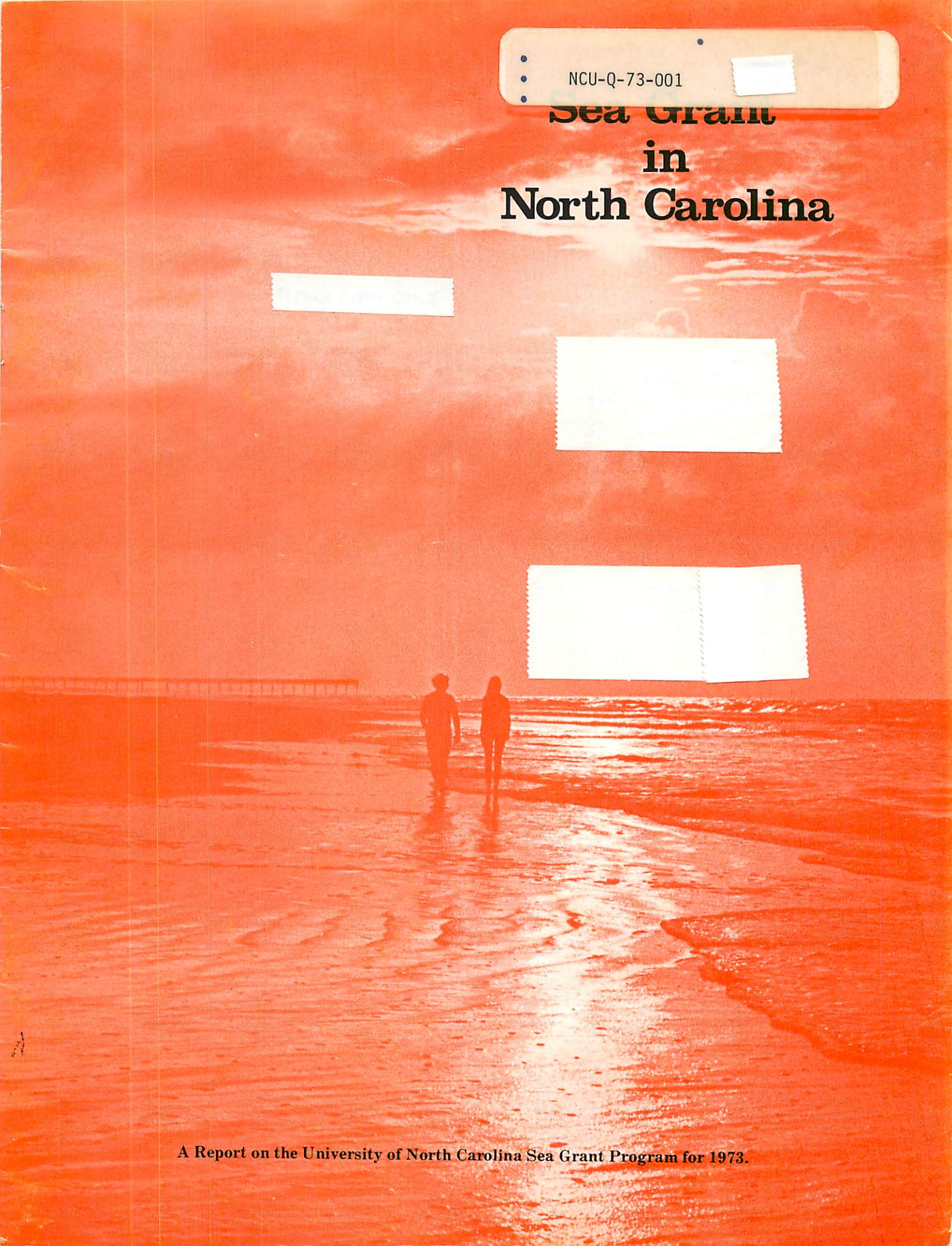
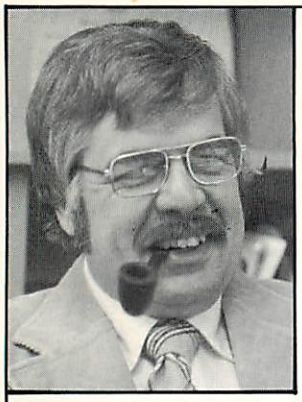
Sea Grant in North Carolina



A Report on the University of North Carolina Sea Grant Program for 1973.



DR. B. J. COPELAND
Director
UNC Sea Grant

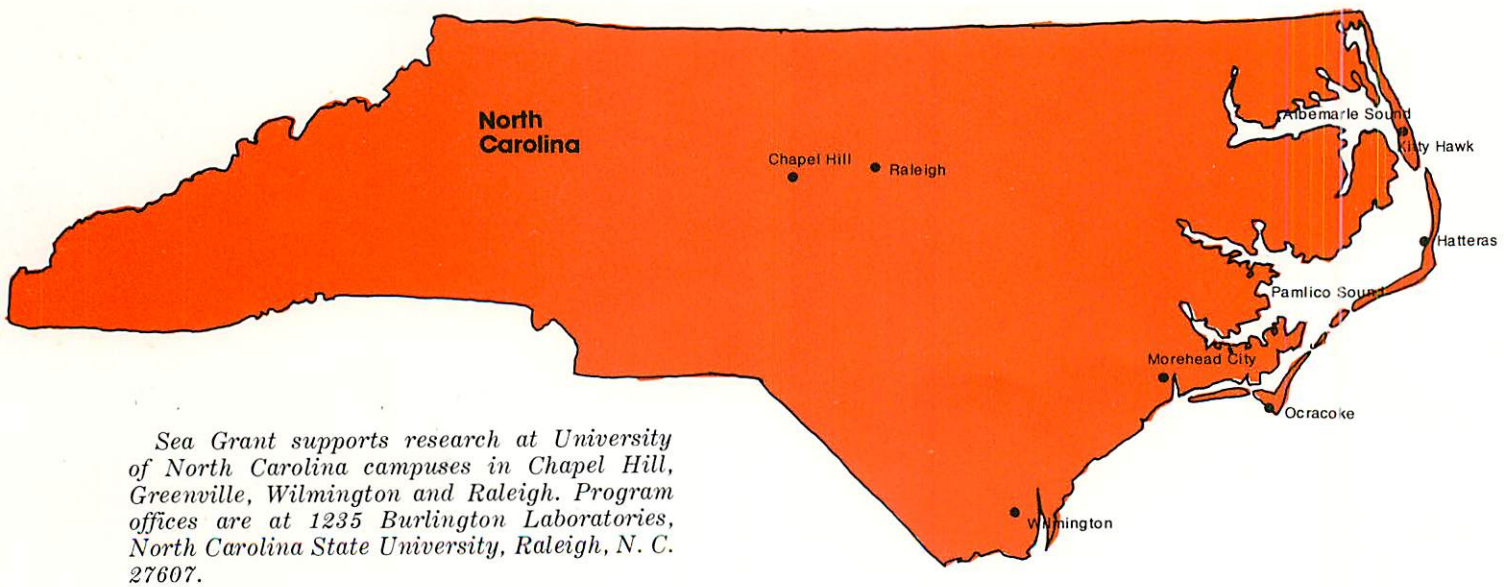
a message from the director

This report covers the third year of Sea Grant institutional support for the University of North Carolina. The Sea Grant Program, in its unique conception and motivation, has helped to bring the University into closer contact with marine resource utilization and management. It has enabled the University to focus its historical involvement and great breadth of expertise on pertinent and timely problems of marine resource development in North Carolina and the nation. With Sea Grant's approach to solving marine resource problems, we have dared to become involved in a meaningful and realistic program of advancing commercial marine opportunities.

