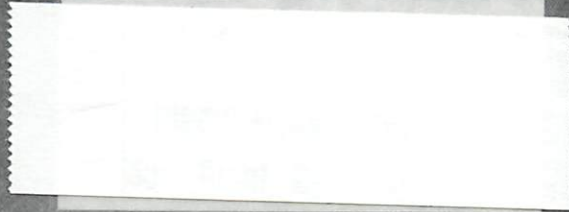


NCU-Q-84-001



Sea Grant in North Carolina 1983-1984

About the cover

Photographer Scott Taylor captured this shot of the Beaufort harbor late at night.

From the Director

We are completing our first 15 years of Sea Grant in North Carolina. I have had the exciting opportunity to preside over the past 12 years — years of transition within a changing world. Even though conditions have changed, we maintained the common thrust of bringing university research and information to the docks and shorelines. The need for good information to assist good people still drives the university toward greater challenges.

This report focuses on those projects that have shown significant progress during the past two years. Just as our program philosophy is directed at solving people problems in the coastal zone, our report features people interactions with technical information.

Our central management team changed during the past two years. Kathy Hart joined Ron Hodson and Jim Murray as assistant director and leader of the communications program. Kathy came through the ranks, joining our communications staff several years ago.

I am looking forward to the next 15 years. I am confident that they will be as challenging as the first 15. It is equally apparent that the coming years will witness more change and increased awareness by the people we serve.



(Left to right) Jim Murray, B.J. Copeland, Kathy Hart and Ron Hodson.

B. J. Copeland



Introduction

Sea Grant is teamwork. It's organizing groups of scientists — biologists, engineers, sociologists and geologists — to tackle the problems nagging at coastal North Carolina.

The problems may be as complex as algae blooms on the Neuse River or as simple as teaching a fisherman how to shed crabs. But whatever it is, Sea Grant knows how to draw together the expertise to find a solution. Sometimes the knowledge can be found in the laboratories of North Carolina's universities. Other times it's Sea Grant's marine advisory agents or specialists who provide the answers.

In North Carolina, Sea Grant has been producing results since 1970. It started as a small program funded by federal and state money to do applied research. Today Sea Grant is a unique blend of research, advisory services, education and communication. Like the other 30 Sea Grant programs, our program solves coastal problems and shares the answers nationwide.

During 1983-1984, Dr. Copeland and his administrative staff focused research in six areas: fisheries, water quality, seafood technology, coastal processes, aquaculture and estuaries. Forty-five scientists teamed up to complete 40 research projects. Sea Grant's Marine Advisory Service, modeled after the agricultural extension service, employed 12 agents and specialists to meet the public head on. And three communicators reported the program's findings to those people making decisions about our coastal resources.

This biennial report highlights the program's achievements during the last two years. Through its pages, you'll meet the players that formed Sea Grant's winning team. ■



Farming takes the upland; fishing, the lowland. Never the two shall meet. Right? Not exactly.

In eastern North Carolina farmland is lowland. To be used agriculturally, this land must be drained. And the most likely outlet for this fresh water is the nearby estuary. That's where fishing and farming meet — head on.

Farmers must flush their fields. But fishermen believe this massive influx of fresh water is reducing their catch. It's a dilemma that has federal and state agencies fishing for answers.

For solutions, Sea Grant researchers Wayne Skaggs, J.W. Gilliam, Len Pietrafesa, John Miller and Jim Reed of N.C. State University approached the problem from the land and the water.

Skaggs and Gilliam took the earthy approach. They developed a computer model to predict how different agricultural practices and drainage methods would affect the amount of water fun-

neled from the fields. So far they have learned that alternative drainage methods can reduce outflow and, perhaps, improve water utilization by crops.

Soundside, Pietrafesa mounted gauges and sensors in Rose Bay to test salinity changes. He learned how salinity responded to freshwater influxes and sound physics — wind speed and direction, current speed, water levels and temperature. His results will be plugged into a model that can predict the effects of freshwater inflows on salinity.

Questions about these effects on fish had Miller and Reed wading through Rose Bay. They wanted to learn how much fresh water a young fish can tolerate. Miller found that minimal changes did not affect the youngsters. But as the changes became more drastic, so did the fish's response.

First the fish temporarily redistributed. With greater salinity drops, the fish moved to salty, open waters that left them vulnerable to predation. And if the drop was drastic, the fish or their food supply died.

From these Sea Grant projects, scientists learned more about the land/estuarine interaction. The results also spurred the Governor's Task Force on Water Management to recommend the

state legislature fund further research. The legislature appropriated money for a demonstration site on Broad Creek in Hyde County. A scientific team, coordinated by Sea Grant Director B.J. Copeland, will complete this project.

To balance the scales between fishing and farming in eastern North Carolina, Sea Grant cosponsored several water management programs with the N.C. Agricultural Extension Service. These meetings brought fishermen and farmers together with the facts about how the estuaries work.

For a look at estuaries coast to coast, Sea Grant hosted the National Estuarine Symposium, which was sponsored by the National Sea Grant College Program and the National Marine Fisheries Service. Some of the nation's best estuarine scientists gathered at the symposium, peered into the future and suggested research strategies to manage the nation's estuaries. ■



(Above, left to right) Len Pietrafesa, J.W. Gilliam and John Miller test the water's salinity level.



(Left) Land drainage may be affecting the quality of estuarine life.

Water Quality

The surface scums affect the fish below and the waters downstream.

Blue-green algal blooms look bad, smell bad and stain boat hulls and bathing suits. Some say the blooms taint the taste of drinking water in the cities and towns along the lower Neuse River. But the problem goes deeper than that.

Ecologist Hans Paerl of the University of North Carolina at Chapel Hill and biologists Don Stanley and Bob Christian of East Carolina University

learned the surface scums affect the fish below and the waters downstream.

During hot, dry summers, the blooms pop to the surface of North Carolina's Neuse River — a river rich in the nutrients nitrogen and phosphorus. Nutrients are pumped into the river from municipal and industrial waste treatment facilities, and they wash off of fertilized farmland and city streets.



(Left to right) Bob Christian, Hans Paerl and Don Stanley will help managers determine nutrient loads for the state's coastal rivers.



Mark Sobsey studies the uptake and elimination of hepatitis A in clams and oysters.

A microscopic view of a type of blue-green algae found in the Neuse and Chowan rivers.

Paerl learned the malodorous scums play havoc with the river's food chain. Blue-green algae, which is a form of phytoplankton, is inedible or toxic to most zooplankton. The algae's abundance, inedibility and toxicity alter the zooplankton communities, which, in turn, adversely affect the fish — bass, flounder and menhaden — that feed on them.

Downriver, the algal blooms die as they meet the brackish waters of the estuary. Stanley and Christian learned the massive die-off creates new problems. The decomposing blooms release a new round of nutrients into the estuary. These nutrients spur the growth of estuarine algal blooms, which may have ramifications on the estuarine food chain.

These Sea Grant findings are significant. They have been used by the state's Environmental Management Commission to consider tougher water quality standards for the Neuse River. They have been presented to the state legislature, where the blooms flowered controversy over a statewide phosphate ban. And they were heard in the nation's capital, where the Potomac River blooms in view of the Capitol and White House.

Blue-green algae isn't the only water quality problem troubling Tar Heel waters. Malfunctioning septic tanks, waste treatment plants, and municipal

and agricultural runoff close thousands of acres of estuary to shellfishing each year.

