The University & The Sea

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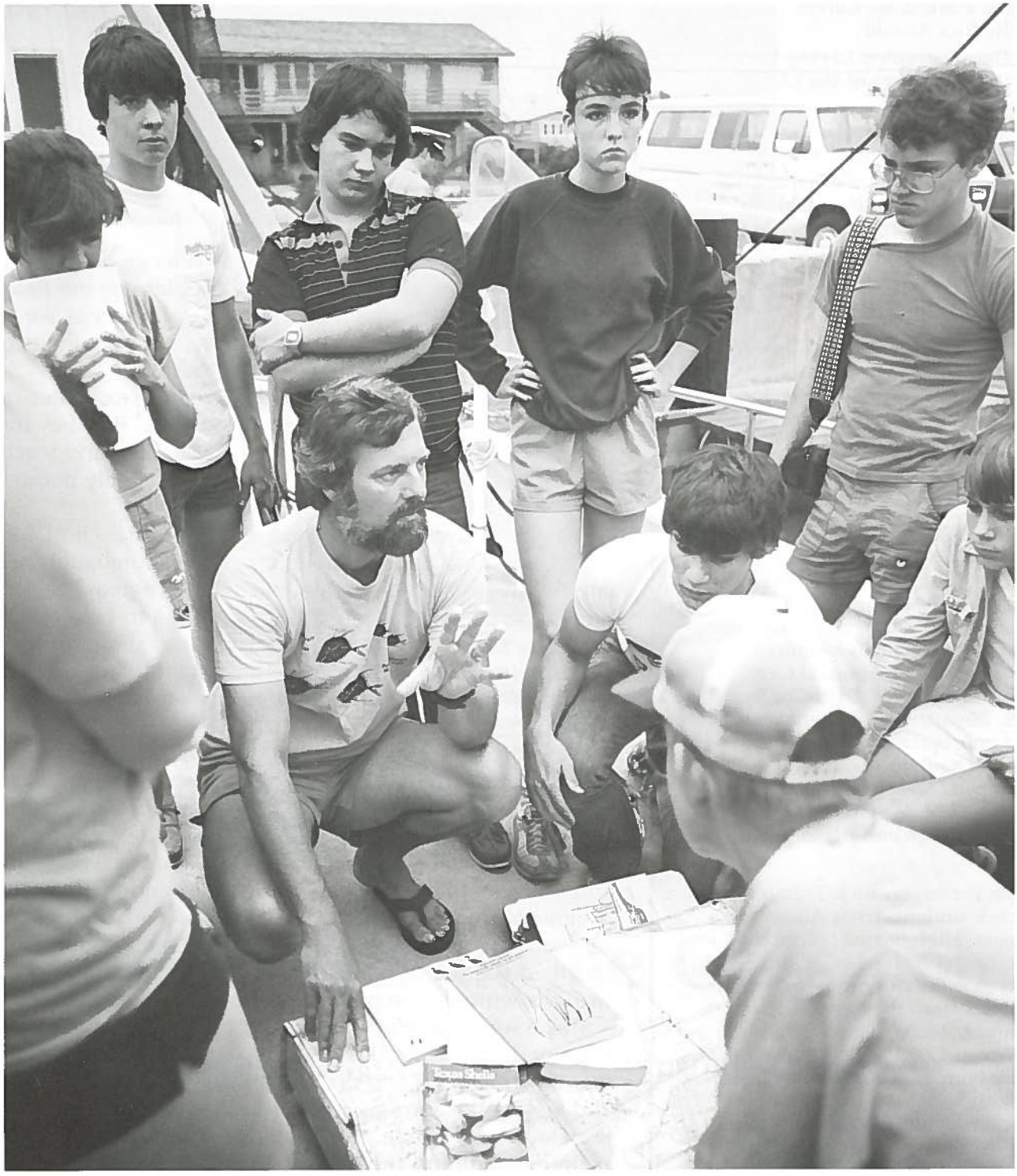

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Texas A&M University's Sea Grant College Program is made possible through an institutional award from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and appropriations from the Texas Legislature and local governments. *Feenan D. Jennings*, Texas A&M Sea Grant Director. *Laura Colunga* and *Bland Crowder*, editors.

On the cover: Rick Tinnin orients science students from Austin's Reagan High School before they embark on University of Texas R/V *Katy* to trawl and bring up bottom samples from the bays off Port Aransas, Texas. Tinnin heads the Office of Continuing Education at UT's Port Aransas Marine Laboratory and educates students and teachers about the Gulf of Mexico. His "Seagoing Experiences" are funded in part by Texas A&M Sea Grant. (Photo by Grif Smith.)

Grif Smith

Marine illiteracy, part of the overall science illiteracy recently acknowledged as a serious national problem by the Reagan Administration, must give way to marine *literacy* as we develop our fragile coastlines and ocean resources to the limits of their endurance. The path to literacy is education.

Almost no subject exists for which marine examples cannot illustrate a point as easily as terrestrial ones. But they haven't been used, and that's the problem: Students—and teachers—have not recognized the sea's importance simply because traditional education focuses on the land.

That focus is what the marine education branch of Texas A&M University's Sea Grant College Program is combatting. Since the late 70's Texas A&M's Marine Education Program has provided books, curricula, workshops and symposia to help teachers bring the sea into their classrooms, and to show students that treating the ocean right is more important than ever before and will be even more vital by the time they take their places in society.

Like other types of education, marine education needn't stop after high school. Jobs in oceanography require an undergraduate, and often a graduate, degree. More and more often these days, positions with maritime industries require training of a more technical nature. Combining classroom, field, shipboard and on-the-job experiences, universities and maritime training programs prepare students for a variety of marine-related careers. And apart from formal studies, special internships give qualified college students a different kind of education: a year working with marine policy makers at the federal level.

This issue of *The University and the Sea* examines the spectrum of marine education: in the schools, universities and maritime colleges, and on Capitol Hill. Texas A&M, Sea Grant and Texas educators have joined forces to make Texans marine literate, a worthwhile goal in a state where more and more people depend on the Gulf of Mexico for work, food, resources and recreation.

Jim Raatz

Making Waves in the Classroom

An educational curriculum doesn't 'marinate' overnight

By Amy Broussard

"The ocean is like the air—it's always been there, it won't go away soon, so why spend precious class time talking about it?"

This is the attitude that Bonnie Blackburn tries to counteract as she travels throughout Texas and neighboring states conducting inservice marine education workshops for elementary and secondary school teachers. Blackburn is coordinator of the Texas A&M University Marine Education Program, a cooperative effort of the Texas A&M Sea Grant College Program and the Department of Educational Curriculum and Instruction (EDCI).

"Some teachers are more informed than others about the marine environment," Blackburn says. "Either they live near the coast, have a natural interest in the oceans or have participated in activities coordinated by the Texas A&M program. These teachers are beginning to realize that the ocean is the new thrust, not just of education, but of Americans' lives and economic well-being."

At present in the continental United States, more than 56 million people live within 50 miles of the sea. The projected population of the United States for the year 2000 is 400 million, and it will be heavily concentrated along the coast. As coastal lands become more crowded, demands for resources increase, and Americans turn to the sea to satisfy a portion of their needs for protein, minerals and fresh water, as well as for transportation, waste disposal and recreation.

"Americans must learn to appreciate the marine environment and understand its importance in our history before they can learn to use marine resources wisely," Blackburn says. "This won't happen overnight, and we believe the classroom is the best place for this learning to take place."

The Texas A&M marine education program began in the late 1970's when Texas A&M Sea Grant administrators decided to concentrate more effort on publishing marine-related materials for elementary and secondary classrooms. Regular textbooks didn't include marine-related examples, and most teachers didn't know where to find them.

Grif Smith

Bonnie Blackburn holds a hermit crab and a decorator crab, temporarily ousted from a marine aquarium in her office. Hermit crabs are attention getters, but they're also easy to keep and a good example of adaptation: they live in snail shells.

Violetta Lien, then a research associate in EDCI, was asked to develop a three-week mini-course for junior high science teachers. That mini-course evolved into the 491-page *Investigating the Marine Environment and Its Resources.* Most materials available at that time concentrated on the Atlantic and Pacific coasts, so Lien used examples from the Gulf of Mexico in her book to make the material particularly relevant for Texas schools. Published in its final form in 1980, the book contains more than 100 teaching and learning activities in all of the sciences, social studies and language arts; a set of specific learning outcomes for each lesson; and a teacher's guide.

