UNC Sea Grant

January, 1982

COASTWATCH

Photo by Howard Kerby

New techniques in bass and perch aquaculture, page 4

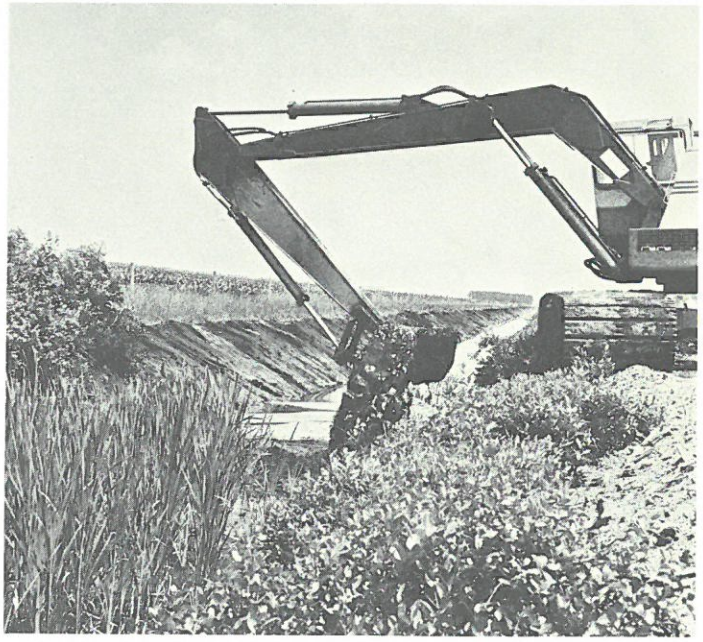
Research grants For 1982

The face of North Carolina's coast is constantly changing. Some changes are easy to accept, but others present problems with no quick remedy.

Each year, UNC Sea Grant identifies some of these problems and funds research designed to help solve them. In 1982, Sea Grant researchers will study several critical impacts on the estuarine system, develop new techniques in fish aquaculture, provide continuing education to local and international groups of commercial fishermen, and design methods for evacuation, should a hurricane strike.

Photo courtesy of Coastland Times

Hurricane evacuation timing, page 6



Agricultural drainage impacts on estuaries, page 2

A unique group studies drainage impacts on estuaries

Estuaries: They are the nursery grounds and habitats of many valuable fish. They are the coastal mixing bowls of fresh and salt water. Wrong amounts of fresh water from upstream, and the balance is upset. And that may be the biggest problem facing the estuaries today. According to Connell Purvis, director of the state's Division of Marine Fisheries, a balanced salinity is especially critical in the primary nursery areas. "Add too much fresh water too often," he says, "and fish are either killed off or driven away. There is a direct relationship between salinity changes and the production of commercially important species."

Maintaining a stable rate of salinity, however, is not an easy task, For openers, there is very little research which quantifies salinity changes and the damaging effects that occur from accelerated freshwater runoff. There are data which indicate that the frequency and quantity of fresh water are important factors, and that the greatest salinity changes occur in the upper reaches of the estuaries, the shallow creeks and bays. It is also known that organisms are not as abundant in areas receiving direct drainage. They are either killed during a peak runoff period, after a rainstorm, or they move to other, often less productive sites.

Agricultural and industrial developments on the Coastal Plains use ditches and canals to drain land, often directly into the estuaries. While this isn't the only method of drainage, it has been effective and cost-efficient in the past. After a rain, the suddenly increased flow of water from such drainage systems can damage estuarine life.

There may be alternative methods for drainage. If so, then we need to determine their effects on salinity and estuarine production, and devise ways for land users to work in harmony with the estuaries. This year, Sea Grant is funding a project that will study these ways and seek the best solution for the salinity problem. B. J. Copeland, director of Sea Grant, says, "If we are going to solve this drainage problem as it relates to estuarine productivity, we are going to have to develop innovative ways to deal with drainage. There needs to be a balance of fresh and salt water to maintain the productivity of those animals we are interested in eating. The quality of the product is definitely related to the stability of the estuarine system."

