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Introduction

Wise use and conservation of the resources of the Gulf of Mexico and Texas coastal zone have long been a major concern of Texas A&M University, and in response to this commitment to the people of Texas, the University was named one of the nation's first four Sea Grant Colleges on September 17, 1971.

The designation followed three years of institutional support from the National Sea Grant Program, established by Congress in 1966 as part of the National Science Foundation. The Program is now part of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce.

Sea Grant-supported activities at Texas A&M began in 1968 with one of the first Sea Grant institutional grants in the nation. Today the Texas A&M University Sea Grant College Program is administered by the Center for Marine Resources, a University-wide unit established in the spring of 1971 to serve as a focal point for the institution's marine programs.

This special report reviews the activities and accomplishments of the Program during the year ending August 31, 1975, in which support was provided for more than 35 projects in six major program areas.

In 1974-75, Sea Grant projects were conducted in Texas A&M's Colleges of Agriculture, Business Administration, Engineering, Geosciences, Liberal Arts, Science and Veterinary Medicine, and in the Moody College of Marine Sciences and Maritime Resources, Texas Agricultural Extension Service, Office of Continuing Education and Industrial Economics Research Division. Also receiving Sea Grant support were activities at Baylor College of Medicine; Brazosport College; Lamar University; the Texas Education Agency Education Service Center, Region II; and the University of Houston.

Expenditures for the 1974-75 fiscal year are shown in the accompanying chart. Some 31 percent of the total was spent on advisory services; 21 percent for marine technology research and development; 18 percent on marine resources development; 13 percent for program management and development; more than 8 percent on marine environmental research; 4 percent for socio-economic and legal studies; and more than 3 percent for marine education and training.

Texas A&M University, both a Sea Grant and Land Grant College, is committed to identifying and serving the needs of

Texans, and this commitment is demonstrated in sharing of costs. Recipients of Sea Grant support must match their federal funds on a one for two basis. A portion of these matching funds has come from the Texas Legislature for the past six years, and appears as a special item in the University's budget.

Also, some state agencies plan their budgets in such a way that funds may be available to match Sea Grant work undertaken jointly; other colleges and universities, associations and private firms also provide support.

Accomplishing this kind of interaction calls for coordination with many other programs and the active involvement of many people in the planning and operational processes. Important among those involved in Sea Grant are the members of the Sea Grant Advisory Council for Texas, 15 persons from business, government agencies and educational institutions who share a common interest in marine affairs. The Advisory Council meets regularly with staff of the Center for Marine Resources to offer advice and direction to the Program.

It is this involvement by private citizens, industry, government and other educational institutions, among other things, that makes Sea Grant unique among university programs. ■

Sea Grant Program Expenditures 1974-75

Program Area	NOAA	Matching	Total
Marine Resources Dev.	257,099	135,115	392,214
Socio-Eco. & Legal Studies	56,872	32,000	88,872
Mar. Tech. Research & Dev.	323,201	132,242	455,443
Mar. Env. Research	125,319	57,284	182,603
Mar. Ed. & Training	46,376	31,823	78,199
Advisory Services	413,871	253,857	667,728
Prog. Manag. & Dev.	130,512	150,742	281,254
Totals	1,353,250	793,063	2,146,313



Fisheries/Mariculture

SHRIMP MARICULTURE SYSTEM

□ Work continued on the project to assist in the development of commercially feasible shrimp production operations designed to capitalize on the land resources of Texas.

Jack Parker, project leader and program manager for marine fisheries and mariculture research for the Sea Grant Program has been evaluating technology for pond production systems to raise shrimp from hatchery-produced postlarvae to bait and edible market size and to explore simplified hatchery techniques to reduce seed stock costs.

This year, two ponds in West Texas were stocked with 10,000 *Penaeus setiferus*. Growth was better than previously experienced for this species in coastal experiments, and after 100 days, the two ponds were harvested and yielded an average of 182 pounds per acre of shrimp measuring 38 count (heads on).

In addition, a program to raise more brood shrimp which would then produce the quantity of seed-stock needed for a commercial operation was begun. Personnel at the Brazoria County Facility, working with the Texas Agricultural Extension Service area marine fisheries specialist, county marine agents and local shrimpers used shrimp trawlers to collect female shrimp which had mated and were ready to spawn. These gravid females were transported to the National Marine Fisheries Service Hatchery at Galveston where they were spawned and the young reared to seed-stock size. This year more than one million seed shrimp were produced through this cooperative program.

Also, researchers attempted to determine the requirements for producing gravid female shrimp from stock reared entirely in captivity. While no eggs hatched, in at least two instances fertilized eggs were observed and such results represent a major breakthrough in shrimp reproduction, according to Parker.

□ A new research program in shrimp biology and mariculture concerned with the reproduction and nutrition of shrimp was begun this year by two University of Houston biologists.

Wallis H. Clark Jr., adjunct professor of biology, and Addison L. Lawrence, professor of biology, began their study of penaeid reproduction in an attempt to provide the information necessary to close the life cycle of penaeid shrimp in

captivity and to develop interspecies *in vitro* fertilization techniques.

This year, several objectives of the project have been met. Light and fine structural studies of spermatogenesis (male gamete formation) and a morphological study of egg activation have been completed. A thorough study of the vas deferens (vasectomy) is nearing completion. Endocrine studies of egg maturation have been started while physiological studies of egg activation and larval nutrition are in progress.

In addition, 13 papers were either published or presented at regional, national and international meetings. Such presentations promoted a significant interest in the work resulting in large numbers of requests for information from governmental agencies, private companies, research groups and libraries.

The work has also prompted joint research projects between the University of Houston, Texas A&M, Ralston Purina and the National Marine Fisheries Service.

AQUATIC ANIMAL HEALTH AND SEAFOOD QUALITY

A study of diseases of marine fish and shellfish was continued in an effort to develop countermeasures to infectious and non-infectious diseases of these fish.

□ Under the direction of project leader Don Lewis, associate professor of veterinary microbiology, the project is specifically concerned with expanding the diagnostic capabilities of the aquatic animal medicine program developed in the College of Veterinary Medicine at Texas A&M and with studying the specific diseases of marine fish and shrimp caused by halophilic *Vibrio Sp.*

During the 1974-75 year, epidemiologic and environmental factors contributing to fish and shrimp kills were identified and studied under controlled laboratory conditions. The tolerance, uptake and tissue response of fish and shrimp to chemotherapeutic measures were also evaluated. In an effort to rid fish and shellfish of disease, the influence of antibiotics on shrimp microflora was assessed.

Nine papers were published and nine presentations made of the research findings during the year in addition to

answering over 400 requests for reprints and information on the work.