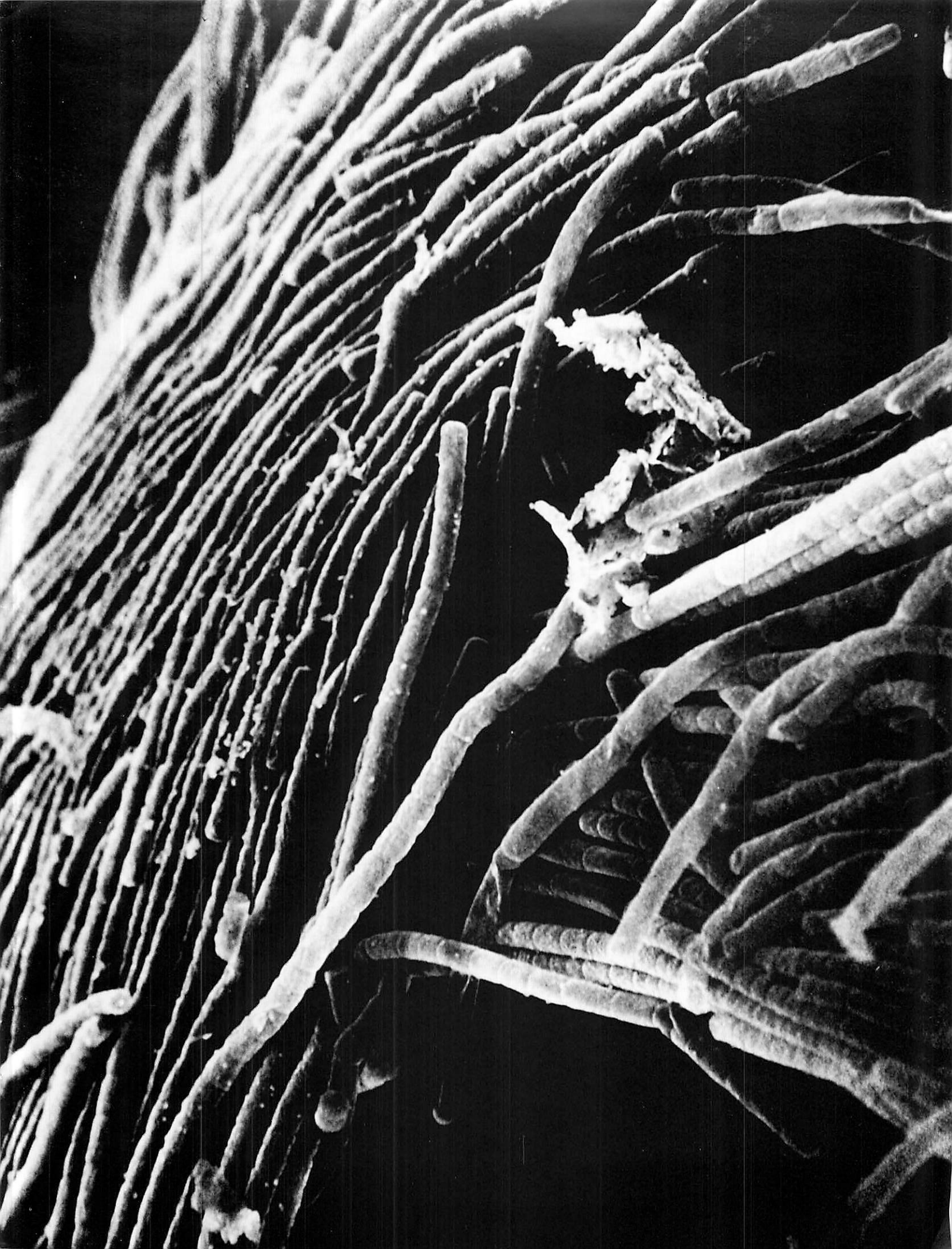
To salvage this lost resource, some states use depuration facilities. Fishermen bring contaminated clams and oysters to these plants and place them in large tanks of clean water. There, the bivalves purge their contaminants, sometimes harmful viruses that cause gastroenteritis or hepatitis A.

These viruses, particularly hepatitis A, have Mark Sobsey concerned. Sobsey, a biologist at UNC at Chapel Hill, wants to be sure all viruses are eliminated from shellfish under depuration conditions, thus protecting this valuable tool of salvage and ensuring the health of the public.

First, he evaluated hepatitis A detection methods. He tested a method he developed against those of the Food and Drug Administration and the National Marine Fisheries Service. His method proved best.

Then he built a laboratory depuration system to determine how well poliovirus and hepatitis A were eliminated from shellfish. Most of the poliovirus was eliminated in two to three days, but the hepatitis A virus persisted. Sobsey says other factors, such as temperature, flow rate, density or the addition of disinfectants, may increase the elimination of hepatitis A.

With the growing interest in depuration facilities, Sobsey's work will help to evaluate and modify current cleansing methods. ■





Fishermen catch fish. It sounds simple, but there are a lot of in-betweens — in-betweens that sometimes mean fishermen don't catch fish. Things like too few fish, too many fishermen, gear inefficiency and regulations.

In its fishery research, Sea Grant concentrated on these in-betweens, the obstacles that sometimes prevent fishermen from catching fish.

Biologist Charles Peterson of the University of North Carolina at Chapel Hill provided answers to a problem that was — all clammed up. North Carolina fishermen rake, dredge and kick up thousands of bushels of hard clams every year. The intense harvest has resource managers worried. Can this long-lived bivalve withstand the pressure?

Peterson's research indicates the clam needs grassy protection. He found that clams survive better nestled in a grass bed than lying on the bare sound floor. And in these beds, he found a

stock of breeding older clams (up to 47 years old) that had been rumored unproductive. These findings further support N.C. Division of Marine Fisheries policies of grass bed protection.

And for those who don't rely on chance for a bushel of clams, Peterson provided "gardening" tips. He determined which sizes of hard clams were most vulnerable to predation by blue crabs. Now clam gardeners can size up their crop for optimal survival. To keep predators out of the garden, Peterson tested several exclusion methods.

In the fish-eat-fish world of Bogue Sound, what factor increases or decreases a fish's chance of survival? Dave Colby of the National Marine Fisheries Service and Ken McKay of the Duke University Marine Laboratory say it's the fish's habitat. An estuarine habitat rich in variety — grass beds, rocky bottoms and flat substrate — provides more refuge and increases a fish's chance of survival.

Disease can be another roadblock in a fish's fight for survival. Many people call the lesions that appear on fish "red-sore," but N.C. State University veterinarian Ed Noga says red sore is actually numerous diseases. In Albemarle Sound, most lesions are caused



Charles Peterson (center) counts clams used in predation tests.

by parasite infestations. But in Pamlico Sound the cause is often a fungal organism. Noga plans to research the causes of these problems, but meanwhile he's helping local, state and federal officials correctly indentify the disease inside and outside North Carolina.

But fishing isn't all fish. People tow the line. They are the ones affected by too few fish or changes in regulations.

Jim Easley, Tom Johnson and Ann McDermed, economists at N.C. State University, took a speculative approach to the scallop fishery using a computer. They set up a program, then keyed in information about scallop biology and the socioeconomics of the fishery. The bottom line? Fishermen would make more money if the scallop fishery delayed its opening until after Christmas and extended the season until the end of February.

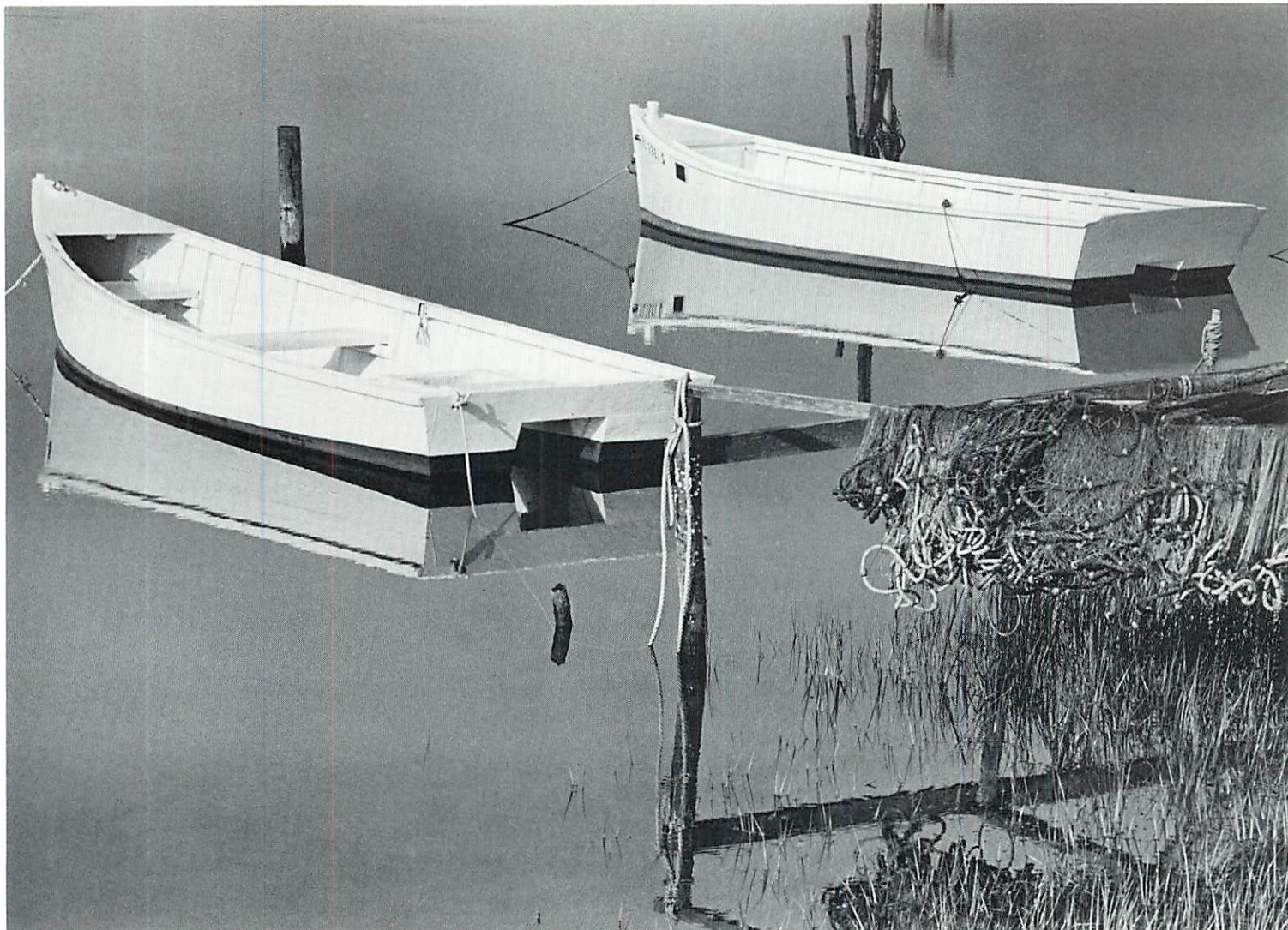
Economist Vito Blomo of East Carolina University studied the impact on the menhaden fishery of proposed changes in regulations. His information

will be used by the N.C. Marine Fisheries Commission as they come to grips with the problems of overfishing.