Photo by Ralph Mills

Wayne Skaggs checks equipment which records water table fluctuations

To cover the broad spectrum of the issue, a team of researchers representing several disciplines is involved. Each researcher will focus his work on Rose Bay, which is considered one of the most productive areas for fishery products in the Pamlico Sound system. In addition, there are already baseline data available on Rose Bay, and this area is also being affected by existing drainage canals. The following researchers are on this project:

—Providing information on current agricultural practices are two North Carolina State University (NCSU) researchers: Wayne Skaggs from the Department of Biological and Agricultural Engineering and Wendell Gilliam from Soil Science. Jimmy Gregory of NCSU's Department of Forestry will be adding data on forestry practices. In previous work on the Coastal Plains, Skaggs developed a numerical model which simulates certain drainage methods combined with long-term weather data. This model will be tailored to the Rose Bay area to determine what effect drainage alternatives have upon fluctuations of freshwater runoff.

—Len Pietrafesa of NCSU's Marine, Earth and Atmospheric Sciences Department is developing a physical model of Rose Bay. By monitoring the area before, during and after storms, he is going to define the physical functions which determine salinity changes during runoff and create his model with this data.

—A biological model of the area is being developed by John Miller and Jim Reed of the Zoology Department of NCSU. Miller and Reed are studying the effects of salinity changes on the production of juvenile shrimp, spot and croaker. Rose Bay provides the nursery grounds for these commercially important species. Field experi-

ments will also be conducted to monitor the effects of salinity functions on growth rates.

—Ken Reckhow from Duke University's School of Forestry and Environmental Studies will combine the research models into an overall model for the project.

Project manager Dave Adams says the drainage problem is complex, but a start must be made towards a solution. Adams, visiting associate professor with NCSU's Department of Forestry and University Studies, says that the study's "tangible product will be a report evaluating its progress toward a predictive model that could be used for resource decisions." The intangible product, Adams explains, is the start of a program and the training of a group of scientists which can begin to address similar environmental problems in the state.

Photo by Mike Dunn

Zoology graduate students sample the Rose Bay estuary

Testing blue-green algae from bloom to decay

The Neuse River, one of North Carolina's most valuable river-estuarine systems, is in danger. Like the Chowan and Pamlico rivers, the Neuse is highly valued for its commercial and sports fisheries as well as its recreational areas. But, like the Chowan and Pamlico, its value may be threatened by nuisance algal blooms.

In recent years, an increase in development along the river has brought an increase in nutrients entering the river system. Phosphate, nitrate, ammonium and other nutrients come from such sources as fertilizers, wastewater treatment plants and industries. During July and August, high temperatures and plenty of sunshine combine with the nutrients to produce broad, paint-like scums of blue-green algae. The particular algae found on the Neuse is *Microcystis*. Side effects of these algal blooms, such as toxicity, odor, fish kills and appearance, seriously threaten use of the river for fishing, boating, drinking water and agricultural and industrial purposes. An additional threat is the possible proliferation of the blue-green algae into the estuarine and marine environment.

To date, there has been very little research on *Microcystis* in the estuary and no research in North Carolina. This year Sea Grant is funding two projects that will examine the bloom potential under varying saline conditions. They will also determine the effect of the bloom in the estuarine system.

Hans Paerl, assistant professor in the University of North Carolina at Chapel Hill's (UNC-CH) Institute of Marine Sciences, believes that salinity may be an important barrier to the proliferation of blue-green algal blooms. "The nuisance blooms detected thus far," he says, "are of freshwater origin. Little is known about their tolerance and hence potential ability to survive and proliferate in the marine environment."

In his study, Paerl will be combining field work with laboratory experiments on *Microcystis*. Samples taken during bloom and non-bloom periods will be used to identify specific nutrients and their ratios. Additional samples will be tested for salinity tolerance to determine if this species could spread into saltwater systems and survive.

In a companion project, Donald Stanley and Robert Christian, associate professors from East Carolina University's (ECU) Department of Biology, will focus on the direct and indirect effects of the bloom on the estuaries downriver. Their goal is to determine if blue-green algal blooms could be serious enough to affect estuarine fisheries resources.

Stanley and Christian will be trying to determine in the first part of their project why the blooms don't penetrate the more saline portions of the estuary. Samples will be collected from stations along the river ranging from freshwater areas to areas with salinities of 15 parts per thousand.

In the second part of their project, they will be studying the effects of the dying, or senescent, bloom. Stanley says the senescent bloom may be even more damaging than the active bloom. Decay of a bloom may decrease oxygen supplies significantly, may create high densities of harmful bacteria or perhaps even worse, may be converted into other undesirable algal forms, a process called recycling.