Lien kept both the traditional and non-traditional teacher in mind as she developed the material.

"Traditional teachers use mainly the readings and questions," Lien says today, "while the less traditional ones expand this with role-playing and simulations and by combining art with science. Teachers can pick and choose depending on their teaching style and subject interest."

This approach carried over into later Sea Grant education materials, as the marine education staff developed texts and supplemental materials for science *(Marine Organisms in Science Teaching),* literature *(Fairy Tales of the Sea)* and history *(Life On Board American Clipper Ships).*

"We know by the very nature of our materials that we first attract the non-traditional teacher," Blackburn says. "After all, these are supplementary materials, not state-adopted textbooks. Some teachers will never use anything but the state-issued texts—unless we can convince them that the marine environment is *so* important that they can't afford to ignore it."

Developing books and convincing educators that they need to use marine-related materials isn't enough, however. Many teachers, particularly those from inland areas, are as unfamiliar as their students with the ocean and its inhabitants.

"When Vi [Lien] was still with the program she surveyed Texas teachers to see how prepared they were for marine education," Blackburn says. "The results confirmed every-

one's suspicions. Ninety percent of the teachers had no formal training in marine education, and another seven percent had completed no more than six semester hours in that area. Sixty percent had attended only one half-day inservice workshop, while the remaining 40 percent had not had that opportunity."

That survey altered the direction of the Texas A&M program, and the marine education staff now also works to educate the educators. The Texas A&M Sea Grant Program offers 39 workshops, lasting from a half-day to a full day, covering all aspects of marine education for teachers, supervisors and administrators. The workshops are conducted at individual schools, during district-wide inservice training days, or at regional or national education meetings. They provide both in-school and field study opportunities.

The workshops begin with the basics, first explaining the concept of marine education. Science teachers, for example, are taken through an introductory activity from *Marine Organisms in Science Teaching* to learn the inquiry method of scientific discovery, the basis for any detailed laboratory investigation.

"We take groups of teachers to the coast, teach them how to do their own collecting, and show them how to conduct field trips for their students," Blackburn says. "We show inland teachers how to set up saltwater aquariums, and give them tips on acquiring inexpensive marine organisms and maintaining the aquariums in their classrooms. Science teachers, in particular, are quick to grasp the importance of marine education."

Interest in marine science is growing—at least in Texas. Joseph Huckestein, director of the Texas Education Agency's science division, reported that in 1982-83 more than 3,600 students were enrolled in marine science classes in the state's public schools. He expects that enrollment to be almost 13,000 for 1983-84, although official figures will not be available until later this fall.

Although science teachers readily accept the value of marine education, teachers in other subject areas are sometimes more difficult to convince, according to Blackburn.

"There has always been a misconception that marine education is just science," she says. "We have to work twice as hard to disprove this. We believe that marine-related examples should be used in every subject area."

Workshops for other subject areas concentrate on infusing these examples into existing material. This includes using *Fairy Tales of the Sea* to teach the language arts skills of listening, reading, speaking and writing, and using sea chanties about whaling, transportation, fishing and exploration to supplement social studies curricula.

"We wanted to expand into other subject areas this year," Blackburn says. "We hope to develop marine-related examples for computer software packages. We know that more and more schools are offering computer classes, and this is one more area where we can educate students about the marine environment." In addition, Blackburn and a team of specialists in the education of the gifted and talented have begun work on a text compiling all materials produced by the national Sea Grant marine education network.

In many respects, teacher training has supplanted student training in the Texas A&M Sea Grant marine education program's priorities, but young people are still the ultimate target.

"It may be more fun to work with a class of 30 children," Blackburn says, "to watch their faces light up as they discover hermit crabs or sea anemones. Children respond so readily—they're excited about new discoveries and always have a million questions.

"Ultimately, we do want to reach these children. But we have only so much time and so many resources. We believe it's better to spend that time with 30 teachers, to get them excited and interested in marine education, and to answer their questions. If we do our job really well, in the end we can multiply those 30 teachers by the number of students they reach in a year. This means we've spread the word to far more children than our four-person staff could ever contact personally." ■

Hey, Teach! Check it out!

Texas A&M Sea Grant offers many materials you can use when you want to slip a little ocean into just about any subject you teach. Many are free, even!

Marine Education is good for starters. During the school year you'll receive four free issues of this newsletter. Each issue presents news about marine science, suggestions for classroom activities, related readings, and a marine fact sheet you can duplicate for your students.

Aquatic Science: Marine Fisheries Biology is the novice beachcomber's handbook and an educational manual focusing on marine animals of Texas. It features waves, tides, estuaries, food chains, fish and shellfish identification, and special classroom projects on life history and management of coastal organisms. (18 p., single copy free; request publication **TAMU-SG-79-405**.)

Trying to 'Marinate' Your Curriculum? is a more complete catalog of Texas A&M Sea Grant's educational publications. For a free copy, request **TAMU-SG-79-406**.

Order publications by title and publication number from Marine Information Service, Sea Grant College Program, Texas A&M University, College Station, Texas 77843.

Plotting a Course for a Maritime Career

Despite recent slumps in offshore industries, officials at Brazosport College and Texas A&M at Galveston have high hopes for their marine technology graduates

By Rita Arnold

Ever dreamed of travel to far off ports, of waking to a sunrise over clear blue waters, of watching dolphins skim across ocean waves? How about performing routine equipment checks over and over, or spending several hours in stormy seas with your head over the rail?

In Texas, two training programs offer would-be seafarers a sample of life at sea, combining classroom and on-board preparation for ocean-related careers in marine industries. In the Oceanic and Marine Technology (OMT) Department at Brazosport College in Lake Jackson, and in the license training option in several degree programs offered at Texas A&M University at Galveston, checking fuel levels, keeping logbooks and standing watch are as routine for students as term papers and exams.

The program at Brazosport College began in 1971 with a grant from the Texas A&M Sea Grant College Program, which supported staff members as they organized the OMT curriculum. Since then, Sea Grant has funded several other projects to help the program develop further.

Brazosport is the only community college in Texas with an oceanic and marine technology program. Students from landlocked states like Kentucky and Arizona, as well as from Texas and other coastal states, enroll in the two-year program that prepares them to become certified able-bodied seamen. If you stroll along the docks while freshmen prepare for their five- to seven-day stint on an offshore supply boat—the first practical test of skills they've learned in class—you'll see men and women with a common goal, but diverse backgrounds.

"Our students range in age from 18 on up. I think the oldest we've had was 56 years old," said Ken Kimble, one of three instructors in the OMT program. "They come from all over the country. In most cases they've heard about the program from a graduate who is working in the field." Two of Kimble's former students had bachelor's degrees when they entered the program, one in journalism, the other in psychology, and a current student will take the examination for her able-bodied seaman's papers when she gets her nursing degree. Two women are among the 20 students who will graduate this year.

In OMT classes students learn shipboard terms, swimming, and geological and physical oceanography. They study marine engineering, electricity, physics, law and economics, math, communications and blueprint reading. They learn to interpret cloud formations, navigate a lifeboat and use a sextant. They study the ocean, its food chains, salinity, temperatures, currents and life forms. And they study vessels and equipment: gas and steam powered turbines, nuclear propulsion, generators, navigation computers, and block and tackle. They find out how to handle hazardous cargoes and how to apply geometry and trigonometry to coastal navigation. They also can earn certificates in radar, scuba diving, first aid, cardiopulmonary resuscitation, firefighting and LORAN-C navigation.

In addition to the offshore supply boat trip with an instructor, they are required to work at least six weeks in the marine transportation industry as an Ordinary Seaman (OS). Brazosport College arranges for the U.S. Coast Guard to issue each student a temporary "Z" card authoriz-

License-option students at Texas A&M at Galveston take three 10-week cruises aboard the training ship Texas Clipper. *They combine study and work as they travel to foreign and domestic ports.*

ing them to work as seamen. They draw wages while gaining the practical experience required by the school. As an OS, a student scrapes, paints and scrubs decks, stands lookout, and assists Able Seamen (AB). An AB stands wheel watches and lookouts; helps deck officers tend mooring lines, gangways, safety nets and lights; assists in handling liquid cargoes and ballast; cleans tanks; and operates cargo booms, rigging, and deck and anchor hauling machines. After the sophomore year, students earn Associate of Applied Science degrees and are ready to take the Coast Guard examination to become AB's themselves.