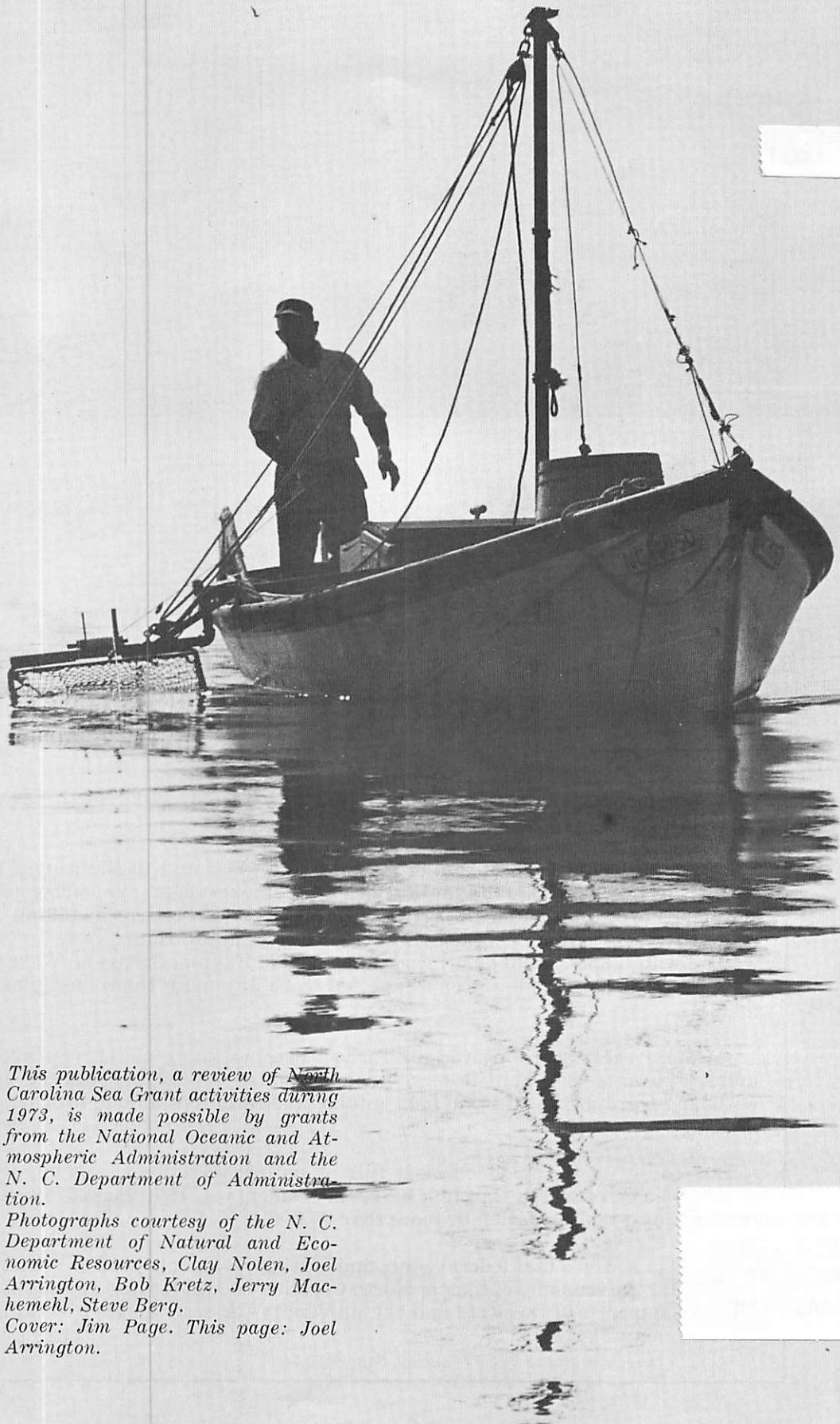
The 1973 Sea Grant year was one of significant change in direction and program management. The University's reorganization to include all state institutions of higher learning under one administrative unit has enabled its marine science efforts to be more sharply focused and coordinated. With the UNC Sea Grant Program as a part of the overall effort in marine sciences, we operate in smoother concert under the general administration. A functioning University Marine Science Council provides advice and evaluation of the Sea Grant Program as it relates to University-wide efforts. A change in state government administration and establishment of a N. C. Office of Marine Affairs has challenged us to develop new avenues of communication and areas of cooperation with North Carolina citizenry.

Adoption of a document prepared by a joint state-federal commission on "North Carolina's Coastal Resources" has set up guidelines for research relevant to coastal needs. Responding to the guidelines, Sea Grant research and advisory services have shifted toward coastal zone management and resource utilization needs identified in the resources document.

This and a continuing review and interaction with relevant state agencies and institutions help shape our program. Considerable progress has been made in many areas of the University of North Carolina Sea Grant Program. Several projects, initiated in previous years, are now yielding results placed into action.



Sea Grant supports research at University of North Carolina campuses in Chapel Hill, Greenville, Wilmington and Raleigh. Program offices are at 1235 Burlington Laboratories, North Carolina State University, Raleigh, N. C. 27607.



This publication, a review of North Carolina Sea Grant activities during 1973, is made possible by grants from the National Oceanic and Atmospheric Administration and the N. C. Department of Administration.

Photographs courtesy of the N. C. Department of Natural and Economic Resources, Clay Nolen, Joel Arrington, Bob Kretz, Jerry Machemehl, Steve Berg.

Cover: Jim Page. This page: Joel Arrington.

A Delicate Balance

It was during the decade of the 60's that they "discovered" North Carolina's beaches.

Refugees fleeing from steaming concrete and glass and traffic sought a world without neon, aluminum and belching smokestacks. Hungering for simpler times, they found in North Carolina a certain charm in taking a ferry to reach a remote beach. Beaches, they realized, didn't have to be wall-to-wall blankets and litter. And in towns like Buxton, Salvo and Waves, they learned that people weren't expected to be any more than "just plain folks."

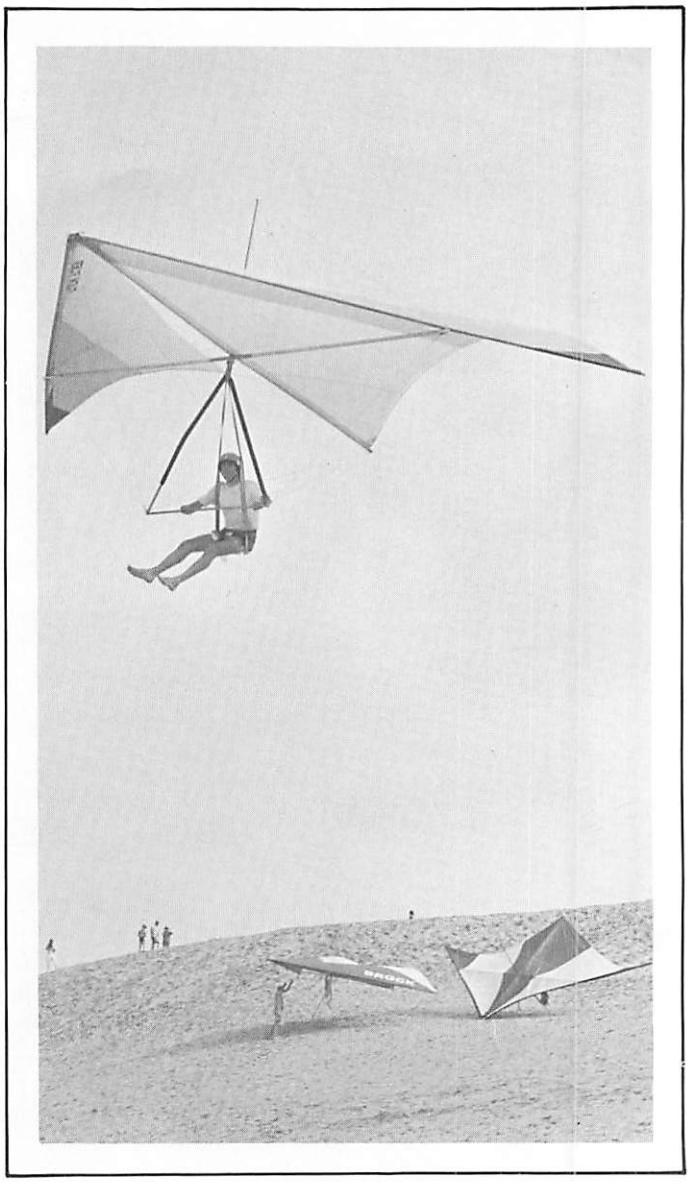
As more vacationers arrived on Tarheel beaches, more motels, cottages and restaurants were built to serve them. Too often development sprang up without regard for its effect on fish, wildlife and resources unique to coastal areas.

But oddly, in a region chocked full of natural resources, annual per capita income of North Carolina's coastal residents in 1970 lagged behind that of the rest of the nation by more than $1,000.

It was in the 60's that federal, state and local governments became acutely aware that the economy of coastal North Carolina needed bolstering. Coastal citizens appealed to the state and the university for assistance in boosting their economy.

(Continued on page 4)

An untouched beach on North Carolina's Outer Banks (opposite page) contrasts with crowded homes at Atlantic Beach. (Photos: Clay Nolen).



Hang gliders at Jockey Ridge, highest sand dune on the east coast near Kitty Hawk. (Photo: Clay Nolen).

Turning to natural resources to help provide that boost, it became apparent that limited resources must be used wisely today for tomorrow's enjoyment.

If the 60's were a time of awareness, the 70's have become a decade for action. Events of the past four years, which promise to shape the character of the state's eastern reaches for many years, have centered on getting to know the coastal environs so they can be managed effectively.