□ The use of antibiotics on shrimp was also studied by *Addison Lawrence*, professor of biology at the University of Houston, who sought to determine the tolerance levels of commercial shrimp larvae and post-larvae to different concentrations of antibiotics and to determine the effect of different concentrations on the fungal and bacterial populations associated with the shrimp.

Because of the results Lawrence obtained this year, antibiotics will be available for the treatment of shrimp diseases in the laboratory, in commercial intensive culture and in pond rearing situations.

Specifically, Lawrence and his associates determined that the oxytetracycline-oleandomycin antibiotic combination can be used safely for the treatment of shrimp bacterial diseases. They also determined that the bacterial flora associated with shrimp was of nutritional importance. This finding suggests, says Lawrence, that indiscriminate use of antibiotics could be harmful to shrimp because of the nutritional importance of the bacteria.

The results of the year's work were transmitted to various groups including Ralston Purina, the Environmental Research Laboratory, Texas A&M and the Texas Parks and Wildlife Department through the presentation of two papers and personal communications.

□ Assuring the safety and wholesomeness of fish and shellfish taken for human consumption from the Gulf of Mexico and minimizing waste of fish and shellfish is the focus of a continuing project now in its seventh year, directed by *Carl Vanderzant*, professor of animal science at Texas A&M, and *Bryant F. Cobb III*, associate professor of animal science.

During the 1974-75 year, the emphasis was on writing and publishing previous results, and 12 papers were published or presented. Nearly 500 requests for information on the project from governmental agencies, research groups, extension agents, libraries and companies involved in fishing, fish processing, aquaculture and the manufacturing of equipment were answered by *Ranzell Nickelson*, Extension seafood specialist.

One such request was from a wholesale fish dealer, who reported that use of the results of the project saved nearly \$30,000 by reducing the level of spoilage of his product.

A seafood advisory panel also was established during the year to help guide in the selection of specific research problems. As a result, a joint research program with the National Marine Fisheries Service was instituted to develop products from underutilized species of fish.

FISHERIES ASSESSMENT

□ *Mark E. Chittenden* and *John D. McEachran*, both of the Wildlife and Fisheries Sciences Department, continued their project to determine quantitatively the fisheries potential of the Texas continental shelf.

During the year, compilation of previous research established that an enormous protein potential exists in the northern Gulf in the form of small fish with short life spans and high mortality rates. Fish with this life cycle typically can be harvested at high rates with little danger of over-fishing, according to Chittenden, who says that Texas-based trawlers alone discard about 483 million pounds of the small fish annually.

The second major activity undertaken in fisheries assessment was to initiate field work to discover the population characteristics of mackerel in the Western Gulf. To do this, eggs and larvae of the mackerel were collected on five cruises and a grid of 16 stations along four transects off Port Aransas and northern Padre Island was sampled each month. Eighty successful collections were made and preliminary results indicate that the western Gulf of Mexico is a major spawning site of the mackerel.

Six papers on the subject were published during the year and the results were communicated to commercial fishermen, researchers, libraries, Texas A&M University extension and research personnel and state and federal government agencies.

SEAFOOD MARKETING AND ECONOMIC SYSTEMS

□ A new project to identify market opportunities for selected seafood products produced from finfish species of the Western Gulf of Mexico and to establish the basic determinants of the demand for finfish was undertaken by two

Texas A&M researchers, *Samuel Gillespie*, associate professor of marketing, and *John P. Nichols*, associate professor of agricultural economics.

In three trips along the Texas coast, industry leaders were interviewed to determine the nature of finfish harvesting and marketing problems and to study the costs of utilizing incidental catch.

A consumer panel of 300 persons evaluated consumer acceptance of several species of finfish. Evaluations were conducted on black drum and sheepshead with flounder used as the control. According to Nichols, results indicate that consumers preferred black drum over flounder and sheepshead for texture, flavor and overall satisfaction.

Restuarant managers' attitudes and perceptions of seafood as a menu item were also investigated during the year. Over 450 respondents from members of the Texas Restaurant Association were contacted and results are being evaluated. Ten reports or presentations were given on the project during the year.

□ A two year project to build a cost and return data bank to be available to shrimp producers to help them make prudent investments and operating decisions was begun by *Wade Griffin*, assistant professor of agricultural economics.

The project is intended to provide current information concerning the economics of owning and operating a shrimp vessel and will be used by owners, managers, financial institutions, government agencies and public policy makers. The National Marine Fisheries Service, for instance, used the costs and returns information collected to advise the Small Business Administration on making loans to shrimp vessel owners.

The 1974-75 year was primarily devoted to contacting shrimp vessel and boat owners and encouraging them to participate in the costs and return study. In addition, a budget generator was developed to analyze monthly data and costs, and returns data was collected for 1974 and the first half of 1975. ■

Coastal Zone Studies

MARINE RESOURCES MANAGEMENT

□ *Charles P. Turco* of Lamar University, Beaumont, coordinated a study that identified the range of recreational activities which the Sabine Estuary could feasibly support.

The results of this investigation included a preliminary land-use map to identify conflicts between recreational and industrial activities, a survey of existing recreational facilities and a study of the recreational activities of Lake Sabine, such as swimming, boating and fishing.

Potential demand on the Sabine Estuary was determined by utilizing historic socio-economic data collected from those areas in Texas and Louisiana where users of the estuary are most likely to reside. Portions of the research will be used in a comprehensive water usage/quality control study for a three-county area in southeast Texas.

□ A preliminary model to describe the present transportation systems between selected geographic locations was developed through a project coordinated by *Christian Phillips*, Industrial Economics Research Division of Texas A&M. The model includes factors such as movement, cost and time en route of goods transported by rail, truck and water.

Preliminary findings of a cost matrix, constructed to include quantities of goods supplied and demanded by the various locations, show inefficient utilization of transportation vessels. This model may be used to improve allocations of transportation resources to insure more efficient cargo distribution, ultimately reducing movement cost, time en route and operating costs to the shipper.

ENVIRONMENTAL QUALITY

Poor water and sediment quality along the Gulf Intracoastal Waterway system in Texas are generally associated with fresh water inflows, according to a research project headed by *Wesley P. James*, Civil Engineering Department.

The Intracoastal Waterway itself is not a major source of pollution; however, the study indicates that the Waterway effectively transports pollutants from areas near Port Arthur to Galveston Bay.

James took an inventory of the existing physical, chemical and biological information on the Waterway and conducted field sampling programs for physical and chemical

water and sediment quality. High values of lead observed from sampling appeared to be associated with urban runoff.

An evaluation of present water and sediment quality of the Waterway and identification of environmental problem areas are in progress. One M.S. thesis, "An Evaluation of Water and Sediment Quality Along the Texas Gulf Intracoastal Waterway," by *R. S. Giesler* will be published during the final year of the project.

□ An extensive literature search and harbor studies in the Corpus Christi and Brownsville areas conducted by *Richard Withers*, Civil Engineering Department, provided significant data on the characteristics of ship channel water and sediment.