"We are basically going to try to measure the death rate of the algae," Stanley says. "When these algae die and decay, nitrogen and phosphorus are given off. Through chemical techniques, we are going to measure how fast the nitrogen and phosphorus are recycled and the rate of conversion of this algal nitrogen back into another algal form."

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The results of Paerl, Stanley and Christian's research will provide much needed information on *Microcystis* growth and harmful effects in the Neuse estuary. Data obtained in the study will be useful to state agencies interested in not only the control or eradication of the bloom, but also what effects it has on fisheries in the Neuse River estuary.

A study in Teamwork

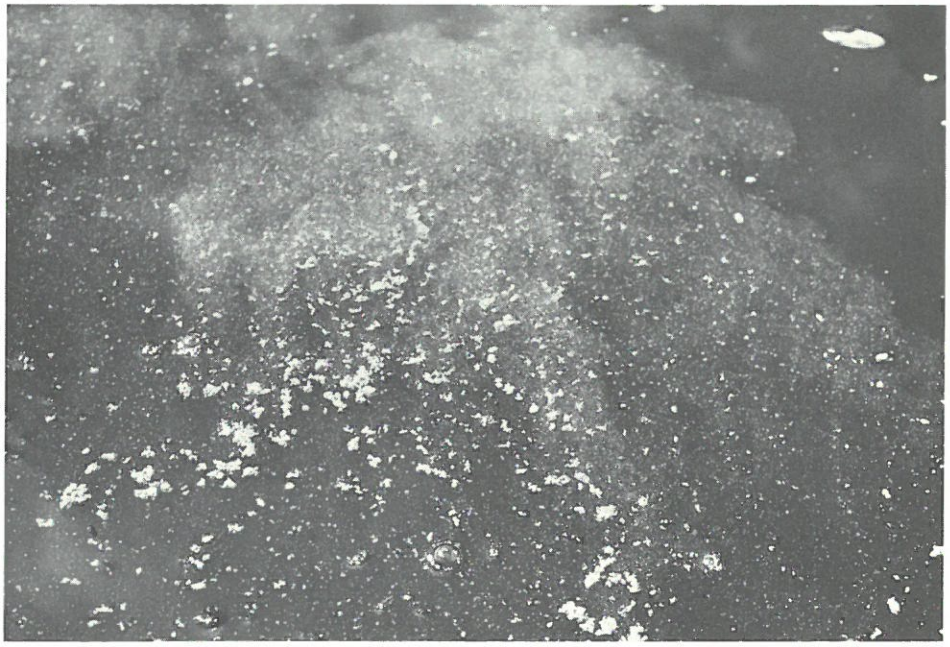
In the past few years, residents along the White Oak River have noticed several changes in the river. Recreational boaters complained of shallower waters and of some areas which had become barely navigable. Commercial fishermen reported that their catches of fish and shellfish were getting smaller. Agreeing that something had to be done to "save their river", they formed the White Oak River Advisory Council.

According to council members, sedimentation is the problem here. Over the years, sediment, such as sand and silt, has been building up at the mouth of the river and causing the channel to become narrower and shallower. Sedimentation was also blamed for the river flowing more slowly than normal. Charles Daly, a spokesman for the council, says past studies have indicated that this buildup of sand and silt on the White Oak was caused by the dredging of the Intracoastal Waterway by the U.S. Army Corps of Engineers and the construction of a causeway, N.C. 24, at Swansboro. The council took their concerns to the governor in an appeal for funds to study the problem.

Last fall, $50,000 was appropriated by the General Assembly. A unique study team, involving state and federal agencies, universities, private consulting firms and local citizens, was formed. This year, Sea Grant will also be lending support to the White Oak River project. Working together on the team are representatives from the council, NCSU, the University of North Carolina at Chapel Hill and Wilmington, ECU, Water Resources Research Institute, Sea Grant, the Department of Transportation's Division of Highways and the Department of Natural Resources and Community Development's Office of Water Resources, Office of Coastal Management, Division of Marine Fisheries and Division of Environmental Management. A report on the team's research will be presented to the legislature this summer.

According to B. J. Copeland, director of Sea Grant, an important outcome of the study will be the example of government agencies working with universities and local citizens. "I think we're on to something good here," Copeland says, "working together as a team, we can put science applications to work on the council's problem, and their involvement is essential in this study. I think this is a very effective way of providing the council and the state with the information needed to solve this problem."