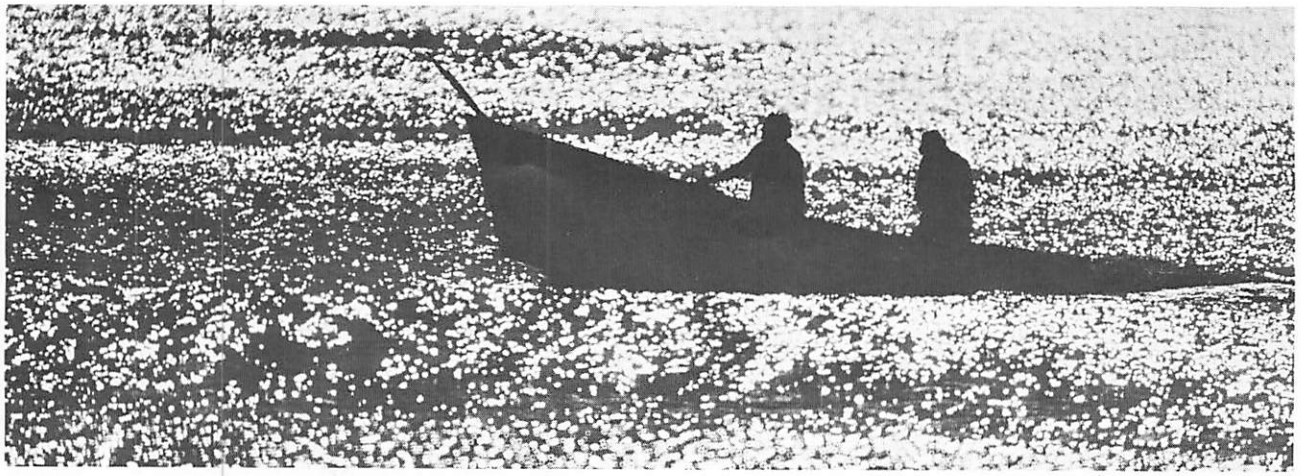
Among these events was the founding of a Sea Grant Program at the University of North Carolina in 1970 with funding from the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the N. C. Department of Administration. Sea Grant is a program supporting coastal and marine research and advisory services aimed at helping coastal residents develop and wisely use their resources. Since 1970, the University, with its historic and continuing involvement in marine science research, education and extension, has been awarded more than $3 million in federal and state Sea Grant funds.

During the early 70's steps have also been taken by the N.C. Marine Science Council to help define and solve coastal issues. A joint federal-state committee developed a plan for the use and preservation of the state's coastal resources. And the University made deeper commitments to marine research and education with the initiation of marine science degree programs and curricula at four campuses including UNC-Chapel Hill, UNC-Wilmington, North Carolina State University and East Carolina University.

With the 1974 N.C. General Assembly's enactment of the Coastal Area Management Act, the fruits of Sea Grant marine activities and those of state agencies and the University can be more easily and effectively applied to coastal problems. With the coastal management act, the state is given the mechanics and authority to practice resource development and conservation.

From 1970-72 was a period of initiation and organization for Sea Grant in North Carolina, a time to mold program themes and goals.

But in 1973, it was time to step back and look at the Program's progress and problems. It was a year to "get the bugs out." Program administra-



(Photo: Bob Kretz)

tion was given a boost when its "coordinator" position was replaced by a full-time director. A change in administrative personnel brought new philosophies to the Program. Office headquarters were moved from Chapel Hill to Raleigh, a location more central to university and state government activities.

A change in state government administration in 1973 made it necessary for UNC Sea Grant administrators to establish new contacts and inroads to governing agencies. And while research remains the backbone of the Program, emphasis shifted more toward application and advisory services.

This year the Program came to grips with themes and goals. Through its research and advisory services, UNC Sea Grant dedicated its work to finding ways to develop and use coastal and marine resources—in a manner that insures their conservation—for the economic improvement of coastal North Carolina.

Sea Grant seeks to carry out its theme of resource conservation and development by striving toward several goals. They are:

—To develop an inventory and a broad understanding of coastal resources that will promote their efficient development and will guide their management.

—To plan and develop research and extension that will provide solutions to problems of the coastal zone.

—To establish a two-way flow of information that will take research results to North Carolinians and bring their research needs to the laboratory.

—To develop technology and experience necessary for wisely using and managing the coastal zone as a part of the University of North Carolina's education system.

Part 1 . . .

SEA GRANT RESEARCH

A favorite pastime on Cedar Island-Ocracoke ferry. (Photo: Clay Nolen).

A Place In the Sun. . . For Waterbirds

Dotting North Carolina's jagged coastline are hundreds of islands, built from sand and mud that clog navigation channels. Some of the islands are covered with pines. Others, topped with fresh spoil, are like small deserts.

For most of the year, the islands lie deserted. But one day in May, the silence engulfing the islands is interrupted by the screeching of hordes of birds—waterbirds arriving to make their summer homes.

Gulls, terns, herons, egrets and dozens of other waterbirds swoop down on the islands, selecting sites perfect for nesting and raising their young. On the islands, life promises to be free of hungry predators and outside interference.

Little was known about the waterbirds' nesting habits until Sea Grant scientists began studying plant succession and spoil stabilization on the islands three springs ago. Now the birds are the center of their research attention.

Researchers found that each species prefers different levels of vegetation for its homesite. Royal terns nest on almost bare sand. Common terns prefer sparse grass. Gulls nest in thick grass and herons and egrets raise their young in shrubs and woody thickets.

The pattern of periodic dumping on the islands has been fortunate for the birds. When spoil is dumped on an island, vegetation levels are returned to year one. After drying, an island with new spoil makes perfect nesting for royal terns. As the natural succession of grasses, shrubs, thickets and trees progresses, other waterbirds can find suitable nesting areas.

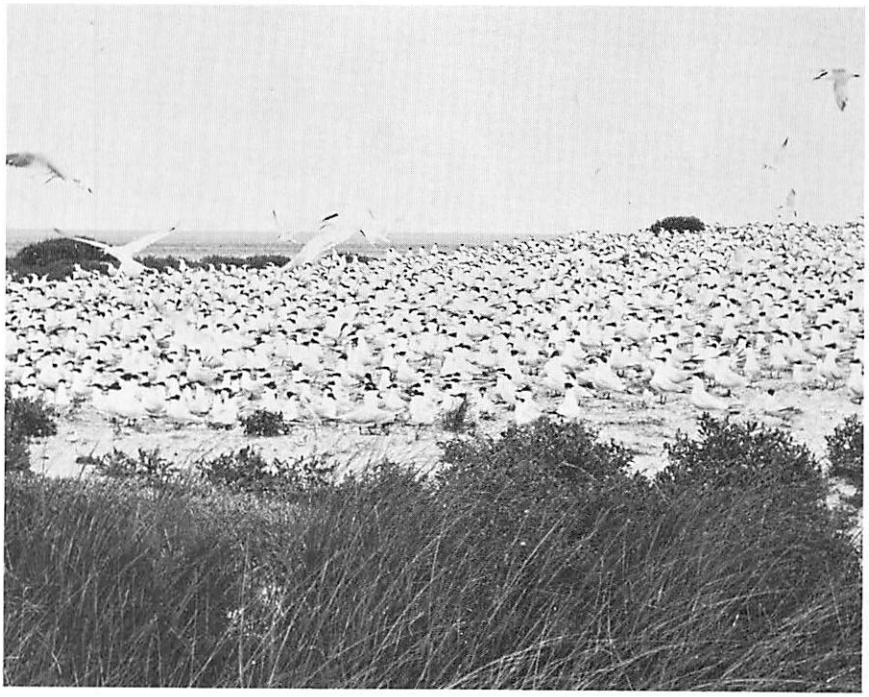
But once the islands are covered with grass, some of the waterbirds, like the royal terns, have no other place to nest.

Periodic dumping has helped waterbirds requiring nesting areas with little vegetation. But the costly dredging operation, with its wear and tear on the environment, may, before too long, undergo changes—changes that would transfer much of the dumping to the mainland.

Facing prospects that some of the birds may lose their nesting sites if dumping on the islands is ended, Sea Grant researchers are exploring ways to "manage" islands for continued use by the waterbirds. With selected herbicides, vegetation levels on the islands can be controlled to meet the needs of several species.

The ideal island, the scientists point out, is isolated, supports varying levels of vegetation and has an open beach where young birds can get to water. It should be four to five feet in elevation and have sandy soil.

No one seems really sure where the waterbirds nested before dredge islands were built, nor are they certain of the birds' importance in the ecosystem. But Sea Grant scientists are convinced that many of the species are in danger of becoming "endangered" if steps are not taken to preserve their nesting sites.



Nestling brown pelicans (above) find a peaceful home on a dredge deposit near Hatteras. They are part of the only North Carolina colony of this endangered species. Royal and Cabot's terns (below) nest on the bare dome of a dredge island near Hatteras Inlet.

Putting A Harness On Beach Sands

Grasses Halt Erosion On Windswept Beaches

When the earliest settlers trickled into coastal North Carolina, their cattle grazed on the rich grasses standing high on sand dunes. The animals grew fat from the stout grasses. But beneath their sharp hooves, the dunes cringed as they were stripped of vegetation and left naked to hungry winds and tides.

The cattle are gone from the dunes today. But dune buggies, beachcombers and harsh storms are still weaving paths through the grasses that help stabilize dunes and shorelines.

A path crossing a dune is kind of like a run in a lady's nylon hose that gets a little bigger every time she moves. Once the path is cleared of vegetation, winds and waters easily rip through, making the path larger until finally the dune practically unravels. Often it becomes necessary to stabilize dunes to protect property and stop eroding beaches.

Sea Grant researchers gained worldwide recognition this year with their continued efforts to harness and repair the sands of protective dunes with beachgrasses. Noting the rising costs to taxpayers and the environmental wear and tear of continual channel dredging, they also directed research to stabilizing dredge spoil. And with an eye on retreating lands bordering sounds and estuaries, they began studies aimed at holding eroding shorelines in check.