Similarly, ECU anthropologist John Maiolo learned some hard facts about hard crabs. Competition is growing between full-time and part-time crabbers. Maiolo answered questions such as who gains from the fishery, how much and when. Resource managers can use Maiolo's findings to lessen competition.

When it comes to passing out information about fishing innovations, ECU anthropologist Jeff Johnson found fishermen are cliquish. They tend to group around a leader—a highliner—a fisherman who knows his business and tries new things. Knowing how fishermen pass information will help marine advisory agents nationwide get more information to the right people.

Marine Advisory Service agent Bob Hines has found one way to reach a lot of fishermen about new types of nets, electronics and boats: the N.C. Commercial Fishing Show. In 1984, Hines organized a show that attracted about 55 exhibitors and 5,000 to 6,000 attendees. The only one of its kind between Baltimore and Miami, the show provides an annual opportunity for the state's watermen to see, compare and purchase equipment and to hear the latest information on research, management and fisheries development through a weekend seminar series.



Tools of the trade.

Gear is that all-important link between fish and fishermen. This year, Sea Grant scientists and advisory agents experimented with several new types of gear:

▷ MAS agent Jim Bahen tested the use of small, wire-mesh traps to catch shrimp. He found the traps to be unproductive.

▷ Bahen also tested a shrimp extruder trawl, which allows the byproducts of shrimping, small fish, crabs and trash, to be released during trawling. Bahen found the net effective.

▷ ECU biologists Graham Davis and Steve Harlan experimented with "grass" peeler pots in Pamlico Sound. They

hung strips of plastic inside the pots to resemble natural grass. They hoped these "refuges" would attract the predominately male peeler populations of Pamlico Sound. The pots did catch more peelers than unadorned pots.

▷ MAS agent Wayne Wescott investigated several filtering systems for closed-system soft crab shedding operations. He found one inexpensive system to be effective. ■



Aquaculture

An obvious possibility for aquaculture was the striped bass.

During the cold winter months, temperatures outside Sea Grant's Aquaculture Center in Aurora sometimes plunged to zero. But in tanks inside a passive solar greenhouse, striped bass hybrids swam in 70-degree water temperatures.

UNC Sea Grant Associate Director Ron Hodson and Marine Advisory Service agent Randy Rouse built the greenhouse to test the feasibility of raising fish year-round. They found that even when the weather was harsh on plants and animals outdoors, fish in the greenhouse fared well.

Along with Sea Grant's other aquaculture projects, the greenhouse ultimately addressed a single issue—opening the way for a new industry in the state.

An obvious possibility for aquaculture was the striped bass. Since 1974, commercial and recreational catches of the prized fish have dwindled. But the striper appeared to perform poorly in culture operations. Now Sea Grant re-

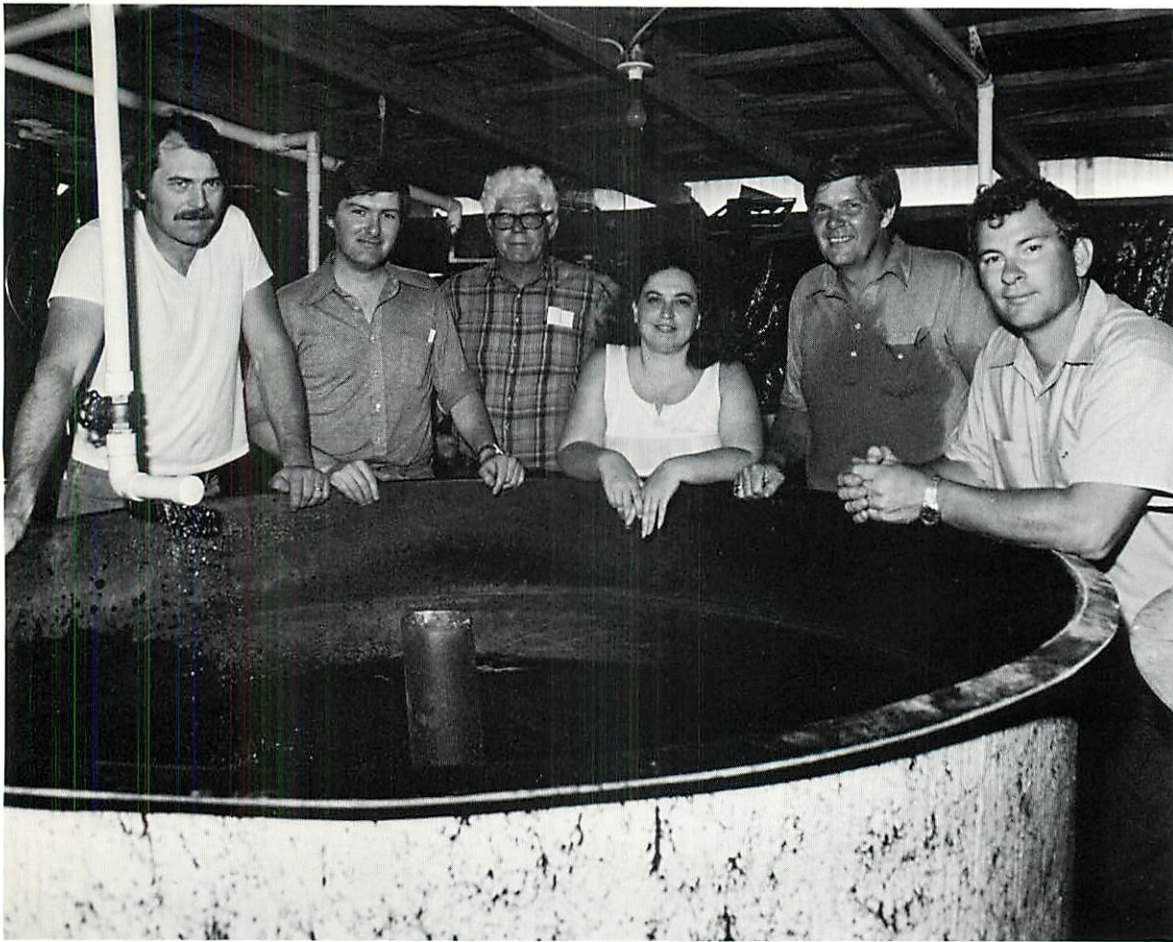
searchers are offering striped bass enthusiasts an alternative at the dinner table, and they're supplying the fledgling aquaculture industry with a viable candidate for culture.

N.C. State University biologists Howard Kerby and Melvin Huish found that a striped bass x white bass hybrid exhibits superior growth rates, improved survival, greater disease resistance and general hardiness and adaptability. In 1983 and 1984, the researchers improved techniques for culturing the hybrids to commercial size in ponds. Through genetic manipulation, Kerby successfully produced triploid fish. A triploid hybrid may have the potential for faster growth, and it's sterile, abating concern of fisheries managers that hybrid stocks might breed with wild stocks.

The success of the aquaculture industry depends on a low-cost nutritional feed for the fish. By finding the best food, Margie Gallagher, a nutritionist at East Carolina University, optimized the effects on the fish's growth, body composition, metabolism and digestion of protein.

The industry faces another hurdle—the control of disease problems. Aquaculturists estimate parasites cost them \$50 million annually. At the NCSU

Howard Kerby adjusts the flow of water into jars of incubating eggs.



School of Veterinary Medicine, Ed Noga developed culture methods for these parasites, making it easier for researchers to study the problem.