Photo by Hans Paerl



Blue-green algae found on the Neuse River near New Bern

Raising fry and fingerlings

In the last 10 years, Atlantic Coast populations of striped bass have been declining rapidly. At the same time, commercial fishing pressure had increased. To replenish stocks of this very desirable food and sport fish, researchers have tried stocking larvae in lakes and reservoirs. But survival rates of the wild-stock larvae have been very low. However, much higher survival rates have been recorded with some striped bass hybrids.

Two Sea Grant researchers, Howard Kerby and Mel Huish of the zoology department at NCSU, have been successful in the past few years raising striped bass X white bass hybrids. Working at the NCSU Aquaculture Demonstration Project at Aurora, they have raised fish from fingerlings stocked in ponds, cages and large circular pools. Survival rates have normally exceeded 90 percent.

"Hybrids," Kerby says, "grow faster, are heavier and have a deeper body. A hybrid the same length as a striped bass will weigh more because of its deeper body. Hybrids are also hardier," he adds, "which makes them easier to handle and work with under culture conditions."

This year, Kerby and Huish, assisted by graduate student Curry Woods, will focus their research on production of striped bass hybrids during the first eight months of life—from fertilized eggs to fingerlings. In one phase of this project, hybrid fry will be cultured to a larval stage in 10,000-gallon circular pools. In a second phase, hybrid larvae will be stocked in quarter-acre ponds for grow-out to the fingerling stage.

Both fresh and estuarine water will be tested in the pools and ponds. A third phase will compare growth and survival rates of the pond-raised fingerlings in the fresh and estuarine water.

Ron Hodson, Sea Grant's associate director and project director of the Aquaculture Demonstration Project, says research efforts with hybrids are just beginning. "We know we can grow marketable hybrids in sixteen to eighteen months. With research, we can probably shorten this time. A lot depends on getting the larvae off to a good start and providing them with optimal growing conditions through the whole process."

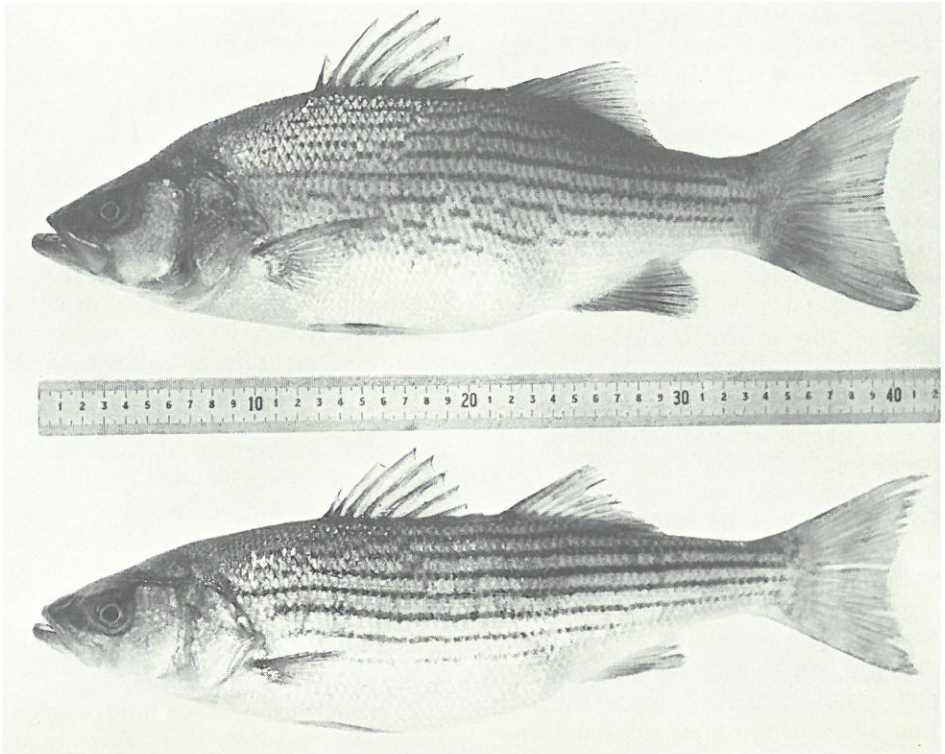
The techniques developed in this project will not only benefit other agencies working with hybrids, but it could be the start of a new aquaculture industry in North Carolina, Kerby says. "Hybrids," he adds, "could be the alternative market fish for the declining striped bass."