While much of their research has centered on American beachgrass as a dune stabilizer, Sea Grant scientists made progress this year in planting a variety of grasses, including sea oats and running beachgrass, on dunes. American beachgrass is easy to establish and quick to grow. But it is vulnerable to insects and disease. When pests strike areas planted only in American beachgrass, they can wipe out the entire vegetative cover, leaving sands unprotected from the wind's erosion. Mixed plantings will guard against such widespread destruction.

Like dunes, dredge spoil is the victim of winds and water. Unprotected by vegetation, the sand and mud spoil finds its way back into navigation channels all too quickly. In studies aimed at growing stabilizing plants on spoil, Sea Grant researchers have found that smooth cordgrass, the dominant marsh grass, does more than slow erosion. With its establishment, spoil is converted to valuable marsh, offering nutrients and nursery to fish and shellfish.

Research has determined procedures for planting and propagating smooth cordgrass. And this year, to make planting over large areas easier, scientists designed and tested machinery to lift planting stock from nursery areas and portable seed equipment for faster, easier seeding.

Winds and tides aren't the only threats to dunes and dredge spoil. Insects also devastate the stabilizing grasses. A related Sea Grant project has determined that the chemical, dimethoate, is effective in wiping out the scale insect that kills American beachgrass. The project is also trying to identify and determine the effects of beetles found infesting smooth cordgrass.

Sea oats and beachgrasses (opposite page) help slow the wind's erosion of protective sand dunes. Sea Grant researchers have gained international attention with their efforts to plant and grow beach and marsh grass. (Photo: Clay Nolen).

Bringing Doom To Biting Beach Bugs

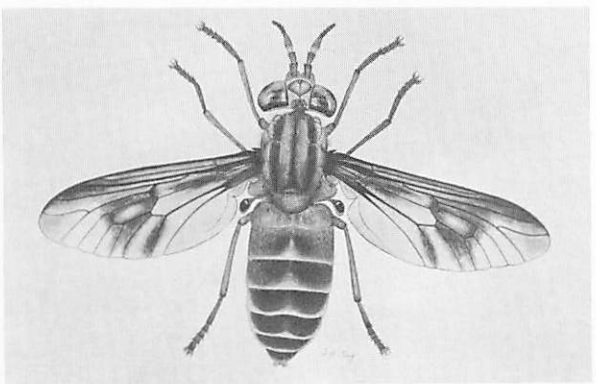
And a Boost To Coastal Bank Accounts

Coastal golf course managers will vouch for it. When mosquitoes and other biting bugs come out, golfers stay in—and business suffers.

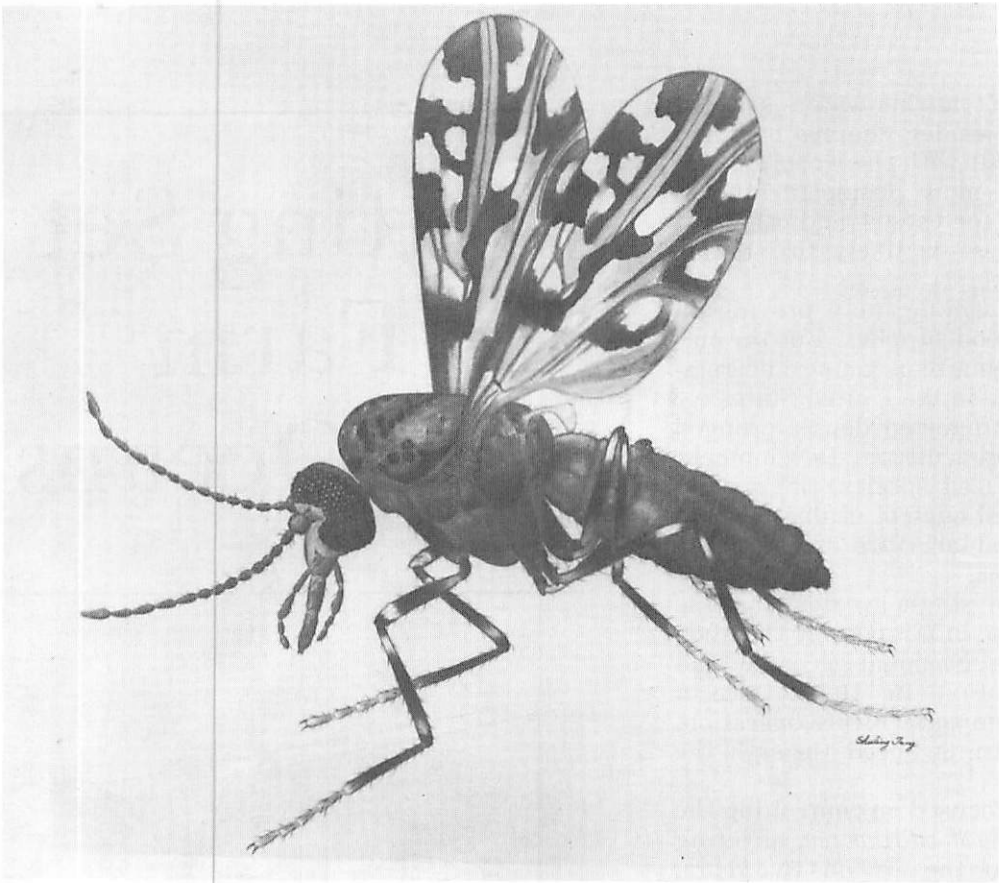
Not too many coastal vacationers want to fight hordes of hungry mosquitoes or those pesky flies that circle non-stop around their heads.

Sea Grant can't blame them. That's why research is underway to find better ways to control the biting varmits. When they bite, the pests nibble right into the bank accounts of coastal tourist and recreation industries. One of Sea Grant's goals is just the opposite—to help build coastal bank accounts.

Deer fly or Yellow fly



They're not making wild promises to forever rid the coast of mosquitoes and biting flies. But Sea Grant researchers are providing assistance to local coastal communities that should enable them to better manage the pests. They are helping communities set up pest management programs, or plans that make use of a variety of control methods all of which are aimed at reducing mosquito and biting fly populations in an environmentally sound



Sand fly
or
Biting gnat

fashion. In pest management programs, the use of controls is tailored to solve the community's or region's specific pest problem.

Three things are central to the success of a pest management scheme: Knowledge of the ecology of the insects; a monitoring program to find out when and where the pests strike in greatest numbers; and pest control operators who are up to date on the latest control equipment and how to use it.

This year Sea Grant took information on all three management keys to the state's coastal communities. Scientists gathered more data on insects' breeding sites and flight and dispersal patterns. They refined monitoring techniques and they laid groundwork for training sessions on control equipment, its use and monitoring.

During 1973, Sea Grant entomologists pioneered the use of ultra low volume (ULV), a method of applying insecticide, in coastal counties. As a result, many communities have replaced hazardous, fogging trucks with truck-mounted ULV equipment. With ULV, a fine mist of selected insecticide is sprayed at the time and location of large outbreaks of the pests. Communities have found that ULV uses less toxic chemical, costs less to operate and is more effective than the old fogging method.

To gauge the impact of biting insects on coastal people, Sea Grant conducted a public opinion poll in coastal Pamlico, Pender and Carteret Counties. Residents responded to the survey that they wanted more community control of the insects—and most said that they would be willing to pay for it.

Paralleling the human survey were surveys of pest populations, aimed at determining when and where mosquitoes, sand flies, deer flies and horseflies are most numerous. Scientists also traced the pests from their breeding sites as they traveled inland. They found that shrubs and trees are helpful in blocking the movement of some of the biting flies, particularly horseflies.

With several years' data on pest populations, the entomologists hope communities will be able to predict—and take measures to prevent—large outbreaks of the insects.

Getting Set To Farm The Oceans

Today, North Carolina's marine waters are still plump with blue crabs, flounder, channel bass and other seafood favorites. But with the world's population growing and with more people turning to the sea for food, demand for these—and other yet untapped marine fisheries—is likely to outstrip supply.

Aquaculture, or fish farming, may provide an answer to dwindling seafood supplies. But the culture of marine species remains a young and relatively undeveloped science in the United States.

Sea Grant this year supported double-pronged research in the area of aquaculture: Development of a currently under-utilized species, the rapidly growing dolphin fish; and control of disease that can spell doom for the aquaculture of blue crab, shrimp and other crustacea.

Disease was cited as the single greatest obstacle to commercial aquaculture in a report by the Mardela Corporation to the National Oceanic and Atmospheric Administration in 1972. Once a disease organism infests an aquaculture operation, it can spread with lightning speed through the entire population.

Research during 1973 focused on controlling the fungal parasite, *Lagenidium callinectes*, affecting blue crab reproduction. For the previous two years, Sea Grant scientists collected data on the life cycle and effects of the parasite, information that this year led to controlling the fungus.

Results of this study had application in Sea Grant aquaculture studies around the nation. Findings relating to *L. callinectes* are proving useful in shrimp, clam and oyster aquaculture where the same or similar disease organisms strike.

Research aimed at properly diagnosing and treating members of the *Lagenidium* genus is underway. Sea Grant researchers are attempting to identify and classify individual strains of the fungus. Their studies of three geographically-separated strains of *Lagenidium* will determine whether the three should be more logically recognized as individual species.