At the Aquaculture Center in Aurora, Rouse took the researchers' work a step further. He passed their findings on to potential aquaculturists. Over 170 people stopped by the center to find out more about aquaculture, and Rouse answered 200 additional requests for information. A three-day workshop on hybrid culture drew participants from industry, universities and private enterprise.

Hodson and Rouse also provided technical advice to the Waccamaw-Siouan Indians in a state-supported project to culture striped bass hybrids and channel catfish.

The striped bass isn't the state's only hope for establishing an aquaculture industry. In 1983 MAS agent Wayne Wescott revived the soft crab fishery. Through workshops, publications and on-site training, Wescott spurred fishermen to turn soft crabs into hard cash. In 1984, the state's gross sales of soft crabs increased by an estimated \$2 million. To help crabbers improve their shedding methods, Ronald Sizemore, a biologist at the University of North Carolina at Wilmington, concentrated on lowering the mortality rates of "peelers." He isolated several bacteria that may be the culprits in high mortality rates. ■



(Left, left to right) Ron Hodson, Ed Noga, Melvin Huish, Margie Gallagher, Howard Kerby and Randy Rouse.

(Above) Howard Kerby (center) squeezes eggs from a female striped bass.

Lanier and Thomas found that menhaden could be transformed into a high quality surimi.

What fish is most like the soybean? For researcher Tyre Lanier, the answer is easy: menhaden. In fact, Lanier thinks the similarities are so strong that he nicknamed the fatty, oily fish “the soybean of the sea.”

At the turn of the century, he explains, soybean research resulted in edible oils and protein concentrates. Now, one or both of those ingredients can be found in almost every domestically manufactured food product.

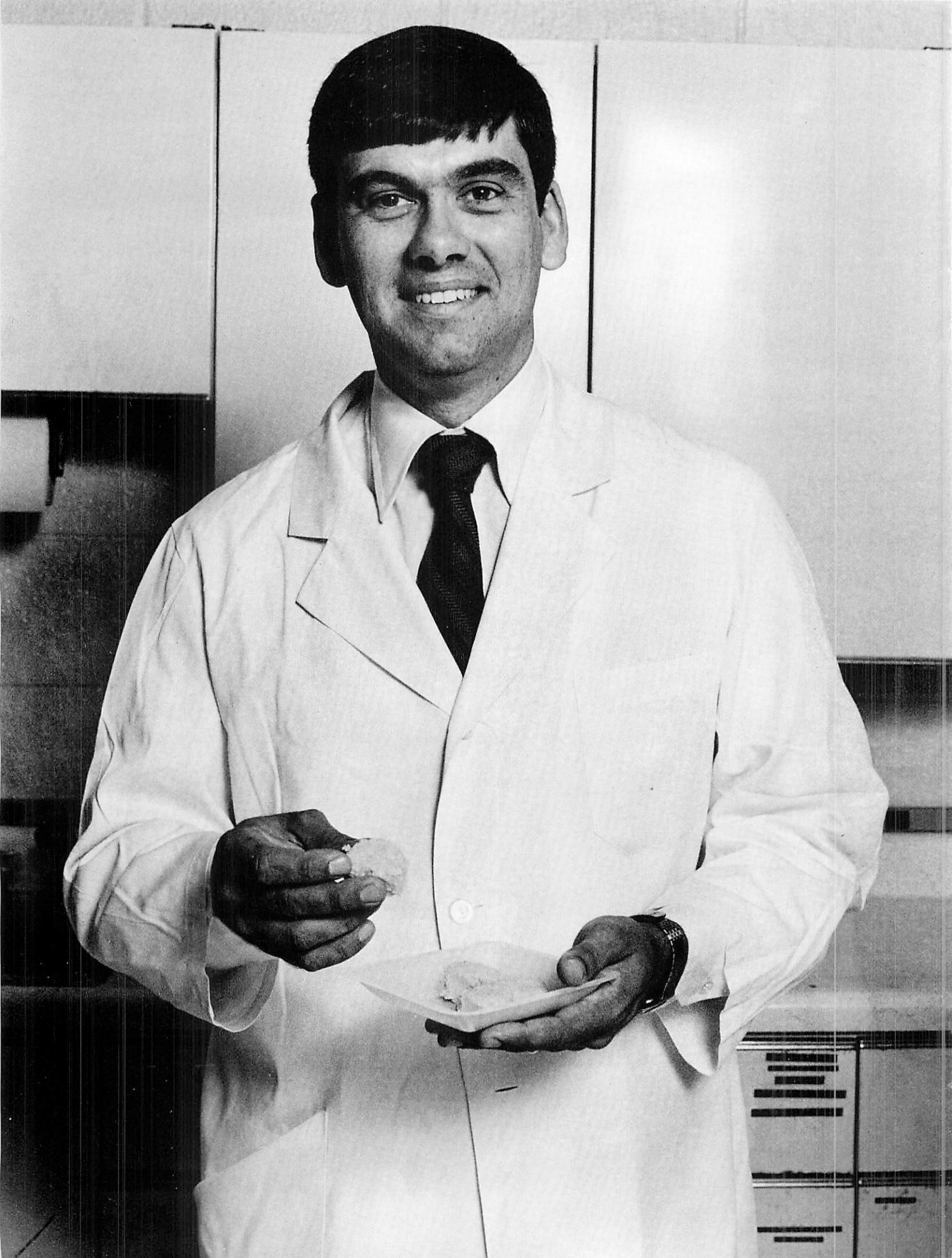
Lanier, an N.C. State University food scientist, predicts a similar outcome for the currently underutilized menhaden. While the menhaden fishery is the nation’s largest in terms of volume, its

value per pound ranks well below other species. The reasons are simple: the menhaden has always been an industrial fish. Until now, it has been used for fertilizer and for chicken feed, but it’s never made it to the dinner table.

Sea Grant research may change that. Lanier and NCSU food scientist Frank Thomas demonstrated that menhaden, as well as some other underutilized species, could be transformed into a high-quality surimi — a minced fish product developed by the Japanese. By water washing the mince, they end up with a protein concentrate suitable for use in restructured seafood products such as shrimp, scallops and crab legs.



(Left to right) Frank Thomas, Donald Hamann, Tyre Lanier and Allen Chao fish for ways to get underutilized species to the table.



The natural counterparts of these foods are high in demand and in price. But the restructured product is low in cost and high in food value. As a result of their research efforts, Thomas and Lanier were given the Earl P. McFee Award for excellence in fisheries technology.

To aid food processors in the formulation and mass production of a menhaden surimi-based seafood product, Lanier and NCSU food scientist Donald Hamann examined the unique gelling properties of the fish proteins. They found that surimi may prove useful as a food ingredient in many non-seafood products as well.

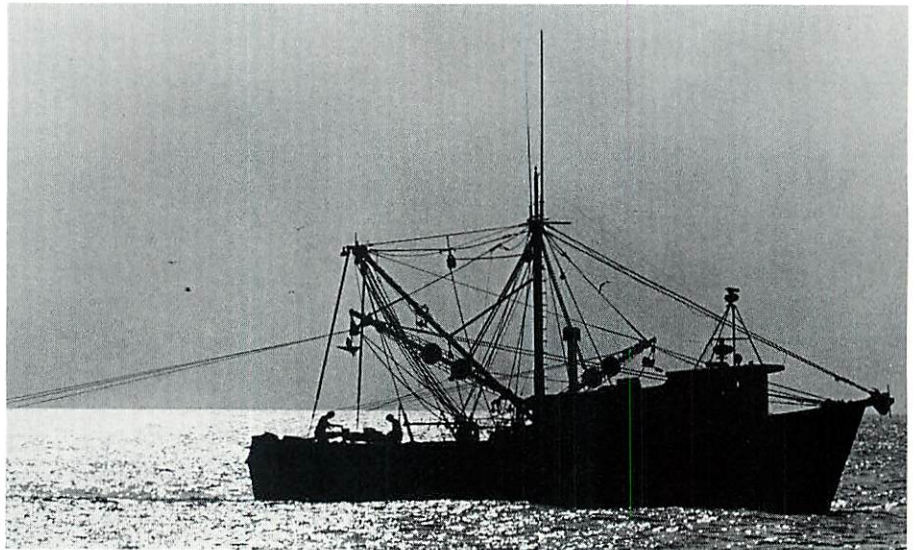
Surimi may be on its way to the baby food shelves. Under the guidance of Frank Thomas, Laura J. Mackintosh, a master's student in food science at NCSU, completed research on a project, funded jointly by Sea Grant and the National Fisheries Institute, that developed baby food made out of surimi.

As a result of the success of these surimi projects, Congress authorized up to \$1 million for industrial research projects to support the development of a menhaden surimi industry on a commercial scale. And the work spurred the development of a pilot facility for surimi production. In Raleigh, the world's largest processor of surimi-based food products, Kibun Products International, constructed a plant for the manufacture of simulated crab-leg products.