Another popular food fish is the yellow perch. In the Midwest, demand for this species far exceeds supply even though great numbers are harvested in the Great Lakes. Aquaculture projects in Wisconsin have been raising yellow perch, but their efforts have been hampered by a short growing season and the lack of a dependable supply of fingerlings.

Coastal North Carolina is on the southernmost range for this species and has the optimum temperatures necessary for a long growing season. But, yellow perch is not commercially fished in this state. Because of the low demand and available supplies, the catch is incidental.

Jeff Hinshaw, a NCSU graduate student working with Kerby and Huish, thinks the yellow perch has much greater potential in North Carolina. This year, he will be using the Aquaculture Demonstration Project's facilities to produce fingerlings from larvae and to produce a dependable supply acclimated to culture conditions.

"One of the potential benefits from this work," Hinshaw says, "will be an exchange program with fish farmers in the Midwest." In North Carolina, the spawning season for yellow perch is one to four months ahead of the Midwest season. Hinshaw hopes to set up a cooperative program with Midwestern fish farmers to ship eggs and larvae to them during their off-season in return for the same during the off-season here, extending the growing season for both regions.



A striped bass hybrid (top) the same length as a striped bass (bottom) generally weighs more because of its deeper body

Research on yellow perch also increases the potential for grow-out in North Carolina or other southeastern states. Climate and the longer growing season give North Carolina an advantage over growers in the Midwest, according to Hinshaw. "We can produce more fish per given unit of time," he says. "There is already a market for this highly valued species, and that's the main criterion for aquaculture."

Transferring technology and skills

Commercial fishing, like most businesses, has gotten more complex over the years with advances in technology. Fishermen today have to keep abreast of the latest in equipment, and know how to use it in the most cost-efficient way. In many small, family-owned operations, which are characteristic of most of the industry in North Carolina, a fisherman may wear a number of hats: bookkeeper, net mender, welder, mechanic, navigator and seafood processor in addition to boat captain.

In 1981, over 250 fishermen learned about the latest developments in technology and improved their technical skills in a program coordinated by Jim McGee of the Division of Continuing Education at ECU. Funded by Sea Grant, this program will be expanded and offered again in 1982.

Designed for both the seasoned fisherman and the novice, the curriculum will begin with an emphasis on business affairs, from financing the boat to paying taxes. "We will be covering a variety of topics," McGee says, "from fuel economy and boat building to navigation and cold water survival. The program will include workshops, lectures, demonstrations and individual instruction."

This year, a special international section has been added to the program. Sea Grant's director, B. J. Copeland, calls the international program a "transfer of technology with very positive benefits for both countries." Forty Nigerians are coming to Dare

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County to learn first-hand about North Carolina's commercial fishing industry. Although the African country of Nigeria has a healthy seafood industry of its own with an abundance of resources, McGee says it is technologically undeveloped by modern standards. Most of the actual fishing and processing work is done with manual labor. (At least 45 percent of this work is handled mechanically in North Carolina.)

"I guess one of the most valuable aspects of this program," McGee says, "will be their exposure to our technology. They will learn about all the mechanical aspects of fishing vessels, the use of electronic equipment, processing of marine products and much greater utilization of their resources through importing and exporting."

During their training program, the Nigerians will participate in the continuing education program in addition to attending extension classes through a local technical college, College of the Albemarle. Trainees interested in a particular skill, such as net making, will also be required to work in an apprenticeship program.

But, the learning process isn't going to be one-sided. McGee anticipates that local fishermen are also going to learn more about the industry, especially on an international level. He hopes that if this program proves successful, it can be used as a model for future involvement in international cooperative ventures.

Planning for Evacuation

The threat of a hurricane is a fear all coastal residents and visitors face each year as the season begins in June. But, perhaps an even greater fear is felt by the community leaders of each small town and village. They must decide when and how to evacuate the people during an emergency.

Consider this hypothetical situation: It's the middle of August, the beaches are packed, and a hurricane warning is issued for the Outer Banks. Over 100,000 residents and tourists are asked to evacuate the area, and there are only two roads leading to the mainland. How long will it take to safely evacuate these people? The answer—no one really knows.