In other work associated with blue crab aquaculture, scientists concluded that female blue crabs ovulate four or more times and have a potential of producing up to eight million offspring.

Sea Grant scientists, conducting other aquaculture research, continued trying to raise the rapidly growing dolphin fish. Focusing this year on raising the fish through the larva stage, scientists succeeded in keeping larvae alive for 12 days. Eggs were hatched and reared in tanks under controlled conditions, with researchers successfully feeding the larvae after the yolk sac stage. Other studies had not succeeded in maintaining the larvae past the three-day-old yolk sac stage when it must begin to feed.

Coastal And Ocean Legalities

Parts of coastal North Carolina are booming with development. Every year more vacationers nose their station wagons and campers in the direction of the state's sandy shores.

Serving them are dozens of new motels, condominiums and hamburger stands, built frequently without regard for their impact on the environment. In many cases, no one bothered to consider what happens when a dune is bulldozed away, when marsh is drained and filled, or what effect more houses and motel rooms will have on already existing sewage problems.

The 1974 N.C. General Assembly passed legislation aimed at preventing unwise, unplanned development and at managing coastal resources. Providing the legal background for the act was a Sea Grant researcher who has devoted his studies to the legal aspects of coastal zone conservation. As the primary architect of the N.C. Coastal Area Management Act, the Sea Grant-supported law professor drafted the original bill and consulted on amendments to the proposed legislation as it was presented to the public and to the legislature.

In preparing the bill for presentation to the General Assembly, the researcher conducted extensive investigations into North Carolina's laws relating to the use of estuarine lands, wetlands and shorelines. To develop legal principles on which to base a comprehensive land-use program, he evaluated federal and state coastal zone laws and analyzed court decisions and legislation defining public legal rights in the state's coastal zone.

In another segment of the Sea Grant legal studies project University of North Carolina law students, many of whom have now graduated and are practicing law in North Carolina, investigated numerous areas of the law of the sea and territorial waters. Some 26 articles and two in-depth publications grew out of the students' work.

Through this project a significant contribution to the body of ocean law literature was made. The literature should benefit coastal states and the nation as issues on fishing and mineral rights under the ocean's waters arise. In addition, law students participating in the project gained valuable expertise in and a feeling for coastal and marine issues that should benefit them in their careers.

Storms wreak havoc on the beach. But even on calm days, the ocean eats away at the beaches.

The Sound and the F

The Atlantic can be vicious as a lion or gentle as a lamb. At times she's whipped to a frenzy by brisk nor'easters. On other days, she lazily meanders in and out with the tides, gently lapping the shores.

But no matter how changeable her mood, the Atlantic constantly nibbles on the state's sandy beaches, taking sands away here and dumping them there.

Man has long tried to replenish sands the Atlantic gobbles up. He's tried pumping sands from one beach to fill another. He's built jetties and groins to catch sand the ocean threatens to wash away. And he's planted grasses to hold beaches in place.

This year Sea Grant supported research that came up with a new and unique answer to the problem of beach stabilization in small, localized areas.

Working solely with a laboratory wave tank—a tank where water and sediment movements similar to those in the ocean can be produced—Sea Grant researchers devised a mechanical stabilizing system that doesn't interfere with the beauty of the beach because it lies hidden under the sand.

The system consists of a number of buried pipes, the ends of which are covered with filter screens so fine that sand cannot pass through. A pump, placed at another location, creates suction in the pipes, turning them into a kind of large vacuum cleaner.

Usually when waves rush onto the beaches, then roll away, sand is carried in and out with them. But when waters cover the beach area where the suction pipes are located, the waters are drawn into the sand and through the filters.

As the amount of water rushing back to the sea is reduced, the amount of sand carried away from the shore is reduced. So sand carried in by the waves remains and accumulates on the beach.

Other Sea Grant ocean engineers this year sought to learn more about forces acting on marine structures. Using mathematical models they found that it is very important to take into account the interaction of waves and current in determining forces exerted on marine structures such as off-shore ports and oil rigs.

Fury

Beach homes near Kitty Hawk following February, 1973 nor'easter. (Photos: Steve Berg & Jerry Machemehl.

Charting Changes in The Estuaries

Scientists Trace Erosion And Nutrients

Sprawling between North Carolina's mainland and its Outer Banks are some 2.6 million acres of sounds and estuaries. To many people, the vast waters stretching from the mainland serve as a playground for boating, fishing and swimming.

But as a resource, the estuaries offer more than recreation for man. Because they also serve as nursery grounds for over 90 per cent of the state's commercial and sports fisheries, the estuaries and sounds rank near the top of the state's list of most valuable resources.

Increasing amounts of sewage from cities and run-off from agriculture are washing into the estuaries, threatening the state's valuable fish and shellfish resources.

Sea Grant led broad-based research this year aimed at unearthing many of the secrets of North Carolina's estuaries. Findings from that research are contributing to state policy insuring a healthier estuarine environment.

In one of five Sea Grant research projects aimed at piecing together the puzzle of the estuaries, scientists traced the nutrients nitrogen and phosphorus as they travel into and through the estuaries. Their goal is to determine what effects nutrients have on fish, shellfish and recreation resources.

In order to see the whole picture of the nutrients' movements and to speed analysis of their data, the researchers employed the computer to map changes in the estuarine waters. With computer-drawn maps, the scientists can see at a glance levels of salinity, temperature, chlorophyll, nitrogen and phosphorous in locations throughout the Neuse and Albemarle River estuaries.

Computer maps also give an unobstructed view of changes in the estuaries over time. Otherwise complex data is reduced to a single page, enabling researchers to easily analyze trends and correlations, such as the relation between high levels of nitrogen and chlorophyll.

Research this year yielded evidence that oxygen concentrations in the estuaries often drop in the summer, as algae blooms thrive and salt water, undisturbed by winds, settles to the bottom.

Fish appear to migrate out of large areas of the estuaries where oxygen is low. Scientists believe that the possible positive correlation between fish migration and low oxygen concentrations provides convincing evidence that more nutrients in the estuaries could lead to longer periods of low oxygen. Such periods could be harmful to fish and organisms that cannot migrate out of the waters, they believe.

Data collected in this research is useful to state agencies charged with monitoring and controlling water quality. With an understanding of the flow of nutrients and their effects, agency officials can more wisely gauge the impact of upstream sources of sewage and nutrients on the estuaries. Already

Sea Grant scientists have made recommendations on maximum temperature standards for industrial effluents to state officials formulating water quality policy.

In a related Sea Grant project, scientists traced the flow of waters through the state's tidal inlets and sounds in field work and with mathematical models. Field research focused on circulation of waters in the Oregon Inlet and Croatan-Roanoke Sound areas, as well as in the Neuse River estuary. Data from this research has been given to the N.C. Department of Natural and Economic Resources for use in locating sewage outfalls.

Mathematical models of Pamlico Sound water quality, surface elevation and water movements under hurricane winds were completed by Sea Grant scientists. A water quality model for the Neuse River was verified with field data. Such models are useful in predicting water flow and water quality and can provide valuable information for land management decisions.

Estuarine Soils and Shoreline Changes

Other Sea Grant research this year aimed at learning more about the soils in the estuarine environs and the processes shaping the state's shoreline.

Two geologists, who initially set out to learn where and in what amounts economically important minerals are located in the Roanoke Island area, turned their efforts to understanding the make-up of the sediment system of that area. Reaching into estuarine soils—both above and below water level—the geologists have gained information on the geologic history of North Carolina's coast for the past 40,000 years.

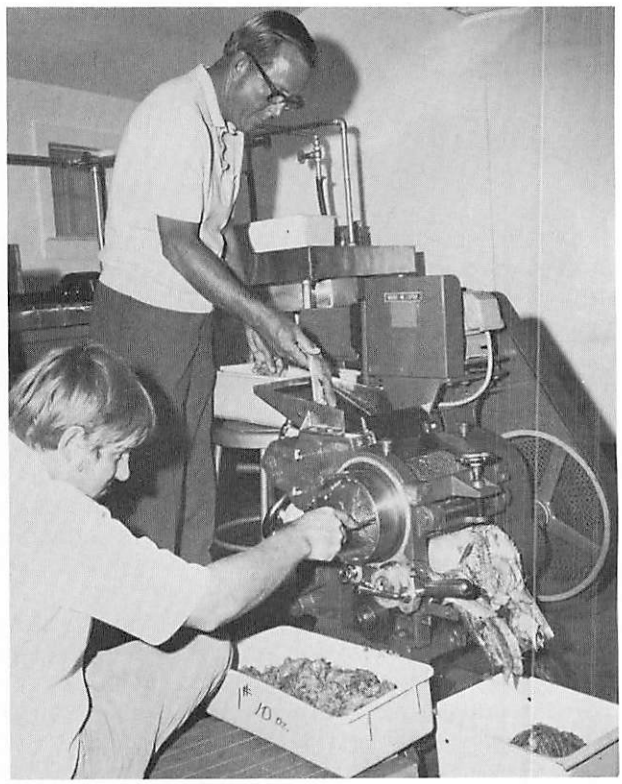
Relying on old maps and sophisticated geologic tests of the area, they have established patterns of deposition and erosion. They have determined what sediments are found at various layers beneath the coastal surface. And their research has traced the changing level of the sea over the past 40,000 years.