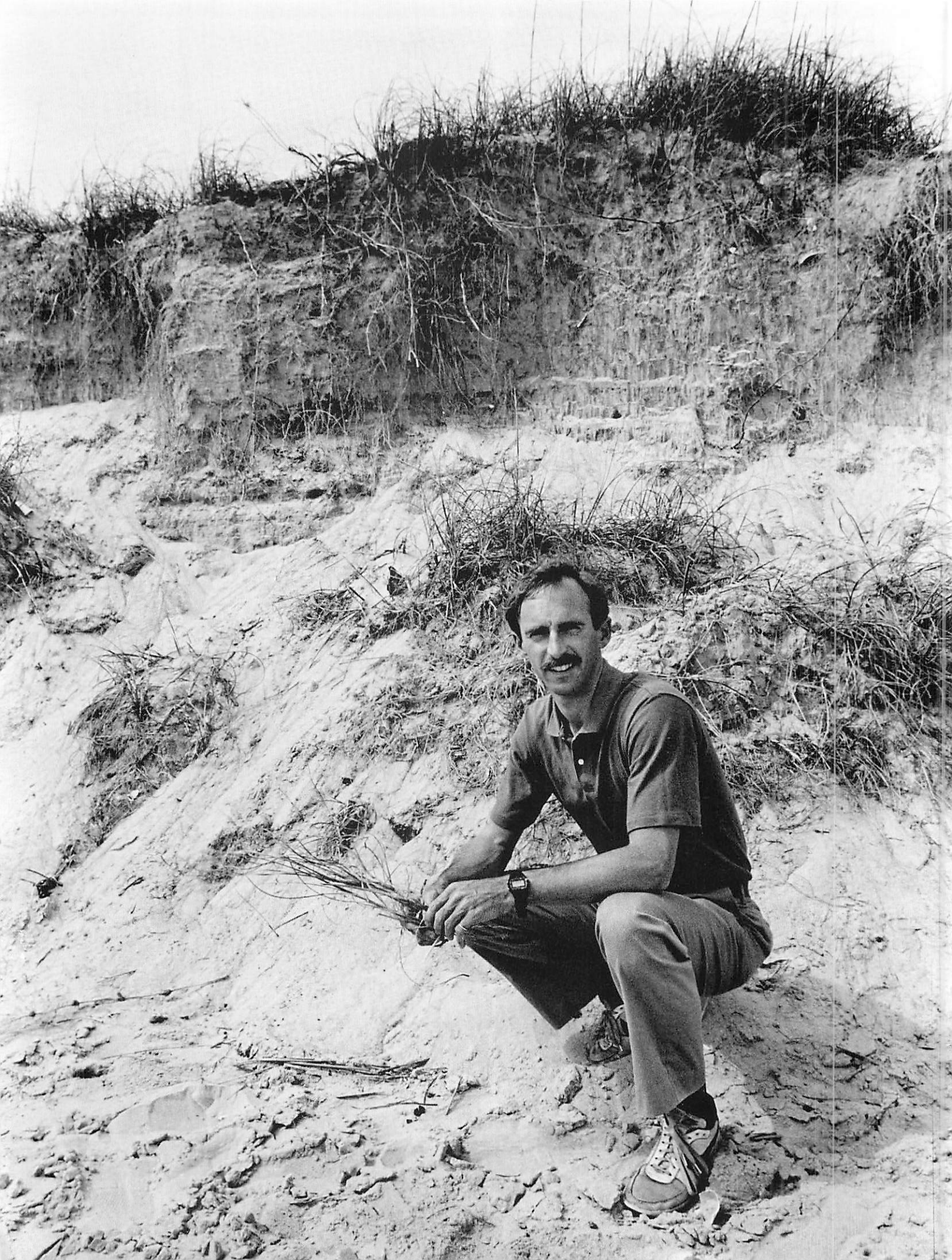
Seafood processing operations such as these require huge volumes of water. But Allen Chao, a civil engineer at NCSU, devised a way to use less water and to recover some of the organic matter produced in the surimi process. The conventional washing process requires a water volume 9 to 15 times the volume of the finished product, and it generates a large effluent treatment load. But his proposed process may reduce the water requirement by up to two-thirds.

MAS specialist Sam Thomas and agent Joyce Taylor delivered the results of Sea Grant's seafood research to the industry. Thomas helped seafood processors improve their processing capabilities, and Taylor improved seafood's image with the public. ■

Tyre Lanier samples surimi-based seafood product.



Shrimp boat trawls waters off Carolina Beach for an early morning catch.



Coastal Processes

Rogers saved the state over \$20,000 by repairing damaged dunes with recycled Christmas trees.

Erosion continues to gnaw at North Carolina's coast. It's one of the forces slowly altering the shape and face of our shoreline. The changes, natural or man-made, are inevitable. But Sea Grant is helping to take some of the guesswork out of the future of our coastal resources.

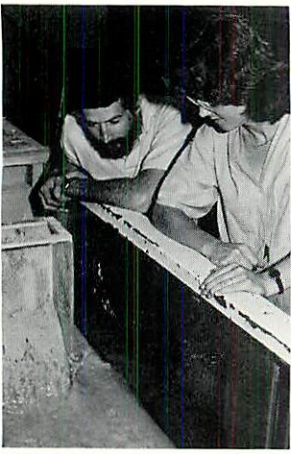
Making scientific predictions was the aim of civil engineers John Fisher and Margery Overton at N.C. State University and Spencer Rogers, a coastal engineer with Sea Grant's Marine Advisory Service. They used a test dune, a wave tank and computers to develop a model for assessing how much erosion takes place during a storm. Their findings should benefit scientists designing protective man-made dunes and planners estimating damage from future storms. These long-term shoreline predictions also will help property owners, coastal managers and developers determine suitable areas for construction.

Rogers took steps to help coastal property owners improve their chances against corrosion, erosion and fierce storms. He worked with the N.C. Building Code Council to implement hurricane-resistance standards along the coast. And Rogers saved the state over \$20,000 by repairing damaged dunes with recycled Christmas trees at the Fort Fisher State Recreation Area. In recognizing corrosion as a constant coastal problem, Rogers recommended builders use wooden wind anchors rather than corrosive metal straps as connections in wooden buildings.

With the increased need for better planning on the coast, planner David Brower at the University of North Carolina at Chapel Hill helped train tomorrow's managers. Brower coordinated a university program that examined legal and policy issues such as beach access, public trust rights and the effects of the condominium boom on local government. Research from the program, conducted primarily by law and planning students, helped state and federal agencies deal more effectively with ocean policy issues.

Sea Grant's coastal law specialist, Walter Clark, worked with Brower, informing state agencies, lawyers, coastal

Spencer Rogers examines dune erosion near Atlantic Beach.



John Fisher and Margery Overton watch simulated wave action in an experimental tank.

managers and the public on environmental and legal issues concerning our coast. Clark researched issues such as riparian rights and aquaculture regulations, then shared his findings through publications, workshops, letters and university classes. In 1984, Clark co-taught an undergraduate course at NCSU addressing coastal issues with marine education specialist Lundie Spence. Clark organized workshops on North Carolina's environmental law and on estate planning.

Improved management of resources and growth may pay off for coastal towns that attract thousands of visitors each year. John Maiolo, an anthropologist at East Carolina University, studied the growth of overnight recreational populations in eight coastal counties. His results gave researchers and policy-makers a basis for assessing growth and its impact on coastal resources.

With increased development, many oceanfront towns face higher demands on their water resources and problems with wastewater loads and water quality. To help reduce this problem, soil scientist Craig Cogger of NCSU examined the ability of different soils on the Outer Banks to treat wastewater. His data will be used by health departments and agencies to establish and enforce safe regulations for on-site waste treatment facilities.

The influx of people on the barrier islands has caused changes in land use, too. Geographer Simon Baker from ECU devised a uniform system for mapping present land use and land cover on the islands. This classification system, which uses aerial photography, can be used by planners and local and state agencies. Baker's survey can also be used as benchmark data for future changes expected on the Outer Banks.

Another kind of mapping went on miles offshore on the continental shelf. Geologists Scott Snyder and Stan Riggs of ECU recorded hardground formations on the ocean floor rich in minerals and phosphates.



Hardgrounds attract a great number and variety of fish because they serve as attachment sites for food sources such as algae, sponges and coral. To help commercial and recreational fishermen locate these prime fishing areas, Snyder and Riggs mapped the hard-ground mesas. They also studied the potential mineral resources found in hardgrounds such as cobalt, nickel, platinum, gold and uranium.

In addition, the team's research included a study of the development and formation of phosphates. Snyder and Riggs learned about the distribution of sediments, which will help them classify hardgrounds and determine their age and origin.