"In general, the job market is tight," admits Rick Baur, another instructor in the Brazosport program. "But for our graduates, job availability is excellent due to our reputation with the offshore oil and mineral industry. Career opportunities are varied and unlimited for persons willing to work." Of the school's 16 1982 graduates, three work in the U.S. Merchant Marine fleet, and the rest are AB's in the offshore oil and mineral fleet.

"We're turning out workers, not officers, although after a year of sea time, our graduates can sit for their 'limited mate's' test and move up the ladder," says Kimble. A limited license sets a maximum weight of boats on which the seamen can work, usually 1,000 gross tons. Persons with one year's experience and a limited mate's license, then, work primarily in the oil, mineral and towing industries, but the license does not authorize them to work in most deepsea maritime industries, which use heavier vessels.

With experience, limited mates eventually can climb to Master Unlimited—the captain of the ship, who's in charge of all ship functions, including navigation, cargo maintenance, state of the vessel, ship's business, payroll, and compliance with maritime laws, rules and regulations—or to Chief Engineer—in command of the engineering department and engineering personnel, responsible for operation, maintenance and repair of all ship machinery and control systems, engineering department payroll, and compliance with maritime laws and regulations covering machinery testing and inspection.

Most deck officers and marine engineers aboard U.S.-registered merchant ships, however, are graduates of accredited three- or four-year nautical schools, including the country's five state-supported maritime academies in California, Maine, Massachusetts, New York and Texas (at Texas A&M at Galveston), and the Great Lakes Maritime Academy and the U.S. Merchant Marine Academy. The Office of Maritime Labor and Training, a division of the Maritime Administration (MarAd), reports that of the 1,000 students who graduated from those institutions in 1982, 51 were from the Texas school. MarAd, part of the U.S. Department of Transportation, oversees U.S. maritime activities, including financing and training.

At present, the employment outlook is bleak for officers, according to Pat Connell, Academies Program Specialist with the Office of Maritime Labor and Training.

"Ships are laid up, and the number of ships in use is dwindling," she said. "There are only about 400 ships in the U.S. Merchant Marine,

Ken Kimble teaches a Brazosport College oceanic and marine technology student how a sextant works.

and each needs a crew of about 32 people. Fewer than half of those are officers, and that doesn't add up to very many jobs. With the worldwide recession, ships are expensive to operate, and markets just aren't there. On the Great Lakes, only half of the usual number of ships are operating. Everybody's in a slump. Business needs to boom again to turn this around."

However, Connell estimates that for every job aboard a ship there are about seven jobs on shore for persons with merchant marine licenses. Shipping companies, marine sales businesses and ports require that their management personnel be licensed.

Capt. James F. McNulty, head of the Department of Marine Transportation at Texas A&M at Galveston, estimates that 170 of the 200 students in the University's license option program are training for their deck officer's license, with the remainder pursuing engineer officer licenses. Students in the program study in either the Texas Maritime College or the Moody College of Marine Technology at the University.

Graduates take qualifying examinations for their Coast Guard license as Third Mate or Third Assistant Engineer. After passing the exams they may seek active duty posts in the U.S. Navy or Coast Guard. However, many more graduates are ashore than at sea. Some take jobs on shore, hoping they'll lead to jobs at sea later, while others specialize in related fields, studying maritime law or entering graduate school in marine studies.

"One way to get a position at sea is to take a shoreside job with a maritime company and wait for an opportunity to go to sea," said McNulty. "Sometimes our graduates take a lower-paying job with a foreign shipping company so they can accumulate sea time, advance their licenses and get experience."

William Clayton, president of Texas A&M at Galveston, is proud of the broad training the University offers.

"The maritime program was established in 1962 as a state maritime academy like the other five programs in the United States," said Clayton. "But, we changed direction when we became a four-year university. We're the only university in the country that offers a variety of marine and maritime curricula in addition to marine transportation and marine engineering. This provides our students the opportunity to receive a well-rounded education by taking marine training a step further than the other institutions."

Among the University's unique offerings are a maritime administration course that prepares students for junior-level business administration in shipping or port operations and a maritime systems engineering course that combines civil engineering with training about how the ocean affects coastal structures.

Students sail on three summer cruises during the four-year program. The College maintains its own training vessel, the T/S *Texas Clipper,* and beginning this fall students will be required to spend more time aboard ship in training and ship maintenance. Clayton added that the many marine-related businesses and industries near the school are valuable adjuncts to classroom studies.

Todd Shipyards, primarily a repair facility for seagoing vessels, is right next door. Two nearby major ports, Galveston and Houston, have attracted a variety of marine industries, and the Texas coast is dotted with more offshore rigs than you'll find on the East or West Coast.

Since 1978, enrollment has been stable in both the license option program at Texas A&M at Galveston and the OMT program at Brazosport College. Despite tough economic conditions and hiring practices requiring workers and officers to have more formal training than was required in the past, interest in a life at sea and in jobs connected with ocean-going vessels is very much alive. ■

For more information:

To learn more about maritime educational opportunities in Texas, write either Texas A&M University at Galveston, Student Records Department, P.O. Box 1675, Galveston, Texas 77553, or Brazosport College, 500 College Drive, Lake Jackson, Texas 77566.

In addition, *Vocational-Technical Marine Career Opportunities in Texas,* a brochure written by Dewayne Hollin, marine business management specialist with the Texas A&M Marine Advisory Service, is available for high school counselors, teachers and students. It focuses on jobs in the state's marine industries. For a free copy, write Marine Information Service, Sea Grant College Program, Texas A&M University, College Station, Texas 77843. Request publication number **TAMU-SG-80-402.**

Oceanography

Laying bare three-quarters of the planet

By Bland Crowder

Flipper, Jacques Cousteau and *Sea Hunt* make good television and have made millions aware of the value of the ocean and its resources. But they do little to describe the important, hard work of studying the ocean.

Calypso cruises as depicted on TV are an oceanographer's dream. But Cousteau's goal is not to show grueling work on the freezing, lurching, wet deck of a small research boat where marine scientists and students sample water, organisms, sediments and bacteria, moor buoys and current meters, and take the water's temperature from surface to bottom.

Lloyd Bridges scuba-ed through acres of magnificent coral reefs and myriad schools of tropical fishes, but *Sea Hunt* seldom emphasized that man may be endangering reefs and marine species as surely as the inevitable weekly slashing of Lloyd's air hose threatened his life.

And Flipper was an almost-human member of the family, but that program didn't show that many porpoises and other marine mammals—many of them endangered species—beach and die each year. Why do they beach? What do they eat? How many of them are left?

Graphic, Bland Crowder; Photo, Giff Smith

Oceanography is hard, often repetitive, work and not an especially financially lucrative pursuit. But for most people who study and work in it, it's rewarding. Like the study of the land, oceanography is a broad field, and its students specialize in one of its main subdisciplines: biology, physics, chemistry or geology. But oceanography as a separate discipline is relatively young, and education and careers in the field have diversified only recently.

"Historically, the main impetus for studying the ocean was fisheries, and marine life was the main interest until World War II," said Robert O. Reid, distinguished professor and head of the Department of Oceanography at Texas A&M University. "During the war, the Navy became interested in the transmission of sound waves in the ocean, for both strategic and navigational purposes. The thermal structure of the oceans is the main determinant of the acoustic properties of seawater. And, if you study thermal structure you also study currents, because the two are interrelated."

World War II, then, caused a shift in emphasis from fisheries biology toward physical oceanography. After the war, oceanography's status declined, probably because so much work in the discipline had gone to support the war effort. However, in the mid-fifties *Sputnik* opened the space race and spurred the federal government's interest in science and technology in general, oceanography included.