A major goal of their studies is to understand the geologic forces acting on the estuarine environment. For example, they have analyzed how such occurrences as the opening and closing of inlets led to patterns of erosion and deposition. Knowledge of geologic processes—and of the location and extent of coastal minerals—can provide sound bases for land-use decisions.

A related Sea Grant project, terminated in 1973, explored changes in the shorelines and on the bottom of sounds and estuaries. Data were gathered that should aid in understanding the processes of erosion and deposition, particularly on the Sound side of the barrier islands.

One Sea Grant researcher, also focusing on the estuarine environment, investigated the mechanisms by which a protozoan parasite *(Terebrospira chattoni)* burrows into the shell of *Palamonetes pugio*, a small shrimp that serves as food for many larger fish species. Research delved into the parasite's life cycle, mode of invasion and digestion of the shrimp's shell.

Putting Fish To Work Feeding Folks



Researchers feed "trash" fish into deboning machine. Experiments are underway to find ways to use deboned fish meat in new food products.

Every day, Old Mother Earth has more mouths to feed. With every new cry for food, the growl in her stomach echoes louder and emptier—especially for foods filled with protein.

Beneath the ocean's surface is an abundance of protein—meat that could make good eating for lots of folks. Yet the sea's bounty remains largely untapped.

The idea of eating some of the creatures from below isn't likely to set human tastebuds to watering. But Sea Grant believes there are ways to put more protein from the sea to work, helping to fill empty bowls.

This year, Sea Grant continued searching for new and better ways to serve the world fruits from the sea. Scientists tested new methods of using "trash" fish, fish that folks never thought much about eating, either because they were too bony or not very tasty. They also looked for ways to sharpen up the quality of seafoods eaten for years.

In their experiments with "trash" fish, Sea Grant researchers used a magical machine that performs the miracle of separating tiny fish bones from the meat around them. The scientists combined the finely-textured deboned fish meat with pork, beef and other seafoods and came up with tasty, protein-filled dishes.

They found that deboned fish can be used to completely replace beef and pork in some foods. Or it can be added to foods such as hamburger, sausage, fish cakes and stuffed clams to stretch them farther.

Seafood researchers also directed their energies to the state's blue crab industry to help improve quality and sanitation. They compared freon and conventional freezing and determined that while freon freezing is superior, after three months in storage, frozen crab meat can't equal fresh. Researchers also tested changes in quality of crab meat pasteurized for different times and at different temperatures. In addition, they studied the loss of protein during crab processing.

Sea Grant studies of blue crab plant sanitation were aimed at determining areas and aspects of processing that are most contaminated. Results from this research promise to help the blue crab industry upgrade sanitation and meet government regulations.

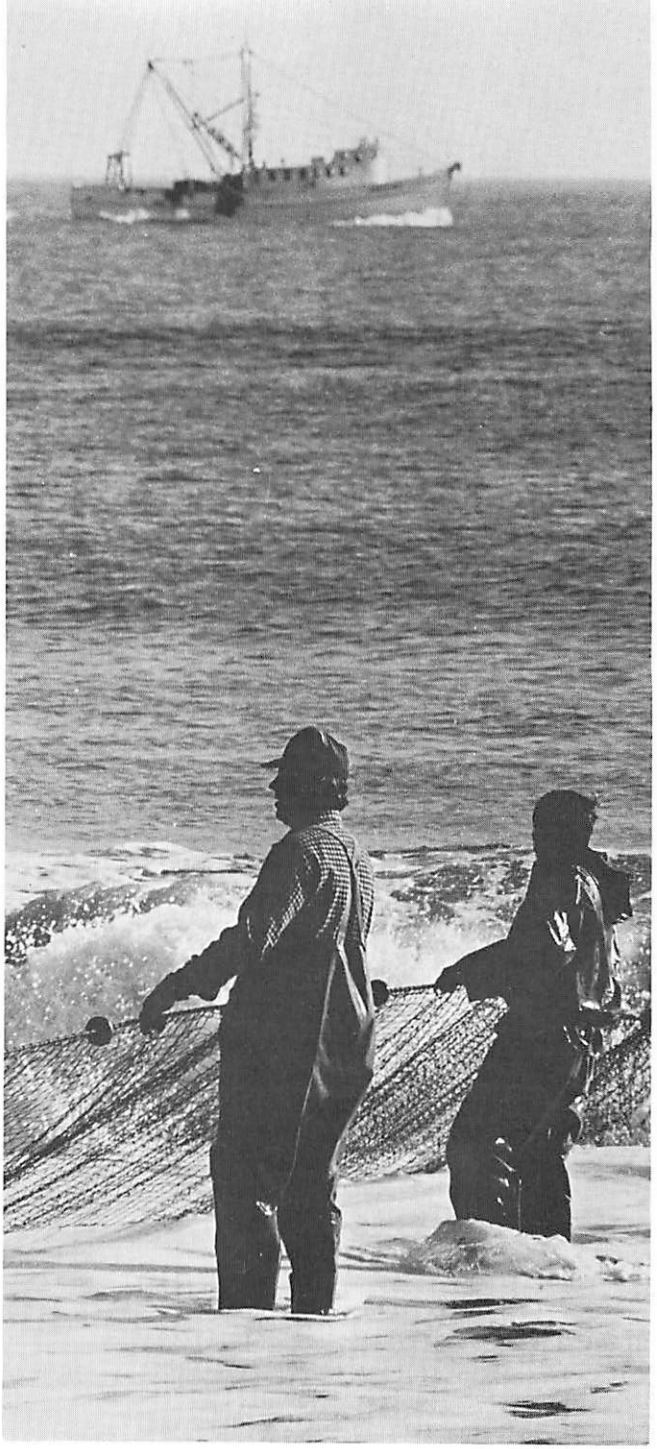
As well as tackling such long-term projects as improving crab meat quality, researchers also devoted efforts to problems requiring short-term research.

In a short-term project, researchers found that scallops chilled rapidly in a cold brine to below freezing had longer shelf life than those packed at room temperature. Other short-term projects have dealt with developing recipes using under-utilized fisheries.

Part 2 . . .

SEA GRANT ADVISORY SERVICES

Reaching Out To People



(Photo: Bob Kretz)

You see him in every local paper. Squinting into the afternoon sun, he stands erect before the camera, a smile plastered from ear to ear. Displayed before him are the glistening trophies—the big ones he landed during last week's cruise.

The proud and happy fisherman—happy at least until he detects that some of his prizes are smelling a little too "fishy". Wrinkling up his nose, he figures he'd better not risk loading them into the hot car. Better just leave them behind, he groans.

It's a story that's sad, but true. North Carolina's sports fishermen land about 25 per cent of the commercial catch each year. And because of a lack of know-how and proper equipment for keeping the catch fresh, much of it goes to waste. Too often the drama of the wasted fish continues when the fisherman gets home with his prizes. He finds out that his wife doesn't really know how to cook or freeze the fish—and alot of it gets thrown out.

(Continued on page 20)

This year Sea Grant took steps to keep that sports fisherman smiling after the camera clicks—and to end the tragedy of the wasted fish.

Through advisory services—from whence help on a multitude of seafood problems flows free—Sea Grant extended a hand to the sports fisherman, his wife, and to everyone else dealing in seafood, from the guy setting the nets to the businessman eating crabcake for lunch.

Sea Grant and the coastal community became closer neighbors this year with the opening of a new seafood laboratory in coastal Morehead City. Working closely with seafood scientists at North Carolina State University, the lab offers the only technology services available to North Carolina's unique fisheries problems. Stationed there are Sea Grant advisory services personnel—folks that make handy neighbors when there's a problem with any aspect of handling the catch between its landing on the dock and the dinner plate.

Revolving around the lab are a whirlwind of activities aimed at taking Sea Grant research findings to the people who can put them to use—and bringing their questions to the lab for research.

This year, the coastal community had a chance to contribute its own brand of expertise to laboratory research. That expertise is in the seafood likes and dislikes of coastal North Carolinians. Bringing their prejudices and preferences, as well as their good cooking skills, to the lab are a dozen Carteret County women of varying ethnic and social backgrounds. Once each month, they shed their aprons for lab jackets and whirl through the lab, concoting new seafood delights and delights from fish that don't sound a bit like seafood.

They've whipped up new dishes out of "trash" fish, added deboned meat to extend other protein and actually replaced beef and pork with fish tissue in some dishes. Like magicians, they've made hamburgers with menhaden and sausage with grey trout.

News of recipes created by the women, the Nutrition Leaders Advisory Committee, travels far and fast throughout the coastal community through home demonstration activities.

In addition to housing research facilities, the seafood lab offers a gold mine of information on fisheries and a wide-range of other marine-related topics—all available in a special information center.

This year, the state's blue crab industries and shellfish and finfish processors received assistance from Sea Grant seafood "advisers," assistance that promises to yield better quality meats, cleaner plants, less pollution and more modern facilities and equipment.

Going into the community armed with helpful information and inviting local citizens to have their say—that's the way Sea Grant proves its neighborliness.