The literature search provided a basis for identifying, describing and classifying the sources of water pollution in the areas, and aided in the development of an assessment of the quality, quantity and frequency of discharge from these sources. Representatives from eight major Texas ports and the Texas Water Control Board were interviewed to obtain various views on the future management of the ship channel-harbor complex environment. A thesis, "The Environmental Management of a Ship Channel - Harbor Complex," related to the project, was written.

□ A research team headed by *Tom Reynolds*, Civil Engineering Department, has determined that the main sources of pollution in selected Texas canal communities are surface runoff from rainfall, septic tank seepage and resuspension of benthic sediments due to intense storm water discharge.

In an attempt to assess the environmental effects of canal communities on water quality, to evaluate the effects of hurricanes on bay waters and to develop engineering design criteria to maintain proper water quality, Reynolds divided the study into several research tasks.

The tasks included the selection of communities to be studied, identification of pollution sources, collection of existing pollution data, a pollution prediction hypothesis and determination of present water quality.

This project is being coordinated with work being done by *Joseph Melnick*, Virology Department of the Baylor College of Medicine in Houston, and the Galveston County Health District. A thesis, "Water Quality in Canal Communities," by *Ernest Hall*, was written during the first year of the project.

□ A report on the history of ocean dumping in the Gulf of Mexico is one result of a Sea Grant project headed by *Roy Hann Jr.*, Civil Engineering Department. From major journals and the National Technical Information Service, Hann's group collected information concerning all aspects of ocean disposal.

This project has resulted in two reports and one masters thesis, and the findings also have been used by the Steering Committee of the National Academy of Science Panel on Ocean Dumping to help develop a report for the Environmental Protection Agency.

□ *Joseph L. Melnick*, Baylor College of Medicine, developed an improved virus concentrator to detect and measure viruses in the waters of coastal communities for the presence of human pathogenic viruses. The new concentrator is capable of processing over 400 gallons of highly turbid estuarine water, significantly reducing the time necessary for operating conventional virus monitoring equipment.

In collaboration with *Reynolds* at Texas A&M, Melnick used field units of the modified virus concentrator to isolate viruses from several canal communities along the Texas coast.

The development of the new virus monitoring device will provide public health agencies with a practical method for detecting health hazards in coastal waters, and could become a factor in the consideration of new standards for water quality.

SHORELINE PROCESSES AND MARINE TECHNOLOGY

□ Proper depth for pipeline burial in the surf zone, the area where the sea swells as waves break on the shore, was investigated by a group of researchers headed by *John B. Herbich*, Ocean Engineering Division of the Civil Engineering Department.

The researchers designed a laboratory model of a beach profile in a two-foot wide tank to assess the required depth of pipeline burial in the surf zone. Pipeline failures are believed to be caused by the scour effect as sand is removed from the areas beneath the pipe, leaving it unsupported.

Using the two-dimensional approach to the problem, they recorded a number of wave conditions and slopes, and the laboratory profiles were compared with Gulf coast beach profiles recorded by the Galveston U.S. Army Corps of Engineers. Preliminary results of the study indicate that a minimum burial depth equal to one diameter of the pipe is sufficient to prevent the pipe in an unsupported position from breaking under its own weight.

As part of the same project, *Richard Dominguez*, Ocean Engineering Division, headed a research team that investigated methods for determining the most efficient placement of offshore pipelines in deeper water.

Offshore pipelines, laid at the bottom of the ocean for conveying gasses and liquids, are exposed to ocean currents and potentially destructive waves that accompany storms. Factors such as depth of pipeline burial and sediment movement at burial sites were examined. The team worked on the extension of a numerical computer simulation model, developed to evaluate the dynamic pressure distribution on an offshore pipeline buried in marine sediment and subjected to ocean wave effects.

A study of the interaction of a two-dimensional pipe-soil-wave system using numerical models based on the finite element and the finite difference techniques was completed. The results of this research lead to another study, done at the request of the U.S. Geological Survey, Construction Division, involving self-burial of pipes.

□ The mechanisms of sediment transport by wind and water in Padre Island National Seashore and Laguna Madre, South Texas, have been defined, determined and qualified by *C. C. Mathewson*, Geology Department. Mathewson measured seasonal changes and rates of landward sediment transport, determined historical changes of the dune complex and related meteorological data to the observed changes.

Field studies at Padre Island in January and May 1975 included surveys of minute variations in an active dune complex and detectable changes in selected dredged material islands. Field expeditions to Padre Island allowed for the collection of meteorological data that was later applied to the indirect determination of sand transport rates. The second part of the project was conducted in the laboratory, where the samples gathered at Padre Island were analyzed for grain size distribution.

Detailed maps were prepared from the field survey data to show seasonal changes and other variations in dunes affected by wind. The maps also provided an accurate description of the topography of the islands. Aerial photographs of the active dune and the dredged material islands were interpreted to determine their sources, extent of development, migration rates and direction of migration.

This project resulted in a graduate field geology course in which students carried out independent coastal zone projects.

□ *Wesley P. James*, Civil Engineering Department, headed a team investigating the physical factors affecting shoaling, the process by which a water channel becomes filled with sediment. Shoaling, induced by wind, rain, current and wave transport of sediment to a channel, causes the channel to become shallower and dangerous for navigation. Barges are forced to carry lighter loads in order to pass through the channels.

The investigators designed composite factor maps of the Texas Gulf Intracoastal Waterway, extending from Port Arthur to Brownsville, which show computed shoaling rates and selected environmental features. Average shoaling rates in 5,000-foot reaches along the Texas Gulf Intracoastal Waterway were computed from maintenance dredging records kept by the U.S. Army Corps of Engineers.

Relevant environmental data from published and unpublished sources were assigned to each reach, and similar reaches were grouped and examined to determine the effect of the environment on shoaling rates. From the information, a model was developed to predict shoaling rates in a reach with known environmental factors.

It was found that the physical factors most significantly affecting shoaling rates are land cut areas of the channel, river crossings, dredged material mounds in bay areas, wind fetch and windward placement of dredged material mounds.

□ *Wayne Ahr*, Geology Department, conducted a study of waves, winds, tides, hurricanes, bathymetry (configuration of the sea bed) and rates of shoreline erosion or deposition on the upper Texas coast.

Maps of actual shoreline change were compared with grouped data on natural processes to determine which pro-

cesses caused most of the shoreline change. Data obtained from the study were processed so that statistical tests could be used to determine whether the process summaries indicate reasons for shoreline change.

The results of this study (now in manuscript) will be useful in predicting shoreline change in any case where enough facts are known about the natural elements in the area. The U.S. Army Coastal Engineering Research Center Laboratory in Virginia requested the results of the processing of wave records, which had not been available for the upper Texas coast prior to this investigation. Because of coastal instability and recurring need for highway repair near High Island, the Texas Highway Department also became interested in the findings of the project.