Transportation studies for evacuation have been done in other states, such as Texas and Florida. In the Galveston and Tampa Bay regions, highly computerized models have been developed to evacuate these large, urban areas should disaster strike. But, these same models can't be applied to North Carolina's coastal communities, which are predominantly small and rural. "That's the wrinkle in my study," says John Stone, assistant professor of civil engineering at NCSU.

In a new Sea Grant project, Stone will be assessing the transportation problem of North Carolina's coast to estimate evacuation time. He says a typical transportation problem for evacuation includes consideration of the following factors: the population and its density; coastal topography; the transportation system and the number of alternate routes; and the storm and its location, intensity, speed and direction of travel.

"Given this type of information," Stone says, "we can basically determine how many vehicles that roadway can carry in an hour." John Sanders, Sea Grant's coastal weather awareness specialist, will be providing Stone with the necessary transportation, topography, storm and population data for two sample areas: Route 130 at Holden Beach and Route 33 in the Lowland-Hobucken area. Stone says the results of this limited study will be a set of simplified techniques designed for small communities.

An example of one manual technique could be used to answer the question asked in the beginning of this article. According to Sanders, the National Hurricane Center estimates that in time of disaster 600 vehicles using a single lane of highway could travel 30 miles in one hour. In each vehicle, there would be approximately 2.5 people. Therefore, to evacuate 100,000 people in an area, it would take approximately 67 hours. The only trouble with this figure is that a warning means a hurricane may strike in 24 hours. While this general formula may not be accurate for the Outer Banks area, it does emphasize the great need for a system coastal communities can use to estimate evacuation.

Photo courtesy of Coastland Times

Flooding is a common transportation problem which slows down hurricane evacuation traffic

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454).

If commercial fishing is your business, mark your calendar to attend the Workboat Expo in Morehead City on March 13 and 14. Sponsored by Sea Grant, the show will feature exhibits by dealers and manufacturers of workboats, fishing nets and gear, radios and electronic equipment and accessories for commercial fishermen. A series of mini-seminars open to the public will also be held during the show. Topics will include financing your boat, sail power as an alternative, net mending, fiberglass repair and maintenance, marine insurance, diesel maintenance and peeler crab operations.

The Workboat Show has been organized by Sea Grant marine advisory services agents Bob Hines and Larry Giardina in Bogue Banks, Jim Bahen in Wilmington and Hughes Tillett in Manteo. The location for the show is the Morehead City National Guard Armory at 3609 Bridges Street. Hours are 10:00 a.m. to 5:00 p.m. on Saturday, March 13 and 11:00 a.m. to 5:00 p.m. on Sunday, March 14. Admission is free for the show and all seminars.

The North Carolina Marine Resources Center at Fort Fisher has a new director. James A. Lanier, who joined the staff February 1, comes to the Center from Princeton, New Jersey, where he was director of education programs for the New Jersey Marine Sciences Consortium. He has also been director of education at the Virginia Institute of Marine Sciences.

Lanier received his masters and doctorate degrees in marine science from William and Mary. He is president of the National Marine Education Association.

Question: Where in North Carolina can you find mountains next to the coast and wildlife right around the corner? Answer: At the Outdoors North Carolina Expo.

Billed as "the largest exposition on the outdoors in the Southeast," the expo is being held March 25 to 28 at the Raleigh Civic Center. The state's Department of Natural Resources and Community Development (NRCD) is coordinating the event which will include exhibits and displays from 11 public-interest groups, the Museum of Natural History and the state departments of Administration, Commerce, Cultural Resources, NRCD and Transportation. There will also be exhibits from commercial manufacturers of outdoor sporting equipment.

The theme of the expo is to promote outdoor recreation in North Carolina, as well as an appreciation of the state's natural resources.

Divers and underwater photographers from across the country will gather in Raleigh March 12 for a three-day salute to life under water.

The occasion is SEAS '82, the second annual Southeast Atlantic States Underwater Conference and Film Festival. For the second year, UNC Sea Grant will help sponsor the conference, which will include workshops, films, exhibits and lectures by some of the nation's top divers and photographers. Among the speakers will be Stan Waterman, who will conduct workshops on underwater photography, and Sir Robert Marx, whose workshops will cover wreck diving and underwater archaeology. Other workshops will include such topics as treasure diving, accidents, sharks and marine geology.