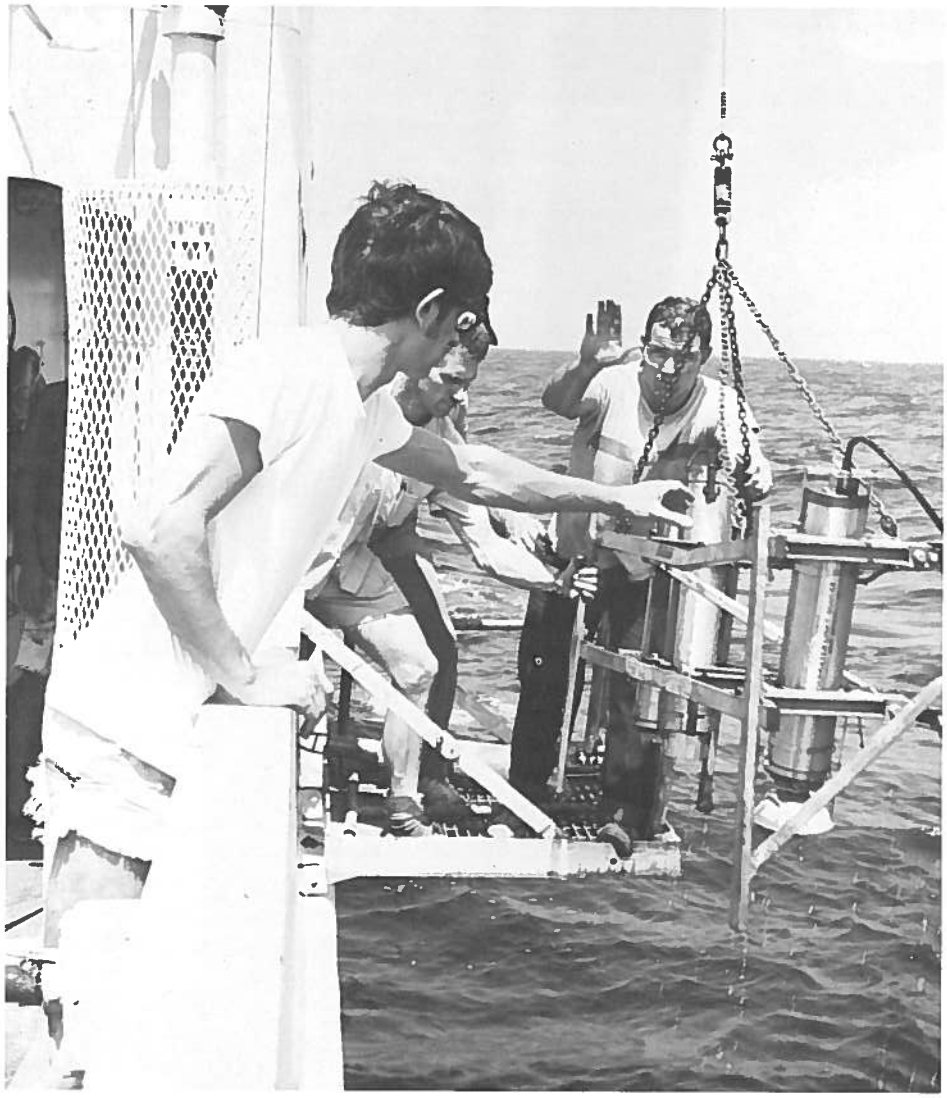
The formation of the National Academy of Sciences Committee on oceanography in 1957 was the first attempt to coordinate federal ocean programs and was the birth of modern oceanography. At about the same time, the boom in graduate education in marine sciences began. Between 1958 and 1978, the number of institutions with active doctoral programs in oceanography increased from 5 to 50, according to a 1981 report by the National Research Council (NRC). Also, between 1962 and 1978, the number of Ph.D.'s employed in oceanography in the United States quadrupled, to 2,600, an increase greater than that in any other major scientific field.

Although 150 colleges in the country offer courses in marine sciences or oceanography, only a few—Texas A&M at Galveston and the University of Washington among them—offer a bachelor's degree in those fields. Texas A&M at Galveston has degree programs in marine sciences, marine fisheries and marine biology, a result of "branching-off" that has taken place during the past seven years or so, says William A. Seitz, associate professor and head of the Department of Marine Sciences, the "parent" program there. The three curricula still have a lot of common ground in course requirements and faculty.

"The first two years of our program emphasize basic sciences and mathematics," he said. "The students specialize in their junior and senior years, taking electives in which they apply the basic knowledge to marine problems.

"We have 75 or 80 students in the marine sciences department this semester, and our small size lets us do things other schools can't do." A required field course takes students into the bays, marshes, Houston Ship Channel and the Gulf of Mexico, where they learn the sampling and analytical techniques of oceanography. A special senior seminar program familiarizes the students with the scientific literature and gives them practice at giving seminars themselves.

Marine paparazzi *lower a camera and strobe flash to the seafloor. The shutter trips about one meter above the bottom.*



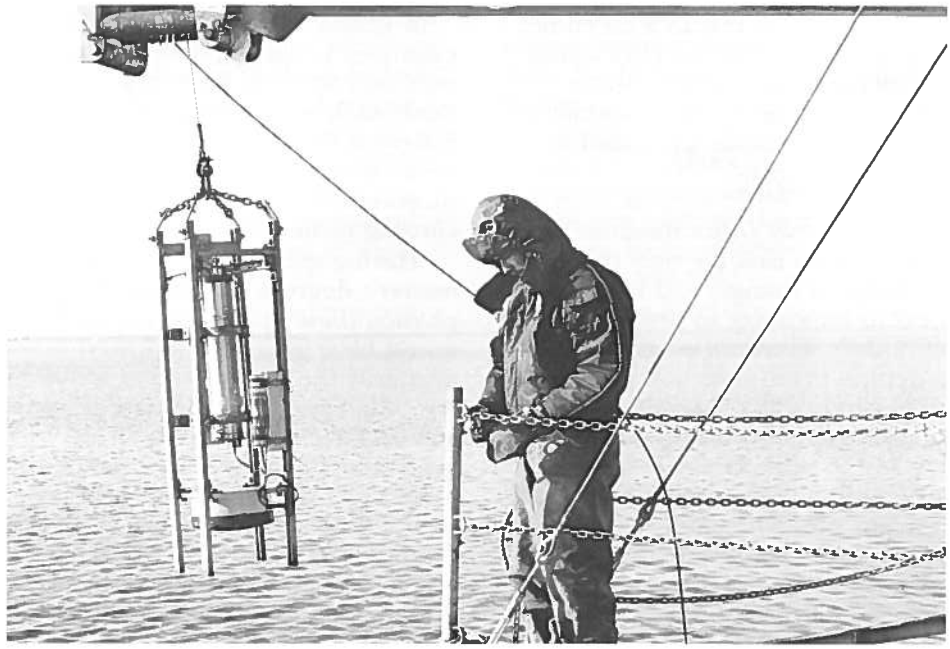
"Half of our students take one three-hour 'special problems' course, which is basically an undergraduate research project," Seitz added. Students may continue their research during two or three consecutive semesters and many eventually publish their results in a scientific journal. This work gives the students an advantage when applying for admission to graduate or medical school.

Seitz says that although a large percentage of their graduates continue their education, many go to work once they get their bachelor's degrees. "They go in two general directions," he said. "Those who have remained generalists in all the fields of marine studies often enter environmental consulting. The marine sciences department also offers specializations in marine geology and chemistry, and these graduates usually go to work in industry, especially the petroleum and chemical industries." Other opportunities include work with government agencies, teaching and careers in wildlife biology.

A career in oceanographic research or teaching marine sciences at the college level, however, requires the more intensive training gained only from a master's or Ph.D. program. After obtaining a bachelor's degree, someone with such career aspirations becomes a graduate student.

In many respects, graduate students are the backbone of oceanography. They do much of the university research in the field and are literally "cheap labor," but often—and moreso in oceanography than in many other fields—their work provides them with financial support and the opportunity to perform the research on which they will base their theses or dissertations. Research assistantships for graduate students usually are included in budgets of research grants, and many federal agencies, private foundations and university programs provide fellowships, scholarships and other awards to the most promising students.

During oceanography's rapid growth period, there have been cycles in which one or another sub-field has dominated. These ups and downs are a result of federal and industrial research priorities ("where the money is") and scientific discoveries that shed light on important new questions and techniques. These, in turn, have affected which subdiscipline in a university program has the most money, and thus which ones are most attractive to new graduate students.



U.S. Coast Guard

A Coast Guard oceanographer prepares for an STD cast. The STD sensor measures water salinity, temperature and depth.

Before 1973, reports the National Research Council, most Ph.D.'s in oceanography were awarded in geological and geophysical oceanography, probably a result of awakening interest in continental drift and petroleum exploration. Since 1973, however, the biology subfield has dominated, most likely due to new regulations requiring developers to assess the impact of their planned activities (such as drilling and dredging) on marine life. In 1978, of the Ph.D.'s working in oceanography in the United States, about one-half were working in biological oceanography, 20 percent each were working in the physical and geological subfields, and 10 percent worked as chemical oceanographers.