The Bureau of Economic Geology at the University of Texas has developed a cooperative relationship with A&M because of similar work in shoreline processes being conducted by the Bureau. The results of the A&M and BEG studies are particularly useful in the growing coastal management program in Texas. ■

Man In The Sea

□ Project leader *William P. Fife*, chief scientist of Texas A&M's Hyperbaric Laboratory, focused his research on three main areas: exposing rats, pigs and dogs to compressed air at simulated depths ranging from 45 to 90 feet of sea water; exposing 45 aquanauts to compressed air in an underwater habitat for 10 days at 50 feet; seeking a simple and reliable way to assess the degree of oxygen toxicity on a diver under field or operational conditions.

Tests with rats, pigs and dogs showed that lungs of pigs and dogs respond to oxygen toxicity similarly to man's. Further, they showed that contrary to previously published reports, man can tolerate oxygen levels above one-half atmosphere (380 mmHg partial pressure) without serious difficulty. Fife's research determined that dogs and pigs could live for extended periods of time on compressed air at least 60 feet deep, but that they would suffer significant pulmonary damage if exposed to compressed air at 90 feet for extended periods (four to seven days).

Based on these observations, man was exposed to a depth of 50 feet for 7 days. Although there was a minor deterioration in pulmonary function during the first 24 hours of exposure, the lungs began to recover and within four days were essentially functioning normally. This work was then followed by another series of studies on aquanauts living at 60 feet breathing compressed air. The lungs again showed a return to essentially normal function within 48 to 72 hours. As a result of these findings, the U.S. Navy felt it was safe to initiate a 30-day saturation dive on compressed air using five divers.

Fife's attempt to correlate oxygen toxicity with the level of blood acetylcholine esterase was inconclusive. Improved assay techniques were indicated, calling for further study. Work related to this project did determine that aquanauts living on compressed air at 50 feet developed a tolerance to nitrogen narcosis and, therefore, could dive to a depth of 250 feet without symptoms of narcosis, whereas, before they would develop narcosis at about 150 feet and were limited to an effective working depth of no more than 200 feet. This finding enabled submersible lock-out dives to be carried out at 250 feet for scientific purposes, thus extending the range of marine scientific observations.

Also, this research made it possible for Fife and his project team to begin studying compressed air saturation diving

at 70 feet. If this depth also is safe, it will open thousands of square miles of ocean bottom to investigation by the more economical compressed air diving. ■



Education and Training

Improving the quality and increasing the scope of education and training of future ocean scientists, technicians, vessel operators and others seeking marine-related careers are significant functions of the Texas A&M University Sea Grant College Program.

During the 1974-75 year, Sea Grant-supported education activities were carried out in veterinary medicine, philosophy, engineering and wildlife and fisheries sciences, as well as in oceanic and marine technology.

Education and training projects include efforts to improve the curriculum in fisheries and aquaculture programs, to establish a University Marine Fellowship Program, to aid in the development and presentation of courses pertaining to aquatic animal health, to assist in the development of undergraduate and graduate ocean engineering programs, to support special programs in oceanic and marine technology and to conduct a series of graduate seminars in coastal zone management, and to survey the humanistic aspects of man's relationship with the sea.

□ The first University Marine Fellows, supported by the Texas A&M Sea Grant College Program, were named during the 1974-75 year. The University Fellowship Program was initiated in January 1974 by *John C. Calhoun Jr.*, vice president for academic affairs, to focus University-wide attention and resources on fields of broad interest, such as health, energy and the environment. The Program is administered through the office of the graduate dean.

Coordinator of the University Marine Fellowship Program is *Donald H. Lewis* of the Department of Veterinary Microbiology, College of Veterinary Medicine. The fellows and their major professors meet once a month to conduct seminars, panel discussions and workshops in an interdisciplinary approach to the consideration of the marine environment.

□ The Oceanic and Marine Technology Program of Brazosport College, Lake Jackson, Texas, headed by *E. D. Middleton Jr.*, offers a two-year Associate of Applied Science degree in marine technology. The program was begun five years ago with support from Texas A&M Sea Grant.

During 1974-75, the Program included training in lifeboat operations; firefighting, using actual fires, foglines and dry chemicals; and long-range navigation (LORAN), and RADAR

observation. LORAN and RADAR training and certification were provided by the U.S. Maritime Administration.

Plans for future courses in marine communication, seismic crew operations and marine architecture are being considered, as well as cooperative programs with other colleges, equipment procurement and augmentation of diesel engine training.

Eleven graduates of the two-year program have become masters and captains of various vessels, with many other graduates and former students assigned to seismic, oceanographic and fisheries vessels, tug boats, tow boats and barges around the world. Others have been employed by a marine machinery service industry, an ocean drilling rig and a drilling ship.

□ *Richard L. Noble*, Texas A&M Department of Wildlife and Fisheries Sciences, headed a project designed to improve the curriculum in fisheries and aquaculture at Texas A&M.

The intent of this Sea Grant project is to improve the quality of existing courses and to increase the number of fisheries/aquaculture courses offered by the Department, rather than to increase the number of graduates with degrees in fisheries sciences.

Project personnel, who included Noble and *John McEachran* and *Mark Chittenden*, also of the Department of Wildlife and Fisheries Sciences, reviewed and revised the curriculum at both the main campus and at Texas A&M's Moody College of Marine Sciences and Maritime Resources in Galveston. They were instrumental in strengthening the teaching staffs with additional qualified marine fisheries personnel and in creating four new courses during the project period.

Two graduate courses were taught at the College Station campus — "Marine Ichthyology," which deals with taxonomy, classification, evolution and distribution of fish in estuarine and near-shore regions; and "Special Topics in Fish Population Analysis," which examines and demonstrates techniques utilized in describing and evaluating the theoretical relationships covered in basic population dynamics courses.

Undergraduate courses, "Marine Ichthyology" and "Fisheries Population Dynamics" were developed during the year, and taught at both the College Station and Galveston campuses.

Results of this work indicate that fisheries graduates, as well as graduates in related disciplines, are entering careers and graduate studies equipped with a broader knowledge of fisheries and specific topics related to aquatic life.

□ Integrating research and training activities is one formula used by *D. H. Lewis*, Department of Veterinary Microbiology, who heads a project to develop and present courses related to the health of aquatic animals.

An effort to provide research data, experience and other information necessary to fisheries management and disease control agencies, this project provides research problem courses, taken by graduate level, second and third year veterinary medicine students. These areas of study include oral immunization of fish, tissue response of fish and diagnostic microbiology of fish pathogens.