SEAS '82 will kick off Friday evening, March 12, with a social, and continue through the weekend, with activities at two Raleigh hotels and a film festival at Raleigh's Enloe High School Auditorium.

If you're interested in attending SEAS '82, register now. For a registration form and more information, write: SEAS '82, P. O. Box 31186, Raleigh, N.C. 27622, or call (919) 781-6330.

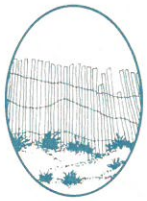
SEAS '82 is sponsored by the N.C. Marine Education and Resources Foundation, the N.C. Wreck Divers Association, the N.C. Office of Marine Affairs and UNC Sea Grant.

State officials and coastal scientists are coming to Elizabeth City, March 3, for a "Conference on the Albemarle Sound—Trends and Management Needs." Area citizens, legislators, state officials and scientists are concerned about the water quality of the Albemarle Sound and its tributaries such as the Chowan and Roanoke Rivers. Already a legislative committee has been appointed to study the problems of water quality in northeastern North Carolina and report to the 1983 General Assembly with its recommendations.

Now the legislative committee, along with representatives from 12 northeastern counties and others, are being invited to attend the March conference, which will be sponsored by UNC Sea Grant, the Water Resources Research Institute and other state agencies. The featured speaker for the conference will be David Stick, historian, who will speak on historical trends of the Albemarle Sound. Other speakers will include UNC Sea Grant Director B.J. Copeland, Jay Langfelder, assistant secretary of

Continued on next page

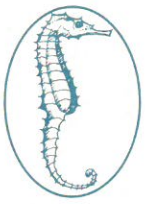
Natural Resources and Community Development and Connell Purvis, director of the state Division of Marine Fisheries. The purpose of this conference will be to inform those who attend about the physical, historical and biological characteristics of the Albemarle Sound and how it responds to environmental and man-made changes.



Yes, Virginia, Christmas trees are still important after the holidays are over. This year, hundreds of trees were given a new purpose in the second annual dune-repair and Christmas-tree-recycling program.

Spencer Rogers, Sea Grant's coastal engineering specialist, set up the program with the North Carolina Marine Resources Center at Fort Fisher and several local organizations. In the past two years, Rogers says several hundred volunteers have braved cold and nasty weather to set out over 600 trees. Trees stripped of decorations are placed in worn areas along the dunes where they trap and hold sand in their branches.

Participants in this year's program met on January 3 at the center. After a 15-minute talk by Rogers on repairing dunes, the volunteers took a field trip to the beach to deposit the trees.



Lundie Mauldin, Sea Grant's marine education specialist, again has organized a series of summer workshops for North Carolina teachers.

The first workshop has a tropical setting—Andros, Bahamas. UNC Sea Grant and the N.C. State Museum of Natural History are sponsoring this tropical workshop set for June 27 to July 3. To be eligible, a teacher must be scheduled to teach science in 1982-83. The approximate cost of the trip is $450. To reserve a spot for the Andros workshop, a $100 deposit must be received by April 15 along with an application form. Space is limited to 20 teachers. For applications and further information, write Lundie Mauldin, 105 1911 Building, North Carolina State University, Raleigh, N.C. 27650 or call (919) 737-2454. Or, contact the museum at (919) 733-7450.

In another cooperative project with the Museum of Natural History, Mauldin has organized a series of three workshops called "Cross Carolina." In these workshops, teachers will examine the mountain, piedmont and coastal habitats and learn how to plan and execute field trips. The mountain workshop will be held July 5-9 in Boone; the piedmont workshop, July 19-23 in Raleigh; the coastal workshop, July 26-30 in Nags Head. Elementary or secondary science teachers may attend one or all three workshops. Tuition for each workshop is $110. This cost covers housing only. Each of the workshops offers 3½ hours course credit through the NCSU Department of Continuing Education. For an application, write or call Mauldin. Space is limited.

Finally, Mauldin is offering a workshop for 15 to 25 teachers at the N.C. Marine Resources Center at Bogue Banks, July 11-17. Called "The Sea and its Harvest", this workshop is designed for vocational instructors teaching home economics, pre-vocational career exploration and marine occupations. Teachers will learn about the harvesting, processing and preparation of seafood. Tuition for the workshop is $100. Three hours course credit will be offered. For an application, write or call Mauldin.

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