Sea Grant advisory specialists have taken steps this year to help sports fishermen (left) and commercial fishermen (above and center) improve and make the most of their catch. Below, Carteret County women working at the Coastal Seafood Lab aid Sea Grant efforts as they concoct new recipes using both trash fish as well as old favorites. (Photos: Clay Nolen, Bob Kretz and Ted Miller).

The Lowly Eel:

A Fast-Growing Seafood Venture

A new industry was born in North Carolina this year. It takes slimy, black eels from the state's coastal waters and turns them into crisp greenbacks—dollars that fatten the pocketbooks of eastern North Carolinians.

In 1973, what used to be only a fledgling concern turned into a healthy seafood industry. Estimates are that the state's 1973 eel catch outweighed that of previous years by some 400,000 pounds. Each of those extra pounds meant extra income for coastal Carolinians.

Providing a boost to the eel industry were Sea Grant advisory services engineers, men who know and like to talk about things like fishing gear and how to use it. As part of the North Carolina State University Industrial Extension Service, the Sea Grant advisory engineers combine technical know-how with a broad knowledge of seafood harvesting and handling.

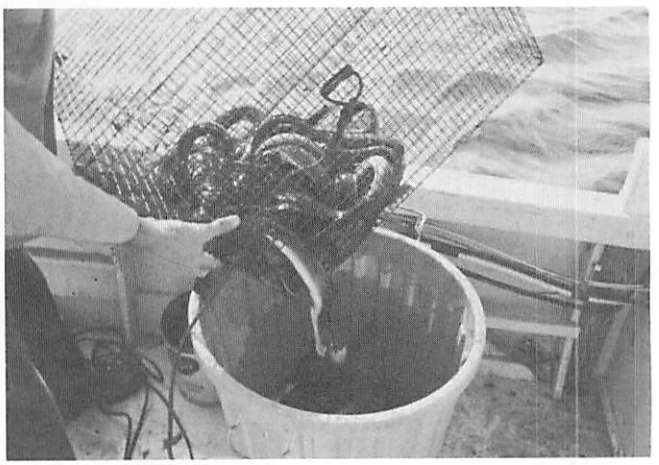
Fulfilling Sea Grant's advisory services mission they were on the scene when eel traps were placed, or when it was time to put eels in holding tanks, armed with facts on harvesting and handling. And if they didn't have an answer, they went to work to find one.

Working alongside more than 200 fishermen, the advisory engineers helped design, build and place eel pots, traps and holding tanks. They instructed on handling eels on the way to the processor. And they lent technical expertise—and good, strong hands—to building a tank truck with a 1,200 gallon capacity for carrying live eels to processing plants.

Besides helping get eels out of the water, Sea Grant advisory engineers turned their attention to the problems of processing, marketing and shipping eels to domestic, European and Asian markets.

Jumping on the bandwagon to harvest eels became such a rage that Sea Grant advisory specialists found themselves answering literally hundreds of inquiries from fishermen, processors, exporters and potential investors. Questions came from as far away as Japan and the Philippines.

North Carolina's shrimpers, too, benefitted from the helping hands of Sea Grant's advisory engineers. With assistance from the University of Georgia Sea Grant Program, the state's shrimpers got their first chance at bat with twin trawling, a method of shrimping using two smaller nets, instead of a single large net, on each side of the boat. In a short test period, they found that the twin-trawl method brought in 10 per cent more shrimp.



Eels caught in North Carolina's coastal waters and sold to foreign and domestic markets are adding dollars to eastern North Carolina bank accounts.

The advisory engineers also found time to return to the scene of a project completed in 1971 which aimed at insulating old fishing vessels. Taking a look at the wear and tear on insulation installed in fish holds and ice bunkers two years ago, they decided that a layer of concrete over the layers of sheet metal and polyurathene foam could provide even better insulation and longer wear.

Part 3 . . .

SEA GRANT EDUCATION

(Photo: Bob Kretz)

Pooling Resources Today For Tomorrow's Profit

Ever since man began trying to make a living from fishing off North Carolina's coast, he has gambled on two things. First he bet on catching enough fish to sell. Then he gambled on the marketplace giving him a good price for his catch.

This year North Carolina fishermen banded together in a fisherman's co-operative, a move that promises to take some of the chance out of dealing in the marketplace.

By pooling their resources in the Sound and Sea Fisherman's Association Inc., more than 200 of the state's commercial fishermen gained a firmer grasp on the market's purse strings. As a group, they can save money buying supplies at cheaper, bulk rates. But more importantly, they are building freezer space

(Photo: Bob Kretz)

and handling facilities for storing their catch until supplies go down and prices go up.

For years, no one believed an independent lot like fishermen could get together in a co-operative venture. But with direction from Sea Grant's program of continuing education, the fishermen were able to see eye to eye on a common goal. Besides laying groundwork for the Association, continuing education project leaders lent a hand in recruiting members, setting up plans for operation and securing funding and economic assistance. Conferences and short courses in business management and accounting refreshed fishermen on the principles of running a sound business.

With grants from the National Marine Fisheries Service, the N.C. Rural Fund for Development and the Farmer Cooperative Service, continuing education project leaders also helped members measure the co-op's economic potential.

Sea Grant continuing education also continued to update North Carolina's fishing community on new gear and its use and new options in fisheries. Gill net fishermen got a look at hydraulic reels and rollers. Crab and eel fishermen were shown and are testing vinyl coated pots for increased yield. And efforts were made in developing clam culture.

A mobile library, stocked with information on just about anything having to do with fishing, travels the roads of northeastern North Carolina, reaching out to the state's commercial fishermen.

This year, an additional sea agent joined the continuing education staff. The program's two sea agents were increasingly involved in the development of marine vocational education in area high schools.

Another Sea Grant continuing education project, ending in 1973, made progress toward compiling a directory of North Carolina's marine fisheries from 1880-1973. Statistics relating to the state's present and past marine fisheries were compiled and will become part of a publication aimed at identifying and reviewing North Carolina's marine fisheries. The publication promises to be of value to fishermen and other persons interested in North Carolina's coastal resources.

A Workshop To Answer Pressing Needs

This year, Sea Grant approached the presentation of a workshop in a way that insured that pressing problems were addressed.

Prior to the November workshop on estuarine assessment, presented to benefit the N. C. Department of Natural and Economic Resources, Sea Grant solicited papers from agency enforcement officials defining precise problems encountered in the state's estuaries.

Problems defined related to dredging and siltation, the development of marginal lands, and freshwater run-off patterns and pollution.

Drawing expertise from within the University and from state and federal agencies, Sea Grant brought together individuals who spoke directly to the problems raised by the agency.

Sponsors of the workshop were the Coastal Plains Center for Marine Development, the N. C. Department of Natural and Economic Resources and Sea Grant.

Students Tackle Marine Problems

During 1973, 20 graduate and five undergraduate students at North Carolina universities simultaneously gained training and expertise while contributing to marine research. The students were supported in full or in part by Sea Grant.

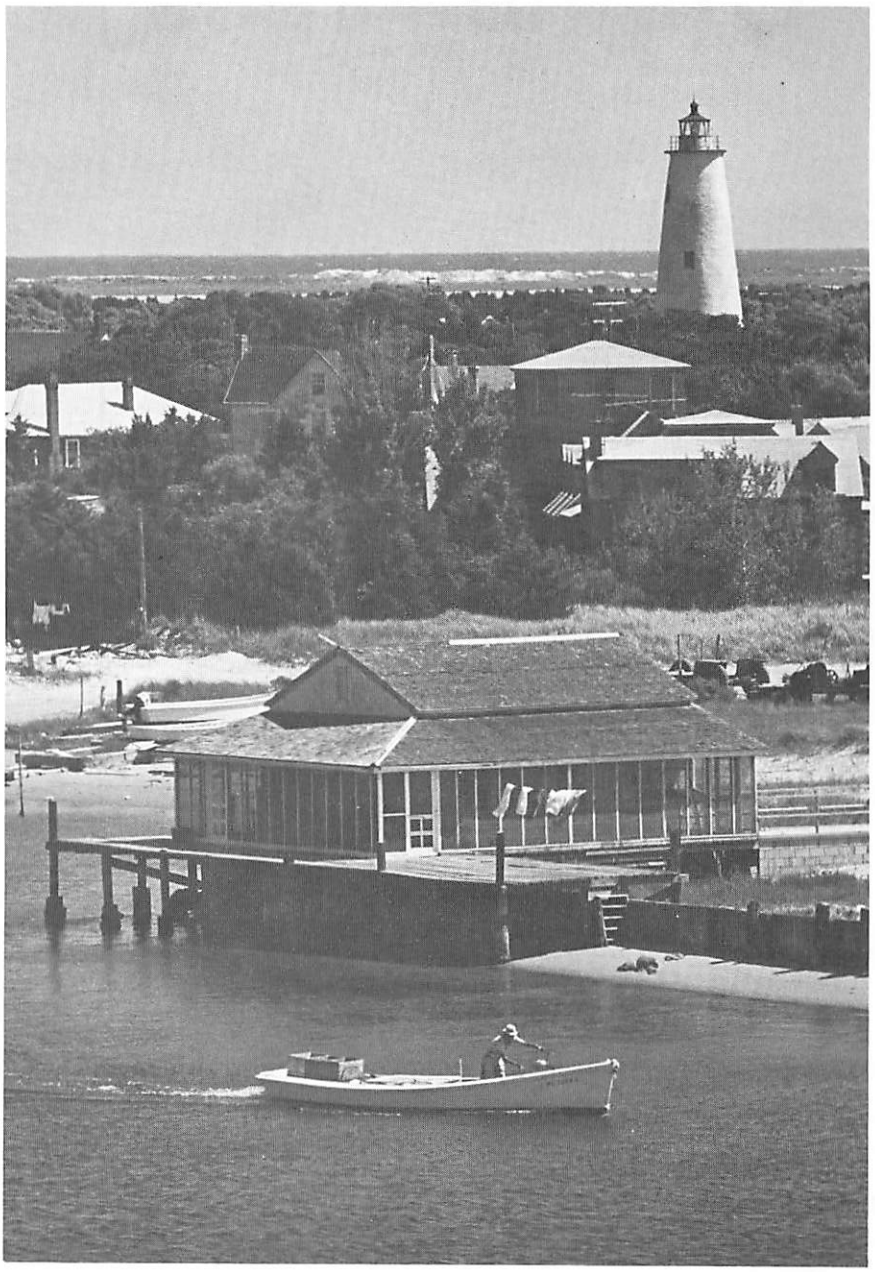
Two of the students earned doctorate degrees and three completed master's requirements.