Materials, including microscopic slides for studying the histology of mullet, catfish and white shrimp, a culture collection of major fish pathogens and recorded lectures and slides on principal protozoan parasites of fish, were developed during the project period for use in autotutorial mode and to supplement lecture-laboratory presentations.

Additional formal courses in fish diseases and aquatic animal health — “Aquatic Animal Microbiology,” “Marine Mammal Surgery,” and two courses in the study of specific diseases in fish were designed during the 1974-75 year.

□ *John B. Herbich*, Texas A&M Civil Engineering Department, and *Ernest L. Kistler*, Department of Marine Sciences, Moody College, are co-leaders of a Sea Grant project to develop undergraduate and graduate academic programs in ocean engineering.

To meet the high demands by industry and government for graduates trained in ocean engineering, an undergraduate degree program in maritime systems engineering was begun at Moody College in the fall of 1973. Enrollment records for this program have shown significant growth since the initiation. On September 1, 1974, approximately 59 students were enrolled, while on the same date one year later, the program included 180 students.

Graduate programs leading to a master of engineering and a PhD in ocean engineering were approved in January

1975; but, graduate courses in coastal and ocean engineering have been offered at the Galveston campus since the fall of 1972.

Courses developed during 1974-75 include “Science of Fluids,” designed to acquaint marine science students with concepts in fluid mechanics; and “Experimental Techniques in the Dynamics of Marine Vehicles,” in which students construct scale models of modern semi-submersible drilling vessels while learning procedures for wave-tank model testing. Other courses developed during the project period were “Dynamics of Waves and Structures,” “Basic Coastal Engineering” and “Measurements in the Ocean.”

A new computer program developed during this period has captured the interest of Avondale Shipyards, Scandrift Offshore Systems and the naval architecture firm of Allen McClure and Associates.

□ An institutional seminar series in coastal zone management was developed by a group of Sea Grant researchers headed by *Clinton Phillips*, Department of Finance.

The series was part of a course dealing with many aspects of coastal zone resources — their uses, conflicts resulting from their uses and techniques for their management — taught by *John Seymour*, Department of Management.

During the fall semester of 1974, the 32 students enrolled in the seminar series were involved in discussions with several experts in the area of coastal zone management, including *Athelstan Spilhaus*, known as the father of the Sea Grant Program and now a special assistant to the director of the National Oceanic and Atmospheric Administration (NOAA); *Ron Jones*, director of the Texas General Land Office's Coastal Zone Management Program; *Dick Gardener*, Office of Coastal Zone Management, NOAA; *Joe Moseley*, executive director of the Texas Coastal and Marine Council; and *Gen. James U. Cross*, Texas Offshore Terminal Commission.

The class also heard presentations by a U.S. Congressman, a University of Delaware economist and marine scientist, and several Texas A&M faculty members in related fields.

Representatives from Houston Power and Light Company, Port of Houston, the Maritime Administration and

Padre Island Investment Corporation were invited to discuss the impacts of their organizations on management of coastal areas.

A conference, "Recreational Land Use and Coastal Zone Development: Issues and Perspectives in Texas," was held during the 1974-75 project period, co-sponsored by the Departments of Management and Recreation and Parks.

□ Humanities of the Sea, a new and unique Sea Grant project coordinated by *James R. Bradley*, director of the Office of Continuing Education, provided the setting for a probe into man's relationship with the sea and its influence on and contribution to man's humanistic and social development.

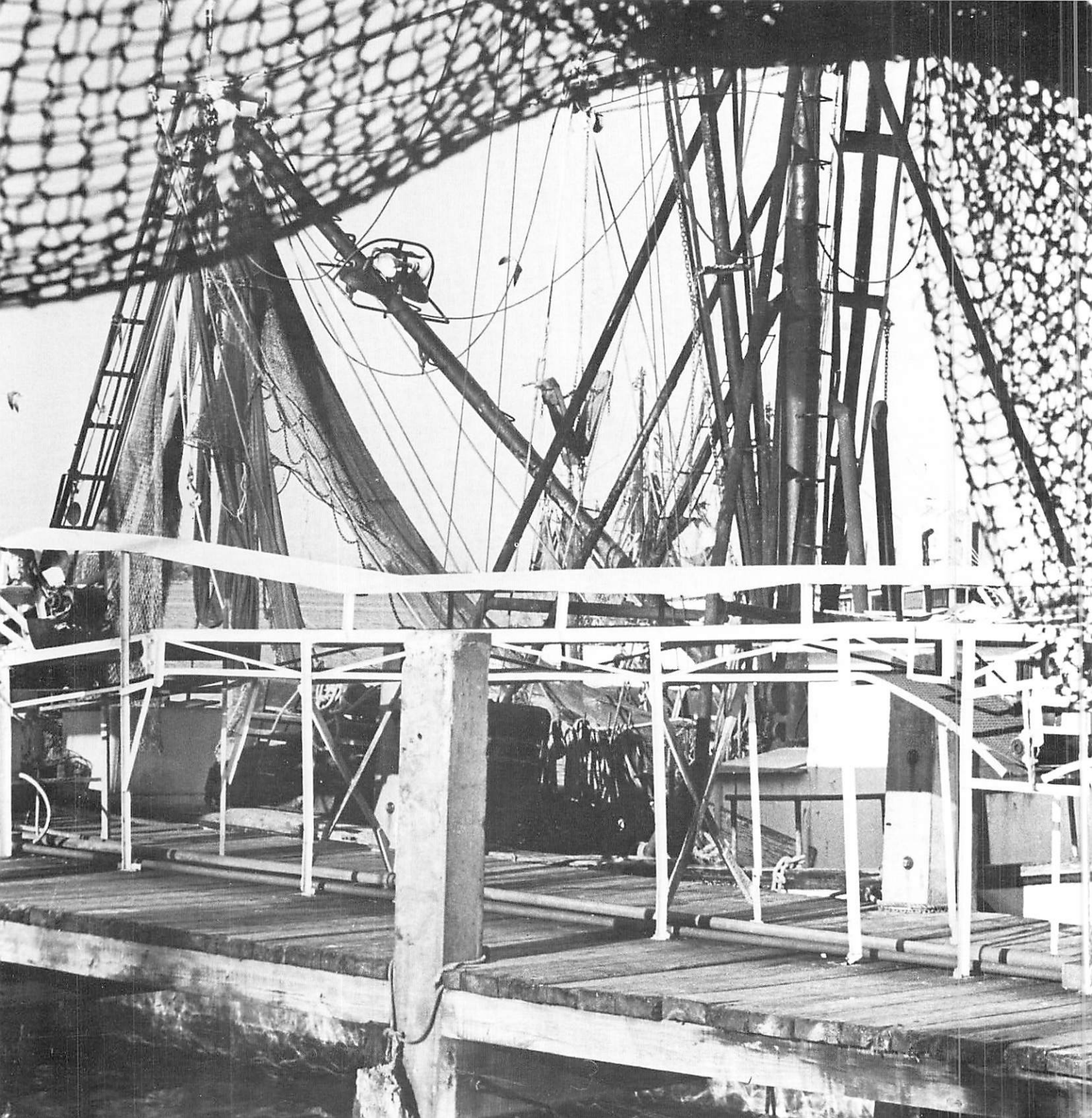
Philosophy and oceanography came together through lectures and a seminar in 1975, coordinated by *Larry A. Hickman*, Department of Philosophy.