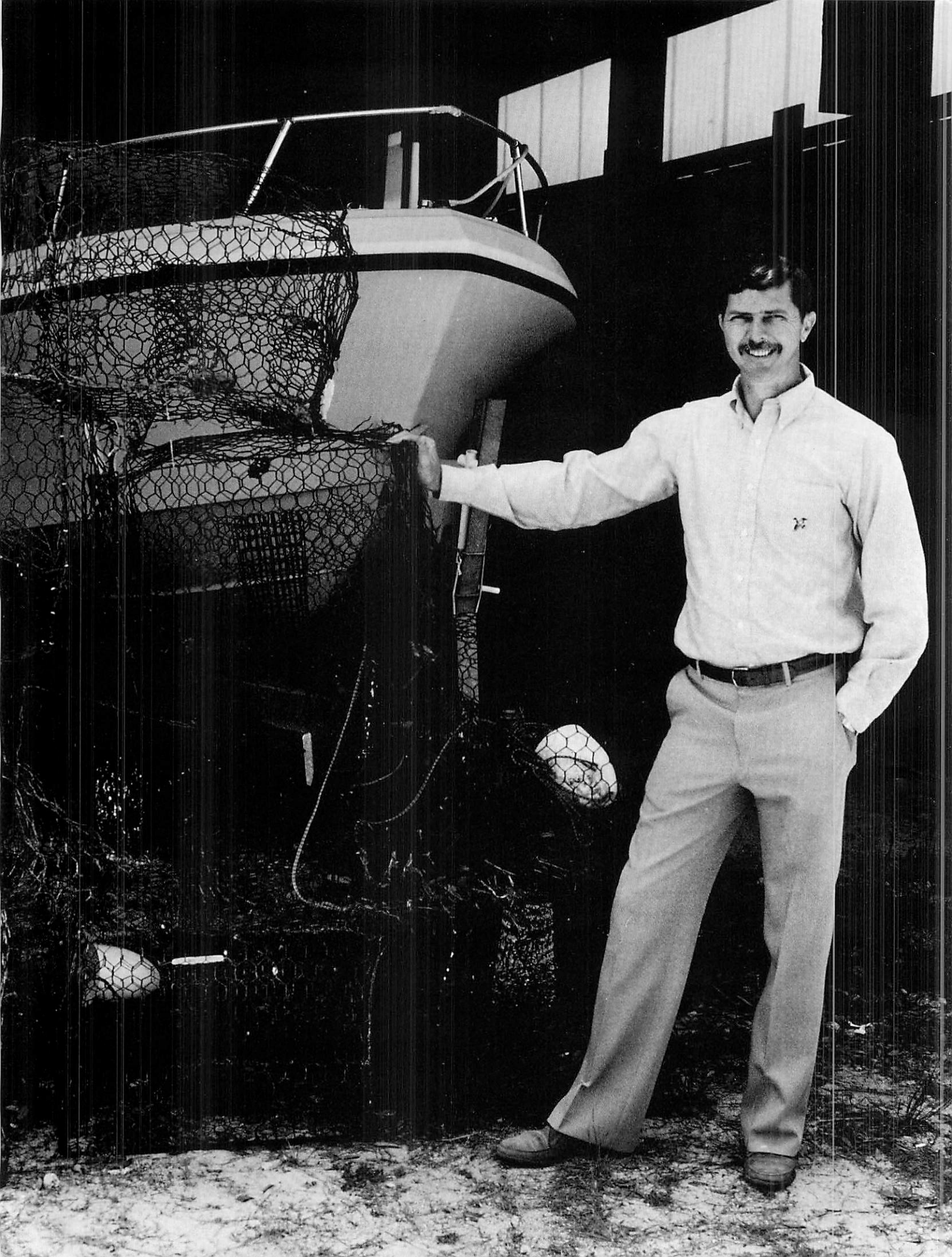
In other Sea Grant research, ornithologist James Parnell of the University of North Carolina at Wilmington com-

pleted the second stage of a survey of North Carolina's estuaries and barrier islands, locating and counting colonial waterbirds.

Comparisons with a similar survey in 1977 revealed that total bird populations increased with such species as laughing gulls, royal terns, white ibises and brown pelicans. Other colonies' numbers declined. Parnell also found fewer and larger colonies that tended to nest mostly on dredged material sites. These findings may help promote the preservation of the coast's waterbird populations and available nesting sites. ■

(Above left) Increased oceanfront development spurs the need for better management.

(Above) Hardgrounds store mineral deposits, and their abundant flora attract a variety of fish.



Marine Advisory Service

Marine advisory specialist Wayne Wescott sold North Carolina fishermen on the idea of soft-shell crabbing. The bottom line was this: At the beginning of the 1983 crabbing season, the highest recorded price for hard crabs was \$1 per pound. At the same time, soft crabs were bringing as much as \$2.33 each or \$28 per dozen.

Wescott went to work, compiling information, visiting shedding facilities and presenting workshops. An article in **Coastwatch** on soft-shell crabbing resulted in several hundred requests for information. His book, **A Guide to Soft Shell Crabbing**, was distributed to over 1,300 people during the first two months after its publication.

In 1983, more than 100 crabbers began to cull out peelers — a five-fold increase from 1982. Over 50 new shedding facilities were constructed, resulting in an estimated additional \$2 million in gross sales of soft crabs. Wescott modestly credits basic economics with

creating the boom in the soft-shell crab business. But area fishermen give Wescott much of the credit. And his work with the industry earned him the award as Sea Grant's Southeast Marine Advisory Service's Agent/Specialist of the Year and an Outstanding Extension Award from N.C. State University.

Sea Grant's Marine Advisory Service Director Jim Murray says Wescott is the epitome of an advisory agent/specialist. In 1983 and 1984, Wescott and 10 other agents and specialists made about 4,700 individual contacts, and 2,200 people visited MAS offices. MAS staff conducted over 260 meetings that were attended by nearly 25,000 individuals. Here are some highlights of the MAS's many accomplishments in 1983 and 1984:

▷ Jim Bahen, commercial and recreational fishing. Commercial and recreational fishermen seek out the Gulf Stream and its eddies because of the warm-water fish that travel its path. But finding this meandering corridor of water is not always easy. Bahen worked with the National Environmental Satellite Service to develop a chart that plots the Gulf Stream's path. The chart provides the width of the Gulf Stream, its average speed and temperature, and

Wayne Wescott helped make the soft-shell crab business boom.



MACHAPUNGA

MOREHEAD CITY

MACHAPUNGA
MOREHEAD CITY, NC

path. As a result, fishermen are saving time and fuel.

▷ *Walter Clark, coastal law and policy.* In cooperation with the N.C. Bar Association and the University of North Carolina's Institute of Government, Clark organized a conference to help coastal lawyers tackle environmental issues. Over 80 attorneys attended, and the bar association asked Clark to make the conference an annual event.

▷ *Bob Hines, commercial fishing.* When charter boat operators in Carteret County wanted to organize an association, they came to Hines. He called several meetings and helped the captains form the Crystal Coast Charter Boat Association. He also arranged programs and provided advice for the group on tax management, financial management, advertising and group insurance coverage. The members say the organization helped them increase their bookings.

▷ *Rich Novak, marine recreation and tourism.* Over six years ago, the town of Manteo began preparing for the onslaught of thousands of tourists. From 1984 to 1987, America would celebrate its 400th anniversary in this small coastal town. To alleviate some of the pressure for lodging, Novak worked with residents interested in turning their homes into bed and breakfast lodging. Now his publication, **Opening a Bed and Breakfast**, is used statewide as a guide to bed and breakfast development.

▷ *Spencer Rogers, coastal engineering.* After Hurricane Alicia hit the Texas

shoreline in 1983, Rogers inspected the damage. He found that even with 100 mph sustained winds, some buildings escaped damage. Where they were used, wooden wind anchors saved the connections in buildings. In some cases, the connections held when the rest of the building was destroyed. Rogers brought that information back to North Carolina, where he spread the word about the new construction method through a Sea Grant Blueprint.

▷ *Randy Rouse, aquaculture.* Rouse tested a method frequently used in Virginia for catching hard crabs and peelers. Peeler pounds are set in shallow water and extend from the shore to a trap at the end. Rouse found that they need to be set in protected areas where winds and waves can't destroy them. But they yield a productive catch.

▷ *Joyce Taylor, consumer seafood utilization.* It's easy to tell folks the virtues of seafood — high in protein and low in fat, cholesterol and calories. But many don't include fish and shellfish in their

The Marine Advisory Service crew: (front, left to right) Wayne Wescott, Jim Bahen, Lundie Spence; (back) Spencer Rogers, Rich Novak, Jim Murray, Randy Rouse, Walter Clark, Joyce Taylor, Bob Hines, Gary Van Housen.