One Ph.D. student made a significant contribution to spoil stabilization by determining nutritional requirements for *Spartina alterniflora*, a marsh grass effective in stabilizing spoil. The other doctoral student designed numerical models for predicting water movements under hurricane winds and water quality in the Pamlico Sound.

Contributing to baseline data on the ecosystem of the estuaries, a biology master's student surveyed epifauna in the Pamlico River Estuary. A geography master's student analyzed the effects of storms on the people of the Outer Banks. And a geology graduate student, studying an unusually shallow area off Oregon Inlet called platt shoals, collected baseline data that will aid in understanding the origin of the shoals.

Some 30 law school students, writing on a wide range of topics relating to the law of the sea, made a large contribution to ocean and coastal law literature. At the same time, they gained an understanding of issues relating to international and territorial waters.

In the past four years, 111 law students have studied the law of the sea and each has prepared a research paper on a related topic. Of this number, 71 papers have been published in Sea Grant publications.



A bird's-eye view of Ocracoke. (Photo: Clay Nolen.).

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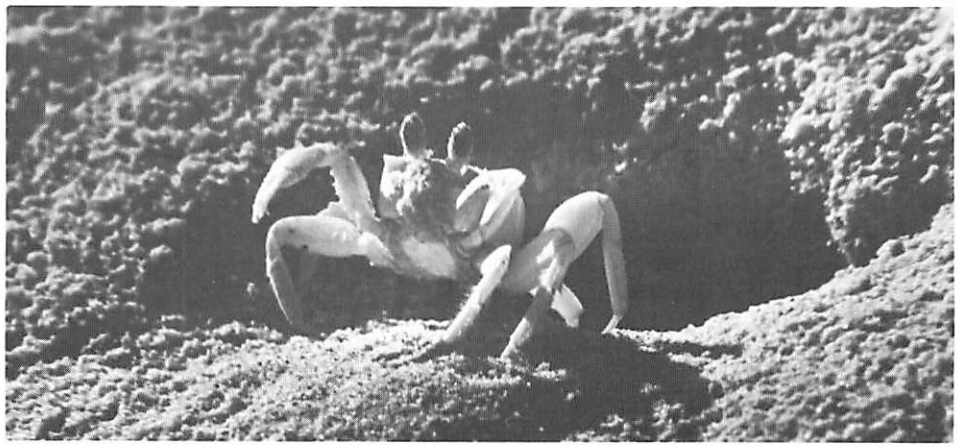

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Net Notes
Addresses problems and items of interest to commercial fishermen. Published irregularly.

FILMS

Storm Erosion and Shoreline Management Alternatives, Outer Banks, N. C. 25 min., 16 mm, color.

To order publications, write:

UNC Sea Grant
1235 Burlington Laboratories
North Carolina State University
Raleigh, N. C. 27607

1973 UNC SEA GRANT BUDGET

	NOAA Grant Funds	University Matching Funds
MARINE RESOURCES DEVELOPMENT		
Aquaculture	$ 23,600	$ 11,800
Living Resources other than Aquaculture	20,112	10,056
Mineral Resources	64,214	32,107
Marine Law	10,930	5,465
MARINE TECHNOLOGY RESEARCH & DEVELOPMENT		
Ocean Engineering	34,224	17,112
Resource Recovery & Utilization	32,414	16,207
MARINE ENVIRONMENTAL RESEARCH		
Research & Studies in Direct Support of Coastal Management Decisions	64,854	32,427
Pollution Studies	36,608	18,304
Environmental Models	30,506	15,253
ADVISORY SERVICES		
Extension Programs	137,886	68,943
Other Advisory Services	11,364	5,682
PROGRAM MANAGEMENT & DEVELOPMENT		
Program Administration	35,288	17,644
TOTALS	$502,000	$251,000

Sea Grant's Supporters

N. C. Department of Administration
N. C. Board of Health
N. C. Division of Sanitary Engineering
Vector and Rodent Control Section
N. C. Department of Community Colleges
N. C. Department of Public Instruction
N. C. Department of Natural & Economic Resources
Division of Commercial & Sport Fisheries
N. C. Board of Science and Technology
N. C. Highway Commission
N. C. Office of Marine Affairs
N. C. Department of Justice
U. S. Department of Defense
U. S. Department of the Army
Corps of Engineers
Coastal Engineering Research Center
Wilmington District
U. S. Department of the Interior
National Park Service
Cape Hatters National Seashore
Bureau of Sports Fisheries & Wildlife
U. S. Department of Agriculture
Soil Conservation Service
U. S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Coastal Plains Regional Commission
University of North Carolina—Chapel Hill
North Carolina State University
University of North Carolina—Wilmington
East Carolina University
College of the Albemarle
Campbell College
American Museum of Natural History, Lerner Marine Laboratory
Duke University Marine Laboratory
UNC Water Resources Research Institute
Carteret Technical Institute
Pamlico Technical Institute
Cape Fear Technical Institute
Coastal Zone Resources Corporation, Wilmington, N. C.
Sound Packing Company, Whortenville, N. C.
Willis Bros. Seafoods, Williston, N. C.
C. A. Davis Fish Company, Beaufort, N. C.
Blanchard Box & Crate Company, Engelhard, N. C.
Pamlico Packing Company, Vandermere, N. C.
Captain Nelson Lee, Trawler *Kirby Allen*, Hobucken, N. C.
Dow Chemical Co., Freeport, Texas
Captain Ottis Fish Market, Morehead City, N. C.
Texas Gulf, Inc., Aurora, N. C.

PROGRAM SUMMARY

PROJECT GROUP	70-71	71-72	73
PROGRAM OPERATIONS			
Administration & Development, Copeland & Rickards	C	C	C
AQUACULTURE & FISHERIES			
Propagation of Dolphin, Hassler	N	C-R	C
Crustacean & Fungal Parasites, Bland	N	C	C
Nutritional Requirements of Fishes, O'Rear	N-T		
Aquaculture Technique Development, Porter	N-T		
ESTUARINE STUDIES			
Dredge Island Succession, Parnell & Soots		N	C
Dune & Dredge Spoil Stabilization, Woodhouse & Seneca	N	C	C
Insects Affecting Vegetation, Campbell	N	C-R	C
Insect Pest Management, Axtell	N	C-R	C
Nutrients in Estuaries, Hobbie	N	C	C
Estuarine System Design, Kuenzler & Chestnut	C	T	
Sediments & Mineral Deposits, Riggs & O'Connor	N	C	C
Erosion & Deposition, Ingram	N	C	T
Flow in Estuaries, Amein & Knowles	N	C	C
Ciliate Parasite, Bradbury			N-T
Benthic Estuarine Ecology, Bellis	N-T		
Community Structure - Smith Island, McCormick	N-T		
Alternative Development Patterns, Huffschmidt	N-T		
Resource Capability - Smith Island, Parnell	N-T		
Microbial Hydrocarbon Degradation, Perry	N-T		
Fate of Pollutants, O'Melia	N-T		
Phosphate in Blue-Green Algae, Schlichting	N-T		
LEGAL & SOCIAL STUDIES			
Marine Resources Legal Research, Wurfel	N	C-R	C
OCEAN ENGINEERING			
Design of Structures, Tung & Huang	N	C-R	C
Beach Stabilization, Huang & Machemehl			N-T
SEAFOOD SCIENCE & TECHNOLOGY			
Applied Research, Webb	N	C	C
EDUCATION & ADVISORY SERVICES			
Engineering Advisory Services, Angel	N	C	C
Education for Fishermen, McGee	N	C	C
Seafood Advisory Services, Thomas	N	C	C
Curriculum Development, Thornton	N-T		
Updated Fisheries, Chestnut	N	C	T

N = Project Initiation
C = Project Continuing
T = Project Termination
R = Project Redirection

This publication was compiled and edited by Dixie Berg, UNC Sea Grant editor. (Photo: Clay Nolen).