In addition to the problem of finding support for their graduate studies, college students wanting to enter graduate school in oceanography might wonder what job prospects await them after graduation. Short-term research trends can be predicted fairly confidently because the funding climate is usually stable for 10-year periods. Long-term trends, however, cannot be forecast with such certainty, states *Future Ocean Research (FORE)*, a 1982 report written after a recommendation by the Intergovernmental Oceanographic Commission. The report states:

> . . . one could hardly have predicted in 1916-1920 the appearance in 1946-1950 of the stimulating ideas put forward by Stockman, Sverdrup, Stommel, and Munk—the ideas which clarified some of the fundamental physics of the general ocean circulation. Also, judging from the contemporary state of the art, one could not exactly foresee in 1944 that 30 years later (around 1977) physical oceanographers across the world would be so intensively preoccupied with synoptic scale eddies.

The ocean, covering nearly three-quarters of the earth's surface, collects—primarily at the equator—most of the sun's heat that reaches the earth. Eddies in the sea and their atmospheric counterpart, cyclones, transfer that heat toward the poles, creating weather. *FORE* cites a 1969 report that misforecast the

importance that research on eddies would gain during the 1970's, and of the topics the authors of the 1969 report did deem important, more than one-half had failed to develop into major research fields as of 1982.

Thus, *Future Ocean Research* proves again that the only thing that is certain is change, and that it is next to impossible to predict oceanography's direction, even as little as a decade in advance. Job prospects, then, change as the supply of oceanographers and research funding in the subdisciplines change. And although unemployment is not a major problem among recipients of advanced degrees in oceanography, finding a job is not as easy as it was when the field was emerging. The laws of supply and demand work in the job market, too.

"At present, biological oceanography is probably the hardest subfield of oceanography to get a job in," said Reid. "There are still a lot of jobs out there, but the people outnumber the jobs. Most of our applicants want to study biological oceanography, and we had to put a quota on the number of biological students we admit simply because we have a finite number of faculty and they can take on just so many. It isn't usually that way in physical, chemical and geological."

In geological oceanography, for example, Texas A&M usually admits only three or four new students each year. Things are a little different this fall. The Department took 10 new geological students, a direct result of the economy, according to Reid.

"Having gotten their bachelor's or master's degrees in geology or geophysics, these applicants normally would have gone into industry, primarily the petrochemical industry," Reid said. "But because things are slacking off there the recent graduates figure, 'Well I'd better go on and get a doctoral degree; maybe oceanography has more to offer than industry' and they return to school." Some of the students enter graduate programs in terrestrial geology or geophysics as well as oceanography, he added.

Texas A&M's new geological oceanography students are in the right place at the right time. The National Science Foundation has chosen the Department to coordinate the Advanced Ocean Drilling Program (AODP), the world's largest geosciences project, which is now in the planning stages. AODP, funded at $30 million annually, will involve extensive sampling and analysis of the seafloor, from which geological oceanographers will learn about the formation and dynamics of the oceanic crust. Seafloor sampling should begin in October 1984. The program means jobs for more than 100 persons, including support for graduate students.

FORE reports that the most important strides in physical oceanography result from new types of oceanographic instrumentation and methods of observation, research and data treatment. These innovations are put to good use in the Texas A&M department, especially by physical oceanographers, who are at the forefront of what Reid sees as the immediate future of physical oceanography: steps toward a global view of ocean physics, made possible by advanced technology. This innovative research also will provide study topics for graduate students.

"We're getting into new programs involving worldwide ocean circulation patterns," he said. "Satellite-tracked drifters are now used successfully to assess currents, as is remote sensing of thermal patterns by satellite. oceanography is just reaching the stage that meteorology has been at for many years: collecting worldwide data on ocean currents."

Reid emphasized the close relationship between meteorology and physical oceanography.

"The atmosphere and the ocean, the earth's two main fluid bodies,

Sea Grant receives $1.7 million for 1983-84

Texas A&M University will continue its statewide program of marine-related research, education and public service under a new $1.7 million grant to its Sea Grant College Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

The federal grant, announced September 15 by Texas A&M Sea Grant Director Feenan D. Jennings, provides funds through August 1984. Matching funds from state, local, university and private sources will bring the total budget to $3.36 million in support of 28 Sea Grant activities in 1983-84.

According to Jennings, the funding includes support for research at Texas A&M, The University of Texas Marine Science Institute, The University of Texas at Tyler, the University of Houston and its campus at Clear Lake City, Baylor College of Medicine, and Texas Southmost College.

In addition to funds appropriated by the Texas Legislature, non-federal funds also are provided by the Texas Parks and Wildlife Department, Texas Agricultural Extension Service, Texas Agricultural Experiment Station, Texas Engineering Experiment Station, the County Courts of Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Matagorda and San Patricio Counties, and by the other participating institutions.

Eleven new projects are included in the 1983-84 program, in the

undergo similar processes, but the great influence of ocean processes on the world's weather has been realized only relatively recently. This is one point of this major new research focus," he said.

The more grandiose programs focus on worldwide, open-ocean processes. But the heading "oceanography" also encompasses studies of the coastal zone, estuaries and continental shelf, and while they may pale beside the grandeur of the larger programs, their importance should not be underemphasized. Many graduate students in oceanography choose to focus on environments closer to shore. Relatively recent legislation requires that before dredging, construction, waste disposal and other activities can be done, the resulting impacts on the environment must be proved minimal. And the "original" oceanography, studies of fisheries, more recently has regained ground as federal and state governments have begun managing those resources. These governmentally mandated activities attract oceanographers, and according to the NRC report, are probably a major reason why new biological oceanography graduates can still find jobs.

"These areas closer to the shore are reservoirs of resources," said Reid. "They are particularly important for fisheries and mineral exploration, and we've become very conscious of pollution in these regions. Government agencies and industry focus much of their attention on the pollution problem and on trying to achieve balance between exploitation of near-shore and coastal resources and maintenance of environmental quality."

The need for ocean scientists to solve such problems requires oceanography graduates from all of the sub-fields. Chemists determine concentrations of marine pollutants, study water/sediment interactions and measure nutrient levels in these life-supporting, near-shore waters. Geologists analyze sediment composition and determine sediment budgets, which are altered by storms and construction on the fragile shoreline. Healthy fisheries depend on unpolluted environments and undisturbed estuaries where young fish mature, as well as managed exploitation of their resource. Biological oceanographers, often working under the label "fisheries biologists," fill these needs. Physical oceanography is integral to all these kinds of studies; analyses of currents, temperature and depth are required for clear interpretations of findings of geological, biological and chemical studies. No oceanographic sub-discipline stands alone.

As the importance of resource management is stressed more and more by decision-makers, oceanographers work increasingly with economists, lawyers, planners and businessmen. Many graduate students are gaining another specialization in one of those disciplines and applying the knowledge in places other than the field or the laboratory. The new diversification of the science oceanography, the increased burden burgeoning coastal populations are placing on the marine environment, and the need for resources found in, on and beneath the sea suggest that career opportunities in oceanography will not soon disappear. ■

For more information

Careers in Oceanography is a booklet written in response to the many requests by young people who are interested in the possibilities of a future in oceanography. Written by Robert Abel, New Jersey Sea Grant director, it discusses education and work in the field, who hires oceanographers, and where to find further information. For a free copy, write Marine Information Service, Sea Grant College Program, Texas A&M University, College Station, Texas 77843. Request publication number **TAMU-SG-79-608.**

areas of mariculture, marine fisheries, marine environmental studies and coastal studies. The remaining 17 are continuations from last year.

In marine fisheries, surveys will be conducted to learn more about participants in sportfishing tournaments and their impacts on fish stocks and fisheries management. Another project will attempt to determine the effects of the parasite *Odostomia impressa* on oyster growth and development. A third will use remote sensing and satellite data to determine distribution patterns of menhaden in the Gulf of Mexico.

Two of the environmental studies involve penaeid shrimp, one measuring carbon assimilation rates and food preferences of postlarval shrimp in Texas salt marshes, and the other examining the interaction of algae and penaeid shrimp in a *Spartina* marsh.

Shore erosion in Texas bays and estuaries is the focus of one coastal study. Another, a joint project of Texas Southmost College and The University of Texas at Tyler, will assess how industrial development and population growth along the Texas coast affects the allocation of marine resources.

Of the continuing projects, five are in Texas A&M's shrimp mariculture program. Maturation and reproduction studies will continue, along with studies of the economics of commercial shrimp mariculture and a project to monitor, develop and apply therapeutic measures for diseases of cultured shrimp. Work will continue toward genetically characterizing shrimp broodstock for future controlled breeding studies, because knowledge of the level of genetic variation is important in selective improvement programs.