Two nationally known authorities in humanities, *John Lilly*, M.D., founder of the Communication Research Institute for the bio-medical study of communication between man and dolphins, and *Ervin Laszlo*, professor of philosophy at the State University of New York and an expert in systems philosophy and communications theory, presented lectures that provided pertinent information on interspecies communication and relationships.

Lilly's presentation to an audience of about 550 included a lecture, "The Science of Our Beliefs About Dolphins," and a one-day seminar, "Problems of Scientific Assumptions in Biological Research with Large-Brained Mammals."

"Bi-Perspectivism — Notes on the Ontology and Ethics of Interspecies Relationship," was the title of a talk presented to about 500 listeners by *Laszlo*.

Traditional boundaries of communication that separate man from other species, particularly those of the sea, were examined in an attempt to explore the scientific and philosophical implications of interspecies relationships. ■



Marine Fisheries and General Extension

□ Advisory services were provided to Texas marine resource users through the cooperative efforts of Texas A&M's Sea Grant College Program and the Texas Agricultural Extension Service. The advisory program's six county Extension marine agents maintained contact with commercial and sport fishermen, seafood processors, businessmen, consumers and other adults and youths who utilize the natural resources of the sea.

With the appointment of *Ralph Rayburn* to San Patricio-Aransas counties, the program had personnel on-the-scene in seven key coastal Texas counties. Rayburn joined marine agents *Bruce Cox*, Cameron County; *Charles Moss*, Brazoria County; *Carl Rasor*, Matagorda County; *Melvin Russell*, Galveston County; and *Joe Surovik*, Calhoun County.

The fisheries advisory program, under the direction of *Wallace G. Klusmann*, Extension Service, added a second marine fisheries specialist, *Russell Miget*, in Corpus Christi. Miget, *Gary Graham*, marine fisheries specialist in Angleton, and *Ranzell Nickleson*, seafood technology specialist in College Station, along with on-call assistance from engineers, economics and management specialists, provide technical expertise to support the county marine agents in their work, which involved contacting more than 15,000 people in response to specific requests for assistance during the 1974-75 year.

Working with county Sea Grant/Extension Service advisory committees, agents and specialists reached the marine resource user through individual contacts, workshops, demonstrations, short courses and talks to civic, school, trade and professional groups. Their efforts resulted in (1) 4,235 adults participating in 109 educational meetings; (2) 1,324 young people working in marine affairs projects; (3) six issues of the *Texas Trawler* newsletter being published and distributed to more than 2,500 readers; (4) 37 radio and television programs being aired on local stations; (5) 52 news articles appearing in local and regional newspapers; and (6) publications being distributed to all states and 36 foreign countries upon request.

The scope of advisory activities was widespread, covering such areas as consumer education (seafood buying, handling, preserving and cooking); seafood marketing; fishing efficiency (using twin, fish, crab trawls and other fishing

gear); marine affairs education for youths (4-H and elementary, secondary and vocational schools); sport fishing (techniques, facilities, safety and resource conservation); business management (labor relations, insurance, taxation, finance, records, health, safety and marine law); medical and hospital assistance for commercial seamen; new product development (chitosan, dried shrimp wastes and mechanically separated crab meat products).

In order to expand the production and variety of fishery products in Texas, advisory personnel developed result, or method, demonstrations in such areas as smoking fish, processing Texas-harvested tuna and utilizing small non-marketable fish caught incidentally in shrimp trawls in minced fish products such as fish sticks and fish cakes. The Seafood Quality Control Advisory Laboratory at Texas A&M, under the direction of *Ranzell Nickelson*, continued to work closely with Texas seafood processors during the year.

Services included bacteriological analysis, proximate analysis, educational programs for laboratory and processing personnel, interpretation of results and implementation of needed actions. The Laboratory assisted at least 12 seafood processors; and, in addition, helped the National Shrimp Breeders and Processors Association, Brownsville-Port Isabel Shrimp Producers Association and Texas Shrimp Association in developing industry guidelines for packing shrimp.

Another advisory service involved designing and field testing a float-weight rig to replace a skid rig for twin trawling. Initial results showed the weight-float rig was easier to handle, fished cleaner and was easier to pull.

In the area of shrimp disease, diagnostic assistance and control recommendations were given to five university projects, one state agency project, one in-state commercial project, two out-of-state commercial projects and three foreign projects. More than 200 samples were received in the Laboratory for monitoring of disease presence.

Twelve seafood selection and preparation demonstrations attended by 443 persons were conducted in Brazoria County by agent Moss to show the nutritious benefits of fish to a family's diet, stressing the importance of selecting and preparing the product. Eighteen attending the demonstrations were home economics teachers from county public schools, and, as a result of their participation, five

additional demonstrations were held in adult education classes and public schools.

Success of such advisory service demonstrations led to the staging of 13 seafood workshops for 275 county Extension home economists across Texas in 1976. Grants from the National Marine Fisheries Service and the Shrimp Association of the Americas covered the expenses of county Extension home economics agents throughout the state to participate in the workshops. In addition, the annual seafood merchandising workshop was held in Dallas, attracting 36 retailers. Assistance was also supplied in determining the need for and feasibility of a retail seafood market in the Freeport area.

Advisory personnel over the 1974-75 year wrote assorted journal articles, conference papers and advisory publications, including *Handbook of Shrimp Diseases*, by S. K. Johnson; *Sport Shrimp Trawling and Bottom Fishing Obstructions: Texas/Louisiana Gulf*, by Gary Graham; and *Now That You've Caught That Fish . . .*, by Ranzell Nickelson and Don Steinbach. ■

ON THE SCENE ON THE TEXAS COAST County Extension Marine Agents

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San Patricio Counties
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Marine Commerce Advisory Services

Advisory services were provided to marine businesses and industries through the joint efforts of Texas A&M Sea Grant and the University's Industrial Economics Research Division (IERD).

□ IERD's Houston-based office focused on disseminating information to marine-oriented business firms through topical seminars. Not only did increasing numbers of Texas/Louisiana industry representatives attend these meetings, but out-of-state conferees from East and West Coast states and foreign countries also participated.