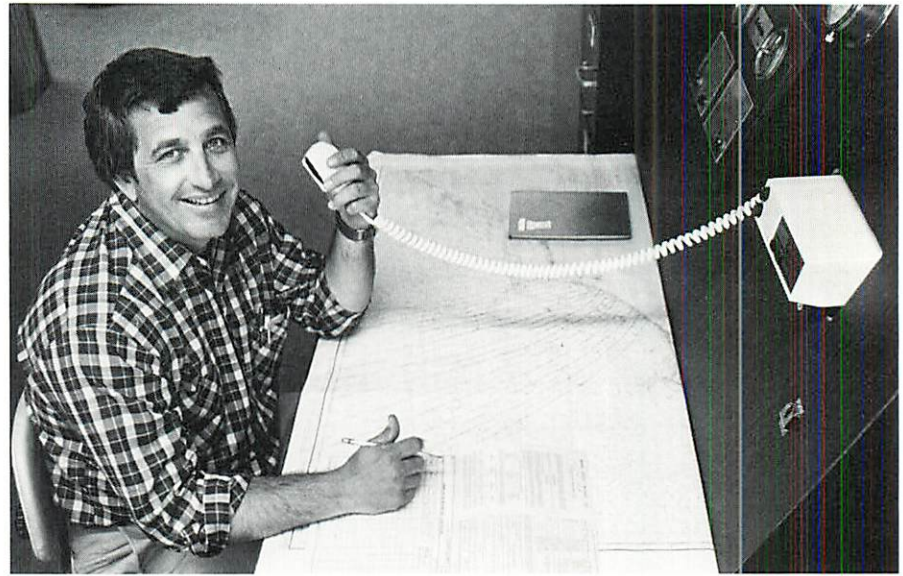
Woman fishes for a bite.

diets because they don't know how to handle and prepare the foods. For hundreds of North Carolinians, Taylor changed that. She took her show on seafood selection, handling, preservation, utilization, nutrition and preparation on the road, conducting workshops to a total audience of about 2,000 people. And, she mailed more than 17,500 pieces of literature to folks with questions about seafood.

▷ Sam Thomas, seafood technology. In 1984, Thomas worked with a North Carolina processing firm interested in marketing squid abroad. As a result, European seafood lovers soon may be popping the top on a can of North Carolina squid. Thomas helped the company perfect its canning operation for squid. He recommended what percentage of brine to use and ways to prevent moisture loss. Already, the company has processed 40,000 pounds of canned squid.

▷ Gary Van Housen, economics and marketing. North Carolina's commercial seafood catch is comprised of over 78 species. But not all of those species are as easily marketed as shrimp and flounder. Van Housen joined the MAS staff late in the biennium to give Sea Grant's MAS a new dimension. He worked with seafood buyers and processors to make them more conscious of quality control.

▷ Jim Murray MAS director and marine recreation specialist. Recreational pier fishing at North Carolina's 34 fishing piers deteriorated during the past decade. Murray teamed up with David Lindquist of the University of North Carolina at Wilmington to test the durability and fishing enhancement characteristics of mid-water fish attractors in the nearshore waters off fishing piers. Thirty-nine species of fish were



found by divers in the water column near the attractors; no fish were found off a control pier two miles away. In the future, the findings could improve pier fishing by bringing the fish to the fishermen. ■

Jim Bahen receives information about offshore weather from fishermen and relays it to the National Weather Service.

Sharing ideas and enthusiasm comes easy for Lundie Spence, Sea Grant's marine education specialist. She's a top-notch salesman promoting North Carolina's coast and its surroundings. She can tell you what grows in salt marshes or what to do on a field trip with 50 scouts. Or if it's coastal problems that concern you, she'll offer suggestions and lead you to an expert.

What Spence knows about the coast and Sea Grant's research is translated into activities and talks for teachers, the public and students from elementary to college age. It's her job to "keep ideas flowing in the state," she says. "I get most excited about seeing what I do being multiplied year to year."

Her primary means for doing this is teacher training. During the 1983-1984 school year, she provided more than 1,200 educators with marine science programs, natural history lessons and ideas for field trips. She held teacher

workshops in 31 city and county school districts, helping to expand the network of ideas.

Five times a year, Spence sends the newsletter **Conchshell** to about 3,000 educators in and out of North Carolina. **Conchshell** contains information on materials, programs and activities useful to educators.

In addition, Spence and school-teacher Vivian Barbee Coxe completed a marine education primer in 1984.

Coastal Capers provided elementary grade teachers with activities that introduce the marine environment to a younger crowd.

Spence went to the head of the class herself to teach an undergraduate course on coastal issues at N.C. State University. She invited scientists and Sea Grant researchers to speak and offer their expertise.

Spence shares her ideas with the public, too. In the past two years, she talked to about 1,000 people at civic groups, fishing clubs, science clubs, museums and various meetings. In 1983, she conducted a workshop in Manteo for educators interested in promoting a coastal interpretation of North Carolina's 400th anniversary celebration. Spence also helped organize activ-





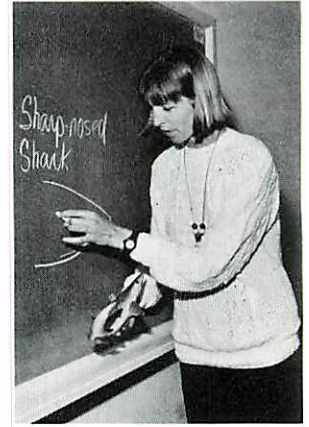
ities for student venturers who are part of Operation Raleigh, a worldwide travel/work program associated with the 400th anniversary.

With her knack for organizing and directing people, Spence displayed her leadership qualities as president of the Sea Grant Association's education group from 1982 to 1983. The following year, she was president of the National Marine Education Association. While holding this office, she worked with teachers and people in marine-related fields and federal agencies to initiate the National Youth Conference in Marine and Aquatic Science. The conference included the first World of Water competition, which honored students with science projects relating to the coastal environment.

In conjunction with the World of Water awards, Spence and Jack Wheat-

ley, an associate professor of math and science education at NCSU, received a grant to recognize and study the teachers who supervised the students with prize-winning projects.

Sea Grant handed out a few of its own awards to students. Lise Knelson, a graduate student at East Carolina University, received the UNC Sea Grant Marine Policy Fellowship. Her solid performance during the fellowship was rewarded with an appointment as a Sea Grant intern for a U.S. Congressional committee responsible for marine policy. ■



(Above left) Teachers use Lundie Spence's ideas about marine education. Here, students try fish printing.

(Above) Lundie Spence explains the sensory perceptions of a shark.

Lundie Spence explains how scales serve as a protective armor for the red drum and indicate the fish's age.



Research is naught and advice nil if it's locked in the mind of the inventor, shut in file drawers or limited to a handful of peers. That's why Sea Grant employs a staff of professionals — Kathy Hart, Nancy Davis and Sarah Friday — to communicate Sea Grant results and advice.

In 1983-1984, the communications staff gathered information from scientists and advisory agents, packaged it in attractive, usable publications and made it available to the public. In record numbers, people called and wrote the program for a subscription to **Coastwatch**, a copy of **A Guide to Soft Shell Crabbing** or a technical report. Over 1,300 copies of **A Guide to Soft Shell Crabbing** were sent out in its first two months of distribution.

Coastwatch, Sea Grant's monthly newsletter, remained the main avenue of communication for the program. With each issue, staff writers focused on a single coastal topic — blue-green algae, floating homes and recreational fishing. They explored the pros and cons of controversial issues, introduced the personalities that shape coastal North Carolina and presented the science that answers to our marine problems.

Now in its sixth year of publication, **Coastwatch** has won three consecutive international awards from the Society of Technical Communications. The newsletter has a circulation of 24,357 and an estimated readership of 52,000.

Each month, the communications staff produces "Seascope," a series of four 60-second radio public service announcements. "Seascope" presents, in an upbeat tone and capsule form, information about Sea Grant activities and research, how-to tips, news items and human interest topics. The spots are distributed to 28 coastal radio stations, which play at least one spot every day.

(Left to right) Nancy Davis, Sarah Friday and Kathy Hart pull **Coastwatch** off the press.



The communications staff helped the Marine Advisory Service edit, design and publish 10 advisory bulletins. These publications helped the public shed crabs, buy fresh seafood, open a bed and breakfast and understand their riparian rights.