Funding also is provided to support studies of such diverse topics as life histories of redfish and red snapper; yield model assessment and population dynamics of Gulf of Mexico fishes; marine turtle behavior, physiology and conservation; the occurrence of pathogenic viruses in shellfish and other marine seafoods; and dissemination of marine education curriculum and program materials throughout Texas elementary and secondary schools. ■

Mr. Smith, Ms. Carnahan and Ms. Rootes Go to Washington

Sea Grant interns get unique schooling on The Hill

By Bland Crowder

Federal policy, the economy and the path of scientific progress have great bearing on the direction of oceanographic research, and communication between science and government is vital for sound decisions regarding marine issues. That communication is enhanced in one way by internships, in which graduate students get a unique education working as professional staffers in the U.S. Senate, House of Representatives and federal agencies. Several groups sponsor internships, including the American Association for the Advancement of Science, the American Geophysical Union and the National Sea Grant College Program.

Sea Grant sponsors 10 interns annually, chosen from a field of candidates nominated by the more than 30 Sea Grant Programs across the country. Each year since the internship program began five years ago, graduate students from Texas A&M University have been among the 10 selected.

A Sea Grant intern works one year for Congress or a federal agency. In June, Rebecca Rootes began 12 months with the House Merchant Marine and Fisheries Committee. A former assistant marine extension agent with the Texas A&M Marine Advisory Service, she received the master's degree in public administration from the University in May. Before coming to Texas A&M, as a Peace Corps volunteer she worked with the Bureau of Fisheries and Aquatic Resources in the Philippines, where she helped establish coral reef management policies.

"Congressional interns help write bills aimed at solving marine-related problems," Rootes said. "We research an issue, negotiate opinions based on our expertise and congressmen's viewpoints, and draft bills. Then we arrange and conduct a hearing on the bill at which the public can express opinions, and brief the head of the Committee on the issues and hearings. The next step is 'markup,' or amending a

piece of legislation. The bill then goes from the Subcommittee to the full Committee, then to the floor of the House, and on to the Senate.

"I feel fortunate because I have been expected to perform up to par with professional staff members from Day 1. My education and background in marine policy are resources to me as an intern, but I'm still learning."

An internship is education, but with a difference. David Smith interned with the minority staff of the Senate Commerce, Science and Transportation Committee in 1981. He received the master's degree in oceanography from Texas A&M in 1982 and is now assistant director of the Virginia Sea Grant Program.

"In a classroom you are on the outside looking in, but the internship is education from inside the system," he said. "You'd never get this experience from a textbook or classroom.

"My science background was very important to me as an intern," Smith added, "but in the policy/legislative area there's seldom enough time for the extensive research and detail I was used to from my scientific training. You have to take the information that has been gathered by agencies and synthesize it fast."

Many interns express that viewpoint. Rootes said that academia does not provide the student with the "conciseness and ability to make quick decisions."

"The academic environment is more geared toward research," she said. "Working as an intern forces you into a mode to use the information available, make a decision and go with it. It gets you into the real world, into a situation you may have been interested in only academically before. Things happen faster."

"Compared to classroom education, the internship was better, harder, more fun and more realistic," said Elizabeth Carnahan, a 1982 Sea Grant intern with the National Oceanic and Atmospheric Administration (NOAA). With NOAA she was introduced to policy making related to her graduate studies at Texas A&M—marine resources management.

"This work let me use my business and environmental background," said Carnahan. "Often someone needed information, and because of my background I knew specific sources for that information.

"I worked on several task forces for NOAA, including the Ocean Service Center Task Force, which led directly into what I'm doing now with NOAA's Office of Oceanography and Marine Services. You need the formal education, but the internship is an important completion step. It's like a doctor's internship. You have to know what's in the book, but you have to have that part in the middle first."

"A year spent in Congress gives you insight regardless of what career you choose later," said Rootes. "It exposes someone interested in marine fields to the legislative and policy-making processes. You get to view the system, and vice versa. You draw upon the expertise of many experts in Washington and all over the country. It's good training for many career options."

It's logical that an aspirant to a career in marine administration would seek the experience and contacts derived from an internship. It's also logical that the government benefits, or it wouldn't hire interns.

"Agencies and Congress benefit because they get people who are already familiar with the system," said Rootes. "Contacts I made with the Texas A&M Marine Advisory Service have been very valuable in getting information I have needed as an intern. And the government doesn't have as great an expense or time lag of a training period."

"You look all around you and notice so many 'dis-incentives' for working for the federal government that many people go elsewhere," Carnahan said. "Internships are a good way to feed good people into the system and convince them to stay there. I refused a good offer from a private company, but the Sea Grant Program meant a lot to me, and I knew the internship would be interesting."

Smith adds that science itself benefits.

"The internships are important to science because scientists must learn to communicate more effectively with the people who set policy," he said. "The program is competitive, so the internship helps the intern's career and helps the marine area of government move ahead. It is important that people involved in science and policy have such an experience." ■

Nailon appointed marine agent for Chambers, Jefferson counties

Robert Nailon was appointed county marine extension agent for Chambers and Jefferson Counties, effective September 1. He replaced Jim Buckner, who is now employed with private industry. His first plans are to meet local industry and community leaders interested in marine-related problems and issues and to become familiar with local concerns. His office is located at the Courthouse Annex, 225 Main Street, Anahuac, Texas 77514, telephone, (409) 267-3185.

Nailon received the bachelor's degree in biology from Southern Methodist University in 1979 and graduated cum laude from Texas A&M University this year with a master's degree in wildlife and fisheries sciences. At Texas A&M he assisted in a survey of fish populations and water quality of Texas flood prevention lakes.

A native of Tulsa, Oklahoma, he was a volunteer and staff member of Amigos de las Americas from 1974 to 1977, where he received medical training and assisted in immunization programs in Central and South America. From 1980 through 1982 he was a biological technician for the U.S. Army Corps of Engineers Waterways Experiment Station's Aquatic Habitat Group. In that capacity he helped develop a procedure for describing the value of estuarine and marine bottom substrates as feeding areas for demersal feeding fishes in Mississippi Sound; collected dredge material samples to determine heavy metal depositional rates and retention times; and determined species composition and seasonal distribution of fish larvae in the lower Mississippi River.

Green reappointed to Council

John Green of Beaumont, Texas, has been reappointed to the Gulf of Mexico Fishery Management Council, on which he has served since 1976. Now Council chairman, he has served on the habitat and environmental committee as well as personnel, administrative policy, billfish, mackerel and swordfish committees.

The Gulf Council is one of eight fishery management councils in the United States that prepare management plans for fish species in waters within their geographic areas. Gulf Council members are nominated by the governors of the five Gulf states. Nominees must be knowledgeable or experienced in management, conservation, or recreational or commercial Gulf fisheries.

Texas license already covers salt water

Bill would require marine fishing licenses nationwide

A bill requiring coastal states to adopt uniform marine recreational fishing licenses is awaiting action in the Subcommittee on Fisheries and Wildlife of the House Merchant Marine and Fisheries Committee. Introduced by Rep. Harold S. Sawyer (R-Mich.), H.R. 2965 would establish a licensing program that would set uniform annual fees, make saltwater fishing licenses valid in all U.S. coastal waters, and earmark license revenues exclusively for projects related to marine recreational fisheries. Monies would be used to develop fishing facilities, support scientific research related to fishery management, protect, maintain and enhance marine habitats, or administer and enforce marine fishing regulations. There are 16 million saltwater fishermen in the United States.

The bill's backers, including the Sport Fishing Institute, feel that a licensing program would let states account for the numbers of saltwater anglers and enhance fishery resources. At present, taxes from tackle sales are redistributed to states based on the number of fishing licenses, and in most states only freshwater anglers must be licensed. Saltwater anglers already are licensed in all west coast states except Hawaii and in all Gulf States except Mississippi.

The bill's opponents argue that the coastal fishing community is a last frontier and should remain unregulated. They also fear that, unless the bill earmarks license revenues specifically for fisheries-related projects, monies will be diverted to unrelated uses.

Ron Schmied, special assistant for recreational fisheries with the National Marine Fisheries Service, said such a uniform license program has been discussed for years. Precedent for the program was set by the Boating Safety Act of 1971, which established uniform state licensing of boats based on minimum federal guidelines. The U.S. Coast Guard acted as a registering agent until the states could establish the programs.