Four of the five seminars conducted during the 1974-75 year were co-sponsored by the Marine Services Association of Texas (MSAT), and the other was co-sponsored by the American Marketing Association. Meetings covered topics such as marine industry shortages, offshore industry marketing, U.S. Coast Guard/ABS requirements, marine-offshore industry procurement and business outlook. Total attendance at the five meetings was 747.

Advisory specialist *Dewayne Hollin* also helped establish a new trade group, the International Transportation Management Association (ITMA), which is made up of representatives of the international shipping/receiving industry. IERD co-sponsored the Association's International Ocean/Air Documentation Seminar.

MSAT, formed in the 1973-74 year with Sea Grant assistance, grew to over 150 members and began publishing a quarterly newsletter in 1974-75. The organization also published the second edition of its *Marine Products and Services Directory*.

Additional organizational support by the Sea Grant marine commerce advisory group aided in the creation of an oil and gas section of the Houston Chapter of the American Marketing Association.

□ A key development in advisory services for the marine recreation industry was the assistance provided to the Marina Association of Texas in the formation of the Marina Association of America. Marina owners and operators from Texas, Illinois, Missouri, North Carolina, New Mexico and Oklahoma attended a January, 1975, meeting, where the

national association's constitution and by-laws were adopted and officers elected.

Marine recreational specialist *Kathryn Delaune* worked closely with marina owners and operators throughout the state and met with various agencies and organizations related to the marina industry. Two marine recreational seminars were conducted in 1974-75 on current and future trends of operating water-related complexes, and innovations in legislation, insurance, leisure and labor for the water-related recreational entrepreneur.

Delaune met with various individuals and state agencies in an effort to stay abreast of new developments in the area of boating safety, and attended a boating safety conference conducted by the U.S. Coast Guard and National Sea Grant Office. In addition, the project year included special visits by request to several Texas marinas to assist with operational problems.

□ An analysis of the role of the Gulf Intracoastal Waterway in Texas, involving six Texas A&M Sea Grant researchers from varying disciplines, was directed by *John Miloy*, Industrial Economics Research Division. The prime motivation for the study was problems encountered by the U.S. Corps of Engineers in maintenance dredging of the waterway and the need to acquire land for disposal of dredged material.

The six studies concerned: (1) environmental implications of maintenance and improvement of the Waterway, (2) engineering aspects of its operations and maintenance, (3) sociological characteristics of the Waterway in Texas, (4) the Waterway's economic impact in the state, (5) an evaluation of funding alternatives for state sponsorship and (6) legal aspects relating to the Waterway.

The projects were developed during the 1974-75 year through monthly workshop meetings sponsored by Texas A&M Sea Grant, the Texas Ports Association, Texas Coastal and Marine Council and also attended by U.S. Corps of Engineers representations. Additionally, separate conferences were held with legal representatives of Texas ports and state agency delegates in Austin.

Because of the scope of the project and high level of interaction between Sea Grant researchers, federal and state agencies, regional groups, and many interested individuals,

an important result of the study was an increased appreciation and awareness of the economic importance of the Waterway to the state.

An estimate of the cost (\$5.4 million) and the number of acres (30,382) required to accommodate materials disposal from maintenance of the Waterway was developed. The researchers found that if the State of Texas were to provide financial support to assist the Corps of Engineers in maintaining and improving the Waterway, an estimate of the cost for state sponsorship was mandatory.

Although the state sponsorship cost of \$5.4 million to purchase land for dredged material disposal appears substantial, research showing that the Waterway produces direct economic benefits of \$1.8 million annually makes the state sponsorship cost a relative bargain, they found.

An appreciation of these facts produced the major results of the project — acting on Senate Bill 472, the 64th Texas Legislature approved the Texas Coastal Waterway Act of 1975, signed into law by Governor *Dolph Briscoe*. The Act commits the State, through the Department of Highways and Public Transportation, to active sponsorship (including financial support) for maintenance, preservation, enhancement and future improvements of the Gulf Intracoastal Waterway in Texas.

Also resulting from the study were two reports published by the Texas A&M Sea Grant College Program: *Analysis of the Role of the Gulf Intracoastal Waterway in Texas* (TAMU-SG-75-202) and *Summary Report: Analysis of the Role of the Gulf Intracoastal Waterway in Texas* (TAMU-SG-75-203). ■

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Coastal Zone Problems Education

□ Directed toward school administrators, teachers and students, the coastal zone problems education advisory project provides direct assistance through marine education packets, books, slide sets and filmstrips. During the 1974-75 year, 370 educators and 1,676 students, elementary and secondary level (and some college level) were contacted.

Project leader *Thomas Tope Jr.*, Texas Education Agency Education Service Center, Region II, Corpus Christi, previewed, developed, organized and disseminated marine education and environmental education materials gathered from more than 100 sources. In addition to other marine-related educational materials, 25 new marine education packets were prepared for teachers to use as background information, as the basis for teaching units and for classroom display, bringing the total number of packets available to 33.

More than 300 persons attended "Sea Day South," a marine careers seminar for high school students, held in April 1975 in Corpus Christi, with Sea Grant support.

Tope and *Gordon Garwood*, marine education consultant at the Region II Center, participated in or arranged 24 classroom demonstrations, field trips and teacher-training activities. In addition, new marine education programs were implemented in seven school districts, with their assistance. Articles listing available marine-related educational media were published regularly in the Region II newsletter.

On-call assistance in marine education, conservation and environmental education was given in helping the Texas State Teachers Association science teachers arrange a field trip and in assisting the Welder Wildlife Foundation in organizing its summer teacher conservation workshop. ■



Department of Marine Resources Information

To help all who are involved in the Texas A&M University Sea Grant College Program in the important task of communicating useful marine-related information to those who need it and will use it is the role of the Department of Marine Resources Information. A team of professional writers, editors and artists assist in the preparation of technical reports, advisory bulletins, news and feature articles for mass media, and provide a variety of other information services, including art and graphics support, photography, library support and assistance with conferences, seminars and special programs.

Regular publications of the Department include *The University and the Sea*, a bi-monthly magazine containing news and features about Sea Grant activities and other marine-related programs of the University. It is written for a lay audience and is distributed to 6,000 persons.

The *Texas Trawler* is a popular newsletter which is issued bi-monthly to more than 3,500 fishermen, seafood processors, researchers, consumers and others concerned with the state's commercial fishing industry.

Sea Grant 70s, a 12-page review of Sea Grant activities across the nation, is distributed monthly to more than 12,000 persons. This magazine is prepared and distributed by the Department under a separate grant from the Office of Sea Grant, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

A clipsheet, *Coastscripts*, is prepared every two weeks and distributed to Sea Grant personnel and others to keep them informed about items on marine-related topics carried by the state's coastal newspapers.

Two films about the Texas A&M Sea Grant College Program are available on a free loan basis from the Department. They are *Seascape and Sea Doc*, both 16-mm, color, sound, 14 minutes.