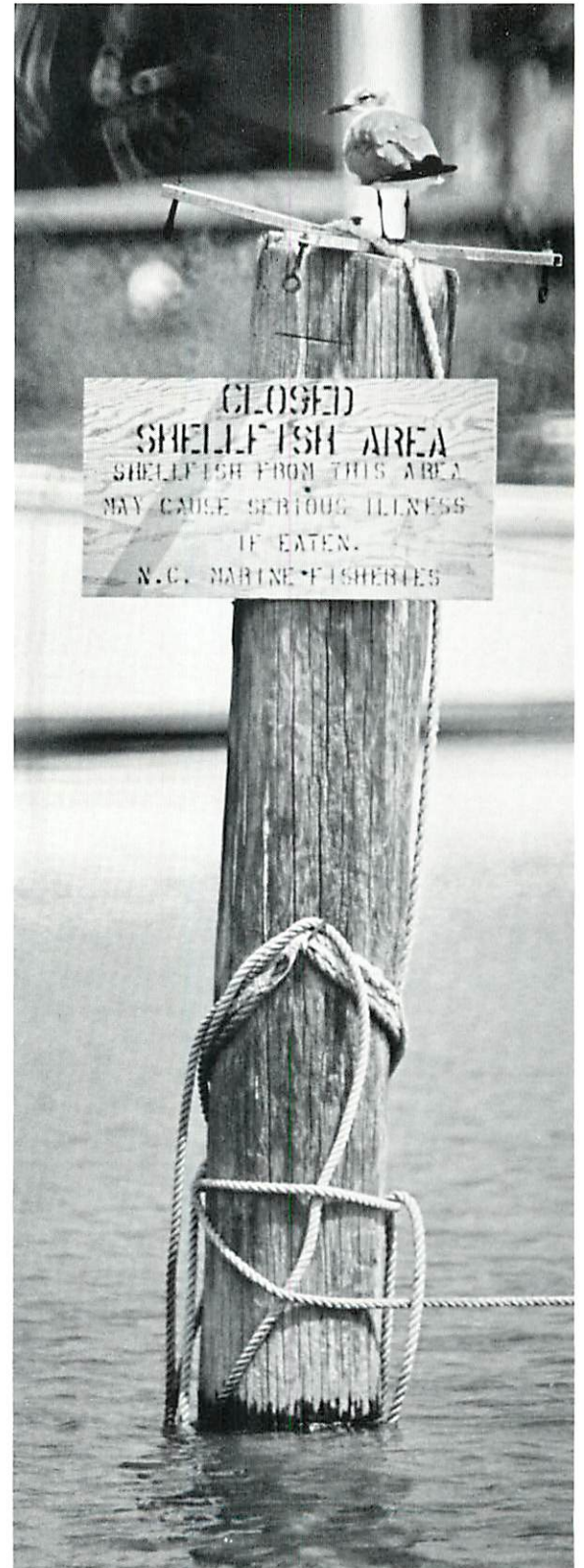
On the scientific front, the communicators edited and produced 12 technical reports and working papers.

The staff reaches out to the state's media with news releases and story ideas. Releases announcing the National Estuarine Symposium, a cooperative venture by the National Sea Grant Program and the National Marine Fisheries Service, resulted in articles in two of the state's major dailies. ■

It's the people who use our coastal resources that Sea Grant wants to reach with information.

In Summary

As Sea Grant closes the file on one coastal problem or works out the flaws in a fisherman's gear, another problem looms in the distance and another fisherman waits at the door. As long as people use our coastal and marine resources, conflicts and problems will continue to crop up. And Sea Grant will continue to assemble the state's best scientists to solve these problems and disseminate the results. ■



Budget, 1983 and 1984

	NOAA*	STATE**
Marine Resources Development		
Aquaculture	\$192,790	\$103,921
Living Resources Other Than Aquaculture	164,197	93,321
Mineral Resources	29,481	18,793
Marine Law and Socioeconomics	73,637	38,045
Marine Technology Research Development		
Ocean Engineering	29,002	26,377
Resources Recovery and Utilization	155,529	84,846
Marine Environmental Research		
Research in Support of Coastal Management	60,979	23,881
Ecosystems Research	134,746	89,941
Pollution Studies	37,167	19,824
Environmental Models	177,314	71,397
Applied Oceanography	67,287	41,824
Marine Education and Training		
Other Education	21,000	
Advisory Services		
Extension Programs	703,323	424,790
Other Advisory Services	183,954	138,040
Program Management and Development		
Program Administration	198,640	
Program Development	120,954	
Total	\$2,350,000	\$1,175,000

*National Oceanic and Atmospheric Administration

**N.C. Department of Administration

Publications

General Interest


- Beached Marine Mammals.** S. Friday. UNC-SG-BP-84-2. Free.
- Coastal Capers: A Marine Education Primer.** L. Spence and V.B. Coxe. UNC-SG-84-05. \$3.50.
- Coastwatch,** UNC Sea Grant newsletter. No publication number. K. Hart, N. Davis and S. Friday. Free.
- A Guide to Soft Shell Crabbing.** W. Wescott. UNC-SG-84-01. Free.
- Hangs and Obstructions to Trawl Fishing: Atlantic Coast of the United States.** J. McGee and H. Tillett. UNC-SG-83-01. \$2.
- How to Manage Your Marina's Fuel Inventory.** L. Abbas and M. Gilfillan. UNC-SG-83-04. Free.
- Living on the Water.** W. Clark. UNC-SG-BP-85-1. Free.
- Marine Weather Relay Program.** J. Bahen. UNC-SG-83-03. Free.
- North Carolina Seafood** (poster). J. Taylor. UNC-SG-84-04. Free.
- Opening a Bed and Breakfast.** R. Novak. UNC-SG-84-03. \$1.
- Recreational Shrimping: Nets, Doors and Power.** W. Wescott. UNC-SG-BP-83-2. Free.
- Riparian Rights: What are they? What are their limits?** W. Clark. UNC-SG-84-1. Free.
- Sea Grant in North Carolina 1981-82.** N. Caudle, K. Hart and N. Davis. UNC-SG-83-05. Free.
- Shellfishing: North Carolina's Aquaculture Regulations.** W. Clark. UNC-SG-84-06. \$1.
- Understanding Septic Systems.** C. Cogger. UNC-SG-BP-83-1. Free.
- Wooden Wind Anchors for Hurricane-Resistant Construction Near the Ocean.** S. Rogers. UNC-SG-BP-84-3. Free.
- Coastal Studies**
- Effect of Ocean Setback Standards on the Location of Permanent Structures in Coastal North Carolina.** A. Stutts, C. Siderelis and S. Rogers. UNC-SG-WP-83-5. \$1.25.
- Evaluation of the Extent of Hurricane Induced Flooding on Coastal Urban Areas in North Carolina.** T.C. Gopalakrishnan, C.C. Tung and J.S. Wei. UNC-SG-WP-84-2. \$2.50.
- Hurricane Emergency Planning: Estimating Evacuation Times for Non-Metropolitan Coastal Communities.** J. Stone. UNC-SG-WP-83-2. \$1.50.
- 1983 Supplement to Atlas of Colonial Waterbirds in North Carolina Estuaries.** J. Parnell and D.A. McCrimmon Jr. UNC-SG-84-07. \$2.50.
- The Use of a Flat-Plate Current Meter in Nearshore Flows.** D.K. Hollingsworth, F.Y. Sorrell and T.B. Curtin. UNC-SG-WP-84-5. \$2.25.

Estuarine Studies

- The Effects of Salinity on the Potential of a Blue-Green Algal (*Microcystis aeruginosa*) Bloom in the Neuse River Estuary, North Carolina.** H. Paerl, P.T. Bland, J.H. Blackwell and N.D. Bowles. UNC-SG-WP-84-1. \$1.25.
- Research for Managing the Nation's Estuaries: Proceedings of Conference in Raleigh, North Carolina.** B.J. Copeland, K. Hart, N. Davis and S. Friday (eds.). UNC-SG-84-08. \$8.
- Fisheries**
- Economic Impact of a Larger Purse Seine Mesh Size and a Closed Fishing Corridor on the N.C. Menhaden Fishery.** V. Blomo and N. Crouse. UNC-SG-WP-84-4. \$2.
- Estimated Socio-Economic Impacts in North Carolina of a Shortened Menhaden Season.** V. Blomo, M. Orbach and J. Maiolo. UNC-SG-WP-83-4.
- Modeling Estuarine Migration and Abundance of the Brown Shrimp (*Panaeus Aztecus*) of Pamlico Sound, North Carolina.** M. Cohen and G. Fishman. UNC-SG-WP-83-1. \$2.75.
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- Social and Economic Impacts of Coastal Zone Development on the Hard Clam and Oyster Fisheries in North Carolina.** P. Tschetter and J. Maiolo. UNC-SG-WP-84-3. \$2.75.
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- An Annotated Bibliography on Mechanically Separated Finfish and Crustacea Meats.** F.B. Thomas, J. Taylor and F. Ramey. UNC-SG-84-02. \$4.
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- An Evaluation of Five Types of Binders to Improve the Artificial Diet of Young American Eels.** J. Salevan. UNC-SG-WP-83-3. \$1.25.


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