ADVISER

By Rita Arnold

MAS testing Kali longline

Staff of the Texas A&M University Marine Advisory Service (MAS) are testing the Kali technique of longline bottom fishing, new to the Gulf of Mexico, that could supplement the income of shrimp fishermen during the off-season. The research is funded by MAS and the Gulf and South Atlantic Fisheries Development Foundation, Inc. The gear is named for its inventor, who first tested it in the Caribbean Sea.

From December through April, little shrimping is done and crews are reduced, but if the Kali system proves economically feasible, fishermen could bottom fish over coral and rocks that aren't easily fished with other gear.

This summer, Gary Graham, MAS marine fishery specialist, and marine agents Richard Tillman (Aransas and San Patricio Counties) and Tony Reisinger (Cameron County) tested the Kali gear on private shrimp boats whose owners are interested in the new technique.

"This gear won't fish some rocks in the Gulf: some places are just too rough," Tillman said. "But when other boats were hanging up or breaking cables in the same fishing area, the Kali gear had no problems."

Test gear uses PVC pipe to hold the hooks, along with a floating line to keep the gear from getting tangled in bottom obstructions. The pipe is buoyed at one end and weighted at the other, so it floats vertically.

The Kali longline fished as well as or somewhat better than conventional bottom cable. One test trip in June netted 1,200 pounds of fish after nine days' fishing in 30- to 200-fathom waters from the Aransas Banks to Louisiana waters. After the gear is modified in light of results of the summer tests, more tests will be made this fall.

Data to be used in fishery management

NMFS surveying charter boat landings

Fourteen charter boat captains from Texas are participating in a one-year survey of landings to provide fishery managers with up-to-date information on catch and effort for species important to recreational fisheries. The study is coordinated by the National Marine Fisheries Service (NMFS).

"In the past, state and federal agencies that set catch quotas have based their decisions on what happened last year or two years ago, because catch and effort totals for recreational fisheries are costly to determine, difficult to estimate and can't be gathered within acceptable time frames," said Harold A. Brusher, fisheries biologist with NMFS. Brusher is helping test a new method of gathering recreational fishing statistics: surveying captains of charter boats.

Researchers at the NMFS laboratory at Panama City, Florida, conducted a pilot survey in 1982 in which they contracted nine charter boat captains to report for each fishing trip the date, zones fished, method of fishing, number of hours fished, and number of each species caught. The method worked, and this year NMFS expanded the survey to include 100 captains who fish the Atlantic Ocean, Gulf of Mexico and Caribbean Sea. Each week the captains report the number of hours they fished and their landings. Texas captains participating fish out of Galveston, Freeport, Port O'Connor and Corpus Christi and off South Padre Island.

"The survey still doesn't give us total catch or effort but lets us compute catch per unit effort, which costs less to determine and can be used in management decisions," said Brusher. "We think charter boat captains are a good source of catch and effort data because they know the best fishing spots, usually fish every day and are concerned with being as efficient as possible. So far the 1983 survey includes 25,000 hours of fishing and more than 100,000 fish landed."

Each month NMFS researchers compute, by region, the trolling and bottom-fishing catch per hour for selected species. The statistics are sent to participating captains and other interested persons. For a copy of the report on the 1982 pilot study, or to receive monthly reports of the 1983 survey, write the Panama City Laboratory, National Marine Fisheries Service, 3500 Delwood Beach Road, Panama City, Florida 32407-7499, or contact Brusher or Barbara Palko at (904) 234-6541.

House wants national fishing week

The U.S. House of Representatives has drafted a resolution that would establish National Fishing Week, tentatively set for June 4-10, 1984. Its purpose is to focus national attention on the social and economic importance of commercial and recreational fisheries in the United States. Plans are underway to have President Ronald Reagan officially endorse the resolution, and activities during the week would include fisheries conferences and a reception at the White House.

Sea Notes

■ Feenan D. Jennings, director of the Sea Grant College Program and the Office of University Research Services at Texas A&M University, was appointed to the Texas Coastal and Marine Council September 22 by Governor Mark White. Jennings replaces John C. Calhoun, Jr., Deputy Chancellor for Engineering Emeritus at Texas A&M.

Texas A&M Sea Grant Director since 1978, Jennings was formerly head of the National Science Foundation's Office for the International Decade of Ocean Exploration in Washington D.C.. He previously served as acting director of the Division of Ocean Sciences and deputy director of the Ocean Science and Technology Division, both within NSF. He is chairman of the National Academy of Sciences Committee on Storm Surges from Hurricanes and of the National Academy of Sciences committee to study regional oceanography programs for the Department of Energy.

The 16 members of the Marine Council serve six-year, staggered terms and are appointed by the Governor, the Lieutenant Governor and the Speaker of the House. Representing government, education, business, industry and the public, members serve as an advisory group on coastal and marine issues in Texas and evaluate current and potential marine-related problems for consideration by the Legislature.

■ Melvin Friedman, professor of geology at Texas A&M University, was appointed dean of the College of Geosciences by the Board of Regents of The Texas A&M University System, effective July 26. Friedman had been interim dean of the College since February when he succeeded Gordon Eaton, now Provost and Vice President for Academic Affairs.

Friedman joined the Texas A&M faculty in 1967. He holds bachelor's and master's degrees in geology from Rutgers University and the Ph.D. from Rice University. He is a fellow of the Geological Society of America and the American Association for the Advancement of Science. Friedman received the Faculty Distinguished Achievement award in Research from the Texas A&M Association of Former Students in 1975.

■ Annette Reddell Hegen, seafood consumer education specialist with the Texas A&M University Marine Advisory Service (MAS), was named 1983 Southeast Marine Advisory Service (SEMAS) Network Specialist of the Year at the annual Sea Grant Association Awards Banquet held July 13 in San Antonio.

Hegen, based in Port Aransas, promotes and tests fishery products of the Gulf of Mexico and travels throughout the state demonstrating to consumers and retailers how to handle, process and prepare fish and shellfish. She periodically holds seafood workshops in cooperation with agents of the Texas Agricultural Extension Service and has produced many publications and recipe cards for seafood, including fish, shellfish, crawfish and alligator.

Hegen received the bachelor's degree in home economics education from Southwest Texas State University and the master's degree in clothing and textiles and mass communications from Texas Tech University. She also attended the Culinary Arts Institute in Chicago. She was a seafood home economist with the Texas Parks and Wildlife Department for two years until her position was transferred to MAS, which she joined in 1977 as seafood consumer education specialist.

The Specialist of the Year Award, sponsored by the Southeast Fisheries Association, is the first such award to be given by SEMAS, an organization of marine agents and specialists in Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina and North Carolina.

■ Roy W. Hann, Jr., head of the Environmental Engineering Division of Texas A&M University's Department of Civil Engineering and the Texas Engineering Experiment Station, was awarded the 1983 Palladium Medal at the annual meeting of the American Association of Engineering Societies (AAES) held in New Orleans in May.

Hann has been a member of the Texas A&M faculty for 18 years and has been an adviser for clean-up efforts at most of the world's major oil spills since 1974. He has been a consultant on oil pollution abatement for seven national governments and 15 agencies and oil firms. Hann heads Texas A&M's Oil Spill Technical Assistance Program, which includes a team of researchers who provide onsite advice for oil spill clean-up.

The Palladium Medal, presented jointly by the AAES and the National Audubon Society, emphasizes the importance of cooperation between conservationists and engineers.

■ The Texas A&M University Marine Advisory Service (MAS) received the Hockaday Memorial Award for outstanding service at the Texas International Fishing Tournament (TIFT), held August 4-7 on South Padre Island. Jay Meade, president of TIFT, Inc., presented the award, which was established in 1967 in memory of tournament founder J.A. Hockaday. Meade said TIFT gives the award to someone who has shown dedication and willingness to work especially hard to support and improve TIFT. MAS is the first group to receive the award, usually presented to an individual.

MAS researchers participated in several tournaments this summer to determine that frozen fish are not entered in competitions. In TIFT and other tournaments, fish must also be judged "edible." MAS personnel analyze the fish in a mobile seafood quality and safety laboratory, with which MAS also tests seafood quality for Texas seafood plants and provides university researchers with information about seafood processing.

■ A graduate of Texas A&M University is one of eight students awarded scholarships for 1983-84 by The Society of Naval Architects and Marine Engineers. Garrett W. Leavitt, who received the B.S. degree in maritime systems engineering from Texas A&M in 1979, was chosen from a field of competitors from the United States and Canada. He is now a graduate student in ocean engineering at the University of Michigan. The Society's Scholarships Committee selected the recipients on the basis of character, leadership and promise for a future in the marine industry, as well as for scholastic ability and the desire to pursue advanced study. The Society is in its 28th year of support of graduate education.