Publications of special interest produced during the 1974-75 year include *Handbook of Shrimp Diseases*, by S. K. Johnson, a 20-page booklet which describes and illustrates in color the common parasites of commercial penaeid shrimp.

Hurricanes on the Texas Coast, a three-volume series of booklets designed to help coastal area residents understand, prepare for and recover from the effects of hurricanes, was written by Walter K. Henry, Dennis M. Driscoll and J. Patrick

McCormack of the Center for Applied Geosciences, and prepared and distributed by the Department. The series was very popular and has subsequently been reprinted in one volume.

Another publication of special interest published by the Department during the project year is *Proceedings of an International Conference on Artificial Reefs*, a compilation of the papers presented at a March, 1974 conference, the first ever devoted entirely to the subject of artificial reefs, held in Houston.

The Department maintains an in-house offset printing press and mailing lists of more than 20,000 names in 12 categories. It also is responsible for a small library of Sea Grant publications and other marine-related documents and periodicals for ready access by project personnel, students and others.

Photographic, audiovisual and graphic arts services are available to support routine activities and for special assistance to researchers and advisory services personnel.

During the 1974-75 year, assistance was provided to advisory services personnel and others in conducting and publicizing several seminars, workshops and meetings, and to the Center for Applied Geosciences with its annual Tropical Storm Seminar held in May, 1975 in Galveston.

Development and support of the nation-wide Sea Grant Program is a major interest of Texas A&M, and is fostered by activities of the Department of Marine Resources Information. In 1975, this commitment included preparation and staffing of an exhibit on behalf of the Texas A&M Sea Grant College Program, the Sea Grant Association and the National Sea Grant Program at the Offshore Technology Conference in May in Houston. ■

Off The Press

ADVISORY SERVICES

- DORAN, EDWIN, JR. and BERNARD P. BROWN. *A Recreational Guide to the Central Texas Coast*. TAMU-SG-75-606. \$2.
- HENRY, WALTER K., DENNIS M. DRISCOLL and J. PATRICK McCORMACK. *Hurricanes on the Texas Coast, Vol. 1*. TAMU-SG-75-501. Not available. See 75-504.
- HENRY, WALTER K., DENNIS M. DRISCOLL and J. PATRICK McCORMACK. *Hurricanes on the Texas Coast, Vol. 2*. TAMU-SG-75-502. Not available. See 75-504.
- HENRY, WALTER K., DENNIS M. DRISCOLL and J. PATRICK McCORMACK. *Hurricanes on the Texas Coast, Vol. 3*. TAMU-SG-75-503. Not available. See 75-504.
- HENRY, WALTER K., DENNIS M. DRISCOLL and J. PATRICK McCORMACK. *Hurricanes on the Texas Coast*. TAMU-SG-75-504. No charge.

COASTAL STUDIES

- BENSON, CLARK ALAN, ROY W. HANN, JR. and TOM W. REYNOLDS. *Analytical Models for the Evaluation of Supplemental Aeration in Texas Estuaries*. TAMU-SG-75-213. \$3.
- DECASTONGRENE, RUSSELL O. and RICHARD F. DOMINGUEZ. *An Investigation into the Properties and Characteristics of Homogeneous Tapered Cables*. TAMU-SG-75-211. \$3.
- ETTER, PAUL C. and JOHN D. COCHRANE. *A Summary of Water Temperature on the Texas/Louisiana Shelf*. TAMU-SG-75-604. No charge.
- JENSEN, PAUL and ROY W. HANN, JR. *The Interrelationship of Material Toxicity, Stream Properties and Quantity of Spilled Materials in Assessing the Risk of Hazardous Material Spills*. TAMU-SG-75-212. \$5.
- LAI, N. W., R. F. DOMINGUEZ and W. A. DUNLAP. *Numerical Solutions for Determining Wave-Induced Pressure Distributions around Buried Pipelines*. TAMU-SG-75-205. \$3.
- MALE, ROBERT and DAVID R. BASCO. *A Dispersion Curve Study of Model Dredge Spoil Basins*. TAMU-SG-75-201. \$3.
- MILLOY, JOHN. *Analysis of the Role of the Gulf Intracoastal Waterway in Texas*. TAMU-SG-75-202. \$3.
- MILLOY, JOHN, et al. *Summary Report: Analysis of the Role of the Gulf Intracoastal Waterway in Texas*. TAMU-SG-75-203. No charge.
- SEA GRANT PROGRAM. *Sea Grant Publications for the Offshore Industry*. TAMU-SG-75-605. No charge.
- SEALEY, JAMES E., JR. and WAYNE M. AHR. *Quantitative Analysis of Shoreline Change, Sargent, Texas*. TAMU-SG-75-209. \$3.

- VERSOWSKY, PAUL E. and JOHN B. HERBICH. *Wave Forces on Models of Submerged Offshore Structures*. TAMU-SG-75-215. \$3.

EDUCATION AND TRAINING

- HAMMER, RICHARD. *Systematics Collection Reprint*. TAMU-SG-75-101. No charge.
- SCHULTZ, CHARLES R. *Bibliography of Maritime and Naval History, Periodical Articles Published 1972-1973*. TAMU-SG-75-601. \$3.

FISHERIES

- GILLESPIE, SAMUEL M. and MICHAEL J. HOUSTON. *An Analysis of Seafood Consumption Patterns and Product Perceptions in Texas*. TAMU-SG-75-216. \$2.
- JOHNSON, S. K. *Handbook of Shrimp Diseases*. TAMU-SG-75-603. No charge for single copies; 2-10 copies, \$2 each; over 10, write for price.
- JONES, LONNIE L., JOHN W. ADAMS, WADE L. GRIFFIN and JEFFREY ALLEN. *Impact of Commercial Shrimp Landings on the Economy of Texas and Coastal Regions*. TAMU-SG-75-204. No charge.

MARICULTURE

- GILMORE, GILL H., SAMMY M. RAY and DAVID V. ALDRICH. *Growth and Mortality of Two Groups of Oysters (Crassostrea Virginica Gmelin), Maintained in Cooling Water at an Estuarine Electric Power Generating Station*. TAMU-SG-75-207. \$3.
- KEISER, RICHARD K., JR. and DAVID V. ALDRICH. *Salinity Preference of Postlarval Brown and White Shrimp (Penaeus aztecus and P. setiferus) in Gradient Tanks*. TAMU-SG-75-208. \$5.

SEA GRANT PROGRAM

- CLARK, W. H. *Handbook for Sea Grant Project Leaders*. TAMU-SG-75-602. No charge.
- SEA GRANT PROGRAM. *Sea Grant Publications/5*. TAMU-SG-75-607. No charge.

ORDERING PUBLICATIONS

- Please order publications by title and TAMU number from:
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