■ The Texas Marine Mammal Stranding Network has received a $1,000 grant from the Harris and Eliza Kempner Fund of Galveston, according to Raymond J. Tarpley, Network director and a research associate in the Department of Veterinary Anatomy at Texas A&M University. The Network includes biologists, marine veterinarians, marine extension agents and interested citizens along the Texas coast who report beached porpoises and whales to Tarpley and his associates in the Department. The grant is the second part of a three-year, $3,000 grant from the Kempner Fund, established in 1946 to support worthwhile local projects, particularly in the fields of medical research and historic preservation. In a sense, the Network involves both.

"The goal of the Network is to try to save stranded animals that are still alive and, in the case of dead animals, to provide scientists with study specimens of these hard-to-come-by mammals," said Tarpley. Most marine mammals are on either the threatened or endangered species list. Scientists still are not sure why the animals beach and hope that by studying their remains they can better explain the phenomenon.

"Most of our responses to calls and purchases of supplies would not have been possible without the support of the Kempner Fund," he said. "I feel that the quality of the program and its services have increased as a result. The public seems to be more aware of the Network than ever before, and I think we're getting more reports for that reason. A total of 26 strandings were reported between June 1982 and April 1983."

Recent acquisitions, a truck for transporting specimens and a 24-hour telephone line for reporting strandings, should increase the Network's efficiency. To report a stranding at any time of day or night, call (409) 845-4344.

■ Several conferences on marine-related topics are scheduled for the upcoming months. Some are listed here.

November 2-3—*Offshore/Marine Industrial Trade Show 1983*, Brazosport, Texas. Contact Lobo's Trade Show, Box 45164, Baton Rouge, La. 70895, (504) 272-4545.

November 3-4—*16th Dredging Seminar*, College Station, Texas. Contact Dr. John B. Herbich, Director, Center for Dredging Studies, Texas A&M University, College Station, Texas 77843, (409) 845-4515.

November 3-5—*Third International Artificial Reef Conference*, Newport Beach, Calif. Contact Dr. John S. Stephens, Jr., Occidental College, Department of Biology, 1600 Campus Road, Los Angeles, Calif. 90041, (213) 259-2675.

November 7-8—*14th Underwater Mining Institute*, Madison, Wis. Contact Dr. J.R. Moore, Marine Science Institute, University of Texas at Austin, 200 East 26½ Street, Austin, Texas 78705, (512) 471-4816.

November 13-17—*36th Annual Gulf and Caribbean Fisheries Institute*, Port of Spain, Trinidad and Tobago. Contact James B. Higman, Executive Director, Gulf and Caribbean Fisheries Institute, 4600 Rickenbacker Causeway, Miama, Fla. 33149.

January 9-12—*9th Annual Tropical and Subtropical Fisheries Technological Conference of the Americas*, Brownsville, Texas. Contact Ranzell Nickelson II, Marine Project Supervisor, 442 Kleberg Center, Texas A&M University, College Station, Texas 77843.

January 9-13—*13th Dredging Short Course*, College Station, Texas. Contact Dr. John B. Herbich, Director, Center for Dredging Studies, Texas A&M University, College Station, Texas 77843, (409) 845-4515.

February 12-17—*7th Annual Energy-Sources Technology Conference & Exhibition*, New Orleans. Contact Frank Demarest, ETCE Exhibits, P.O. Box 59489, Dallas, Texas 75229, (214) 247-1747.

February 28-29—*Seafood '84*, Boston. Contact William Bower, Denex International, 615 Martin's Point, Friendship, Maine 04547, (207) 232-6346. ■

New Publications

The following publications are available from the Marine Information Service, Sea Grant College Program, Texas A&M University, College Station, Texas 77843. Prices quoted are for single copies; write for prices for multiple copies. Please request publication by both title and TAMU-SG number, and send a check payable to Texas A&M University.

Environmental Quality

Computer-Accessible Annotated Bibliography of the Corpus Christi Bay Estuary. R. Warren Flint. 280 pages. $5. **TAMU-SG-83-605.**

The Corpus Christi Bay system is one of Texas' major estuaries, with a surface area of almost 600 square kilometers of water, grass beds, tidal flats and salt marshes. Unlike most U.S. estuaries, the Corpus Christi Bay system is located in a semi-arid climate, one that receives less than 70 cm of rain annually. Evaporation exceeds precipitation, causing the water to be hypersaline. Droughts, floods and hurricanes cause continual environmental variation, and the estuary is compartmentalized into several bodies of water with different hydrological and sedimentary regimes.

Recent changes have been associated with human activity in the area, such as dredging, shipping, sewage disposal, filling of wetlands, and energy exploration. This annotated bibliography compiles citations of publications relating to the physics, chemistry, biology and sociology of the Bay system, information that will be useful to those who study the ecology and dynamics of the Bay and the effects of development on the system and the area. A list of key words directs the user to citations by subject area.

Fisheries

Contracting Problems and Regulation: The Case of the Fishery. Ronald N. Johnson and **Gary D. Libecap.** *In* Amer. Econ. Rev. 72(5):1005-1022. 18 pages, 2 figures. $1. **TAMU-SG-83-809.**

User Guide for General Bioeconomic Fishery Simulation Model (GBFSM). Wade L. Griffin and **William E. Grant.** 117 pages, 14 figures. $5. **TAMU-SG-83-204.**

This manual describes a General Bioeconomic Fisheries Simulation Model (GBFSM) designed for use in management programs of marine fish species that do not exhibit a significant relationship between the size of the parental population and the number of young recruited into the fishery. The purpose of GBFSM is to predict how alternate management policies would affect a fishery.

Effects are assessed in terms of total harvest; species, size-class and seasonal distribution of the harvest; total revenue, fishing costs and rent in the fishery; and distribution of revenue, costs and rent among different classes of fishing vessels. The user may select any number of species, size classes, fishing areas, depths and vessel classes for inclusion in the model. The model's design is versatile enough to be applicable to a wide range of fisheries.

Changes in LH and Progesterone Associated with the Nesting Cycle and Ovulation in the Olive Ridley Sea Turtle, *Lepidochelys olivacea*. Paul Licht, David W. Owens, Kim Cliffton and **Cuauhtemoc Penaflores.** *In* Gen. Comp. Endocrinol. 48:247-253. 7 pages, 2 figures, 1 table. $1. **TAMU-SG-83-815.**

Mariculture

Maturation, Reproduction, and Growth of *Penaeus vannamei* and *P. stylirostris* Fed Natural Diets. G.W. Chamberlain and **A.L. Lawrence.** *In* J. World Maricul. Soc. 12(1):209-224. 16 pages, 3 figures, 1 table. $1. **TAMU-SG-83-805.**

Effects of Temperature and Salinity on Egg Hatching and Larval Survival of Red Drum, *Sciaenops ocellata*. Joan Holt, Robert Godbout and **C.R. Arnold.** *In* Fish. Bull. 79(3):569-573. 5 pages, 4 tables. $1. **TAMU-SG-83-811.**

The Effects of Fatty Acid and Shrimp Meal Composition of Prepared Diets on Growth of Juvenile Shrimp, *Penaeus stylirostris*. J.L. Fenucci, A.L. Lawrence and **Z.P. Zein-Eldin.** *In* J. World Maricul. Soc. 12(1):315-324. 10 pages, 2 figures, 3 tables. $1. **TAMU-SG-83-806.**

References

Saltwater Fishes of Texas: A Dichotomous Key. Edward O. Murdy. 220 pages, spiral bound, 500+ drawings. $7. **TAMU-SG-83-607.**

In the 10 years since the publication of the second edition of *Key to the Estuarine and Marine Fishes of Texas,* many studies have improved our knowledge of Texas marine fishes. Notable among these works are Bright and Cashman (1974), Hoese and Moore (1976) and the FAO Species Identification Sheets for the Western Central Atlantic (1978). These publications and other sources provided the impetus and much of the new information for *Saltwater Fishes of Texas.*

The new key retains the format and style of the earlier key, but roughly 50 percent of the keys have been updated at the ordinal, familial and species levels. *Saltwater Fishes of Texas* includes 130 species not found in the earlier volume and contains more than 500 new drawings of fishes and diagnostic structures referred to in the keys.

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